

GGF – FHS, SAP, HEM

Elmhurst Energy



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Agenda

- ❖ Background
- ❖ Future Homes Standard
- ❖ Home Energy Model
- ❖ SAP 10.3
- ❖ Q + A





Background

Policy Landscape

- UK set legally binding Net Zero target by 2050. Net Zero Strategy published 19th October 2021.
- Cost of living crisis, general election, 1.5 million homes...
- CCC 'UK Housing fit for the Future?' report suggested various changes to regulations and energy rating methodology
- Homes being built now must be future proofed for low carbon heat as will still exist in 2050.
- "The Government believes that by improving energy efficiency and moving to cleaner sources of heat, we can reduce carbon emissions and keep energy costs for consumers down now and in the future."*

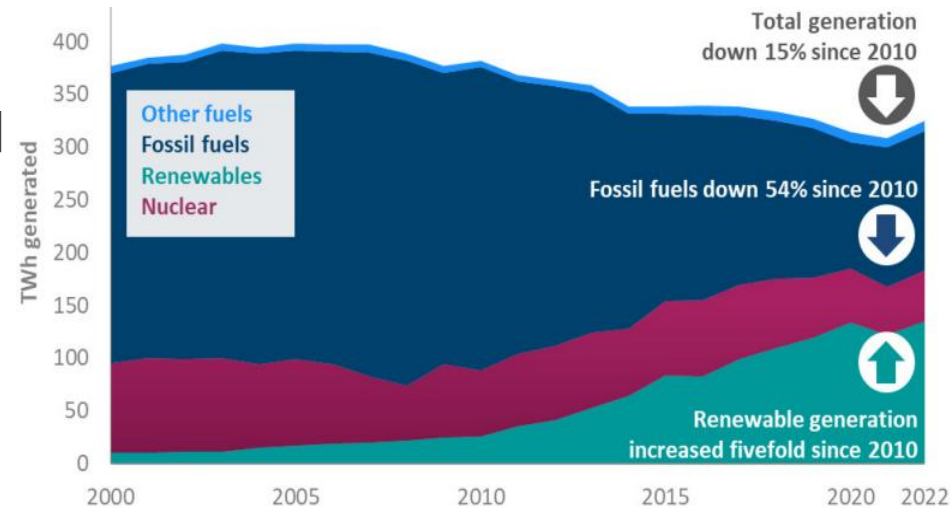


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A decarbonizing grid

- The electricity grid continues to decarbonise.
- Renewable sources accounted for 41.5% (+2%) of generation in 2022.
- Wind accounted for 24.7% alone.
- The share of generation from fossil fuels fell to 40.8% (-1.8%).

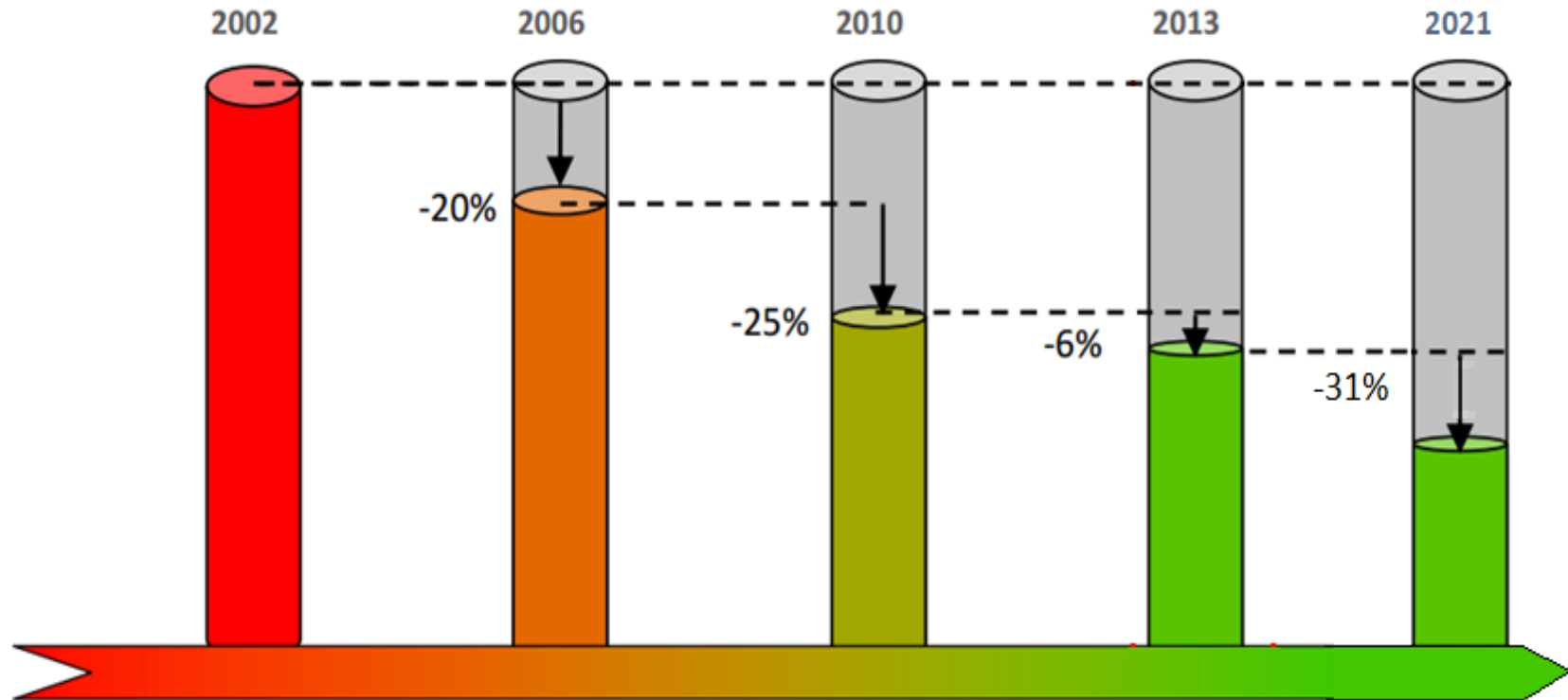




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Reducing Carbon Emissions



Part L 2021 - Recap

- ❖ SAP 10, Part F, L, O 2021 issued on 15th December 2021, commenced 15th June 2022.
- ❖ SAP 10 specification and test cases incomplete and contained errors.
- ❖ Test cases for certain technologies not ready until after commencement of regulations.
- ❖ Many test cases deferred leaving gaps in testing process.
- ❖ BREL engine/report format not delivered to schemes until April 2022.
- ❖ Further changes to methodology for diverter savings, existing heat networks implemented late 2022.

The rest of the UK?

- Each devolved administration controls energy efficiency Building Regulations/Standards;

Wales

- Part L 2025 consultation responses published February 2026.
- Confirmed Part L 2025 to be released spring/summer 2026 and implemented 4th March 2027.
- Will use SAP 10.3 until HEM ready.

Scotland

- Section 6 2022 commenced 1st December 2022.
- 'Passivhaus equivalent' consultation in Autumn 2024.
- Further revision expected 2028

Northern Ireland

- Technical Booklet F commenced 30th June 2022.
- In 2023 consulted on next change.
- Further revision expected 2026.



The Future Homes Standard



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First Consultation

First Consultation

- First consultation from DLUHC ran from 1st October 2019 to 7th February 2020.
- Set the aim for Part L in 2025, with an interim uplift in 2020 proposed.
- Received over 3300 responses; a record for a Part L consultation





“

By 2025 homes to be future proofed with low carbon heating and world leading levels of energy efficiency.

A new home built to Future Homes Standard in 2025 was to have 75-80% lower carbon emissions than Part L 2013.

”

CHRISTOPHER PINCHER MP
DLUHC

Second Consultation

Second Consultation

- ❖ Second consultation launched 13th December 2023.
- ❖ Ran to 27th March 2024.
- ❖ Covers Phase 3 on the timeline – finer detail of the specification.
- ❖ Government published responses on 24th March 2026.





“ *These standards will be in line with meeting our 2050 net zero target and will mean no further work will be needed for new buildings to produce zero carbon emissions as the electricity grid decarbonises* ”

FHS CONSULTATION 2023

Introducing Part L 2026

Aka The Future Homes Standard

- Released 24th March 2026.
- New Approved Documents;
 - AD F 2026 - Ventilation
 - AD L 2026 Volume 1 – Dwellings
 - AD L 2026 Volume 2 – Non dwellings
- Name change to “Energy and Greenhouse Gas Emissions”.
- FHS & HEM:FHS consultation responses published.



FHS released

SAP 10.3 available

**March
2026**

**March
2027**

FHS commences for HRBs

Transitional arrangements
commence for HRBs

**Sept
2027**

**March
2028**

Transitional arrangements end for HRBs

New
applications
subject to FHS

**Sept
2028**

FHS commences for non HRBs

Transitional arrangements
commence for non HRBs

Transitional arrangements end for non HRBs

New
applications
subject to FHS

Performance Standards

Performance Standards recap

- Part L 2021 was an interim step towards FHS.
- FHS goal is to reduce carbon emissions over Part L 2013 by 75-80%.
- FHS consultation proposed two uplift options for new homes.
- Focus on decarbonisation of heating but need to ensure fuel bills do not increase.



Notional Dwelling - Fabric

	Part L 2021	Part L 2026 (FHS)
Floor (w/m ² k)		0.13
Wall (w/m ² k)		0.18
Roof (w/m ² k)		0.11
Door (w/m ² k)		1
Window (w/m ² k)	u-1.2, g-0.63	u-1.2, g-same as actual
Thermal Bridging	y-0.05/Table R2 SAP 10	
Airtightness	5 m ³ /m ² /hr @ 50 Pa	4 m ³ /m ² /hr @ 50 Pa



Notional Dwelling - Services

	Part L 2021	Part L 2026 (FHS)
Ventilation	Natural with intermittent fans	Continuous dMEV, 0.15 w/l/s
Cooling	None	If none in actual dwelling or cooling present but not due to Part O then none. If 'Active cooling needed for Part O?' indicated then; SEER 5.1 Cooled area same as actual dwelling
Lighting	Fixed lighting capacity (lm) = 185 x TFA, 80 l/w	Fixed lighting capacity (lm) = 1139 x (TFA x N) ^{0.39} , 120 l/w

Notional Dwelling - Services

	Part L 2021	Part L 2026 (FHS)
Space + Water Heating	Mains gas boiler 89.5% efficiency, radiators, 55°C flow temp., central heating pump 2013 or later, in heated space If existing heat network – same as actual dwelling	If single dwelling heating system or unsleeved heat network - individual Air Source Heat Pump with SCOP of 2.5. If sleeved heat network – same as actual dwelling If communal heating system – Communal heat pump, 300% efficient, distribution loss factor 1.15.
Hot Water Cylinder	$\text{Loss} = 0.85 \times (0.2 + 0.051 V^{2/3}) \text{ kWh/day}$	$\text{Loss} = 0.85 \times (0.2 + 0.051 V^{2/3}) \text{ kWh/day}$
HIU	If existing heat network – HIU data is obtained from PCDB entry 400001. Otherwise, not applicable.	Where the sleeved heat network approach or communal heating system for heating and/or water heating is used, HIU data is obtained from PCDB entry 400011. Otherwise, not applicable.
WWHRS	Y - 36% recovery efficiency	No for single storey dwellings Yes for >1 storey dwellings - 50% recovery efficiency



Notional Dwelling - Services

	Part L 2021	Part L 2026 (FHS)
PV	For houses kWp = 40% of ground floor area, including unheated spaces / 6.5 For flats and maisonettes kWp = 40% of dwelling floor area / (6.5 x number of storeys in block) Orientation - SE/SW, 45° pitch. Overshading is 'none' Connected to dwelling's meter for houses Not connected to the dwellings meter for flats Export-capable meter present	None if no PV on actual dwelling. If PV present on actual dwelling, same kWp as actual dwelling up to; For houses kWp = 40% of ground floor area, including unheated spaces / 4.5 For flats and maisonettes kWp = 40% of dwelling floor area / (4.5 x number of storeys in block) Orientation, pitch and overshading - same as actual building Connected to dwelling's meter for houses Not connected to the dwellings meter for flats Export-capable meter present

Heating Source



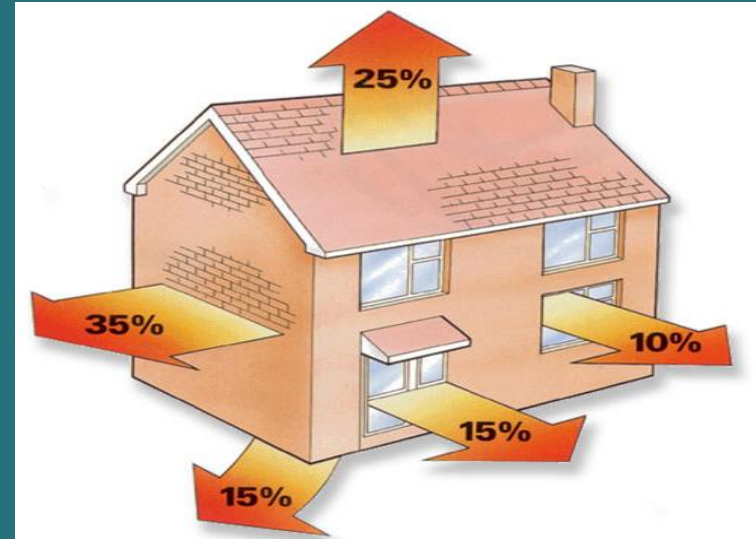
- These changes will result in heat pumps being the main heating technology in new homes.
- Heat networks will also have an important role due to the ability to integrate low carbon heating.
- *“We found no practical way to allow the installation of fossil fuel boilers while also delivering significant carbon savings and ‘zero-carbon ready’ homes.”*
- *“We do not expect fossil fuel heating, such as gas, hybrid heat pumps and hydrogen-ready boilers, will meet these standards.”*

Minimum fabric standards



Fabric Standards

- ❖ In Part L 2021 minimum fabric standards were uplifted from Part L 2013.
- ❖ The retention of the FEES metric and uplift of whole dwelling standards also led to an improvement in fabric performance.
- ❖ For FHS there are no changes to the minimum fabric standards for new homes.



Minimum Standards for Fabric Performance

External walls	0.26 w/m ² k
Party walls	0.2 w/m ² k
Floors	0.18 w/m ² k
Roofs	0.16 w/m ² k
Windows (inc. Roof windows)	1.6 w/m ² k
Rooflights	2.2 w/m ² k
Doors	1.6 w/m ² k
Airtightness	8.0 m ³ /m ² /hr @ 50Pa or 1.57 m ³ /m ² /hr @ 4Pa

Window and Door U-values

- Part L 2021 allows the U-value of a window or door to be determined using standard sizes and configurations.
- In FHS u-value of windows and doors in new homes should be calculated using either;
 - the actual size and configuration of the window or door BS EN ISO 10077-1/10077-2, or
 - measured using the hot box method in BS EN ISO 12567-1/12567-2
- Not possible to use standard sizes or configurations; every unit configuration will need an individual u-value to be calculated.
- Will result in an increase in u-value modelling/testing for different window sizes and configurations.
- Windows and doors in existing homes can continue using the previous method.

Window and Door U-values

Part L 2021;

4.2 The **U-value** of a window should be assessed using one of the following methods.

- Calculated using the actual size and configuration of the window.
- Calculated for a standard window 1.23m ($\pm 25\%$) wide $\times$ 1.48m (-25%) high and the actual configuration of the window.
- Calculated for a standard window 1.23m ($\pm 25\%$) wide $\times$ 1.48m (-25%) high and one of the following standard configurations.
 - For a casement window, a central vertical divider with one opening light and one fixed light.
 - For a vertical sliding sash window, a central horizontal divider with two opening lights.
 - For a **roof window**, no divider.
- Measured using the hot-box method as set out in **BS EN ISO 12567-1** for windows and **BS EN ISO 12567-2** for **roof windows**.

Part L 2026;

New dwellings

3.2 For new **dwellings**, the **U-value** of a window or door should be determined using one of the following.

- Measured using the hot-box method set out in **BS EN ISO 12567-1** for windows and in **BS EN ISO 12567-2** for **roof windows**.
- Calculated using the actual size and configuration of the window in line with **BS EN ISO 10077-1** and **BS EN ISO 10077-2**.

3.3 For new **dwellings**, determination of a window or door **U-value** is to *include* all of the following where present.

- Actual frame sections, e.g. different width outer frames.
- Sills/thresholds.
- Add-ons/frame extenders (any additional non-structural element that extends the size of the frame), e.g. 15mm, 30mm etc.
- Dummy sashes (non-opening sash/vent fixed in place)
- Dummy transoms/mullions
- Decorative glazing bars within the glazing unit cavity, e.g. Georgian bars/duplex, both internal.
- Non dead-load-bearing coupling components, e.g. PVC H-coupler.

For new **dwellings**, determination of a window or door **U-value** is to *exclude* the following where present.

- Any dead-load-bearing component items, e.g. bay poles.

SAP and HEM

- In 2023 the Government consulted on replacing SAP with the Home Energy Model (HEM).
- HEM is a brand new methodology, not a revision of SAP.
- Since the consultations Government have been developing HEM, but not yet completed.
- Concerns over a hard switch from SAP to HEM raised by industry stakeholders.
- HEM still under development by MHCLG/DESNZ/Sustenic.

- On 14th May 2025 MHCLG announced both the Home Energy Model and SAP could be used to demonstrate compliance with the Future Homes Standard.
- On 10th February 2026 MHCLG confirmed Future Homes Standard would be released in Q1 with only SAP 10.3 to be used to demonstrate compliance.**
- SAP 10.3 is a modified version of the current SAP methodology.
- Will provide a smoother transition to the Future Homes Standard whilst the industry adjusts to the Home Energy Model.
- Initially applies in England. Wales will also adopt SAP 10.3 in future.
- The intent is still for Home Energy Model to replace SAP when it is fully ready.

SAP to HEM Transition

- The FHS consultation responses confirmed the following transition;
 - At least 3 months after the FHS is released (24th March 2026) that HEM will be ready and become an approved methodology for the FHS.
 - From then at least a two year dual running period will begin where SAP and HEM can be used for the FHS.
 - Towards the end of the dual running period MHCLG will give a six month notice that HEM will be taking over from SAP.
 - At the end of the six month period any uncommenced plots must be assessed on HEM

Estimated Timeline

HEM Approved

> 3 months later HEM
Methodology approved,
dual running commences

Notice of end of dual running

Government signals HEM
to take over with at least
six months notice

HEM only transition ends

HEM must be
used for new
work

**March
2026**

**Mid
2026**

**March
2027**

**Late
2027**

**March
2028**

**Early
2029**

FHS released

SAP 10.3 available

FHS commences

FHS commences within
Building Regulations

Transitional arrangements
commence

Transitional arrangements end

HEM only transition begins

Work that commences can use
SAP 10.3

What is SAP 10.3?

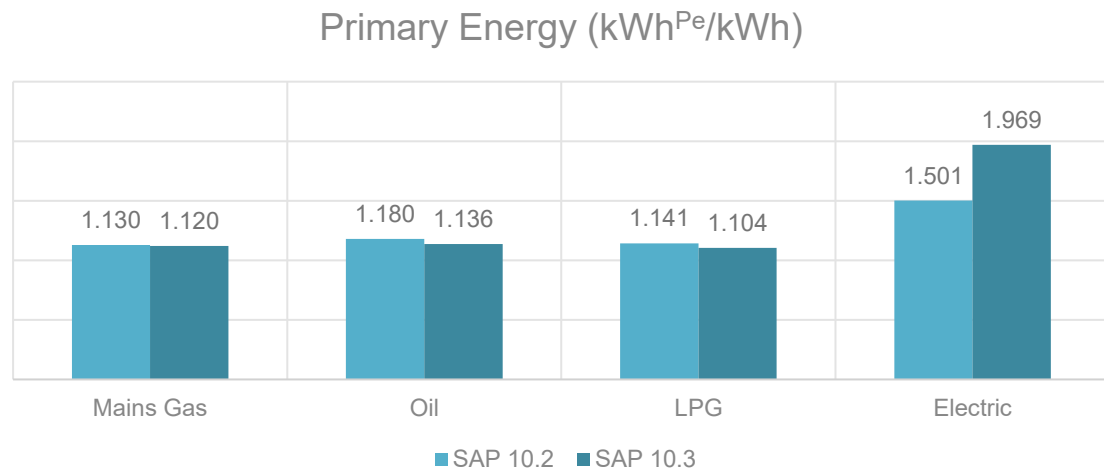
- On 14th May MHCLG announced both the Home Energy Model and SAP could be used to demonstrate compliance with the Future Homes Standard.
- SAP 10.3 is a modified version of the current SAP methodology.
- Will provide a smoother transition to the Future Homes Standard whilst the industry adjusts to the Home Energy Model.
- The intent is still for Home Energy Model to replace SAP when it is 'fully ready' but details of the transition are still being determined.

What is new in SAP 10.3?

- No changes to core calculation engine.
- New notional dwelling to set the compliance metrics for Future Homes Standard.
- New Carbon and Primary Energy factors for fuels (SAP Table 12).
- New Cooling & Heat Network fields.

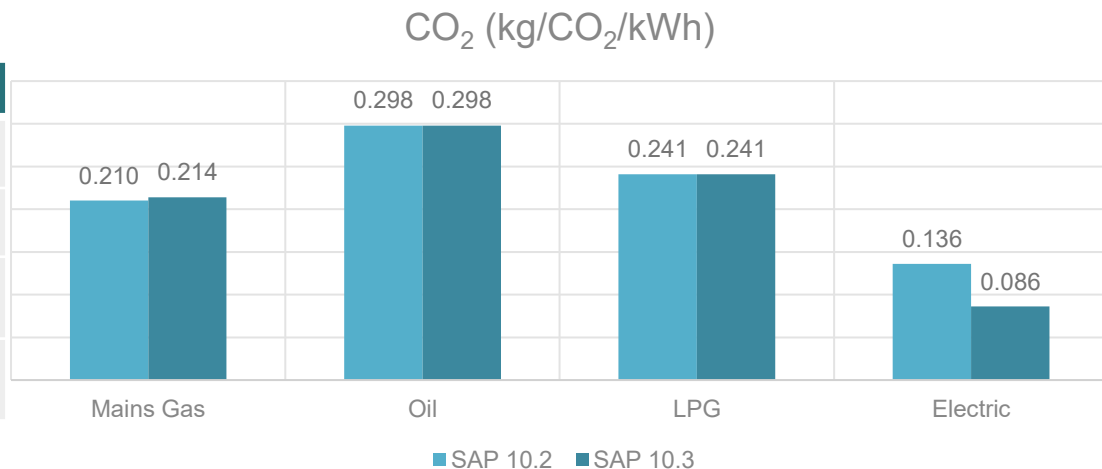
Primary Energy Factors – SAP 10.3

Fuel	SAP 10.2	SAP 10.3
Mains Gas	1.130	1.120
Oil	1.180	1.136
LPG	1.141	1.104
Electricity	1.501	1.969



Carbon Factors - SAP 10.3

Fuel	SAP 10.2	SAP 10.3
Mains Gas	0.210	0.214
Oil	0.298	0.298
LPG	0.241	0.241
Electricity	0.136	0.086



Openings

- ❧ Opening Types
- ❧ Opening Types Data Fields
- ❧ Entering Openings

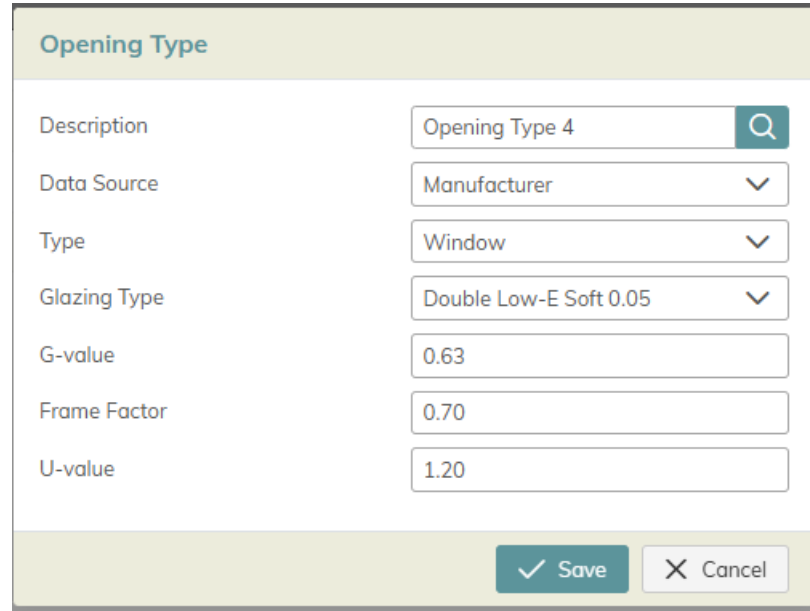


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Opening Types

- “Opening Types” are set-up first.
- Data sources are;
 - SAP table – will assign a conservative u-value/g-value based on characteristics of the opening.
 - Manufacturer – where data is provided for the whole unit from the manufacturer.
 - BFRC, BSI or CERTASS data – where the unit is assessed against the Window Energy Rating scheme.



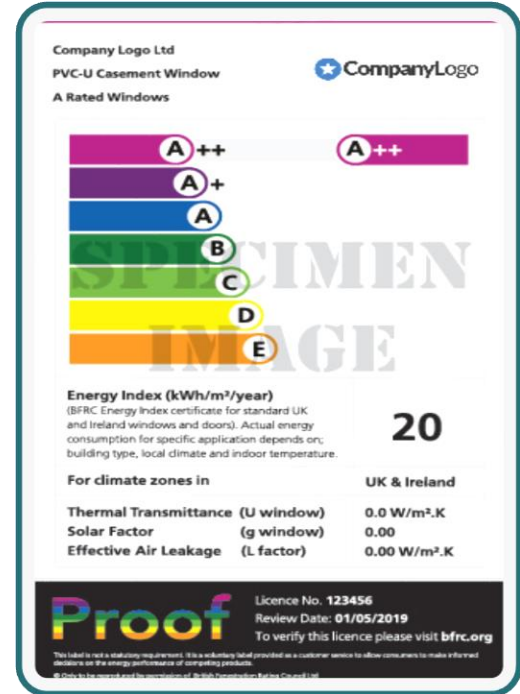
The screenshot shows a software interface for configuring an 'Opening Type'. The form has a title bar 'Opening Type' and several input fields. The 'Description' field contains 'Opening Type 4' with a search icon. The 'Data Source' is set to 'Manufacturer' with a dropdown arrow. The 'Type' is set to 'Window' with a dropdown arrow. The 'Glazing Type' is set to 'Double Low-E Soft 0.05' with a dropdown arrow. The 'G-value' is 0.63, 'Frame Factor' is 0.70, and 'U-value' is 1.20. At the bottom right, there are 'Save' and 'Cancel' buttons.

Opening Type	
Description	Opening Type 4
Data Source	Manufacturer
Type	Window
Glazing Type	Double Low-E Soft 0.05
G-value	0.63
Frame Factor	0.70
U-value	1.20

✓ Save ✕ Cancel

BFRC/Window Energy Ratings

- To make use of 'BFRC data' the assessor must have sight of the full BFRC certificate.
- Enter U and g values (solar transmittance), which are expressed as a whole opening basis in the certificate – U_{window} & g_{window}
- The frame factor will automatically be set to 1.0.

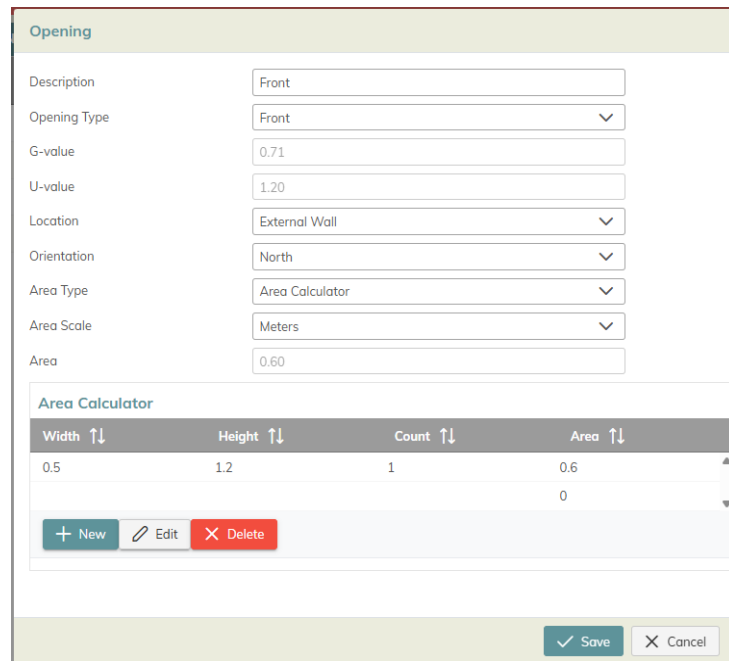


Opening Type Data Fields

Field	Description	Unit
Source Type	The source of performance data for the unit	SAP Table, Manufacturer or BFRC
Glazing Type	Reflects the type of unit and emissivity of glass e.g. single, double or triple glazed, hard or soft coat	
Glazing Gap	The gap between the glazed panes	mm
Glazing Fill Type	The gas the glazing gap is filled with	Air, Argon or Krypton
G-value	Solar energy transmittance, the fraction of solar energy that the glazing transmits into the dwelling	0-1
Frame Type	The material of the frame	PVC, Timber, Metal break
Frame Factor	The ratio of glazing to frame. Pre-set to 0.7 but can be overwritten if data is available	0-1
U-value	The heat loss through the full unit in accordance with BS EN ISO 10077-1	w/m ² k

Entering Openings

- Having set-up the Opening Types, the Openings section is used to apply them to the various Openings in the dwelling.
- Under Part L 2021 Openings can be grouped into entries by type and elevation.
- The Area Calculator tool can be used to save doing the maths and it will automatically feed lintel, sill and jamb lengths into the thermal bridging import.



Opening

Description: Front

Opening Type: Front

G-value: 0.71

U-value: 1.20

Location: External Wall

Orientation: North

Area Type: Area Calculator

Area Scale: Meters

Area: 0.60

Area Calculator

Width ↑↓	Height ↑↓	Count ↑↓	Area ↑↓
0.5	1.2	1	0.6
			0

+ New Edit Delete

Save Cancel

HOME ENERGY MODEL

Introducing the Home Energy Model



- Replacement for SAP.
- Previously known as “SAP 11”.
- Created by BRE.
- A complete rebuild of the methodology.
- To be used for the Future Homes Standard first.

What is the Home Energy Model?

- The Home Energy Model is a completely new methodology.
- Core model is based on modern international standards and 'open source'.
- 'Wrappers' define the inputs to, and outputs from, the core model for a purpose e.g. Building Regulations compliance and EPCs.
- Much more detail needed in areas such as infiltration, space and domestic hot water heating.

Two Consultations

HEM Consultation

- Closed 27th March 2024.
- Covers the overhaul to the SAP methodology and new approach taken by the HEM.
- 18 supporting documents detailing different areas of the HEM.

HEM: Future Homes Standard assessment Consultation

- Closed 27th March 2024.
- Covers the parts of the HEM methodology specific to demonstrating compliance with the FHS.
- 6 supporting documents detailing assumptions and fuel factors used for FHS calculations.

<https://homeenergymodelconsultation.org.uk/>

Home Energy Model Recap

- Key differences to SAP in Home Energy Model include;
 - Half hourly calculation timestep compared to monthly in SAP.
 - Shading from surrounding objects can be modelled.
 - Dwelling thermal elements require more detail such as orientation.
 - Infiltration requires details of background ventilators, altitude, dwelling exposure etc.
 - Space heating emitters are assessed against the space heat demand to determine capacity.
 - Domestic Hot Water includes measurement of primary and secondary pipework characteristics.

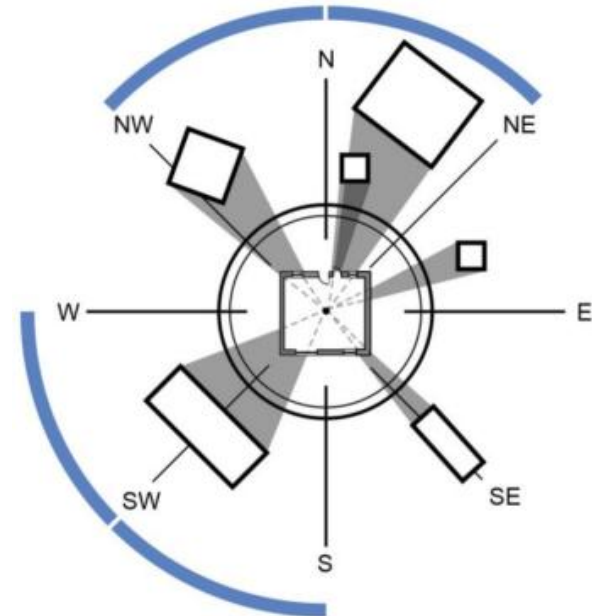
Calculation Time Resolution

- SAP 10 calculates energy use on a monthly basis.
- Improved over SAP 2012 but still struggles with new technologies, time of use tariffs etc.
- HEM will calculate on 30 minute intervals.
- Will ensure it is more suited to new innovations.
- However makes the model much more complex.



- SAP 10 is very simplistic when assessing shading with generic categories e.g. 'heavy overshading'.
- HEM takes a much more detailed assessment of overshading. Two types are accounted for;
 - Shading from distant objects e.g. other buildings.
 - Shading over windows from overhangs and/or reveals.
- Significantly more information needed compared with SAP.

Distant Shading



 Shaded segment

OPENINGS

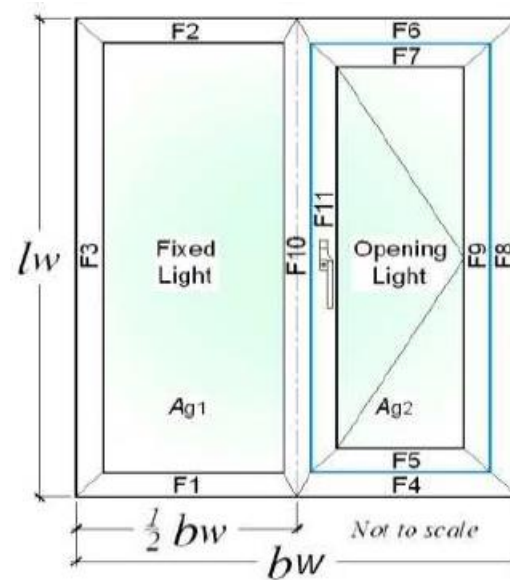


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Openings

- Each opening must be entered individually with its respective performance data and dimensions.
- Must be assigned to a wall/roof type.
- For windows, openable parts must be defined.
- Shading must also be added where relevant.



Sample Style:
Casement

Fixed Light /
Side Hung

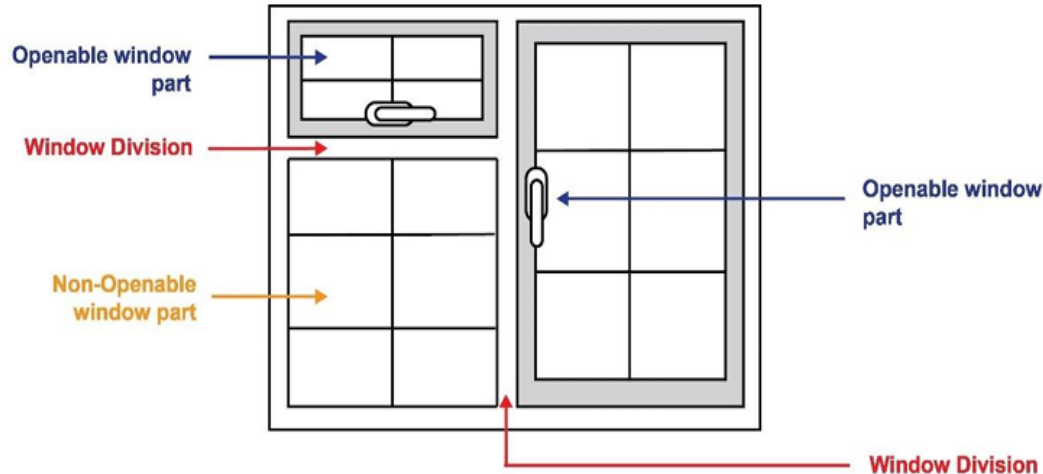
*Blue line illustrates
opening light length
(air leakage)*

Windows Data Fields

Field	Description	Unit
Name	Your name for the opening	N/A
Orientation	The compass orientation angle of the building component, from 0-360	Degrees
Pitch	Pitch of the external surface of the window. Typically this will be 90° for doors and windows. Roof windows/lights will typically be the pitch of the roof element they are located within.	Degrees
Base Height	Height of the bottom of the opening above the ground level	m
Height	Height of the top of the opening starting from base height	m
Width	Width of the opening	m
Nett Area	Nett area of the opening	m ²
U-value	U-value	W/m ² K
G-value	Solar energy transmittance, the fraction of solar energy that the glazing transmits into the dwelling	Decimal 0-1
Frame Area Fraction	The proportion of the total opening area taken up by the frame. Calculated as per BS EN ISO 52016- 1:2017	Decimal 0-1
Security Risk?	Can the window be left open during sleeping hours? GF, basements or easily accessible windows would be deemed as having a risk	Y/N

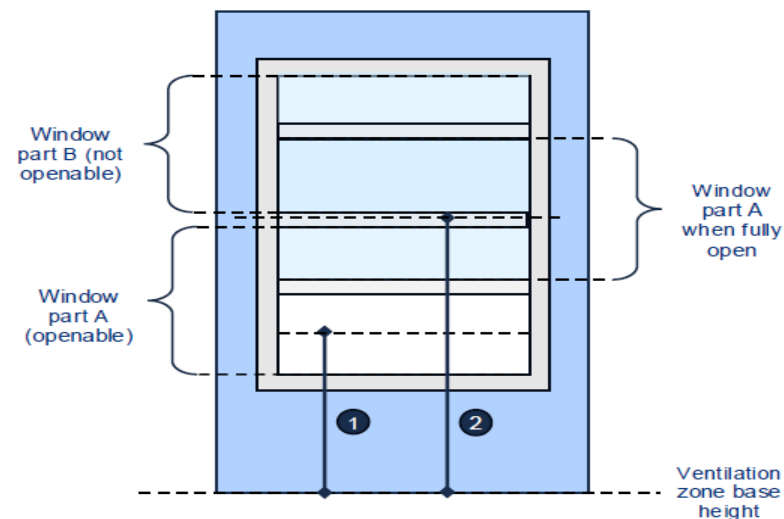
Openings – Openable Parts

Field	Description	Unit
Number of openable parts	Number of openable parts of each opening	
Openable part mid height	The height from the ground to the midpoint of the openable section of the window	m
Maximum openable area	Equivalent area of the window that can be opened as defined in Part O	m ²



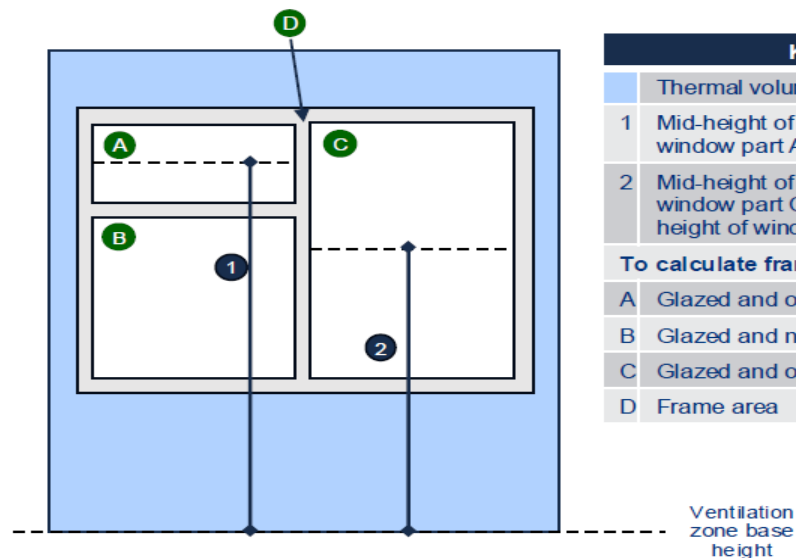
3.6 Windows

3.6.2 Examples of air flow paths



Key	
	Thermal volume
1	Mid-height of air flow path of window part A
2	Mid-height of window

Figure 3.6.b – Example of mid-height air flow path and max openable area of a sash window where the bottom half is partially openable and the top half is not openable.



Key	
	Thermal volume
1	Mid-height of air flow path of window part A
2	Mid-height of air flow path of window part C AND the mid height of window
To calculate frame-area fraction:	
A	Glazed and openable area
B	Glazed and non-openable area
C	Glazed and openable area
D	Frame area

$$\text{Frame area fraction} = 1 - \frac{A + B + C}{A + B + C + D}$$

Figure 3.6.c – Example of mid-height air flow paths and calculation of frame-area-fraction for a window with multiple openable parts

DRAFT

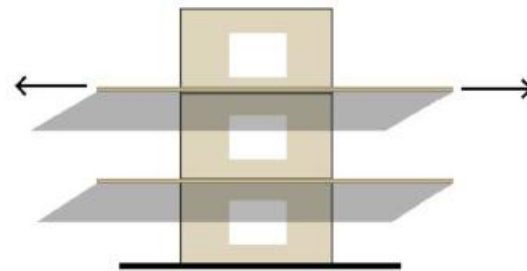
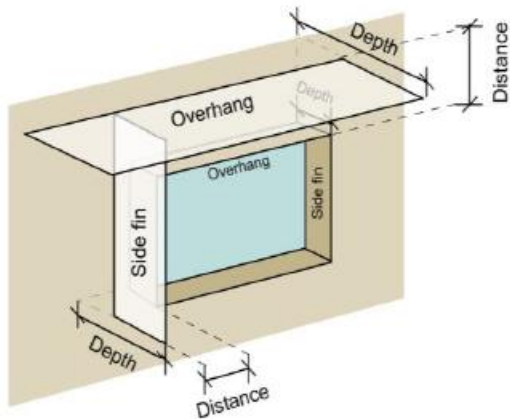
Window Shading

- On building shading devices can be modelled in HEM.
- This includes overhangs, side fins, reveals and obstacles.
- Obstacles include balcony balustrades or permanent fixed shaders.
- Curtains and blinds can also be entered.
- Assigned to each individual window.



Opening Shading Data Fields

Field	Description	Unit
Shading Type	Type of shading structure – overhang, side fin, reveal, obstacle	N/A
Depth	Depth away from the face of the glass to furthest edge of shading object.	m
Distance	Distance of the closest edge of the shading from the glass, not to window frame	m
Height	Height from the ground to the top of the obstacle (obstacles only)	m
Transparency	Transparency of the shading object. 0 is fully opaque and 1 is fully transparent.	0-1



Shading width/length is assumed to be infinite, but only shades the window it is applied to

— . . . AFT

Opening Shading Data Fields

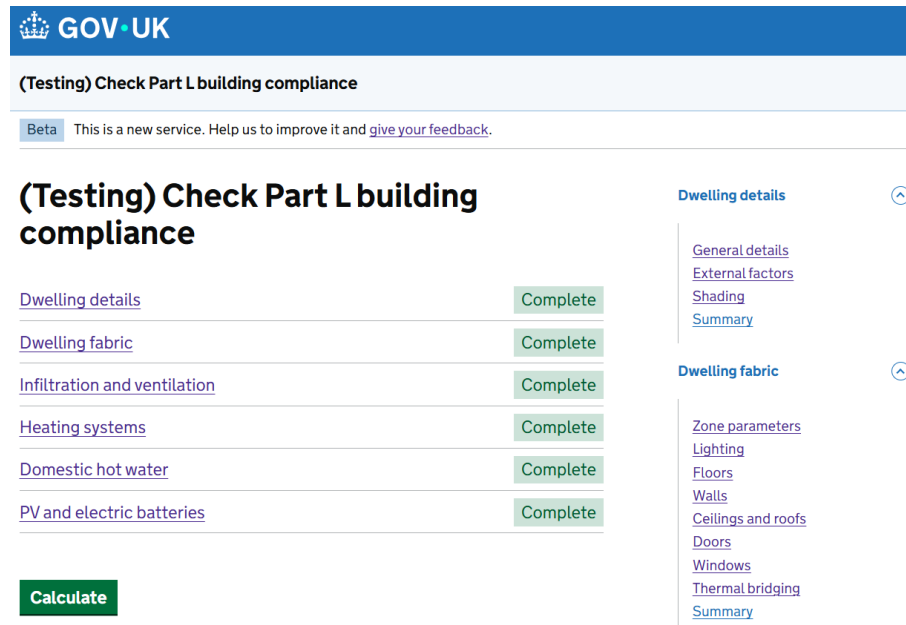
Field	Description	Unit
Type	Type of internal shading	Curtains, Blinds
Controls	Control type for the curtain or blind	Auto motorized, Manual
Resistance increase	Increase in thermal resistance of the window from the curtain or blind	m ² k/W
Solar transmittance reduction	Reduction in g-value from curtain or blind	0-1

Curtain or blind type	Optical properties of blind		Solar transmittance reduction factor	
	Absorption	Transmission	Blind inside	Blind outside
White venetian blinds	0.1	0.05	0.25	0.10
		0.1	0.30	0.15
		0.3	0.45	0.35
White curtains	0.1	0.5	0.65	0.55
		0.7	0.8	0.75
		0.9	0.95	0.95
Coloured textiles	0.3	0.1	0.42	0.17
		0.3	0.57	0.37
		0.5	0.77	0.57
Aluminium- coated textiles	0.2	0.05	0.2	0.08

Table 3.6.b – default values of the solar transmittance reduction factor
for typical types of blinds

Home Energy Model Interface

- MHCLG working on a user interface to HEM for FHS.
- Free to use and open to all EPC accreditations scheme members.
- Two rounds of user testing have taken place with schemes and energy assessors.
- Not complete yet; contains many limited sections.



The screenshot shows the 'GOV.UK' header and the title '(Testing) Check Part L building compliance'. Below the title is a beta notice: 'Beta This is a new service. Help us to improve it and [give your feedback](#).' The main content area is titled '(Testing) Check Part L building compliance' and contains a table of sections with 'Complete' status indicators. To the right, there are two sidebars: 'Dwelling details' and 'Dwelling fabric', each with a list of sub-sections. At the bottom left is a 'Calculate' button.

Section	Status
Dwelling details	Complete
Dwelling fabric	Complete
Infiltration and ventilation	Complete
Heating systems	Complete
Domestic hot water	Complete
PV and electric batteries	Complete

[Calculate](#)

Dwelling details

- [General details](#)
- [External factors](#)
- [Shading](#)
- [Summary](#)

Dwelling fabric

- [Zone parameters](#)
- [Lighting](#)
- [Floors](#)
- [Walls](#)
- [Ceilings and roofs](#)
- [Doors](#)
- [Windows](#)
- [Thermal bridging](#)
- [Summary](#)