

Client Report :

Comparison of running costs
for different heating options in
hard to treat flats

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Executive Summary

The purpose of this study was to estimate comparable running costs in hard to heat flats supplied by different heating systems. The results will be useful in life cycle cost analysis when considering heating upgrades for such dwellings.

Based on national housing stock data, dwellings representing the majority of hard to treat flats were devised, along with floor area variants of these. These were modelled using BREDEM-12, giving their energy requirements.

Suitable efficiencies and fuel costs for each heating system were collected, allowing annual running costs to be calculated.

The report concludes that a gas fired communal CHP system has the potential to give the lowest running costs assuming fuel costs are offset by electricity sales. Of the non-CHP systems, it finds that a gas fired communal boiler system would have the lowest running costs. Electric storage heating would have the highest running costs.

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Introduction

This study was commissioned to aid an Energy Efficiency Partnership sub-group looking at the cost-effectiveness of installing heating systems in hard to treat flats. Figures were required to allow a fair comparison of the running costs for flats with different heating systems. It was agreed that the options to be looked at would include:

- Electric storage heating
- Communal boiler system heating a number of flats
- Communal CHP system providing heat and power to a number of flats

In addition it was decided that it would be informative to look at the running costs for each of these systems for a number of flat types and sizes, in case the most suitable option was found to vary between a large flat and a very small one, implying that different heating strategies might be appropriate.

Description of the project

The study consisted of 3 tasks:

1. Research into which 3 to 5 flat types would most adequately describe the hard to treat flats found in the UK
2. Calculation of their energy consumption using BREDEM
3. Using the energy consumption figures to estimate likely running costs

Flat types in the UK

The English, Scottish and Northern Irish House Condition Surveys (HCSs) were the main sources of information on flat types (ref. 1,2,3). From these, the four most common types were seen to be:

- Converted flat
- Low rise flat
- High rise flat
- Tenement flat

For each type, an average floor area figure was available (an important factor for modelling energy consumption). In addition, a typical age of construction was indicated, enabling construction details and likely insulation levels to be predicted – so for each flat type, a list of the main characteristics relevant to energy use was drawn up. The main assumptions are given below.

Converted flat – Pre-1919 construction, therefore solid walls; one floor of a semi-detached house, therefore 3 external walls; floor area 66m²; average SAP 43.

Low rise flat – Post war construction (1945 -1980 most likely), therefore uninsulated cavity wall construction; assumed 2 external walls; floor area 57m²; average SAP 61.

High rise flat – Year of construction 1945 – 1980, but system build with typical wall U-value 1.2W/m²K* (implying some wall insulation present); uninsulated versions also built and more likely to be relevant as hard to treat; assumed 2 external walls; floor area 59m²; average SAP 52.

Tenement – typically pre-1919 construction, hence solid walls (probably sandstone); 3 external walls; floor area 68m²; average NHER 5.07 (SAP not quoted in Scottish HCS).

*typical U-value for system build flat obtained from ref 4

It was decided to model two versions of the high rise flat, one with typical wall U-values (including a small thickness of insulation) and one with no wall insulation (some were built like this and these are more likely to be relevant in the context of hard to treat homes).

In addition to the five basic dwelling types, which were all assumed to have two bedrooms, a one and three bedroom variant of each was devised (dwelling size and shape information necessary for the energy calculation was calculated).

Energy modelling

BRE's Domestic Energy Model (BREDEM-12) was used to calculate the energy required for heating, hot water, lights & appliances and cooking. This had to be evaluated for four scenarios. The first assumed morning and evening heating (as is assumed in SAP) and a system supplying hot water to radiators, the second assumed an all day heating pattern with the same heating system. The third and fourth assumed electric storage heating with morning and evening heating, and with all day heating. The energy required for each scenario is given in appendices A and B.

From these figures, the running costs for each system and fuel were calculated.

Calculating running costs

Converting energy consumption figures to energy costs is in theory simply a matter of multiplying the energy used by a suitable energy cost factor. There is however a complication with CHP systems, in that they not only generate heat, but also electricity. So as well as finding suitable energy cost factors and efficiencies, an estimate was needed of the amount of electricity produced by the CHP unit and the price that can be expected for the electricity generated. This is vital to the economic viability of a CHP system, since electricity is generally a more valuable commodity than heat.

A view was acquired from a CHP Association representative as to the likely output of a CHP system that might be used in a block of flats. It was suggested that typically such a system would be between 85 and 90% efficient overall and that the heat output would typically be twice as much as the electrical energy generated. In other words, the unit would convert about 60% of the energy in it's fuel to heat and 30% to electricity. These figures were used in conjunction with the previously calculated heat requirement to calculate how much would need to be spent on gas (or oil) to produce the required heat and how much electricity would be produced in the process.

For the communal boiler systems looked at, in each case a boiler efficiency of 90% was assumed. This is comparable to the efficiency of modern domestic boilers given in SEDBUK. It is possible that large boilers could be slightly more efficient than their smaller domestic counterparts, but there is very little scope for extra efficiency beyond the 90% level, so this was seen as a reasonable figure to use.

Suitable prices were then needed for the cost of gas, oil, LPG, electricity and the price likely to be obtained for CHP generated electricity. The cost of electricity used was the

domestic rate, since if electric storage heaters are installed, occupants are likely to pay individual bills. The electricity cost was therefore taken from SAP 2001. But for gas, oil and LPG, it was assumed that a central boiler system supplying heat to a number of flats would be eligible to pay a lower business rate, so SAP was not the source of these figures. Instead, median figures from the DTI's quarterly energy prices for non-domestic customers was used (ref 5). The view of the CHP Association representative was again sought on the likely price that would be paid for CHP electricity generated. It was decided that two prices should be used: one of about 6p per kWh for situations where the electricity can be sold to residents and local networks (e.g. another nearby group of flats under the same ownership), and one of 2p per kWh which is the much lower price that might be expected if the electricity were to be bought by an electricity company.

The costs for each end use (heating, hot water, etc.) were then calculated for each heating system and for each flat type and added up to give a total annual running cost. For the CHP systems, the revenue for electricity generated was subtracted from the total. Tables of annual running costs are shown in full in appendices C and D, but a table summarising the results is given in the next section of this report.

Findings

Tables 1 and 2, below, show the total energy costs for the dwelling types looked at. This shows that flats with electric storage heating have the highest running costs (averaging about £715/yr in morning/evening heated dwellings and £725/yr in those heated all day). Gas fuelled CHP systems give the lowest running costs, averaging £80-90/yr assuming a good price is obtained for electricity sales, or about £300/yr assuming a lower price is obtained. CHP's ranking as the cheapest system is mainly thanks to the substantial amount of money generated from electricity sales, which offsets the expenditure for fuel. Oil fuelled CHP also gives lower annual running costs than the non-CHP systems, but only if the more favourable electricity price is obtained. This demonstrates that the price obtained for electricity is a very significant factor in the economics of a CHP system.

Of the non-CHP systems, a gas fired communal boiler system has the lowest annual running costs (averaging about £340/yr). Oil and LPG fired systems are more expensive in proportion to their higher fuel prices. All three fuels give significantly lower running costs than electric storage heating.

However, in one respect this is not exactly a like for like comparison. It should be noted that the costs given are, in the case of electric storage heating, the full costs to the occupant. But for the other systems, the costs given are those to the managing agent of the communal system per flat supplied. Thus there may well be additional administrative costs incurred in supplying the energy services to the occupant (whether that be included in rent or in a separate energy bill). In any full life cycle costs analysis, this should be taken into account.

Other facts noted during the study were:

- The extra energy consumption due to heating all day rather than just in the mornings and evenings was not very large, hence running costs are not strongly affected by the heating pattern. (This agrees with findings in previous studies)
- Although flat size makes a considerable difference to the energy consumption (as can be seen from the small and large variants of each flat type), this does not alter the ranking of the heating systems in terms of which ones offer the lowest running costs.

Table 1 - Annual energy costs for five flat types with various heating systems providing morning and evening heating (£/yr)

Flat type	Bedrooms	Floor area m ²	Heating type							
			Electric	Gas	Oil	LPG	Gas CHP1	Gas CHP2	Oil CHP1	Oil CHP2
Converted	1	51	634	287	367	424	49	252	206	373
	2	66	756	350	443	507	77	310	257	448
	3	81	885	424	527	599	121	380	321	534
Low-rise	1	42	539	252	316	360	66	225	189	320
	2	57	648	310	383	434	95	278	237	387
	3	72	784	382	466	525	134	346	297	471
Typical high-rise	1	44	502	242	299	338	77	218	186	302
	2	59	607	299	364	409	107	271	234	368
	3	74	739	370	445	497	148	337	294	450
Uninsulated high-rise	1	44	552	257	323	369	64	229	192	327
	2	59	663	316	391	444	93	283	240	396
	3	74	801	389	476	537	132	351	302	482
Tenement	1	53	727	317	416	484	27	274	218	422
	2	68	861	384	497	576	52	336	271	504
	3	83	1024	468	597	688	87	412	339	606

Electric = individual electric storage heater systems

Gas, oil, and LPG assume a central boiler system supplying a number of flats

Gas CHP1 assumes CHP unit fired by gas supplies heat and electricity to the occupants and spare electricity is sold to a local network for 6p/kWh

Gas CHP2 assumes any spare electricity is sold to an electricity company for 2p/kWh

Oil CHP1 & 2 are the same as gas CHP1 & 2, except for the fuel type

Table 2 - Annual energy costs for five flat types with various heating systems providing all day heating (£/yr)

Flat type	Bedrooms	Floor area m ²	Heating type							
			Electric	Gas	Oil	LPG	Gas CHP1	Gas CHP2	Oil CHP1	Oil CHP2
Converted	1	51	651	297	384	445	40	260	210	390
	2	66	774	361	461	531	67	318	261	467
	3	81	904	436	547	624	110	389	325	554
Low-rise	1	42	550	259	327	374	60	230	192	332
	2	57	660	317	395	450	88	284	240	400
	3	72	779	387	474	534	131	349	300	479
Typical high-rise	1	44	511	248	308	350	72	222	188	312
	2	59	617	305	374	422	102	275	236	378
	3	74	733	373	451	504	146	340	296	455
Uninsulated high-rise	1	44	564	265	335	384	58	235	194	340
	2	59	676	324	405	461	86	289	243	410
	3	74	796	394	484	547	129	355	304	490
Tenement	1	53	750	331	438	513	15	285	223	445
	2	68	885	399	522	607	39	347	277	530
	3	83	1025	478	614	709	80	420	343	623

Electric = individual electric storage heater systems

Gas, oil, and LPG assume a central boiler system supplying a number of flats

Gas CHP1 assumes CHP unit fired by gas supplies heat and electricity to the occupants and spare electricity is sold to a local network for 6p/kWh

Gas CHP2 assumes any spare electricity is sold to an electricity company for 2p/kWh

Oil CHP1 & 2 are the same as gas CHP1 & 2, except for the fuel type

Conclusions

The conclusions from this study are:

- CHP systems have the potential to give significantly lower net annual running costs than the other systems looked at, although this depends very strongly on the unit price received for the electricity generated.
- Of the non-CHP systems, a system powered by a communal gas fired boiler gives the lowest running costs.
- Electric storage heating would lead to the highest running costs

Heating costs in hard to treat flats

Appendix A – Useful energy requirement for flats assuming morning/evening heating pattern.

Useful energy required in a dwelling with a responsive heating system (GJ/yr)						
Flat type	Floor area	Space heating	Water heating	Lights and appliances	Cooking	Total
Converted	51	25.67	9.78	6.02	2.04	43.51
	66	29.00	11.71	7.92	2.38	51.01
	81	31.65	13.64	10.51	2.72	58.52
Low-rise	42	18.03	9.78	5.67	2.04	35.53
	57	20.37	11.71	7.47	2.38	41.92
	72	23.01	14.02	9.82	2.78	49.63
Typical high-rise	44	14.95	9.78	5.73	2.04	32.51
	59	16.89	11.71	7.54	2.38	38.52
	74	19.08	14.02	9.92	2.78	45.80
Uninsulated high-rise	44	19.04	9.78	5.75	2.04	36.61
	59	21.51	11.71	7.56	2.38	43.16
	74	24.30	14.02	9.95	2.78	51.04
Tenement	53	33.54	9.78	6.11	2.04	51.47
	68	37.89	11.71	8.04	2.38	60.01
	83	42.80	14.02	10.57	2.78	70.17

Note: figures in bold actually calculated - rest inferred

Useful energy required in a dwelling with a storage heating system (GJ/yr)							
Flat type	Floor area	Space heating	Secondary heating	Water heating	Lights and appliances	Cooking	Total
Converted	51	27.04	3.00	7.57	5.65	2.04	45.31
	66	30.25	3.36	9.50	7.53	2.38	53.03
	81	32.78	3.64	11.43	10.11	2.72	60.68
Low-rise	42	19.02	2.11	7.57	5.34	2.04	36.09
	57	21.28	2.36	9.50	7.11	2.38	42.64
	72	23.81	2.65	11.92	9.48	2.78	50.63
Typical high-rise	44	15.61	1.73	7.57	5.41	2.04	32.37
	59	17.47	1.94	9.50	7.21	2.38	38.50
	74	19.54	2.17	11.92	9.60	2.78	46.02
Uninsulated high-rise	44	20.08	2.23	7.57	5.41	2.04	37.34
	59	22.47	2.50	9.50	7.21	2.38	44.05
	74	25.14	2.79	11.92	9.60	2.78	52.23
Tenement	53	35.27	3.92	7.57	5.72	2.04	54.52
	68	39.45	4.38	9.50	7.63	2.38	63.35
	83	44.14	4.90	11.92	10.16	2.78	73.90

Note: figures in bold actually calculated - rest inferred

Heating costs in hard to treat flats

Appendix B – Useful energy requirement for flats assuming all-day heating pattern.

Useful energy required in a dwelling with a responsive heating system (GJ/yr)						
Flat type	Floor area	Space heating	Water heating	Lights and appliances	Cooking	Total
Converted	51	28.53	9.78	6.02	2.04	46.37
	66	32.14	11.71	7.92	2.38	54.15
	81	35.04	13.64	10.51	2.72	61.92
Low-rise	42	20.00	9.78	5.67	2.04	37.49
	57	22.53	11.71	7.47	2.38	44.09
	72	24.56	13.64	9.91	2.72	50.83
Typical high-rise	44	16.51	9.78	5.73	2.04	34.07
	59	18.60	11.71	7.54	2.38	40.24
	74	20.28	13.64	10.02	2.72	46.65
Uninsulated high-rise	44	21.10	9.78	5.75	2.04	38.66
	59	23.77	11.71	7.56	2.38	45.42
	74	25.91	13.64	10.04	2.72	52.31
Tenement	53	37.37	9.78	6.11	2.04	55.30
	68	42.11	11.71	8.04	2.38	64.23
	83	45.91	13.64	10.67	2.72	72.93

Note: figures in bold actually calculated - rest inferred

Useful energy required in a dwelling with a storage heating system (GJ/yr)							
Flat type	Floor area	Space heating	Secondary heating	Water heating	Lights and appliances	Cooking	Total
Converted	51	28.53	3.17	7.57	5.65	2.04	46.97
	66	31.88	3.54	9.50	7.53	2.38	54.83
	81	34.52	3.84	11.43	10.11	2.72	62.61
Low-rise	42	20.07	2.23	7.57	5.34	2.04	37.25
	57	22.42	2.49	9.50	7.11	2.38	43.91
	72	24.27	2.70	11.43	9.55	2.72	50.67
Typical high-rise	44	16.45	1.83	7.57	5.41	2.04	33.30
	59	18.37	2.04	9.50	7.21	2.38	39.50
	74	19.90	2.21	11.43	9.67	2.72	45.93
Uninsulated high-rise	44	21.17	2.35	7.57	5.41	2.04	38.55
	59	23.66	2.63	9.50	7.21	2.38	45.37
	74	25.62	2.85	11.43	9.67	2.72	52.28
Tenement	53	37.31	4.15	7.57	5.72	2.04	56.79
	68	41.68	4.63	9.50	7.63	2.38	65.82
	83	45.13	5.01	11.43	10.23	2.72	74.53

Note: figures in bold actually calculated - rest inferred

Heating costs in hard to treat flats

Appendix C – Energy costs calculations for flats with morning/evening heating pattern.

Flat type	Bedrooms	Floor area m2	Heating costs in flats with an electric storage heating system (£/yr)					
			Space heating	Water heating	Lights and appliances	Cooking	Standing charges	Total
Converted	1	51	276.93	181.35	117.59	42.43	16.00	634.30
	2	66	309.82	224.30	156.67	49.50	16.00	756.29
	3	81	335.67	286.63	210.24	56.58	16.00	885.12
Low-rise	1	42	194.81	174.29	111.07	42.43	16.00	538.59
	2	57	217.94	216.39	147.99	49.50	16.00	647.83
	3	72	243.83	288.94	197.18	57.75	16.00	783.71
Typical high-rise	1	44	159.91	171.29	112.52	42.43	16.00	502.15
	2	59	178.91	213.03	149.92	49.50	16.00	607.36
	3	74	200.16	285.19	199.75	57.75	16.00	738.85
Uninsulated high-rise	1	44	205.67	175.22	112.52	42.43	16.00	551.84
	2	59	230.10	217.44	149.92	49.50	16.00	662.96
	3	74	257.43	270.11	199.75	57.75	16.00	801.05
Tenement	1	53	361.16	188.60	119.04	42.43	16.00	727.23
	2	68	404.06	232.40	158.60	49.50	16.00	860.57
	3	83	452.05	286.86	211.33	57.75	16.00	1023.99

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a communal gas boiler heating system (£/yr)					
			Space heating	Water heating	Lights and appliances	Cooking	Standing charges	Total
Converted	1	51	92.83	35.29	118.50	40.17	0.00	286.59
	2	66	104.64	42.25	155.91	46.86	0.00	349.66
	3	81	114.18	49.21	207.01	53.56	0.00	423.95
Low-rise	1	42	65.06	35.29	111.71	40.17	0.00	252.23
	2	57	73.49	42.25	146.99	46.86	0.00	309.59
	3	72	83.02	50.58	193.39	54.67	0.00	381.66
Typical high-rise	1	44	53.94	35.29	112.89	40.17	0.00	242.29
	2	59	60.94	42.25	148.53	46.86	0.00	298.57
	3	74	68.83	50.58	195.42	54.67	0.00	369.50
Uninsulated high-rise	1	44	68.70	35.29	113.14	40.17	0.00	257.30
	2	59	77.60	42.25	148.86	46.86	0.00	315.57
	3	74	87.66	50.58	195.86	54.67	0.00	388.77
Tenement	1	53	121.02	35.29	120.25	40.17	0.00	316.72
	2	68	136.70	42.25	158.21	46.86	0.00	384.02
	3	83	154.42	50.58	208.16	54.67	0.00	467.83

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a communal oil boiler heating system (£/yr)					
			Space heating	Water heating	Lights and appliances	Cooking	Standing charges	Total
Converted	1	51	151.19	57.60	118.50	40.17	0.00	367.46
	2	66	170.79	68.96	155.91	46.86	0.00	442.52
	3	81	186.35	80.31	207.01	53.56	0.00	527.23
Low-rise	1	42	106.19	57.60	111.71	40.17	0.00	315.67
	2	57	119.95	68.96	146.99	46.86	0.00	382.75
	3	72	135.50	82.55	193.39	54.67	0.00	456.11
Typical high-rise	1	44	88.05	57.60	112.89	40.17	0.00	298.70
	2	59	99.46	68.96	148.53	46.86	0.00	363.80
	3	74	112.35	82.55	195.42	54.67	0.00	444.99
Uninsulated high-rise	1	44	112.13	57.60	113.14	40.17	0.00	323.04
	2	59	126.66	68.96	148.86	46.86	0.00	391.34
	3	74	143.08	82.55	195.86	54.67	0.00	476.16
Tenement	1	53	197.52	57.60	120.25	40.17	0.00	415.54
	2	68	223.12	68.96	158.21	46.86	0.00	497.15
	3	83	252.04	82.55	208.16	54.67	0.00	597.42

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a communal LPG boiler heating system (£/yr)					
			Space heating	Water heating	Lights and appliances	Cooking	Standing charges	Total
Converted	1	51	191.93	73.12	118.50	40.17	0.00	423.71
	2	66	216.80	87.53	155.91	46.86	0.00	507.10
	3	81	236.56	101.95	207.01	53.56	0.00	599.07
Low-rise	1	42	134.80	73.12	111.71	40.17	0.00	359.79
	2	57	152.26	87.53	146.99	46.86	0.00	433.64
	3	72	172.00	104.79	193.39	54.67	0.00	524.85
Typical high-rise	1	44	111.77	73.12	112.89	40.17	0.00	337.93
	2	59	126.25	87.53	148.53	46.86	0.00	409.17
	3	74	142.61	104.79	195.42	54.67	0.00	497.49
Uninsulated high-rise	1	44	142.34	73.12	113.14	40.17	0.00	368.76
	2	59	160.78	87.53	148.86	46.86	0.00	444.04
	3	74	181.62	104.79	195.86	54.67	0.00	536.94
Tenement	1	53	250.74	73.12	120.25	40.17	0.00	484.26
	2	68	283.23	87.53	158.21	46.86	0.00	575.83
	3	83	319.93	104.79	208.16	54.67	0.00	687.56

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a gas fired CHP system (£/yr) - CHP electricity sold locally						
			Space heating	Water heating	Lights and appliances	Cooking	Generation	Standing charges	Total
Converted	1	51	138.95	52.93	118.50	40.17	-301.37	0.00	49.18
	2	66	156.96	63.37	155.91	46.86	-348.04	0.00	77.06
	3	81	171.26	73.81	207.01	53.56	-384.91	0.00	120.73
Low-rise	1	42	97.59	52.93	111.71	40.17	-236.41	0.00	66.00
	2	57	110.24	63.37	146.99	46.86	-272.67	0.00	94.79
	3	72	124.52	75.87	193.39	54.67	-314.73	0.00	133.73
Typical high-rise	1	44	80.92	52.93	112.89	40.17	-210.22	0.00	76.68
	2	59	91.40	63.37	148.53	46.86	-243.09	0.00	107.08
	3	74	103.25	75.87	195.42	54.67	-281.31	0.00	147.90
Uninsulated high-rise	1	44	103.05	52.93	113.14	40.17	-244.99	0.00	64.30
	2	59	116.41	63.37	148.86	46.86	-282.35	0.00	93.14
	3	74	131.49	75.87	195.86	54.67	-325.67	0.00	132.22
Tenement	1	53	181.53	52.93	120.25	40.17	-368.24	0.00	26.63
	2	68	205.05	63.37	158.21	46.86	-421.58	0.00	51.92
	3	83	231.63	75.87	208.16	54.67	-482.94	0.00	87.39

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a gas fired CHP system (£/yr) - CHP sold to electricity company						
			Space heating	Water heating	Lights and appliances	Cooking	Generation	Standing charges	Total
Converted	1	51	138.95	52.93	118.50	40.17	-98.57	0.00	251.99
	2	66	156.96	63.37	155.91	46.86	-113.18	0.00	309.93
	3	81	171.26	73.81	207.01	53.56	-125.89	0.00	379.75
Low-rise	1	42	97.59	52.93	111.71	40.17	-77.32	0.00	225.09
	2	57	110.24	63.37	146.99	46.86	-89.18	0.00	278.28
	3	72	124.52	75.87	193.39	54.67	-102.93	0.00	345.52
Typical high-rise	1	44	80.92	52.93	112.89	40.17	-68.76	0.00	218.15
	2	59	91.40	63.37	148.53	46.86	-79.50	0.00	270.66
	3	74	103.25	75.87	195.42	54.67	-92.01	0.00	337.20
Uninsulated high-rise	1	44	103.05	52.93	113.14	40.17	-80.13	0.00	229.17
	2	59	116.41	63.37	148.86	46.86	-92.35	0.00	283.15
	3	74	131.49	75.87	195.86	54.67	-106.51	0.00	351.37
Tenement	1	53	181.53	52.93	120.25	40.17	-120.44	0.00	274.44
	2	68	205.05	63.37	158.21	46.86	-137.88	0.00	335.62
	3	83	231.63	75.87	208.16	54.67	-157.95	0.00	412.38

Heating costs in hard to treat flats

Appendix D – Energy costs calculations for flats with all-day heating pattern.

Flat type	Bedrooms	Floor area m2	Heating costs in flats with an electric storage heating system (£/yr)					Total
			Space heating	Water heating	Lights and appliances	Cooking	Standing charges	
Converted	1	51	292.23	182.67	117.59	42.43	16.00	650.91
	2	66	326.47	225.73	156.67	49.50	16.00	774.38
	3	81	353.51	268.17	210.24	56.58	16.00	904.49
Low-rise	1	42	205.50	175.21	111.07	42.43	16.00	550.21
	2	57	229.58	217.39	147.99	49.50	16.00	660.46
	3	72	248.60	259.14	198.58	56.58	16.00	778.90
Typical high-rise	1	44	168.43	172.02	112.52	42.43	16.00	511.40
	2	59	168.17	213.83	149.92	49.50	16.00	617.42
	3	74	203.76	255.28	201.17	56.58	16.00	732.79
Uninsulated high-rise	1	44	216.85	176.18	112.52	42.43	16.00	563.99
	2	59	242.26	218.48	149.92	49.50	16.00	676.17
	3	74	262.33	260.32	201.17	56.58	16.00	796.40
Tenement	1	53	382.07	190.40	119.04	42.43	16.00	749.94
	2	68	426.84	234.36	158.60	49.50	16.00	885.32
	3	83	462.20	277.52	212.83	56.58	16.00	1025.13

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a communal gas boiler heating system (£/yr)					Total
			Space heating	Water heating	Lights and appliances	Cooking	Standing charges	
Converted	1	51	102.94	35.29	118.50	40.17	0.00	296.89
	2	66	115.98	42.25	155.91	46.86	0.00	361.00
	3	81	126.44	49.21	207.01	53.56	0.00	436.21
Low-rise	1	42	72.15	35.29	111.71	40.17	0.00	259.33
	2	57	81.30	42.25	146.99	46.86	0.00	317.39
	3	72	88.53	49.21	195.16	53.56	0.00	386.55
Typical high-rise	1	44	93.57	35.29	112.89	40.17	0.00	247.92
	2	59	67.12	42.25	148.53	46.86	0.00	304.76
	3	74	73.17	49.21	197.21	53.56	0.00	373.14
Uninsulated high-rise	1	44	76.11	35.29	113.14	40.17	0.00	264.71
	2	59	85.76	42.25	148.86	46.86	0.00	323.72
	3	74	93.49	49.21	197.65	53.56	0.00	393.90
Tenement	1	53	134.54	35.29	120.25	40.17	0.00	330.55
	2	68	151.93	42.25	158.21	46.86	0.00	399.25
	3	83	165.63	49.21	210.06	53.56	0.00	478.46

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a communal oil boiler heating system (£/yr)					Total
			Space heating	Water heating	Lights and appliances	Cooking	Standing charges	
Converted	1	51	168.01	57.60	118.50	40.17	0.00	384.28
	2	66	189.30	68.96	155.91	46.86	0.00	461.03
	3	81	206.37	80.31	207.01	53.56	0.00	547.25
Low-rise	1	42	117.77	57.60	111.71	40.17	0.00	327.25
	2	57	132.69	68.96	146.99	46.86	0.00	395.49
	3	72	144.66	80.31	195.16	53.56	0.00	473.69
Typical high-rise	1	44	97.23	57.60	112.89	40.17	0.00	307.88
	2	59	109.55	68.96	148.53	46.86	0.00	373.89
	3	74	119.43	80.31	197.21	53.56	0.00	450.51
Uninsulated high-rise	1	44	124.23	57.60	113.14	40.17	0.00	335.13
	2	59	139.97	68.96	148.86	46.86	0.00	404.64
	3	74	152.59	80.31	197.65	53.56	0.00	484.11
Tenement	1	53	220.09	57.60	120.25	40.17	0.00	438.10
	2	68	247.97	68.96	158.21	46.86	0.00	522.00
	3	83	270.34	80.31	210.06	53.56	0.00	614.27

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a communal LPG boiler heating system (£/yr)					Total
			Space heating	Water heating	Lights and appliances	Cooking	Standing charges	
Converted	1	51	213.27	73.12	118.50	40.17	0.00	445.05
	2	66	240.29	87.53	155.91	46.86	0.00	530.60
	3	81	261.97	101.95	207.01	53.56	0.00	624.48
Low-rise	1	42	149.49	73.12	111.71	40.17	0.00	374.49
	2	57	168.43	87.53	146.99	46.86	0.00	449.81
	3	72	183.63	101.95	195.16	53.56	0.00	534.29
Typical high-rise	1	44	123.42	73.12	112.89	40.17	0.00	349.59
	2	59	139.06	87.53	148.53	46.86	0.00	421.98
	3	74	151.60	101.95	197.21	53.56	0.00	504.31
Uninsulated high-rise	1	44	157.69	73.12	113.14	40.17	0.00	384.12
	2	59	177.67	87.53	148.86	46.86	0.00	460.92
	3	74	193.70	101.95	197.65	53.56	0.00	546.85
Tenement	1	53	279.38	73.12	120.25	40.17	0.00	512.91
	2	68	314.77	87.53	158.21	46.86	0.00	607.37
	3	83	343.16	101.95	210.06	53.56	0.00	708.73

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a gas fired CHP system (£/yr) - CHP electricity sold locally						
			Space heating	Water heating	Lights and appliances	Cooking	Generation	Standing charges	Total
Converted	1	51	154.41	52.93	118.50	40.17	-325.65	0.00	40.36
	2	66	173.97	63.37	155.91	46.86	-372.76	0.00	67.35
	3	81	189.66	73.81	207.01	53.56	-413.80	0.00	110.24
Low-rise	1	42	108.23	52.93	111.71	40.17	-253.12	0.00	59.92
	2	57	121.94	63.37	146.99	46.86	-291.05	0.00	88.11
	3	72	132.94	73.81	195.16	53.56	-324.72	0.00	130.75
Typical high-rise	1	44	89.36	52.93	112.89	40.17	-223.48	0.00	71.87
	2	59	100.68	63.37	148.53	46.86	-257.65	0.00	101.79
	3	74	109.76	73.81	197.21	53.56	-288.31	0.00	146.02
Uninsulated high-rise	1	44	114.17	52.93	113.14	40.17	-262.45	0.00	57.96
	2	59	128.63	63.37	148.86	46.86	-301.56	0.00	86.17
	3	74	140.24	73.81	197.65	53.56	-336.17	0.00	129.07
Tenement	1	53	202.27	52.93	120.25	40.17	-400.81	0.00	14.80
	2	68	227.89	63.37	158.21	46.86	-457.45	0.00	38.89
	3	83	248.45	73.81	210.06	53.56	-506.12	0.00	79.75

Flat type	Bedrooms	Floor area m2	Heating costs in flats with a gas fired CHP system (£/yr) - CHP sold to electricity company						
			Space heating	Water heating	Lights and appliances	Cooking	Generation	Standing charges	Total
Converted	1	51	154.41	52.93	118.50	40.17	-106.51	0.00	259.50
	2	66	173.97	63.37	155.91	46.86	-121.91	0.00	318.20
	3	81	189.66	73.81	207.01	53.56	-135.34	0.00	388.70
Low-rise	1	42	108.23	52.93	111.71	40.17	-82.79	0.00	230.26
	2	57	121.94	63.37	146.99	46.86	-95.19	0.00	283.97
	3	72	132.94	73.81	195.16	53.56	-106.20	0.00	349.27
Typical high-rise	1	44	89.36	52.93	112.89	40.17	-73.09	0.00	222.25
	2	59	100.68	63.37	148.53	46.86	-84.27	0.00	275.17
	3	74	109.76	73.81	197.21	53.56	-94.29	0.00	340.04
Uninsulated high-rise	1	44	114.17	52.93	113.14	40.17	-85.84	0.00	234.57
	2	59	128.63	63.37	148.86	46.86	-98.63	0.00	289.10
	3	74	140.24	73.81	197.65	53.56	-109.95	0.00	355.30
Tenement	1	53	202.27	52.93	120.25	40.17	-131.09	0.00	284.52
	2	68	227.89	63.37	158.21	46.86	-149.61	0.00	346.72
	3	83	248.45	73.81	210.06	53.56	-165.53	0.00	420.34

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