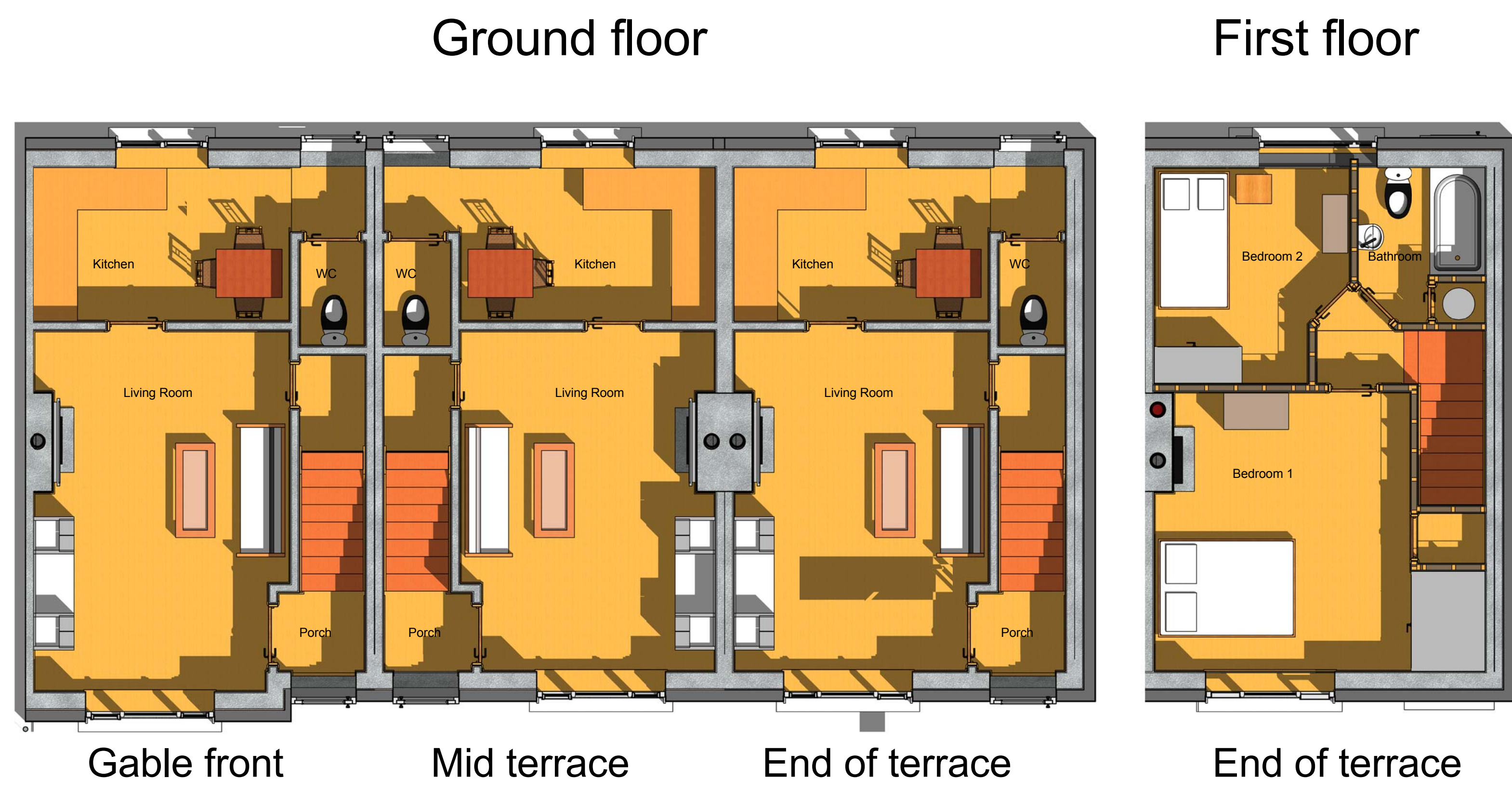


DIT School of Architecture - Digital Analysis in Energy Retrofit - DT774

nZEB Retrofit Design of a terrace of 3 housing units at Crumlin

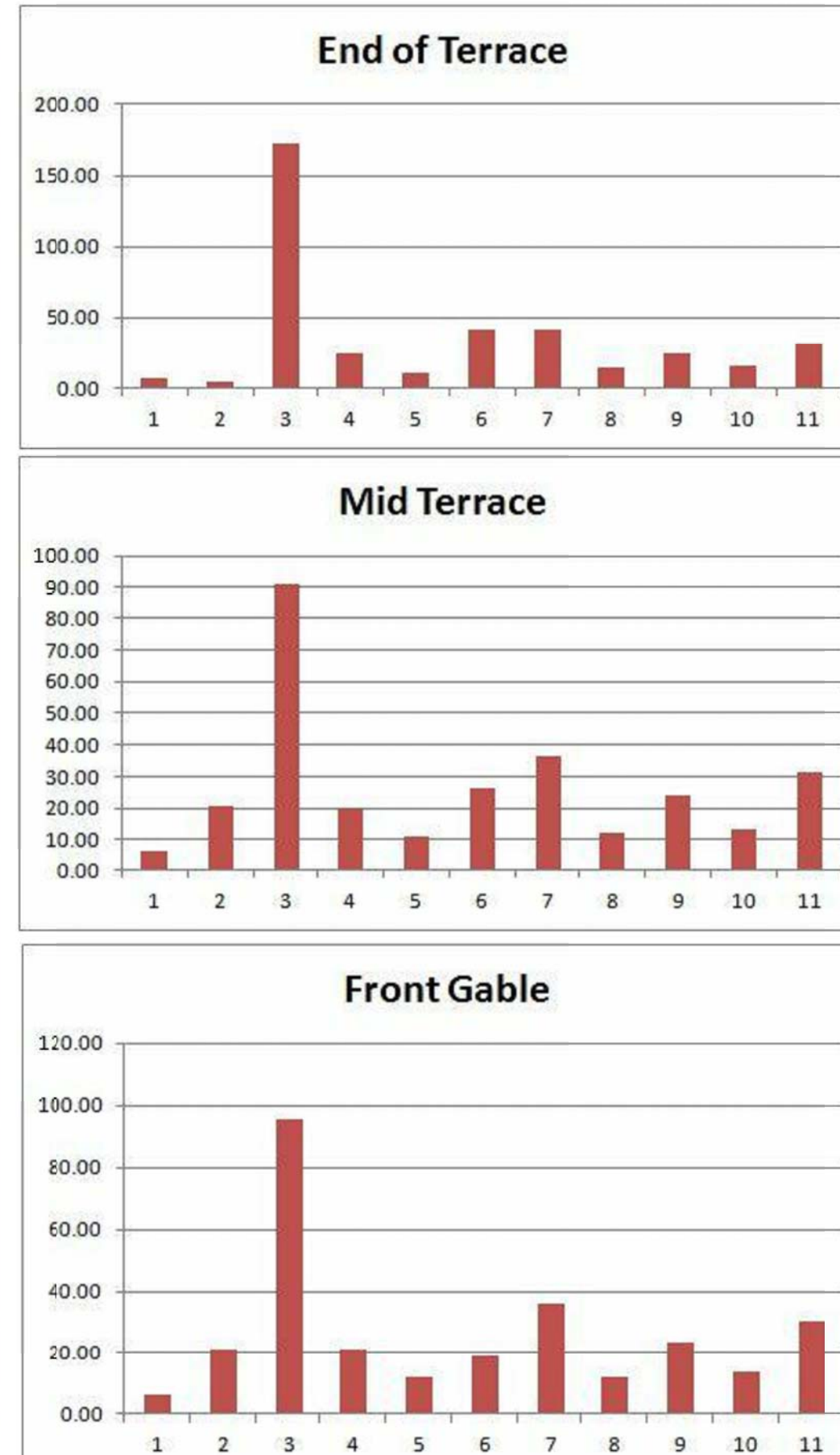


Energy retrofit analysis - step by step

Step	Measure	End of Terrace		Mid terrace		Gable front	
		Energy value kWh/m ² /y	BER	Energy value kWh/m ² /y	BER	Energy value kWh/m ² /y	BER
0	Base scenario.	428.92	F	N.A.	332.56	E1	N.A.
1	Energy saving lights fitted.	422.70	F	6.22	326.26	E1	6.30
2	Rear porch enclosed to the thermal envelope.	418.92	F	3.78	305.48	E1	20.78
3	Walls insulated with 150 mm of external phenolic insulation.	246.82	D1	172.10	214.36	C3	91.12
4	Existing concrete ground floor removed (partition walls left). New floor insulated with 150 mm of polyurethane boards.	223.08	C3	23.74	194.11	C2	20.25
5	Main roof insulated with 300 mm of mineral wool. Plasterboard ceiling replaced with composite insulation polyurethane boards, 62.5 mm thick.	213.17	C3	9.91	182.82	C2	11.29
6	Sloping ceiling insulated with 75 mm of rigid polyurethane boards between rafters. Plasterboard ceiling replaced with composite insulation polyurethane boards, 92.5 mm thick	171.13	C1	42.04	156.57	C1	18.64
7	Windows and doors replaced and moved outwards.	129.74	B3	41.39	120.24	B3	36.33
8	Air permeability improved to 1 m ³ /h.m ² . Chimney blocked and chimney breast filled with vermiculite bags.	115.72	B2	14.02	108.22	B2	12.02
9	Heating controls upgrade: full zone control installed including two heating zones and one for the hot water, two room thermostats, 7day 3-channel programmer, TRVs, new hot water cylinder with 50mm of foam insulation and cylinder thermostat, weather compensator, primary pipework insulated.	91.72	B1	24.00	84.32	B1	23.90
10	Mechanical Ventilation with Heat Recovery unit installed in the attic. Efficiency: 92%, Specific Fan Power: 0.55 W/(l/s). Access to the unit through new attic hatch and pull down stairs & walkboards.	76.49	B1	15.23	70.85	A3	13.47
11	4 x 260 kWp photovoltaic panels per house installed on South-Western slope of the roof, including micro inverters.	45.15	A2	31.34	39.51	A2	31.34

Area weighted Average BER for 3 units: 41.43 kWh/m²/year

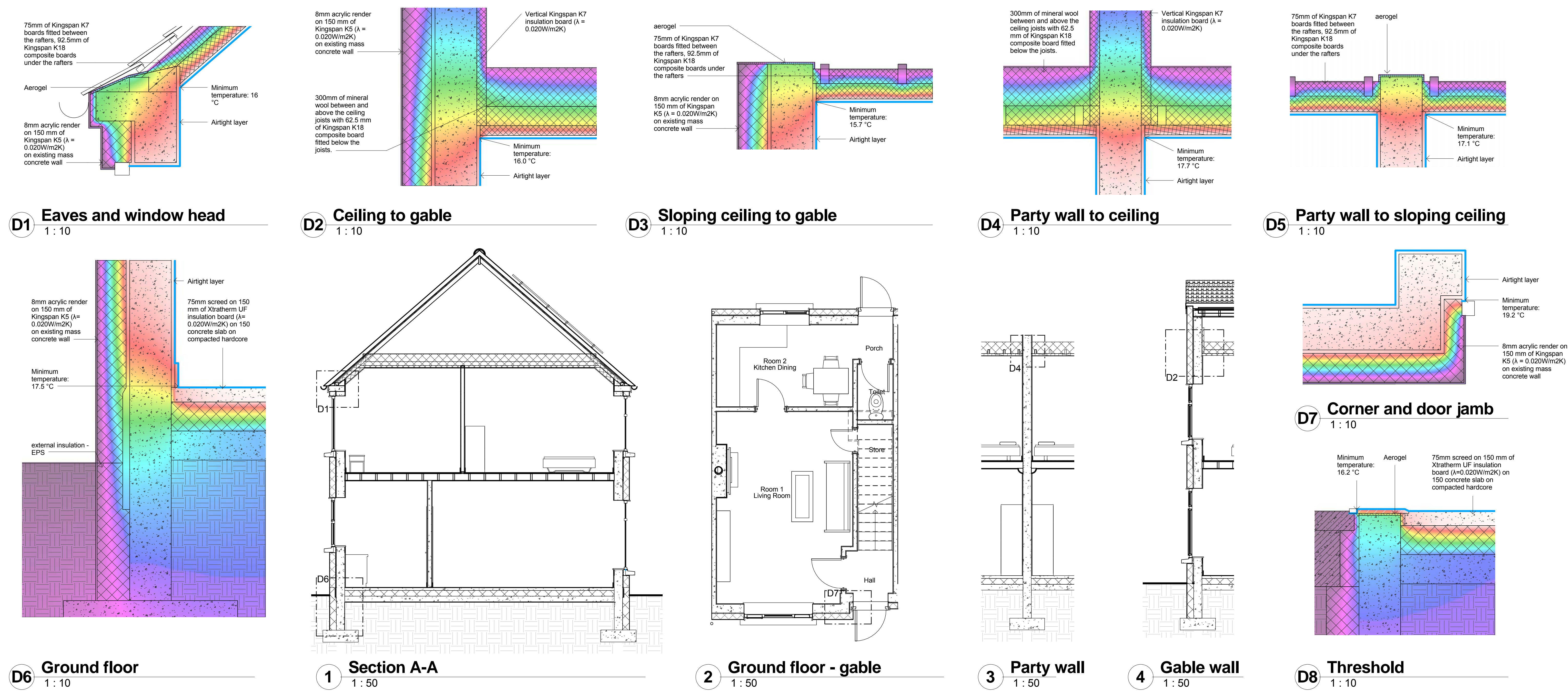
Savings per measure kWh/m²/year



Linear thermal bridging detailed calculation

Junction	Source	Final W	Length	End of Terrace	Mid Terrace	Front gable	RSI	Temp
Floor junction EOT	Modelled	0.2315	14.25	2.298	N.A.	N.A.	N.A.	0.880
Floor junction MidT	Modelled	0.2150	N.A.	N.A.	7.30	1.569	N.A.	0.875
Floor junction MidT + gable	Modelled	0.2150	N.A.	N.A.	N.A.	2.58	1.630	0.875
Eaves and head	Modelled	0.2888	3.40	8.982	3.40	0.982	1.62	0.468
Eaves only	Modelled	0.2799	12.65	5.40	5.70	1.956	5.58	1.560
Roof to partition abutment	Modelled	0.0070	12.17	0.085	14.16	0.099	14.16	0.099
Sloping ceiling to sloping abutment	Modelled	0.0158	3.31	0.052	0.66	0.010	0.66	0.010
Flat ceiling to sloping ceiling	Modelled	0.0052	14.03	0.073	9.10	0.048	7.024	0.037
Combined party wall and door jamb	Modelled	0.0164	N.A.	N.A.	4.50	0.074	4.50	0.074
Party wall only	Modelled	0.0159	10.46	0.167	16.41	0.262	16.842	0.268
Jamb only	Modelled	0.0008	16.34	0.014	16.34	0.014	14.09	0.012
lintel only	Modelled	0.0010	8.44	0.008	8.44	0.008	8.44	0.008
party wall to sloping ceiling	Modelled	0.1497	1.32	0.198	2.65	0.396	1.986	0.297
party wall to flat ceiling	Modelled	0.1288	5.92	0.763	11.84	1.525	12.633	1.629
Corner	Modelled	0.0682	5.96	0.406	N.A.	N.A.	N.A.	0.935
Corner with door jamb	Modelled	0.0710	4.50	0.319	N.A.	N.A.	N.A.	0.950
Two corners with door jamb (gable)	Modelled	0.0022	N.A.	N.A.	N.A.	2.25	0.005	0.960
Two corners (front gable house)	Modelled	0.0172	N.A.	N.A.	N.A.	3.13	0.054	0.960
Flat ceiling to front gable	Modelled	0.2322	N.A.	N.A.	N.A.	2.853	0.637	0.800
Sloping ceiling to front gable	Modelled	0.2632	N.A.	N.A.	N.A.	0.398	0.105	0.785
Threshold EOT	Modelled	0.1709	1.80	0.308	N.A.	N.A.	N.A.	0.810
Threshold MidT	Modelled	0.1609	N.A.	N.A.	1.80	0.290	N.A.	0.810
Threshold MidT + front gable	Modelled	0.1610	N.A.	N.A.	N.A.	1.8	0.290	0.810
Window sill	Ref G.22 - AC'D's	0.1090	6.64	0.724	6.64	0.724	6.64	0.724
Ground floor to masonry party wall	Ref G.05.2 - AC'D's	0.1200	8.95	8.734	13.90	1.668	14.18	1.702
ground floor to masonry partition	Ref G.05.2 - AC'D's	0.1500	8.61	2.92	8.61	2.92	8.61	2.92
Main wall to partition / intern. floor	Modelled	Negligible						0.975
Total				13.064	10.553	10.793		
Area of elements				149.920	112.640	116.220		
** factor				0.087	0.094	0.093		

Linear thermal bridging analysis & insulation details

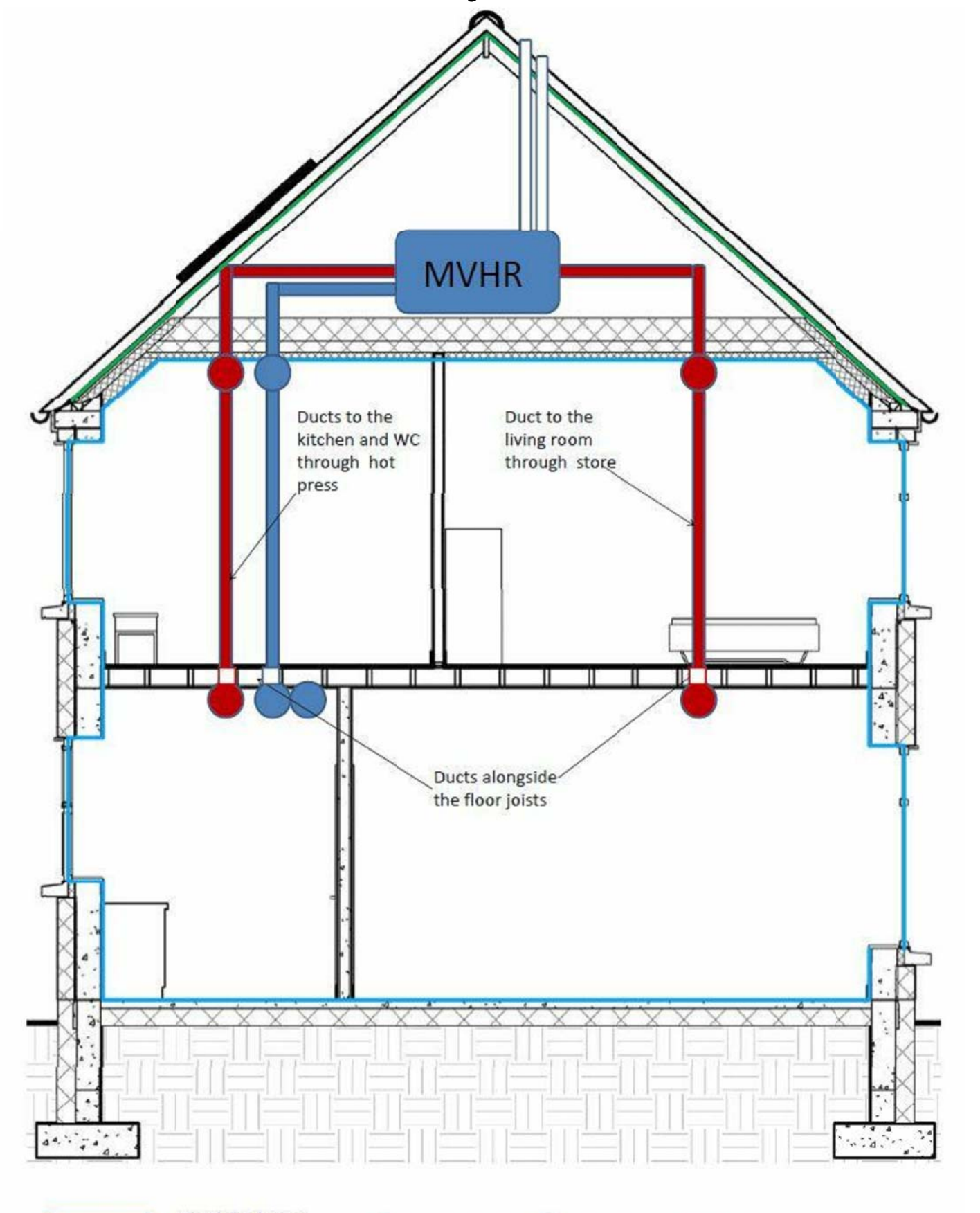
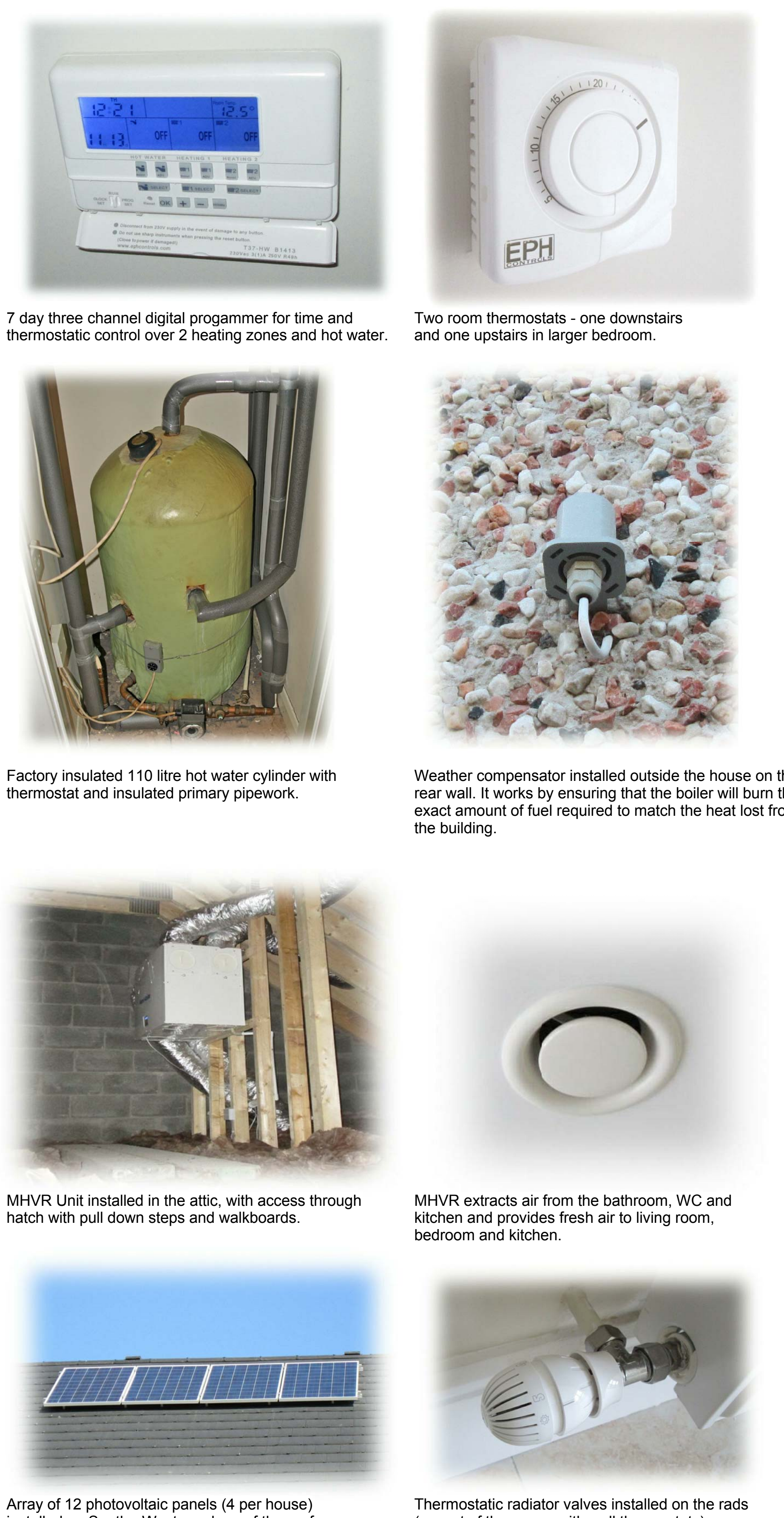
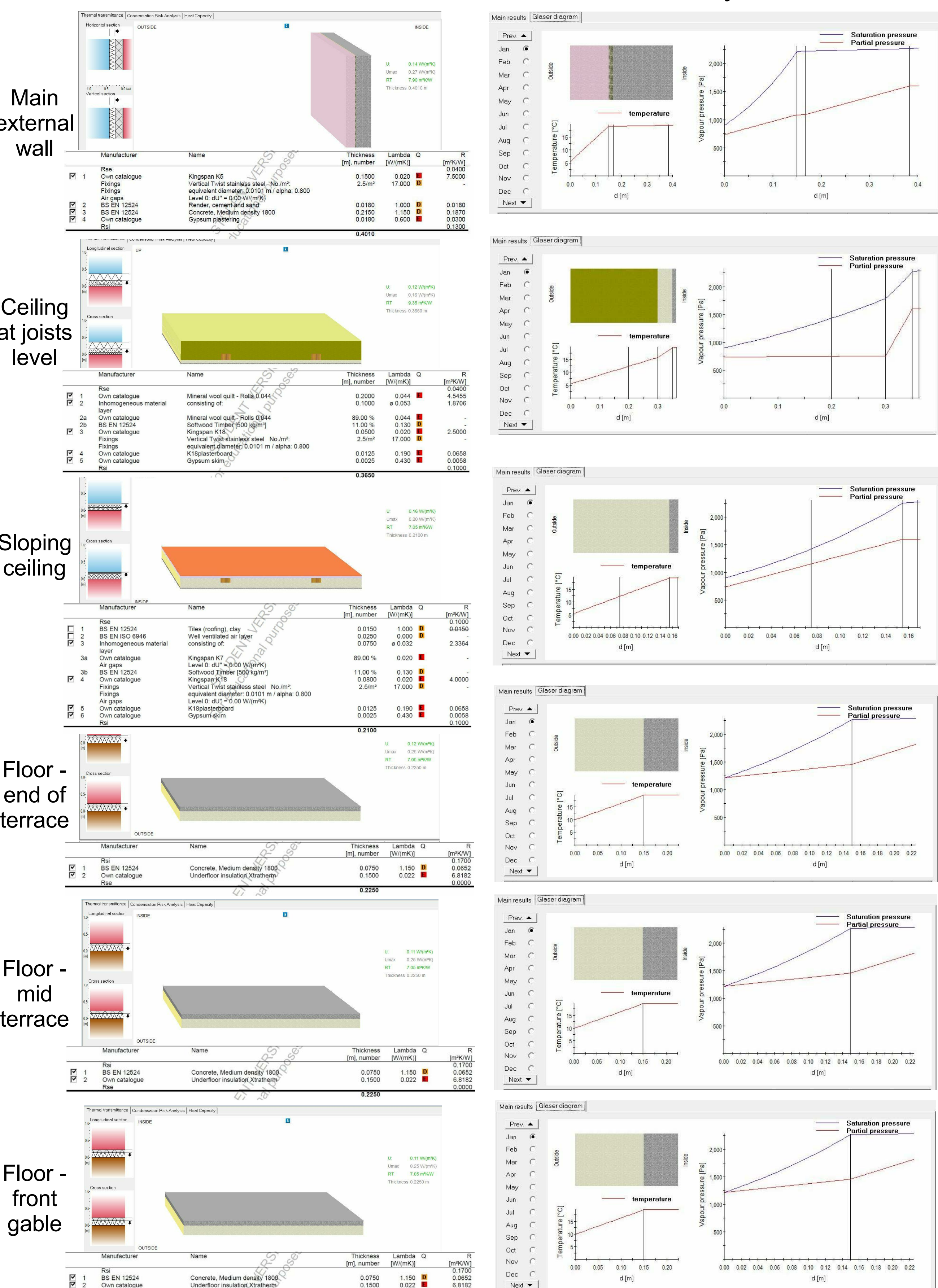


U-value calculation

Condensation risk analysis

House services and systems

Mechanical Ventilation with Heat recovery schematic



Sustainability assessment estimator (BREAM)

Category	Weight	Score	Percentage	Minimum Standard
Energy	10%	100	100%	100
Water	10%	100	100%	100
Materials	10%	100	100%	100
Indoor Climate	10%	100	100%	100
Health and Wellbeing	10%	100	100%	100
Management	10%	100	100%	100
Total	60%	64.17%	64.17%	

Sustainability Certificate (BREAM)

bream The Code for Sustainable Buildings

This is to certify that **Crumlin House** has achieved a score of 64.17%, and a BREAM rating of **EXCELLENT**

Five stars (1 Poor, 2 Fair, 3 Good, 4 Very Good, 5 Excellent)

This Post Construction assessment was carried out under the 2008 version of BREAM Offices

Prepared by: **Joe Bloggs** (Building Services Engineer), **Joe Bloggs** (Building Services Engineer), **Joe Bloggs** (Building Services Engineer)

Checked by: **Joe Bloggs** (Building Services Engineer), **Joe Bloggs** (Building Services Engineer), **Joe Bloggs** (Building Services Engineer)

25-03-2015

DEAP Results - End of terrace

Category	Weight	Score	Percentage	Minimum Standard
Energy	10%	100	100%	100
Water	10%	100	100%	100
Materials	10%	100	100%	100
Indoor Climate	10%	100	100%	100
Health and Wellbeing	10%	100	100%	100
Management	10%	100	100%	100
Total	60%	64.17%	64.17%	

DEAP Results - Mid terrace

Category	Weight	Score	Percentage	Minimum Standard
Energy	10%	100	100%	100
Water	10%	100	100%	100
Materials	10%	100	100%	100
Indoor Climate	10%	100	100%	100
Health and Wellbeing	10%	100	100%	100
Management	10%	100	100%	100
Total	60%	64.17%	64.17%	

DEAP Results - Front gable

Category	Weight	Score	Percentage	Minimum Standard
Energy	10%	100	100%	100
Water	10%	100	100%	100
Materials	10%	100	100%	100
Indoor Climate	10%	100	100%	100
Health and Wellbeing	10%	100	100%	100
Management	10%	100	100%	100
Total	60%	64.17%	64.17%	

