

Appendix

Table A1. Weibull parameters used in the model.

Equipment	λ	β	Median lifetime (years)
Gas boiler	23.09	2.55	20.5
Oil boiler	23.73	2.15	21.0
Biomass boiler	25.78	2.31	22.9
Electric resistance heating	23.09	2.55	20.5
Air-to-water heat pump	21.92	4.00	20.1
Air-to-air heat pump	21.92	4.00	20.1
Ground-source heat pump	25.69	5.38	24.4
Wood stove	23.09	2.55	20.5
Fireplace/stove insert/cooking stove	30.90	2.72	27.5
District heating	52.86	6.58	50.5

Table A2. Selected entries of the Technical Constraint Matrix (dwelling-level base probabilities).

Building type	Heating system	Current system	Gas Boiler	AW Heat Pump	AA HP	WW HP	Hybrid HP	Electrical Heaters	Biomass Boiler	Stove	DH
House	Individual	Electric heating	0	0	0.42	0	0	0.40	0.01	0.17	0
House	Individual	Gas boiler	0.30	0.35	0	0.10	0.02	0	0.23	0	0
House	Individual	Oil boiler	0.30	0.35	0	0.05	0.02	0	0.28	0	0
House	Individual	Stove	0	0	0.30	0	0	0.07	0.01	0.62	0
House	Individual	Fireplace	0	0	0.20	0	0	0.07	0.01	0.72	0
House	Individual	AW Heat Pump	0.20	0.80	0	0	0	0	0	0	0
House	Individual	Biomass boiler	0.30	0.35	0	0.05	0.02	0	0.28	0	0
House	Individual	AA HP	0	0	0.80	0	0	0.20	0	0	0
House	Individual	Cooking stove	0	0	0.20	0	0	0.07	0.01	0.72	0
House	Individual	WW HP	0.10	0.20	0	0.70	0	0	0	0	0
Apartment	Individual	Electric heating	0	0	0.35	0	0	0.65	0	0	0
Apartment	Individual	AA HP	0	0	0.80	0	0	0.20	0	0	0
Apartment	Individual	Gas boiler	0.70	0.13	0.05	0.05	0.02	0.05	0	0	0
Apartment	Individual	Oil boiler	0.70	0.13	0.05	0.05	0.02	0.05	0	0	0
Apartment	Individual	Biomass boiler	0.70	0.13	0.05	0.05	0.02	0.05	0	0	0
Apartment	Individual	AW Heat Pump	0.10	0.73	0.05	0.05	0.02	0.05	0	0	0
Apartment	Individual	WW HP	0.10	0.73	0.05	0.05	0.02	0.05	0	0	0
Apartment	Individual	Fireplace	0	0.23	0.10	0.05	0.02	0.03	0.27	0.30	0
Apartment	Individual	Stove	0	0.23	0.10	0.05	0.02	0.03	0.27	0.30	0

Apartment	Collective	Gas boiler	0.20	0.15	0	0.05	0.02	0	0	0	0.58
Apartment	Collective	Oil boiler	0.20	0.12	0	0.05	0.02	0	0.03	0	0.58
Apartment	Collective	Biomass boiler	0.20	0.10	0	0.05	0.02	0	0.08	0	0.55
Apartment	Collective	DHN	0.05	0.05	0	0	0	0	0	0	0.90
Apartment	Collective	AW Heat Pump	0.10	0.73	0.05	0.05	0.02	0.05	0	0	0
Apartment	Collective	WW HP	0.10	0.73	0.05	0.05	0.02	0.05	0	0	0

Abbreviations: AW Heat Pump = air-to-water heat pump; AA HP = air-to-air heat pump; WW HP = water-to-water (ground-source) heat pump; Hybrid HP = hybrid heat pump (heat pump combined with a gas boiler); DH = district heating (as a technology option).

Table A3. Selected entries of the Household Decision Matrix (multiplicative scaling factors).

Occupancy status	Income level	EPC	Gas Boiler	AW Heat Pump	AA HP	WW HP	Hybrid HP	Electrical Heaters	Biomass Boiler	Stove	DH
Owner	Low	A–D	1	0.5	0.5	0.5	0.5	1	1	1	1
Owner	Low	E–G	1	1	1	1	1	1	1	1	1
Owner	Middle	A–D	1	0.1	0.1	0.1	0.1	1	1	1	1
Owner	Middle	E–G	1	0.3	0.3	0.3	0.3	1	1	1	1
Owner	High	A–D	1	1	1	1	1	1	1	1	1
Owner	High	E–G	1	2	2	2	2	1	1	1	1
Tenant	Any	A–D	1	0.1	0.1	0.1	0.1	1	1	1	1
Tenant	Any	E–G	1	1	1	1	1	1	1	1	1
Social tenant	Any	A–D	1	0.1	0.1	0.1	0.1	1	1	1	1
Social tenant	Any	E–G	1	1	1	1	1	1	1	1	1

Abbreviations: AW Heat Pump = air-to-water heat pump; AA HP = air-to-air heat pump; WW HP = water-to-water (ground-source) heat pump; Hybrid HP = hybrid heat pump (heat pump combined with a gas boiler); DH = district heating (as a technology option).

Table A4. Selected entries of the Territorial Matrix (multiplicative scaling factors).

Density	Listed DHN	DHN present	PDA	Gas	Climate zone	Gas boiler	AW Heat Pump	AA HP	WW HP	Hybrid HP	Electrical Heaters	Biomass Boiler	Stove	DH
Dense	Yes	Yes	No	Yes	Warm	1	1	2	0	1	1	0	0	3
Dense	Yes	Yes	Yes	Yes	Warm	1	1	2	0	1	1	0	0	3
Dense	Yes	Yes	No	Yes	Cold	1	1	1	0	1	1	0	0	3
Dense	Yes	Yes	Yes	Yes	Cold	1	1	1	0	1	1	0	0	3
Dense	Yes	Yes	No	No	Warm	0	1	2	0	0	1	0	0	3
Dense	Yes	Yes	Yes	No	Warm	0	1	2	0	0	1	0	0	3
Dense	Yes	Yes	No	No	Cold	0	1	1	0	0	1	0	0	3
Dense	Yes	Yes	Yes	No	Cold	0	1	1	0	0	1	0	0	3
Dense	No	Yes	No	Yes	Warm	1	1	2	0	1	1	0	0	2
Dense	No	Yes	Yes	Yes	Warm	1	1	2	0	1	1	0	0	2

Dense	No	Yes	No	Yes	Cold	1	1	1	0	1	1	0	0	2
Dense	No	Yes	Yes	Yes	Cold	1	1	1	0	1	1	0	0	2
Dense	No	Yes	No	No	Warm	0	1	2	0	0	1	0	0	2
Dense	No	Yes	No	No	Cold	0	1	1	0	0	1	0	0	2
Dense	No	Yes	Yes	No	Cold	0	1	1	0	0	1	0	0	2
Dense	No	No	Yes	Yes	Warm	1	1	2	0	1	1	0	0	1.5
Dense	No	No	Yes	Yes	Cold	1	1	1	0	1	1	0	0	1.5
Dense	No	No	Yes	No	Warm	0	1	2	0	0	1	0	0	1.5
Dense	No	No	Yes	No	Cold	0	1	1	0	0	1	0	0	1.5
Dense	No	No	No	Yes	Warm	1	1	2	0	1	1	0	0	1
Dense	No	No	No	Yes	Cold	1	1	1	0	1	1	0	0	1
Dense	No	No	No	No	Warm	0	1	2	0	0	1	0	0	1
Dense	No	No	No	No	Cold	0	1	1	0	0	1	0	0	1
Low-density	Yes	Yes	No	Yes	Warm	1	1	2	1	1	1	1	1	3
Low-density	Yes	Yes	No	Yes	Cold	1	1	1	1	1	1	1	1	3
Low-density	Yes	Yes	No	No	Warm	0	1	2	1	0	1	1	1	3
Low-density	Yes	Yes	No	No	Cold	0	1	1	1	0	1	1	1	3
Low-density	No	Yes	No	Yes	Warm	1	1	2	1	1	1	1	1	2
Low-density	No	Yes	No	Yes	Cold	1	1	1	1	1	1	1	1	2
Low-density	No	Yes	No	No	Warm	0	1	2	1	0	1	1	1	2
Low-density	No	Yes	No	No	Cold	0	1	1	1	0	1	1	1	2
Low-density	Yes	Yes	Yes	Yes	Warm	1	1	2	1	1	1	1	1	3
Low-density	Yes	Yes	Yes	Yes	Cold	1	1	1	1	1	1	1	1	3
Low-density	Yes	Yes	Yes	No	Warm	0	1	2	1	0	1	1	1	3
Low-density	Yes	Yes	Yes	No	Cold	0	1	1	1	0	1	1	1	3
Low-density	No	Yes	Yes	Yes	Warm	1	1	2	1	1	1	1	1	2
Low-density	No	Yes	Yes	Yes	Cold	1	1	1	1	1	1	1	1	2

Low-density	No	Yes	Yes	No	Warm	0	1	2	1	0	1	1	1	2
Low-density	No	Yes	Yes	No	Cold	0	1	1	1	0	1	1	1	2
Low-density	No	No	Yes	Yes	Warm	1	1	2	1	1	1	1	1	1.5
Low-density	No	No	Yes	Yes	Cold	1	1	1	1	1	1	1	1	1.5
Low-density	No	No	Yes	No	Warm	0	1	2	1	0	1	1	1	1.5
Low-density	No	No	Yes	No	Cold	0	1	1	1	0	1	1	1	1.5
Low-density	No	No	No	Yes	Warm	1	1	2	1	1	1	1	1	0
Low-density	No	No	No	Yes	Cold	1	1	1	1	1	1	1	1	0
Low-density	No	No	No	No	Warm	0	1	2	1	0	1	1	1	0
Low-density	No	No	No	No	Cold	0	1	1	1	0	1	1	1	0

Abbreviations: AW Heat Pump = air-to-water heat pump; AA HP = air-to-air heat pump; WW HP = water-to-water (ground-source) heat pump; Hybrid HP = hybrid heat pump (heat pump combined with a gas boiler); DH = district heating (as a technology option); DHN = district heating network (as the currently installed system); PDA = Priority Development Area, i.e. an area identified as a priority for district heating network development.