

Figure 1 – Overview of the employed methodology. Parts within dashed boxes are documented in detail in the given sources, so are not the focus of this paper. Letters refer to subsections in section 3.

Table 1 – Overview of dwelling/household archetypes (DHAs)

HEUS Archetype	No. of occupants	No. of electrical appliances	Average social grade <sup>1</sup>	Likely to invest in Low Carbon Tech.?	Dominant building type	Internal floor area (m <sup>2</sup> )	Existing technology	Future technology	Electricity demand (kWh/year)	SH demand (kWh/year)	DHW demand (kWh/year)
<b>1. Profligate Potential (PP)</b>	3	53	Low	No	Semi-detached	112	Boiler and grid	Boiler and grid	7,839	11,496	4,017
<b>2. Thrifty Values (TV)</b>	2	27	Low	No	Terrace	78	Boiler and grid	Boiler and grid	2,254	7,272	3,443
<b>3. Lavish Lifestyles (LL)</b>	3	53	High	Yes	Detached	169	Boiler and grid	Optimised	5,567	3,763	14,634
<b>4. Modern Living (ML)</b>	1	31	High-medium	Yes	Semi-detached	77	Boiler and grid	Optimised	1,868	5,882	2,750
<b>5. Practical Considerations (PC)</b>	5 <sup>2</sup>	43	High-medium	Yes	Semi-detached	107	Boiler and grid	Optimised	4,084	9,868	4,424
<b>6. Off-Peak Users (OP)</b>	2	48	Medium	Yes	Detached	111	Boiler and grid	Optimised	3,491	12,175	3,828
<b>7. Peak-time Users (PU)</b>	3	47	Medium	Yes	Detached	97	Boiler and grid	Optimised	5,871	8,505	3,865

<sup>1</sup> National Readership Survey (NRS) categories

<sup>2</sup> In order to ensure a wide spread in the number of occupants across the employed archetypes, the number of occupants in the Practical Considerations archetype was increased from 4 to 5.

Table 2 – Overview of neighbourhood clusters compared to the average over all employed Output Areas

	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C0<sup>3</sup></b>
<b>Dwelling/hectare (ha<sup>-1</sup>)</b>	15.8	17.0	6.9	12.6
<b>Mean weighted floor area per dwelling (m<sup>2</sup>)</b>	86.3	81.3	94.0	88.1
<b>Mean area of Output Areas in cluster (hectares)</b>	39.8	50.7	294.3	12.6
<b>Mean no. of Households in cluster</b>	126	130	127	127
<b>No. of semi-detached dwellings</b>	86	43	29	38
<b>No. of detached dwellings</b>	29	29	88	38
<b>No. of terraced dwellings</b>	11	58	10	15

Table 3 – Allocation of DHAs to neighbourhood clusters and number of CHAP load profiles generated per LCT system and DHA (for abbreviations see Table 1)

Cluster \ DHA	1	2	3	4	5	6	7	Total
	(PP)	(TV)	(LL)	(ML) 4	(PC)5	(OP)6	(PU)7	
<b>C1</b>	19	11	5	42	25	9	15	126
<b>C2</b>	4	58	3	32	9	5	21	132
<b>C3</b>	11	10	21	9	9	29	38	127
<b>C0</b>	11	26	10	28	14	14	25	128
<b>No. of load profiles per LCT system</b>	5	15	5	11	6	7	10	59

<sup>3</sup> This column shows the average across all employed OAs, i.e. after the rejection of approximately 56% in the pre-filtering as described above.

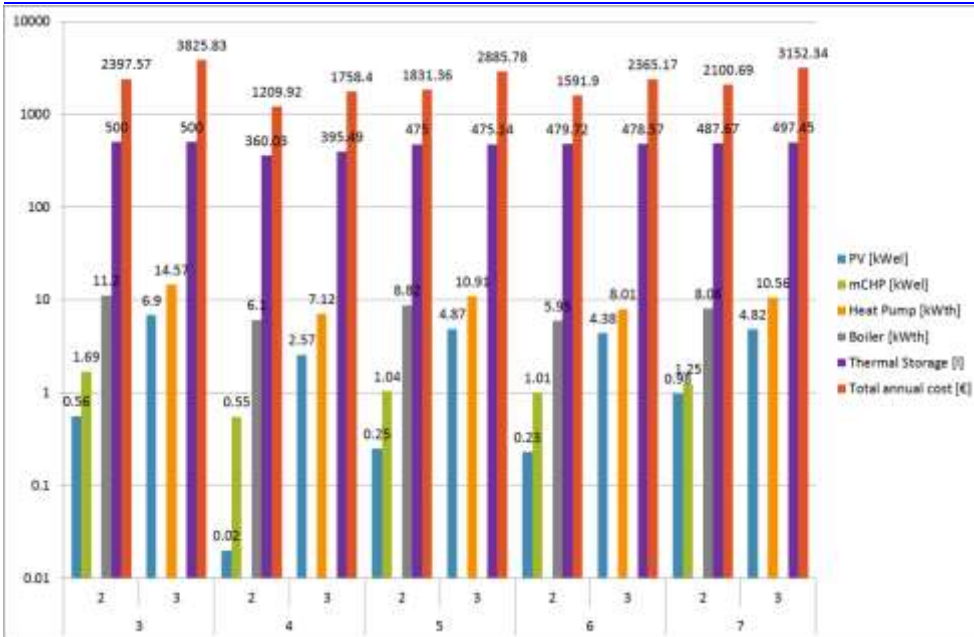
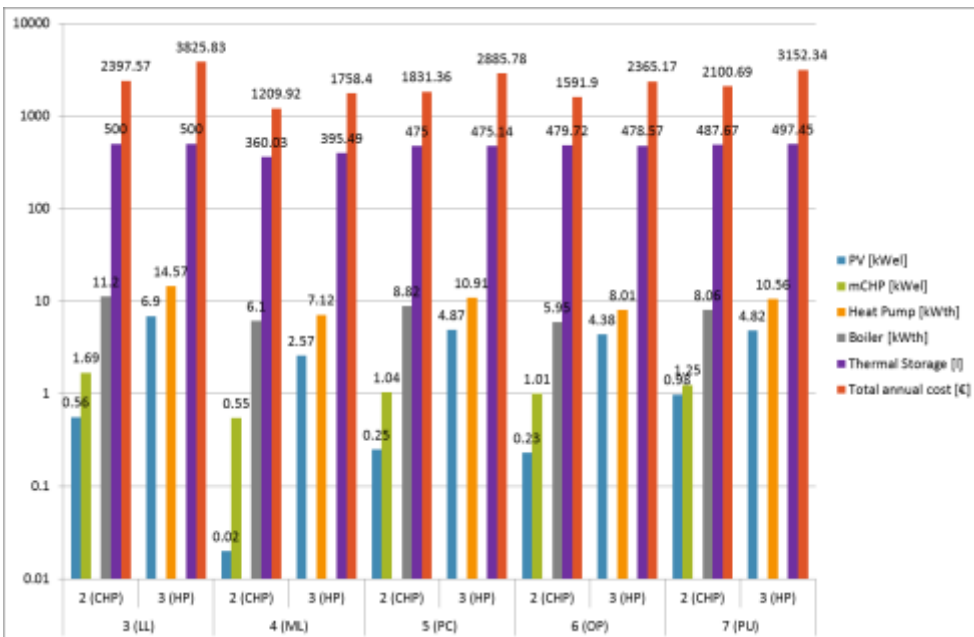


Figure 2 – Determined capacities for the five optimised DHAs 3-7 (for abbreviations see Table 1) with LCT systems 2 (CHP) and 3 (HP), showing the mean over all profiles (logarithmic axis)<sup>4</sup>

Table 4 – Definition of LCT technology penetration scenarios for the neighbourhood clusters

Cluster	Baseline	25%	50%	100%_HP	100%_CHP
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<sup>4</sup> Note that no battery capacities are included in this figure due to their not being part of the solution at the assumed level of investment (for details see McKenna et al. 2016).

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Description	No technology optimisation, all dwellings supplied with the electricity from the grid	25% of <a href="#">optimized</a> households have CHP and HP respectively	50% of <a href="#">optimized</a> households have CHP and HP respectively	All <a href="#">optimized</a> households have HP	All <a href="#">optimized</a> households have CHP
C1	C1_B	C1_25	C1_50	C1_100_HP	C1_100_CHP
C2	C2_B	C2_25	C2_50	C2_100_HP	C2_100_CHP
C3	C3_B	C3_25	C3_50	C3_100_HP	C3_100_CHP
C0	C0_B				

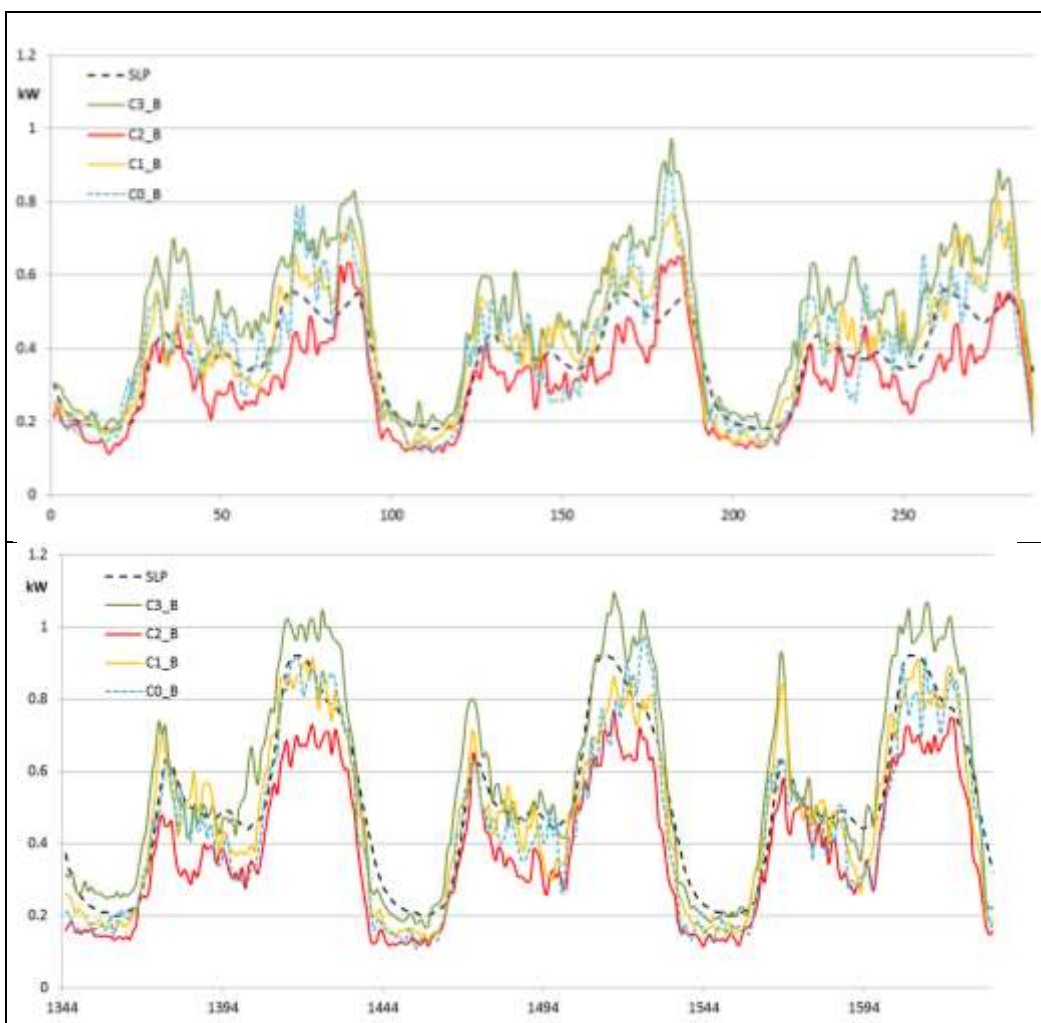


Figure 3 – Electrical load profiles in the baseline scenario for three weekdays in summer (top) and winter (bottom). The horizontal axis shows the 15-minute period of the nine modelled weeks (for further details see Hofmann et al. (2016)), [The profiles relate to the neighbourhood clusters given in Table 2 and are normalized with respect to the number of households.](#)

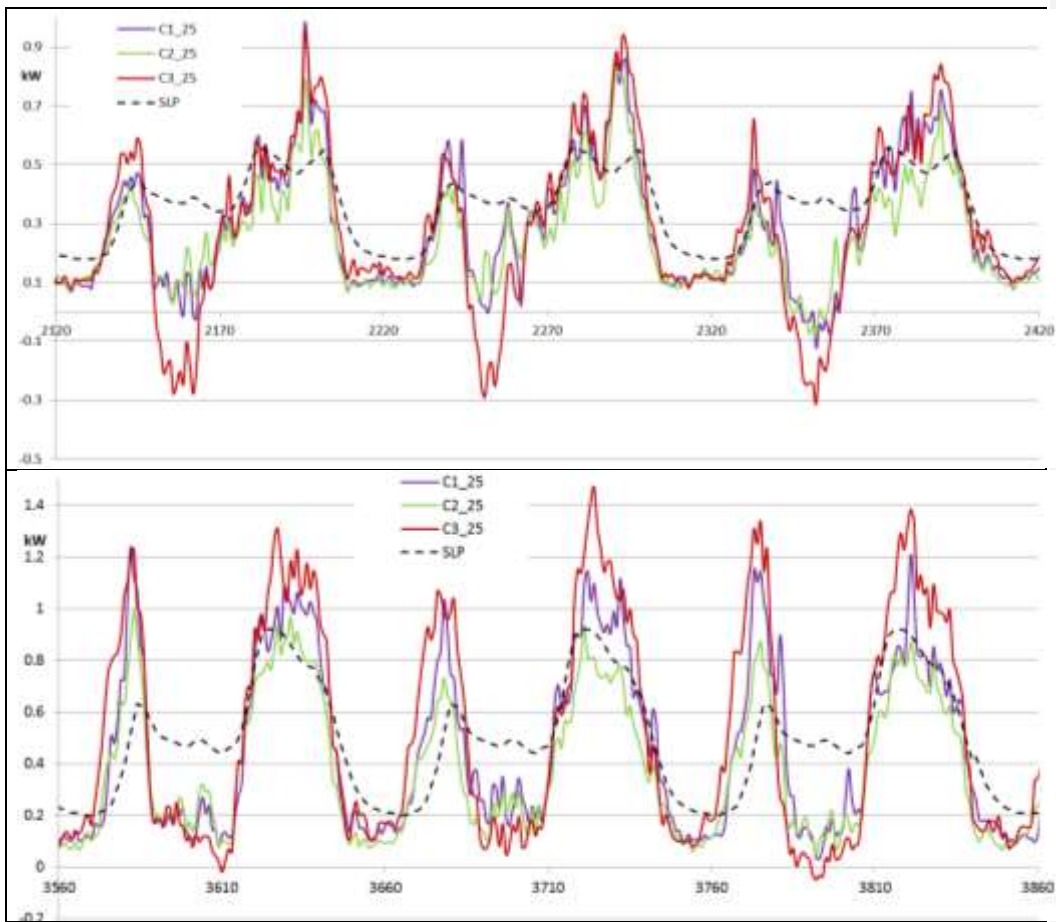


Figure 4 – Electrical load profiles in the 25% scenario for the three neighbourhood clusters for three weekdays in summer (top) and winter (bottom). The horizontal axis shows the 15-minute period of the nine modelled weeks (for further details see Hofmann et al. (2016)). [The profiles relate to the neighbourhood clusters given in Table 2 and are normalized with respect to the number of households.](#)

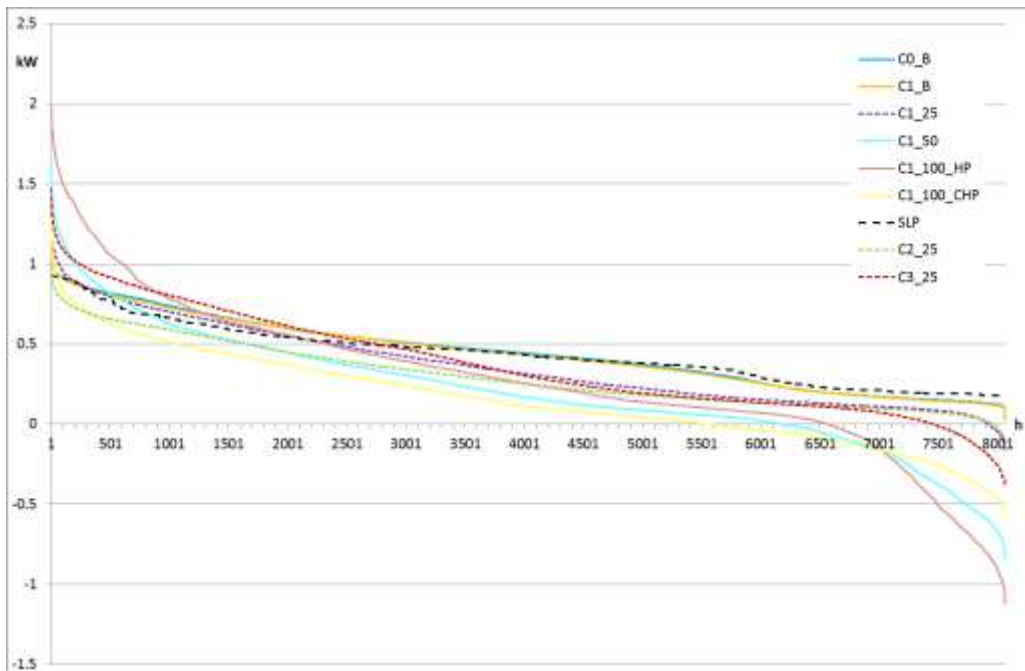


Figure 5 – Sorted residual load profiles for C1 (all scenarios), C2\_25, C3\_25 and standard load profile, normalized per household (not all scenarios shown for clarity)

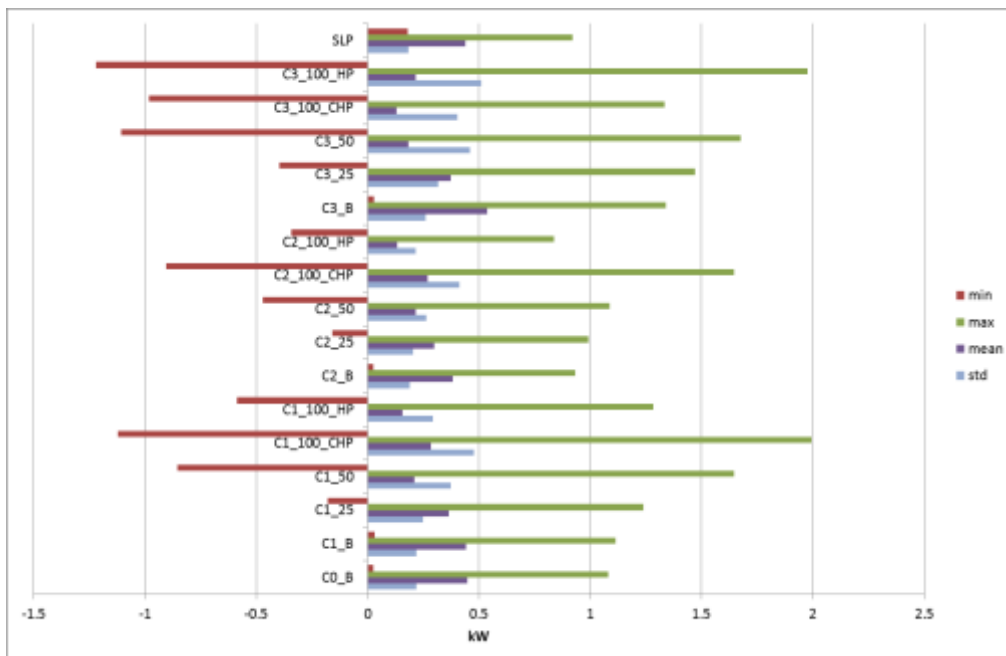


Figure 6 – Key load profile statistics for the neighbourhood clusters and scenarios

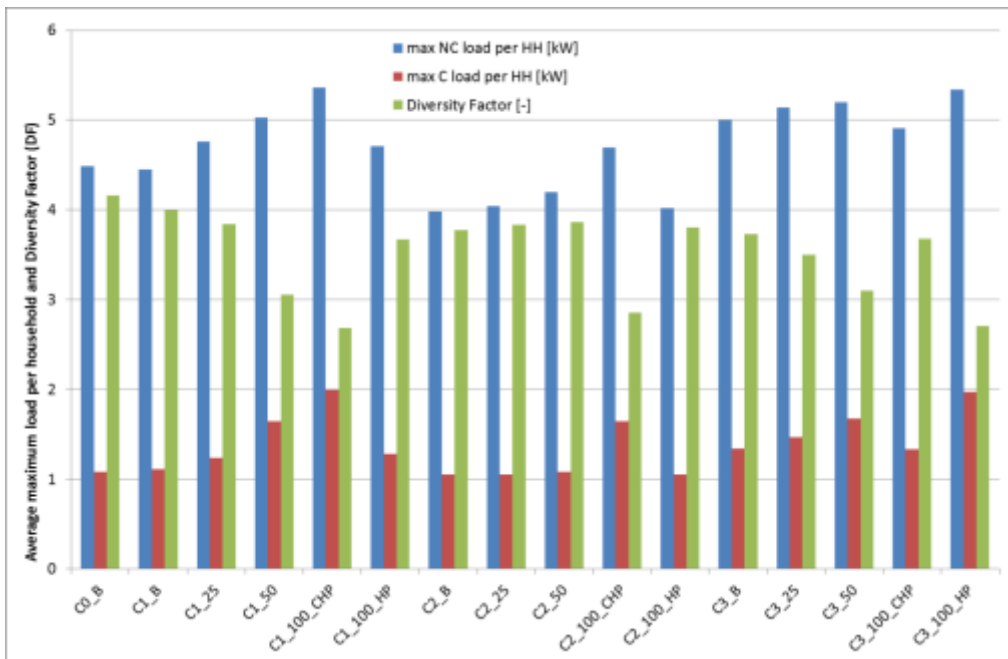


Figure 7 – Maximum non-concurrent and concurrent load, determined for each cluster and expressed per household, and Diversity Factors, for all scenarios

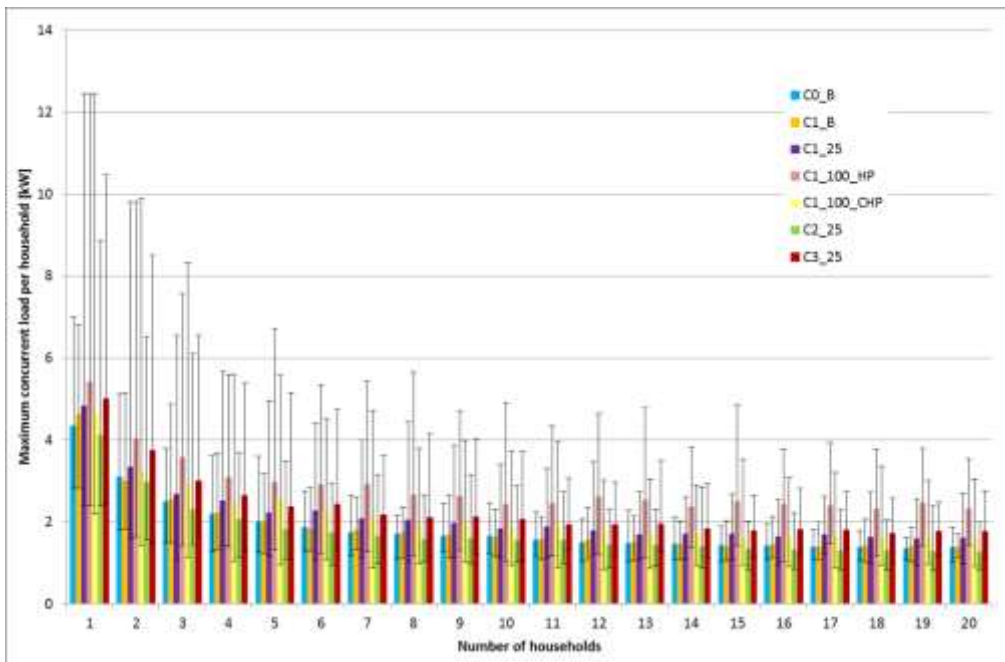


Figure 8 – Maximum concurrent load per household (After Diversity Maximum Demand, ADMD) for selected clusters and LCT penetrations. The mean of 100 random selections from the cluster population is shown, along with minimum and maximum values as error bars



## List of Abbreviations

<b>Abbreviation</b>	<b>Definition</b>
<b>ADMD</b>	After Diversity Maximum Demand
<b>BIC</b>	Bayesian Information Criteria
<b>CHAP</b>	CREST Combined Heat and Power (model)
<b>CHM</b>	Cambridge Housing Model
<b>CHP</b>	Combined Heat and Power
<b>CSE</b>	Centre for Sustainable Energy
<b>DDM</b>	Dynamic Dispatch Model
<b>DF</b>	Diversity Factor
<b>DHAs</b>	dwelling/household archetypes
<b>DHW</b>	Domestic Hot Water
<b>EFUS</b>	Energy Follow Up Survey
<b>HEUS</b>	Household Energy Use Study
<b>HP</b>	Heat Pump
<b>HRP</b>	Household Representative Person
<b>LCTs</b>	Low Carbon Technologies
<b>mCHP</b>	micro-Combined Heat and Power
<b>MILP</b>	Mixed Integer Linear Program
<b>NHM</b>	National Household Model
<b>NRS</b>	National Readership Survey
<b>OA</b>	Output Areas
<b>PV</b>	Photovoltaics
<b>RC</b>	(thermal) Resistance-Capacitance (model)
<b>SH</b>	Space Heating
<b>SLP</b>	Standard Load Profile
<b>WholeSEM</b>	Whole Systems Energy Modelling