



Future Homes and the Built Environment

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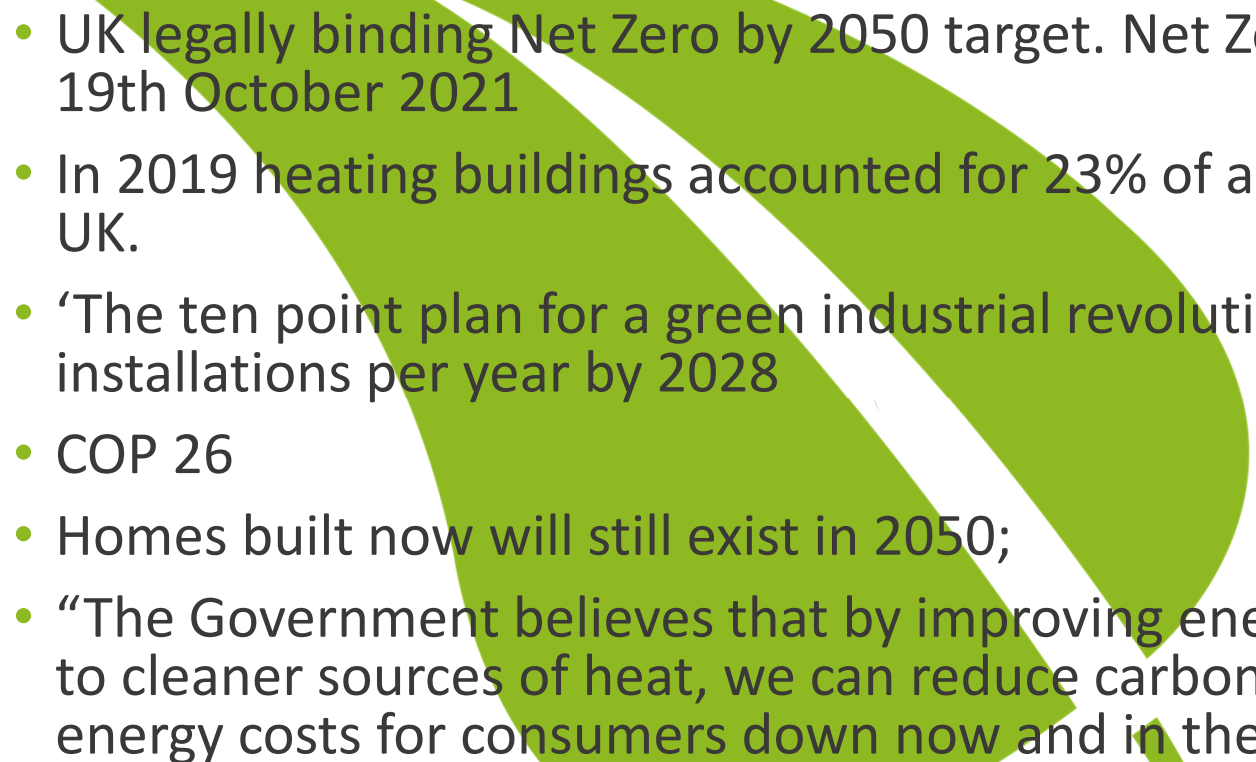
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- UK legally binding Net Zero by 2050 target. Net Zero Strategy published 19th October 2021
 - In 2019 heating buildings accounted for 23% of all carbon emissions in the UK.
 - ‘The ten point plan for a green industrial revolution’ – 600,000 heat pump installations per year by 2028
 - COP 26
 - Homes built now 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.”

Heat in Buildings Strategy

Published 18th October

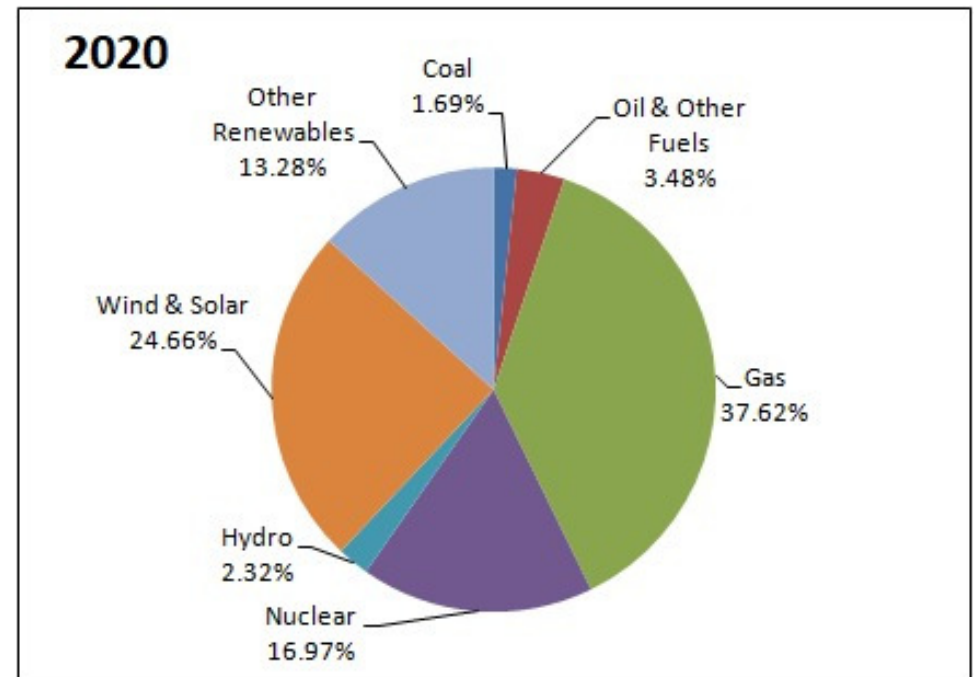
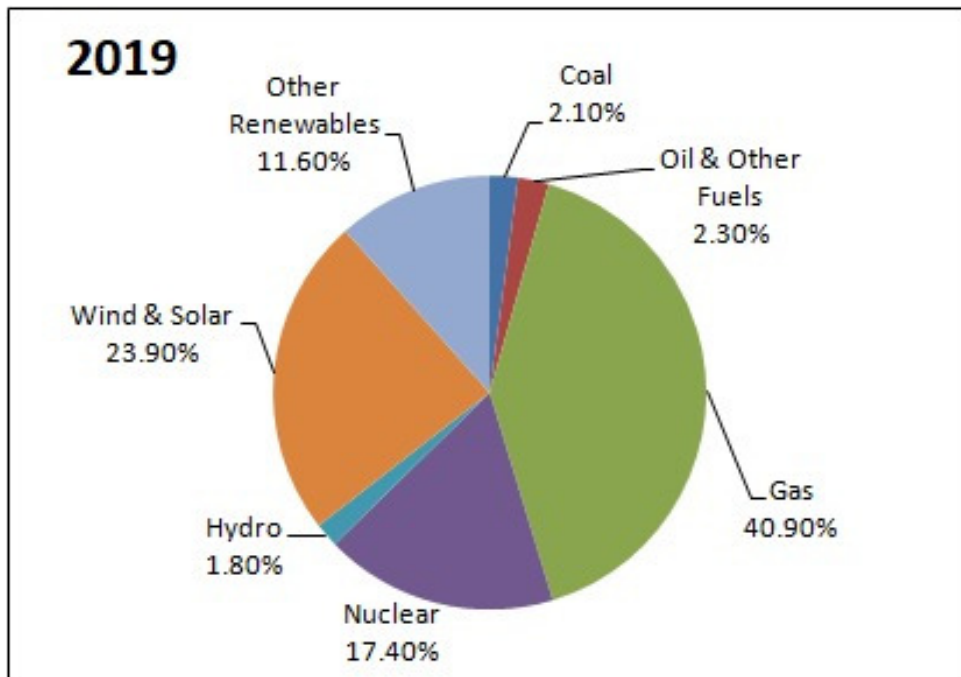
- £5k grants for replacing boilers with heat pumps
- Decision on hydrogen as a heating fuel due in 2026
- From 2035 all new heating systems to be low carbon
- Call for evidence on shifting levies from electricity to gas due in 2022
- No mention of a retrofitting programme for existing homes

Phasing out fossil fuels in off gas grid homes

- Estimated 1.1 million homes are off gas grid
- Currently electrification of heating is the only proven at scale solution for off gas grid homes
- Consultation proposed;
 - An end to installation of fossil fuel heating in homes off gas grid by 2026
 - A heat pump first approach to replacing heating from 2026
 - Require 'high performance heating where heat pumps not viable'

Grid Supplied Electric

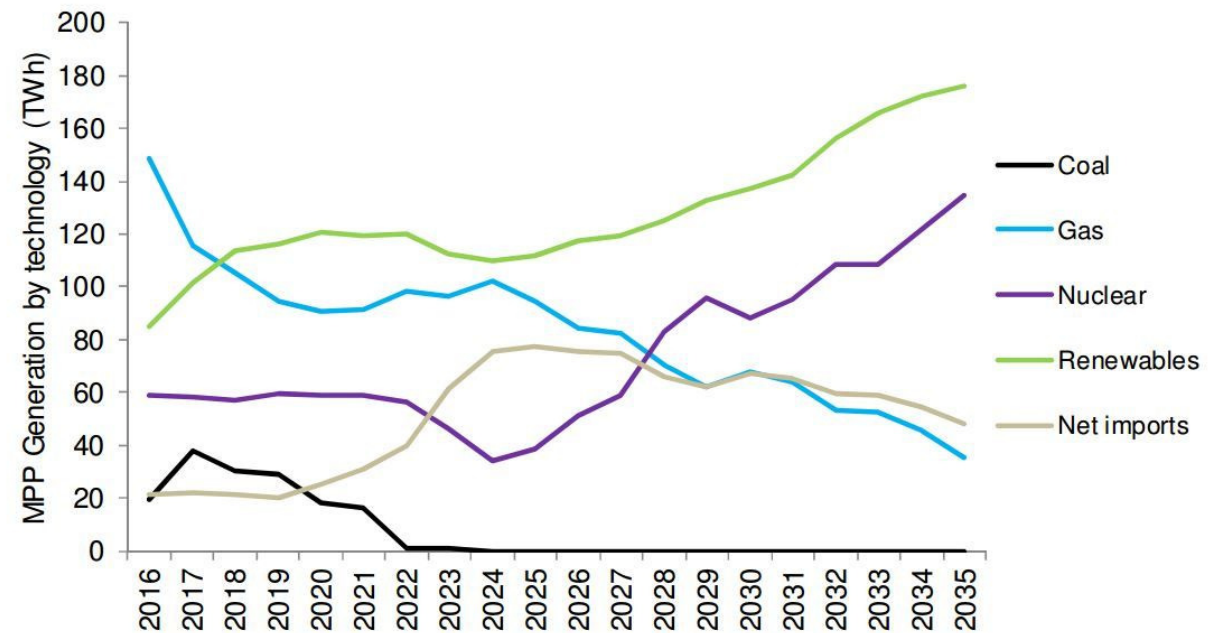
- The electricity grid has changed rapidly since Part L 2013.
- In 2010 fossil fuels accounted for 75% of total generation.
- In 2020 low carbon energy generated more than ½ of UK electricity (59.3%)



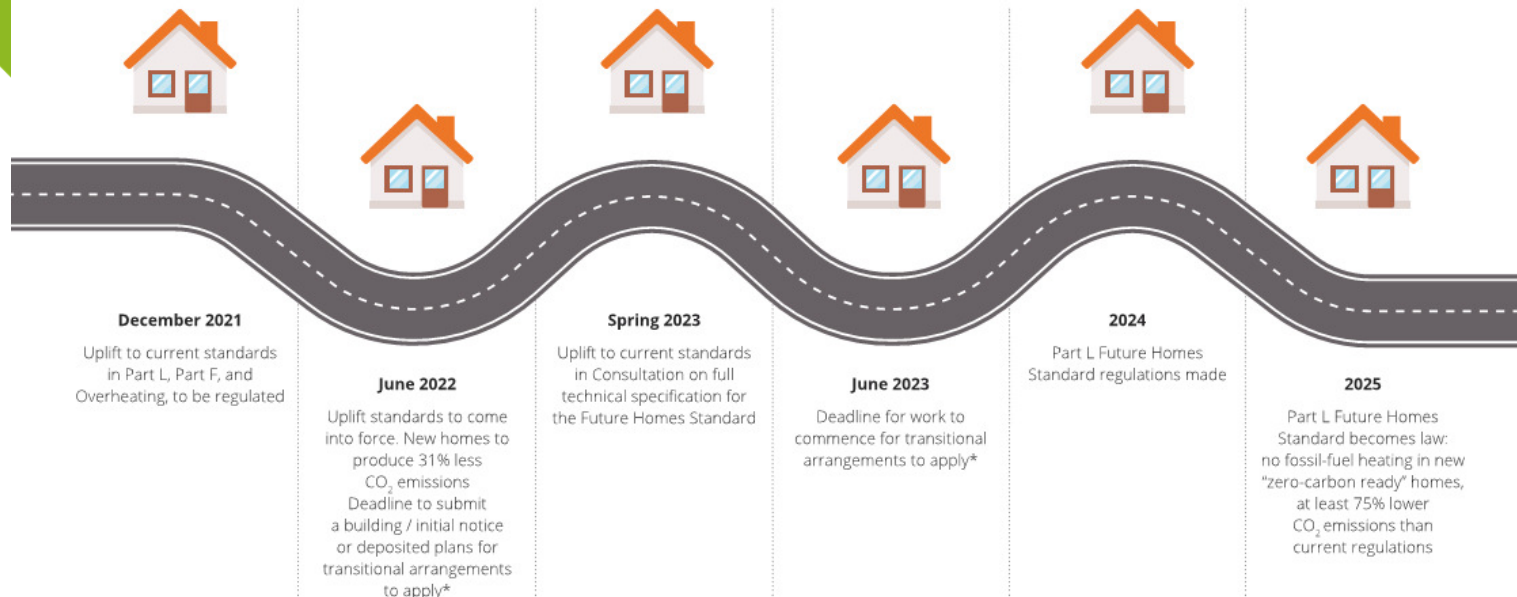
A decarbonizing grid

- Future projections show renewables will become the dominant generation method.
- Nuclear and imports will also increase.
- Coal will not be used in future.

Figure 5.1: Generation and net imports, TWh



The Future Homes Standard



*Regulatory transitional arrangements for a period of 1 year will apply on an individual unit start-date basis, not on the normal development-wide basis
Part L refers to Approved Document Part L, Volume 1: Dwellings (Conservation of fuel and power)
Part F refers to Approved Document Part F, Volume 1: Dwellings (Ventilation)

The Future Homes Standard

- “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



Heating future homes?

- It is expected that from 2025 new homes will not be able to be heated with Gas, Oil or LPG.
- Homes will have very high fabric standards including triple glazing.
- It was anticipated mainly heat pumps, heat networks and even direct electric heating will be used.
- Response from Surveys:
 - 70% felt heat pumps had a role in the FHS.
 - 26% supported the use of heat networks
 - 8% supported direct electric heating



- DLUHC will set the FHS so that fossil fuel heating will not be able to be used.
Will this be an outright ban?
Expected that heat pumps will be the main heating technology in homes.
- Heat networks will also have an important role due to the ability to integrate low carbon heating.



Energy Price Rises £££

Options to Reduce CO₂

Simple energy savings





Infrared Heating

- ✓ Heating Film and all Materials
 - ✓ Solar PV 4KW with Solar Edge
 - ✓ Hybrid Inverter with 10KW Lifepo4 Battery
- Wholesale based on past 12 months (10th June 2020 to 10th June 2021)

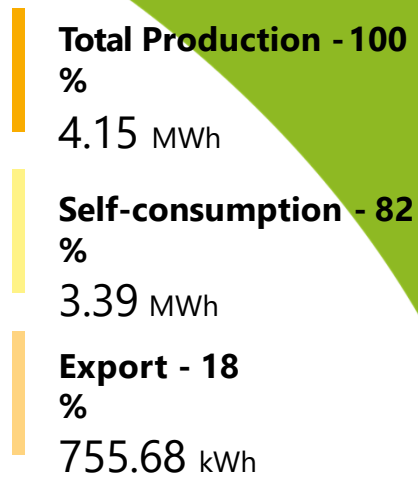
Heat Pump

£14,500

- ✓ 12KW Air to Water Heat Pump
- ✓ Buffer Tank
- ✓ Materials for All plumbing and Radiators
- ✓ Standard Tariff 16p per KWh

Heat Consumption from Solar PV and annual CO2 Emissions Saved

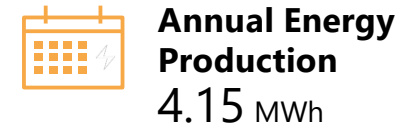
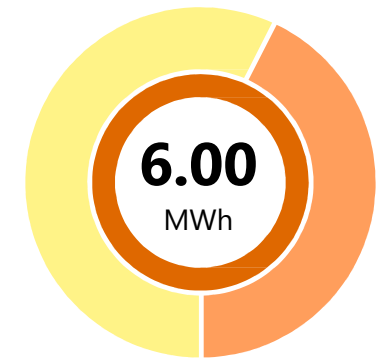
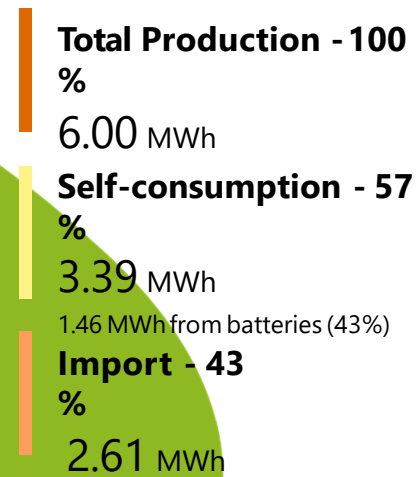
SYSTEM PRODUCTION



SIMULATION RESULTS



CONSUMPTION



Electricity Costs Other Than for Heating Using Solar PV and Battery Storage. Only including the iheat Option

This is based on all other electric costs other than heating.

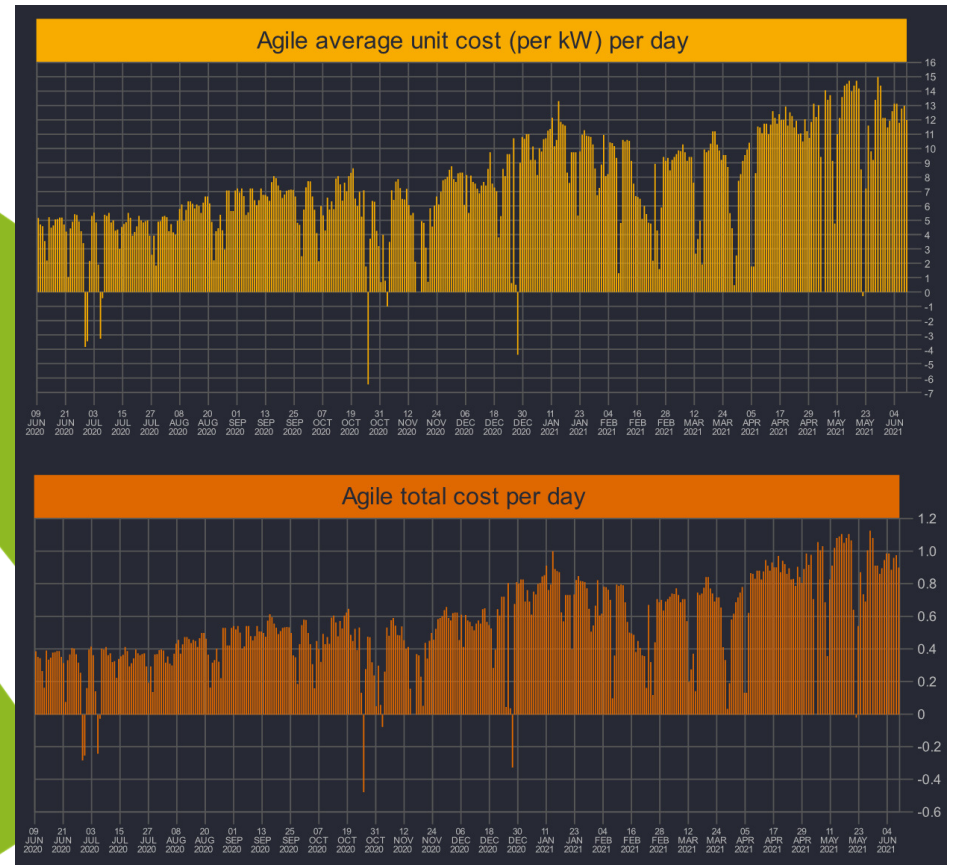
With an intelligent battery install we can also manage the cost more efficiently. Taking the last 12 months and with a battery. We can reduce the cost based on 3100KWh per annum by £241 compared to a normal tariff

Summary of results for the selected time frame

Agile average per unit cost	7.20p
Agile average per day cost	£0.54
Agile total cost	£197.10
Expensive alternative (16 Op) total cost	£438.00
Percentage saving between total costs	55 0%

Historical Agile tariff pricing based on 3 x 30 minute charge slots each day

Looking to add 7.5kWh per day at a charge rate of 7.2kW per hour



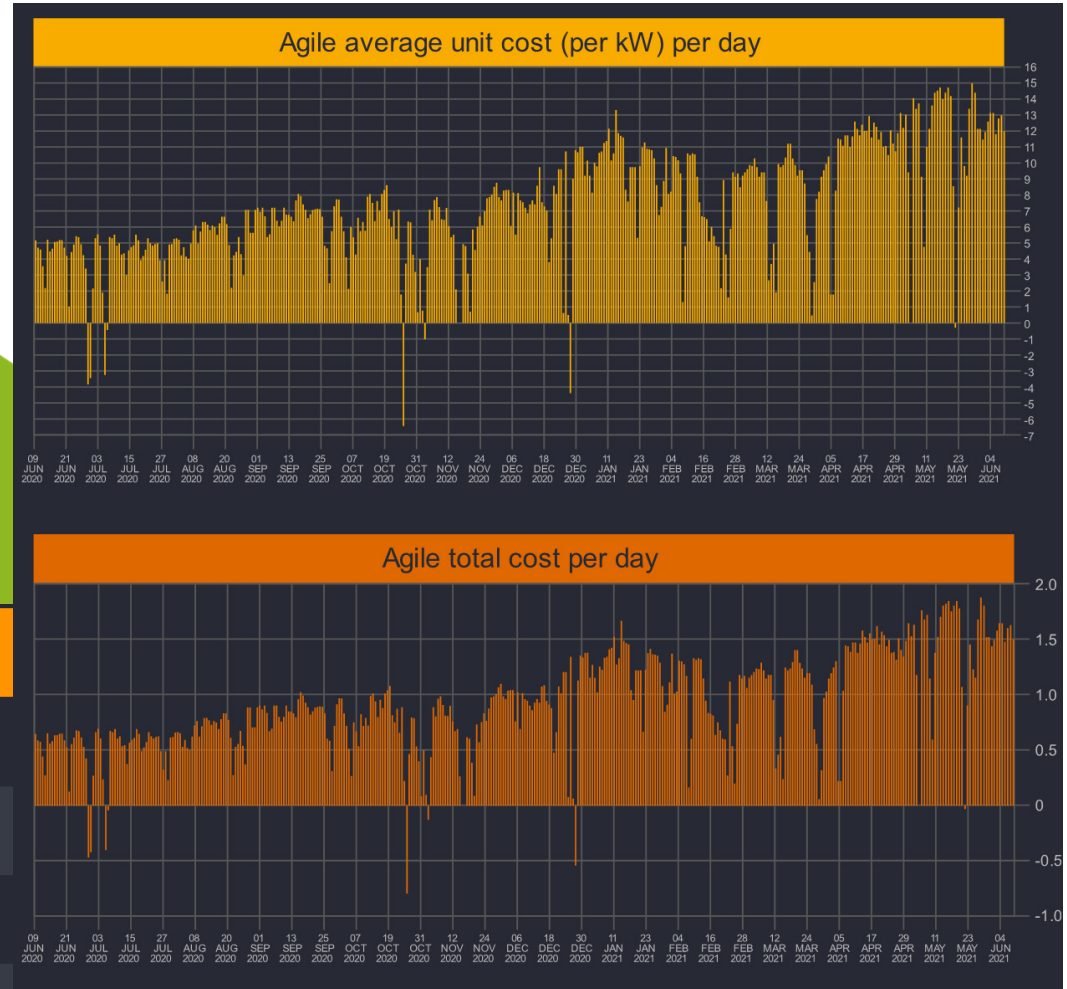
Electricity Costs including Electric Car and Electric Other Than for Heating

Using Solar PV and Battery Storage. Only included in the iheat Option

This is based on a 64KWh EV being charged every 3 days heating. With an intelligent battery installed we can, using a battery management system. Using a wholesale tariff. Reduce the cost, based on the calculations on the below , by £321.21 compared to a normal tariff

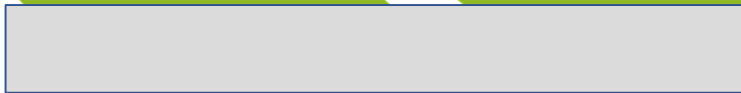
Summary of results for the selected time frame

Agile average per unit cost	7.20p
Agile average per day cost	£0.72
Agile total cost	£262.79
Expensive alternative (16 Op) total cost	£584.00
Percentage saving between total costs	55.0%



Total Electricity Bill Including Heating Without Electric Car

● £571



● £336

iheat Heating 42% Less Cost

- Heat Pump
Based on a Seasonal COP of 2.8
3571KWh per Annum

Convection Heating 3100Kwh
Electric

Radiator System

- iheat Heating

6000Kwh per Annum Far

Infrared Heating 3100Kwh with
Battery and Solar

Based on wholesale Tariff

Fitted on Ceiling

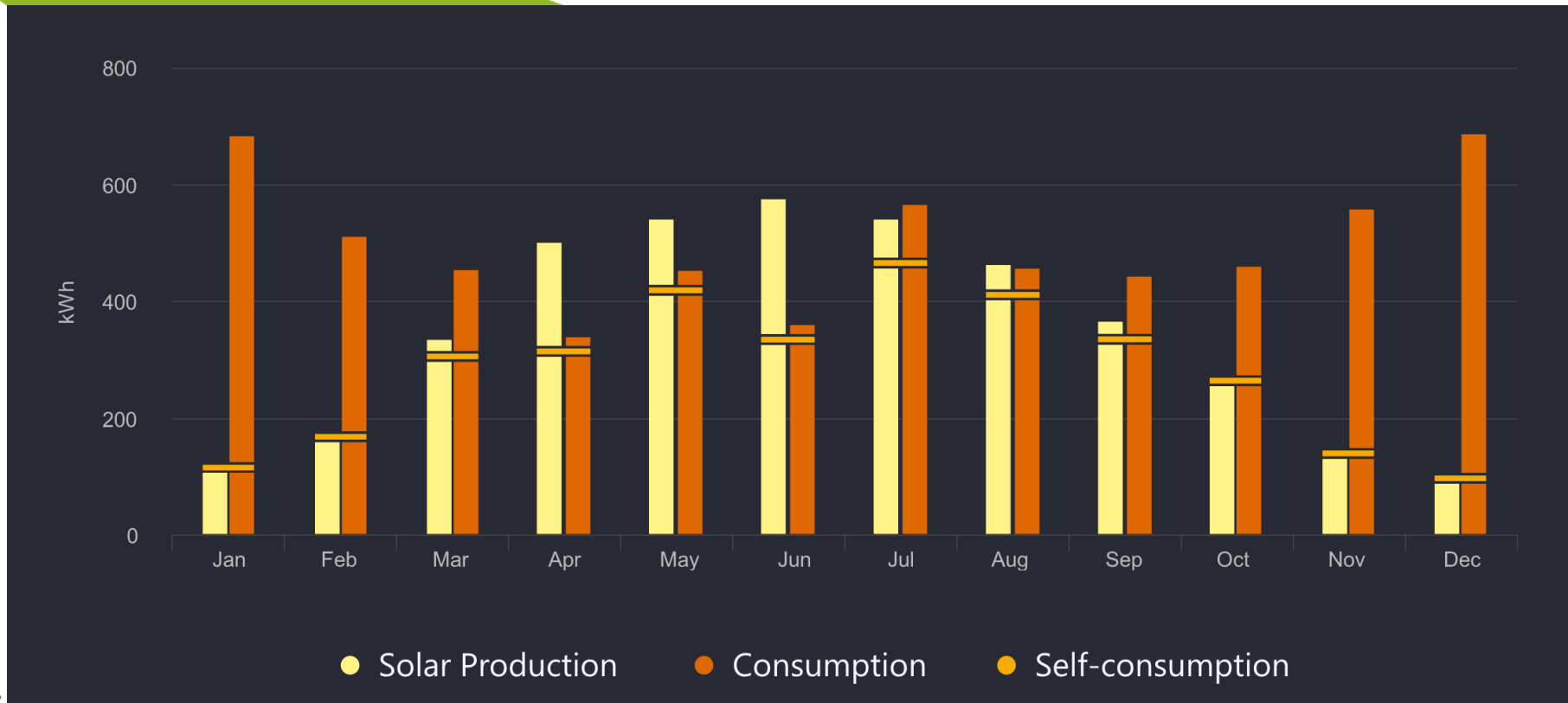
Total Electricity Bill Including Heating With Electric Car



iheat Heating 43% Less Cost

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Based on a Seasonal COP of 2.8
3571KWh per Annum
Convection Heating 3100Kwh
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6000Kwh per Annum Far
Infrared Heating 3100Kwh with
Battery and Solar
Based on wholesale Tariff
Fitted on Ceiling

ESTIMATED MONTHLY ENERGY



MEES

- Currently a £5000 fine for not complying
- MEES were introduced in 2018 and require privately rented properties to achieve an EPC E rating.
- There is currently a strategy from central Government to increase this to an EPC C rating by 2035
- However a white paper issued in January 2021 proposes a phased trajectory for achieving the improvements for new tenancies only from 2025 and for all tenancies from 2028;
- To achieve this there is potentially a fine uplift from £5k to £30k
- & Increasing the maximum investment amount, resulting in an average per-property spend of £4,700 under a £10,000 cap;
- There are currently a range of different options being considered as part of this with fundamental changes to the EPC's themselves and the background methodology to prioritise a fabric first approach and to reduce energy demands

Options for Increasing EPC's

Recommended measures	Indicative cost	Typical savings per year	Rating after improvement
Room-in-roof insulation	£1,500-£2,700	£837	E39
Internal or external wall insulation	£4,000-£14,000	£195	E45
Solid floor insulation	£4,000-£6,000	£122	E49
Increase hot water cylinder insulation	£15-£30	£142	E54
Draught proofing	£80-£120	£18	D55
Low energy lighting	£20	£21	D56
High heat retention storage heaters / dual immersion cylinder	£1,200-£1,800	£319	D67
Solar water heating	£4,000-£6,000	£57	C69
Replace single glazed windows with low-E double glazed windows	£3,300-£6,500	£123	C73
Solar photovoltaic panels	£5,000-£8,000	£287	B83



Question Time

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Fabric Standards for Future Homes

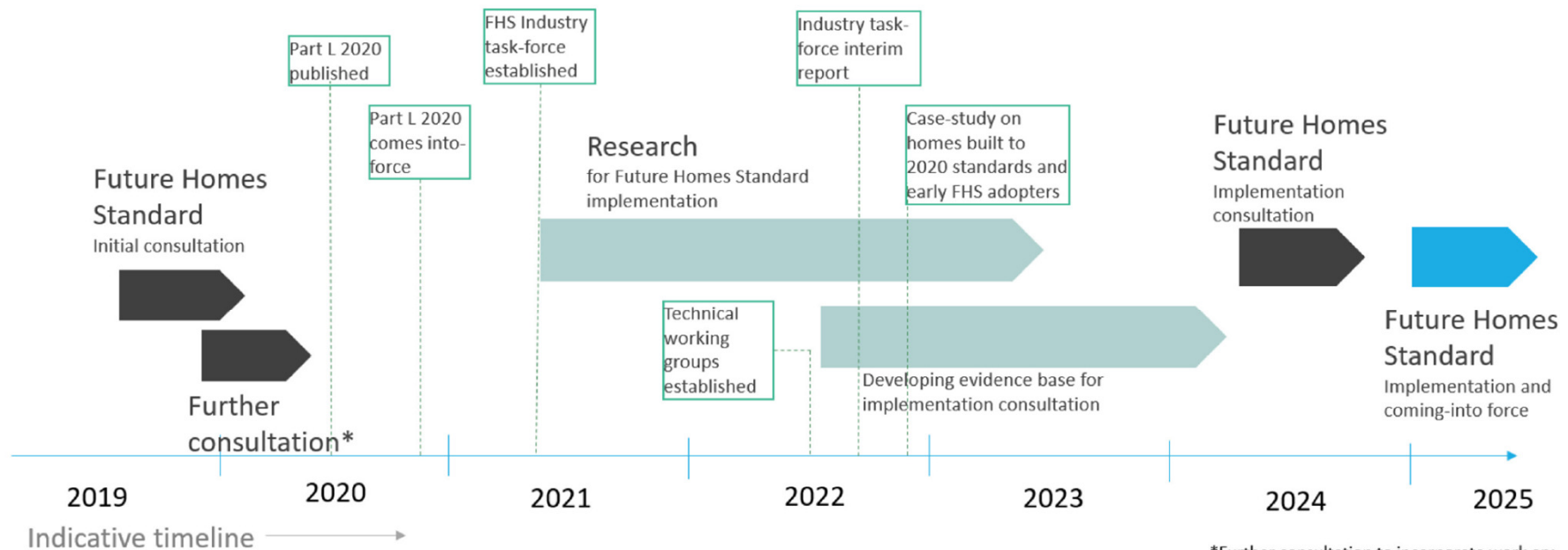
- The consultation indicated the fabric standard would require.
- These are the standards for the notional building, not the limiting values

	Part L 2013	Part L 2021	Future Homes Standard
Floor (w/m ² k)	0.13	0.13	0.11
Wall (w/m ² k)	0.18	0.18	0.15
Roof (w/m ² k)	0.13	0.11	0.11
Window (w/m ² k)	1.4	1.2	0.8
Door (w/m ² k)	1/1.2	1	1
Air Tightness (m ³ /m ² /hr)	5	5	5
Y-value (w/m ² k)	0.05	0.05	0.05

Going beyond regulations?

- Planning and Energy Act 2008 allows local planning authorities to set standards higher than Part L.
- Resulted in inconsistency and confusion between authorities, but also standards higher than regulations.
- Consultation proposed to restrict authorities from setting higher standards than building regulations.
- DLUHC agreed through consultations to not implement this.

Future Homes Standard Roadmap



*Further consultation to incorporate work on:

- Work to existing buildings
- Overheating in new dwellings
- New non-domestic buildings



Part L 2021

Timescales

- New Approved Documents (AD) F, L and O issued 15th December 2021
- Part L 2021 is NOT the Future Homes Standard
- New standards come into force 15th June 2022
- All new ADs now available to view online

Overheating

- Significant concern around Overheating in new homes.
- Current procedure aimed at limiting heat loss from pipes, not internal temperatures.
- A new Building Regulation and Approved Document O published.
- Will remove overheating compliance from Part L and SAP.
- Same timelines as Part L. Comes into Force June 2022

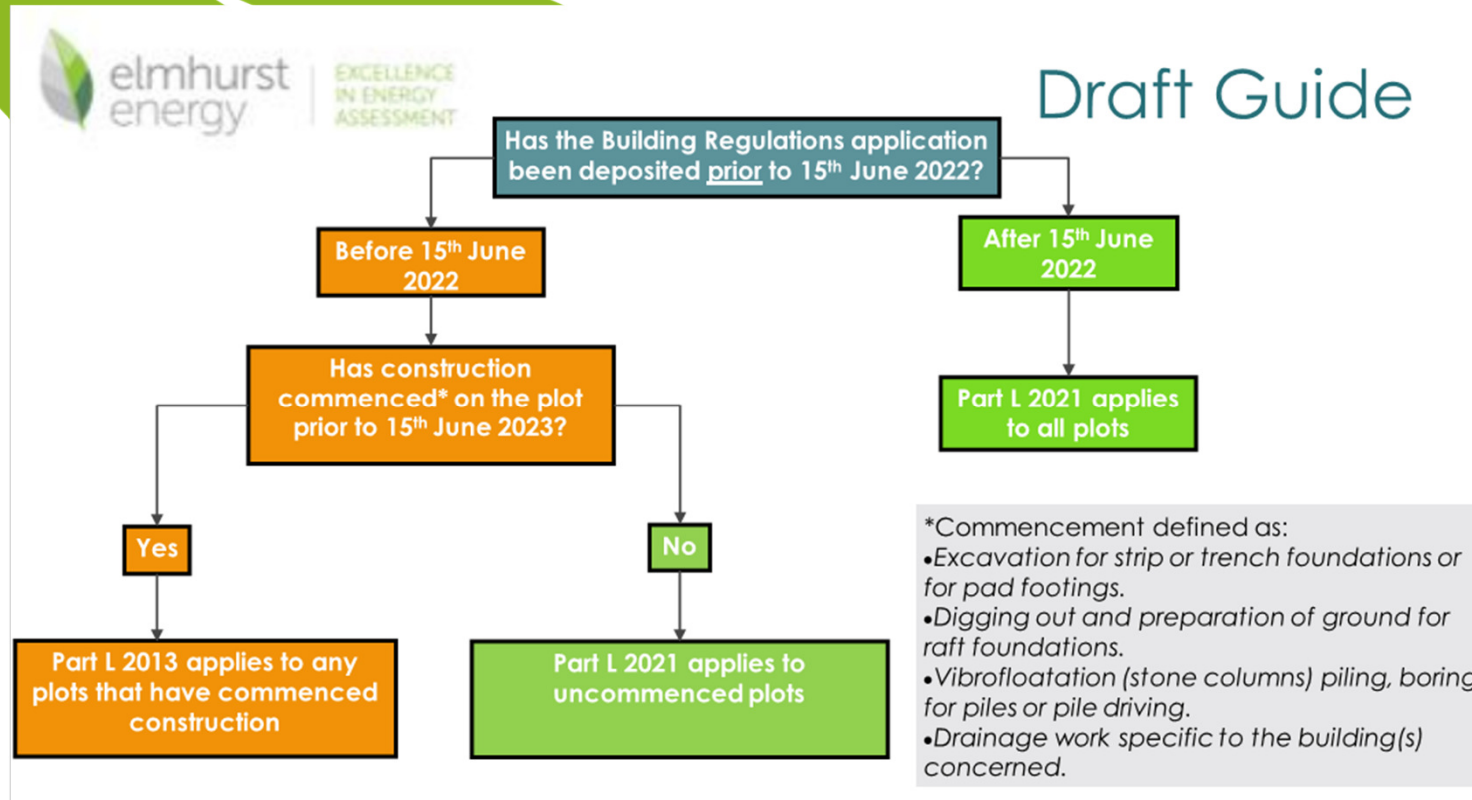


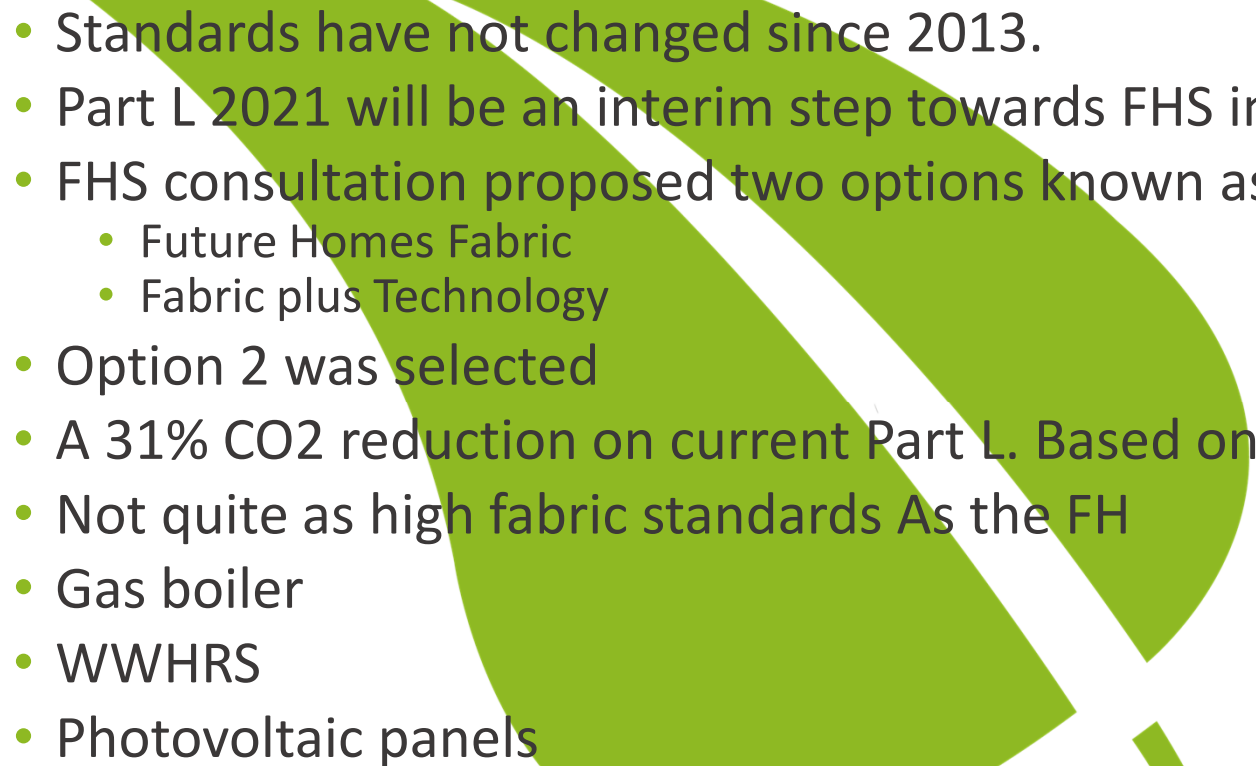
Transitional Arrangements

Transitional Arrangements

- Allows consistency of specification across large sites.
- Homeowners never know that their new build is not built to current standards.
- New homes contributing more carbon than expected – not aligned with our net zero goals.
- The Amendment Regulations and accompanying Approved Documents L: Volumes 1 and 2 come into force on 15 June 2022. However, the changes will not apply in relation to building work where a building notice or an initial notice has been given to, or full plans deposited with, a local authority before 15 June 2022 provided that the building work is started before 15 June 2023.
- Please note that “building notice”, “initial notice” and “full plans” have the meanings given in Regulation 2 of the Building Regulations 2010. In some cases, applications will be in respect of a number of buildings on a site, for example a number of houses. In such cases, it is only those individual buildings for which work is commenced which can take advantage of the transitional provisions

Transitional Arrangements TAKE NOTE!!!



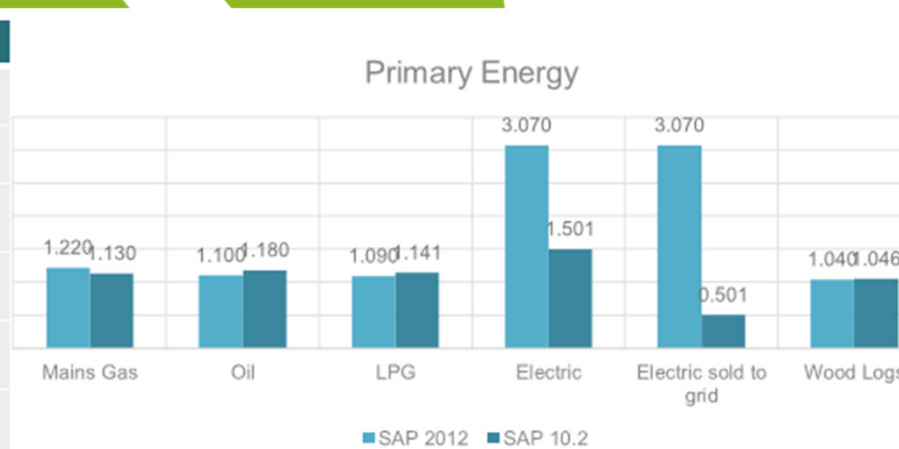
- 
- Standards have not changed since 2013.
 - Part L 2021 will be an interim step towards FHS in 2025.
 - FHS consultation proposed two options known as;
 - Future Homes Fabric
 - Fabric plus Technology
 - Option 2 was selected
 - A 31% CO2 reduction on current Part L. Based on;
 - Not quite as high fabric standards As the FH
 - Gas boiler
 - WWHRS
 - Photovoltaic panels

What is Primary Energy?

- “Energy from renewable and non-renewable sources which has not undergone any conversion or transformation process”.
- Key factors include;
- Planting of biofuel sources
- Extraction of fuels
- Transformation of fuels
- Transmission and distribution losses
- Some fuels are low Carbon but high Primary Energy and vice versa.

- EPBD requires ‘nearly zero energy buildings where cost optimal’ from 2021.
- As the electricity grid is being de-carbonised, using carbon as a measure of energy efficiency is arguably less relevant.
- Takes into account upstream activities therefore could discourage

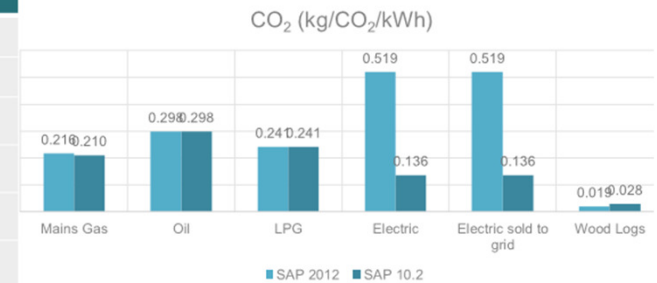
Fuel	SAP 2012	SAP 10.2
Mains Gas	1.22	1.13 (-7%)
Oil	1.1	1.18 (+7%)
LPG	1.09	1.141 (+5%)
Electricity	3.07	1.501 (-51%)
Electric sold to grid	3.07	0.501 (-83%)
Wood Logs	1.04	1.046 (+1%)



What About Carbon

- To align with policies operational carbon emissions have to be considered.
- Therefore a carbon based standard will remain.
- This is in the form of the Dwelling Emission Rate (DER) vs Target Emission Rate (TER).
- However carbon intensity of some fuels has been reclassified...
- FEE remains as the third compliance metric

Fuel	SAP 2012	SAP 10.2
Mains Gas	0.216	0.21 (-5%)
Oil	0.298	0.298 (0%)
LPG	0.241	0.241 (0%)
Electricity	0.519	0.136 (-74%)
Electric sold to grid	0.519	0.136 (-74%)
Wood Logs	0.019	0.028 (+53%)



SETTING THE TARGETS

	Value
External walls	0.18 w/m ² k
Party Walls	0 w/m ² k
Floors	0.13 w/m ² k
Roofs	0.11 w/m ² k (Part L 2013 = 0.13)
Doors	1.0 w/m ² k
Windows	1.2 w/m ² k (Part L 2013 = 1.4)
Air Permeability	5 m ³ /m ² /hr @ 50Pa
Thermal Bridging	If using default (y-0.2) in actual, notional = y-0.05 w/m ² k If calculated in actual= Psi values from App. R of SAP 10

	Value
Thermal Mass	As per dwelling (Part L 2013 = medium)
Space + Water Heating	Mains gas boiler (system/combi as per actual), 89.5% (SEDBUK), radiators, flow temp 55°C*
Controls	Single storey, where living area > 70% of floor area – Prog. Stat and TRVs All other - Time and Temp. zone control All – Interlock, ErP Class V Compensator
WWHRS	Instantaneous WWHRS, connected to all showers
Lighting	Capacity - 185 X Floor Area, Efficacy – 80 lm/W
Ventilation	Natural with intermittent fans (System 1)
PV	Houses - kWp = 40% of ground floor area (incl. unheated spaces) / 6.5 Flats - kWp = 40% of dwelling floor area / (6.5*no. of storeys in block)

*except where using an existing heat network

How to Con

Detached Dwelling – Mains Gas

- Wall – 0.2 w/m²k
- Roof + Floor – 0.11 w/m²k
- Door – 1.2 w/m²k
- Windows – 1.2 w/m²k
- Constructive Details psi values
- Air Test – 3 m³/m²/hr
- MVHR – 90%, SFP 0.58 w/l/s
- Lighting – 80 l/cw
- 90% boiler
- Time and Temp zone controls, delayed start
- WWHRS
- 1.5 kWh/day heat loss on HWC
- 1.5 kWp PV array (approx. 6m²)

	Actual	Target
Primary Energy	44.61 kWh/m ² /yr	44.63 kWh/m ² /yr
Carbon	8.02 kgCO ₂ /m ² /yr	8.54 kgCO ₂ /m ² /yr
Fabric Energy	36.64 kWh/m ² /yr	38.37 kWh/m ² /yr

How to Con

Detached Dwelling – Direct Electric

- Wall – 0.2 w/m2k
- Roof + Floor – 0.11 w/m2k
- Door – 1.2 w/m2k
- Windows – 1.2 w/m2k
- Constructive Details psi values
- Air Test – 3 m3/m2/hr
- MVHR – 90%, SFP 0.58 w/l/s
- Lighting – 80 l/cw
- Direct Panel Heaters
- Immersion heater, 180 L, 2.1 kWh/day
- 1.5 kWh/day heat loss on HWC
- 2.3 kWp PV array (approx. 9 m2)
- PV diverter (e.g. eddi)

	Actual	Target
Primary Energy	44.46 kWh/m ² /yr	44.68 kWh/m ² /yr
Carbon	3.76 kgCO ₂ /m ² /yr	8.55 kgCO ₂ /m ² /yr
Fabric Energy	36.64 kWh/m ² /yr	38.37 kWh/m ² /yr

How to Com

Detached Dwelling – Heat Pump

- Wall – 0.18 w/m²k
- Roof – 0.11 w/m²k
- Floor – 0.11 w/m²k
- Door – 1.2 w/m²k
- Windows – 1.2 w/m²k
- Constructive Details psi values
- Air Test – 3 m³/m²/hr
- MVHR – 90%, SFP 0.58 w/l/s
- Lighting – 80 l/cw
- SAP default ASHP serving radiators
- Time and Temp. zone controls
- 1.5 kWh/day heat loss on HWC

	Actual	Target
Primary Energy	44.02 kWh/m ² /yr	44.63 kWh/m ² /yr
Carbon	4.22 kgCO ₂ /m ² /yr	8.54 kgCO ₂ /m ² /yr
Fabric Energy	35.68 kWh/m ² /yr	38.37 kWh/m ² /yr

Summary of changes on SAP 10

- Oil and LPG heated dwellings will find compliance tougher than ever.
- Electric heated dwellings will comply with the carbon standard easily, but still have to work to meet primary energy standard.
- Some form of renewable technology will be required in the majority of dwellings.
- Retention of Fabric Efficiency Standard will ensure appropriate emphasis on 'fabric first approach'.
- The increasing importance of hot water generation may see more widespread use of WWHRS, FGHRs, lower flow showers, solar hot water panels or PV diverters.
- More use of mechanical ventilation compared to traditional intermittent fans.
- All new residential units to require an air test
- Photographic evidence will be required
- Lighting needs to be assessed
- Showers need to be included
- Batteries can be input
- Eddi diverters can be used

Item	PE Before	PE After	CO ₂ Before	CO ₂ After
WWHRS (2 showers)	79.84	76.65 (-4%)	13.33	12.74 (-4.43%)
MVHR	79.84	74.65 (-6.5%)	13.33	12.23 (-8.25%)
dMEV	79.84	78.88 (-1.2%)	13.33	13.05 (-2.1%)
Lighting (90 l/cw)	79.84	78.78 (-1.33%)	13.33	13.23 (-0.75%)
Electric Fire	78.53	79.73 (+1.53%)	14	13.73 (-1.93%)
Wood Stove	78.53	79.84 (+2%)	14	13.33 (-4.79%)
Wood Chip Boiler	78.53	74.75 (-4.81%)	13.33	2.11 (-84.17%)
PV (2.5 kWp)	79.84	72.47 (-8.77%)	13.33	11.32 (-15.08%)
+PV Diverter	79.84	65.81 (-18%)	13.33	10.08 (-24.38%)

Evidential Changes

- Guidance from Appendix B, AD L 2021;
- “Photographs should be taken for each dwelling on a development as a record during the construction of a property.
- The photographs should be made available to the energy assessor and the building control body. No restrictions are imposed on the persons authorised to take the photographs.”
- “Photographs should be taken at various construction stages for each detail listed below and should be unique to each property”.
- “Photographic images should be digital and of sufficient quality and resolution to allow a qualitative audit of the subject detail.
- Image files name should include the plot number and detail reference according to the numbers used in paragraph B.7. E.g. Plot 1 eaves detail would be P1/3b.”

Examples



1. Foundations and ground floor

To indicate thermal continuity of insulation and quality at:

- Ground floor perimeter edge insulation
- External door threshold
- Below damp-proof course on external walls



2. External walls

For each wall type to indicate thermal continuity of insulation, and quality at;

- Ground floor to wall junction
- Structural penetrating elements



3. Roof

For each roof type to indicate thermal continuity of insulation, and quality at;

- Joist/rafter level
- Eaves and gable edges



4. Openings

For each opening type to indicate thermal continuity of insulation, and quality at;

- Window positioning in relation to cavity closer or insulation line
- External doorset positioning in relation to cavity closer or insulation line



5. Airtightness

Additional photos for all details 1-4 to identify airtightness detail (if not included in continuity of insulation image).



6. Services

For space + water heating, ventilation, low/zero carbon tech;

- Plant/equipment identification label(s) including make/model and serial number
- Primary pipework continuity of insulation
- Mechanical ventilation ductwork continuity of insulation (for duct sections outside of thermal envelope)

Existing Dwellings

	'Threshold' U-value	Part L 2013 'Improved' U-value	Proposed Part L 2021 'Improved' U-value
Wall – cavity insulation	0.7	0.55	0.55
Wall – external or internal wall insulation	0.7	0.3	0.3
Pitched roof – insulation at ceiling level	0.35	0.16	0.16
Pitched roof – insulation between rafters	0.35	0.18	0.16
Flat roof or roof with integral insulation	0.35	0.18	0.16
Floors	0.7	0.25	0.25



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