Energie Sprong uk

Transition Zero

> Performance requirements: Part L UK vs Energiesprong vs Passivhaus.

Introduction

The purpose of this paper is to highlight and compare the difference in performance requirements between UK Building Regulations Part L, Energiesprong NZEB and Passivhaus. There have been various policy setbacks over the past 24 months which have reduced the incentive and requirement for buildings with a high energy performance, resulting in the majority of new builds continuing to be built based on 2013 regulations. The scrapping of the Zero Carbon Policy and the Code for Sustainable Homes has left little for housing associations and house builders to aim for, although Passivhaus continues to grow as a favoured design option. Examples of this standard being embraced are highlighted by the local planning policies set by Exeter and Norwich City Council. A new approach to net zero buildings first developed in Holland is now offering an alternative option to Passivhaus – Energiesprong. The Energiesprong and Passivhaus standards do share similarities in terms of the designed performance requirements, although there are also some differences. The main difference being the focus of Energiesprong to create a return on investment and payback for the uplift in capital expenditure, twinned with a 30 year performance warranty.

Part L UK Building Regulations

The 2013 revision of the building regulations placed a greater emphasis on the performance of the fabric (roof, windows, walls and floor) by creating the Fabric Energy Efficiency Standard (FEES) and provides guidance on the performance of the notional and as designed dwellings as well as the maximum space heating and cooling required by the new dwelling. The Target Emissions Rate (TER) has also been set to ensure that builders and designers are designing new homes which emit lower amounts of CO_2. The Standard Assessment Procedure (SAP) is set by Government and used by industry to assess whether new housing complies with Part L of the building regulations. These requirements can be summarised as shown in table 1.

Unlike Passivhaus and Energiesprong which set performance requirements only, Part L does include limiting fabric parameters to ensure the correct quality of fabric is achieved. The main components required in order to comply with the FEES can be altered to suit the design of the building as long as the TER and FEES are met. For example, the u-value of the wall could be increased if triple glazed windows were used instead of double glazed.

Passivhaus Standard

The Passivhaus standard has been included within this report as it sets much higher performance standards than that of Part L 2016, and is a well-known design standard within the UK. Therefore it provides a second comparison against the building regulations and Energiesprong requirements. The Passivhaus approach has many similarities to that of an Energiesprong unit and requires the fabric of the building to be more thermally efficient and airtight than standard regulations, with typical u-values of 0.1 W/m^{2}K and no thermal bridges. The space heating demand equivalent to the FEES is 15 kwh/m^2/year, which is a drastic improvement and understandably so; previous research has shown that a reduction in regulated CO_2 emissions (kg/m^2/yr) of around 47% can be achieved by reducing the space heating energy demand of a house to 15kWh/m^2/yr.

Additional work completed by the zero carbon hub 'Defining a Fabric Energy Efficiency Standard' highlighted reductions in regulated emissions achieved by a close to Passivhaus and Passivhaus with gas heating and grid electricity: 30% and 32% for a small ground floor flats; 32% and 40% for a semi-detached or end terrace house; and 36% and 46% for a detached house. The 'nearly' Passivhaus unit had a space heating demand requirement similar to Energiesprong of 30 kWh/m^2/yr.

Energiesprong

As the above paragraph highlights, there are still substantially lower CO_2 emissions when designing to a space heating requirement of 30kWh/m^2/yr, and the running costs are also much lower than that of a unit built to current UK regulations. It is therefore worth noting and appreciating that although the space heating requirements are not as low as that of Passivhaus, Energiesprong does achieve higher standards whilst also allowing for an energy service plan to act as a return on investment for the uplift in CAPEX and creates a sustainable business model supported by a long-term performance warranty.

The performance requirements of an Energiesprong unit and the desired performance output is more aligned to Passivhaus requirements than building regulations. However, as all of the three standards require different components, values and performance it is not easy to form a direct comparison between them. The varying space heating demands can be compared against one another but this does not reveal how much energy is required and how much a dwelling will cost to run.

	Building Regulations	Passivhaus	Energiesprong
External Walls (W/m^{2}K)	0.18	0.1*	0.1*
Floor (W/m^{2}K)	0.13	0.15*	0.1*
Roof (W/m^{2}K)	0.13	0.15*	0.1*
Windows (W/m^{2}K)	1.4 (g=0.63)	<0.8	1*
Air tightness	5	0.6	3*
Thermal Bridging (y-value)	0.15	0.01	0.03*
TER/DER (kgCO_2/m^2/yr)	16	0	0
TFEE (kwh/m^2/yr)	54.26	15	<30
Ventilation	Natural - extract fans)	Mechanical Heat Recovery - 30m^3/hr/person	Mechanical - with extract fans

* Not specified but likely to be required to ensure certification

Tables 4 and 5 provide further evaluation on the performance of three standards in question.

Table 4 shows the input requirements for 3 dwellings based on matching construction methods and materials and factors in the different performance requirements including fabric u-values, glazing type, thermal bridging, ventilation, heating source and any renewables technology.

Table 5 includes the results of the above inputs on the dwellings performance and provides a comparison for each dwelling. These results highlight the key performance of the three standards, including space heating demand, CO_2 emissions, fuel costs and SAP performance. It is clear to see that Energiesprong and Passivhaus create a significant uplift in performance compared to the building regulations and the difference between the two enhanced standards is minimal.

Table 4 – Input variables for Building Regulations, Energiesprong and Passivhaus

	BRUKL	ESUK 2	PH
FABRIC ENVELOPE			
	U-value (W/(m²K)	U-value (W/(m²K)	U-value (W/(m²K)
Ground floor	0.13	0.10	0.12
External wall	0.18	0.10	0.12
Roof	0.13	0.10	0.12
Party wall	0.0	0.0	0.0
Internal floor	0.0	0.0	0.0
Internal walls	0.0	0.0	0.0
Entrance door	1.0	1.00	1.0
Back door	1.2	1.20	1.0
GLAZING			
Construction	Double glazing	Double glazing	Triple glazing
Gas	Argon	Argon	Argon
Coating	Low-e, En=0.1, soft coat	Low-e, En=0.1, soft coat	Low-e, En=0.05, soft coat
Frame factor	0.2	0.20	0.2
Uw (W/(m²K)	1.2	1.00	0.7
g-value	0.7	0.70	0.5
Overhang	No	No	Yes (S / E / W)
THERMAL BRIDGING			
y-value (W/m²K)	0.0051	0.0039	N/a taken into account via model oversized to external dimensions as per PHPP approach

INFILTRATION AND VENTILATION			
Air permeability rate ($m^3/(m^2h)$)	5.0	3.0	1.0
Ventilation type	Natural	Balanced with heat recovery (Zehnder ComfoAir 180 GB Luxe PH)	Balanced with heat recovery (Zehnder ComfoAir 180 GB Luxe PH)
Number of fans	3	0	0
SPACE HEATING			
Generation system	Mains gas boiler	Electric heat pump	Electric heat pump
Efficiency	0.893	0.893 0.2 PSR: 4.087 0.5 PSR: 4.101 0.8 PSR: 4.300 1.0 PSR: 4.333 1.2 PSR: 4.339 1.5 PSR: 4.261 2.0 PSR: 4.135	0.2 PSR: 4.087 0.5 PSR: 4.101 0.8 PSR: 4.300 1.0 PSR: 4.333 1.2 PSR: 4.339 1.5 PSR: 4.261 2.0 PSR: 4.135
Flow temperature	<=45°C	<=35°C	<=35°C
Controls	Programmer and at least two room thermostats	Time and temperature zone control by suitable arrangement of plumbing and electrical services	Time and temperature zone control by suitable arrangement of plumbing and electrical services
Flue type	Room-sealed	N/a	N/a
Fan-flued	Yes	N/a	N/a
DOMESTIC HOT WATER			
Generation system	Mains gas boiler	Electric immersion (dual)	Electric immersion (dual)
Cylinder volume	170 l	170 l	170 l
Cylinder insulation	Factory, 120 mm	Factory, 120 mm	Factory, 120 mm
Pipework insulation	Fully insulated	N/a	N/a
Controls	Cylinderstat	Cylinderstat	Cylinderstat
PHOTOVOLTAIC			
Peak power (kWp)	1	3	3
Tilt of collectors	45°	45°	45°
Collector orientation	South	South	South
Overshading	None / very little	None / very little	None / very little
SOLAR THERMAL			
Technology	N/a	N/a	Evacuated tube
Area (m^2)	N/a	N/a	3
LIGHTING			
No of light outlets	13	13	13
% of low energy	100%	100%	100%

Table 5 – Space heating demand, CO_2 Emissions, Fuel Costs and SAP Performance Results

	Unit of measure	BRUKL	ESUK2	PH
Space heating energy demand	kWh/m²year	43	25	8
ENERGY CONSUMPTION				
Space heating	kWh/m²year	46	12	4
Domestic hot water	kWh/m²year	42	6	6
Pump, fans and electric keep hot	kWh/m²year	1	5	5
Lighting	kWh/m²year	5	5	5
Photovoltaic	kWh/year	-854	-2,563	-2,563
Total energy	kWh/m²year	83	-5	-13
CARBON DIOXIDE EMISSIONS				
Space heating	$kgCO_2$/m²year	9.95	6.22	4.59
Domestic hot water	$kgCO_2$/m²year	8.98	3.26	3.01
Pump, fans and electric keep hot	$kgCO_2$/m²year	0.51	2.76	2.70
Lighting	$kgCO_2$/m²year	2.74	2.74	2.72
Photovoltaic	$kgCO_2$/year	-443	-1,330	-1,330
Total CO_2	kWh/m²year	16.37	-2.46	-1.38
FUEL COSTS				
Space heating	£/year	112	84.49	61
Domestic hot water	£/year	133	58.88	67
Pump, fans and electric keep hot	£/year	13	62.13	73
Lighting	£/year	69	69.22	83
Additional standing charges	£/year	90	8.00	8
Photovoltaic	£/year	-140	-419.44	-419
Total fuel costs	£/year	£ 277.59	-£136.72	-£126.47
Total gas costs	£/year	245.29		
Total electricity costs	£/year	82.11	274.72	284.97
Additional standing charges	£/year	90	8	8

Photovoltaic	£/year	-140	-419	-419
SAP PERFORMANCE OUTPUTS				
Target Fabric Energy Efficiency	kWh/m^{2}year	47.60	47.60	47.40
Dwelling Fabric Energy Efficiency	kWh/m^{2}year	47.10	36.50	34.60
Target Carbon Dioxide Emission Rate (TER)	kgCO_2/m^{2}year	17.81	25.53	24.22
Dwelling Carbon Dioxide Emission Rate (DER)	kgCO_2/m^{2}year	16.37	-2.46	-1.38
SAP rating	-	B 87	A 105	A 104
EI rating	-	B 88	A 104	A 103

Summary

Energiesprong provides a performance assured net zero energy design option for new build where energy generated is equal to energy consumed.

The holistic net zero design offers a generous supply of heat, hot water and electricity for lighting and appliances, similar in principle to a mobile phone plan.

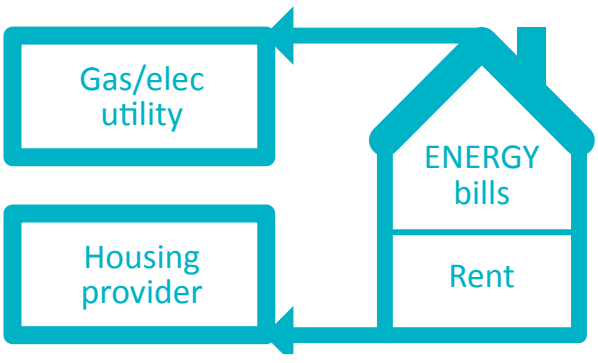
The outcome based specification competes with Passivhaus on energy demand, CO_2 emissions, running costs and is a drastic improvement on current building regulations.

The net zero energy approach focuses on the fabric of the building and also combines micro generation to supply as much energy as is consumed over one year.

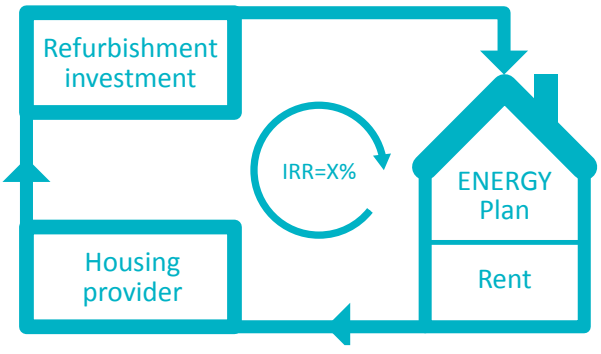
The space heating costs of Energiesprong are comparable with Passivhaus, yet the micro generation capacity means that total fuel costs are lower.

The energy services plan creates a sustainable mechanism to enable the recovery of the additional investment required to achieve the Energiesprong standard.

The 30 year performance warranty provides quality assurance and risk management to ensure the building and technology performance for the duration of the warranty, whilst also removing the requirement for maintenance.



Building Regulations and Passivhaus



Energiesprong Net Zero Energy