Towards Zero Carbon:
A Short Introduction to Passivhaus at Tye Green

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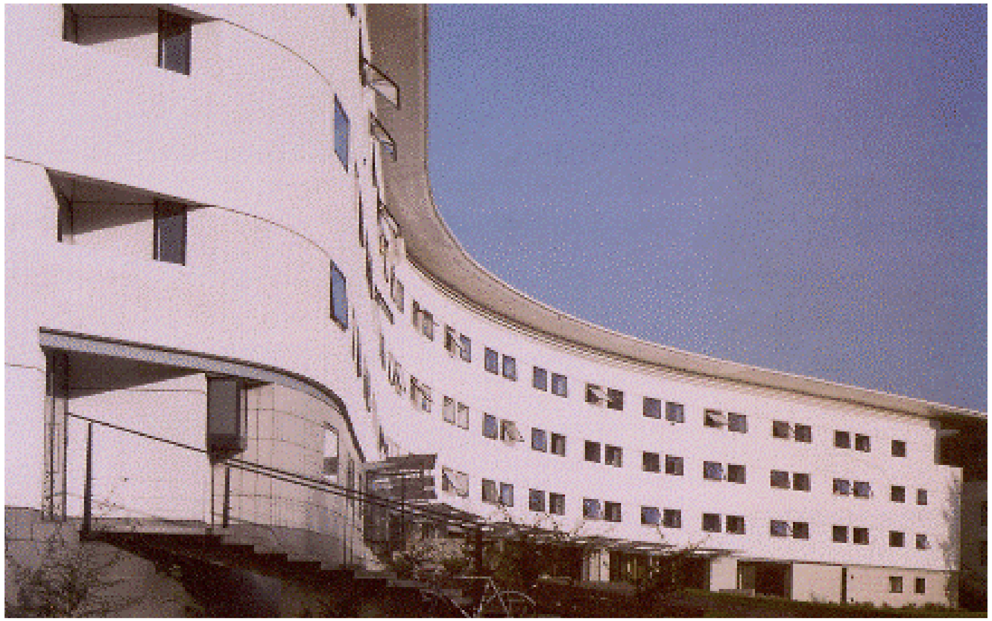
What is Passivhaus?

An energy and comfort standard for buildings

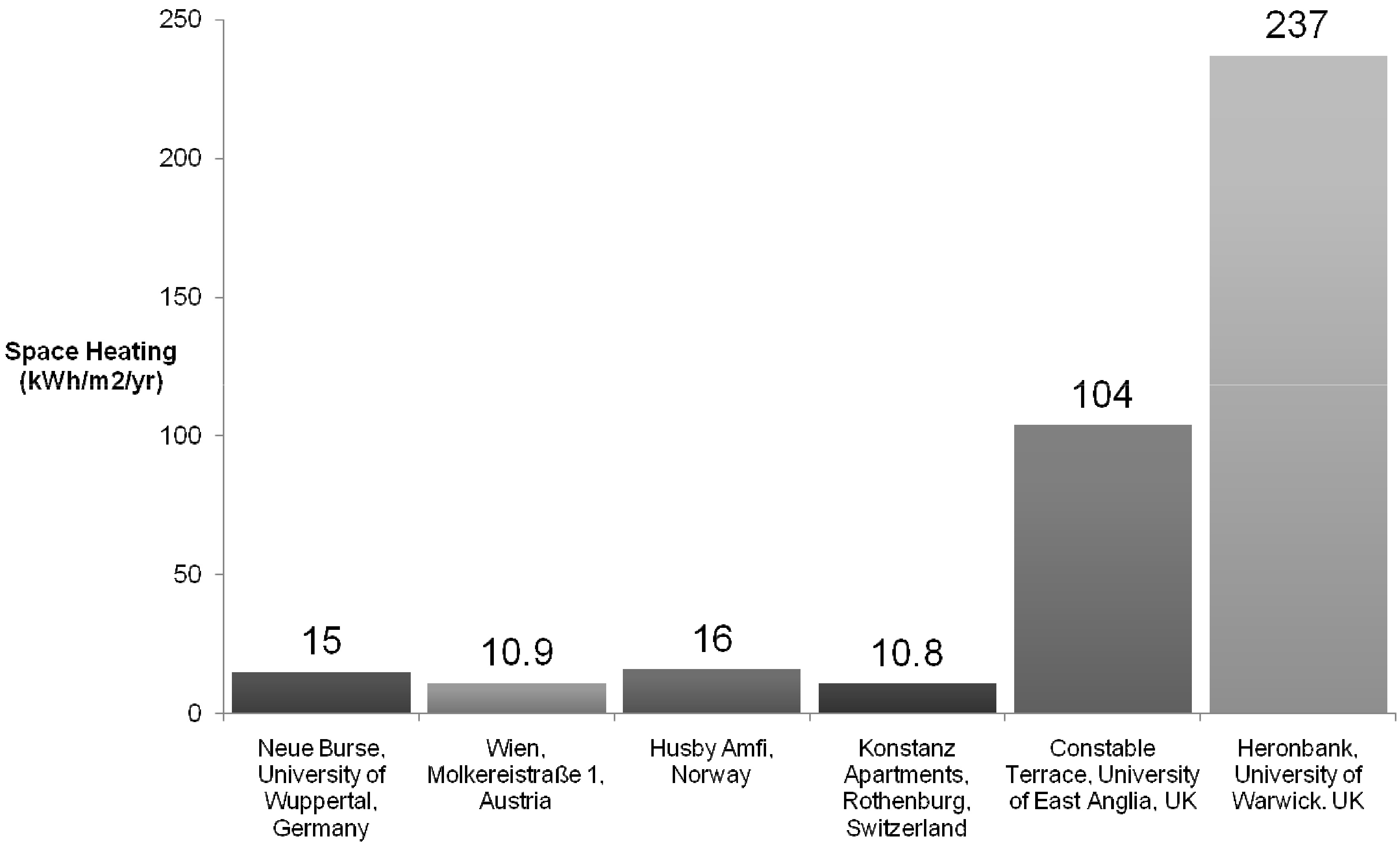
Developed in Germany in the 1980’s.

Proven in over 7000 buildings worldwide

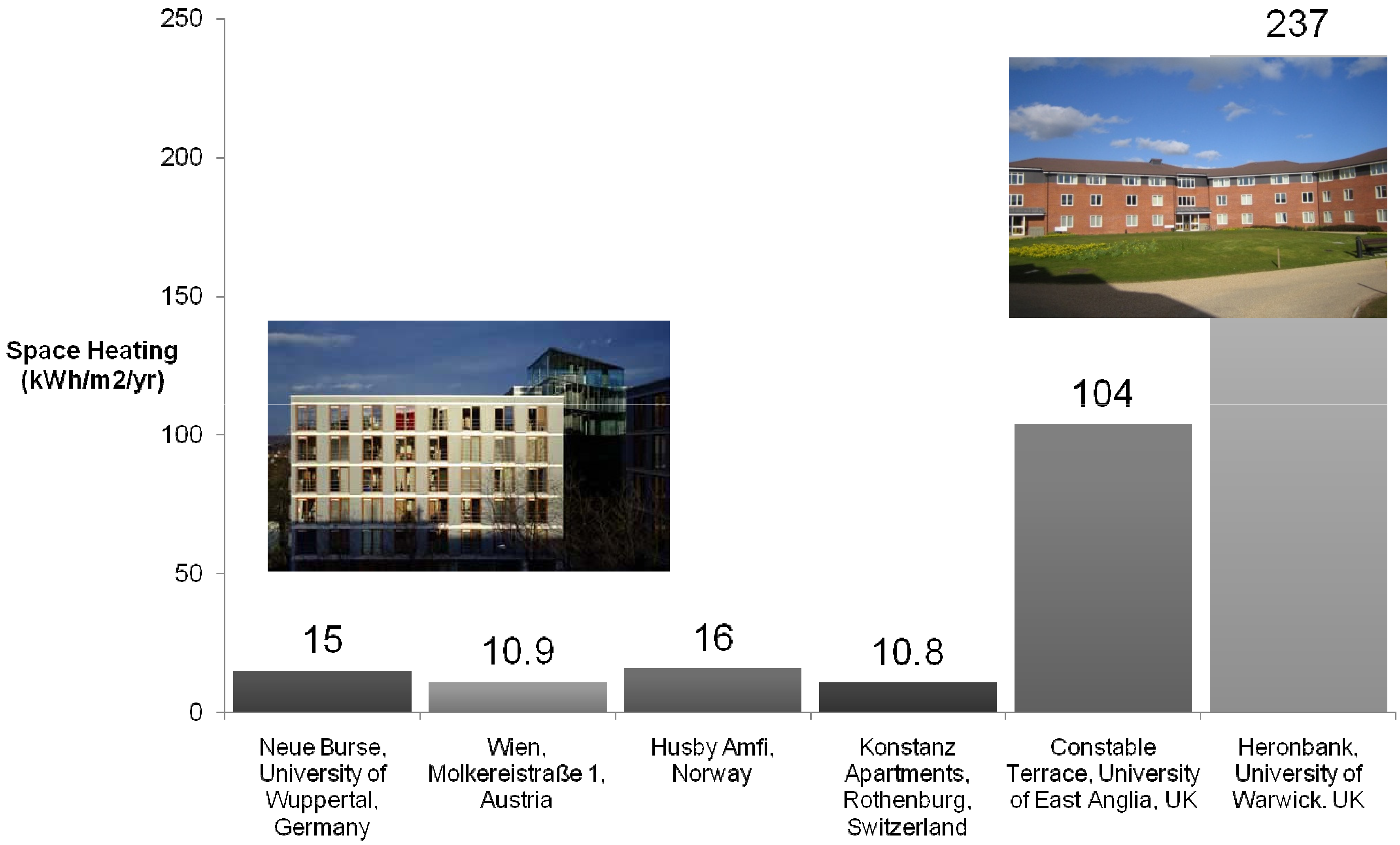

Huge reductions in energy use for heating

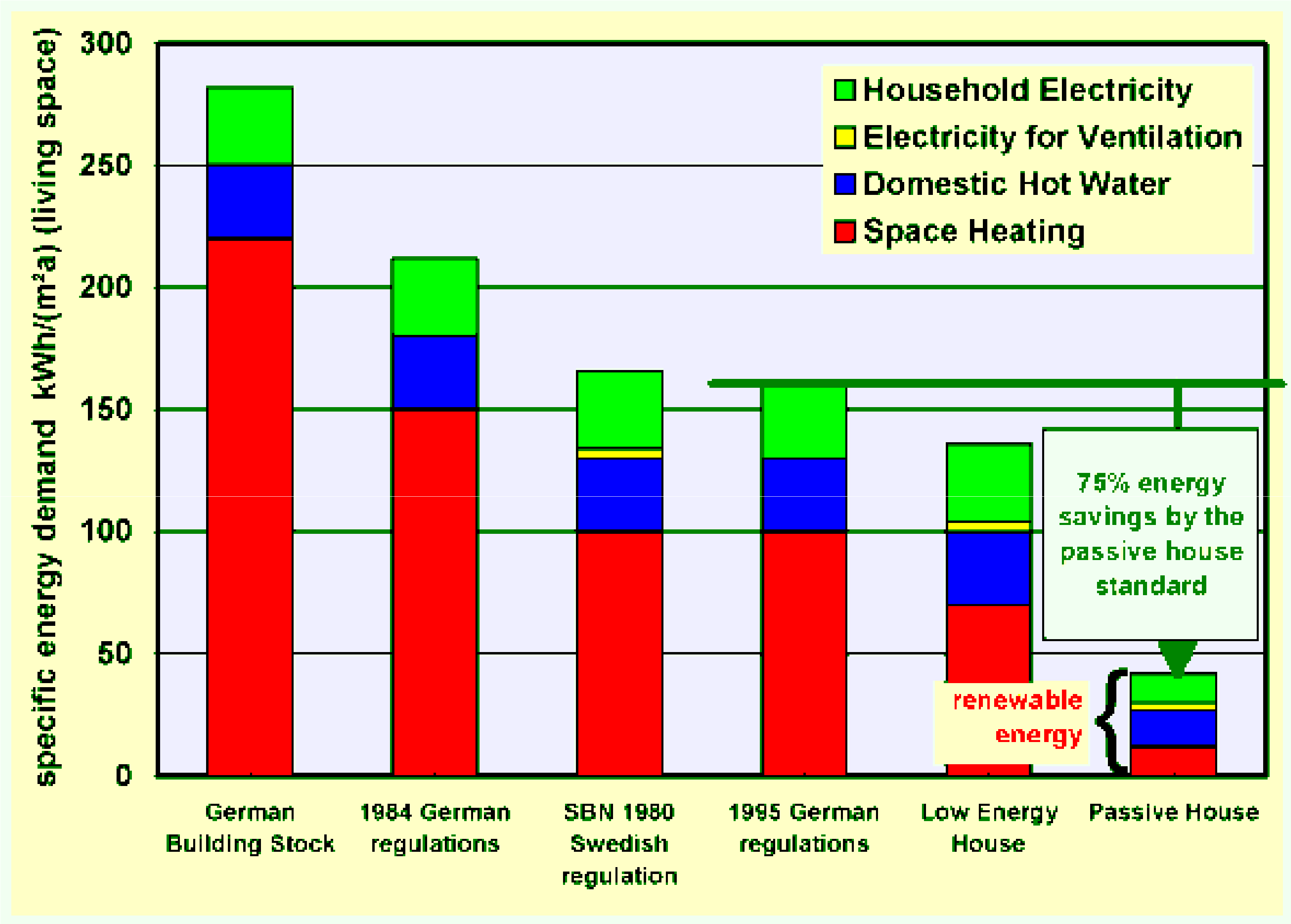



Comparison of UK and European Best Practice



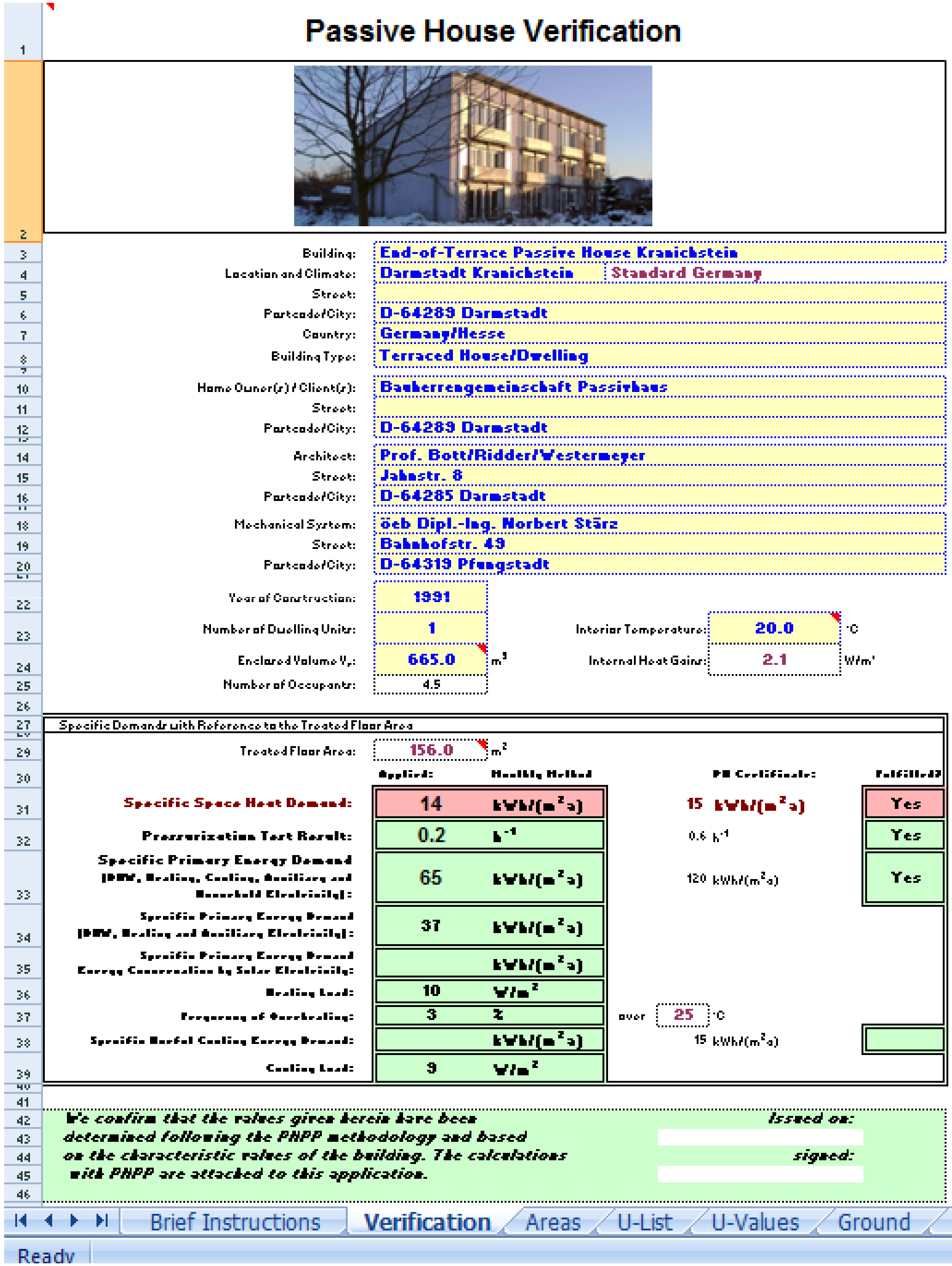
Comparison of UK and European Best Practice





Source: Passivhaus Institut, Darmstadt

How do we do it?



Passive House Verification

Building:	End-of-Terrace Passive House Kranichstein
Location and Climate:	Darmstadt Kranichstein / Standard Germany
Street:	
Postcode/City:	D-64289 Darmstadt
Country:	Germany/Hesse
Building Type:	Terraced House/Dwelling
Home Owner(s) / Client(s):	Bauherrengemeinschaft Passivhaus
Street:	
Postcode/City:	D-64289 Darmstadt
Architect:	Prof. Bott/Ridder/Westermeyer
Street:	Jahnstr. 8
Postcode/City:	D-64285 Darmstadt
Mechanical System:	öeb Dipl.-Ing. Norbert Stärz
Street:	Bahnhofstr. 49
Postcode/City:	D-64319 Pfungstadt
Year of Construction:	1991
Number of Dwelling Units:	1
Enclosed Volume V_e:	665.0 m^3
Number of Occupants:	4.5
Interior Temperature:	20.0 °C
Internal Heat Gains:	2.1 W/m²

Specific Demands with Reference to the Treated Floor Area

Treated Floor Area: 156.0 m^2

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Specific Space Heat Demand:	14	kWh/(m²a)	15 kWh/(m²a)	Yes
Pressurization Test Result:	0.2	h^{-1}	0.6 h^{-1}	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	65	kWh/(m²a)	120 kWh/(m²a)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	37	kWh/(m²a)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kWh/(m²a)		
Heating Load:	10	W/m²		
Frequency of Overheating:	3	%	over 25 °C	
Specific Useful Cooling Energy Demand:		kWh/(m²a)	15 kWh/(m²a)	
Cooling Load:	9	W/m²		

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:

Brief Instructions | Verification | Areas | U-List | U-Values | Ground | Windows | WinType | Shading | Ventilation | Annua

Ready

Calculate energy using the Passive House Planning Package (PHPP).

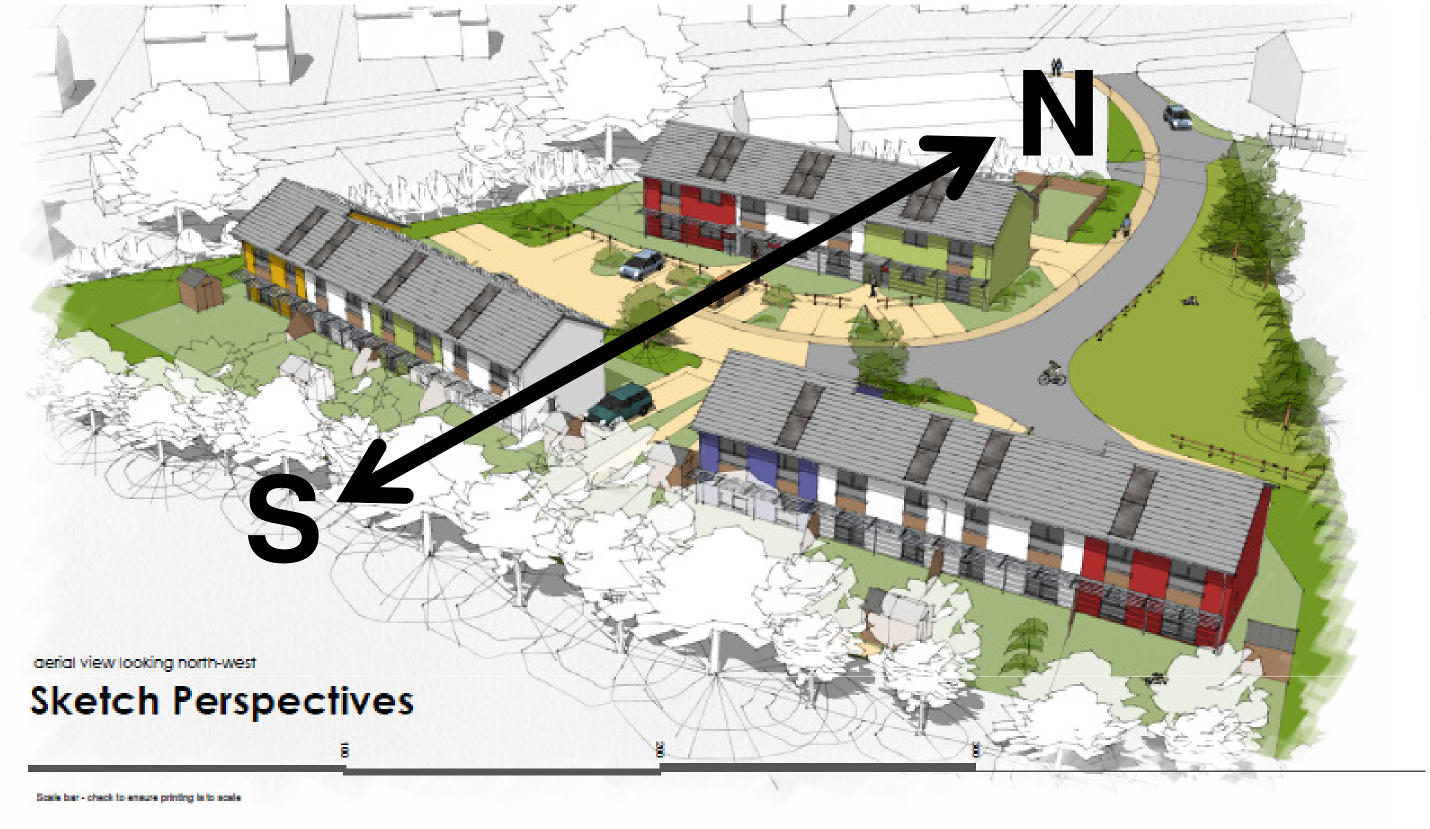
Maximise ‘free’ heat savings

Huddle buildings together into terraces or flats

Increase windows on the South to capture the suns heat.

Keep the building simple.

Balconies or radiator fins?



South facin

12.0
kWh/m²/ yr

North facing

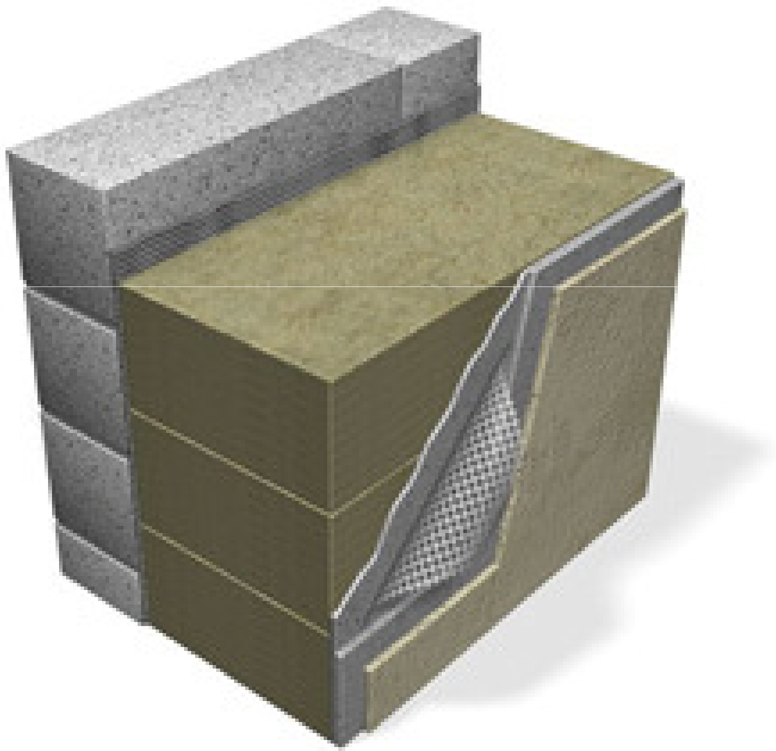
19.3
kWh/m²/ yr

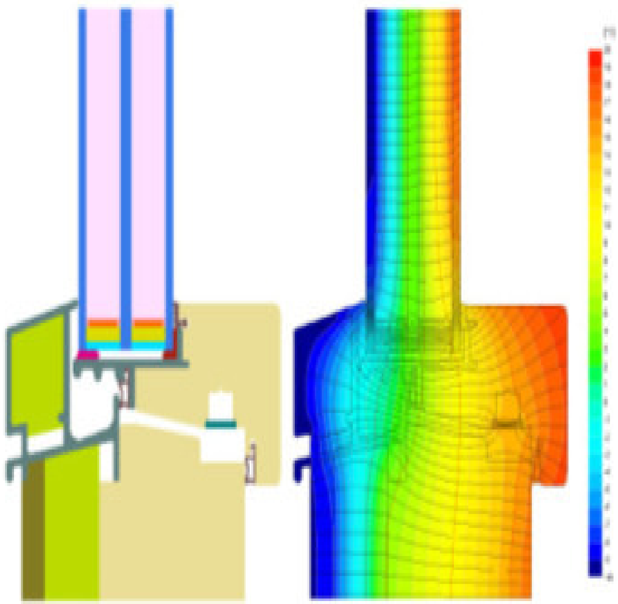
	South facing		North facing	
Specific Space Heat Demand:	12	kWh/(m^{2}a)	19	kWh/(m^{2}a)
Pressurization Test Result:	0.6	h^{-1}	0.6	h^{-1}
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	100	kWh/(m^{2}a)	103	kWh/(m^{2}a)
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	56	kWh/(m^{2}a)	60	kWh/(m^{2}a)
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kWh/(m^{2}a)		kWh/(m^{2}a)
Heating Load:	9	W/m^2	9	W/m^2
Frequency of Overheating:	1	%	0	%
Specific Useful Cooling Energy Demand:		kWh/(m^{2}a)		kWh/(m^{2}a)
Cooling Load:	7	W/m^2	5	W/m^2

Tea cosy of insulation

>30cm thick, no gaps (e.g thermal bridge free)

Triple glazed windows, insulated doors





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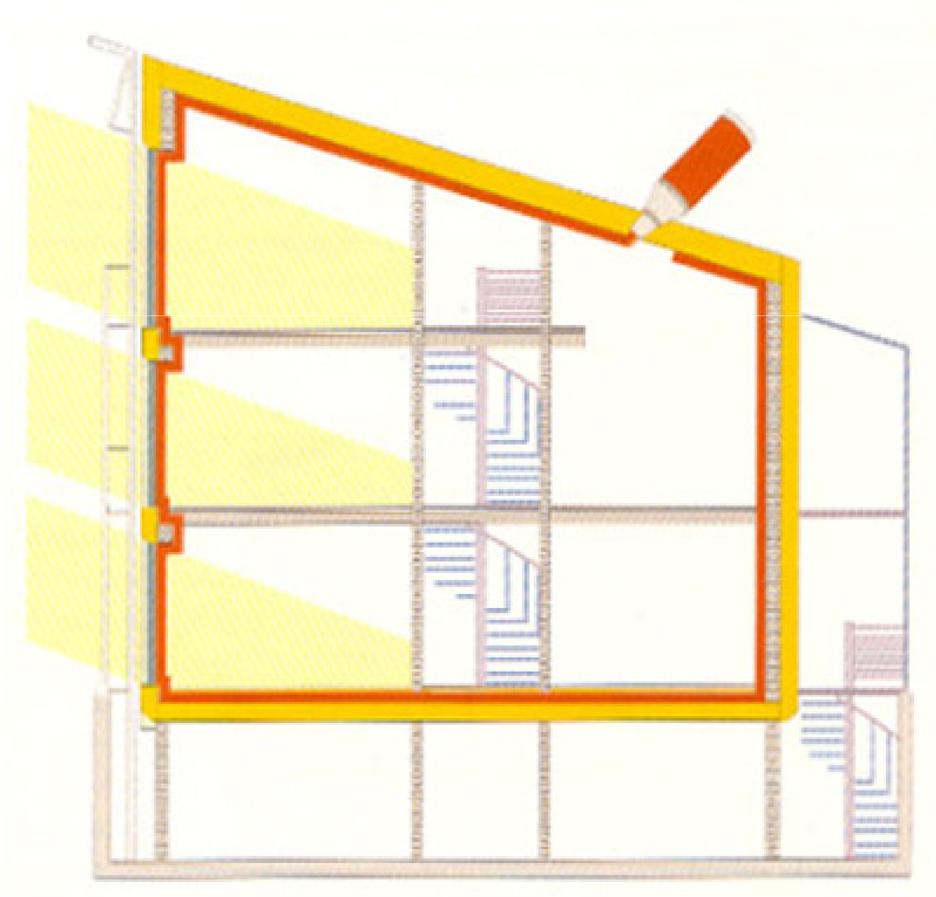
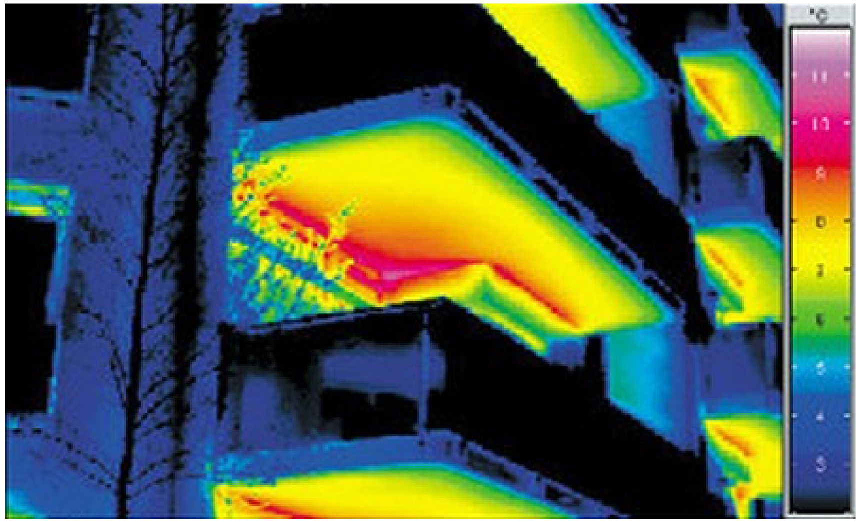




Eliminate air leakage

10X better than building regulations

Building Type	Air Permeability ($m^3/hr/m^2$ at 50 Pa)	
	Good practice	**Best practice**
Dwellings	10.0	5.0
Dwellings (with balanced mech. vent.)	5.0	3.0
Offices (naturally ventilated)	7.0	3.5
Offices (with balanced mech. Vent.)	3.5	2.0
Superstores	3.0	1.5
Offices (low energy)	3.5	2.0
Industrial	10.0	2.0
Museums and Archives	**1.7**	**1.25**
Cold Storage	**0.8**	**0.4**
Air Leakage Standards, based on CIBSE TM23 2000 (upper five), BSRIA Specification 10/98 and BRE BR448, 2002 (lower four).		

Build quality must be game changing

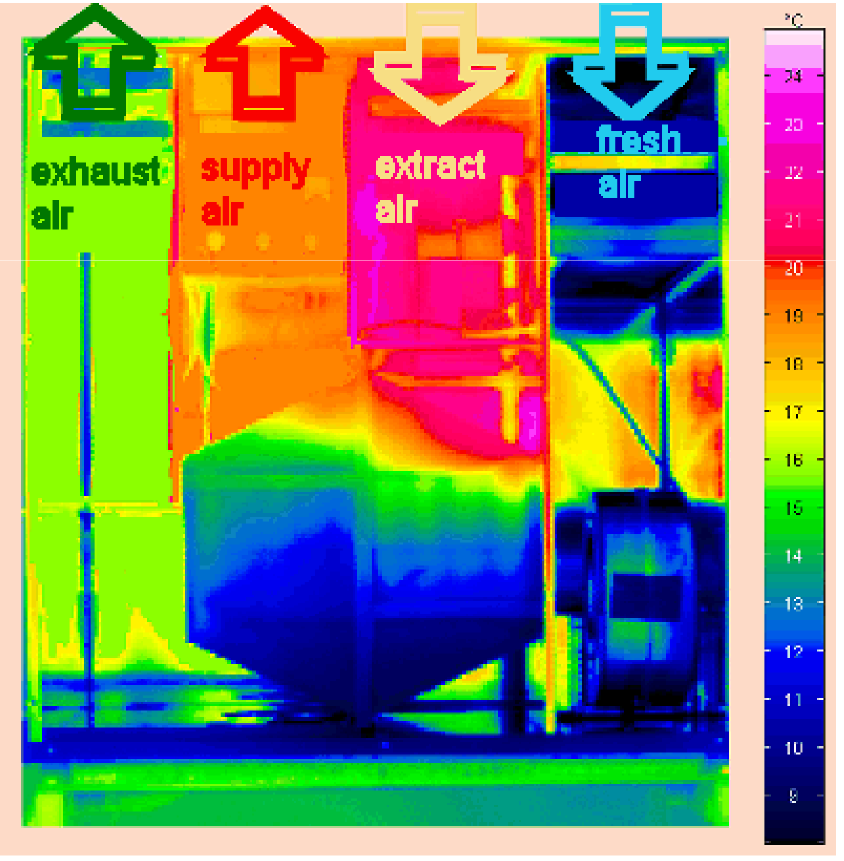
Ventilation

Continuous flow of fresh, filtered air into the home.

Heat is recovered from extract air.

Passivhaus is mixed mode so windows can be opened!

MVHR filter after 6 months in Central London
Image from bere:architects.co.uk



10X smaller heating system needed to stay warm

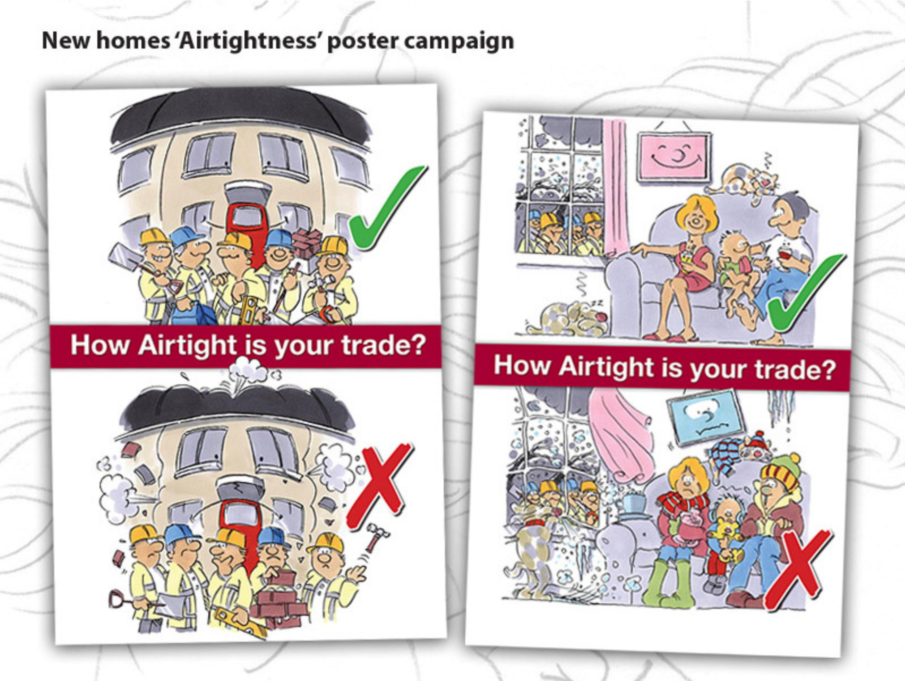
Building stays warm “passively” from solar gain, appliances and people!

You could heat the house with a hair dryer!

Mercedes Benz quality

Comfort is reliant on good workmanship

Opportunity to improve low carbon skills



Passivhaus V Code for Sustainable Homes

Passivhaus only deals with energy. Code addresses water, materials, biodiversity etc.

Focus on fabric and energy rather than renewables and carbon. You need both for a zero carbon home.

Passivhaus = Code Level 3 or 4.

Passivhaus principles will be standard practice within 10 years

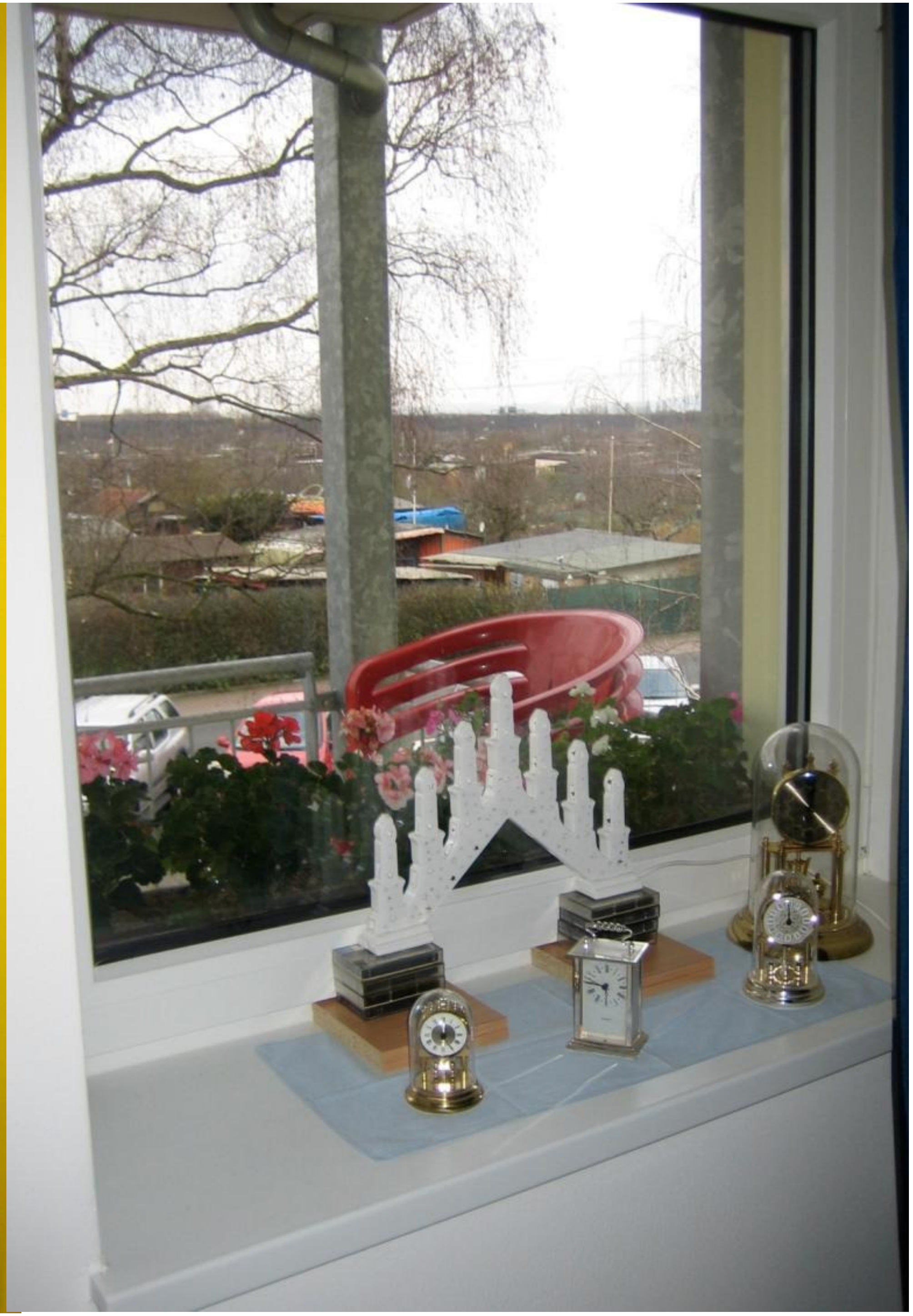
Homes not houses

“I want to reduce my carbon emissions”

“We need a warm house as my husband has Raynauds syndrome”

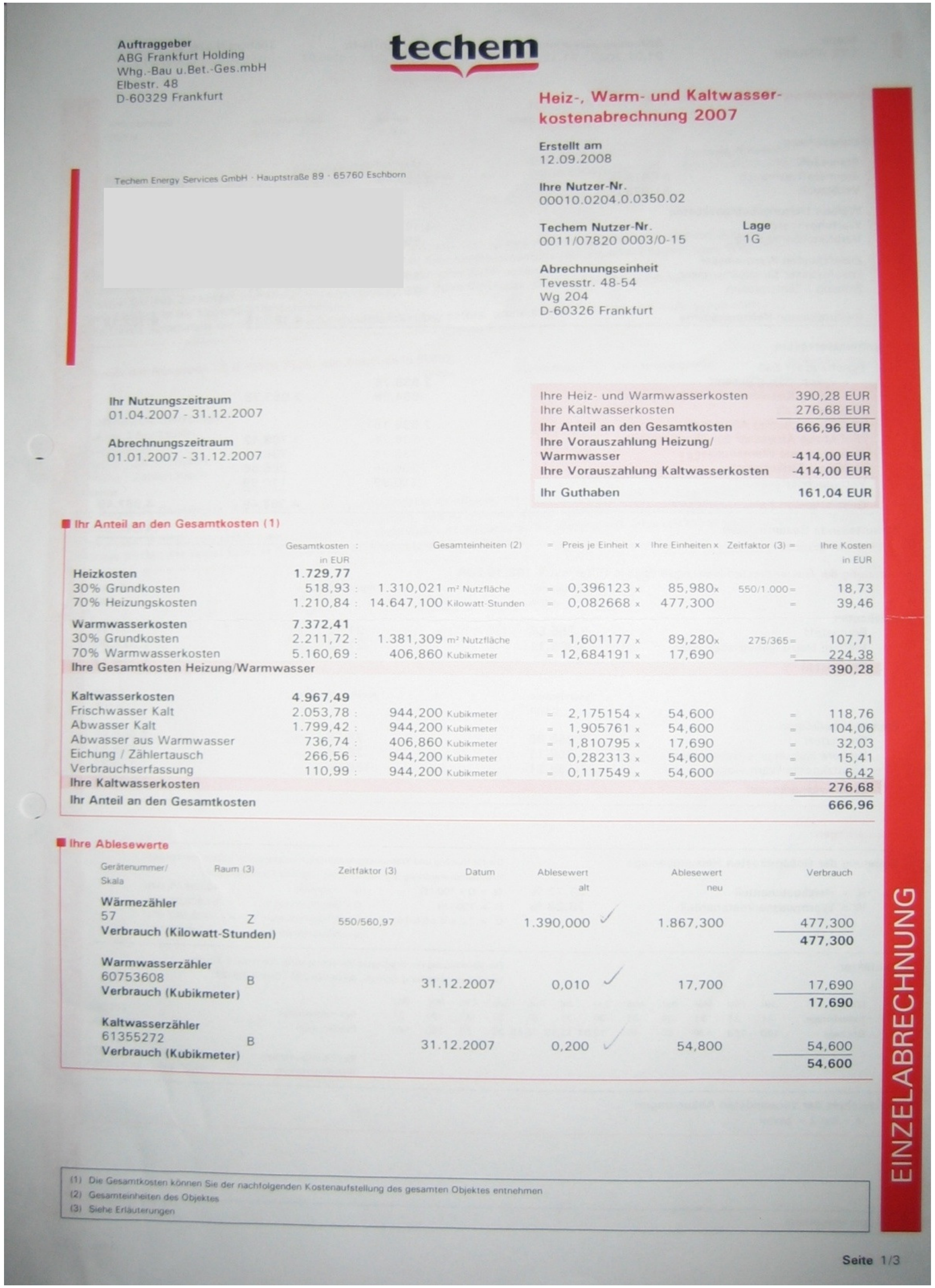
“We want to save on fuel bills, they’re only going to go up”

“Filtering the air will help with my hayfever”



Huge reductions in
energy costs

€39 bill for 8 months
of heating!



Auftraggeber
ABG Frankfurt Holding
Whg.-Bau u.Bet.-Ges.mbH
Elbestr. 48
D-60329 Frankfurt

techem

Techem Energy Services GmbH · Hauptstraße 89 · 65760 Eschborn

Heiz-, Warm- und Kaltwasser-kostenabrechnung 2007

Erstellt am
12.09.2008

Ihre Nutzer-Nr.
00010.0204.0.0350.02

Techem Nutzer-Nr. 0011/07820 0003/0-15 — **Lage** 1G

Abrechnungseinheit
Tevesstr. 48-54
Wg 204
D-60326 Frankfurt

Ihr Nutzungszeitraum
01.04.2007 - 31.12.2007

Abrechnungszeitraum
01.01.2007 - 31.12.2007

Ihre Heiz- und Warmwasserkosten	390,28 EUR
Ihre Kaltwasserkosten	276,68 EUR
Ihr Anteil an den Gesamtkosten	**666,96 EUR**
Ihre Vorauszahlung Heizung/ Warmwasser	**-414,00 EUR**
Ihre Vorauszahlung Kaltwasserkosten	**-414,00 EUR**
Ihr Guthaben	**161,04 EUR**

Ihr Anteil an den Gesamtkosten (1)

	Gesamtkosten : in EUR	Gesamteinheiten (2)	= Preis je Einheit x	Ihre Einheiten x	Zeitfaktor (3) =	Ihre Kosten in EUR
Heizkosten	**1.729,77**					
30% Grundkosten	518,93 :	1.310,021 m² Nutzfläche	= 0,396123 x	85,980x	550/1.000=	18,73
70% Heizungskosten	1.210,84 :	14.647,100 Kilowatt-Stunden	= 0,082668 x	477,300	=	39,46
Warmwasserkosten	**7.372,41**					
30% Grundkosten	2.211,72 :	1.381,309 m² Nutzfläche	= 1,601177 x	89,280x	275/365=	107,71
70% Warmwasserkosten	5.160,69 :	406,860 Kubikmeter	= 12,684191 x	17,690	=	224,38
Ihre Gesamtkosten Heizung/Warmwasser						**390,28**
Kaltwasserkosten	**4.967,49**					
Frischwasser Kalt	2.053,78 :	944,200 Kubikmeter	= 2,175154 x	54,600	=	118,76
Abwasser Kalt	1.799,42 :	944,200 Kubikmeter	= 1,905761 x	54,600	=	104,06
Abwasser aus Warmwasser	736,74 :	406,860 Kubikmeter	= 1,810795 x	17,690	=	32,03
Eichung / Zählertausch	266,56 :	944,200 Kubikmeter	= 0,282313 x	54,600	=	15,41
Verbrauchserfassung	110,99 :	944,200 Kubikmeter	= 0,117549 x	54,600	=	6,42
Ihre Kaltwasserkosten						**276,68**
Ihr Anteil an den Gesamtkosten						**666,96**

Ihre Ablesewerte

Gerätenummer/ Skala	Raum (3)	Zeitfaktor (3)	Datum	Ablesewert alt	Ablesewert neu	Verbrauch
Wärmezähler 57	Z	550/560,97		1.390,000	1.867,300	477,300
Verbrauch (Kilowatt-Stunden)						**477,300**
Warmwasserzähler 60753608	B		31.12.2007	0,010	17,700	17,690
Verbrauch (Kubikmeter)						**17,690**
Kaltwasserzähler 61355272	B		31.12.2007	0,200	54,800	54,600
Verbrauch (Kubikmeter)						**54,600**

(1) Die Gesamtkosten können Sie der nachfolgenden Kostenaufstellung des gesamten Objektes entnehmen
(2) Gesamteinheiten des Objektes
(3) Siehe Erläuterungen

EINZELABRECHNUNG

Seite 1/3

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