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Supplementary data

Appendix: Dwellings included in this study along with characteristics and retrofit features

Case Study Ref.	Dwelling type	Dwelling Age	Wall upgrade	Heating system	Mech. Ventilation	Solar	PHPP	Pre air-perm.	Post air-perm	Pre-retrofit measured Electricity	Post-retrofit measured Electricity	Pre-retrofit measured gas	Post-retrofit measured gas	Pre-retrofit measured CO2	Post-retrofit measured CO2
								m3/m2/hr @50Pa		kWh/yr				kgCO2/m2/yr	
H1	MT	1950 - 1966	EWI	Biomass		Thermal		9.02	6.16						13.93
H2	SD	1930 - 1949	EWI	Biomass	MVHR		Y	8.5	0.85	18830		3130		157	14.8
H3	SD	1950 - 1966	EWI	Gas		PV		7.46	4.25	2033	1601	18213	3421	60	15.87
H4	SD	1950 - 1966	EWI	Gas		PV		8	4.16	2033	2545	18213	2756	60	19.57
H5	SD	1950 - 1966	EWI	Electric	MVHR			9.32	5.13						21.77
H6	ET		EWI	ASHP	MVHR	PV+ thermal		7.65	2.94	7895	3475	66507	9075	105	22
H7	ET	1976 - 1982	EWI	Gas	MVHR	PV+ thermal		10.05	3.33	547	2253	23490	2665	68	25
H8	ET	1991 - 1995	EWI	Gas	MVHR	PV		9.04	5.96						25.01
H9	SD	1930 - 1949	EWI	Biomass	MVHR		Y	9.66	1						28.44

H10	SD	1950 - 1966	EWI	ASHP	MVHR		Y		3.2	1885	5506	39377	0	125	32.9
H11			EWI	Gas	MVHR	PV+ thermal		11.9	11.1						36.51
H12	SD	1950 - 1966	EWI	Gas	MVHR	Thermal	Y	8.75	5.51	3337		29073		87	39.09
H13	MT		EWI	Gas	d-MEV	PV+ thermal		15.02	9.94	2223	1839	15811	8807	76	45.93
H14	SD	1950 - 1966	EWI	Gas		PV+ thermal		15.82	12.51	2751	4913	18587	2509	62	46.55
H15	MT		EWI	Electric	MVHR	PV+ thermal		8.89							46.71
H16	SD	1930-1949	EWI	Gas	MVHR	Thermal		12.32	6.46						46.83
H17	MT	1950 - 1966	EWI	Gas	MVHR	PV+ thermal		8.12	6.45						47.7
H18	SD	1950 - 1966	EWI	ASHP	EAHR	Thermal		7.52	6.09						48.76
H19	MT	pre 1900	EWI	Gas	MVHR	Thermal		10.44	4.27	1733	4296	38723	5446	141	57
H20	MT	pre 1900	IWI	ASHP	MVHR	Thermal	Y	19.87	0.33					120	20.57
H21	MT	pre 1900	IWI	Gas	MVHR	Thermal		15.32	2.58	2808		32860		120	24
H22	ET	1983 - 1990	IWI	GSHP	MVHR	PV+ thermal		9.68	7.73	1505		28020		115	24
H23	ET		IWI	Gas	MVHR	Thermal	Y	14.53	2.75	5550	2668	17500	5775	77	31
H24	MT	pre 1900	IWI	ASHP	EAHR	PV			4.22	3779	9558	9302	0	47	42.68
H25	MT	1900-1929	IWI	GSHP		PV+ thermal		8.06	10.92	5474	5503	21772	0	134	43.53
H26	MT	pre 1900	IWI	Gas	d-MEV	PV+ thermal		8.88	8.95	2861	4941	34933	9628	102	47.7
H27	MT	pre 1900	IWI	Gas	EAHR	PV+ thermal		9.47	7.73					41	47.83
H28	ET	1950 - 1966	CWI+S WI	GSHP	d-MEV	PV			5.25	2640		22946		38	17
H29	SD	pre 1900	CWI+S WI	Gas	MVHR	PV+ thermal		5.86	4.04	802	1879	24138	3957	104	21
H30	MT	1991 - 1995	CWI+S WI	ASHP	EAHR	PV+ thermal	Y	15.59	6.76	11451	6368	0	0	68	24.73
H31	SD	1950 - 1966	CWI+S WI	Gas	MVHR	Thermal		9.03	5.43						25.5
H32	MT	1991 - 1995	CWI+S WI	Gas	MVHR	PV+ thermal		5.62	6.76	3303	4319	11983	5016	70	36.96
H33	SD	1950 - 1966	CWI+S WI	Electric	MVHR			10.66	5.8	3241		27154		89	41.5
H34	MT	1950 -	CWI+S	ASHP	EAHR	PV+		6.56	2.43	6593				81	50.79

		1966	WI			thermal									
H35	MT	1950 - 1966	EWI+IW I	Gas	MVHR	Thermal	Y	6	1.78	3029	4496	43306	7559	103	21.81
H36	MT	pre 1900	EWI+IW I	Gas	EAHR	Thermal		16.77	5.92	1097	1324	25810	2860	98	21.95
H37	D	pre 1900	EWI+IW I	Gas	MVHR	Thermal		9.76	3	4061	3915	80054	8407	107	23
H38	MT	1900-1929	EWI+IW I	Gas	MVHR	PV+ thermal		5.59	8.14	214		25987		79	30.7
H39	ET	1950-1966	EWI+IW I	GSHP	MVHR	PV+ thermal		4.86	3.65						33.88
H40	MT	1900-1929	EWI+IW I	Gas	MVHR	Thermal		17	2.66	2897		70164		148	39
H41	SD		EWI+IW I	ASHP	EAHR	PV	Y	13.79	2.18	5433	9858	16287	0	57	41.1
H42	SD	1930 - 1949	EWI+IW I	ASHP	MVHR	PV+ thermal		7.51	2.95	4412	7018	15212	0	69	41.37
H43	MT		EWI+IW I	Electric	MVHR	PV		7.02	3.26	968	10038	21283	0	98	67
H44	MT	pre 1900	IWI	Gas	MVHR	PV		12.43	0.25	7250	2657	22000		99	18
H45	SD	1900 - 1929	EWI	ASHP	EAHR	Thermal	Y	7.73	0.57	2155		59250		124	
H46	ET	1930 - 1949	EWI	Gas	MVHR	PV+ thermal		10.63	3.79	2010		40107		123	
H47	ET				MVHR	PV+ thermal		11.9	11.1	10669	4049	22565	7004	146	51
H48	ET	1950 - 1966						6.98	5.35						
H49	MT	1950 - 1966	EWI	Biomass		Thermal		9.92	9.16						
H50	SD	1950 - 1966	EWI	Gas	MVHR	Thermal		9.31	6.62						
H51	MT	1900-1929	EWI+IW I	Gas		Thermal		15.5	6.81	3151		63241		94	
H52	ET		IWI	Micro CHP	EAHR			7.19	2.08	1588		30115		114	
H53	ET	1930 - 1949	CWI+S WI	ASHP	MVHR	PV+ thermal		5.28	3.44	37554				435	
H54	SD	1950 - 1966	EWI+IW I	GSHP	MVHR	PV		4.19	2.54	37050				227	
H55	SD		CWI+S WI	Gas	MVHR	PV		6.8	3.74	16193				357	
H56	ET		EWI	Gas + Micro CHP	MVHR	PV		10.25	5.48	3977		17060		65	

H57	ET	1950 - 1966	EWI	Gas + Micro CHP	EAHR	PV		11.62	7.77	2968		27631		89	
H58	MT	pre 1900		Gas + Micro CHP	MVHR			13.68	2.94	2581		20980		99	
H59	ET		EWI	Gas	MVHR	PV+ thermal		6.6	8.82						
H60	SD			Gas				9.06	7.59	2029		2461		21	23.85
H61	ET		EWI+IW I	Gas + Micro CHP	EAHR	PV		5.65	3.64	1051		7411		28	
H62	SD			Gas				21.34	12.78	197		213		1	
H63	SD			Gas	MVHR		Y	5.38	2.81	1812		28659		109	
H64	SD	1900 - 1929	EWI	Gas	MVHR	PV+ thermal		7.36	6.4	2169		2651		21	
H65	ET	1930 - 1949		ASHP				12.63	6.35	16113		3439		143	
H66	MT	pre 1900	EWI+IW I	Gas	MVHR			17.01	1.23	2684		33051		79	
H67	ET	1900 - 1929	IWI	Gas	MVHR	PV+ thermal		11.64	11.83	980		27559		89	
H68	MT	pre 1900	EWI+IW I	Gas	MVHR	Thermal		12.6	7.08	18718		41541		169	
H69	SD	1950 - 1966		Gas		PV		8.05	5.12						
H70	MT	1950 - 1966		Gas	MVHR			9.12	3.72						
H71	MT	1900-1929	EWI	Gas	MVHR	PV+ thermal		7.84	7.07						
H72	SD			Gas	MVHR		Y	8.4	4.64	2190		49702		148	
H73	SD	1930 - 1949	EWI		MVHR	PV+ thermal		8.49		752.5		26803.9		78	
H74	ET	1950 - 1966	IWI	ASHP	MVHR	PV+ thermal		5.88		13060				120	
H75	SD		EWI	Gas	MVHR	Thermal	Y	7.21	3.02						
H76	SD			ASHP	MVHR	Thermal		27.83	9.55	5410	7928	0	0	42	62
H77	MT	1967 - 1975	CWI+S WI	Gas + Micro CHP	MVHR	PV+ thermal		12.2	5.41	3000		14000		63	
H78	SD			ASHP	MVHR	PV+ thermal		12.12	12.72	30121		11804		218	
H79	SD	1950 -	IWI	ASHP	MVHR	PV+		9.18	2.42	17487		964		176	

		1966				thermal									
H80	SD		EWI	ASHP	MVHR	PV+ thermal		9.84	9.63						
H81	ET		EWI	Gas	MVHR	PV+ thermal		8.23	9.14						
H82	MT	1900-1929	EWI	Gas				6.65	3.2						
H83	SD	1950 - 1966	EWI+IW I	Gas	MVHR	PV+ thermal	Y	7.06	1.39	2795		55234		155	
H84	SD	1930 - 1949	EWI	Biomass		PV+ thermal		7.37							
H85	SD		EWI	ASHP	MVHR	PV+ thermal			3.17	24635				168	
H86	MT	1900-1929		Gas		PV		14.97	6.44						