

ASHRAE Standard 140-2017

Test Results Comparison for

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

Results for TRNSYS18.06.0002
(TRNSYS18)

vs.

Informative Annex B8, Section B8.1 Example Results

Prepared By
Thermal Energy System Specialists, LLC
(TESS)

Results Developed
19-Aug-2024

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

^aCERL-U.S. Army Construction Engineering Research Laboratories

^bNREL-National Renewable Energy Laboratory

^cLANL/LBNL-Los Alamos National Laboratory/Lawrence Berkeley National Laboratory

^dBRE-Building Research Establishment

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By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024

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TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024

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)

Case	Simulation Model:	ESP	BLAST	DOE21D	SRES-SUN	SRES*	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18 TESS
	Organization or Country:	DMU	US-IT	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND	Min	Max	Mean	(Max-Min)/ 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)]

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Note: The statistics in the tables below are based on the Standard 140 informative example results.
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Table B8-2. Annual Sensible Cooling Loads (MWh)

Simulation Model: Organization or Country: Case	ESP	BLAST	DOE21D	SRES-SUN	SRES*	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18 TESS
	DMU	US-IT	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND	Min	Max	Mean	(Max-Min)/ 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	<i>10.350</i>		8.764	8.714	7.528	<i>10.350</i>	<i>8.976</i>	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	<i>8.089</i>		6.699	7.431	5.204	<i>8.089</i>	<i>7.051</i>	40.9%	6.666
300 East/West Window	4.302	5.836		6.665	<i>7.100</i>		5.721	5.781	4.302	<i>7.100</i>	<i>5.901</i>	47.4%	5.679
310 East/West Shading	2.732	4.570		5.245	<i>5.471</i>		3.727		2.732	<i>5.471</i>	<i>4.349</i>	63.0%	3.755
320 Thermostat	5.061	5.906		6.725	<i>7.304</i>		5.956	5.663	5.061	<i>7.304</i>	<i>6.103</i>	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
TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024

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														Example Result Statistics				TRNSYS18											
Simulation Model:	ESP		BLAST			DOE21D			SRES-SUN			SRES	S3PAS			TSYS			TASE			TRNSYS18							
Organization or Country:	DMU		US-IT			NREL			NREL			BRE*	SPAIN			BEL-BRE			FINLAND			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)	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														Example Result Statistics				TRNSYS18												
Simulation Model:	ESP		BLAST			DOE21D			SRES-SUN			SRES	S3PAS			TSYS			TASE			TRNSYS18								
Organization or Country:	DMU		US-IT			NREL			NREL			BRE*	SPAIN			BEL-BRE			FINLAND			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)	Date	Hr	T (°C)	Date	Hr	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										Example Result Statistics				TRNSYS18															
Simulation Model:	ESP		BLAST			DOE21D			SRES-SUN			SRES	S3PAS			TSYS			TASE			TRNSYS18							
Organization or Country:	DMU		US-IT			NREL			NREL			BRE	SPAIN			BEL-BRE			FINLAND			TESS							
Case	T (°C)		T (°C)		T (°C)		T (°C)		T (°C)		T (°C)	T (°C)	T (°C)		T (°C)		T (°C)		T (°C)		T (°C)	T (°C)	T (°C)	(Max-Min)/	T (°C)			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		24.2		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		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		18.4		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		14.5		14.6		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		26.4		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
TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024

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				TRNSYS18 TESS
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** (%)	
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]									Statistics for Example Results				TRNSYS18 TESS
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** (%)	
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				TRNSYS18 TESS
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** (%)	
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				TRNSYS18 TESS
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** (%)	
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 through 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

TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results

By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024

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				TRNSYS18 TESS
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** (%)	
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				TRNSYS18 TESS
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** (%)	
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				TRNSYS18 TESS
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** (%)	
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				TRNSYS18 TESS
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** (%)	
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

TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results

By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024

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				TRNSYS18 TESS
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** (%)	
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				TRNSYS18 TESS
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** (%)	
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	1.080	1.195	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				TRNSYS18 TESS
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** (%)	
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				TRNSYS18 TESS
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** (%)	
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

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TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024

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

TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results

By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024

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: Organization or Country: Case	ESP	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18 TESS
	DMU	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND	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: Organization or Country: Case	ESP	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18 TESS
	DMU	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND	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/m²)

Simulation Model: Organization or Country: Case	ESP	DOE21D	SRES-SUN	SRES	S3PAS	TSYS	TASE	Statistics for Example Results				TRNSYS18 TESS
	DMU	NREL	NREL	BRE	SPAIN	BEL-BRE	FINLAND	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
 TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results
 By Thermal Energy System Specialists, LLC (TESS), 19-Aug-2024**

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/m²)

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

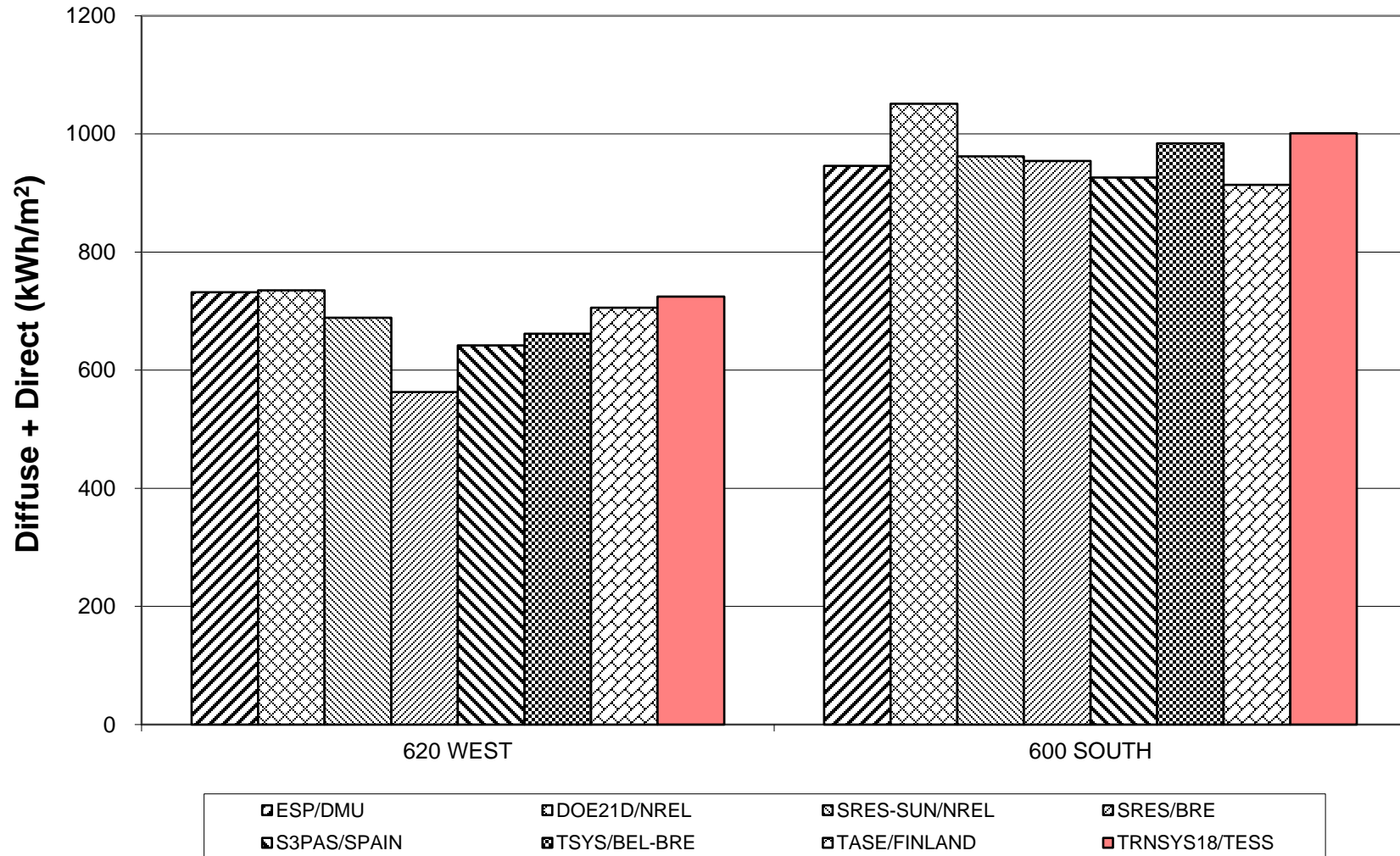
* ABS[(Max-Min) / (Mean of Example Simulation Results)]

Table B8-15. Case 600 Annual Transmitted Solar Radiation - Shaded (kWh/m²)

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

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

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



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

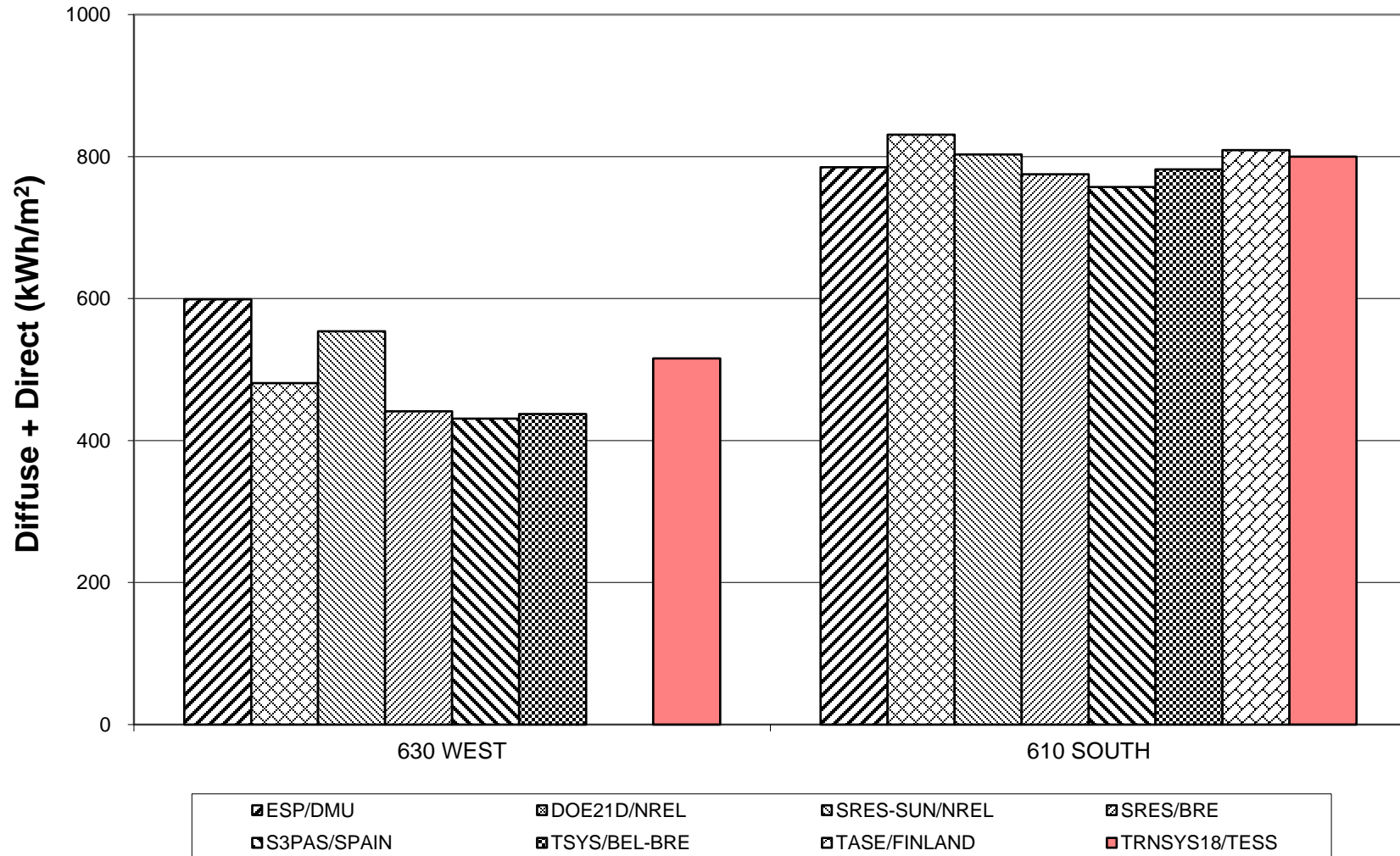


Figure B8-4. BESTEST BASIC
Annual Transmissivity Coefficient of Windows
(Unshaded Transmitted)/(Incident Solar Radiation)

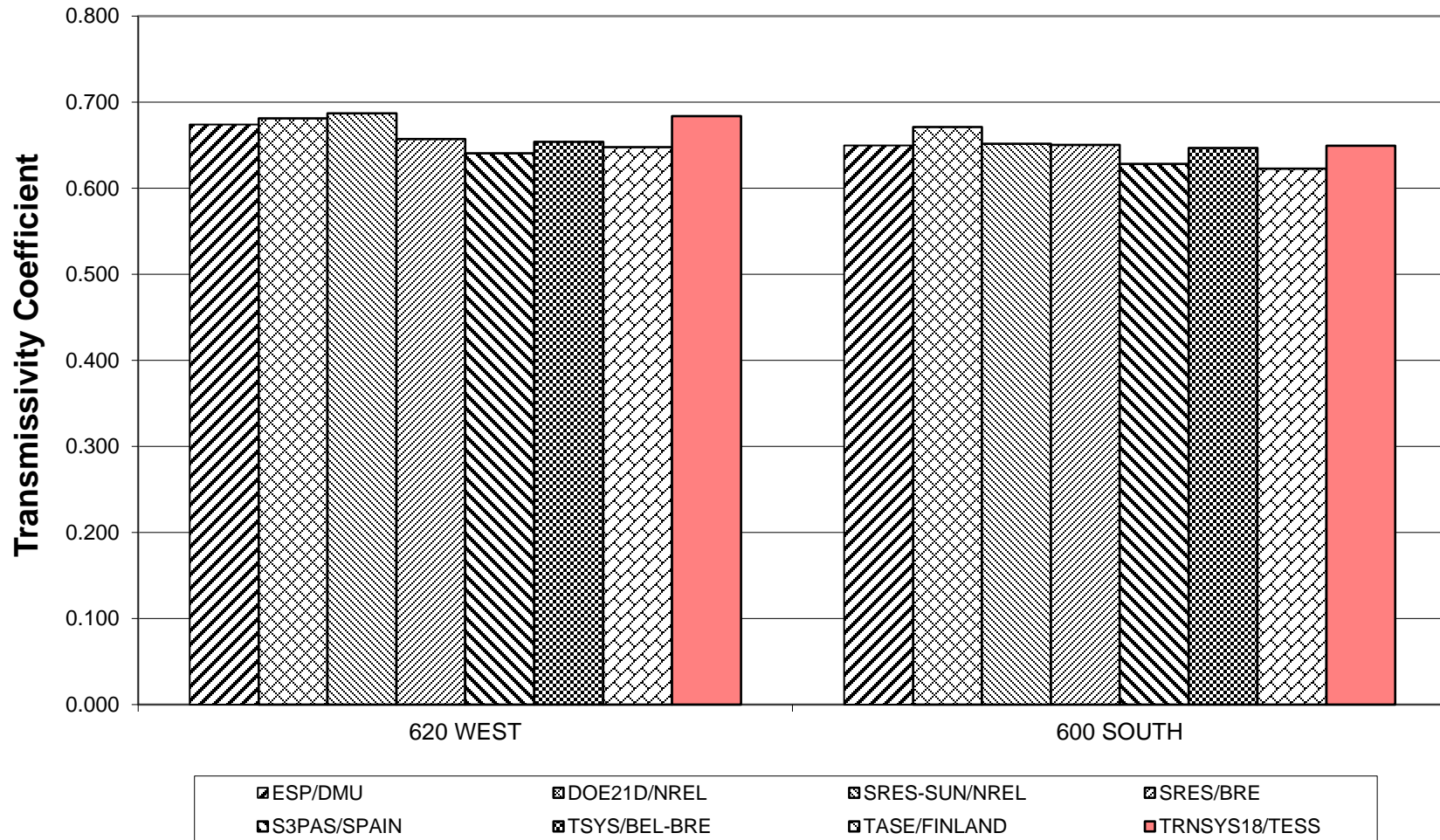
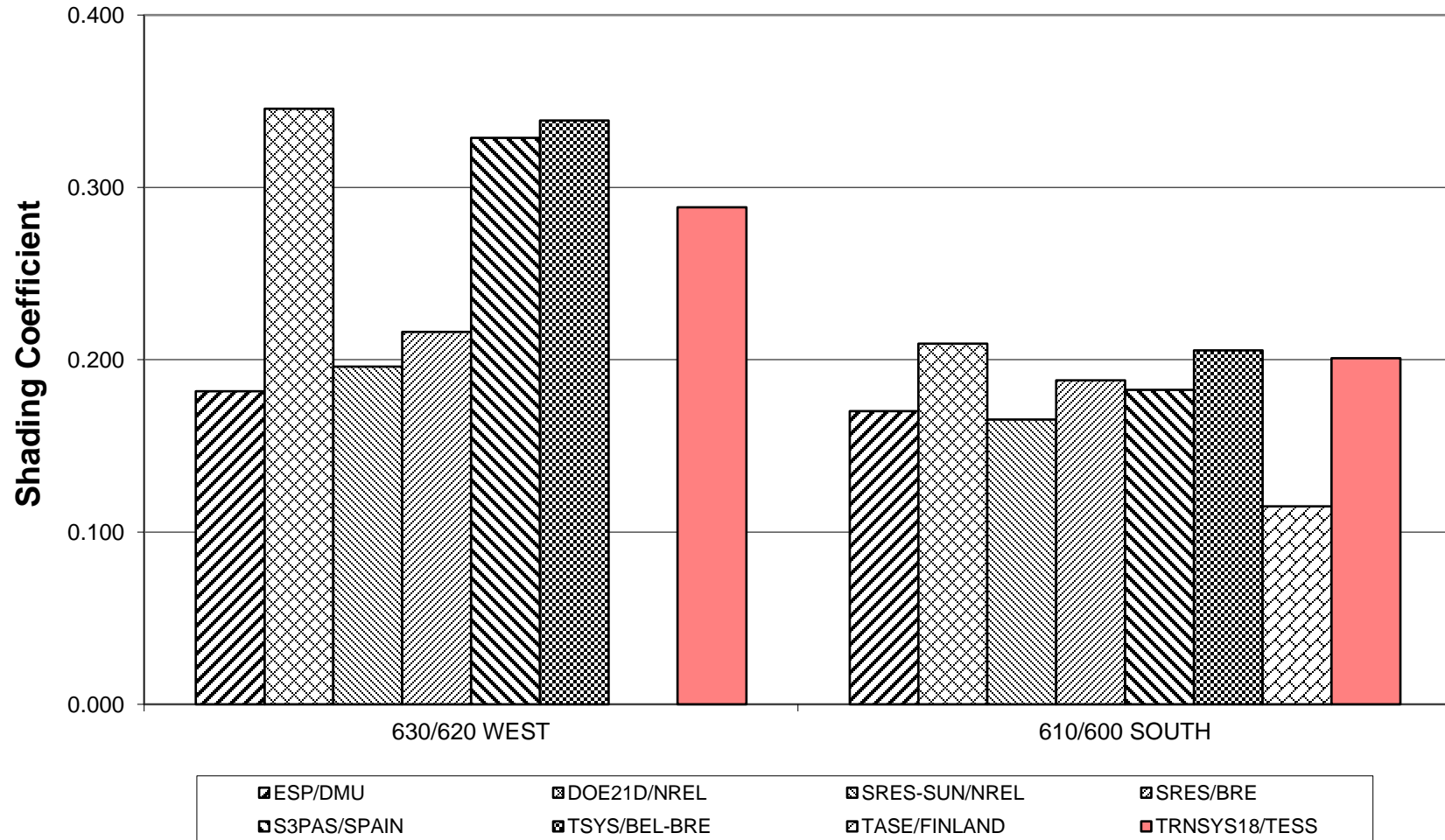
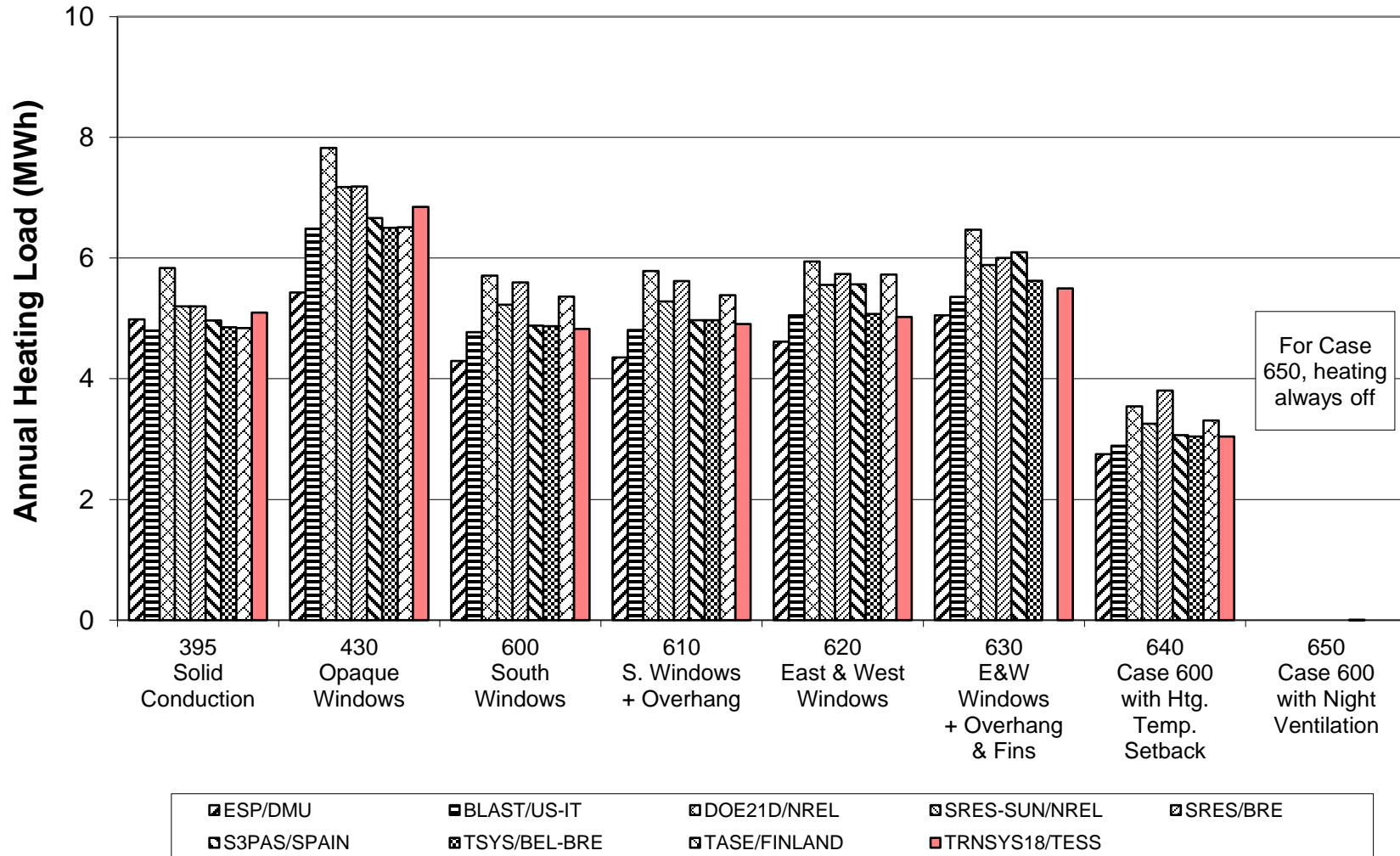


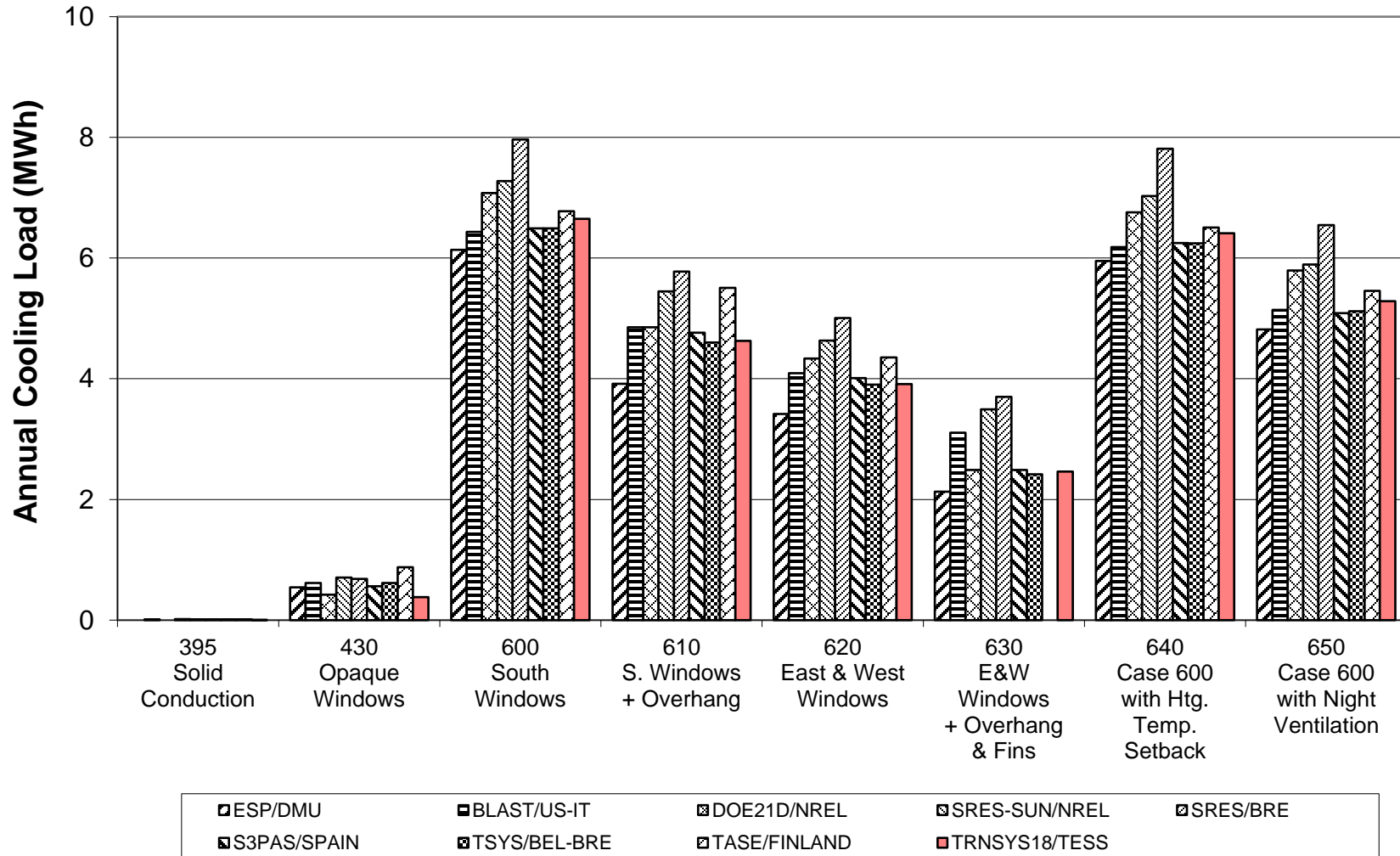
Figure B8-5. BESTEST BASIC
Annual Overhang and Fin Shading Coefficients
(1-(Shaded)/(Unshaded)) Transmitted Solar Radiation



**Figure B8-6. BESTEST BASIC
Low Mass Annual Heating**

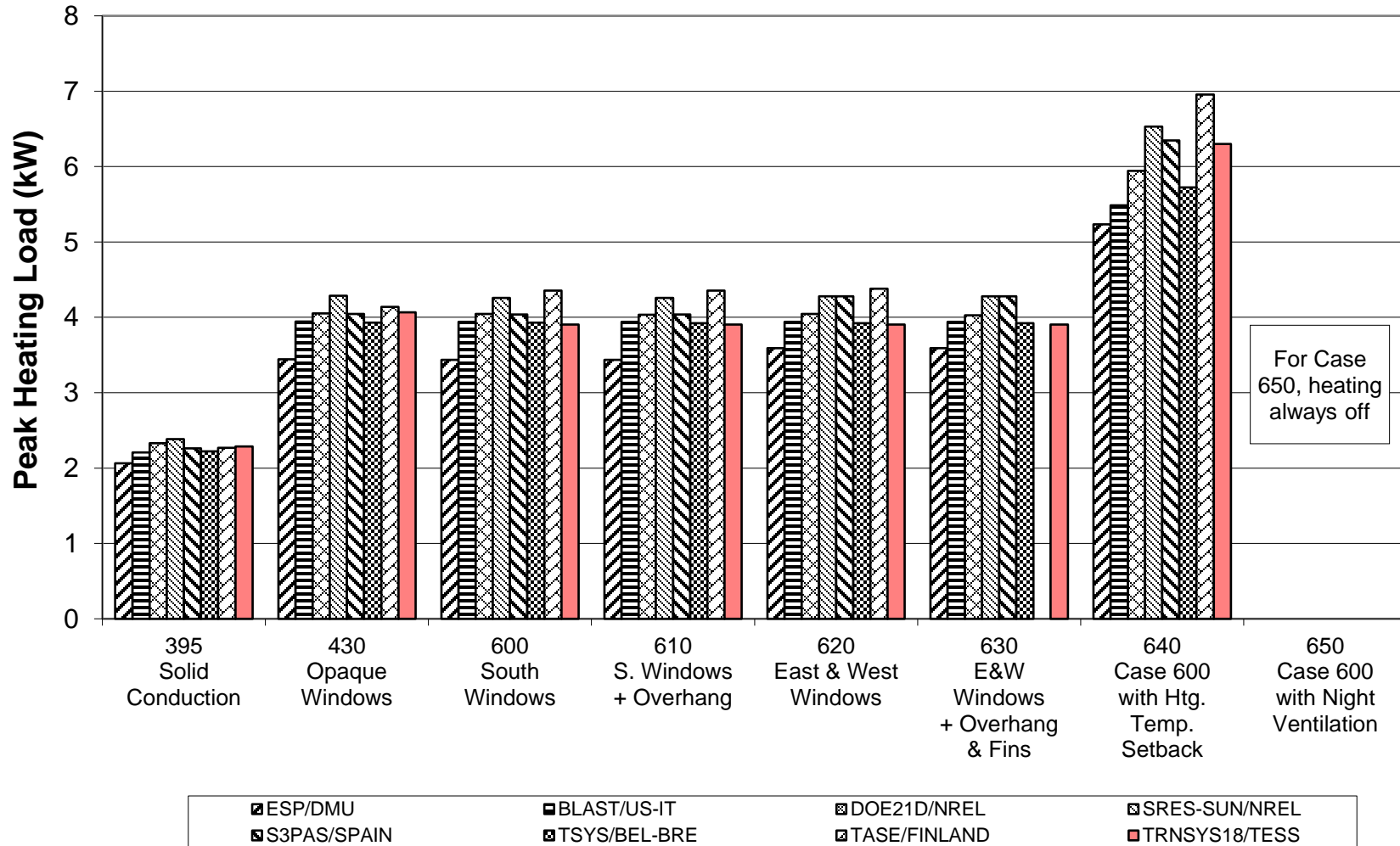


**Figure B8-7. BESTEST BASIC
Low Mass Annual Sensible Cooling**



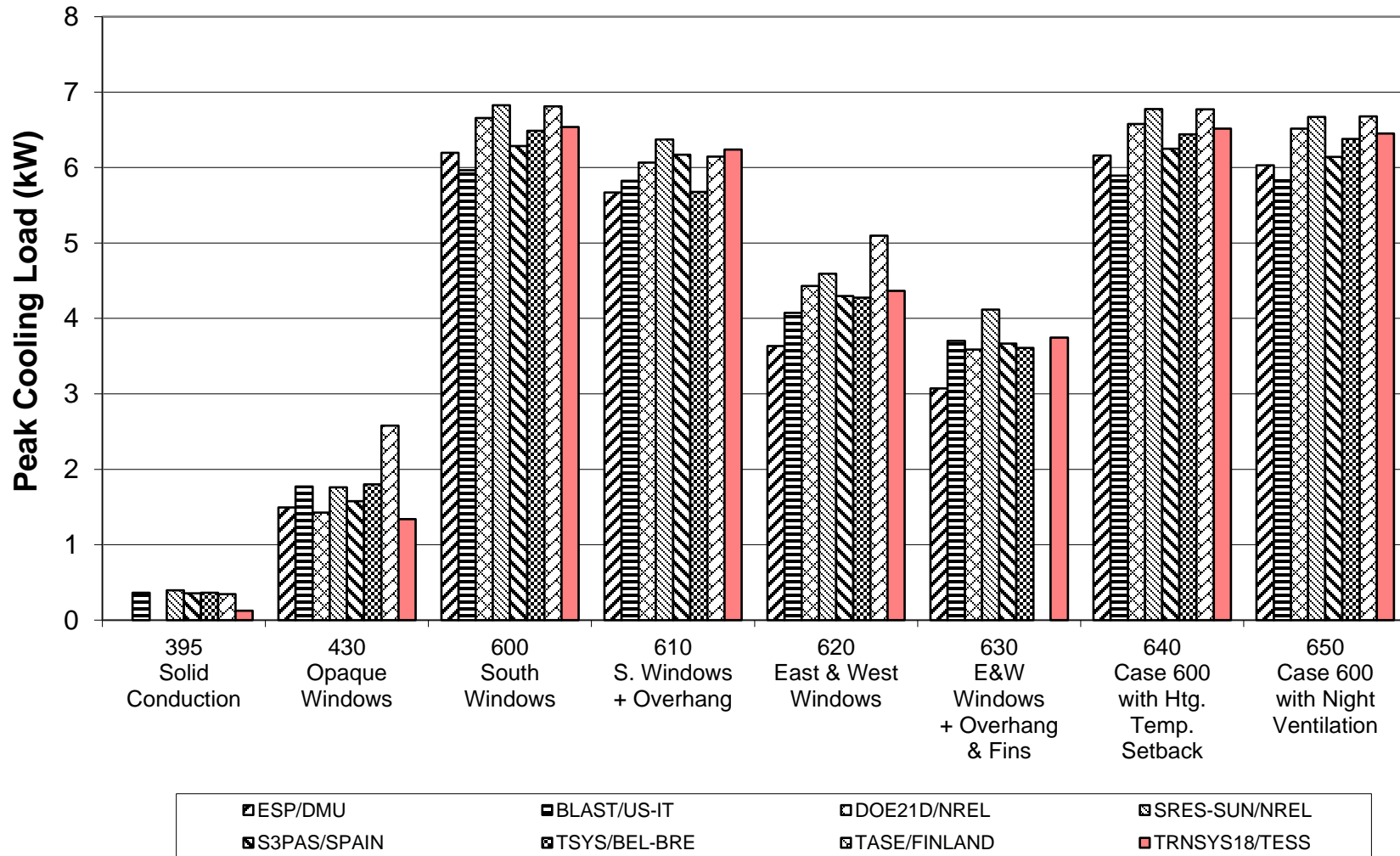
ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

**Figure B8-8. BESTEST BASIC
Low Mass Peak Heating**

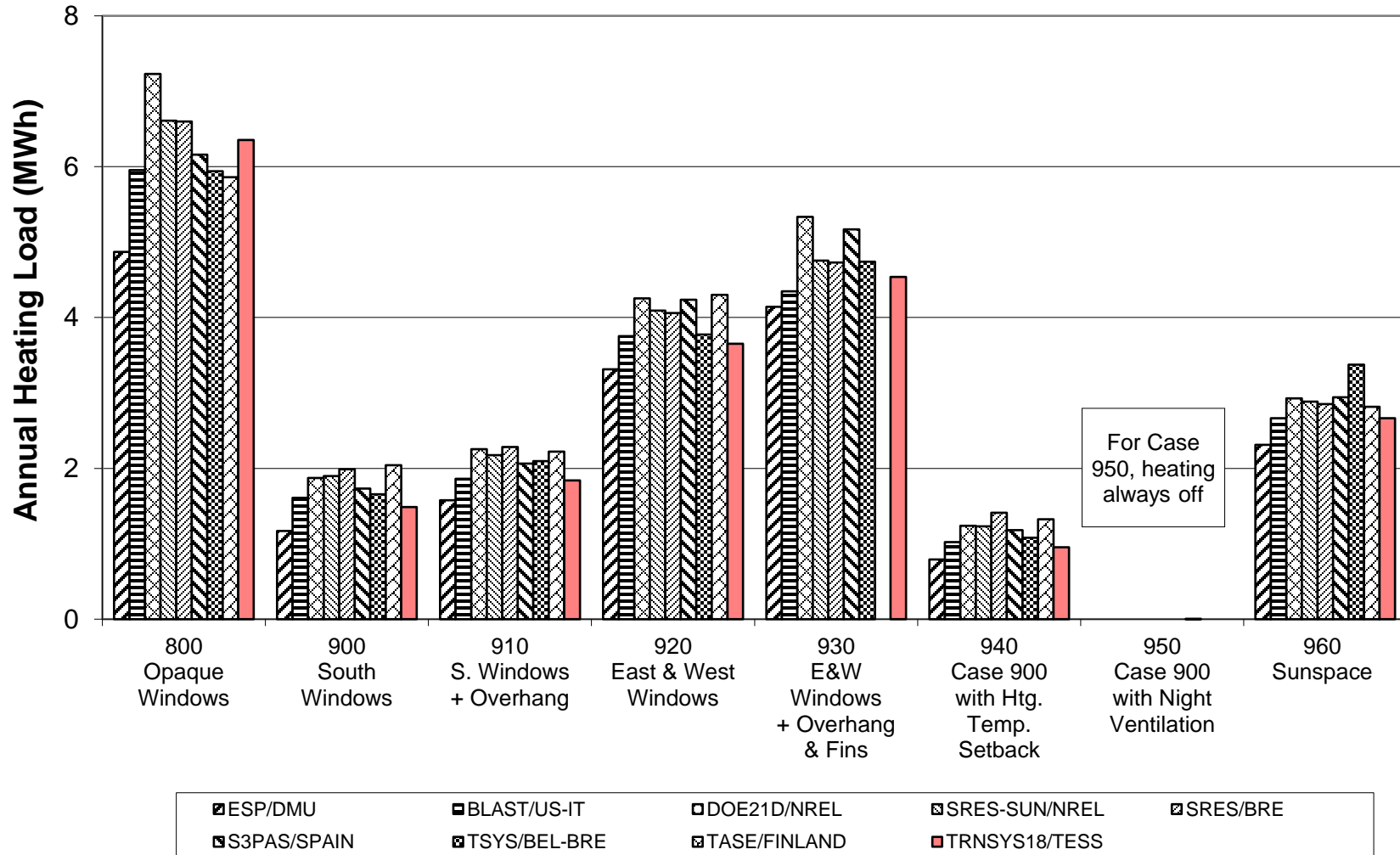


ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

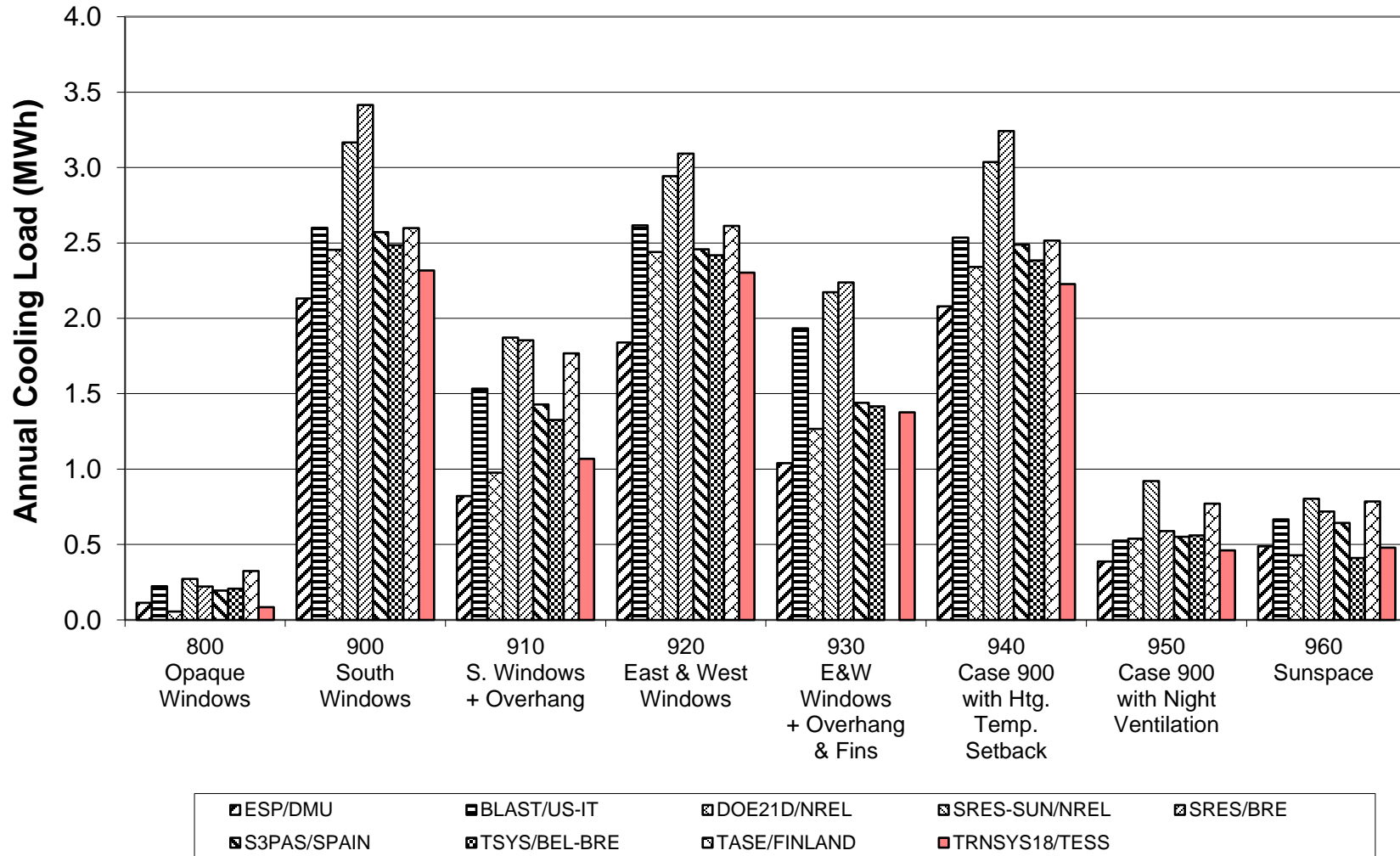
**Figure B8-9. BESTEST BASIC
Low Mass Peak Sensible Cooling**



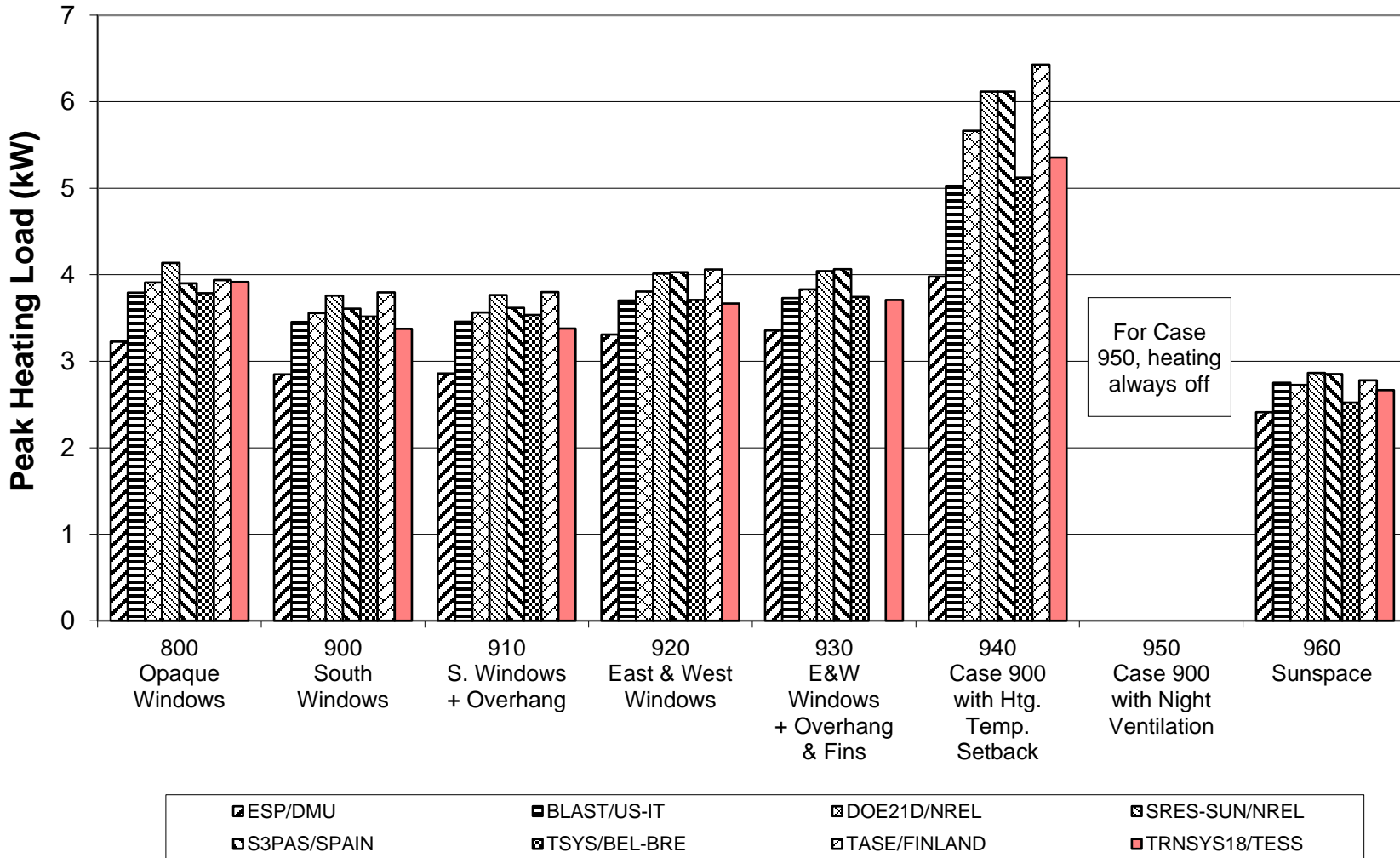
**Figure B8-10. BESTEST BASIC
High Mass Annual Heating**



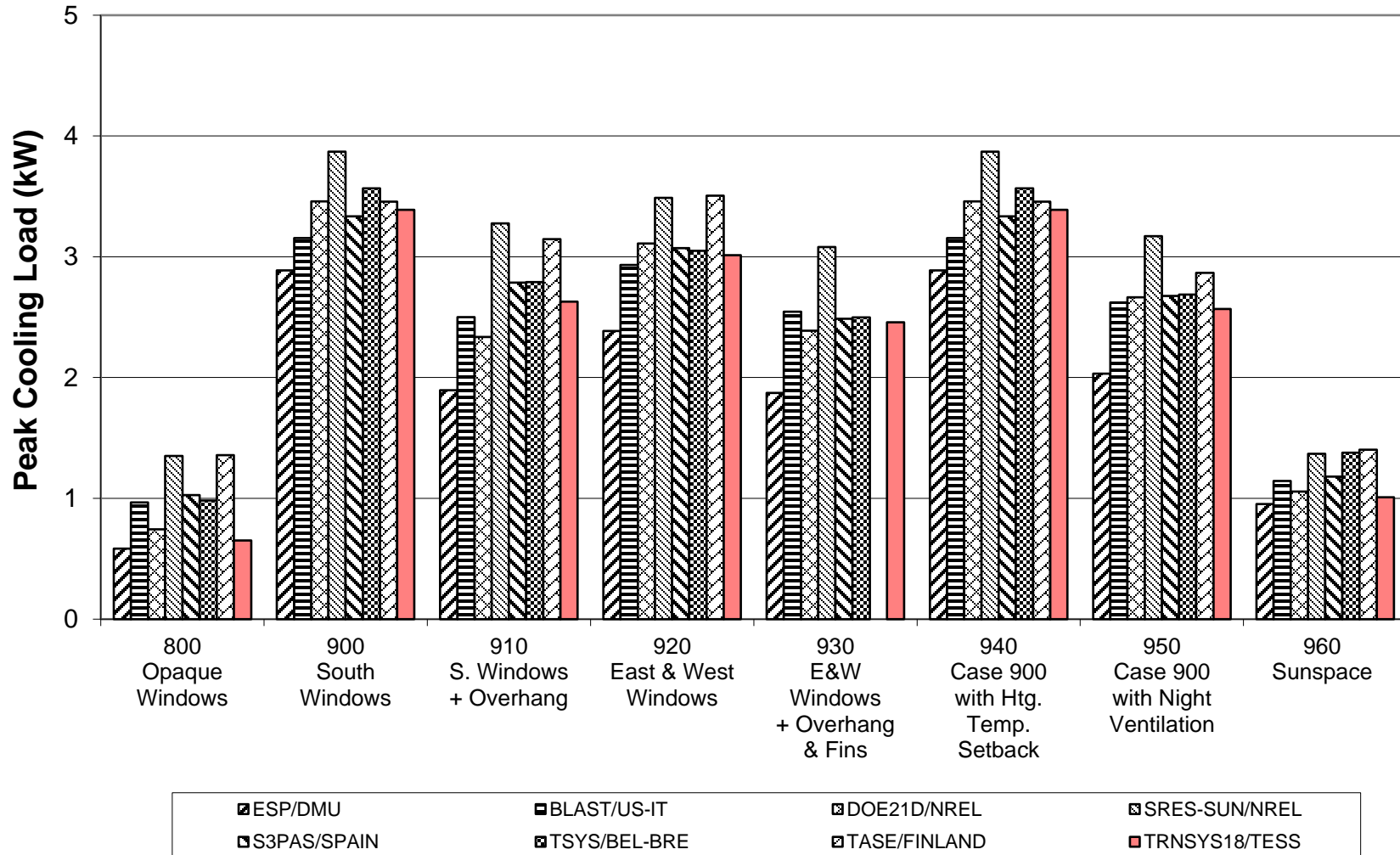
**Figure B8-11. BESTEST BASIC
High Mass Annual Sensible Cooling**



**Figure B8-12. BESTEST BASIC
High Mass Peak Heating**

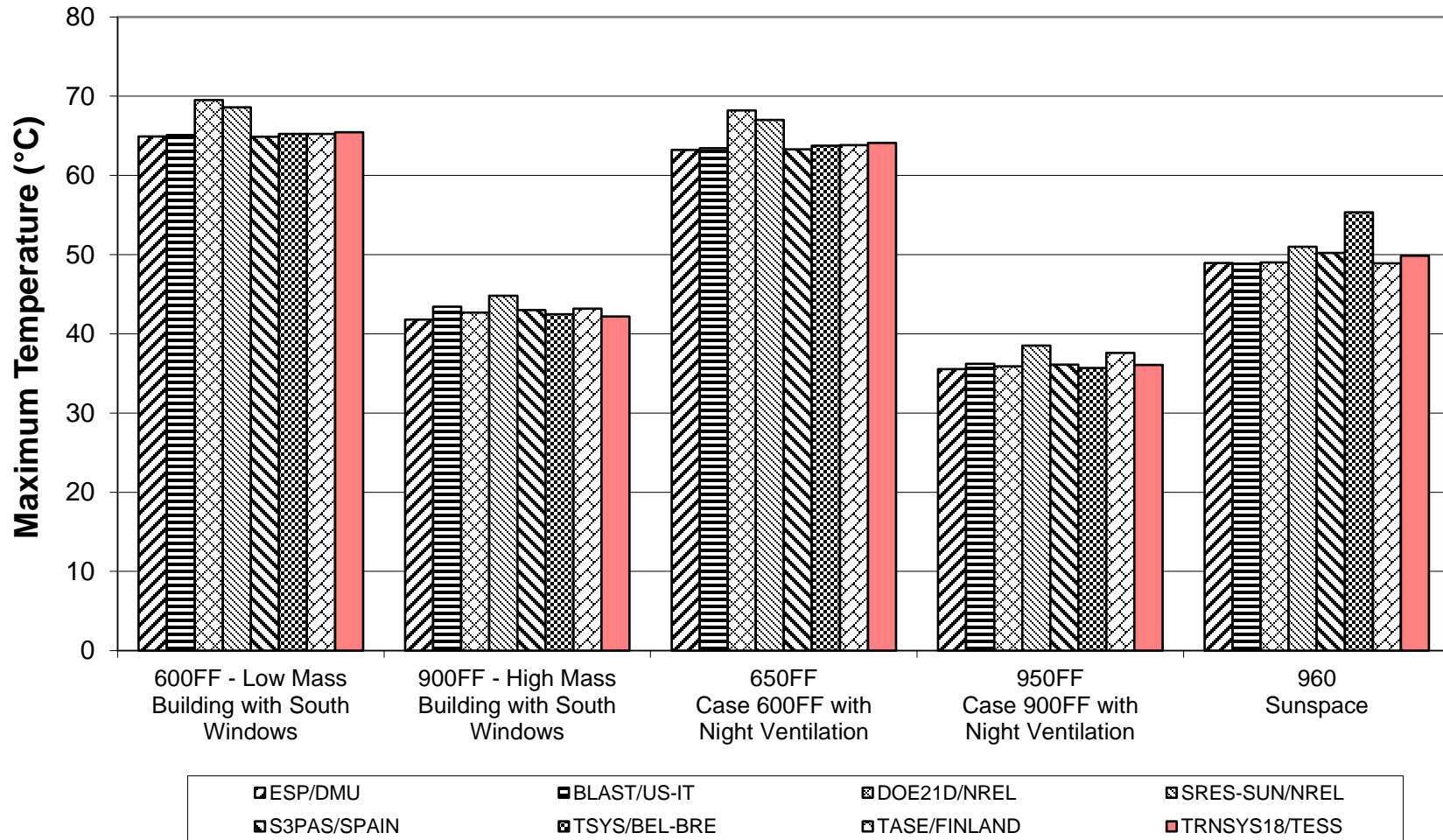


**Figure B8-13. BESTEST BASIC
High Mass Peak Sensible Cooling**

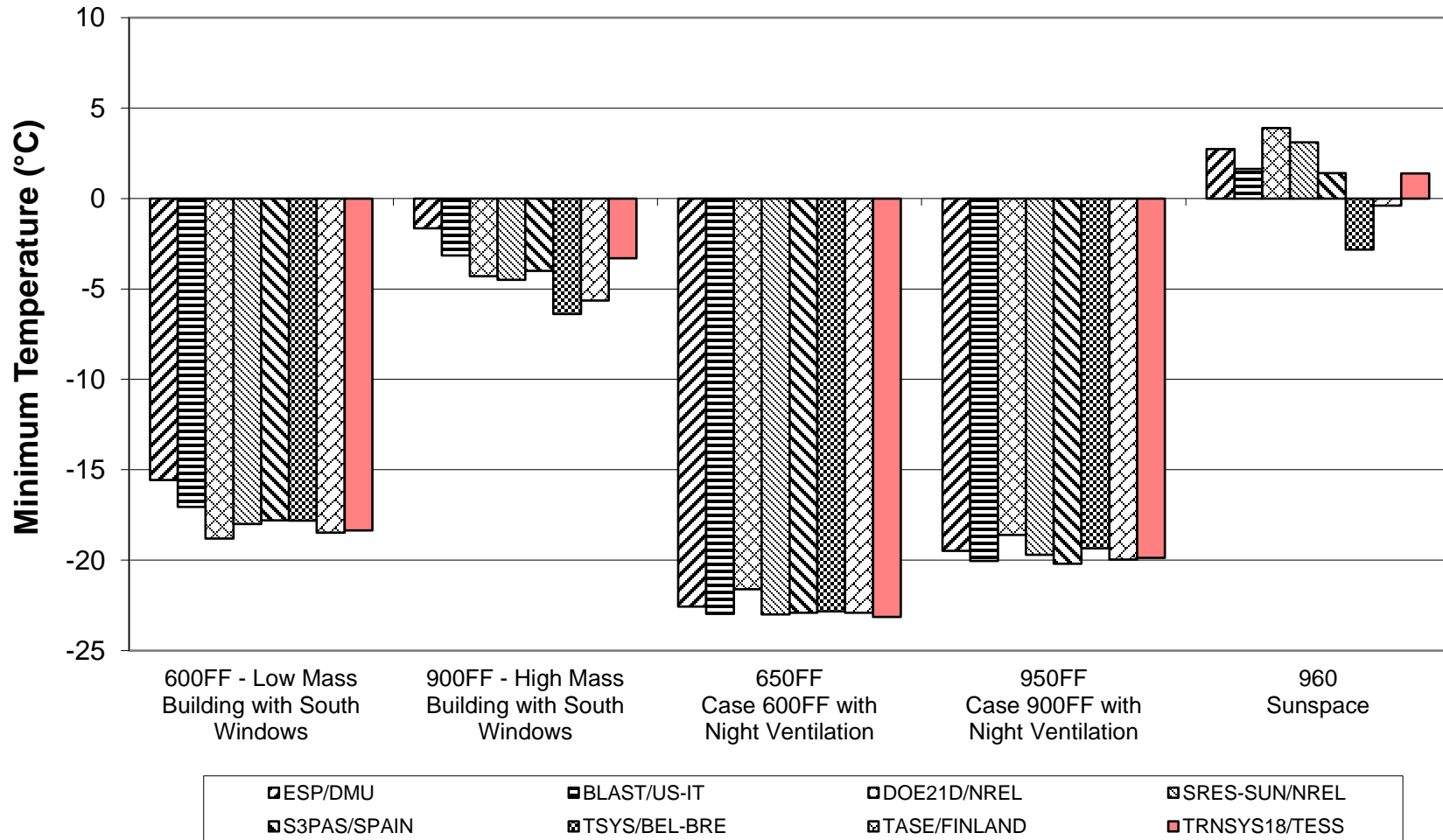


ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

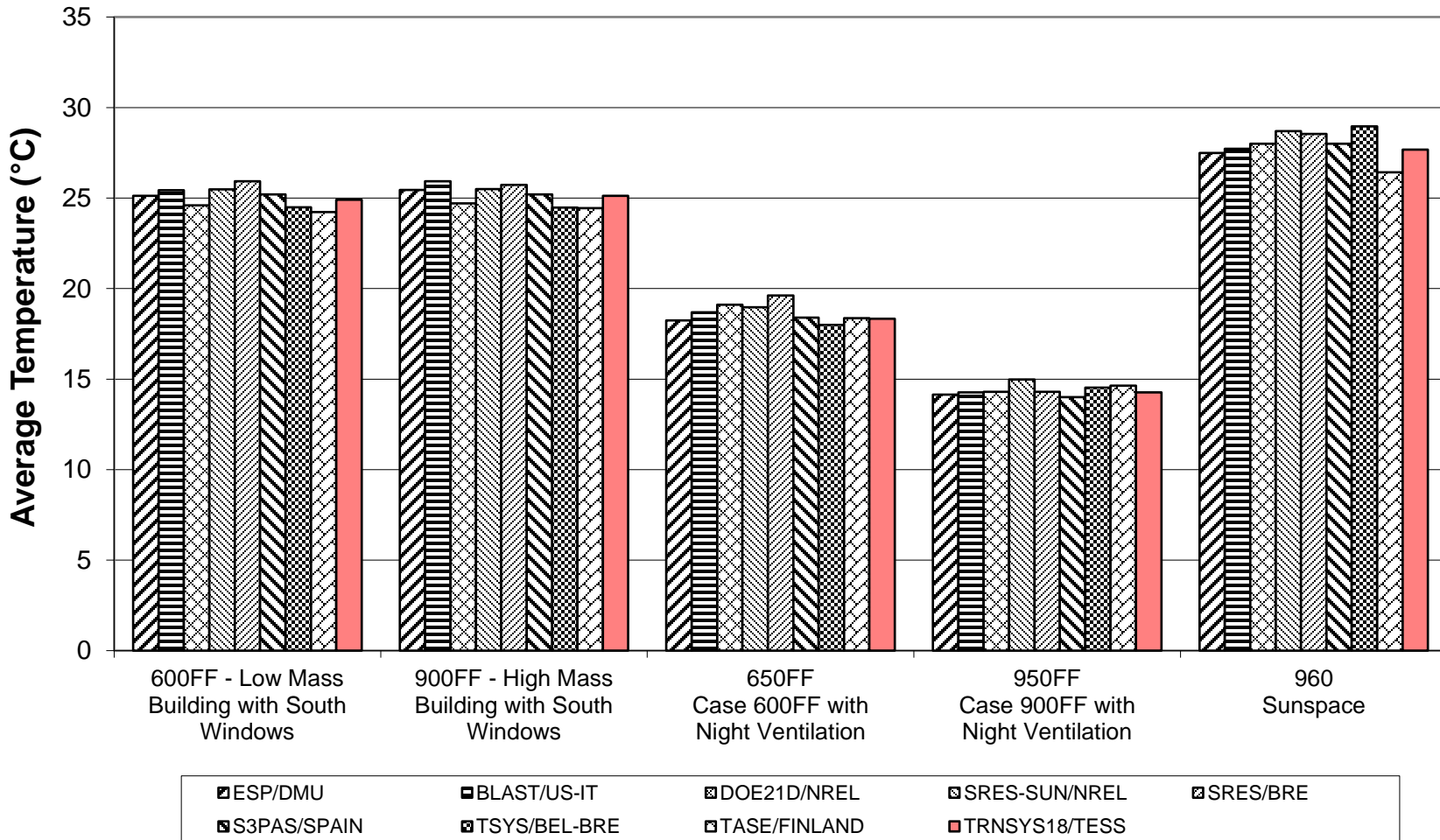
**Figure B8-14. BESTEST BASIC
Maximum Hourly Annual Temperature
Free-Float Cases**



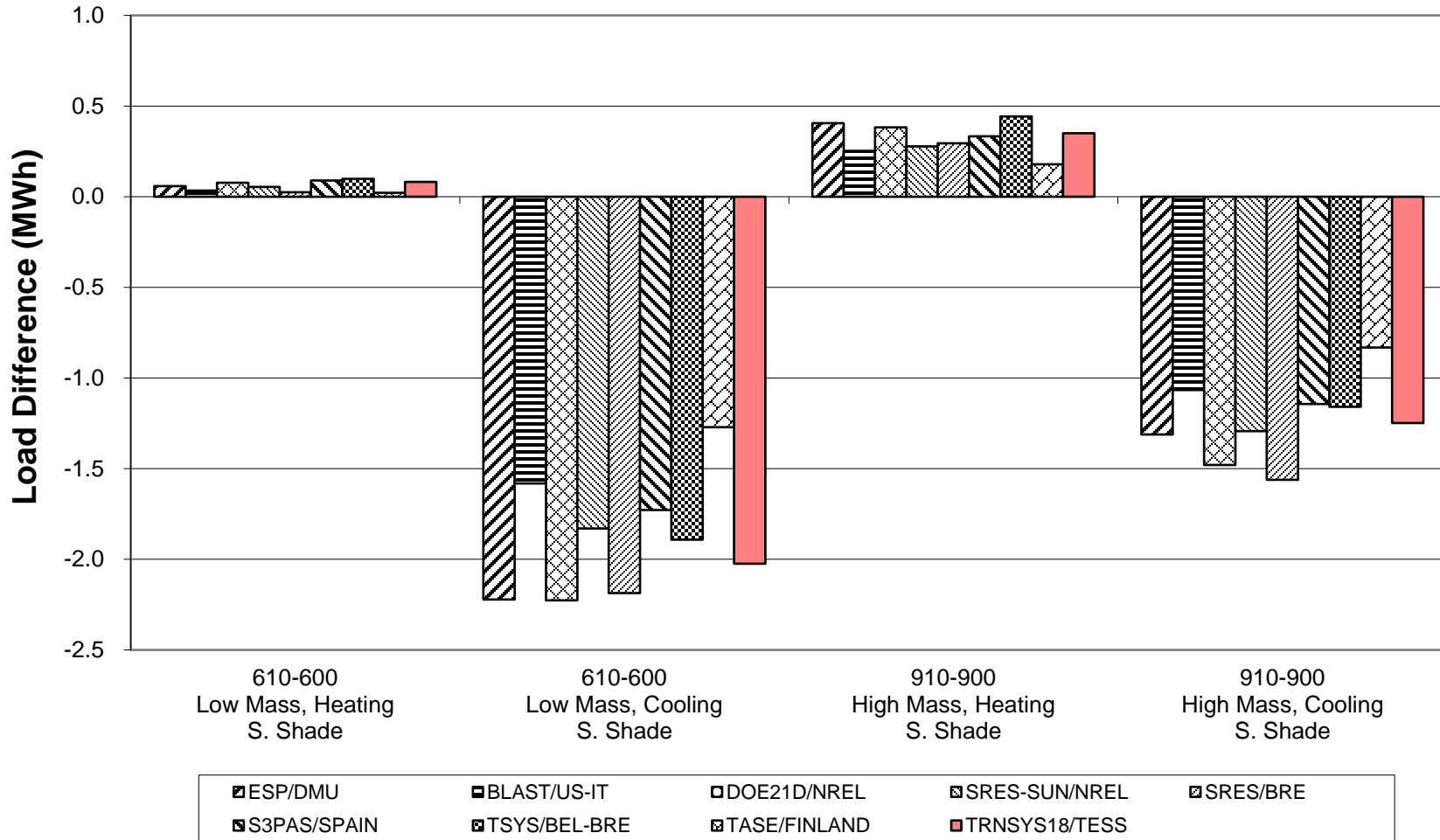
**Figure B8-15. BESTEST BASIC
Minimum Hourly Annual Temperature
Free-Float Cases**



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

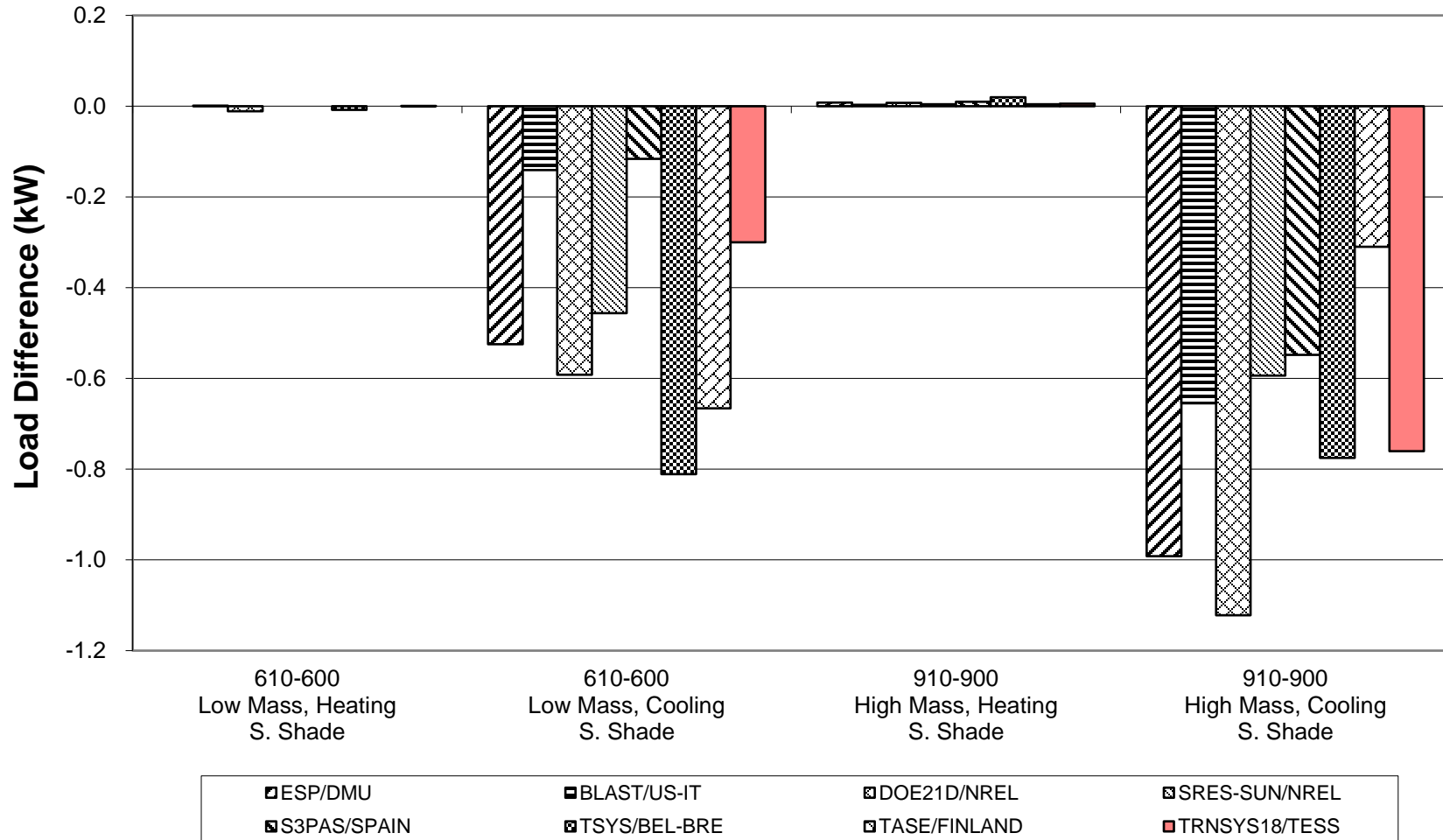


**Figure B8-17. BESTEST BASIC
 South Window Shading (Delta)
 Annual Heating and Sensible Cooling**



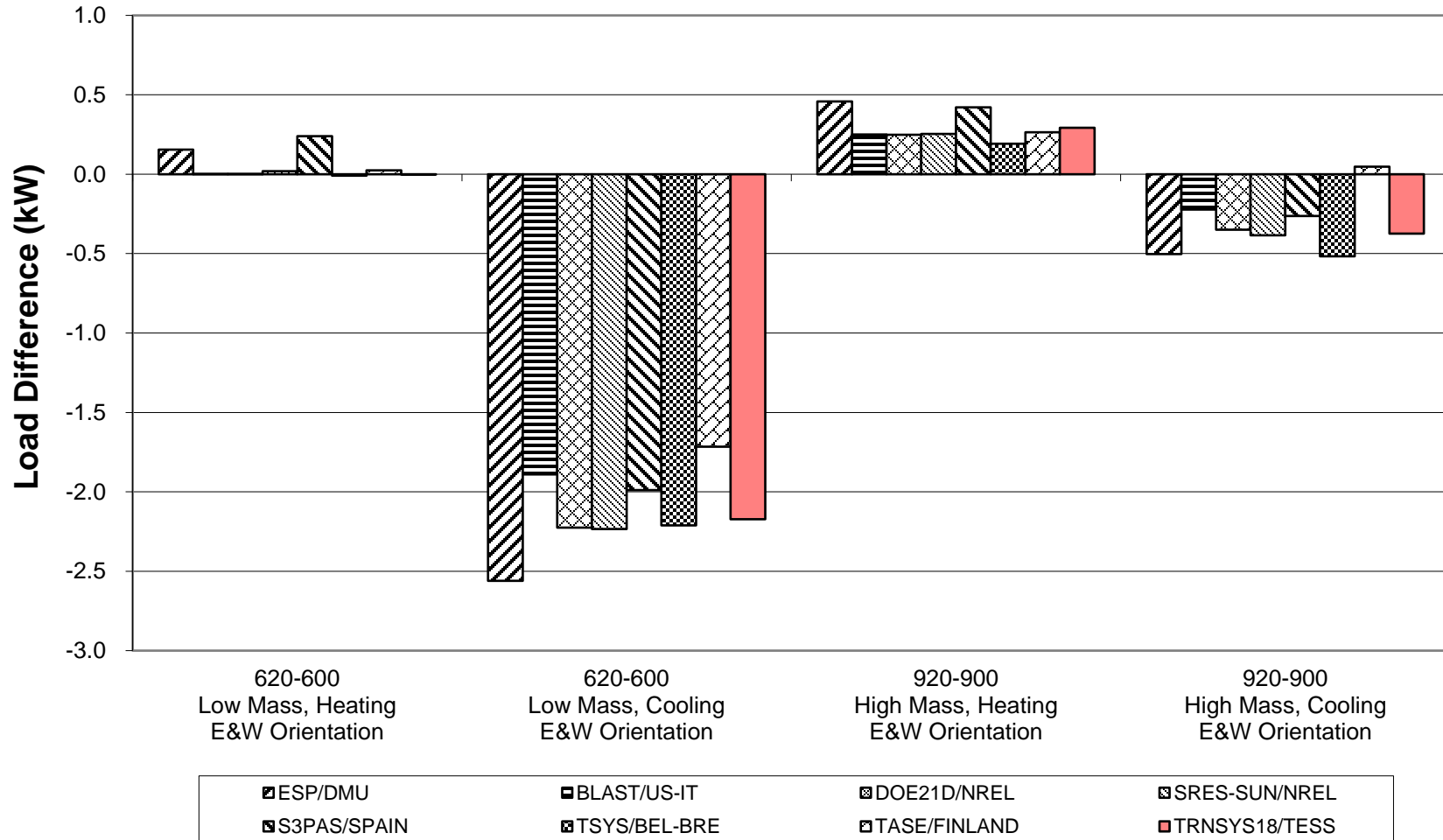
ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
 TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

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

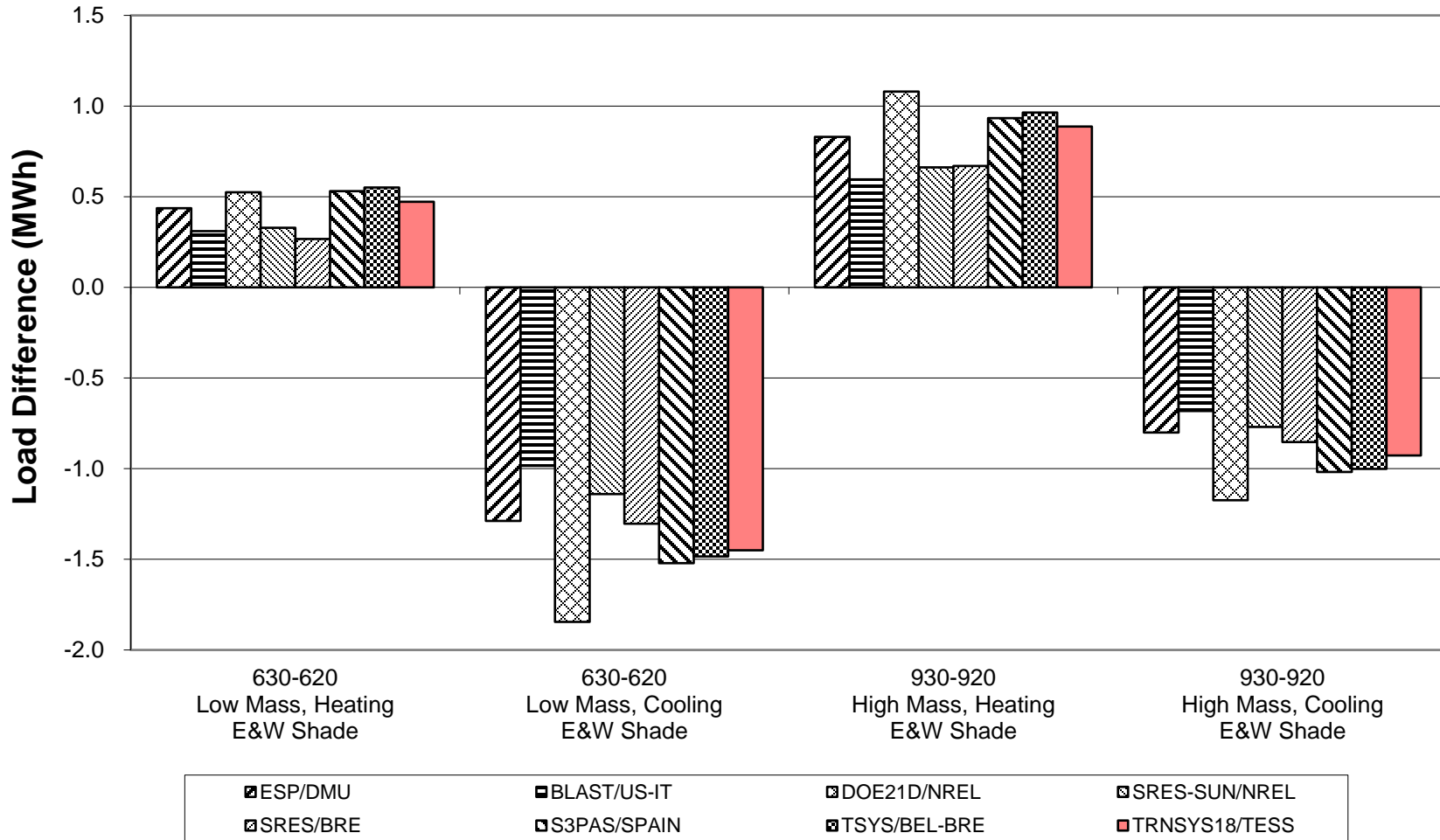


ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
 TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

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

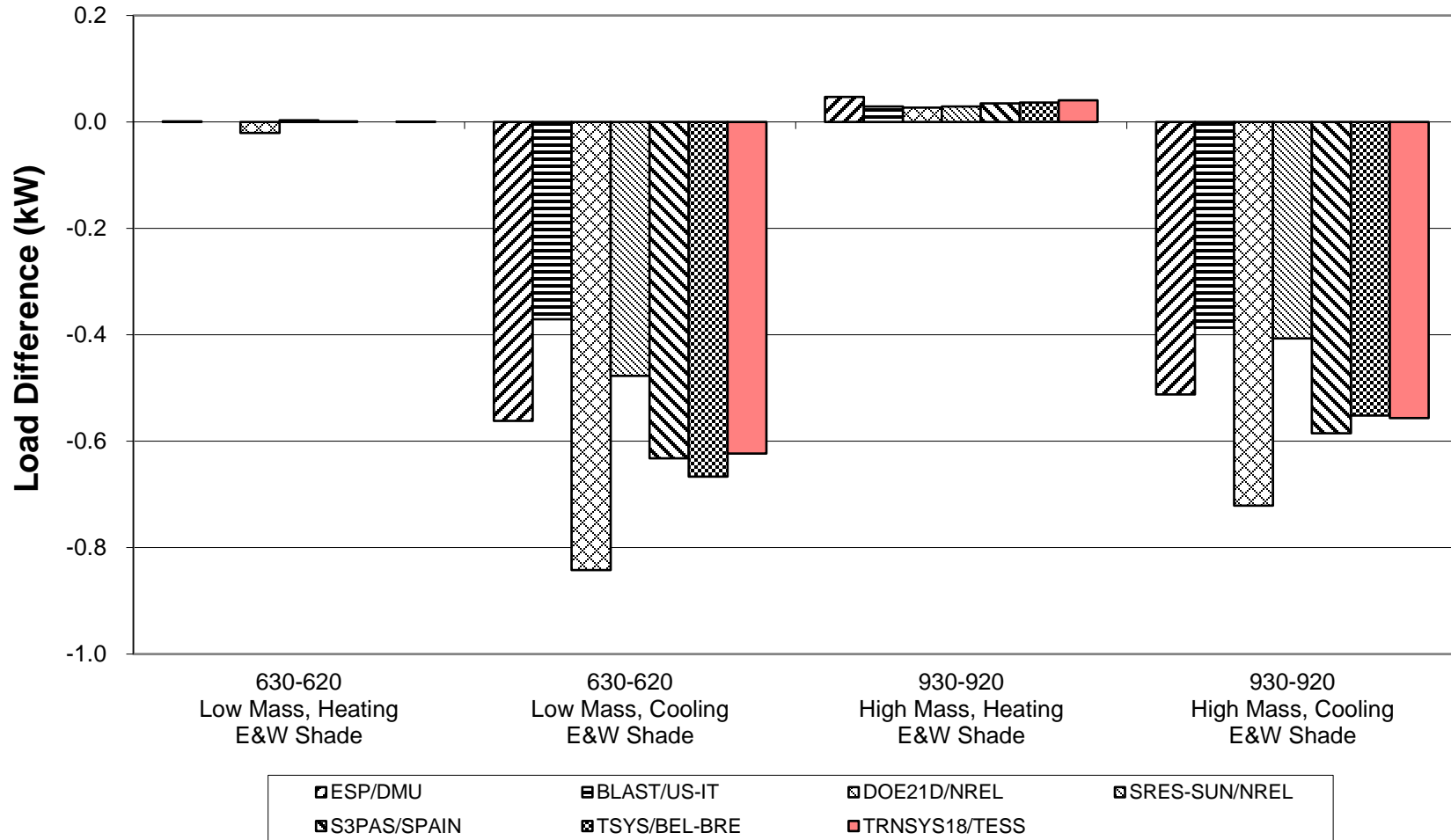


**Figure B8-21. BESTEST BASIC
 East & West Shaded Window (Delta)
 Annual Heating and Sensible Cooling**



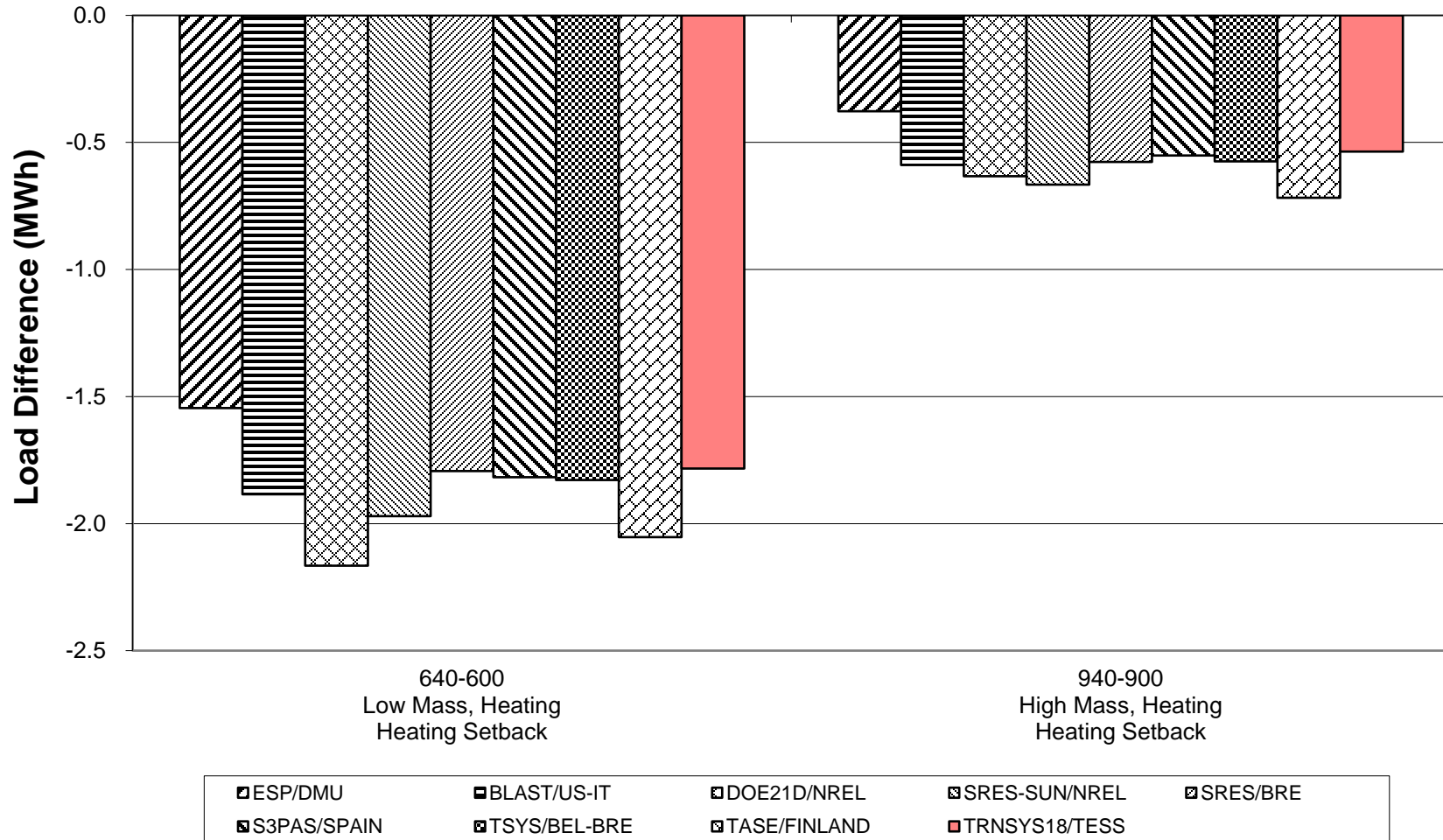
ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
 TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

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

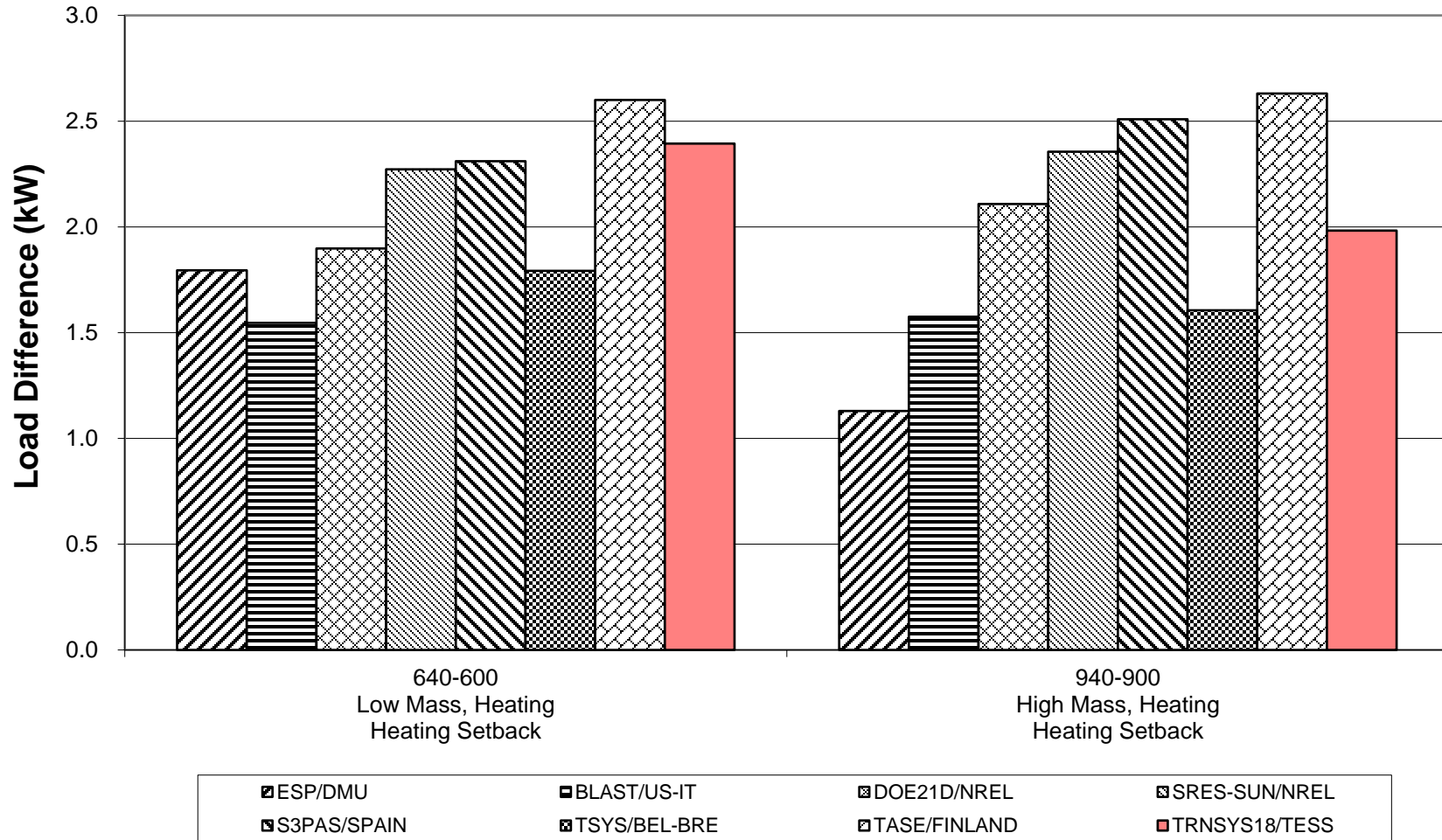


ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
 TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

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

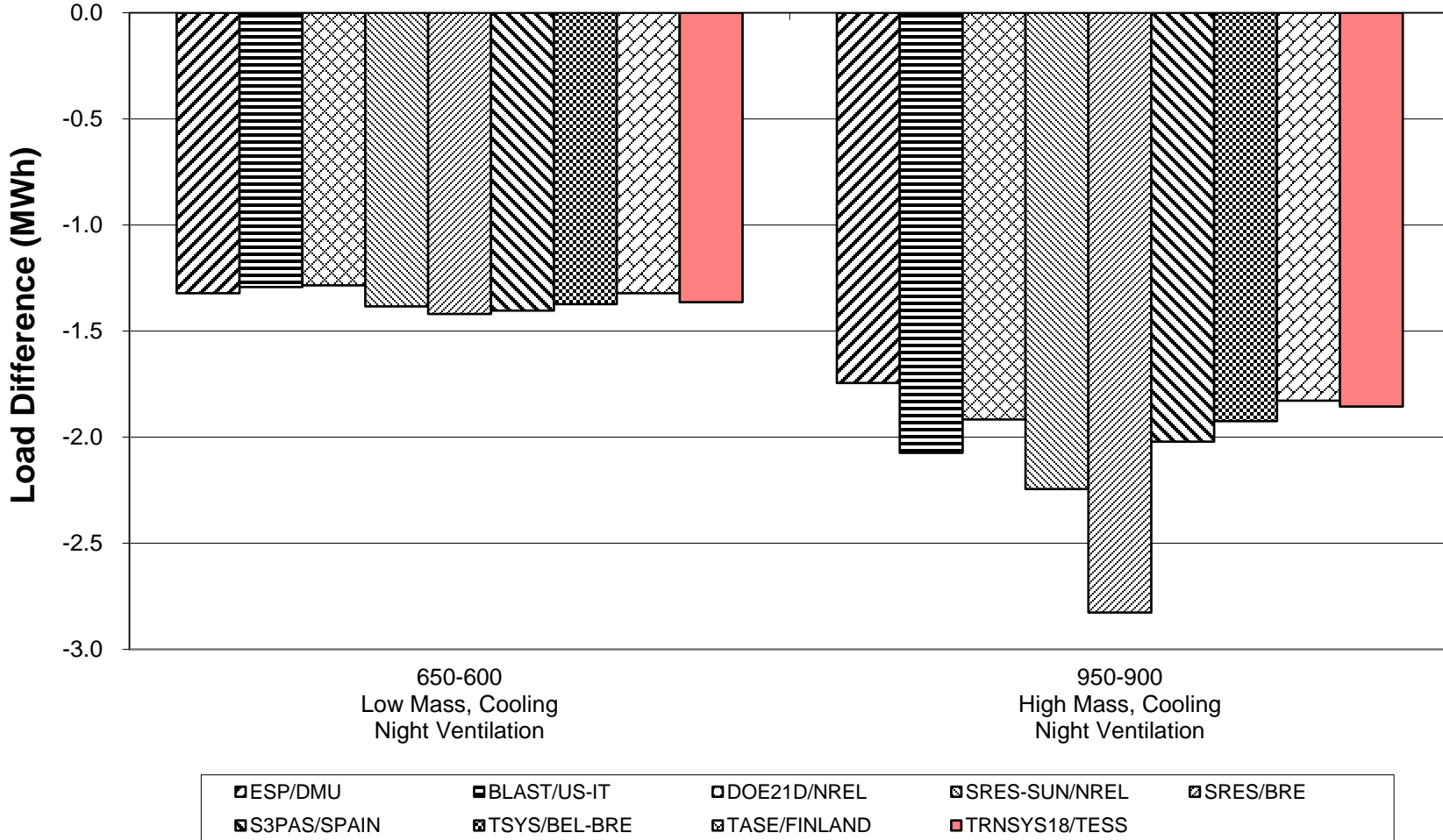


**Figure B8-24. BESTEST BASIC
 Thermostat Setback (Delta)
 Peak Heating**

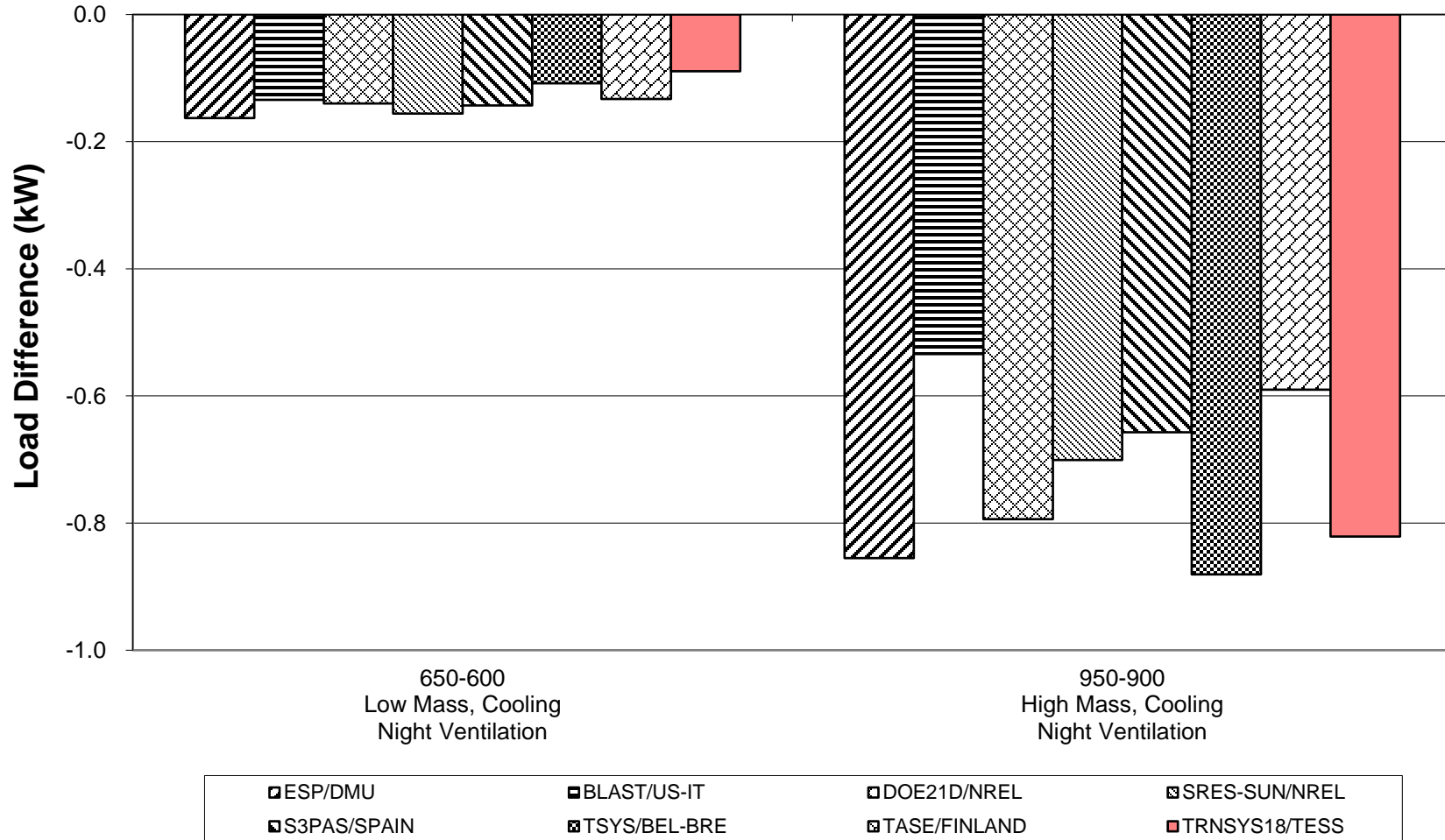


ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF
 TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

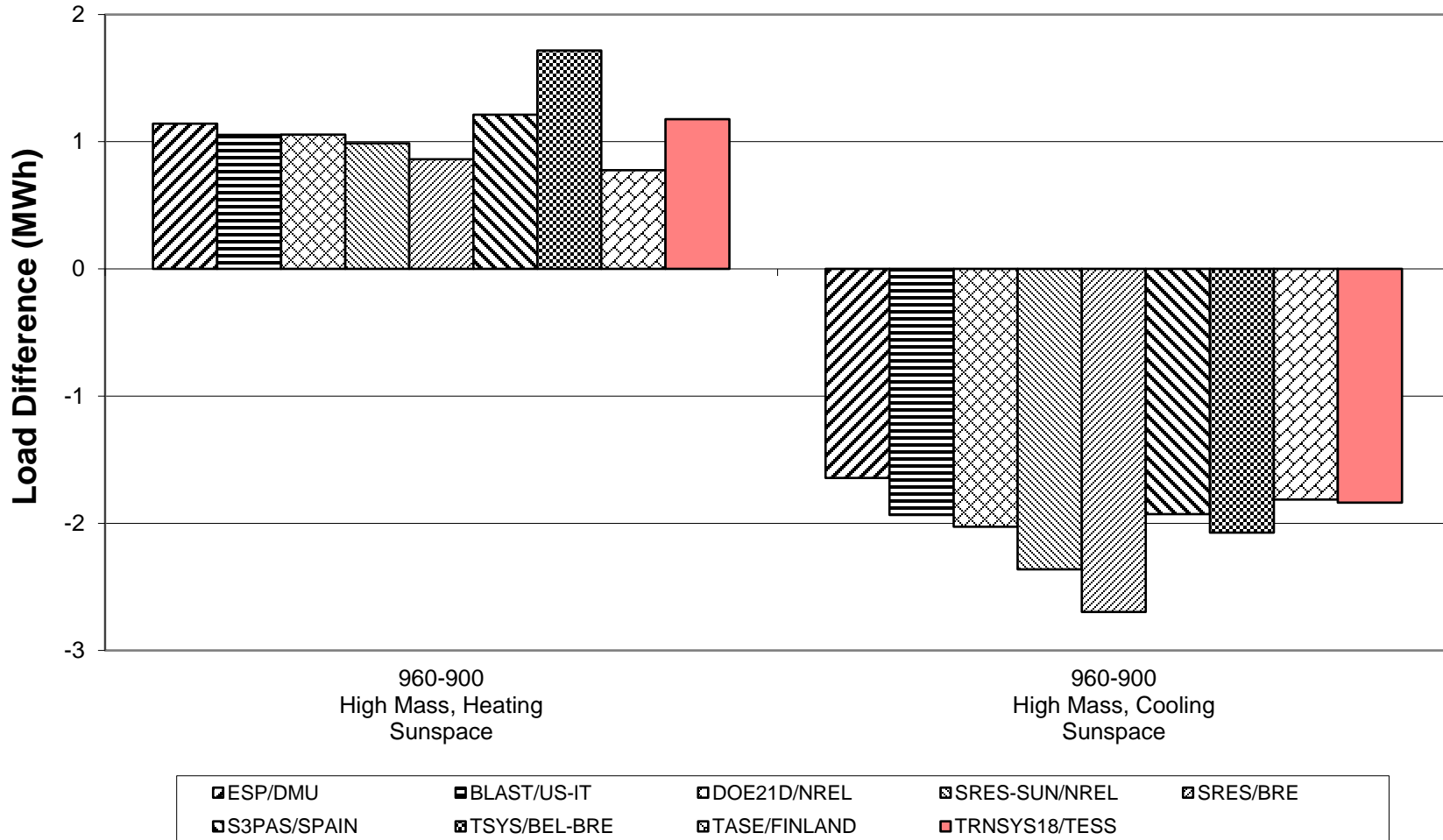
**Figure B8-25. BESTEST BASIC
 Vent Cooling (Delta)
 Annual Sensible Cooling**



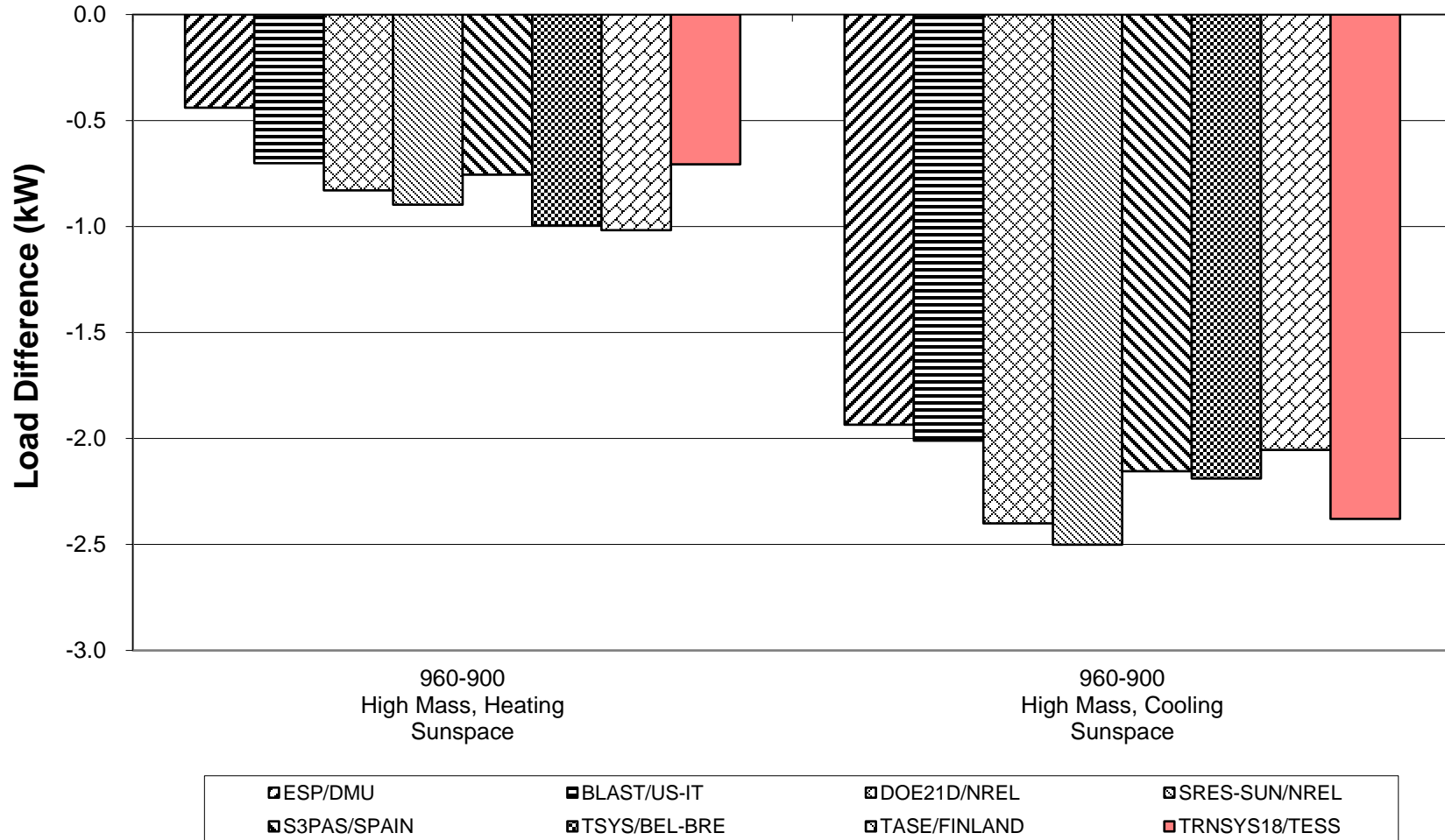
**Figure B8-26. BESTEST BASIC
 Vent Cooling (Delta)
 Peak Sensible Cooling**



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

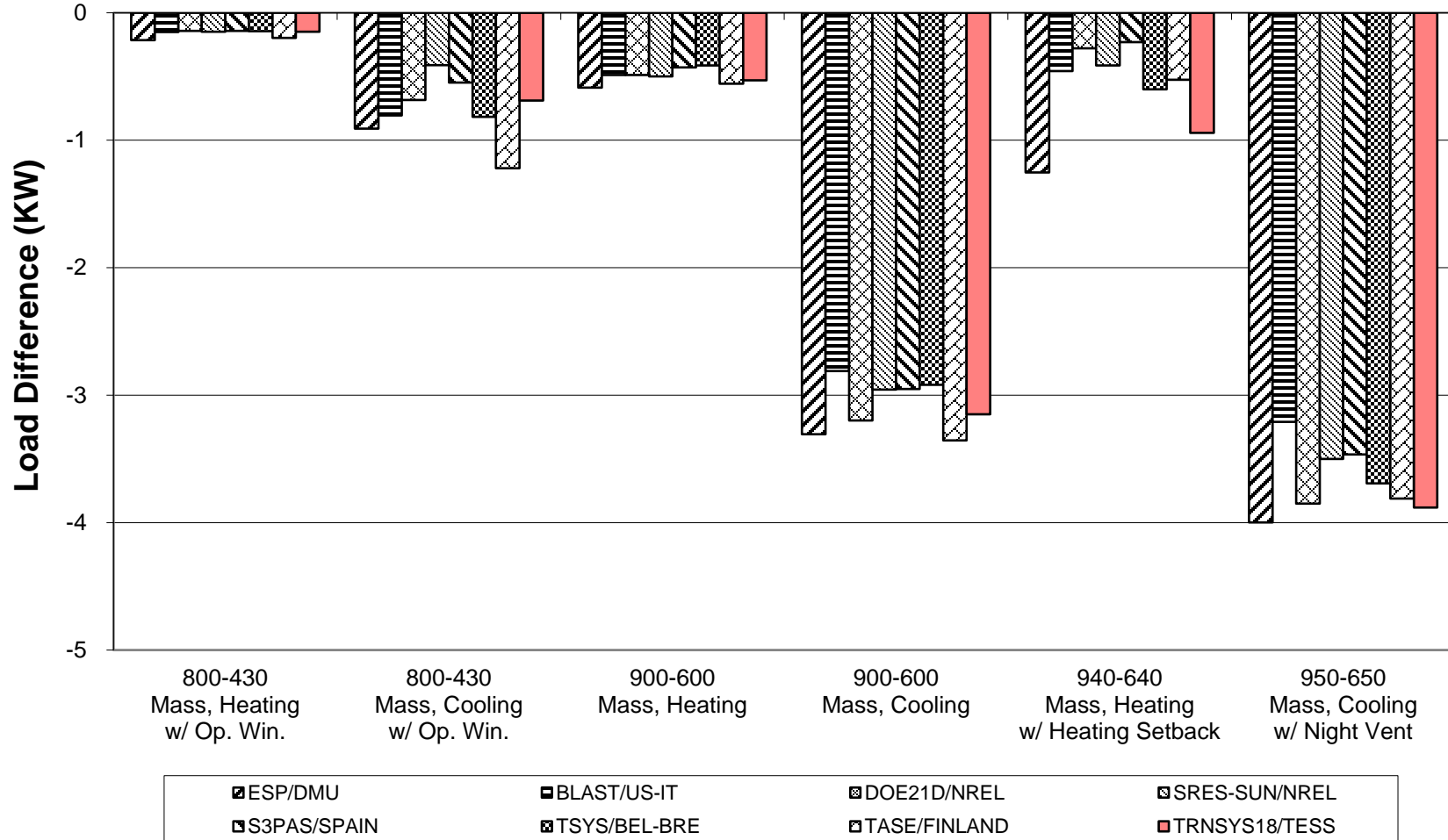


**Figure B8-28. BESTEST BASIC
 Sunspace (Delta)
 Peak Heating and Sensible Cooling**

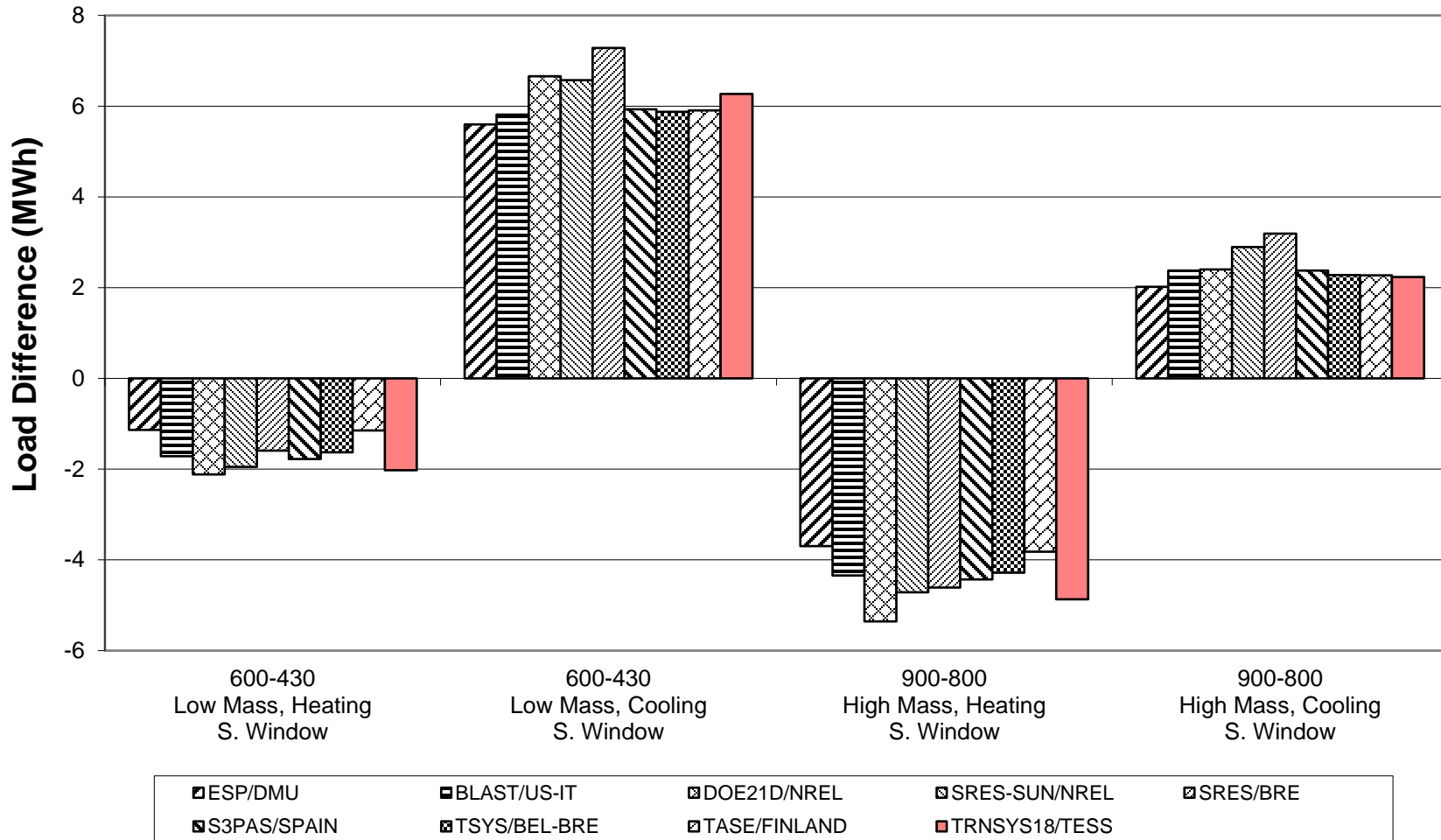


ASHRAE Standard 140-2017 Test Results Comparison for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-960 & 600FF-950FF TRNSYS18.06.0002 (TRNSYS18) vs. Annex B8, Section B8.1 Example Results, by Thermal Energy System Specialists, LLC (TES)

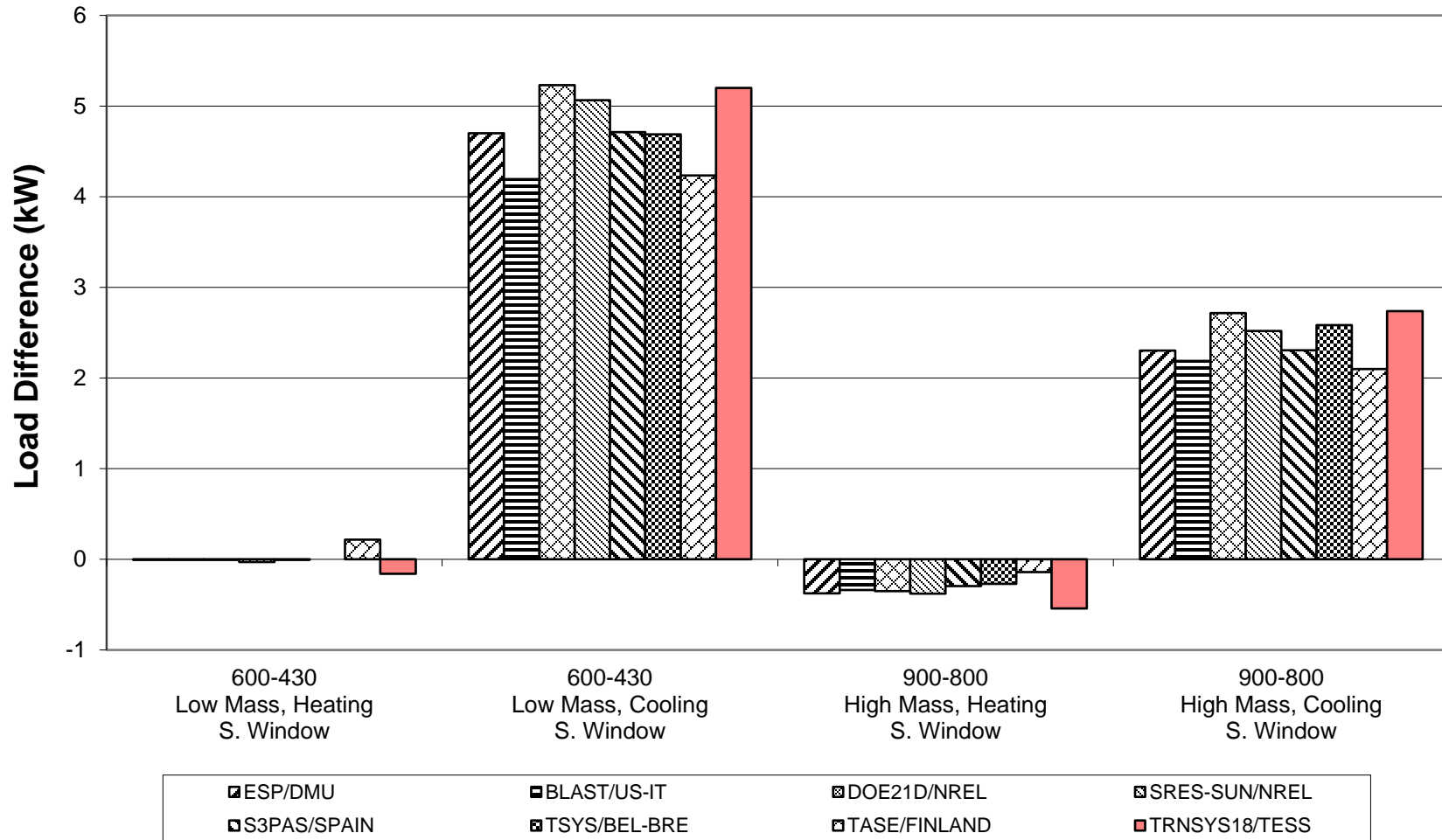
**Figure B8-30. BESTEST BASIC AND IN-DEPTH
Mass Effect (Delta)
Peak Heating and Sensible Cooling**



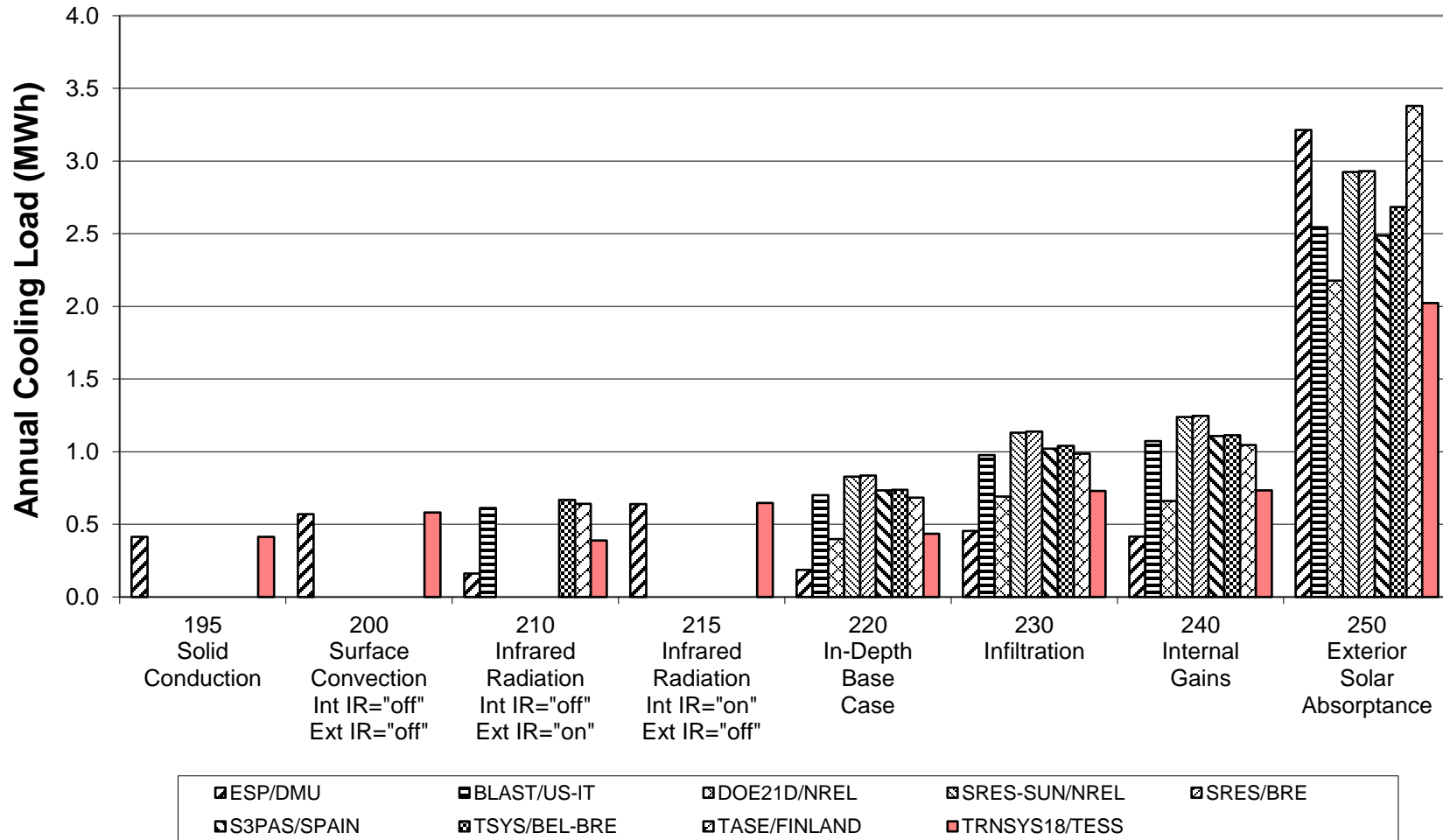
**Figure B8-31. BESTEST IN-DEPTH
South Window (Delta)
Annual Heating and Sensible Cooling**



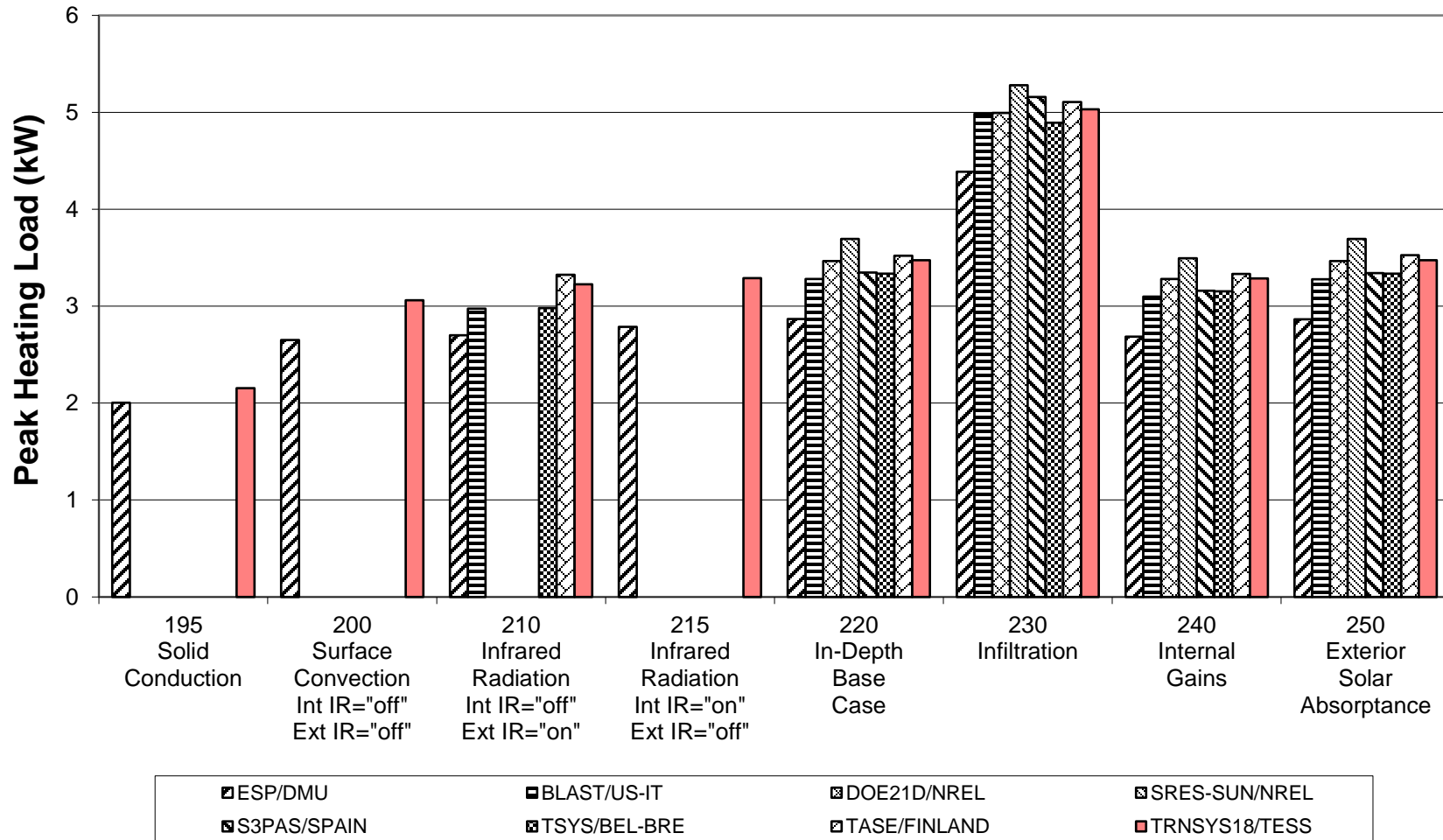
**Figure B8-32. BESTEST IN-DEPTH
 South Window (Delta)
 Peak Heating and Sensible Cooling**



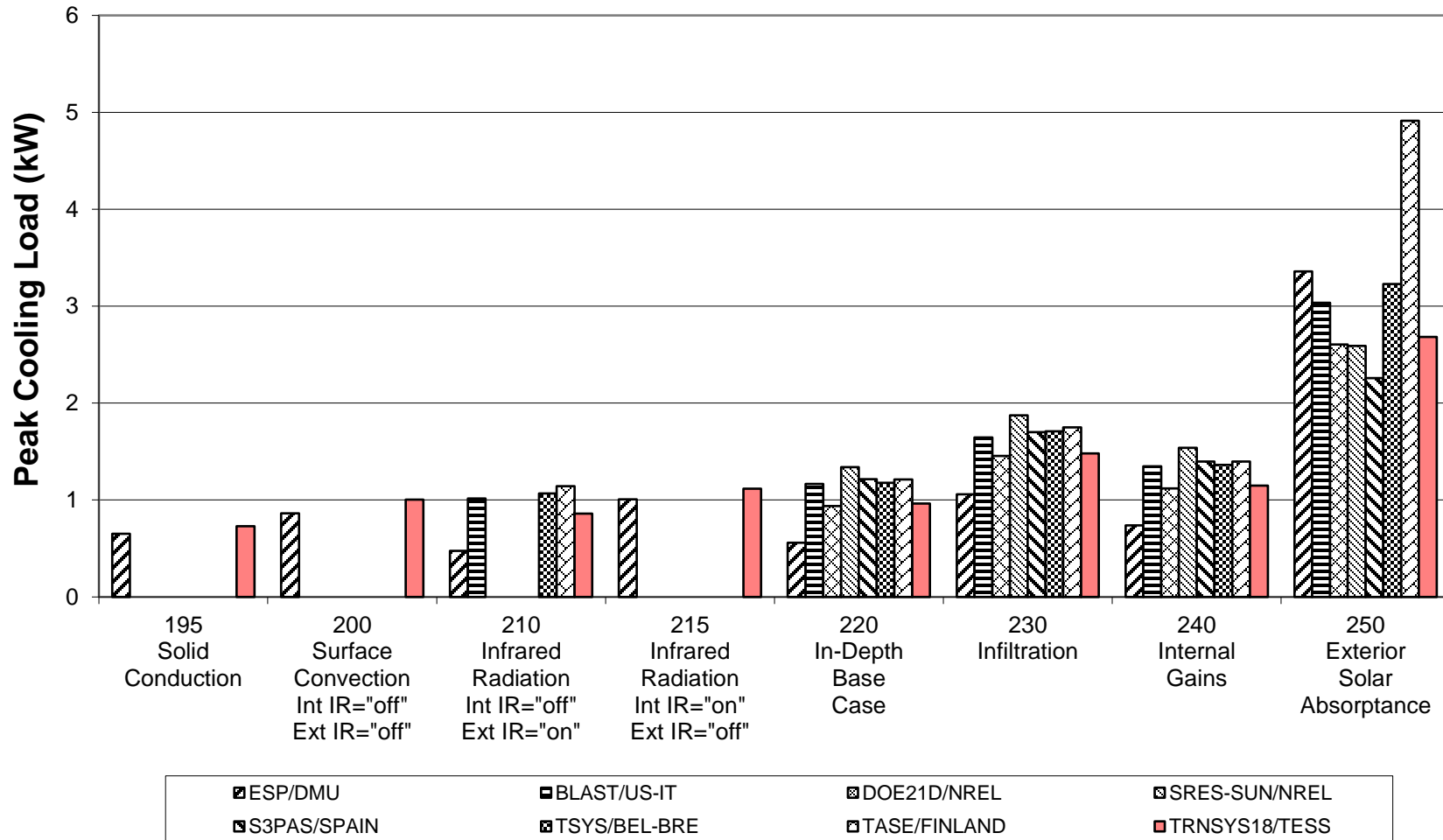
**Figure B8-34. BESTEST IN-DEPTH
Low Mass Annual Sensible Cooling
Cases 195 to 250**



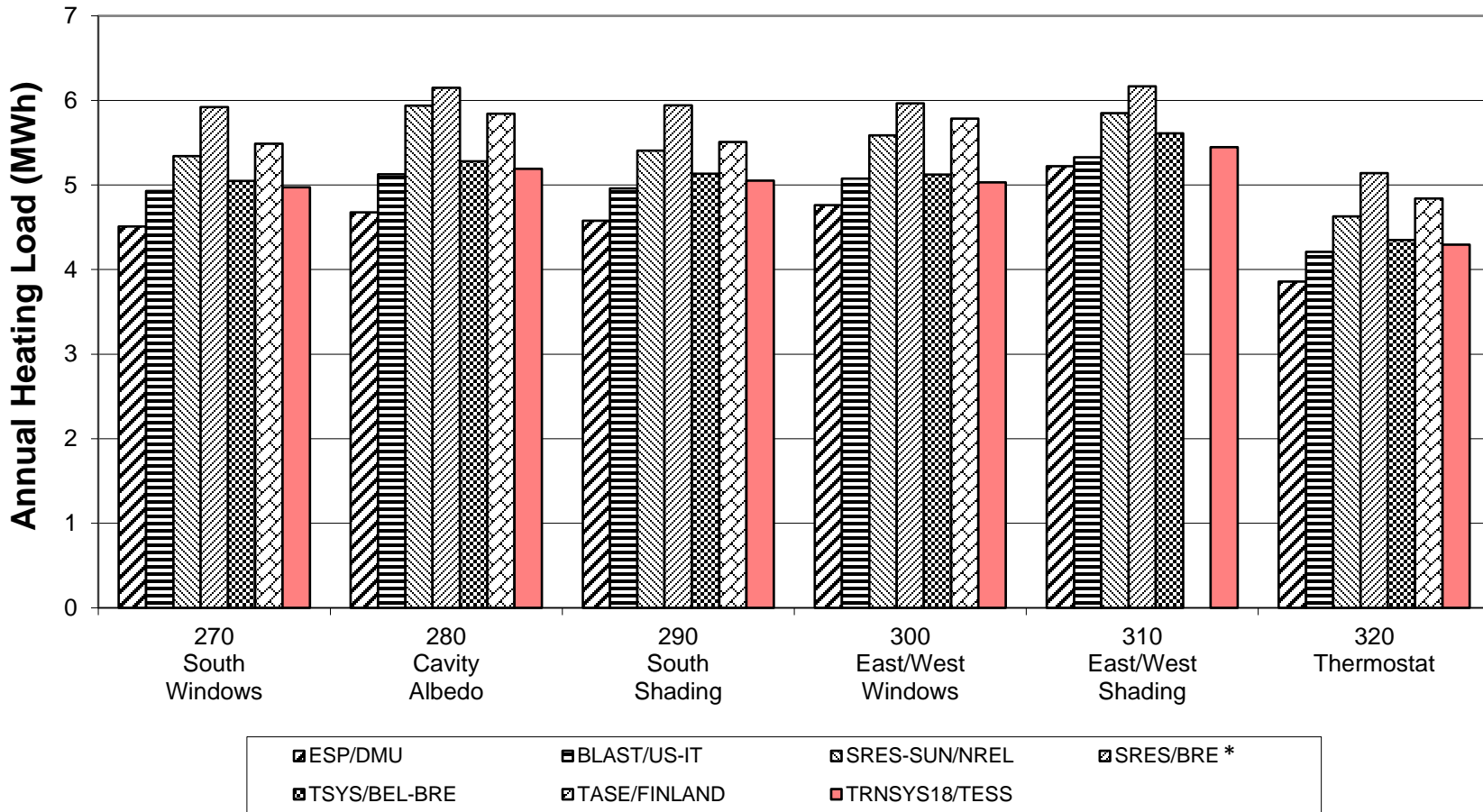
**Figure B8-35. BESTEST IN-DEPTH
Low Mass Peak Heating
Cases 195 to 250**



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

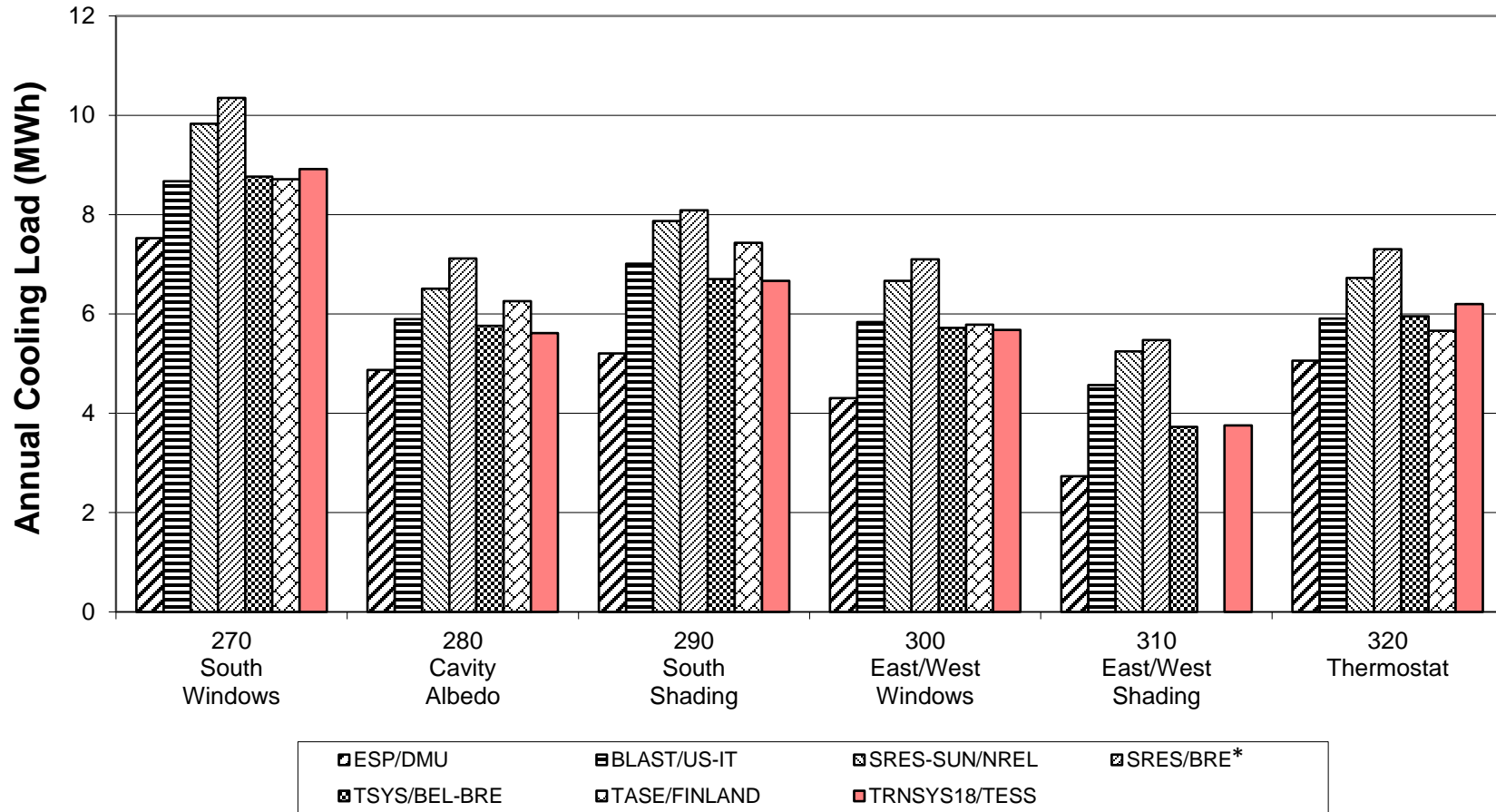


**Figure B8-37. BESTEST IN-DEPTH
Low Mass Annual Heating
Cases 270 to 320**



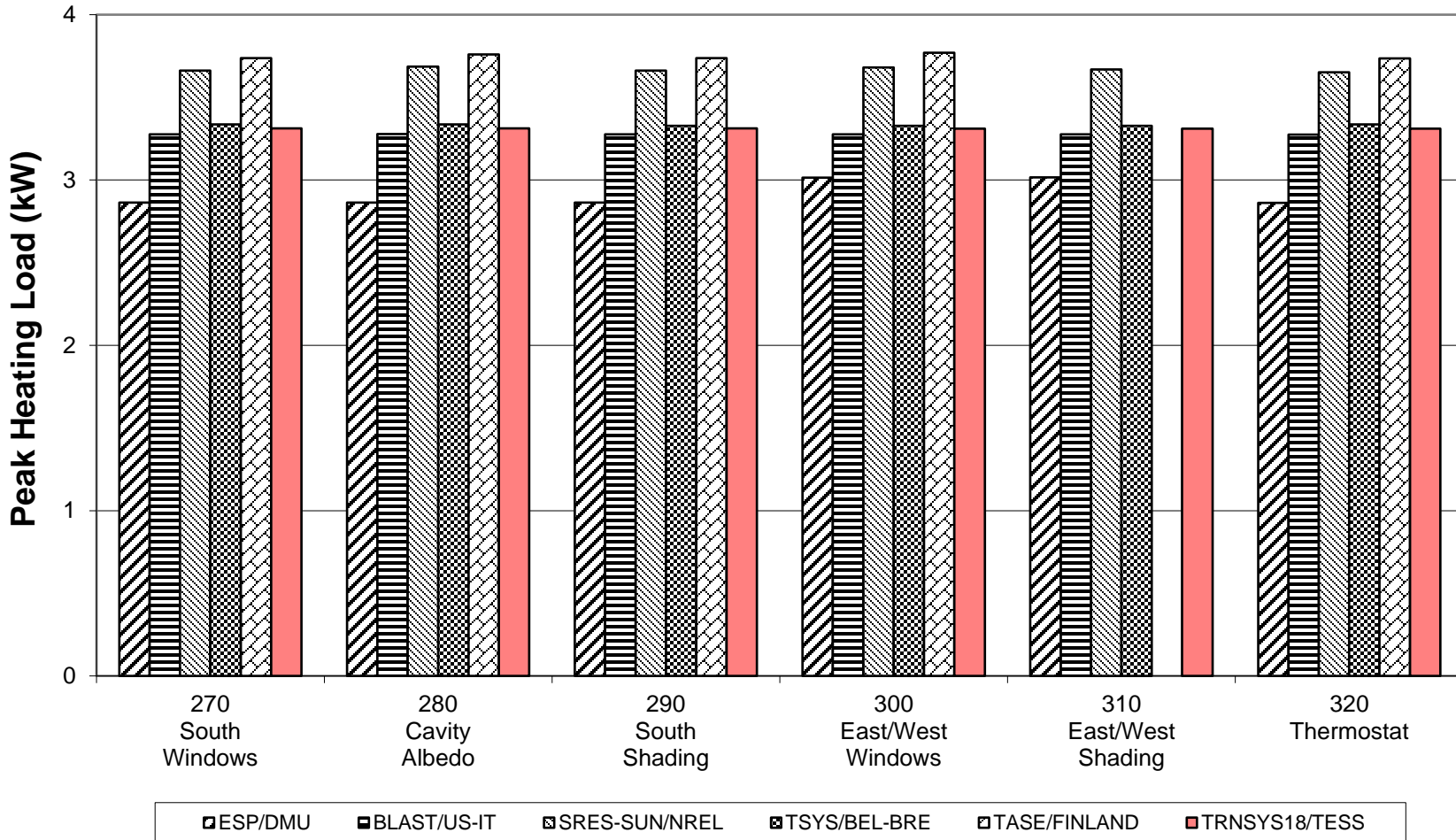
* SRES/BRE Cases 270, 290-320 have input error likely affecting results by <0.2 MWh/y (<3%)

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

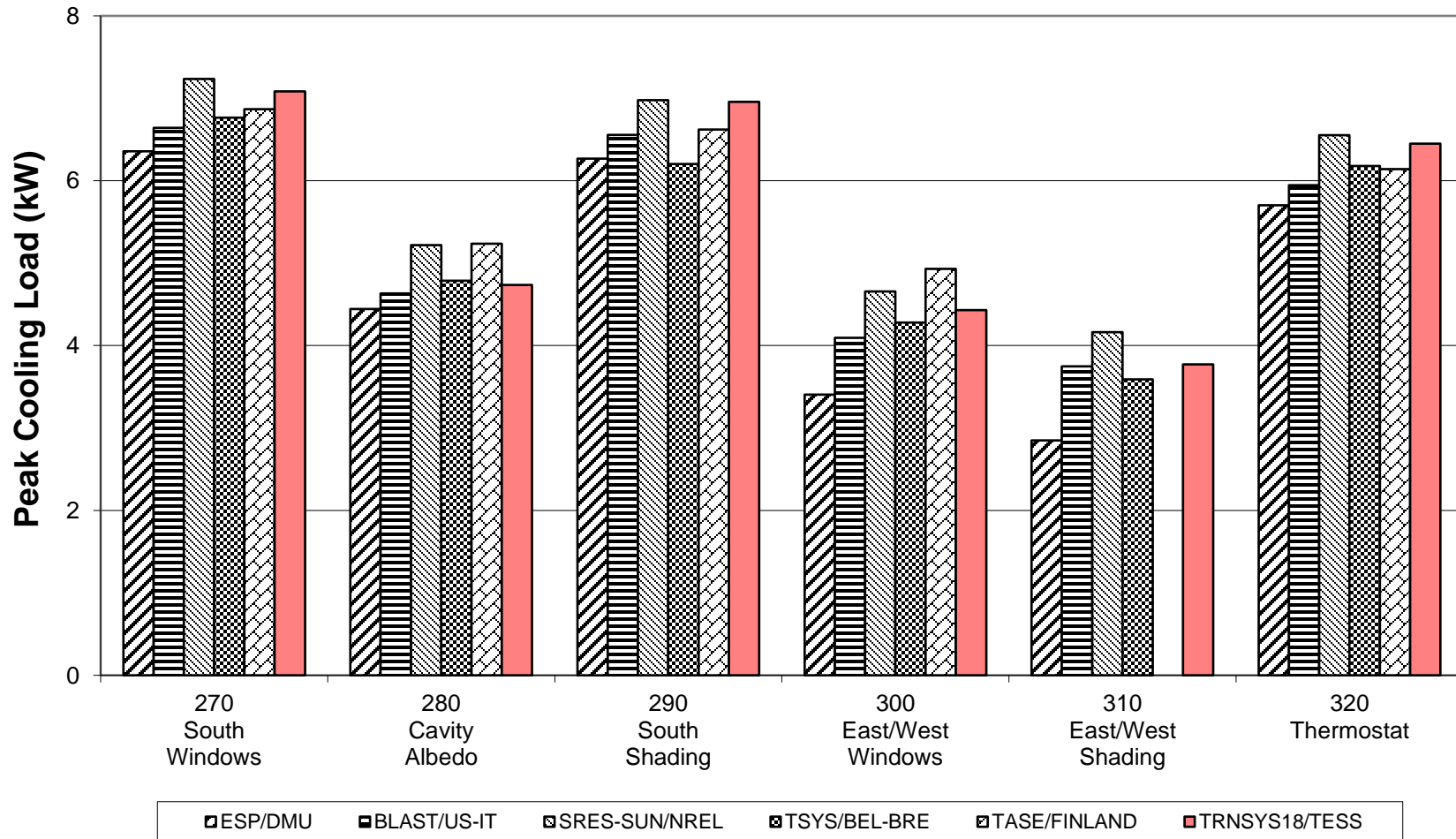


* SRES/BRE Cases 270, 290-320 have input error likely affecting results by <0.2 MWh/y (<3%)

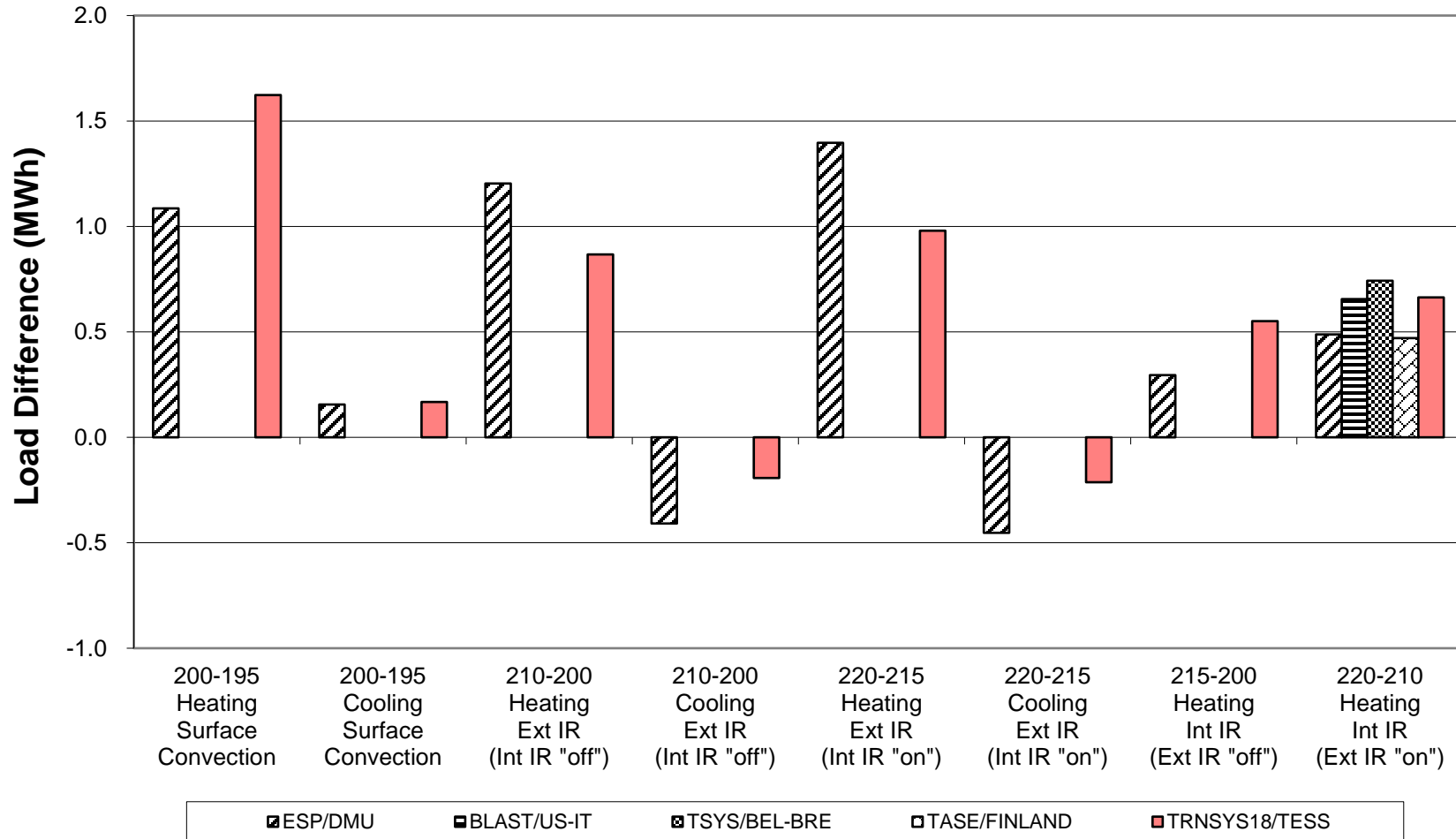
**Figure B8-39. BESTEST IN-DEPTH
Low Mass Peak Heating
Cases 270 to 320**



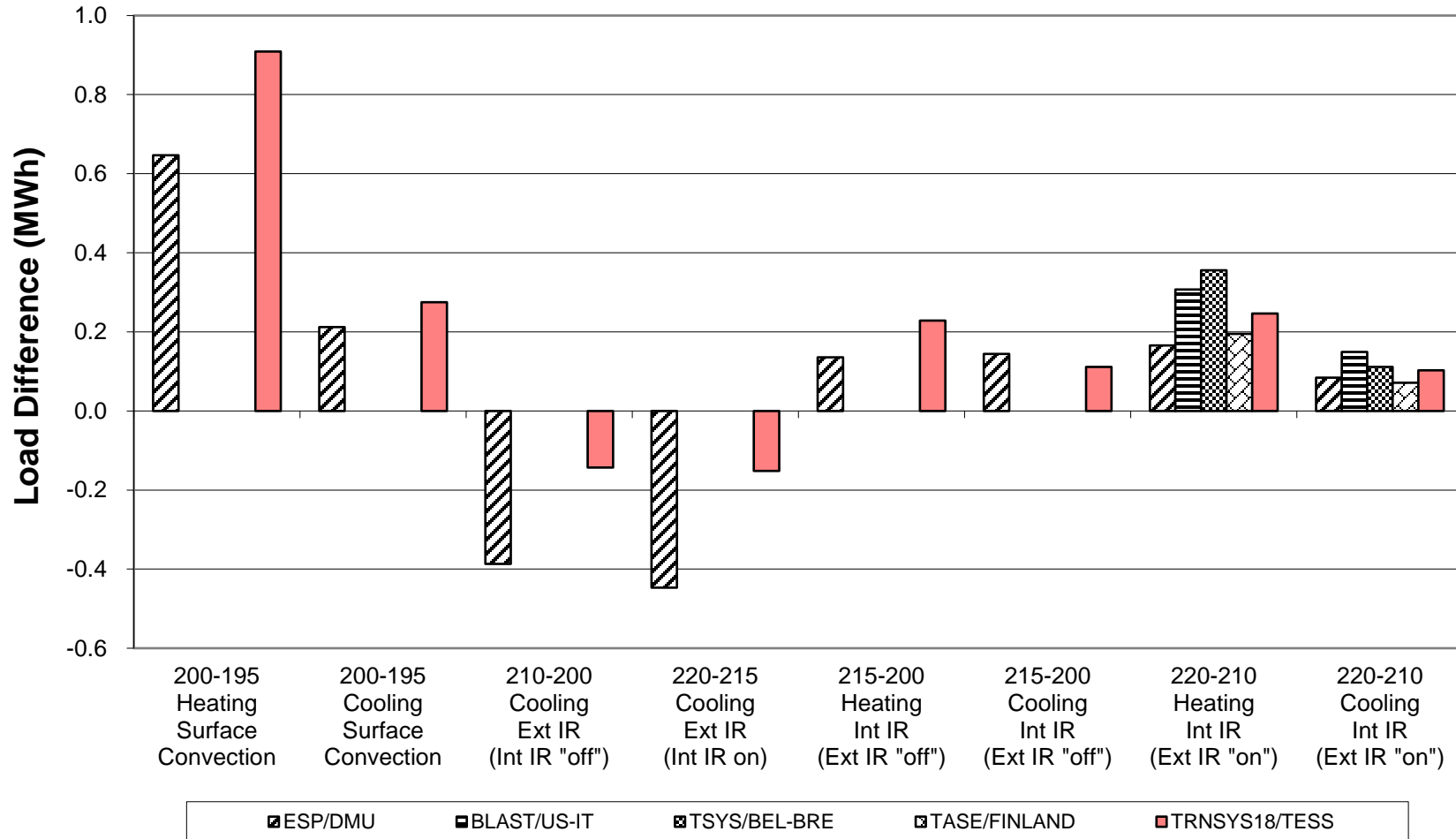
**Figure B8-40. BESTEST IN-DEPTH
Low Mass Peak Sensible Cooling
Cases 270 to 320**



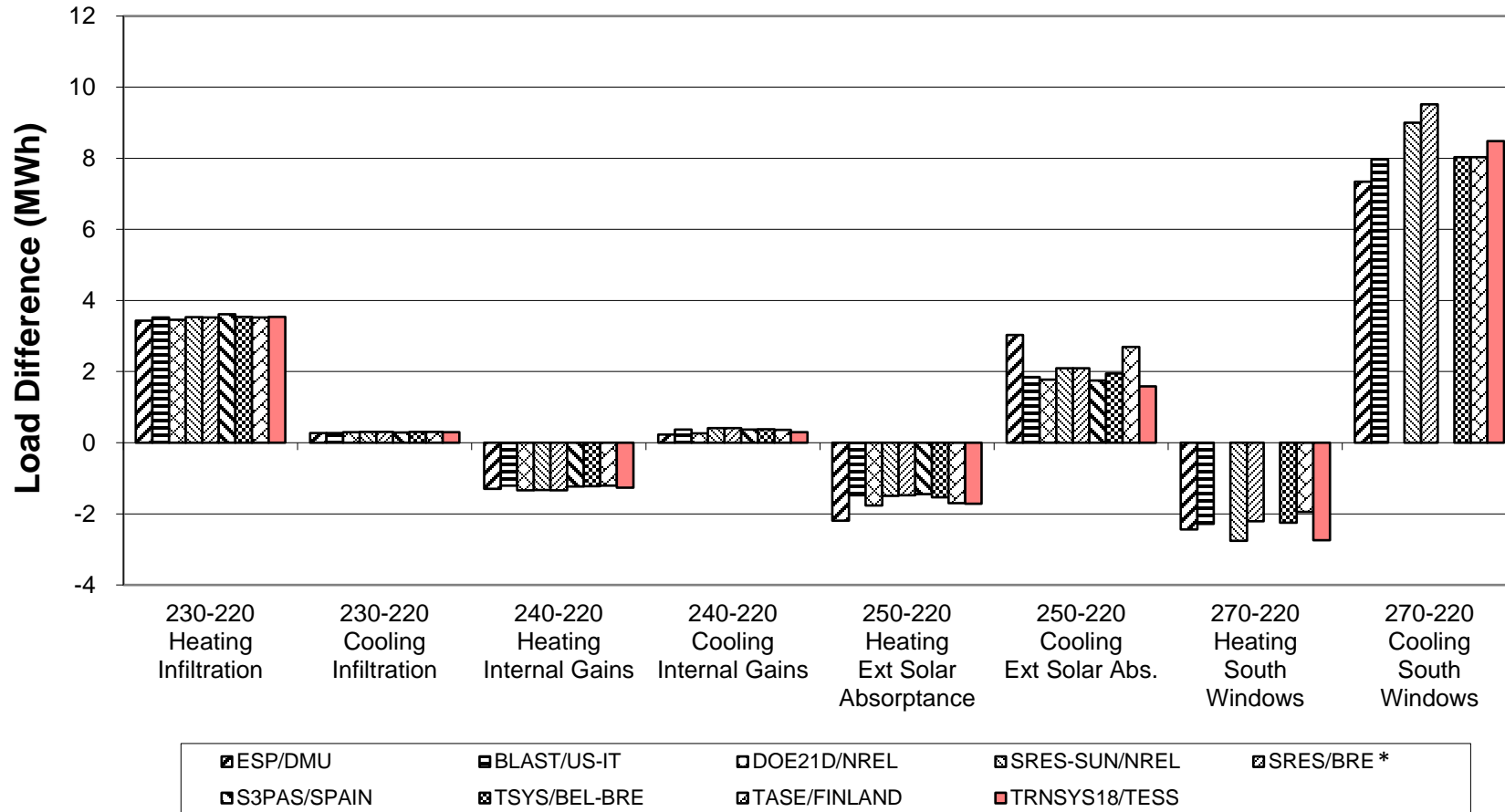
**Figure B8-41. BESTEST IN-DEPTH
Cases 195 to 220 (Delta)
Annual Heating and Sensible Cooling**



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

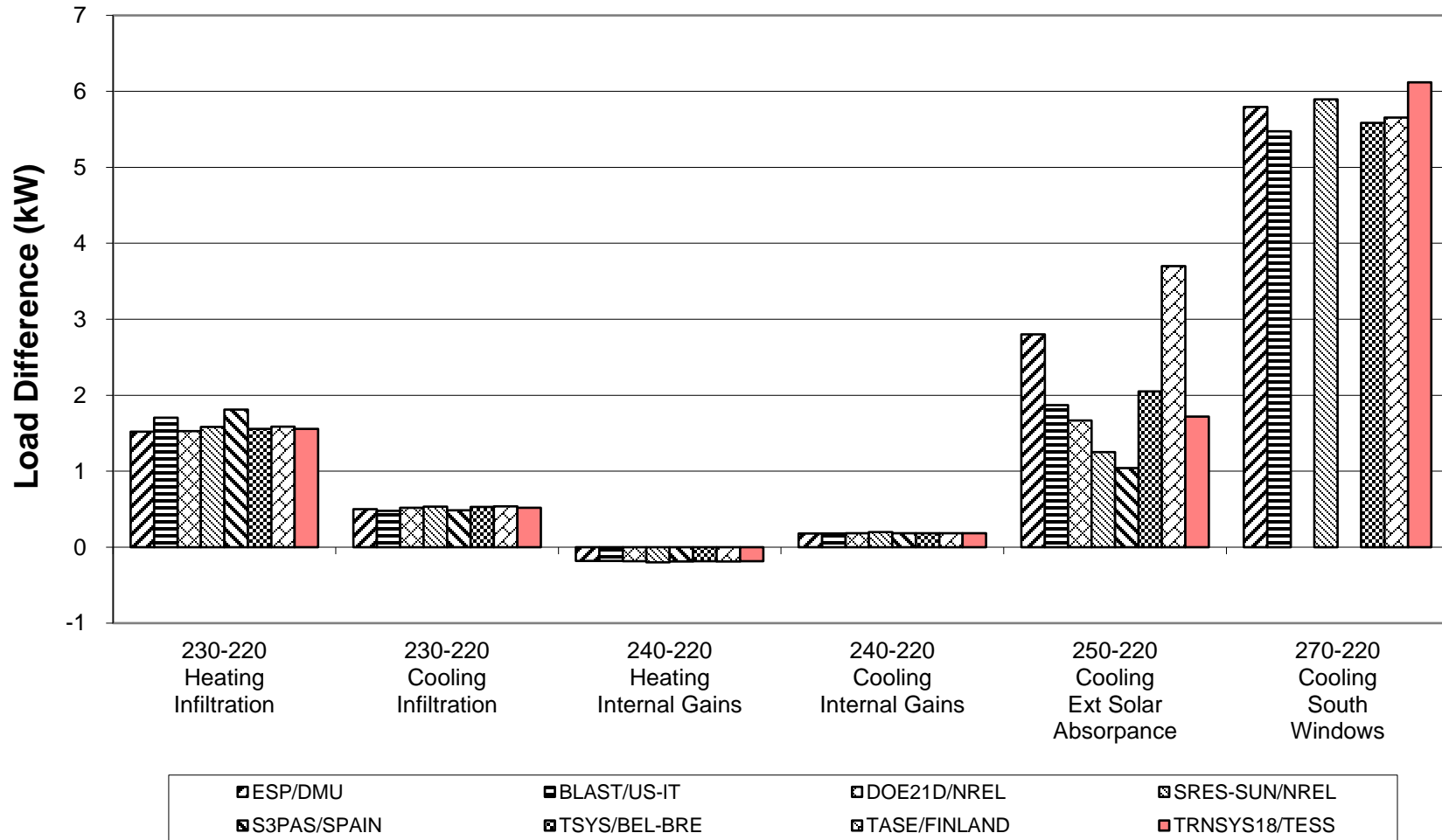


**Figure B8-43. BESTEST IN-DEPTH
Cases 220 to 270 (Delta)
Annual Heating and Sensible Cooling**

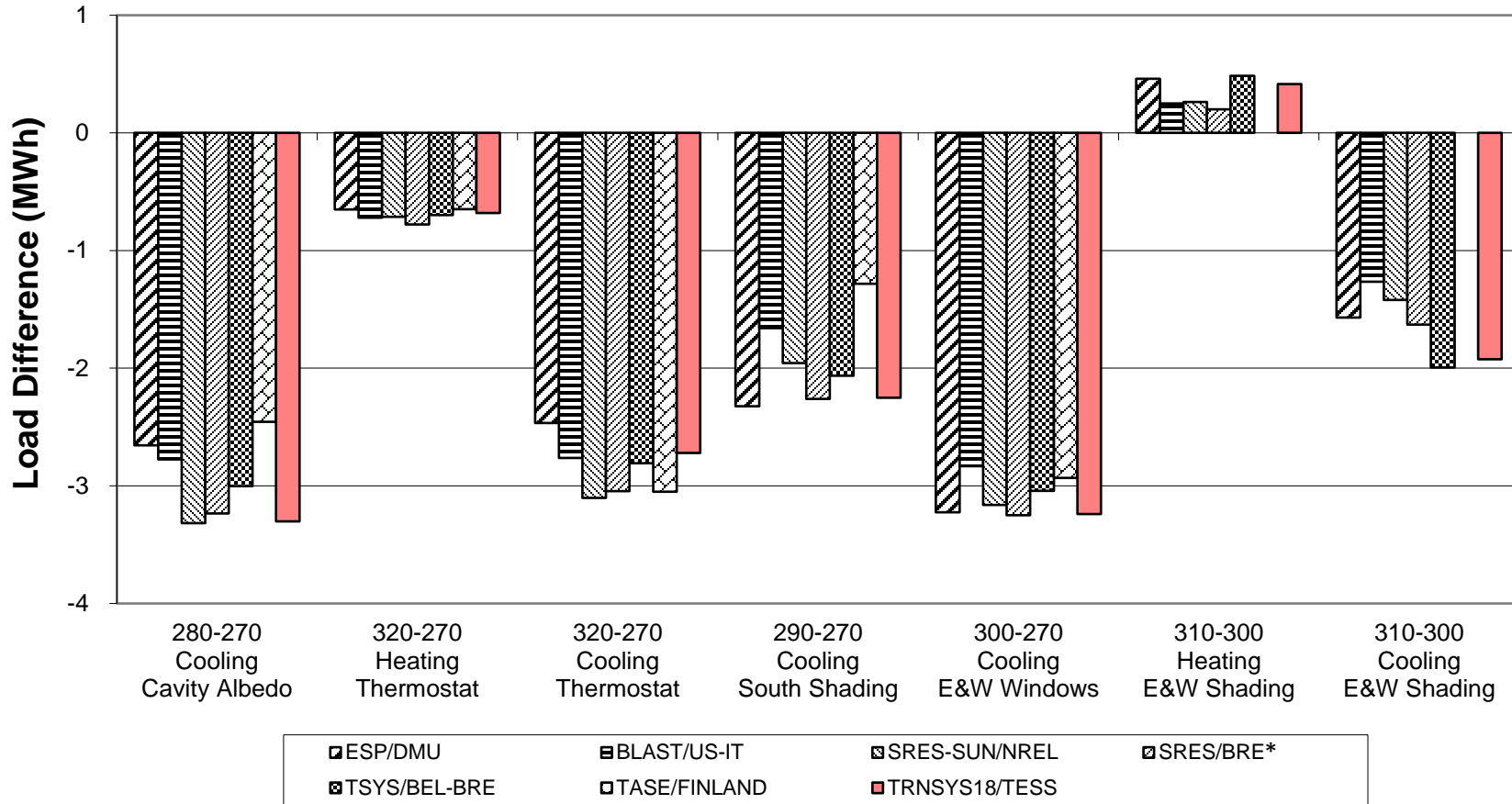


* SRES/BRE Case 270 has input error likely affecting 270-220 sensitivity results for heating by <0.2 MWh/y (<6%), and for cooling by <0.2 MWh/y (<3%)

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

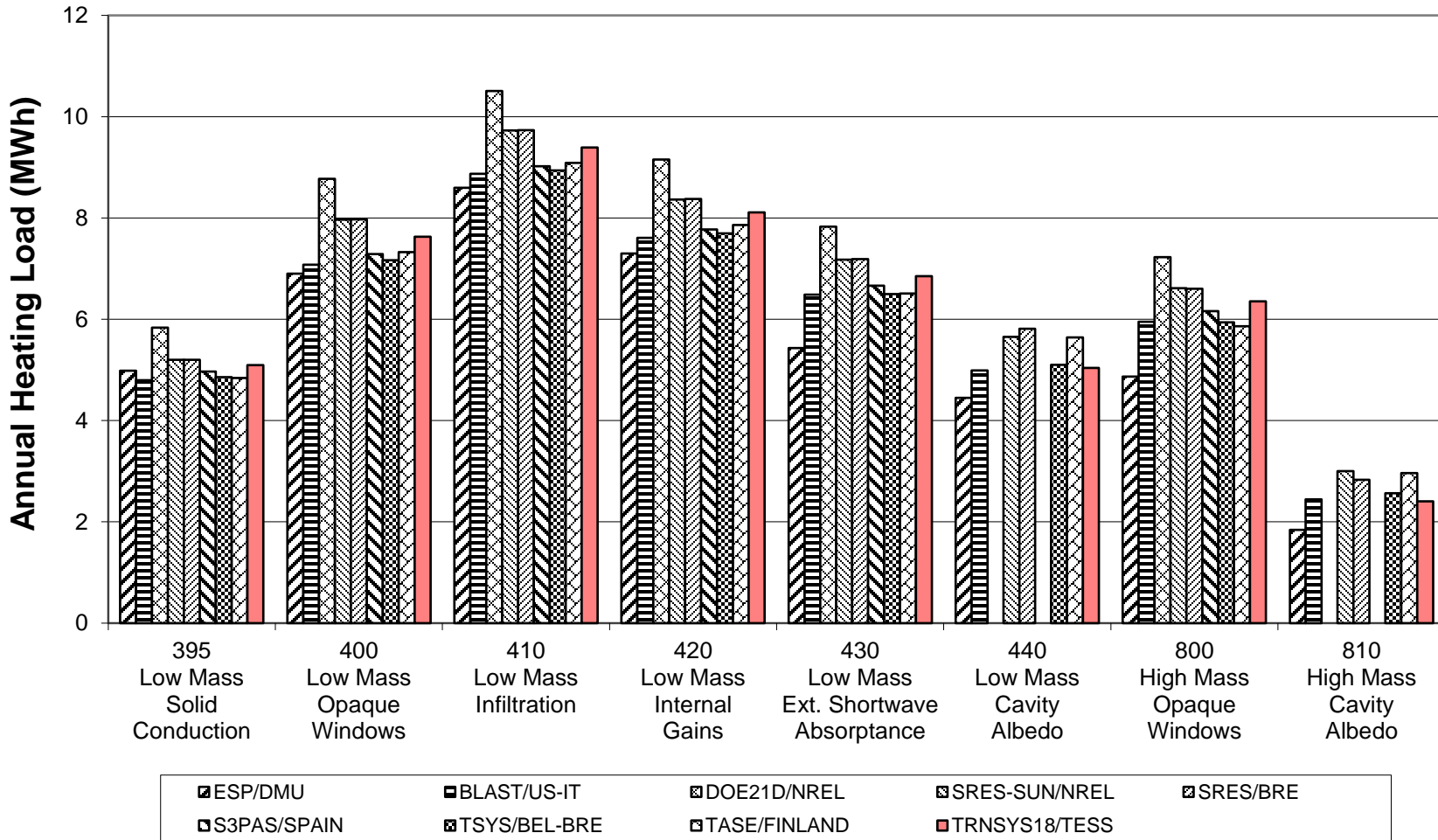


**Figure B8-45. BESTEST IN-DEPTH
Cases 270 to 320 (Delta)
Annual Heating and Sensible Cooling**

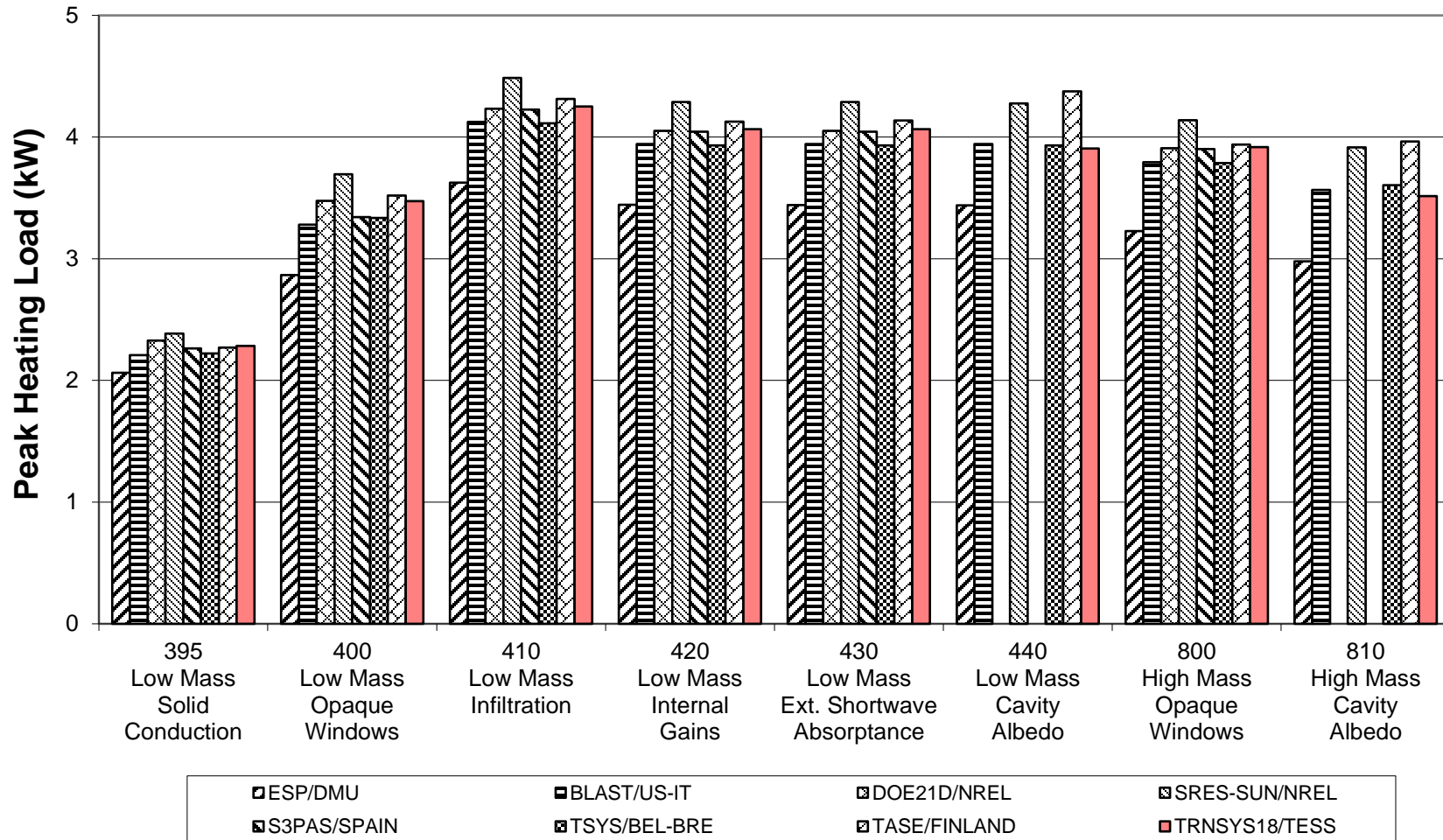


* SRES-BRE Cases 270, 290-320 have input error likely affecting sensitivity results for heating by <0.2 MWh/y (<6%), and for cooling by <0.2 MWh/y (<3%)

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



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



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

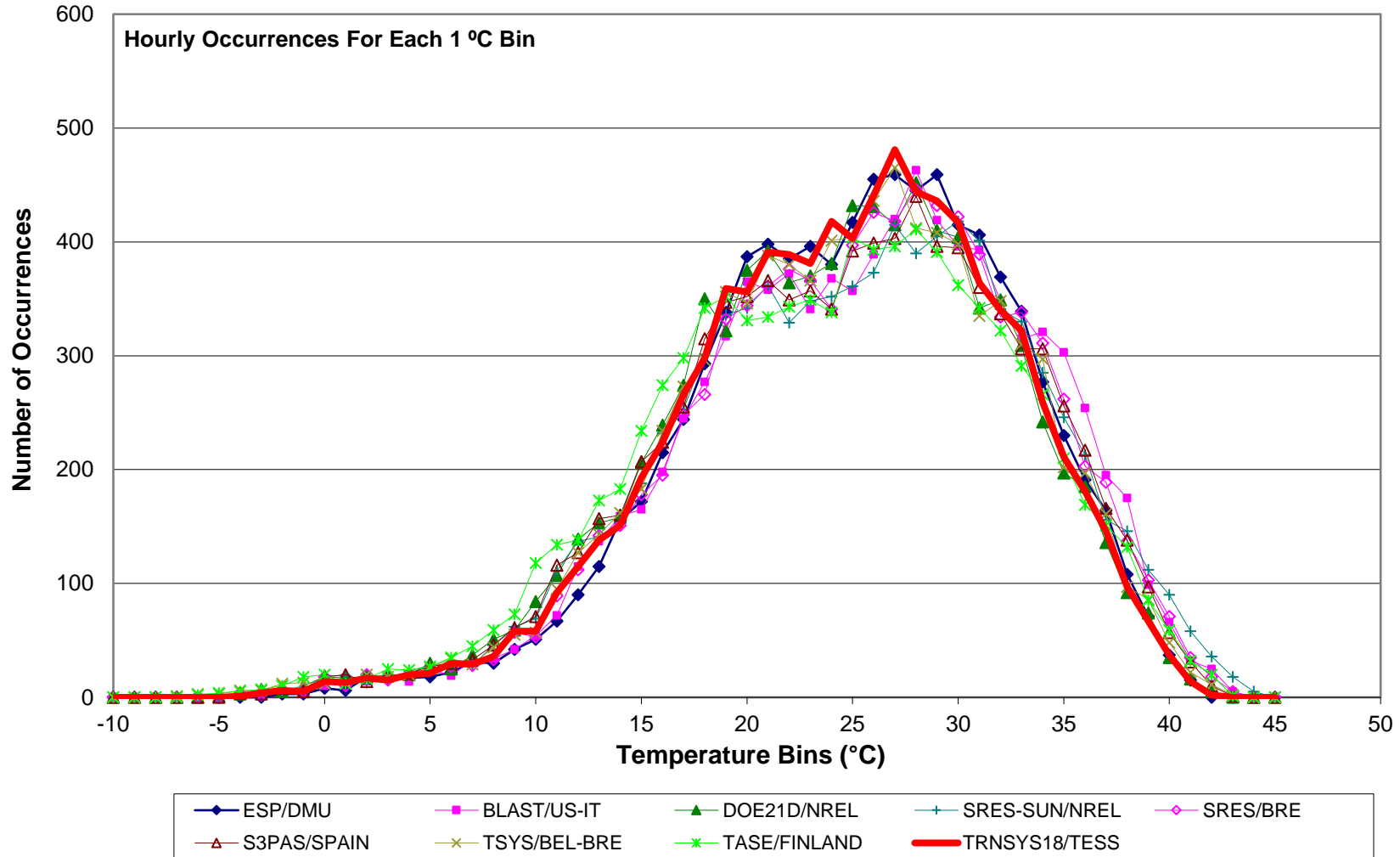


Figure B8-54. BESTEST Case 600
Cloudy & Clear Day Hourly Incident Solar
South Facing Surface

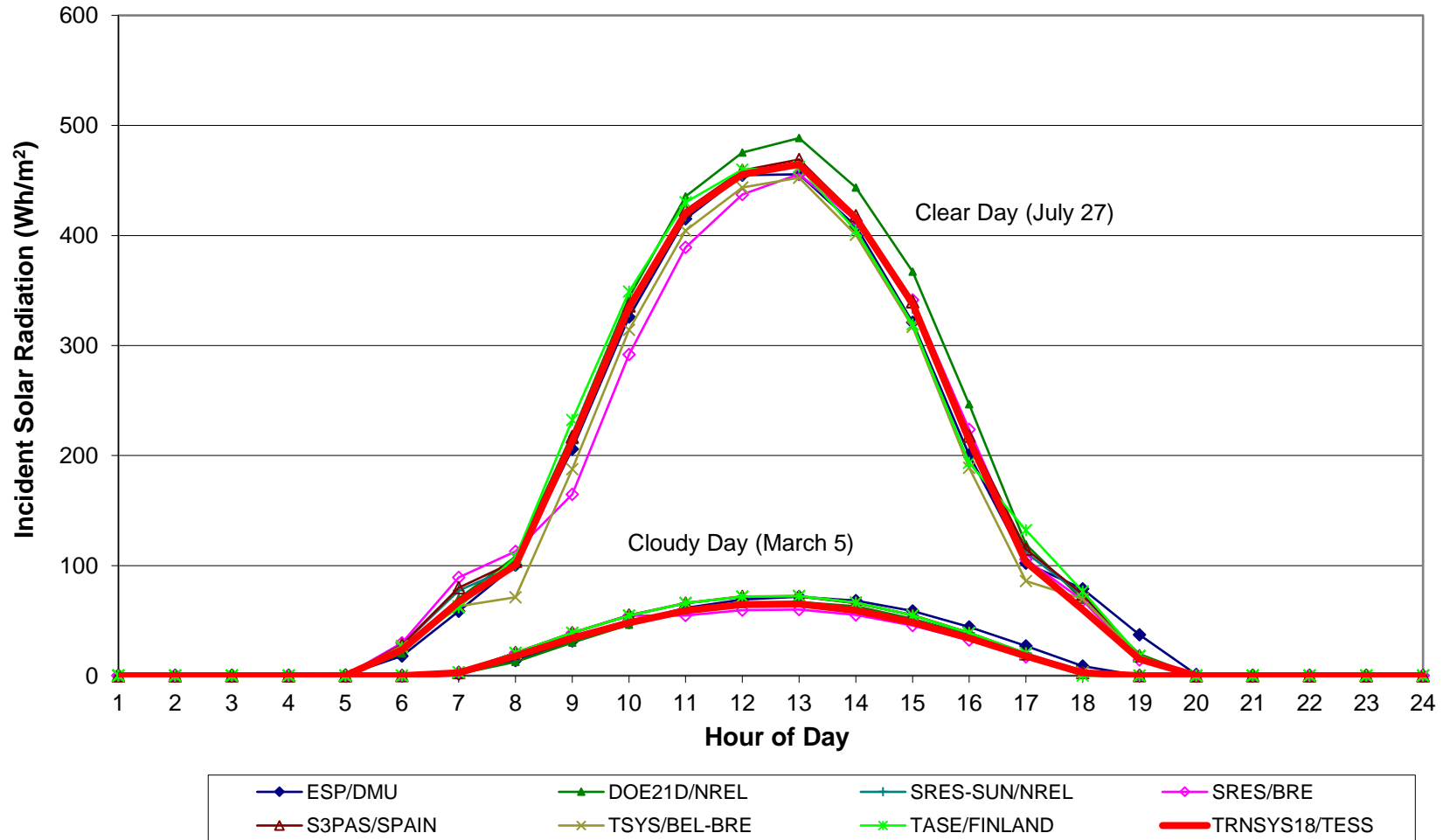
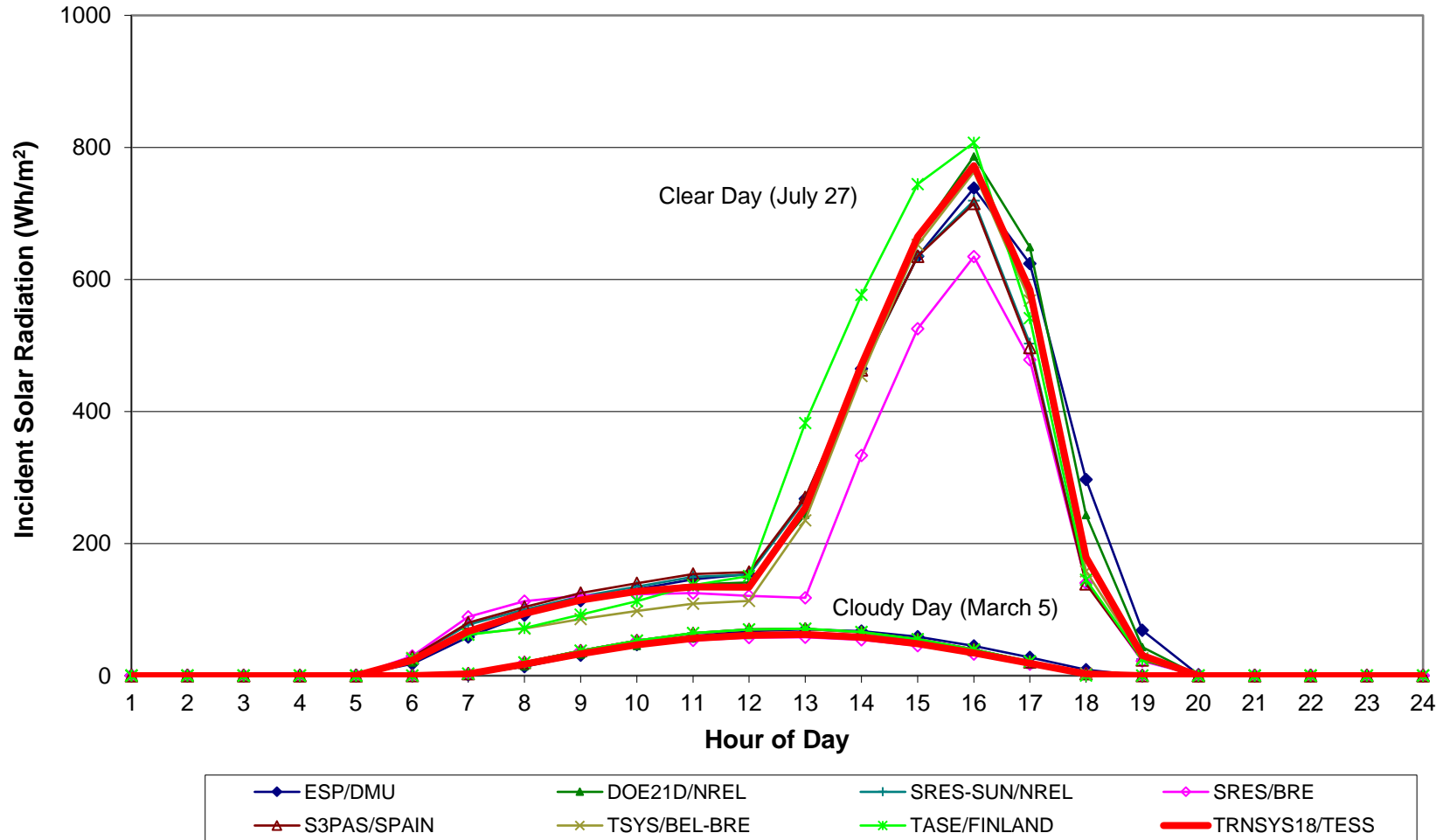
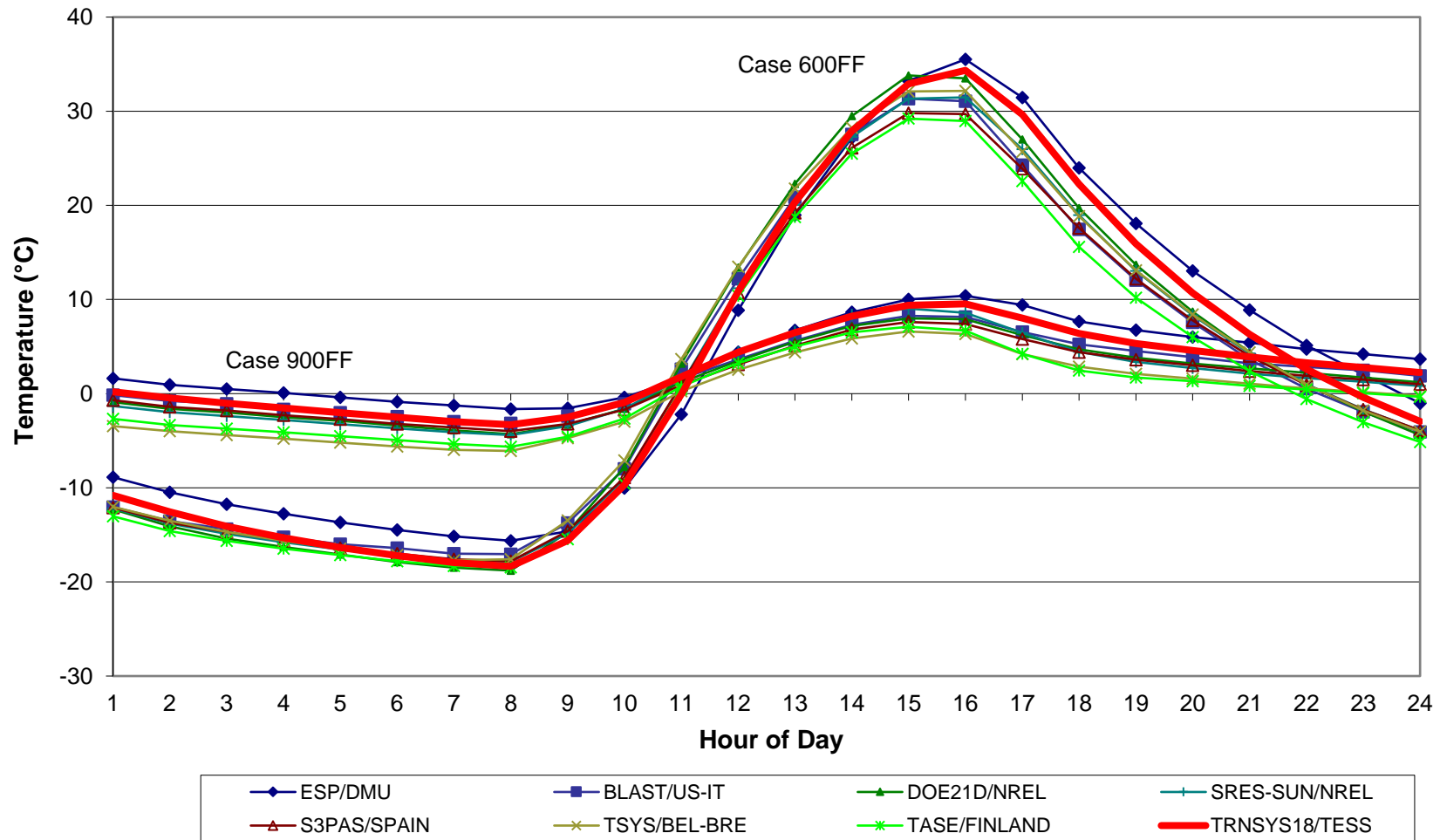


Figure B8-55. BESTEST Case 600
Cloudy & Clear Day Hourly Incident Solar
West Facing Surface



**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**

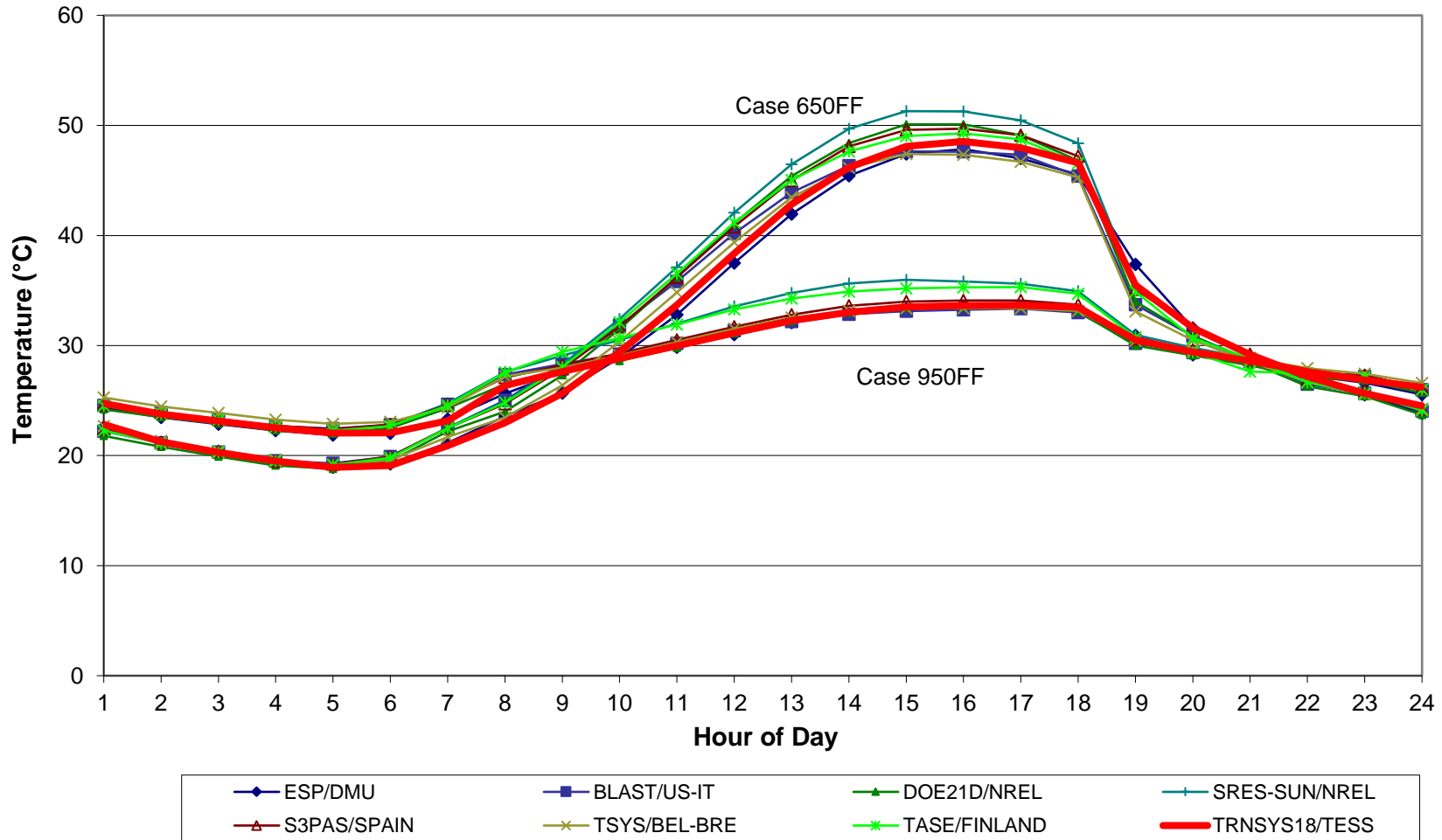


Figure B8-59. BESTEST HOURLY LOADS
Clear Cold Day, Case 900
Heating (+), Sensible Cooling (-)

