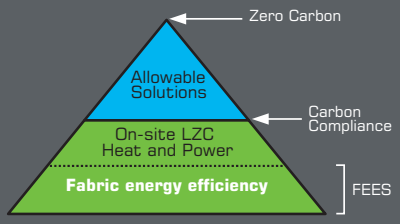
FABRIC ENERGY EFFICIENCY FOR ZERO CARBON HOMES

A flexible performance standard for 2016

- From 2016, as part of zero-carbon performance, new homes will need to meet high standards of fabric energy efficiency. Fabric energy efficiency is the first element of the zero carbon homes policy hierarchy (below) and is part of the Government's wider strategy for achieving a national 80% reduction in carbon emissions by 2050.

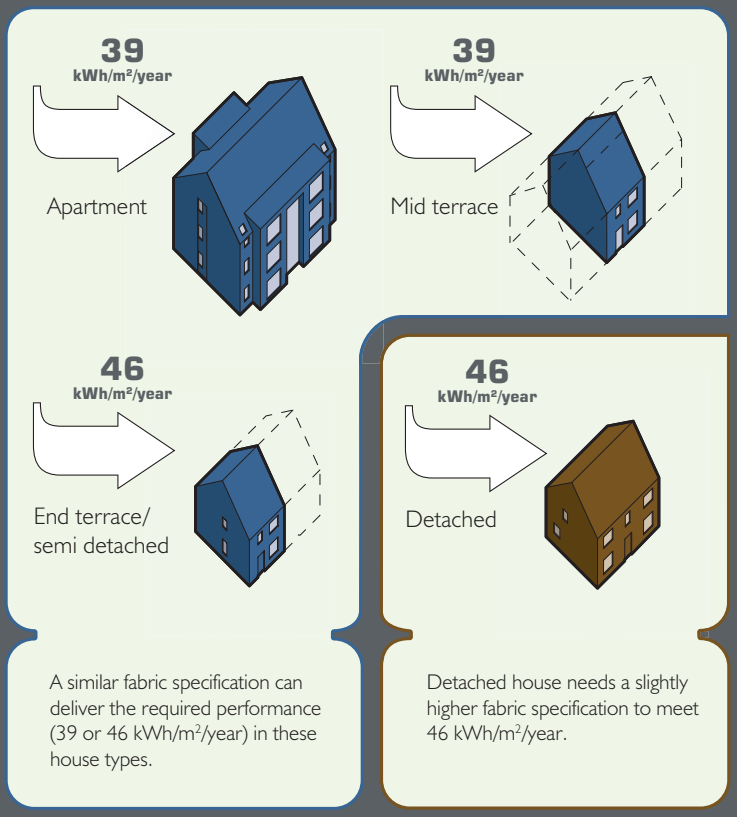


Zero carbon homes policy hierarchy (Department for Communities and Local Government)

- In 2009, based on extensive R&D and collaboration with the industry, the Zero Carbon Hub made initial proposals for a Fabric Energy Efficiency Standard (FEES). This Standard was developed to support the development of AD L1A, 2016. FEES is now incorporated in the Code for Sustainable Homes.
- The FEES sets a maximum limit on the amount of energy (in kWh/m^2/year) that would normally be needed to maintain comfortable internal temperatures in a home. For the majority of homes, levels of 39 and 46 kWh/m^2/year (see left) are proposed. For a home to be 'FEES-compliant', the fabric must be sufficiently good (see table inside) to ensure that heating and cooling energy demand does not exceed these figures.
- These target fabric levels, while challenging, can be achieved by a variety of build types, including traditional construction.
- The simplicity of FEES is that semi-detached, end- terrace, mid terrace and apartments, will normally achieve their allocated target (either 39 or 46 kWh/m^2/year) with a very similar building specification (simply because apartments and mid terrace homes have a lower proportion of external wall, and fabric specifications will achieve the higher performance in these home types). This is a hugely important practical benefit for housebuilding, minimising the number of specifications required across developments. FEES, however, does identify the detached home as a specific case requiring a higher build specification.
- Fabric performance is measured in units of energy rather than units of carbon. This will give an ongoing, consistent target for construction of the fabric: something that would be harder to achieve if performance was carbon-based.

Above: Some pioneering projects are already building close to the FEES target

Below: Targets proposed in FEES

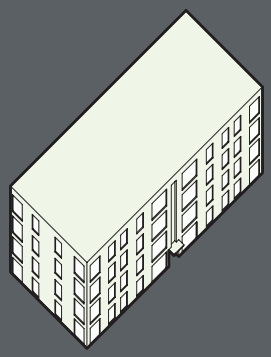


A similar fabric specification can deliver the required performance (39 or 46 kWh/m^2/year) in these house types.

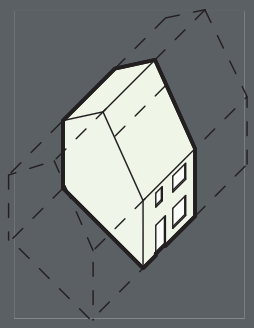
Detached house needs a slightly higher fabric specification to meet 46 kWh/m^2/year.

Flexibility of FEES

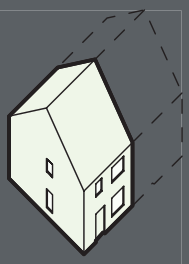
The Fabric Energy Efficiency Standard is a performance standard, setting minimum levels for overall fabric performance. Achievement of the FEES is affected by building fabric U-values, thermal bridging, thermal mass, and features which affect lighting and solar gains. It is not influenced by building services, for example heating system, fixed lighting, or ventilation strategy. In this chart are illustrated two worked examples that would meet the Standard.



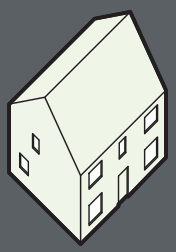
Apartments
4 storeys



Mid
terrace house



End terrace/
semi-detached
house



Detached
house

	External wall U-value (W/m^2K)	Party wall U-value (W/m^2K)	Sheltered wall U-value (W/m^2K)	Ground floor U-value (W/m^2K)	Roof U-value (W/m^2K)	Window U-value (W/m^2K)
Example 1 'Balanced'	0.18	0.00	0.17	0.15	0.13	1.4 double glazed
Example 2 Part L 2013 Backstop	0.20	0.00	0.19	0.18	0.16	1.2 double glazed
Example 1 'Balanced'	0.18	0.00	N/A	0.15	0.13	1.4 double glazed
Example 2 Part L 2013 Backstop	0.20	0.00	N/A	0.18	0.16	1.2 double glazed
Example 1 'Balanced'	0.18	0.00	N/A	0.13	0.13	1.4 double glazed
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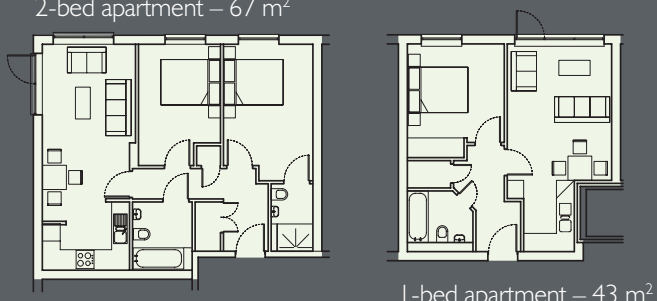
Example 1 'Balanced'	0.15	N/A	N/A	0.13	0.13	1.2 double glazed
Example 2 Part L 2013 Backstop	0.20	N/A	N/A	0.18	0.16	0.8 triple glazed

Example 1 is described as a 'balanced' approach, which sets out to improve performance across all fabric elements. **Example 2** demonstrates an approach which utilises the proposed fabric backstops for wall, floor and roof U-values set out in the current consultation on Part L 2013. Both examples shown here maintain air permeability at around 5m³/hr/m² @ 50Pa. These are offered for illustrative purposes to indicate the minimum levels of fabric performance that might be required from 2016 as part of meeting the zero carbon standard. Many other options would be available.

	Door U-value (W/m²K)	Air permeability (m³/hr/m² @ 50Pa)	Thermal bridging (W/m²K)	**Dwelling FEE performance (kWh/m²/year)**
	1.4	5.2	0.07	**38.9**
	1.6	5.4	0.07	**39.0**
	1.2	5.2	0.04	**39.0**
	1.0	4.9	0.04	**39.0**
	1.0	5.0	0.05	**46.0**
	1.0	4.8	0.04	**45.9**
	1.0	5.2	0.04	**46.0**
	1.0	5.1	0.025	**46.0**

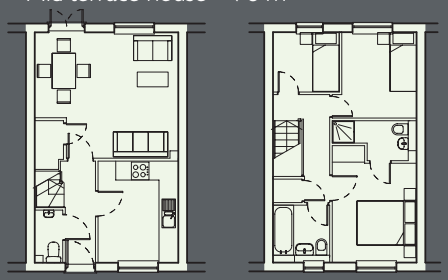
Plans of home types used in Examples 1 and 2

2-bed apartment – 67 m²



1-bed apartment – 43 m²

Mid terrace house – 76 m²

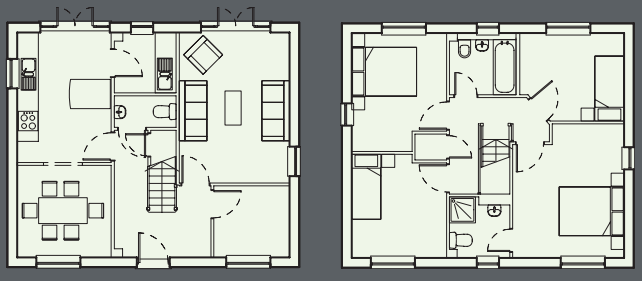


Ground floor First floor

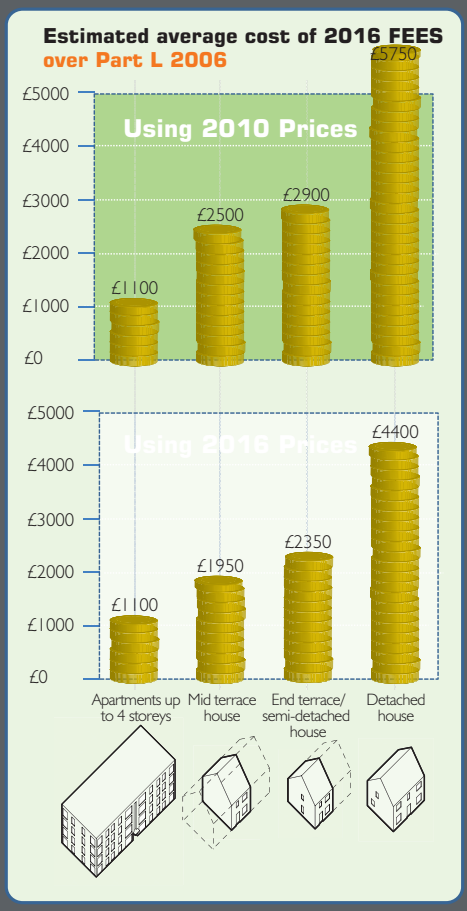
Semi-detached and End terrace house – 76 m²

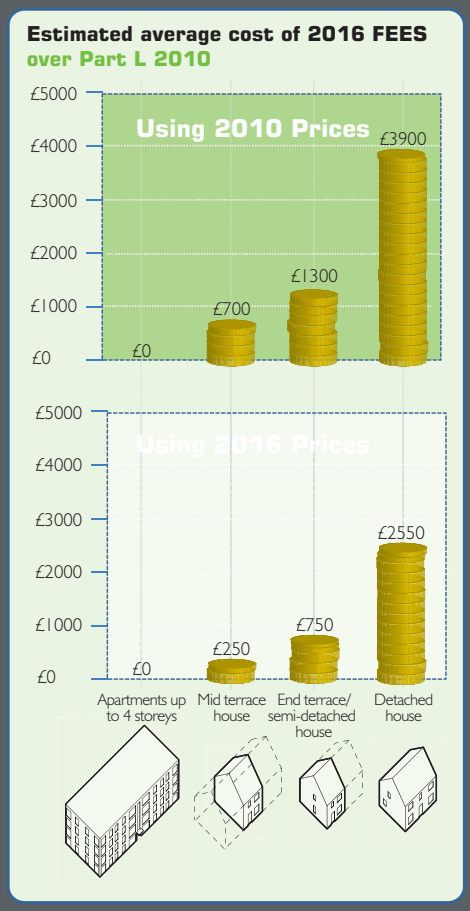
Ground floor First floor

Detached house – 118 m²

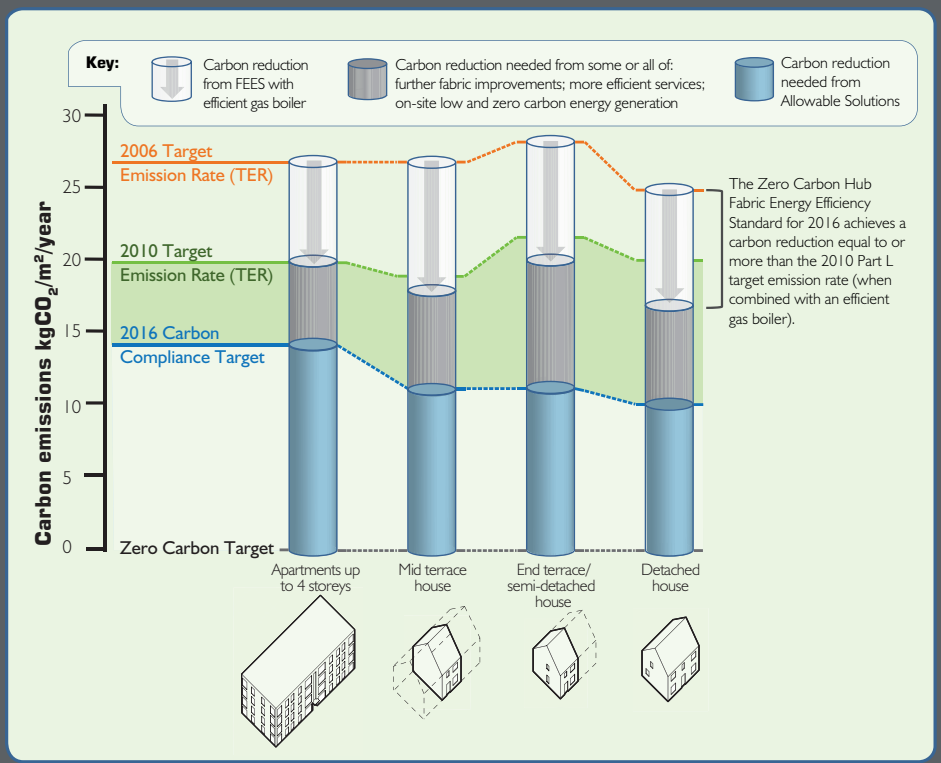


Ground floor First floor





Costs The most recent results from cost analysis for building to the FEES is summarised above for common dwelling types. The uplift from 2006 is shown because many housebuilders may not yet have experienced designing or building to 2010 standards. The 2016 cost estimates adopt 'learning rates', which predict likely trends in prices. Please note that the costs shown are based on typical values for masonry construction and should only be used as a rough guide. The FEES cost estimate is only part of the cost of delivering zero carbon.



FEES contribution to the zero carbon target Although FEES is expressed in energy terms, it is important to understand its contribution to carbon emissions reductions. In this chart, which is based on carbon emission factors projected for 2016, the significant impact of FEES on carbon emissions levels can be appreciated.

Further development of the Fabric Energy Efficiency Standard

Part L 2013 The consultation proposals for Part L 2013 include the recommendation that new homes should comply with a mandatory minimum fabric performance standard. Two alternative levels are being consulted upon:

- 'Full FEES' – the 39 and 46 kWh/m²/yr discussed in this document
- 'Interim FEE' – a less onerous standard of 43 and 52 kWh/m²/yr

The outcome from this consultation will determine (for Part L 2013) the contribution that fabric will need to make to overall carbon emissions reduction for the home.

More complex plans and elevations

To take account of more complex terrace designs, a methodology has been developed to allow mid terrace homes with additional heat loss side wall areas to be assessed against an adjusted target, on a 'sliding-scale' between the 39 and 46 kWh/m²/yr targets. It is also suggested that some small apartment blocks with characteristics similar to detached or semi-detached houses can be assessed at the less onerous 46kWh/m²/yr target.

Building averaging The Building Regulations currently allow the Target Emissions Rate (TER) and Dwelling Emissions Rate (DER) to be averaged in buildings which contain more than one dwelling. This can apply, for instance, to an apartment block or terrace of houses. The consultation on Part L 2013 considers extending this averaging methodology to the calculation of the target and dwelling Fabric Energy Efficiency.

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