

Gwynedd Rural Housing Enabler

Passivhaus social housing, Ebbw Vale.... and the wider opportunity for low cost, community-self-build

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The regeneration project

The Works site at Ebbw Vale is one of the largest regeneration projects in Wales. It is a major mixed use regeneration project (being developed in partnership between Blaenau Gwent County Borough Council and Welsh Assembly Government) set over an area of 200 acres at the former Ebbw Vale steel works. The competition was initiated in association with the Building Research Establishment (Wales) and the United Welsh Housing Association.

Key objectives of the Passive House competition

To create “The Welsh Passive House”

To take into account local natural resources, climate and geography to determine what is the most suitable approach to delivery a low energy / low carbon house in Wales

To meet the Welsh Assembly Government’s target that all buildings built from 2011 will meet CSH Level 5.

To meet the DQR standard for social housing and to meet the requirements of the United Welsh Housing Association (competition delivery partners)

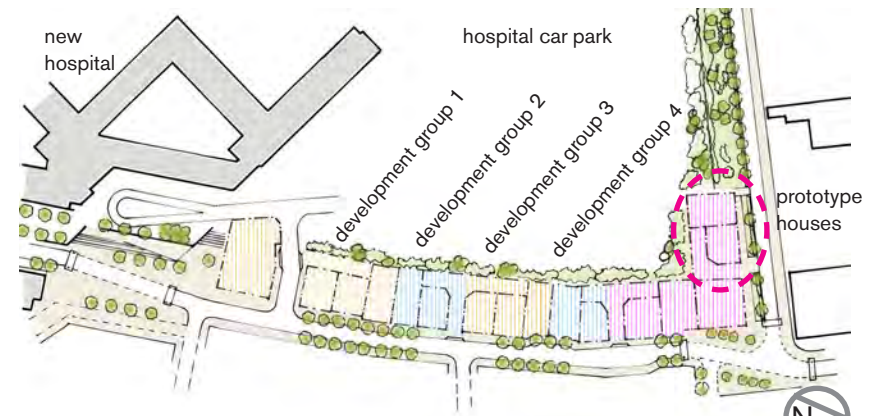
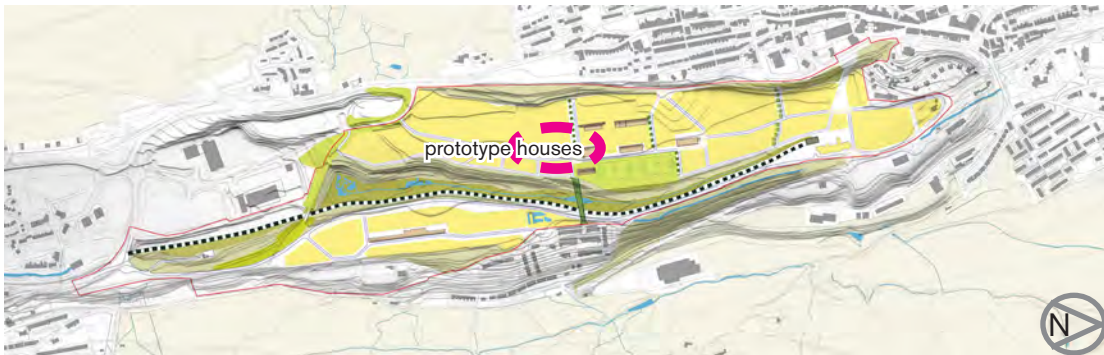
Realistic and achievable concepts that demonstrate how Passivhaus compliance can be delivered in low cost housing by June 2010



site of the former steelworks at Ebbw Vale



masterplan by Alan Baxter & Associates



Westgate site layout by Alan Baxter & Associates

GREEN HOMES 2010

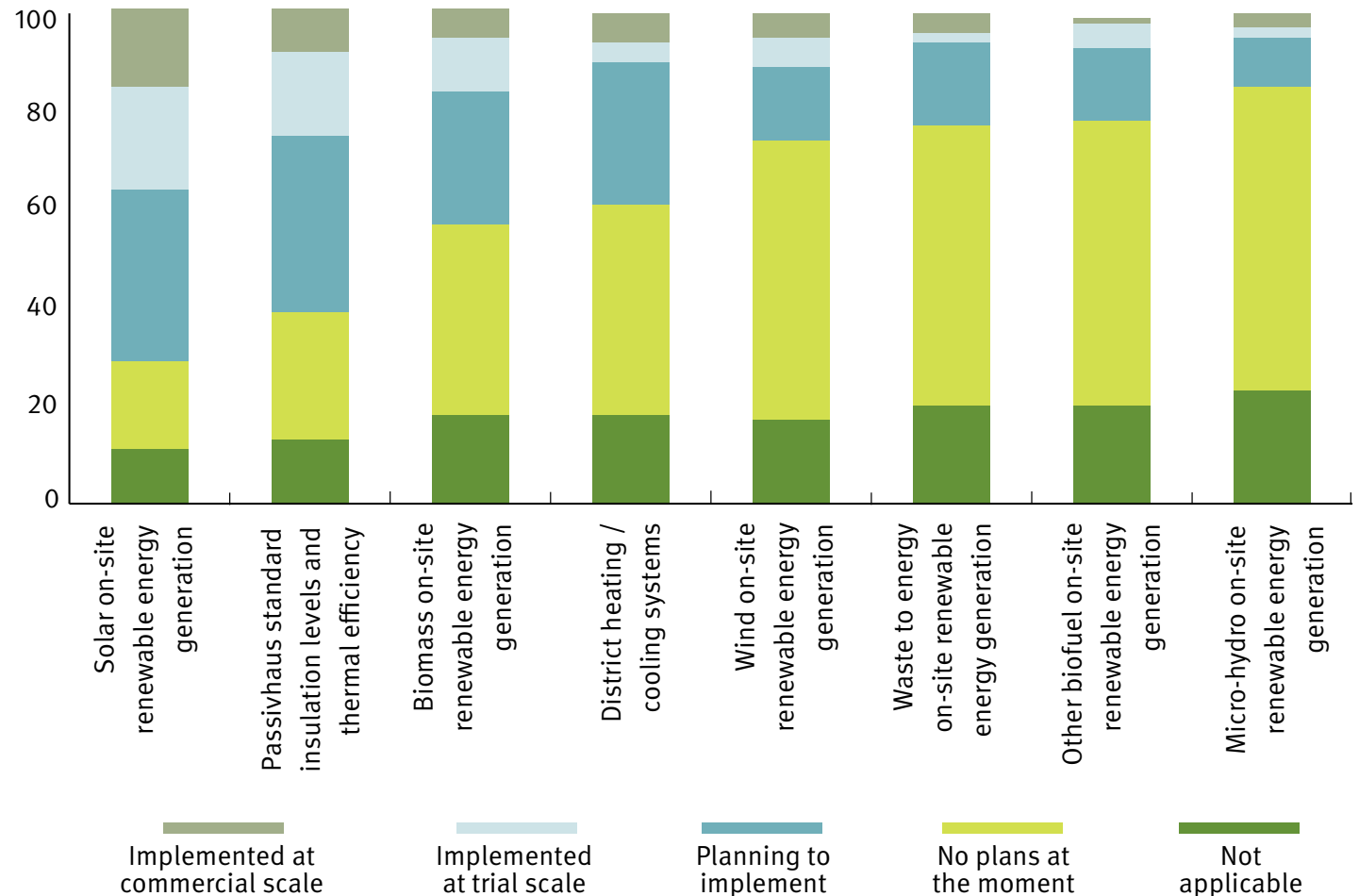
Zero carbon, sustainability and the house-building sector

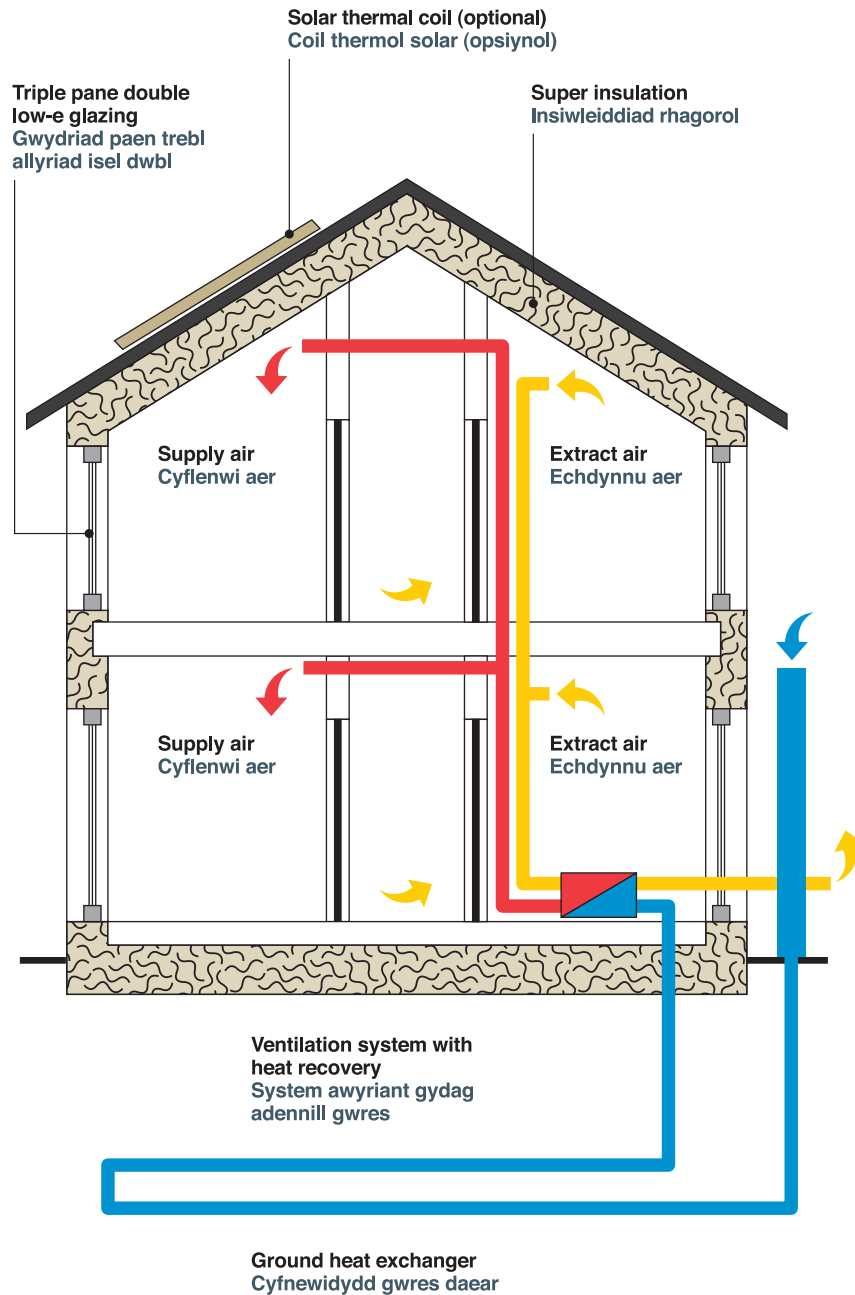
Knight Frank



The Knight Frank Green Homes Survey was undertaken in September 2010 and the results reflect the views of 142 senior house-building representatives including managing directors, CEO's, directors and managers, all of whom are involved in the house-building process.

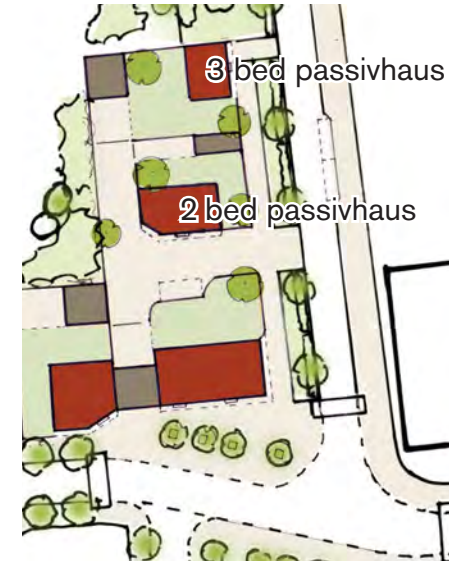
What is your organisation doing to prepare for the shift from Code Level 4 to Code Level 6?



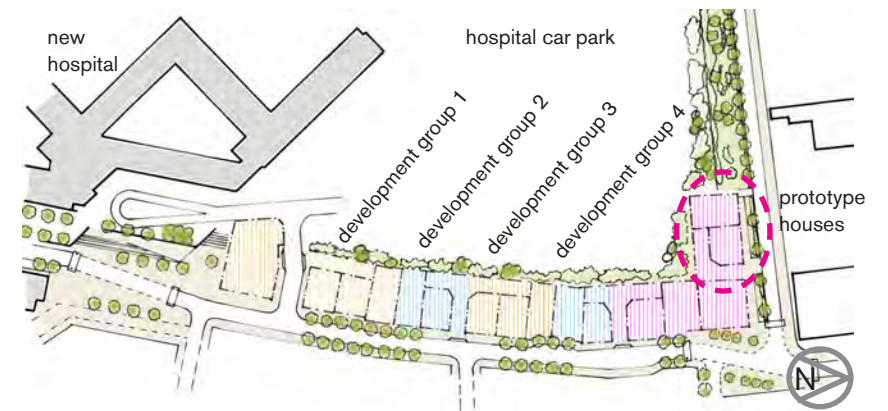




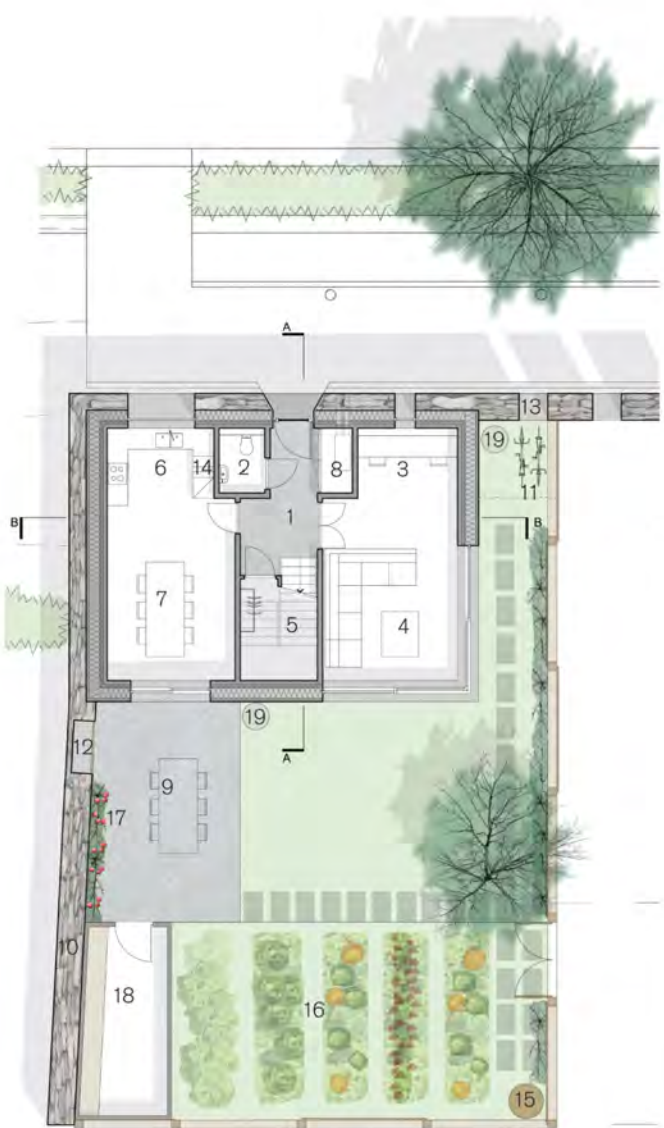
The site:
1000 ft above sea level
cold
cloudy



Westgate plot layouts
by Alan Baxter
& Associates

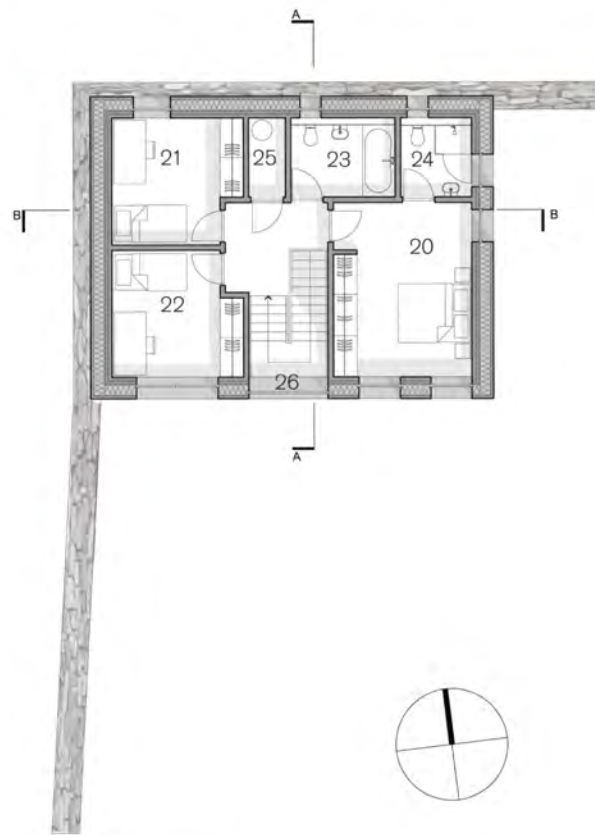




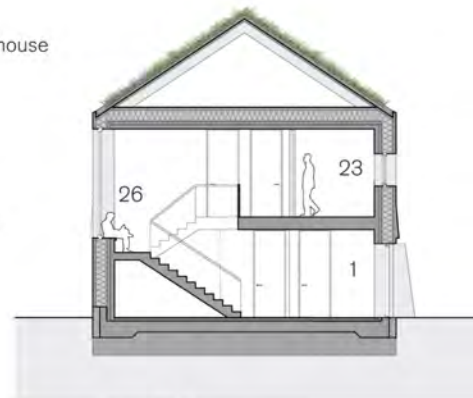


Ground floor plan

- Key
- | | | |
|-----------------------------------|-----------------------------|-------------------------------|
| 1. Entrance hall | 9. External terrace | 18. Potting area / Greenhouse |
| 2. WC | 10. Dry-stone wall | 19. Water butt |
| 3. Study | 11. Cycle storage | 20. Master bedroom |
| 4. Living room | 12. Bin store | 21. Bedroom 1 |
| 5. Storage | 13. Smoot | 22. Bedroom 2 |
| 6. Kitchen | 14. Recycling | 23. Family bathroom |
| 7. Dining room | 15. Wormery | 24. Ensuite bathroom |
| 8. Cloakroom / Heat recovery unit | 16. Vegetable garden | 25. Drying / Boiler room |
| | 17. Fan trained fruit trees | 26. Window seat |



First floor plan



Section AA



Section BB





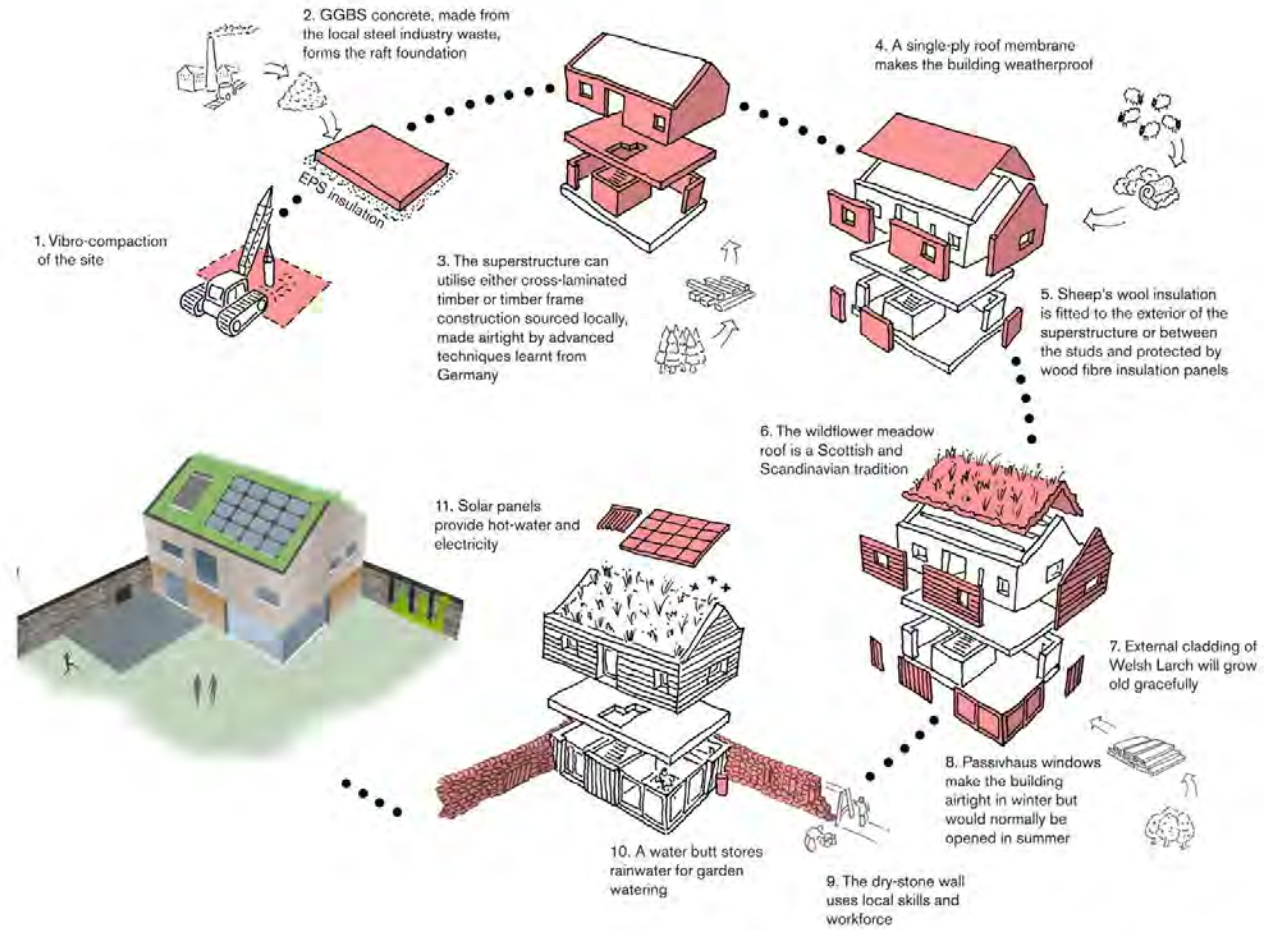


camden passivhaus

knowledge transfer from Austria to Wales



bere:architects



prefabricated timber construction sequence diagram





3 bedroom prototype (99m²)

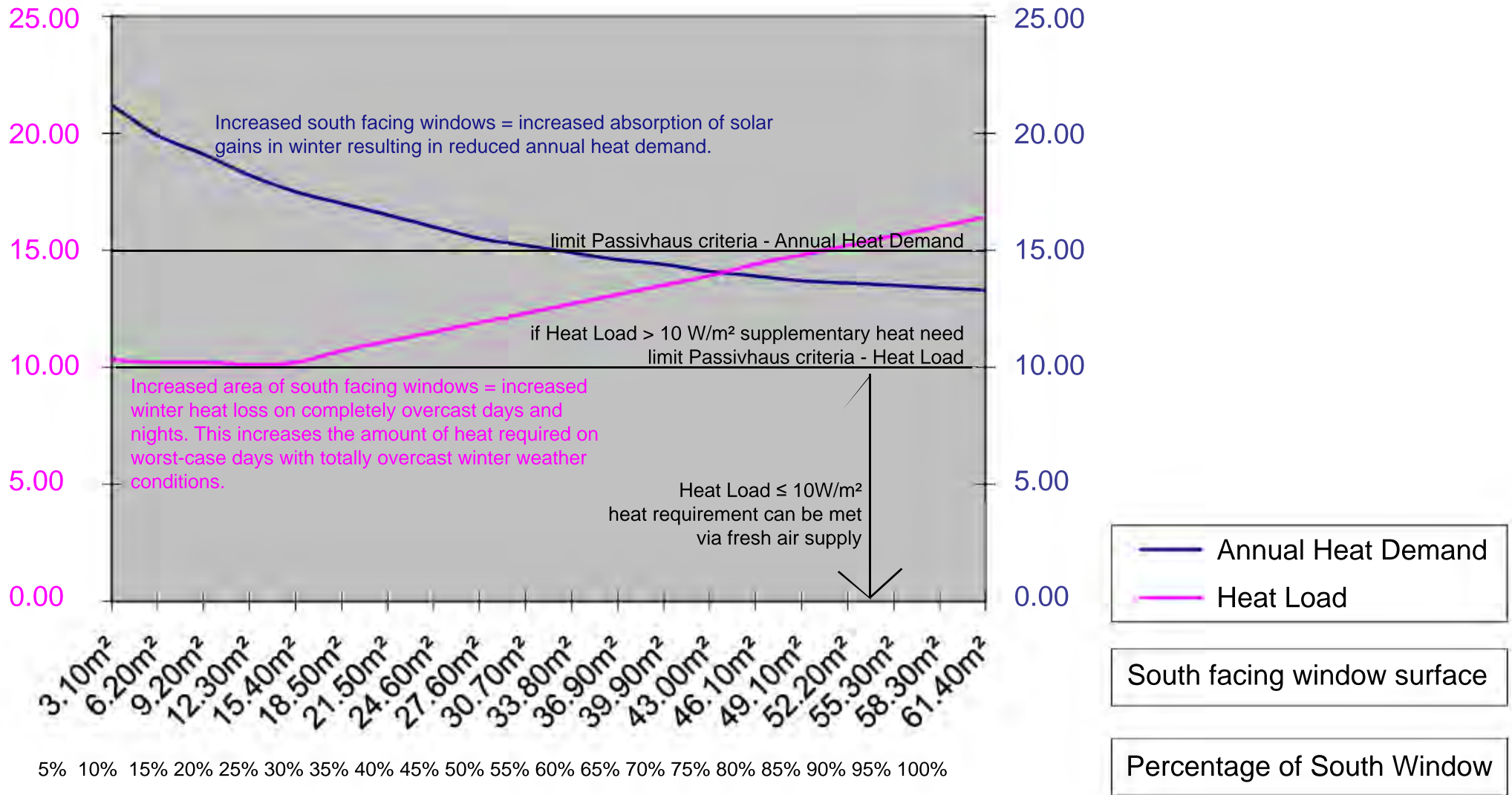
- used traditional method of certification, based on maximising external solar gains
- designed to keep below 15kWh/m²/yr total heat requirement
- 55% south facing glazing
- maximising the benefit of external (solar) heat gains
- however the coldest days will require peak heat supply of around 12W/m²
- expensive windows
- solar shading required in summer to avoid over-heating

2 bedroom prototype (76m²)

- alternative method of certification by peak load
- designed to keep below 10W/m² peak heat requirement
- 22% south facing glazing
- maximising the benefit of internal heat gains
- however total heat requirement 17kWh/m²/yr
- cheaper windows
- no solar shading required

Heat Load
W/m²

Annual Heat Demand
kWh/(m²a)





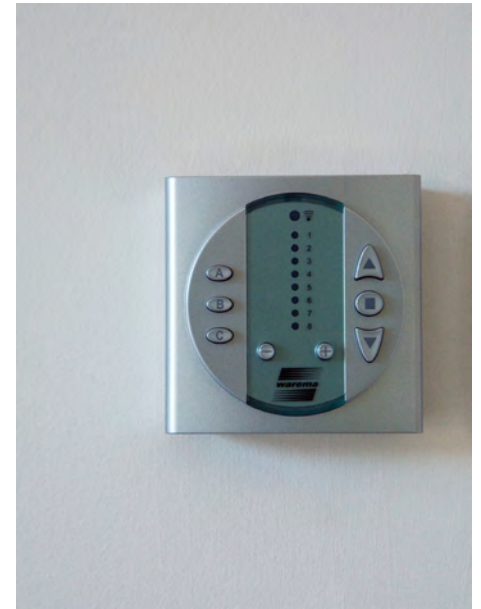
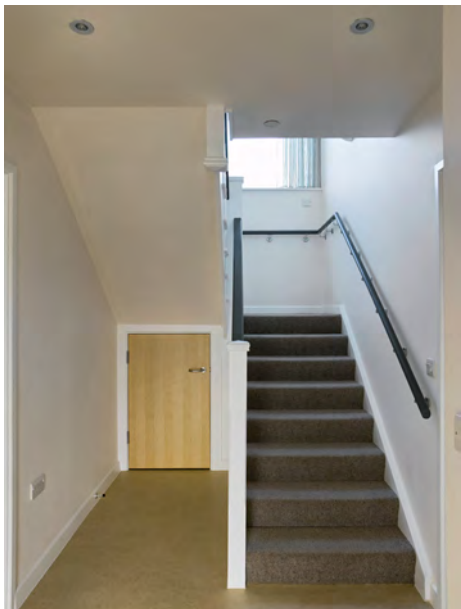
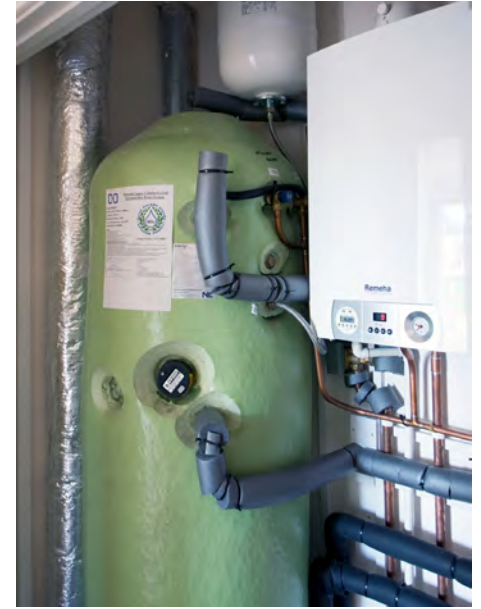
Larch House



Lime House







PHPP Verification page showing 3 bed Passivhaus in Ebbw Vale

Passive House Verification

Photo or Drawing

The calculation uses local weather data provided by the BRE

Building: **Hwylus Haus**
 Location and Climate: **Ebbw Vale** Wales - Ebbw Vale (MN)
 Street:
 Postcode/City:
 Country: **Wales/United Kingdom**
 Building Type: **Detached residential house**

Home Owner(s) / Client(s): **Blaenau Gwent County Borough Council**
 Street: **Steelworks Road**
 Postcode/City: **NP23 6YL Ebbw Vale**

Architect: **bere:architects**
 Street: **73 Poets Road**
 Postcode/City: **N5 2SH London**

Mechanical System: **Alan Clarke and Peter Warm**
 Street:
 Postcode/City:

Year of Construction: **2010**

Number of Dwelling Units: **1** Interior Temperature: **20.0** °C
 Enclosed Volume V_e: **434.4** m³ Internal Heat Gains: **2.1** W/m²
 Number of Occupants: **2.5**

Specific Demands with Reference to the Treated Floor Area

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Treated Floor Area:	86.7	m ²		
Specific Space Heat Demand:	13	kWh/(m ² a)	15 kWh/(m ² a)	Yes
Pressurization Test Result:	0.2	h ⁻¹	0.6 h ⁻¹	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	83	kWh/(m ² a)	120 kWh/(m ² a)	Yes
Specific Primary Energy Dem and (DHW, Heating and Auxiliary Electricity):	48	kWh/(m ² a)		
Specific Primary Energy Dem and Energy Conservation by Solar Electricity:	60	kWh/(m ² a)		
Heating Load:	11	W/m ²		
Frequency of Overheating:	6	%	over 25 °C	
Specific Useful Cooling Energy Demand:		kWh/(m ² a)	15 kWh/(m ² a)	
Cooling Load:	2	W/m ²		

We confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The calculations with PHPP are attached to this application.

Issued on: _____ signed: _____

The verification page shows that in Ebbw Vale, the 3 bed house exceeds Passivhaus standard

Passive House Verification

Photo or Drawing

Building: **Hwylus Haus**
 Location and Climate: **Ebbw Vale** GB - Manchester
 Street:
 Postcode/City:
 Country: **Wales/United Kingdom**
 Building Type: **Detached residential house**

Home Owner(s) / Client(s): **Blaenau Gwent County Borough Council**
 Street: **Steelworks Road**
 Postcode/City: **NP23 6YL Ebbw Vale**

Architect: **bere:architects**
 Street: **73 Poets Road**
 Postcode/City: **N5 2SH London**

Mechanical System: **Alan Clarke and Peter Warm**
 Street:
 Postcode/City:

Year of Construction: **2010**

Number of Dwelling Units: **1** Interior Temperature: **20.0** °C
 Enclosed Volume V_e: **434.4** m³ Internal Heat Gains: **2.1** W/m²
 Number of Occupants: **2.5**

Specific Demands with Reference to the Treated Floor Area

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Treated Floor Area:	86.7	m ²		
Specific Space Heat Demand:	6	kWh/(m ² a)	15 kWh/(m ² a)	Yes
Pressurization Test Result:	0.2	h ⁻¹	0.6 h ⁻¹	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	77	kWh/(m ² a)	120 kWh/(m ² a)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	42	kWh/(m ² a)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:	60	kWh/(m ² a)		
Heating Load:	10	W/m ²		
Frequency of Overheating:	1	%	over 25 °C	
Specific Useful Cooling Energy Demand:		kWh/(m ² a)	15 kWh/(m ² a)	
Cooling Load:	8	W/m ²		

We confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The calculations with PHPP are attached to this application.

Issued on: _____ signed: _____

PHPP Verification page showing 3 bed Passivhaus in Ebbw Vale

Passive House Verification

Photo or Drawing

The calculation uses local weather data provided by the BRE

Building	Hvylus Haus
Location and Climate	Ebbw Vale Wales - Ebbw Vale (MN)
Street	
Postcode/City	
Country	Wales/United Kingdom
Building Type	Detached residential house
Home Owner(s) / Client(s)	Blaenau Gwent County Borough Council
Street	Steelworks Road
Postcode/City	NP23 6YL Ebbw Vale
Architect	bere:architects
Street	73 Poets Road
Postcode/City	N5 2SH London
Mechanical System	Alan Clarke and Peter Warm
Street	
Postcode/City	
Year of Construction	2010
Number of Dwelling Units	1
Interior Temperature	20.0 °C
Enclosed Volume V _e	434.4 m ³
Internal Heat Gains	2.1 W/m ²
Number of Occupants	2.5

Specific Demands with Reference to the Treated Floor Area			
	Treated Floor Area	Applied	PH Certificate
Specific Space Heat Demand:	86.7 m ²	13 kWh/(m ² a)	15 kWh/(m ² a)
Pressurization Test Result:		0.2 h ⁻¹	0.6 h ⁻¹
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):		83 kWh/(m ² a)	120 kWh/(m ² a)
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):		48 kWh/(m ² a)	
Specific Primary Energy Demand and Energy Conservation by Solar Electricity:		60 kWh/(m ² a)	
Heating Load:		11 W/m ²	over 25 °C
Frequency of Overheating:		6 %	
Specific Useful Cooling Energy Demand:		kWh/(m ² a)	15 kWh/(m ² a)
Cooling Load:		2 W/m ²	

We confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The calculations with PHPP are attached to this application.

Issued on: _____ signed: _____

The verification page shows that in Ebbw Vale, the 3 bed house exceeds Passivhaus standard

How does the same house perform in Austria?

Passive House Verification

Photo or Drawing

If the weather data is changed to Salzburg, Austria...

Building	Hvylus Haus
Location and Climate	Ebbw Vale S - Salzburg
Street	
Postcode/City	
Country	Wales/United Kingdom
Building Type	Detached residential house
Home Owner(s) / Client(s)	Blaenau Gwent County Borough Council
Street	Steelworks Road
Postcode/City	NP23 6YL Ebbw Vale
Architect	bere:architects
Street	73 Poets Road
Postcode/City	N5 2SH London
Mechanical System	Alan Clarke and Peter Warm
Street	
Postcode/City	
Year of Construction	2010
Number of Dwelling Units	1
Interior Temperature	20.0 °C
Enclosed Volume V _e	434.4 m ³
Internal Heat Gains	2.1 W/m ²
Number of Occupants	2.5

Specific Demands with Reference to the Treated Floor Area			
	Treated Floor Area	Applied	PH Certificate
Specific Space Heat Demand:	86.7 m ²	6 kWh/(m ² a)	15 kWh/(m ² a)
Pressurization Test Result:		0.2 h ⁻¹	0.6 h ⁻¹
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):		75 kWh/(m ² a)	120 kWh/(m ² a)
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):		39 kWh/(m ² a)	
Specific Primary Energy Demand and Energy Conservation by Solar Electricity:		60 kWh/(m ² a)	
Heating Load:		14 W/m ²	over 25 °C
Frequency of Overheating:		3 %	
Specific Useful Cooling Energy Demand:		kWh/(m ² a)	15 kWh/(m ² a)
Cooling Load:		12 W/m ²	

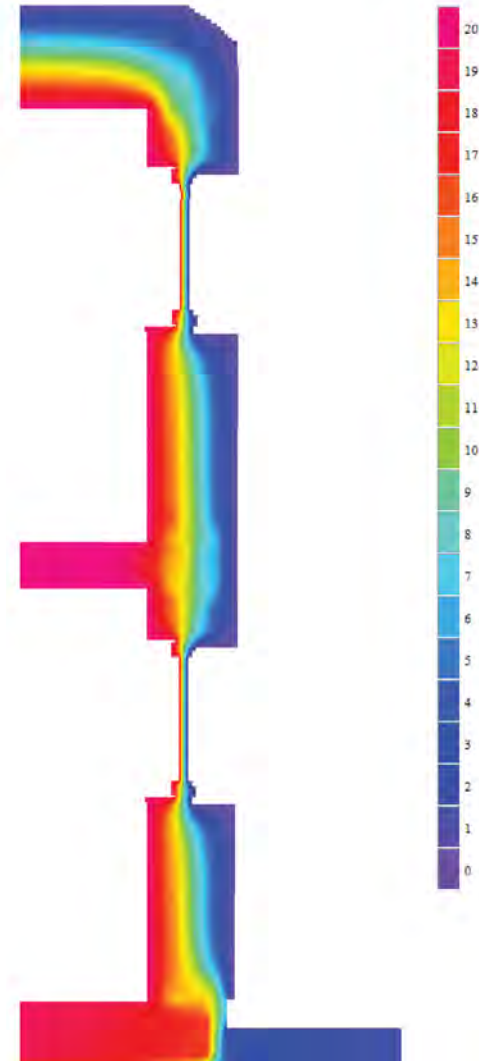
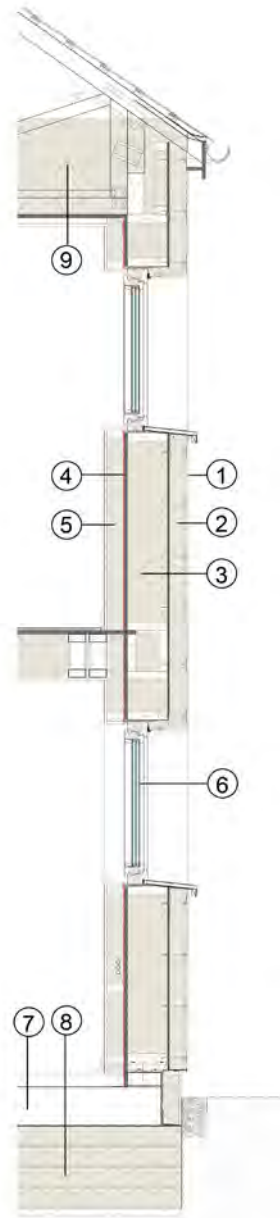
We confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The calculations with PHPP are attached to this application.

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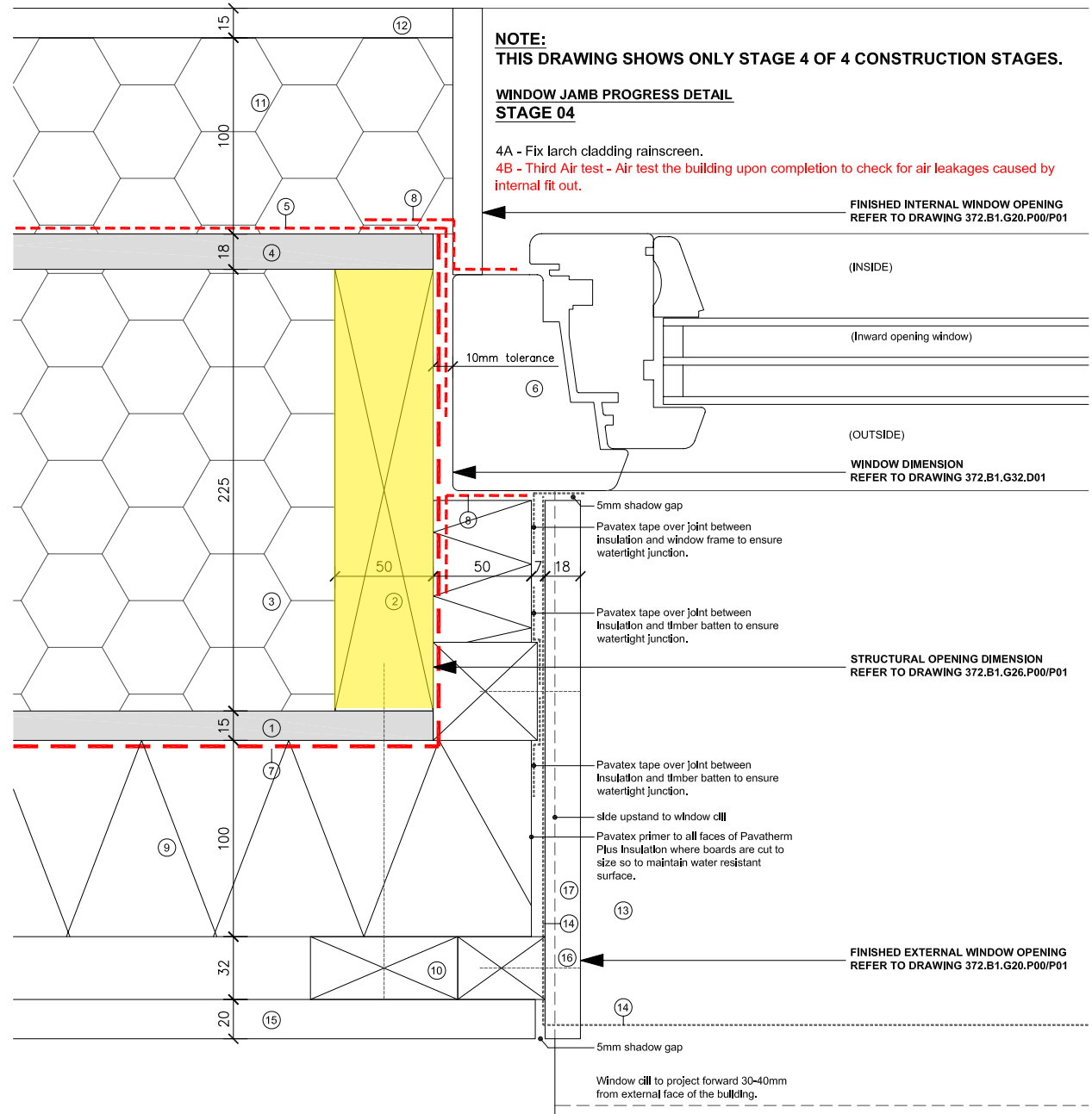
...the specific heat and primary energy demand both drop dramatically.

Detail section through the Lime House

- ① Welsh lime render
- ② Rigid wood fibre insulation
- ③ Glass mineral wool insulation between Welsh manufactured timber frame
- ④ Draught proofing membrane
- ⑤ Loose fill wood fibre insulation
- ⑥ Triple glazed window with insulated frames manufactured in Wales
- ⑦ Concrete using recycled material
- ⑧ Extruded polystyrene insulation
- ⑨ Welsh glass mineral wool insulation in roof space



215mm spruce studs at the limit of what can be home-grown in Wales



Code for Sustainable Homes (May 09 version 2)

Design - Draft



This report is approved by BRE as evidence to demonstrate compliance with issues ENE 1, 2 and 7 of the Code for Sustainable Homes.

This Design Assessment has been carried out by an Authorised SAP Assessor. It has been prepared from plans and specifications and may not reflect the property as constructed. Code calculations are from the Technical Guide (May 09 version 2).

Assessor name	Mr Nick Devlin	Assessor number	1824
Client		Last modified	09/07/2010
Address	1 TBC, TBC, Gwent, NP23		

Building regulation assessment - criterion 1

	kg/m ² /yr
DER	-11.22
TER	23.99

Assessment of zero carbon home and low or zero carbon technologies

		Credits	Level
Dwelling emission rate (Ene 1)	CO ₂ reduction = 146%	15	6
Building fabric (Ene 2)	HLP = 0.67	2	
Low or zero carbon technologies (Ene 7)	CO ₂ reduction = 94%	2	

Ene 1 - dwelling emission rate

	%	kWh/m ²	kg/m ² /yr
Assessment of Ene 1 (level 1-5)			
DER from SAP 2005 DER worksheet			-11.22
CO ₂ emissions from mechanical cooling			0.00
Sub total CO ₂ emissions			-11.22
CO ₂ emissions offset from community biomass CHP systems			0.00
Additional allowable generation		0.00	
CO ₂ emissions offset from generation			0.00
Total CO ₂ reduction from low or zero carbon technologies			0.00
Total predicted CO ₂ emissions			-11.22
CO ₂ reduction compared to TER			35.21
CO ₂ reduction as % of TER	146.77		

Assessment of Ene 1 (level 6) and zero carbon home			
DER from SAP 2005 DER worksheet		-11.22	(ZC1)
CO ₂ emissions from appliances and cooking		12.63	(ZC2)
Sub total CO ₂ emissions		1.41	(ZC3)
Additional LEL and no assumed secondary heating		-1.63	(ZC4)
CO ₂ emissions offset from community biomass CHP systems		0.00	(ZC5)
Additional allowable generation and its CO ₂ emissions offset	0.00		(ZC6)
CO ₂ emissions offset from generation		0.00	(ZC7)
Net CO ₂ emissions		-0.22	(ZC8)
CO ₂ emissions from mechanical cooling		0.00	(ZC9)
Total predicted CO ₂ emissions		-0.22	

URN: 3BED CSHL6 COMPLIANT version 1
Plan Assessor version 4.5.25
SAP version 9.81

Daniel Hayes
Bere: Architects
73 Poets Road
London
N5 2SH

30th July 2010

Dear Daniel,

Re: Plot 1 Future Works, 3 Bed House

I write to confirm that the above house has been designed and constructed to a standard to satisfy the requirements for Code Level 6 under the Code for Sustainable Homes.

In order to achieve this, the design has had to incorporate exemplar standards of energy and water efficiency and furthermore address all aspects of current exemplar practice for sustainable design and construction. This includes the specification of materials and all aspects of the construction management process.

It should also be stated that by satisfying the requirements for Code Level 6 the dwelling can formally be classed as a Zero Carbon dwelling, in that the combination of efficiency measures and renewable energy systems result in no net annual carbon dioxide emissions for the operation of all space heating, hot water and electrical consumption.

The tables on the following page provide a summary of the maximum category scores and those achieved by the scheme.

If you have any further questions, please do not hesitate to contact me.

Yours Sincerely,

Nick Devlin.



Building Research Establishment
Watford
Herts
WD25 9XX
United Kingdom

Authorised by:
Passivhaus Institut
Dr. Wolfgang Feist
Rheinstr. 44/46
D-64283 Darmstadt



Certificate

The Building Research Establishment certifies the building
The Larch House, The Works Ebbw Vale, Blaenau Gwent County Borough,
Steelworks Road, Ebbw Vale NP23 6AA

Principal Consultant: **Rob McLeod**
Building Research Establishment

Architect: **Bere:architects**
73 Poets Road, London, N5 2SH

Mechanical Services: **Alan Clarke**
The Woodlands, Woodland Close, Whitecroft, Lydney, GL15 4PL

as a

Quality Approved Passive House

The planning of this building meets the criteria for Passive Houses set up by the
Passivhaus Institut.

With appropriate execution it will conform to the following standards:

- The building features excellent complete thermal insulation and first grade connection details with respect to building physics. Estival heat protection has been considered. The heating demand is limited to

15 kWh per m² living area and year or a heating load of max. 10 W/m²

- The building shell features excellent air tightness, proven in accordance to ISO 9972, which guarantees the building to be free of draughts and reduces energy demand. The air change rate of the building shell at 50 pascal pressure difference is limited to

0,6 ach, with respect to the building's volume

- The building features a controlled ventilation system with high class filters, highly efficient heat recovery and low electric power consumption. Thus, excellent air quality is achieved in combination with low energy consumption.
- The primary energy demand for standard use of heating, domestic hot water, ventilation and all other electric appliances sums up to less than

120 kWh per m² living area and year

This certificate is to be used together with the certification documents only which describe the exact characteristics of the building.

Passive Houses offer high comfort during summer as well as in winter and can be heated with little effort, e.g. by heating of supply air. The building shell of a Passive House is evenly warm on the inside, inside such that surface temperatures hardly differ from room air temperatures. Due to the highly air tight, draughts cannot appear during normal use. The ventilation system constantly provides good air quality. Heating costs in a Passive House are very low. Thanks to their low energy consumption Passive Houses offer security against future rises in energy prices and against energy scarceness. Moreover, the environmental impact is low as energy resources are spent very economically and only small amounts of carbon dioxide (CO₂) and other pollutants are emitted.

issued:

Kym Mead, Senior Consultant
Building Research Establishment, United Kingdom

Passivhaus
Institut
Dr. Wolfgang Feist
Rheinstraße 44/46
D-64283 Darmstadt



Certificate

valid until 31.12.2010

Component suitable for
Passive Houses: **Window Frame**

Manufacturer: **Wales Forest Business Partnership
Machynlleth, Powys, SY20 8AX**

Name of product: **The Vale Passive Window**

The following criteria were checked to award the certificate:

The criteria are valid for the cool temperate climate.

Passive House comfort criterion:

Under standard conditions (use of glazing with $U_g = 0.7 \text{ W}/(\text{m}^2\text{K})$, width of window 1.23 m, height of window 1.48 m) the U-Value of the window fulfils the following condition:

$$U_w = 0.79 \leq 0.80 \text{ W}/(\text{m}^2\text{K})$$

Thermal data of the window frame:

Frame	jamb	parapet
U_f [W/(m ² K)]	0.77	0.80
Width [mm]	128	128

Spacer	Swisspacer V
Ψ_g [W/(mK)]	0.028

Conditions specific for Passive Houses:

The suitability for Passive Houses was checked only with the spacer denoted above; thermally worse spacers, especially those made of aluminium, lead to significantly higher thermal losses.

Installing the window suitable for Passive House:

Including all thermal bridge effects, the window fulfils the condition

$$U_{w,installed} \leq 0,85 \text{ W}/(\text{m}^2\text{K}),$$

if the window is installed into wall constructions suitable for Passive Houses (brick wall with thermal insulation, light weight wooden construction and form work for concrete of polystyrene) according to the drawings of details given in the appendix.

The certificate has to be used as follows:

Component suitable for
Passive Houses
Dr. Wolfgang Feist



Window frame:

$$U_f = 0.77 / 0.80 \text{ W}/(\text{m}^2\text{K})$$

$$\Psi_g = 0.028 \text{ W}/(\text{mK})$$

$$\text{Width} = 128 / 128 \text{ mm}$$

Gwynedd Rural Housing Enabler

.....an opportunity for low cost, community-self-build?
(2 bed super low-energy passivhaus for under £100,000)



Lime House



■ Choose site



Running total



■ Prepare site	£1,289	(Material supplied)
-Excavation	£500	
-Subbase	£633	
-Sand blinding	£156	



Running total	£1,289
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■ Lay insulation	£4,775	(Material supplied)
-480mm Styrofoam	£4,368	
-Edge insulation	£407	



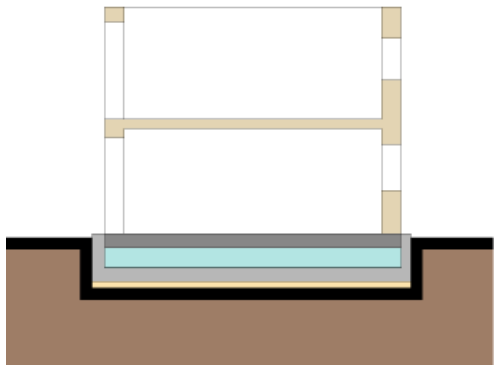
Running total £6,064



■ Pour concrete slab	£2,646	(Material supplied)
-DPM and tanking	£276	
-Mesh reinforcement	£496	
-U bars & splice	£205	
-Shuttering to slab	£168	
-225mm thick concrete slab	£935	
-Thermalite blockwork	£167	
-Service ducts	£400	



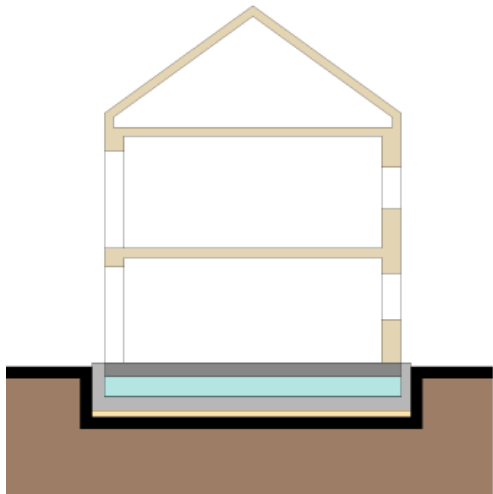
Running total	£8,711
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■ Timber frame constructed £17,662 (Fully installed)



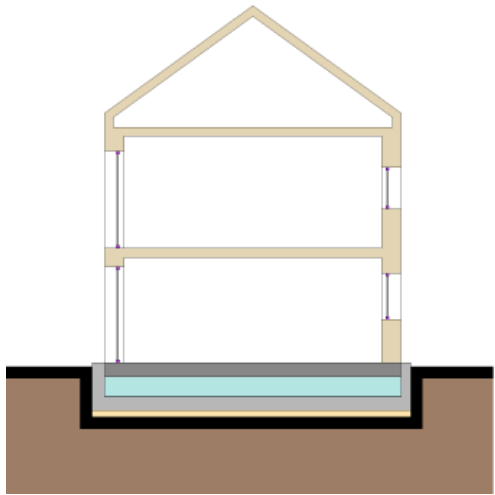
Running total £26,373



■ Complete superstructure	£17,797	(Material supplied)
-Roof covering	£4,806	
-Stairs	£448	
-External insulation	£5,963	
-Internal insulation	£2,033	
-Internal walls	£2,209	
-External render*	£2,338	
(larch cladding additional)		



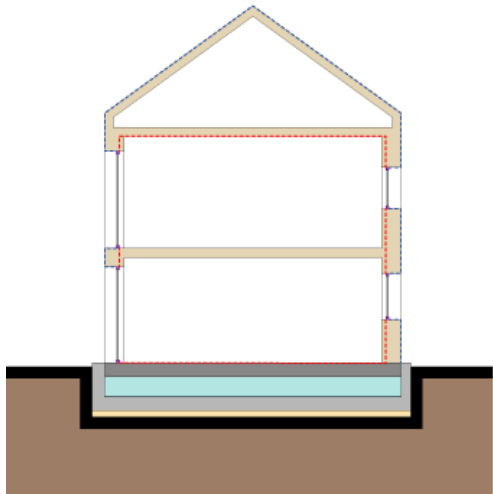
Running total	£44,170
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■ Windows & ext. doors fitted £8,828 (Fully installed)



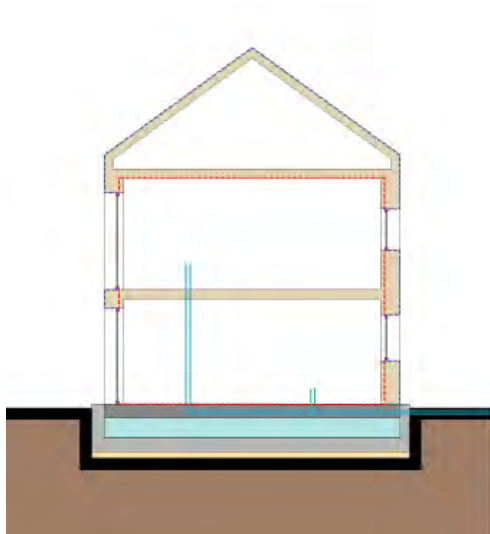
Running total £52,997



■ Apply finishes	£8,493	(Material supplied)
-Wall finishes	£4,061	
-Floor finishes	£2,672	
-Ceiling finishes	£949	
-Internal doors	£812	



Running total	£61,490
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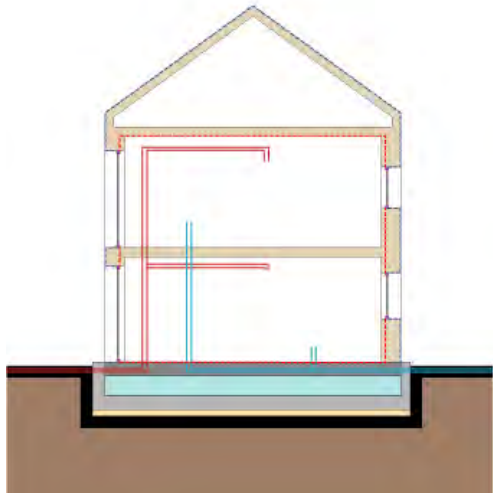


■ Plumbing fitted £7,450 (Fully installed)

-Subcontractor's fee including plumbing, sanitaryware and solar hot water heating



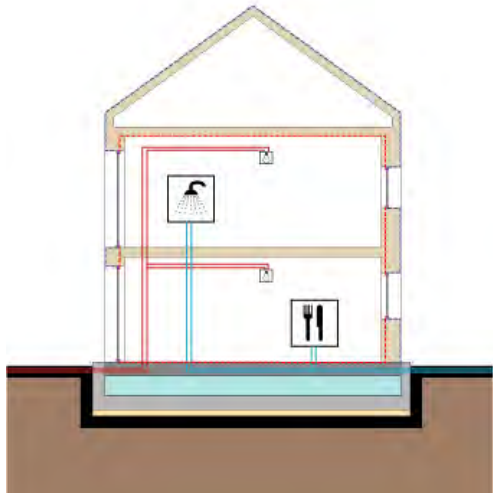
Running total £68,940



■ M&E fitted	£15,627	(Fully installed)
-Ventilation	£8,372	
-Electrical installation	£6,485	
-Grid connection	£770	



Running total	£84,567
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■ Fit kitchens and bathrooms £1,172 (Materials supplied)

- Kitchen units and eco bin £1,000
- Bathroom cabinet, mirror and other fittings £172

(sanitaryware already included in plumbing package)



Running total £85,739

Overall breakdown

■ Site prepared	£1,289	(Materials supplied)
■ Insulation laid	£4,775	(Materials supplied)
■ Concrete slab poured	£2,646	(Materials supplied)
■ Timber frame constructed	£17,662	(Fully installed)
■ Superstructure completed	£17,797	(Materials supplied)
■ Windows fitted	£8,827	(Fully installed)
■ Finishes applied	£8,493	(Materials supplied)
■ Plumbing installed	£7,450	(Fully installed)
■ M&E fitted	£15,627	(Fully installed)
■ Kitchens & bathrooms	£1,172	(Materials supplied)

*Excludes prelims and design fees. Labour to be provided by self builder.

Total price	£85,739*
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