ASHRAE Standard 140-2017

Test Results Comparison
for
Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF

Results for TRNSYS 18.05.0001
(TRNSYS18)
vs.
Informative Annex B8, Section B8.1 Example Results

Prepared By
Thermal Energy System Specialists, LLC
(TESS)

Results Developed
15-Apr-2023

ASHRAE Standard 140-2017
Computer Programs, Program Authors, and Producers of Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF

The programs used to generate the example results are described in Table B11-1. Under the computer program column, the first entry in each cell is the proper program name and version number. The entries in parentheses are the abbreviations for the programs generally used in the tables and charts which follow.

The second column ("Authoring Organization") indicates the national research facility, university, or industry organization with expertise in building science that wrote the simulation software.

The third column ("Implemented By") indicates the national research facility, university, or industry organization with expertise in building science that performed the simulations. The majority of organizations that performed simulations either ran software written by their organization or otherwise ran other building energy simulation software in addition to that written by their organization.

See Standard 140, Annex B11 for further details.

TABLE B11-1
Computer Programs, Program Authors, and Producers of Example Results

Computer Program (Abbrev.)	Authoring Organization	Example Results Produced by
BLAST-3.0 level 193 v.1 (BLAST-US/IT)	CERL,[a] United States (U.S.)	NREL,[b] U.S. Politecnico Torino, Italy
DOE-2.1D 14 (DOE21D)	LANL/LBNL,[c] U.S.	NREL, U.S.
ESP-RV8 (ESP-DMU)	Strathclyde University, United Kingdom (U.K.)	De Montfort University, U.K.
SERIRES/SUNCODE 5.7 (SRES/SUN)	NREL/Ecotope, U.S.	NREL, U.S.
SERIRES 1.2 (SRES-BRE)	NREL/BRE,[d] U.S./U.K.	BRE, U.K.
S3PAS	University of Sevilla, Spain	University of Sevilla, Spain
TASE	Tampere University, Finland	Tampere University, Finland
TRNSYS 13.1 (TSYS-BEL/BRE)	University of Wisconsin, U.S.	BRE, U.K. Vrije Universiteit (VUB) Brussels, Belgium

[a]CERL-U.S. Army Construction Engineering Research Laboratories

[b]NREL-National Renewable Energy Laboratory

[c]LANL/LBNL-Los Alamos National Laboratory/Lawrence Berkeley National Laboratory

[d]BRE-Building Research Establishment

ASHRAE Standard 140-2010 Section 5.2 - Building Thermal Envelope and Fabric Load Tests
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

List of Tables

ASHRAE Standard 140-2010 Section 5.2 - Building Thermal Envelope and Fabric Load Tests
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

List of Figures

ASHRAE Standard 140-2010 Section 5.2 - Building Thermal Envelope and Fabric Load Tests
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

List of Figures

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-1. Annual Heating Loads (MWh)

Simulation Model:	ESP	BLAST	DOE21D	SRES-SUN	SRES*	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18
Organization or Country:	DMU	US-IT	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND	Min	Max	Mean	(Max-Min)/	TESS
Case												Mean** (%)	
600 Base Case, South Windows	4.296	4.773	5.709	5.226	5.596	4.882	4.872	5.362	4.296	5.709	5.090	27.8%	4.827
610 S. Windows + Overhang	4.355	4.806	5.786	5.280	5.620	4.971	4.970	5.383	4.355	5.786	5.146	27.8%	4.908
620 East & West Windows	4.613	5.049	5.944	5.554	5.734	5.564	5.073	5.728	4.613	5.944	5.407	24.6%	5.024
630 E&W Windows + Overhang & Fins	5.050	5.359	6.469	5.883	6.001	6.095	5.624		5.050	6.469	5.783	24.5%	5.496
640 Case 600 with Htg Temp. Setback	2.751	2.888	3.543	3.255	3.803	3.065	3.043	3.309	2.751	3.803	3.207	32.8%	3.044
650 Case 600 with Night Ventilation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	----	0.000
900 South Windows	1.170	1.610	1.872	1.897	1.988	1.730	1.655	2.041	1.170	2.041	1.745	49.9%	1.488
910 S. Windows + Overhang	1.575	1.862	2.254	2.174	2.282	2.063	2.097	2.220	1.575	2.282	2.066	34.2%	1.839
920 East & West Windows	3.313	3.752	4.255	4.093	4.058	4.235	3.776	4.300	3.313	4.300	3.973	24.8%	3.653
930 E&W Windows + Overhang & Fins	4.143	4.347	5.335	4.755	4.728	5.168	4.740		4.143	5.335	4.745	25.1%	4.539
940 Case 900 with Htg Temp. Setback	0.793	1.021	1.239	1.231	1.411	1.179	1.080	1.323	0.793	1.411	1.160	53.3%	0.952
950 Case 900 with Night Ventilation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	----	0.000
960 Sunspace	2.311	2.664	2.928	2.884	2.851	2.943	3.373	2.816	2.311	3.373	2.846	37.3%	2.664
195 Solid Conduction	4.167								4.167	4.167	4.167	0.0%	4.562
200 Surface Convection (Int & Ext IR="off")	5.252								5.252	5.252	5.252	0.0%	6.185
210 Infrared Radiation (Int IR="off", Ext IR="on")	6.456	6.559					6.554	6.967	6.456	6.967	6.634	7.7%	7.053
215 Infrared Radiation (Int IR="on", Ext IR="off")	5.547								5.547	5.547	5.547	0.0%	6.736
220 In-Depth Base Case	6.944	7.215	8.787	8.102	8.127	7.422	7.297	7.437	6.944	8.787	7.666	24.0%	7.716
230 Infiltration	10.376	10.740	12.243	11.633	11.649	11.037	10.840	10.964	10.376	12.243	11.185	16.7%	11.254
240 Internal Gains	5.649	6.009	7.448	6.769	6.786	6.194	6.076	6.234	5.649	7.448	6.396	28.1%	6.448
250 Exterior Shortwave Absorptance	4.751	5.739	7.024	6.608	6.653	5.974	5.764	5.738	4.751	7.024	6.031	37.7%	6.000
270 South Solar Windows	4.510	4.930		5.341	*5.920*		5.047	5.489	4.510	*5.920*	*5.206*	*27.1%*	4.973
280 Cavity Albedo	4.675	5.125		5.937	6.148		5.279	5.841	4.675	6.148	5.501	26.8%	5.191
290 South Shading	4.577	4.959		5.406	*5.942*		5.132	5.509	4.577	*5.942*	*5.254*	*26.0%*	5.051
300 East/West Window	4.761	5.077		5.587	*5.964*		5.124	5.786	4.761	*5.964*	*5.383*	*22.3%*	5.032
310 East/West Shading	5.221	5.327		5.850	*6.165*		5.610		5.221	*6.165*	*5.635*	*16.8%*	5.446
320 Thermostat	3.859	4.209		4.627	*5.141*		4.348	4.840	3.859	*5.141*	*4.504*	*28.5%*	4.293
395 Low Mass Solid Conduction	4.984	4.799	5.835	5.199	5.201	4.967	4.855	4.839	4.799	5.835	5.085	20.4%	5.094
400 Low Mass Opaque Windows	6.900	7.075	8.770	7.966	7.973	7.287	7.166	7.326	6.900	8.770	7.558	24.7%	7.627
410 Low Mass Infiltration	8.596	8.873	10.506	9.726	9.734	9.019	8.936	9.085	8.596	10.506	9.309	20.5%	9.389
420 Low Mass Internal Gains	7.298	7.610	9.151	8.365	8.373	7.774	7.697	7.863	7.298	9.151	8.016	23.1%	8.109
430 Low Mass Ext. Shortwave Absorptance	5.429	6.488	7.827	7.178	7.186	6.662	6.500	6.510	5.429	7.827	6.723	35.7%	6.849
440 Low Mass Cavity Albedo	4.449	4.987		5.652	5.811		5.098	5.642	4.449	5.811	5.273	25.8%	5.040
800 High Mass Opaque Windows	4.868	5.953	7.228	6.611	6.600	6.161	5.940	5.861	4.868	7.228	6.153	38.4%	6.355
810 High Mass Cavity Albedo	1.839	2.446		3.004	2.828		2.567	2.962	1.839	3.004	2.608	44.7%	2.403

* SRES-BRE simulations for cases with interior solar absorptance = 0.9 have an input error that likely affects annual heating and cooling loads by <0.2 MWh/y (2-3%); see Annex B7, Section B7.1.1.

** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-2. Annual Sensible Cooling Loads (MWh)

Simulation Model:	ESP	BLAST	DOE21D	SRES-SUN	SRES*	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18
Organization or Country:	DMU	US-IT	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND	Min	Max	Mean	(Max-Min)/	TESS
Case												Mean** (%)	
600 Base Case, South Windows	6.137	6.433	7.079	7.278	7.964	6.492	6.492	6.778	6.137	7.964	6.832	26.7%	6.650
610 S. Windows + Overhang	3.915	4.851	4.852	5.448	5.778	4.764	4.601	5.506	3.915	5.778	4.964	37.5%	4.626
620 East & West Windows	3.417	4.092	4.334	4.633	5.004	4.011	3.901	4.351	3.417	5.004	4.218	37.6%	3.911
630 E&W Windows + Overhang & Fins	2.129	3.108	2.489	3.493	3.701	2.489	2.416		2.129	3.701	2.832	55.5%	2.461
640 Case 600 with Htg Temp. Setback	5.952	6.183	6.759	7.026	7.811	6.247	6.246	6.508	5.952	7.811	6.592	28.2%	6.410
650 Case 600 with Night Ventilation	4.816	5.140	5.795	5.894	6.545	5.088	5.119	5.456	4.816	6.545	5.482	31.5%	5.286
900 South Windows	2.132	2.600	2.455	3.165	3.415	2.572	2.485	2.599	2.132	3.415	2.678	47.9%	2.317
910 S. Windows + Overhang	0.821	1.533	0.976	1.872	1.854	1.428	1.326	1.767	0.821	1.872	1.447	72.6%	1.069
920 East & West Windows	1.840	2.616	2.440	2.943	3.092	2.457	2.418	2.613	1.840	3.092	2.552	49.1%	2.303
930 E&W Windows + Overhang & Fins	1.039	1.934	1.266	2.173	2.238	1.439	1.416		1.039	2.238	1.644	73.0%	1.376
940 Case 900 with Htg. Temp. Setback	2.079	2.536	2.340	3.036	3.241	2.489	2.383	2.516	2.079	3.241	2.578	45.1%	2.227
950 Case 900 with Night Ventilation	0.387	0.526	0.538	0.921	0.589	0.551	0.561	0.771	0.387	0.921	0.605	88.2%	0.461
960 Sunspace	0.488	0.666	0.428	0.803	0.718	0.643	0.411	0.786	0.411	0.803	0.618	63.4%	0.479
195 Solid Conduction	0.414								0.414	0.414	0.414	0.0%	0.414
200 Surface Convection (Int & Ext IR="off")	0.570								0.570	0.570	0.570	0.0%	0.582
210 Infrared Radiation (Int IR="off", Ext IR="on")	0.162	0.613					0.668	0.641	0.162	0.668	0.521	97.1%	0.389
215 Infrared Radiation (Int IR="on", Ext IR="off")	0.639								0.639	0.639	0.639	0.0%	0.647
220 In-Depth Base Case	0.186	0.701	0.399	0.827	0.835	0.734	0.737	0.683	0.186	0.835	0.638	101.8%	0.434
230 Infiltration	0.454	0.976	0.692	1.131	1.139	1.020	1.040	0.985	0.454	1.139	0.930	73.7%	0.729
240 Internal Gains	0.415	1.072	0.660	1.239	1.246	1.108	1.114	1.045	0.415	1.246	0.987	84.2%	0.733
250 Exterior Shortwave Absorptance	3.213	2.545	2.177	2.924	2.931	2.486	2.684	3.380	2.177	3.380	2.793	43.1%	2.023
270 South Solar Windows	7.528	8.670		9.828	*10.350*		8.764	8.714	7.528	*10.350*	*8.976*	*31.4%*	8.918
280 Cavity Albedo	4.873	5.895		6.511	7.114		5.761	6.257	4.873	7.114	6.069	36.9%	5.615
290 South Shading	5.204	7.011		7.871	*8.089*		6.699	7.431	5.204	*8.089*	*7.051*	*40.9%*	6.666
300 East/West Window	4.302	5.836		6.665	*7.100*		5.721	5.781	4.302	*7.100*	*5.901*	*47.4%*	5.679
310 East/West Shading	2.732	4.570		5.245	*5.471*		3.727		2.732	*5.471*	*4.349*	*63.0%*	3.755
320 Thermostat	5.061	5.906		6.725	*7.304*		5.956	5.663	5.061	*7.304*	*6.103*	*36.8%*	6.198
395 Low Mass Solid Conduction	0.000	0.011	0.000	0.016	0.014	0.010	0.010	0.011	0.000	0.016	0.009	177.1%	0.001
400 Low Mass Opaque Windows	0.000	0.040	0.002	0.061	0.058	0.042	0.045	0.044	0.000	0.061	0.036	167.3%	0.007
410 Low Mass Infiltration	0.000	0.059	0.010	0.084	0.084	0.063	0.067	0.065	0.000	0.084	0.054	155.5%	0.019
420 Low Mass Internal Gains	0.011	0.147	0.051	0.189	0.188	0.154	0.158	0.143	0.011	0.189	0.130	136.9%	0.072
430 Low Mass Ext. Shortwave Absorptance	0.542	0.617	0.422	0.704	0.684	0.563	0.617	0.875	0.422	0.875	0.628	72.1%	0.380
440 Low Mass Cavity Albedo	3.967	4.172		4.674	5.204		3.975	4.684	3.967	5.204	4.446	27.8%	3.939
800 High Mass Opaque Windows	0.113	0.224	0.055	0.272	0.222	0.195	0.207	0.325	0.055	0.325	0.202	133.9%	0.085
810 High Mass Cavity Albedo	1.052	1.405		1.711	1.708		1.191	1.624	1.052	1.711	1.449	45.5%	0.992

* SRES-BRE (SERIRES 1.2) simulations for cases with interior solar absorptance = 0.9 have an input error that likely affects annual heating and cooling loads by <0.2 MWh/y (2-3%); see Annex B7, Section B7.1.1. Affected results for Cases 270 and 290 through 320 are indicated by italics

** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-3. Annual Hourly Integrated Peak Heating Loads

Simulation Model:	ESP			BLAST			DOE21D			SRES-SUN			SRES	S3PAS			TSYS			TASE			Example Result Statistics				TRNSYS18		
Organization or Country:	DMU			US-IT			NREL			NREL			BRE*	SPAIN			BEL-BRE			FINLAND			Min	Max	Mean	(Max-Min)/	TESS		
Case	kW	Date	Hr	kW	Date	Hr	kW	Date	Hr	kW	Date	Hr		kW	Date	Hr	kW	Date	Hr	kW	Date	Hr	kW	kW	kW	Mean** (%)	kW	Date	Hr
600 Base Case, South Windows	3.437	04-Jan	5	3.940	04-Jan	5	4.045	04-Jan	5	4.258	04-Jan	2		4.037	04-Jan	2	3.931	04-Jan	6	4.354	04-Jan	2	3.437	4.354	4.000	22.9%	3.905	04-Jan	5
610 S. Windows + Overhang	3.437	04-Jan	5	3.941	04-Jan	5	4.034	04-Jan	5	4.258	04-Jan	2		4.037	04-Jan	2	3.922	04-Jan	6	4.354	04-Jan	2	3.437	4.354	3.998	22.9%	3.905	04-Jan	5
620 East & West Windows	3.591	04-Jan	6	3.941	04-Jan	5	4.046	04-Jan	5	4.277	04-Jan	2		4.277	04-Jan	2	3.922	04-Jan	6	4.379	04-Jan	2	3.591	4.379	4.062	19.4%	3.903	04-Jan	5
630 E&W Windows + Overhang & Fins	3.592	04-Jan	7	3.941	04-Jan	5	4.025	04-Jan	5	4.280	04-Jan	2		4.278	04-Jan	2	3.922	04-Jan	6				3.592	4.280	4.006	17.2%	3.903	04-Jan	5
640 Case 600 with Htg. Temp. Setback	5.232	04-Jan	7	5.486	04-Jan	8	5.943	04-Jan	8	6.530	04-Jan	8		6.347	04-Jan	8	5.722	04-Jan	8	6.954	04-Jan	8	5.232	6.954	6.031	28.6%	6.299	04-Jan	8
650 Case 600 with Night Ventilation	0.000			0.000	04-Jan		0.000			0.000				0.000			0.000			0.000			0.000	0.000	0.000	----	0.000	01-Jan	1
900 South Windows	2.850	04-Jan	7	3.453	04-Jan	7	3.557	04-Jan	7	3.760	04-Jan	7		3.608	04-Jan	8	3.517	04-Jan	7	3.797	04-Jan	7	2.850	3.797	3.506	27.0%	3.374	04-Jan	7
910 S. Windows + Overhang	2.858	04-Jan	7	3.456	04-Jan	7	3.564	04-Jan	7	3.764	04-Jan	7		3.618	04-Jan	8	3.536	04-Jan	7	3.801	04-Jan	7	2.858	3.801	3.514	26.8%	3.379	04-Jan	7
920 East & West Windows	3.308	04-Jan	7	3.703	04-Jan	7	3.805	04-Jan	7	4.013	04-Jan	7		4.029	04-Jan	7	3.708	04-Jan	7	4.061	04-Jan	7	3.308	4.061	3.804	19.8%	3.667	04-Jan	7
930 E&W Windows + Overhang & Fins	3.355	04-Jan	7	3.732	04-Jan	7	3.832	04-Jan	7	4.042	04-Jan	7		4.064	04-Jan	7	3.744	04-Jan	7				3.355	4.064	3.795	18.7%	3.707	04-Jan	7
940 Case 900 with Htg. Temp. Setback	3.980	04-Jan	7	5.028	04-Jan	8	5.665	04-Jan	8	6.116	04-Jan	8		6.117	04-Jan	8	5.122	03-Jan	9	6.428	04-Jan	8	3.980	6.428	5.494	44.6%	5.356	04-Jan	8
950 Case 900 with Night Ventilation	0.000			0.000			0.000			0.000				0.000			0.000			0.000			0.000	0.000	0.000	----	0.000	01-Jan	1
960 Sunspace	2.410	04-Jan	7	2.751	04-Jan	8	2.727	04-Jan	8	2.863	04-Jan	8		2.852	04-Jan	8	2.522	04-Jan	8	2.779	04-Jan	8	2.410	2.863	2.701	16.8%	2.668	04-Jan	8
195 Solid Conduction	2.004	04-Jan	2																				2.004	2.004	2.004	0.0%	2.153	04-Jan	3
200 Surface Convection (Int & Ext IR="off")	2.651	04-Jan	5																				2.651	2.651	2.651	0.0%	3.062	04-Jan	5
210 Infrared Radiation (Int IR="off", Ext IR="on")	2.701	04-Jan	5	2.973	04-Jan	5											2.981	04-Jan	5	3.325	04-Jan	2	2.701	3.325	2.995	20.8%	3.226	04-Jan	5
215 Infrared Radiation (Int IR="on", Ext IR="off")	2.787	04-Jan	5																				2.787	2.787	2.787	0.0%	3.290	04-Jan	6
220 In-Depth Base Case	2.867	04-Jan	5	3.280	04-Jan	5	3.465	04-Jan	5	3.695	04-Jan	2		3.348	04-Jan	8	3.336	04-Jan	6	3.520	04-Jan	2	2.867	3.695	3.359	24.7%	3.473	04-Jan	5
230 Infiltration	4.386	04-Jan	5	4.984	04-Jan	2	4.994	04-Jan	2	5.279	04-Jan	2		5.159	04-Jan	2	4.892	04-Jan	6	5.107	04-Jan	2	4.386	5.279	4.972	18.0%	5.030	04-Jan	5
240 Internal Gains	2.685	04-Jan	5	3.100	04-Jan	5	3.282	04-Jan	5	3.495	04-Jan	2		3.159	04-Jan	8	3.153	04-Jan	6	3.333	04-Jan	8	2.685	3.495	3.172	25.5%	3.287	04-Jan	5
250 Exterior Shortwave Absorptance	2.866	04-Jan	5	3.279	04-Jan	5	3.465	04-Jan	5	3.695	04-Jan	2		3.341	04-Jan	6	3.336	04-Jan	6	3.525	04-Jan	2	2.866	3.695	3.358	24.7%	3.473	04-Jan	5
270 South Windows	2.863	04-Jan	5	3.277	04-Jan	5				3.661	04-Jan	2					3.336	04-Jan	6	3.738	04-Jan	2	2.863	3.738	3.375	25.9%	3.312	04-Jan	5
280 Cavity Albedo	2.864	04-Jan	5	3.278	04-Jan	5				3.685	04-Jan	2					3.336	04-Jan	6	3.759	04-Jan	2	2.864	3.759	3.384	26.4%	3.312	04-Jan	5
290 South Shading	2.863	04-Jan	5	3.277	04-Jan	5				3.661	04-Jan	2					3.328	04-Jan	6	3.738	04-Jan	2	2.863	3.738	3.373	25.9%	3.312	04-Jan	5
300 East/West Window	3.014	04-Jan	6	3.276	04-Jan	5				3.681	04-Jan	2					3.328	04-Jan	6	3.770	04-Jan	2	3.014	3.770	3.414	22.1%	3.310	04-Jan	5
310 East/West Shading	3.015	04-Jan	6	3.277	04-Jan	5				3.669	04-Jan	2					3.328	04-Jan	6				3.015	3.669	3.322	19.7%	3.310	04-Jan	5
320 Thermostat	2.861	04-Jan	5	3.275	04-Jan	5				3.651	04-Jan	2					3.336	04-Jan	6	3.735	04-Jan	3	2.861	3.735	3.372	25.9%	3.311	04-Jan	5
395 Low Mass Solid Conduction	2.062	04-Jan	7	2.209	04-Jan	8	2.328	04-Jan	3	2.385	04-Jan	3		2.263	04-Jan	4	2.221	04-Jan	8	2.270	04-Jan	3	2.062	2.385	2.248	14.4%	2.285	04-Jan	4
400 Low Mass Opaque Windows	2.867	04-Jan	5	3.280	04-Jan	5	3.476	04-Jan	5	3.695	04-Jan	2		3.342	04-Jan	8	3.336	04-Jan	6	3.520	04-Jan	2	2.867	3.695	3.359	24.6%	3.473	04-Jan	5
410 Low Mass Infiltration	3.625	04-Jan	5	4.124	04-Jan	5	4.233	04-Jan	5	4.487	04-Jan	2		4.227	04-Jan	2	4.114	04-Jan	6	4.314	04-Jan	2	3.625	4.487	4.161	20.7%	4.251	04-Jan	5
420 Low Mass Internal Gains	3.443	04-Jan	5	3.944	04-Jan	5	4.050	04-Jan	5	4.287	04-Jan	2		4.044	04-Jan	2	3.931	04-Jan	6	4.126	04-Jan	2	3.443	4.287	3.975	21.2%	4.066	04-Jan	5
430 Low Mass Ext. Shortwave Absorptance	3.442	04-Jan	5	3.944	04-Jan	5	4.050	04-Jan	5	4.287	04-Jan	2		4.044	04-Jan	2	3.931	04-Jan	6	4.137	04-Jan	2	3.442	4.287	3.976	21.3%	4.066	04-Jan	5
440 Low Mass Cavity Albedo	3.439	04-Jan	5	3.942	04-Jan	5				4.277	04-Jan	2					3.931	04-Jan	6	4.376	04-Jan	2	3.439	4.376	3.993	23.5%	3.905	04-Jan	5
800 High Mass Opaque Windows	3.227	04-Jan	5	3.793	04-Jan	7	3.909	04-Jan	7	4.138	04-Jan	2		3.902	04-Jan	8	3.786	04-Jan	7	3.939	04-Jan	7	3.227	4.138	3.813	23.9%	3.917	04-Jan	7
810 High Mass Cavity Albedo	2.979	04-Jan	7	3.566	04-Jan	7				3.915	04-Jan	7					3.606	04-Jan	7	3.963	04-Jan	7	2.979	3.963	3.606	27.3%	3.516	04-Jan	7

* SRES-BRE (SERIRES 1.2) simulations did not produce output for this variable.

** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-4. Annual Hourly Integrated Peak Sensible Cooling Loads

Simulation Model:	ESP			BLAST			DOE21D			SRES-SUN			SRES	S3PAS			TSYS			TASE			Example Result Statistics				TRNSYS18		
Organization or Country:	DMU			US-IT			NREL			NREL			BRE*	SPAIN			BEL-BRE			FINLAND			Min	Max	Mean	(Max-Min)/	TESS		
Case	kW	Date	Hr	kW	Date	Hr	kW	Date	Hr	kW	Date	Hr		kW	Date	Hr	kW	Date	Hr	kW	Date	Hr	kW	kW	kW	Mean** (%)	kW	Date	Hr
600 Base Case, South Windows	6.194	17-Oct	13	5.965	16-Oct	14	6.656	16-Oct	13	6.827	16-Oct	14		6.286	25-Nov	14	6.486	16-Oct	14	6.812	17-Oct	14	5.965	6.827	6.461	13.3%	6.539	16-Oct	14
610 S. Windows + Overhang	5.669	25-Nov	13	5.824	25-Nov	14	6.064	13-Jan	14	6.371	25-Nov	14		6.170	25-Nov	14	5.675	25-Nov	14	6.146	17-Oct	14	5.669	6.371	5.988	11.7%	6.239	13-Jan	14
620 East & West Windows	3.634	26-Jul	16	4.075	26-Jul	17	4.430	26-Jul	17	4.593	26-Jul	17		4.297	26-Jul	17	4.275	26-Jul	17	5.096	26-Jul	16	3.634	5.096	4.343	33.7%	4.367	26-Jul	17
630 E&W Windows + Overhang & Fins	3.072	26-Jul	16	3.704	26-Jul	17	3.588	26-Jul	17	4.116	26-Jul	17		3.665	26-Jul	17	3.608	26-Jul	17				3.072	4.116	3.626	28.8%	3.744	26-Jul	17
640 Case 600 with Htg. Temp. Setback	6.161	17-Oct	13	5.892	16-Oct	14	6.576	16-Oct	14	6.776	16-Oct	14		6.250	25-Nov	14	6.442	16-Oct	14	6.771	17-Oct	14	5.892	6.776	6.410	13.8%	6.514	16-Oct	14
650 Case 600 with Night Ventilation	6.031	17-Oct	13	5.831	16-Oct	14	6.516	16-Oct	14	6.671	16-Oct	14		6.143	25-Nov	14	6.378	17-Oct	14	6.679	17-Oct	14	5.831	6.679	6.321	13.4%	6.450	17-Oct	14
900 South Windows	2.888	17-Oct	14	3.155	06-Oct	15	3.458	17-Oct	14	3.871	17-Oct	14		3.334	17-Oct	15	3.567	17-Oct	15	3.457	17-Oct	15	2.888	3.871	3.390	29.0%	3.388	17-Oct	15
910 S. Windows + Overhang	1.896	17-Oct	15	2.500	21-Oct	15	2.336	17-Oct	15	3.277	17-Oct	15		2.786	17-Oct	15	2.792	17-Oct	15	3.147	17-Oct	15	1.896	3.277	2.676	51.6%	2.628	17-Oct	15
920 East & West Windows	2.385	26-Jul	16	2.933	26-Jul	17	3.109	26-Jul	17	3.487	26-Jul	17		3.071	26-Jul	17	3.050	26-Jul	17	3.505	26-Jul	17	2.385	3.505	3.077	36.4%	3.014	26-Jul	17
930 E&W Windows + Overhang & Fins	1.873	26-Jul	17	2.546	26-Jul	17	2.388	26-Jul	18	3.080	26-Jul	17		2.486	26-Jul	17	2.498	26-Jul	17				1.873	3.080	2.479	48.7%	2.458	26-Jul	18
940 Case 900 with Htg. Temp. Setback	2.888	17-Oct	14	3.155	06-Oct	15	3.458	17-Oct	14	3.871	17-Oct	14		3.334	17-Oct	15	3.567	17-Oct	15	3.457	17-Oct	15	2.888	3.871	3.390	29.0%	3.388	17-Oct	15
950 Case 900 with Night Ventilation	2.033	02-Sep	14	2.621	02-Sep	15	2.664	02-Sep	15	3.170	02-Sep	14		2.677	02-Sep	15	2.686	02-Sep	15	2.867	02-Sep	14	2.033	3.170	2.674	42.5%	2.567	02-Sep	15
960 Sunspace	0.953	16-Aug	16	1.144	26-Jul	16	1.057	26-Jul	16	1.370	26-Jul	16		1.179	26-Jul	16	1.378	26-Jul	16	1.403	26-Jul	16	0.953	1.403	1.212	37.1%	1.009	02-Sep	17
195 Solid Conduction	0.651	26-Jul	15																				0.651	0.651	0.651	0.0%	0.729	26-Jul	17
200 Surface Convection (Int & Ext IR="off")	0.863	16-Aug	14																				0.863	0.863	0.863	0.0%	1.004	26-Jul	16
210 Infrared Radiation (Int IR="off", Ext IR="on")	0.476	16-Aug	16	1.017	26-Jul	15											1.068	26-Jul	16	1.142	26-Jul	15	0.476	1.142	0.926	71.9%	0.861	27-Jul	15
215 Infrared Radiation (Int IR="on", Ext IR="off")	1.007	11-Aug	14																				1.007	1.007	1.007	0.0%	1.116	26-Jul	16
220 In-Depth Base Case	0.560	27-Jul	15	1.166	26-Jul	15	0.937	27-Jul	14	1.340	26-Jul	15		1.215	26-Jul	16	1.179	26-Jul	16	1.213	26-Jul	15	0.560	1.340	1.087	71.7%	0.964	27-Jul	15
230 Infiltration	1.059	27-Jul	15	1.646	26-Jul	15	1.455	27-Jul	14	1.875	26-Jul	15		1.700	26-Jul	15	1.708	26-Jul	16	1.749	26-Jul	15	1.059	1.875	1.599	51.0%	1.482	27-Jul	15
240 Internal Gains	0.739	27-Jul	15	1.347	26-Jul	15	1.119	27-Jul	14	1.540	26-Jul	15		1.398	26-Jul	16	1.361	26-Jul	16	1.397	26-Jul	15	0.739	1.540	1.272	63.0%	1.148	27-Jul	15
250 Exterior Shortwave Absorptance	3.360	05-Sep	12	3.036	05-Sep	12	2.605	05-Sep	11	2.590	26-Aug	14		2.258	26-Aug	14	3.228	05-Sep	13	4.912	05-Sep	12	2.258	4.912	3.141	84.5%	2.684	05-Sep	13
270 South Windows	6.356	25-Nov	13	6.641	25-Nov	14				7.234	16-Oct	14					6.764	17-Oct	14	6.867	16-Oct	14	6.356	7.234	6.772	13.0%	7.083	13-Jan	14
280 Cavity Albedo	4.444	17-Oct	13	4.631	25-Nov	13				5.220	16-Oct	14					4.786	16-Oct	14	5.236	16-Oct	14	4.444	5.236	4.863	16.3%	4.734	16-Oct	14
290 South Shading	6.269	13-Jan	13	6.555	25-Nov	14				6.976	25-Nov	14					6.203	25-Nov	14	6.621	25-Nov	14	6.203	6.976	6.525	11.9%	6.958	13-Jan	14
300 East/West Window	3.404	26-Jul	16	4.093	26-Jul	17				4.657	26-Jul	17					4.278	26-Jul	17	4.929	26-Jul	17	3.404	4.929	4.272	35.7%	4.430	26-Jul	17
310 East/West Shading	2.848	26-Jul	16	3.749	30-Jun	17				4.164	26-Jul	17					3.589	26-Jul	17				2.848	4.164	3.587	36.7%	3.773	26-Jul	17
320 Thermostat	5.701	25-Nov	13	5.946	25-Nov	14				6.553	16-Oct	14					6.178	17-Oct	14	6.141	16-Oct	14	5.701	6.553	6.104	14.0%	6.449	13-Jan	14
395 Low Mass Solid Conduction	0.000			0.362	26-Jul	18	0.000			0.394	26-Jul	17		0.356	26-Jul	18	0.363	26-Jul	18	0.345	26-Jul	18	0.000	0.394	0.260	151.6%	0.125	27-Jul	18
400 Low Mass Opaque Windows	0.000			0.581	26-Jul	17	0.265	27-Jul	17	0.666	26-Jul	16		0.612	26-Jul	17	0.613	26-Jul	17	0.572	26-Jul	17	0.000	0.666	0.473	140.9%	0.308	27-Jul	18
410 Low Mass Infiltration	0.035	27-Jul	16	0.699	26-Jul	17	0.413	27-Jul	17	0.814	26-Jul	15		0.724	26-Jul	16	0.743	26-Jul	17	0.710	26-Jul	17	0.035	0.814	0.591	131.8%	0.459	27-Jul	17
420 Low Mass Internal Gains	0.258	27-Jul	15	0.923	26-Jul	15	0.631	27-Jul	15	1.047	26-Jul	15		0.938	26-Jul	15	0.938	26-Jul	16	0.921	26-Jul	15	0.258	1.047	0.808	97.7%	0.682	27-Jul	17
430 Low Mass Ext. Shortwave Absorptance	1.493	16-Aug	14	1.772	26-Aug	14	1.427	16-Aug	14	1.762	26-Jul	15		1.575	26-Jul	15	1.798	05-Sep	13	2.578	05-Sep	12	1.427	2.578	1.772	64.9%	1.341	16-Aug	15
440 Low Mass Cavity Albedo	4.546	17-Oct	13	4.424	16-Oct	14				5.053	16-Oct	14					4.686	16-Oct	14	5.278	17-Oct	14	4.424	5.278	4.797	17.8%	4.623	16-Oct	14
800 High Mass Opaque Windows	0.585	27-Jul	14	0.967	16-Aug	14	0.743	28-Jul	14	1.352	27-Jul	14		1.028	27-Jul	15	0.983	16-Aug	14	1.358	05-Sep	12	0.585	1.358	1.002	77.1%	0.652	28-Jul	14
810 High Mass Cavity Albedo	1.852	02-Sep	14	2.357	26-Aug	14				2.991	02-Sep	14					2.344	02-Sep	14	2.862	02-Sep	14	1.852	2.991	2.481	45.9%	2.167	02-Sep	15

* SRES-BRE (SERIRES 1.2) simulations did not produce output for this variable.

** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-5. Free-Float Temperature Output

MAXIMUM ANNUAL HOURLY INTEGRATED ZONE TEMPERATURE

Simulation Model:	ESP			BLAST			DOE21D			SRES-SUN			SRES	S3PAS			TSYS			TASE			Example Result Statistics				TRNSYS18		
Organization or Country:	DMU			US-IT			NREL			NREL			BRE*	SPAIN			BEL-BRE			FINLAND			Min	Max	Mean	(Max-Min)/	TESS		
Case	T (°C)	Date	Hr	T (°C)	Date	Hr	T (°C)	Date	Hr	T (°C)	Date	Hr		T (°C)	Date	Hr	T (°C)	Date	Hr	T (°C)	Date	Hr	T (°C)	T (°C)	T (°C)	Mean** (%)	T (°C)	Date	Hr
600FF - Low Mass with S. Windows	64.9	17-Oct	15	65.1	16-Oct	15	69.5	17-Oct	15	68.6	16-Oct	15		64.9	16-Oct	16	65.3	17-Oct	16	65.3	15-Oct	16	64.9	69.5	66.2	6.9%	65.4	17-Oct	16
900FF - High Mass with S. Windows	41.8	17-Oct	15	43.4	02-Sep	16	42.7	02-Sep	15	44.8	02-Sep	15		43.0	02-Sep	15	42.5	17-Oct	15	43.2	15-Sep	15	41.8	44.8	43.1	6.9%	42.2	02-Sep	16
650FF Case 600FF with Night Ventilation	63.2	17-Oct	15	63.5	16-Oct	15	68.2	17-Oct	15	67.0	16-Oct	15		63.3	16-Oct	16	63.7	17-Oct	16	63.8	16-Oct	16	63.2	68.2	64.7	7.7%	64.1	17-Oct	16
950FF Case 900FF with Night Ventilation	35.5	02-Sep	16	36.2	02-Sep	16	35.9	02-Sep	16	38.5	02-Sep	15		36.1	02-Sep	16	35.7	02-Sep	15	37.6	15-Sep	16	35.5	38.5	36.5	8.1%	36.1	02-Sep	16
960 Sunspace	48.9	17-Oct	15	48.9	06-Oct	15	49.0	17-Oct	15	51.0	17-Oct	15		50.2	17-Oct	15	55.3	17-Oct	15	48.9	15-Oct	15	48.9	55.3	50.3	12.8%	49.8	17-Oct	15

MINIMUM ANNUAL HOURLY INTEGRATED ZONE TEMPERATURE

Simulation Model:	ESP			BLAST			DOE21D			SRES-SUN			SRES	S3PAS			TSYS			TASE			Example Result Statistics				TRNSYS18		
Organization or Country:	DMU			US-IT			NREL			NREL			BRE*	SPAIN			BEL-BRE			FINLAND			Min	Max	Mean	(Max-Min)/	TESS		
Case	T (°C)	Date	Hr	T (°C)	Date	Hr	T (°C)	Date	Hr	T (°C)	Date	Hr		T (°C)	Date	Hr	T (°C)	Date	Hr	T (°C)	Date	Hr	T (°C)	T (°C)	T (°C)	Mean** (%)	T (°C)	Date	Hr
600FF - Low Mass with S. Windows	-15.6	04-Jan	7	-17.1	04-Jan	8	-18.8	04-Jan	8	-18.0	04-Jan	7		-17.8	04-Jan	8	-17.8	04-Jan	7	-18.5	08-Jan	9	-18.8	-15.6	-17.6	18.3%	-18.3	04-Jan	8
900FF - High Mass with S. Windows	-1.6	04-Jan	8	-3.2	04-Jan	8	-4.3	04-Jan	8	-4.5	04-Jan	8		-4.0	04-Jan	8	-6.4	04-Jan	8	-5.6	08-Jan	9	-6.4	-1.6	-4.2	111.9%	-3.3	04-Jan	8
650FF Case 600FF with Night Ventilation	-22.6	04-Jan	6	-23.0	04-Jan	7	-21.6	04-Jan	2	-23.0	04-Jan	2		-22.9	04-Jan	2	-22.8	04-Jan	7	-22.9	02-Jan	23	-23.0	-21.6	-22.7	6.2%	-23.1	04-Jan	3
950FF Case 900FF with Night Ventilation	-19.5	04-Jan	6	-20.0	04-Jan	7	-18.6	04-Jan	7	-19.7	04-Jan	7		-20.2	04-Jan	7	-19.3	04-Jan	7	-20.0	07-Jan	22	-20.2	-18.6	-19.6	8.2%	-19.9	04-Jan	7
960 Sunspace	2.7	06-Feb	6	1.6	06-Feb	7	3.9	06-Feb	7	3.1	06-Feb	7		1.4	06-Feb	6	-2.8	04-Jan	8	-0.4	05-Feb	7	-2.8	3.9	1.4	492.6%	1.4	06-Feb	7

AVERAGE ANNUAL HOURLY INTEGRATED ZONE TEMPERATURE

Simulation Model:	ESP	BLAST	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Example Result Statistics				TRNSYS18
Organization or Country:	DMU	US-IT	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND	Min	Max	Mean	(Max-Min)/	TESS
Case	T (°C)	T (°C)	T (°C)	T (°C)	T (°C)	T (°C)	T (°C)	T (°C)	T (°C)	T (°C)	T (°C)	Mean** (%)	T (°C)
600FF - Low Mass with S. Windows	25.1	25.4	24.6	25.5	25.9	25.2	24.5	24.2	24.2	25.9	25.1	6.8%	24.9
900FF - High Mass with S. Windows	25.5	25.9	24.7	25.5	25.7	25.2	24.5	24.5	24.5	25.9	25.2	5.9%	25.1
650FF Case 600FF with Night Ventilation	18.2	18.7	19.1	19.0	19.6	18.4	18.0	18.4	18.0	19.6	18.7	8.7%	18.3
950FF Case 900FF with Night Ventilation	14.1	14.3	14.3	15.0	14.3	14.0	14.5	14.6	14.0	15.0	14.4	6.7%	14.3
960 Sunspace	27.5	27.7	28.0	28.7	28.5	28.0	29.0	26.4	26.4	29.0	28.0	9.0%	27.7

* SRES-BRE (SERIRES 1.2) simulations did not produce output for this variable.

** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-6. Low Mass Basic Sensitivity Tests

ANNUAL HEATING [MWh]									Statistics for Example Results				
Case	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
610-600 Heat, S. Shade	0.059	0.033	0.077	0.054	0.024	0.089	0.098	0.021	0.021	0.098	0.057	135.4%	0.081
620-600 Heat, E&W Orient.	0.317	0.276	0.235	0.328	0.138	0.682	0.201	0.366	0.138	0.682	0.318	171.1%	0.196
630-620 Heat, E&W Shade	0.437	0.310	0.525	0.329	0.267	0.531	0.551		0.267	0.551	0.421	67.4%	0.472
640-600 Heat, Htg. Setback	-1.545	-1.885	-2.166	-1.971	-1.793	-1.817	-1.829	-2.053	-2.166	-1.545	-1.882	33.0%	-1.783
ANNUAL SENSIBLE COOLING [MWh]									Statistics for Example Results				
Case	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
610-600 Cool, S. Shade	-2.222	-1.582	-2.227	-1.830	-2.186	-1.728	-1.891	-1.272	-2.227	-1.272	-1.867	51.1%	-2.024
620-600 Cool, E&W Orient.	-2.720	-2.341	-2.745	-2.645	-2.960	-2.481	-2.591	-2.427	-2.960	-2.341	-2.614	23.7%	-2.739
630-620 Cool, E&W Shade	-1.288	-0.984	-1.845	-1.140	-1.303	-1.522	-1.485		-1.845	-0.984	-1.367	63.0%	-1.450
640-600 Cool, Htg. Setback	-0.185	-0.250	-0.320	-0.252	-0.153	-0.245	-0.246	-0.270	-0.320	-0.153	-0.240	69.5%	-0.239
650-600 Cool, Night Vent	-1.321	-1.293	-1.284	-1.384	-1.419	-1.404	-1.373	-1.322	-1.419	-1.284	-1.350	10.0%	-1.364
PEAK HEATING [kW]									Statistics for Example Results				
Case	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE*	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
610-600 Heat, S. Shade	0.000	0.001	-0.011	0.000		0.000	-0.008	0.000	-0.011	0.001	-0.003	458.2%	0.000
620-600 Heat, E&W Orient.	0.154	0.001	0.001	0.019		0.240	-0.008	0.025	-0.008	0.240	0.062	402.7%	-0.001
630-620 Heat, E&W Shade	0.001	0.000	-0.021	0.003		0.001	0.000		-0.021	0.003	-0.003	900.0%	0.000
640-600 Heat, Htg. Setback	1.795	1.546	1.898	2.272		2.310	1.792	2.600	1.546	2.600	2.030	51.9%	2.394
PEAK SENSIBLE COOLING [kW]									Statistics for Example Results				
Case	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE*	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
610-600 Cool, S. Shade	-0.525	-0.141	-0.592	-0.456		-0.116	-0.811	-0.666	-0.811	-0.116	-0.472	147.1%	-0.300
620-600 Cool, E&W Orient.	-2.560	-1.890	-2.226	-2.234		-1.989	-2.211	-1.716	-2.560	-1.716	-2.118	39.8%	-2.172
630-620 Cool, E&W Shade	-0.562	-0.371	-0.842	-0.477		-0.632	-0.667		-0.842	-0.371	-0.592	79.6%	-0.623
640-600 Cool, Htg. Setback	-0.033	-0.073	-0.080	-0.051		-0.036	-0.044	-0.041	-0.080	-0.033	-0.051	91.8%	-0.025
650-600 Cool, Night Vent	-0.163	-0.134	-0.140	-0.156		-0.143	-0.108	-0.133	-0.163	-0.108	-0.140	39.2%	-0.089

* SRES-BRE (SERIRES 1.2) simulations did not produce output for this variable.
** ABS[(Max-Min) / (Mean of Example Simulation Results)]

Table B8-7. High Mass Basic Sensitivity Tests

ANNUAL HEATING [MWh]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
900-600 Mass, Heat	-3.126	-3.163	-3.837	-3.329	-3.608	-3.152	-3.217	-3.321	-3.837	-3.126	-3.344	21.3%	-3.340
910-900 Heat, S. Shade	0.405	0.252	0.382	0.277	0.294	0.333	0.442	0.179	0.179	0.442	0.321	82.1%	0.351
920-900 Heat, E&W Orient.	2.143	2.142	2.383	2.196	2.070	2.505	2.121	2.259	2.070	2.505	2.227	19.5%	2.165
930-920 Heat, E&W Shade	0.830	0.595	1.080	0.662	0.670	0.933	0.964		0.595	1.080	0.819	59.2%	0.886
940-900 Heat, Htg. Setback	-0.377	-0.589	-0.633	-0.666	-0.577	-0.551	-0.575	-0.718	-0.718	-0.377	-0.586	58.2%	-0.536
960-900 Heat, Sunspace	1.141	1.054	1.056	0.987	0.863	1.213	1.718	0.775	0.775	1.718	1.101	85.7%	1.176
ANNUAL SENSIBLE COOLING [MWh]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
900-600 Mass, Cool	-4.005	-3.833	-4.624	-4.113	-4.549	-3.920	-4.007	-4.179	-4.624	-3.833	-4.154	19.0%	-4.332
910-900 Cool, S. Shade	-1.311	-1.067	-1.479	-1.293	-1.561	-1.144	-1.159	-0.832	-1.561	-0.832	-1.231	59.2%	-1.248
920-900 Cool, E&W Orient.	-0.292	0.016	-0.015	-0.222	-0.323	-0.115	-0.067	0.014	-0.323	0.016	-0.126	270.1%	-0.015
930-920 Cool, E&W Shade	-0.801	-0.682	-1.174	-0.770	-0.854	-1.018	-1.002		-1.174	-0.682	-0.900	54.7%	-0.927
940-900 Cool, Htg. Setback	-0.053	-0.064	-0.115	-0.129	-0.174	-0.083	-0.102	-0.083	-0.174	-0.053	-0.100	120.5%	-0.090
950-900 Cool, Night Vent	-1.745	-2.074	-1.917	-2.244	-2.826	-2.021	-1.924	-1.828	-2.826	-1.745	-2.072	52.2%	-1.856
960-900 Cool, Sunspace	-1.644	-1.934	-2.027	-2.362	-2.697	-1.929	-2.074	-1.813	-2.697	-1.644	-2.060	51.1%	-1.838
PEAK HEATING [kW]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE*	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
900-600 Mass, Heat	-0.587	-0.487	-0.488	-0.498		-0.429	-0.414	-0.557	-0.587	-0.414	-0.494	35.0%	-0.531
910-900 Heat, S. Shade	0.008	0.003	0.007	0.004		0.010	0.019	0.004	0.003	0.019	0.008	207.6%	0.005
920-900 Heat, E&W Orient.	0.458	0.250	0.248	0.253		0.421	0.192	0.264	0.192	0.458	0.298	89.4%	0.293
930-920 Heat, E&W Shade	0.047	0.029	0.027	0.029		0.035	0.036		0.027	0.047	0.034	59.1%	0.041
940-900 Heat, Htg. Setback	1.130	1.575	2.108	2.356		2.509	1.606	2.631	1.130	2.631	1.988	75.5%	1.982
960-900 Heat, Sunspace	-0.440	-0.702	-0.830	-0.897		-0.756	-0.995	-1.018	-1.018	-0.440	-0.805	71.8%	-0.706
PEAK SENSIBLE COOLING [kW]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE*	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
900-600 Mass, Cool	-3.306	-2.810	-3.198	-2.956		-2.952	-2.919	-3.355	-3.355	-2.810	-3.071	17.7%	-3.151
910-900 Cool, S. Shade	-0.992	-0.655	-1.122	-0.594		-0.548	-0.775	-0.310	-1.122	-0.310	-0.714	113.8%	-0.760
920-900 Cool, E&W Orient.	-0.503	-0.222	-0.349	-0.384		-0.263	-0.517	0.048	-0.517	0.048	-0.313	180.5%	-0.374
930-920 Cool, E&W Shade	-0.512	-0.387	-0.721	-0.407		-0.585	-0.552		-0.721	-0.387	-0.527	63.3%	-0.556
940-900 Cool, Htg. Setback	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	-----	0.000
950-900 Cool, Night Vent	-0.855	-0.534	-0.794	-0.701		-0.657	-0.881	-0.590	-0.881	-0.534	-0.716	48.4%	-0.821
960-900 Cool, Sunspace	-1.935	-2.011	-2.401	-2.501		-2.155	-2.189	-2.054	-2.501	-1.935	-2.178	26.0%	-2.379

* SRES-BRE (SERIRES 1.2) simulations did not produce output for this variable.
** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-8. Low Mass In-Depth (Cases 195 thru 320) Sensitivity Tests

ANNUAL HEATING [MWh]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES* BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
200-195 Surface Convection	1.085								1.085	1.085	1.085	0.0%	1.623
210-200 Ext IR (Int IR "off")	1.204								1.204	1.204	1.204	0.0%	0.867
220-215 Ext IR (Int IR "on")	1.397								1.397	1.397	1.397	0.0%	0.980
215-200 Int IR (Ext IR "off")	0.295								0.295	0.295	0.295	0.0%	0.550
220-210 Int IR (Ext IR "on")	0.488	0.656					0.743	0.470	0.470	0.743	0.589	46.3%	0.663
230-220 Infiltration	3.432	3.525	3.456	3.531	3.522	3.615	3.543	3.527	3.432	3.615	3.519	5.2%	3.538
240-220 Internal Gains	-1.295	-1.206	-1.339	-1.333	-1.341	-1.228	-1.221	-1.203	-1.341	-1.203	-1.271	10.9%	-1.267
250-220 Ext Solar Abs.	-2.193	-1.476	-1.763	-1.494	-1.474	-1.448	-1.533	-1.699	-2.193	-1.448	-1.635	45.6%	-1.716
270-220 South Windows	-2.434	-2.285		-2.761	*-2.207*		-2.250	-1.948	-2.761	-1.948	*-2.314*	*35.1%*	-2.743
280-270 Cavity Albedo	0.165	0.195		0.596	*0.228*		0.232	0.352	0.165	0.596	*0.295*	*146.3%*	0.218
320-270 Thermostat	-0.651	-0.721		-0.714	*-0.779*		-0.699	-0.649	*-0.779*	-0.649	*-0.702*	*18.5%*	-0.680
290-270 South Shading	0.067	0.029		0.065	*0.022*		0.085	0.020	0.020	0.085	*0.048*	*135.4%*	0.078
300-270 E&W Windows	0.251	0.147		0.246	*0.044*		0.077	0.297	*0.044*	0.297	*0.177*	*142.9%*	0.059
310-300 E&W Shading	0.460	0.250		0.263	*0.201*		0.486		*0.201*	0.486	*0.332*	*85.8%*	0.414
ANNUAL SENSIBLE COOLING [MWh]													
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES* BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
200-195 Surface Convection	0.156								0.156	0.156	0.156	0.0%	0.167
210-200 Ext IR (Int IR "off")	-0.408								-0.408	-0.408	-0.408	0.0%	-0.192
220-215 Ext IR (Int IR "on")	-0.453								-0.453	-0.453	-0.453	0.0%	-0.213
215-200 Int IR (Ext IR "off")	0.069								0.069	0.069	0.069	0.0%	0.065
220-210 Int IR (Ext IR "on")	0.024	0.088					0.069	0.042	0.024	0.088	0.056	114.8%	0.045
230-220 Infiltration	0.268	0.275	0.293	0.304	0.304	0.286	0.303	0.302	0.268	0.304	0.292	12.3%	0.295
240-220 Internal Gains	0.229	0.371	0.261	0.412	0.411	0.374	0.377	0.362	0.229	0.412	0.350	52.3%	0.299
250-220 Ext Solar Abs.	3.027	1.844	1.778	2.097	2.096	1.752	1.947	2.697	1.752	3.027	2.155	59.2%	1.589
270-220 South Windows	7.342	7.969		9.001	*9.515*		8.027	8.031	7.342	*9.515*	*8.314*	*26.1%*	8.484
280-270 Cavity Albedo	-2.655	-2.775		-3.317	*-3.236*		-3.003	-2.457	-3.317	*-2.457*	*-2.907*	*29.6%*	-3.303
320-270 Thermostat	-2.467	-2.764		-3.103	*-3.046*		-2.808	-3.051	-3.103	-2.467	*-2.873*	*22.1%*	-2.721
290-270 South Shading	-2.324	-1.659		-1.957	*-2.261*		-2.065	-1.283	-2.324	-1.283	*-1.925*	*54.1%*	-2.252
300-270 E&W Windows	-3.226	-2.834		-3.163	*-3.250*		-3.043	-2.933	*-3.250*	-2.834	*-3.075*	*13.5%*	-3.240
310-300 E&W Shading	-1.570	-1.266		-1.420	*-1.629*		-1.994		-1.994	-1.266	*-1.576*	*46.2%*	-1.923
PEAK HEATING [kW]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES* BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
200-195 Surface Convection	0.647								0.647	0.647	0.647	0.0%	0.909
210-200 Ext IR (Int IR "off")	0.050								0.050	0.050	0.050	0.0%	0.164
220-215 Ext IR (Int IR "on")	0.080								0.080	0.080	0.080	0.0%	0.183
215-200 Int IR (Ext IR "off")	0.136								0.136	0.136	0.136	0.0%	0.228
220-210 Int IR (Ext IR "on")	0.166	0.307					0.356	0.195	0.166	0.356	0.256	74.1%	0.247
230-220 Infiltration	1.519	1.704	1.529	1.584		1.811	1.556	1.587	1.519	1.811	1.613	18.1%	1.557
240-220 Internal Gains	-0.182	-0.180	-0.183	-0.200		-0.189	-0.183	-0.187	-0.200	-0.180	-0.186	10.7%	-0.185
250-220 Ext Solar Abs.	-0.001	-0.001	0.000	0.000		-0.007	0.000	0.005	-0.007	0.005	-0.001	2100.0%	0.000
270-220 South Windows	-0.004	-0.003		-0.034			0.000	0.218	-0.034	0.218	0.035	711.9%	-0.161
280-270 Cavity Albedo	0.001	0.001		0.024			0.000	0.021	0.000	0.024	0.009	255.3%	0.000
320-270 Thermostat	-0.002	-0.002		-0.010			0.000	-0.003	-0.010	0.000	-0.003	294.1%	0.000
290-270 South Shading	0.000	0.000		0.000			-0.008	0.000	-0.008	0.000	-0.002	500.0%	0.000
300-270 E&W Windows	0.151	-0.001		0.020			-0.008	0.032	-0.008	0.151	0.039	411.4%	-0.002
310-300 E&W Shading	0.001	0.001		-0.012			0.000		-0.012	0.001	-0.002	520.0%	0.000
PEAK SENSIBLE COOLING [kW]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES* BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
200-195 Surface Convection	0.212								0.212	0.212	0.212	0.0%	0.275
210-200 Ext IR (Int IR "off")	-0.387								-0.387	-0.387	-0.387	0.0%	-0.143
220-215 Ext IR (Int IR "on")	-0.447								-0.447	-0.447	-0.447	0.0%	-0.151
215-200 Int IR (Ext IR "off")	0.144								0.144	0.144	0.144	0.0%	0.112
220-210 Int IR (Ext IR "on")	0.084	0.149					0.111	0.071	0.071	0.149	0.104	75.2%	0.103
230-220 Infiltration	0.499	0.480	0.518	0.535		0.485	0.529	0.536	0.480	0.536	0.512	10.9%	0.518
240-220 Internal Gains	0.179	0.181	0.182	0.200		0.183	0.183	0.184	0.179	0.200	0.185	11.4%	0.184
250-220 Ext Solar Abs.	2.800	1.870	1.668	1.250		1.043	2.049	3.699	1.043	3.699	2.054	129.3%	1.719
270-220 South Windows	5.796	5.475		5.894			5.585	5.654	5.475	5.894	5.681	7.4%	6.119
280-270 Cavity Albedo	-1.912	-2.010		-2.014			-1.978	-1.631	-2.014	-1.631	-1.909	20.1%	-2.349
320-270 Thermostat	-0.655	-0.695		-0.681			-0.586	-0.726	-0.726	-0.586	-0.669	20.9%	-0.635
290-270 South Shading	-0.087	-0.086		-0.258			-0.561	-0.246	-0.561	-0.086	-0.248	191.9%	-0.125
300-270 E&W Windows	-2.952	-2.548		-2.577			-2.486	-1.938	-2.952	-1.938	-2.500	40.6%	-2.654
310-300 E&W Shading	-0.556	-0.344		-0.493			-0.689		-0.689	-0.344	-0.520	66.3%	-0.656

* SRES-BRE (SERIRES 1.2) simulations for cases with interior solar absorptance = 0.9 have an input error that likely affects annual heating and cooling load sensitivities by <0.2 MWh/y. (<6% for heating, <3% for cooling); see Annex B7, Section B7.1.1. Affected results involving Cases 270 and 290 throiugh 320 are indicated with italics.

** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-9. Low Mass In-Depth (Cases 395 thru 440) Sensitivity Tests

ANNUAL HEATING [MWh]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
400-395 Surf. Conv. & IR	1.916	2.276	2.935	2.767	2.772	2.320	2.311	2.487	1.916	2.935	2.473	41.2%	2.533
410-400 Infiltration	1.696	1.798	1.736	1.760	1.761	1.732	1.770	1.759	1.696	1.798	1.752	5.8%	1.761
420-410 Internal Gains	-1.298	-1.263	-1.355	-1.361	-1.361	-1.245	-1.239	-1.222	-1.361	-1.222	-1.293	10.8%	-1.280
430-420 Ext Solar Abs.	-1.869	-1.122	-1.324	-1.187	-1.187	-1.112	-1.197	-1.353	-1.869	-1.112	-1.294	58.5%	-1.260
600-430 South Windows	-1.133	-1.715	-2.118	-1.952	-1.590	-1.780	-1.628	-1.148	-2.118	-1.133	-1.633	60.3%	-2.021
440-600 Cavity Albedo	0.153	0.214		0.426	0.215		0.226	0.280	0.153	0.426	0.252	108.2%	0.213

ANNUAL SENSIBLE COOLING [MWh]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
400-395 Surf. Conv. & IR	0.000	0.029	0.002	0.045	0.044	0.032	0.034	0.033	0.000	0.045	0.027	164.1%	0.006
410-400 Infiltration	0.000	0.019	0.008	0.023	0.026	0.021	0.022	0.021	0.000	0.026	0.018	148.2%	0.012
420-410 Internal Gains	0.011	0.088	0.041	0.105	0.104	0.091	0.090	0.078	0.011	0.105	0.076	123.6%	0.054
430-420 Ext Solar Abs.	0.531	0.470	0.371	0.515	0.496	0.409	0.460	0.732	0.371	0.732	0.498	72.5%	0.308
600-430 South Windows	5.595	5.816	6.657	6.574	7.280	5.929	5.875	5.903	5.595	7.280	6.204	27.2%	6.270
440-600 Cavity Albedo	-2.170	-2.261		-2.604	-2.760		-2.517	-2.094	-2.760	-2.094	-2.401	27.7%	-2.711

PEAK HEATING [kW]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE*	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
400-395 Surf. Conv. & IR	0.805	1.071	1.148	1.310		1.079	1.115	1.250	0.805	1.310	1.111	45.4%	1.188
410-400 Infiltration	0.758	0.844	0.757	0.792		0.885	0.778	0.794	0.757	0.885	0.801	16.0%	0.778
420-410 Internal Gains	-0.182	-0.180	-0.183	-0.200		-0.183	-0.183	-0.188	-0.200	-0.180	-0.186	10.8%	-0.185
430-420 Ext Solar Abs.	-0.001	0.000	0.000	0.000		0.000	0.000	0.011	-0.001	0.011	0.001	840.0%	0.000
600-430 South Windows	-0.005	-0.004	-0.005	-0.029		-0.007	0.000	0.217	-0.029	0.217	0.024	1031.1%	-0.161
440-600 Cavity Albedo	0.002	0.002		0.019			0.000	0.022	0.000	0.022	0.009	244.4%	0.000

PEAK SENSIBLE COOLING [kW]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE*	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
400-395 Surf. Conv. & IR	0.000	0.219	0.265	0.272		0.256	0.251	0.227	0.000	0.272	0.213	127.8%	0.182
410-400 Infiltration	0.035	0.118	0.148	0.148		0.112	0.130	0.138	0.035	0.148	0.118	95.4%	0.151
420-410 Internal Gains	0.223	0.224	0.218	0.233		0.214	0.195	0.211	0.195	0.233	0.217	17.7%	0.223
430-420 Ext Solar Abs.	1.235	0.849	0.796	0.715		0.637	0.861	1.657	0.637	1.657	0.964	105.8%	0.659
600-430 South Windows	4.701	4.193	5.229	5.065		4.711	4.688	4.234	4.193	5.229	4.689	22.1%	5.198
440-600 Cavity Albedo	-1.648	-1.541		-1.774			-1.800	-1.534	-1.800	-1.534	-1.659	16.0%	-1.916

* SRES-BRE (SERIRES 1.2) simulations did not produce output for this variable.

** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-10. High Mass Basic and In-Depth Sensitivity Tests

ANNUAL HEATING [MWh]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
800-430 Mass, w/ Op. Win.	-0.561	-0.535	-0.599	-0.567	-0.586	-0.501	-0.560	-0.649	-0.649	-0.501	-0.570	26.0%	-0.494
900-800 Himass, S. Win.	-3.698	-4.343	-5.356	-4.714	-4.612	-4.431	-4.285	-3.820	-5.356	-3.698	-4.407	37.6%	-4.867
900-810 Himass, Int. Sol. Abs.	-0.669	-0.836		-1.107	-0.840		-0.912	-0.921	-1.107	-0.669	-0.881	49.7%	-0.915
910-610 Mass, w/ S. Shade	-2.780	-2.944	-3.532	-3.106	-3.338	-2.908	-2.873	-3.163	-3.532	-2.780	-3.081	24.4%	-3.070
920-620 Mass, w/ E&W Win.	-1.300	-1.297	-1.689	-1.461	-1.676	-1.329	-1.297	-1.428	-1.689	-1.297	-1.435	27.3%	-1.370
930-630 Mass w/ E&W Shade	-0.907	-1.012	-1.134	-1.128	-1.273	-0.927	-0.884		-1.273	-0.884	-1.038	37.5%	-0.956
940-640 Mass, w/ Htg. Setback	-1.958	-1.867	-2.304	-2.024	-2.392	-1.886	-1.963	-1.986	-2.392	-1.867	-2.048	25.6%	-2.092
ANNUAL SENSIBLE COOLING [MWh]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
800-430 Mass, w/ Op. Win.	-0.429	-0.393	-0.367	-0.432	-0.462	-0.368	-0.410	-0.550	-0.550	-0.367	-0.426	42.9%	-0.295
900-800 Himass, S. Win.	2.019	2.376	2.400	2.893	3.193	2.377	2.278	2.274	2.019	3.193	2.476	47.4%	2.232
900-810 Himass, Int. Sol. Abs.	1.080	1.195		1.454	1.707		1.294	0.975	0.975	1.707	1.284	57.0%	1.325
910-610 Mass, w/ S. Shade	-3.094	-3.318	-3.876	-3.576	-3.924	-3.336	-3.275	-3.739	-3.924	-3.094	-3.517	23.6%	-3.557
920-620 Mass, w/ E&W Win.	-1.577	-1.476	-1.894	-1.690	-1.912	-1.554	-1.483	-1.738	-1.912	-1.476	-1.666	26.2%	-1.609
930-630 Mass w/ E&W Shade	-1.090	-1.174	-1.223	-1.320	-1.463	-1.050	-1.000		-1.463	-1.000	-1.189	39.0%	-1.085
940-640 Mass, w/ Htg. Setback	-3.873	-3.647	-4.419	-3.990	-4.570	-3.758	-3.863	-3.992	-4.570	-3.647	-4.014	23.0%	-4.183
950-650 Mass, w/ Night Vent	-4.429	-4.614	-5.257	-4.973	-5.956	-4.537	-4.558	-4.685	-5.956	-4.429	-4.876	31.3%	-4.824
PEAK HEATING [kW]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE*	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
800-430 Mass, w/ Op. Win.	-0.215	-0.151	-0.141	-0.149		-0.142	-0.144	-0.198	-0.215	-0.141	-0.163	45.4%	-0.149
900-800 Himass, S. Win.	-0.377	-0.340	-0.352	-0.378		-0.294	-0.269	-0.142	-0.378	-0.142	-0.307	76.7%	-0.543
900-810 Himass, Int. Sol. Abs.	-0.129	-0.113		-0.155			-0.089	-0.166	-0.166	-0.089	-0.130	59.1%	-0.142
910-610 Mass, w/ S. Shade	-0.579	-0.485	-0.470	-0.494		-0.419	-0.386	-0.553	-0.579	-0.386	-0.484	39.9%	-0.526
920-620 Mass, w/ E&W Win.	-0.283	-0.238	-0.241	-0.264		-0.248	-0.214	-0.318	-0.318	-0.214	-0.258	40.4%	-0.237
930-630 Mass w/ E&W Shade	-0.237	-0.209	-0.193	-0.238		-0.214	-0.178		-0.238	-0.178	-0.211	28.5%	-0.196
940-640 Mass, w/ Htg. Setback	-1.252	-0.458	-0.278	-0.414		-0.230	-0.600	-0.526	-1.252	-0.230	-0.537	190.4%	-0.942
PEAK SENSIBLE COOLING [kW]									Statistics for Example Results				
CASES	ESP DMU	BLAST US-IT	DOE21D NREL	SRES-SUN NREL	SRES BRE*	S3PAS SPAIN	TSYS BEL-BRE	TASE FINLAND	Min	Max	Mean	(Max-Min)/ Mean** (%)	TRNSYS18 TESS
800-430 Mass, w/ Op. Win.	-0.908	-0.805	-0.684	-0.410		-0.547	-0.816	-1.220	-1.220	-0.410	-0.770	105.2%	-0.689
900-800 Himass, S. Win.	2.303	2.188	2.715	2.519		2.306	2.584	2.099	2.099	2.715	2.388	25.8%	2.736
900-810 Himass, Int. Sol. Abs.	1.036	0.798		0.880			1.223	0.595	0.595	1.223	0.906	69.3%	1.221
910-610 Mass, w/ S. Shade	-3.773	-3.324	-3.728	-3.094		-3.384	-2.883	-2.999	-3.773	-2.883	-3.312	26.9%	-3.611
920-620 Mass, w/ E&W Win.	-1.249	-1.142	-1.321	-1.106		-1.226	-1.225	-1.591	-1.591	-1.106	-1.266	38.3%	-1.353
930-630 Mass w/ E&W Shade	-1.199	-1.158	-1.200	-1.036		-1.179	-1.110		-1.200	-1.036	-1.147	14.3%	-1.286
940-640 Mass, w/ Htg. Setback	-3.273	-2.737	-3.118	-2.905		-2.916	-2.875	-3.314	-3.314	-2.737	-3.020	19.1%	-3.126
950-650 Mass, w/ Night Vent	-3.998	-3.210	-3.852	-3.501		-3.466	-3.692	-3.812	-3.998	-3.210	-3.647	21.6%	-3.883

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
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By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

* SRES-BRE (SERIRES 1.2) simulations did not produce output for this variable.
** ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
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Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-11. Annual Transmissivity Coefficient of Windows

(ANNUAL UNSHADED TRANSMITTED SOLAR RADIATION)/(ANNUAL UNSHADED INCIDENT SOLAR RADIATION)

Simulation Model:	ESP	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18
Organization or Country:	DMU	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND					TESS
Case								Min	Max	Mean	(Max-Min)/ Mean* (%)	
620 West	0.674	0.681	0.687	0.657	0.641	0.654	0.648	0.641	0.687	0.663	7.0%	0.684
600 South	0.650	0.671	0.652	0.650	0.628	0.647	0.623	0.623	0.671	0.646	7.5%	0.649

* ABS[(Max-Min) / (Mean of Example Simulation Results)]

Table B8-12. Annual Shading Coefficient of Window Shading Devices: Overhangs & Fins

(1-(ANNUAL SHADED TRANSMITTED SOLAR RADIATION)/(ANNUAL UNSHADED TRANSMITTED SOLAR RADIATION))

Simulation Model:	ESP	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18
Organization or Country:	DMU	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND					TESS
Case								Min	Max	Mean	(Max-Min)/ Mean* (%)	
630/620 West	0.182	0.346	0.196	0.216	0.329	0.339		0.182	0.346	0.268	61.2%	0.288
610/600 South	0.170	0.209	0.165	0.188	0.183	0.205	0.115	0.115	0.209	0.177	53.5%	0.201

* ABS[(Max-Min) / (Mean of Example Simulation Results)]

Table B8-13. Case 600 Annual Incident Solar Radiation (kWh/m^2)

Simulation Model:	ESP	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18
Organization or Country:	DMU	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND					TESS
Case								Min	Max	Mean	(Max-Min)/ Mean* (%)	
North	427	434	456	407	457	367	453	367	457	429	20.9%	418
East	959	1155	1083	1217	1082	1101	962	959	1217	1080	23.9%	1132
West	1086	1079	1003	857	1002	1012	1090	857	1090	1018	22.9%	1060
South	1456	1566	1476	1468	1474	1522	1468	1456	1566	1490	7.4%	1542
Horizontal	1797	1831	1832	1832	1832	1832	1832	1797	1832	1827	1.9%	1832

* ABS[(Max-Min) / (Mean of Example Simulation Results)]

ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
TRNSYS 18.05.0001 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 15-Apr-2023

Note: The statistics in the tables below are based on the Standard 140 informative example results.
These statistics do not have any substantial importance and are not to be interpreted as acceptance criteria.

Table B8-14. Case 600 Annual Transmitted Solar Radiation - Unshaded (kWh/m^2)

Simulation Model:	ESP	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18
Organization or Country:	DMU	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND				(Max-Min)/	TESS
Case								Min	Max	Mean	Mean* (%)	
West	732	735	689	563	642	662	706	563	735	676	25.5%	725
South	946	1051	962	954	926	984	914	914	1051	962	14.2%	1001

* ABS[(Max-Min) / (Mean of Example Simulation Results)]

Table B8-15. Case 600 Annual Transmitted Solar Radiation - Shaded (kWh/m^2)

Simulation Model:	ESP	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18
Organization or Country:	DMU	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND				(Max-Min)/	TESS
Case								Min	Max	Mean	Mean* (%)	
West	599	481	554	441	431	438		431	599	491	34.2%	516
South	785	831	803	775	757	782	809	757	831	792	9.3%	800

* ABS[(Max-Min) / (Mean of Example Simulation Results)]

Figure B8-1. BESTEST BASIC Annual Incident Solar Radiation

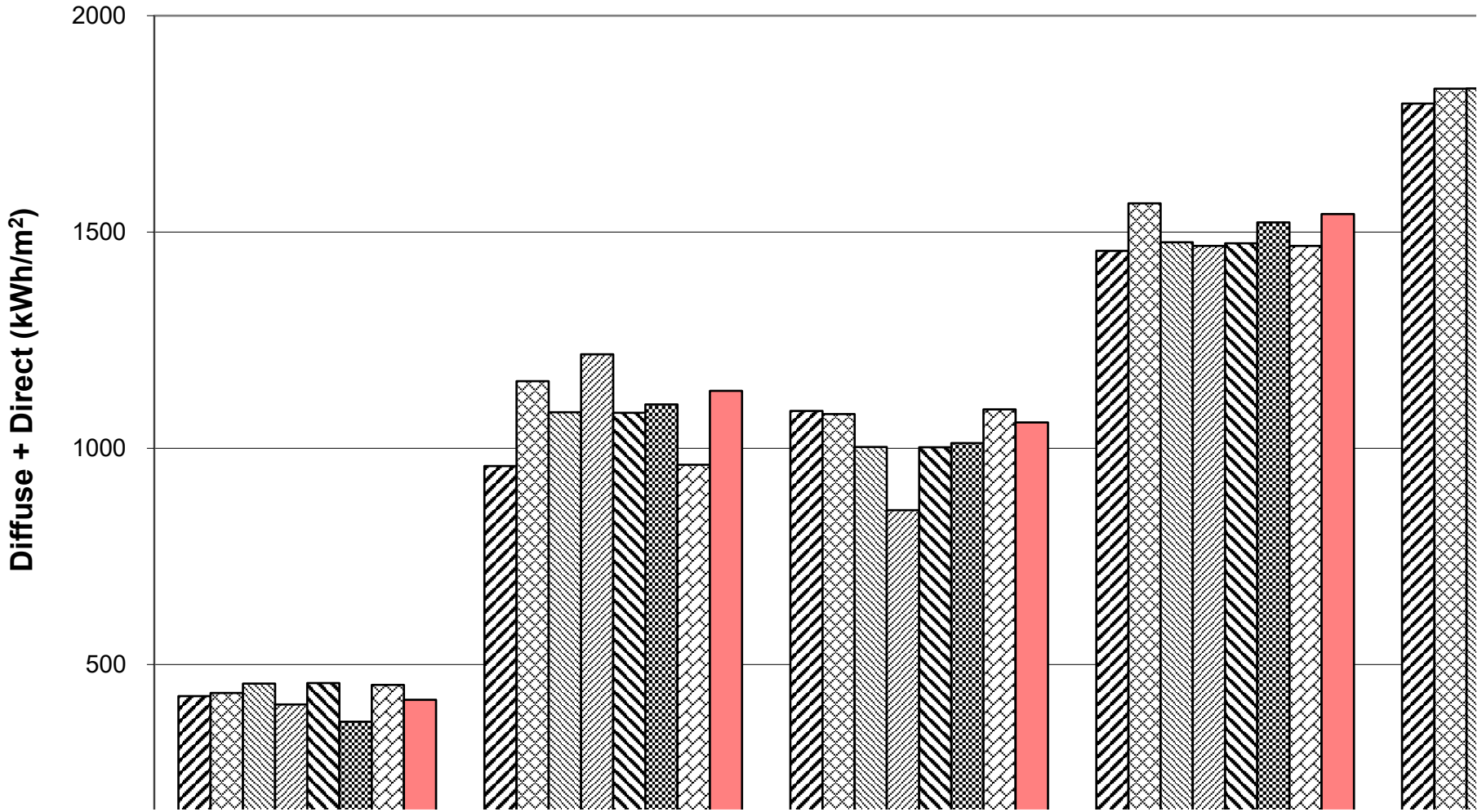

Figure B8-2. BESTEST BASIC
Annual Transmitted Solar Radiation - Unshaded

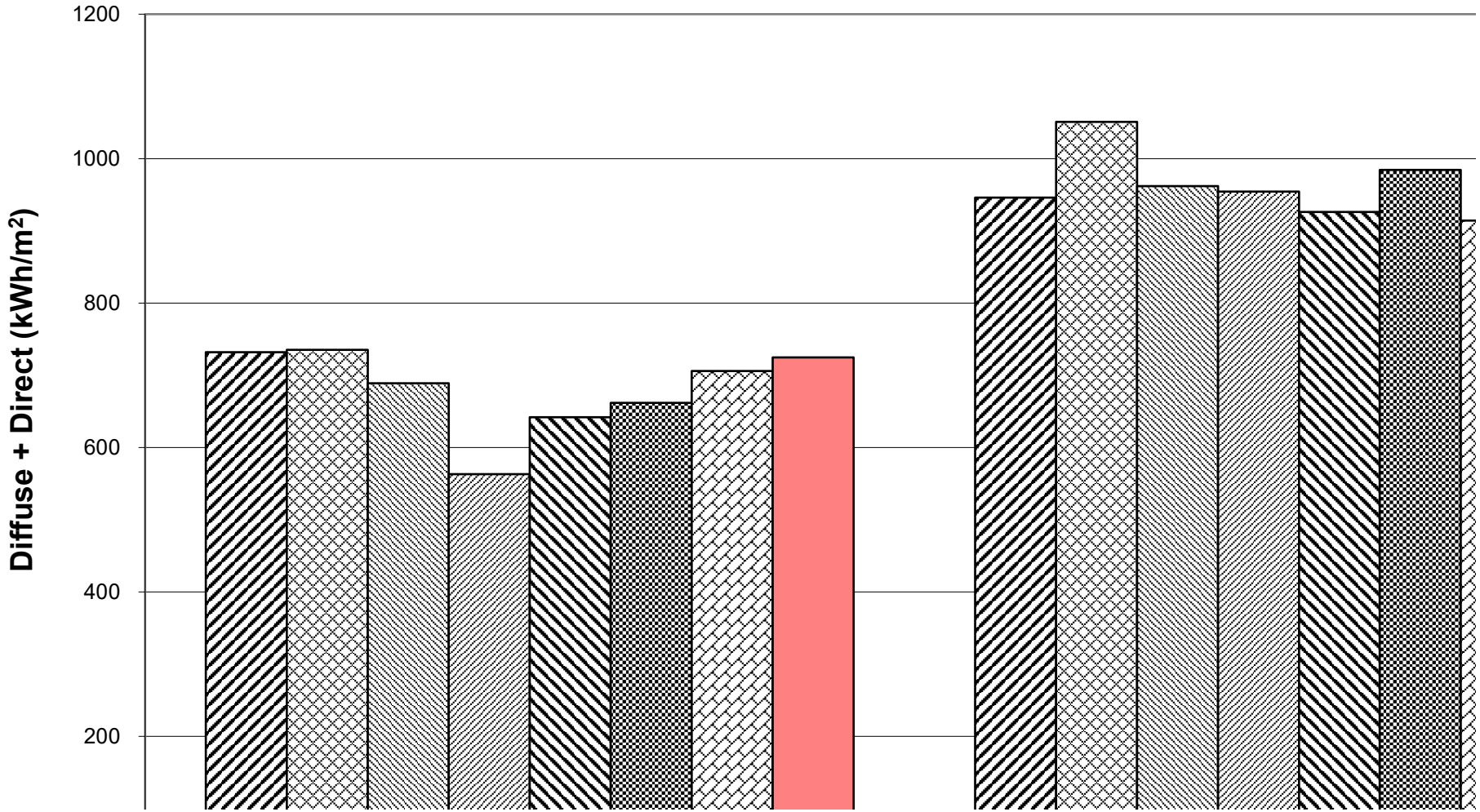

Figure B8-3. BESTEST BASIC
Annual Transmitted Solar Radiation - Shaded

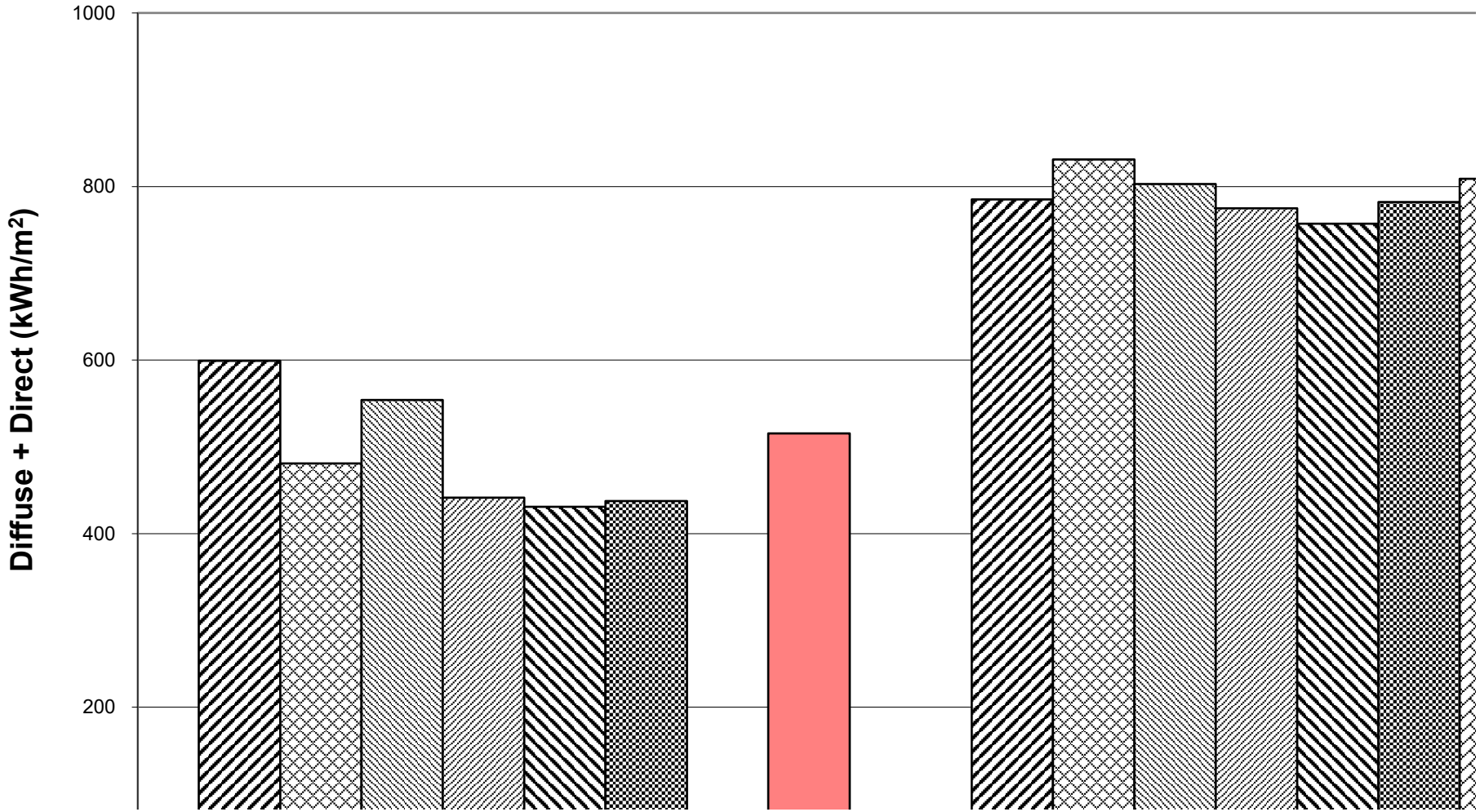

Figure B8-4. BESTEST BASIC
Annual Transmissivity Coefficient of Windows
(Unshaded Transmitted)/(Incident Solar Radiation)

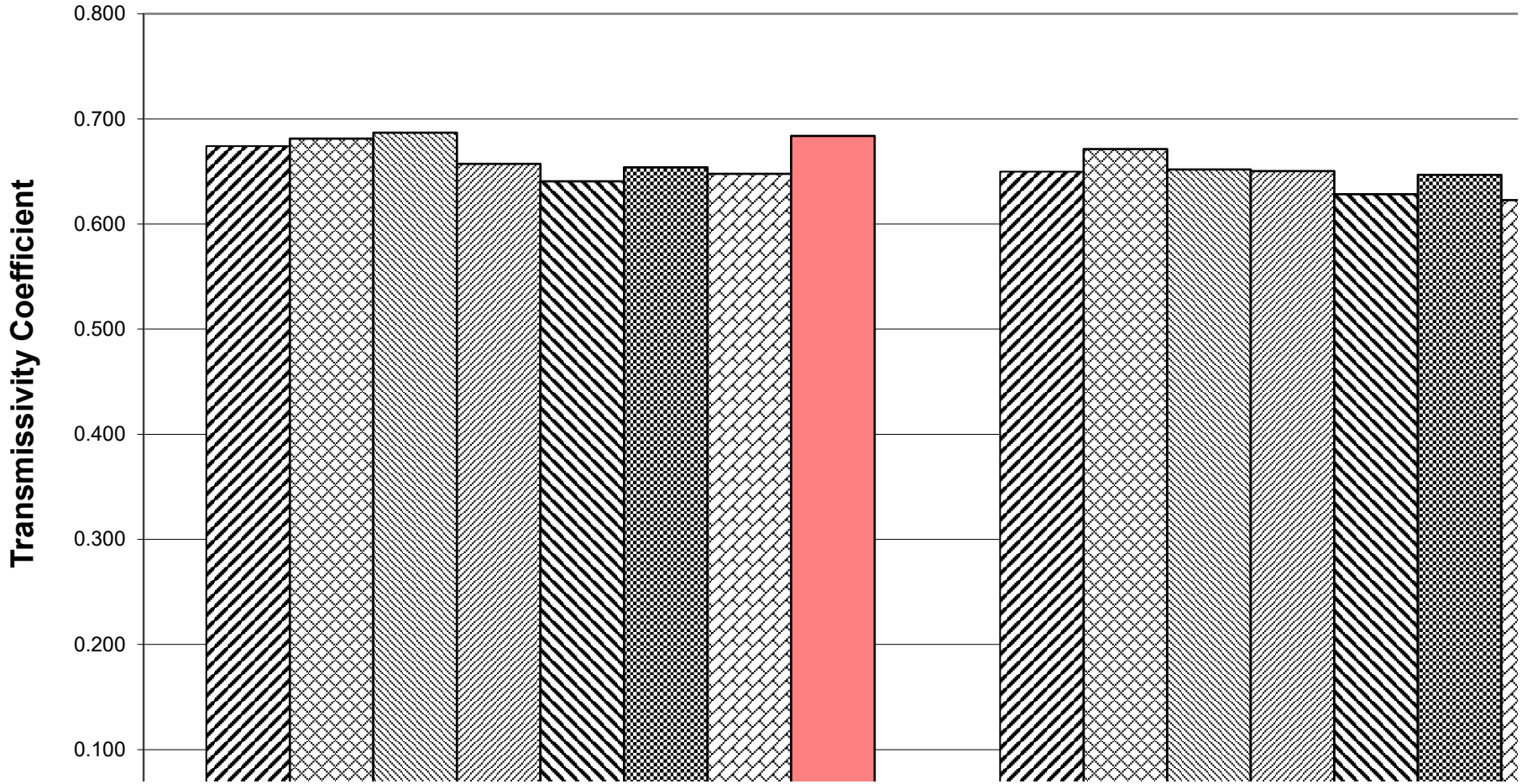

Figure B8-5. BESTEST BASIC
Annual Overhang and Fin Shading Coefficients
(1-(Shaded)/(Unshaded)) Transmitted Solar Radiation

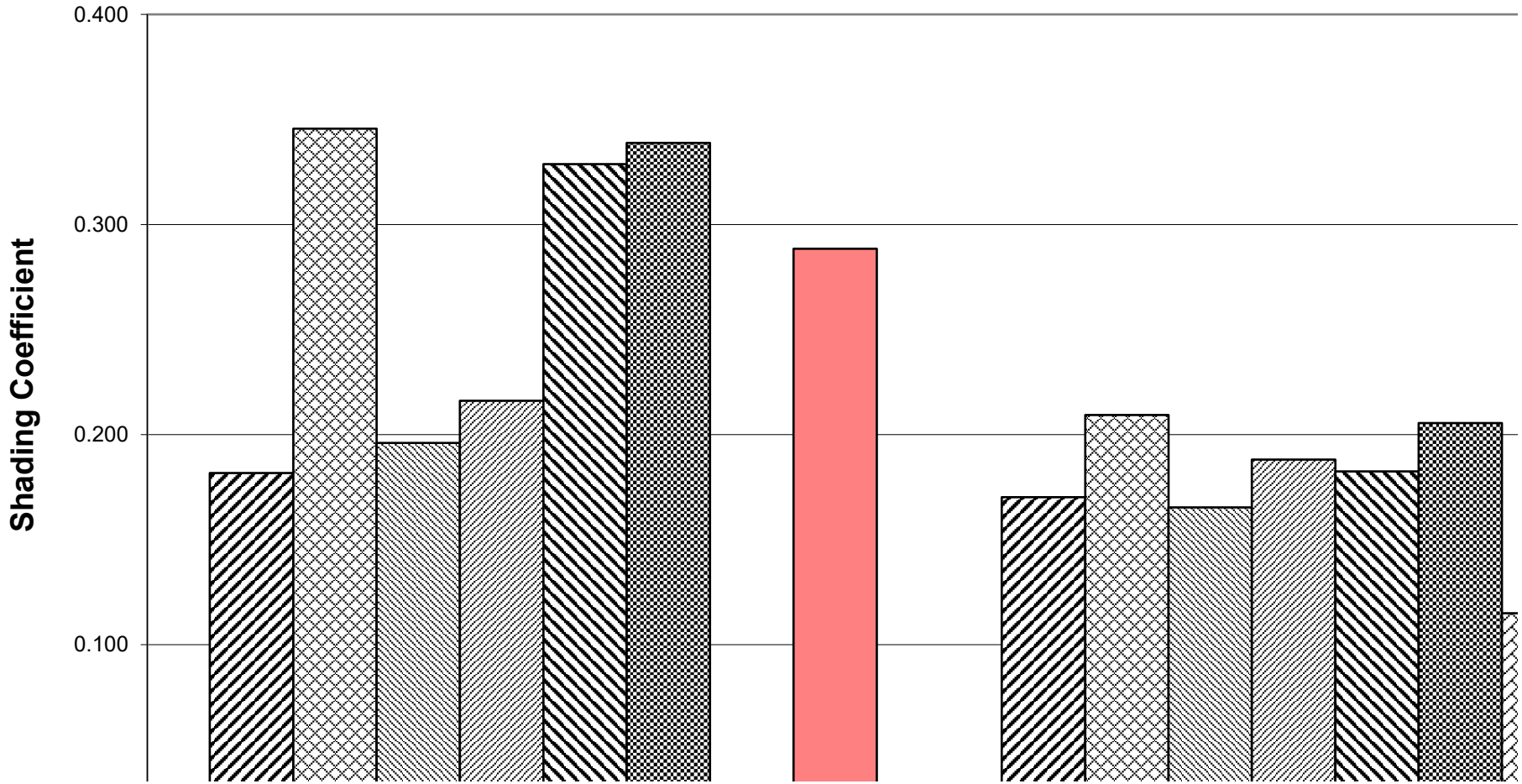

Figure B8-6. BESTEST BASIC Low Mass Annual Heating

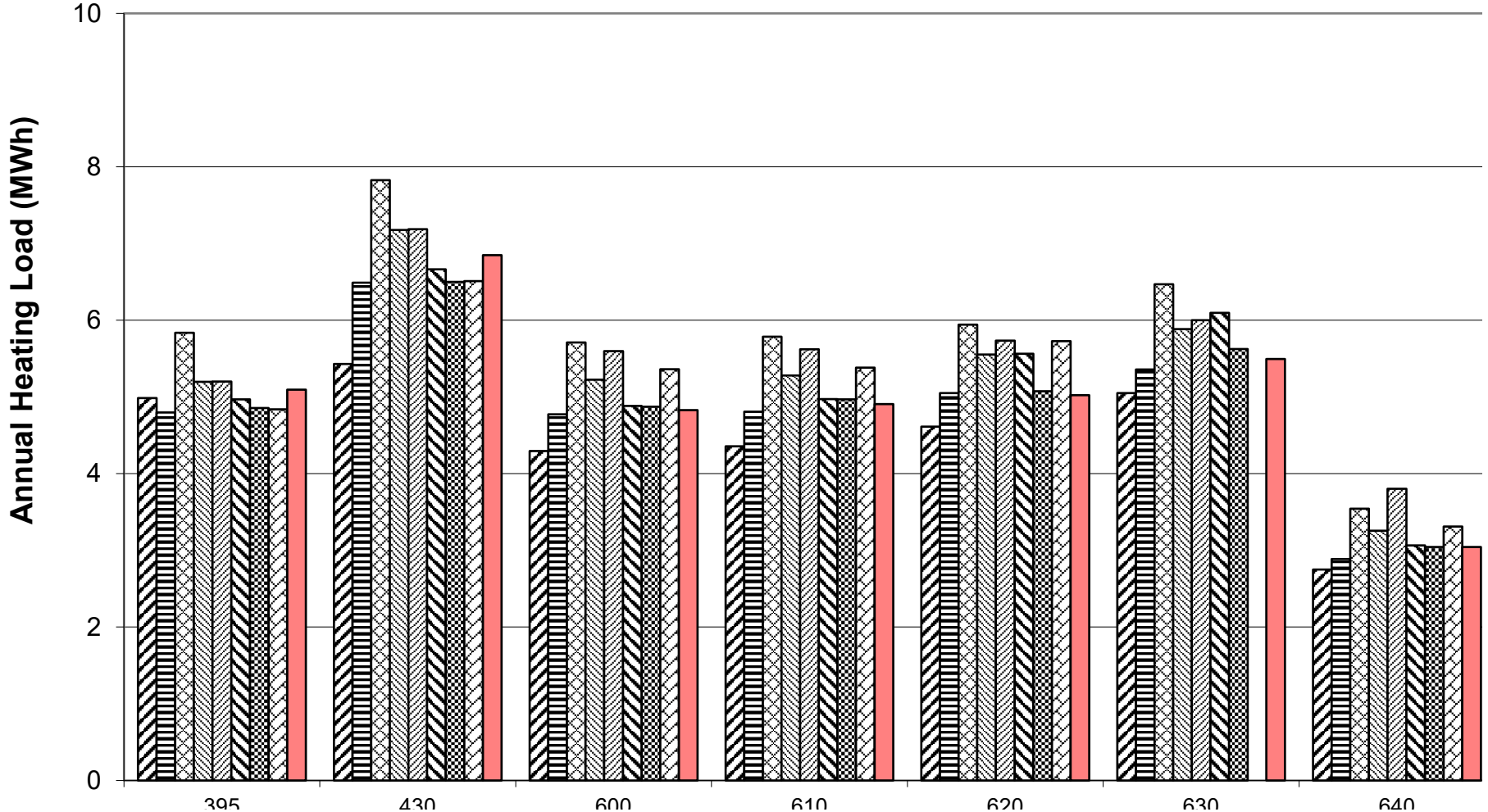

Figure B8-7. BESTEST BASIC Low Mass Annual Sensible Cooling

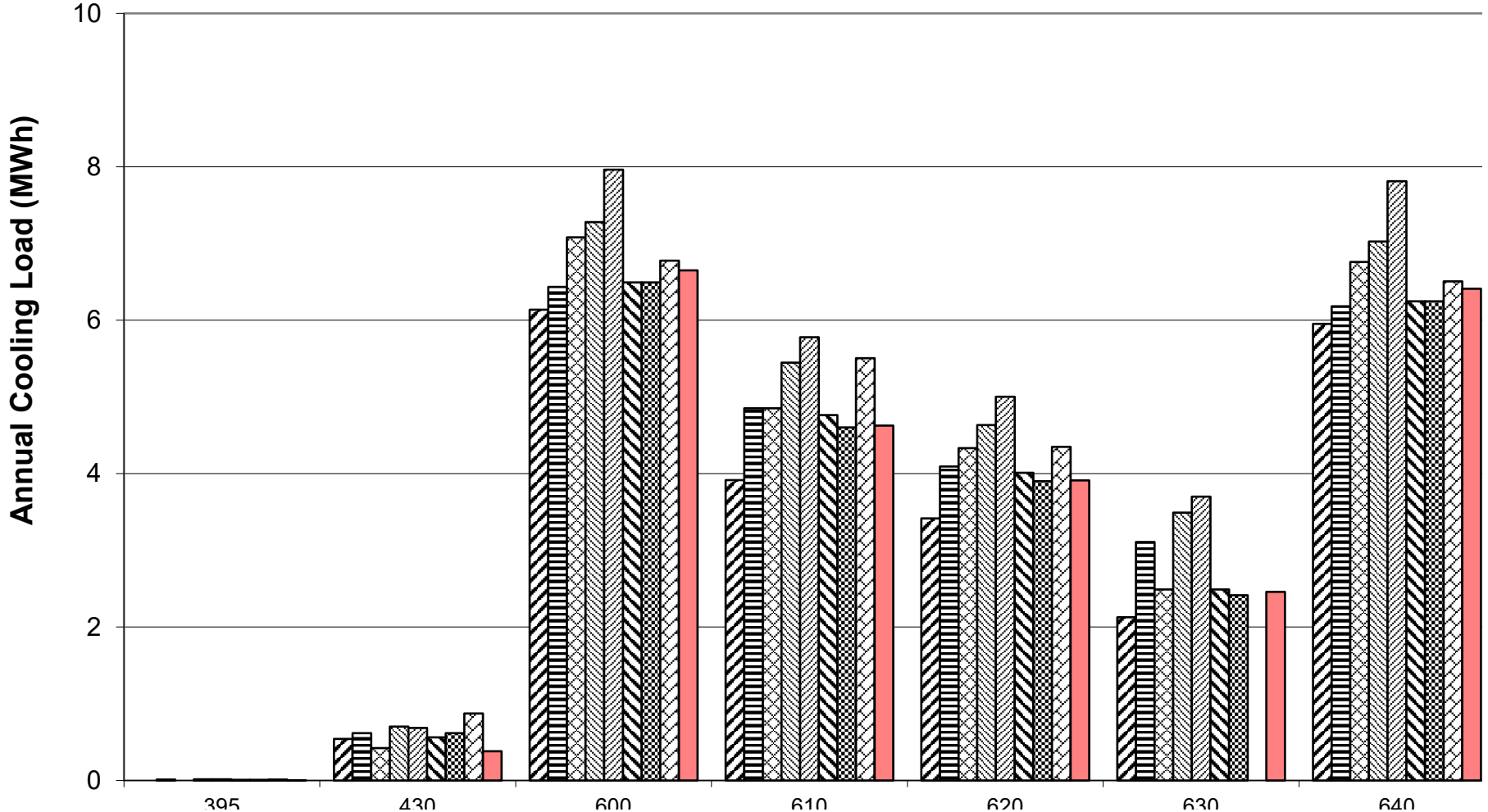

Figure B8-8. BESTEST BASIC Low Mass Peak Heating

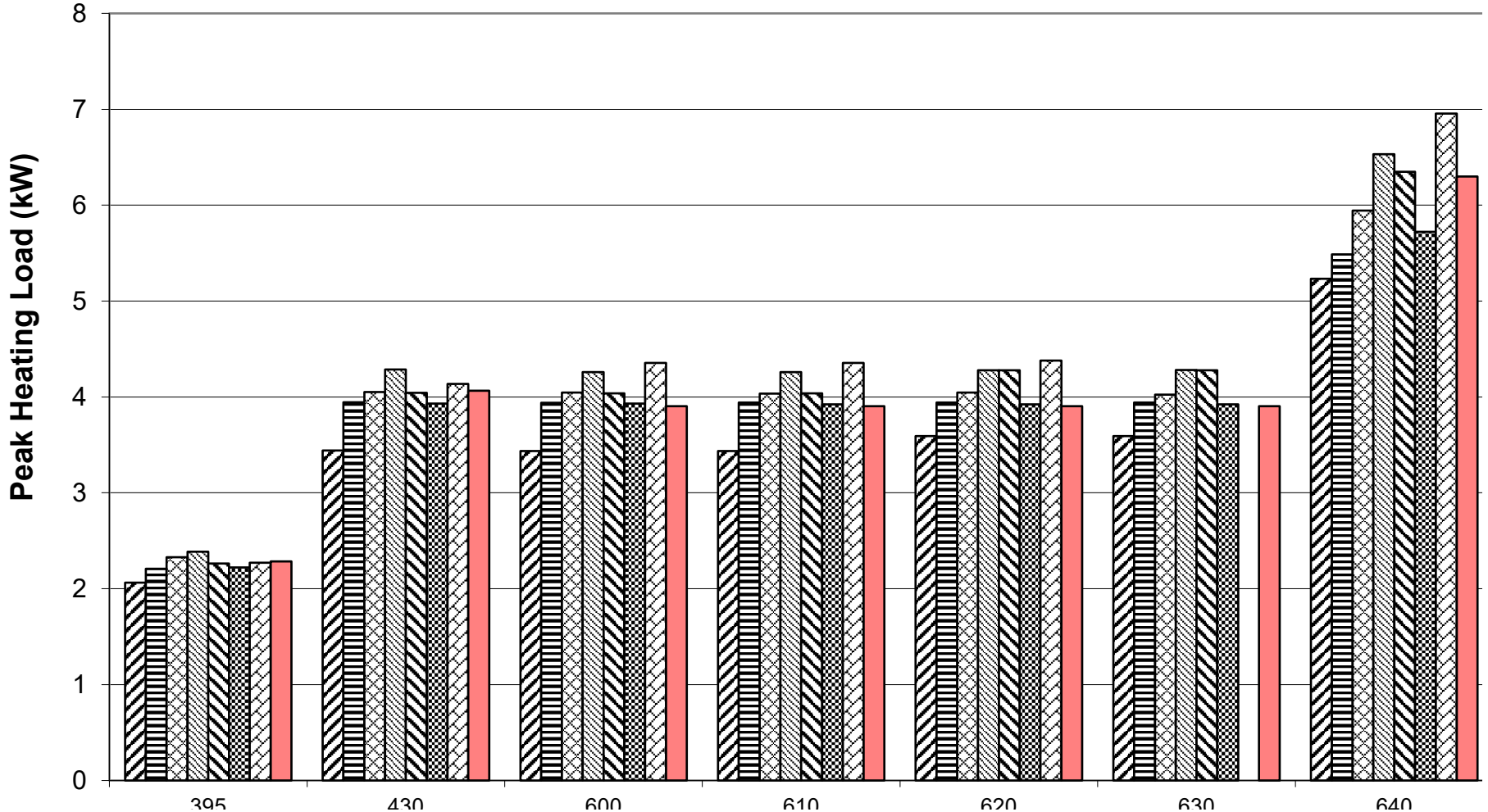

Figure B8-9. BESTEST BASIC Low Mass Peak Sensible Cooling

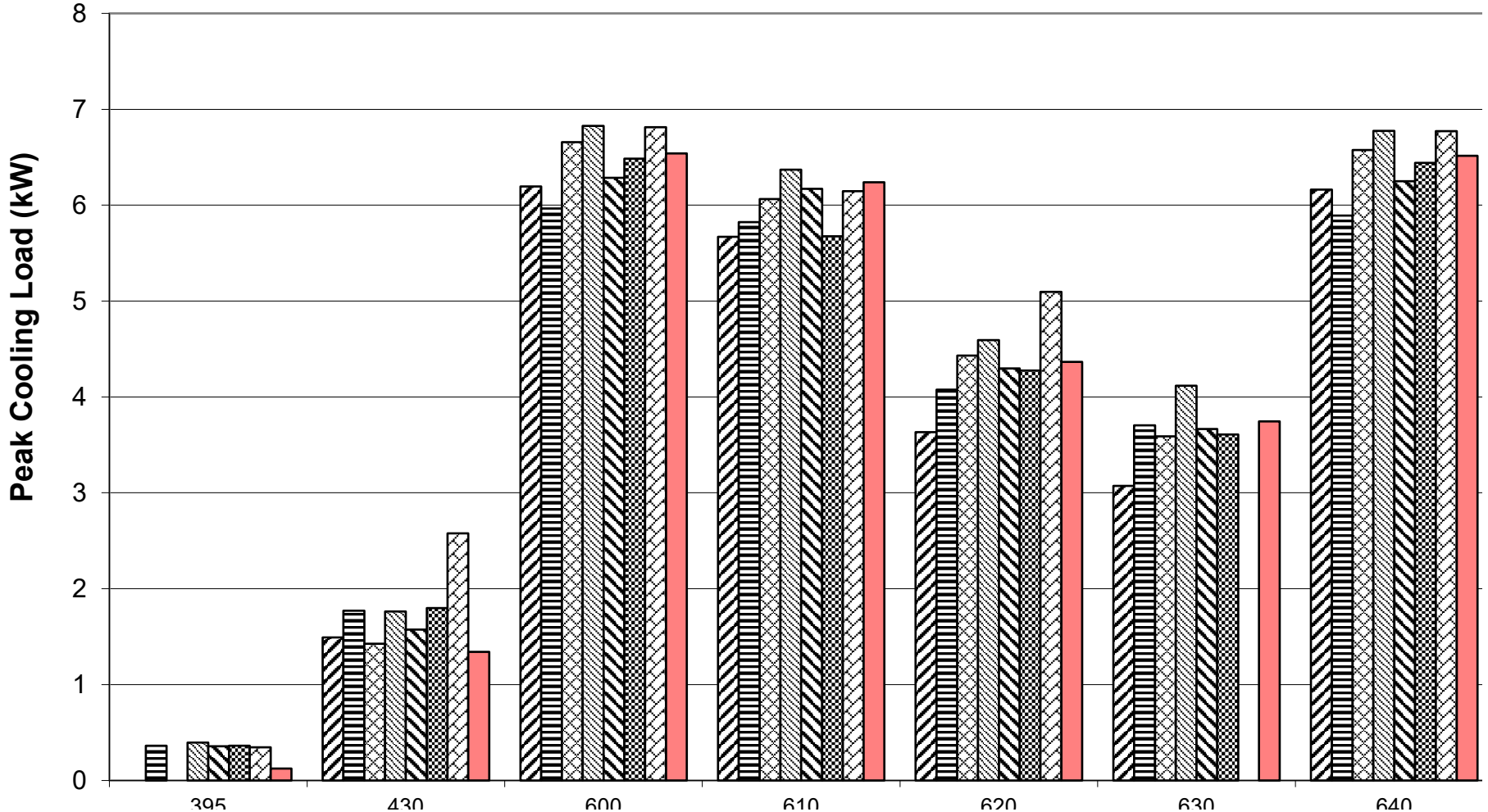

Figure B8-10. BESTEST BASIC High Mass Annual Heating

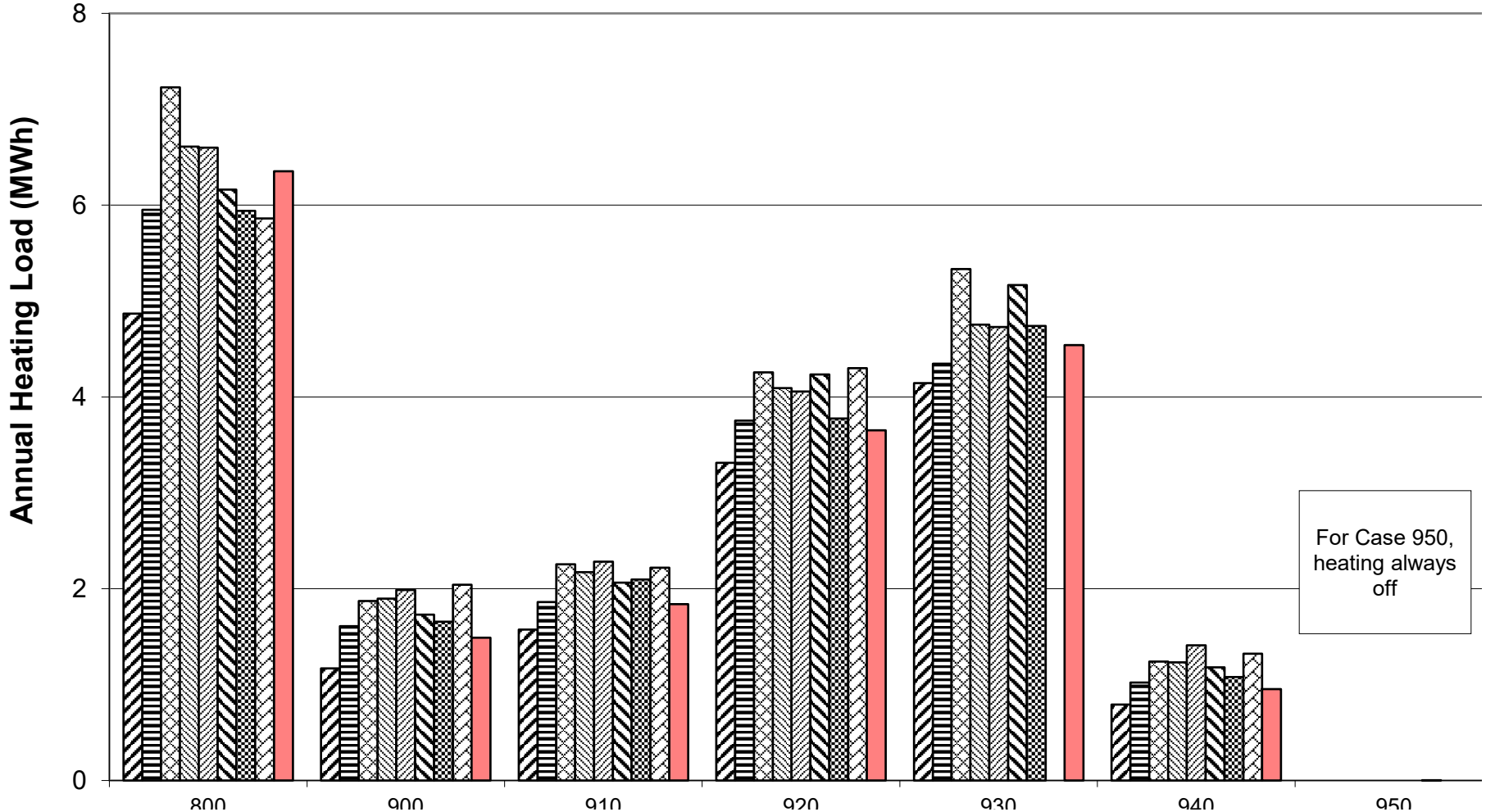

Figure B8-11. BESTEST BASIC High Mass Annual Sensible Cooling

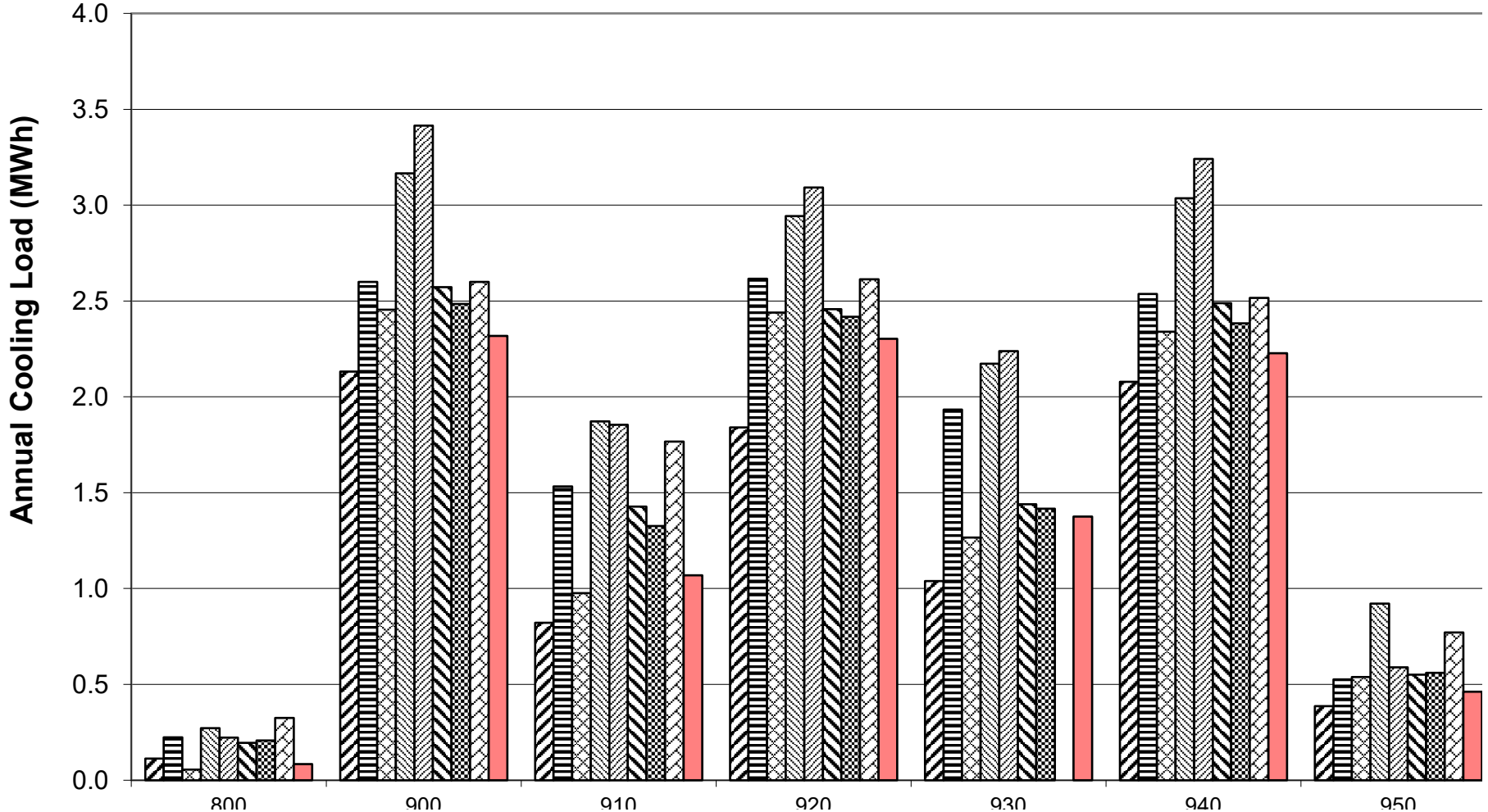

Figure B8-12. BESTEST BASIC High Mass Peak Heating

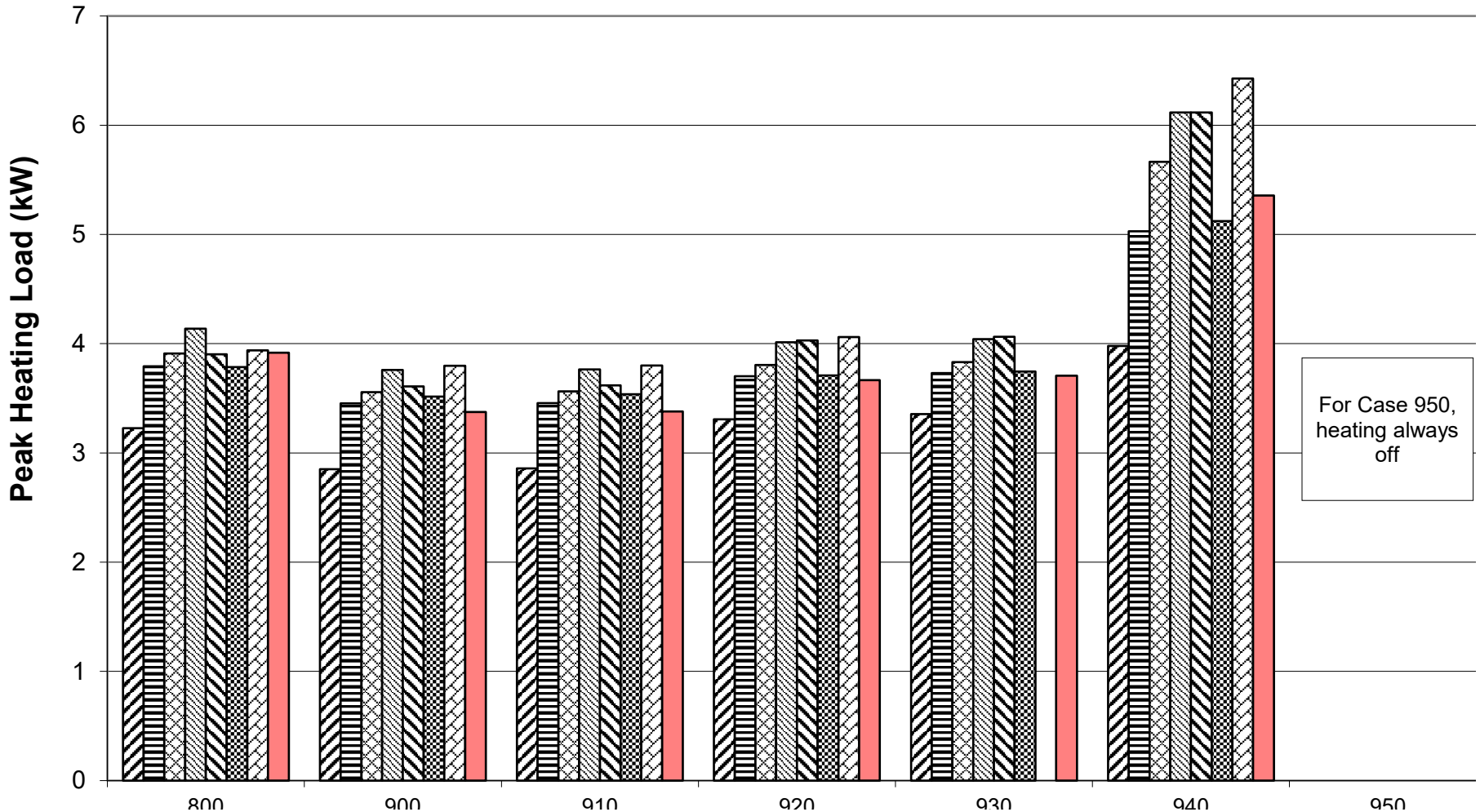

Figure B8-13. BESTEST BASIC High Mass Peak Sensible Cooling

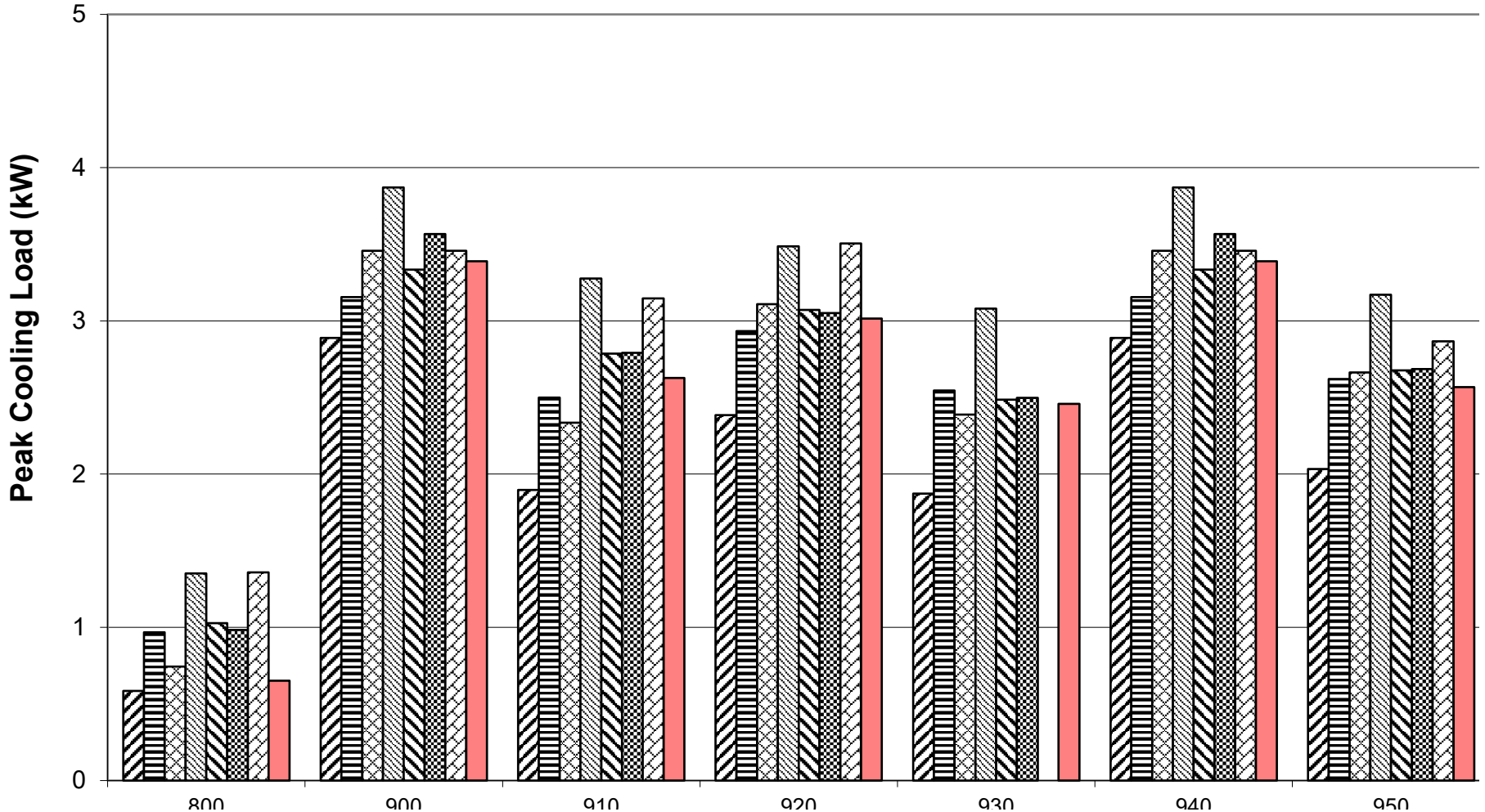

Figure B8-14. BESTEST BASIC Maximum Hourly Annual Temperature Free-Float Cases

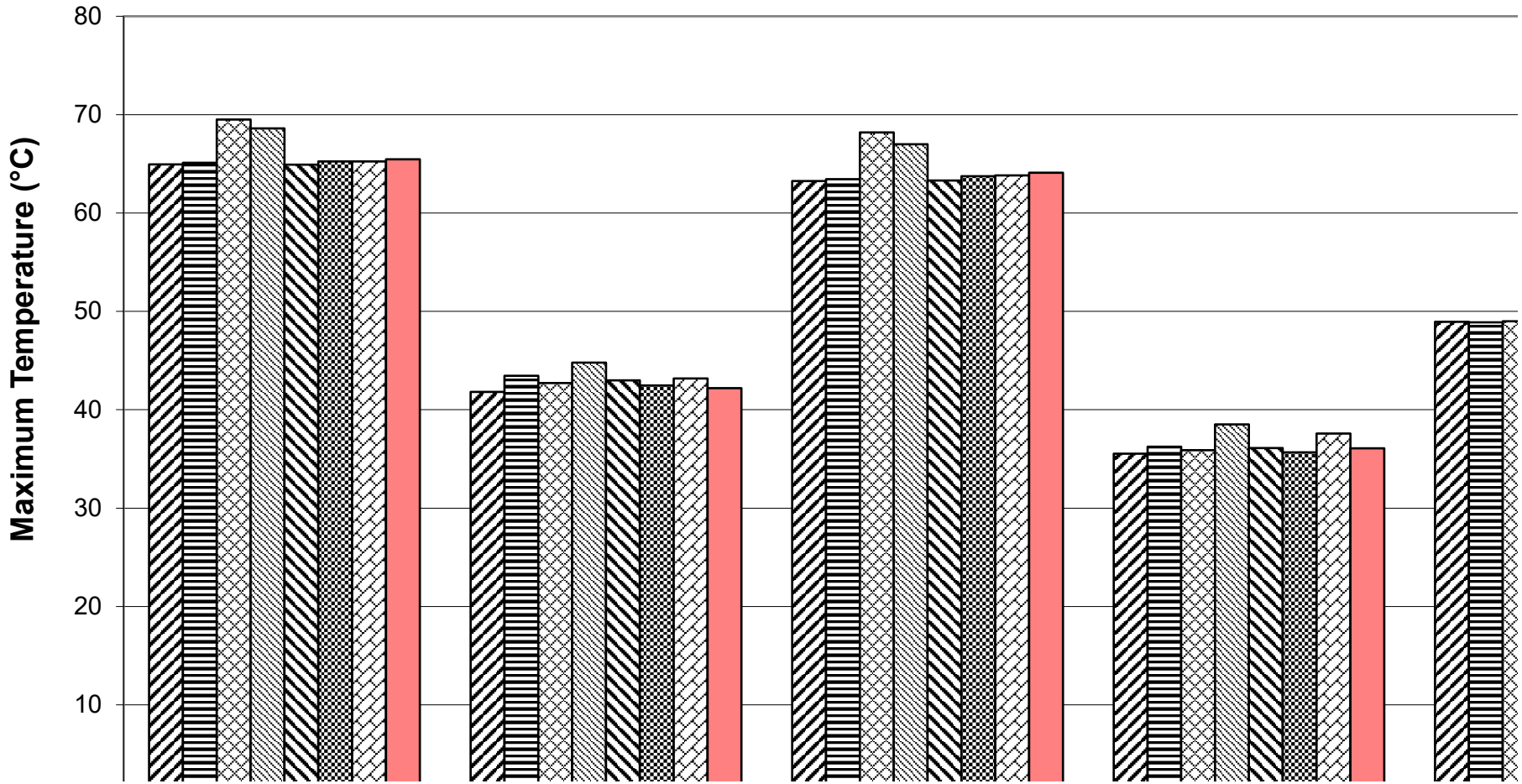

Figure B8-15. BESTEST BASIC Minimum Hourly Annual Temperature Free-Float Cases

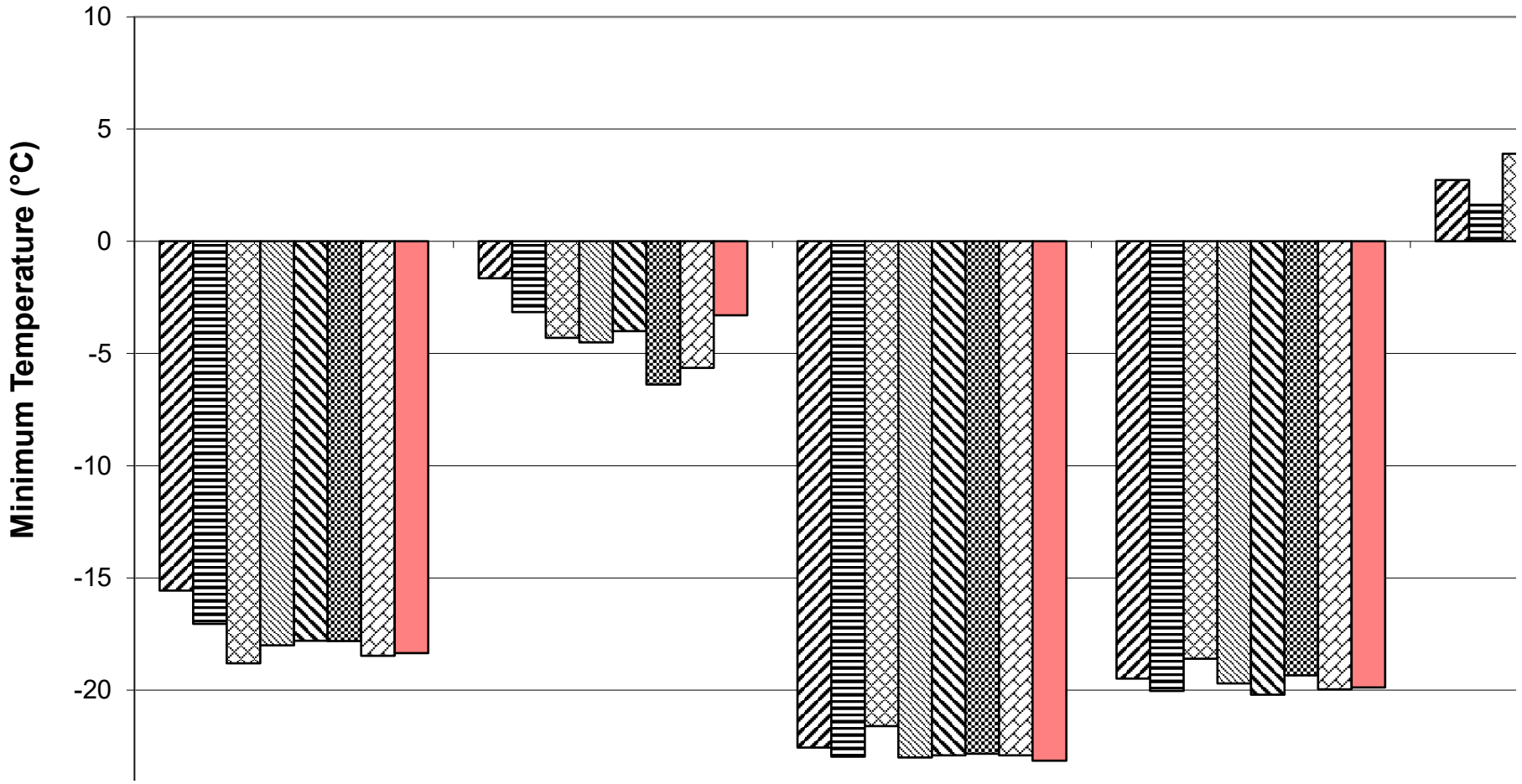

Figure B8-16. BESTEST BASIC Average Hourly Annual Temperature Free-Float Cases

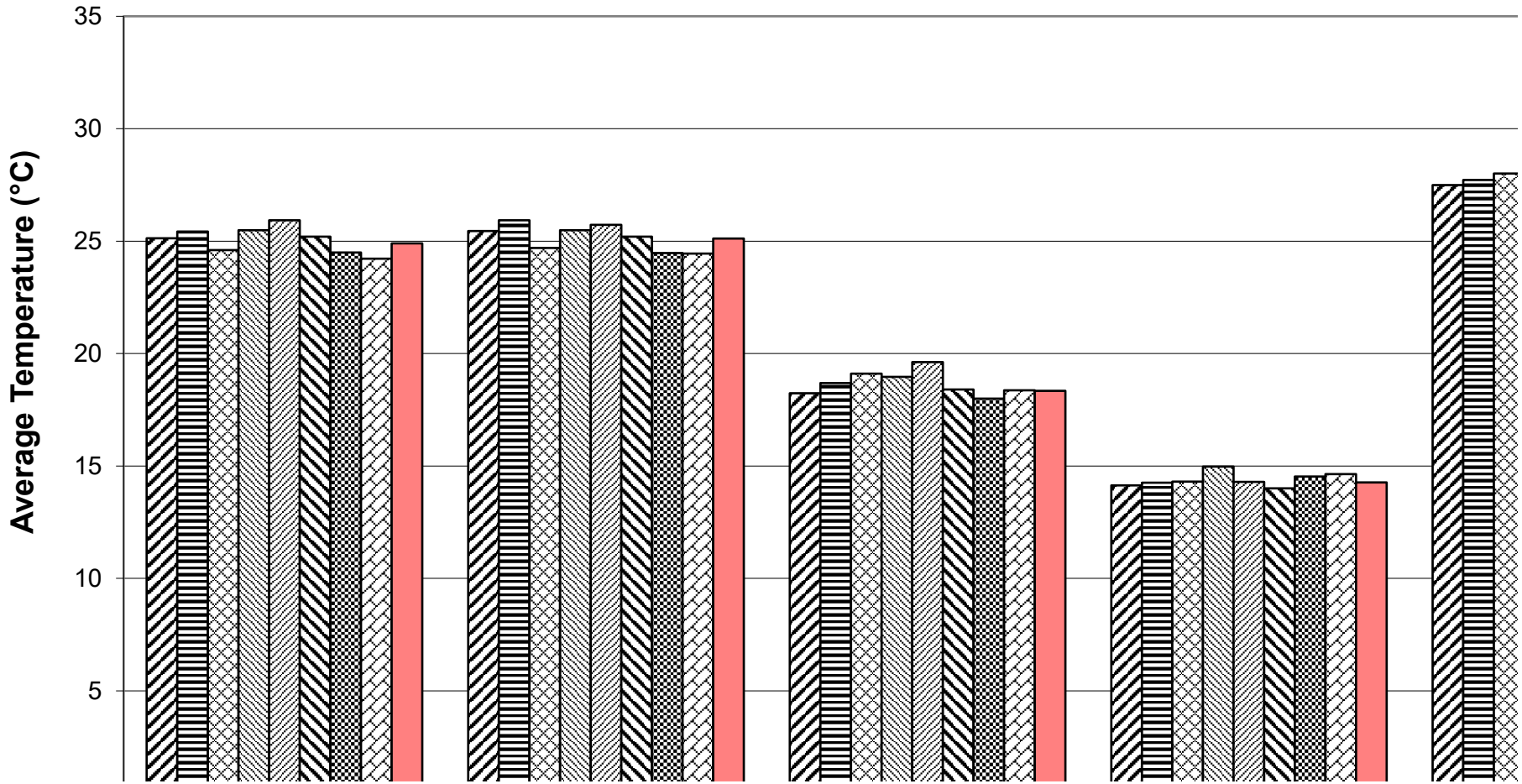

Figure B8-17. BESTEST BASIC South Window Shading (Delta) Annual Heating and Sensible Cooling

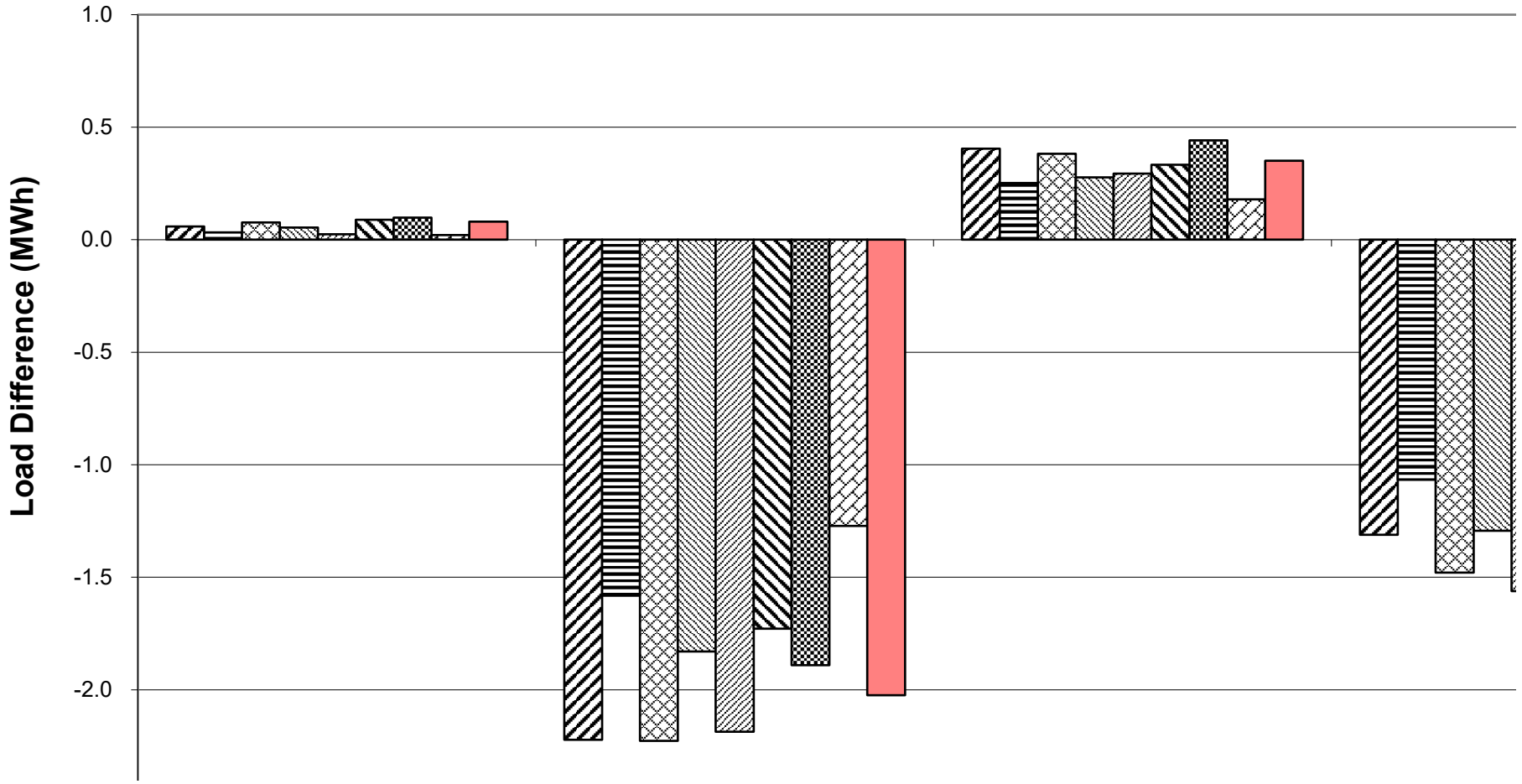

Figure B8-18. BESTEST BASIC South Window Shading (Delta) Peak Heating and Sensible Cooling

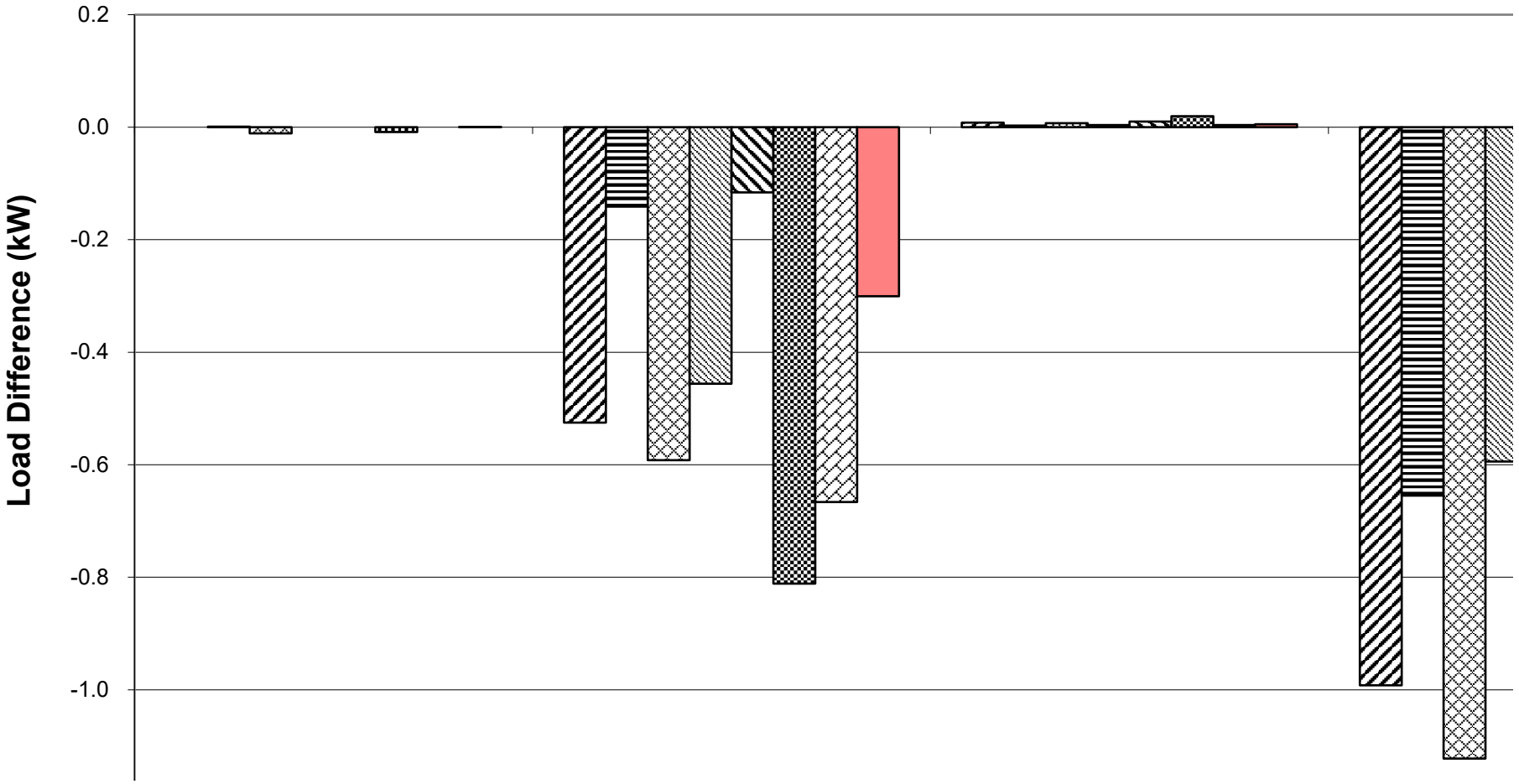

Figure B8-19. BESTEST BASIC East & West Window (Delta) Annual Heating and Sensible Cooling

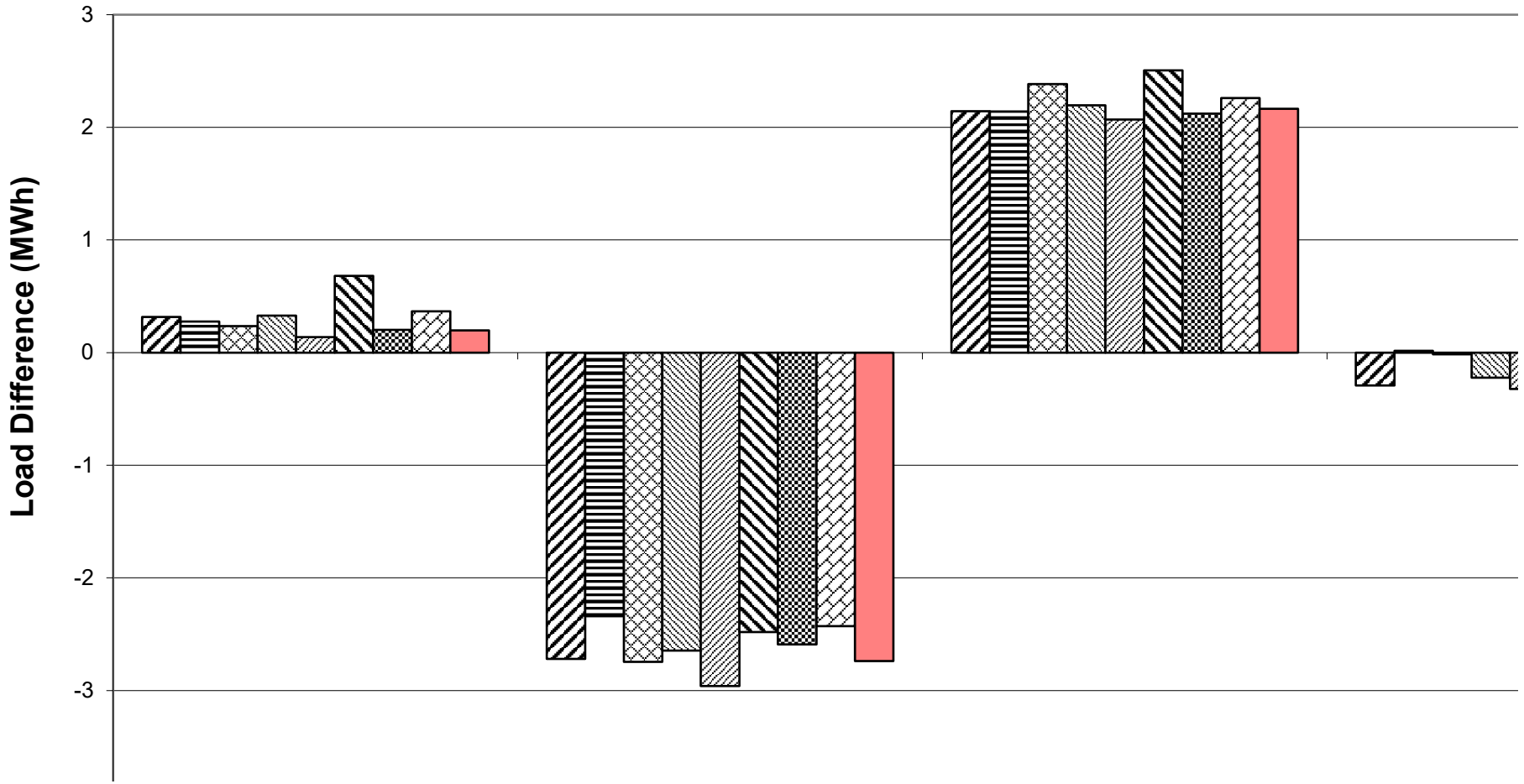

Figure B8-20. BESTEST BASIC East & West Window (Delta) Peak Heating and Sensible Cooling

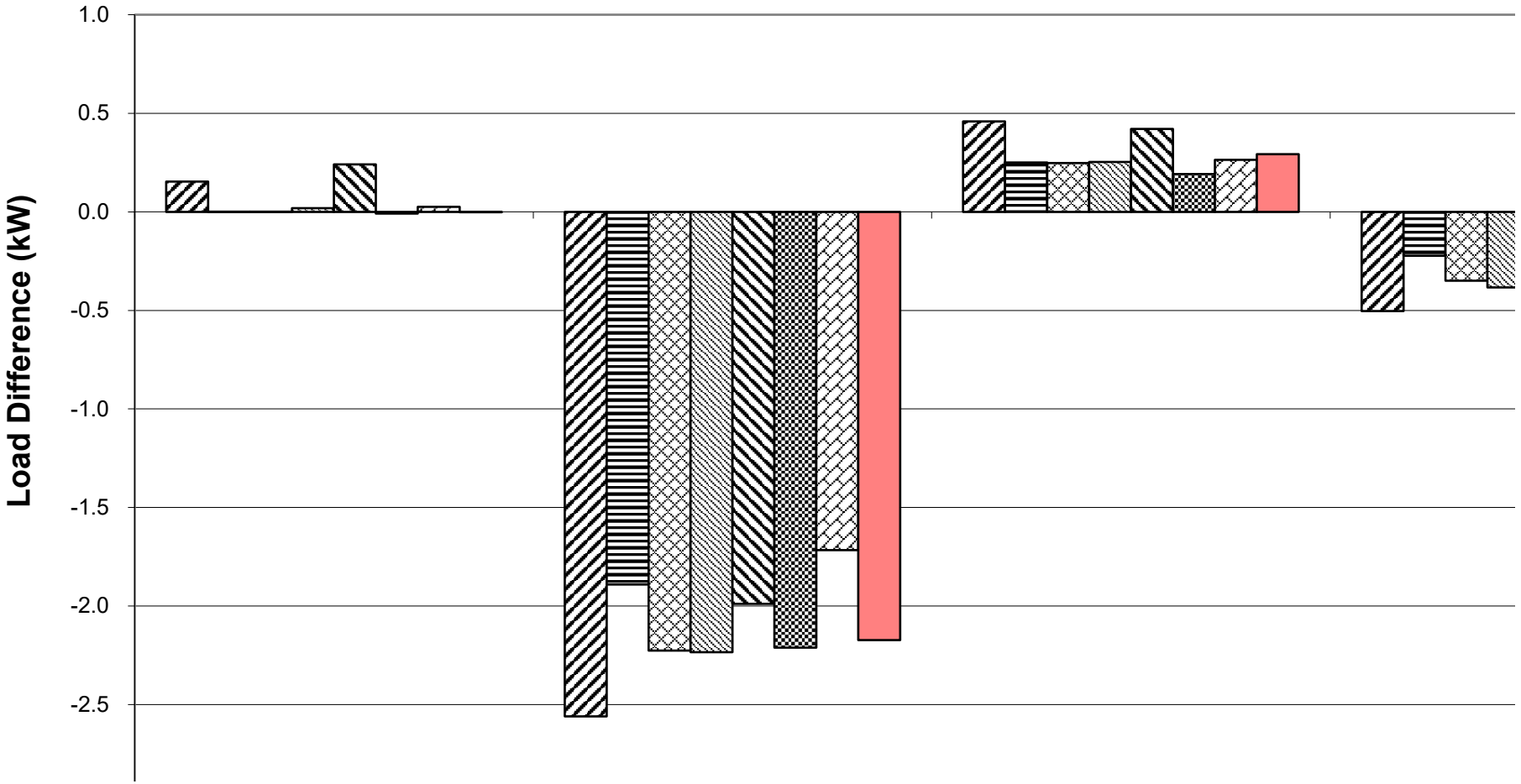

Figure B8-21. BESTEST BASIC East & West Shaded Window (Delta) Annual Heating and Sensible Cooling

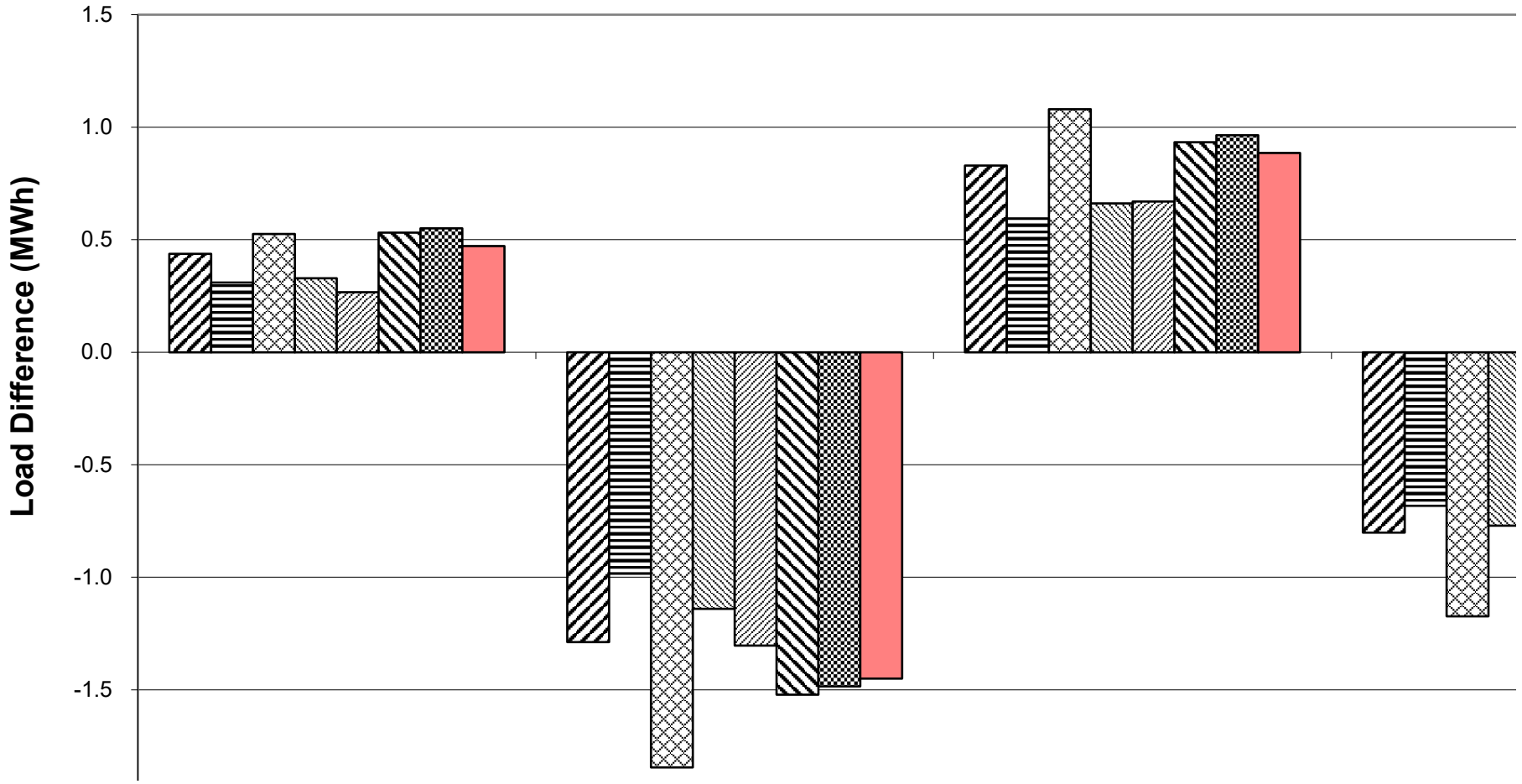

Figure B8-22. BESTEST BASIC East & West Shaded Window (Delta) Peak Heating and Sensible Cooling

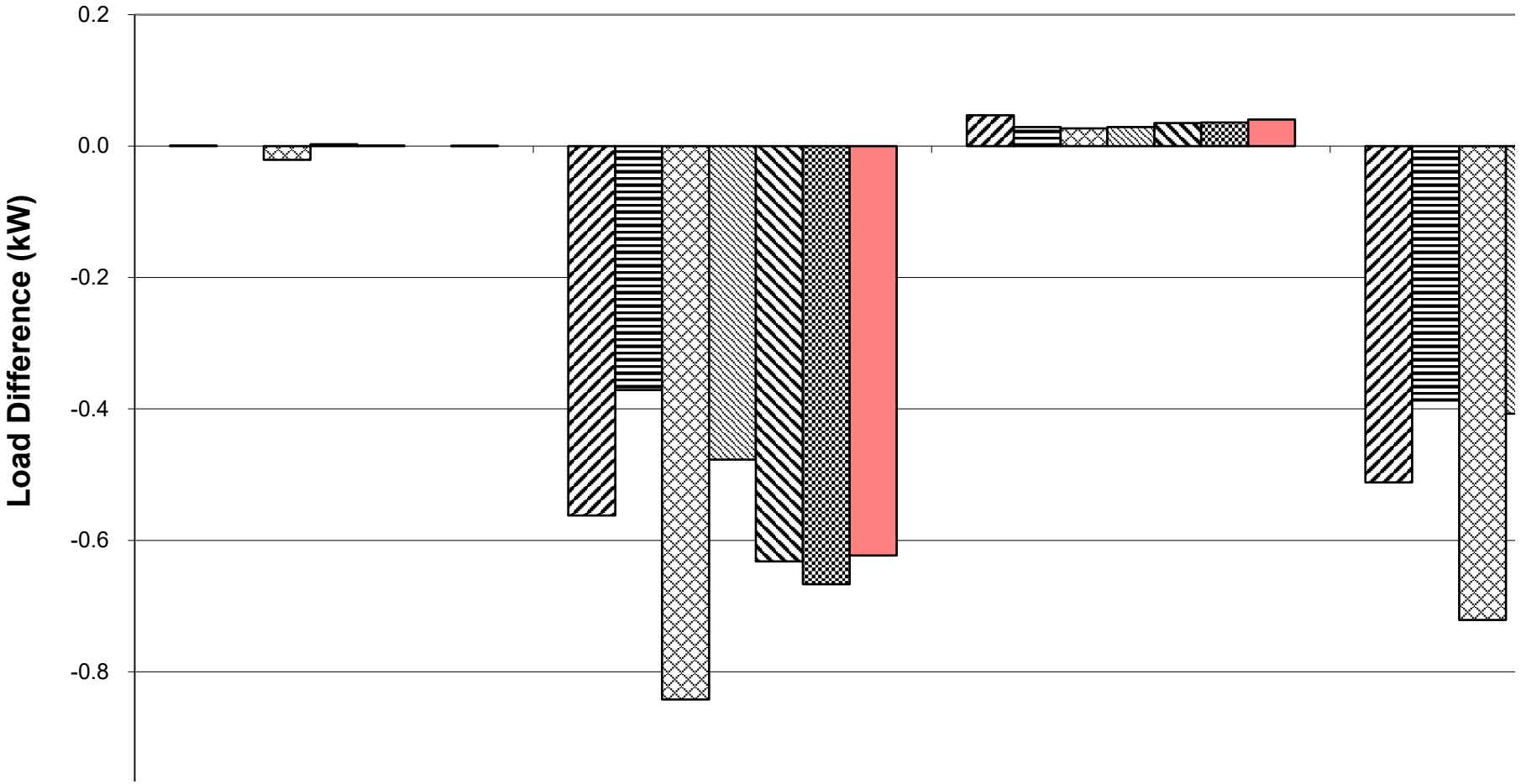

Figure B8-23. BESTEST BASIC Thermostat Setback (Delta) Annual Heating

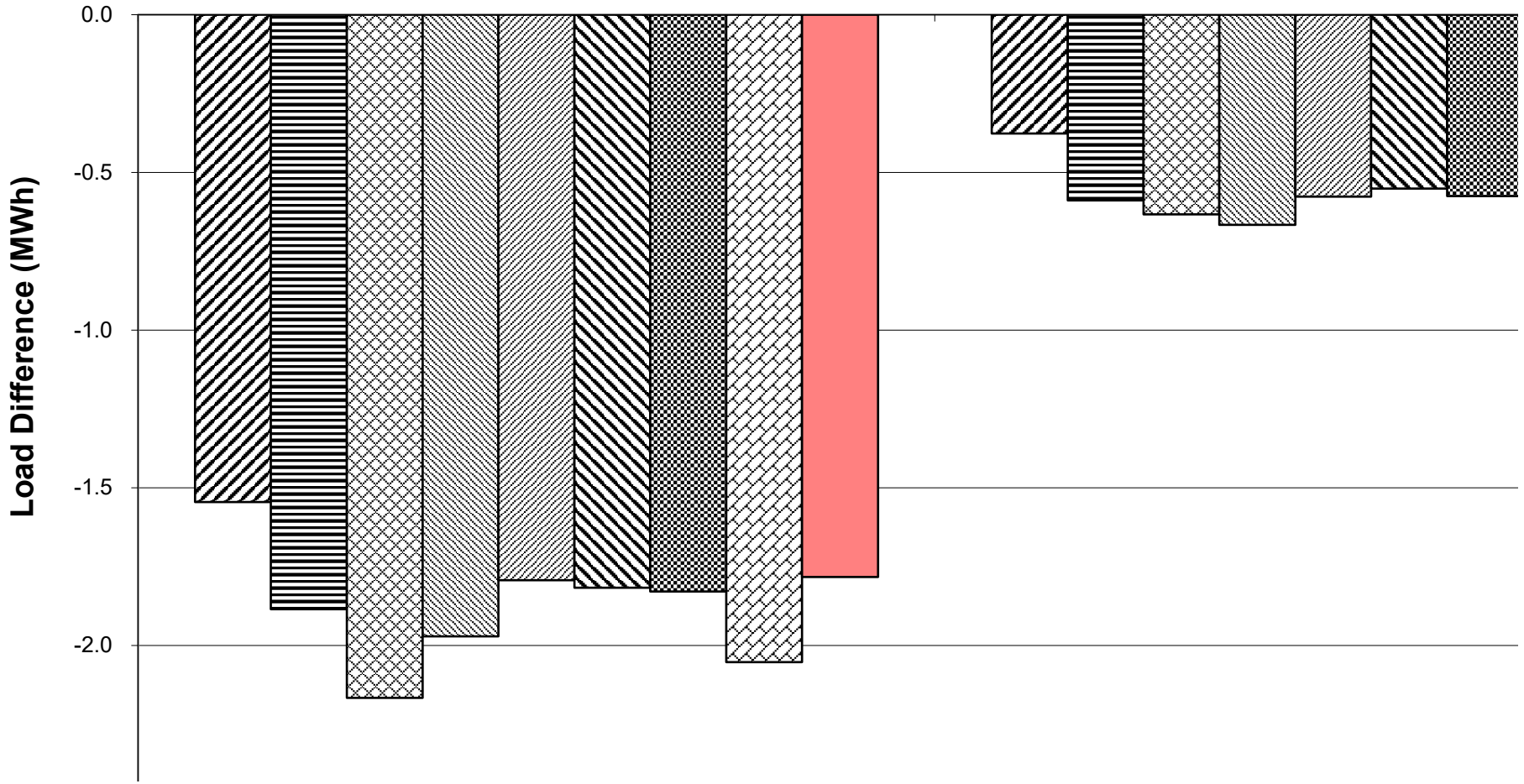

Figure B8-24. BESTEST BASIC Thermostat Setback (Delta) Peak Heating

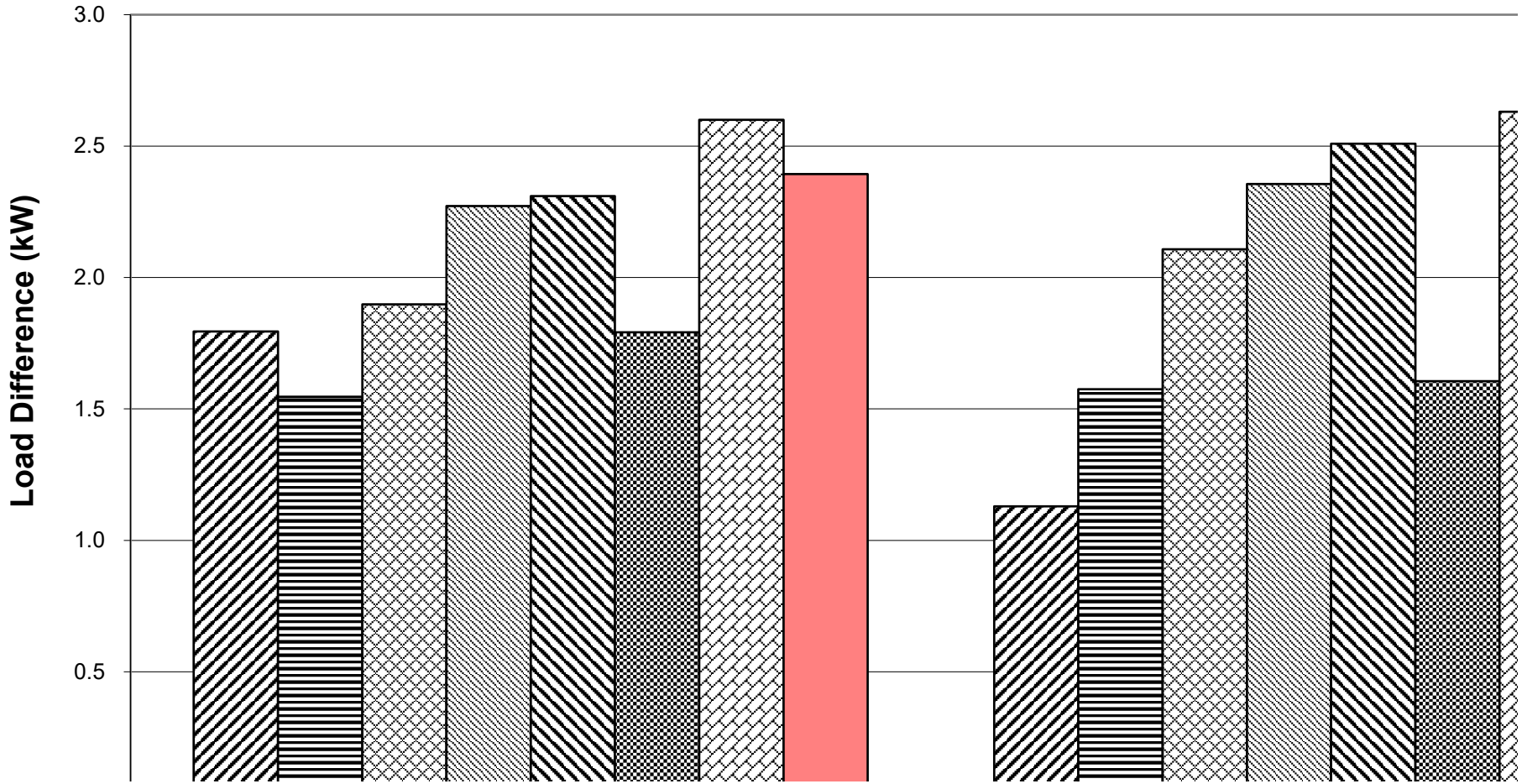

Figure B8-25. BESTEST BASIC Vent Cooling (Delta) Annual Sensible Cooling

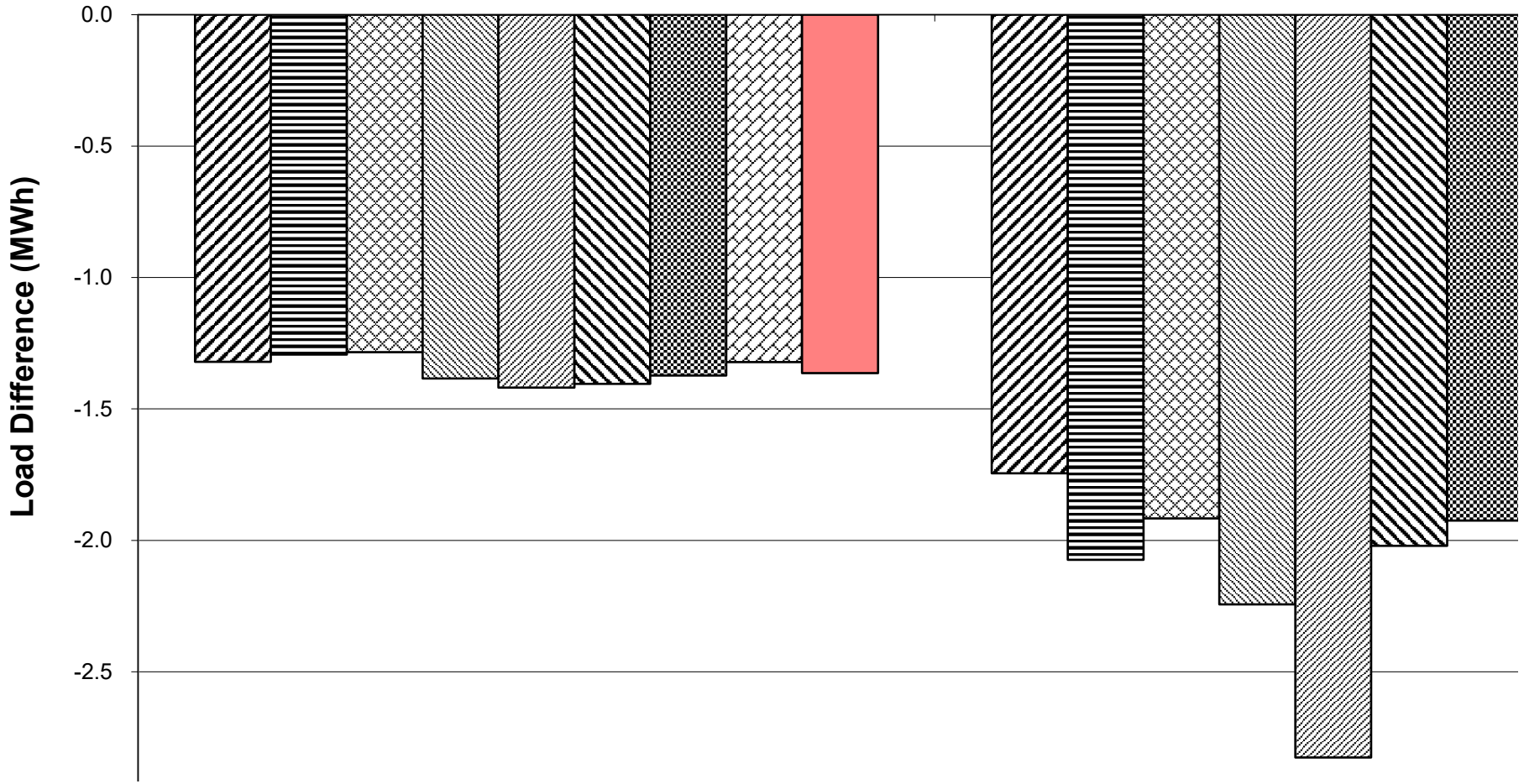

Figure B8-26. BESTEST BASIC Vent Cooling (Delta) Peak Sensible Cooling

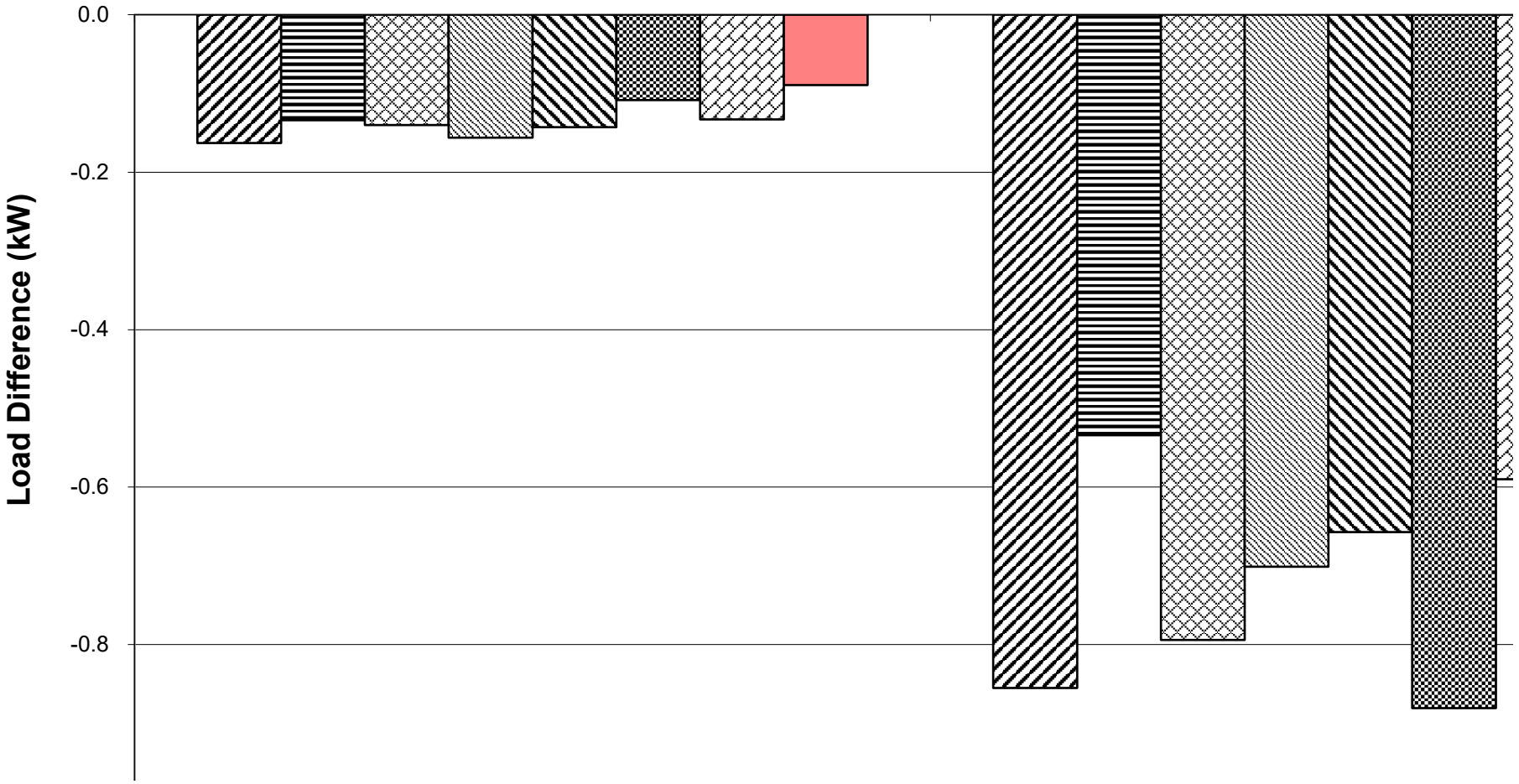

Figure B8-27. BESTEST BASIC Sunspace (Delta) Annual Heating and Sensible Cooling

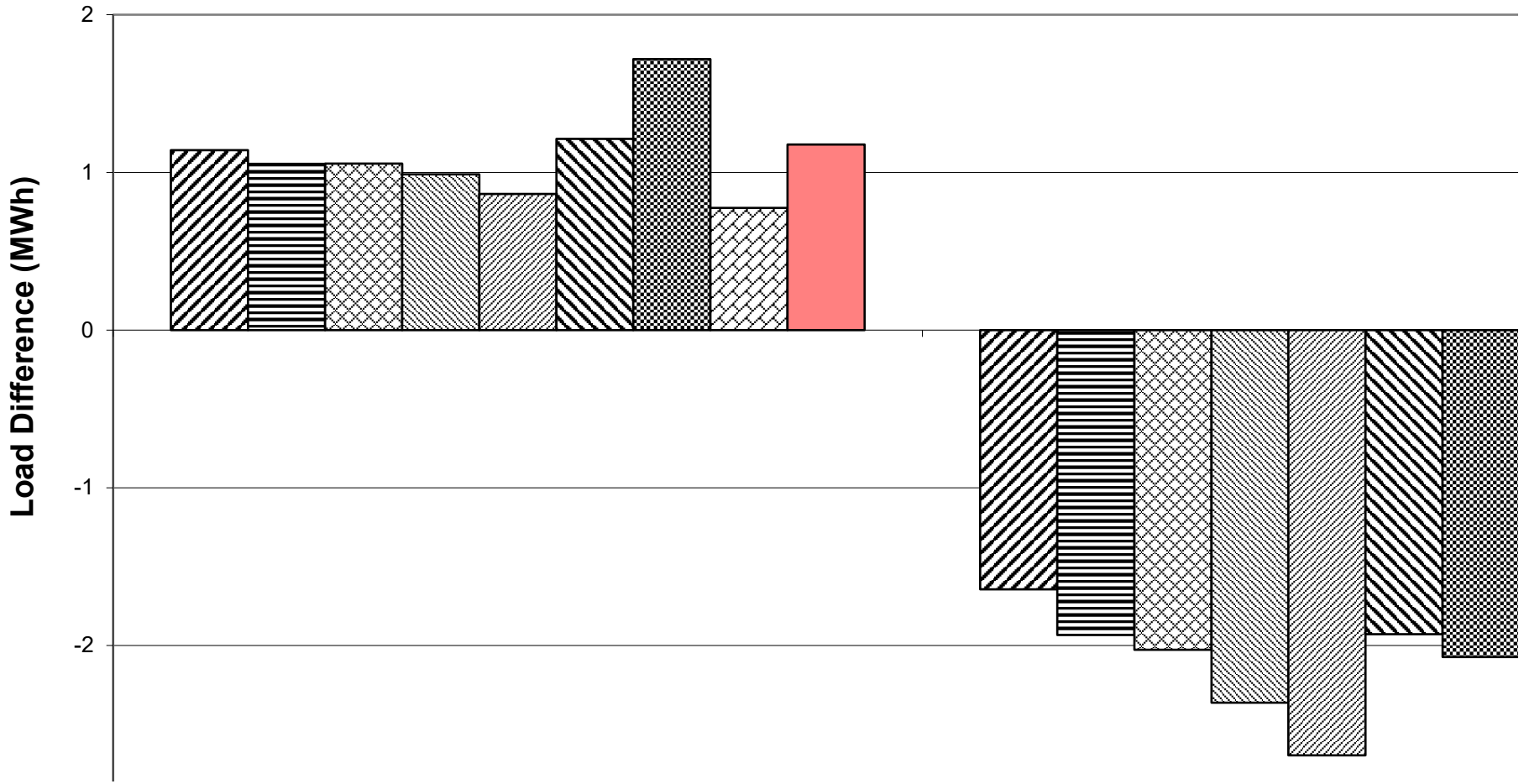

Figure B8-28. BESTEST BASIC Sunspace (Delta) Peak Heating and Sensible Cooling

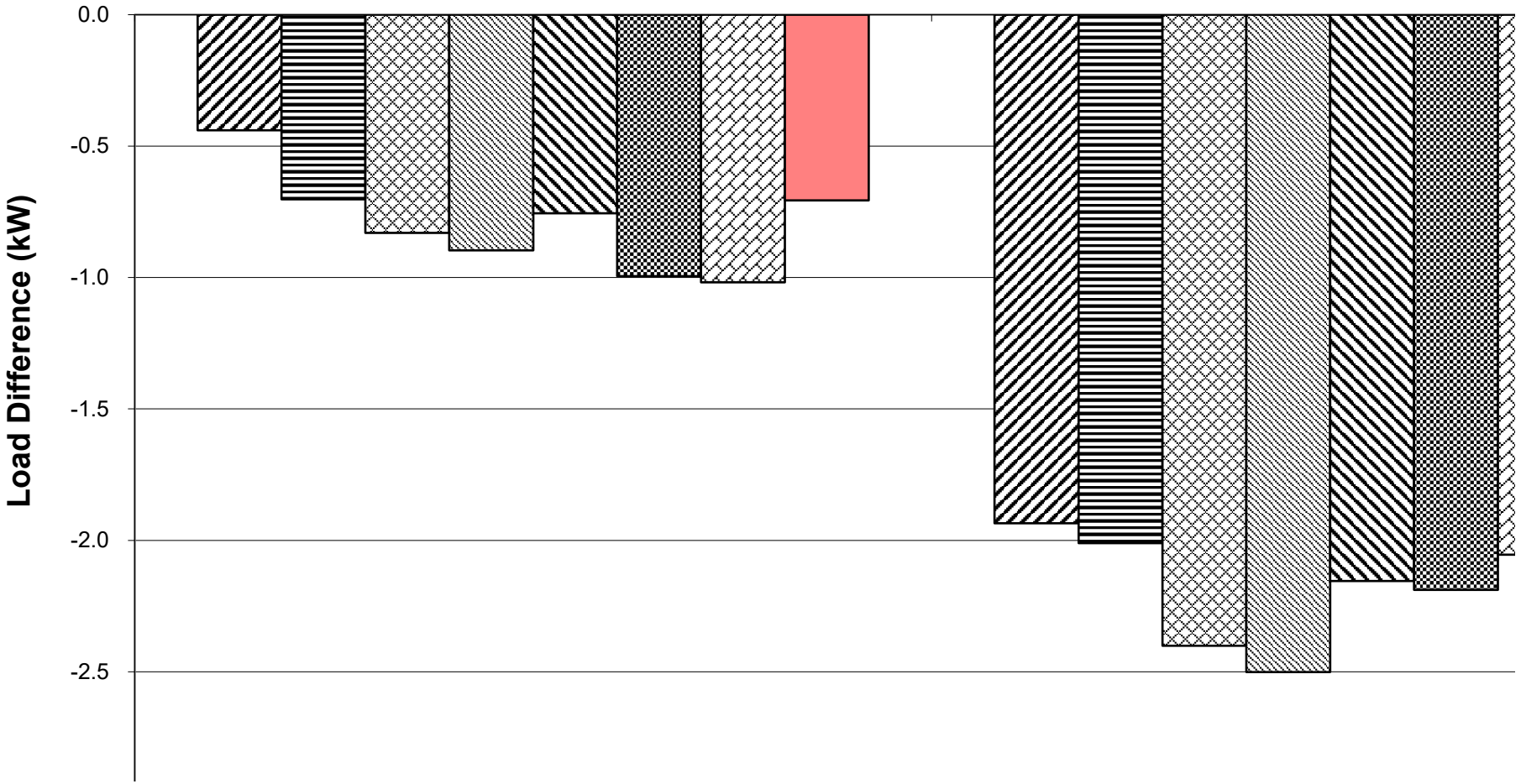

Figure B8-29. BESTEST BASIC AND IN-DEPTH
Mass Effect (Delta)
Annual Heating and Sensible Cooling

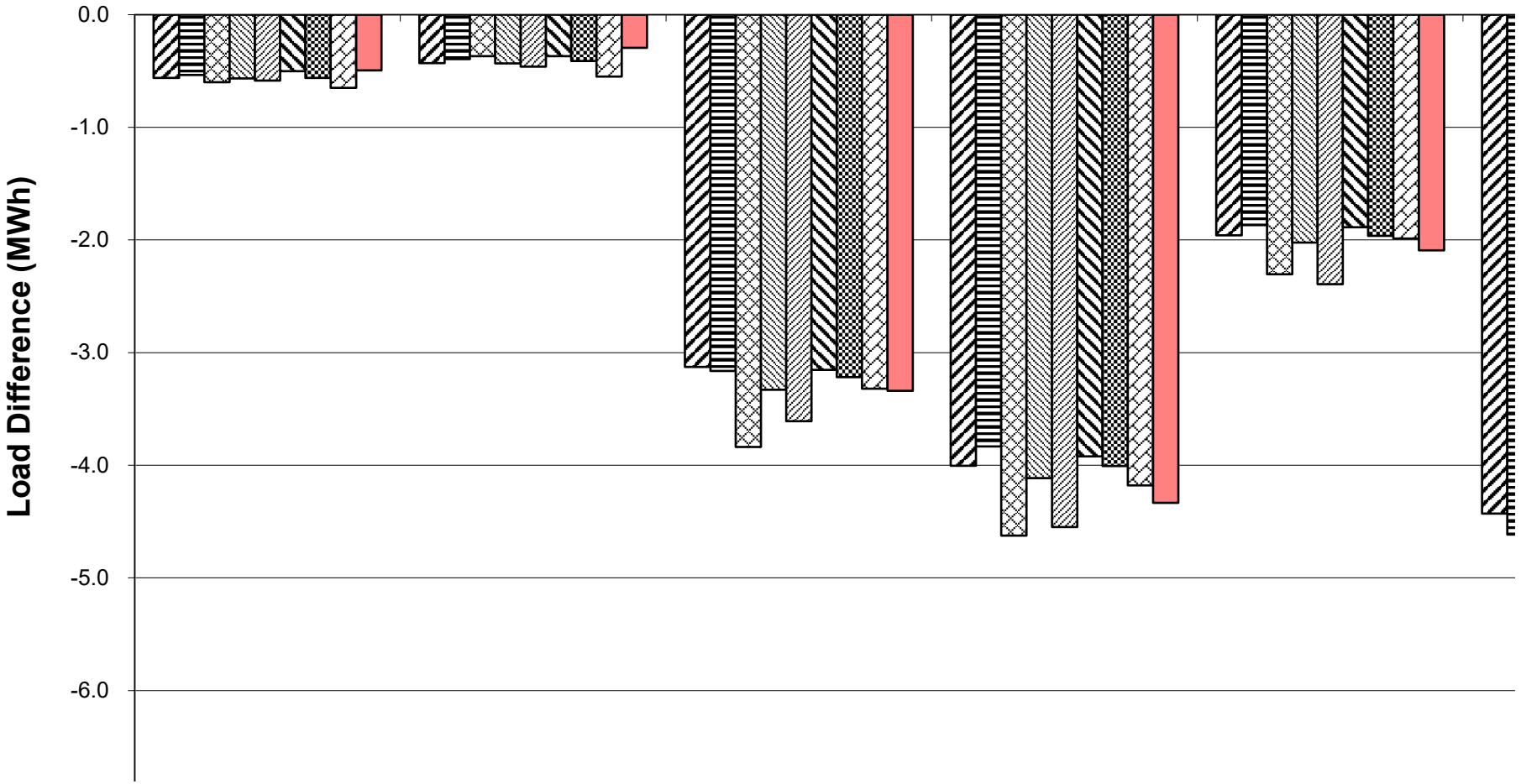

Figure B8-30. BESTEST BASIC AND IN-DEPTH
Mass Effect (Delta)
Peak Heating and Sensible Cooling

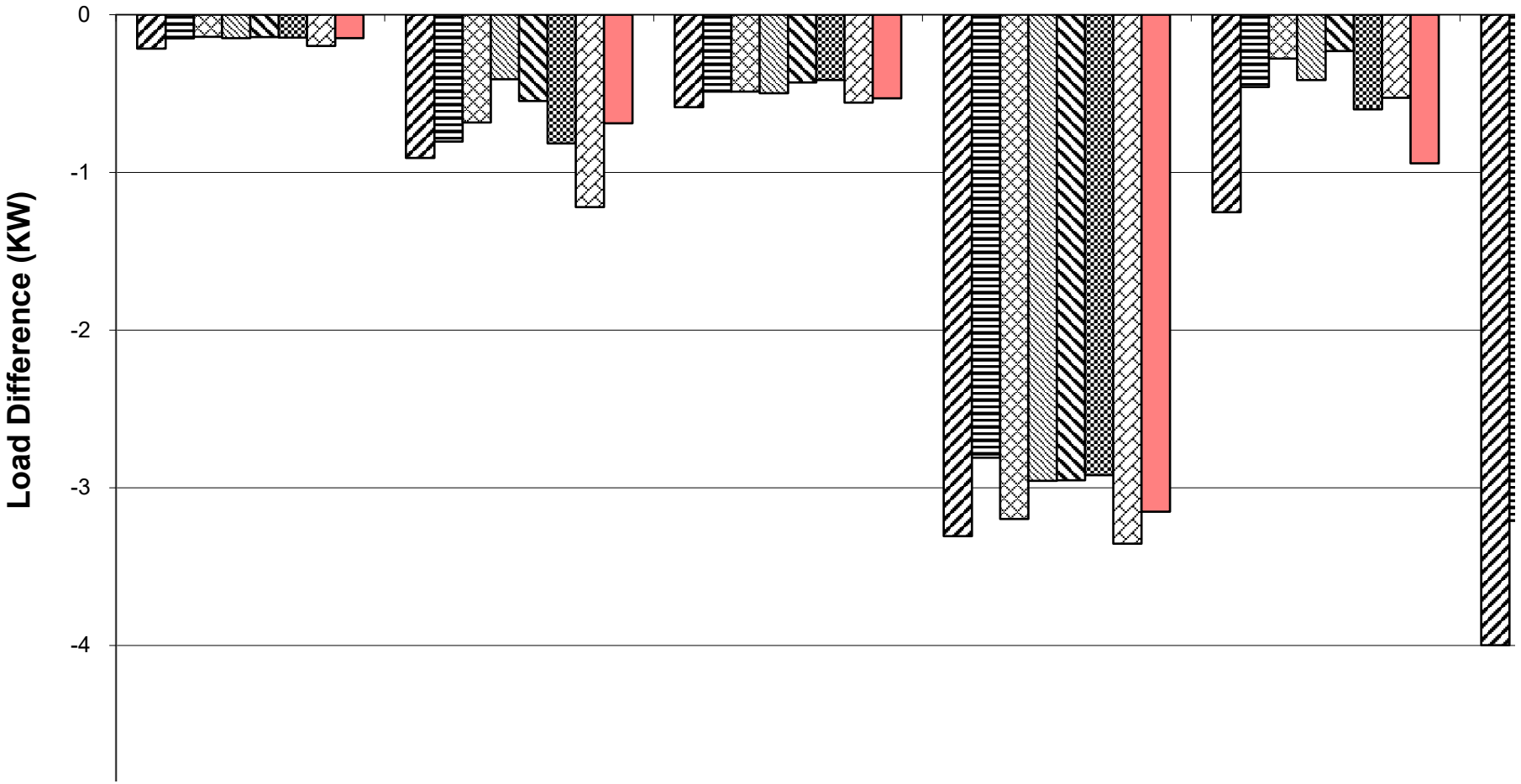

Figure B8-31. BESTEST IN-DEPTH
South Window (Delta)
Annual Heating and Sensible Cooling

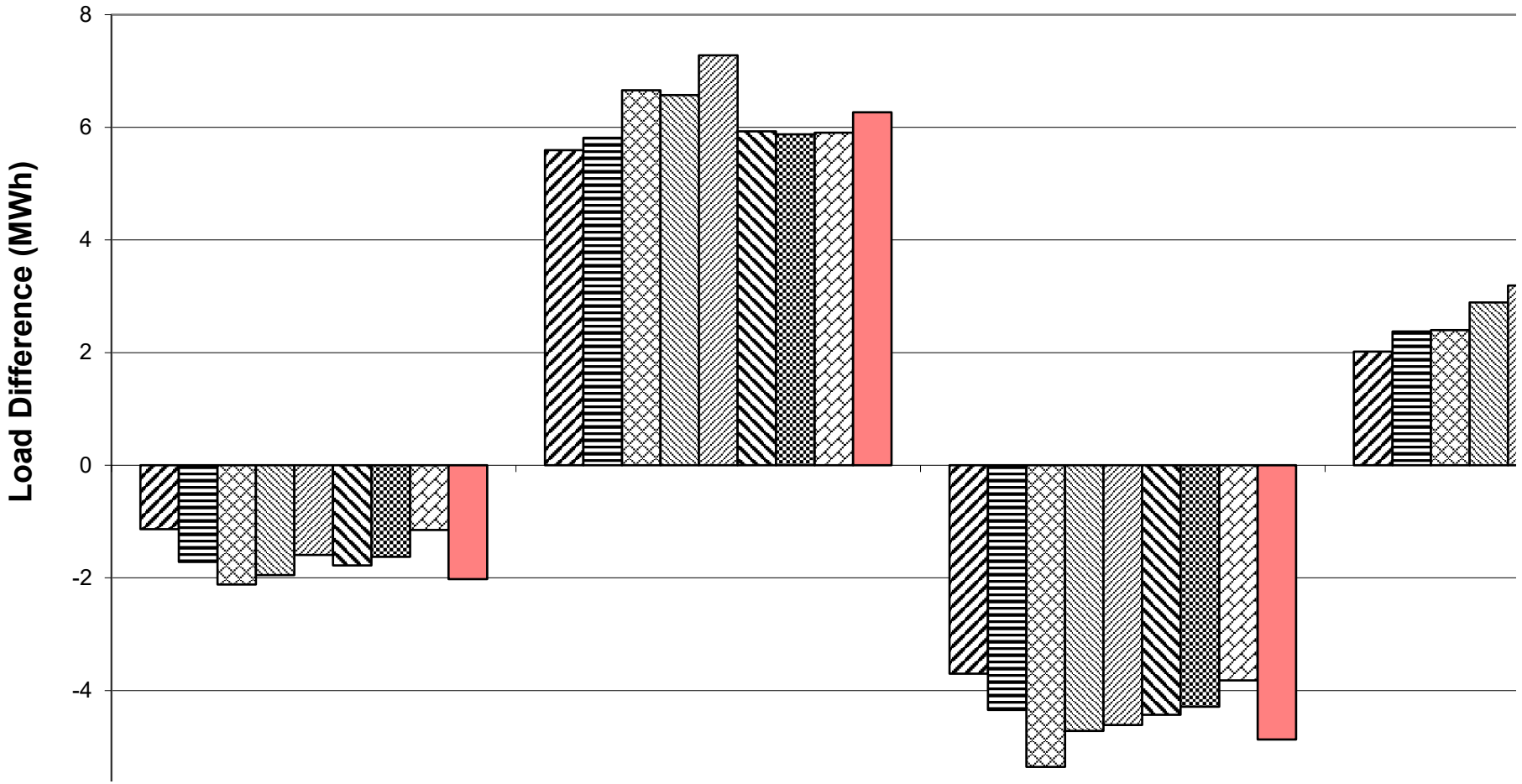

Figure B8-32. BESTEST IN-DEPTH
South Window (Delta)
Peak Heating and Sensible Cooling

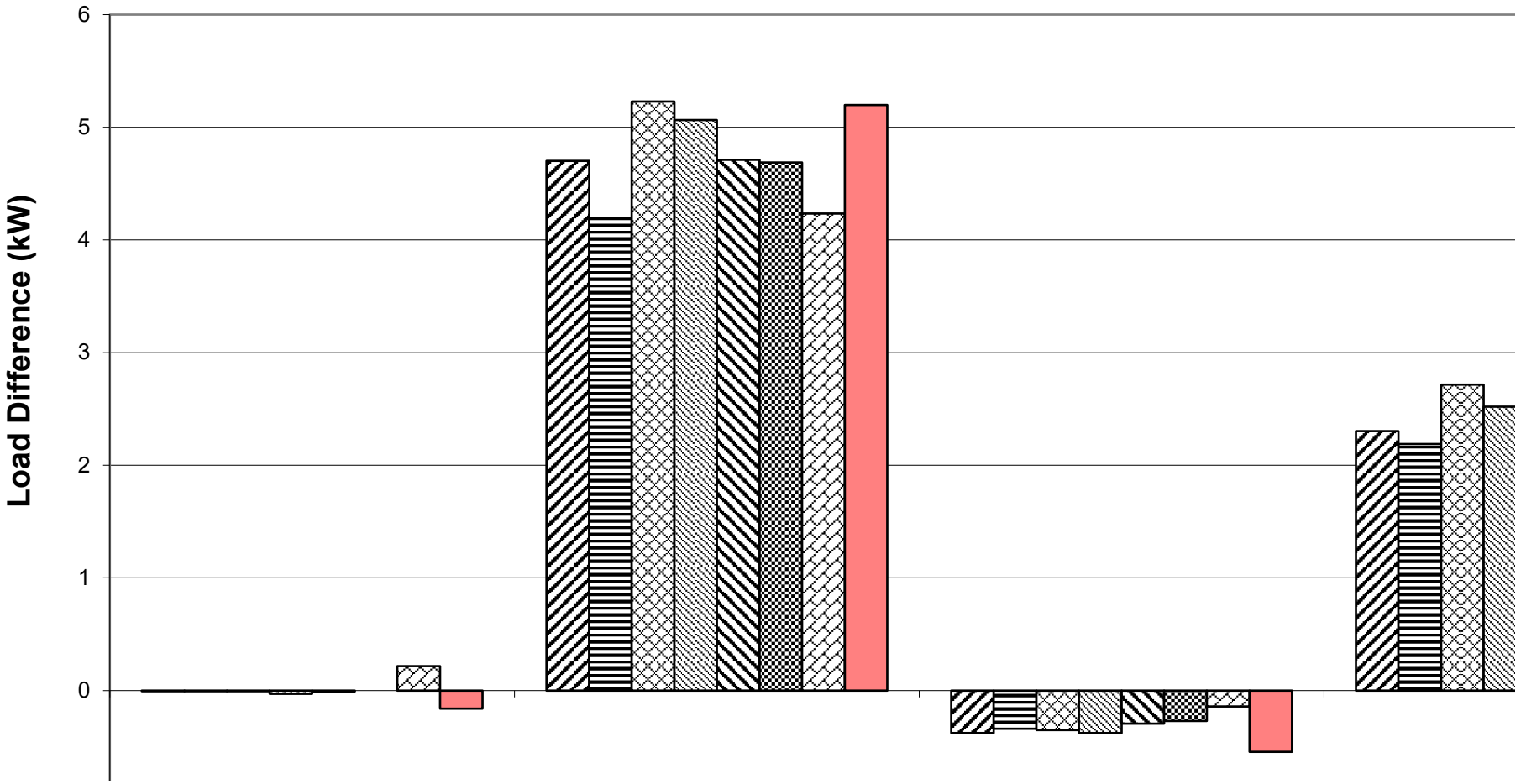

Figure B8-33. BESTEST IN-DEPTH Low Mass Annual Heating Cases 195 to 250

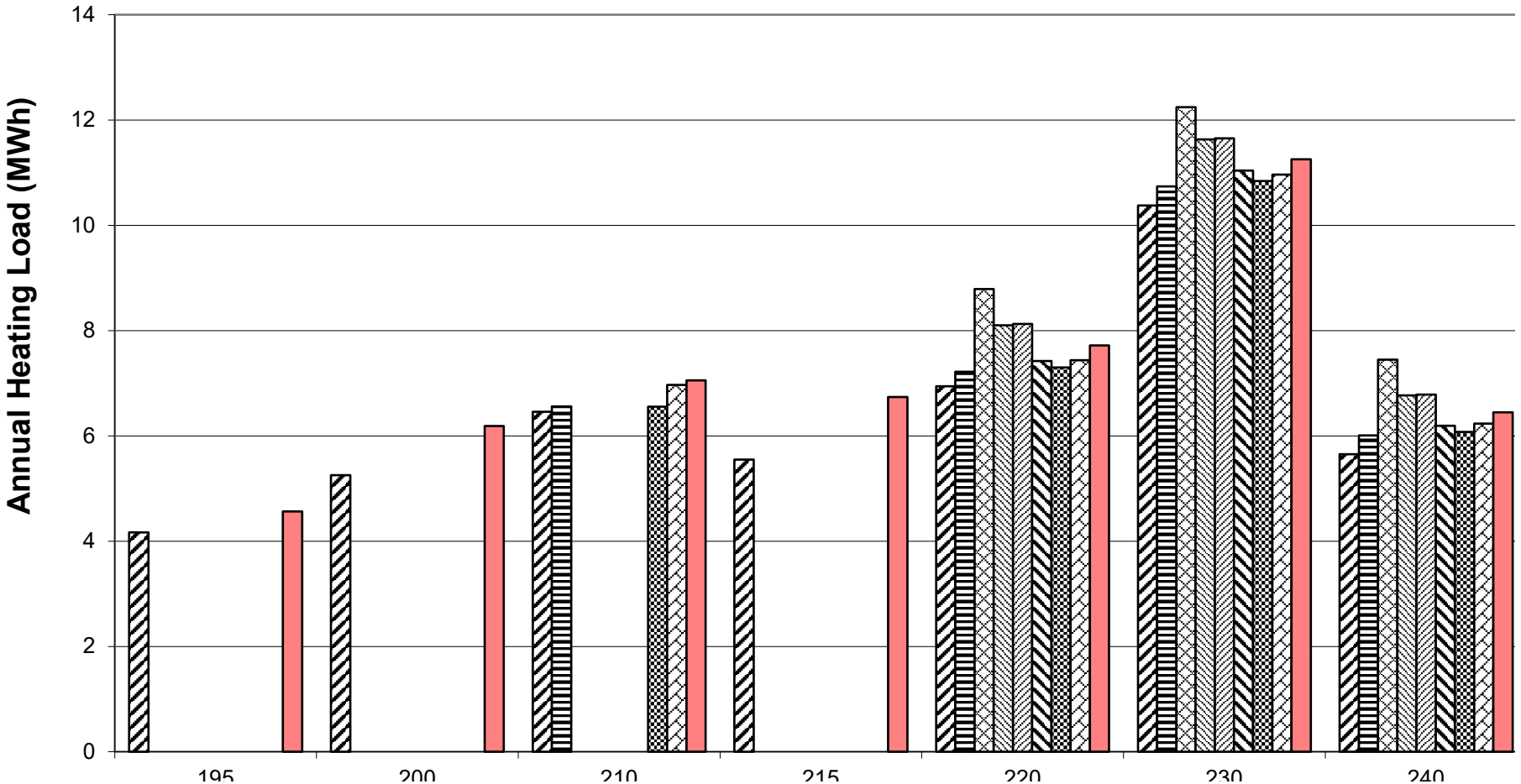

Figure B8-34. BESTEST IN-DEPTH Low Mass Annual Sensible Cooling Cases 195 to 250

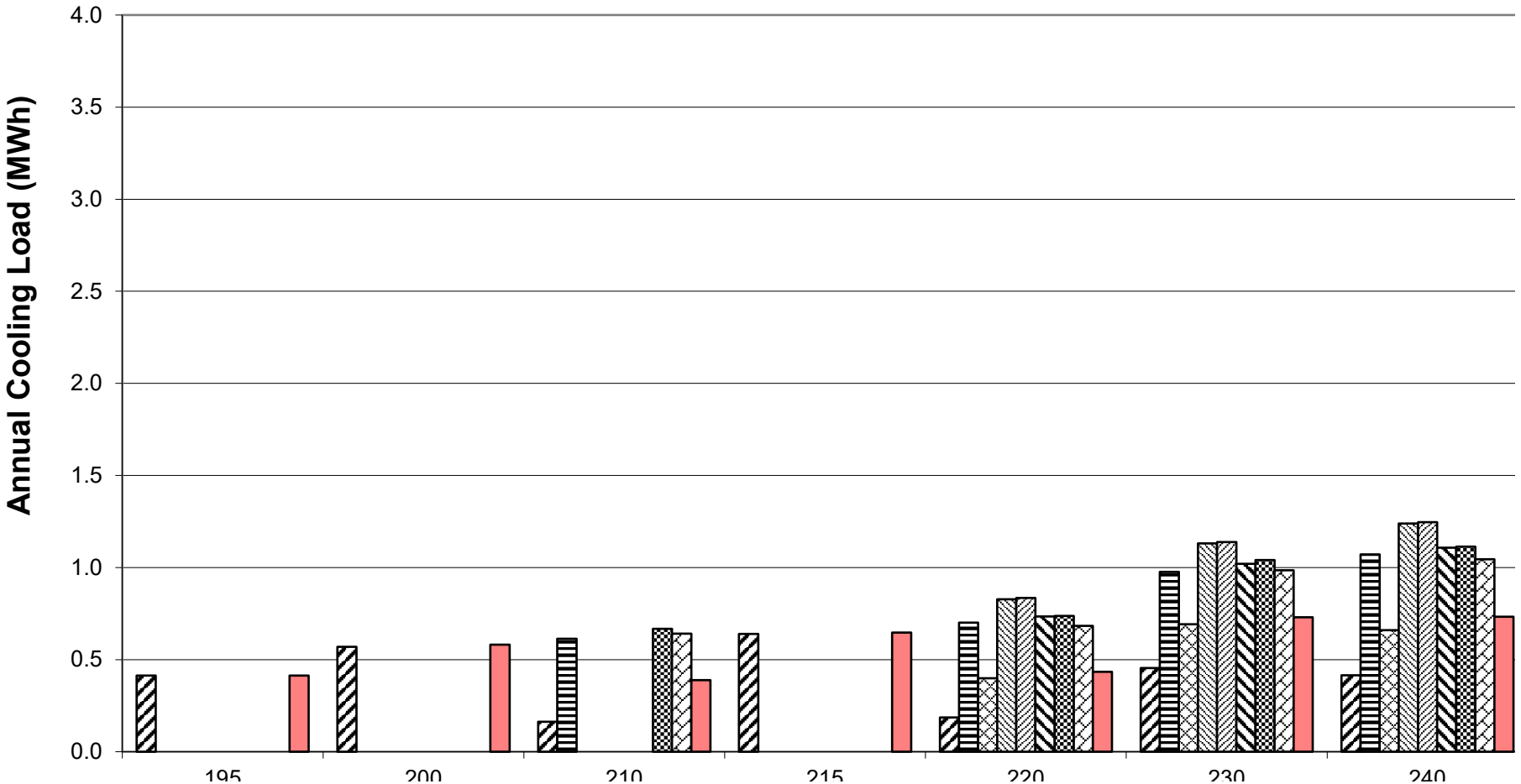

Figure B8-35. BESTEST IN-DEPTH Low Mass Peak Heating Cases 195 to 250

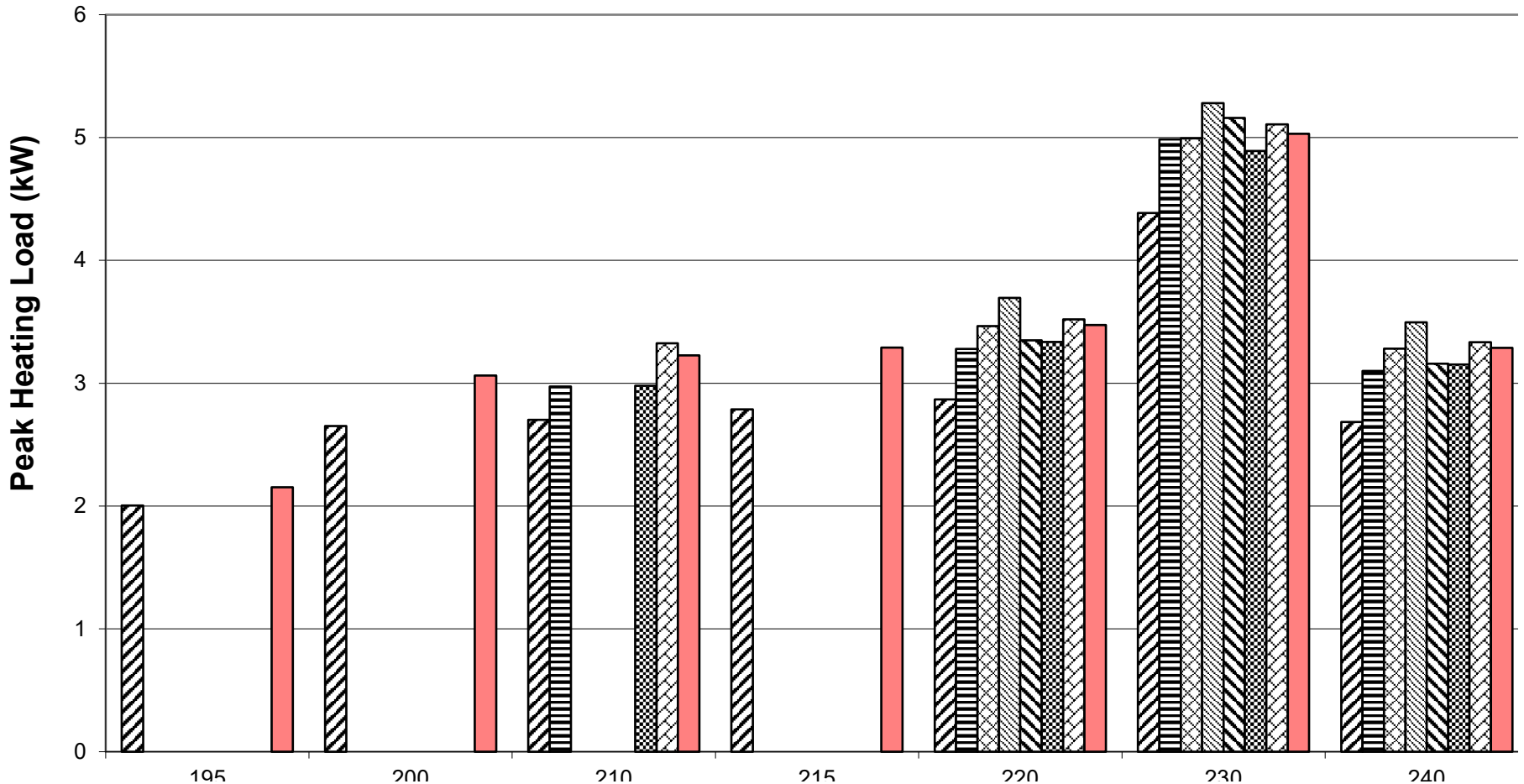

Figure B8-36. BESTEST IN-DEPTH Low Mass Peak Sensible Cooling Cases 195 to 250

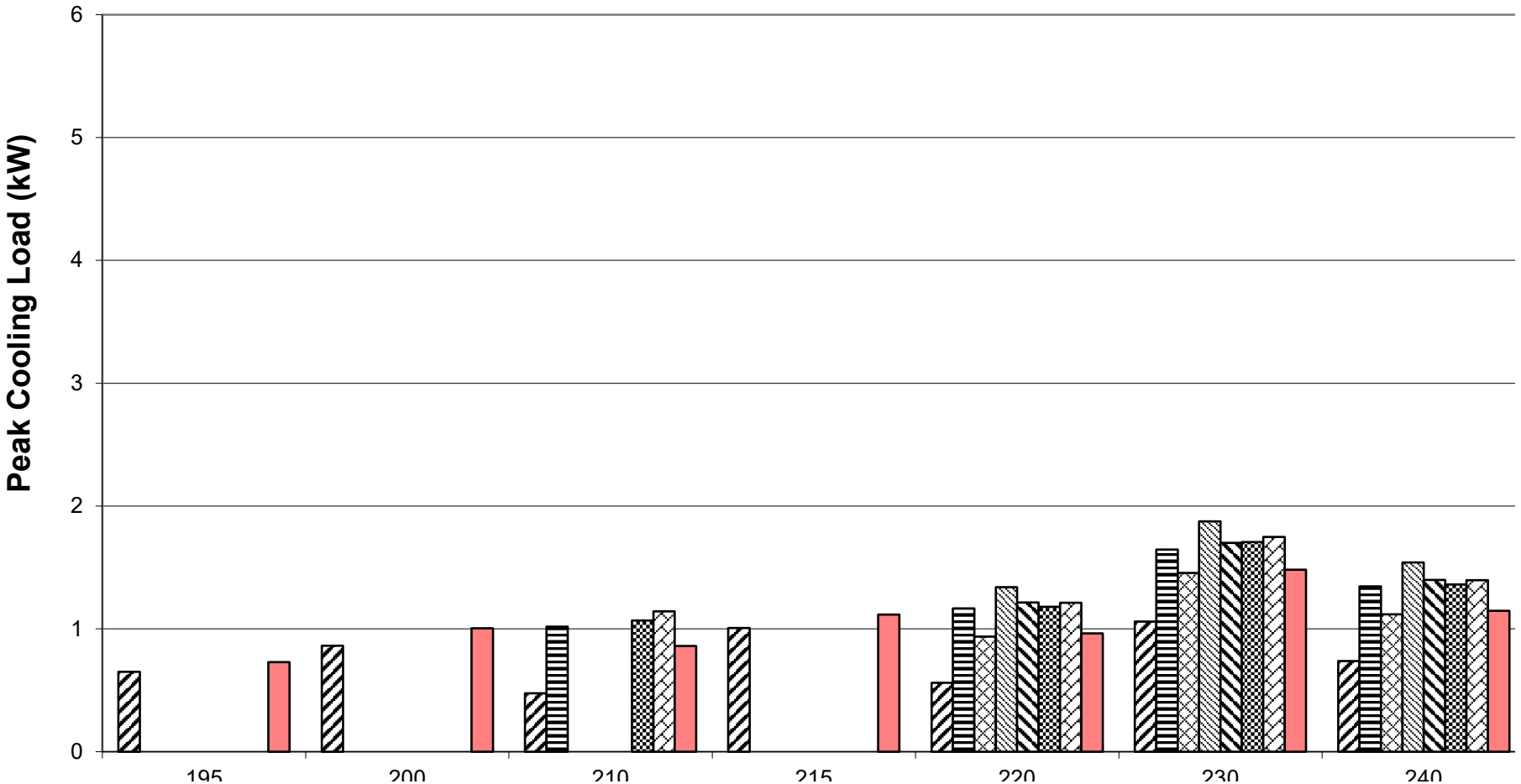

Figure B8-37. BESTEST IN-DEPTH Low Mass Annual Heating Cases 270 to 320

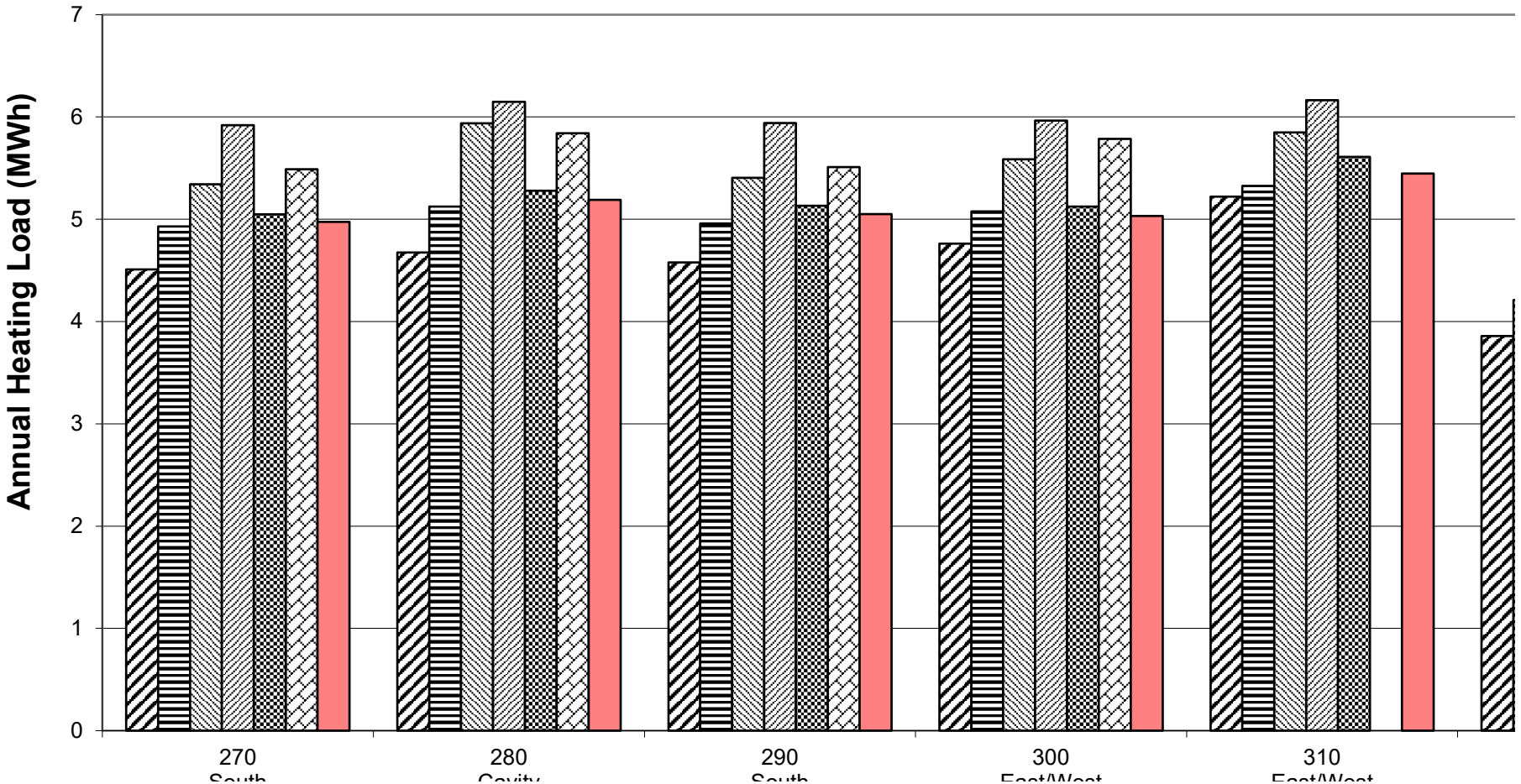

Figure B8-38. BESTEST IN-DEPTH Low Mass Annual Sensible Cooling Cases 270 to 320

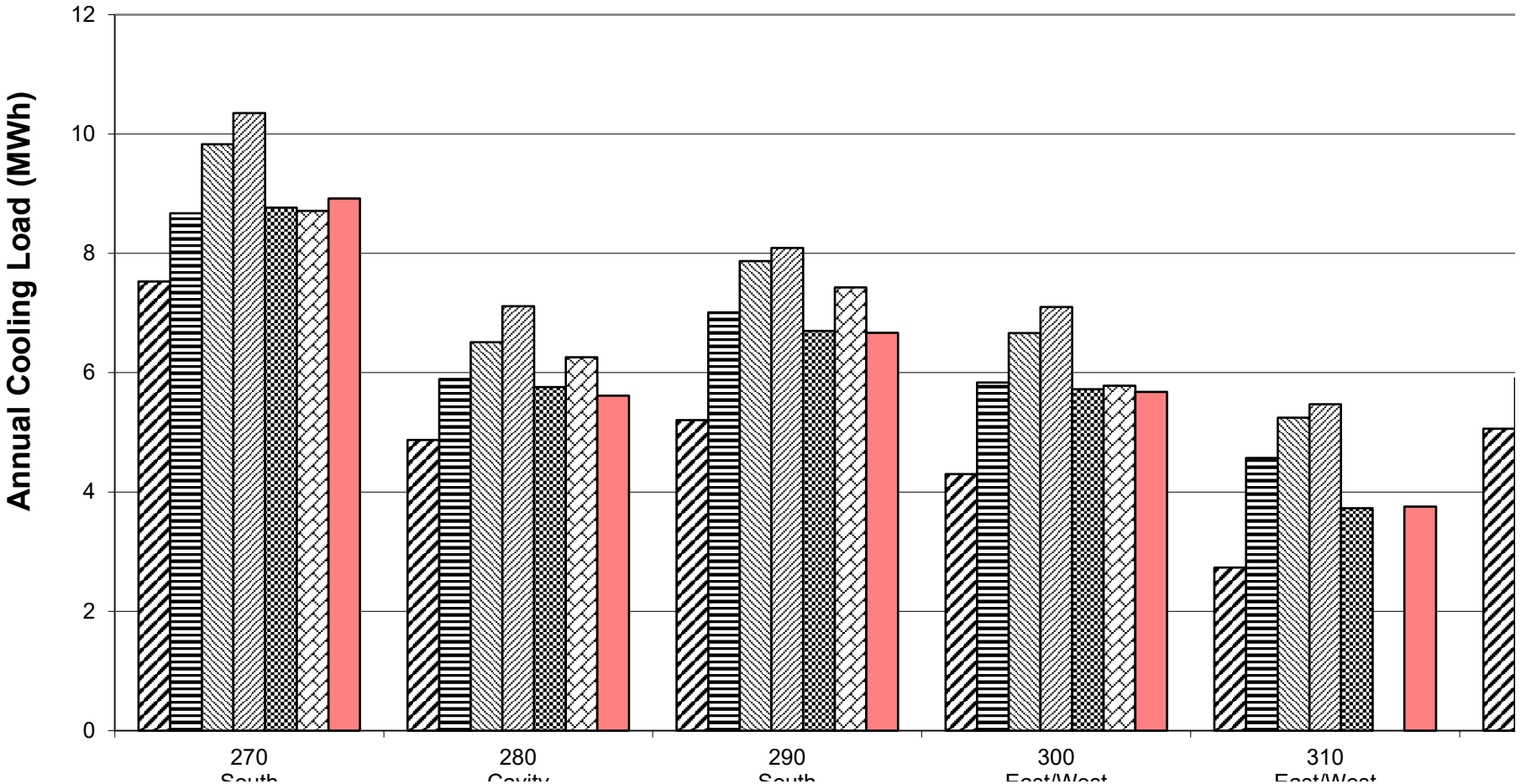

Figure B8-39. BESTEST IN-DEPTH
Low Mass Peak Heating
Cases 270 to 320

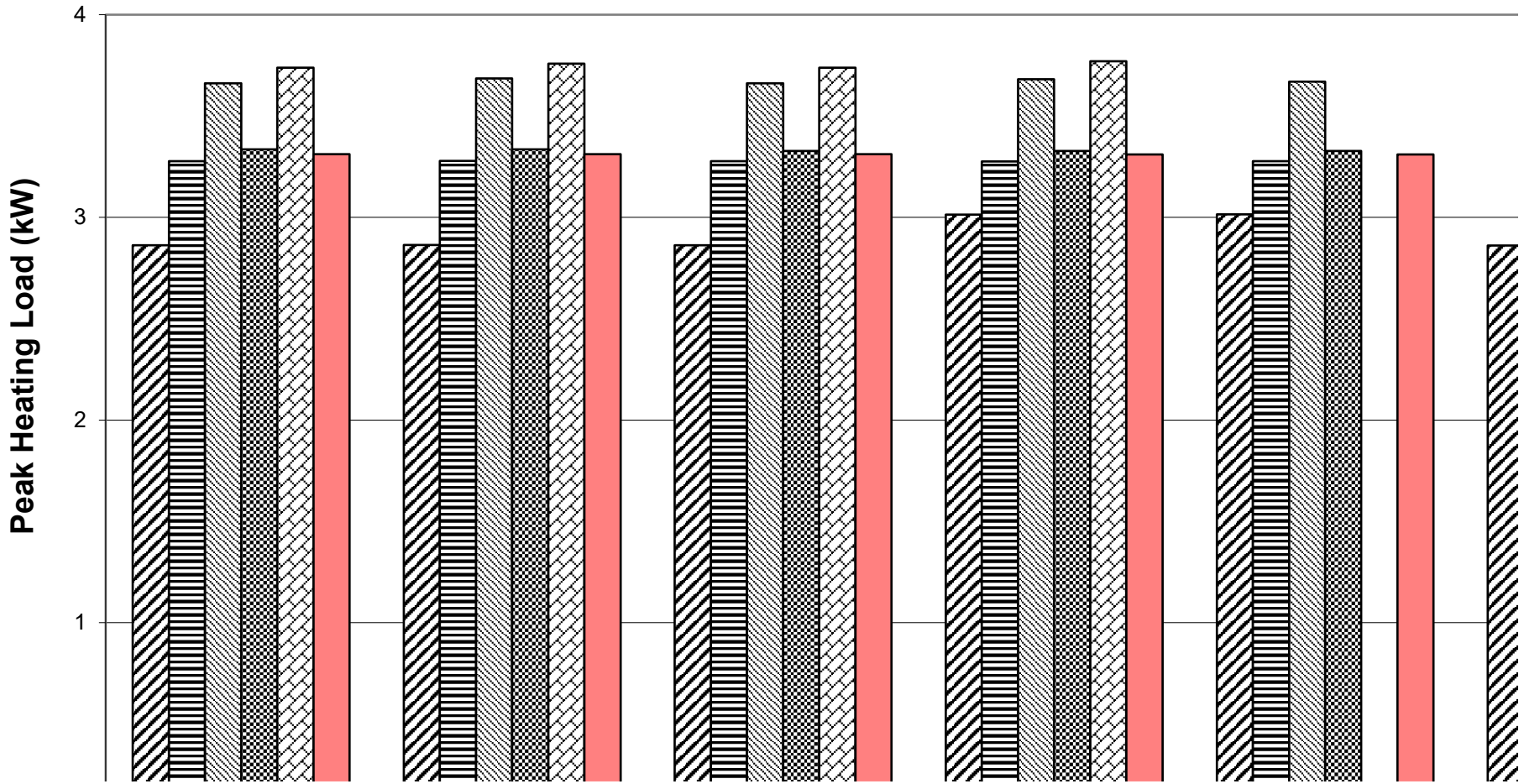

Figure B8-40. BESTEST IN-DEPTH Low Mass Peak Sensible Cooling Cases 270 to 320

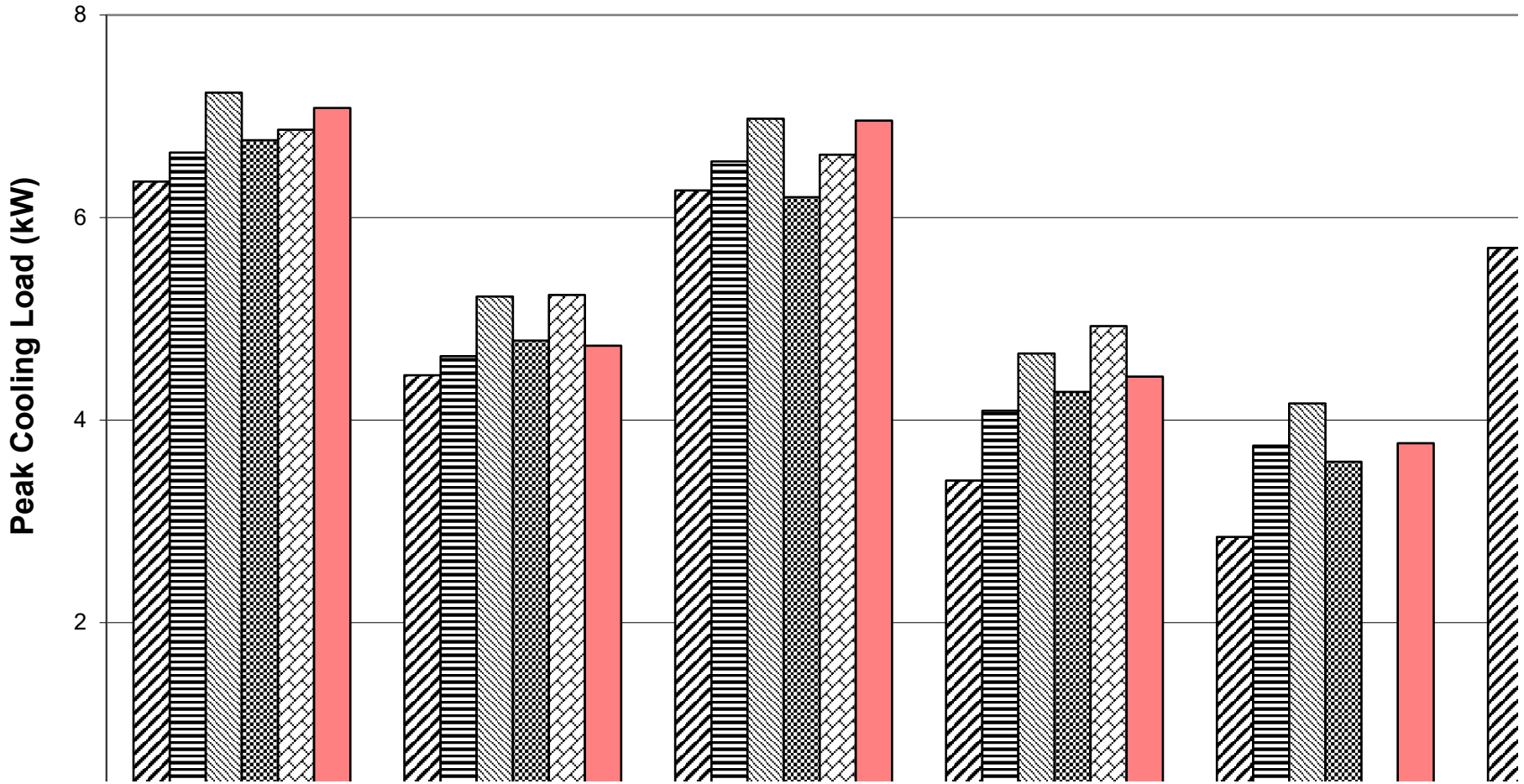

Figure B8-41. BESTEST IN-DEPTH
Cases 195 to 220 (Delta)
Annual Heating and Sensible Cooling

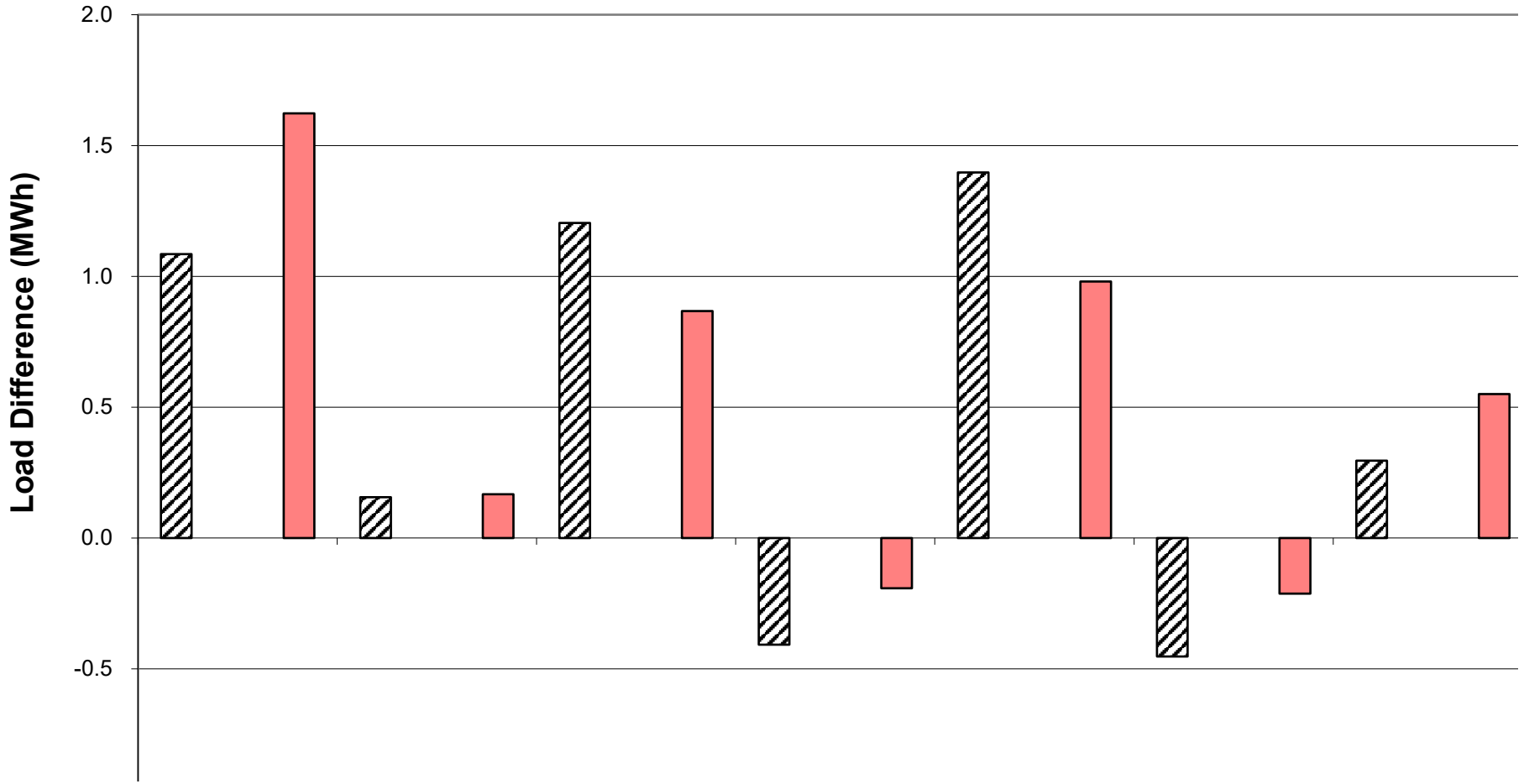

Figure B8-42. BESTEST IN-DEPTH Cases 195 to 220 (Delta) Peak Heating and Sensible Cooling

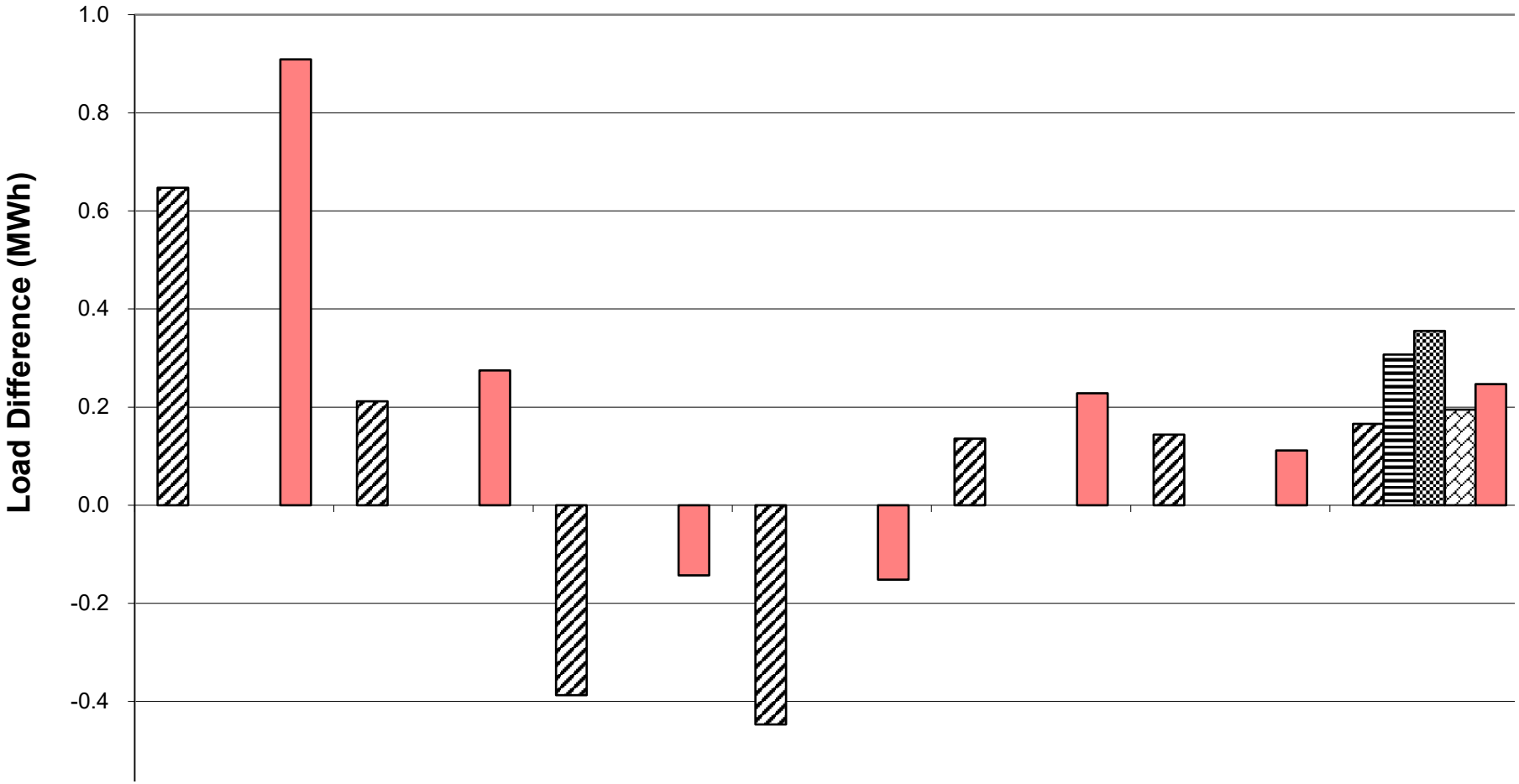

Figure B8-43. BESTEST IN-DEPTH Cases 220 to 270 (Delta) Annual Heating and Sensible Cooling

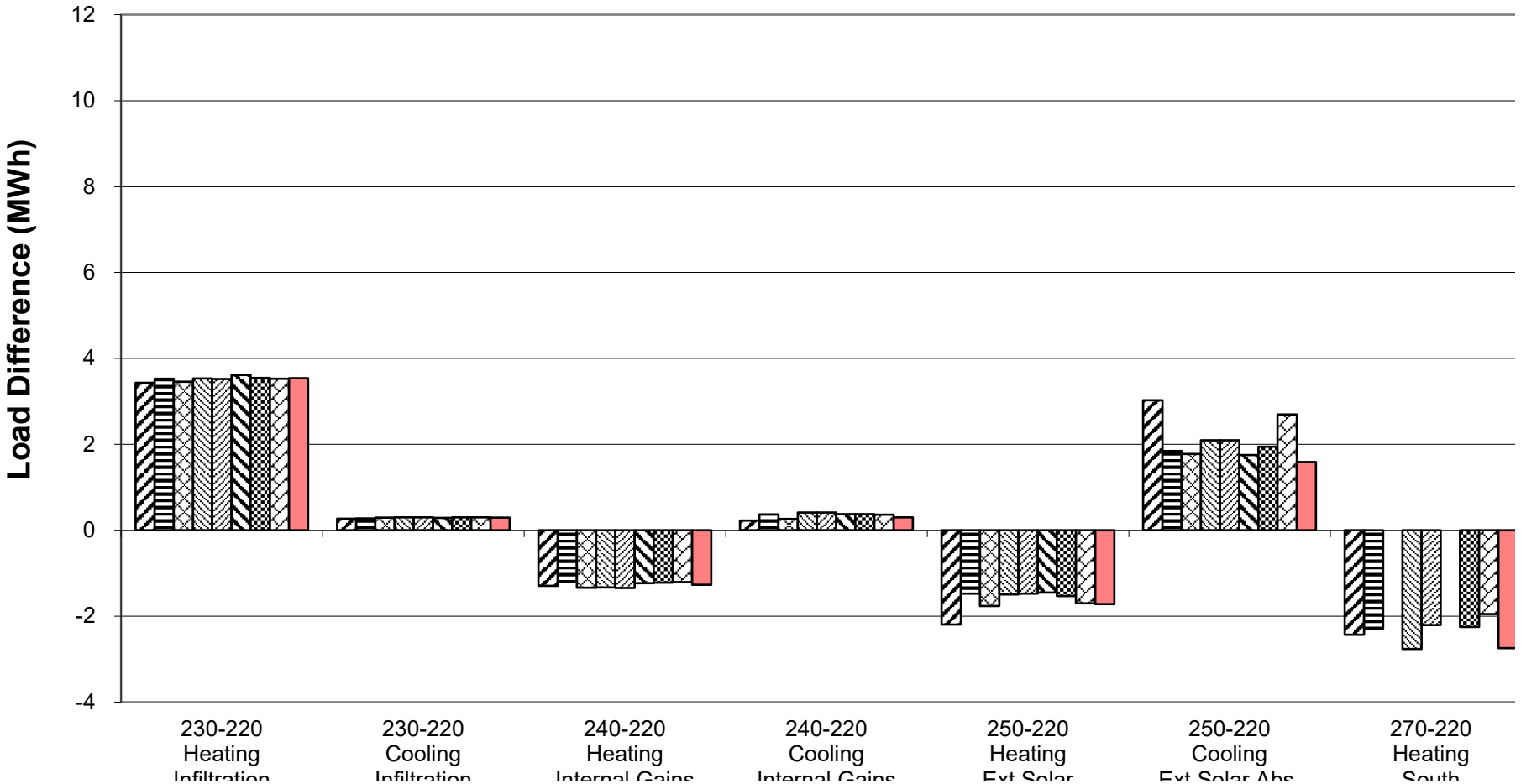

Figure B8-44. BESTEST IN-DEPTH Cases 220 to 270 (Delta) Peak Heating and Sensible Cooling

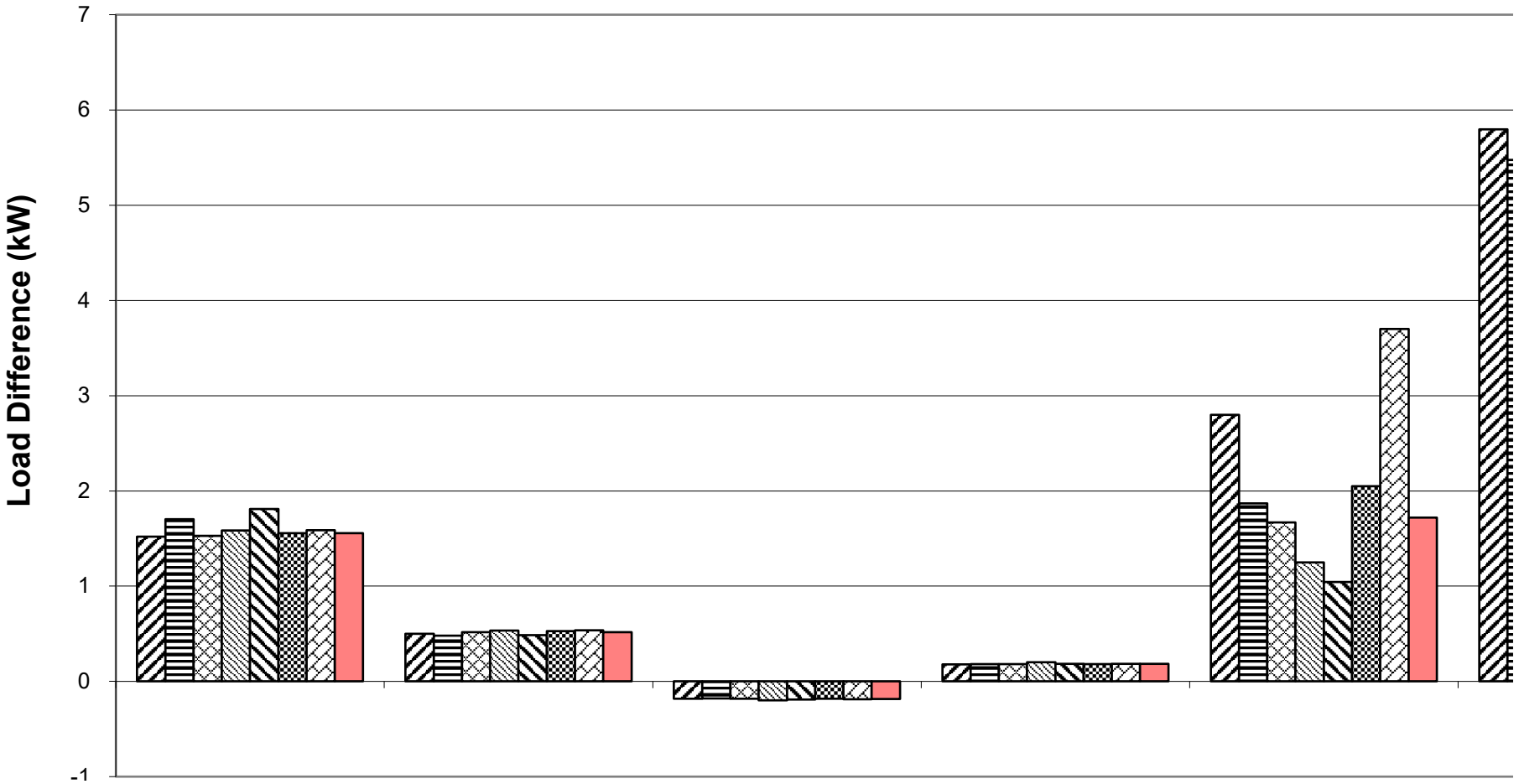

Figure B8-45. BESTEST IN-DEPTH Cases 270 to 320 (Delta) Annual Heating and Sensible Cooling

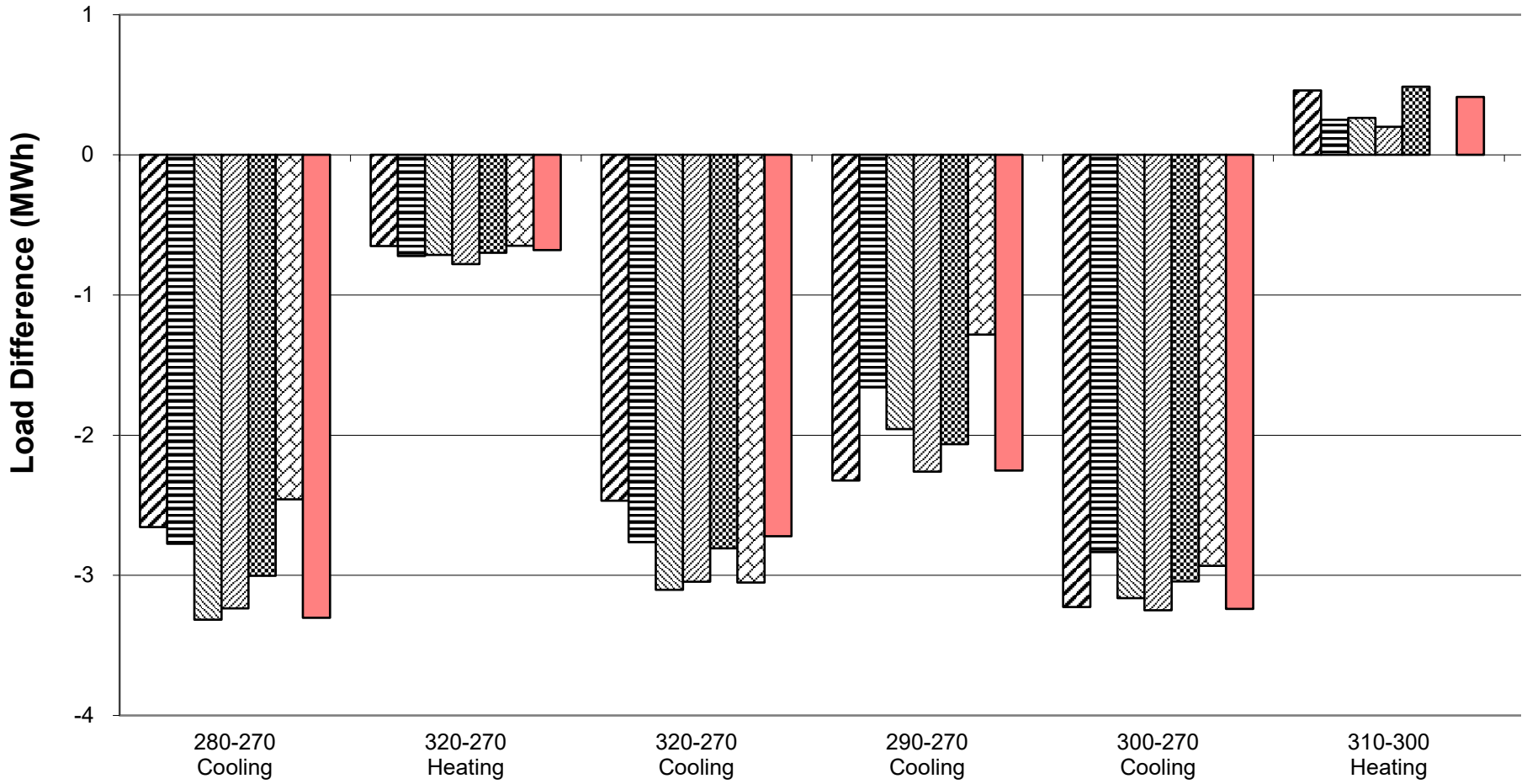

Figure B8-46. BESTEST IN-DEPTH Cases 270 to 320 (Delta) Peak Sensible Cooling

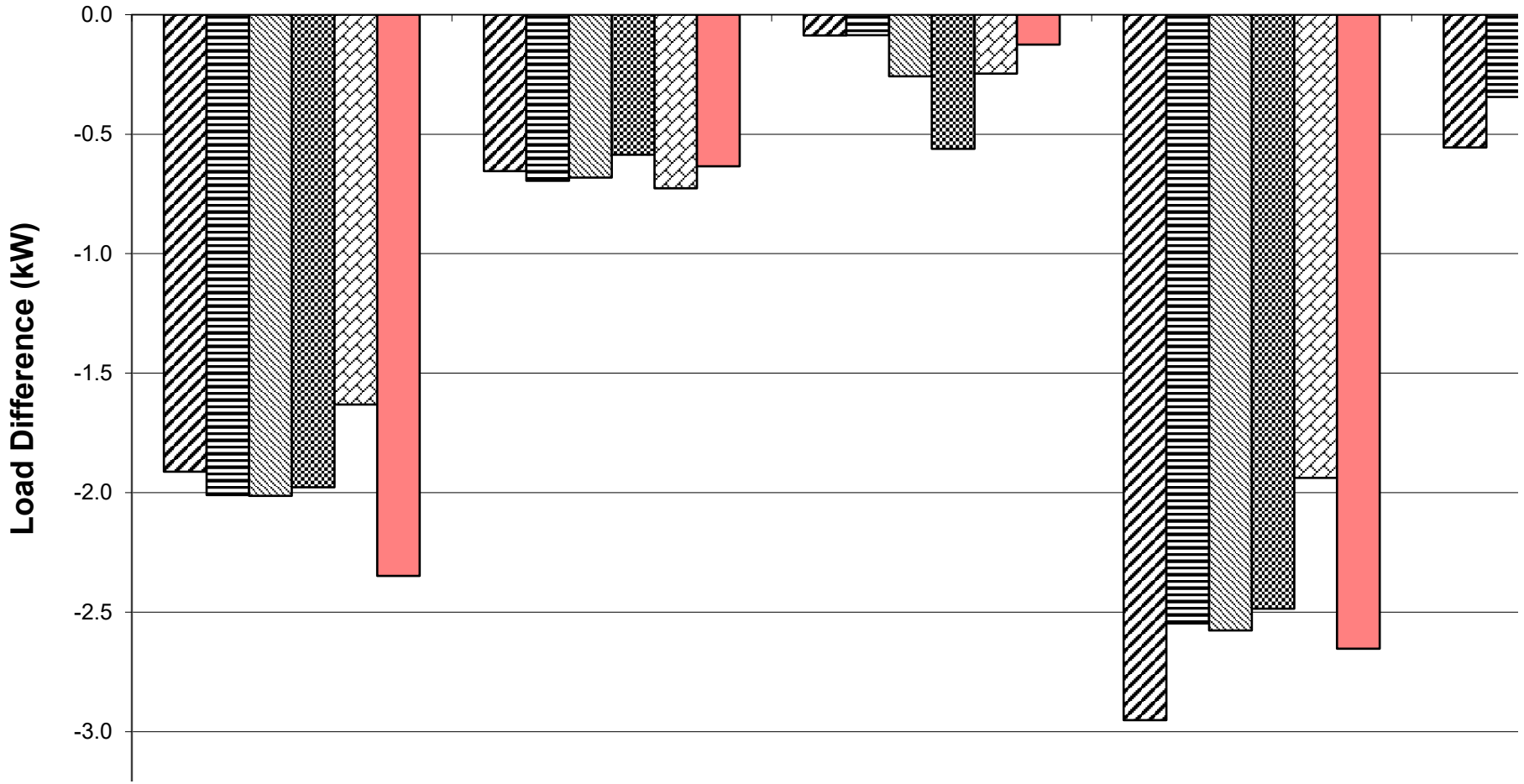

Figure B8-47. BESTEST IN-DEPTH
Annual Heating
Cases 395 to 440, 800, 810

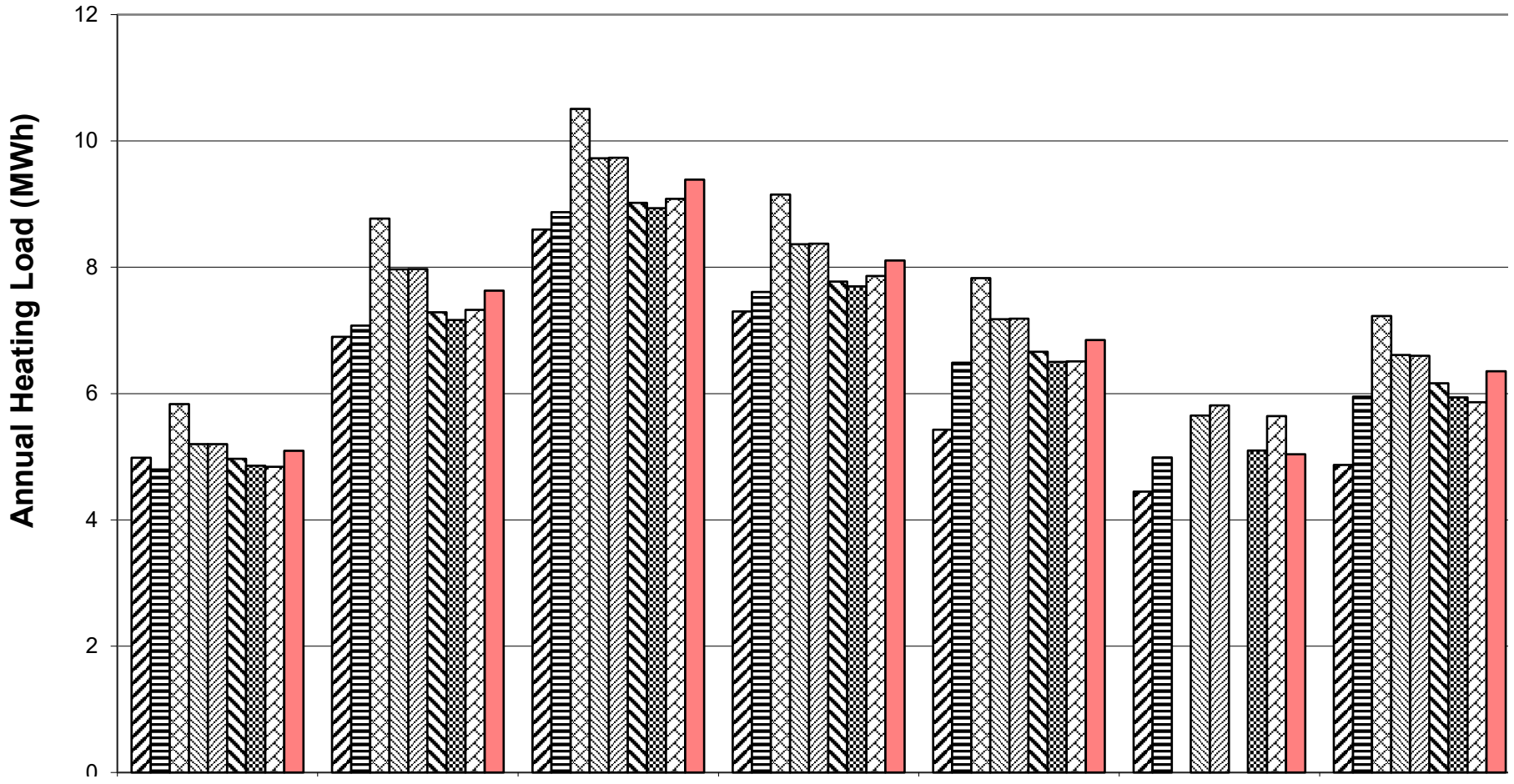

Figure B8-48. BESTEST IN-DEPTH
Annual Sensible Cooling
Cases 395 to 440, 800, 810

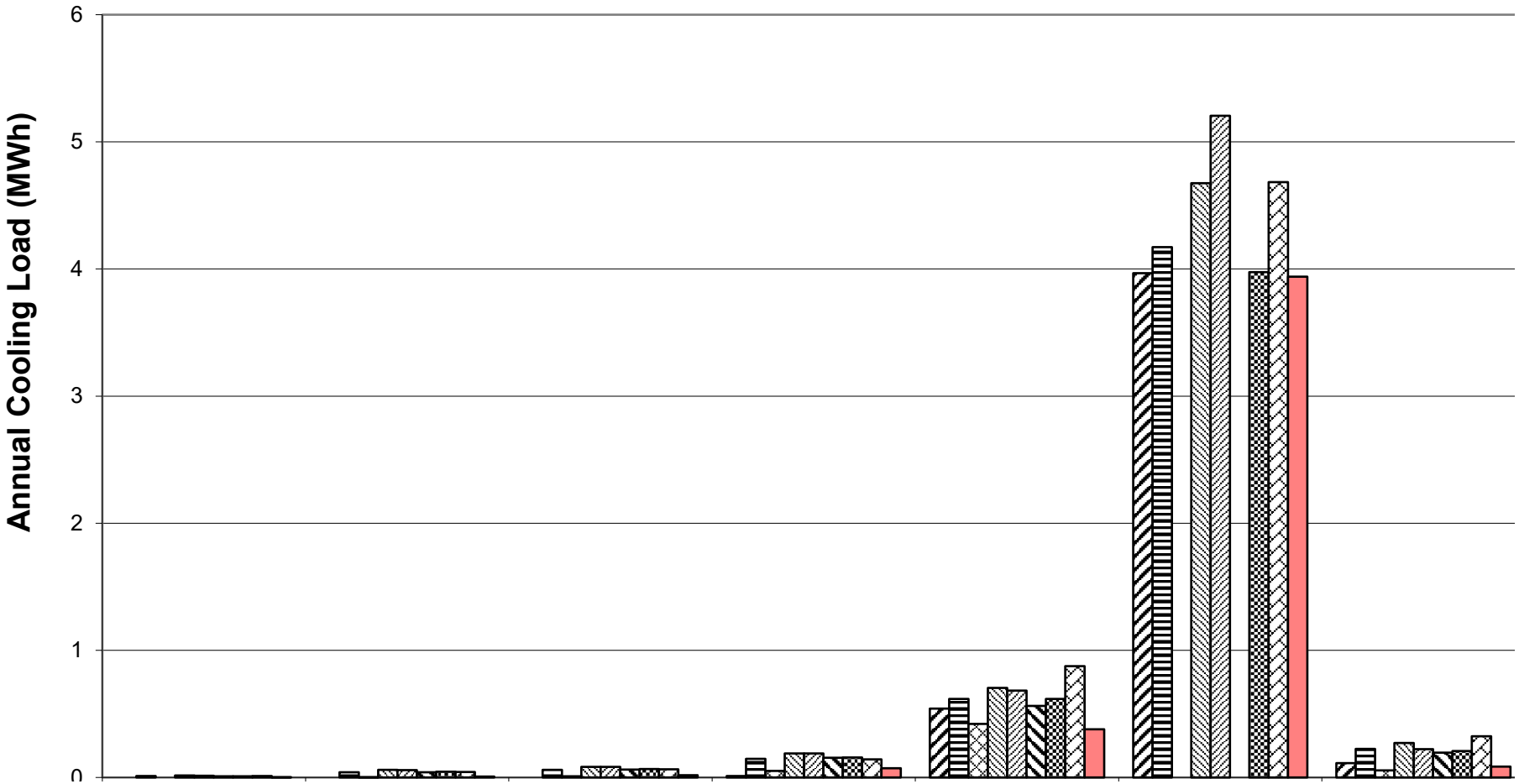

Figure B8-49. BESTEST IN-DEPTH
Peak Heating
Cases 395 to 440, 800, 810

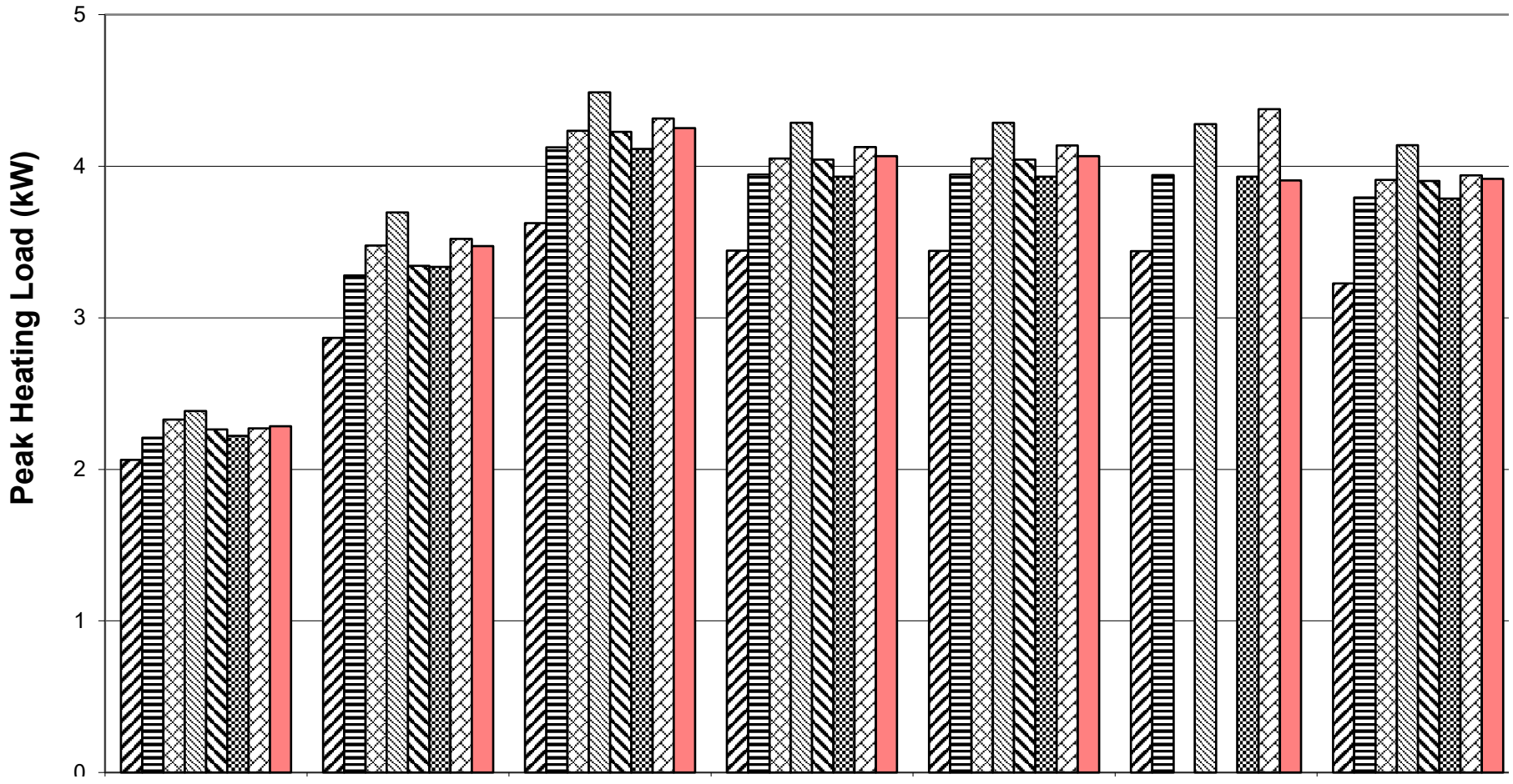

Figure B8-50. BESTEST IN-DEPTH
Peak Sensible Cooling
Cases 395 to 440, 800, 810

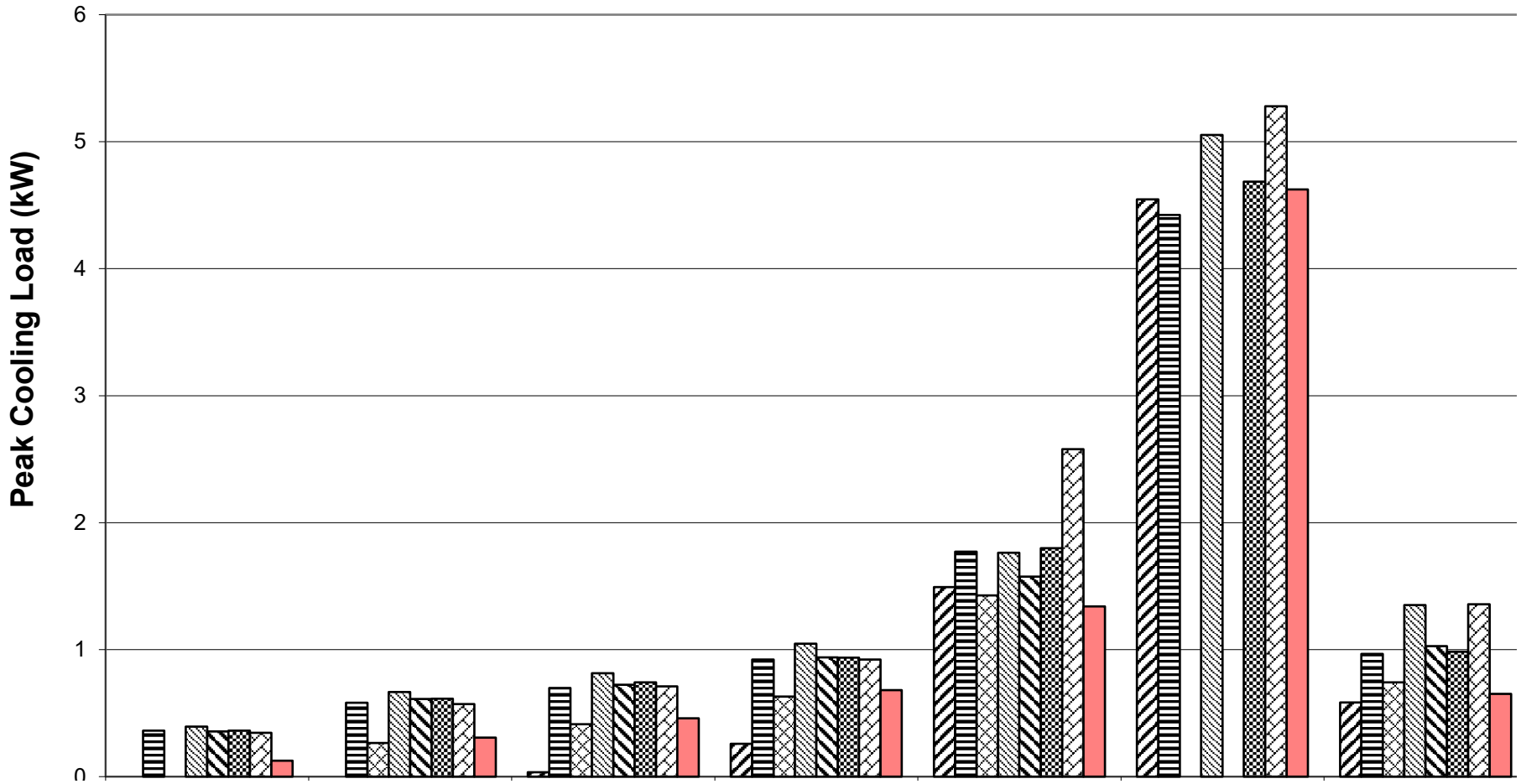

Figure B8-51. BESTEST IN-DEPTH
Cases 395 to 600 (Delta)
Annual Heating and Sensible Cooling

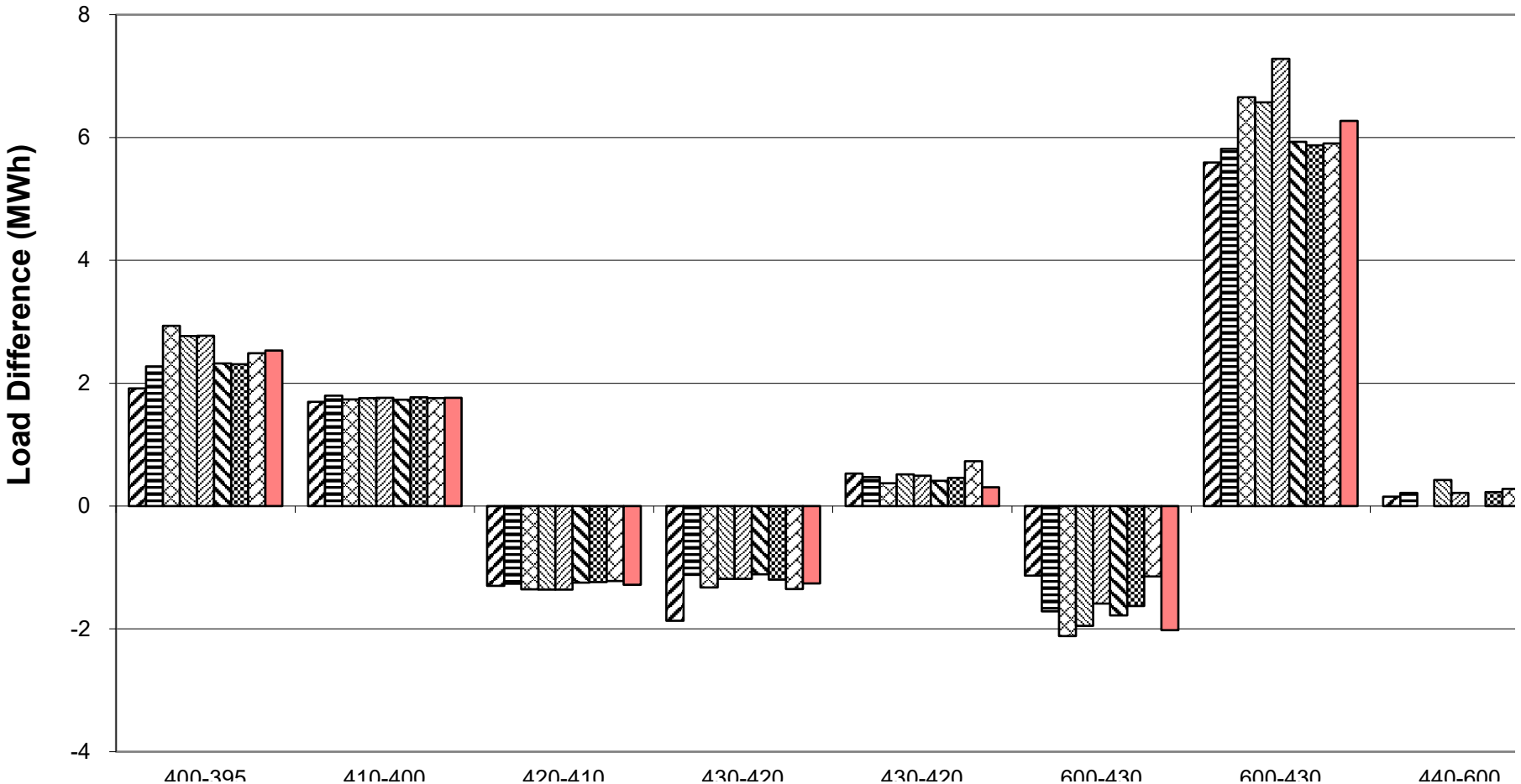

Figure B8-52. BESTEST IN-DEPTH Cases 395 to 600 (Delta) Peak Heating and Sensible Cooling

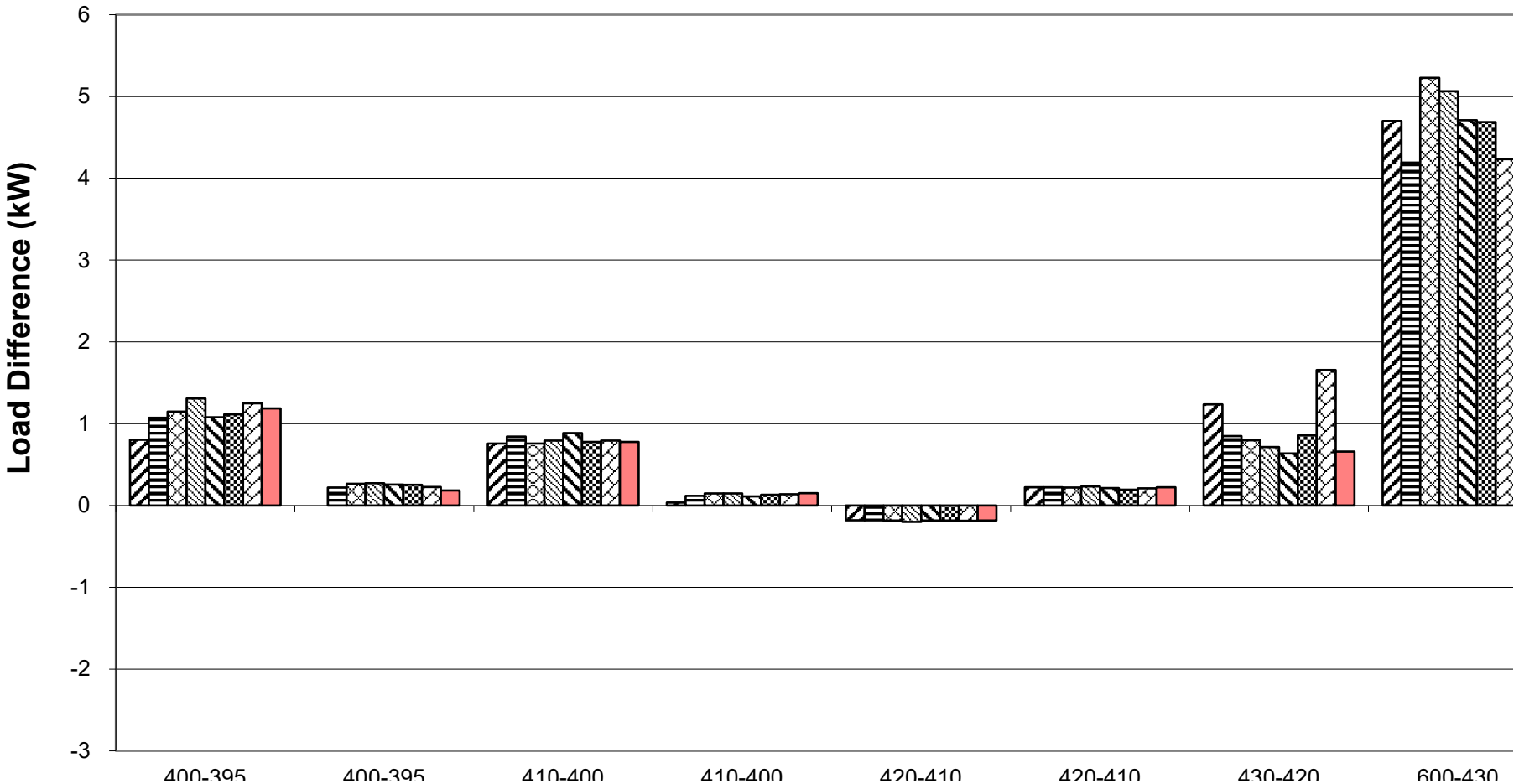

Figure B8-53. BESTEST Case 900FF
Annual Hourly Temperature Frequency

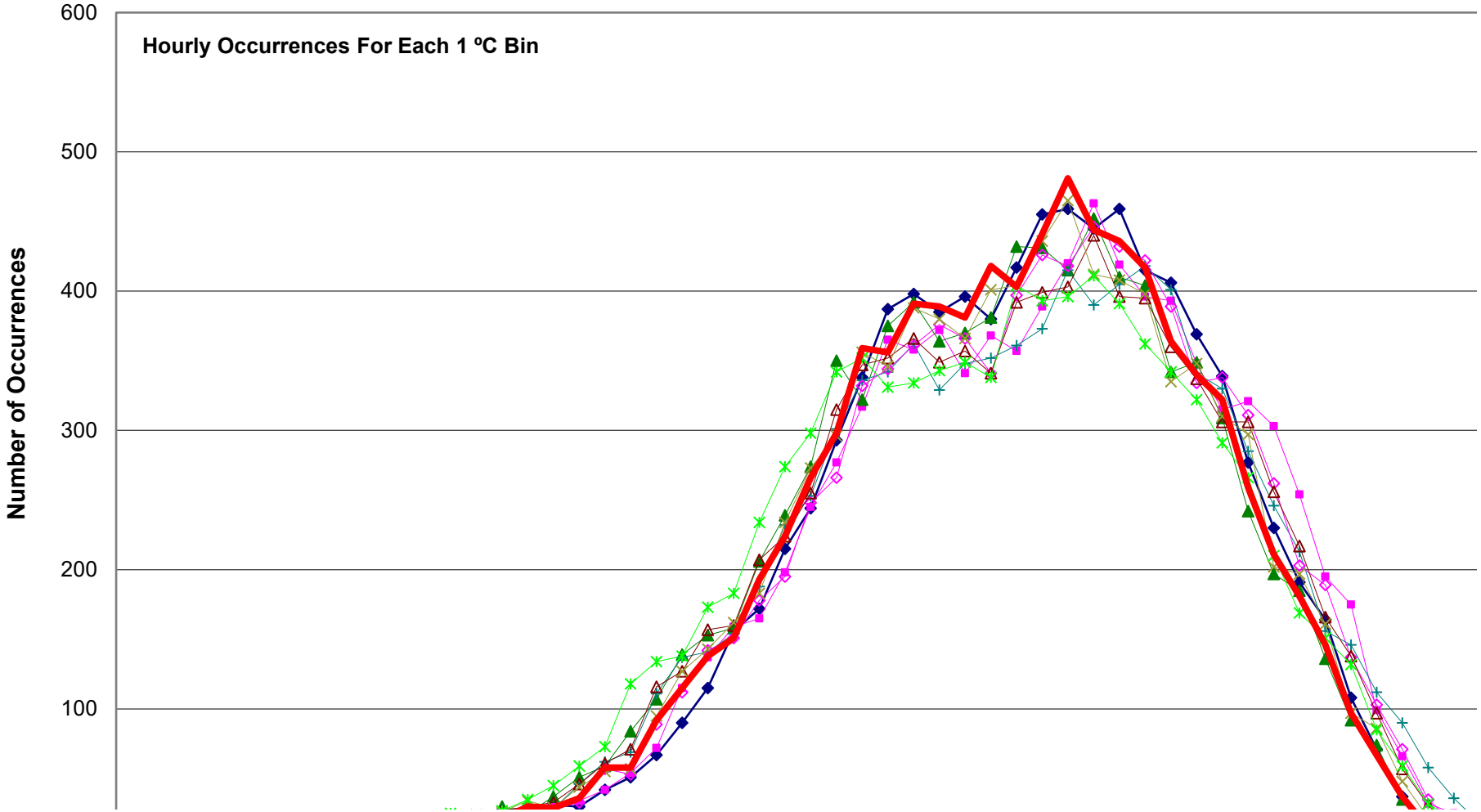

Figure B8-54. BESTEST Case 600 Cloudy & Clear Day Hourly Incident Solar South Facing Surface

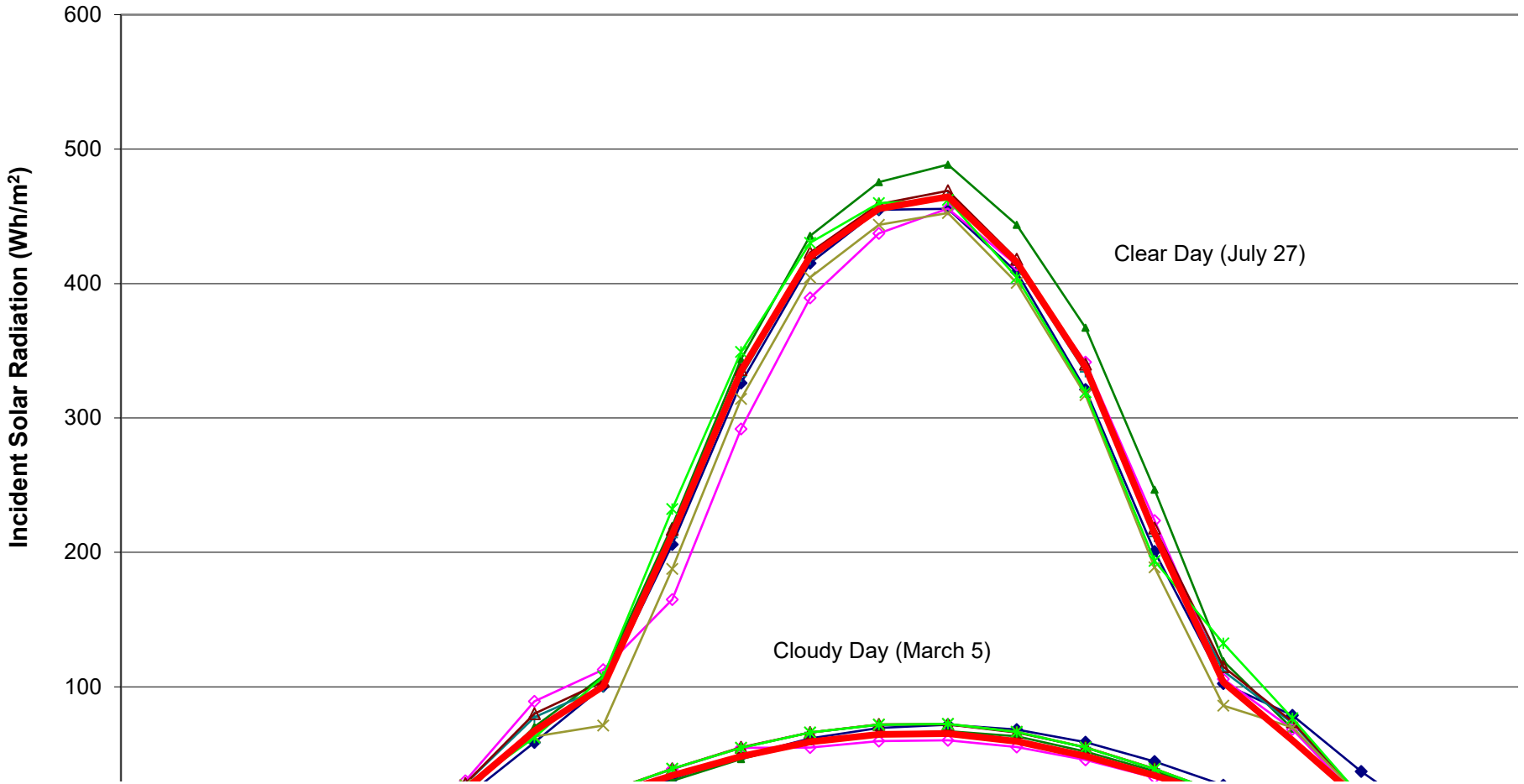

Figure B8-55. BESTEST Case 600 Cloudy & Clear Day Hourly Incident Solar West Facing Surface

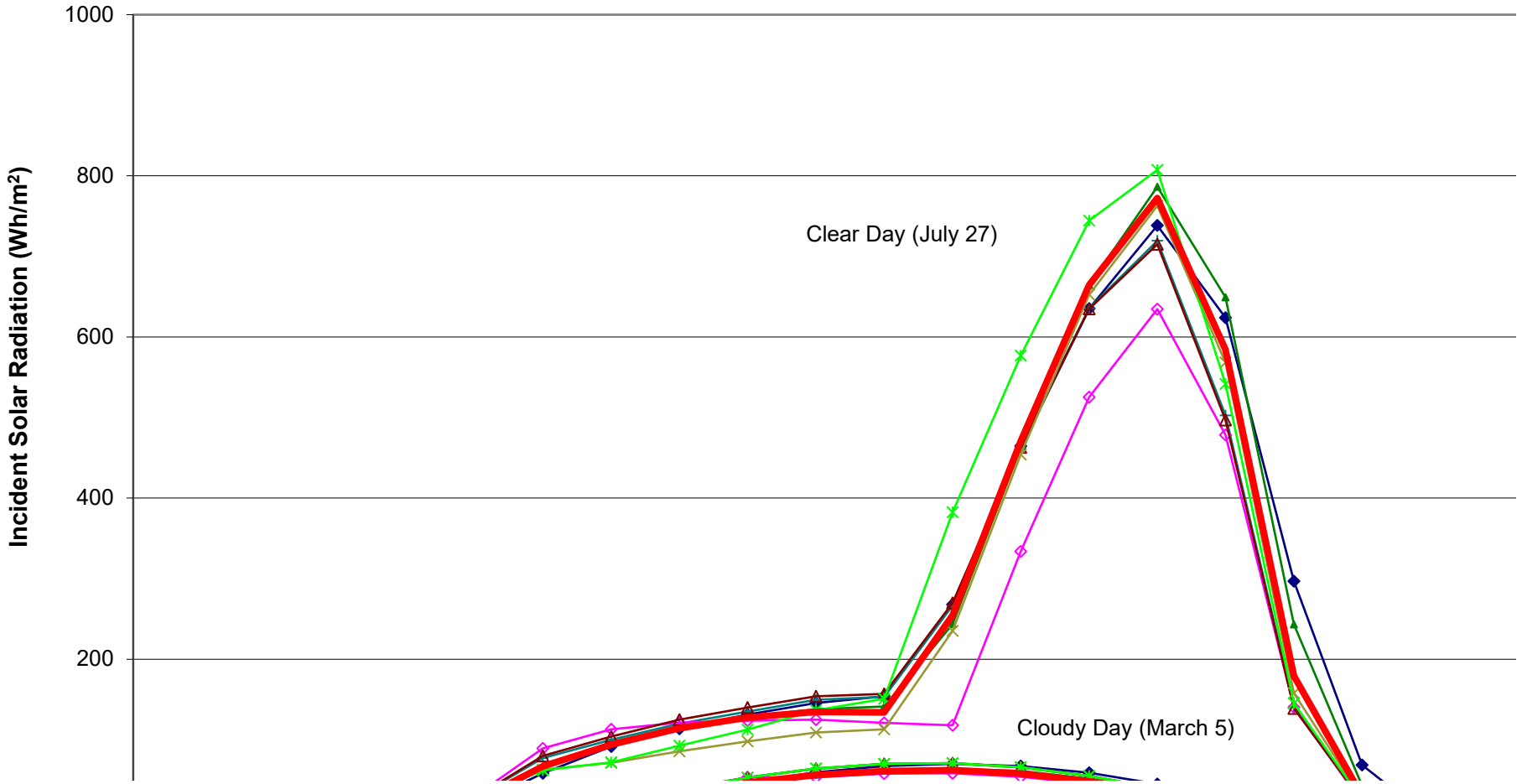

Figure B8-56. BESTEST HOURLY FREE FLOAT TEMPERATURES Clear Cold Day - Cases 600FF and 900FF

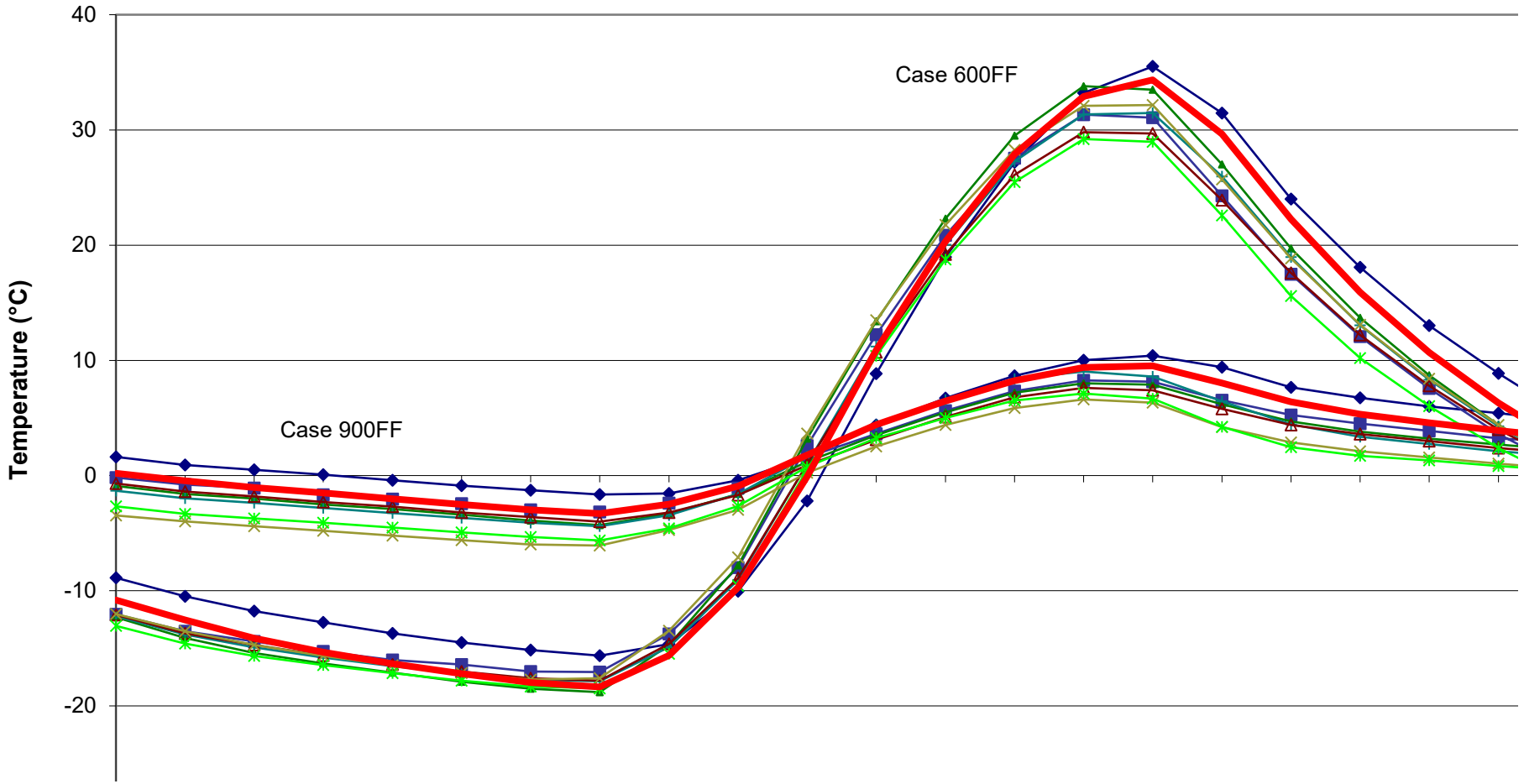

Figure B8-57. BESTEST HOURLY FREE FLOAT TEMPERATURES Clear Hot Day - Cases 650FF and 950FF

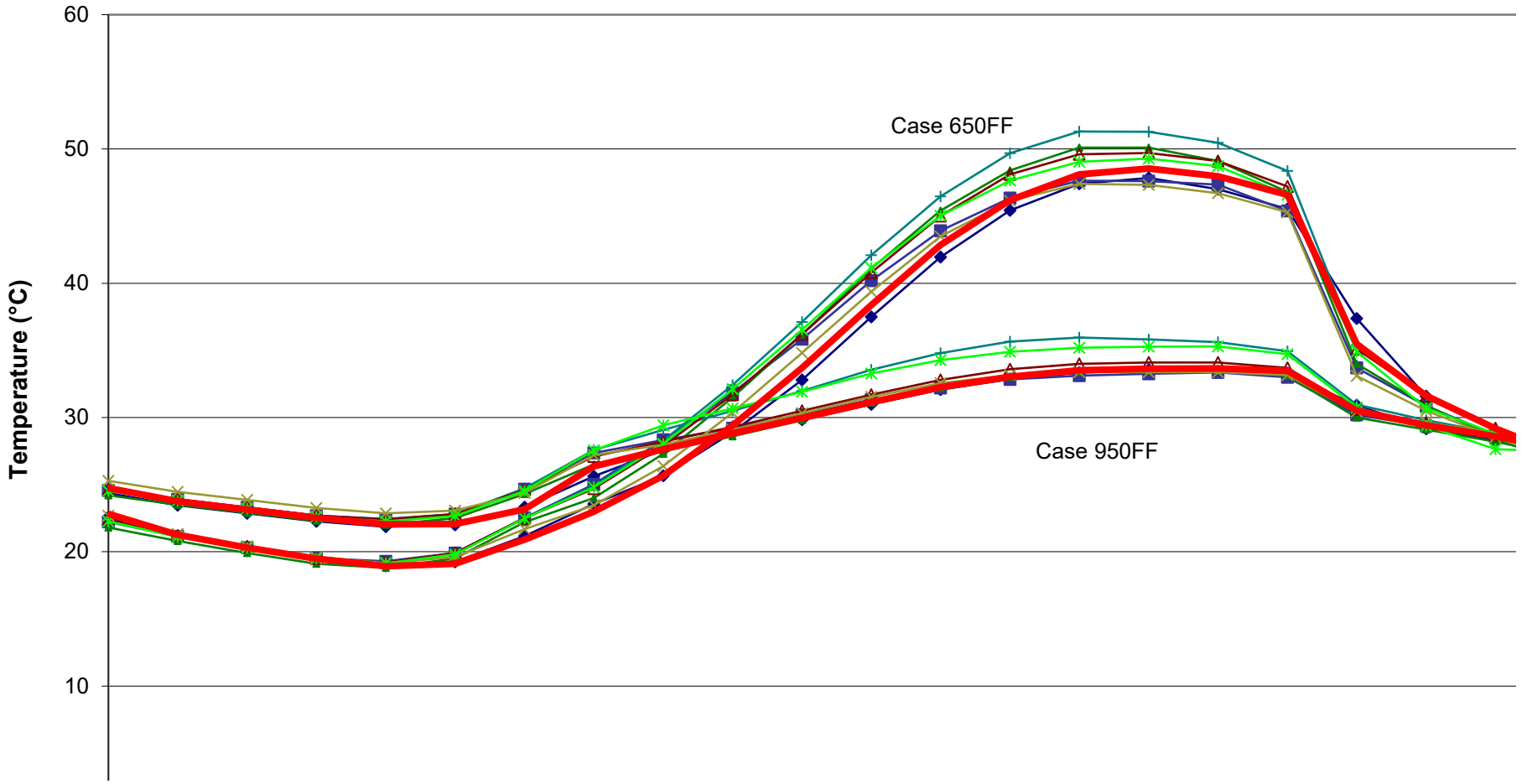

Figure B8-58. BESTEST HOURLY LOADS
Clear Cold Day, Case 600
Heating (+), Sensible Cooling (-)

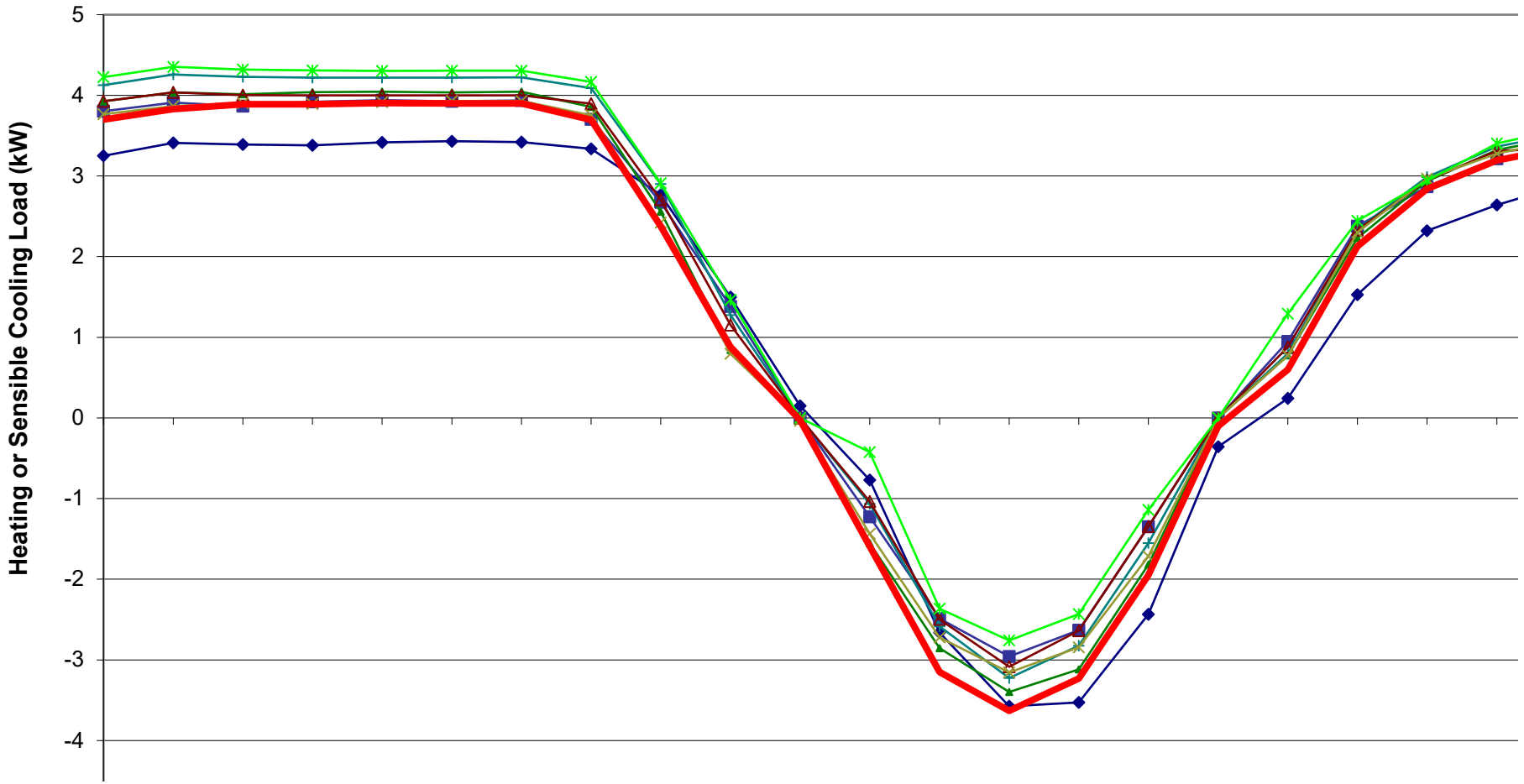

Figure B8-59. BESTEST HOURLY LOADS
Clear Cold Day, Case 900
Heating (+), Sensible Cooling (-)