4.5 Typical house archetype examples

So far, we have looked at the big picture to derive LETI's targets for retrofit. But what does this mean in practice? The rest of this chapter sets out a series of typical house archetypes based on average data for each building type from the stock model. We start with an existing pre-retrofit building and then show what happens when the LETI targets are applied. In some cases, we have used the 'constrained' retrofit values, whilst others show the effect of an 'unconstrained' retrofit.

In all cases, we show the pre and post-retrofit space heating demand and Energy Use Intensity as a primary measure of the impact of the retrofit. We also show the overall reduction in actual energy use for each archetype. To make the examples a bit more real, we've provided some signposts to actual case-study retrofits which are similar to the illustrative archetypes.

Retrofit improvements - the package of retrofit measures that have been undertaken to get to the post-retrofit state.

Post-retrofit energy - The total amount of energy needed over the course of a year by the building with a typical occupancy once it has been retrofitted.

Pre-retrofit energy - The total amount of energy needed over the course of a year by the building with a typical occupancy in its pre-retrofit condition.

Key

- LETI best practice unconstrained with no additional allowance
- LETI best practice constrained with additional allowance
- Additional allowance for homes under 75m²
- LETI exemplar

Delivered - the amount of energy required by the building, this is sometimes called energy consumption, it includes the effect/efficiency of the heat source. This includes the benefit of fabric and systems. Delivered energy is independent of PV generation.

Demand

Space heating demand - the heat energy that the heat pump or boiler generates to heat the home, this figure includes systems losses. The better the building fabric the lower the space heating demand. Space heating demand is independent of the type/efficiency of heat source.

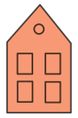
Hot water demand - the heat energy that the heat pump or boiler generates to heat domestic hot water, this figure includes systems losses. Hot water demand is independent of the type/efficiency of heat source.

Total energy demand - The space heating demand; hot water demand; and the electricity required for lights, ventilation and plug loads. Energy demand is independent of the type/efficiency of heat source.

Energy Use Intensity (EUI) - the delivered energy (sometimes called energy consumption) per m² that is required by the building over the course of a year. In this document the floor area (m²) is the 'treated floor area' unless otherwise stated. This includes regulated (heating, hot water, ventilation and lighting) and unregulated (plug loads). EUI is independent of PV generation (e.g. regardless of how much PV generation is attributed to the building the EUI is the same).

Semi-detached - LETI best practice constrained retrofit

	Targets	Achieved in example
Fossil fuel free	Fossil fuel free home	Fossil fuel free home
Space heating demand	60 (50+10) kWh/m²/yr	51 kWh/m²/yr
Hot water demand	20 kWh/m²/yr	20 kWh/m²/yr
Energy Use Intensity	60 (50+10) kWh/m²/yr	60 kWh/m²/yr
Renewable energy	40% of roof covered in PV	40% of rooftop covered in PV

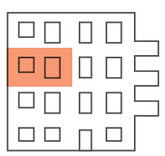


Detached - LETI best practice constrained retrofit

	Targets	Achieved in example
Fossil fuel free	Fossil fuel free home	Fossil fuel free home
Space heating demand	60 (50+10) kWh/m²/yr	55 kWh/m²/yr
Hot water demand	20 kWh/m²/yr	14 kWh/m²/yr
Energy Use Intensity	60 (50+10) kWh/m²/yr	58 kWh/m²/yr
Renewable energy	40% of roof covered in PV	No PV

Mid-terrace - LETI best exemplar retrofit

	Targets	Achieved in example
Fossil fuel free	Fossil fuel free home	Fossil fuel free home
Space heating demand	20 kWh/m²/yr	16 kWh/m²/yr
Hot water demand	20 kWh/m²/yr	20 kWh/m²/yr
Energy Use Intensity	40 kWh/m²/yr	40 kWh/m²/yr
Renewable energy	40% of roof covered in PV	40% of rooftop covered in PV



Flat - LETI best practice unconstrained retrofit

	Targets	Achieved in example
Fossil fuel free	Fossil fuel free home	Fossil fuel free home
Space heating demand	50 kWh/m²/yr	26 kWh/m²/yr
Hot water demand	25 (20+5) kWh/m²/yr	24 kWh/m²/yr
Energy Use Intensity	50 kWh/m²/yr	49 kWh/m²/yr
Renewable energy	40% of roof covered in PV	No PV

Figure 4.6 - Typical house archetypes from the stock model showing what could be achieved

Semi-detached example

Best practice constrained retrofit

Based on average UK building stock

Archetype data from model

Areas

Treated floor area	100 m²
Heat loss floor	48 m²
Roof	46 m²
External Walls	89 m²
Single Glazing	4 m²
Double Glazing	16 m²

Occupants

Adult Occupiers	2
Child Occupiers	1

Related case study

Zetland Road, Manchester

Deep retrofit of a semi-detached home originally constructed in 1894.

SIGNPOST *Chapter 6 - Zetland Road case study*

Energy targets

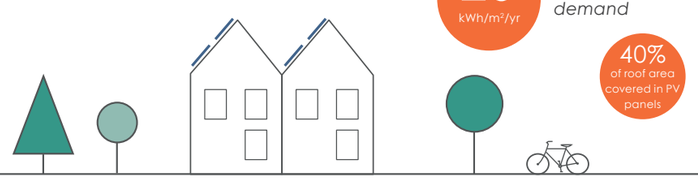
Fossil fuel free home

60 kWh/m²/yr — *Energy Use Intensity (EUI) over treated floor Area (TFA) (constrained)*

Space heating demand (constrained) 60 kWh/m²/yr

20 kWh/m²/yr — *Hot water demand*

40% of roof area covered in PV panels



Existing specification

Fabric

		Existing
Walls	Solid uninsulated walls	1.35 W/m².K
Floors	Uninsulated suspended timber floors	1.00 W/m².K
Roof	Minimal loft insulation	1.00 W/m².K
Glazing	Single glazing	4.80 W/m².K
	Double glazing	2.00 W/m².K
Air Tightness	Leaky building	11.50 ach@50Pa
Thermal Bridging	High thermal bridging	0.20 W/m.K

Systems

Space heating
Gas

Ventilation
Natural
(with extract fans)

Hot Water

Shower Use	35.5 litres/person/day
Other Uses	15 litres/person/day
Tank Insulation	3.0 W/K
Pipe Insulation	0% *(percentage of the overall primary pipe length (heat source to heat store) that is insulated)*

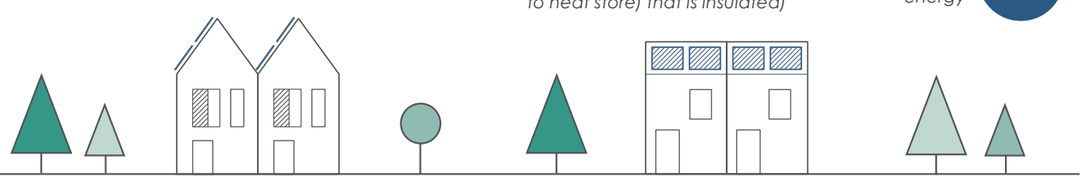
Pre-retrofit

240 kWh/m²/yr — *Energy Use Intensity (EUI) over Treated Floor Area (TFA) (89% efficient gas boiler)*

Space heating demand 168 kWh/m²/yr

38 kWh/m²/yr — *Hot water demand*

Renewable energy No PV



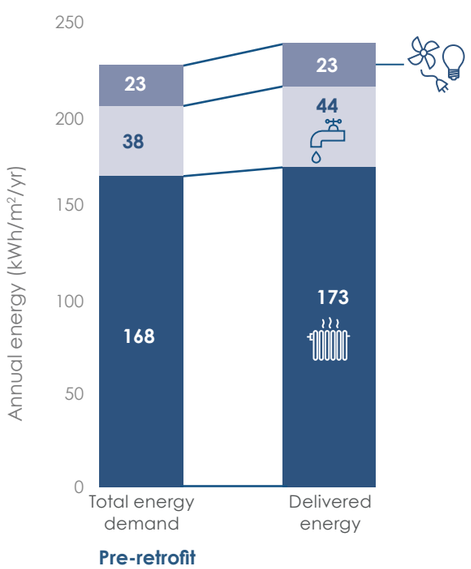
Retrofit improvements

Total energy demand the space heating demand; hot water demand; and the electricity required for lights, ventilation and plug loads.

Delivered energy refers to the energy consumed by the building for heating, hot water and electricity. It is called Energy Use Intensity when divided by the floor area of the building.

SIGNPOST

Annex A: How do our homes produce carbon?



Final specification

Fabric

		Best practice: Unconstrained	Best practice: Constrained	Exemplar
Walls	Internal wall insulation	0.18 W/m².K	0.32 W/m².K	0.15 W/m².K
Floors	Insulated between joists	0.18 W/m².K	0.20 W/m².K	0.15 W/m².K
Roof	Additional loft insulation	0.12 W/m².K	0.12 W/m².K	0.12 W/m².K
Glazing	Replace glazing	1.00 W/m².K	1.30 W/m².K	0.8 W/m².K
Air Tightness	Draught-proofing and sealing	2.00 ach@50Pa	3.00 ach@50Pa	1.0 ach@50Pa
Thermal Bridging	Mitigated	0.10 W/m.K	0.10 W/m.K	0.08 W/m.K

Underlined values have been used to achieve the post-retrofit EUI and space heating demand

Systems

Space heating
ASHP

Ventilation
MVHR

Renewables

Photovoltaics
40% of rooftop fitted with PV

40% of roof area covered in PV panels

Hot water

Use of low flow fittings and improved insulation

Shower use	16 litres/person/day
Other uses	9 litres/person/day
Tank insulation	1.5 W/K
Pipe insulation	90% *(percentage of the overall primary pipe length (heat source to heat store) that is insulated)*

Post-retrofit

60 kWh/m²/yr — *Energy Use Intensity (EUI) over treated floor area (TFA)*

Fossil fuel free home — *(0% from gas/ fossil fuel)*

51 kWh/m²/yr — *Space heating demand*

20 kWh/m²/yr — *Hot water demand*

Detached example

Best practice constrained retrofit

Based on average UK building stock

Archetype data from model

Areas

Treated floor area	172 m²
Heat loss floor	83 m²
Roof	78 m²
External Walls	162 m²
Single Glazing	12 m²
Double Glazing	25 m²

Occupants

Adult Occupiers	2
Child Occupiers	1

Related case study

The Nook, Brighton

Deep retrofit of a detached, 6 bedroom home "hard to treat" home.

SIGNPOST *Chapter 6 - The Nook case study*

Energy targets

Fossil fuel free home

60 kWh/m²/yr — *Energy Use Intensity (EUI) over treated floor Area (TFA) (constrained)*

Space heating demand (constrained) 60 kWh/m²/yr

20 kWh/m²/yr — *Hot water demand*

40% of roof area covered in PV panels

Existing specification

Fabric

		Existing
Walls	Solid uninsulated walls	1.35 W/m².K
Floors	Uninsulated solid floors	0.80 W/m².K
Roof	Minimal loft insulation	1.00 W/m².K
Glazing	Single glazing	4.80 W/m².K
	Double glazing	2.00 W/m².K
Air Tightness	Leaky building	11.50 ach@50Pa
Thermal Bridging	High thermal bridging	0.20 W/m.K

Systems

Space heating
Gas

Ventilation
Natural
(with extract fans)

Hot Water

Shower Use	35.5 litres/person/day
Other Uses	15 litres/person/day
Tank Insulation	3.0 W/K
Pipe Insulation	0% *(percentage of the overall primary pipe length (heat source to heat store) that is insulated)*

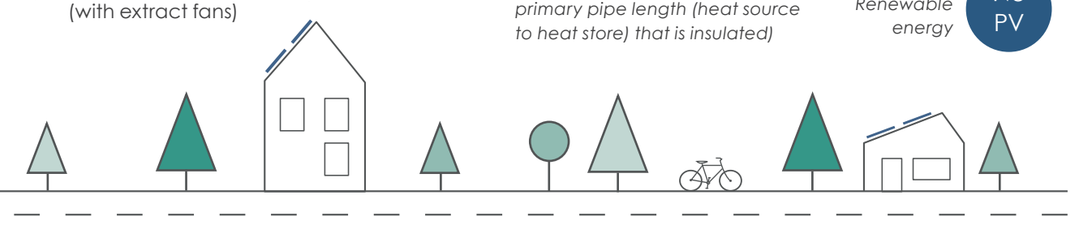
Pre-retrofit

216 kWh/m²/yr — *Energy Use Intensity (EUI) over Treated Floor Area (TFA) (89% efficient gas boiler)*

Space heating demand 167 kWh/m²/yr

27 kWh/m²/yr — *Hot water demand*

Renewable energy No PV



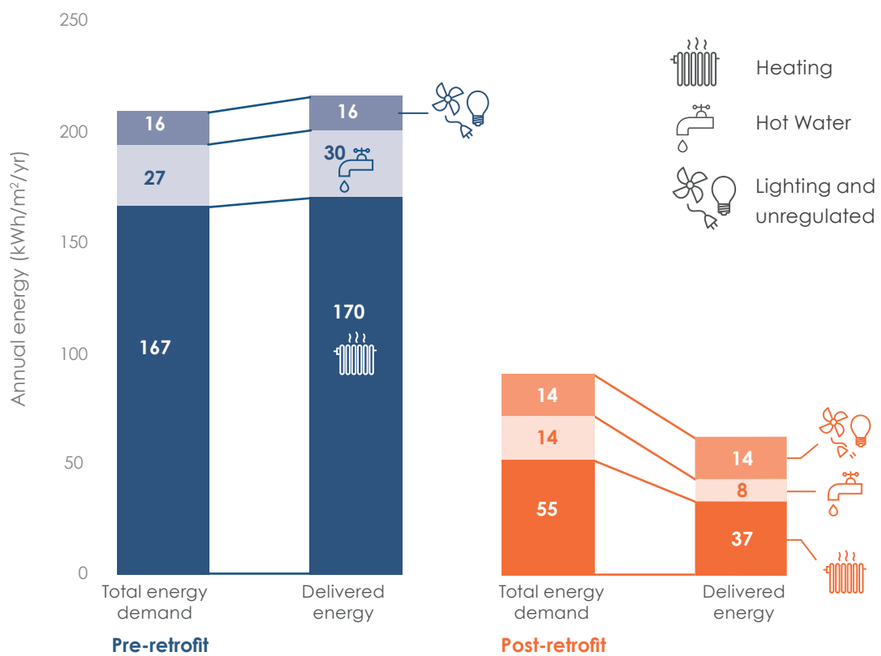
Retrofit improvements

Total energy demand the space heating demand; hot water demand; and the electricity required for lights, ventilation and plug loads.

Delivered energy refers to the energy consumed by the building for heating, hot water and electricity. It is called Energy Use Intensity when divided by the floor area of the building.

SIGNPOST

Annex A: How do our homes produce carbon?



Final specification

Fabric

		Best practice: Unconstrained	Best practice: Constrained	Best practice: Exemplar
Walls	Internal wall insulation	0.18 W/m².K	0.32 W/m².K	0.15 W/m².K
Floors	No action	0.18 W/m².K	0.80 W/m².K	0.15 W/m².K
Roof	Additional loft insulation	0.12 W/m².K	0.12 W/m².K	0.12 W/m².K
Glazing	Replace glazing	1.00 W/m².K	1.30 W/m².K	0.8 W/m².K
Air Tightness	Draught-proofing and sealing	2.00 ach@50Pa	3.00 ach@50Pa	1.0 ach@50Pa
Thermal Bridging	Mitigated	0.10 W/m.K	0.10 W/m.K	0.08 W/m.K

Underlined values have been used to achieve the post-retrofit EUI and space heating demand

Systems

Space heating
ASHP

Ventilation
MVHR

Renewables

Photovoltaics
None

No PV

Hot water

Use of low flow fittings and improved insulation

Shower use	16 litres/person/day
Other uses	9 litres/person/day
Tank insulation	1.5 W/K
Pipe insulation	90% *(percentage of the overall primary pipe length (heat source to heat store) that is insulated)*

Post-retrofit

58 kWh/m²/yr — *Energy Use Intensity (EUI) over treated floor area (TFA)*

Fossil fuel free home

(0% from gas/ fossil fuel)

55 kWh/m²/yr — *Space heating demand*

14 kWh/m²/yr — *Hot water demand*

Mid-terrace example

Exemplar retrofit

Based on average UK building stock

Archetype data from model

Areas

Treated floor area	85 m²
Heat loss floor	41 m²
Roof	40 m²
External Walls	49 m²
Single Glazing	1 m²
Double Glazing	13 m²

Occupants

Adult Occupiers	2
Child Occupiers	1

Related case study

Haddington Way, Aylesbury

A comprehensive retrofit for a row of terraced homes.

SIGNPOST *Chapter 6 - Haddington Way case study*

Energy targets

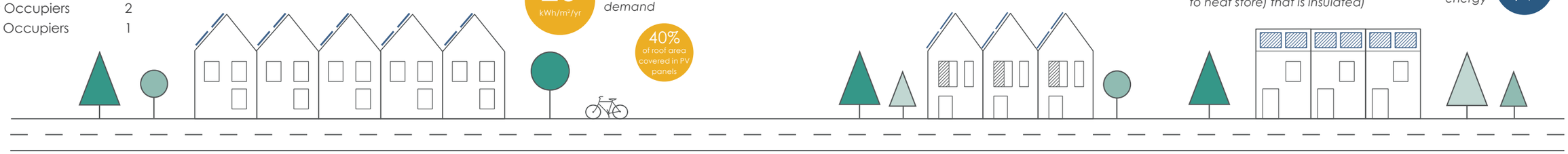
Fossil fuel free home

40 kWh/m²/yr — *Energy Use Intensity (EUI) over treated floor Area (TFA) (exemplar)*

Space heating demand (exemplar) 20 kWh/m²/yr

20 kWh/m²/yr — *Hot water demand*

40% of roof area covered in PV panels



Existing specification

Fabric

		Existing
Walls	Cavity uninsulated walls	1.00 W/m².K
Floors	Uninsulated solid floors	0.35 W/m².K
Roof	Minimal loft insulation	1.00 W/m².K
Glazing	Single glazing	4.80 W/m².K
	Double glazing	2.00 W/m².K
Air Tightness	Leaky building	11.50 ach@50Pa
Thermal Bridging	High thermal bridging	0.20 W/m.K

Systems

Space heating
Gas

Ventilation
Natural
(with extract fans)

Hot Water

Shower Use	35.5 litres/person/day
Other Uses	15 litres/person/day
Tank Insulation	3.0 W/K
Pipe Insulation	0% *(percentage of the overall primary pipe length (heat source to heat store) that is insulated)*

Pre-retrofit

212 kWh/m²/yr — *Energy Use Intensity (EUI) over Treated Floor Area (TFA) (89% efficient gas boiler)*

Space heating demand 110 kWh/m²/yr

41 kWh/m²/yr — *Hot water demand*

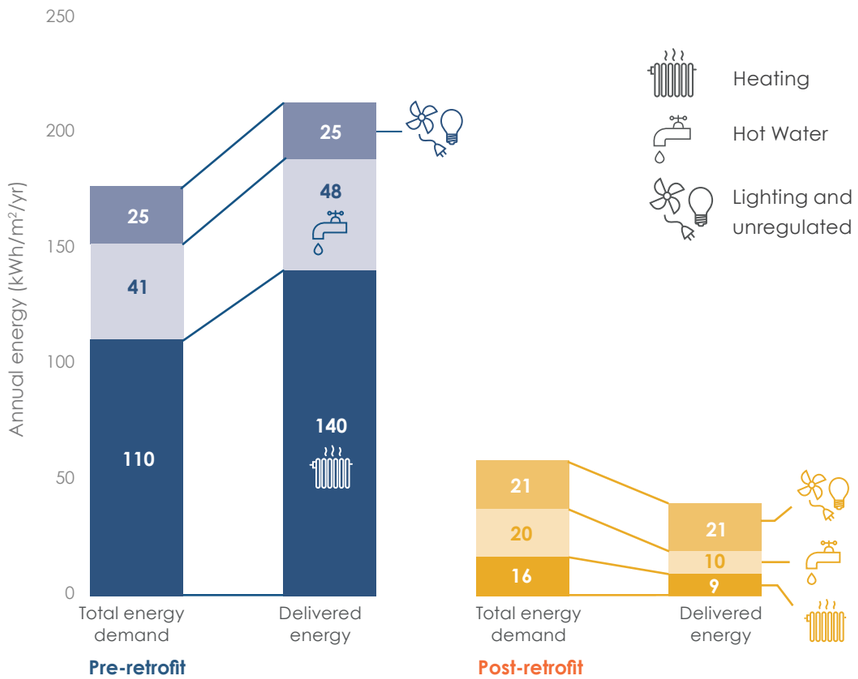
Renewable energy No PV

Retrofit improvements

Total energy demand the space heating demand; hot water demand; and the electricity required for lights, ventilation and plug loads.

Delivered energy refers to the energy consumed by the building for heating, hot water and electricity. It is called Energy Use Intensity when divided by the floor area of the building.

SIGNPOST *Annex A: How do our homes produce carbon?*



Final specification

Fabric

		Best practice: Unconstrained	Best practice: Constrained	Best practice: Exemplar
Walls	Cavity and external insulation	0.18 W/m².K	0.32 W/m².K	0.15 W/m².K
Floors	Insulate below new screed	0.18 W/m².K	0.20 W/m².K	0.15 W/m².K
Roof	Additional loft insulation	0.12 W/m².K	0.12 W/m².K	0.12 W/m².K
Glazing	Replace glazing	1.00 W/m².K	1.30 W/m².K	0.8 W/m².K
Air Tightness	Draught-proofing and sealing	2.00 ach@50Pa	3.00 ach@50Pa	1.0 ach@50Pa
Thermal Bridging	Mitigated	0.10 W/m.K	0.10 W/m.K	0.08 W/m.K

Underlined values have been used to achieve the post-retrofit EUI and space heating demand

Systems

Space heating
ASHP

Ventilation
MVHR

Renewables

Photovoltaics
40% of rooftop fitted with PV

40% of roof area covered in PV panels

Hot Water

Use of low flow fittings and improved insulation

Shower use	16 litres/person/day
Other uses	9 litres/person/day
Tank insulation	1.5 W/K
Pipe insulation	90%

(percentage of the overall primary pipe length (heat source to heat store) that is insulated)

Post-retrofit

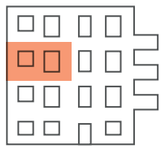
40 kWh/m²/yr — *Energy Use Intensity (EUI) over treated floor area (TFA)*

Fossil fuel free home — *(0% from gas/ fossil fuel)*

20 kWh/m²/yr — *Space heating demand*

16 kWh/m²/yr — *Hot water demand*

Flat example



Best practice unconstrained retrofit

Based on average UK building stock

Archetype data from model

Areas

Treated floor area	73 m²
Heat loss floor	34 m²
Roof	18 m²
External Walls	48 m²
Single Glazing	1 m²
Double Glazing	10 m²

Occupants

Adult Occupiers	1
Child Occupiers	1

Related case study

Wilmcote House, Portsmouth

Retrofit of an existing 11 storey housing estate with residents in occupation.

SIGNPOST *Chapter 6 - Wilmcote House case study*

Energy targets

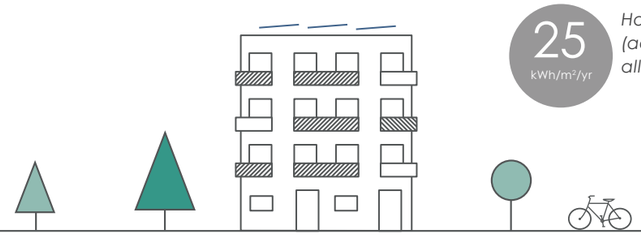
Fossil fuel free home

50 kWh/m²/yr — *Energy Use Intensity (EUI) over treated floor Area (TFA) (unconstrained)*

Space heating demand (unconstrained) 50 kWh/m²/yr

25 kWh/m²/yr — *Hot water demand (additional allowance)*

40% of roof area covered in PV panels



Existing specification

Fabric

		Existing
Walls	Insulated cavity walls	0.43 W/m².K
Floors	Uninsulated solid floors	0.35 W/m².K
Roof	Minimal loft insulation	1.00 W/m².K
Glazing	Single glazing	4.80 W/m².K
	Double glazing	2.00 W/m².K
Air Tightness	Leaky building	11.50 ach@50Pa
Thermal Bridging	High thermal bridging	0.20 W/m.K

Systems

Space heating
Gas

Ventilation
Natural
(with extract fans)

Hot Water

Shower Use	35.5 litres/person/day
Other Uses	15 litres/person/day
Tank Insulation	3.0 W/K
Pipe Insulation	0% *(percentage of the overall primary pipe length (heat source to heat store) that is insulated)*

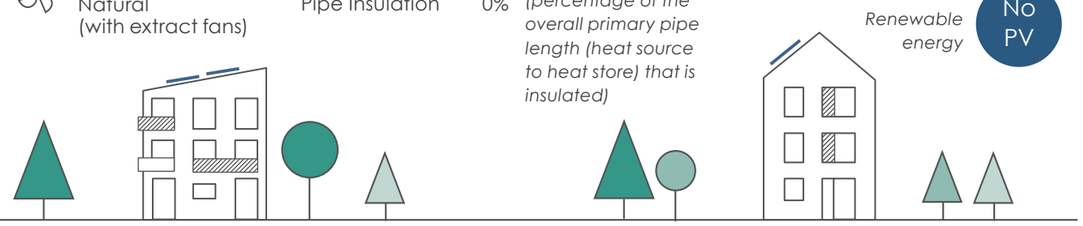
Pre-retrofit

203 kWh/m²/yr — *Energy Use Intensity (EUI) over Treated Floor Area (TFA) (89% efficient gas boiler)*

Space heating demand 118 kWh/m²/yr

46 kWh/m²/yr — *Hot water demand*

Renewable energy No PV



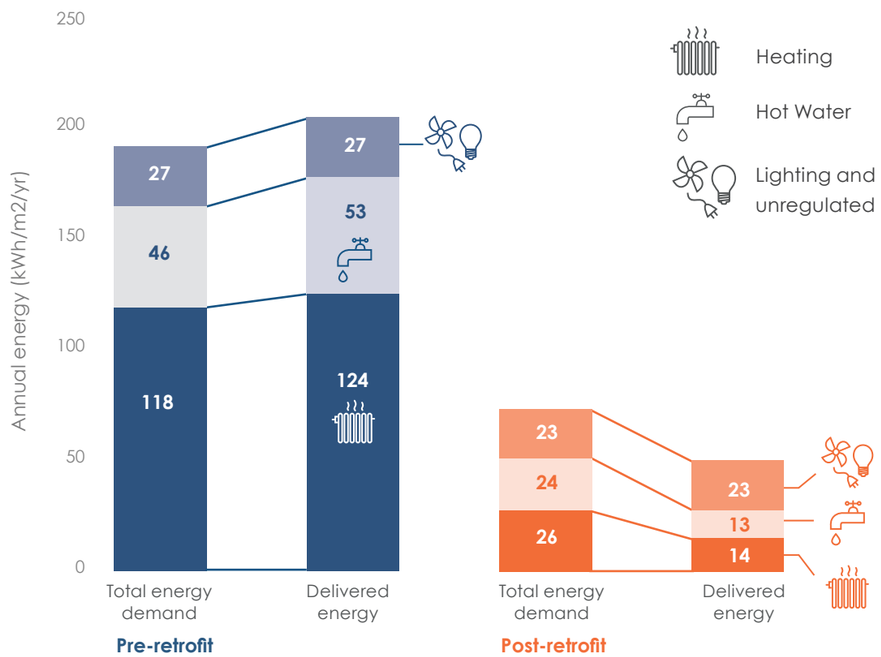
Retrofit improvements

Total energy demand the space heating demand; hot water demand; and the electricity required for lights, ventilation and plug loads.

Delivered energy refers to the energy consumed by the building for heating, hot water and electricity. It is called Energy Use Intensity when divided by the floor area of the building.

SIGNPOST

Annex A: How do our homes produce carbon?



Final specification

Best practice

Fabric

		Unconstrained	Constrained	Exemplar
Walls	External wall insulation	0.18 W/m².K	0.32 W/m².K	0.15 W/m².K
Floors	Insulated below new screed	0.18 W/m².K	0.80 W/m².K	0.15 W/m².K
Roof	Additional loft insulation	0.12 W/m².K	0.12 W/m².K	0.12 W/m².K
Glazing	Replace glazing	1.00 W/m².K	1.30 W/m².K	0.8 W/m².K
Air Tightness	Draught-proofing and sealing	2.00 ach@50Pa	3.00 ach@50Pa	1.0 ach@50Pa
Thermal Bridging	Mitigated	0.10 W/m.K	0.10 W/m.K	0.08 W/m.K

Underlined values have been used to achieve the post-retrofit EUI and space heating demand

Systems

Space heating
ASHP

Ventilation
MVHR

Renewables

Photovoltaics
None

No PV

Hot Water

Use of low flow fittings and improved insulation

Shower use	16 litres/person/day
Other uses	9 litres/person/day
Tank insulation	1.5 W/K
Pipe insulation	90% *(percentage of the overall primary pipe length (heat source to heat store) that is insulated)*

Post-retrofit

49 kWh/m²/yr — *Energy Use Intensity (EUI) over treated floor area (TFA)*

Fossil fuel free home

(0% from gas/ fossil fuel)

26 kWh/m²/yr — *Space heating demand*

24 kWh/m²/yr — *Hot water demand*