**Trane C.D.S.**
2213 20th Street
La Crosse, WI 54601 USA
Tel (608) 787-3926
http://www.tranecds.com

January 14, 2025

Dear TRACE™ 3D Plus User:

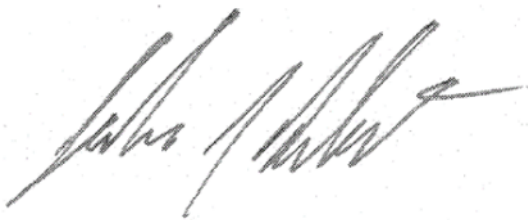
We are pleased to inform you that TRACE 3D Plus version 7.0 was tested in compliance with ANSI/ASHRAE Standard 140-2020, *Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs*.

As you may know, ANSI/ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings, Except Low-Rise Residential Buildings*, stipulates that any computer program used to demonstrate code compliance via the performance path's Energy Cost Budget Method must be tested in accordance with Standard 140. The required BESTTEST test cases provided by the standard have been simulated and validated in TRACE 3D Plus version 7.0.

As required by the standard, test results have been posted and can be downloaded from our Trane CDS Download Center. These can be used for compliance of state and local code-writing bodies that reference ASHRAE Standard 90.1 or used along with other pertinent documentation for federal tax deductions.

If you have questions about the results or about any of Trane's design and analysis tools, please contact our C.D.S. Support Center at 608-787-3926 or cdshelp@trane.com.

Sincerely,



***Joshua J Bohnert***
Lead Engineer
Trane C.D.S.™
+1.608.787.3926
cdshelp@trane.com
http://www.tranecds.com

# ASHRAE Standard 140-2020

## Informative Annex B8, Section B8.1

## Example Results
## for
## Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF

# ASHRAE Standard 140-2020
# Computer Programs, Program Authors, and Producers of Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF

The programs used to generate the example results for Sections 5.2.1, 5.2.2, and 5.2.3 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 used in the tables and charts of this

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 ("Example Results Produced By") indicates the national research facility, university, or industry organization with expertise in building science that performed the simulations. Most of the organizations that performed simulations are members of the development team for the simulation model that they ran.

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 |
|---|---|---|
| BSIMAC 9, Version 9.0.74 (BSIMAC) | Alec Johannsen Consulting Engineers, South Africa | Alec Johannsen Consulting Engineers, South Africa |
| California Simulation Engine, Version 0.861.1 (CSE) | J.R. Barnaby/C.S. Barnaby/Big Ladder Software LLC/Wrightsoft Corp., United States | Big Ladder Software LLC, United States |
| DeST 2.0, Version 20190401 (DeST) | Tsinghua University, China | Southeast University, China<br>Tsinghua University, China |
| EnergyPlus, Version 9.0.1 (EnergyPlus) | U.S. Department of Energy, Building Technologies Office, United States | GARD Analytics, Inc., United States |
| ESP-r, Version 13.3 (ESP-r) | University of Strathclyde, United Kingdom | University of Strathclyde, United Kingdom |
| TRNSYS, Version 18.01.0001 (TRNSYS) | Transsolar Energietechnik GmbH, Germany; Thermal Energy System Specialists, United States | Transsolar Energietechnik GmbH, Germany |
| TRNSYS, Versions 17.02.0005 and 18.00.0017 (N/A) | Transsolar Energietechnik GmbH, Germany; Thermal Energy System Specialists, United States | Ecole Polytechnique Montréal, Canada[a,b] |

[a] Ecole Polytechnique and GARD also worked on simulations for developing alternative constant interior and exterior surface coefficients, applying TRNSYS and EnergyPlus, respectively.

[b] Also checking input files versus the Transsolar participant's files and vice versa.

Note: Results for "TestSpec-Alt" are shown in Table B8-16 and in Figures B8-6, B8-H10, and B8-H11; contents of tables and figures are further described in sheet tabs labeled "Table List" and "Figure List". "TestSpec-Alt" results are alternative values resulting from optional alternative inputs for sky temperature provided in the test specification (see Section 5.2.1.1.1.2 and Annex A1, Section A1.1.1.2).

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**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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: / Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean** (%) | |
| 600 Base Case, South Windows | 4.050 | 3.993 | 4.047 | 4.324 | 4.362 | 4.504 | 3.993 | 4.504 | 4.213 | 12.1% | 4.319 |
| 610 S. Windows + Overhang | 4.163 | 4.066 | 4.144 | 4.375 | 4.527 | 4.592 | 4.066 | 4.592 | 4.311 | 12.2% | 4.370 |
| 620 East & West Windows | 4.370 | 4.094 | 4.297 | 4.485 | 4.514 | 4.719 | 4.094 | 4.719 | 4.413 | 14.2% | 4.479 |
| 630 E&W Windows + Overhang & Fins | 4.923 | 4.356 | 4.677 | 4.784 | 5.051 | 5.139 | 4.356 | 5.139 | 4.821 | 16.2% | 4.778 |
| 640 Case 600 with Htg Temp. Setback | 2.682 | 2.403 | 2.619 | 2.662 | 2.654 | 2.653 | 2.403 | 2.682 | 2.612 | 10.7% | 2.674 |
| 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 |
| 660 Low-E Windows | 3.574 | 3.602 | 3.821 | 3.707 | 3.787 | 3.790 | 3.574 | 3.821 | 3.713 | 6.7% | 3.703 |
| 670 Single-Pane Windows | 5.484 | 5.300 | 5.573 | 5.616 | 5.975 | 6.140 | 5.300 | 6.140 | 5.681 | 14.8% | 5.608 |
| 680 Case 600 with Increased Insulation | 2.219 | 1.786 | 1.732 | 2.180 | 2.132 | 2.286 | 1.732 | 2.286 | 2.056 | 27.0% | 2.176 |
| 685 Case 600 with "20/20" Thermostat | 4.532 | 4.574 | 4.646 | 4.877 | 4.904 | 5.042 | 4.532 | 5.042 | 4.763 | 10.7% | 4.876 |
| 695 Case 685 with Increased Insulation | 2.709 | 2.415 | 2.385 | 2.802 | 2.732 | 2.892 | 2.385 | 2.892 | 2.656 | 19.1% | 2.801 |
| 900 South Windows | 1.726 | 1.379 | 1.591 | 1.664 | 1.585 | 1.814 | 1.379 | 1.814 | 1.626 | 26.8% | 1.662 |
| 910 S. Windows + Overhang | 2.163 | 1.648 | 1.860 | 1.956 | 2.067 | 2.132 | 1.648 | 2.163 | 1.971 | 26.1% | 1.953 |
| 920 East & West Windows | 3.500 | 2.956 | 3.259 | 3.337 | 3.300 | 3.607 | 2.956 | 3.607 | 3.326 | 19.6% | 3.332 |
| 930 E&W Windows + Overhang & Fins | 4.270 | 3.524 | 3.933 | 3.994 | 4.278 | 4.384 | 3.524 | 4.384 | 4.064 | 21.2% | 3.989 |
| 940 Case 900 with Htg Temp. Setback | 1.389 | 0.863 | 1.149 | 1.067 | 1.015 | 1.169 | 0.863 | 1.389 | 1.109 | 47.4% | 1.077 |
| 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 |
| 960 Sunspace | | 2.522 | 2.771 | 2.689 | 2.624 | 2.860 | 2.522 | 2.860 | 2.693 | 12.5% | 2.704 |
| 980 Case 900 with Increased Insulation | 0.720 | 0.246 | 0.266 | 0.411 | 0.351 | 0.450 | 0.246 | 0.720 | 0.407 | 116.4% | 0.411 |
| 985 Case 900 with "20/20" Thermostat | 2.801 | 2.120 | 2.279 | 2.369 | 2.283 | 2.536 | 2.120 | 2.801 | 2.398 | 28.4% | 2.367 |
| 995 Case 985 with Increased Insulation | 1.330 | 0.755 | 0.770 | 1.006 | 0.905 | 1.077 | 0.755 | 1.330 | 0.974 | 59.0% | 1.006 |
| 195 Solid Conduction | 4.217 | 3.990 | 4.157 | 4.070 | 3.951 | 4.094 | 3.951 | 4.217 | 4.080 | 6.5% | 4.068 |
| 200 Surface Convection (Int & Ext IR="off") | 5.041 | 4.813 | 5.226 | 5.105 | 4.920 | 5.143 | 4.813 | 5.226 | 5.042 | 8.2% | 5.094 |
| 210 Infrared Radiation (Int IR="off", Ext IR="on") | 5.627 | 5.966 | 6.531 | 6.047 | 6.317 | 6.429 | 5.627 | 6.531 | 6.153 | 14.7% | 6.044 |
| 215 Infrared Radiation (Int IR="on", Ext IR="off") | 5.652 | 5.307 | 5.697 | 5.405 | 5.181 | 5.443 | 5.181 | 5.697 | 5.448 | 9.5% | 5.390 |
| 220 In-Depth Base Case | 6.377 | 6.666 | 7.178 | 6.455 | 6.726 | 6.868 | 6.377 | 7.178 | 6.712 | 11.9% | 6.450 |
| 230 Infiltration | 9.851 | 9.812 | 10.417 | 9.930 | 9.939 | 10.234 | 9.812 | 10.417 | 10.031 | 6.0% | 9.925 |
| 240 Internal Gains | 5.116 | 5.443 | 5.944 | 5.279 | 5.539 | 5.657 | 5.116 | 5.944 | 5.496 | 15.1% | 5.274 |
| 250 Exterior Shortwave Absorptance | 4.733 | 5.044 | 5.373 | 4.899 | 4.935 | 5.105 | 4.733 | 5.373 | 5.015 | 12.8% | 4.890 |
| 270 South Solar Windows | | 4.346 | 4.273 | 4.385 | 4.576 | 4.631 | 4.273 | 4.631 | 4.442 | 8.1% | 4.385 |
| 280 Cavity Albedo | | 4.525 | 4.619 | 4.570 | 4.738 | 4.870 | 4.525 | 4.870 | 4.664 | 7.4% | 4.570 |
| 290 South Shading | | 4.424 | 4.381 | 4.424 | 4.745 | 4.725 | 4.381 | 4.745 | 4.540 | 8.0% | 4.424 |
| 300 East/West Window | | 4.318 | 4.460 | 4.425 | 4.668 | 4.726 | 4.318 | 4.726 | 4.519 | 9.0% | 4.423 |
| 310 East/West Shading | | 4.580 | 4.846 | 4.691 | 5.240 | 5.163 | 4.580 | 5.240 | 4.904 | 13.4% | 4.689 |
| 320 Thermostat | | 3.677 | 3.599 | 3.771 | 3.970 | 4.031 | 3.599 | 4.031 | 3.810 | 11.3% | 3.766 |
| 395 Low Mass Solid Conduction | 4.565 | 4.855 | 5.145 | 4.641 | 4.866 | 4.908 | 4.565 | 5.145 | 4.830 | 12.0% | 4.641 |
| 400 Low Mass High Cond. Wall Elements | 5.906 | 6.536 | 7.047 | 6.348 | 6.610 | 6.769 | 5.906 | 7.047 | 6.536 | 17.5% | 6.343 |
| 410 Low Mass Infiltration | 7.630 | 8.045 | 8.661 | 8.080 | 8.212 | 8.445 | 7.630 | 8.661 | 8.179 | 12.6% | 8.075 |
| 420 Low Mass Internal Gains | 6.399 | 6.834 | 7.433 | 6.906 | 7.027 | 7.236 | 6.399 | 7.433 | 6.973 | 14.8% | 6.900 |
| 430 Low Mass Ext. Shortwave Absorptance | 5.171 | 5.454 | 5.954 | 5.620 | 5.545 | 5.851 | 5.171 | 5.954 | 5.599 | 14.0% | 5.607 |
| 440 Low Mass Cavity Albedo | | 4.156 | 4.330 | 4.500 | 4.504 | 4.721 | 4.156 | 4.721 | 4.442 | 12.7% | 4.495 |
| 450 Constant Interior and Exterior Surf Coeffs | 3.743 | 3.990 | 3.375 | 3.962 | 3.850 | 3.871 | 3.375 | 3.990 | 3.799 | 16.2% | 3.954 |
| 460 Constant Interior Surface Coefficients | 3.828 | 4.056 | 3.873 | 4.194 | 4.263 | 4.290 | 3.828 | 4.290 | 4.084 | 11.3% | 4.182 |
| 470 Constant Exterior Surface Coefficients | 4.042 | 3.899 | 3.540 | 4.094 | 3.960 | 4.075 | 3.540 | 4.094 | 3.935 | 14.1% | 4.090 |
| 800 High Mass High Cond. Wall Elements | 5.141 | 4.906 | 5.403 | 5.116 | 4.980 | 5.369 | 4.906 | 5.403 | 5.152 | 9.7% | 5.098 |
| 810 High Mass Cavity Albedo | | 2.038 | 2.454 | 2.342 | 2.185 | 2.610 | 2.038 | 2.610 | 2.326 | 24.6% | 2.339 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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: / Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean** (%) | |
| 600 Base Case, South Windows | 5.822 | 5.913 | 5.432 | 6.027 | 6.162 | 5.780 | 5.432 | 6.162 | 5.856 | 12.5% | 6.027 |
| 610 S. Windows + Overhang | 4.299 | 4.382 | 4.173 | 4.333 | 4.233 | 4.117 | 4.117 | 4.382 | 4.256 | 6.2% | 4.332 |
| 620 East & West Windows | 4.404 | 4.079 | 3.909 | 4.060 | 4.246 | 3.841 | 3.841 | 4.404 | 4.090 | 13.8% | 4.060 |
| 630 E&W Windows + Overhang & Fins | 3.074 | 3.020 | 2.787 | 2.836 | 2.595 | 2.573 | 2.573 | 3.074 | 2.814 | 17.8% | 2.837 |
| 640 Case 600 with Htg Temp. Setback | 5.804 | 5.644 | 5.237 | 5.763 | 5.893 | 5.477 | 5.237 | 5.893 | 5.636 | 11.6% | 5.771 |
| 650 Case 600 with Night Ventilation | 4.629 | 4.654 | 4.186 | 4.817 | 4.945 | 4.632 | 4.186 | 4.945 | 4.644 | 16.3% | 4.778 |
| 660 Low-E Windows | 3.014 | 3.340 | 3.260 | 3.232 | 3.219 | 2.966 | 2.966 | 3.340 | 3.172 | 11.8% | 3.230 |
| 670 Single-Pane Windows | 6.539 | 6.578 | 5.954 | 6.623 | 6.520 | 6.198 | 5.954 | 6.623 | 6.402 | 10.4% | 6.622 |
| 680 Case 600 with Increased Insulation | 5.938 | 6.430 | 5.932 | 6.444 | 6.529 | 6.310 | 5.932 | 6.529 | 6.264 | 9.5% | 6.439 |
| 685 Case 600 with "20/20" Thermostat | 9.130 | 8.859 | 8.238 | 9.119 | 9.121 | 8.851 | 8.238 | 9.130 | 8.886 | 10.0% | 9.125 |
| 695 Case 685 with Increased Insulation | 8.755 | 8.974 | 8.386 | 9.172 | 9.149 | 9.039 | 8.386 | 9.172 | 8.912 | 8.8% | 9.175 |
| 900 South Windows | 2.714 | 2.464 | 2.383 | 2.489 | 2.488 | 2.267 | 2.267 | 2.714 | 2.467 | 18.1% | 2.491 |
| 910 S. Windows + Overhang | 1.484 | 1.415 | 1.490 | 1.383 | 1.283 | 1.191 | 1.191 | 1.490 | 1.374 | 21.8% | 1.386 |
| 920 East & West Windows | 3.128 | 2.789 | 2.706 | 2.731 | 2.814 | 2.549 | 2.549 | 3.128 | 2.786 | 20.8% | 2.734 |
| 930 E&W Windows + Overhang & Fins | 2.161 | 2.075 | 1.908 | 1.919 | 1.654 | 1.672 | 1.654 | 2.161 | 1.898 | 26.7% | 1.921 |
| 940 Case 900 with Htg. Temp. Setback | 2.613 | 2.397 | 2.343 | 2.424 | 2.428 | 2.203 | 2.203 | 2.613 | 2.401 | 17.1% | 2.428 |
| 950 Case 900 with Night Ventilation | 0.586 | 0.598 | 0.618 | 0.707 | 0.656 | 0.642 | 0.586 | 0.707 | 0.634 | 19.1% | 0.694 |
| 960 Sunspace | | 0.926 | 0.909 | 0.907 | 0.950 | 0.789 | 0.789 | 0.950 | 0.896 | 17.9% | 0.901 |
| 980 Case 900 with Increased Insulation | 3.501 | 3.995 | 3.758 | 3.712 | 3.775 | 3.519 | 3.501 | 3.995 | 3.710 | 13.3% | 3.714 |
| 985 Case 900 with "20/20" Thermostat | 7.273 | 6.234 | 5.880 | 6.359 | 6.249 | 6.113 | 5.880 | 7.273 | 6.351 | 21.9% | 6.364 |
| 995 Case 985 with Increased Insulation | 7.482 | 7.202 | 6.771 | 7.203 | 7.149 | 7.064 | 6.771 | 7.482 | 7.145 | 10.0% | 7.206 |
| 195 Solid Conduction | 0.712 | 0.606 | 0.628 | 0.612 | 0.611 | 0.592 | 0.592 | 0.712 | 0.627 | 19.2% | 0.612 |
| 200 Surface Convection (Int & Ext IR="off") | 0.839 | 0.800 | 0.835 | 0.814 | 0.800 | 0.788 | 0.788 | 0.839 | 0.813 | 6.2% | 0.816 |
| 210 Infrared Radiation (Int IR="off", Ext IR="on") | 0.688 | 0.503 | 0.496 | 0.560 | 0.519 | 0.459 | 0.459 | 0.688 | 0.537 | 42.6% | 0.560 |
| 215 Infrared Radiation (Int IR="on", Ext IR="off") | 0.952 | 0.946 | 0.922 | 0.877 | 0.895 | 0.850 | 0.850 | 0.952 | 0.907 | 11.2% | 0.879 |
| 220 In-Depth Base Case | 0.803 | 0.611 | 0.550 | 0.610 | 0.576 | 0.498 | 0.498 | 0.803 | 0.608 | 50.2% | 0.609 |
| 230 Infiltration | 1.184 | 0.991 | 0.929 | 0.991 | 0.955 | 0.897 | 0.897 | 1.184 | 0.991 | 29.0% | 0.991 |
| 240 Internal Gains | 1.287 | 0.982 | 0.876 | 0.979 | 0.922 | 0.834 | 0.834 | 1.287 | 0.980 | 46.2% | 0.978 |
| 250 Exterior Shortwave Absorptance | 3.612 | 3.429 | 3.471 | 3.182 | 3.467 | 2.904 | 2.904 | 3.612 | 3.344 | 21.2% | 3.205 |
| 270 South Solar Windows | | 7.271 | 6.698 | 7.522 | 7.309 | 7.289 | 6.698 | 7.522 | 7.217 | 11.4% | 7.524 |
| 280 Cavity Albedo | | 4.996 | 4.215 | 5.183 | 5.206 | 4.808 | 4.215 | 5.206 | 4.882 | 20.3% | 5.185 |
| 290 South Shading | | 5.610 | 5.310 | 5.743 | 5.321 | 5.461 | 5.310 | 5.743 | 5.489 | 7.9% | 5.744 |
| 300 East/West Window | | 5.055 | 4.805 | 5.152 | 5.038 | 4.913 | 4.805 | 5.152 | 4.993 | 7.0% | 5.153 |
| 310 East/West Shading | | 3.752 | 3.402 | 3.669 | 3.128 | 3.324 | 3.128 | 3.752 | 3.455 | 18.1% | 3.670 |
| 320 Thermostat | | 4.859 | 4.420 | 4.986 | 4.913 | 4.788 | 4.420 | 4.986 | 4.793 | 11.8% | 4.980 |
| 395 Low Mass Solid Conduction | 0.021 | 0.008 | 0.006 | 0.010 | 0.006 | 0.004 | 0.004 | 0.021 | 0.009 | 193.7% | 0.010 |
| 400 Low Mass High Cond. Wall Elements | 0.063 | 0.023 | 0.017 | 0.031 | 0.024 | 0.013 | 0.013 | 0.063 | 0.028 | 176.6% | 0.030 |
| 410 Low Mass Infiltration | 0.096 | 0.048 | 0.041 | 0.057 | 0.052 | 0.035 | 0.035 | 0.096 | 0.055 | 110.6% | 0.057 |
| 420 Low Mass Internal Gains | 0.228 | 0.141 | 0.119 | 0.153 | 0.142 | 0.109 | 0.109 | 0.228 | 0.149 | 79.8% | 0.152 |
| 430 Low Mass Ext. Shortwave Absorptance | 1.084 | 0.906 | 0.944 | 0.856 | 0.953 | 0.739 | 0.739 | 1.084 | 0.914 | 37.8% | 0.860 |
| 440 Low Mass Cavity Albedo | | 3.985 | 3.458 | 4.085 | 4.414 | 3.741 | 3.458 | 4.414 | 3.937 | 24.3% | 4.084 |
| 450 Constant Interior and Exterior Surf Coeffs | 6.172 | 5.689 | 6.161 | 6.507 | 6.613 | 6.531 | 5.689 | 6.613 | 6.279 | 14.7% | 6.485 |
| 460 Constant Interior Surface Coefficients | 6.260 | 5.940 | 5.929 | 6.475 | 6.729 | 6.243 | 5.929 | 6.729 | 6.263 | 12.8% | 6.457 |
| 470 Constant Exterior Surface Coefficients | 5.987 | 5.644 | 5.649 | 6.029 | 6.005 | 6.056 | 5.644 | 6.056 | 5.895 | 7.0% | 6.023 |
| 800 High Mass High Cond. Wall Elements | 0.473 | 0.380 | 0.362 | 0.374 | 0.391 | 0.282 | 0.282 | 0.473 | 0.377 | 50.6% | 0.376 |
| 810 High Mass Cavity Albedo | | 1.481 | 1.357 | 1.508 | 1.606 | 1.295 | 1.295 | 1.606 | 1.449 | 21.5% | 1.510 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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: | BSIMAC | | | | CSE | | | | DeST | | | | EnergyPlus | | | | ESP-r | | | | TRNSYS | | | | Example Result Statistics | | | | TRACE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | Min | Max | Mean | (Max-Min)/ | | | | |
| Case | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | kW | kW | Mean** (%) | kW | Mo. | Day | Hr |
| 600 Base Case, South Windows | 3.255 | Nov | 26 | 8 | 3.020 | Jan | 1 | 1 | 3.035 | Jan | 1 | 0 | 3.204 | Dec | 31 | 24 | 3.228 | Jan | 1 | 1 | 3.359 | Jan | 1 | 1 | 3.020 | 3.359 | 3.184 | 10.6% | 3.204 | DEC | 31 | 24 |
| 610 S. Windows + Overhang | 3.166 | Nov | 26 | 8 | 3.021 | Jan | 1 | 1 | 3.039 | Jan | 1 | 0 | 3.192 | Dec | 31 | 24 | 3.233 | Jan | 1 | 1 | 3.360 | Jan | 1 | 1 | 3.021 | 3.360 | 3.168 | 10.7% | 3.191 | DEC | 31 | 24 |
| 620 East & West Windows | 3.145 | Dec | 31 | 24 | 3.038 | Jan | 1 | 1 | 3.068 | Jan | 1 | 0 | 3.229 | Dec | 31 | 24 | 3.253 | Jan | 1 | 1 | 3.385 | Jan | 1 | 1 | 3.038 | 3.385 | 3.186 | 10.9% | 3.229 | DEC | 31 | 24 |
| 630 E&W Windows + Overhang & Fins | 3.252 | Dec | 31 | 24 | 3.039 | Jan | 1 | 1 | 3.072 | Jan | 1 | 0 | 3.207 | Dec | 31 | 24 | 3.259 | Jan | 1 | 1 | 3.388 | Jan | 1 | 1 | 3.039 | 3.388 | 3.203 | 10.9% | 3.207 | DEC | 31 | 24 |
| 640 Case 600 with Htg. Temp. Setback | 4.633 | Feb | 8 | 9 | 4.222 | Nov | 26 | 8 | 4.658 | Nov | 26 | 7 | 4.559 | Nov | 26 | 8 | 4.101 | Nov | 26 | 8 | 4.039 | Nov | 26 | 8 | 4.039 | 4.658 | 4.369 | 14.2% | 4.681 | NOV | 26 | 8 |
| 650 Case 600 with Night Ventilation | 0.000 | | | | 0.000 | Jan | 1 | 1 | 0.000 | | | | 0.000 | Jan | 1 | 1 | 0.000 | Jan | 1 | 1 | 0.000 | Dec | 31 | 0 | 0.000 | 0.000 | 0.000 | ---- | 0.000 | JAN | 1 | 1 |
| 660 Low-E Windows | 2.620 | Nov | 26 | 8 | 2.758 | Jan | 1 | 1 | 2.798 | Jan | 1 | 0 | 2.831 | Dec | 31 | 24 | 2.846 | Jan | 1 | 1 | 2.955 | Jan | 1 | 1 | 2.620 | 2.955 | 2.801 | 12.0% | 2.831 | DEC | 31 | 24 |
| 670 Single-Pane Windows | 4.122 | Nov | 26 | 8 | 3.655 | Jan | 1 | 1 | 3.812 | Jan | 1 | 0 | 3.854 | Nov | 26 | 7 | 3.992 | Nov | 26 | 7 | 4.221 | Nov | 26 | 8 | 3.655 | 4.221 | 3.943 | 14.3% | 3.854 | NOV | 26 | 7 |
| 680 Case 600 with Increased Insulation | 2.126 | Nov | 26 | 8 | 1.778 | Feb | 9 | 6 | 1.811 | Jan | 1 | 1 | 2.052 | Nov | 26 | 7 | 2.022 | Feb | 9 | 7 | 2.115 | Nov | 26 | 8 | 1.778 | 2.126 | 1.984 | 17.6% | 2.052 | NOV | 26 | 7 |
| 685 Case 600 with "20/20" Thermostat | 3.169 | Nov | 26 | 8 | 3.032 | Jan | 1 | 1 | 3.054 | Jan | 1 | 0 | 3.223 | Dec | 31 | 24 | 3.247 | Jan | 1 | 1 | 3.374 | Jan | 1 | 1 | 3.032 | 3.374 | 3.183 | 10.8% | 3.223 | DEC | 31 | 24 |
| 695 Case 685 with Increased Insulation | 2.138 | Nov | 26 | 8 | 1.795 | Jan | 1 | 1 | 1.855 | Jan | 1 | 1 | 2.072 | Dec | 31 | 24 | 2.025 | Nov | 26 | 7 | 2.118 | Nov | 26 | 8 | 1.795 | 2.138 | 2.000 | 17.1% | 2.072 | DEC | 31 | 24 |
| 900 South Windows | 2.551 | Feb | 8 | 24 | 2.443 | Feb | 9 | 6 | 2.453 | Feb | 9 | 5 | 2.687 | Feb | 9 | 6 | 2.633 | Feb | 9 | 7 | 2.778 | Feb | 9 | 7 | 2.443 | 2.778 | 2.591 | 12.9% | 2.688 | FEB | 9 | 6 |
| 910 S. Windows + Overhang | 2.761 | Feb | 8 | 24 | 2.469 | Feb | 9 | 6 | 2.474 | Feb | 9 | 5 | 2.699 | Feb | 9 | 6 | 2.684 | Feb | 9 | 7 | 2.799 | Feb | 9 | 6 | 2.469 | 2.799 | 2.648 | 12.5% | 2.699 | FEB | 9 | 6 |
| 920 East & West Windows | 2.895 | Nov | 26 | 8 | 2.512 | Feb | 9 | 6 | 2.513 | Feb | 9 | 5 | 2.770 | Feb | 9 | 6 | 2.706 | Feb | 9 | 7 | 2.864 | Feb | 9 | 6 | 2.512 | 2.895 | 2.710 | 14.1% | 2.770 | FEB | 9 | 6 |
| 930 E&W Windows + Overhang & Fins | 2.968 | Dec | 31 | 24 | 2.537 | Feb | 9 | 6 | 2.549 | Feb | 9 | 5 | 2.785 | Feb | 9 | 6 | 2.765 | Feb | 9 | 6 | 2.900 | Feb | 9 | 6 | 2.537 | 2.968 | 2.751 | 15.7% | 2.785 | FEB | 9 | 6 |
| 940 Case 900 with Htg. Temp. Setback | 3.882 | Feb | 8 | 9 | 3.052 | Jan | 1 | 9 | 3.659 | Feb | 9 | 7 | 3.143 | Dec | 31 | 9 | 3.122 | Feb | 9 | 9 | 3.405 | Jan | 1 | 9 | 3.052 | 3.882 | 3.377 | 24.6% | 3.154 | DEC | 31 | 9 |
| 950 Case 900 with Night Ventilation | 0.000 | | | | 0.000 | Jan | 1 | 1 | 0.000 | | | | 0.000 | Jan | 1 | 1 | 0.000 | Jan | 1 | 1 | 0.000 | Dec | 31 | 0 | 0.000 | 0.000 | 0.000 | ---- | 0.000 | JAN | 1 | 1 |
| 960 Sunspace | | | | | 2.132 | Feb | 9 | 6 | 2.085 | Jan | 1 | 0 | 2.259 | Feb | 9 | 6 | 2.201 | Feb | 9 | 6 | 2.300 | Feb | 9 | 6 | 2.085 | 2.300 | 2.196 | 9.8% | 2.263 | FEB | 9 | 6 |
| 980 Case 900 with Increased Insulation | 1.693 | Feb | 8 | 24 | 1.254 | Feb | 9 | 6 | 1.382 | Feb | 9 | 5 | 1.538 | Feb | 9 | 6 | 1.473 | Feb | 9 | 7 | 1.592 | Feb | 9 | 7 | 1.254 | 1.693 | 1.489 | 29.5% | 1.538 | FEB | 9 | 6 |
| 985 Case 900 with "20/20" Thermostat | 2.754 | Feb | 8 | 24 | 2.452 | Feb | 9 | 6 | 2.458 | Feb | 9 | 5 | 2.695 | Feb | 9 | 6 | 2.642 | Feb | 9 | 7 | 2.785 | Feb | 9 | 6 | 2.452 | 2.785 | 2.631 | 12.7% | 2.695 | FEB | 9 | 6 |
| 995 Case 985 with Increased Insulation | 1.711 | Nov | 26 | 8 | 1.370 | Feb | 9 | 6 | 1.462 | Feb | 9 | 5 | 1.622 | Feb | 9 | 6 | 1.560 | Feb | 9 | 7 | 1.662 | Feb | 9 | 6 | 1.370 | 1.711 | 1.564 | 21.8% | 1.622 | FEB | 9 | 6 |
| 195 Solid Conduction | 1.802 | Dec | 31 | 24 | 1.791 | Jan | 1 | 1 | 1.799 | Jan | 1 | 0 | 1.794 | Dec | 31 | 24 | 1.802 | Jan | 1 | 1 | 1.796 | Jan | 1 | 1 | 1.791 | 1.802 | 1.797 | 0.6% | 1.794 | DEC | 31 | 24 |
| 200 Surface Convection (Int & Ext IR="off") | 2.272 | Nov | 26 | 8 | 2.226 | Nov | 26 | 8 | 2.308 | Jan | 1 | 0 | 2.341 | Nov | 26 | 8 | 2.275 | Dec | 31 | 24 | 2.353 | Nov | 26 | 8 | 2.226 | 2.353 | 2.296 | 5.5% | 2.338 | NOV | 26 | 8 |
| 210 Infrared Radiation (Int IR="off", Ext IR="on" | 2.374 | Dec | 31 | 24 | 2.629 | Jan | 1 | 2 | 2.605 | Jan | 1 | 0 | 2.565 | Dec | 31 | 24 | 2.671 | Jan | 1 | 1 | 2.750 | Jan | 1 | 1 | 2.374 | 2.750 | 2.599 | 14.5% | 2.564 | DEC | 31 | 24 |
| 215 Infrared Radiation (Int IR="on", Ext IR="off" | 2.521 | Nov | 26 | 8 | 2.420 | Nov | 26 | 8 | 2.520 | Jan | 1 | 0 | 2.478 | Nov | 26 | 8 | 2.390 | Nov | 26 | 8 | 2.489 | Nov | 26 | 8 | 2.390 | 2.521 | 2.470 | 5.3% | 2.474 | NOV | 26 | 8 |
| 220 In-Depth Base Case | 2.631 | Nov | 26 | 8 | 2.839 | Jan | 1 | 1 | 2.863 | Jan | 1 | 0 | 2.692 | Dec | 31 | 24 | 2.788 | Jan | 1 | 1 | 2.879 | Jan | 1 | 1 | 2.631 | 2.879 | 2.782 | 8.9% | 2.691 | DEC | 31 | 24 |
| 230 Infiltration | 4.219 | Dec | 31 | 24 | 4.133 | Jan | 1 | 1 | 4.223 | Jan | 1 | 0 | 4.316 | Dec | 31 | 24 | 4.160 | Jan | 1 | 1 | 4.315 | Jan | 1 | 1 | 4.133 | 4.316 | 4.228 | 4.3% | 4.315 | DEC | 31 | 24 |
| 240 Internal Gains | 2.431 | Nov | 26 | 8 | 2.651 | Jan | 1 | 1 | 2.685 | Jan | 1 | 0 | 2.507 | Dec | 31 | 24 | 2.605 | Jan | 1 | 1 | 2.693 | Jan | 1 | 1 | 2.431 | 2.693 | 2.595 | 10.1% | 2.506 | DEC | 31 | 24 |
| 250 Exterior Shortwave Absorptance | 2.631 | Nov | 26 | 8 | 2.837 | Jan | 1 | 1 | 2.855 | Jan | 1 | 0 | 2.687 | Dec | 31 | 24 | 2.780 | Jan | 1 | 1 | 2.874 | Jan | 1 | 1 | 2.631 | 2.874 | 2.777 | 8.8% | 2.686 | DEC | 31 | 24 |
| 270 South Solar Windows | | | | | 2.611 | Jan | 1 | 2 | 2.560 | Jan | 1 | 1 | 2.597 | Dec | 31 | 24 | 2.748 | Jan | 1 | 1 | 2.843 | Jan | 1 | 2 | 2.560 | 2.843 | 2.672 | 10.6% | 2.596 | DEC | 31 | 24 |
| 280 Cavity Albedo | | | | | 2.612 | Jan | 1 | 2 | 2.568 | Jan | 1 | 1 | 2.602 | Dec | 31 | 24 | 2.752 | Jan | 1 | 1 | 2.849 | Jan | 1 | 1 | 2.568 | 2.849 | 2.677 | 10.5% | 2.602 | DEC | 31 | 24 |
| 290 South Shading | | | | | 2.611 | Jan | 1 | 2 | 2.561 | Jan | 1 | 1 | 2.583 | Dec | 31 | 24 | 2.750 | Jan | 1 | 1 | 2.843 | Jan | 1 | 2 | 2.561 | 2.843 | 2.670 | 10.6% | 2.583 | DEC | 31 | 24 |
| 300 East/West Window | | | | | 2.614 | Jan | 1 | 1 | 2.589 | Jan | 1 | 0 | 2.603 | Dec | 31 | 24 | 2.766 | Jan | 1 | 1 | 2.854 | Jan | 1 | 1 | 2.589 | 2.854 | 2.685 | 9.9% | 2.603 | DEC | 31 | 24 |
| 310 East/West Shading | | | | | 2.615 | Jan | 1 | 1 | 2.592 | Jan | 1 | 0 | 2.580 | Dec | 31 | 24 | 2.771 | Jan | 1 | 1 | 2.856 | Jan | 1 | 1 | 2.580 | 2.856 | 2.683 | 10.3% | 2.580 | DEC | 31 | 24 |
| 320 Thermostat | | | | | 2.609 | Jan | 1 | 1 | 2.546 | Jan | 1 | 1 | 2.573 | Dec | 31 | 24 | 2.733 | Jan | 1 | 2 | 2.834 | Jan | 1 | 2 | 2.546 | 2.834 | 2.659 | 10.8% | 2.573 | DEC | 31 | 24 |
| 395 Low Mass Solid Conduction | 1.948 | Dec | 31 | 24 | 2.157 | Jan | 1 | 2 | 2.085 | Jan | 1 | 1 | 1.952 | Dec | 31 | 24 | 2.090 | Jan | 1 | 2 | 2.161 | Jan | 1 | 2 | 1.948 | 2.161 | 2.066 | 10.3% | 1.952 | DEC | 31 | 24 |
| 400 Low Mass High Cond. Wall Elements | 2.559 | Nov | 26 | 8 | 2.839 | Jan | 1 | 1 | 2.863 | Jan | 1 | 0 | 2.692 | Dec | 31 | 24 | 2.788 | Jan | 1 | 1 | 2.879 | Jan | 1 | 1 | 2.559 | 2.879 | 2.770 | 11.5% | 2.691 | DEC | 31 | 24 |
| 410 Low Mass Infiltration | 3.338 | Dec | 31 | 24 | 3.441 | Jan | 1 | 1 | 3.543 | Jan | 1 | 0 | 3.504 | Dec | 31 | 24 | 3.473 | Jan | 1 | 1 | 3.597 | Jan | 1 | 1 | 3.338 | 3.597 | 3.483 | 7.4% | 3.503 | DEC | 31 | 24 |
| 420 Low Mass Internal Gains | 3.138 | Dec | 31 | 24 | 3.256 | Jan | 1 | 1 | 3.365 | Jan | 1 | 0 | 3.319 | Dec | 31 | 24 | 3.290 | Jan | 1 | 1 | 3.411 | Jan | 1 | 1 | 3.138 | 3.411 | 3.297 | 8.3% | 3.318 | DEC | 31 | 24 |
| 430 Low Mass Ext. Shortwave Absorptance | 3.300 | Dec | 31 | 24 | 3.254 | Jan | 1 | 1 | 3.360 | Jan | 1 | 0 | 3.316 | Dec | 31 | 24 | 3.285 | Jan | 1 | 1 | 3.409 | Jan | 1 | 1 | 3.254 | 3.409 | 3.321 | 4.7% | 3.315 | DEC | 31 | 24 |
| 440 Low Mass Cavity Albedo | | | | | 3.027 | Jan | 1 | 1 | 3.060 | Jan | 1 | 0 | 3.219 | Dec | 31 | 24 | 3.237 | Jan | 1 | 1 | 3.374 | Jan | 1 | 1 | 3.027 | 3.374 | 3.183 | 10.9% | 3.218 | DEC | 31 | 24 |
| 450 Constant Interior and Exterior Surf Coeffs | 2.989 | Nov | 26 | 8 | 2.978 | Jan | 1 | 1 | 2.753 | Jan | 1 | 0 | 3.100 | Dec | 31 | 24 | 3.042 | Jan | 1 | 1 | 3.037 | Jan | 1 | 1 | 2.753 | 3.100 | 2.983 | 11.6% | 3.099 | DEC | 31 | 24 |
| 460 Constant Interior Surface Coefficients | 3.055 | Nov | 26 | 8 | 2.971 | Jan | 1 | 1 | 2.980 | Jan | 1 | 0 | 3.091 | Dec | 31 | 24 | 3.101 | Jan | 1 | 1 | 3.160 | Jan | 1 | 1 | 2.971 | 3.160 | 3.060 | 6.2% | 3.090 | DEC | 31 | 24 |
| 470 Constant Exterior Surface Coefficients | 3.118 | Nov | 26 | 8 | 3.001 | Jan | 1 | 1 | 2.807 | Jan | 1 | 0 | 3.207 | Dec | 31 | 24 | 3.169 | Jan | 1 | 1 | 3.231 | Jan | 1 | 1 | 2.807 | 3.231 | 3.089 | 13.7% | 3.206 | DEC | 31 | 24 |

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 High Mass High Cond. Wall Elements | 2.957 | Dec | 31 | 24 | 2.778 | Feb | 9 | 6 | 2.864 | Feb | 9 | 5 | 2.924 | Feb | 9 | 6 | 2.840 | Feb | 9 | 7 | 2.967 | Feb | 9 | 6 | 2.778 | 2.967 | 2.888 | 6.6% | 2.922 | FEB | 9 | 6 |
| 810 High Mass Cavity Albedo | | | | | 2.500 | Feb | 9 | 6 | 2.512 | Feb | 9 | 5 | 2.749 | Feb | 9 | 6 | 2.695 | Feb | 9 | 7 | 2.845 | Feb | 9 | 6 | 2.500 | 2.845 | 2.660 | 13.0% | 2.749 | FEB | 9 | 6 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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: | BSIMAC | | | | CSE | | | | DeST | | | | EnergyPlus | | | | ESP-r | | | | TRNSYS | | | | Example Result Statistics | | | | TRACE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | Min | Max | Mean | (Max-Min)/ | | | | |
| Case | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | Mo. | Day | Hr | kW | kW | kW | Mean** (%) | kW | Mo. | Day | Hr |
| 600 Base Case, South Windows | 5.650 | Jan | 22 | 15 | 6.481 | Jan | 22 | 14 | 5.422 | Jan | 22 | 14 | 6.352 | Jan | 22 | 14 | 6.193 | Jan | 22 | 14 | 6.046 | Jan | 22 | 14 | 5.422 | 6.481 | 6.024 | 17.6% | 6.351 | JAN | 22 | 14 |
| 610 S. Windows + Overhang | 5.466 | Jan | 22 | 15 | 6.432 | Dec | 1 | 14 | 5.331 | Jan | 22 | 14 | 6.135 | Dec | 1 | 14 | 5.934 | Jan | 22 | 14 | 5.868 | Dec | 1 | 14 | 5.331 | 6.432 | 5.861 | 18.8% | 6.135 | DEC | 1 | 14 |
| 620 East & West Windows | 4.704 | Jun | 26 | 18 | 4.493 | Jun | 26 | 17 | 3.955 | Jun | 26 | 17 | 4.797 | Jun | 26 | 17 | 4.622 | Jun | 26 | 17 | 4.588 | Jun | 26 | 17 | 3.955 | 4.797 | 4.527 | 18.6% | 4.797 | JUN | 26 | 17 |
| 630 E&W Windows + Overhang & Fins | 4.121 | Jun | 26 | 18 | 3.998 | Jun | 26 | 18 | 3.526 | Jun | 26 | 17 | 4.212 | Jun | 26 | 17 | 3.971 | Jun | 26 | 17 | 3.949 | Jun | 26 | 17 | 3.526 | 4.212 | 3.963 | 17.3% | 4.212 | JUN | 26 | 17 |
| 640 Case 600 with Htg. Temp. Setback | 5.650 | Jan | 22 | 15 | 6.429 | Jan | 22 | 14 | 5.365 | Jan | 22 | 14 | 6.297 | Jan | 22 | 14 | 6.127 | Jan | 22 | 14 | 5.967 | Jan | 22 | 14 | 5.365 | 6.429 | 5.973 | 17.8% | 6.298 | JAN | 22 | 14 |
| 650 Case 600 with Night Ventilation | 5.648 | Jan | 22 | 15 | 6.290 | Dec | 1 | 14 | 5.045 | Oct | 18 | 14 | 6.138 | Oct | 18 | 14 | 5.961 | Oct | 18 | 14 | 5.797 | Oct | 18 | 14 | 5.045 | 6.290 | 5.813 | 21.4% | 6.133 | OCT | 18 | 14 |
| 660 Low-E Windows | 3.343 | Oct | 18 | 15 | 3.933 | Oct | 1 | 13 | 3.355 | Oct | 11 | 14 | 3.770 | Oct | 18 | 14 | 3.530 | Oct | 1 | 14 | 3.457 | Oct | 18 | 14 | 3.343 | 3.933 | 3.565 | 16.6% | 3.768 | OCT | 18 | 14 |
| 670 Single-Pane Windows | 6.217 | Oct | 18 | 14 | 6.925 | Oct | 1 | 13 | 5.839 | Oct | 10 | 13 | 6.806 | Jan | 22 | 14 | 6.482 | Oct | 18 | 14 | 6.401 | Oct | 18 | 14 | 5.839 | 6.925 | 6.445 | 16.9% | 6.805 | JAN | 22 | 14 |
| 680 Case 600 with Increased Insulation | 5.761 | Jan | 22 | 15 | 7.051 | Jan | 22 | 14 | 5.861 | Jan | 22 | 14 | 6.770 | Jan | 22 | 14 | 6.676 | Jan | 22 | 14 | 6.557 | Jan | 22 | 14 | 5.761 | 7.051 | 6.446 | 20.0% | 6.769 | JAN | 22 | 14 |
| 685 Case 600 with "20/20" Thermostat | 6.318 | Jan | 22 | 15 | 7.159 | Jan | 22 | 14 | 6.071 | Jan | 22 | 14 | 7.107 | Jan | 22 | 14 | 6.934 | Jan | 22 | 14 | 6.867 | Jan | 22 | 14 | 6.071 | 7.159 | 6.743 | 16.1% | 7.107 | JAN | 22 | 14 |
| 695 Case 685 with Increased Insulation | 6.232 | Jan | 22 | 15 | 7.541 | Jan | 22 | 14 | 6.355 | Jan | 22 | 14 | 7.334 | Jan | 22 | 14 | 7.239 | Jan | 22 | 14 | 7.175 | Jan | 22 | 14 | 6.232 | 7.541 | 6.979 | 18.8% | 7.335 | JAN | 22 | 14 |
| 900 South Windows | 3.039 | Oct | 1 | 15 | 3.376 | Oct | 1 | 14 | 2.556 | Sep | 11 | 14 | 3.040 | Oct | 1 | 14 | 2.896 | Oct | 12 | 15 | 2.940 | Oct | 1 | 14 | 2.556 | 3.376 | 2.975 | 27.6% | 3.041 | OCT | 1 | 14 |
| 910 S. Windows + Overhang | 2.493 | Oct | 18 | 14 | 2.722 | Oct | 2 | 15 | 2.103 | Oct | 12 | 14 | 2.222 | Oct | 18 | 15 | 2.212 | Oct | 2 | 15 | 2.081 | Oct | 12 | 15 | 2.081 | 2.722 | 2.306 | 27.8% | 2.223 | OCT | 18 | 15 |
| 920 East & West Windows | 3.481 | Jun | 26 | 18 | 3.057 | Jun | 26 | 18 | 2.710 | Jun | 26 | 17 | 3.260 | Jun | 26 | 18 | 3.099 | Jun | 26 | 18 | 3.154 | Jun | 26 | 18 | 2.710 | 3.481 | 3.127 | 24.7% | 3.260 | JUN | 26 | 18 |
| 930 E&W Windows + Overhang & Fins | 3.052 | Jun | 26 | 18 | 2.662 | Jun | 26 | 18 | 2.335 | Jun | 26 | 17 | 2.782 | Jun | 26 | 18 | 2.494 | Jun | 26 | 18 | 2.613 | Jun | 26 | 18 | 2.335 | 3.052 | 2.656 | 27.0% | 2.782 | JUN | 26 | 18 |
| 940 Case 900 with Htg. Temp. Setback | 3.158 | Oct | 1 | 15 | 3.376 | Oct | 1 | 14 | 2.556 | Sep | 11 | 14 | 3.040 | Oct | 1 | 14 | 2.891 | Oct | 12 | 15 | 2.938 | Oct | 1 | 14 | 2.556 | 3.376 | 2.993 | 27.4% | 3.041 | OCT | 1 | 14 |
| 950 Case 900 with Night Ventilation | 2.366 | Sep | 10 | 15 | 2.364 | Sep | 4 | 15 | 2.054 | Sep | 11 | 14 | 2.388 | Sep | 11 | 15 | 2.202 | Sep | 10 | 15 | 2.236 | Sep | 11 | 15 | 2.054 | 2.388 | 2.268 | 14.7% | 2.374 | SEP | 11 | 15 |
| 960 Sunspace | | | | | 1.377 | Jun | 26 | 17 | 1.367 | Jun | 26 | 16 | 1.480 | Jun | 26 | 17 | 1.403 | Jun | 26 | 17 | 1.338 | Jun | 26 | 17 | 1.338 | 1.480 | 1.393 | 10.2% | 1.480 | JUN | 26 | 17 |
| 980 Case 900 with Increased Insulation | 3.384 | Oct | 18 | 14 | 3.668 | Oct | 2 | 14 | 2.930 | Oct | 18 | 14 | 3.450 | Oct | 18 | 15 | 3.341 | Oct | 12 | 15 | 3.313 | Oct | 12 | 14 | 2.930 | 3.668 | 3.348 | 22.0% | 3.451 | OCT | 18 | 15 |
| 985 Case 900 with "20/20" Thermostat | 3.977 | Oct | 18 | 14 | 4.225 | Oct | 1 | 14 | 3.208 | Oct | 11 | 14 | 3.915 | Oct | 18 | 15 | 3.736 | Oct | 12 | 15 | 3.885 | Oct | 1 | 14 | 3.208 | 4.225 | 3.824 | 26.6% | 3.916 | OCT | 18 | 15 |
| 995 Case 985 with Increased Insulation | 4.129 | Jan | 22 | 14 | 4.224 | Jan | 22 | 15 | 3.315 | Jan | 22 | 14 | 4.177 | Jan | 22 | 15 | 3.954 | Jan | 22 | 15 | 4.115 | Jan | 22 | 15 | 3.315 | 4.224 | 3.986 | 22.8% | 4.178 | JAN | 22 | 15 |
| 195 Solid Conduction | 1.118 | Jun | 26 | 17 | 0.994 | Jun | 26 | 17 | 0.973 | Jun | 26 | 16 | 1.041 | Jun | 26 | 17 | 0.944 | Jun | 26 | 17 | 0.994 | Jun | 26 | 17 | 0.944 | 1.118 | 1.011 | 17.2% | 1.041 | JUN | 26 | 17 |
| 200 Surface Convection (Int & Ext IR="off") | 1.271 | Jun | 26 | 17 | 1.215 | Jun | 26 | 17 | 1.239 | Jun | 26 | 16 | 1.307 | Jun | 26 | 17 | 1.198 | Jun | 26 | 17 | 1.259 | Jun | 26 | 17 | 1.198 | 1.307 | 1.248 | 8.8% | 1.306 | JUN | 26 | 17 |
| 210 Infrared Radiation (Int IR="off", Ext IR="on" | 1.193 | Jun | 26 | 17 | 0.946 | Jun | 13 | 15 | 0.937 | Jun | 26 | 16 | 1.084 | Jun | 26 | 17 | 0.877 | Jun | 14 | 14 | 0.884 | Jun | 26 | 18 | 0.877 | 1.193 | 0.987 | 32.0% | 1.083 | JUN | 26 | 17 |
| 215 Infrared Radiation (Int IR="on", Ext IR="off" | 1.393 | Jun | 26 | 17 | 1.369 | Jun | 26 | 17 | 1.386 | Jun | 26 | 16 | 1.400 | Jun | 26 | 17 | 1.366 | Jun | 26 | 17 | 1.352 | Jun | 26 | 17 | 1.352 | 1.400 | 1.378 | 3.5% | 1.399 | JUN | 26 | 17 |
| 220 In-Depth Base Case | 1.336 | Jun | 26 | 18 | 1.108 | Jun | 13 | 15 | 1.040 | Jun | 26 | 16 | 1.184 | Jun | 26 | 18 | 1.012 | Jun | 14 | 15 | 0.968 | Jun | 26 | 18 | 0.968 | 1.336 | 1.108 | 33.2% | 1.181 | JUN | 26 | 18 |
| 230 Infiltration | 1.994 | Jun | 26 | 17 | 1.728 | Jun | 26 | 17 | 1.734 | Jun | 26 | 16 | 1.841 | Jun | 26 | 17 | 1.701 | Jun | 26 | 17 | 1.694 | Jun | 26 | 17 | 1.694 | 1.994 | 1.782 | 16.9% | 1.840 | JUN | 26 | 17 |
| 240 Internal Gains | 1.534 | Jun | 26 | 18 | 1.295 | Jun | 13 | 15 | 1.218 | Jun | 26 | 16 | 1.366 | Jun | 26 | 18 | 1.192 | Jun | 14 | 15 | 1.150 | Jun | 26 | 18 | 1.150 | 1.534 | 1.292 | 29.7% | 1.363 | JUN | 26 | 18 |
| 250 Exterior Shortwave Absorptance | 2.913 | Sep | 12 | 14 | 2.790 | Sep | 12 | 14 | 2.751 | Sep | 3 | 14 | 2.867 | Sep | 12 | 14 | 3.034 | Sept | 12 | 14 | 2.688 | Sep | 12 | 14 | 2.688 | 3.034 | 2.840 | 12.2% | 2.869 | SEP | 12 | 14 |
| 270 South Solar Windows | | | | | 7.011 | Jan | 22 | 14 | 5.832 | Jan | 22 | 14 | 6.839 | Jan | 22 | 14 | 6.613 | Jan | 22 | 14 | 6.637 | Jan | 22 | 14 | 5.832 | 7.011 | 6.586 | 17.9% | 6.839 | JAN | 22 | 14 |
| 280 Cavity Albedo | | | | | 4.765 | Jan | 22 | 14 | 3.768 | Dec | 1 | 13 | 4.727 | Jan | 22 | 14 | 4.676 | Jan | 22 | 14 | 4.400 | Jan | 22 | 14 | 3.768 | 4.765 | 4.467 | 22.3% | 4.727 | JAN | 22 | 14 |
| 290 South Shading | | | | | 6.872 | Jan | 22 | 14 | 5.739 | Jan | 22 | 14 | 6.595 | Jan | 22 | 14 | 6.411 | Jan | 22 | 14 | 6.402 | Jan | 22 | 14 | 5.739 | 6.872 | 6.404 | 17.7% | 6.595 | JAN | 22 | 14 |
| 300 East/West Window | | | | | 4.163 | Jun | 26 | 17 | 3.695 | Jun | 26 | 17 | 4.475 | Jun | 26 | 17 | 4.221 | Jun | 26 | 17 | 4.278 | Jun | 26 | 17 | 3.695 | 4.475 | 4.167 | 18.7% | 4.475 | JUN | 26 | 17 |
| 310 East/West Shading | | | | | 3.796 | Jun | 26 | 18 | 3.252 | Jun | 26 | 17 | 3.970 | Jun | 26 | 18 | 3.618 | Jun | 26 | 18 | 3.701 | Jun | 26 | 18 | 3.252 | 3.970 | 3.667 | 19.6% | 3.969 | JUN | 26 | 18 |
| 320 Thermostat | | | | | 6.473 | Jan | 22 | 14 | 5.304 | Jan | 22 | 14 | 6.209 | Jan | 22 | 14 | 5.993 | Jan | 22 | 14 | 5.949 | Jan | 22 | 14 | 5.304 | 6.473 | 5.986 | 19.5% | 6.207 | JAN | 22 | 14 |
| 395 Low Mass Solid Conduction | 0.547 | Jun | 26 | 18 | 0.357 | Jun | 14 | 18 | 0.308 | Jun | 14 | 16 | 0.377 | Jun | 26 | 19 | 0.294 | Aug | 5 | 18 | 0.265 | Jun | 14 | 18 | 0.265 | 0.547 | 0.358 | 78.7% | 0.377 | JUN | 26 | 19 |
| 400 Low Mass High Cond. Wall Elements | 0.798 | Jun | 26 | 18 | 0.494 | Jun | 14 | 15 | 0.457 | Jun | 26 | 17 | 0.607 | Jun | 26 | 18 | 0.456 | Aug | 5 | 17 | 0.372 | Jun | 14 | 17 | 0.372 | 0.798 | 0.531 | 80.3% | 0.605 | JUN | 26 | 18 |
| 410 Low Mass Infiltration | 1.011 | Jun | 26 | 17 | 0.700 | Jun | 26 | 18 | 0.709 | Jun | 26 | 16 | 0.828 | Jun | 26 | 18 | 0.624 | Jun | 26 | 18 | 0.604 | Jun | 26 | 18 | 0.604 | 1.011 | 0.746 | 54.6% | 0.825 | JUN | 26 | 18 |
| 420 Low Mass Internal Gains | 1.208 | Jun | 26 | 17 | 0.909 | Jun | 26 | 18 | 0.917 | Jun | 26 | 16 | 1.033 | Jun | 26 | 18 | 0.836 | Jun | 26 | 17 | 0.814 | Jun | 26 | 18 | 0.814 | 1.208 | 0.953 | 41.3% | 1.030 | JUN | 26 | 18 |
| 430 Low Mass Ext. Shortwave Absorptance | 2.167 | Jun | 26 | 16 | 1.840 | Jun | 26 | 15 | 1.840 | Jun | 26 | 15 | 1.929 | Jun | 26 | 16 | 1.874 | Jul | 17 | 14 | 1.704 | Jun | 26 | 15 | 1.704 | 2.167 | 1.892 | 24.5% | 1.930 | JUN | 26 | 15 |
| 440 Low Mass Cavity Albedo | | | | | 4.666 | Oct | 1 | 13 | 3.766 | Oct | 11 | 13 | 4.686 | Oct | 18 | 14 | 4.679 | Oct | 18 | 14 | 4.308 | Oct | 18 | 14 | 3.766 | 4.686 | 4.421 | 20.8% | 4.686 | OCT | 18 | 14 |
| 450 Constant Interior and Exterior Surf Coeffs | 5.812 | Jan | 22 | 15 | 6.180 | Jan | 22 | 14 | 6.063 | Jan | 22 | 13 | 6.466 | Jan | 22 | 14 | 6.501 | Jan | 22 | 14 | 6.313 | Jan | 22 | 14 | 5.812 | 6.501 | 6.223 | 11.1% | 6.463 | JAN | 22 | 14 |
| 460 Constant Interior Surface Coefficients | 5.804 | Jan | 22 | 15 | 6.243 | Jan | 22 | 14 | 5.902 | Jan | 22 | 13 | 6.374 | Jan | 22 | 14 | 6.304 | Jan | 22 | 14 | 6.069 | Jan | 22 | 14 | 5.804 | 6.374 | 6.116 | 9.3% | 6.371 | JAN | 22 | 14 |
| 470 Constant Exterior Surface Coefficients | 5.695 | Jan | 22 | 15 | 6.388 | Jan | 22 | 14 | 5.570 | Jan | 22 | 14 | 6.444 | Jan | 22 | 14 | 6.407 | Jan | 22 | 14 | 6.320 | Jan | 22 | 14 | 5.570 | 6.444 | 6.137 | 14.2% | 6.442 | JAN | 22 | 14 |

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 High Mass High Cond. Wall Elements | 1.286 | Jun | 26 | 16 | 1.102 | Aug | 5 | 15 | 1.157 | Aug | 5 | 14 | 1.046 | Jun | 26 | 16 | 1.052 | Aug | 5 | 15 | 0.936 | Aug | 5 | 15 | 0.936 | 1.286 | 1.096 | 32.0% | 1.047 | JUN | 26 | 16 |
| 810 High Mass Cavity Albedo | | | | | 2.410 | Sep | 4 | 15 | 1.940 | Sep | 11 | 14 | 2.270 | Sep | 11 | 15 | 2.179 | Sep | 4 | 15 | 2.113 | Sep | 11 | 15 | 1.940 | 2.410 | 2.183 | 21.6% | 2.271 | SEP | 11 | 15 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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: | BSIMAC | | | | CSE | | | | DeST | | | | EnergyPlus | | | | ESP-r | | | | TRNSYS | | | | Example Result Statistics | | | | TRACE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | Min | Max | Mean | (Max-Min)/ | | | | |
| Case | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | T (°C) | T (°C) | Mean** (%) | T (°C) | Mo. | Day | Hr |
| 600FF - Low Mass with S. Windows | 63.4 | Oct | 18 | 17 | 68.4 | Oct | 1 | 16 | 65.0 | Oct | 11 | 15 | 63.8 | Oct | 18 | 16 | 64.6 | Oct | 1 | 16 | 62.4 | Oct | 1 | 15 | 62.4 | 68.4 | 64.6 | 9.3% | 63.5 | OCT | 19 | 15 |
| 900FF - High Mass with S. Windows | 46.0 | Oct | 1 | 17 | 45.1 | Sep | 4 | 15 | 44.5 | Sep | 11 | 15 | 44.3 | Sep | 12 | 15 | 44.3 | Sep | 12 | 16 | 43.3 | Sep | 12 | 15 | 43.3 | 46.0 | 44.6 | 6.2% | 44.3 | SEP | 13 | 14 |
| 650FF Case 600FF with Night Ventilation | 62.1 | Oct | 18 | 17 | 66.8 | Oct | 1 | 16 | 62.6 | Oct | 11 | 15 | 62.5 | Oct | 18 | 16 | 63.3 | Oct | 1 | 16 | 61.1 | Oct | 1 | 15 | 61.1 | 66.8 | 63.1 | 9.1% | 61.7 | OCT | 19 | 15 |
| 950FF Case 900FF with Night Ventilation | 37.1 | Oct | 1 | 17 | 36.8 | Sep | 11 | 15 | 36.4 | Sep | 11 | 15 | 36.7 | Sep | 11 | 16 | 36.4 | Aug | 5 | 16 | 36.1 | Sep | 11 | 16 | 36.1 | 37.1 | 36.6 | 2.7% | 36.6 | SEP | 12 | 15 |
| 680FF Case 600FF with Increased Insulation | 72.5 | Jan | 22 | 17 | 78.5 | Jan | 22 | 16 | 75.0 | Oct | 12 | 15 | 70.1 | Jan | 22 | 16 | 72.2 | Oct | 12 | 16 | 69.8 | Jan | 22 | 16 | 69.8 | 78.5 | 73.0 | 12.0% | 69.7 | JAN | 23 | 15 |
| 980FF Case 900FF with Increased Insulation | 49.7 | Oct | 1 | 17 | 52.2 | Sep | 12 | 15 | 52.8 | Oct | 21 | 14 | 49.6 | Sep | 12 | 16 | 50.2 | Sep | 12 | 15 | 48.5 | Sep | 12 | 15 | 48.5 | 52.8 | 50.5 | 8.5% | 49.6 | SEP | 13 | 14 |
| 960 Sunspace | | | | | 48.9 | Oct | 2 | 16 | 53.2 | Oct | 20 | 14 | 49.9 | Oct | 12 | 15 | 49.5 | Oct | 12 | 15 | 48.1 | Oct | 12 | 15 | 48.1 | 53.2 | 49.9 | 10.2% | 49.0 | OCT | 13 | 14 |

MINIMUM ANNUAL HOURLY INTEGRATED ZONE TEMPERATURE

| Simulation Model: | BSIMAC | | | | CSE | | | | DeST | | | | EnergyPlus | | | | ESP-r | | | | TRNSYS | | | | Example Result Statistics | | | | TRACE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | Min | Max | Mean | (Max-Min)/ | | | | |
| Case | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | T (°C) | T (°C) | Mean** (%) | T (°C) | Mo. | Day | Hr |
| 600FF - Low Mass with S. Windows | -9.9 | Nov | 26 | 8 | -12.9 | Feb | 9 | 7 | -13.5 | Feb | 9 | 6 | -12.6 | Feb | 9 | 7 | -13.5 | Feb | 9 | 7 | -13.8 | Feb | 9 | 7 | -13.8 | -9.9 | -12.7 | 31.1% | -12.6 | FEB | 10 | 6 |
| 900FF - High Mass with S. Windows | 0.6 | Feb | 8 | 11 | 2.2 | Feb | 9 | 7 | 1.3 | Feb | 9 | 7 | 1.2 | Feb | 9 | 7 | 1.6 | Feb | 9 | 7 | 0.6 | Feb | 9 | 7 | 0.6 | 2.2 | 1.3 | 124.2% | 1.2 | FEB | 10 | 6 |
| 650FF Case 600FF with Night Ventilation | -16.7 | Dec | 31 | 24 | -17.8 | Jan | 1 | 1 | -17.4 | Dec | 30 | 23 | -17.1 | Dec | 31 | 24 | -17.5 | Jan | 1 | 1 | -17.5 | Dec | 31 | 24 | -17.8 | -16.7 | -17.3 | 6.1% | -17.0 | DEC | 32 | 23 |
| 950FF Case 900FF with Night Ventilation | -13.2 | Dec | 31 | 24 | -13.2 | Jan | 1 | 1 | -13.4 | Dec | 30 | 23 | -12.8 | Feb | 9 | 7 | -12.5 | Feb | 9 | 6 | -12.8 | Feb | 9 | 6 | -13.4 | -12.5 | -13.0 | 6.6% | -12.8 | FEB | 10 | 5 |
| 680FF Case 600FF with Increased Insulation | -5.7 | Feb | 8 | 11 | -6.2 | Feb | 9 | 7 | -6.9 | Feb | 9 | 7 | -7.1 | Feb | 9 | 7 | -7.2 | Feb | 9 | 7 | -8.1 | Feb | 9 | 7 | -8.1 | -5.7 | -6.9 | 34.6% | -7.1 | FEB | 10 | 6 |
| 980FF Case 900FF with Increased Insulation | 7.3 | Feb | 8 | 11 | 12.5 | Nov | 4 | 7 | 12.4 | Nov | 5 | 6 | 9.9 | Nov | 4 | 7 | 10.5 | Nov | 4 | 8 | 9.5 | Nov | 4 | 7 | 7.3 | 12.5 | 10.4 | 50.6% | 9.9 | NOV | 5 | 6 |
| 960 Sunspace | | | | | 8.0 | Feb | 9 | 8 | 6.7 | Feb | 9 | 6 | 5.1 | Feb | 9 | 7 | 5.0 | Feb | 9 | 7 | 4.2 | Feb | 9 | 7 | 4.2 | 8.0 | 5.8 | 65.0% | 5.0 | FEB | 10 | 6 |

AVERAGE ANNUAL HOURLY INTEGRATED ZONE TEMPERATURE

| Simulation Model: | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Example Result Statistics | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ | |
| Case | 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 | 26.1 | 25.6 | 25.3 | 24.9 | 25.3 | 24.3 | 24.3 | 26.1 | 25.2 | 7.3% | 24.9 |
| 900FF - High Mass with S. Windows | 25.5 | 25.7 | 25.3 | 25.1 | 25.3 | 24.5 | 24.5 | 25.7 | 25.2 | 4.9% | 25.1 |
| 650FF Case 600FF with Night Ventilation | 17.6 | 18.5 | 18.0 | 18.4 | 18.9 | 18.4 | 17.6 | 18.9 | 18.3 | 7.3% | 18.4 |
| 950FF Case 900FF with Night Ventilation | 15.0 | 14.7 | 14.4 | 14.8 | 14.8 | 14.7 | 14.4 | 15.0 | 14.7 | 4.4% | 14.8 |
| 680FF Case 600FF with Increased Insulation | 31.8 | 33.1 | 33.3 | 31.0 | 31.7 | 30.2 | 30.2 | 33.3 | 31.8 | 9.8% | 30.9 |
| 980FF Case 900FF with Increased Insulation | 30.7 | 33.3 | 33.3 | 31.2 | 31.8 | 30.5 | 30.5 | 33.3 | 31.8 | 8.8% | 31.2 |
| 960 Sunspace | | 28.6 | 29.5 | 27.7 | 27.7 | 26.8 | 26.8 | 29.5 | 28.1 | 9.5% | 27.5 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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 | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 610-600 Heat, S. Shade | 0.113 | 0.074 | 0.097 | 0.050 | 0.165 | 0.089 | 0.050 | 0.165 | 0.098 | 117.0% | 0.051 |
| 620-600 Heat, E&W Orient. | 0.320 | 0.101 | 0.250 | 0.161 | 0.152 | 0.215 | 0.101 | 0.320 | 0.200 | 109.6% | 0.160 |
| 630-620 Heat, E&W Shade | 0.553 | 0.262 | 0.380 | 0.298 | 0.536 | 0.420 | 0.262 | 0.553 | 0.408 | 71.2% | 0.299 |
| 640-600 Heat, Htg. Setback | -1.368 | -1.590 | -1.428 | -1.663 | -1.708 | -1.851 | -1.851 | -1.368 | -1.601 | 30.2% | -1.646 |
| 660-600 Heat, Low-E Win. | -0.476 | -0.391 | -0.226 | -0.618 | -0.575 | -0.714 | -0.714 | -0.226 | -0.500 | 97.6% | -0.616 |
| 670-600 Heat, 1-Pane Win. | 1.434 | 1.307 | 1.526 | 1.292 | 1.613 | 1.636 | 1.292 | 1.636 | 1.468 | 23.5% | 1.289 |
| 680-600 Heat, > Ins. 20/27 | -1.831 | -2.207 | -2.315 | -2.145 | -2.230 | -2.217 | -2.315 | -1.831 | -2.157 | 22.4% | -2.144 |
| 685-600 Heat, 20/20 tstat | 0.482 | 0.582 | 0.599 | 0.553 | 0.542 | 0.539 | 0.482 | 0.599 | 0.549 | 21.3% | 0.557 |
| 695-685 Heat, > Ins. 20/20 | -1.823 | -2.159 | -2.261 | -2.075 | -2.171 | -2.150 | -2.261 | -1.823 | -2.107 | 20.8% | -2.075 |
| ANNUAL SENSIBLE COOLING [MWh] | | | | | | | Statistics for Example Results | | | | |
| Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 610-600 Cool, S. Shade | -1.523 | -1.531 | -1.259 | -1.694 | -1.929 | -1.663 | -1.929 | -1.259 | -1.600 | 41.9% | -1.695 |
| 620-600 Cool, E&W Orient. | -1.418 | -1.834 | -1.523 | -1.968 | -1.916 | -1.939 | -1.968 | -1.418 | -1.766 | 31.1% | -1.967 |
| 630-620 Cool, E&W Shade | -1.330 | -1.059 | -1.122 | -1.223 | -1.650 | -1.268 | -1.650 | -1.059 | -1.275 | 46.4% | -1.224 |
| 640-600 Cool, Htg. Setback | -0.018 | -0.269 | -0.195 | -0.264 | -0.269 | -0.302 | -0.302 | -0.018 | -0.220 | 129.5% | -0.256 |
| 650-600 Cool, Night Vent | -1.193 | -1.259 | -1.246 | -1.210 | -1.217 | -1.147 | -1.259 | -1.147 | -1.212 | 9.2% | -1.249 |
| 660-600 Heat, Low-E Win. | -2.808 | -2.573 | -2.172 | -2.796 | -2.943 | -2.813 | -2.943 | -2.172 | -2.684 | 28.7% | -2.797 |
| 670-600 Heat, 1-Pane Win. | 0.717 | 0.665 | 0.522 | 0.596 | 0.358 | 0.418 | 0.358 | 0.717 | 0.546 | 65.7% | 0.595 |
| 680-600 Heat, > Ins. 20/27 | 0.116 | 0.517 | 0.500 | 0.417 | 0.368 | 0.530 | 0.116 | 0.530 | 0.408 | 101.6% | 0.412 |
| 685-600 Heat, 20/20 tstat | 3.308 | 2.946 | 2.806 | 3.092 | 2.960 | 3.072 | 2.806 | 3.308 | 3.031 | 16.6% | 3.098 |
| 695-685 Heat, > Ins. 20/20 | -0.375 | 0.115 | 0.148 | 0.053 | 0.028 | 0.188 | -0.375 | 0.188 | 0.026 | 2164.0% | 0.050 |
| PEAK HEATING [kW] | | | | | | | Statistics for Example Results | | | | |
| Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 610-600 Heat, S. Shade | -0.089 | 0.001 | 0.004 | -0.013 | 0.005 | 0.001 | -0.089 | 0.005 | -0.015 | 616.7% | -0.013 |
| 620-600 Heat, E&W Orient. | -0.110 | 0.018 | 0.033 | 0.025 | 0.025 | 0.026 | -0.110 | 0.033 | 0.003 | 5355.3% | 0.026 |
| 630-620 Heat, E&W Shade | 0.107 | 0.002 | 0.004 | -0.023 | 0.006 | 0.003 | -0.023 | 0.107 | 0.016 | 786.0% | -0.023 |
| 640-600 Heat, Htg. Setback | 1.378 | 1.202 | 1.623 | 1.354 | 0.873 | 0.680 | 0.680 | 1.623 | 1.185 | 79.6% | 1.477 |
| 660-600 Heat, Low-E Win. | -0.635 | -0.262 | -0.237 | -0.373 | -0.382 | -0.404 | -0.635 | -0.237 | -0.382 | 104.1% | -0.373 |
| 670-600 Heat, 1-Pane Win. | 0.867 | 0.635 | 0.777 | 0.649 | 0.764 | 0.862 | 0.635 | 0.867 | 0.759 | 30.5% | 0.650 |
| 680-600 Heat, > Ins. 20/27 | -1.129 | -1.243 | -1.224 | -1.152 | -1.206 | -1.244 | -1.244 | -1.129 | -1.200 | 9.6% | -1.151 |
| 685-600 Heat, 20/20 tstat | -0.086 | 0.012 | 0.019 | 0.019 | 0.019 | 0.016 | -0.086 | 0.019 | 0.000 | 29982.6% | 0.019 |
| 695-685 Heat, > Ins. 20/20 | -1.031 | -1.237 | -1.199 | -1.151 | -1.222 | -1.257 | -1.257 | -1.031 | -1.183 | 19.1% | -1.151 |
| PEAK SENSIBLE COOLING [kW] | | | | | | | Statistics for Example Results | | | | |
| Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 610-600 Cool, S. Shade | -0.184 | -0.049 | -0.091 | -0.217 | -0.259 | -0.178 | -0.259 | -0.049 | -0.163 | 129.0% | -0.215 |
| 620-600 Cool, E&W Orient. | -0.946 | -1.988 | -1.467 | -1.554 | -1.571 | -1.457 | -1.988 | -0.946 | -1.497 | 69.6% | -1.553 |
| 630-620 Cool, E&W Shade | -0.583 | -0.495 | -0.429 | -0.585 | -0.651 | -0.639 | -0.651 | -0.429 | -0.564 | 39.4% | -0.585 |
| 640-600 Cool, Htg. Setback | 0.000 | -0.052 | -0.057 | -0.054 | -0.066 | -0.079 | -0.079 | 0.000 | -0.051 | 153.3% | -0.053 |
| 650-600 Cool, Night Vent | -0.002 | -0.191 | -0.377 | -0.213 | -0.232 | -0.248 | -0.377 | -0.002 | -0.211 | 178.0% | -0.218 |
| 660-600 Heat, Low-E Win. | -2.307 | -2.548 | -2.067 | -2.581 | -2.663 | -2.588 | -2.663 | -2.067 | -2.459 | 24.2% | -2.582 |
| 670-600 Heat, 1-Pane Win. | 0.567 | 0.444 | 0.417 | 0.455 | 0.289 | 0.356 | 0.289 | 0.567 | 0.421 | 66.0% | 0.455 |
| 680-600 Heat, > Ins. 20/27 | 0.111 | 0.570 | 0.439 | 0.419 | 0.483 | 0.511 | 0.111 | 0.570 | 0.422 | 108.8% | 0.418 |
| 685-600 Heat, 20/20 tstat | 0.668 | 0.678 | 0.649 | 0.755 | 0.741 | 0.822 | 0.649 | 0.822 | 0.719 | 24.0% | 0.756 |
| 695-685 Heat, > Ins. 20/20 | -0.086 | 0.381 | 0.284 | 0.228 | 0.305 | 0.308 | -0.086 | 0.381 | 0.237 | 197.5% | 0.228 |

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

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

## Table B8-7. High Mass Basic Sensitivity Tests

| ANNUAL HEATING [MWh] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 900-600 Mass, Heat | -2.324 | -2.614 | -2.456 | -2.661 | -2.777 | -2.690 | -2.777 | -2.324 | -2.587 | 17.5% | -2.657 |
| 910-900 Heat, S. Shade | 0.437 | 0.269 | 0.269 | 0.292 | 0.483 | 0.318 | 0.269 | 0.483 | 0.345 | 62.0% | 0.291 |
| 920-900 Heat, E&W Orient. | 1.774 | 1.577 | 1.668 | 1.673 | 1.715 | 1.793 | 1.577 | 1.793 | 1.700 | 12.7% | 1.669 |
| 930-920 Heat, E&W Shade | 0.770 | 0.568 | 0.674 | 0.657 | 0.978 | 0.777 | 0.568 | 0.978 | 0.737 | 55.6% | 0.657 |
| 940-900 Heat, Htg. Setback | -0.337 | -0.516 | -0.442 | -0.596 | -0.570 | -0.645 | -0.645 | -0.337 | -0.518 | 59.5% | -0.585 |
| 960-900 Heat, Sunspace | | 1.143 | 1.180 | 1.025 | 1.039 | 1.046 | 1.025 | 1.180 | 1.087 | 14.2% | 1.042 |
| 980-900 Heat, > Ins. 20/27 | -1.006 | -1.133 | -1.325 | -1.253 | -1.234 | -1.364 | -1.364 | -1.006 | -1.219 | 29.3% | -1.251 |
| 985-900 Heat, 20/20 tstat | 1.075 | 0.741 | 0.688 | 0.706 | 0.699 | 0.722 | 0.688 | 1.075 | 0.772 | 50.1% | 0.705 |
| 995-985 Heat, > Ins. 20/20 | -1.471 | -1.365 | -1.509 | -1.363 | -1.379 | -1.459 | -1.509 | -1.363 | -1.424 | 10.3% | -1.362 |

| ANNUAL SENSIBLE COOLING [MWh] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 900-600 Mass, Cool | -3.108 | -3.449 | -3.049 | -3.538 | -3.674 | -3.512 | -3.674 | -3.049 | -3.389 | 18.4% | -3.536 |
| 910-900 Cool, S. Shade | -1.230 | -1.049 | -0.893 | -1.105 | -1.205 | -1.076 | -1.230 | -0.893 | -1.093 | 30.8% | -1.105 |
| 920-900 Cool, E&W Orient. | 0.414 | 0.325 | 0.323 | 0.242 | 0.327 | 0.282 | 0.242 | 0.414 | 0.319 | 53.9% | 0.243 |
| 930-920 Cool, E&W Shade | -0.967 | -0.714 | -0.798 | -0.812 | -1.161 | -0.877 | -1.161 | -0.714 | -0.888 | 50.3% | -0.812 |
| 940-900 Cool, Htg. Setback | -0.101 | -0.067 | -0.040 | -0.064 | -0.060 | -0.064 | -0.101 | -0.040 | -0.066 | 92.3% | -0.063 |
| 950-900 Cool, Night Vent | -2.128 | -1.866 | -1.765 | -1.782 | -1.832 | -1.626 | -2.128 | -1.626 | -1.833 | 27.4% | -1.797 |
| 960-900 Cool, Sunspace | | -1.538 | -1.474 | -1.582 | -1.538 | -1.478 | -1.582 | -1.474 | -1.522 | 7.1% | -1.590 |
| 980-900 Heat, > Ins. 20/27 | 0.787 | 1.531 | 1.375 | 1.223 | 1.287 | 1.251 | 0.787 | 1.531 | 1.242 | 59.9% | 1.223 |
| 985-900 Heat, 20/20 tstat | 4.559 | 3.770 | 3.497 | 3.870 | 3.762 | 3.846 | 3.497 | 4.559 | 3.884 | 27.3% | 3.873 |
| 995-985 Heat, > Ins. 20/20 | 0.209 | 0.969 | 0.891 | 0.844 | 0.900 | 0.950 | 0.209 | 0.969 | 0.794 | 95.7% | 0.842 |

| PEAK HEATING [kW] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 900-600 Mass, Heat | -0.704 | -0.577 | -0.582 | -0.517 | -0.595 | -0.580 | -0.704 | -0.517 | -0.593 | 31.6% | -0.516 |
| 910-900 Heat, S. Shade | 0.210 | 0.026 | 0.021 | 0.011 | 0.051 | 0.021 | 0.011 | 0.210 | 0.057 | 350.6% | 0.011 |
| 920-900 Heat, E&W Orient. | 0.344 | 0.069 | 0.060 | 0.083 | 0.073 | 0.086 | 0.060 | 0.344 | 0.119 | 238.5% | 0.083 |
| 930-920 Heat, E&W Shade | 0.073 | 0.025 | 0.036 | 0.015 | 0.059 | 0.036 | 0.015 | 0.073 | 0.041 | 143.7% | 0.015 |
| 940-900 Heat, Htg. Setback | 1.331 | 0.609 | 1.206 | 0.455 | 0.489 | 0.626 | 0.455 | 1.331 | 0.786 | 111.4% | 0.466 |
| 960-900 Heat, Sunspace | | -0.311 | -0.368 | -0.428 | -0.432 | -0.478 | -0.478 | -0.311 | -0.404 | 41.3% | -0.424 |
| 980-900 Heat, > Ins. 20/27 | -0.858 | -1.190 | -1.071 | -1.150 | -1.160 | -1.186 | -1.190 | -0.858 | -1.102 | 30.1% | -1.150 |
| 985-900 Heat, 20/20 tstat | 0.203 | 0.009 | 0.005 | 0.008 | 0.009 | 0.007 | 0.005 | 0.203 | 0.040 | 493.6% | 0.008 |
| 995-985 Heat, > Ins. 20/20 | -1.043 | -1.083 | -0.996 | -1.073 | -1.082 | -1.123 | -1.123 | -0.996 | -1.067 | 11.9% | -1.073 |

| PEAK SENSIBLE COOLING [kW] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 900-600 Mass, Cool | -2.611 | -3.105 | -2.866 | -3.311 | -3.297 | -3.106 | -3.311 | -2.611 | -3.049 | 23.0% | -3.309 |
| 910-900 Cool, S. Shade | -0.546 | -0.654 | -0.453 | -0.818 | -0.684 | -0.859 | -0.859 | -0.453 | -0.669 | 60.7% | -0.818 |
| 920-900 Cool, E&W Orient. | 0.442 | -0.320 | 0.154 | 0.220 | 0.203 | 0.214 | -0.320 | 0.442 | 0.152 | 500.5% | 0.219 |
| 930-920 Cool, E&W Shade | -0.429 | -0.395 | -0.375 | -0.479 | -0.605 | -0.541 | -0.605 | -0.375 | -0.471 | 48.9% | -0.479 |
| 940-900 Cool, Htg. Setback | 0.119 | 0.000 | 0.000 | 0.000 | -0.005 | -0.002 | -0.005 | 0.119 | 0.019 | 669.9% | 0.000 |
| 950-900 Cool, Night Vent | -0.673 | -1.013 | -0.502 | -0.653 | -0.694 | -0.704 | -1.013 | -0.502 | -0.706 | 72.3% | -0.667 |

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 960-900 Cool, Sunspace | | -1.999 | -1.189 | -1.561 | -1.493 | -1.602 | -1.999 | -1.189 | -1.569 | 51.7% | -1.561 |
| 980-900 Heat, > Ins. 20/27 | 0.345 | 0.292 | 0.374 | 0.410 | 0.445 | 0.372 | 0.292 | 0.445 | 0.373 | 41.1% | 0.410 |
| 985-900 Heat, 20/20 tstat | 0.938 | 0.849 | 0.652 | 0.874 | 0.840 | 0.945 | 0.652 | 0.945 | 0.850 | 34.4% | 0.874 |
| 995-985 Heat, > Ins. 20/20 | 0.152 | -0.001 | 0.107 | 0.263 | 0.218 | 0.230 | -0.001 | 0.263 | 0.161 | 163.7% | 0.262 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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 | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 200-195 Surface Convection | 0.824 | 0.823 | 1.069 | 1.036 | 0.970 | 1.049 | 0.823 | 1.069 | 0.962 | 25.5% | 1.027 |
| 210-200 Ext IR (Int IR "off") | 0.586 | 1.153 | 1.305 | 0.941 | 1.397 | 1.287 | 0.586 | 1.397 | 1.111 | 72.9% | 0.949 |
| 220-215 Ext IR (Int IR "on") | 0.725 | 1.360 | 1.481 | 1.050 | 1.545 | 1.424 | 0.725 | 1.545 | 1.264 | 64.8% | 1.060 |
| 215-200 Int IR (Ext IR "off") | 0.611 | 0.493 | 0.471 | 0.300 | 0.261 | 0.301 | 0.261 | 0.611 | 0.406 | 86.3% | 0.296 |
| 220-210 Int IR (Ext IR "on") | 0.750 | 0.700 | 0.647 | 0.409 | 0.409 | 0.438 | 0.409 | 0.750 | 0.559 | 61.1% | 0.407 |
| 230-220 Infiltration | 3.474 | 3.146 | 3.239 | 3.475 | 3.213 | 3.366 | 3.146 | 3.475 | 3.319 | 9.9% | 3.475 |
| 240-220 Internal Gains | -1.261 | -1.224 | -1.234 | -1.176 | -1.186 | -1.211 | -1.261 | -1.176 | -1.215 | 7.0% | -1.176 |
| 250-220 Ext Solar Abs. | -1.644 | -1.622 | -1.805 | -1.556 | -1.791 | -1.763 | -1.805 | -1.556 | -1.697 | 14.7% | -1.560 |
| 270-220 South Windows | | -2.320 | -2.905 | -2.070 | -2.149 | -2.237 | -2.905 | -2.070 | -2.336 | 35.8% | -2.065 |
| 280-270 Cavity Albedo | | 0.178 | 0.346 | 0.185 | 0.162 | 0.239 | 0.162 | 0.346 | 0.222 | 83.0% | 0.185 |
| 320-270 Thermostat | | -0.669 | -0.674 | -0.614 | -0.607 | -0.600 | -0.674 | -0.600 | -0.633 | 11.7% | -0.619 |
| 290-270 South Shading | | 0.078 | 0.108 | 0.039 | 0.168 | 0.094 | 0.039 | 0.168 | 0.097 | 132.8% | 0.039 |
| 300-270 E&W Windows | | -0.028 | 0.187 | 0.039 | 0.092 | 0.094 | -0.028 | 0.187 | 0.077 | 280.1% | 0.038 |
| 310-300 E&W Shading | | 0.262 | 0.386 | 0.267 | 0.572 | 0.437 | 0.262 | 0.572 | 0.385 | 80.5% | 0.266 |
| ANNUAL SENSIBLE COOLING [MWh] | | | | | | | | | | | |
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 200-195 Surface Convection | 0.127 | 0.195 | 0.207 | 0.203 | 0.189 | 0.197 | 0.127 | 0.207 | 0.186 | 42.9% | 0.204 |
| 210-200 Ext IR (Int IR "off") | -0.151 | -0.297 | -0.339 | -0.254 | -0.282 | -0.329 | -0.339 | -0.151 | -0.275 | 68.3% | -0.256 |
| 220-215 Ext IR (Int IR "on") | -0.149 | -0.335 | -0.372 | -0.268 | -0.319 | -0.353 | -0.372 | -0.149 | -0.299 | 74.5% | -0.270 |
| 215-200 Int IR (Ext IR "off") | 0.113 | 0.146 | 0.087 | 0.063 | 0.094 | 0.062 | 0.062 | 0.146 | 0.094 | 88.6% | 0.063 |
| 220-210 Int IR (Ext IR "on") | 0.115 | 0.108 | 0.054 | 0.050 | 0.058 | 0.038 | 0.038 | 0.115 | 0.070 | 108.6% | 0.050 |
| 230-220 Infiltration | 0.381 | 0.381 | 0.379 | 0.381 | 0.379 | 0.399 | 0.379 | 0.399 | 0.383 | 5.3% | 0.381 |
| 240-220 Internal Gains | 0.484 | 0.372 | 0.326 | 0.369 | 0.346 | 0.336 | 0.326 | 0.484 | 0.372 | 42.5% | 0.369 |
| 250-220 Ext Solar Abs. | 2.809 | 2.818 | 2.921 | 2.572 | 2.891 | 2.406 | 2.406 | 2.921 | 2.736 | 18.8% | 2.596 |
| 270-220 South Windows | | 6.660 | 6.148 | 6.912 | 6.732 | 6.791 | 6.148 | 6.912 | 6.649 | 11.5% | 6.914 |
| 280-270 Cavity Albedo | | -2.274 | -2.483 | -2.339 | -2.103 | -2.480 | -2.483 | -2.103 | -2.336 | 16.3% | -2.339 |
| 320-270 Thermostat | | -2.412 | -2.278 | -2.536 | -2.396 | -2.501 | -2.536 | -2.278 | -2.424 | 10.6% | -2.544 |
| 290-270 South Shading | | -1.661 | -1.388 | -1.779 | -1.988 | -1.827 | -1.988 | -1.388 | -1.729 | 34.7% | -1.779 |
| 300-270 E&W Windows | | -2.216 | -1.893 | -2.370 | -2.271 | -2.376 | -2.376 | -1.893 | -2.225 | 21.7% | -2.370 |
| 310-300 E&W Shading | | -1.303 | -1.403 | -1.483 | -1.910 | -1.589 | -1.910 | -1.303 | -1.538 | 39.5% | -1.483 |
| PEAK HEATING [kW] | | | | | | | Statistics for Example Results | | | | |
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 200-195 Surface Convection | 0.470 | 0.435 | 0.509 | 0.547 | 0.473 | 0.557 | 0.435 | 0.557 | 0.499 | 24.4% | 0.544 |
| 210-200 Ext IR (Int IR "off") | 0.102 | 0.403 | 0.297 | 0.223 | 0.396 | 0.397 | 0.102 | 0.403 | 0.303 | 99.3% | 0.225 |
| 220-215 Ext IR (Int IR "on") | 0.110 | 0.419 | 0.343 | 0.214 | 0.398 | 0.389 | 0.110 | 0.419 | 0.312 | 99.1% | 0.217 |
| 215-200 Int IR (Ext IR "off") | 0.249 | 0.194 | 0.212 | 0.136 | 0.115 | 0.137 | 0.115 | 0.249 | 0.174 | 77.1% | 0.135 |
| 220-210 Int IR (Ext IR "on") | 0.257 | 0.210 | 0.258 | 0.127 | 0.117 | 0.129 | 0.117 | 0.258 | 0.183 | 77.0% | 0.127 |
| 230-220 Infiltration | 1.588 | 1.294 | 1.360 | 1.624 | 1.372 | 1.437 | 1.294 | 1.624 | 1.446 | 22.9% | 1.624 |
| 240-220 Internal Gains | -0.200 | -0.188 | -0.178 | -0.185 | -0.183 | -0.185 | -0.200 | -0.178 | -0.187 | 11.8% | -0.185 |
| 250-220 Ext Solar Abs. | 0.000 | -0.002 | -0.008 | -0.005 | -0.008 | -0.004 | -0.008 | 0.000 | -0.005 | 176.8% | -0.005 |
| 270-220 South Windows | | -0.228 | -0.303 | -0.095 | -0.040 | -0.035 | -0.303 | -0.035 | -0.140 | 190.7% | -0.094 |
| 280-270 Cavity Albedo | | 0.001 | 0.008 | 0.005 | 0.004 | 0.005 | 0.001 | 0.008 | 0.005 | 150.6% | 0.005 |
| 320-270 Thermostat | | -0.002 | -0.014 | -0.023 | -0.015 | -0.010 | -0.023 | -0.002 | -0.013 | 161.1% | -0.024 |
| 290-270 South Shading | | 0.000 | 0.001 | -0.013 | 0.002 | 0.000 | -0.013 | 0.002 | -0.002 | 763.1% | -0.013 |
| 300-270 E&W Windows | | 0.003 | 0.029 | 0.007 | 0.018 | 0.010 | 0.003 | 0.029 | 0.013 | 197.7% | 0.007 |
| 310-300 E&W Shading | | 0.001 | 0.003 | -0.023 | 0.005 | 0.003 | -0.023 | 0.005 | -0.002 | 1211.6% | -0.023 |
| PEAK SENSIBLE COOLING [kW] | | | | | | | Statistics for Example Results | | | | |
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 200-195 Surface Convection | 0.153 | 0.221 | 0.266 | 0.266 | 0.254 | 0.265 | 0.153 | 0.266 | 0.238 | 47.8% | 0.265 |
| 210-200 Ext IR (Int IR "off") | -0.078 | -0.270 | -0.302 | -0.223 | -0.321 | -0.375 | -0.375 | -0.078 | -0.261 | 113.5% | -0.223 |
| 220-215 Ext IR (Int IR "on") | -0.057 | -0.261 | -0.346 | -0.216 | -0.354 | -0.384 | -0.384 | -0.057 | -0.270 | 121.3% | -0.217 |
| 215-200 Int IR (Ext IR "off") | 0.122 | 0.154 | 0.147 | 0.093 | 0.168 | 0.093 | 0.093 | 0.168 | 0.130 | 58.0% | 0.092 |
| 220-210 Int IR (Ext IR "on") | 0.143 | 0.163 | 0.103 | 0.100 | 0.135 | 0.084 | 0.084 | 0.163 | 0.121 | 65.1% | 0.098 |
| 230-220 Infiltration | 0.658 | 0.620 | 0.694 | 0.656 | 0.689 | 0.726 | 0.620 | 0.726 | 0.674 | 15.7% | 0.658 |
| 240-220 Internal Gains | 0.198 | 0.186 | 0.178 | 0.181 | 0.180 | 0.182 | 0.178 | 0.198 | 0.184 | 10.9% | 0.181 |
| 250-220 Ext Solar Abs. | 1.577 | 1.682 | 1.711 | 1.682 | 2.022 | 1.720 | 1.577 | 2.022 | 1.732 | 25.7% | 1.687 |
| 270-220 South Windows | | 5.903 | 4.792 | 5.654 | 5.601 | 5.669 | 4.792 | 5.903 | 5.524 | 20.1% | 5.657 |
| 280-270 Cavity Albedo | | -2.246 | -2.064 | -2.112 | -1.937 | -2.238 | -2.246 | -1.937 | -2.119 | 14.6% | -2.112 |
| 320-270 Thermostat | | -0.538 | -0.528 | -0.630 | -0.620 | -0.688 | -0.688 | -0.528 | -0.601 | 26.6% | -0.632 |
| 290-270 South Shading | | -0.139 | -0.093 | -0.244 | -0.202 | -0.236 | -0.244 | -0.093 | -0.183 | 82.8% | -0.244 |
| 300-270 E&W Windows | | -2.848 | -2.137 | -2.363 | -2.392 | -2.359 | -2.848 | -2.137 | -2.420 | 29.4% | -2.364 |

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 310-300 E&W Shading | | -0.367 | -0.443 | -0.506 | -0.603 | -0.577 | -0.603 | -0.367 | -0.499 | 47.2% | -0.506 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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 | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 400-395 Surf. Conv. & IR | 1.341 | 1.681 | 1.902 | 1.707 | 1.744 | 1.861 | 1.341 | 1.902 | 1.706 | 32.9% | 1.701 |
| 410-400 Infiltration | 1.724 | 1.509 | 1.614 | 1.733 | 1.602 | 1.676 | 1.509 | 1.733 | 1.643 | 13.6% | 1.733 |
| 420-410 Internal Gains | -1.231 | -1.211 | -1.228 | -1.175 | -1.185 | -1.209 | -1.231 | -1.175 | -1.206 | 4.7% | -1.175 |
| 430-420 Ext Solar Abs. | -1.228 | -1.380 | -1.479 | -1.286 | -1.482 | -1.386 | -1.482 | -1.228 | -1.374 | 18.5% | -1.294 |
| 600-430 South Windows | -1.121 | -1.461 | -1.907 | -1.296 | -1.183 | -1.347 | -1.907 | -1.121 | -1.386 | 56.7% | -1.288 |
| 440-600 Cavity Albedo | | 0.163 | 0.283 | 0.176 | 0.142 | 0.217 | 0.142 | 0.283 | 0.196 | 71.9% | 0.176 |
| 450-600 Const Int&Ext Surf Coefs | -0.307 | -0.002 | -0.672 | -0.362 | -0.512 | -0.633 | -0.672 | -0.002 | -0.415 | 161.5% | -0.366 |
| 460-600 Const Int Surf Coefs | -0.222 | 0.063 | -0.174 | -0.131 | -0.099 | -0.214 | -0.222 | 0.063 | -0.130 | 219.8% | -0.137 |
| 460-450 Auto Ext Surf Heat Transf | 0.085 | 0.065 | 0.498 | 0.231 | 0.412 | 0.419 | 0.065 | 0.498 | 0.285 | 151.9% | 0.229 |
| 470-600 Const Ext Surf Coefs | -0.008 | -0.093 | -0.507 | -0.231 | -0.402 | -0.429 | -0.507 | -0.008 | -0.278 | 179.3% | -0.229 |
| 470-450 Auto Int Surf Heat Transf | 0.299 | -0.091 | 0.165 | 0.131 | 0.109 | 0.204 | -0.091 | 0.299 | 0.136 | 286.2% | 0.137 |

| ANNUAL SENSIBLE COOLING [MWh] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 400-395 Surf. Conv. & IR | 0.042 | 0.016 | 0.011 | 0.020 | 0.019 | 0.009 | 0.009 | 0.042 | 0.019 | 168.7% | 0.020 |
| 410-400 Infiltration | 0.033 | 0.025 | 0.024 | 0.027 | 0.028 | 0.022 | 0.022 | 0.033 | 0.027 | 39.8% | 0.027 |
| 420-410 Internal Gains | 0.132 | 0.092 | 0.078 | 0.095 | 0.090 | 0.074 | 0.074 | 0.132 | 0.094 | 61.7% | 0.095 |
| 430-420 Ext Solar Abs. | 0.856 | 0.766 | 0.825 | 0.703 | 0.811 | 0.630 | 0.630 | 0.856 | 0.765 | 29.6% | 0.707 |
| 600-430 South Windows | 4.738 | 5.007 | 4.488 | 5.171 | 5.209 | 5.040 | 4.488 | 5.209 | 4.942 | 14.6% | 5.168 |
| 440-600 Cavity Albedo | | -1.928 | -1.974 | -1.942 | -1.748 | -2.038 | -2.038 | -1.748 | -1.926 | 15.1% | -1.944 |
| 450-600 Const Int&Ext Surf Coefs | 0.350 | -0.224 | 0.729 | 0.480 | 0.451 | 0.751 | -0.224 | 0.751 | 0.423 | 230.6% | 0.458 |
| 460-600 Const Int Surf Coefs | 0.438 | 0.027 | 0.497 | 0.448 | 0.567 | 0.464 | 0.027 | 0.567 | 0.407 | 132.9% | 0.430 |
| 460-450 Auto Ext Surf Heat Transf | 0.088 | 0.251 | -0.232 | -0.033 | 0.116 | -0.287 | -0.287 | 0.251 | -0.016 | 3319.8% | -0.028 |
| 470-600 Const Ext Surf Coefs | 0.165 | -0.269 | 0.217 | 0.002 | -0.156 | 0.276 | -0.269 | 0.276 | 0.039 | 1392.5% | -0.004 |
| 470-450 Auto Int Surf Heat Transf | -0.185 | -0.045 | -0.512 | -0.478 | -0.608 | -0.475 | -0.608 | -0.045 | -0.384 | 146.6% | -0.462 |

| PEAK HEATING [kW] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 400-395 Surf. Conv. & IR | 0.611 | 0.682 | 0.778 | 0.740 | 0.698 | 0.717 | 0.611 | 0.778 | 0.704 | 23.7% | 0.739 |
| 410-400 Infiltration | 0.779 | 0.601 | 0.680 | 0.812 | 0.685 | 0.718 | 0.601 | 0.812 | 0.713 | 29.6% | 0.812 |
| 420-410 Internal Gains | -0.200 | -0.184 | -0.178 | -0.185 | -0.183 | -0.185 | -0.200 | -0.178 | -0.186 | 11.8% | -0.185 |
| 430-420 Ext Solar Abs. | 0.162 | -0.002 | -0.005 | -0.003 | -0.005 | -0.003 | -0.005 | 0.162 | 0.024 | 695.2% | -0.003 |
| 600-430 South Windows | -0.045 | -0.234 | -0.325 | -0.112 | -0.057 | -0.050 | -0.325 | -0.045 | -0.137 | 204.3% | -0.111 |
| 440-600 Cavity Albedo | | 0.007 | 0.025 | 0.014 | 0.009 | 0.015 | 0.007 | 0.025 | 0.014 | 127.7% | 0.015 |
| 450-600 Const Int&Ext Surf Coefs | -0.266 | -0.042 | -0.282 | -0.105 | -0.186 | -0.322 | -0.322 | -0.042 | -0.200 | 139.6% | -0.104 |
| 460-600 Const Int Surf Coefs | -0.200 | -0.049 | -0.055 | -0.113 | -0.127 | -0.199 | -0.200 | -0.049 | -0.124 | 122.0% | -0.114 |
| 460-450 Auto Ext Surf Heat Transf | 0.066 | -0.007 | 0.227 | -0.009 | 0.059 | 0.122 | -0.009 | 0.227 | 0.076 | 308.4% | -0.009 |
| 470-600 Const Ext Surf Coefs | -0.137 | -0.020 | -0.228 | 0.002 | -0.059 | -0.127 | -0.228 | 0.002 | -0.095 | 243.0% | 0.003 |
| 470-450 Auto Int Surf Heat Transf | 0.129 | 0.022 | 0.054 | 0.107 | 0.127 | 0.194 | 0.022 | 0.194 | 0.106 | 162.7% | 0.107 |

| PEAK SENSIBLE COOLING [kW] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 400-395 Surf. Conv. & IR | 0.251 | 0.136 | 0.149 | 0.229 | 0.162 | 0.107 | 0.107 | 0.251 | 0.172 | 83.7% | 0.228 |
| 410-400 Infiltration | 0.213 | 0.206 | 0.252 | 0.221 | 0.168 | 0.232 | 0.168 | 0.252 | 0.215 | 39.0% | 0.221 |
| 420-410 Internal Gains | 0.197 | 0.209 | 0.208 | 0.205 | 0.212 | 0.210 | 0.197 | 0.212 | 0.207 | 7.3% | 0.205 |
| 430-420 Ext Solar Abs. | 0.959 | 0.931 | 0.923 | 0.897 | 1.038 | 0.890 | 0.890 | 1.038 | 0.940 | 15.7% | 0.900 |
| 600-430 South Windows | 3.483 | 4.641 | 3.582 | 4.422 | 4.319 | 4.342 | 3.483 | 4.641 | 4.132 | 28.0% | 4.420 |
| 440-600 Cavity Albedo | | -1.815 | -1.656 | -1.666 | -1.514 | -1.738 | -1.815 | -1.514 | -1.678 | 18.0% | -1.665 |
| 450-600 Const Int&Ext Surf Coefs | 0.162 | -0.301 | 0.641 | 0.115 | 0.308 | 0.268 | -0.301 | 0.641 | 0.199 | 474.2% | 0.112 |
| 460-600 Const Int Surf Coefs | 0.154 | -0.238 | 0.480 | 0.023 | 0.111 | 0.023 | -0.238 | 0.480 | 0.092 | 779.6% | 0.021 |
| 460-450 Auto Ext Surf Heat Transf | -0.008 | 0.063 | -0.161 | -0.092 | -0.197 | -0.244 | -0.244 | 0.063 | -0.107 | 288.5% | -0.092 |
| 470-600 Const Ext Surf Coefs | 0.045 | -0.093 | 0.148 | 0.092 | 0.214 | 0.274 | -0.093 | 0.274 | 0.113 | 324.3% | 0.092 |
| 470-450 Auto Int Surf Heat Transf | -0.117 | 0.208 | -0.493 | -0.023 | -0.094 | 0.007 | -0.493 | 0.208 | -0.085 | 821.0% | -0.021 |

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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 | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 800-430 Mass, w/ High Cond. Wall | -0.030 | -0.548 | -0.551 | -0.505 | -0.565 | -0.481 | -0.565 | -0.030 | -0.447 | 119.8% | -0.509 |
| 900-800 Himass, S. Win. | -3.415 | -3.527 | -3.812 | -3.452 | -3.395 | -3.555 | -3.812 | -3.395 | -3.526 | 11.8% | -3.436 |
| 900-810 Himass, Int. Sol. Abs. | | -0.659 | -0.863 | -0.678 | -0.600 | -0.796 | -0.863 | -0.600 | -0.719 | 36.5% | -0.677 |
| 910-610 Mass, w/ S. Shade | -2.000 | -2.419 | -2.284 | -2.419 | -2.460 | -2.460 | -2.460 | -2.000 | -2.340 | 19.7% | -2.417 |
| 920-620 Mass, w/ E&W Win. | -0.870 | -1.138 | -1.038 | -1.149 | -1.215 | -1.112 | -1.215 | -0.870 | -1.087 | 31.7% | -1.148 |
| 930-630 Mass w/ E&W Shade | -0.653 | -0.832 | -0.744 | -0.790 | -0.773 | -0.754 | -0.832 | -0.653 | -0.758 | 23.7% | -0.789 |
| 940-640 Mass, w/ Htg. Setback | -1.293 | -1.540 | -1.470 | -1.594 | -1.640 | -1.484 | -1.640 | -1.293 | -1.503 | 23.1% | -1.597 |
| 980-680 Mass, w/ Insulation 20/27 | -1.499 | -1.540 | -1.466 | -1.769 | -1.781 | -1.836 | -1.836 | -1.466 | -1.648 | 22.4% | -1.765 |
| 985-685 Mass, w/ 20/20 Tstat | -1.731 | -2.454 | -2.367 | -2.508 | -2.620 | -2.506 | -2.620 | -1.731 | -2.364 | 37.6% | -2.509 |
| 995-695 Mass, w/ Insulation 20/20 | -1.379 | -1.660 | -1.615 | -1.795 | -1.827 | -1.815 | -1.827 | -1.379 | -1.682 | 26.7% | -1.796 |
| ANNUAL SENSIBLE COOLING [MWh] | | | | | | | Statistics for Example Results | | | | |
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 800-430 Mass, w/ High Cond. Wall | -0.611 | -0.526 | -0.582 | -0.482 | -0.561 | -0.457 | -0.611 | -0.457 | -0.537 | 28.7% | -0.483 |
| 900-800 Himass, S. Win. | 2.241 | 2.084 | 2.021 | 2.115 | 2.096 | 1.985 | 1.985 | 2.241 | 2.090 | 12.2% | 2.115 |
| 900-810 Himass, Int. Sol. Abs. | | 0.983 | 1.026 | 0.981 | 0.882 | 0.973 | 0.882 | 1.026 | 0.969 | 14.9% | 0.981 |
| 910-610 Mass, w/ S. Shade | -2.815 | -2.967 | -2.683 | -2.949 | -2.950 | -2.926 | -2.967 | -2.683 | -2.882 | 9.9% | -2.947 |
| 920-620 Mass, w/ E&W Win. | -1.276 | -1.290 | -1.203 | -1.329 | -1.431 | -1.292 | -1.431 | -1.203 | -1.303 | 17.5% | -1.327 |
| 930-630 Mass w/ E&W Shade | -0.913 | -0.945 | -0.879 | -0.917 | -0.942 | -0.901 | -0.945 | -0.879 | -0.916 | 7.2% | -0.915 |
| 940-640 Mass, w/ Htg. Setback | -3.191 | -3.247 | -2.894 | -3.339 | -3.465 | -3.274 | -3.465 | -2.894 | -3.235 | 17.7% | -3.343 |
| 950-650 Mass, w/ Night Vent | -4.043 | -4.056 | -3.568 | -4.110 | -4.289 | -3.991 | -4.289 | -3.568 | -4.009 | 18.0% | -4.084 |
| 980-680 Mass, w/ Insulation 20/27 | -2.437 | -2.435 | -2.174 | -2.732 | -2.755 | -2.791 | -2.791 | -2.174 | -2.554 | 24.2% | -2.726 |
| 985-685 Mass, w/ 20/20 Tstat | -1.857 | -2.626 | -2.358 | -2.760 | -2.872 | -2.738 | -2.872 | -1.857 | -2.535 | 40.0% | -2.761 |
| 995-695 Mass, w/ Insulation 20/20 | -1.273 | -1.772 | -1.615 | -1.969 | -2.000 | -1.975 | -2.000 | -1.273 | -1.767 | 41.1% | -1.969 |
| PEAK HEATING [kW] | | | | | | | Statistics for Example Results | | | | |
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 800-430 Mass, w/ High Cond. Wall | -0.343 | -0.476 | -0.496 | -0.393 | -0.445 | -0.442 | -0.496 | -0.343 | -0.432 | 35.4% | -0.393 |
| 900-800 Himass, S. Win. | -0.406 | -0.334 | -0.411 | -0.236 | -0.207 | -0.188 | -0.411 | -0.188 | -0.297 | 74.9% | -0.235 |
| 900-810 Himass, Int. Sol. Abs. | | -0.057 | -0.059 | -0.062 | -0.062 | -0.066 | -0.066 | -0.057 | -0.061 | 15.4% | -0.062 |
| 910-610 Mass, w/ S. Shade | -0.405 | -0.552 | -0.565 | -0.493 | -0.549 | -0.560 | -0.565 | -0.405 | -0.521 | 30.7% | -0.492 |
| 920-620 Mass, w/ E&W Win. | -0.250 | -0.525 | -0.555 | -0.459 | -0.547 | -0.520 | -0.555 | -0.250 | -0.476 | 64.1% | -0.459 |
| 930-630 Mass w/ E&W Shade | -0.284 | -0.502 | -0.523 | -0.422 | -0.494 | -0.487 | -0.523 | -0.284 | -0.452 | 52.9% | -0.422 |
| 940-640 Mass, w/ Htg. Setback | -0.751 | -1.171 | -0.999 | -1.416 | -0.979 | -0.634 | -1.416 | -0.634 | -0.992 | 78.9% | -1.527 |
| 980-680 Mass, w/ Insulation 20/27 | -0.433 | -0.524 | -0.429 | -0.515 | -0.549 | -0.523 | -0.549 | -0.429 | -0.495 | 24.2% | -0.514 |
| 985-685 Mass, w/ 20/20 Tstat | -0.415 | -0.580 | -0.596 | -0.528 | -0.605 | -0.589 | -0.605 | -0.415 | -0.552 | 34.4% | -0.527 |
| 995-695 Mass, w/ Insulation 20/20 | -0.427 | -0.426 | -0.393 | -0.450 | -0.465 | -0.456 | -0.465 | -0.393 | -0.436 | 16.5% | -0.449 |
| PEAK SENSIBLE COOLING [kW] | | | | | | | Statistics for Example Results | | | | |
| CASES | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| 800-430 Mass, w/ High Cond. Wall | -0.881 | -0.738 | -0.683 | -0.884 | -0.822 | -0.768 | -0.884 | -0.683 | -0.796 | 25.2% | -0.883 |
| 900-800 Himass, S. Win. | 1.753 | 2.275 | 1.399 | 1.995 | 1.844 | 2.004 | 1.399 | 2.275 | 1.878 | 46.6% | 1.994 |
| 900-810 Himass, Int. Sol. Abs. | | 0.966 | 0.616 | 0.770 | 0.717 | 0.827 | 0.616 | 0.966 | 0.779 | 44.9% | 0.771 |
| 910-610 Mass, w/ S. Shade | -2.973 | -3.710 | -3.228 | -3.912 | -3.722 | -3.787 | -3.912 | -2.973 | -3.555 | 26.4% | -3.912 |
| 920-620 Mass, w/ E&W Win. | -1.223 | -1.436 | -1.245 | -1.537 | -1.523 | -1.434 | -1.537 | -1.223 | -1.400 | 22.4% | -1.537 |
| 930-630 Mass w/ E&W Shade | -1.069 | -1.336 | -1.191 | -1.431 | -1.477 | -1.336 | -1.477 | -1.069 | -1.307 | 31.2% | -1.430 |
| 940-640 Mass, w/ Htg. Setback | -2.492 | -3.053 | -2.809 | -3.257 | -3.236 | -3.029 | -3.257 | -2.492 | -2.979 | 25.7% | -3.257 |
| 950-650 Mass, w/ Night Vent | -3.282 | -3.926 | -2.991 | -3.751 | -3.759 | -3.561 | -3.926 | -2.991 | -3.545 | 26.4% | -3.759 |
| 980-680 Mass, w/ Insulation 20/27 | -2.377 | -3.383 | -2.931 | -3.320 | -3.335 | -3.244 | -3.383 | -2.377 | -3.098 | 32.5% | -3.318 |
| 985-685 Mass, w/ 20/20 Tstat | -2.341 | -2.934 | -2.863 | -3.192 | -3.198 | -2.983 | -3.198 | -2.341 | -2.918 | 29.4% | -3.192 |
| 995-695 Mass, w/ Insulation 20/20 | -2.103 | -3.317 | -3.040 | -3.157 | -3.285 | -3.060 | -3.317 | -2.103 | -2.994 | 40.6% | -3.157 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

Note: The statistics in the tables below are based on the listed 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: / Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean* (%) | |
| 600 South | 0.591 | 0.627 | 0.624 | 0.587 | 0.597 | 0.594 | 0.587 | 0.627 | 0.603 | 6.7% | 0.587 |
| 620 West | 0.600 | | 0.629 | 0.601 | 0.616 | 0.640 | 0.600 | 0.640 | 0.617 | 6.5% | 0.633 |
| 660 South, Low-E | 0.322 | 0.381 | 0.392 | 0.318 | 0.325 | 0.324 | 0.318 | 0.392 | 0.344 | 21.6% | 0.318 |
| 670 South, Single-Pane | 0.748 | 0.750 | 0.770 | 0.747 | 0.754 | 0.751 | 0.747 | 0.770 | 0.753 | 3.1% | 0.747 |

* 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: / Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean* (%) | |
| 610/600 South | 0.218 | 0.194 | 0.176 | 0.196 | 0.224 | 0.195 | 0.176 | 0.224 | 0.201 | 24.0% | 0.196 |
| 630/620 West | 0.268 | | 0.299 | 0.278 | 0.342 | 0.286 | 0.268 | 0.342 | 0.294 | 25.2% | 0.273 |

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

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

| Simulation Model: / Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean* (%) | |
| Horizontal | 1670 | 1663 | 1667 | 1664 | 1665 | 1669 | 1663 | 1670 | 1666 | 0.4% | 1664 |
| North | 453 | 399 | 477 | 438 | 432 | 440 | 399 | 477 | 440 | 17.8% | 438 |
| East | 1061 | 1027 | 1017 | 1062 | 1054 | 1068 | 1017 | 1068 | 1048 | 4.9% | 1062 |
| South | 1387 | 1317 | 1291 | 1370 | 1363 | 1384 | 1291 | 1387 | 1352 | 7.1% | 1370 |
| West | 997 | 903 | 906 | 967 | 961 | 974 | 903 | 997 | 951 | 9.9% | 967 |

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

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

| Simulation Model: / Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean* (%) | |
| 600 South | 820 | 826 | 805 | 804 | 814 | 823 | 804 | 826 | 815 | 2.6% | 804 |
| 620 West | 598 | | 569 | 581 | 592 | 624 | 569 | 624 | 593 | 9.2% | 612 |
| 660 South | 447 | 501 | 506 | 436 | 443 | 448 | 436 | 506 | 464 | 15.2% | 436 |
| 670 South | 1037 | 988 | 994 | 1024 | 1028 | 1039 | 988 | 1039 | 1018 | 5.0% | 1024 |

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

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

| Simulation Model: / Case | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean* (%) | |
| 610 South | 641 | 665 | 663 | 646 | 631 | 662 | 631 | 665 | 651 | 5.2% | 647 |
| 630 West | 438 | | 399 | 419 | 390 | 446 | 390 | 446 | 418 | 13.4% | 445 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

## Table B8-16. Sky Temperature Output, Case 600

MAXIMUM ANNUAL HOURLY INTEGRATED SKY TEMPERATURE

| Simulation Model: | BSIMAC | | | | CSE | | | | DeST | | | | EnergyPlus | | | | ESP-r | | | | TRNSYS | | | | TestSpec-Alt | | | | Example Result Statistics | | | | TRACE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | Alternative Values | | | | Min | Max | Mean | (Max-Min)/ | | | | |
| Case | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | Mo. | Day | Hr | T (°C) | T (°C) | T (°C) | Mean** (%) | T (°C) | Mo. | Day | Hr |
| Average Annual Hourly Integrated | | | | | -3.9 | | | | -5.9 | | | | -2.0 | | | | -5.2 | | | | -5.1 | | | | -5.9 | | | | -5.9 | -2.0 | -4.7 | 83.2% | -2.0 | | | |
| Minimum Annual Hourly Integrated | | | | | -46.2 | Dec | 31 | 24 | -46.9 | Dec | 31 | 23 | -38.0 | Dec | 31 | 24 | -46.9 | Dec | 31 | 23 | -46.2 | Dec | 31 | 24 | -46.9 | | | | -46.9 | -38.0 | -45.2 | 19.8% | -38.0 | DEC | 32 | 23 |
| Maximum Annual Hourly Integrated | | | | | 30.1 | Jun | 13 | 15 | 24.6 | Aug | 4 | 15 | 24.7 | Aug | 4 | 16 | 26.7 | Aug | 4 | 15 | 26.0 | Jun | 13 | 18 | 24.6 | | | | 24.6 | 30.1 | 26.1 | 20.9% | 24.7 | AUG | 5 | 15 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

## Table B8-M1. Monthly Heating Loads (kWh)

| Simulation Model: | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean** (%) | |
| **Case 600** | | | | | | | | | | | |
| Jan | 664.0 | 655.6 | 672.7 | 711.9 | 732.0 | 734.9 | 655.6 | 734.9 | 695.2 | 11.4% | 711.0 |
| Feb | 653.3 | 626.3 | 635.3 | 682.6 | 682.0 | 702.1 | 626.3 | 702.1 | 663.6 | 11.4% | 681.9 |
| Mar | 433.5 | 435.7 | 450.5 | 472.2 | 481.0 | 495.0 | 433.5 | 495.0 | 461.3 | 13.3% | 471.5 |
| Apr | 511.0 | 457.0 | 448.0 | 510.1 | 479.0 | 517.3 | 448.0 | 517.3 | 487.1 | 14.2% | 509.4 |
| May | 112.8 | 127.8 | 128.0 | 136.8 | 139.0 | 150.7 | 112.8 | 150.7 | 132.5 | 28.6% | 136.6 |
| Jun | 2.7 | 11.7 | 11.2 | 10.1 | 14.0 | 16.0 | 2.7 | 16.0 | 10.9 | 120.7% | 10.1 |
| Jul | 4.8 | 11.5 | 10.1 | 12.0 | 14.0 | 16.7 | 4.8 | 16.7 | 11.5 | 103.0% | 12.0 |
| Aug | 1.4 | 6.9 | 8.4 | 6.6 | 9.0 | 9.6 | 1.4 | 9.6 | 7.0 | 118.1% | 6.6 |
| Sep | 51.8 | 74.3 | 76.7 | 73.3 | 81.0 | 84.8 | 51.8 | 84.8 | 73.7 | 44.9% | 73.3 |
| Oct | 317.0 | 328.4 | 324.1 | 347.7 | 354.0 | 367.1 | 317.0 | 367.1 | 339.7 | 14.7% | 347.2 |
| Nov | 598.7 | 575.6 | 585.8 | 625.3 | 629.0 | 645.8 | 575.6 | 645.8 | 610.0 | 11.5% | 624.6 |
| Dec | 698.7 | 682.0 | 697.8 | 735.7 | 750.0 | 763.5 | 682.0 | 763.5 | 721.3 | 11.3% | 735.0 |
| **Case 900** | | | | | | | | | | | |
| Jan | 277.8 | 206.1 | 275.3 | 255.8 | 266.0 | 291.9 | 206.1 | 291.9 | 262.2 | 32.7% | 255.6 |
| Feb | 307.4 | 243.2 | 292.9 | 294.2 | 283.0 | 322.1 | 243.2 | 322.1 | 290.5 | 27.2% | 293.9 |
| Mar | 134.4 | 102.4 | 120.0 | 125.5 | 115.0 | 143.8 | 102.4 | 143.8 | 123.5 | 33.5% | 125.4 |
| Apr | 275.7 | 222.4 | 214.2 | 268.7 | 228.0 | 275.5 | 214.2 | 275.7 | 247.4 | 24.9% | 268.3 |
| May | 20.1 | 33.3 | 26.8 | 33.4 | 29.0 | 37.5 | 20.1 | 37.5 | 30.0 | 58.0% | 33.3 |
| Jun | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | #DIV/0! | 0.0 |
| Jul | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | #DIV/0! | 0.0 |
| Aug | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | #DIV/0! | 0.0 |
| Sep | 2.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.5 | 0.0 | 2.1 | 0.5 | 458.3% | 0.1 |
| Oct | 80.5 | 65.1 | 63.6 | 81.1 | 70.0 | 85.0 | 63.6 | 85.0 | 74.2 | 28.9% | 81.0 |
| Nov | 298.2 | 251.6 | 283.9 | 297.0 | 286.0 | 318.2 | 251.6 | 318.2 | 289.2 | 23.0% | 296.7 |
| Dec | 329.8 | 254.7 | 314.3 | 307.9 | 308.0 | 339.4 | 254.7 | 339.4 | 309.0 | 27.4% | 307.8 |

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

## Table B8-M2. Monthly Sensible Cooling Loads (kWh)

| Simulation Model: | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Statistics for Example Results | | | | TRACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Min | Max | Mean | (Max-Min)/ Mean** (%) | |
| **Case 600** | | | | | | | | | | | |
| Jan | 475.4 | 554.0 | 417.9 | 521.8 | 523.0 | 495.0 | 417.9 | 554.0 | 497.9 | 27.3% | 521.6 |
| Feb | 349.2 | 394.3 | 315.4 | 387.5 | 398.0 | 367.4 | 315.4 | 398.0 | 368.6 | 22.4% | 387.5 |
| Mar | 450.3 | 474.4 | 410.7 | 484.4 | 489.0 | 457.4 | 410.7 | 489.0 | 461.0 | 17.0% | 484.2 |
| Apr | 218.7 | 220.1 | 230.2 | 240.5 | 263.0 | 235.4 | 218.7 | 263.0 | 234.6 | 18.9% | 240.0 |
| May | 342.7 | 321.2 | 338.6 | 339.9 | 364.0 | 325.2 | 321.2 | 364.0 | 338.6 | 12.7% | 339.9 |
| Jun | 578.3 | 497.4 | 526.4 | 539.6 | 550.0 | 516.1 | 497.4 | 578.3 | 534.6 | 15.1% | 541.6 |
| Jul | 568.4 | 505.9 | 525.1 | 536.4 | 556.0 | 514.4 | 505.9 | 568.4 | 534.4 | 11.7% | 536.7 |
| Aug | 658.2 | 606.5 | 621.1 | 648.5 | 674.0 | 634.1 | 606.5 | 674.0 | 640.4 | 10.5% | 650.2 |
| Sep | 724.8 | 705.2 | 672.1 | 733.7 | 743.0 | 710.5 | 672.1 | 743.0 | 714.9 | 9.9% | 734.0 |
| Oct | 628.4 | 676.1 | 611.1 | 675.3 | 681.0 | 649.5 | 611.1 | 681.0 | 653.6 | 10.7% | 675.6 |
| Nov | 394.3 | 454.7 | 377.1 | 437.7 | 444.0 | 418.6 | 377.1 | 454.7 | 421.1 | 18.4% | 437.6 |
| Dec | 433.3 | 503.3 | 386.2 | 481.9 | 476.0 | 456.1 | 386.2 | 503.3 | 456.1 | 25.7% | 481.6 |
| **Case 900** | | | | | | | | | | | |
| Jan | 73.3 | 67.8 | 33.5 | 53.3 | 42.0 | 44.6 | 33.5 | 73.3 | 52.4 | 76.0% | 53.1 |
| Feb | 24.0 | 15.1 | 4.7 | 12.3 | 11.0 | 9.2 | 4.7 | 24.0 | 12.7 | 151.4% | 12.4 |
| Mar | 86.4 | 68.5 | 40.9 | 65.4 | 56.0 | 50.6 | 40.9 | 86.4 | 61.3 | 74.2% | 65.6 |
| Apr | 29.3 | 12.3 | 18.3 | 18.5 | 22.0 | 16.1 | 12.3 | 29.3 | 19.4 | 87.8% | 18.6 |
| May | 131.1 | 117.8 | 128.6 | 114.5 | 125.0 | 98.4 | 98.4 | 131.1 | 119.2 | 27.5% | 114.9 |
| Jun | 447.5 | 372.3 | 408.5 | 401.3 | 404.0 | 365.8 | 365.8 | 447.5 | 399.9 | 20.4% | 404.2 |
| Jul | 440.9 | 380.4 | 408.1 | 398.7 | 410.0 | 365.5 | 365.5 | 440.9 | 400.6 | 18.8% | 399.7 |
| Aug | 532.6 | 485.7 | 510.2 | 510.3 | 531.0 | 487.6 | 485.7 | 532.6 | 509.6 | 9.2% | 512.9 |
| Sep | 517.9 | 484.0 | 466.1 | 492.8 | 492.0 | 458.9 | 458.9 | 517.9 | 485.3 | 12.2% | 493.4 |
| Oct | 296.2 | 305.6 | 269.6 | 292.7 | 281.0 | 260.9 | 260.9 | 305.6 | 284.3 | 15.7% | 292.8 |
| Nov | 72.7 | 80.5 | 56.2 | 68.0 | 63.0 | 60.2 | 56.2 | 80.5 | 66.8 | 36.4% | 68.0 |
| Dec | 62.1 | 73.7 | 38.1 | 60.9 | 48.0 | 49.5 | 38.1 | 73.7 | 55.4 | 64.4% | 60.8 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

## Table B8-M3. Monthly Hourly Integrated Peak Heating Loads

| Simulation Model: | BSIMAC | | | CSE | | | DeST | | | EnergyPlus | | | ESP-r | | | TRNSYS | | | Example Result Statistics | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | Min | Max | Mean | (Max-Min)/ | | | |
| **Case 600** | kW | Day | Hr | kW | Day | Hr | kW | Day | Hr | kW | Day | Hr | kW | Day | Hr | kW | Day | Hr | kW | kW | kW | Mean** (%) | kW | Day | Hr |
| Jan | 3.100 | 29 | 7 | 3.020 | 1 | 1 | 3.036 | 1 | 0 | 2.978 | 1 | 3 | 3.230 | 1 | 1 | 3.359 | 1 | 1 | 2.978 | 3.359 | 3.120 | 12.2% | 2.990 | 1 | 3 |
| Feb | 3.041 | 9 | 7 | 2.900 | 9 | 6 | 2.922 | 9 | 5 | 3.067 | 9 | 6 | 3.140 | 9 | 6 | 3.225 | 9 | 6 | 2.900 | 3.225 | 3.049 | 10.7% | 3.080 | 9 | 6 |
| Mar | 2.275 | 2 | 7 | 2.034 | 17 | 6 | 2.065 | 17 | 5 | 2.115 | 17 | 6 | 2.230 | 17 | 6 | 2.287 | 17 | 6 | 2.034 | 2.287 | 2.168 | 11.7% | 2.150 | 17 | 6 |
| Apr | 2.446 | 3 | 6 | 2.207 | 11 | 6 | 2.238 | 11 | 5 | 2.322 | 11 | 5 | 2.380 | 11 | 6 | 2.457 | 11 | 6 | 2.207 | 2.457 | 2.342 | 10.7% | 2.350 | 11 | 5 |
| May | 1.645 | 3 | 5 | 1.592 | 1 | 5 | 1.569 | 1 | 4 | 1.624 | 1 | 5 | 1.750 | 1 | 5 | 1.778 | 1 | 5 | 1.569 | 1.778 | 1.660 | 12.6% | 1.630 | 1 | 5 |
| Jun | 0.805 | 9 | 5 | 0.778 | 9 | 5 | 0.748 | 9 | 4 | 0.732 | 9 | 5 | 0.760 | 10 | 5 | 0.853 | 9 | 5 | 0.732 | 0.853 | 0.779 | 15.4% | 0.770 | 9 | 5 |
| Jul | 0.599 | 25 | 6 | 0.540 | 26 | 5 | 0.512 | 26 | 4 | 0.514 | 26 | 5 | 0.570 | 26 | 5 | 0.619 | 26 | 5 | 0.512 | 0.619 | 0.559 | 19.1% | 0.540 | 26 | 5 |
| Aug | 0.572 | 10 | 7 | 0.553 | 17 | 6 | 0.532 | 17 | 5 | 0.479 | 17 | 6 | 0.560 | 17 | 6 | 0.591 | 17 | 6 | 0.479 | 0.591 | 0.548 | 20.5% | 0.500 | 17 | 6 |
| Sep | 1.229 | 28 | 24 | 1.120 | 29 | 1 | 1.114 | 29 | 2 | 1.130 | 28 | 24 | 1.190 | 29 | 1 | 1.212 | 28 | 24 | 1.114 | 1.229 | 1.166 | 9.9% | 1.160 | 28 | 24 |
| Oct | 1.702 | 6 | 7 | 1.624 | 15 | 6 | 1.619 | 9 | 5 | 1.682 | 15 | 5 | 1.770 | 9 | 6 | 1.813 | 15 | 6 | 1.619 | 1.813 | 1.702 | 11.4% | 1.710 | 15 | 5 |
| Nov | 3.255 | 26 | 8 | 2.850 | 26 | 8 | 2.931 | 26 | 7 | 3.106 | 26 | 7 | 3.110 | 26 | 7 | 3.207 | 26 | 8 | 2.850 | 3.255 | 3.076 | 13.2% | 3.120 | 26 | 7 |
| Dec | 3.171 | 31 | 24 | 2.941 | 31 | 24 | 2.972 | 31 | 23 | 3.204 | 31 | 24 | 3.170 | 31 | 24 | 3.278 | 31 | 24 | 2.941 | 3.278 | 3.123 | 10.8% | 3.250 | 31 | 24 |
| **Case 900** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Jan | 2.322 | 7 | 7 | 2.077 | 1 | 5 | 2.178 | 1 | 4 | 1.903 | 29 | 7 | 2.200 | 1 | 5 | 2.379 | 1 | 5 | 1.903 | 2.379 | 2.176 | 21.9% | 1.970 | 29 | 7 |
| Feb | 2.551 | 8 | 24 | 2.443 | 9 | 6 | 2.453 | 9 | 5 | 2.687 | 9 | 6 | 2.630 | 9 | 7 | 2.778 | 9 | 7 | 2.443 | 2.778 | 2.591 | 12.9% | 2.710 | 9 | 6 |
| Mar | 1.774 | 16 | 7 | 1.613 | 17 | 6 | 1.646 | 17 | 5 | 1.744 | 17 | 6 | 1.760 | 17 | 7 | 1.858 | 17 | 6 | 1.613 | 1.858 | 1.733 | 14.2% | 1.780 | 17 | 6 |
| Apr | 1.997 | 2 | 7 | 1.771 | 3 | 4 | 1.725 | 3 | 3 | 2.004 | 3 | 4 | 1.930 | 3 | 4 | 2.036 | 3 | 4 | 1.725 | 2.036 | 1.910 | 16.3% | 2.010 | 3 | 3 |
| May | 1.295 | 4 | 6 | 1.142 | 1 | 5 | 1.124 | 1 | 5 | 1.268 | 1 | 5 | 1.230 | 1 | 5 | 1.324 | 1 | 5 | 1.124 | 1.324 | 1.231 | 16.3% | 1.270 | 1 | 5 |
| Jun | 0.000 | | | 0.000 | 1 | 1 | | | | 0.000 | 1 | 1 | 0.000 | 1 | 1 | 0.000 | 31 | 0 | 0.000 | 0.000 | 0.000 | ---- | 0.000 | 1 | 1 |
| Jul | 0.000 | | | 0.000 | 1 | 1 | | | | 0.000 | 1 | 1 | 0.000 | 1 | 1 | 0.000 | 31 | 0 | 0.000 | 0.000 | 0.000 | ---- | 0.000 | 1 | 1 |
| Aug | 0.000 | | | 0.000 | 1 | 1 | | | | 0.000 | 1 | 1 | 0.000 | 1 | 1 | 0.000 | 31 | 0 | 0.000 | 0.000 | 0.000 | ---- | 0.000 | 1 | 1 |
| Sep | 0.113 | 28 | 6 | 0.000 | 1 | 1 | | | | 0.064 | 29 | 7 | 0.000 | 1 | 1 | 0.194 | 29 | 7 | 0.000 | 0.194 | 0.074 | 261.6% | 0.070 | 29 | 7 |
| Oct | 1.201 | 6 | 7 | 1.188 | 7 | 7 | 1.158 | 7 | 6 | 1.326 | 7 | 7 | 1.210 | 7 | 7 | 1.331 | 7 | 7 | 1.158 | 1.331 | 1.236 | 14.0% | 1.330 | 7 | 7 |
| Nov | 2.427 | 1 | 7 | 2.086 | 26 | 8 | 2.201 | 26 | 7 | 2.316 | 26 | 7 | 2.280 | 26 | 8 | 2.463 | 26 | 8 | 2.086 | 2.463 | 2.296 | 16.4% | 2.370 | 26 | 8 |
| Dec | 2.120 | 31 | 8 | 1.927 | 31 | 8 | 1.981 | 9 | 6 | 2.175 | 31 | 7 | 2.040 | 9 | 7 | 2.180 | 9 | 7 | 1.927 | 2.180 | 2.070 | 12.2% | 2.200 | 31 | 8 |

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

## Table B8-M4. Monthly Hourly Integrated Peak Sensible Cooling Loads

| Simulation Model: | BSIMAC | | | CSE | | | DeST | | | EnergyPlus | | | ESP-r | | | TRNSYS | | | Example Result Statistics | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | Min | Max | Mean | (Max-Min)/ | | | |
| **Case 600** | kW | Day | Hr | kW | Day | Hr | kW | Day | Hr | kW | Day | Hr | kW | Day | Hr | kW | Day | Hr | kW | kW | kW | Mean** (%) | kW | Day | Hr |
| Jan | 5.650 | 22 | 15 | 6.481 | 22 | 14 | 5.422 | 22 | 14 | 6.352 | 22 | 14 | 6.190 | 22 | 14 | 6.046 | 22 | 14 | 5.422 | 6.481 | 6.023 | 17.6% | 6.400 | 22 | 14 |
| Feb | 4.921 | 15 | 15 | 5.393 | 15 | 14 | 4.444 | 15 | 14 | 5.537 | 2 | 14 | 5.420 | 2 | 14 | 5.155 | 2 | 14 | 4.444 | 5.537 | 5.145 | 21.2% | 5.590 | 2 | 14 |
| Mar | 4.458 | 24 | 14 | 5.148 | 24 | 13 | 4.252 | 9 | 14 | 5.009 | 9 | 14 | 5.040 | 9 | 14 | 4.740 | 9 | 14 | 4.252 | 5.148 | 4.774 | 18.8% | 5.090 | 24 | 13 |
| Apr | 3.473 | 12 | 14 | 4.015 | 27 | 14 | 3.600 | 7 | 14 | 3.931 | 12 | 14 | 4.040 | 12 | 14 | 3.803 | 12 | 14 | 3.473 | 4.040 | 3.810 | 14.9% | 3.990 | 12 | 14 |
| May | 2.774 | 10 | 14 | 3.080 | 21 | 14 | 2.894 | 10 | 14 | 3.086 | 10 | 13 | 3.100 | 10 | 14 | 3.040 | 21 | 14 | 2.774 | 3.100 | 2.996 | 10.9% | 3.140 | 10 | 13 |
| Jun | 3.253 | 26 | 15 | 3.249 | 13 | 13 | 3.067 | 14 | 14 | 3.449 | 13 | 13 | 3.430 | 13 | 14 | 3.379 | 13 | 13 | 3.067 | 3.449 | 3.304 | 11.6% | 3.530 | 13 | 13 |
| Jul | 3.319 | 17 | 14 | 3.290 | 17 | 14 | 3.155 | 29 | 13 | 3.628 | 17 | 14 | 3.640 | 17 | 14 | 3.497 | 17 | 14 | 3.155 | 3.640 | 3.422 | 14.2% | 3.650 | 17 | 14 |
| Aug | 4.192 | 26 | 14 | 4.120 | 8 | 14 | 4.038 | 29 | 13 | 4.672 | 26 | 14 | 4.700 | 29 | 14 | 4.651 | 27 | 13 | 4.038 | 4.700 | 4.395 | 15.1% | 4.770 | 27 | 13 |
| Sep | 5.086 | 30 | 14 | 5.450 | 2 | 14 | 4.911 | 30 | 13 | 5.715 | 30 | 13 | 5.580 | 30 | 14 | 5.420 | 30 | 14 | 4.911 | 5.715 | 5.360 | 15.0% | 5.780 | 30 | 13 |
| Oct | 5.577 | 18 | 14 | 6.270 | 1 | 13 | 5.278 | 10 | 13 | 6.222 | 18 | 14 | 6.070 | 18 | 14 | 5.923 | 18 | 14 | 5.278 | 6.270 | 5.890 | 16.8% | 6.290 | 18 | 14 |
| Nov | 5.476 | 28 | 14 | 6.149 | 28 | 13 | 5.229 | 29 | 13 | 6.194 | 28 | 13 | 6.030 | 28 | 14 | 5.824 | 28 | 14 | 5.229 | 6.194 | 5.817 | 16.6% | 6.330 | 28 | 13 |
| Dec | 5.537 | 1 | 14 | 6.450 | 1 | 14 | 5.294 | 1 | 13 | 6.251 | 1 | 14 | 6.120 | 1 | 14 | 5.942 | 1 | 14 | 5.294 | 6.450 | 5.932 | 19.5% | 6.390 | 1 | 14 |
| **Case 900** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Jan | 1.982 | 22 | 16 | 2.242 | 22 | 15 | 1.637 | 22 | 15 | 2.078 | 22 | 15 | 1.810 | 22 | 16 | 1.878 | 22 | 15 | 1.637 | 2.242 | 1.938 | 31.2% | 2.130 | 22 | 15 |
| Feb | 1.096 | 15 | 16 | 0.996 | 15 | 15 | 0.588 | 15 | 15 | 0.979 | 15 | 15 | 0.850 | 15 | 16 | 0.829 | 15 | 15 | 0.588 | 1.096 | 0.890 | 57.1% | 1.040 | 15 | 15 |
| Mar | 1.508 | 10 | 15 | 1.434 | 24 | 15 | 1.143 | 10 | 14 | 1.493 | 11 | 14 | 1.270 | 10 | 15 | 1.426 | 11 | 14 | 1.143 | 1.508 | 1.379 | 26.5% | 1.580 | 11 | 14 |
| Apr | 1.093 | 7 | 15 | 0.631 | 19 | 14 | 1.032 | 8 | 14 | 0.953 | 7 | 15 | 0.950 | 8 | 15 | 0.837 | 8 | 15 | 0.631 | 1.093 | 0.916 | 50.4% | 0.970 | 7 | 15 |
| May | 1.555 | 11 | 15 | 1.427 | 21 | 14 | 1.446 | 11 | 14 | 1.534 | 11 | 14 | 1.460 | 11 | 15 | 1.465 | 11 | 14 | 1.427 | 1.555 | 1.481 | 8.6% | 1.550 | 11 | 14 |
| Jun | 2.101 | 26 | 15 | 1.897 | 14 | 14 | 1.873 | 14 | 14 | 1.966 | 14 | 14 | 1.890 | 14 | 15 | 1.974 | 14 | 14 | 1.873 | 2.101 | 1.950 | 11.7% | 1.980 | 14 | 14 |
| Jul | 2.140 | 17 | 15 | 1.943 | 17 | 14 | 1.830 | 17 | 14 | 2.068 | 17 | 15 | 1.970 | 17 | 15 | 1.975 | 17 | 15 | 1.830 | 2.140 | 1.988 | 15.6% | 2.100 | 17 | 14 |
| Aug | 2.632 | 26 | 15 | 2.485 | 5 | 14 | 2.212 | 29 | 14 | 2.526 | 29 | 15 | 2.510 | 29 | 15 | 2.534 | 29 | 15 | 2.212 | 2.632 | 2.483 | 16.9% | 2.570 | 29 | 15 |
| Sep | 2.961 | 30 | 15 | 3.137 | 4 | 14 | 2.556 | 11 | 14 | 2.989 | 11 | 15 | 2.810 | 11 | 15 | 2.871 | 11 | 15 | 2.556 | 3.137 | 2.887 | 20.1% | 3.010 | 11 | 15 |
| Oct | 3.039 | 1 | 15 | 3.376 | 1 | 14 | 2.549 | 12 | 14 | 3.040 | 1 | 14 | 2.900 | 12 | 15 | 2.940 | 1 | 14 | 2.549 | 3.376 | 2.974 | 27.8% | 3.060 | 1 | 14 |
| Nov | 1.982 | 6 | 15 | 2.233 | 20 | 15 | 1.683 | 20 | 14 | 2.002 | 20 | 15 | 1.940 | 20 | 15 | 1.941 | 22 | 14 | 1.683 | 2.233 | 1.963 | 28.0% | 2.070 | 22 | 14 |
| Dec | 2.069 | 1 | 15 | 2.105 | 1 | 15 | 1.595 | 2 | 14 | 1.968 | 2 | 15 | 1.670 | 2 | 15 | 1.690 | 2 | 15 | 1.595 | 2.105 | 1.850 | 27.6% | 1.980 | 2 | 15 |

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

**ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1**
**Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF**

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

## Table B8-M5. Monthly Load 600-900 Sensitivity Tests

| ANNUAL HEATING [MWh] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| Jan | 386.2 | 449.5 | 397.4 | 456.0 | 466.0 | 443.0 | 386.2 | 466.0 | 433.0 | 18.4% | 455.4 |
| Feb | 345.9 | 383.0 | 342.4 | 388.5 | 399.0 | 379.9 | 342.4 | 399.0 | 373.1 | 15.2% | 387.9 |
| Mar | 299.1 | 333.3 | 330.5 | 346.7 | 366.0 | 351.2 | 299.1 | 366.0 | 337.8 | 19.8% | 346.1 |
| Apr | 235.3 | 234.6 | 233.8 | 241.5 | 251.0 | 241.8 | 233.8 | 251.0 | 239.7 | 7.2% | 241.1 |
| May | 92.7 | 94.4 | 101.2 | 103.4 | 110.0 | 113.2 | 92.7 | 113.2 | 102.5 | 20.1% | 103.4 |
| Jun | 2.7 | 11.7 | 11.2 | 10.1 | 14.0 | 16.0 | 2.7 | 16.0 | 10.9 | 120.7% | 10.1 |
| Jul | 4.8 | 11.5 | 10.1 | 12.0 | 14.0 | 16.7 | 4.8 | 16.7 | 11.5 | 103.0% | 12.0 |
| Aug | 1.4 | 6.9 | 8.4 | 6.6 | 9.0 | 9.6 | 1.4 | 9.6 | 7.0 | 118.1% | 6.6 |
| Sep | 49.7 | 74.3 | 76.7 | 73.2 | 81.0 | 84.3 | 49.7 | 84.3 | 73.2 | 47.3% | 73.2 |
| Oct | 236.5 | 263.3 | 260.6 | 266.6 | 284.0 | 282.0 | 236.5 | 284.0 | 265.5 | 17.9% | 266.3 |
| Nov | 300.5 | 324.0 | 301.9 | 328.3 | 343.0 | 327.6 | 300.5 | 343.0 | 320.9 | 13.3% | 327.9 |
| Dec | 368.9 | 427.3 | 383.5 | 427.9 | 442.0 | 424.2 | 368.9 | 442.0 | 412.3 | 17.7% | 427.2 |

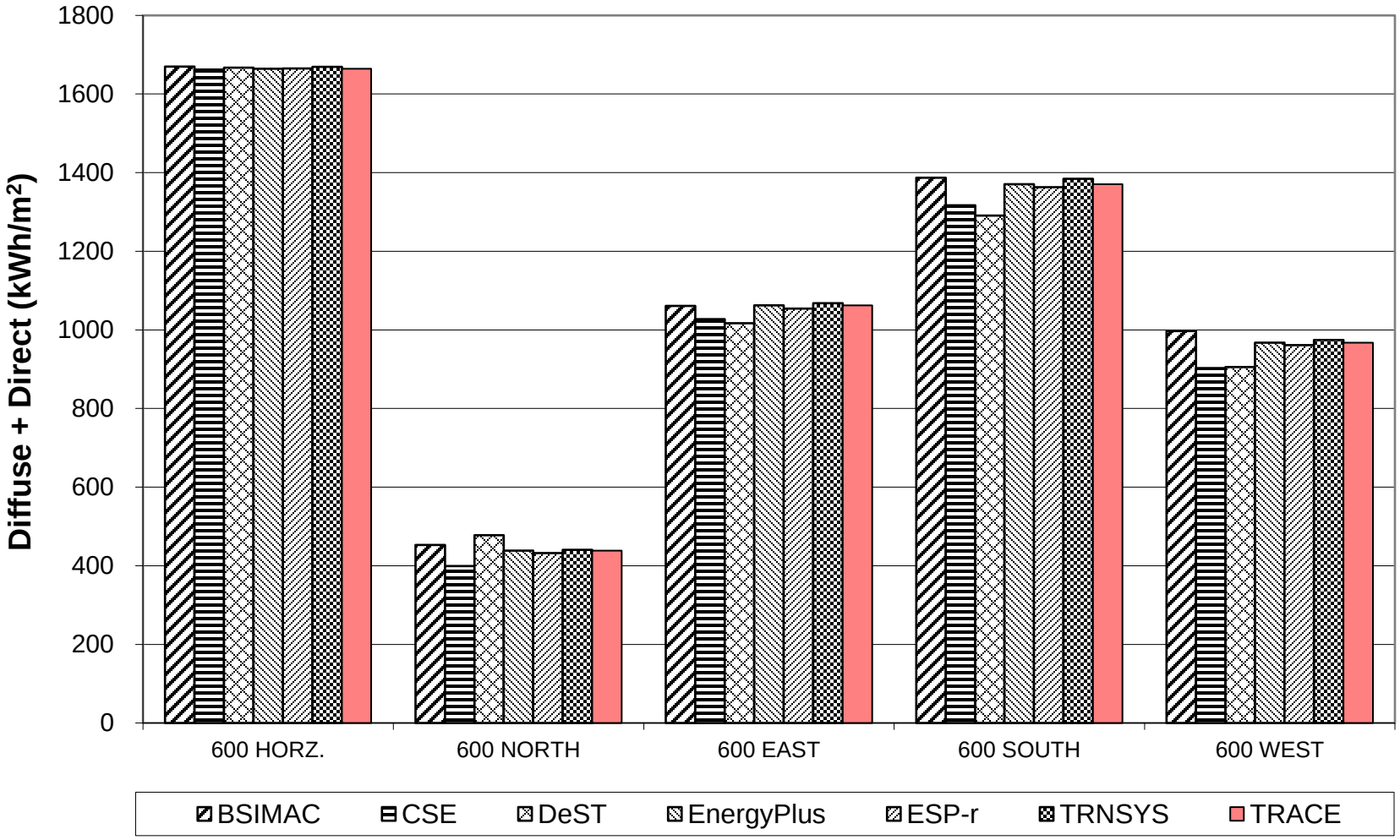
| ANNUAL SENSIBLE COOLING [MWh] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| Jan | 402.1 | 486.2 | 384.4 | 468.5 | 481.0 | 450.4 | 384.4 | 486.2 | 445.4 | 22.8% | 468.5 |
| Feb | 325.2 | 379.2 | 310.7 | 375.2 | 387.0 | 358.2 | 310.7 | 387.0 | 355.9 | 21.4% | 375.1 |
| Mar | 363.9 | 405.8 | 369.8 | 419.0 | 433.0 | 406.8 | 363.9 | 433.0 | 399.7 | 17.3% | 418.7 |
| Apr | 189.4 | 207.8 | 211.9 | 222.0 | 241.0 | 219.3 | 189.4 | 241.0 | 215.2 | 24.0% | 221.4 |
| May | 211.6 | 203.3 | 210.0 | 225.4 | 239.0 | 226.8 | 203.3 | 239.0 | 219.4 | 16.3% | 225.0 |
| Jun | 130.8 | 125.2 | 118.0 | 138.3 | 146.0 | 150.2 | 118.0 | 150.2 | 134.7 | 24.0% | 137.4 |
| Jul | 127.5 | 125.4 | 117.0 | 137.7 | 146.0 | 148.9 | 117.0 | 148.9 | 133.7 | 23.8% | 137.0 |
| Aug | 125.6 | 120.8 | 110.9 | 138.2 | 143.0 | 146.6 | 110.9 | 146.6 | 130.8 | 27.2% | 137.3 |
| Sep | 206.9 | 221.2 | 206.0 | 240.9 | 251.0 | 251.6 | 206.0 | 251.6 | 229.6 | 19.9% | 240.6 |
| Oct | 332.2 | 370.6 | 341.6 | 382.6 | 400.0 | 388.6 | 332.2 | 400.0 | 369.3 | 18.4% | 382.8 |
| Nov | 321.6 | 374.3 | 320.9 | 369.7 | 381.0 | 358.4 | 320.9 | 381.0 | 354.3 | 17.0% | 369.6 |
| Dec | 371.2 | 429.5 | 348.2 | 420.9 | 428.0 | 406.6 | 348.2 | 429.5 | 400.7 | 20.3% | 420.8 |

| PEAK HEATING [kW] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| Jan | 0.778 | 0.943 | 0.858 | 1.075 | 1.030 | 0.980 | 0.778 | 1.075 | 0.944 | 31.4% | 1.020 |
| Feb | 0.490 | 0.456 | 0.469 | 0.379 | 0.510 | 0.447 | 0.379 | 0.510 | 0.459 | 28.5% | 0.370 |
| Mar | 0.501 | 0.422 | 0.419 | 0.370 | 0.470 | 0.429 | 0.370 | 0.501 | 0.435 | 30.1% | 0.370 |
| Apr | 0.449 | 0.437 | 0.513 | 0.319 | 0.450 | 0.421 | 0.319 | 0.513 | 0.431 | 45.0% | 0.340 |
| May | 0.350 | 0.450 | 0.445 | 0.356 | 0.520 | 0.454 | 0.350 | 0.520 | 0.429 | 39.6% | 0.360 |
| Jun | 0.805 | 0.778 | 0.748 | 0.732 | 0.760 | 0.853 | 0.732 | 0.853 | 0.779 | 15.4% | 0.770 |
| Jul | 0.599 | 0.540 | 0.512 | 0.514 | 0.570 | 0.619 | 0.512 | 0.619 | 0.559 | 19.1% | 0.540 |
| Aug | 0.572 | 0.553 | 0.532 | 0.479 | 0.560 | 0.591 | 0.479 | 0.591 | 0.548 | 20.5% | 0.500 |
| Sep | 1.116 | 1.120 | 1.114 | 1.065 | 1.190 | 1.017 | 1.017 | 1.190 | 1.104 | 15.7% | 1.090 |
| Oct | 0.501 | 0.435 | 0.461 | 0.356 | 0.560 | 0.482 | 0.356 | 0.560 | 0.466 | 43.7% | 0.380 |
| Nov | 0.828 | 0.764 | 0.730 | 0.790 | 0.830 | 0.744 | 0.730 | 0.830 | 0.781 | 12.8% | 0.750 |
| Dec | 1.051 | 1.014 | 0.991 | 1.030 | 1.130 | 1.098 | 0.991 | 1.130 | 1.052 | 13.2% | 1.050 |

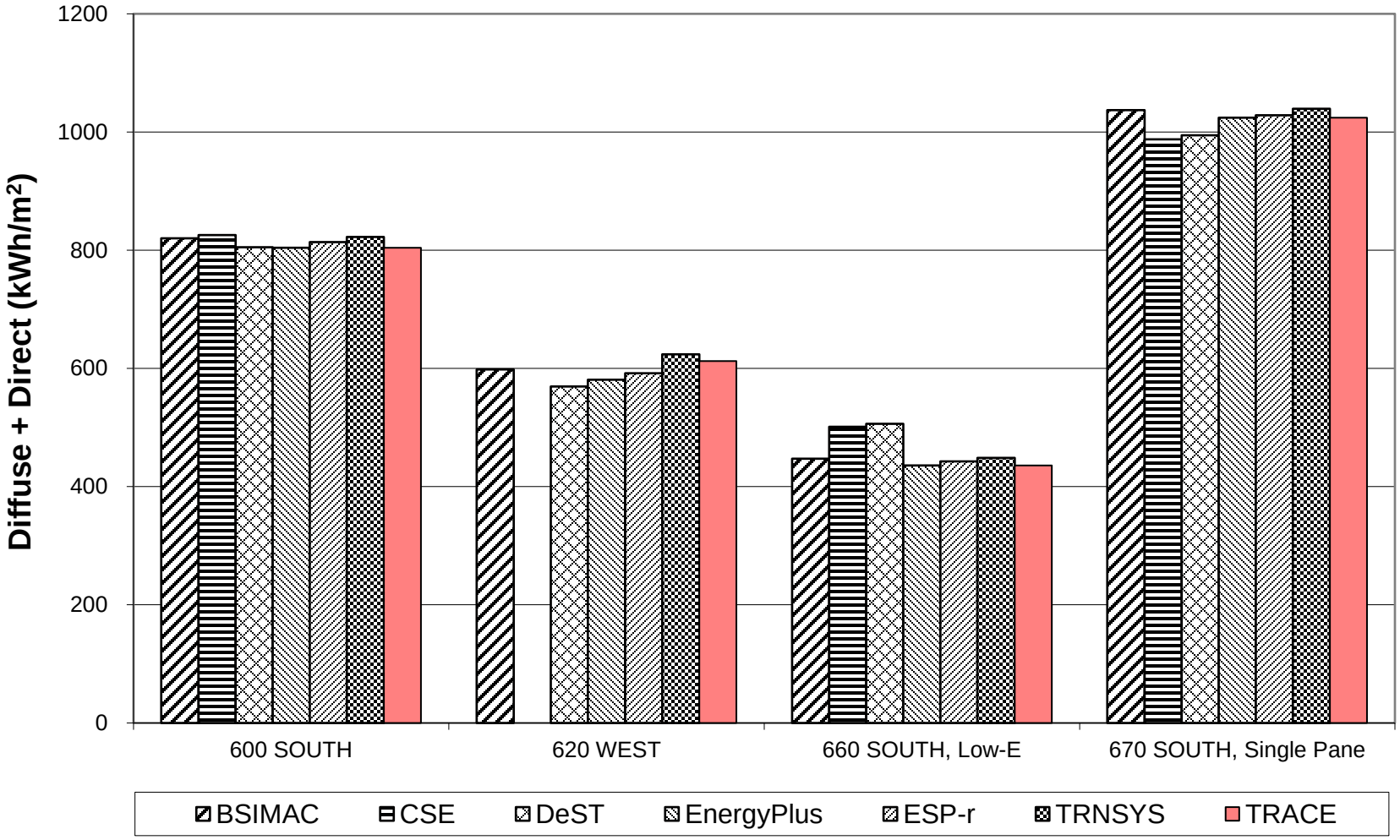
| PEAK SENSIBLE COOLING [kW] | | | | | | | Statistics for Example Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | BSIMAC | CSE | DeST | EnergyPlus | ESP-r | TRNSYS | Min | Max | Mean | (Max-Min)/ Mean** (%) | TRACE |
| Jan | 3.668 | 4.239 | 3.785 | 4.274 | 4.380 | 4.168 | 3.668 | 4.380 | 4.086 | 17.4% | 4.270 |
| Feb | 3.825 | 4.397 | 3.856 | 4.558 | 4.570 | 4.326 | 3.825 | 4.570 | 4.255 | 17.5% | 4.550 |
| Mar | 2.950 | 3.714 | 3.109 | 3.515 | 3.770 | 3.314 | 2.950 | 3.770 | 3.395 | 24.2% | 3.510 |
| Apr | 2.380 | 3.384 | 2.568 | 2.978 | 3.090 | 2.966 | 2.380 | 3.384 | 2.894 | 34.7% | 3.020 |
| May | 1.219 | 1.652 | 1.448 | 1.553 | 1.640 | 1.576 | 1.219 | 1.652 | 1.515 | 28.6% | 1.590 |
| Jun | 1.152 | 1.352 | 1.194 | 1.483 | 1.540 | 1.405 | 1.152 | 1.540 | 1.354 | 28.7% | 1.550 |
| Jul | 1.179 | 1.347 | 1.325 | 1.560 | 1.670 | 1.522 | 1.179 | 1.670 | 1.434 | 34.3% | 1.550 |
| Aug | 1.560 | 1.634 | 1.826 | 2.146 | 2.190 | 2.117 | 1.560 | 2.190 | 1.912 | 32.9% | 2.200 |
| Sep | 2.125 | 2.313 | 2.355 | 2.726 | 2.770 | 2.549 | 2.125 | 2.770 | 2.473 | 26.1% | 2.770 |
| Oct | 2.538 | 2.894 | 2.729 | 3.182 | 3.170 | 2.983 | 2.538 | 3.182 | 2.916 | 22.1% | 3.230 |
| Nov | 3.494 | 3.916 | 3.546 | 4.192 | 4.090 | 3.883 | 3.494 | 4.192 | 3.854 | 18.1% | 4.260 |
| Dec | 3.468 | 4.345 | 3.699 | 4.283 | 4.450 | 4.252 | 3.468 | 4.450 | 4.083 | 24.1% | 4.410 |

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

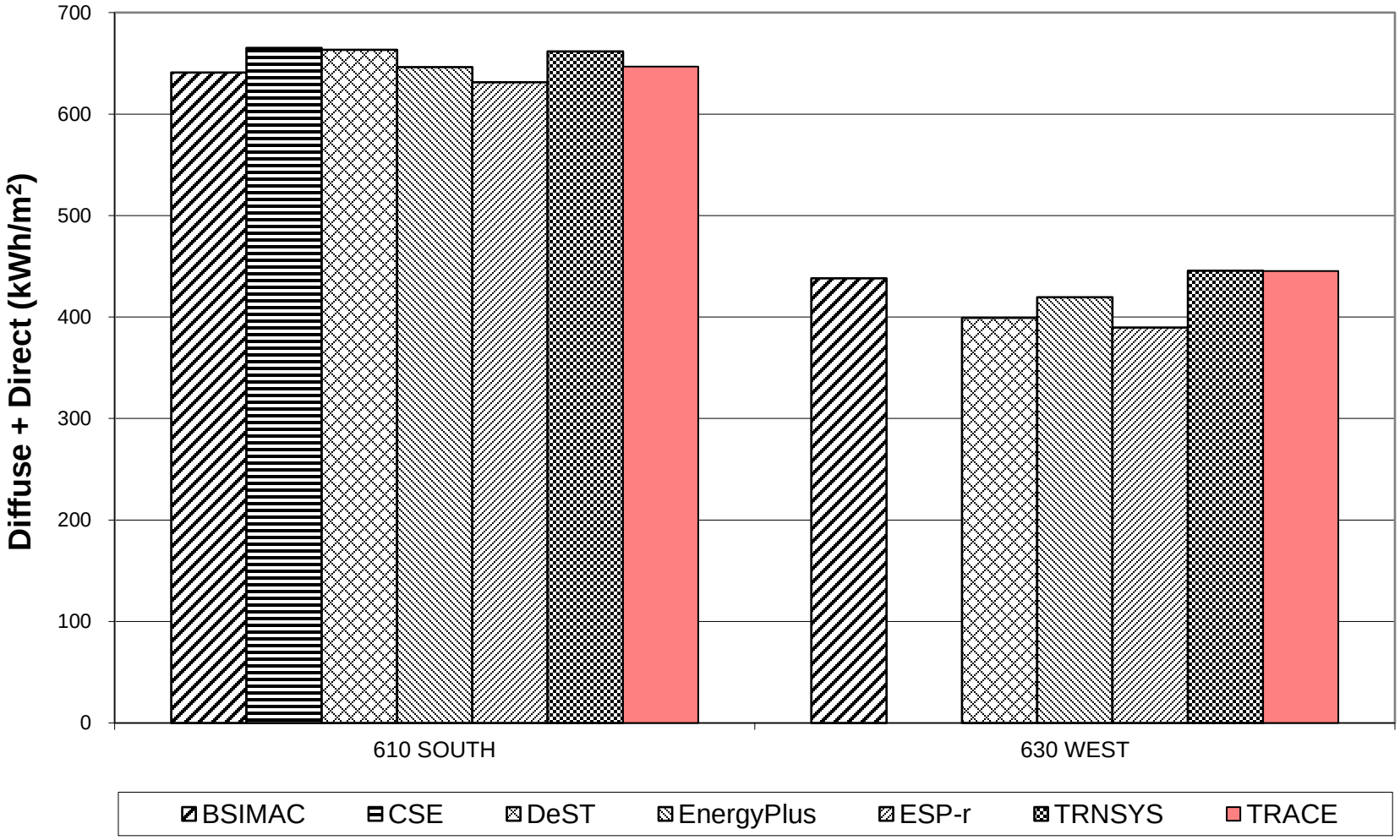
# Figure B8-1.
# Annual Incident Solar Radiation



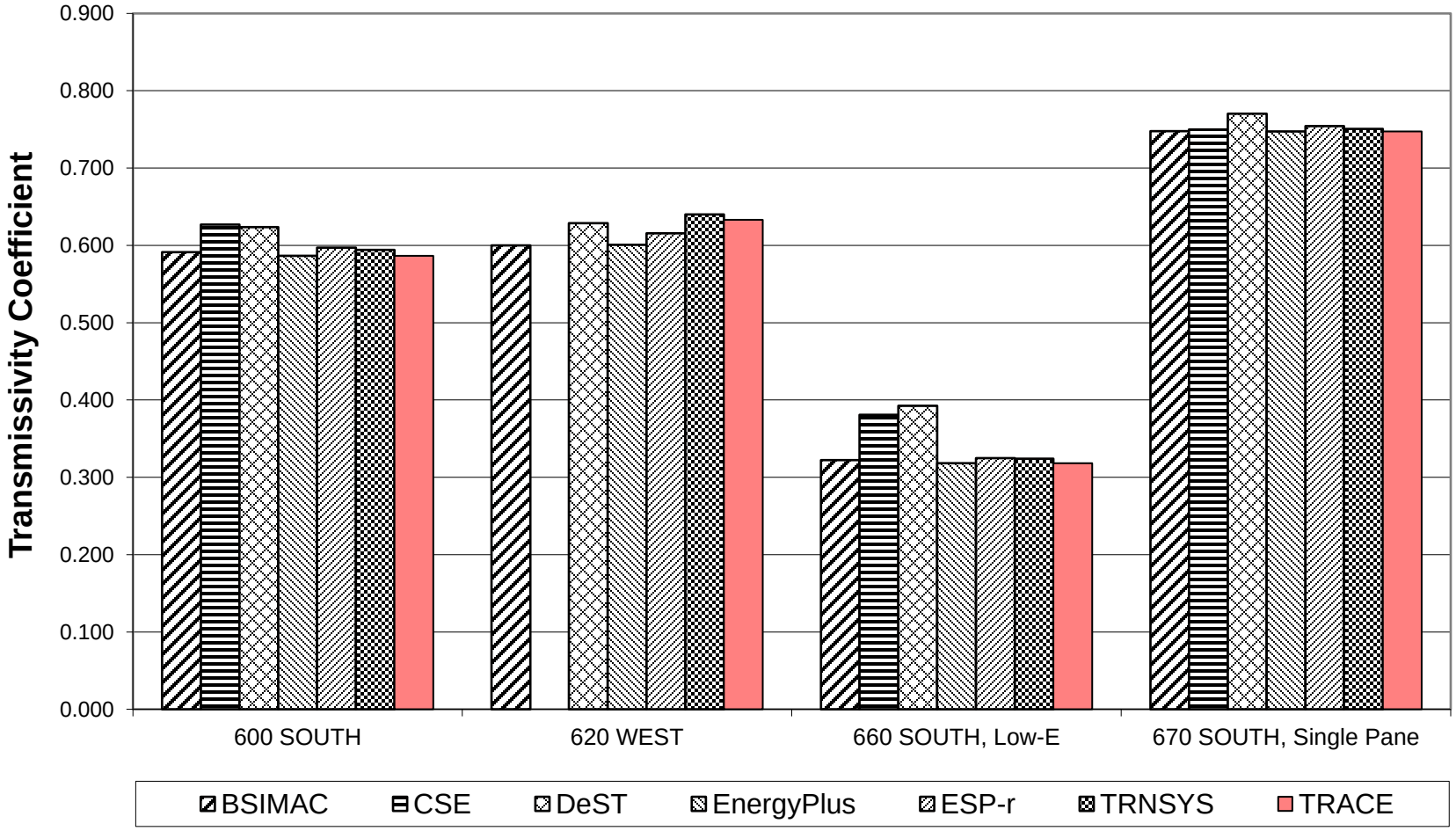
# Figure B8-2.
# Annual Transmitted Solar Radiation - Unshaded



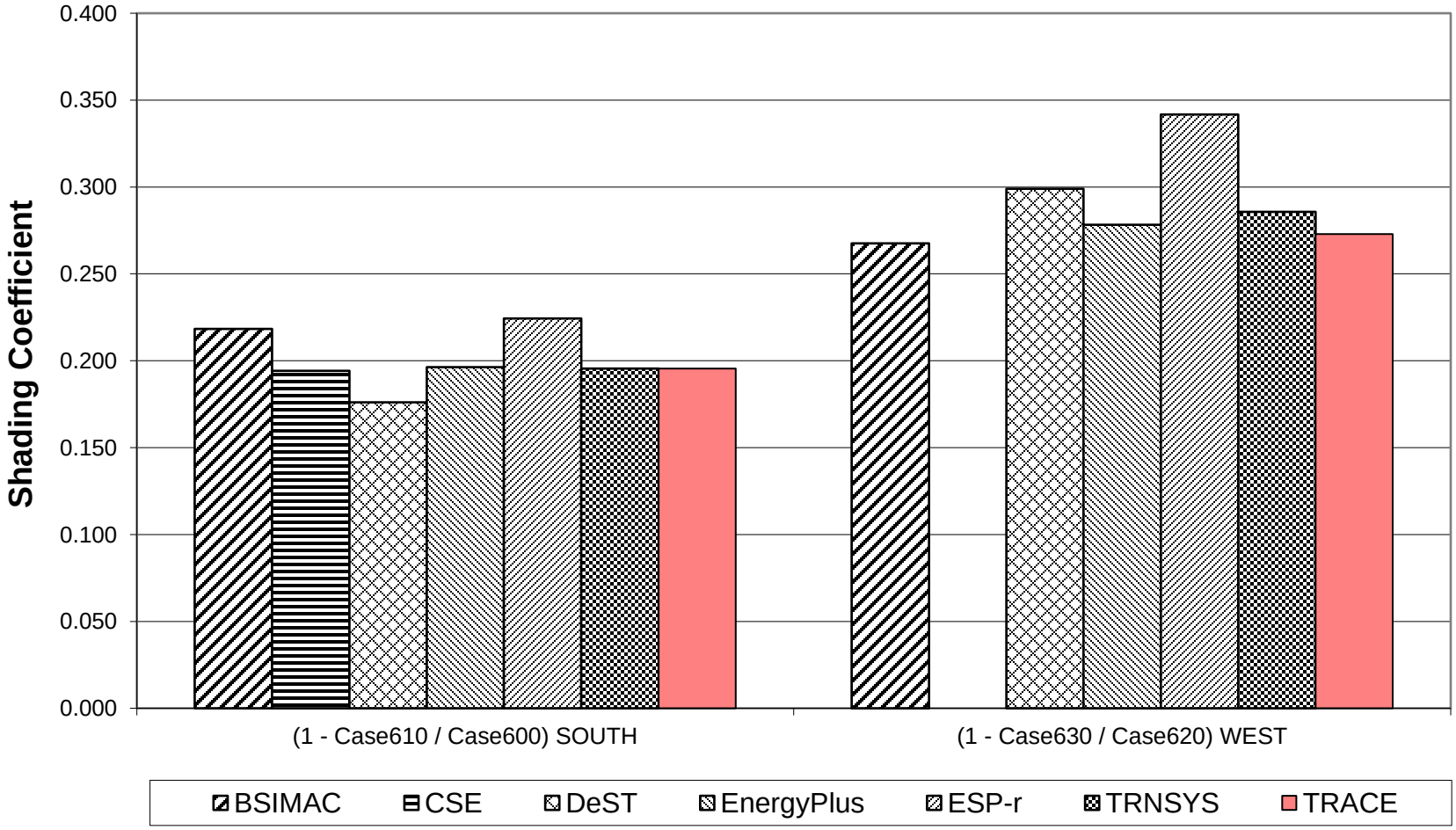
# Figure B8-3.
# Annual Transmitted Solar Radiation - Shaded



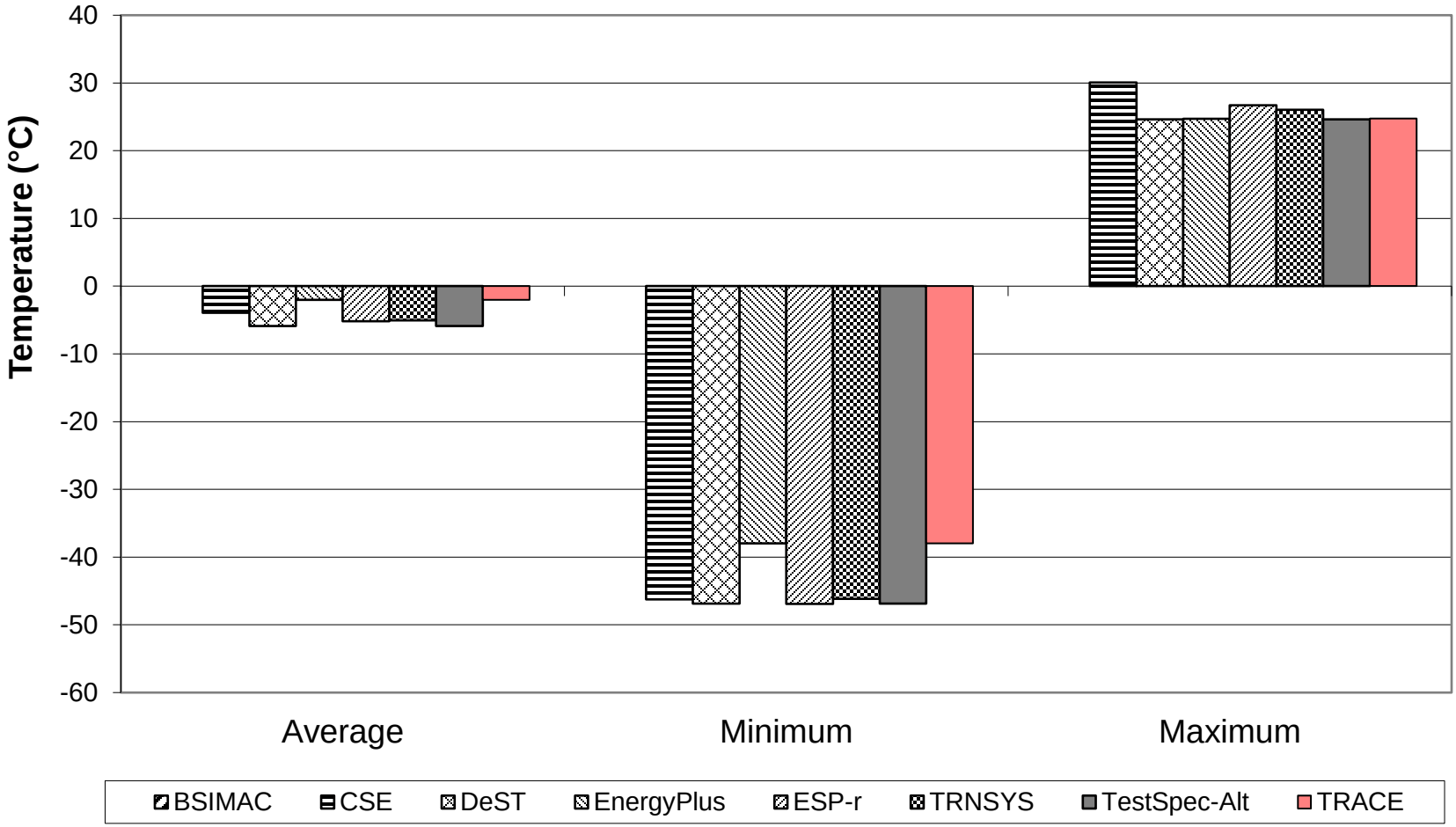
# Figure B8-4.
# Annual Transmissivity Coefficient of Windows (Unshaded Transmitted)/(Incident Solar Radiation)



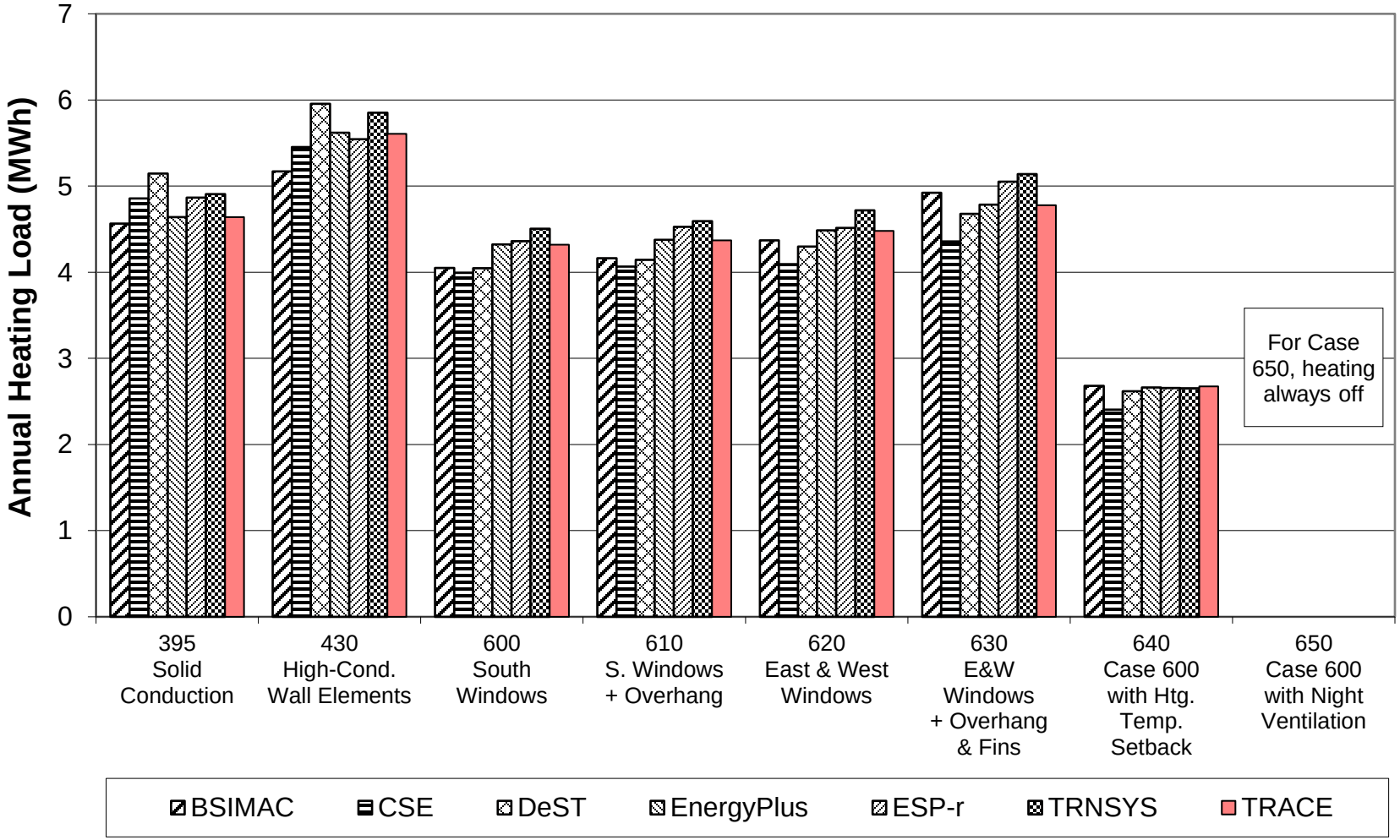
# Figure B8-5.
# Annual Overhang and Fin Shading Coefficients
# (1-(Shaded)/(Unshaded)) Transmitted Solar Radiation



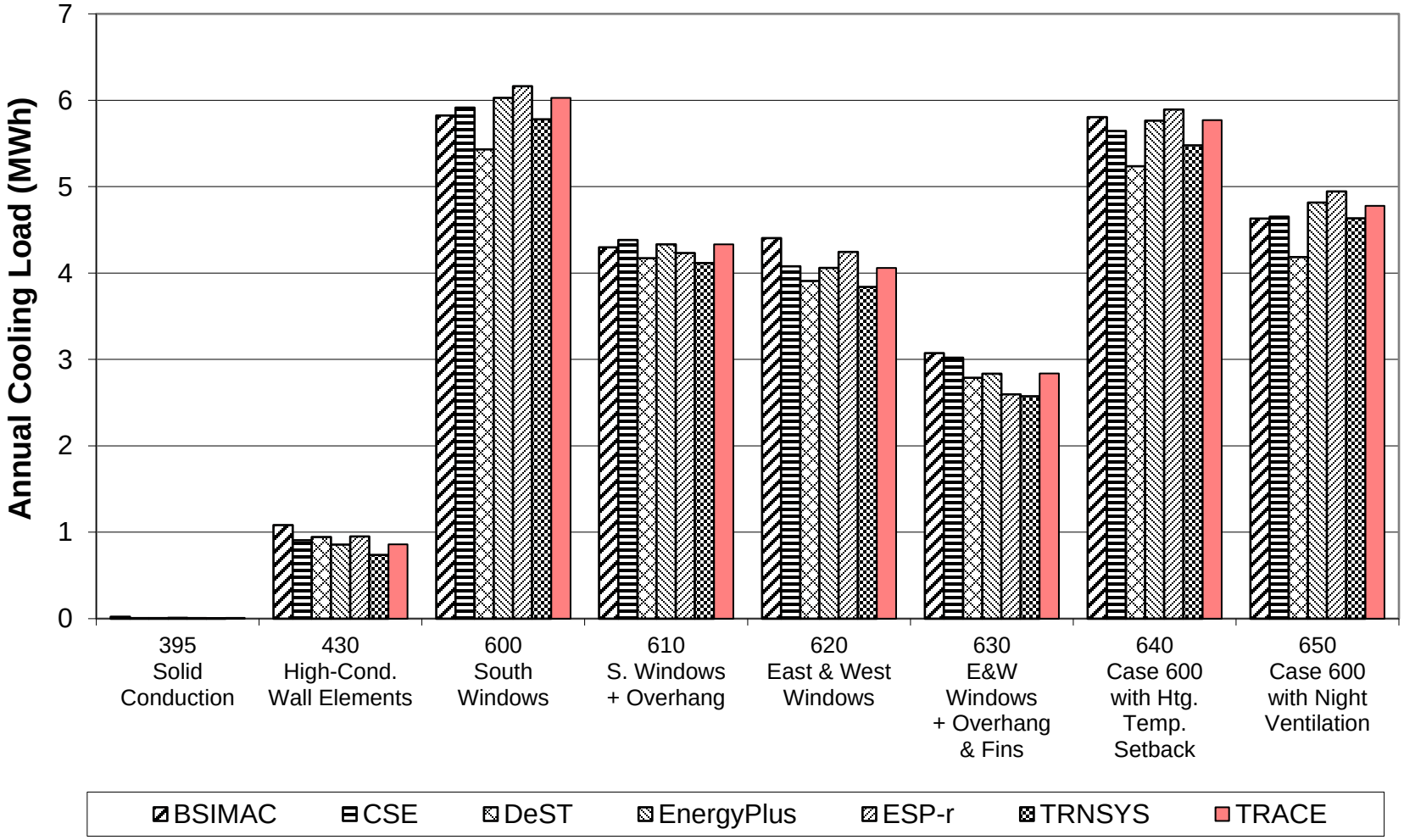
# Figure B8-6.
# Average, Minimum and Maximum Sky Temperature
# Case 600



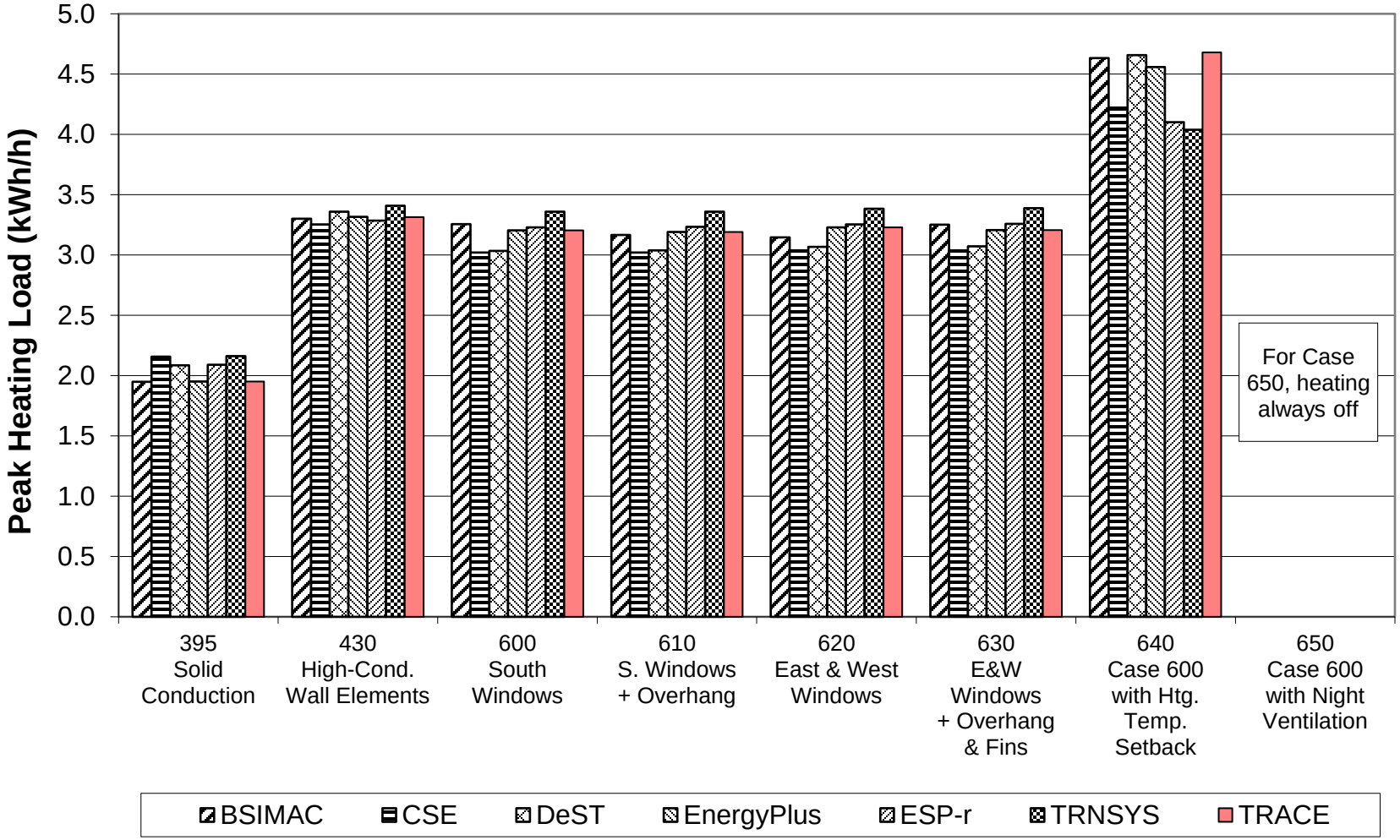
# Figure B8-7. Basic: Low Mass Annual Heating



# Figure B8-8. Basic: Low Mass Annual Sensible Cooling

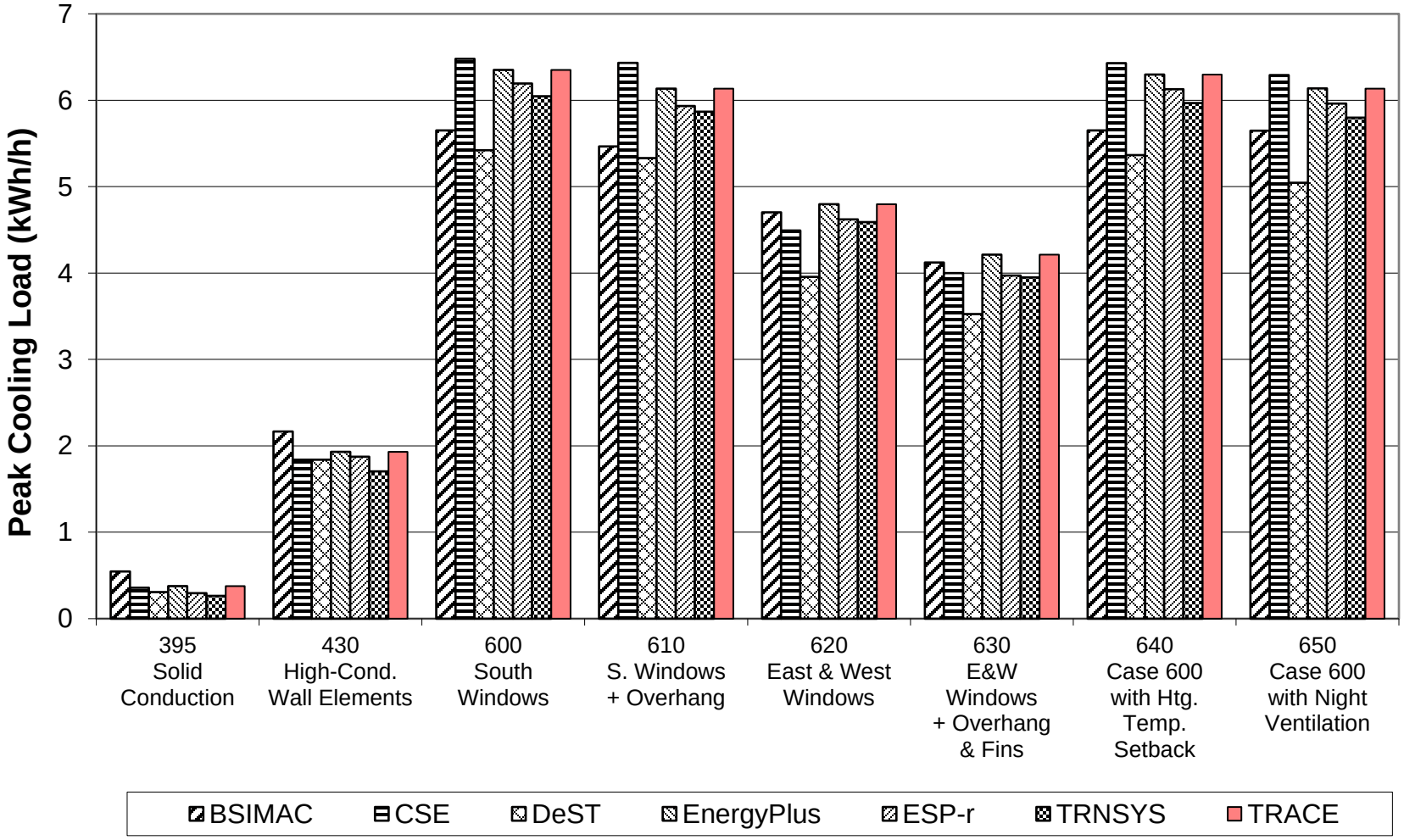


# Figure B8-9. Basic: Low Mass Peak Heating

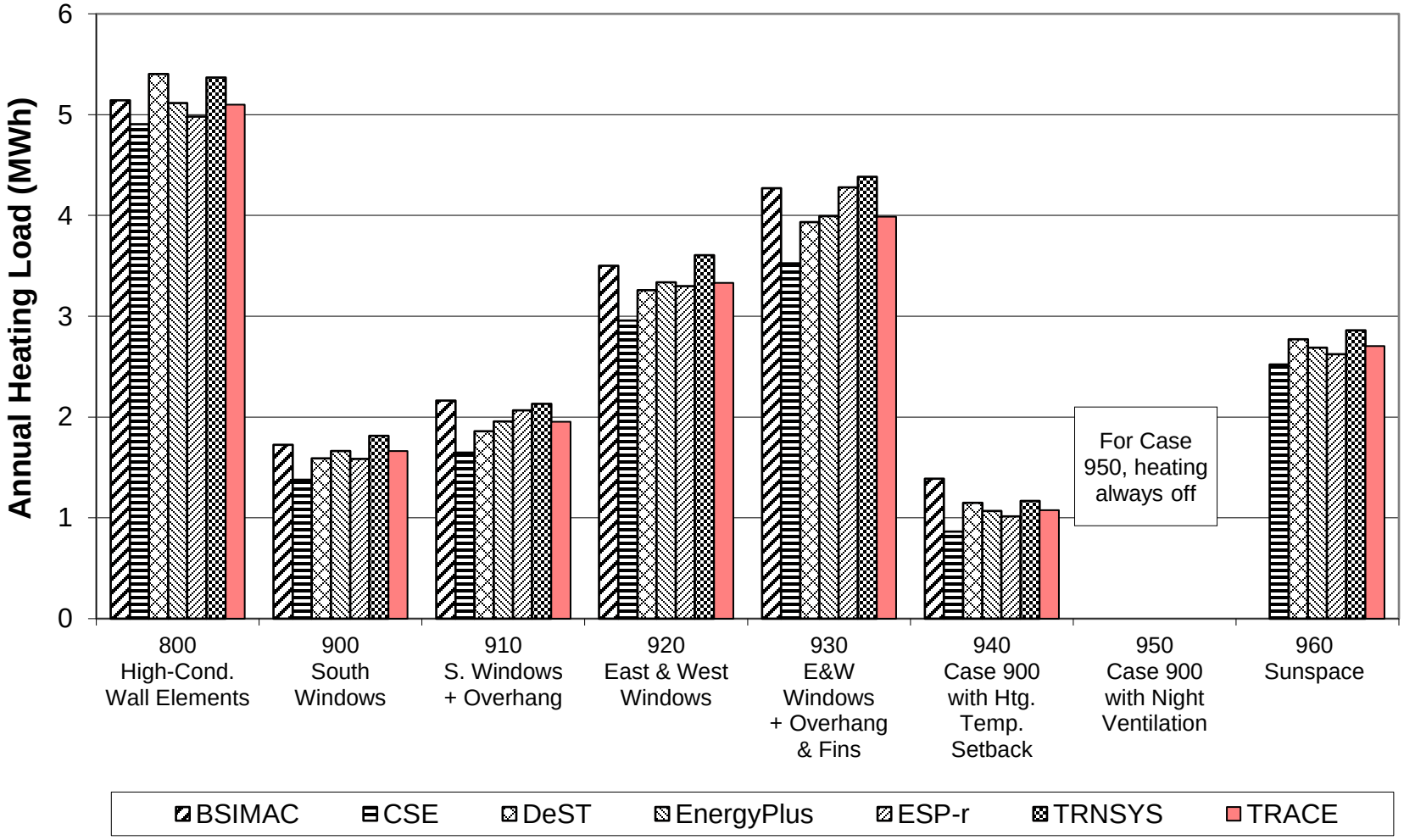


ASHRAE Standard 140-2020, Informative Annex B8, Section B8.1
Example Results for Section 5.2 - Building Thermal Envelope and Fabric Load Cases 195-995 & 600FF-980FF

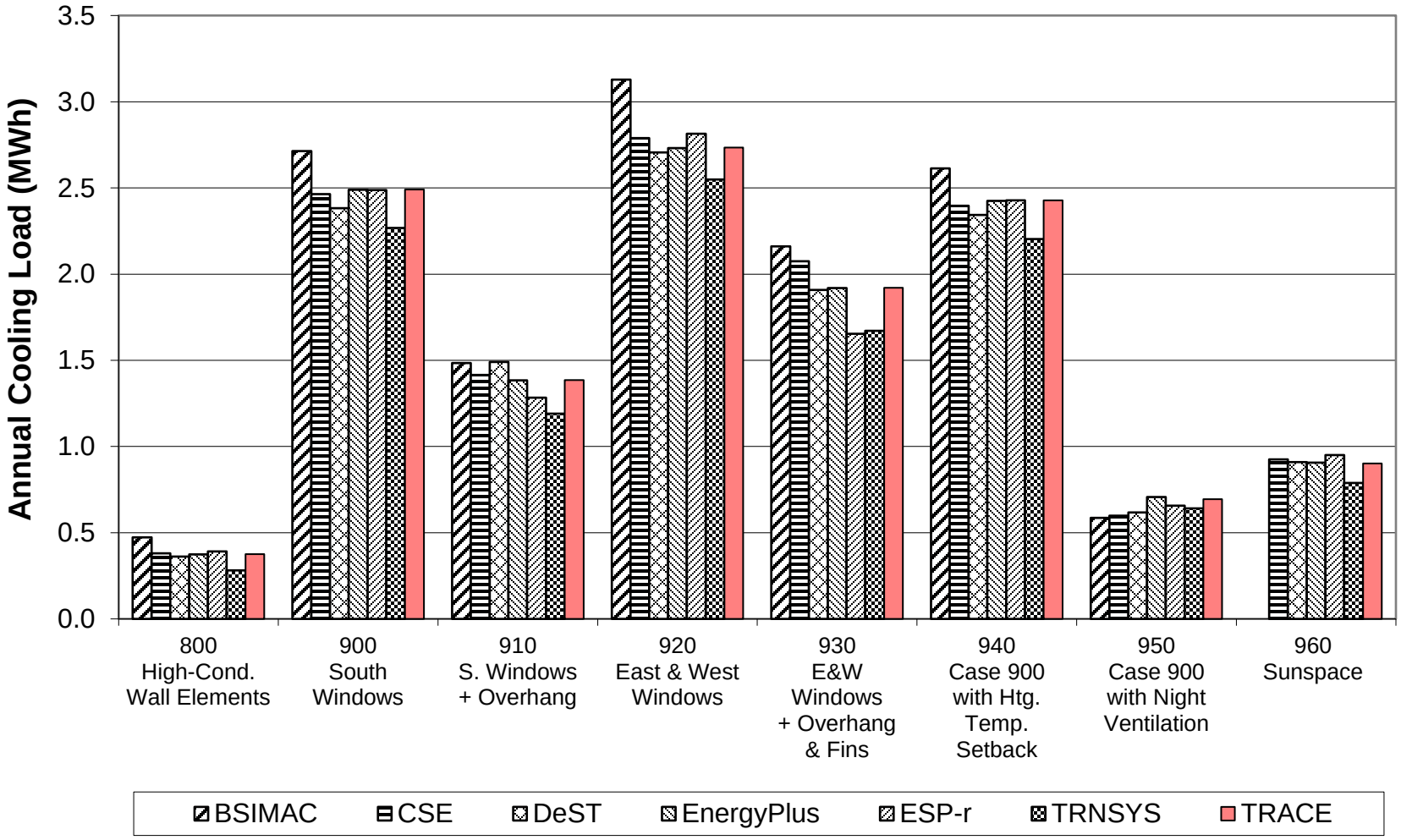
# Figure B8-10. Basic: Low Mass Peak Sensible Cooling



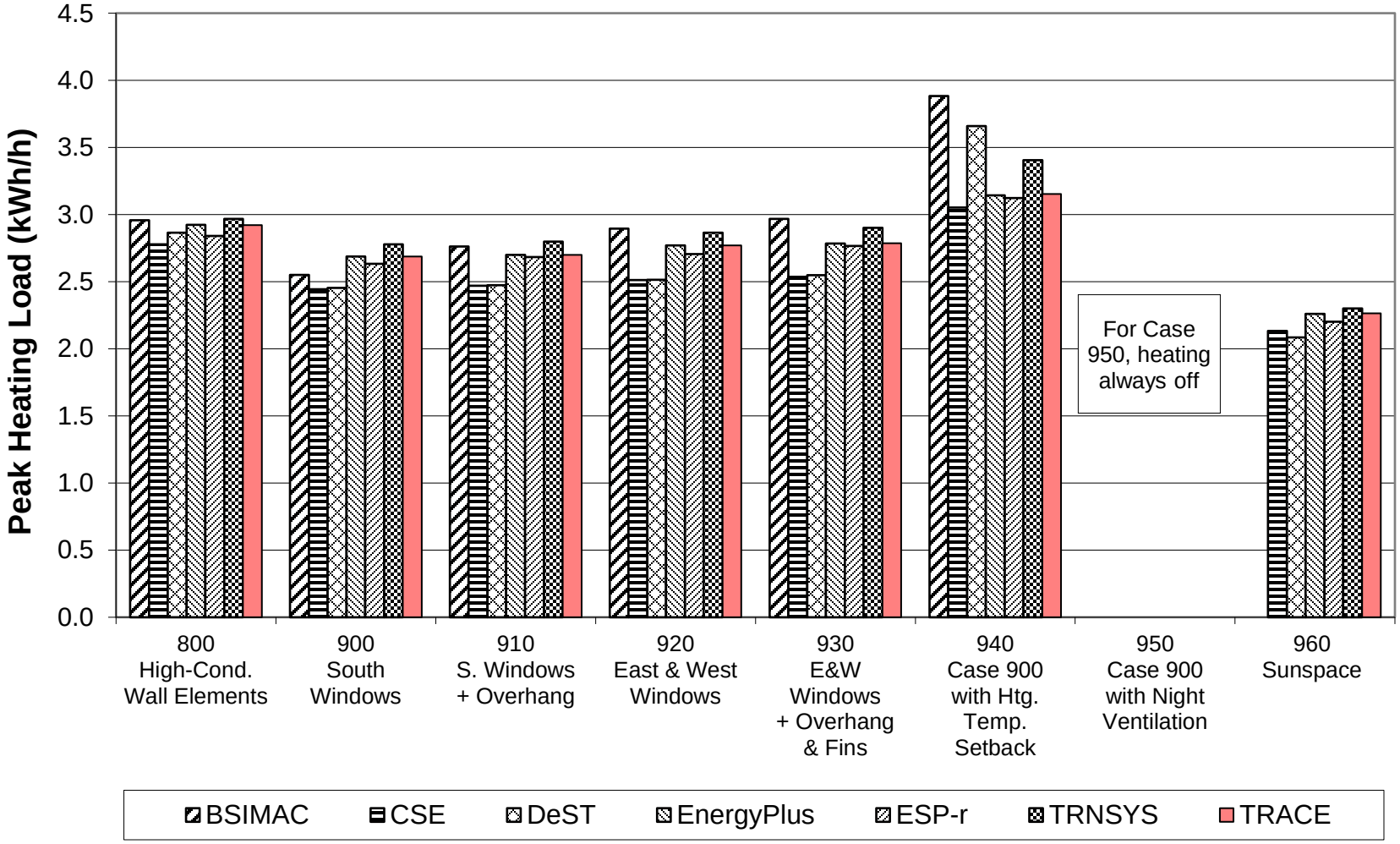
# Figure B8-11. Basic: High Mass Annual Heating



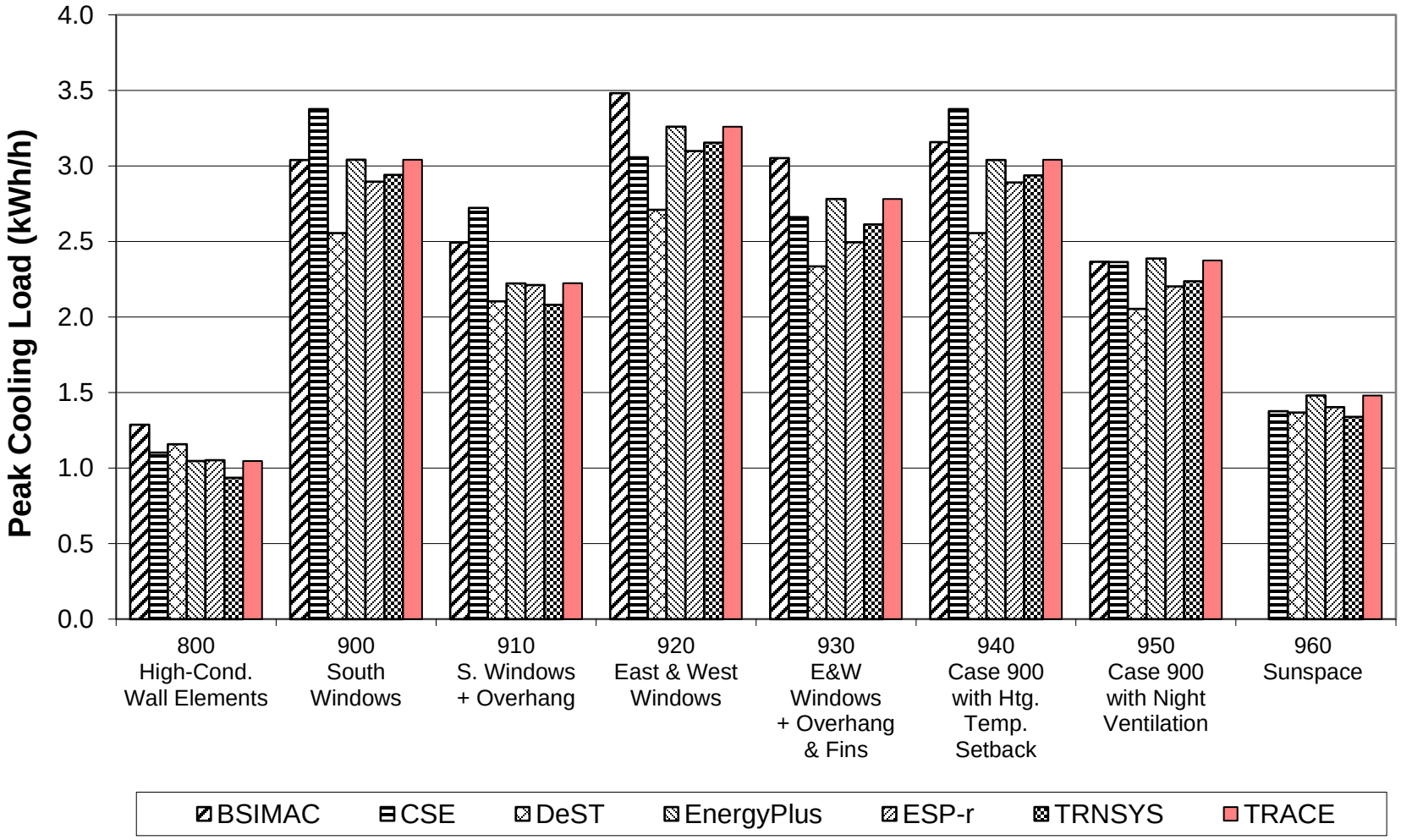
# Figure B8-12. Basic: High Mass Annual Sensible Cooling



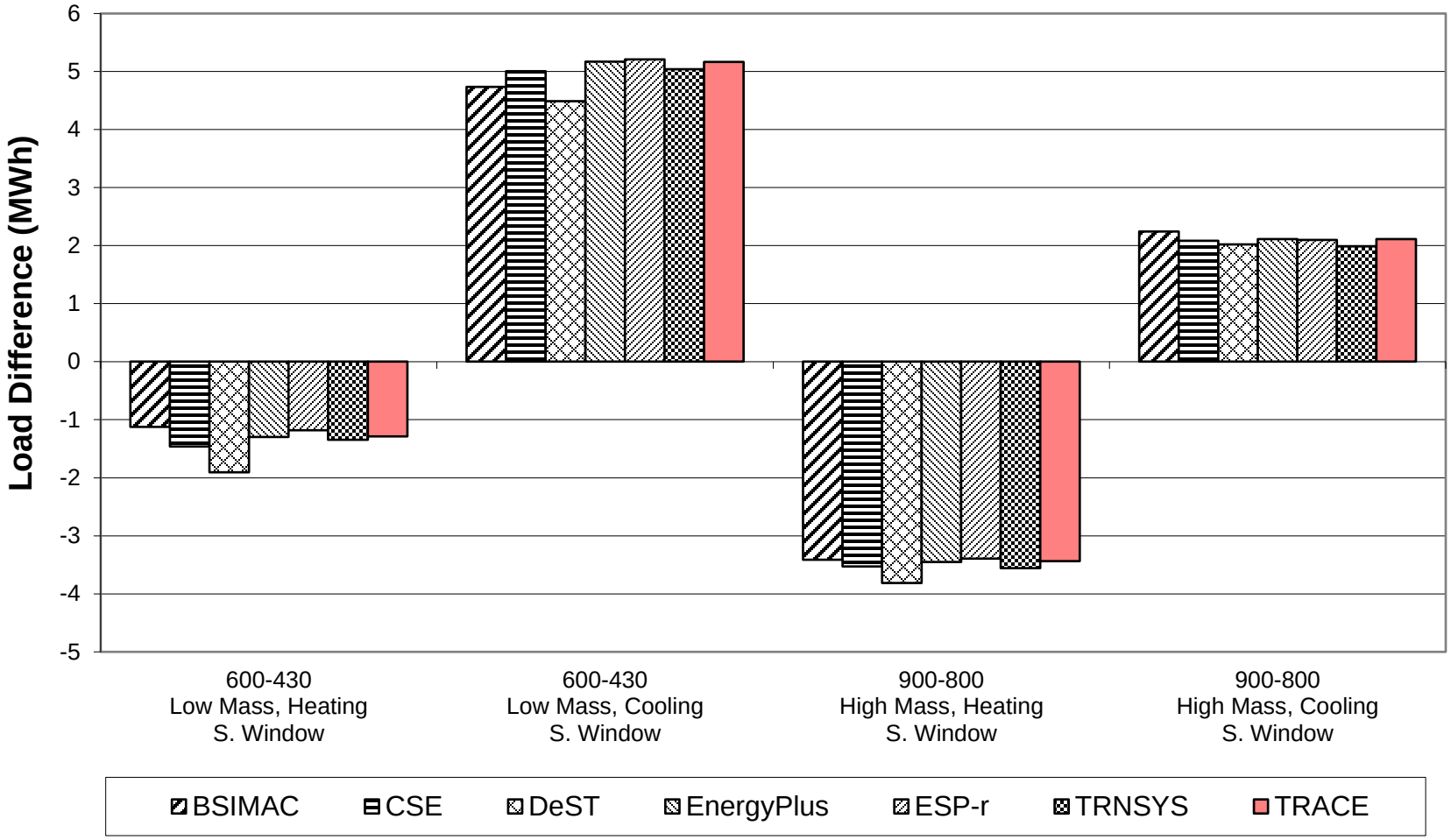
# Figure B8-13. Basic: High Mass Peak Heating



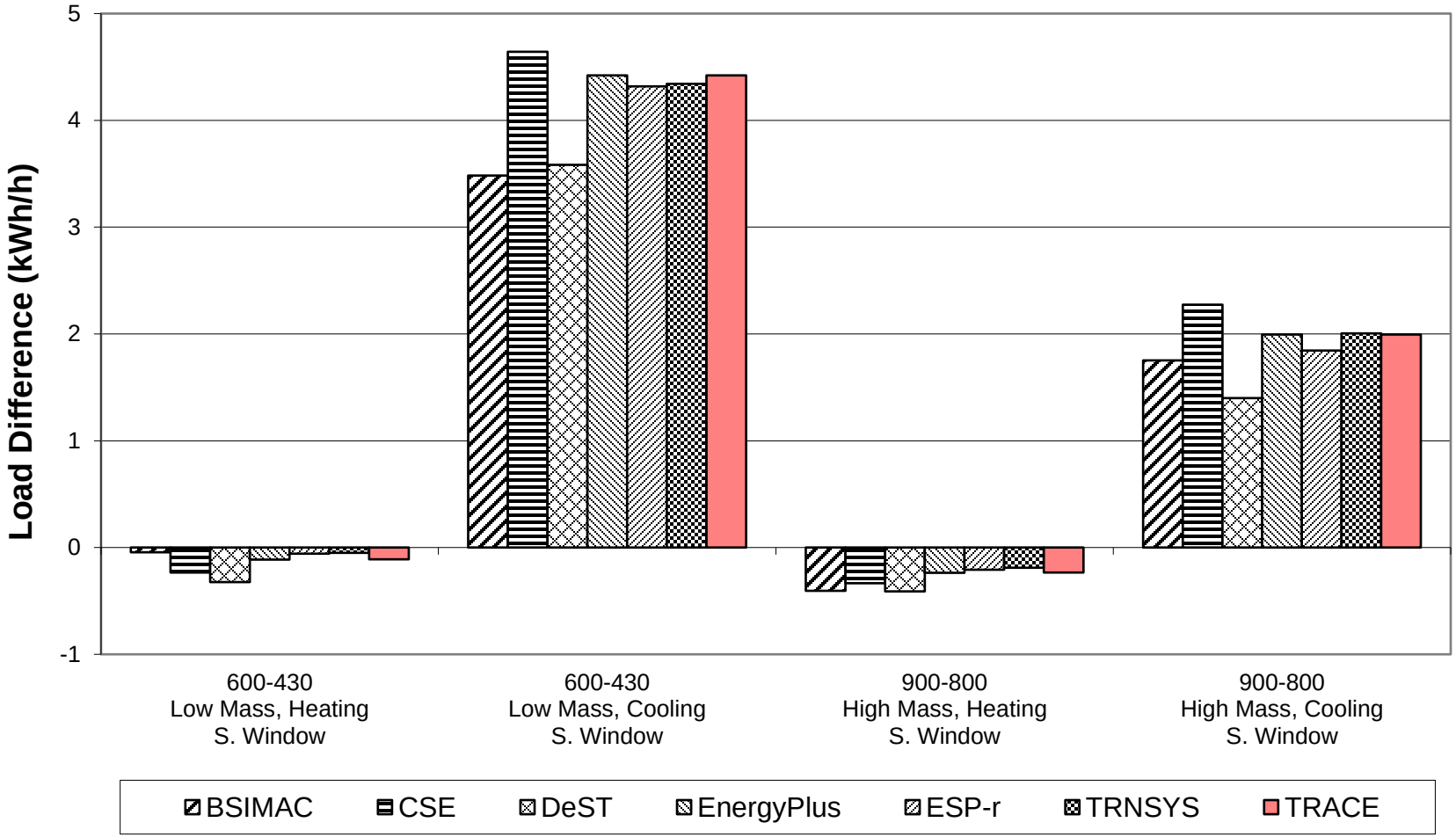
# Figure B8-14. Basic: High Mass Peak Sensible Cooling



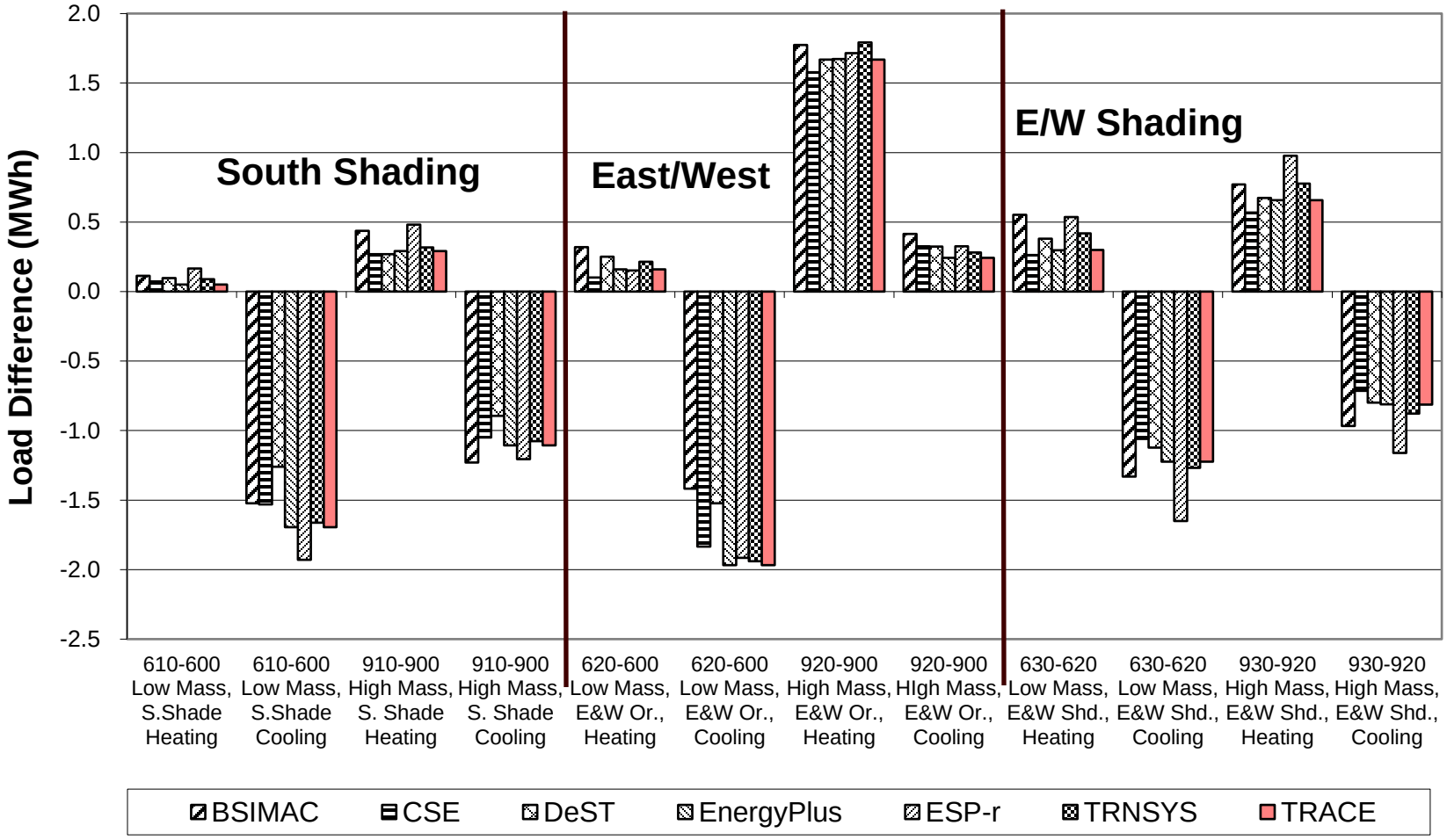
# Figure B8-15. Basic and In-Depth: South Window (Delta) Annual Heating and Sensible Cooling



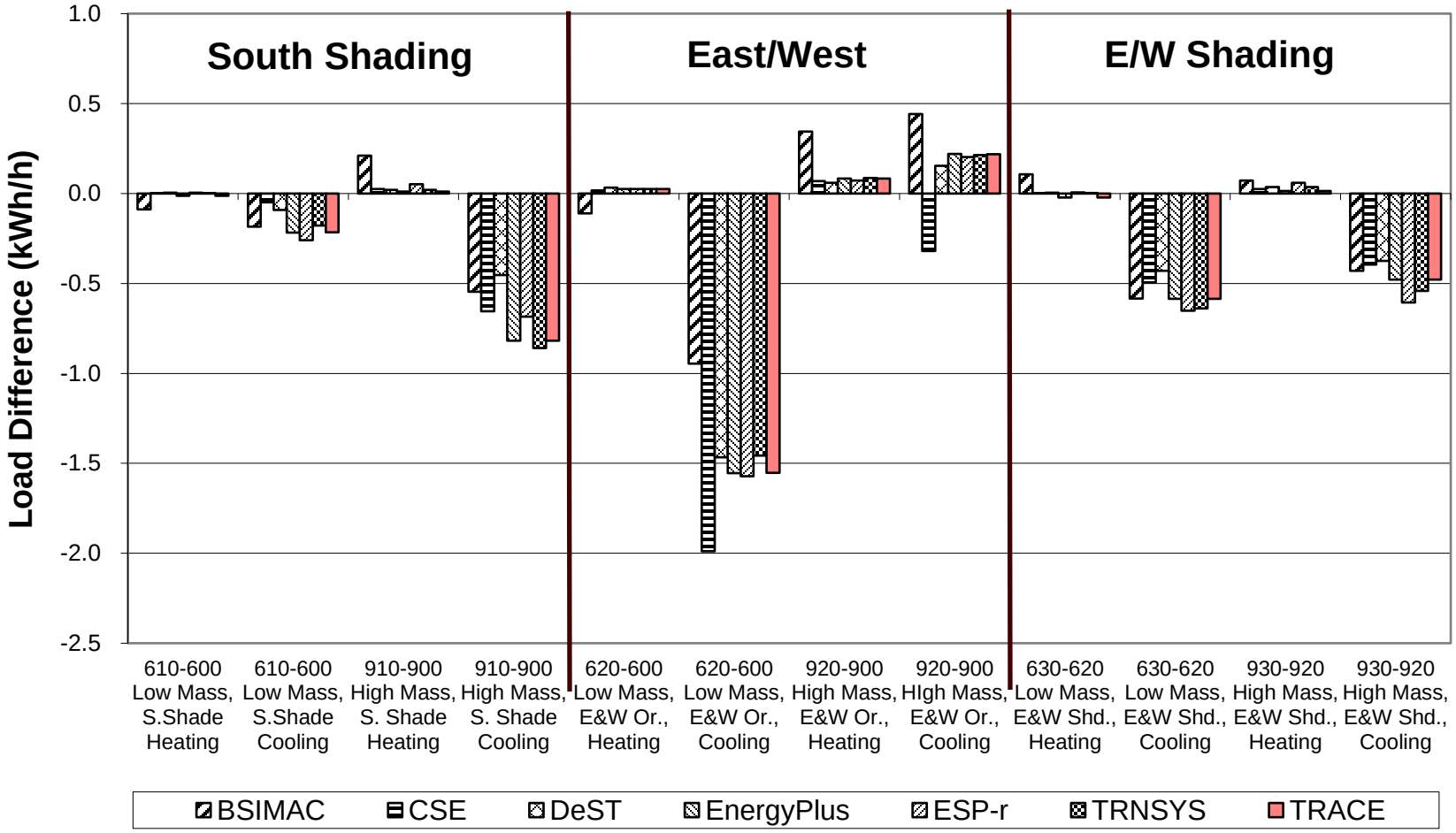
# Figure B8-16. Basic and In-Depth: South Window (Delta) Peak Heating and Sensible Cooling



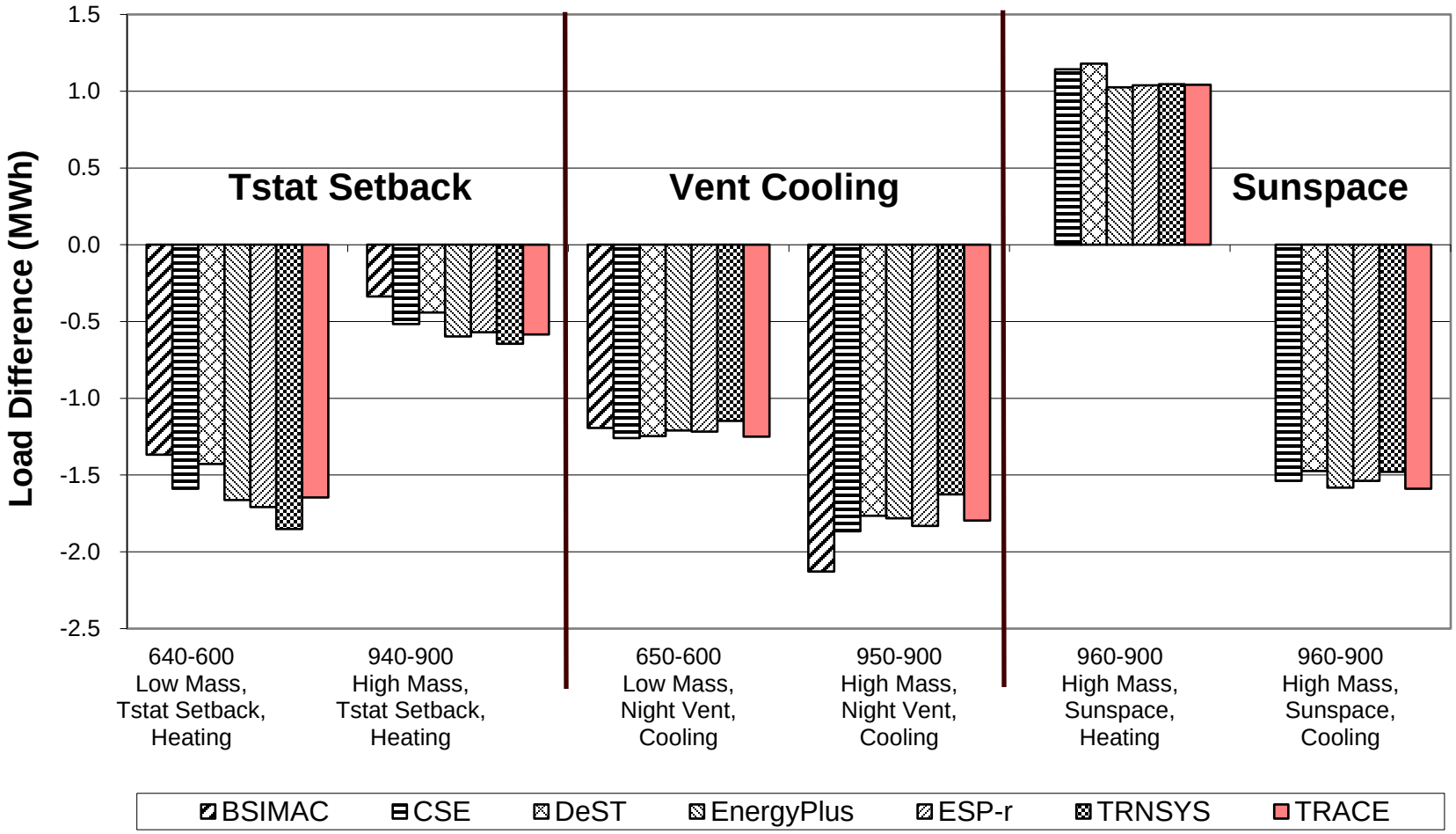
# Figure B8-17. Basic: Window Shading and Orientation (Delta) Annual Heating and Sensible Cooling



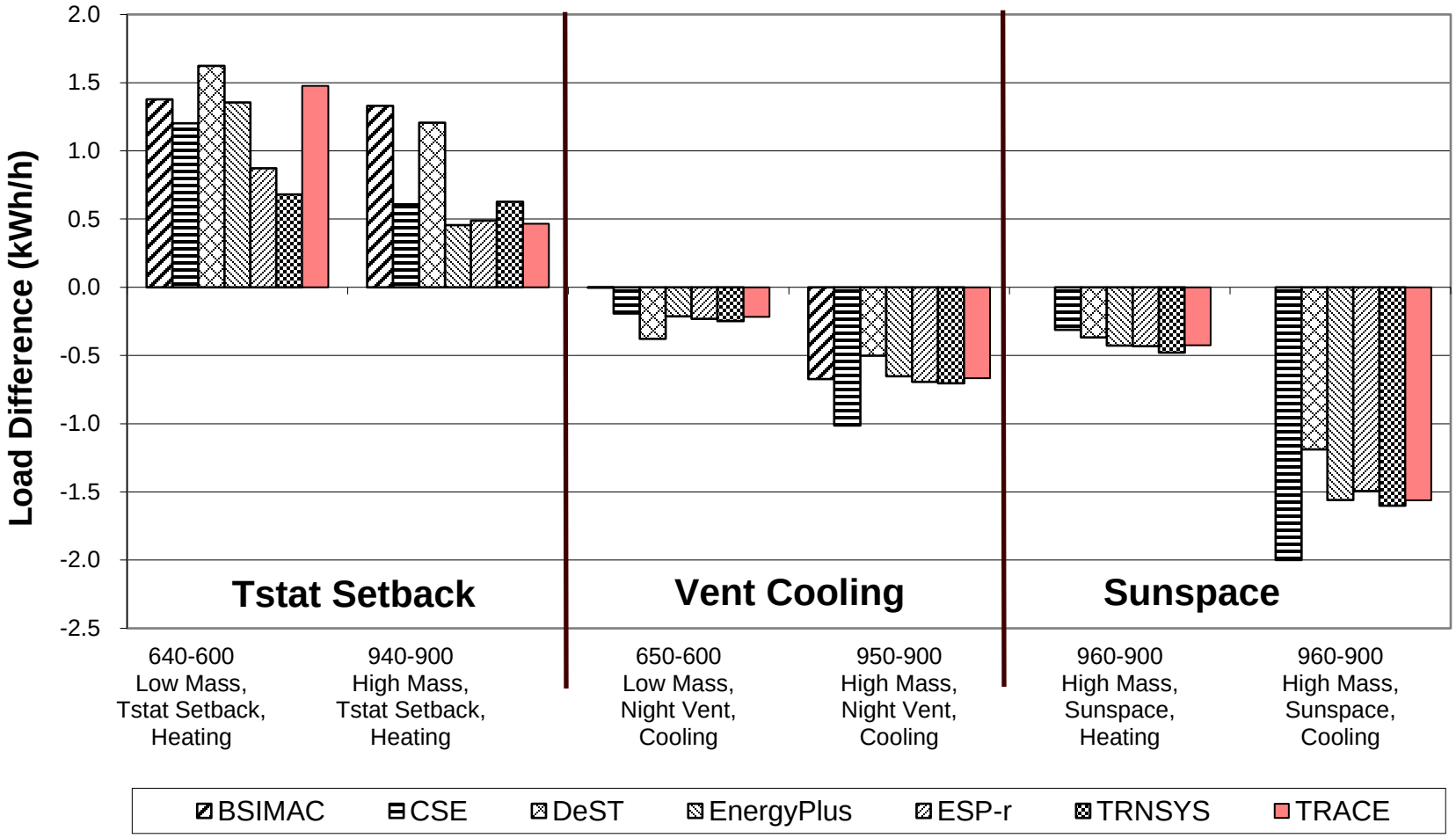
# Figure B8-18. Basic: Window Shading and Orientation (Delta) Peak Heating and Sensible Cooling



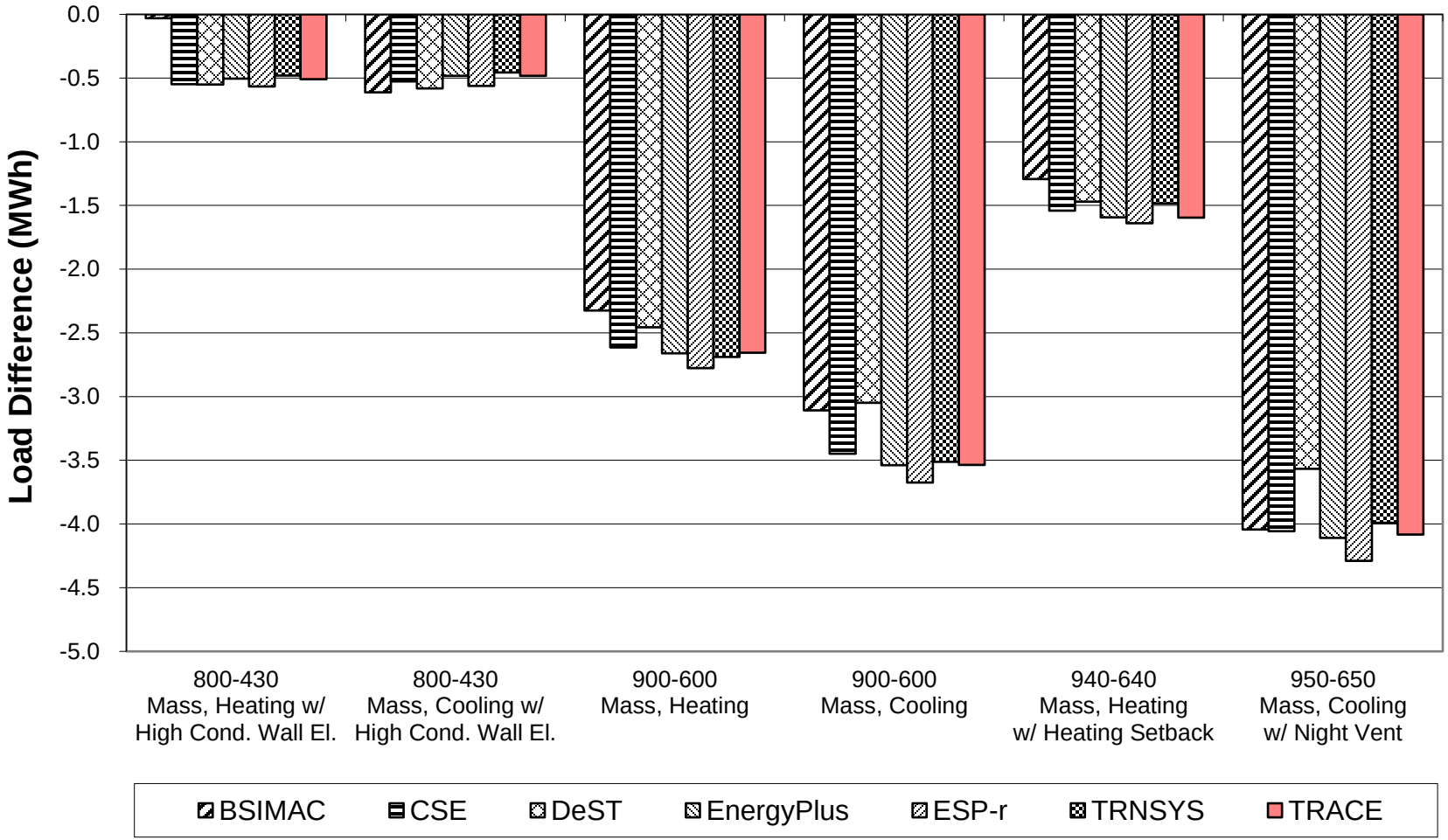
# Figure B8-19. Basic: Thermostat Setback, Vent Cooling, and Sunspace (Delta) Annual Heating and Sensible Cooling



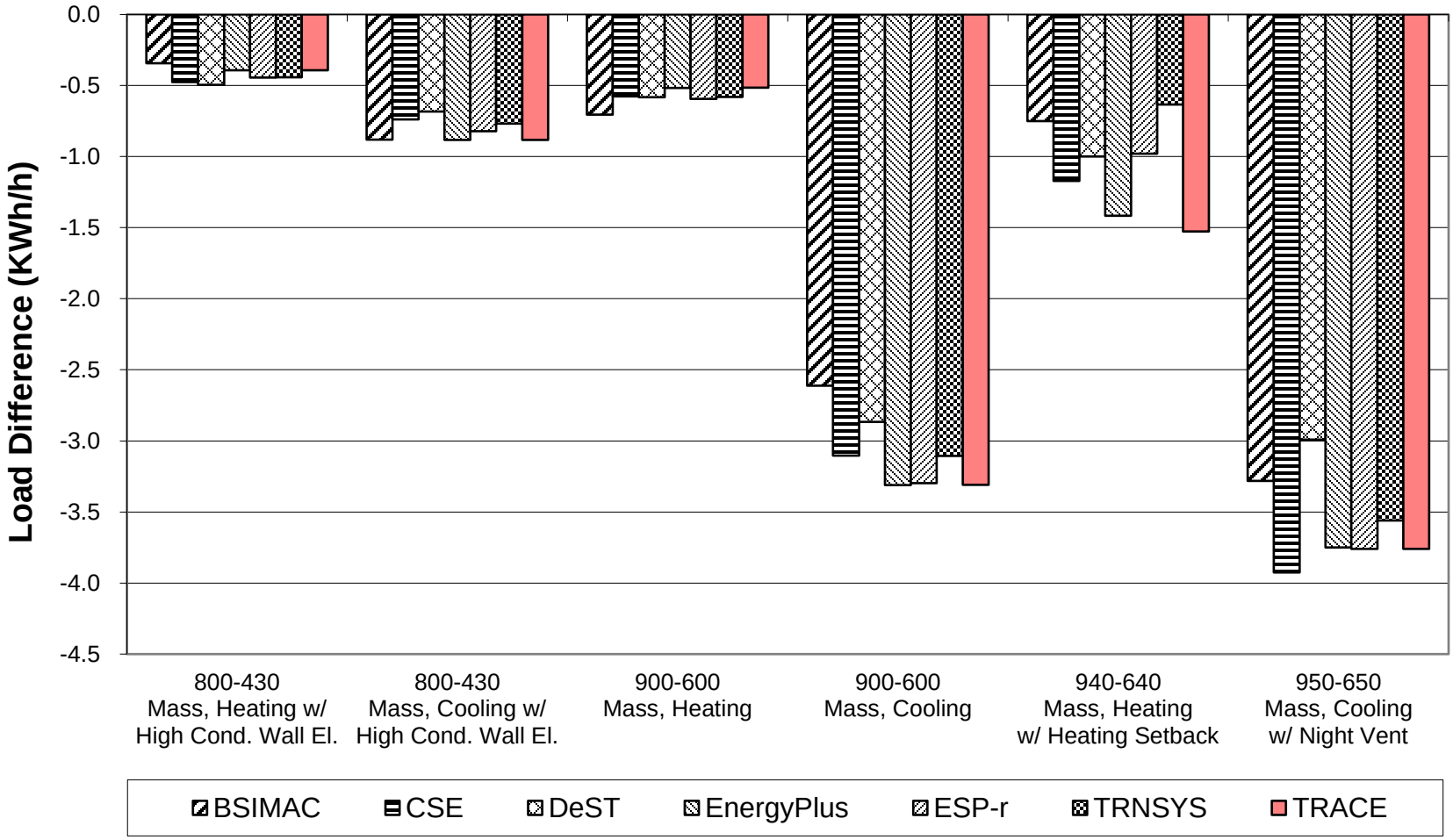
# Figure B8-20. Basic: Thermostat Setback, Vent Cooling, and Sunspace (Delta) Peak Heating and Sensible Cooling



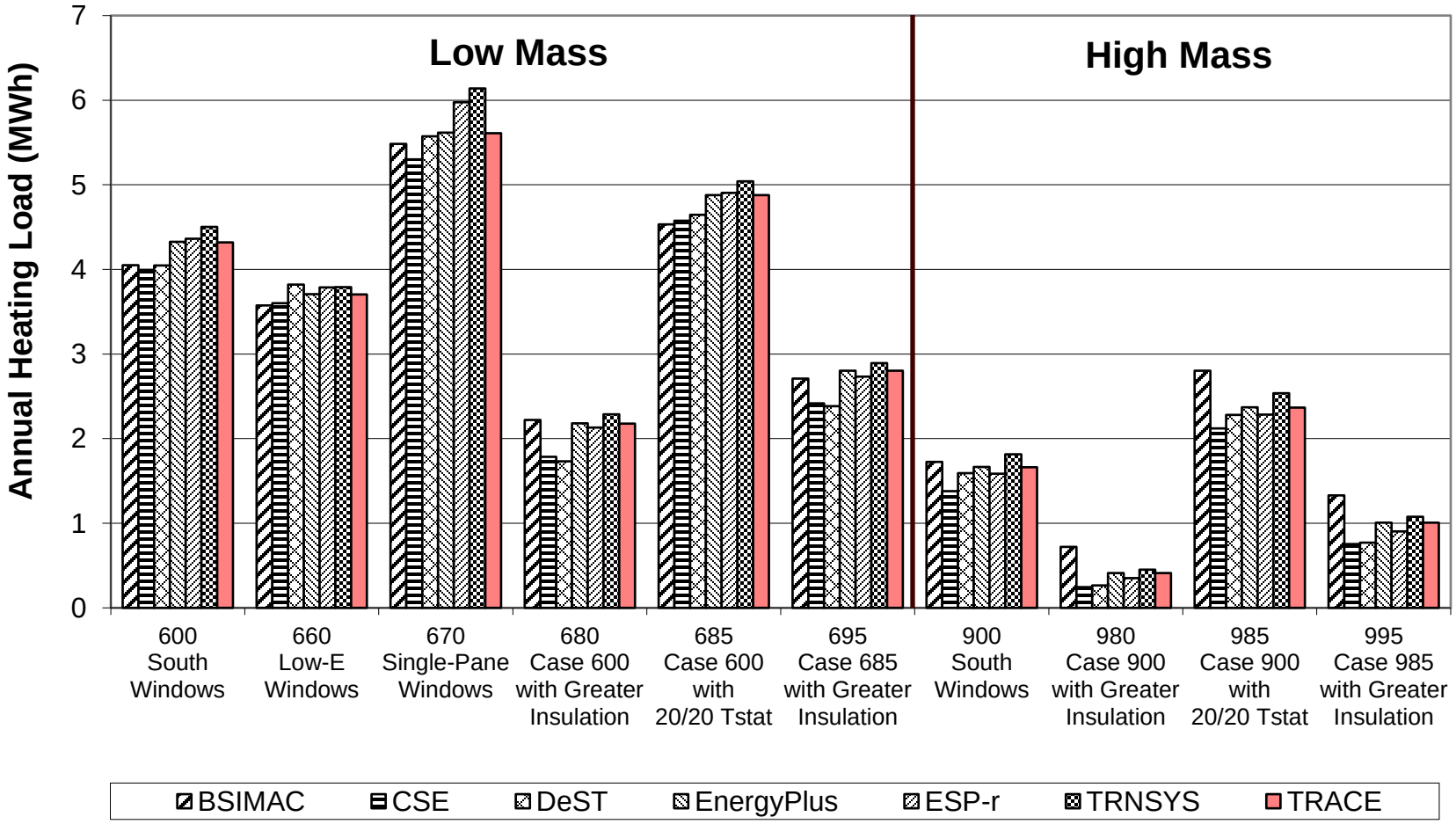
# Figure B8-21. Basic and In-Depth: Mass Effect (Delta) Annual Heating and Sensible Cooling



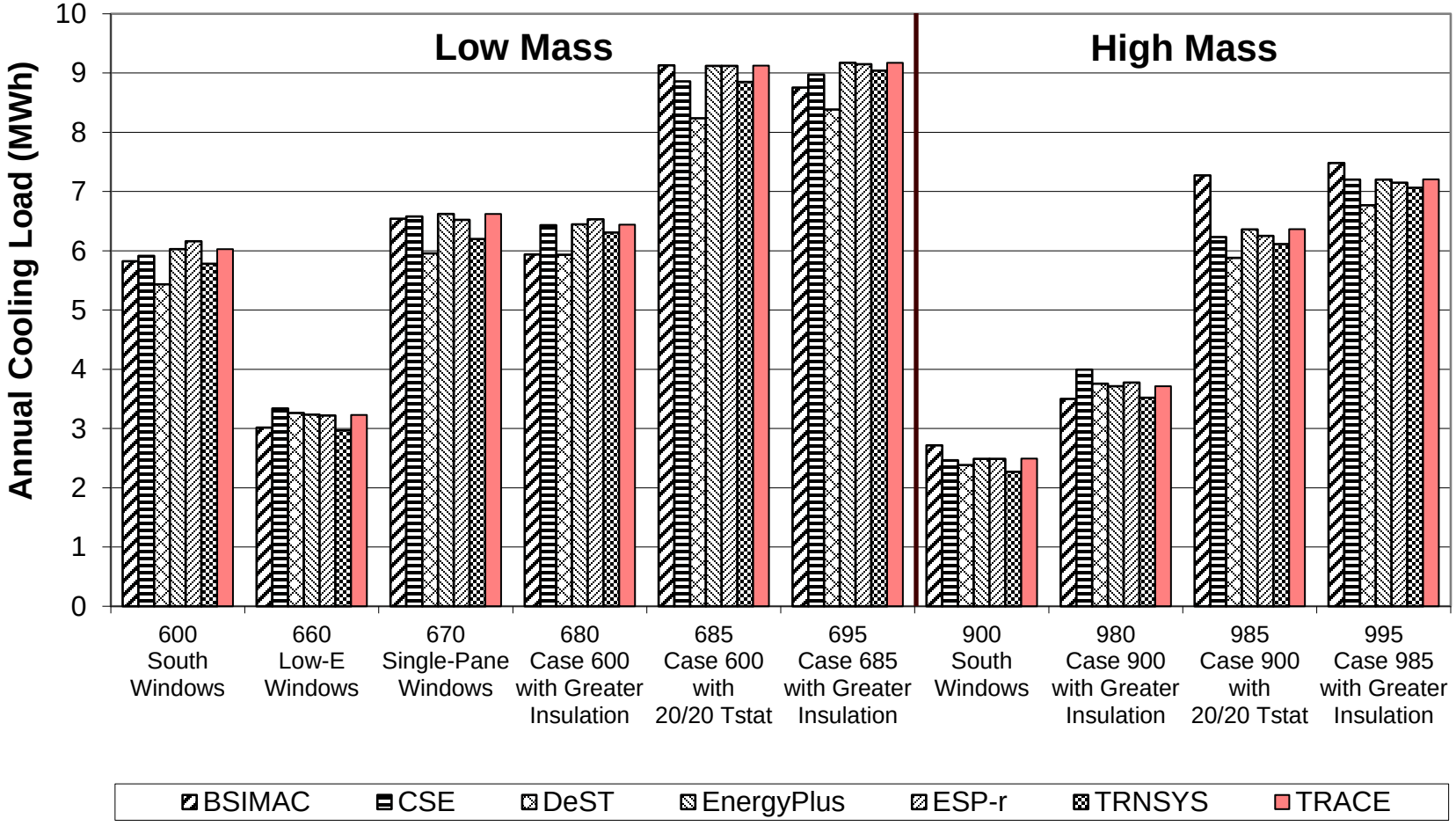
# Figure B8-22. Basic and In-Depth: Mass Effect (Delta) Peak Heating and Sensible Cooling



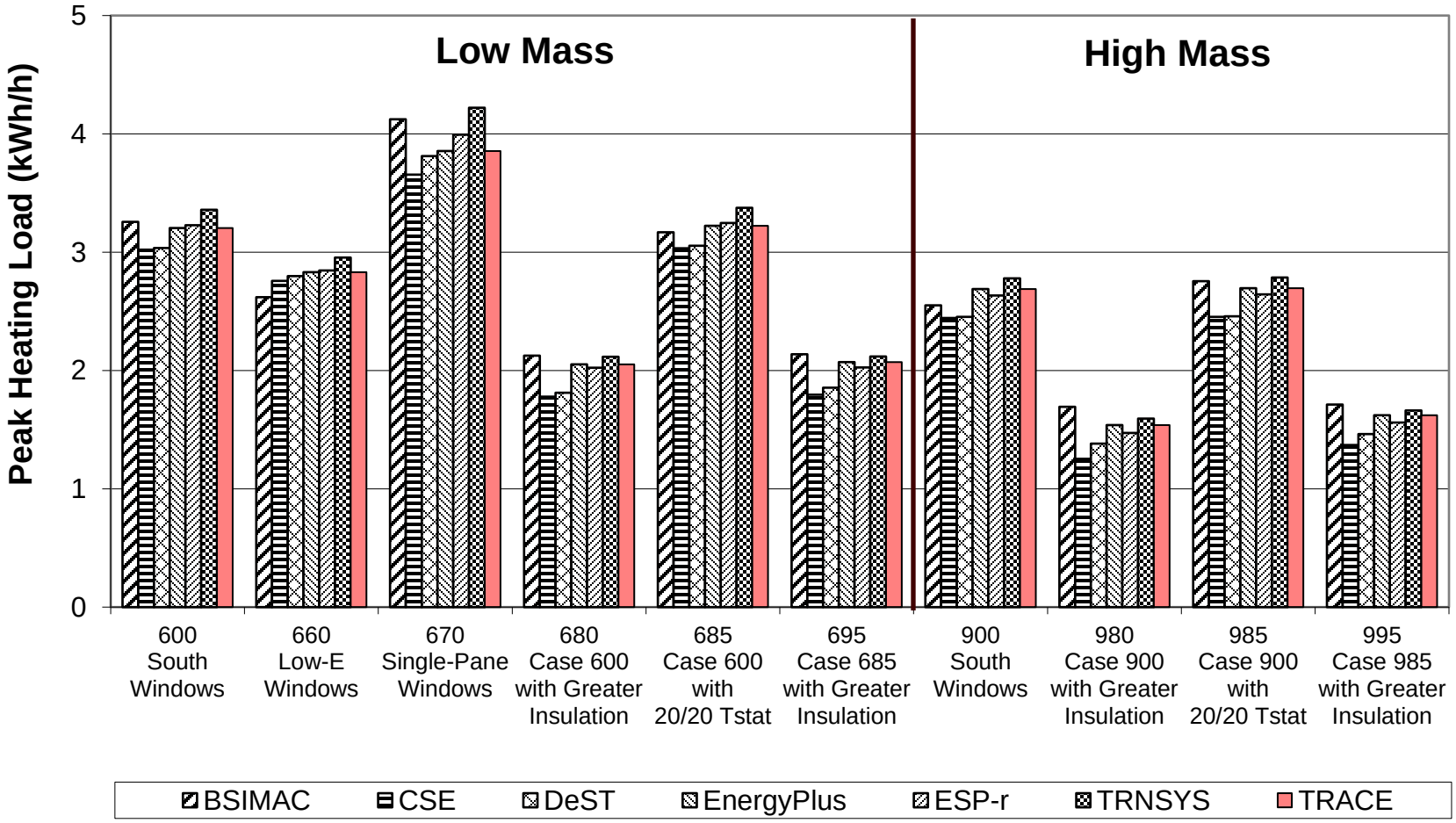
# Figure B8-23. Basic: Cases 660 to 695 and 980 to 995 Annual Heating



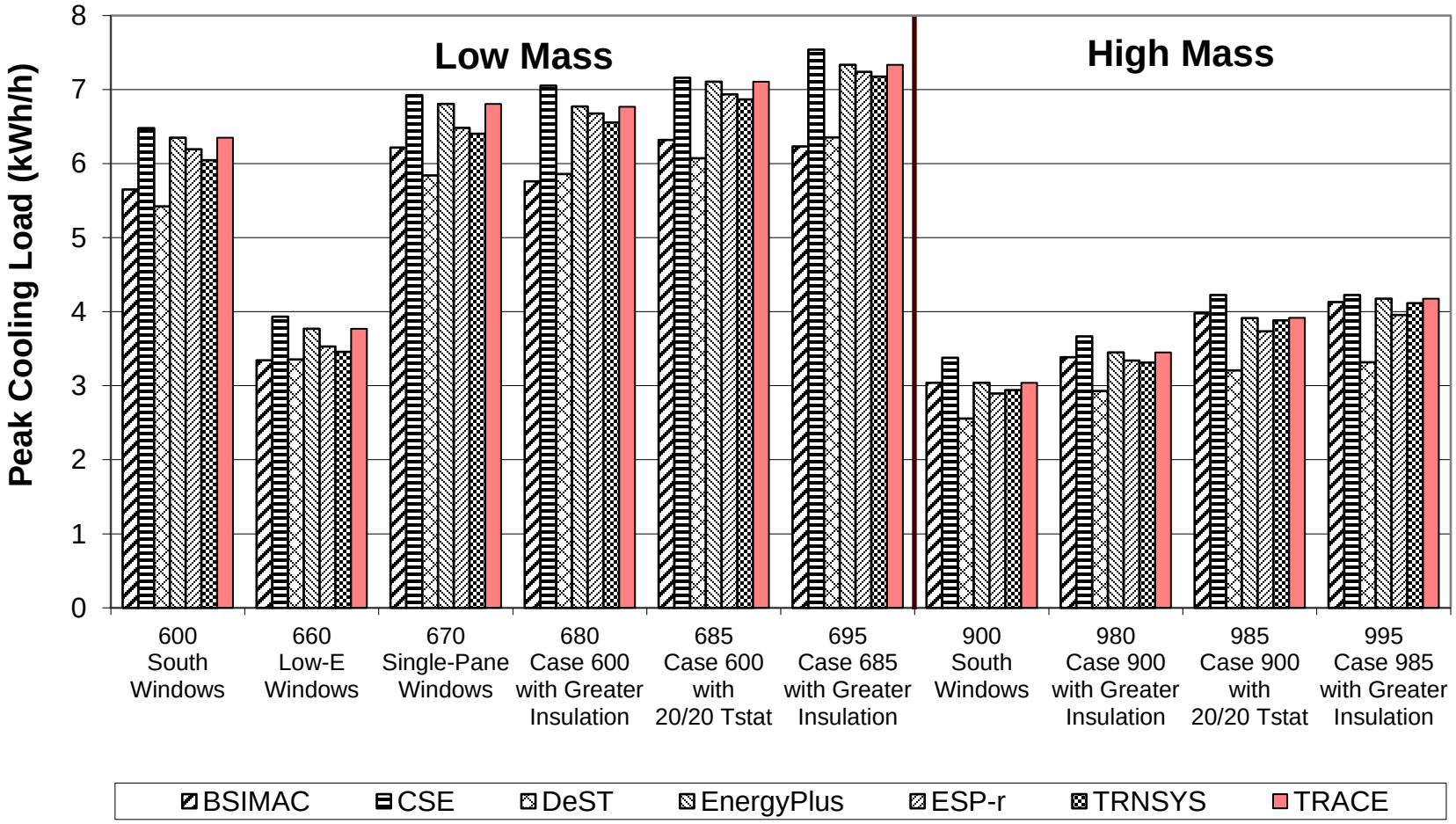
## Figure B8-24. Basic: Cases 660 to 695 and 980 to 995 Annual Cooling



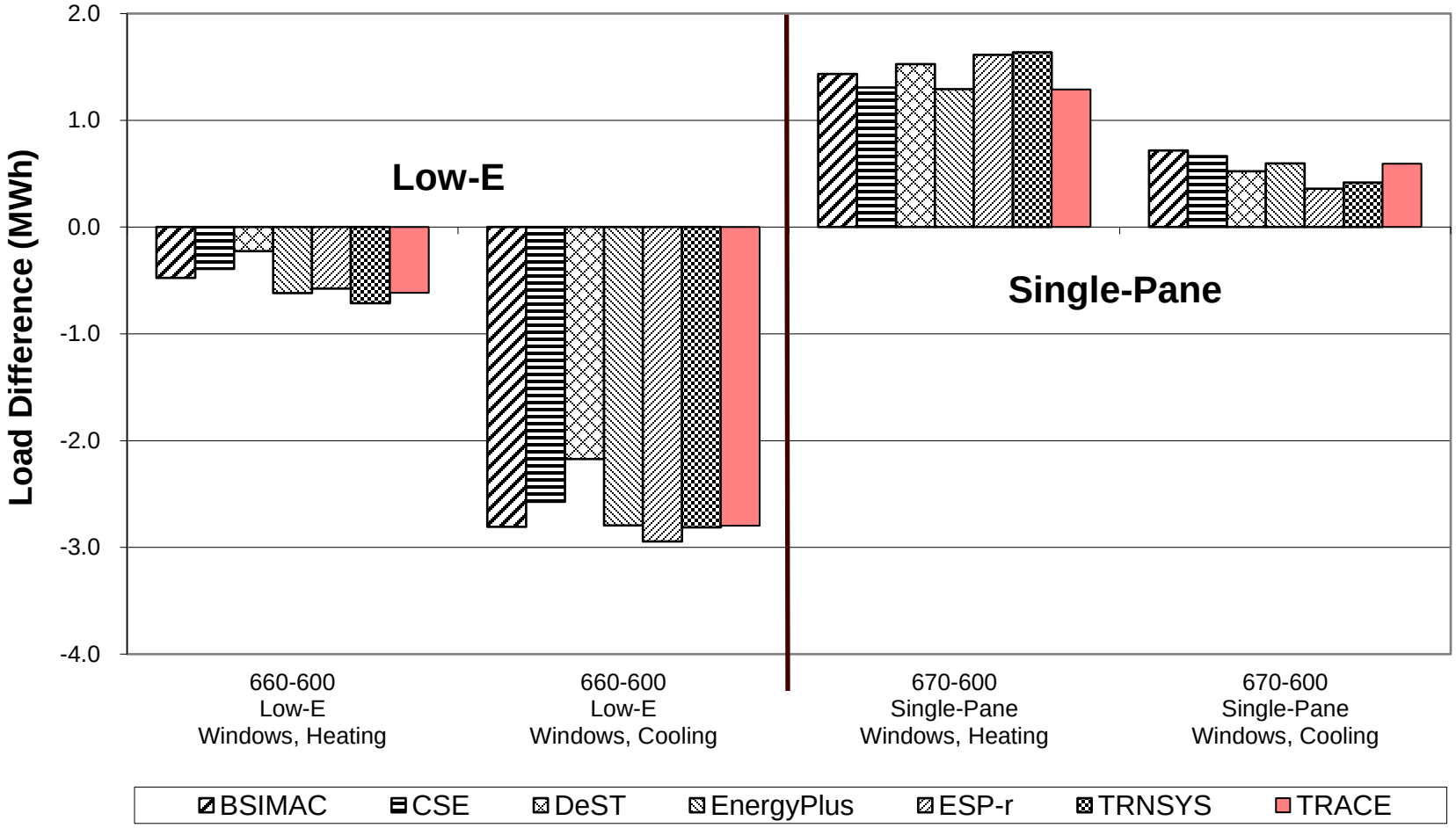
## Figure B8-25. Basic: Cases 660 to 695 and 980 to 995 Peak Heating



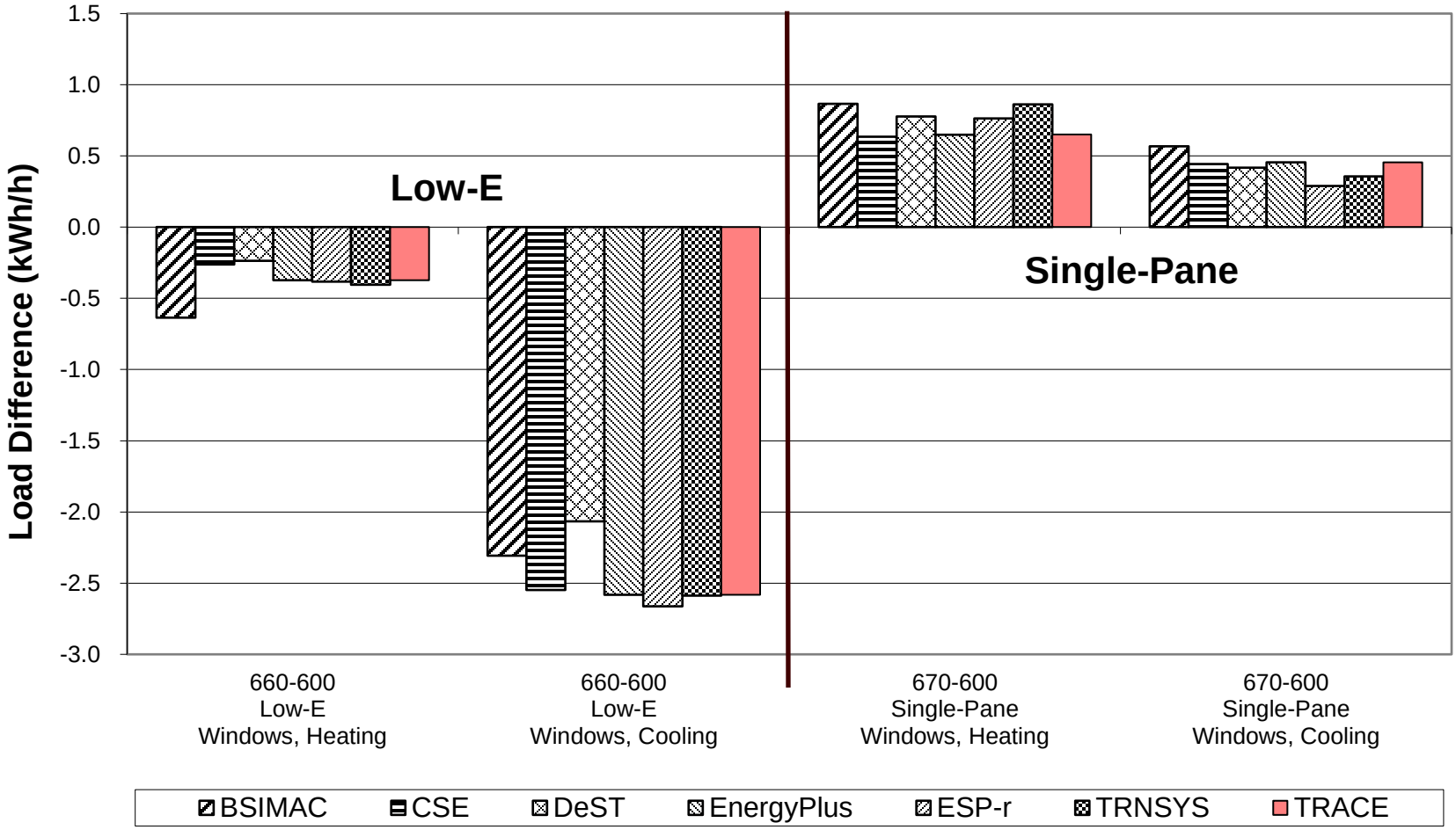
## Figure B8-26. Basic: Cases 660 to 695 and 980 to 995 Peak Cooling



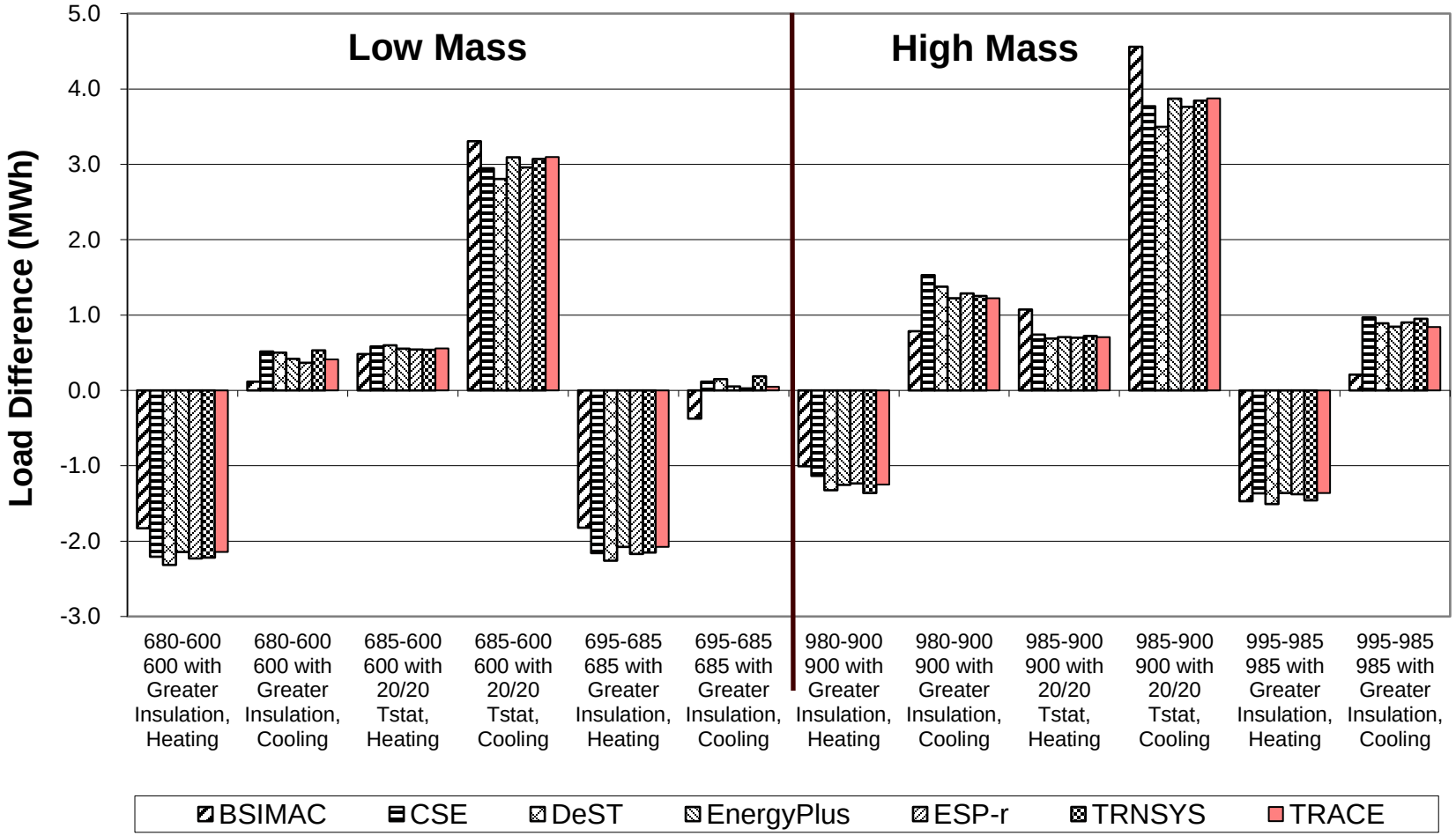
# Figure B8-27. Basic: Window Types (Delta) Annual Heating and Sensible Cooling



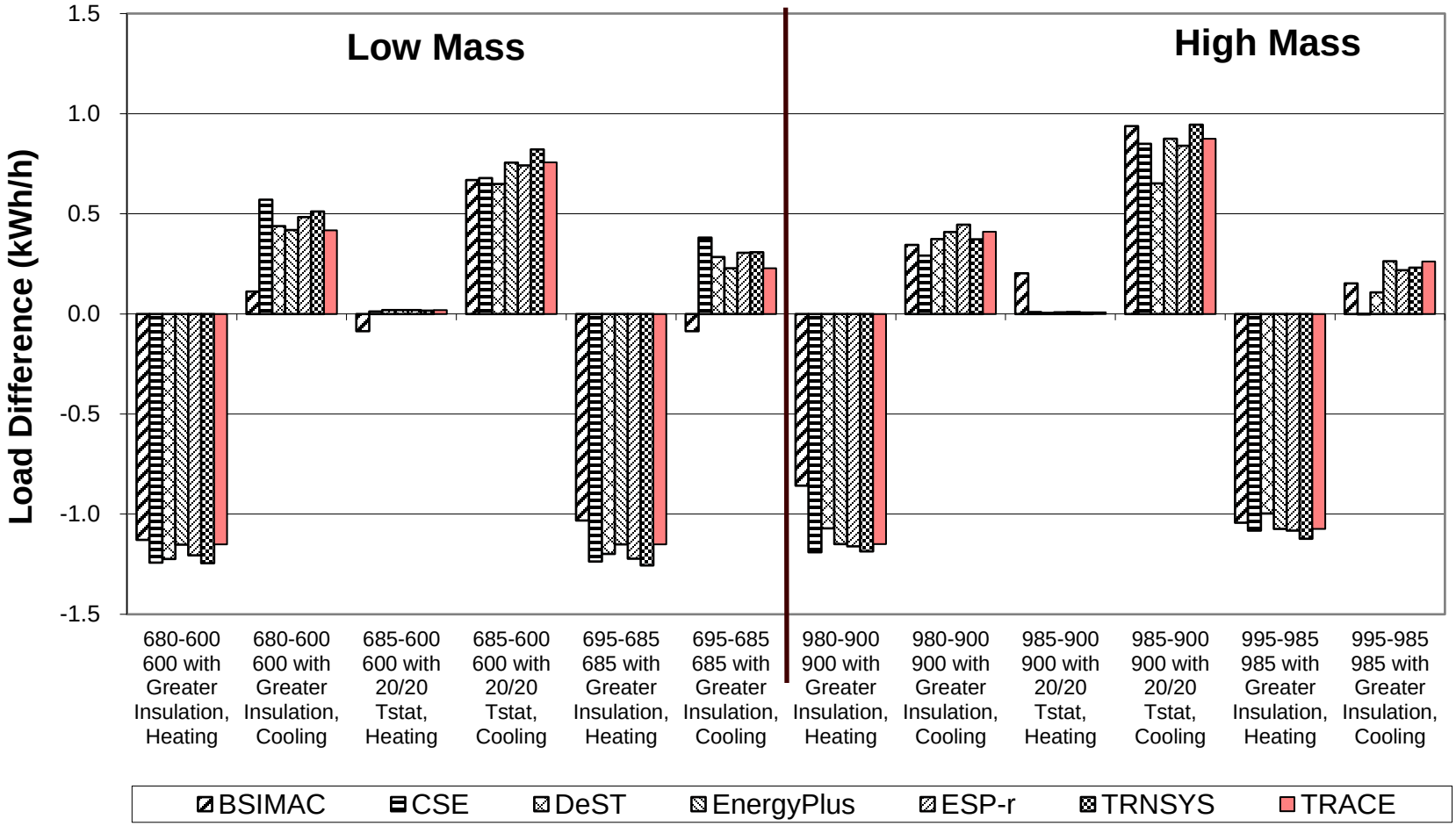
# Figure B8-28. Basic: Window Types (Delta) Peak Heating and Sensible Cooling



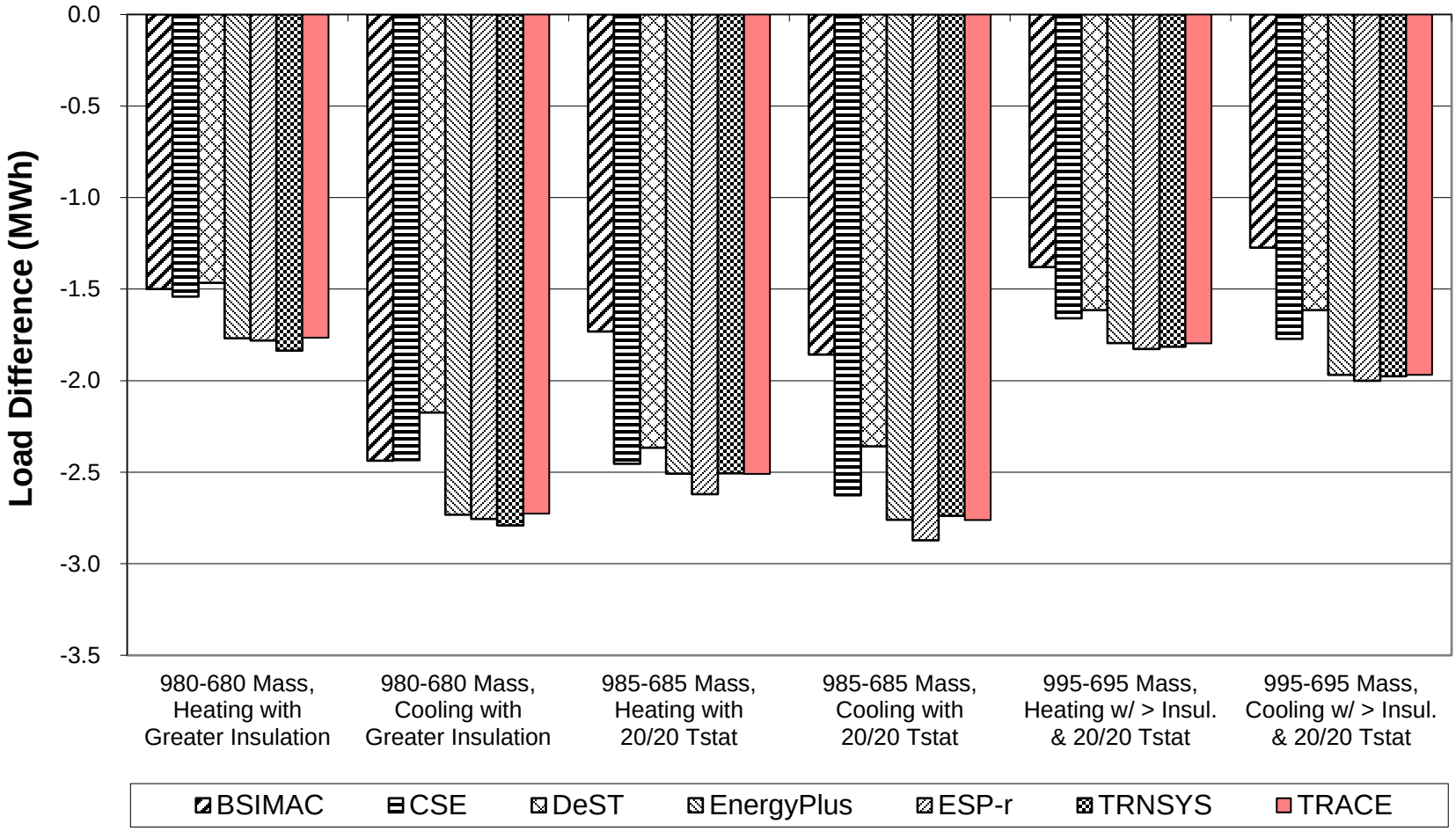
# Figure B8-29. Basic: Insulation (Delta) Annual Heating and Sensible Cooling



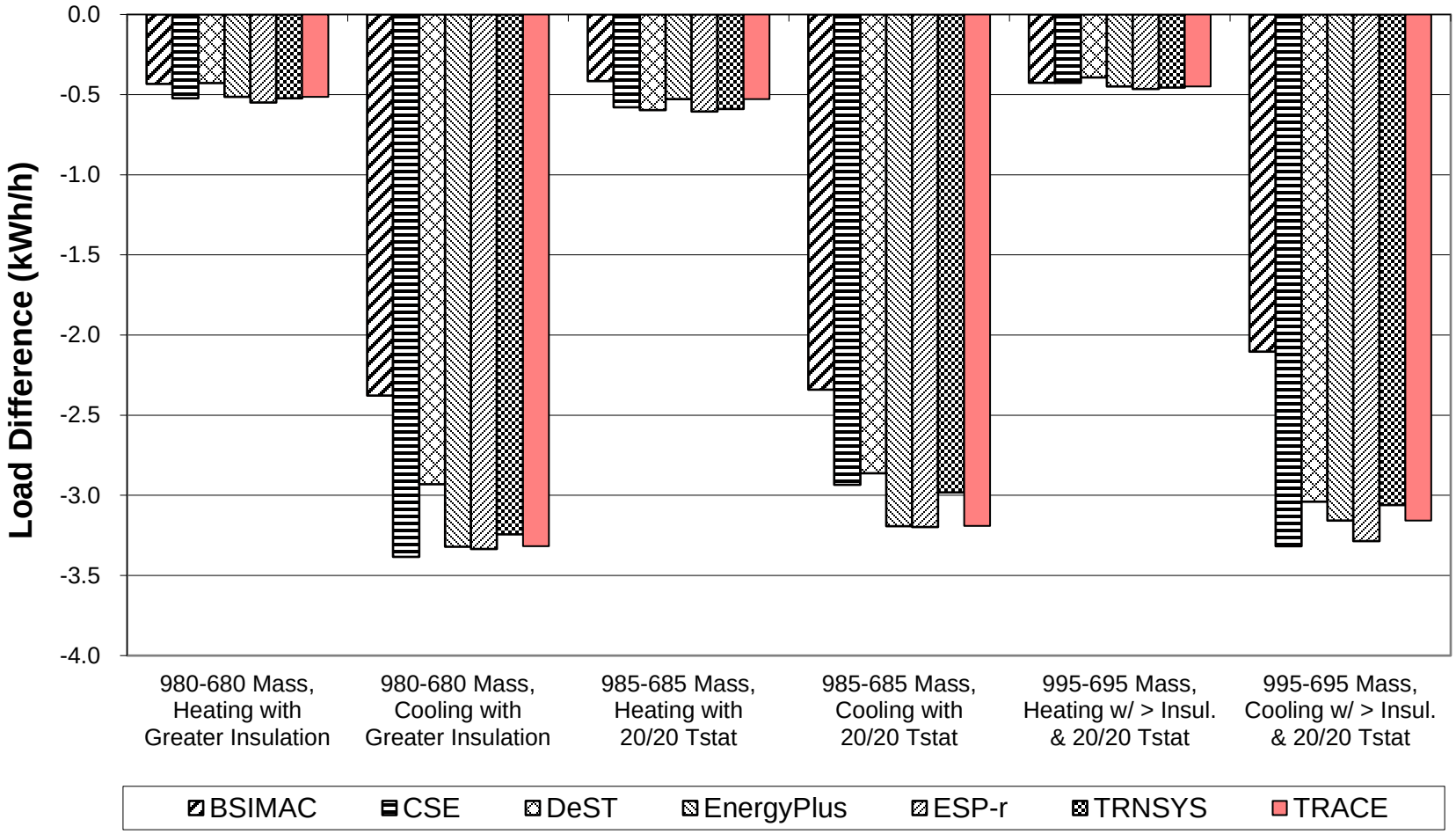
# Figure B8-30. Basic: Insulation (Delta) Peak Heating and Sensible Cooling



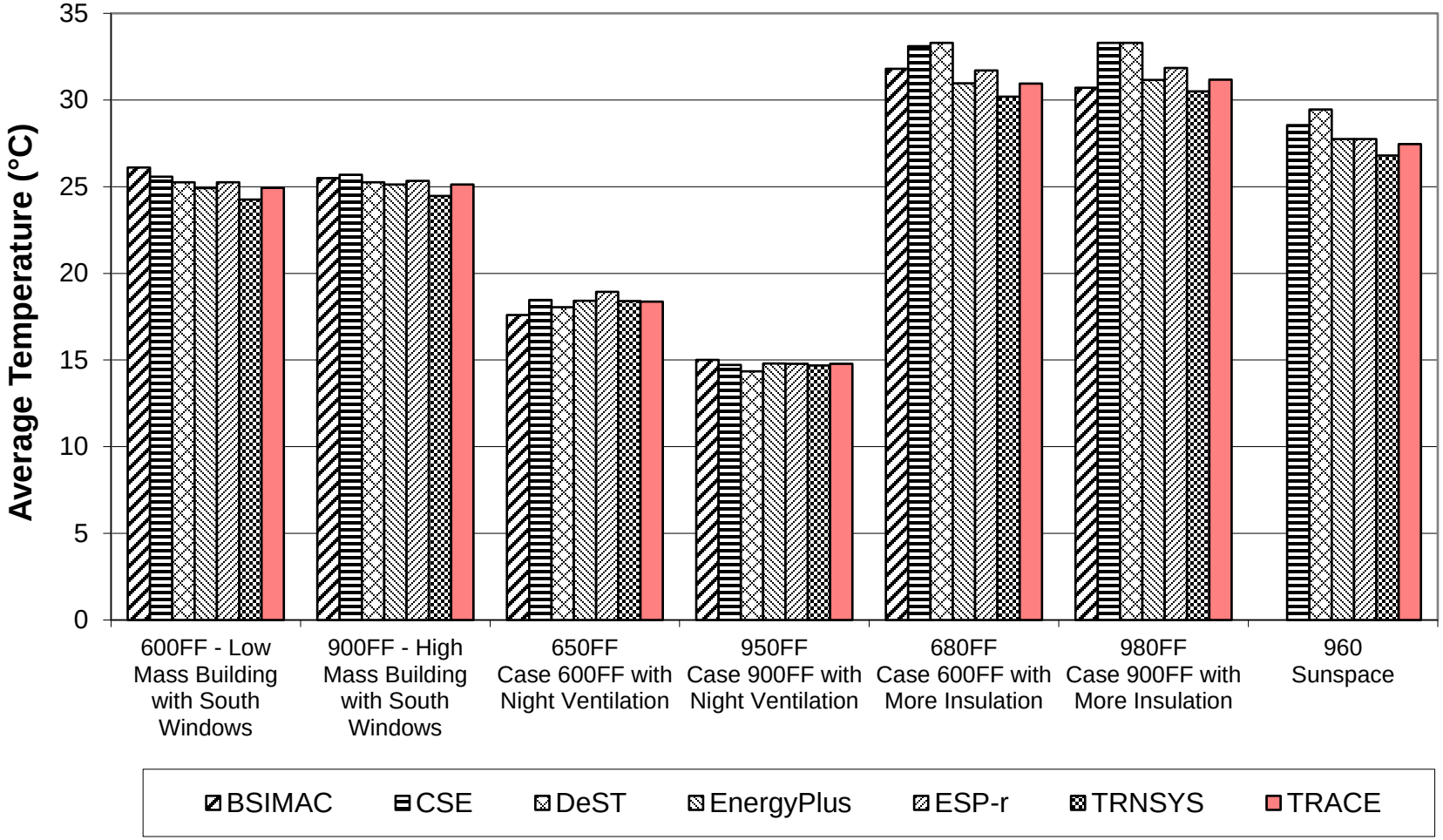
# Figure B8-31. Basic: Insulation, Mass Effect (Delta) Annual Heating and Sensible Cooling



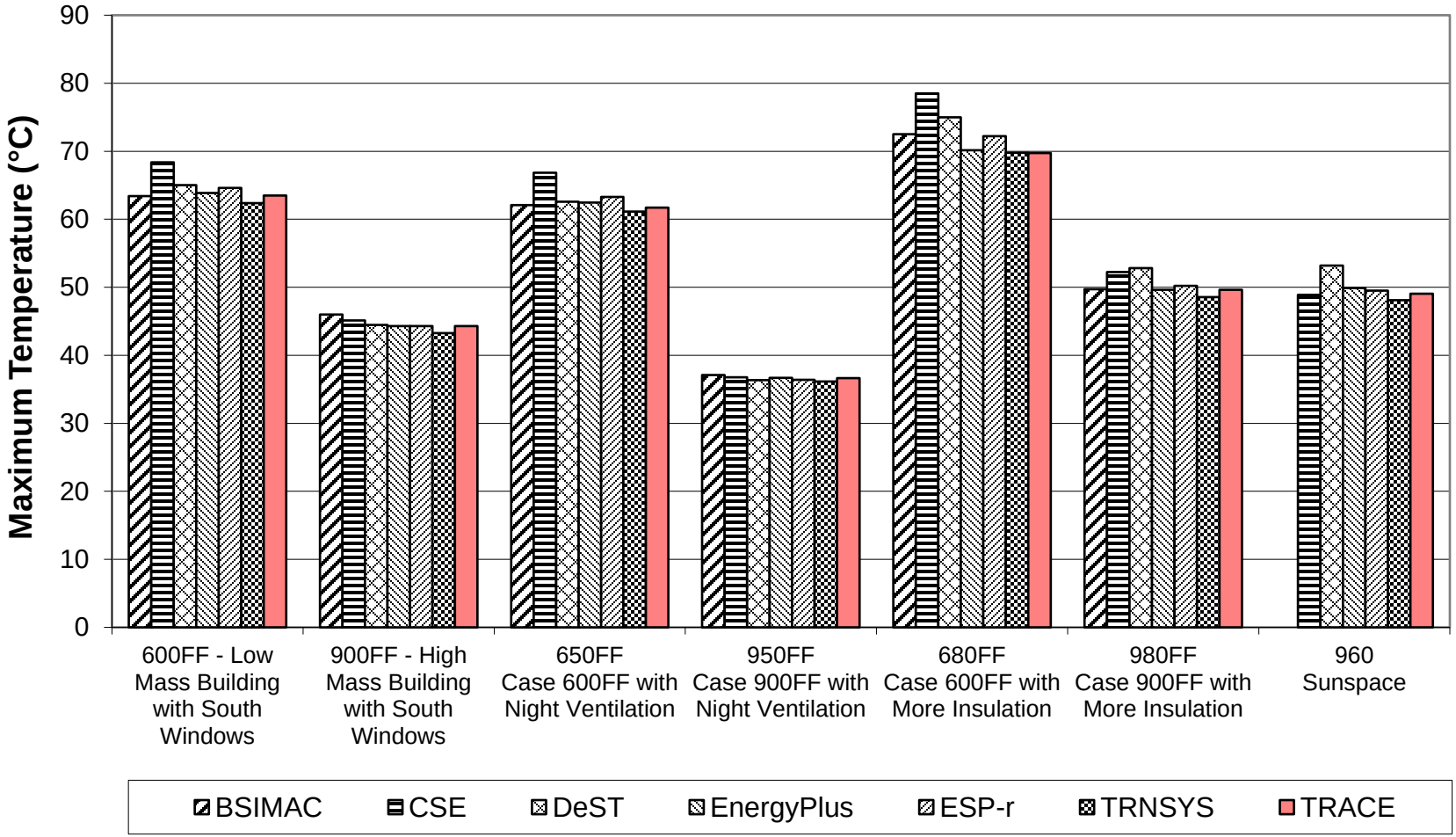
# Figure B8-32. Basic: Insulation, Mass Effect (Delta) Peak Heating and Sensible Cooling



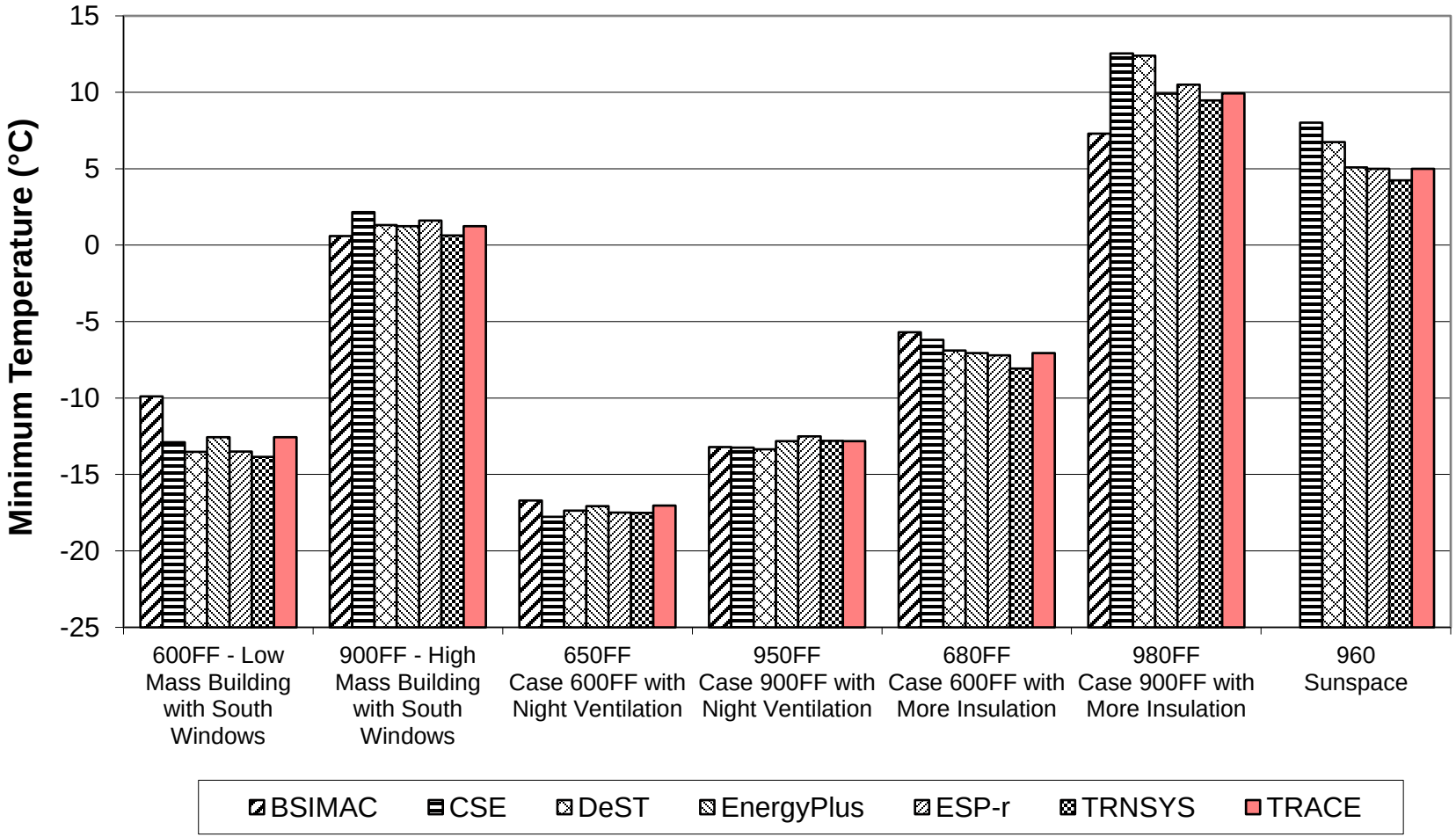
# Figure B8-33. Basic: Average Hourly Annual Temperature Free-Float Cases



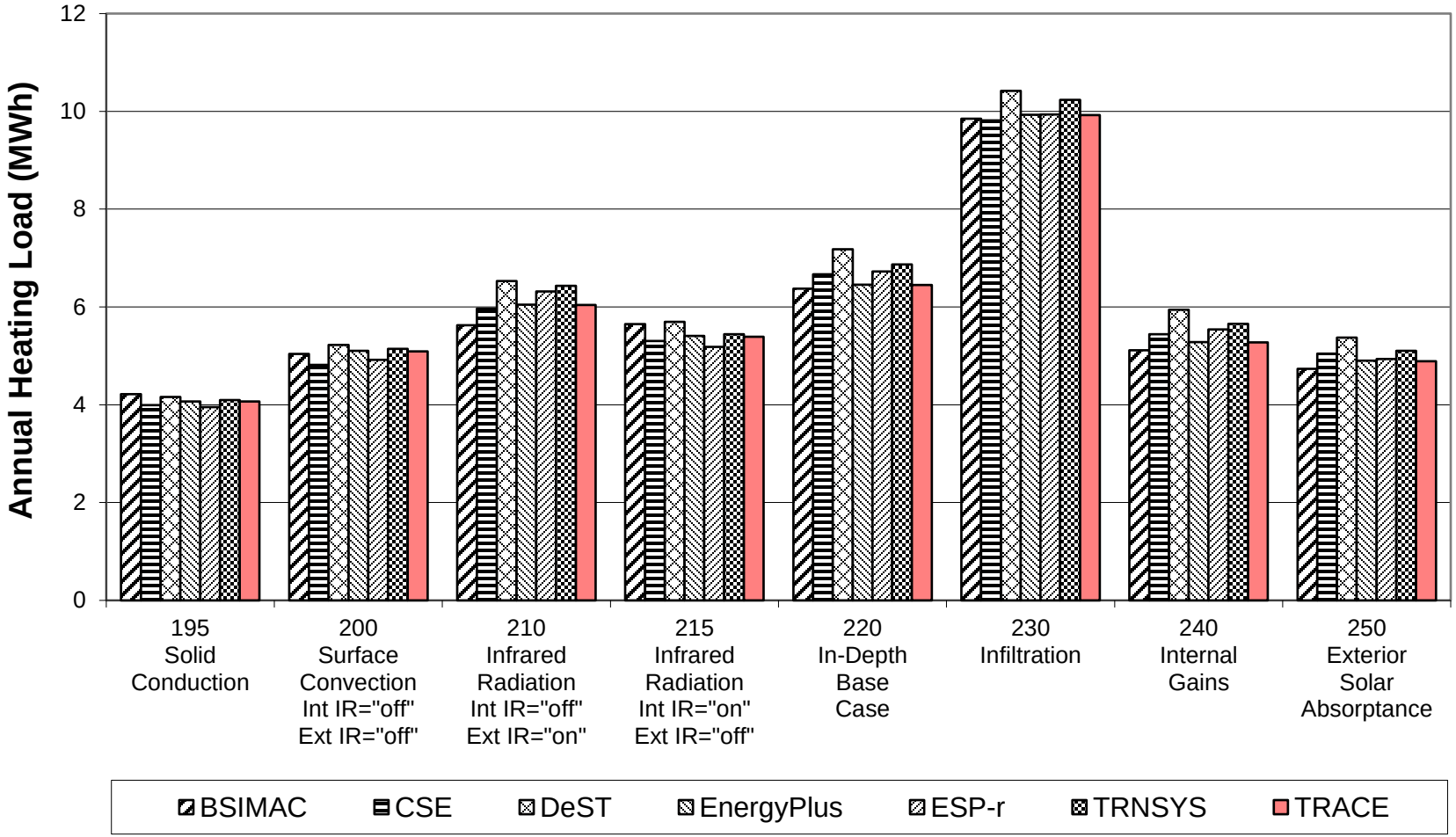
# Figure B8-34. Basic: Maximum Hourly Annual Temperature Free-Float Cases



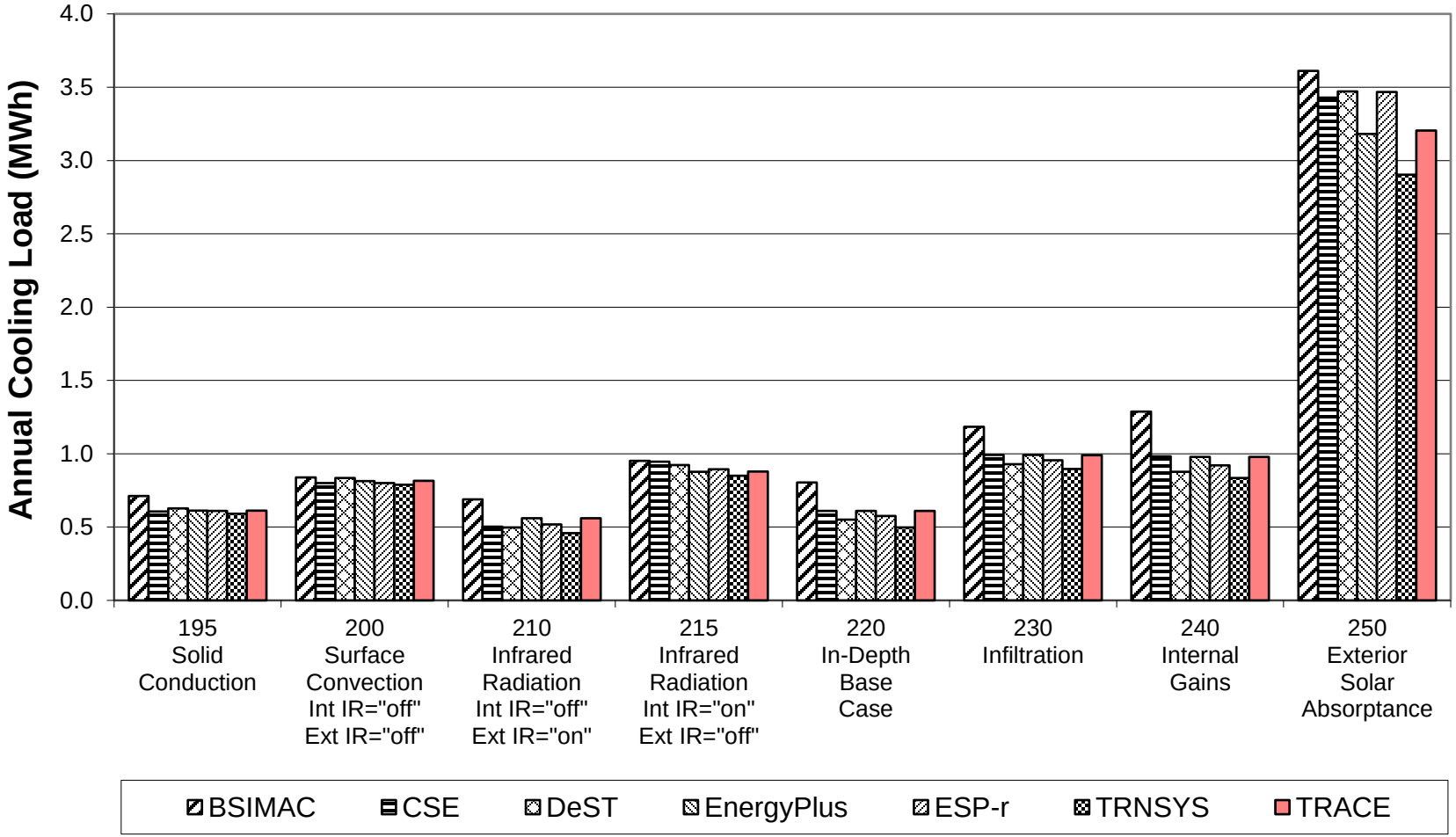
# Figure B8-35. Basic: Minimum Hourly Annual Temperature Free-Float Cases



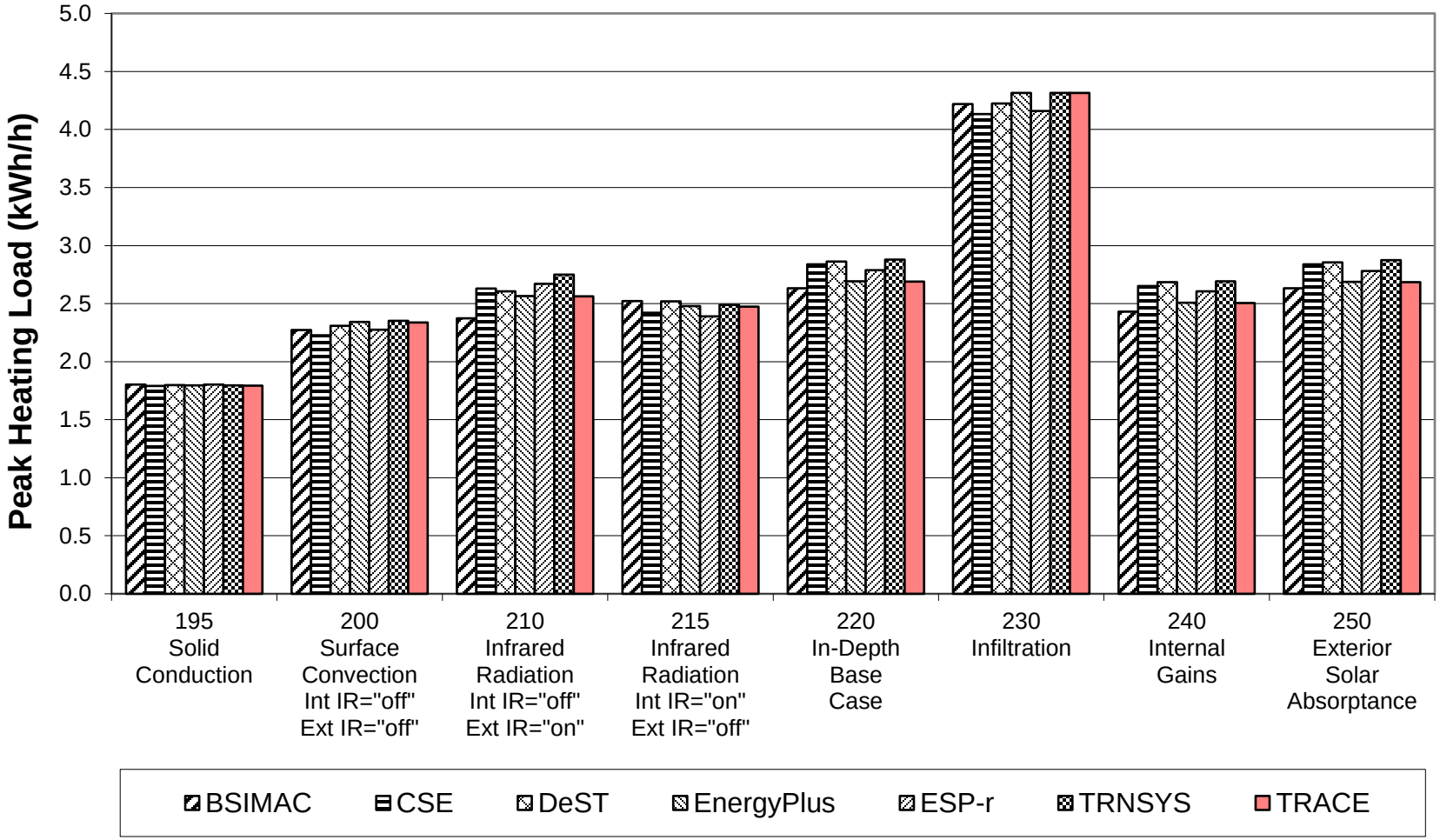
# Figure B8-36. In-Depth: Low Mass Cases 195 to 250 Annual Heating



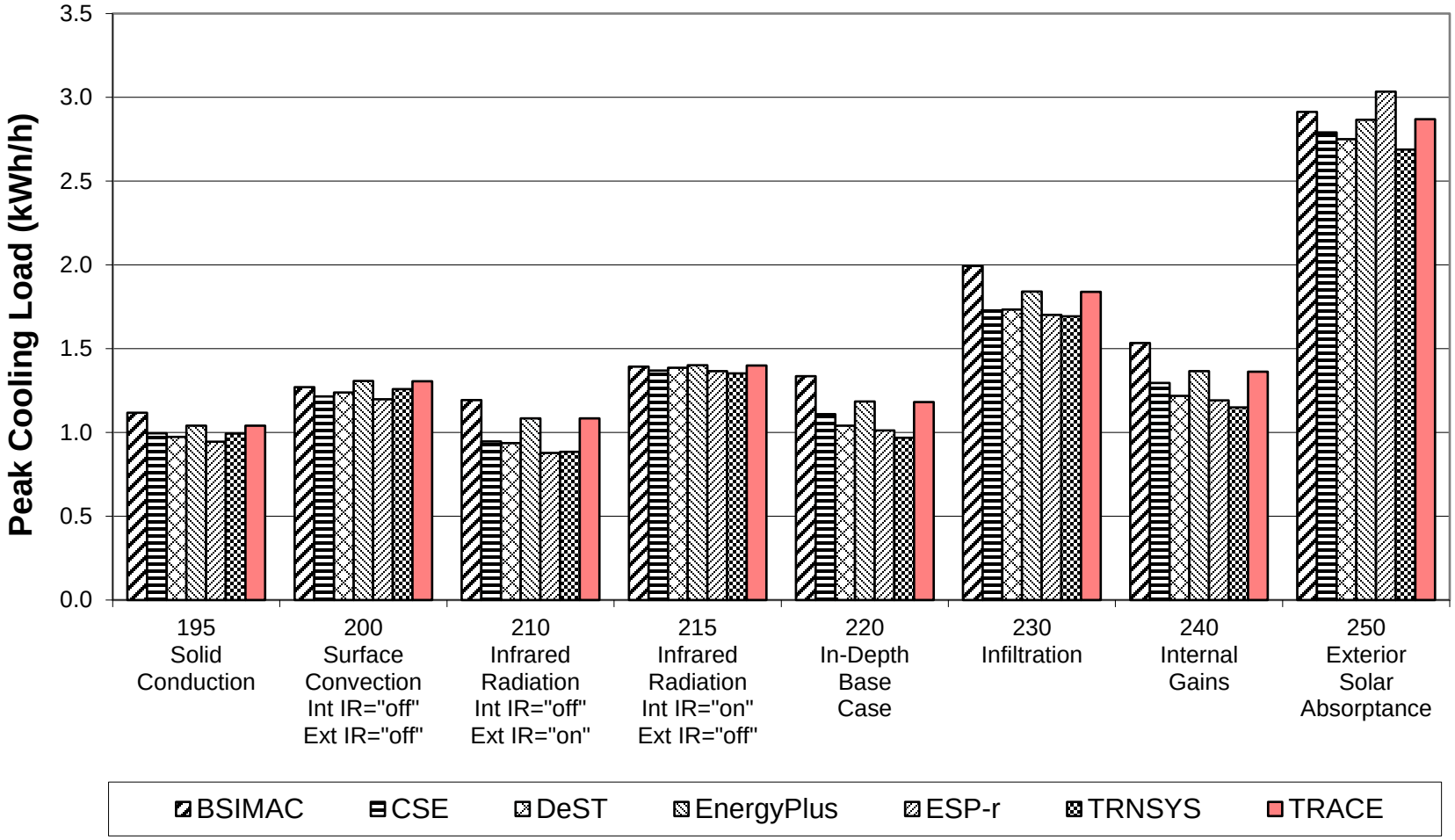
# Figure B8-37. In-Depth: Low Mass Cases 195 to 250 Annual Sensible Cooling



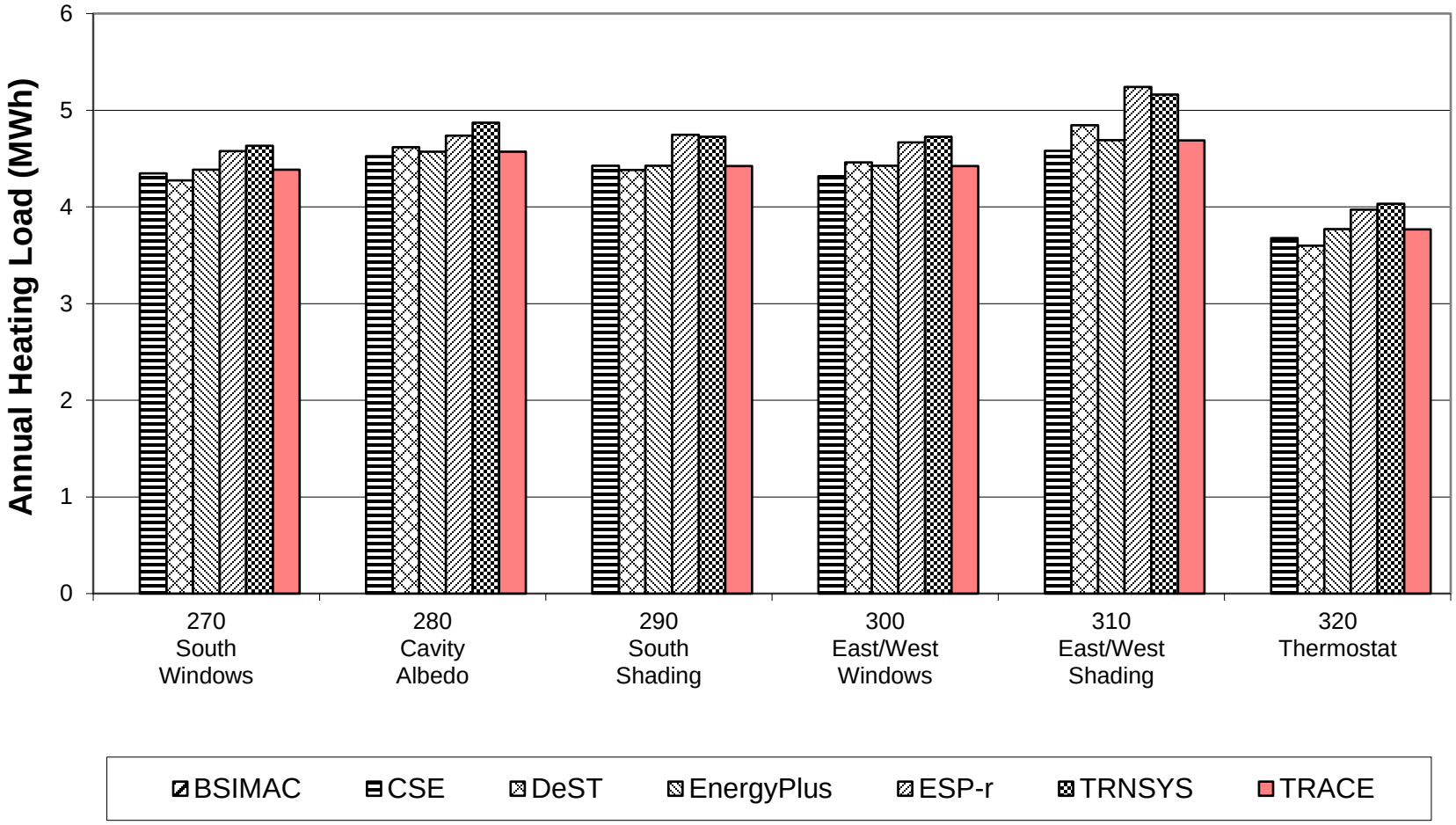
# Figure B8-38. In-Depth: Low Mass Cases 195 to 250 Peak Heating



# Figure B8-39. In-Depth: Low Mass Cases 195 to 250 Peak Sensible Cooling



# Figure B8-40. In-Depth: Low Mass Cases 270 to 320 Annual Heating



# Figure B8-41. In-Depth: Low Mass Cases 270 to 320 Annual Sensible Cooling

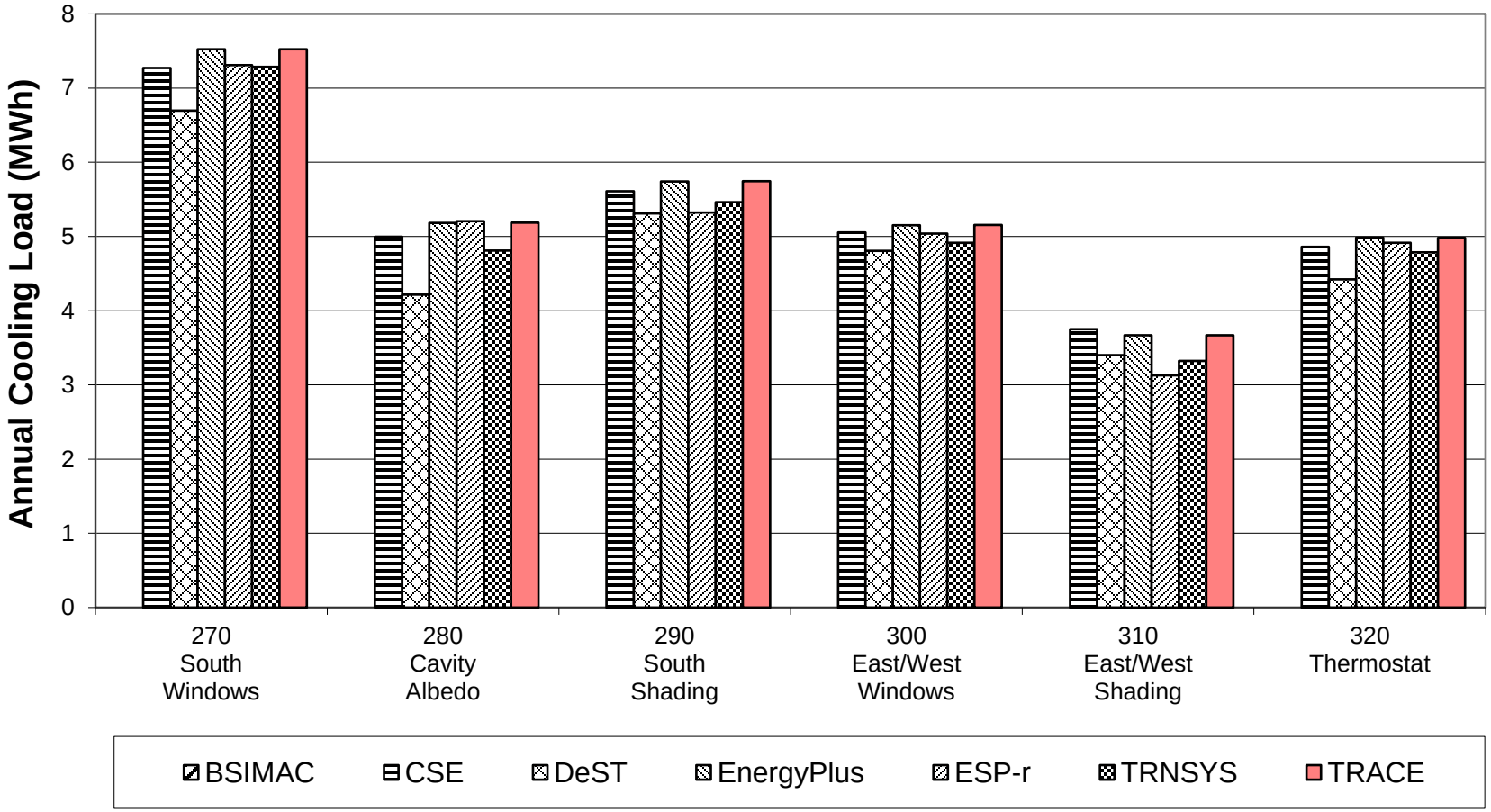
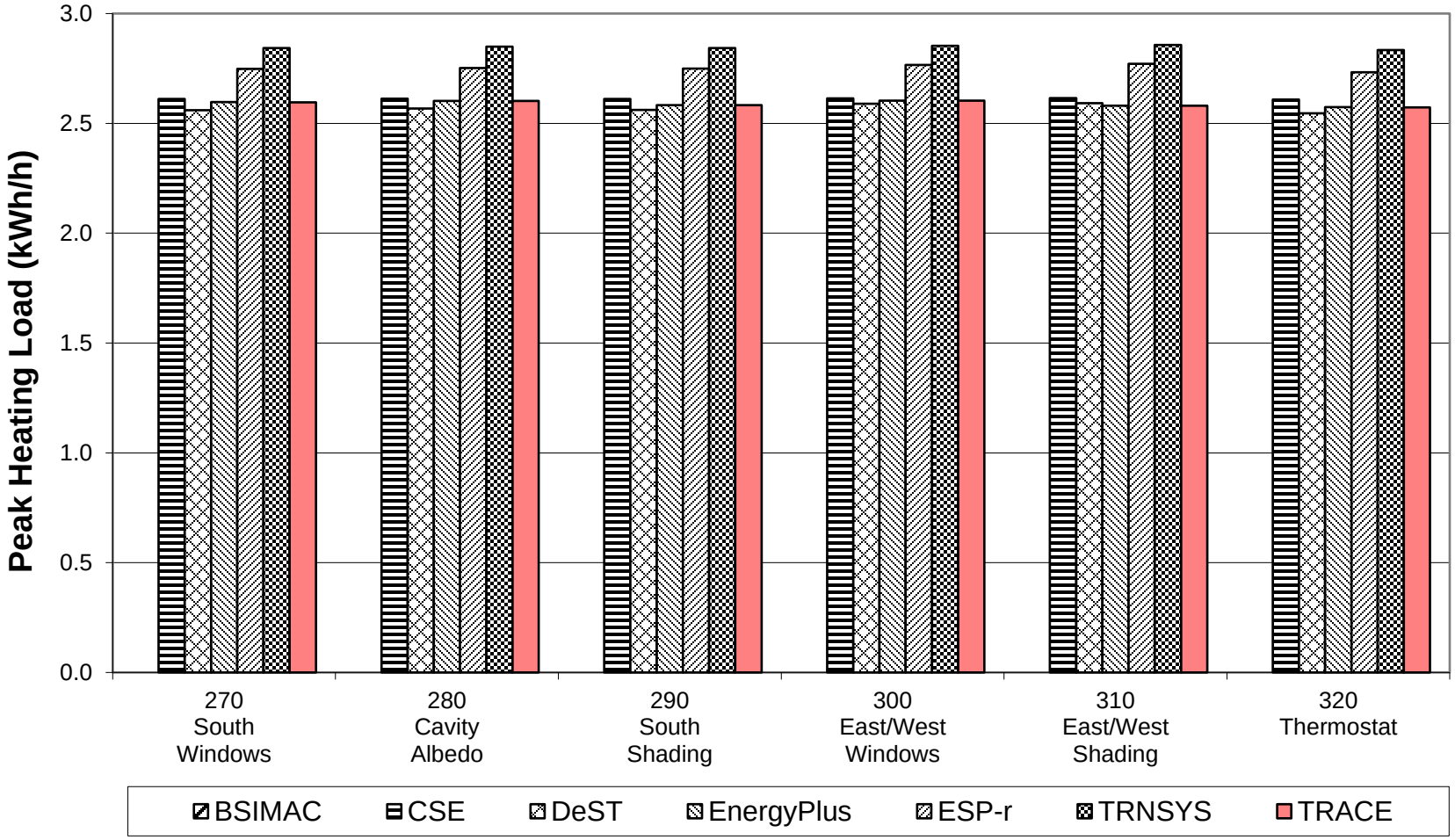
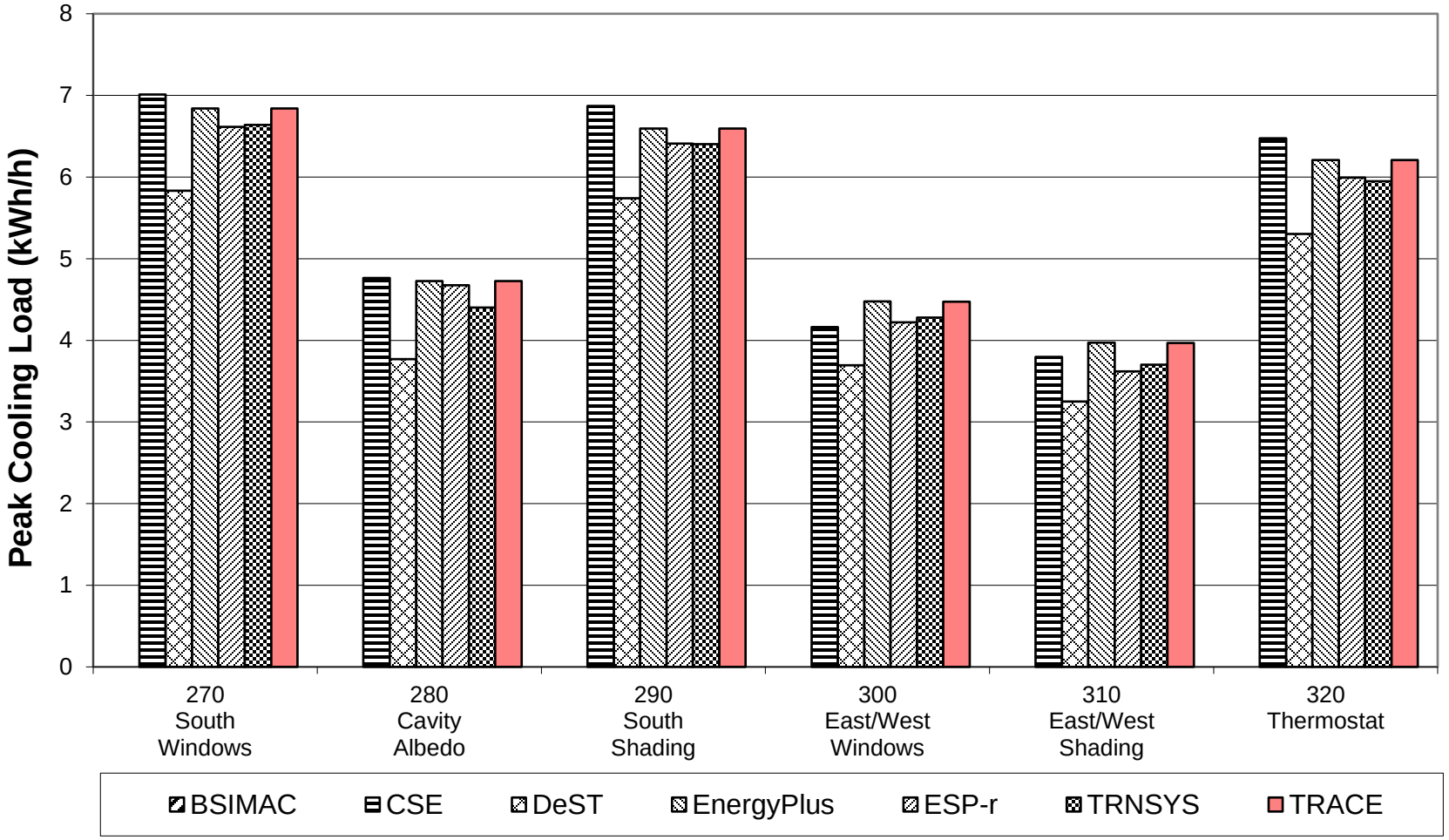


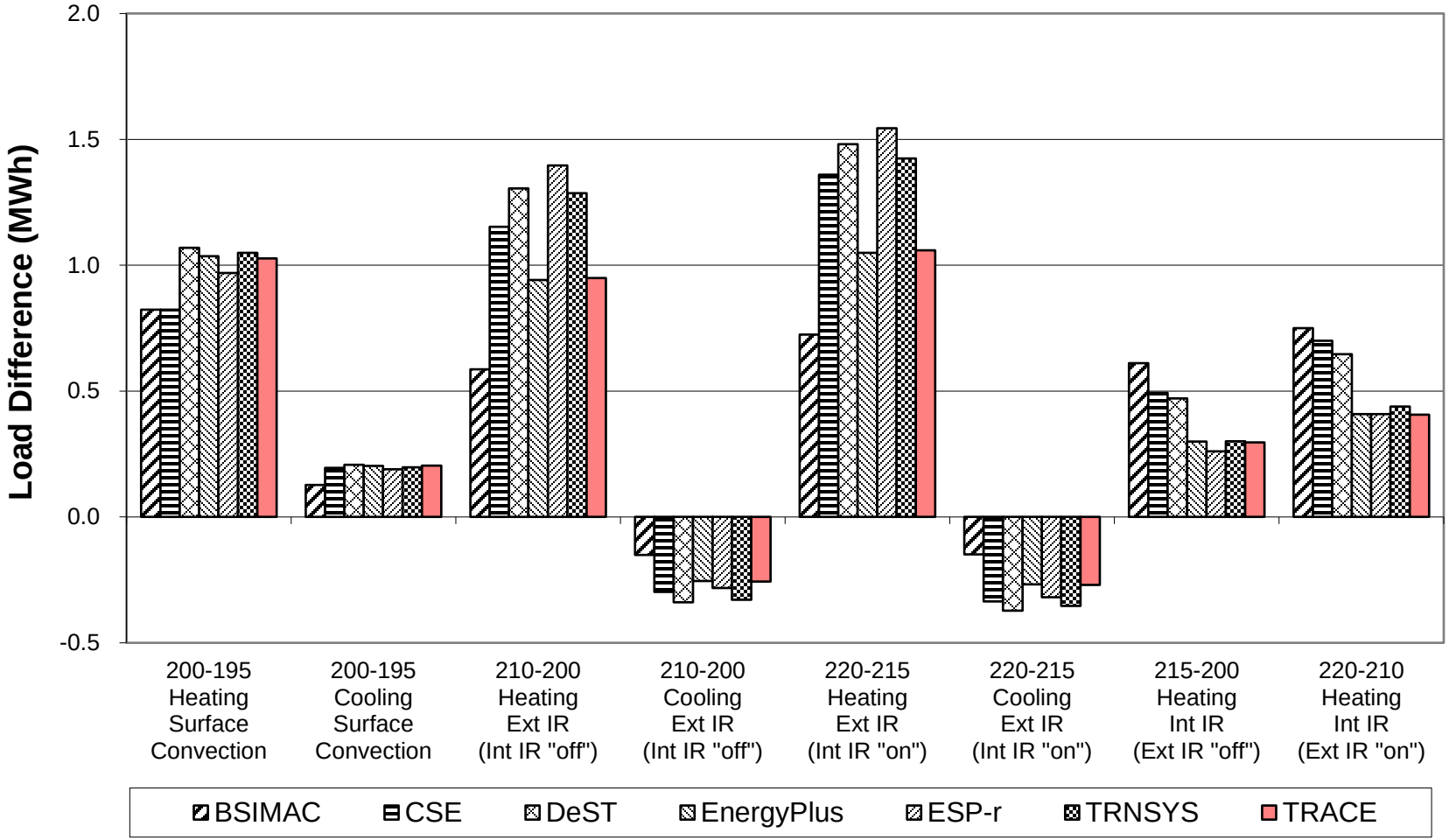
**Figure B8-42. In-Depth:
Low Mass Cases 270 to 320
Peak Heating**



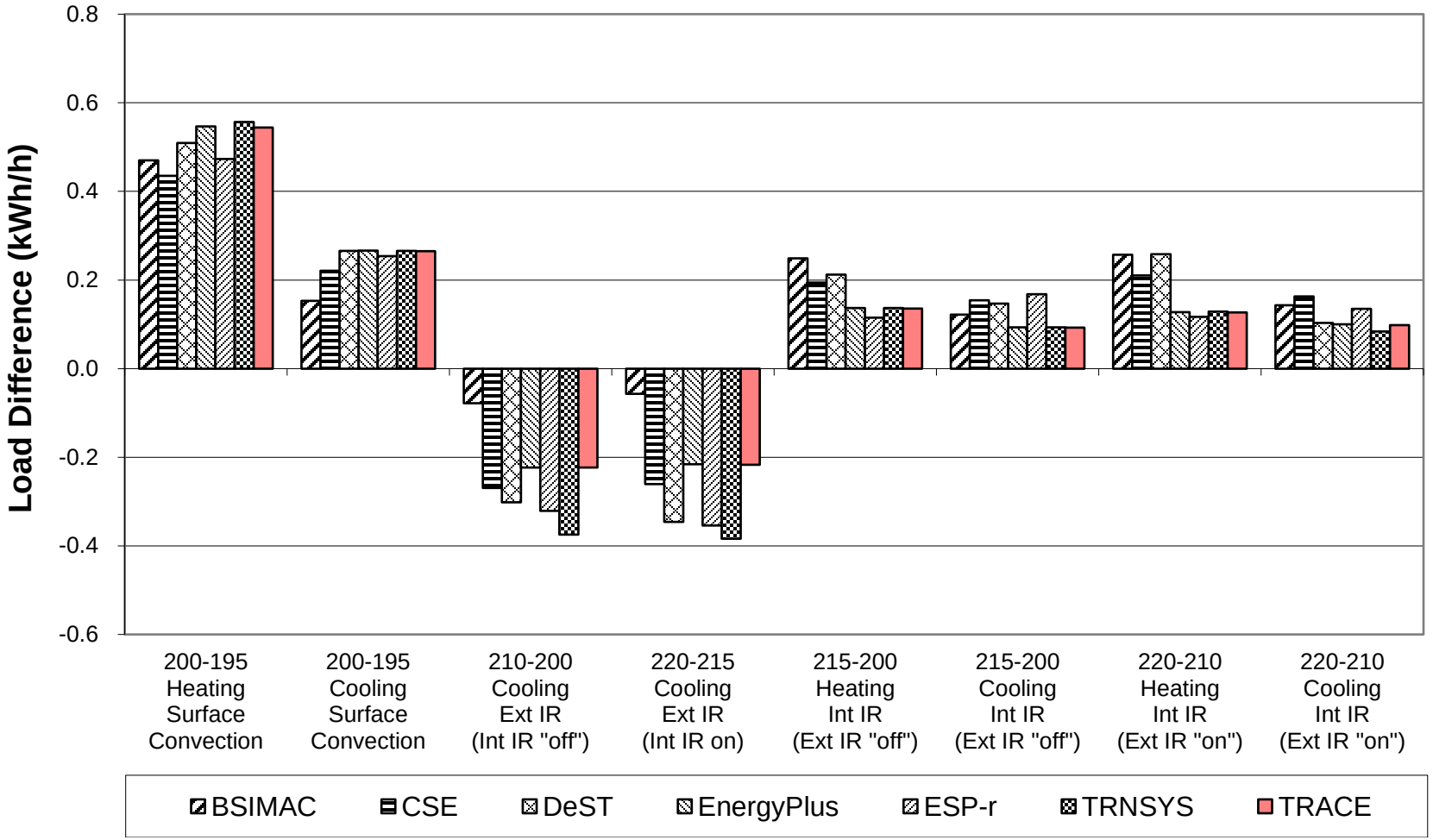
# Figure B8-43. In-Depth: Low Mass Cases 270 to 320 Peak Sensible Cooling



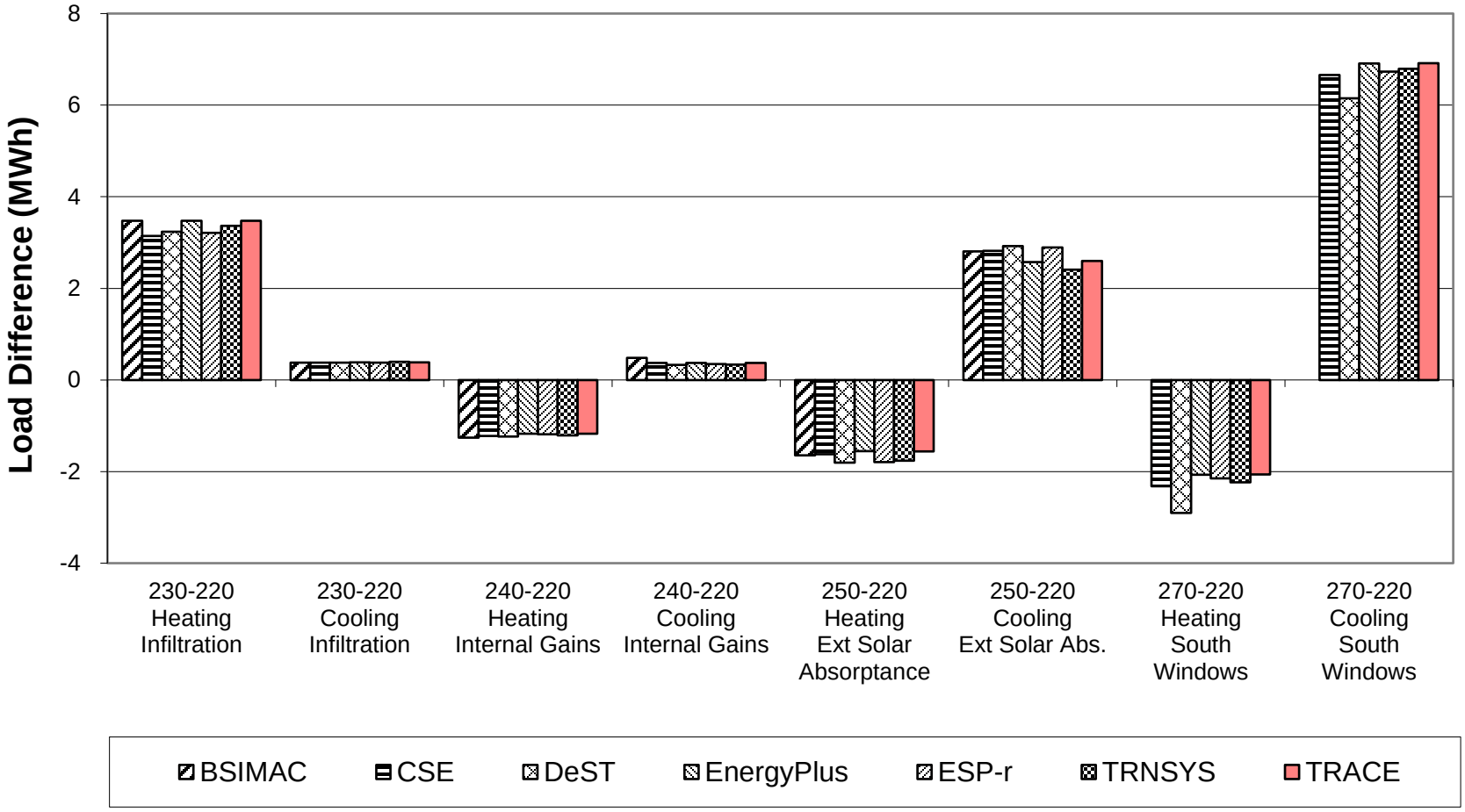
# Figure B8-44. In-Depth: Cases 195 to 220 (Delta) Annual Heating and Sensible Cooling



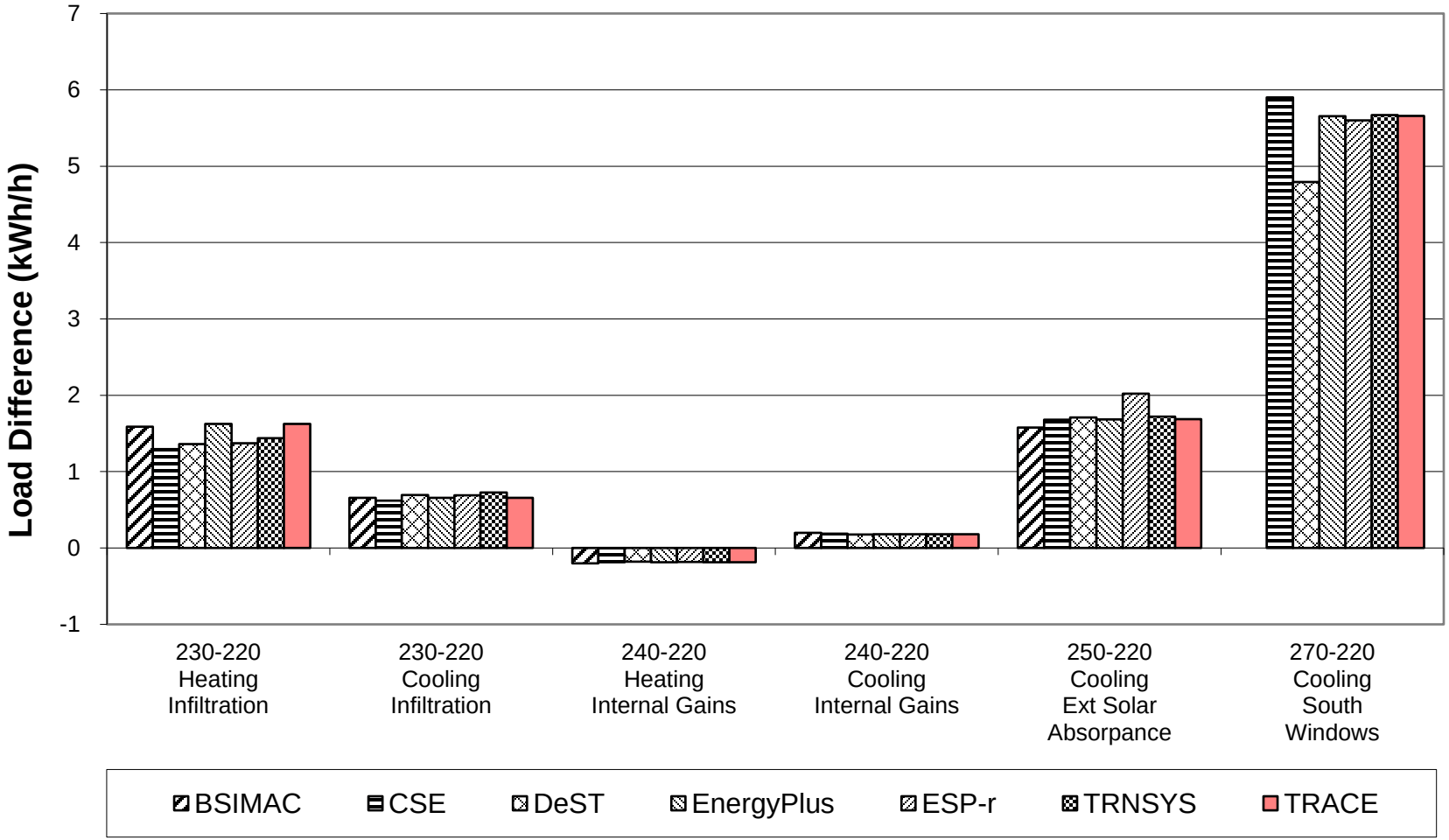
# Figure B8-45. In-Depth: Cases 195 to 220 (Delta) Peak Heating and Sensible Cooling



# Figure B8-46. In-Depth: Cases 220 to 270 (Delta) Annual Heating and Sensible Cooling



# Figure B8-47. In-Depth: Cases 220 to 270 (Delta) Peak Heating and Sensible Cooling



# Figure B8-48. In-Depth: Cases 270 to 320 (Delta) Annual Heating and Sensible Cooling

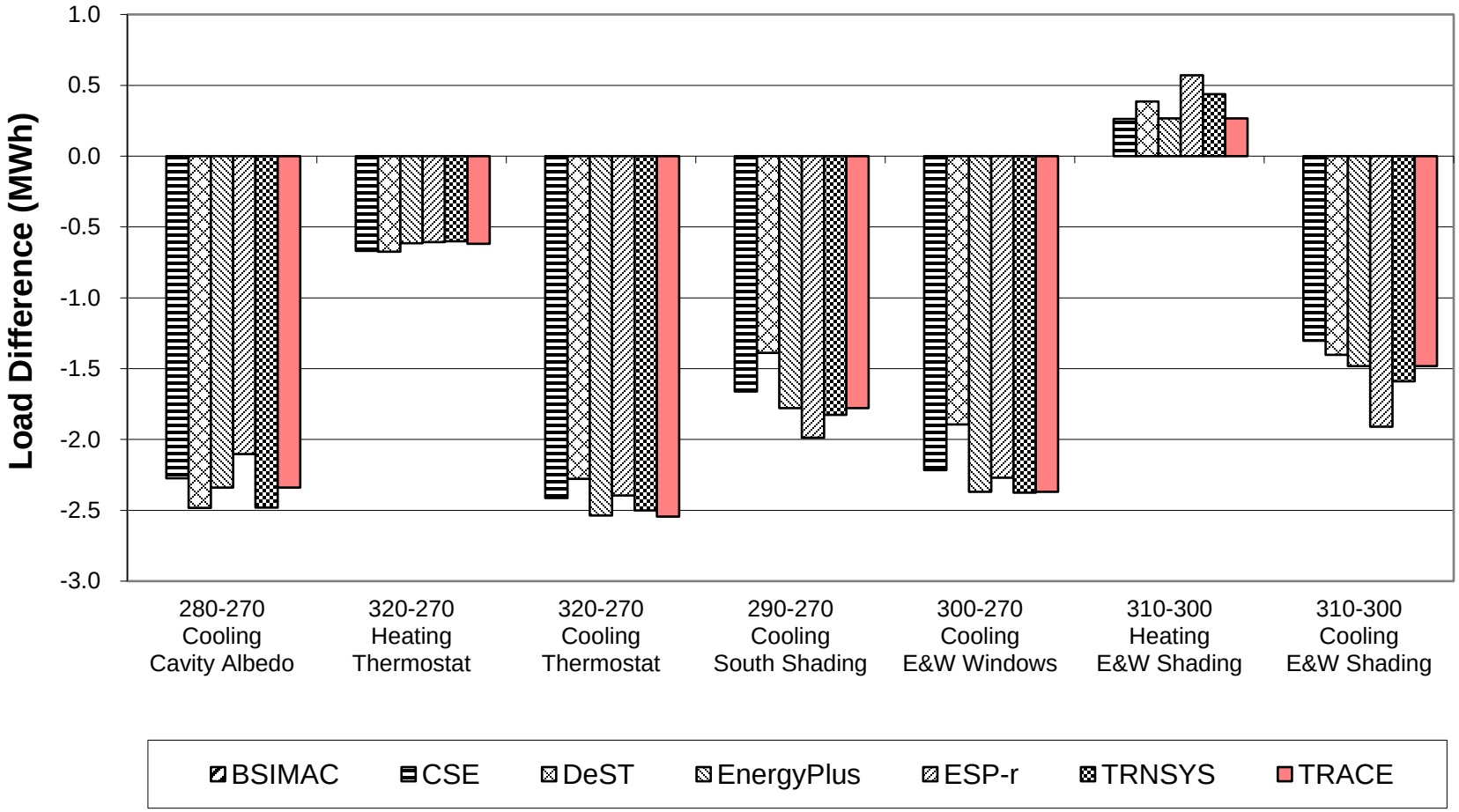
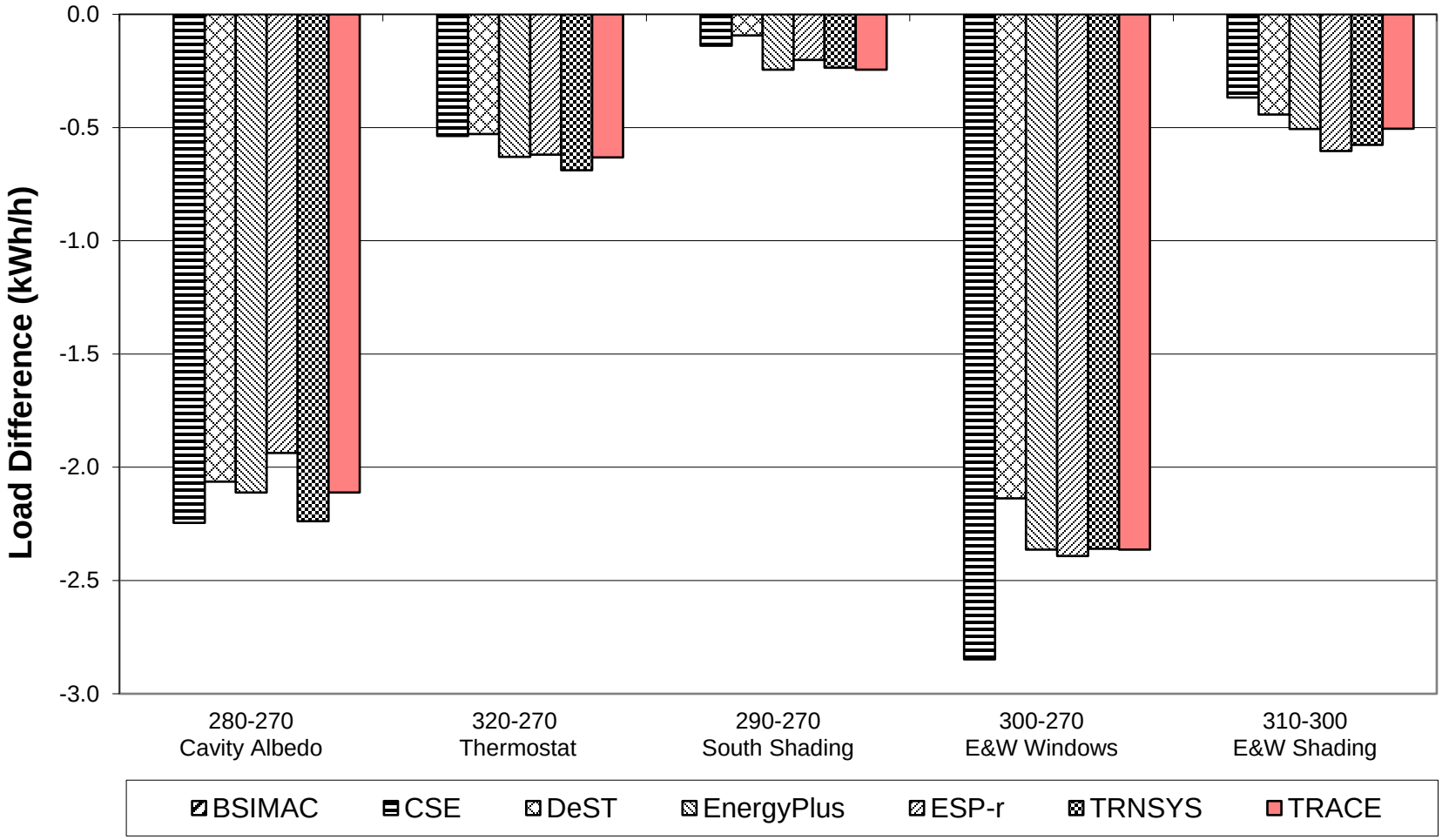
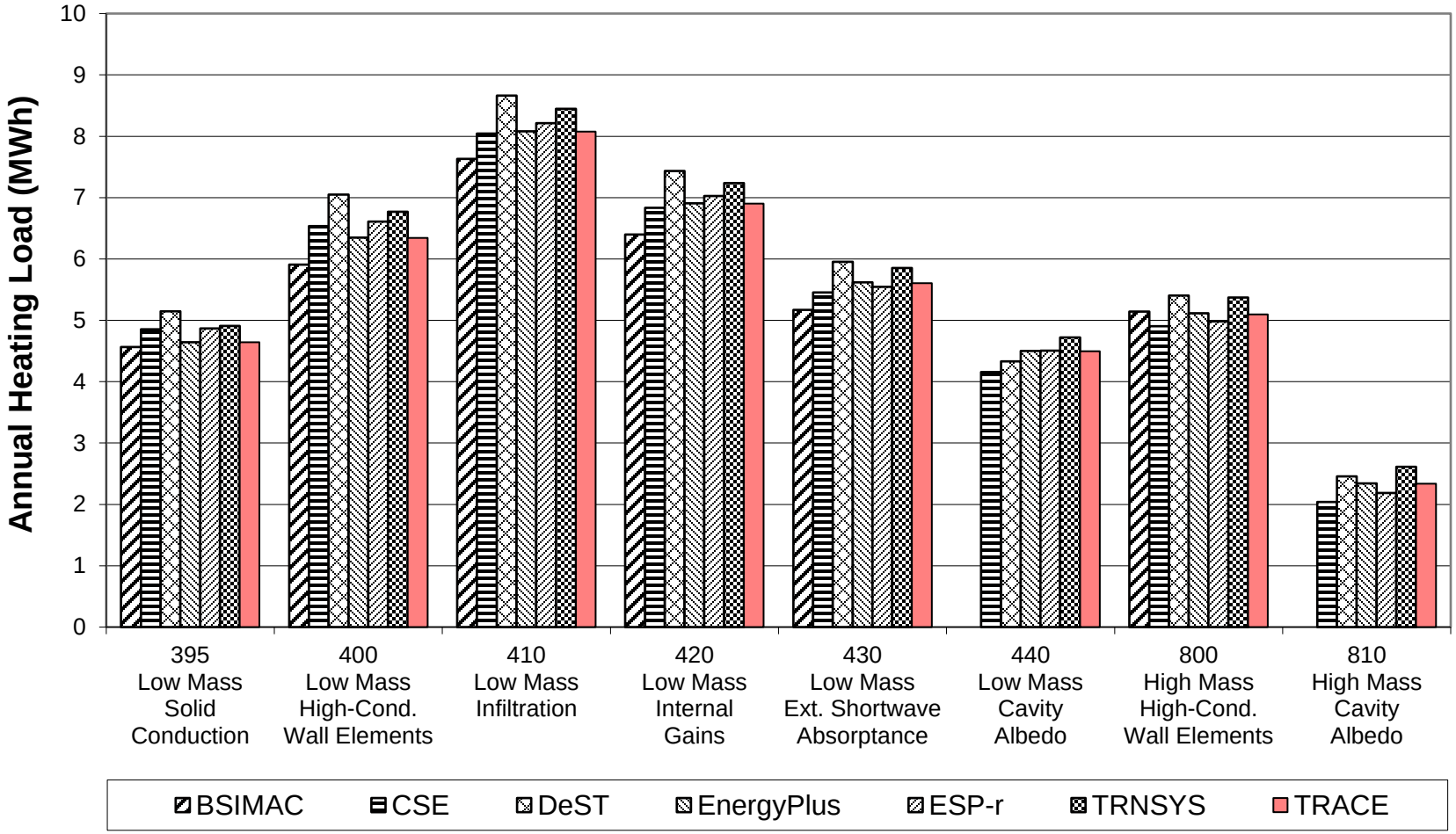


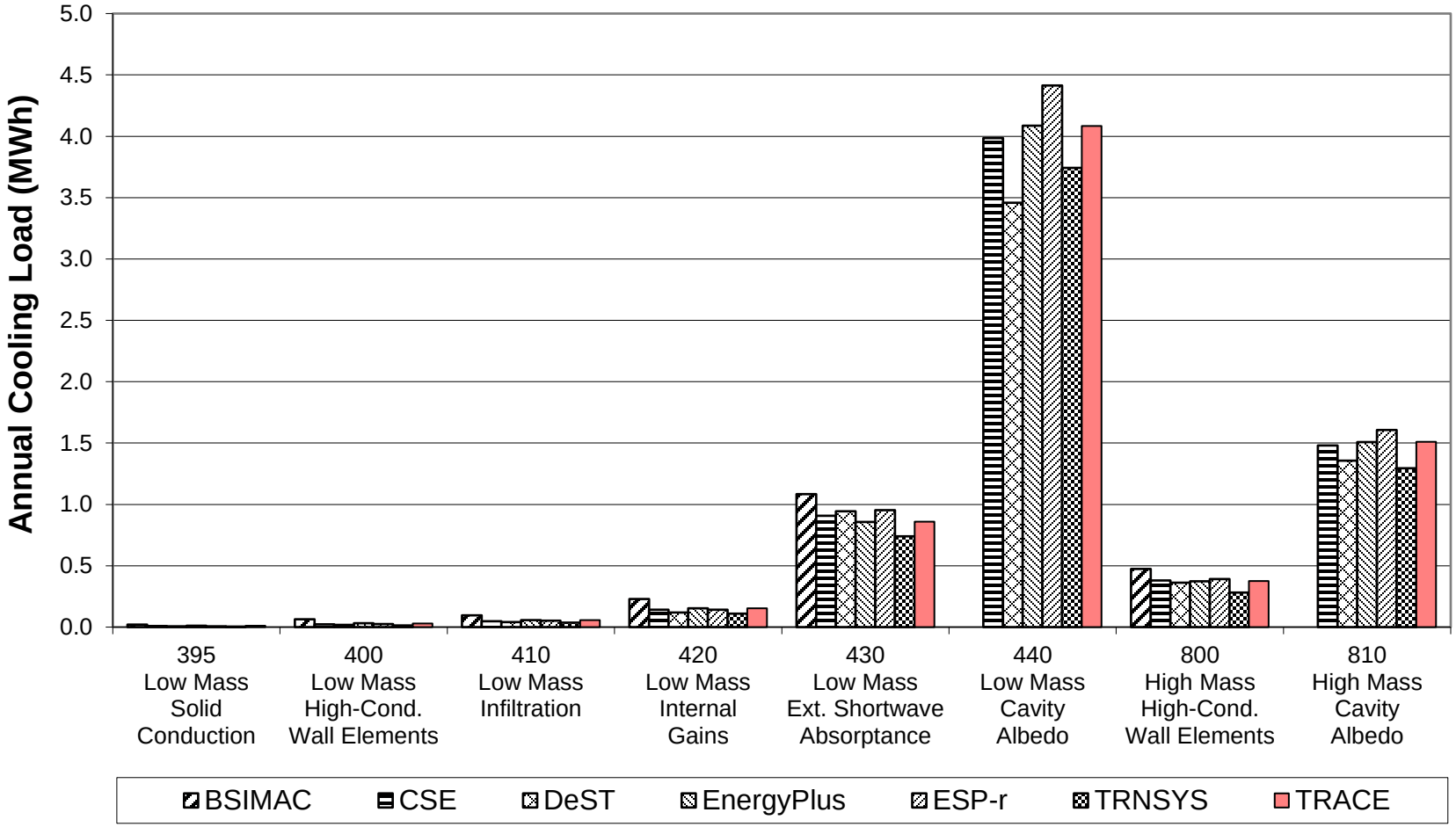
**Figure B8-49. In-Depth: Cases 270 to 320 (Delta) Peak Sensible Cooling**



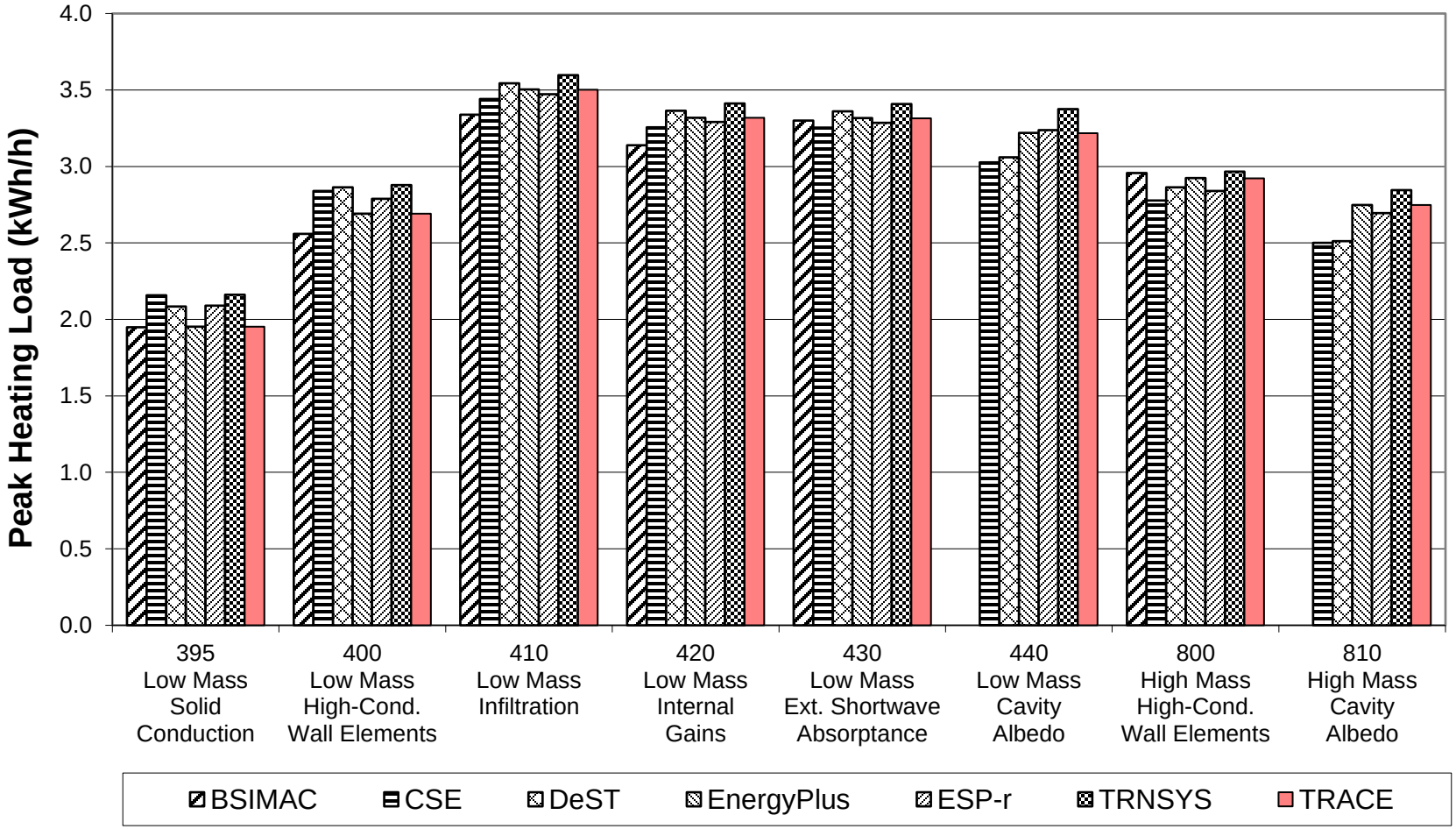
# Figure B8-50. In-Depth: Cases 395 to 440, 800, 810 Annual Heating



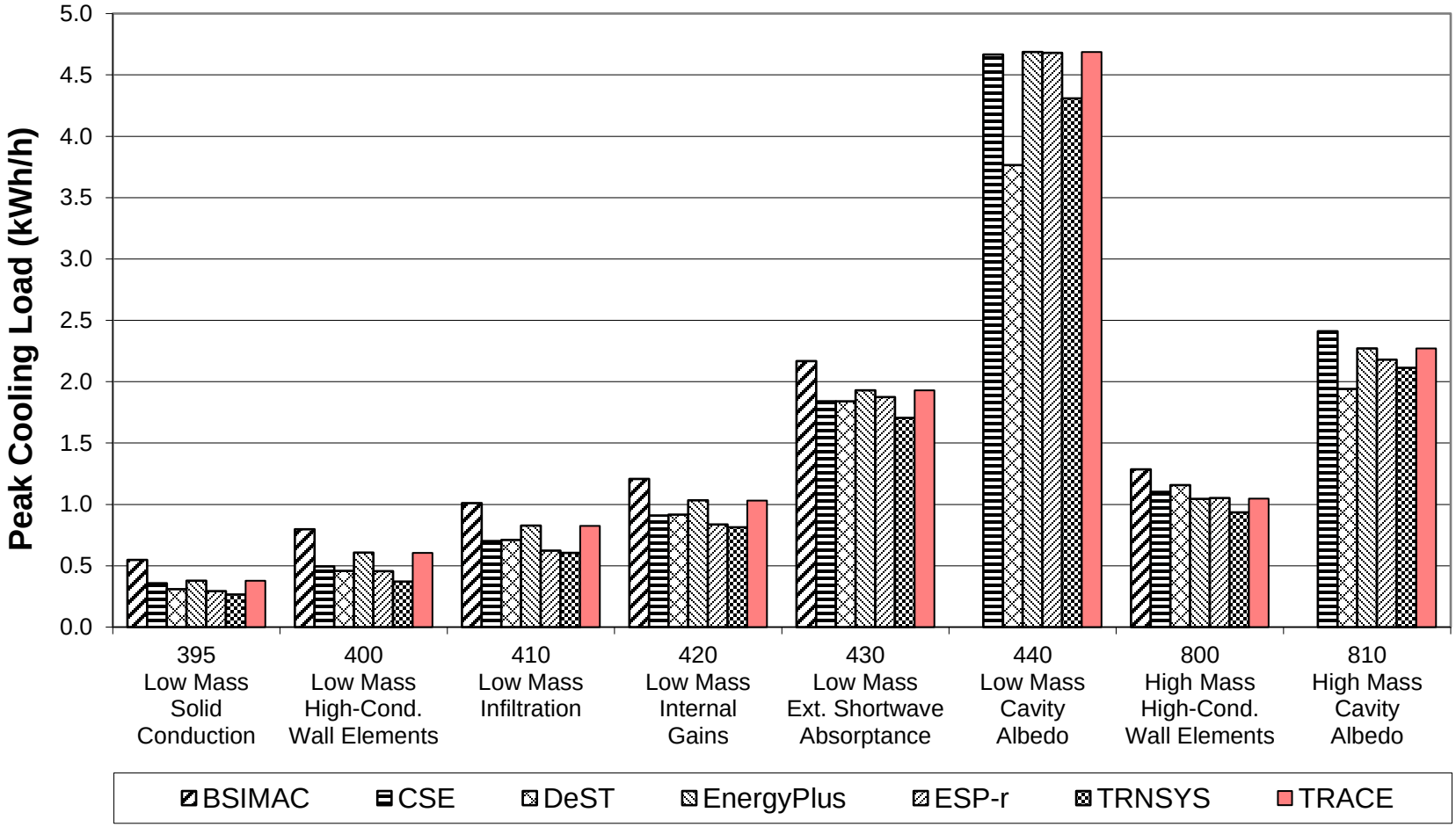
# Figure B8-51. In-Depth: Cases 395 to 440, 800, 810 Annual Sensible Cooling



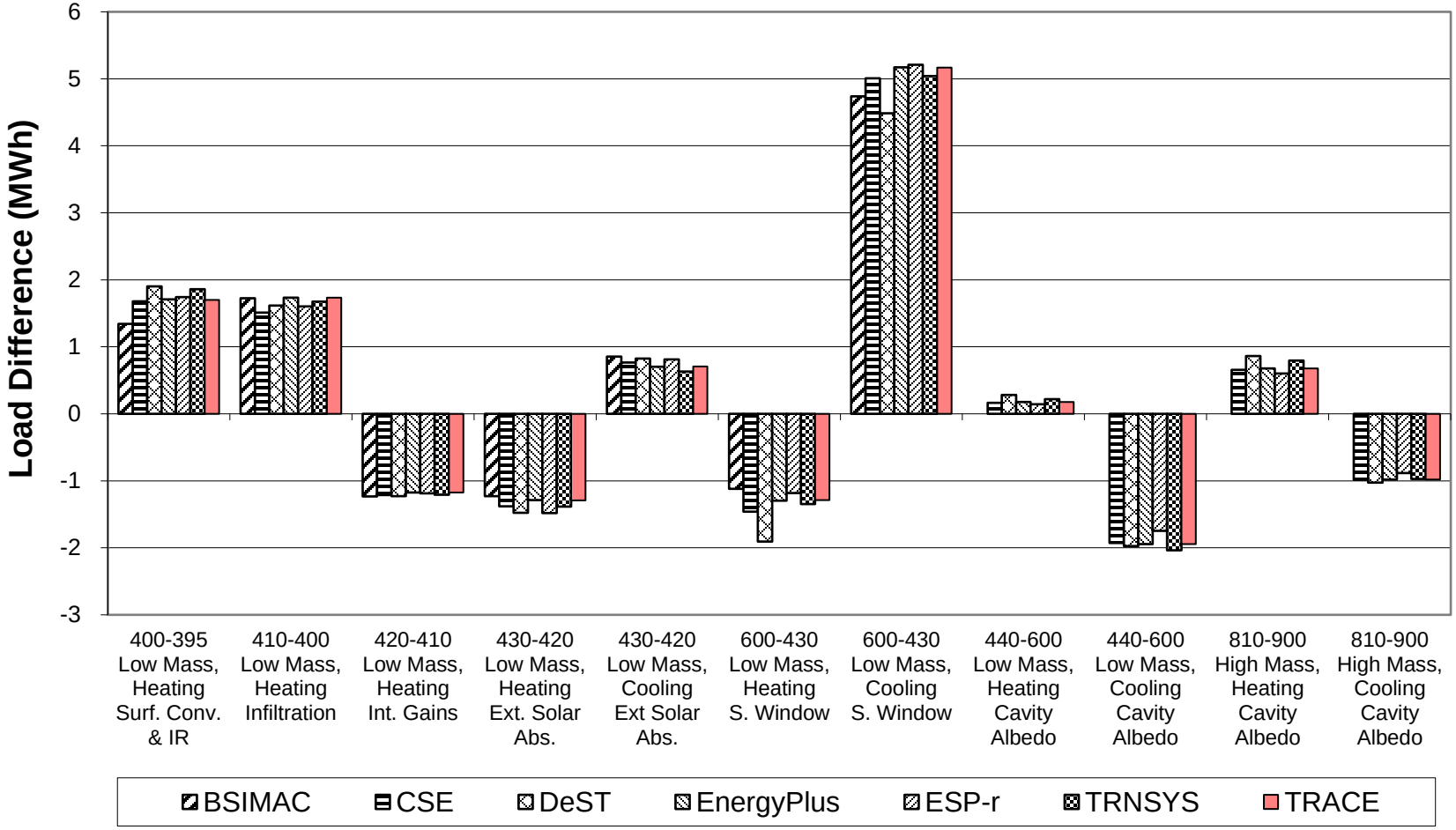
## Figure B8-52. In-Depth: Cases 395 to 440, 800, 810 Peak Heating



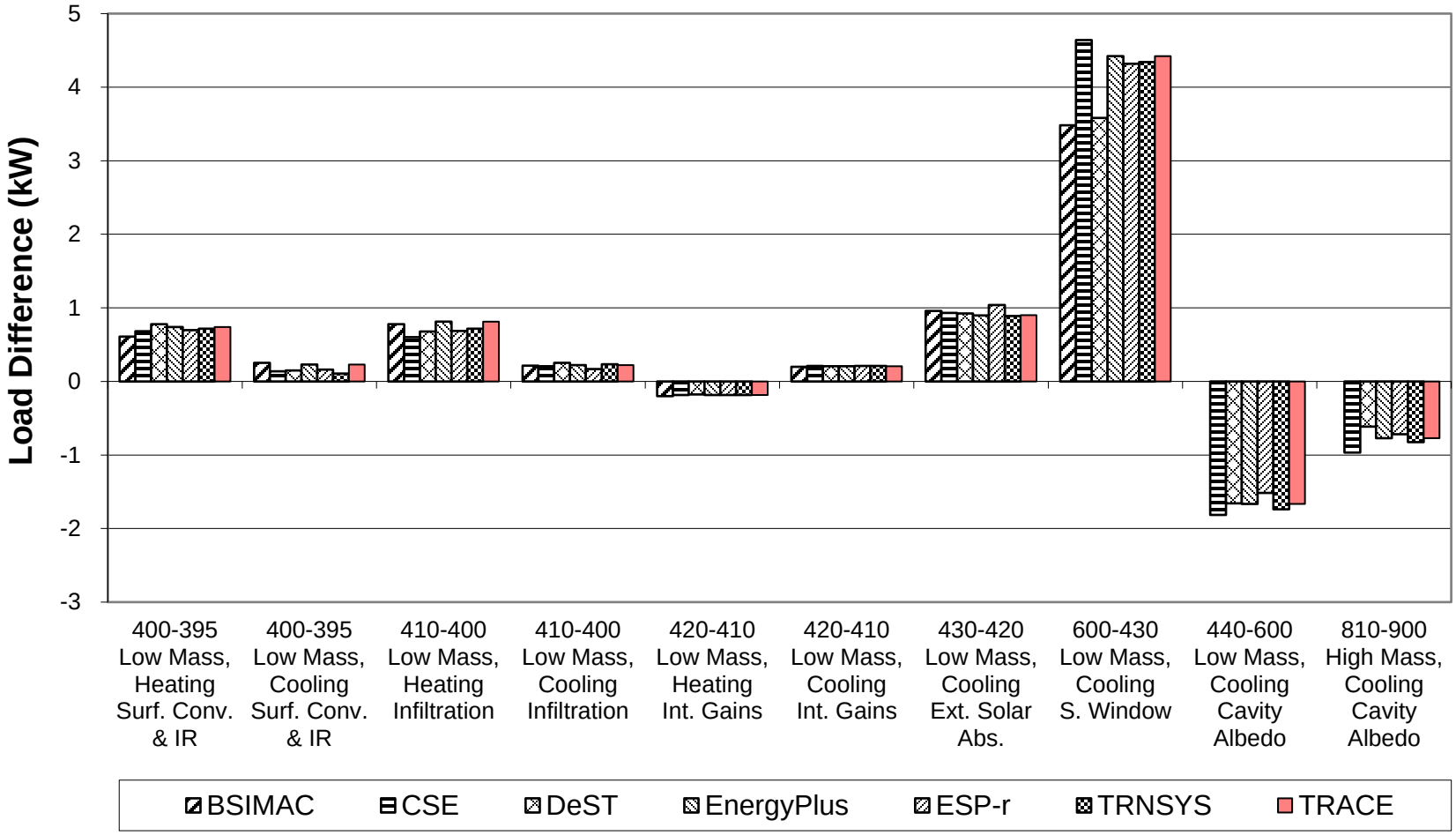
# Figure B8-53. In-Depth: Cases 395 to 440, 800, 810 Peak Sensible Cooling



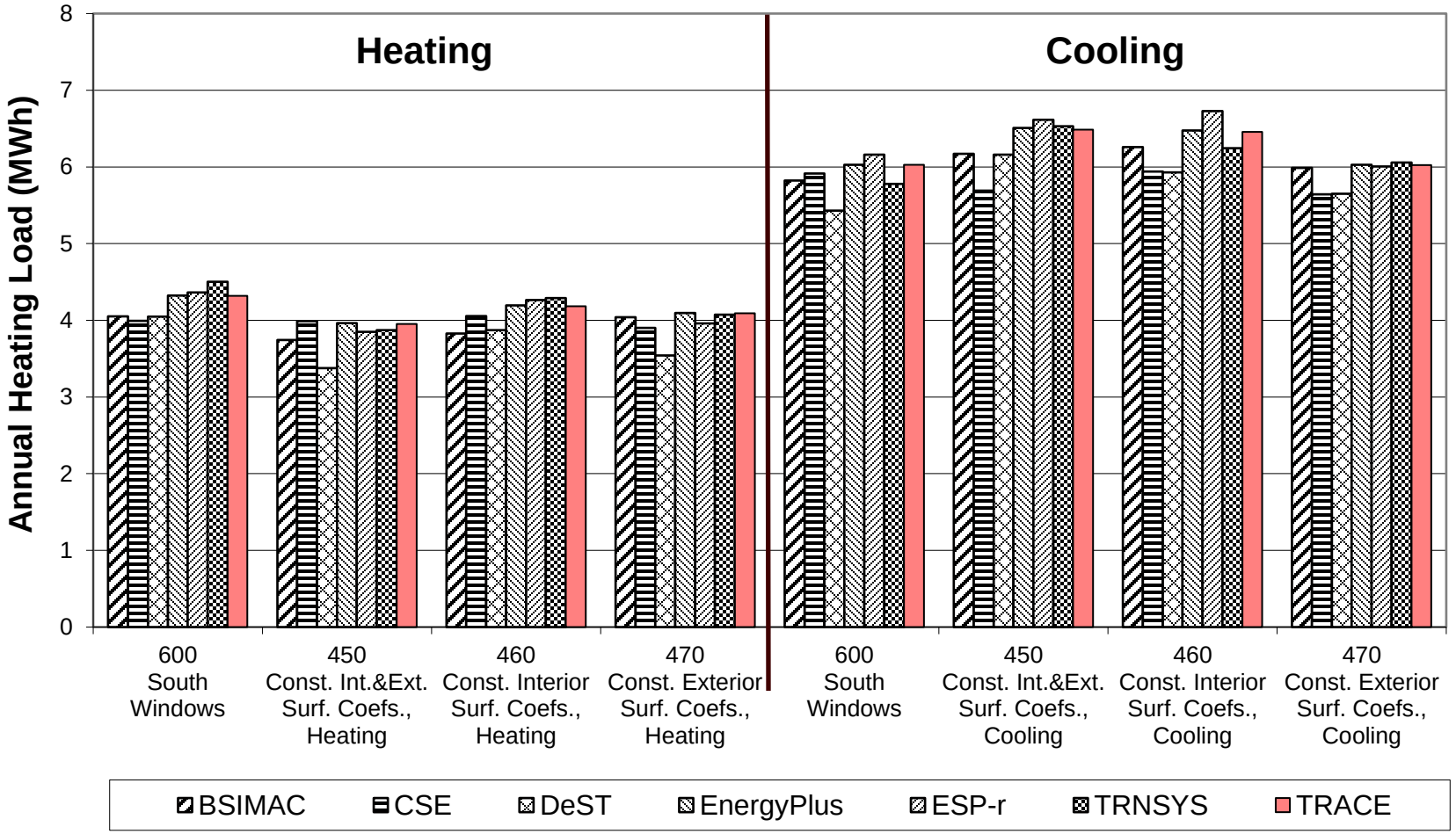
# Figure B8-54. In-Depth: Cases 395 to 600, 810 to 900 (Delta) Annual Heating and Sensible Cooling



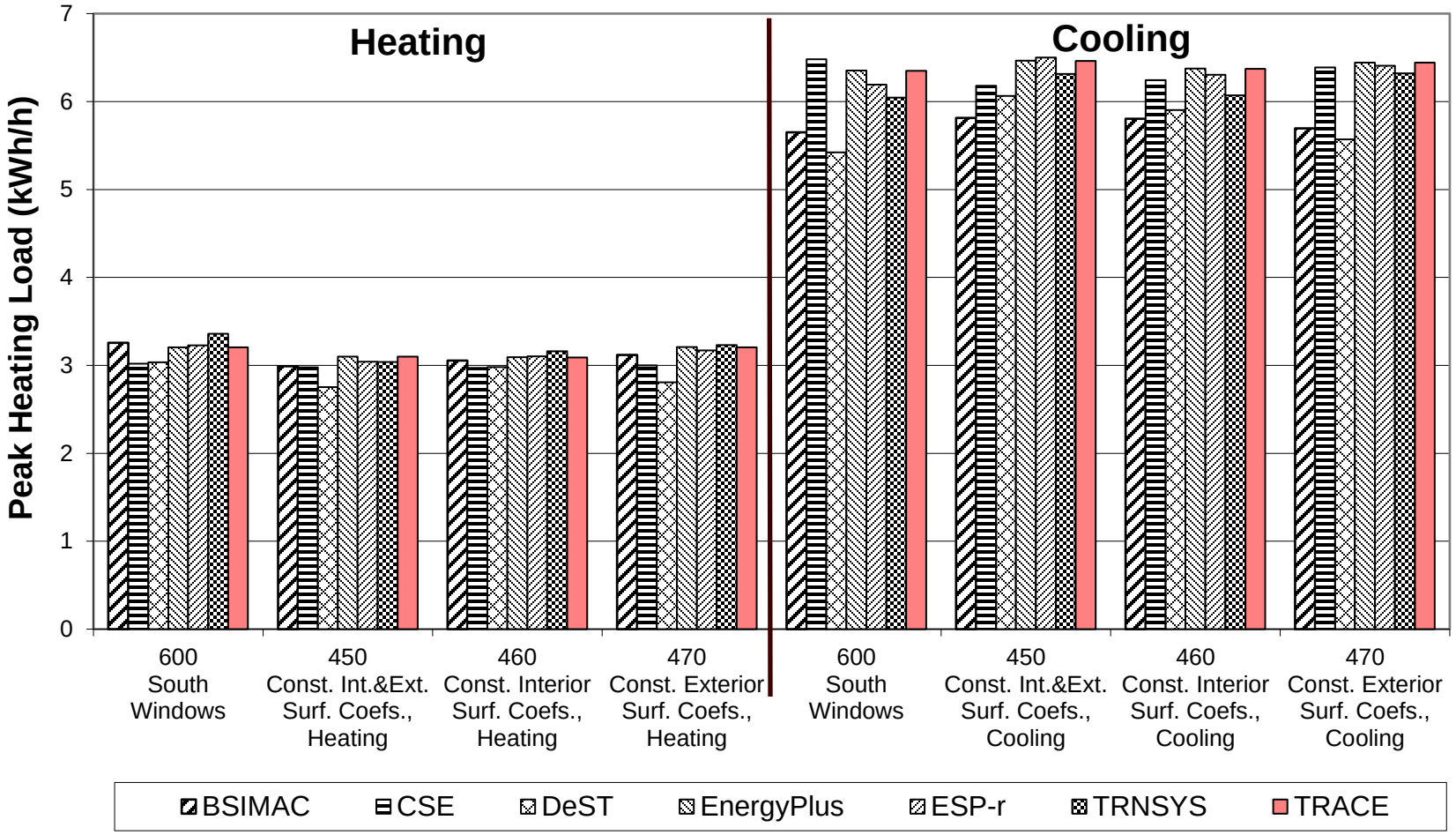
# Figure B8-55. In-Depth: Cases 395 to 600, 810 to 900 (Delta) Peak Heating and Sensible Cooling



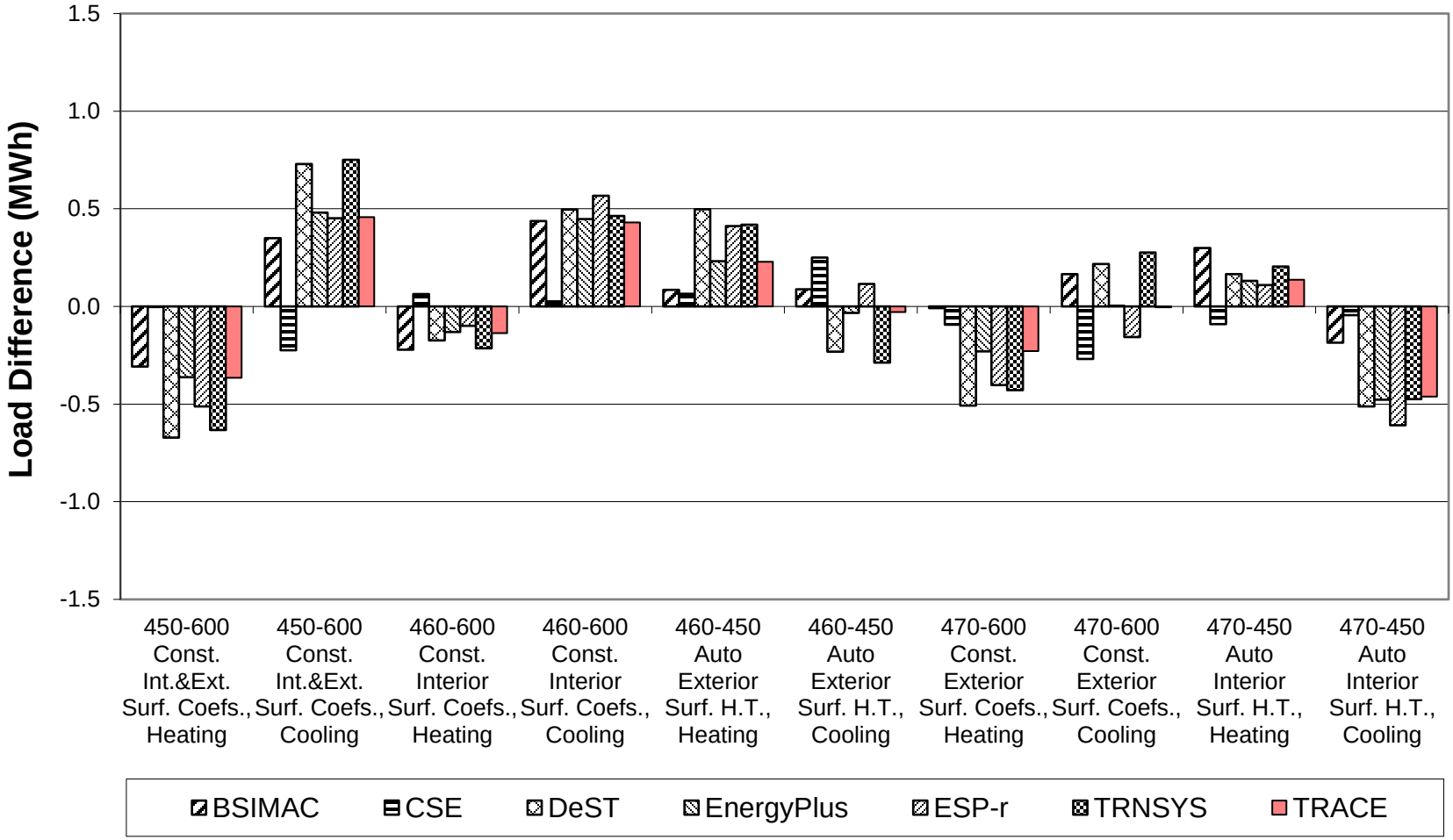
# Figure B8-56. In-Depth: Surface Heat Transfer Cases 600, 450, 460, 470 Annual Heating and Sensible Cooling



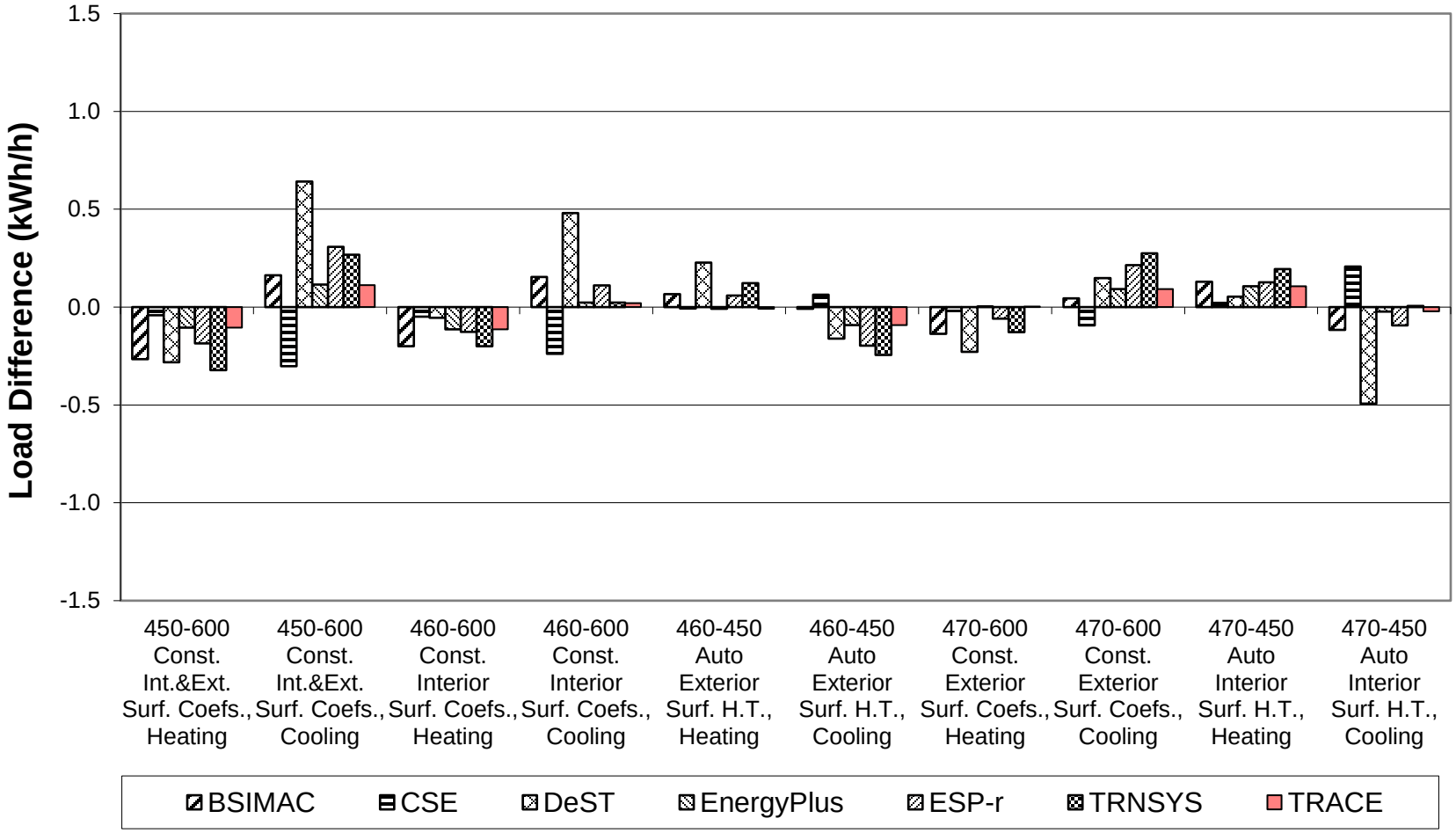
# Figure B8-57. In-Depth: Surface Heat Transfer Cases 600, 450, 460, 470 Peak Heating and Sensible Cooling



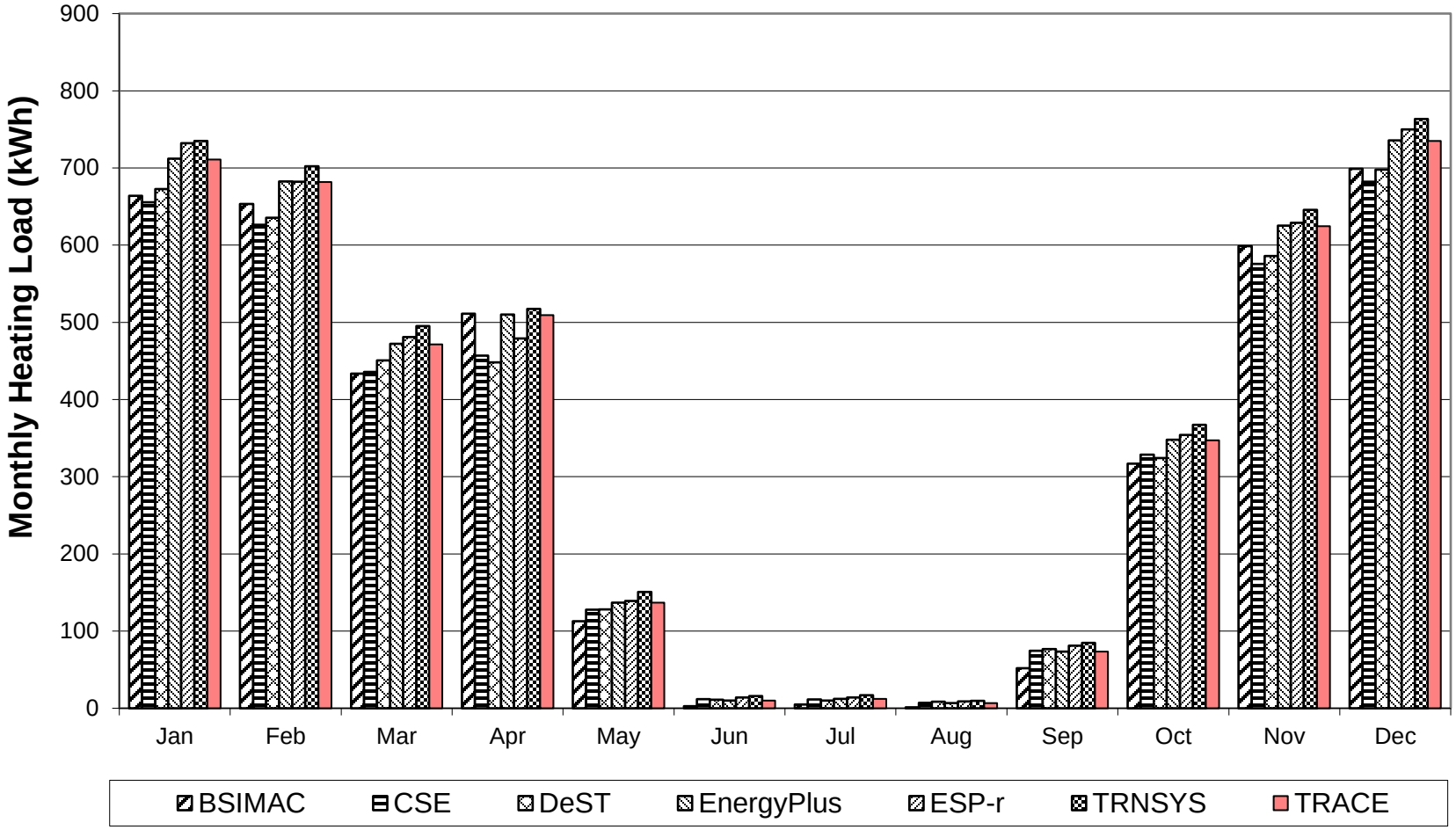
# Figure B8-58. In-Depth: Surface Heat Transfer Cases 450 to 600 (Delta) Annual Heating and Sensible Cooling



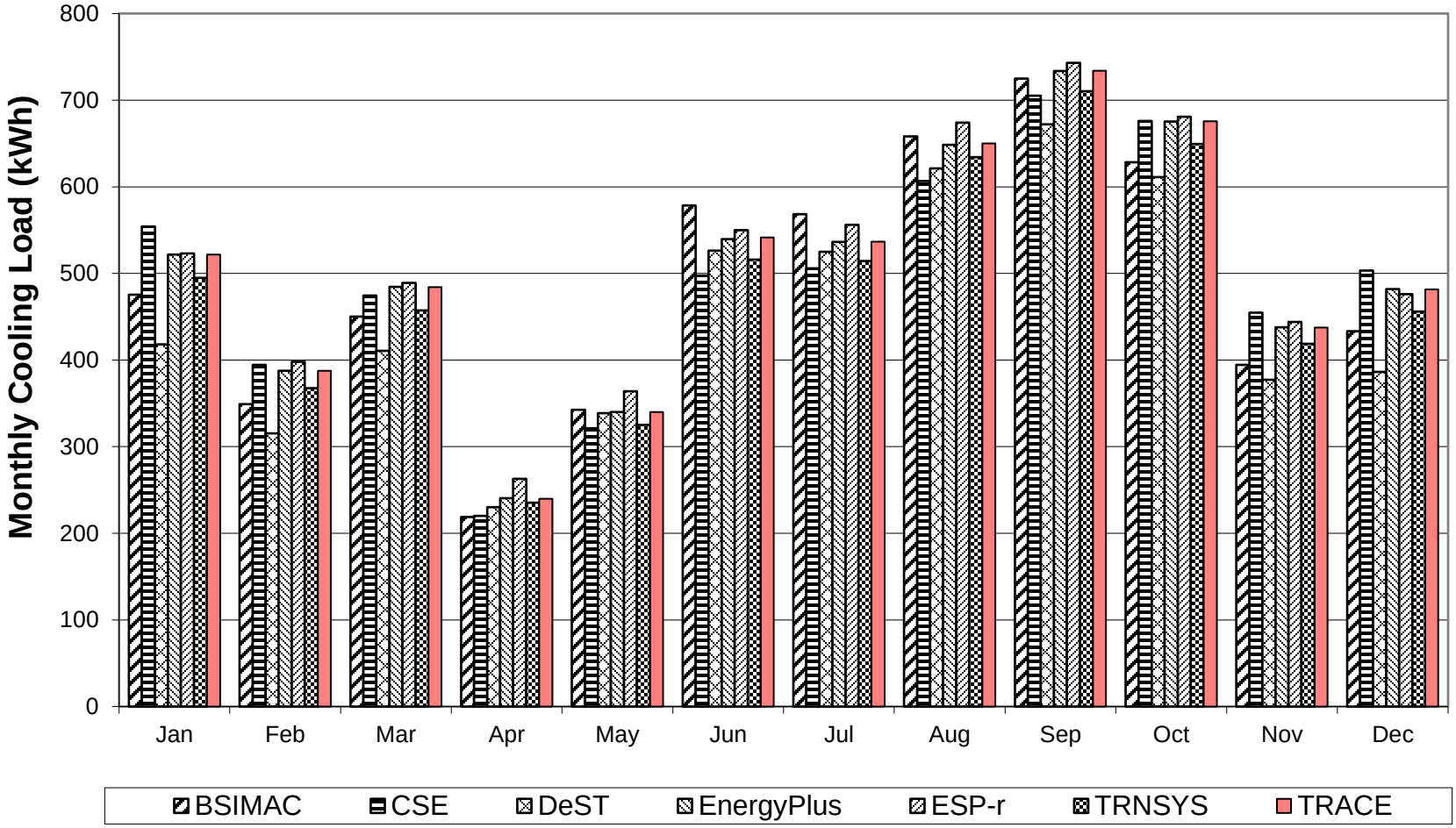
# Figure B8-59. In-Depth: Surface Heat Transfer Cases 450 to 600 (Delta) Peak Heating and Sensible Cooling



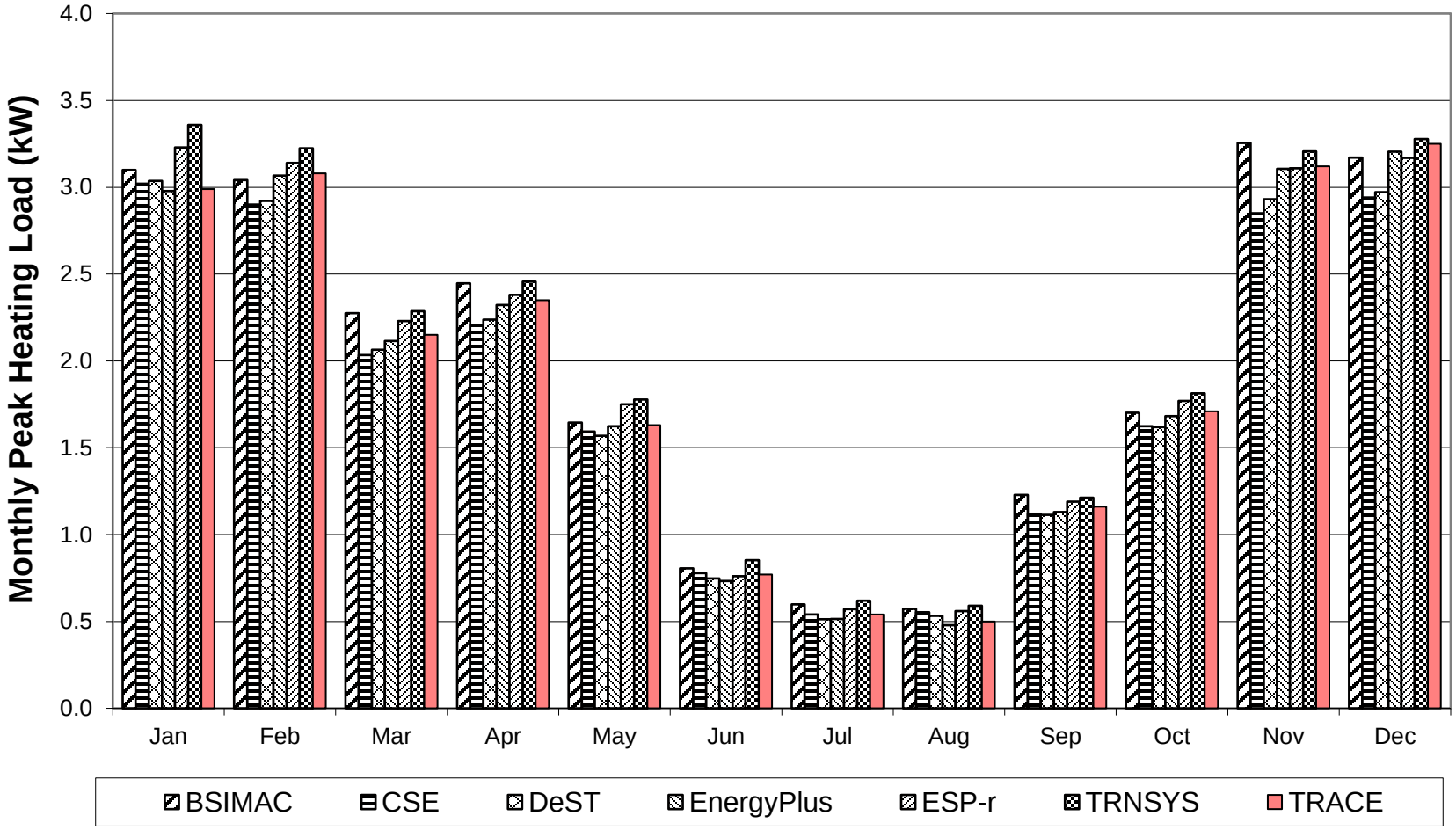
# Figure B8-M1.
# Monthly Heating
# Case 600



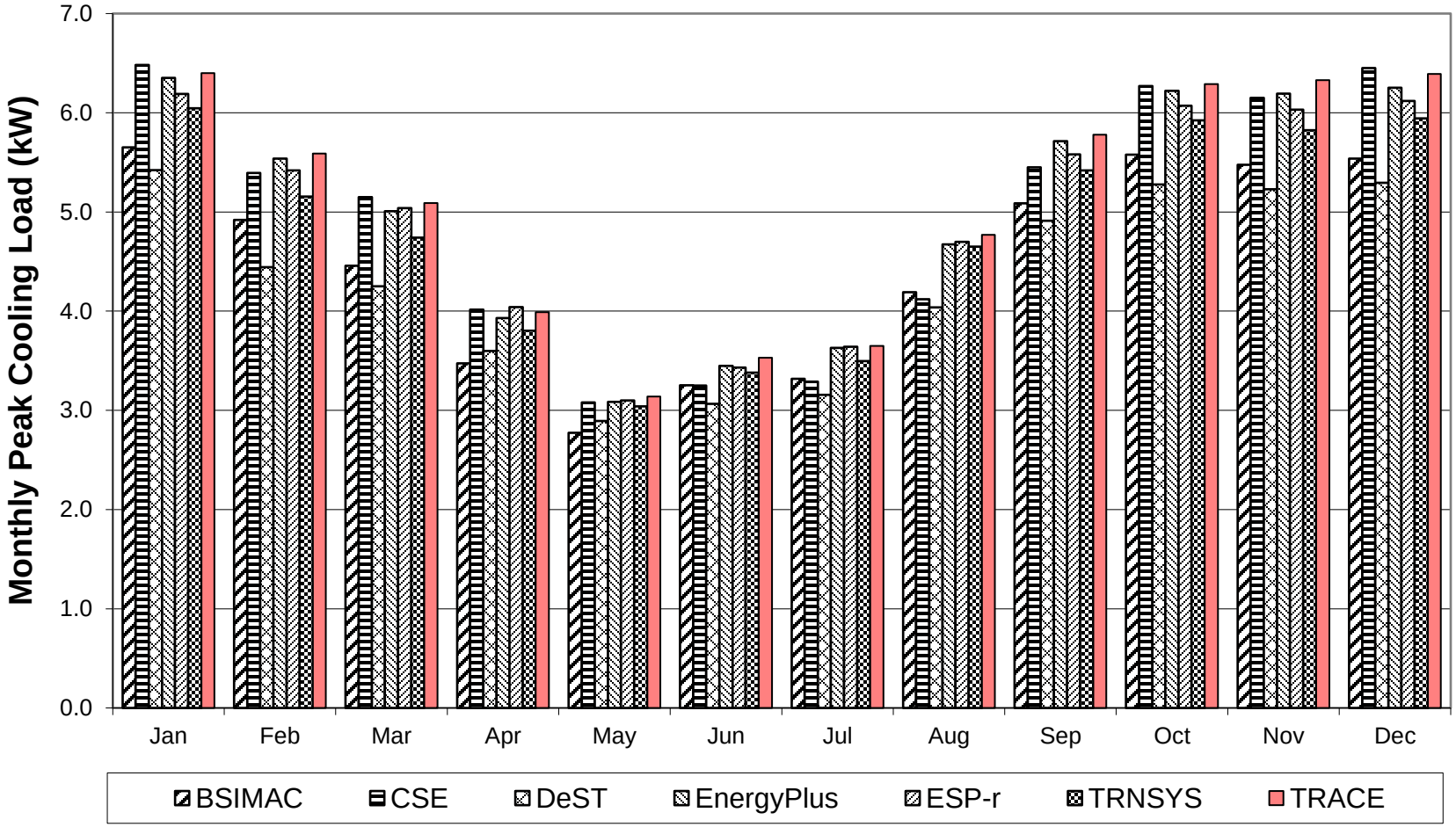
# Figure B8-M2.
# Monthly Sensible Cooling
# Case 600



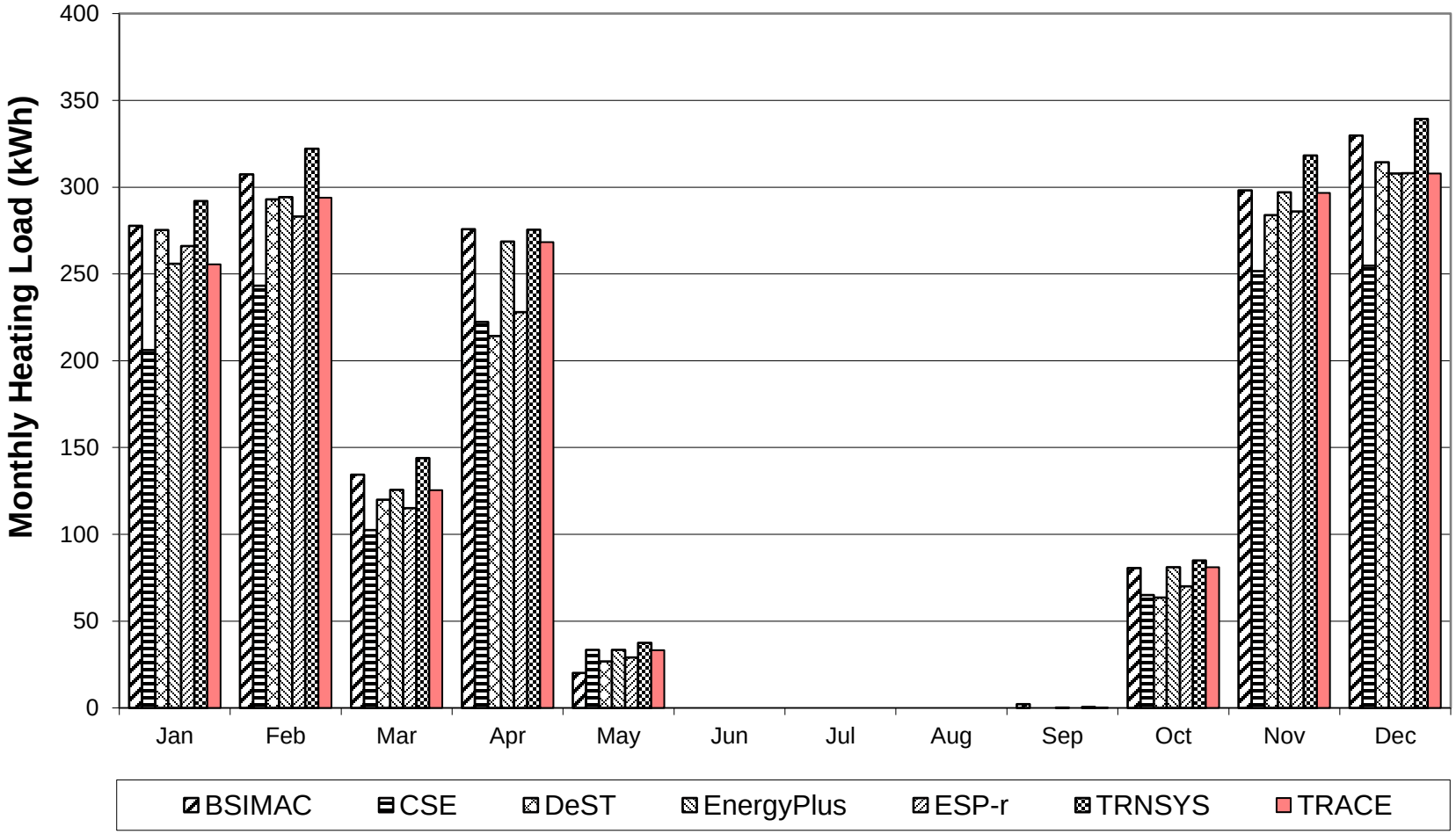
# Figure B8-M3.
# Monthly Peak Heating
# Case 600



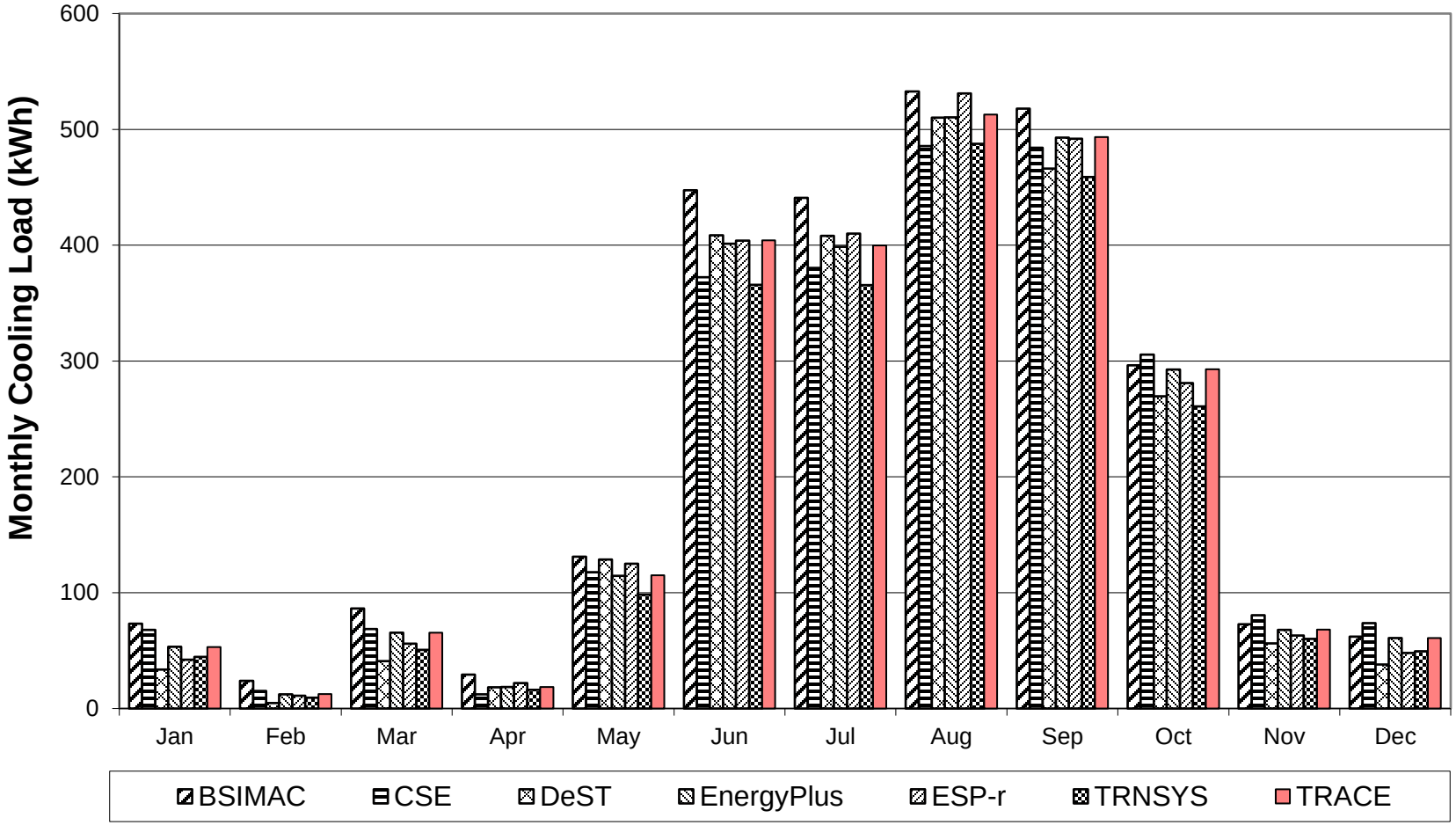
# Figure B8-M4.
# Monthly Peak Sensible Cooling
# Case 600



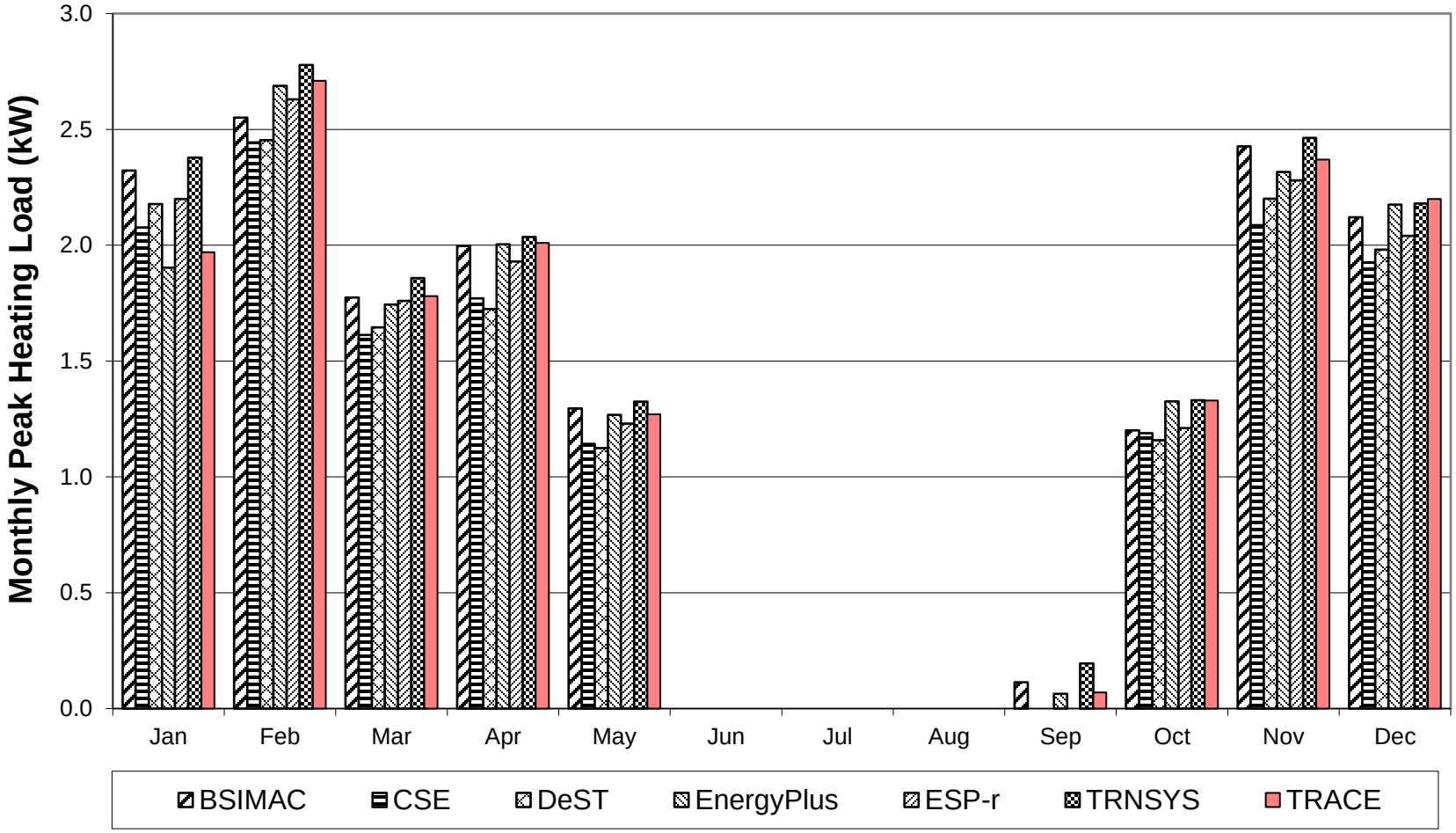
# Figure B8-M5.
# Monthly Heating
# Case 900



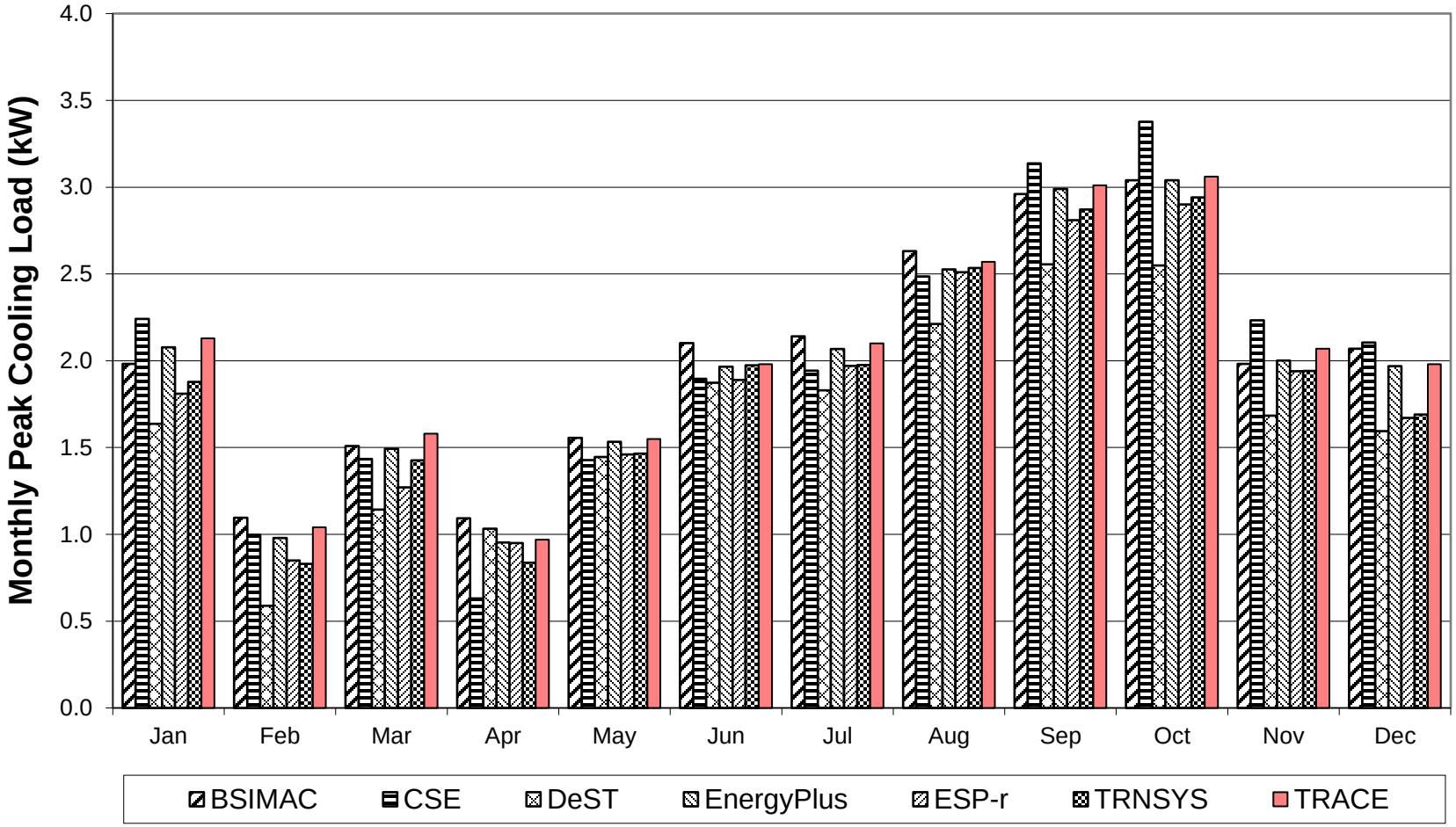
# Figure B8-M6.
# Monthly Sensible Cooling
# Case 900



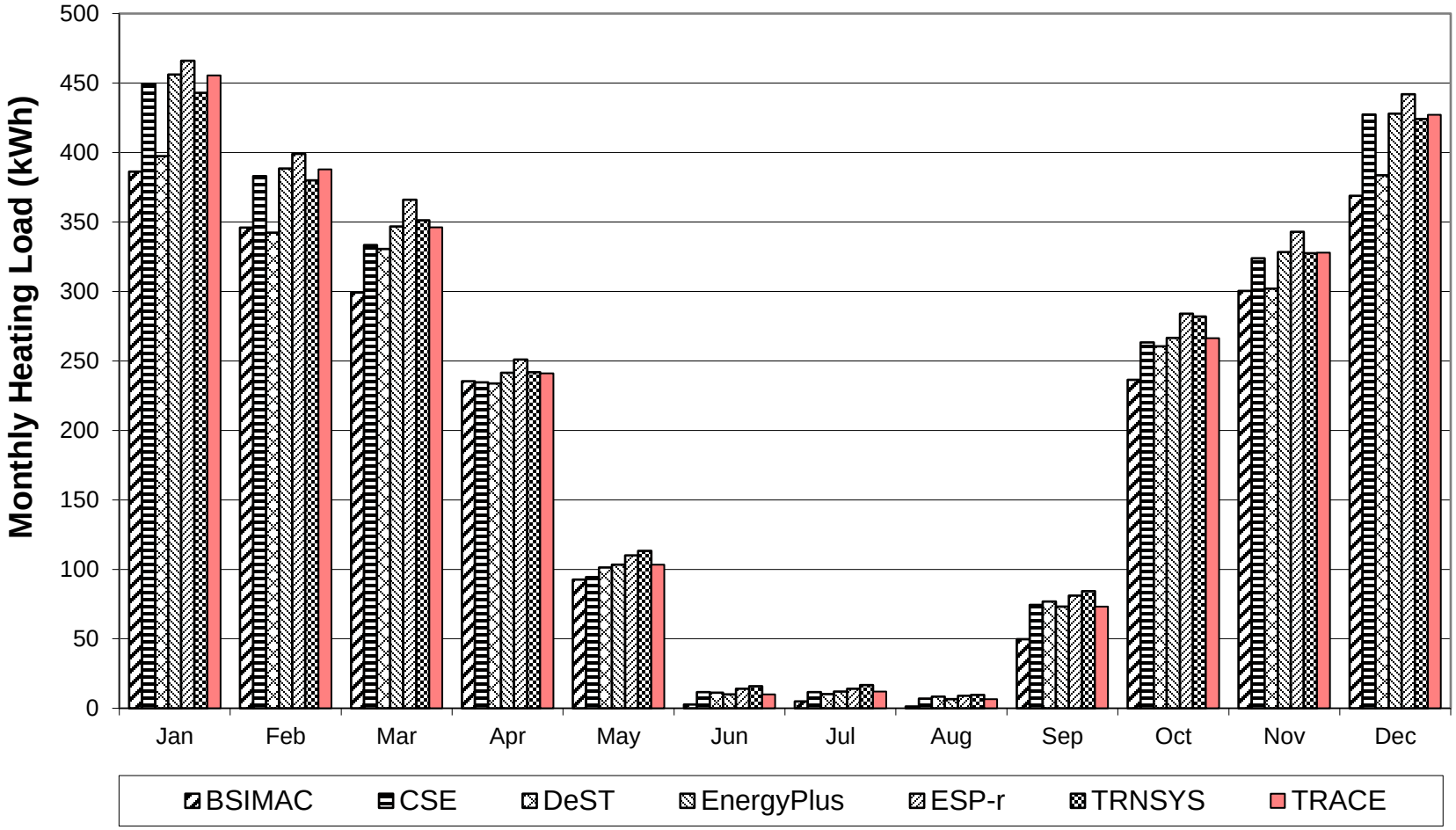
# Figure B8-M7.
# Monthly Peak Heating
# Case 900



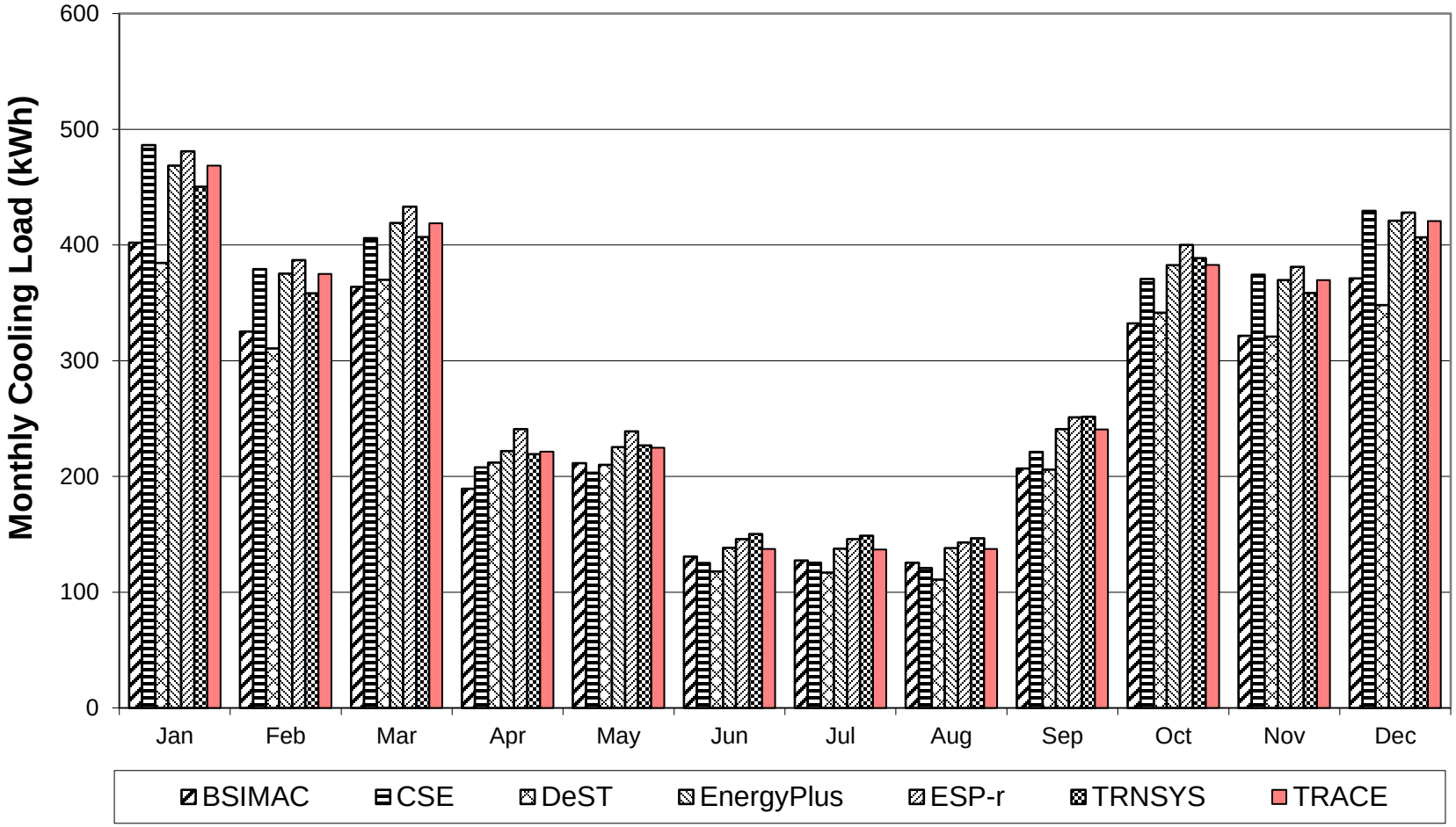
# Figure B8-M8.
# Monthly Peak Sensible Cooling
# Case 900



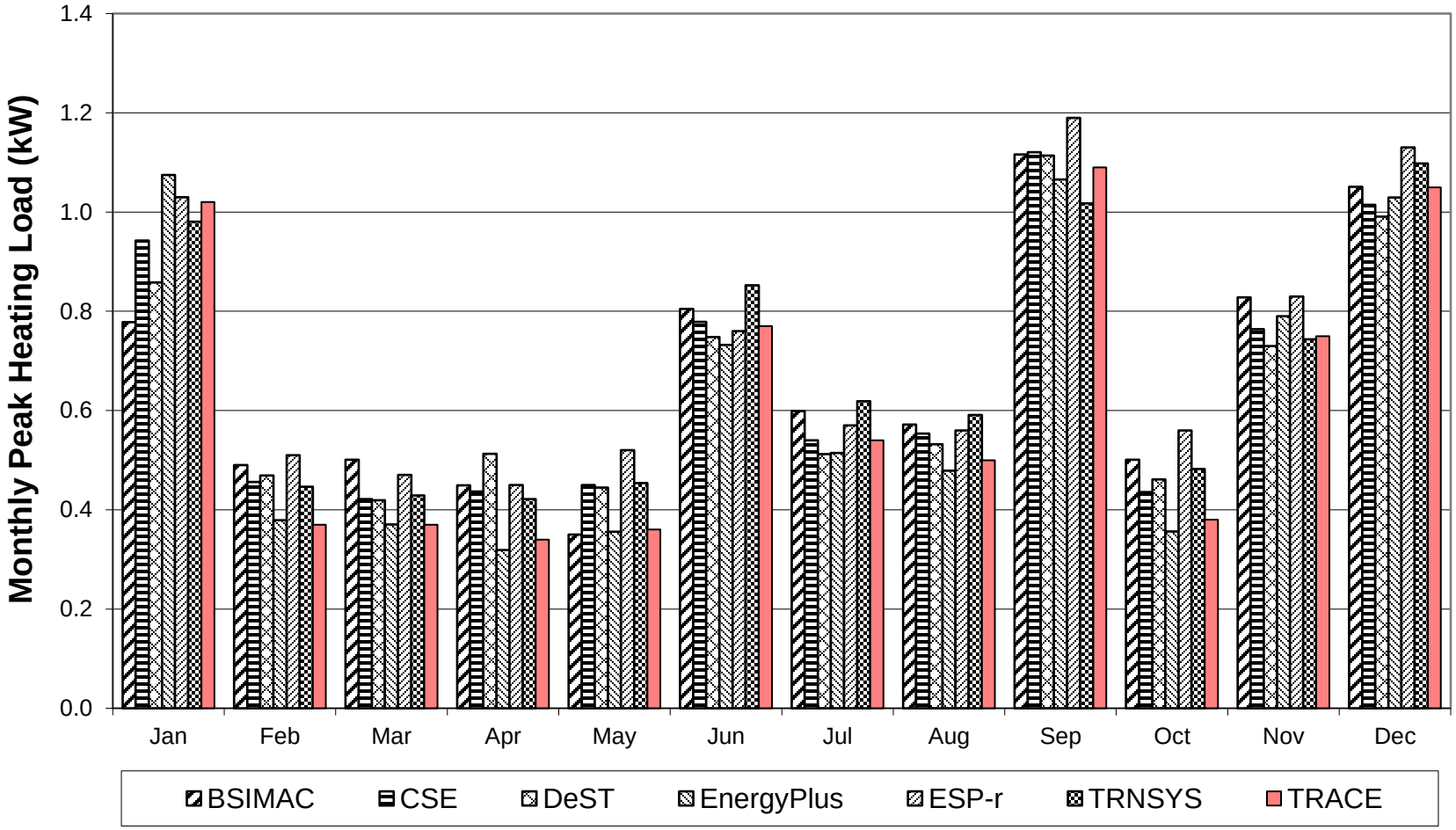
# Figure B8-M9.
# Monthly Heating Sensitivity (Delta)
# Case 600-900



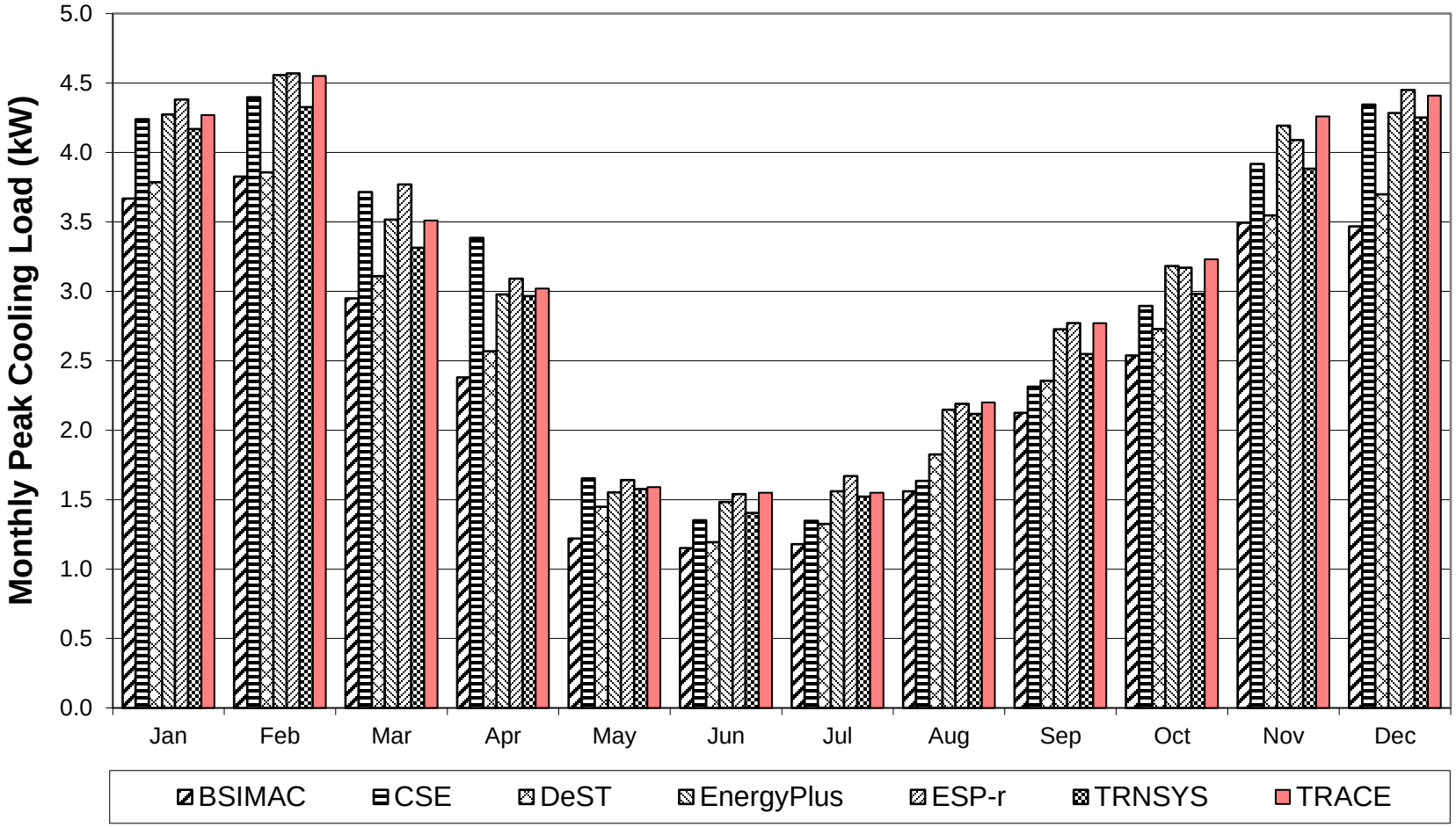
# Figure B8-M10.
# Monthly Cooling Sensitivity (Delta)
# Case 600-900



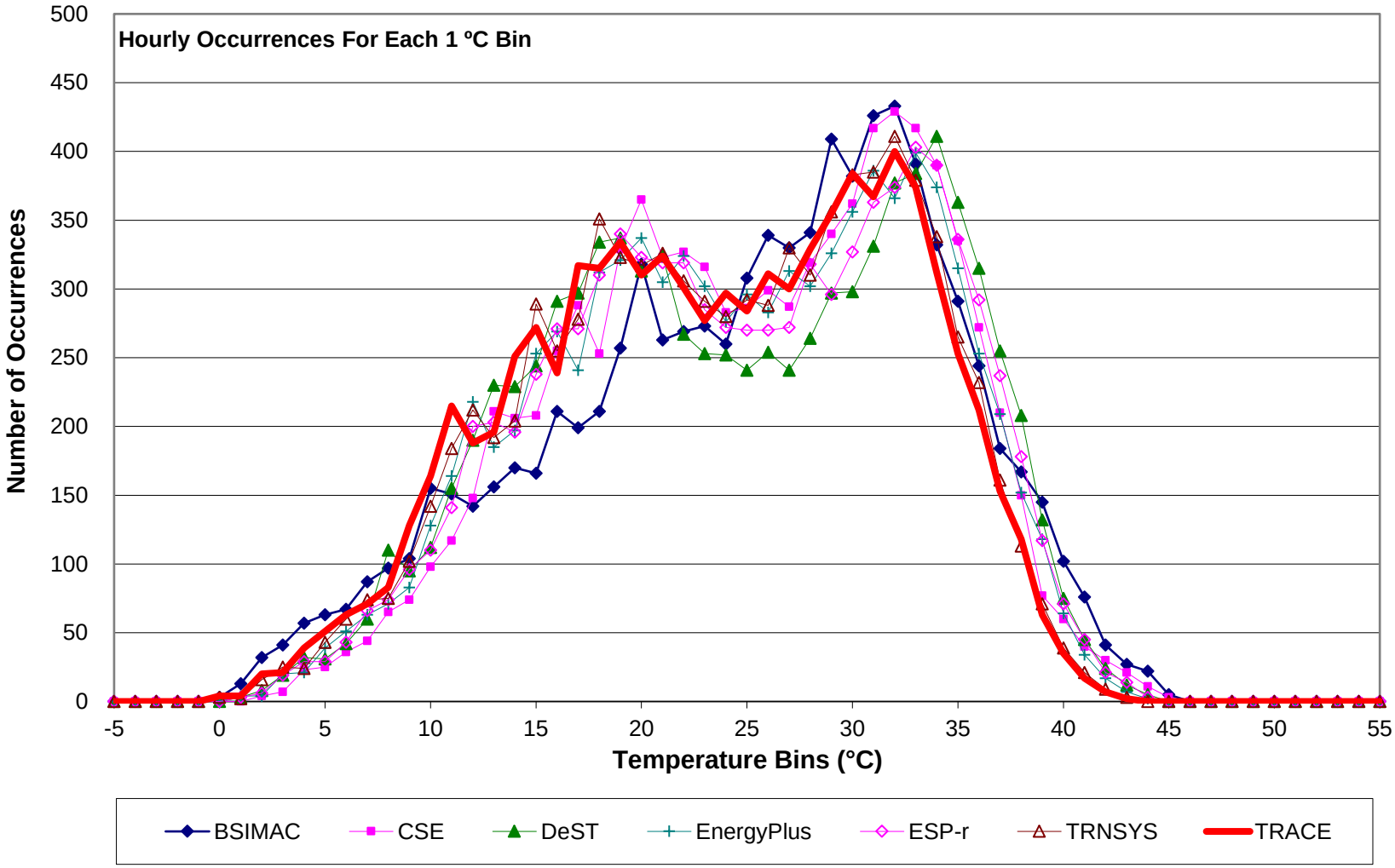
# Figure B8-M11.
# Monthly Peak Heating Sensitivity (Delta)
# Case 600-900



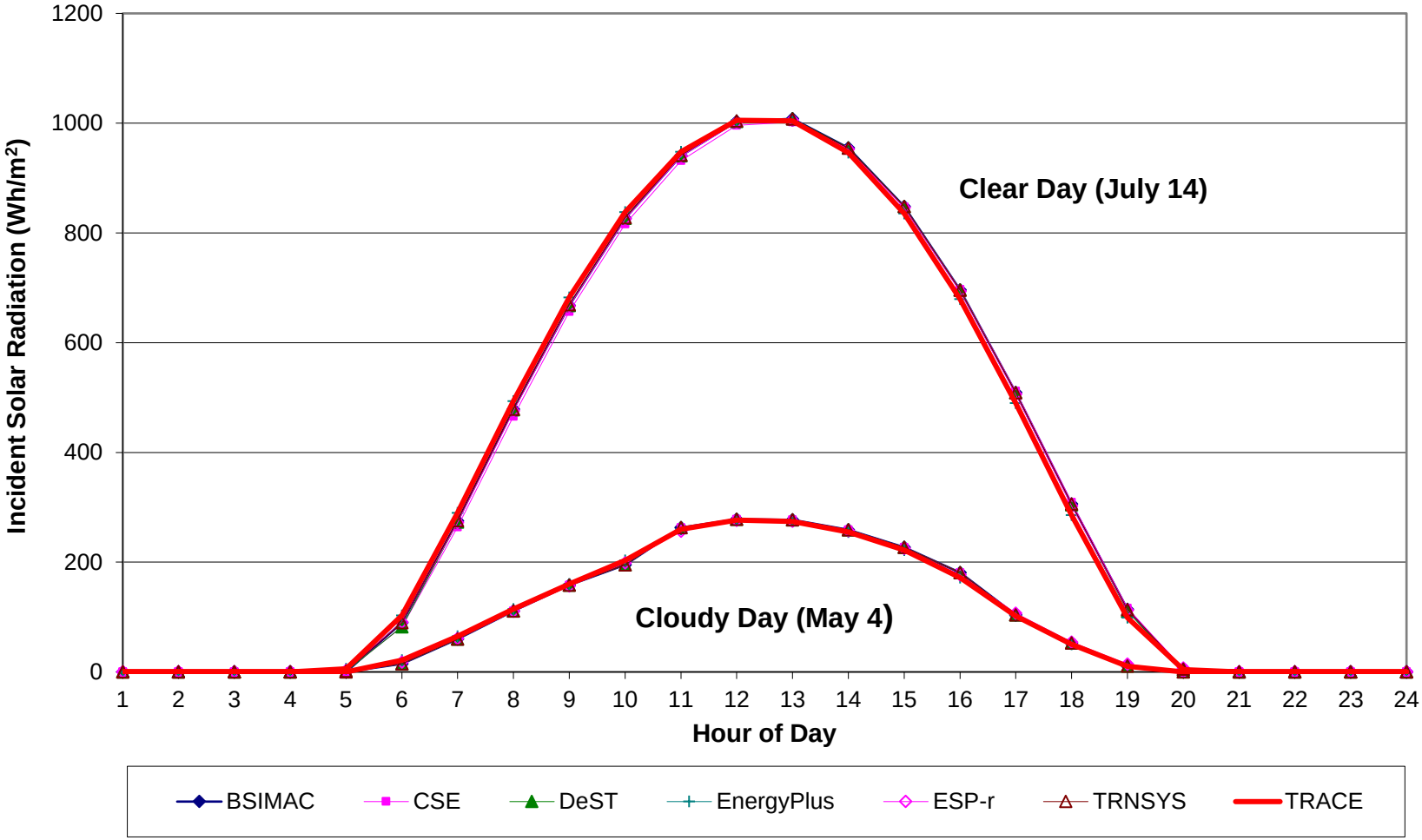
# Figure B8-M12.
# Monthly Peak Cooling Sensitivity (Delta)
# Case 600-900



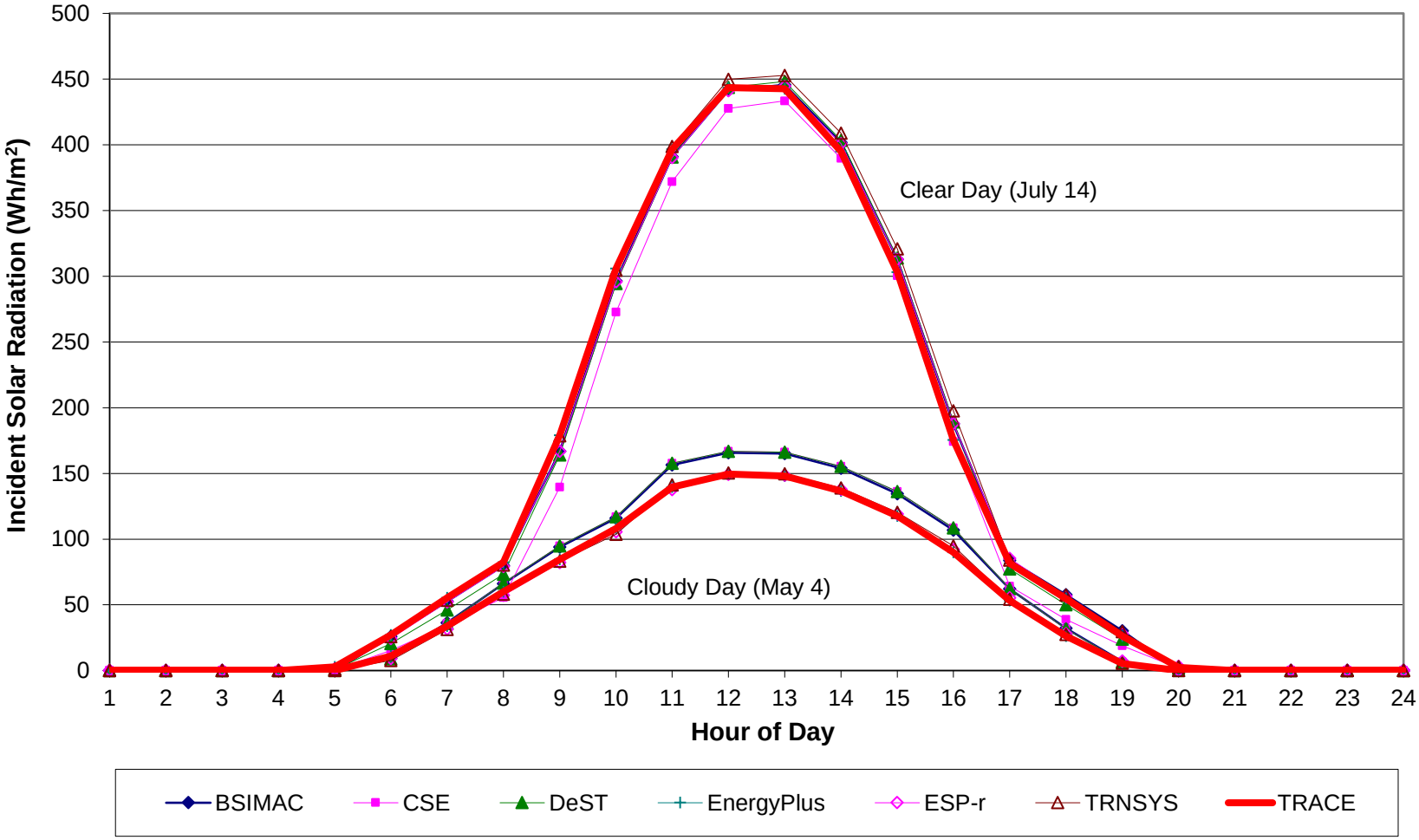
# Figure B8-H1. Case 900FF
# Annual Hourly Zone Air Temperature Frequency



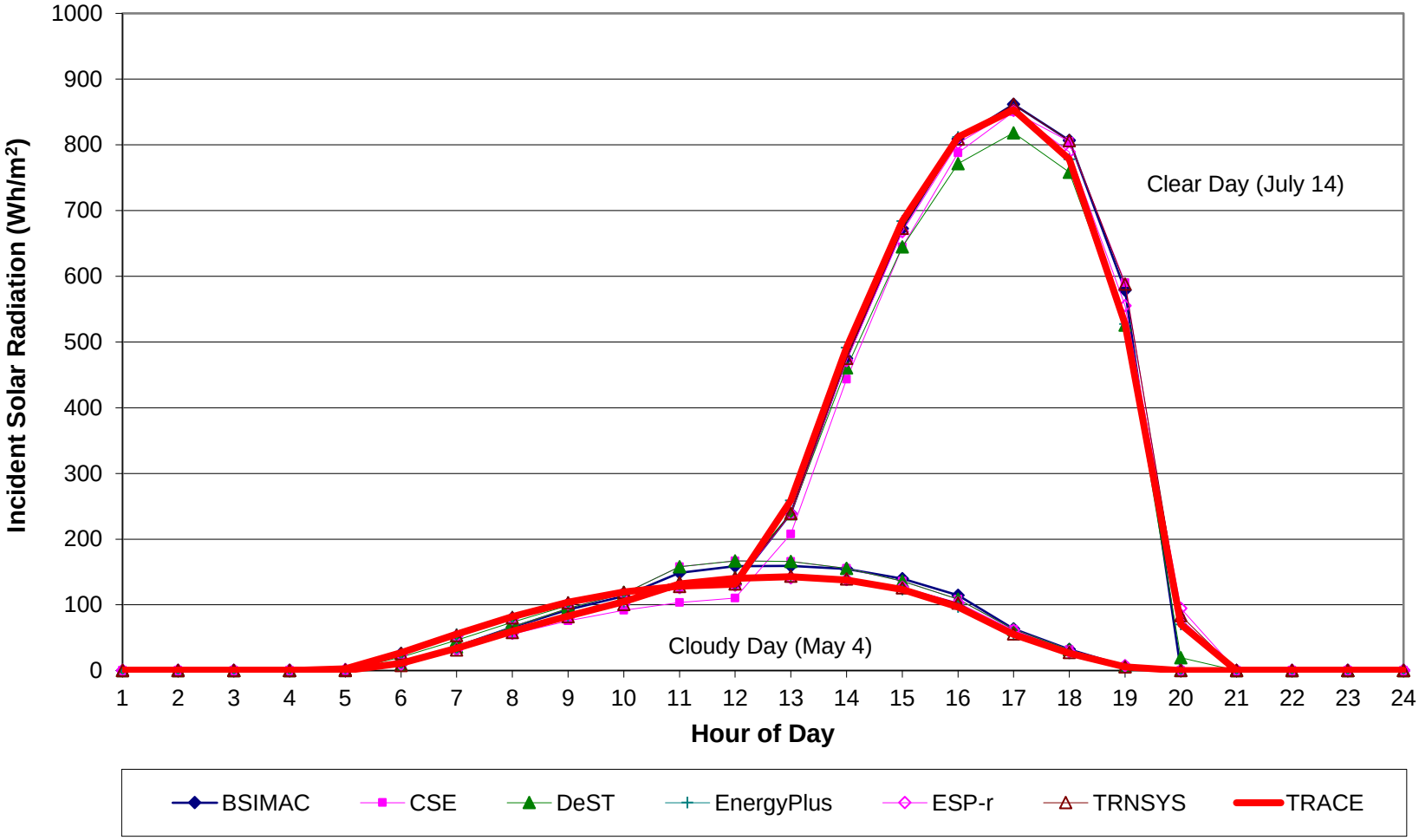
# Figure B8-H2. Case 600
# Cloudy & Clear Day Hourly Incident Solar
# Horizontal (Upward) Facing Surface



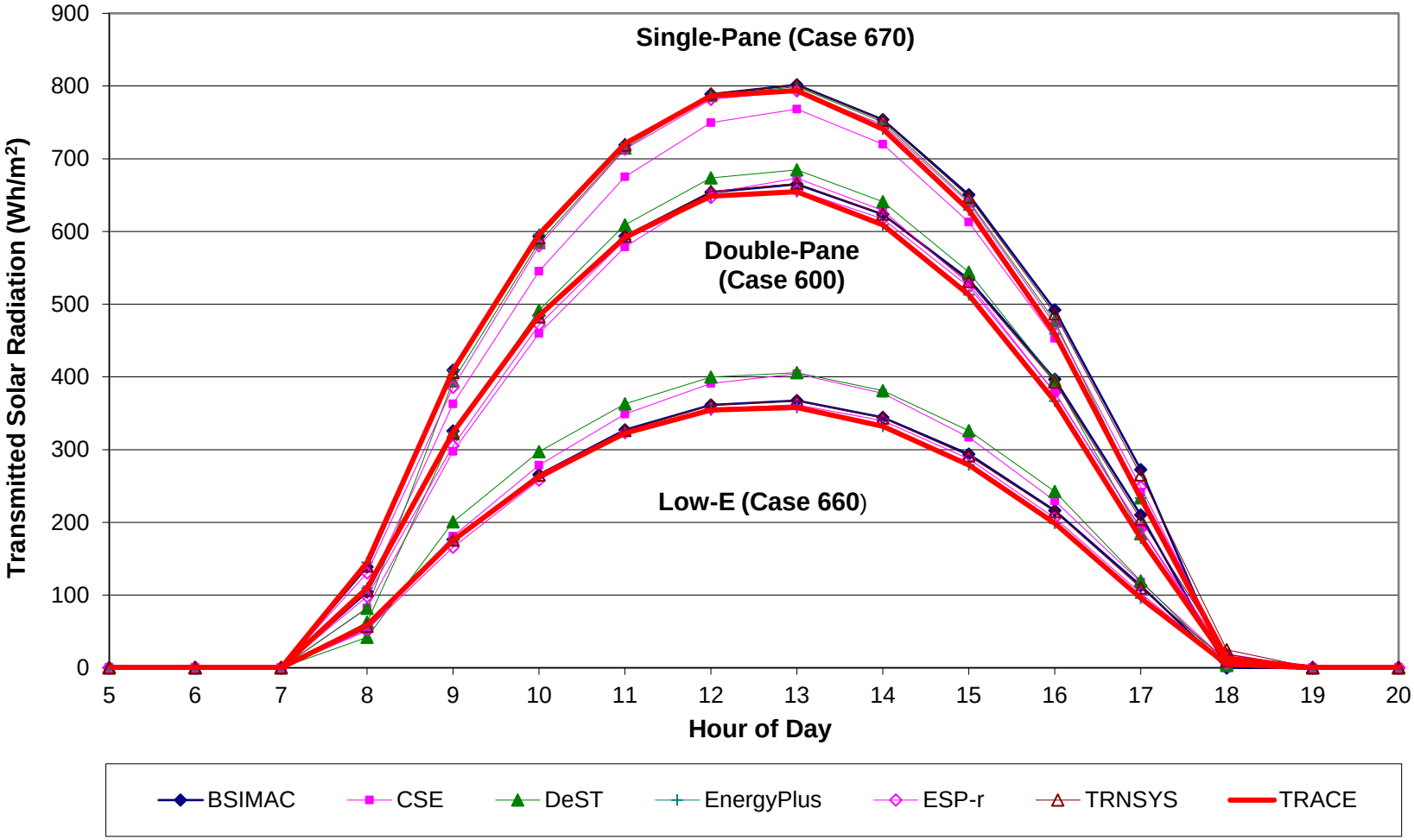
# Figure B8-H3. Case 600
# Cloudy & Clear Day Hourly Incident Solar
# South Facing Surface



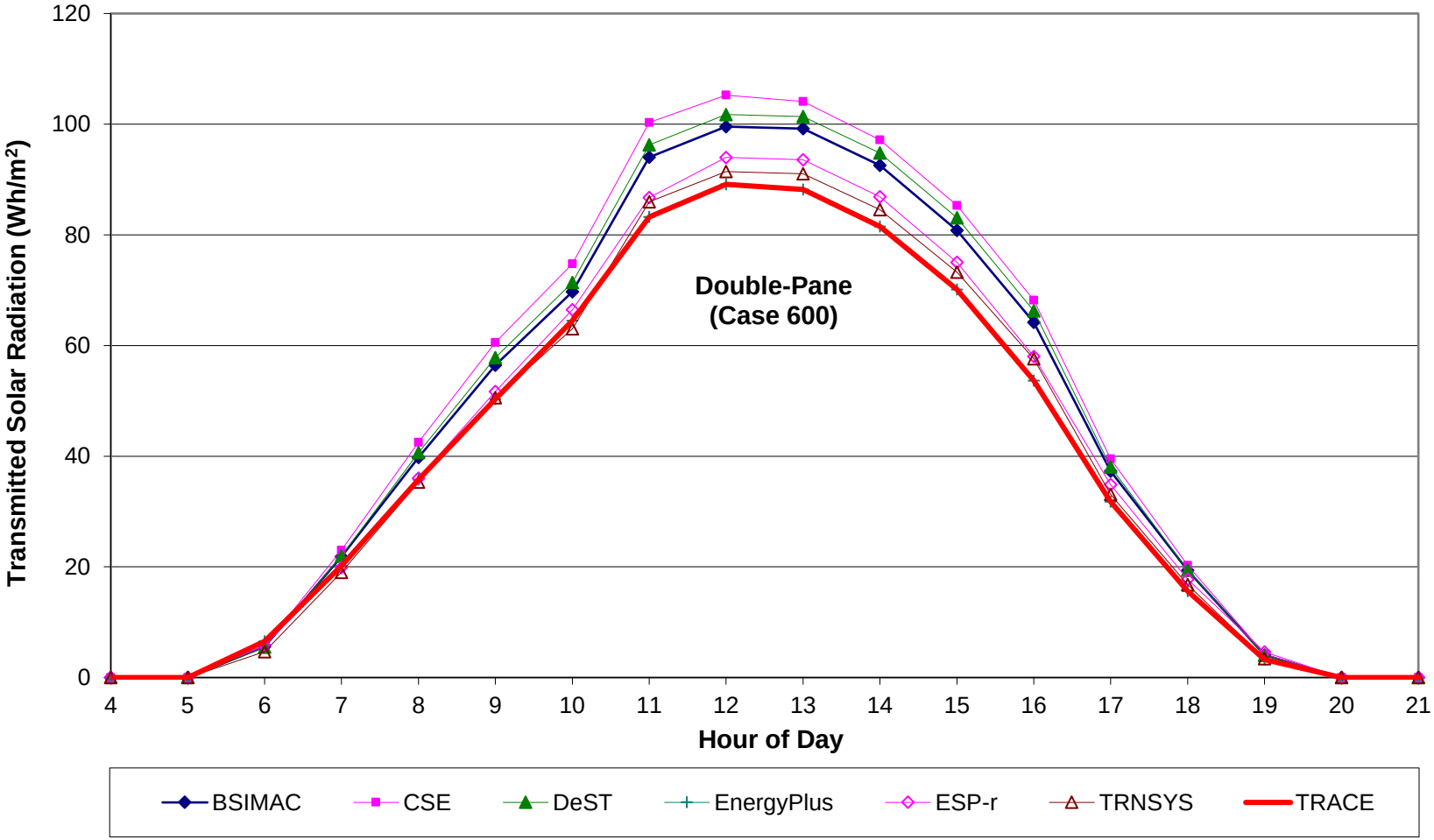
# Figure B8-H4. Case 600
# Cloudy & Clear Day Hourly Incident Solar
# West Facing Surface



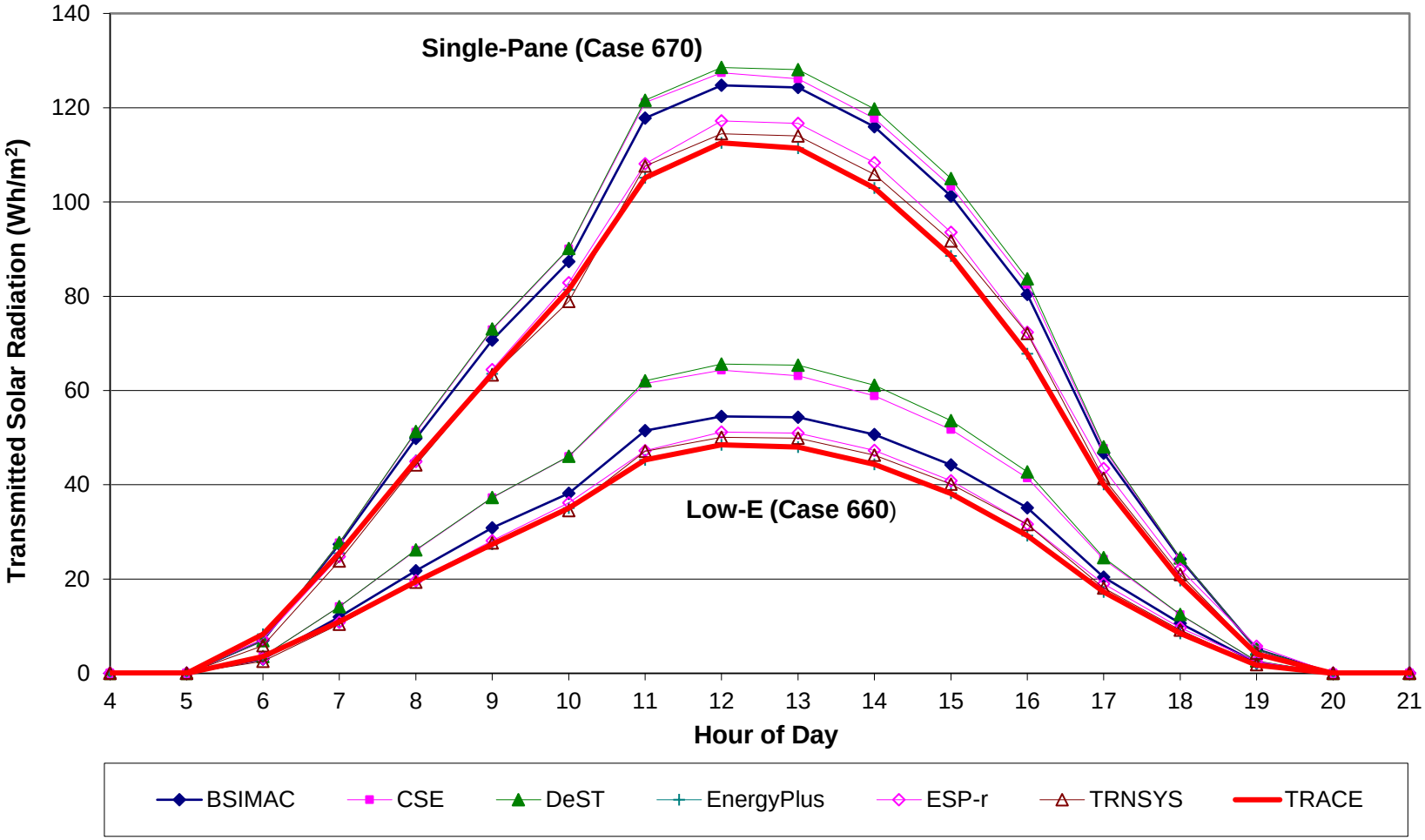
# Figure B8-H5. Cases 600, 660, 670
# Hourly Transmitted Solar, Clear/Cold Day (Feb 1)
# Double-Pane, Low-E, Single-Pane Windows



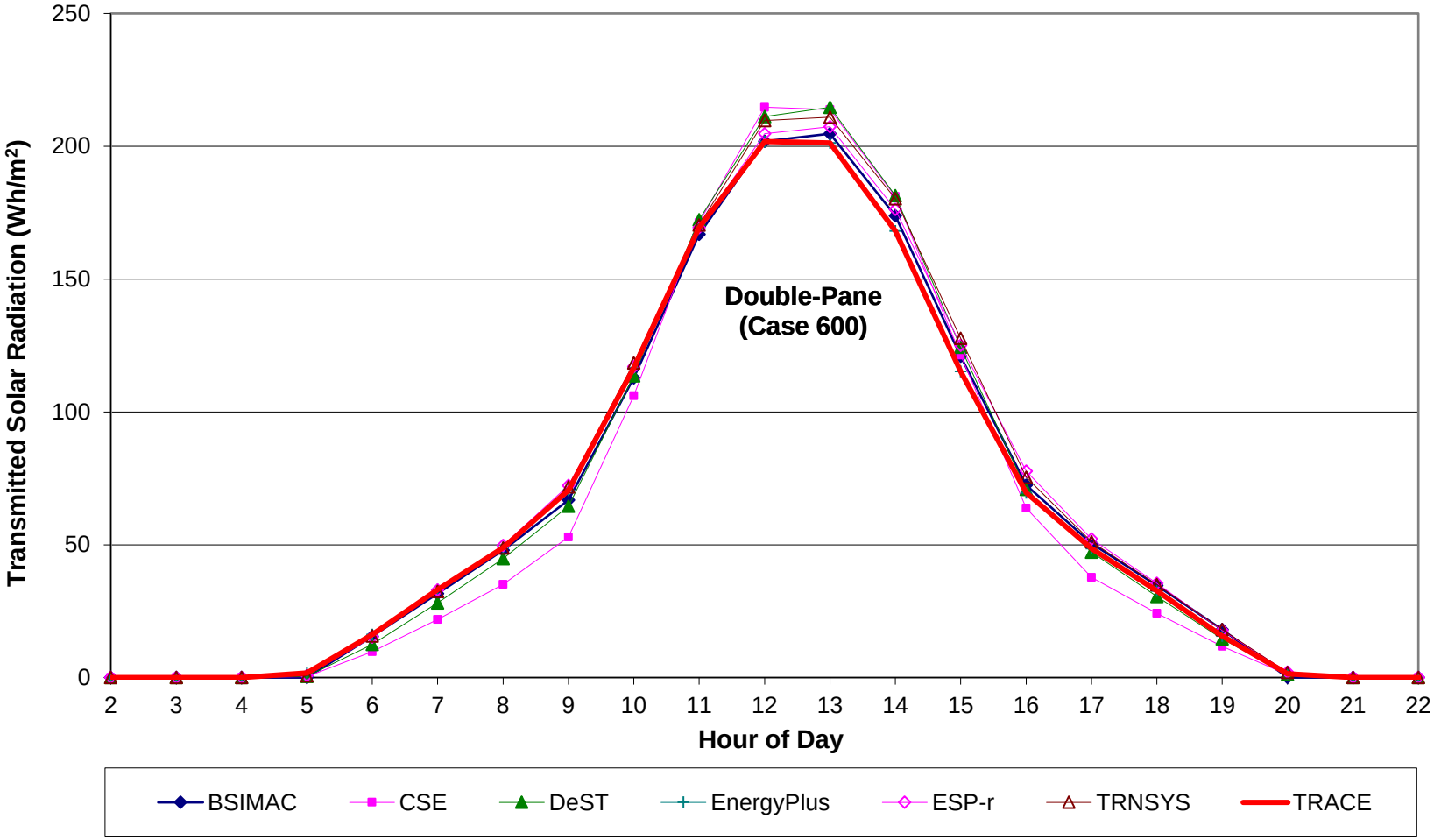
# Figure B8-H6. Case 600
# Hourly Transmitted Solar, Cloudy Day (May 4)
# Double-Pane Windows



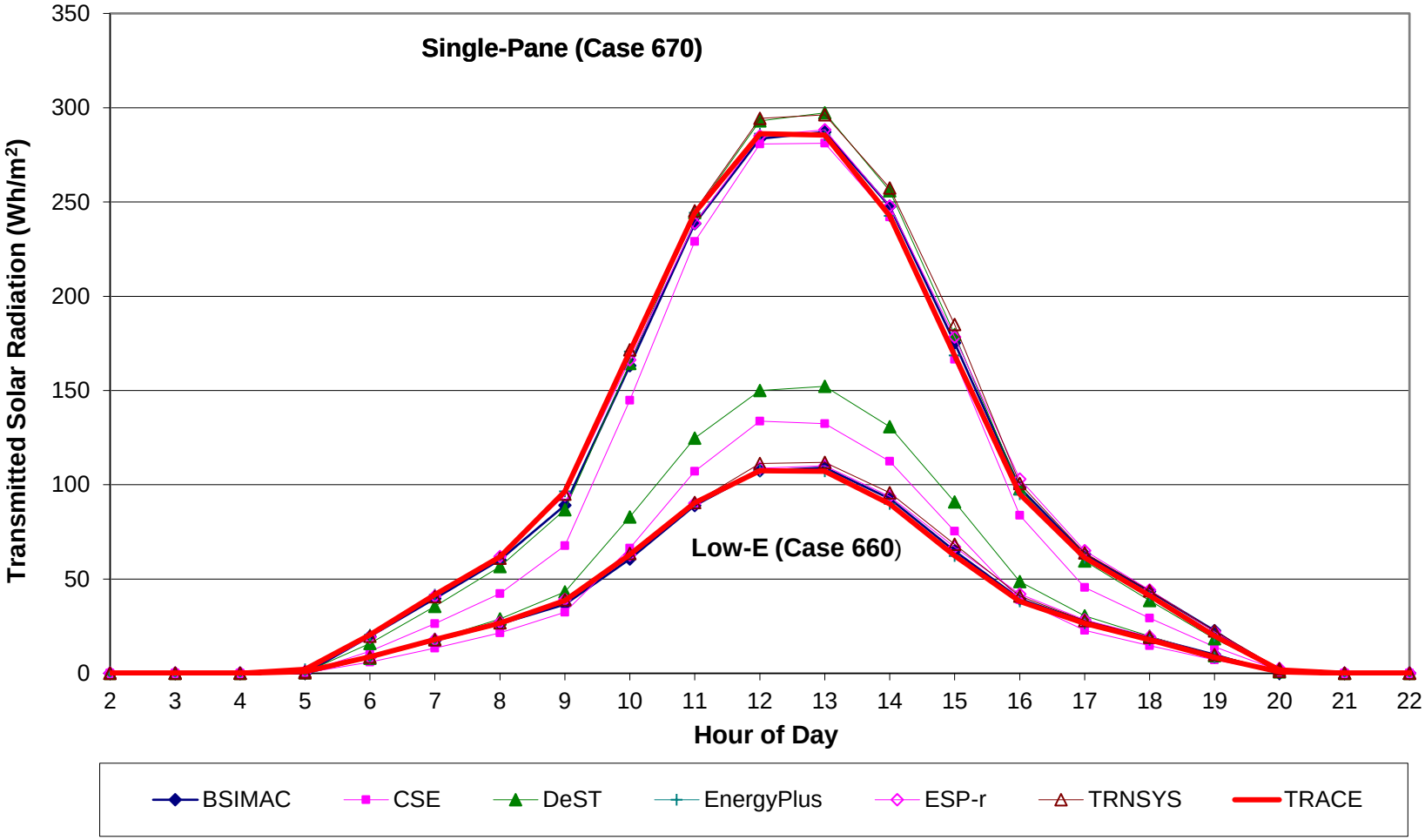
# Figure B8-H7. Cases 660, 670
# Hourly Transmitted Solar, Cloudy Day (May 4)
# Low-E and Single-Pane Windows



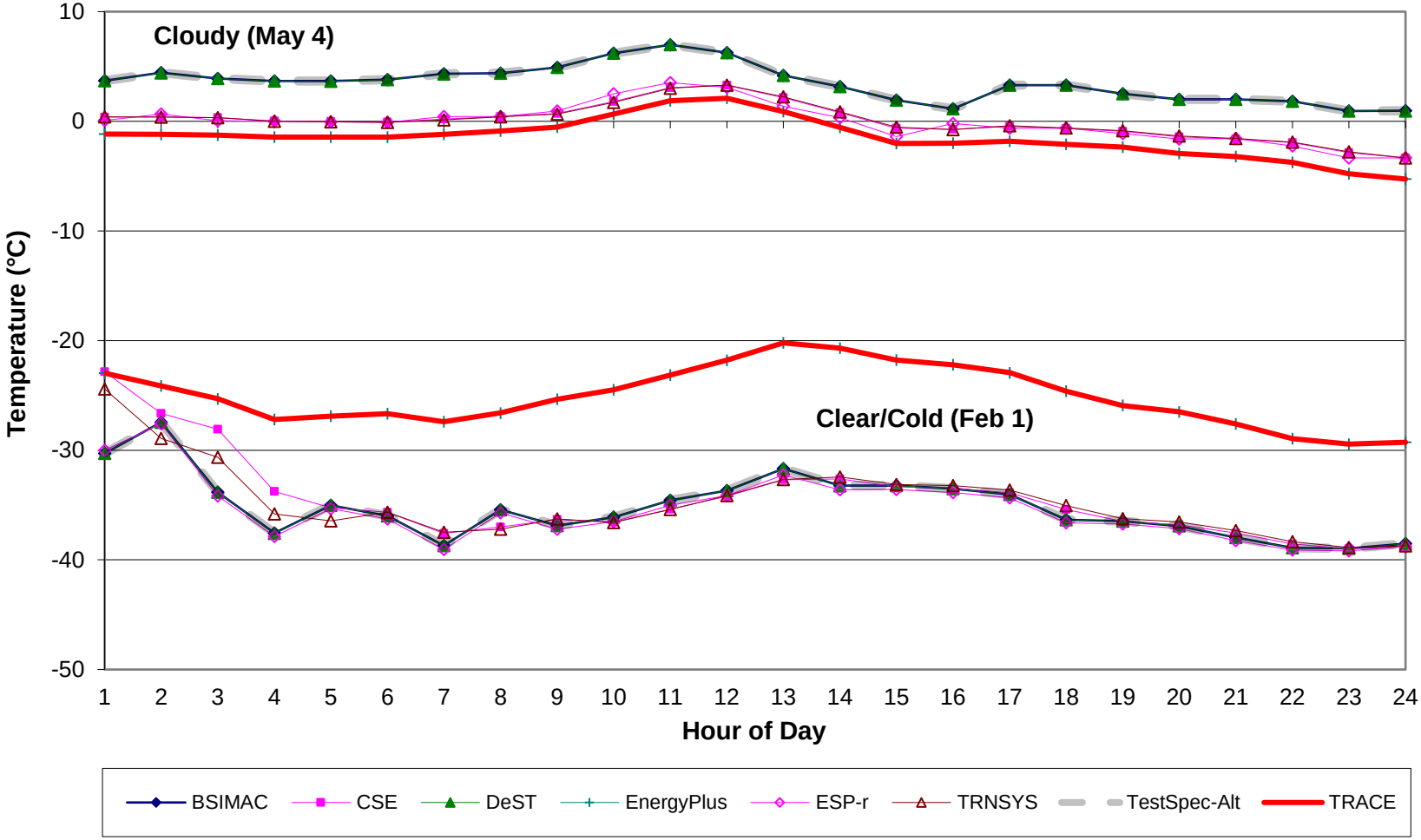
# Figure B8-H8. Case 600
# Hourly Transmitted Solar, Clear/Hot Day (Jul 14)
# Double-Pane Windows



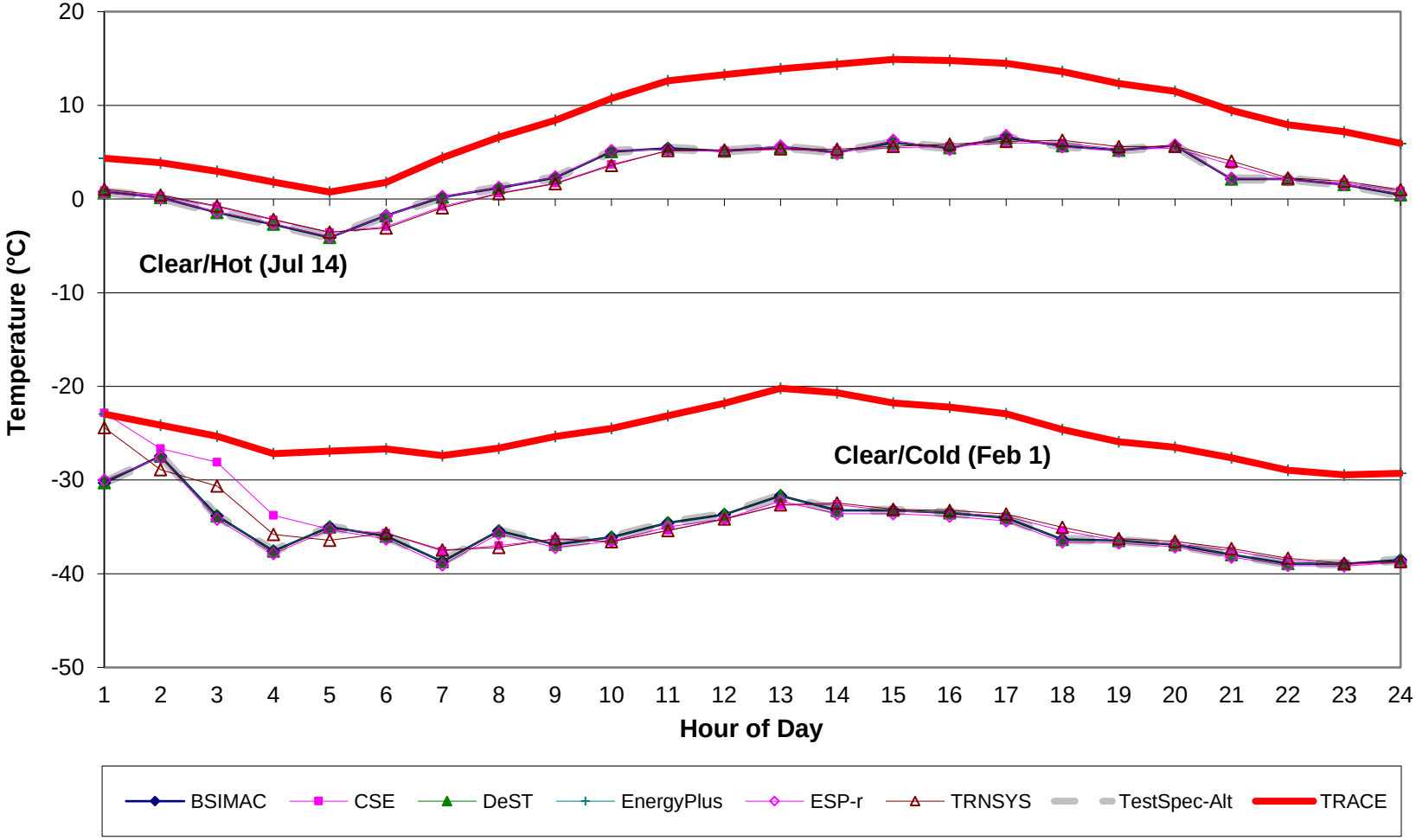
# Figure B8-H9. Cases 660, 670
# Hourly Transmitted Solar, Clear/Hot Day (Jul 14)
# Low-E and Single-Pane Windows



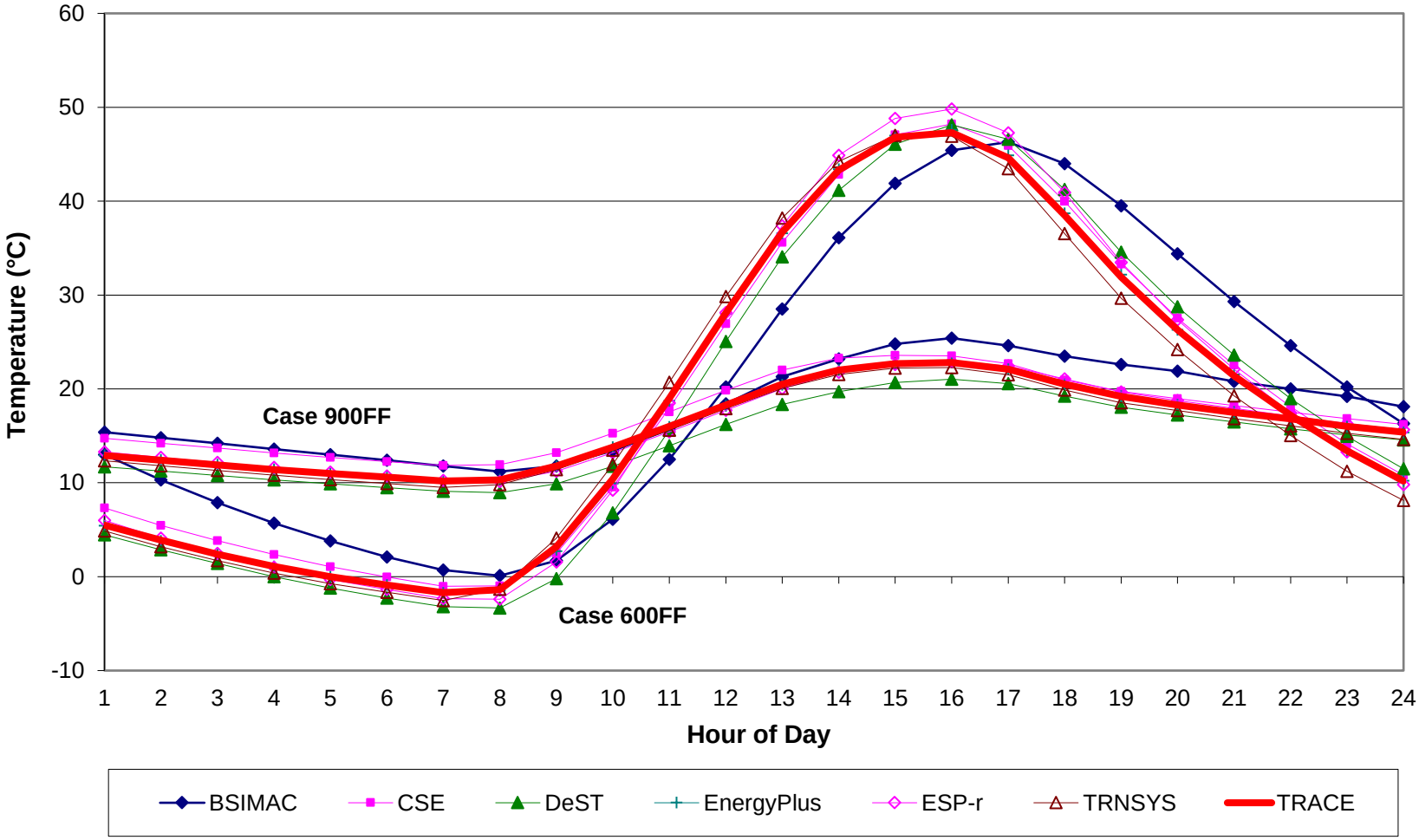
# Figure B8-H10.
# Hourly Sky Temperatures
# Case 600: Clear/Cold, Cloudy Days



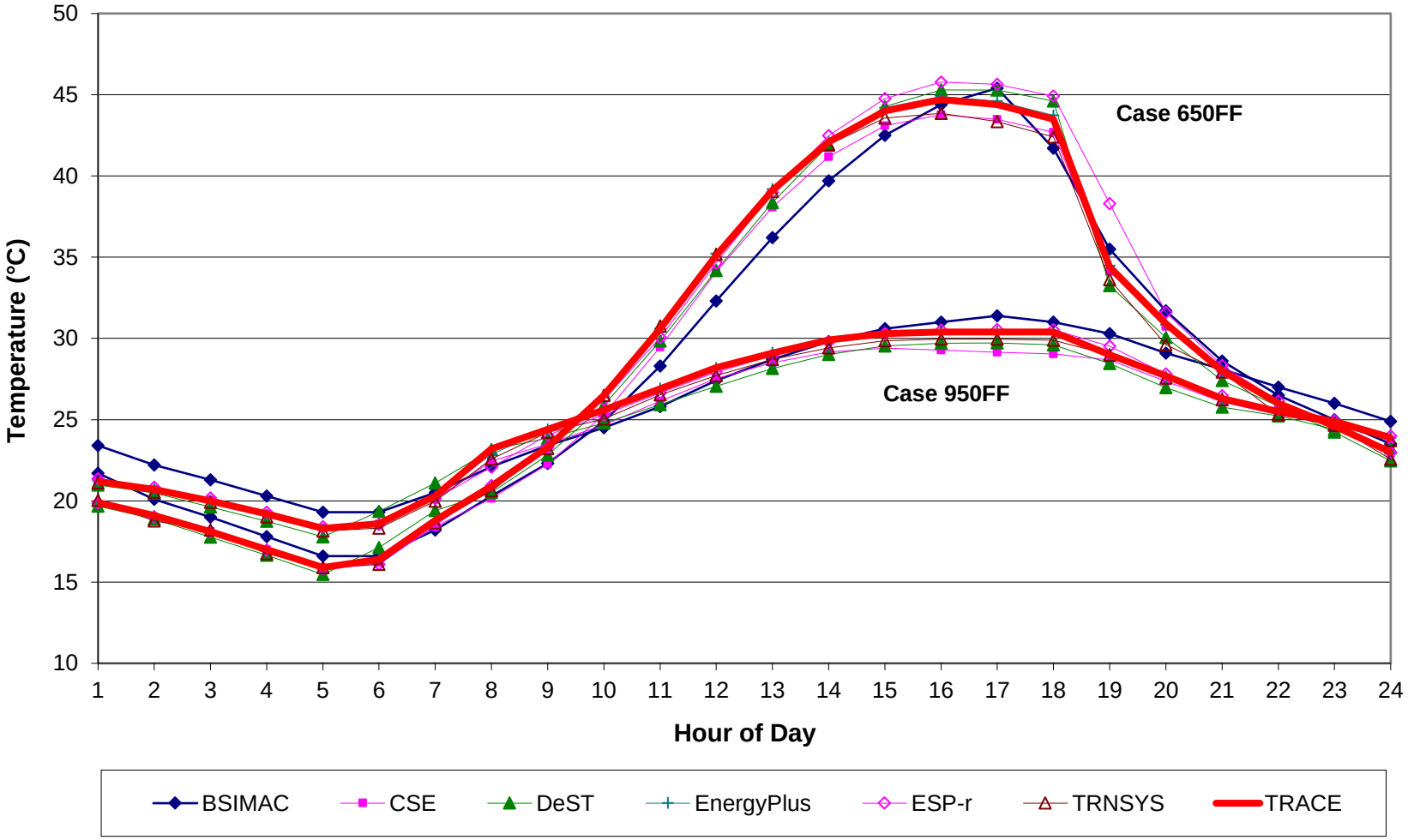
# Figure B8-H11.
# Hourly Sky Temperatures
# Case 600: Clear/Cold, Clear/Hot Days



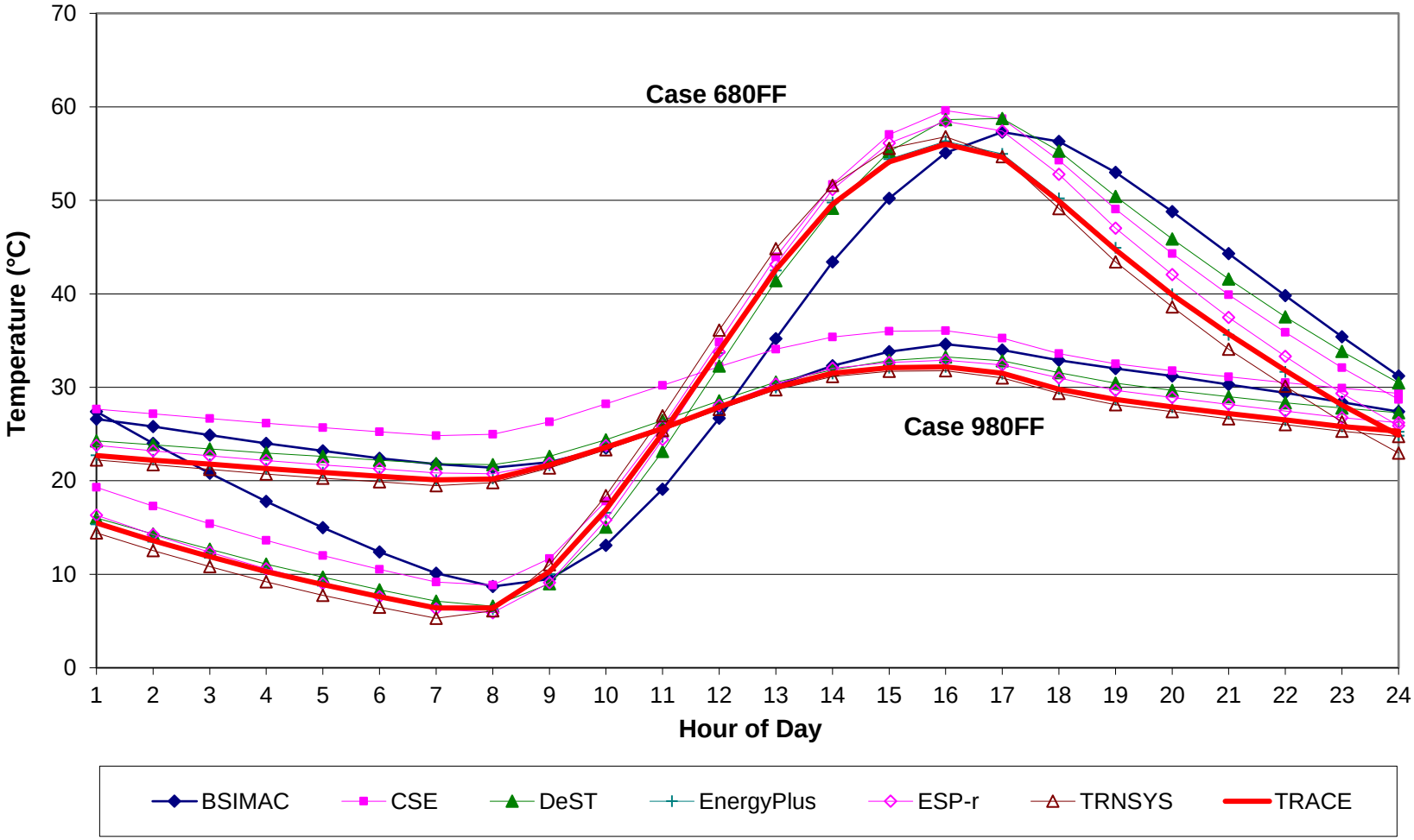
# Figure B8-H12.
# Hourly Free-Float Temperatures
# Clear Cold Day (Feb 1), Cases 600FF and 900FF



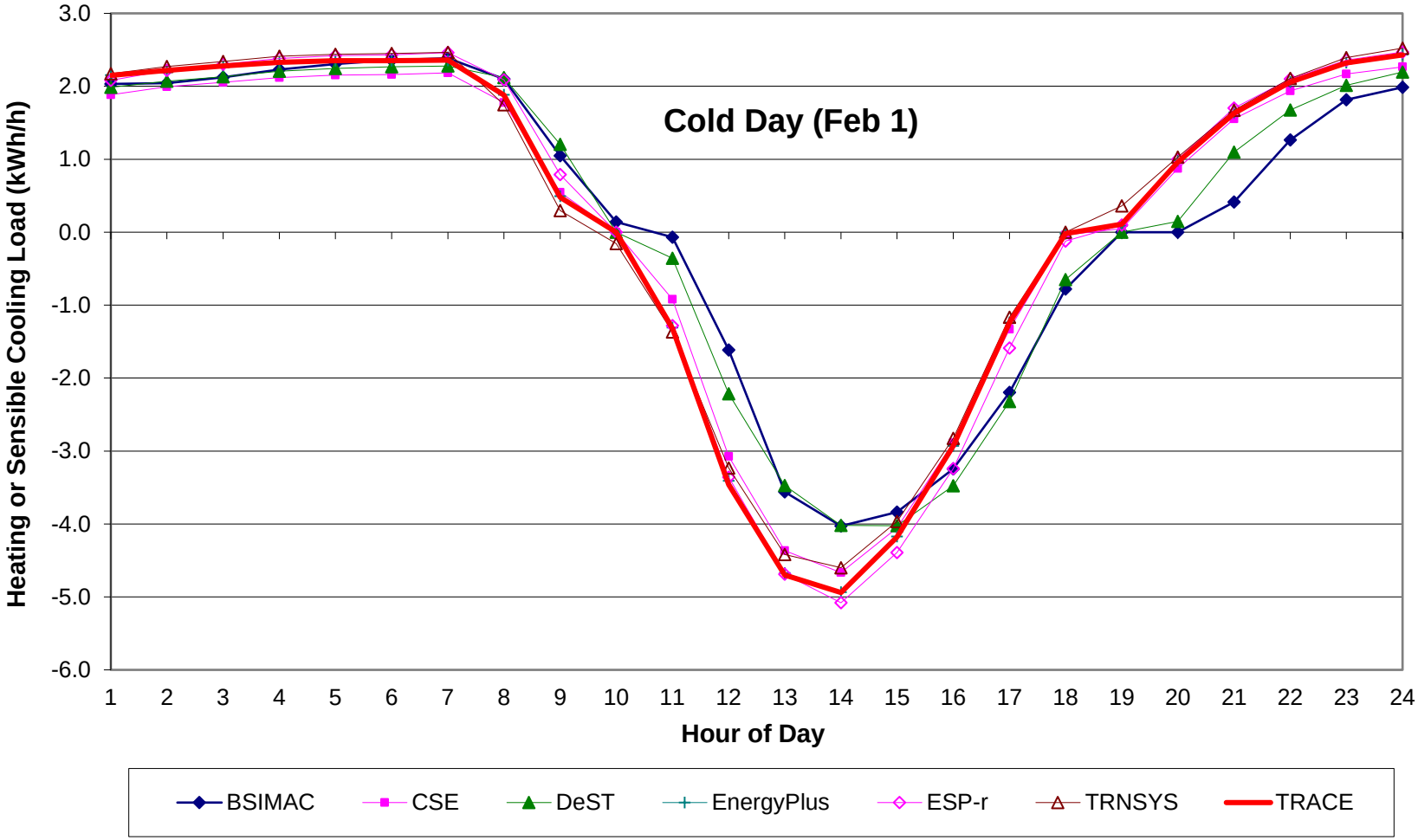
# Figure B8-H13.
# Hourly Free-Float Temperatures
# Clear Hot Day (Jul 14), Cases 650FF and 950FF



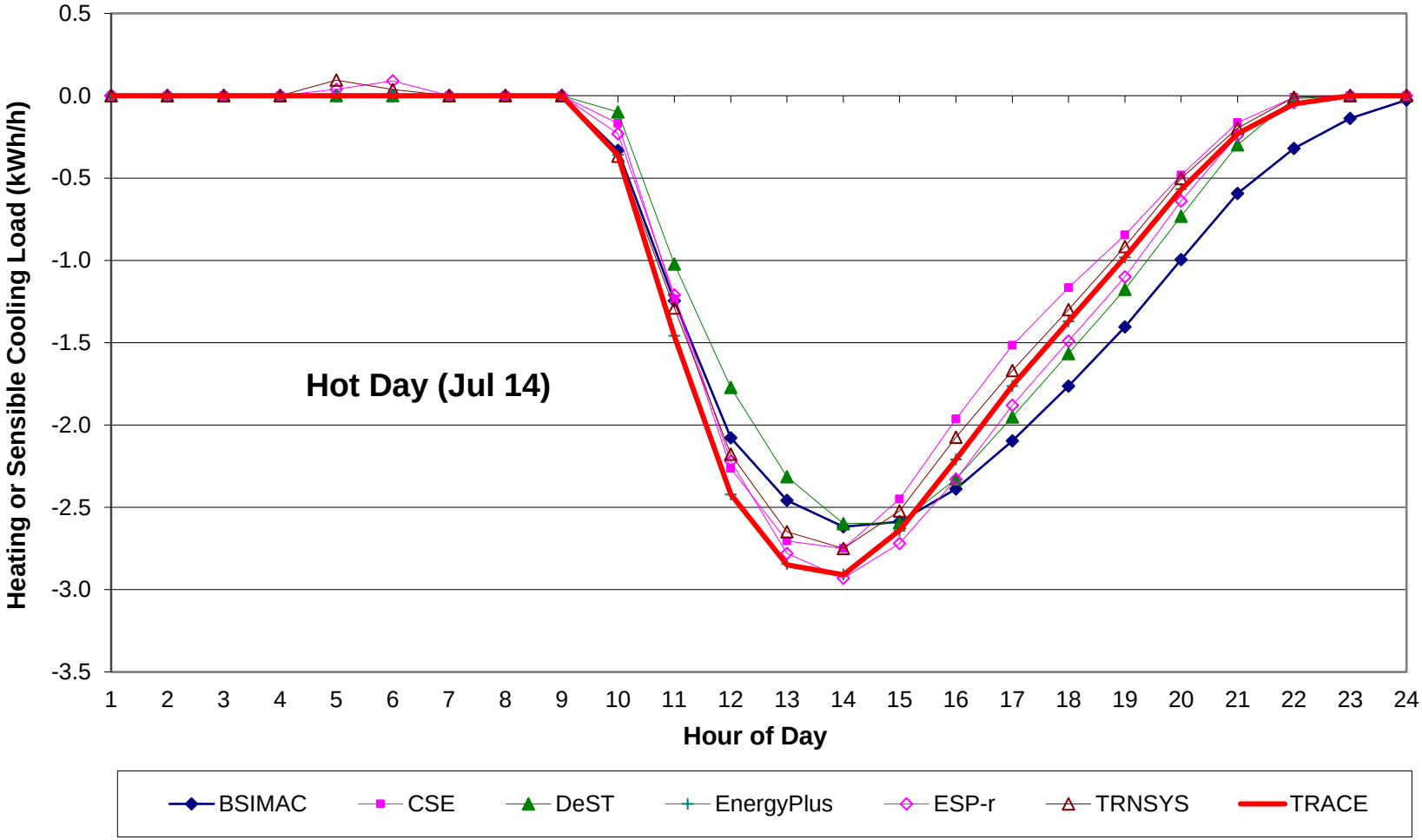
# Figure B8-H14.
# Hourly Free-Float Temperatures
# Clear Cold Day (Feb1), Cases 680FF and 980FF



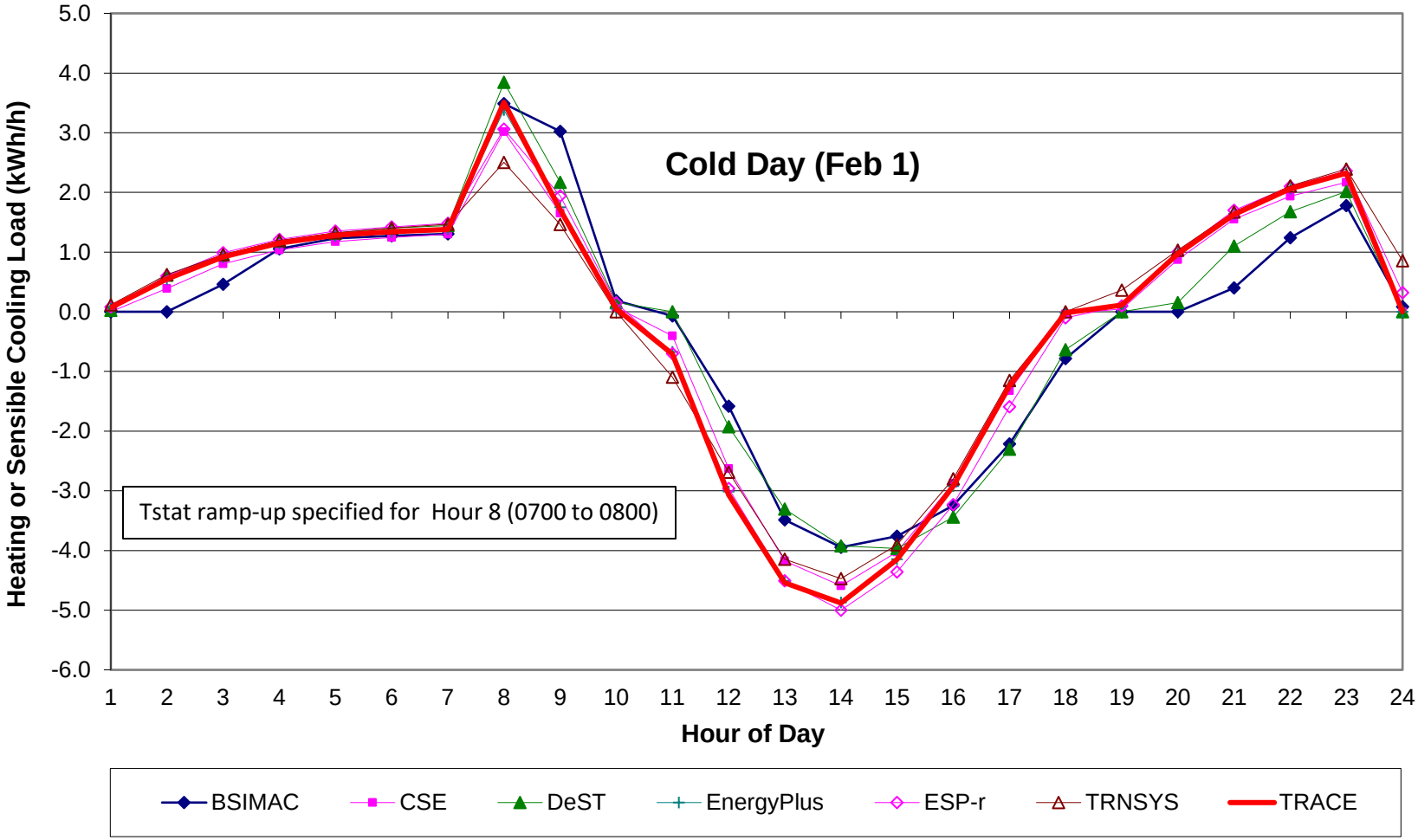
# Figure B8-H15. Hourly Loads
# Clear Cold Day, Case 600 (Low Mass, Double-Clear Window)
# Heating (+), Sensible Cooling (-)



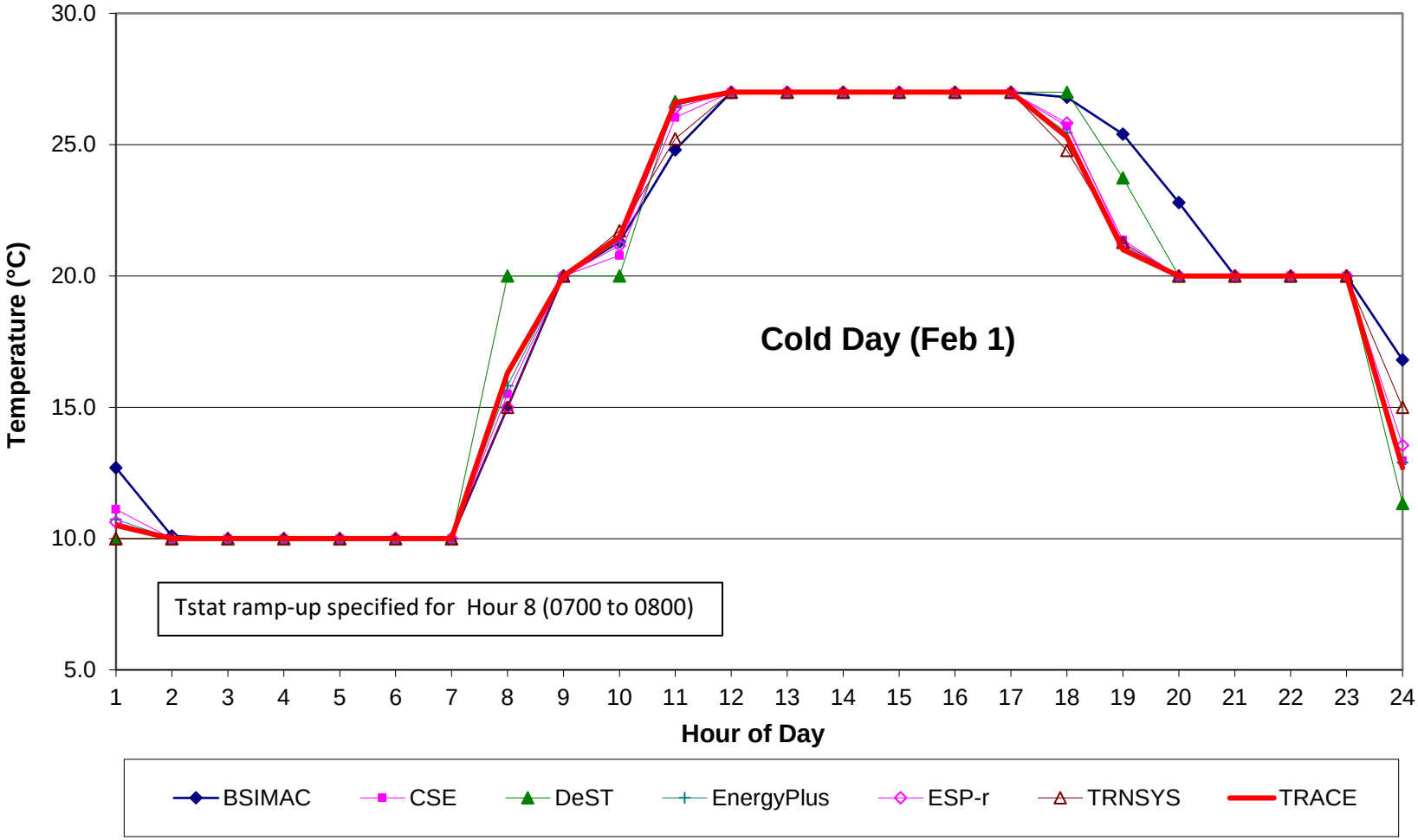
# Figure B8-H16. Hourly Loads
# Clear Hot Day, Case 600 (Low Mass, Double-Clear Window)
# Heating (+), Sensible Cooling (-)



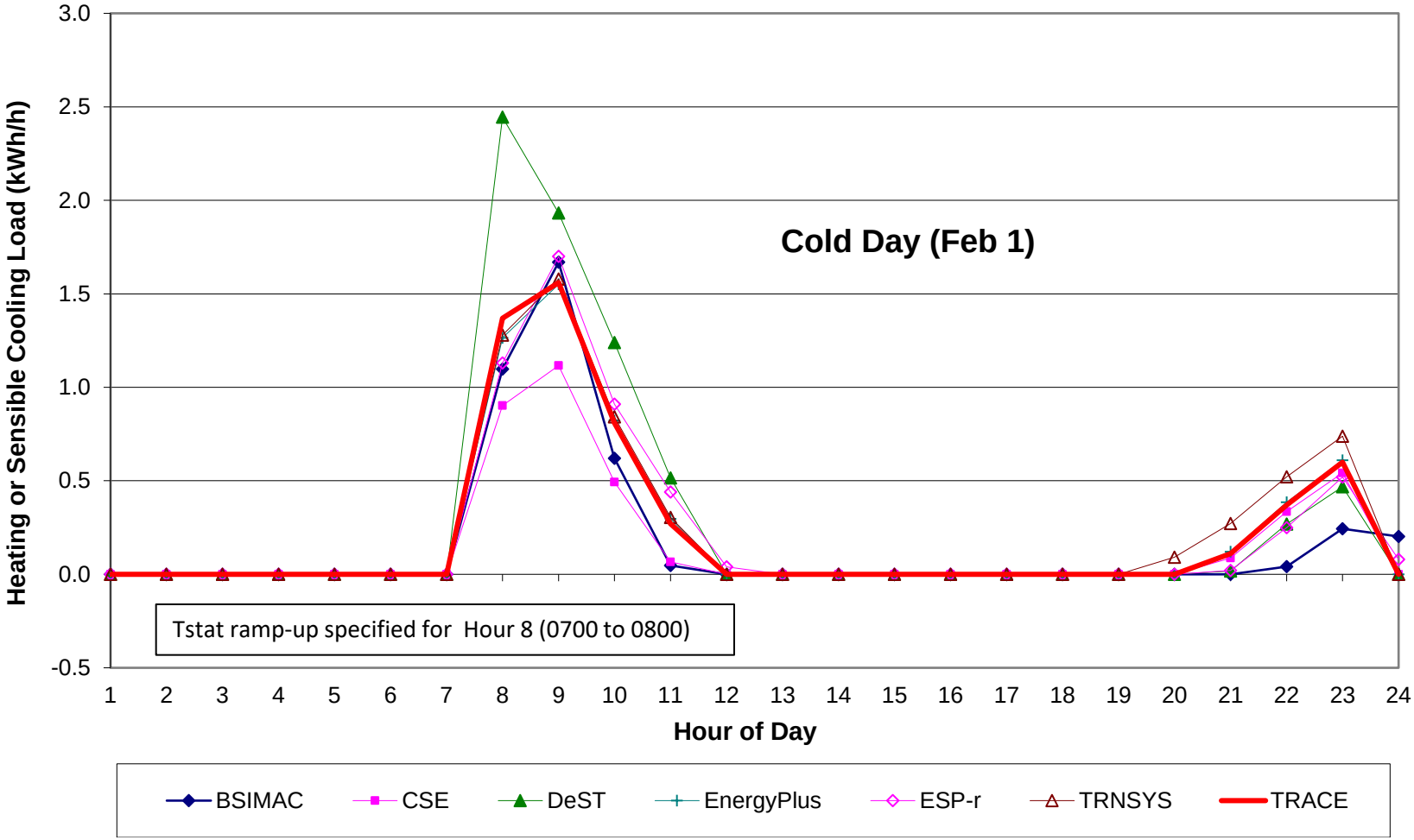
# Figure B8-H17. Hourly Loads
# Clear Cold Day, Case 640 (Low Mass, Night Setback)
# Heating (+), Sensible Cooling (-)



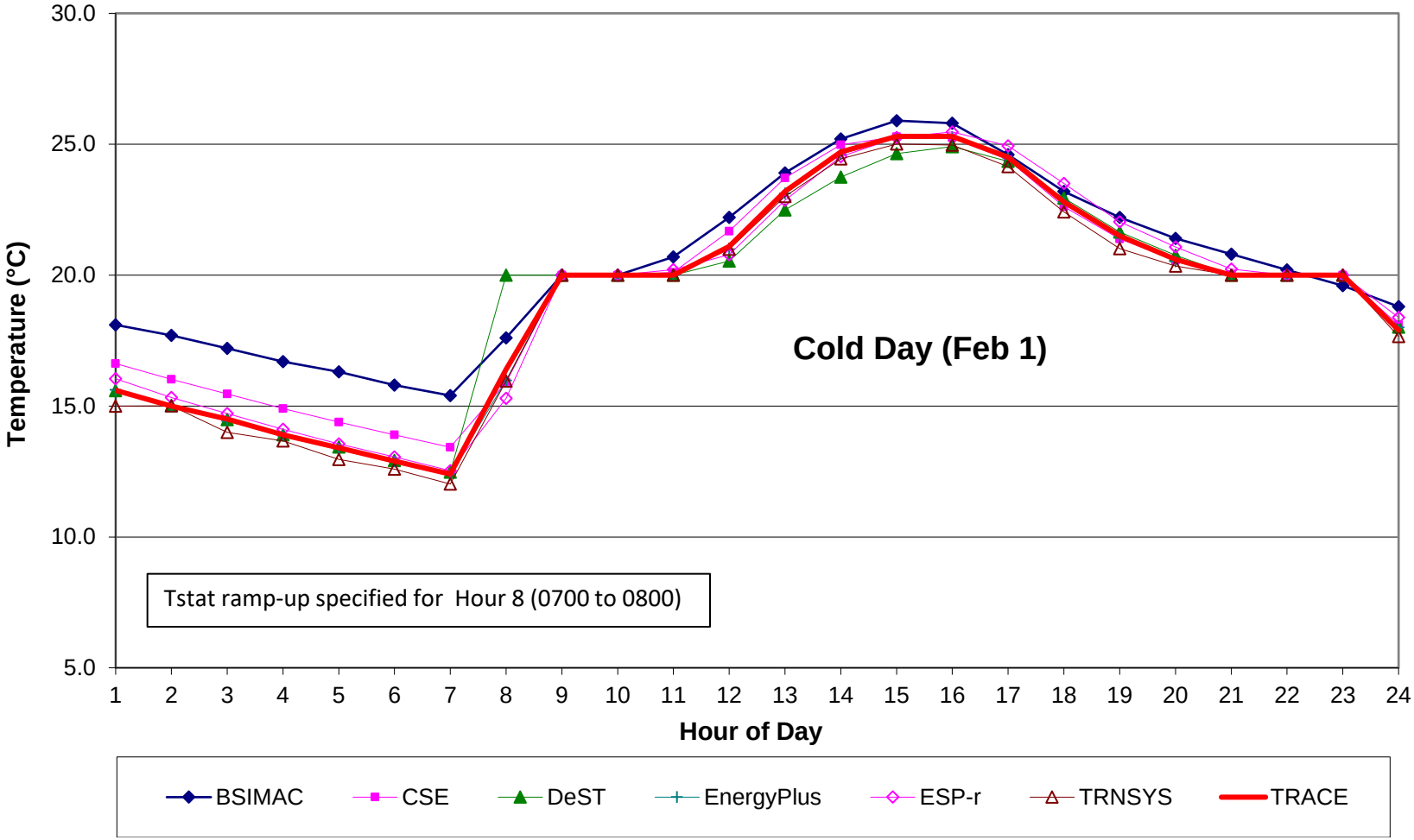
# Figure B8-H18.
# Hourly Conditioned Zone Temperatures
# Clear Cold Day, Case 640



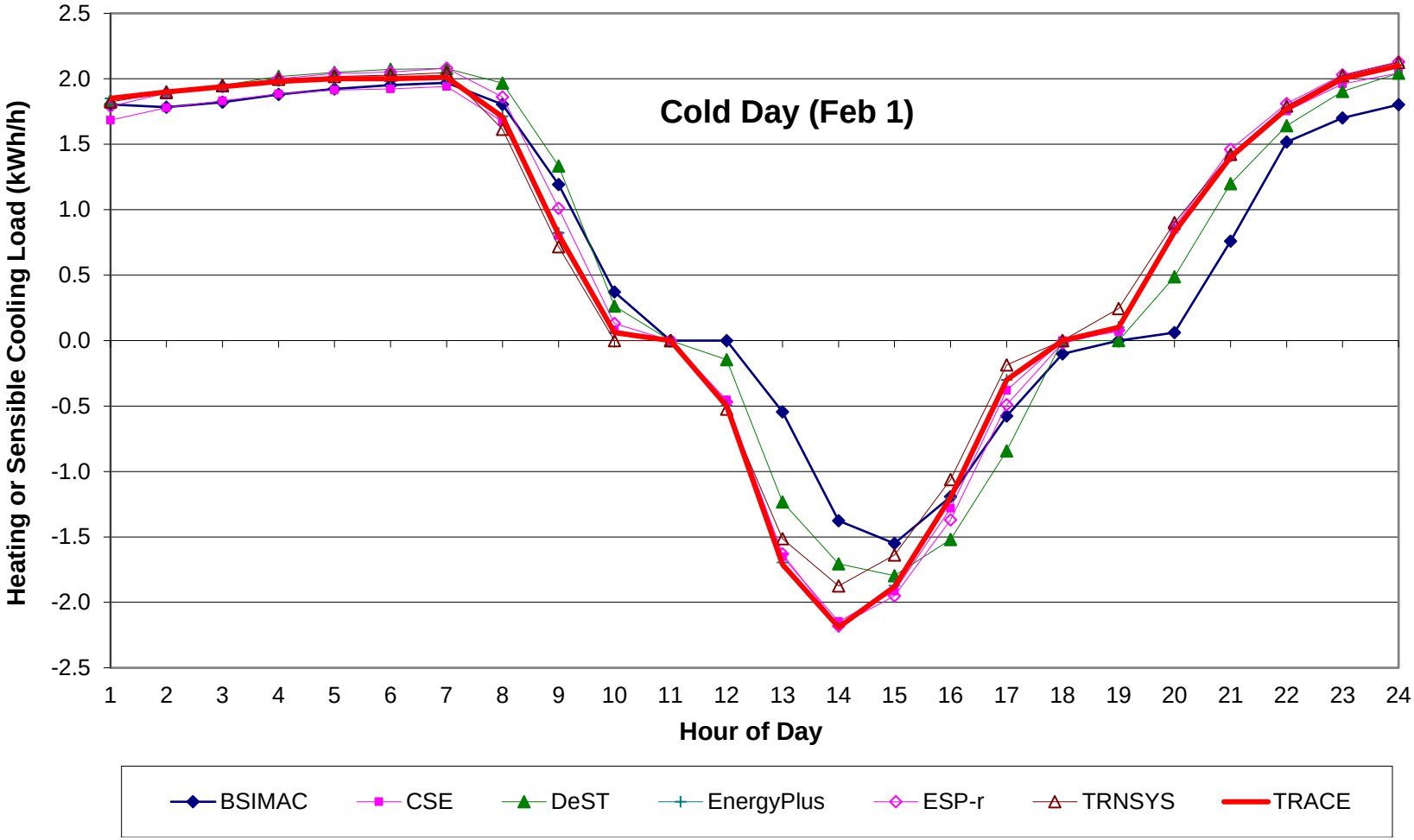
# Figure B8-H19. Hourly Loads
# Clear Cold Day, Case 940 (High Mass, Night Setback)
# Heating (+), Sensible Cooling (-)



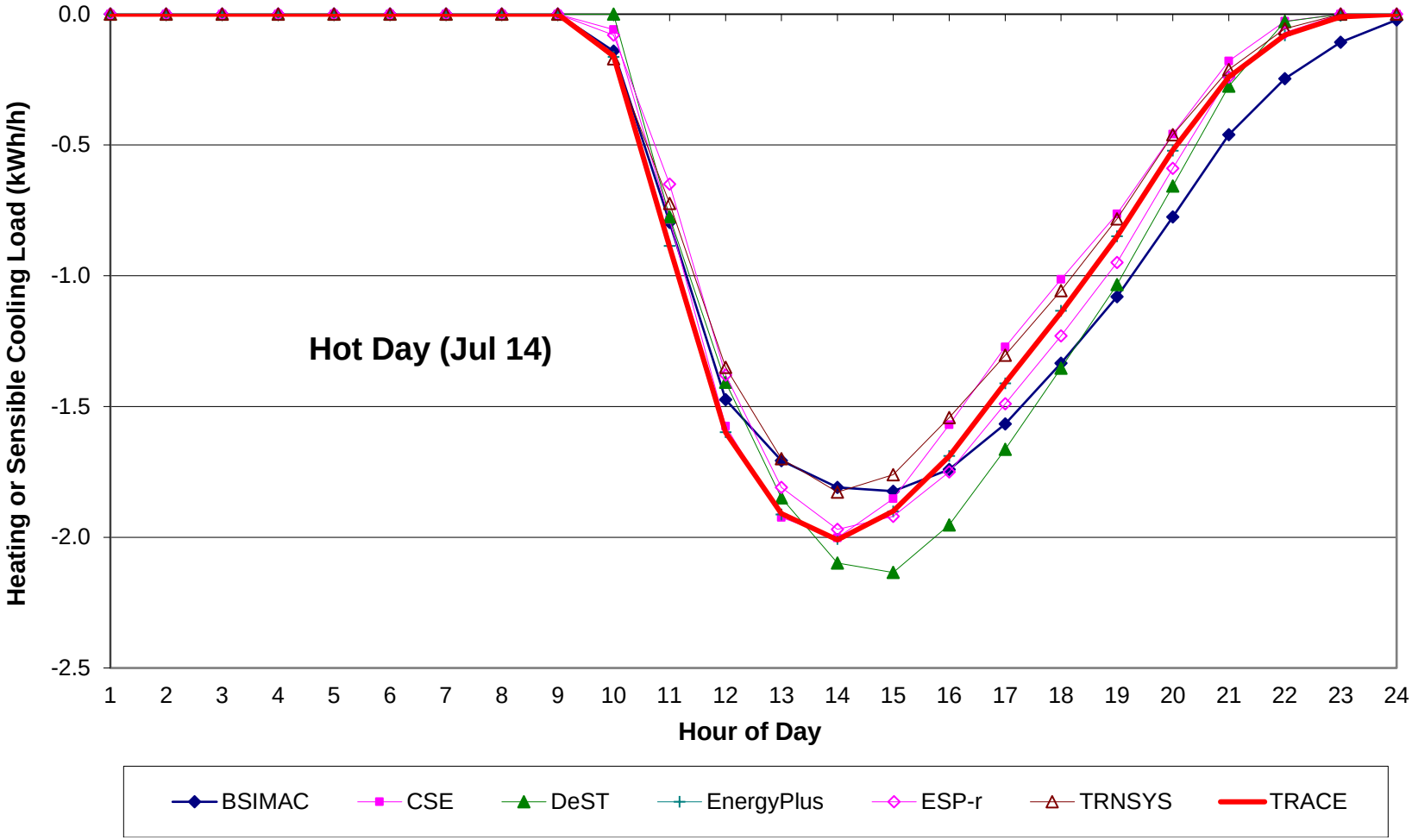
# Figure B8-H20.
# Hourly Conditioned Zone Temperatures
# Clear Cold Day, Case 940



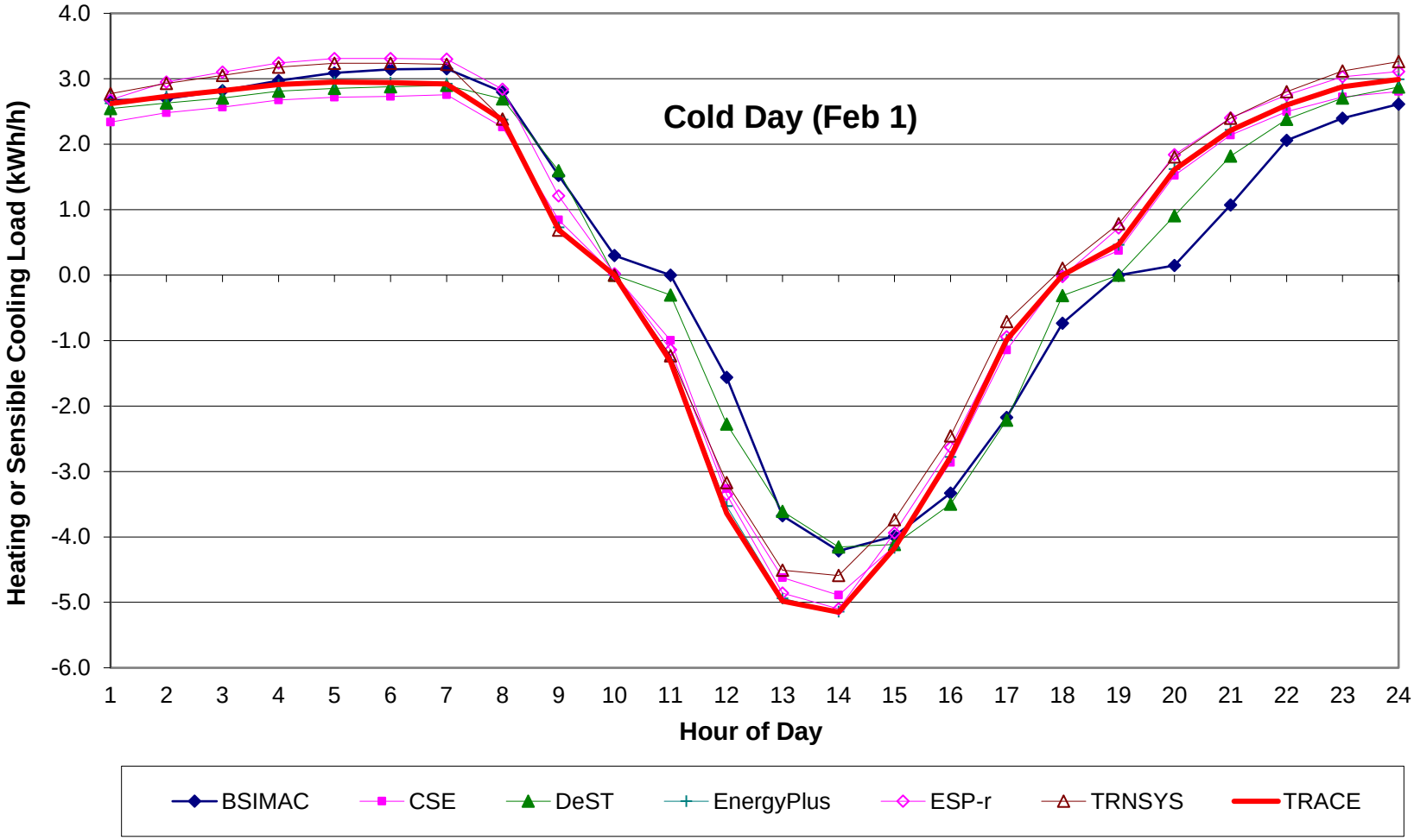
# Figure B8-H21. Hourly Loads
# Clear Cold Day, Case 660 (Low-E Window)
# Heating (+), Sensible Cooling (-)



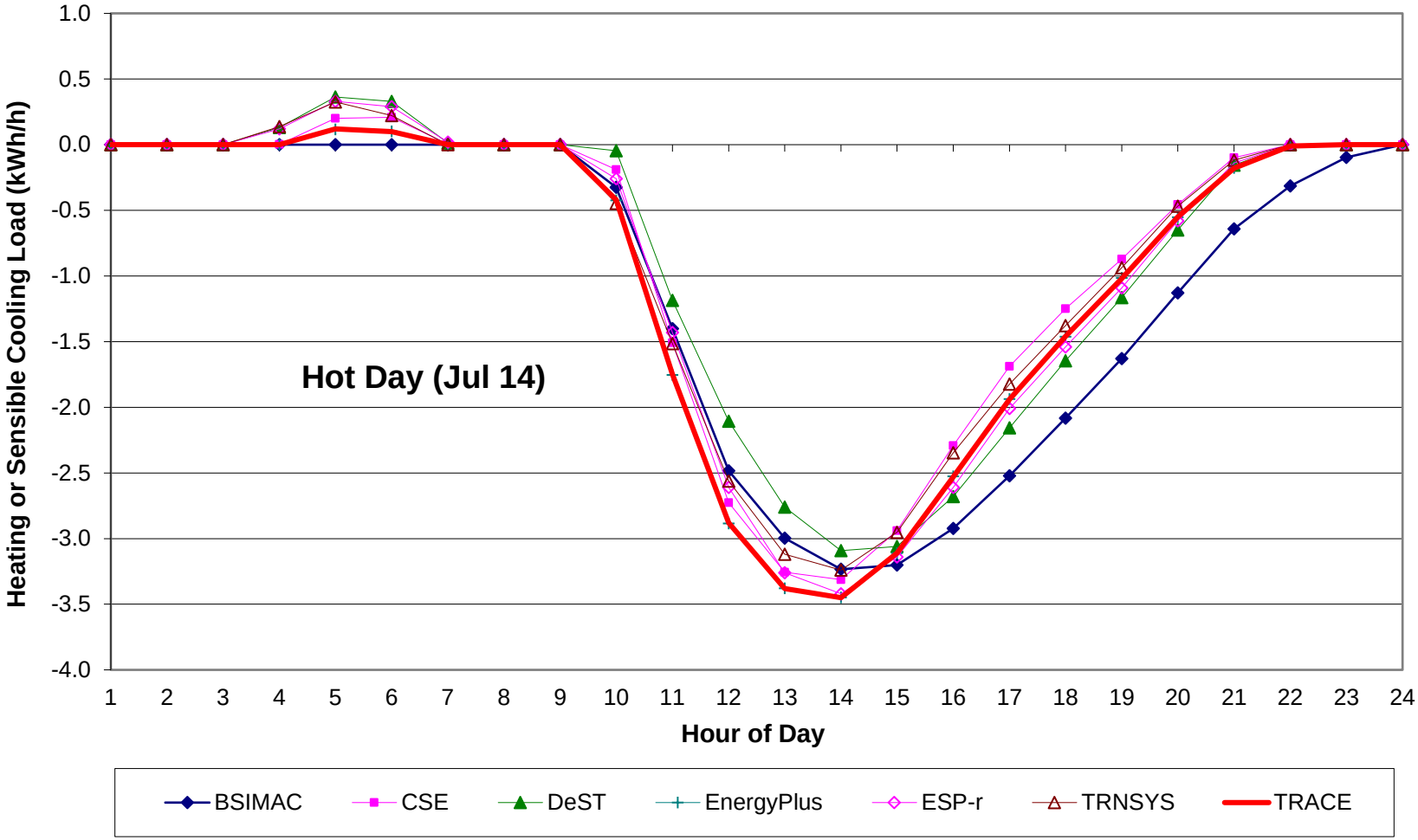
# Figure B8-H22. Hourly Loads
# Clear Hot Day, Case 660 (Low-E Window)
# Heating (+), Sensible Cooling (-)



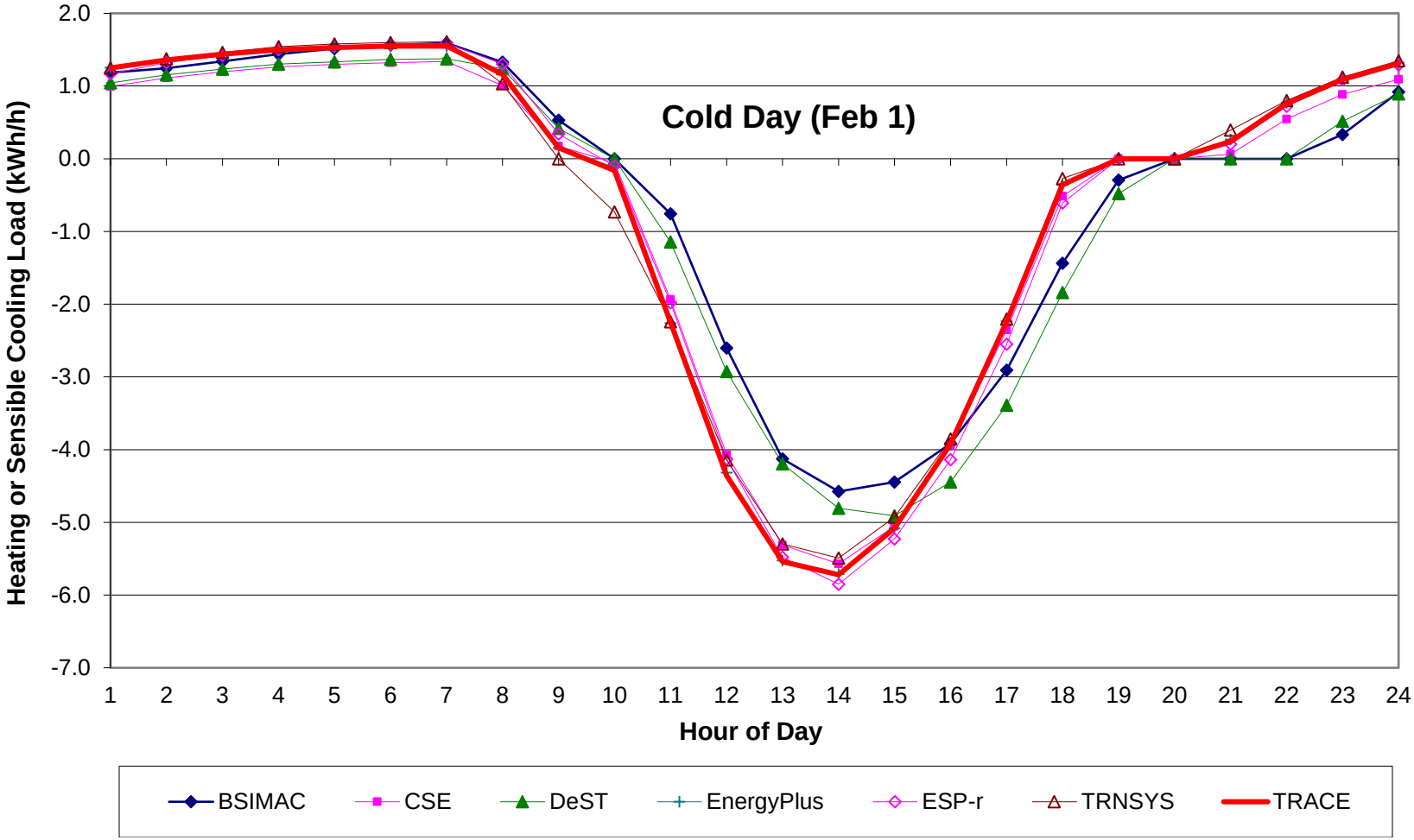
# Figure B8-H23. Hourly Loads
# Clear Cold Day, Case 670 (Single-Pane Window)
# Heating (+), Sensible Cooling (-)



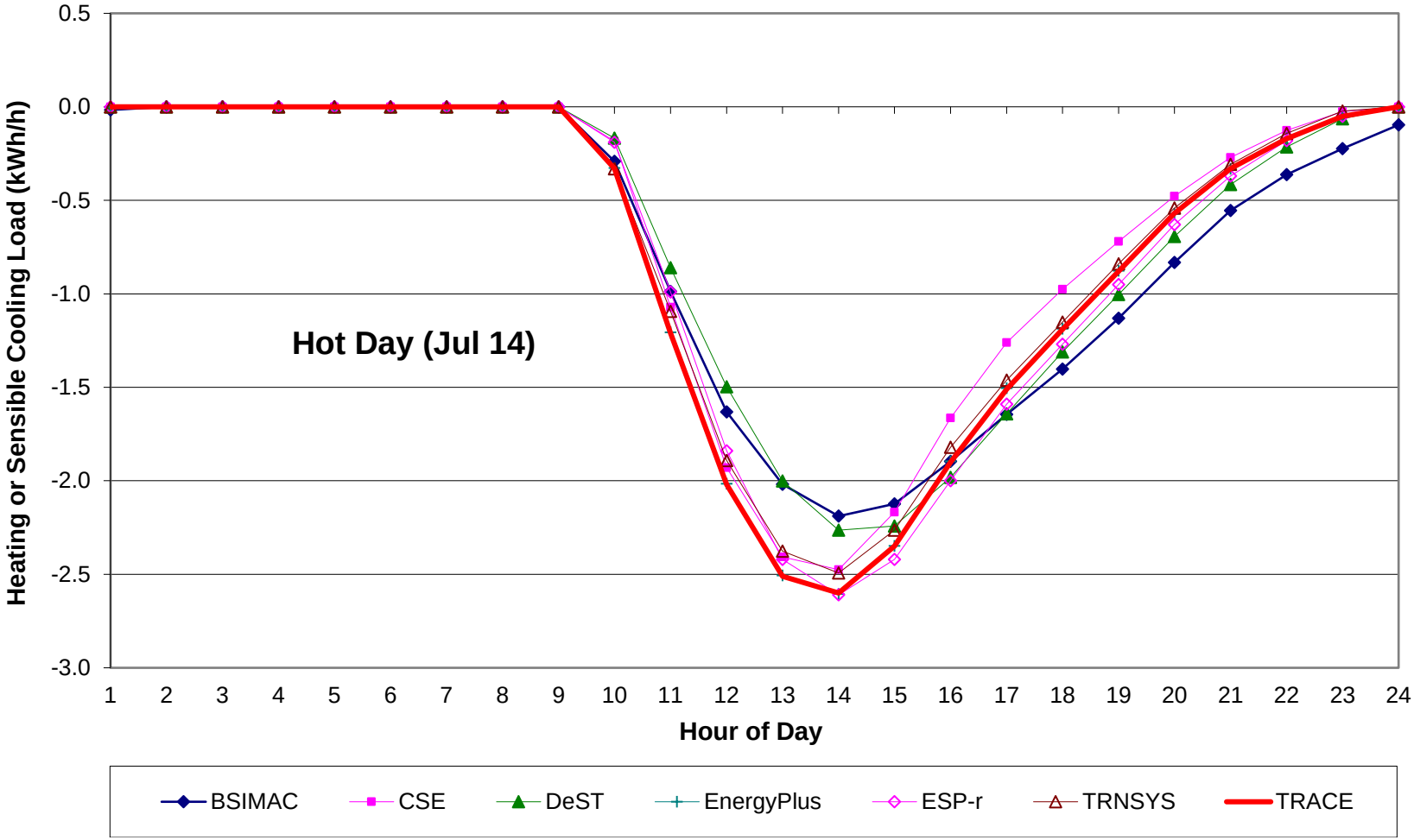
## Figure B8-H24. Hourly Loads
## Clear Hot Day, Case 670 (Single-Pane Window)
## Heating (+), Sensible Cooling (-)



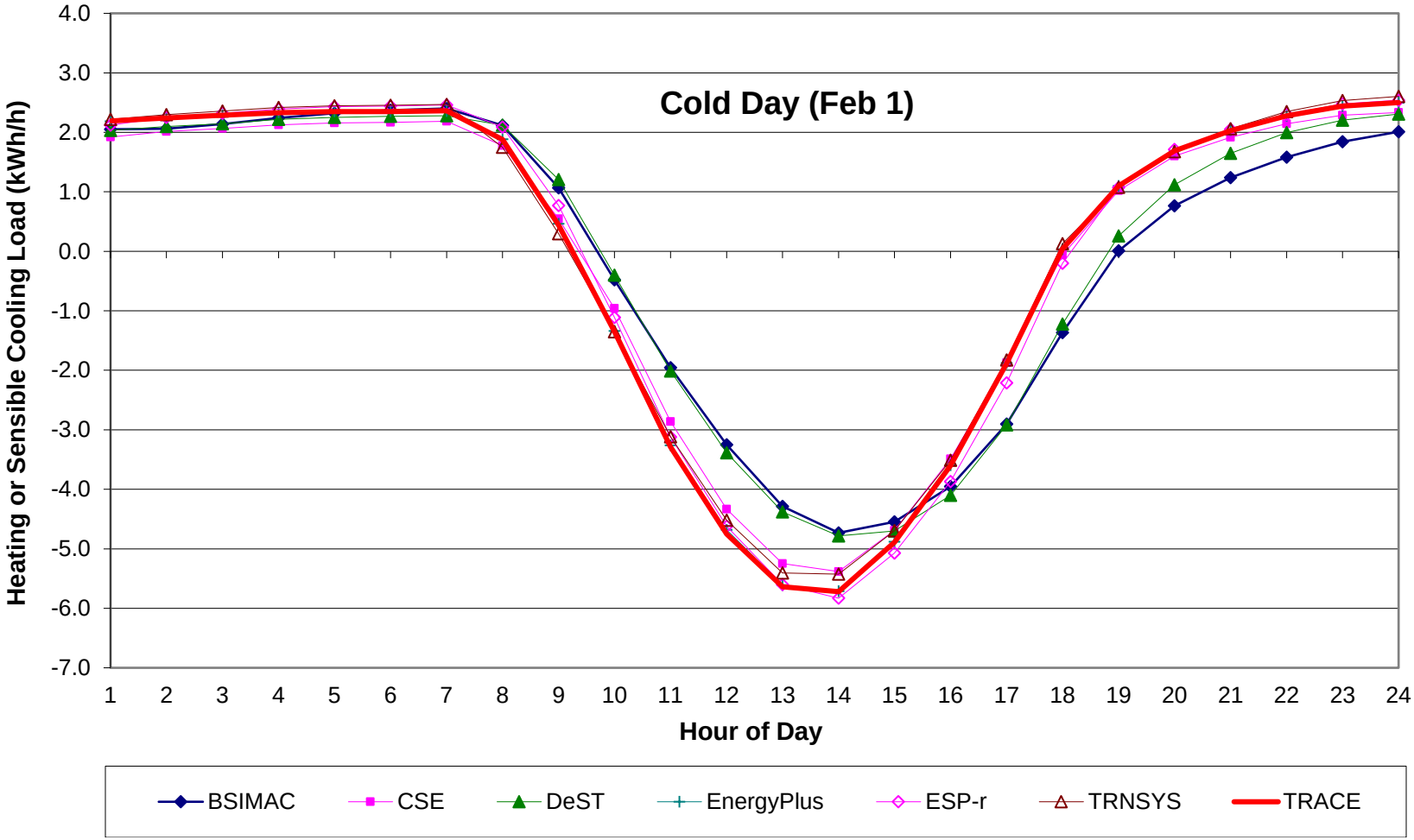
# Figure B8-H25. Hourly Loads
# Clear Cold Day, Case 680 (Insulation)
# Heating (+), Sensible Cooling (-)



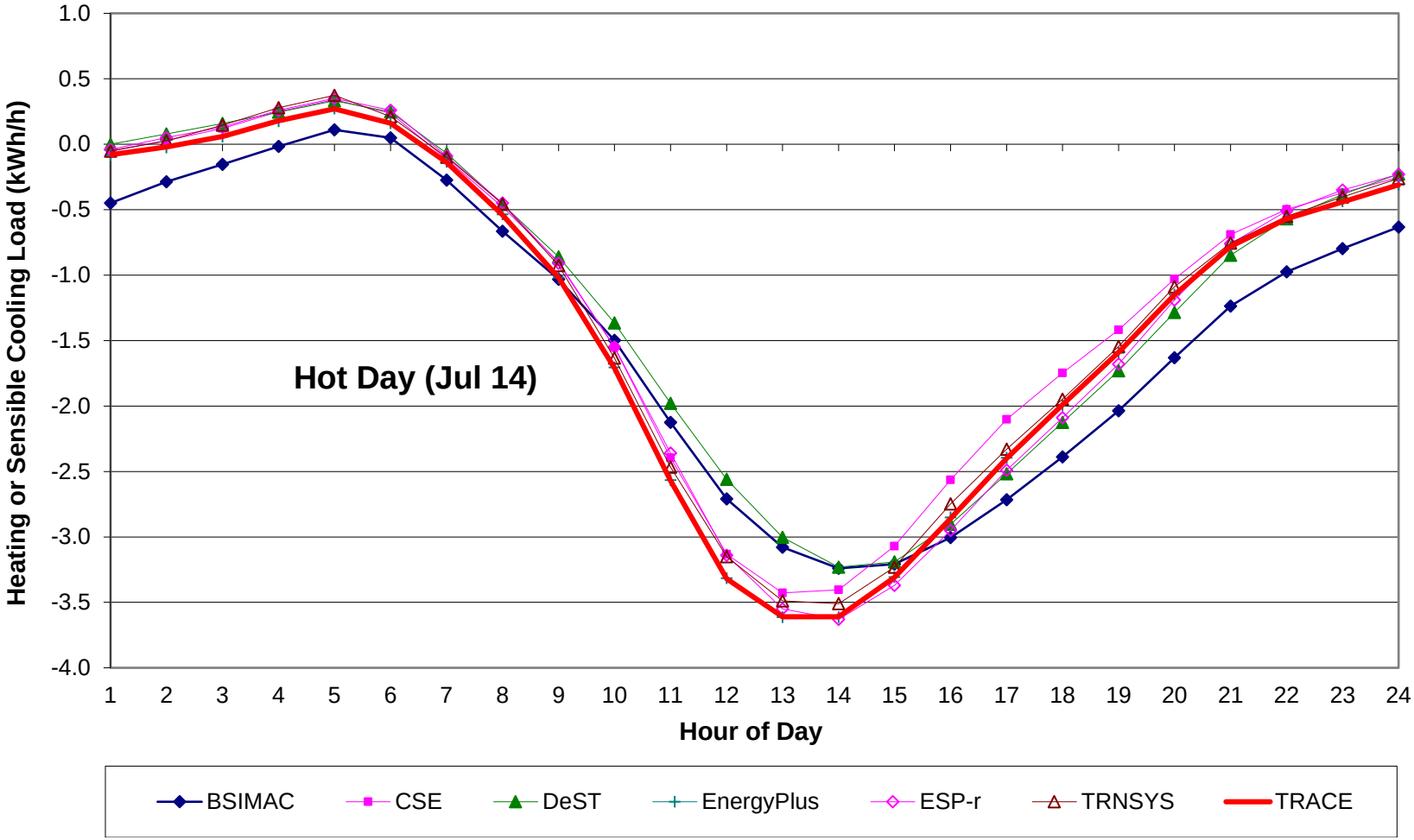
# Figure B8-H26. Hourly Loads
# Clear Hot Day, Case 680 (Insulation)
# Heating (+), Sensible Cooling (-)



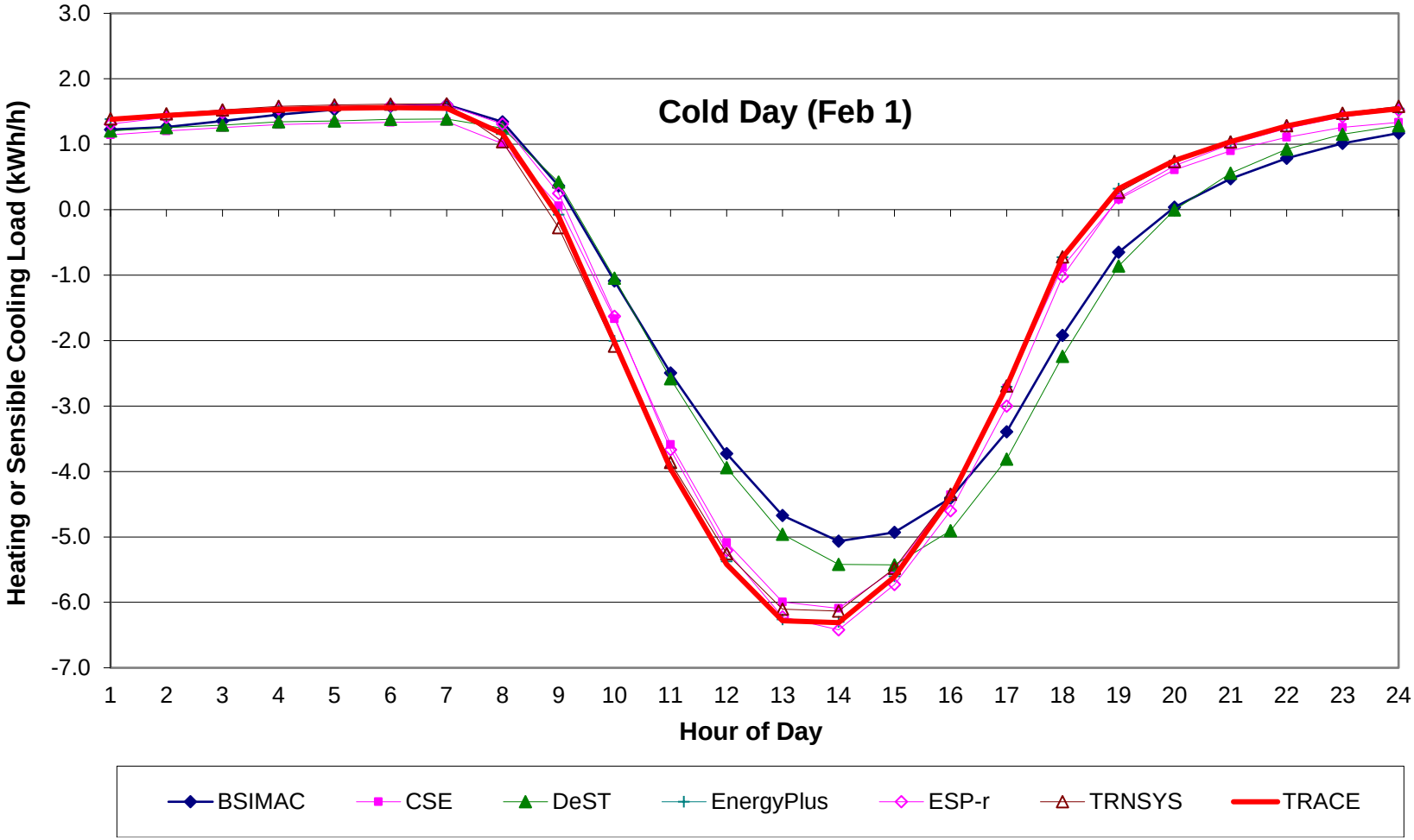
# Figure B8-H27. Hourly Loads
# Clear Cold Day, Case 685 (20/20 Tstat)
# Heating (+), Sensible Cooling (-)



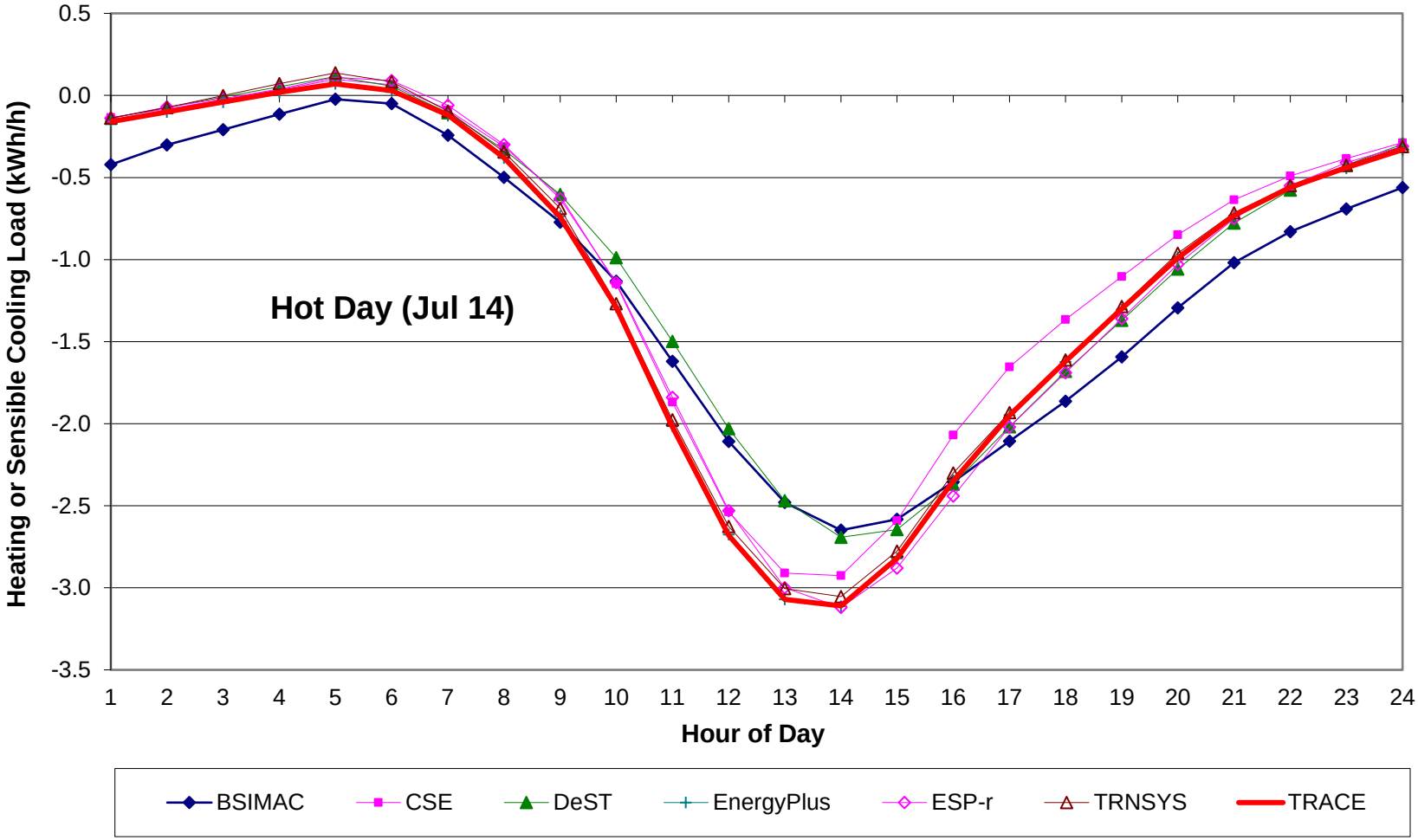
# Figure B8-H28. Hourly Loads
# Clear Hot Day, Case 685 (20/20 Tstat)
# Heating (+), Sensible Cooling (-)



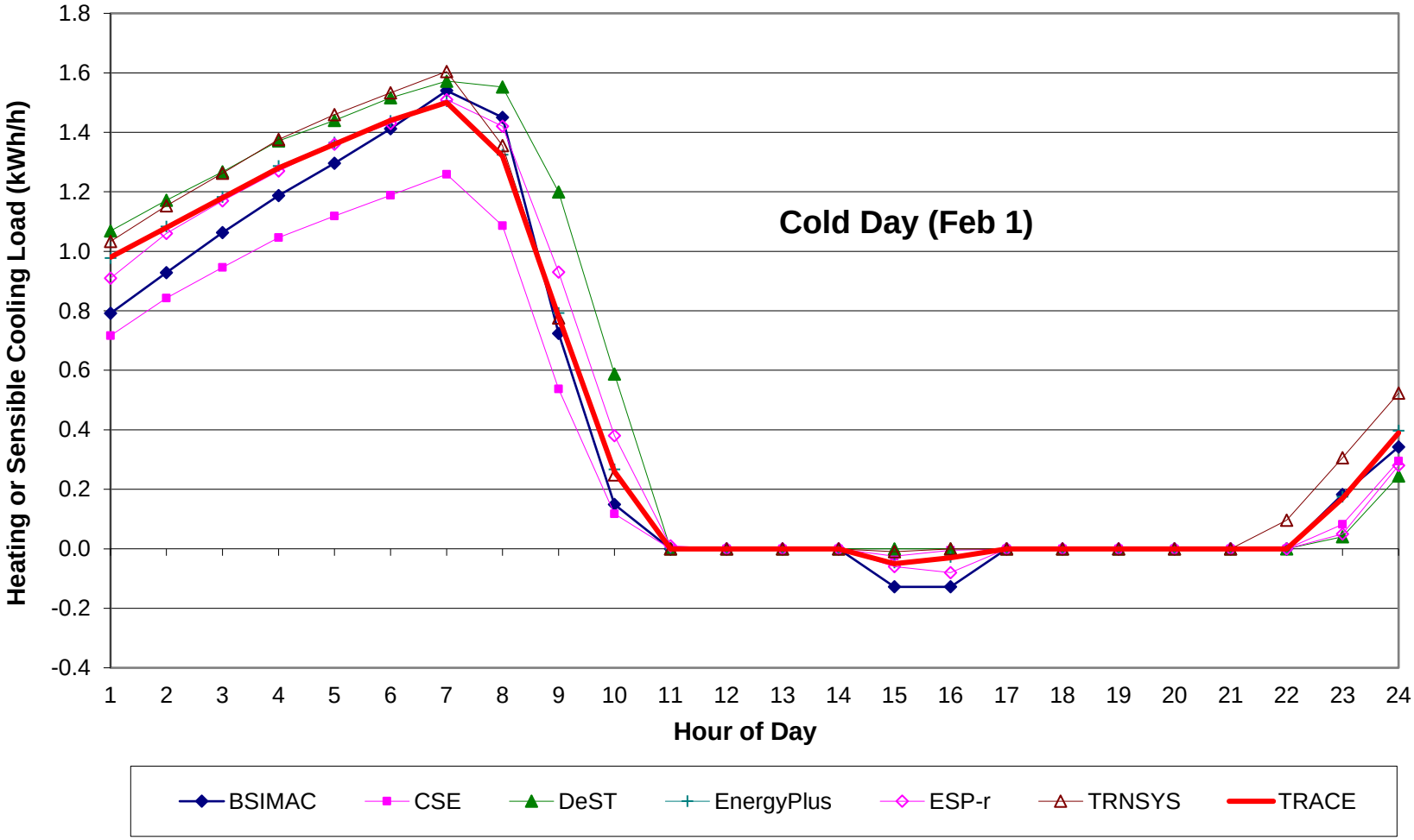
# Figure B8-H29. Hourly Loads
# Clear Cold Day, Case 695 (20/20, Insulation)
# Heating (+), Sensible Cooling (-)



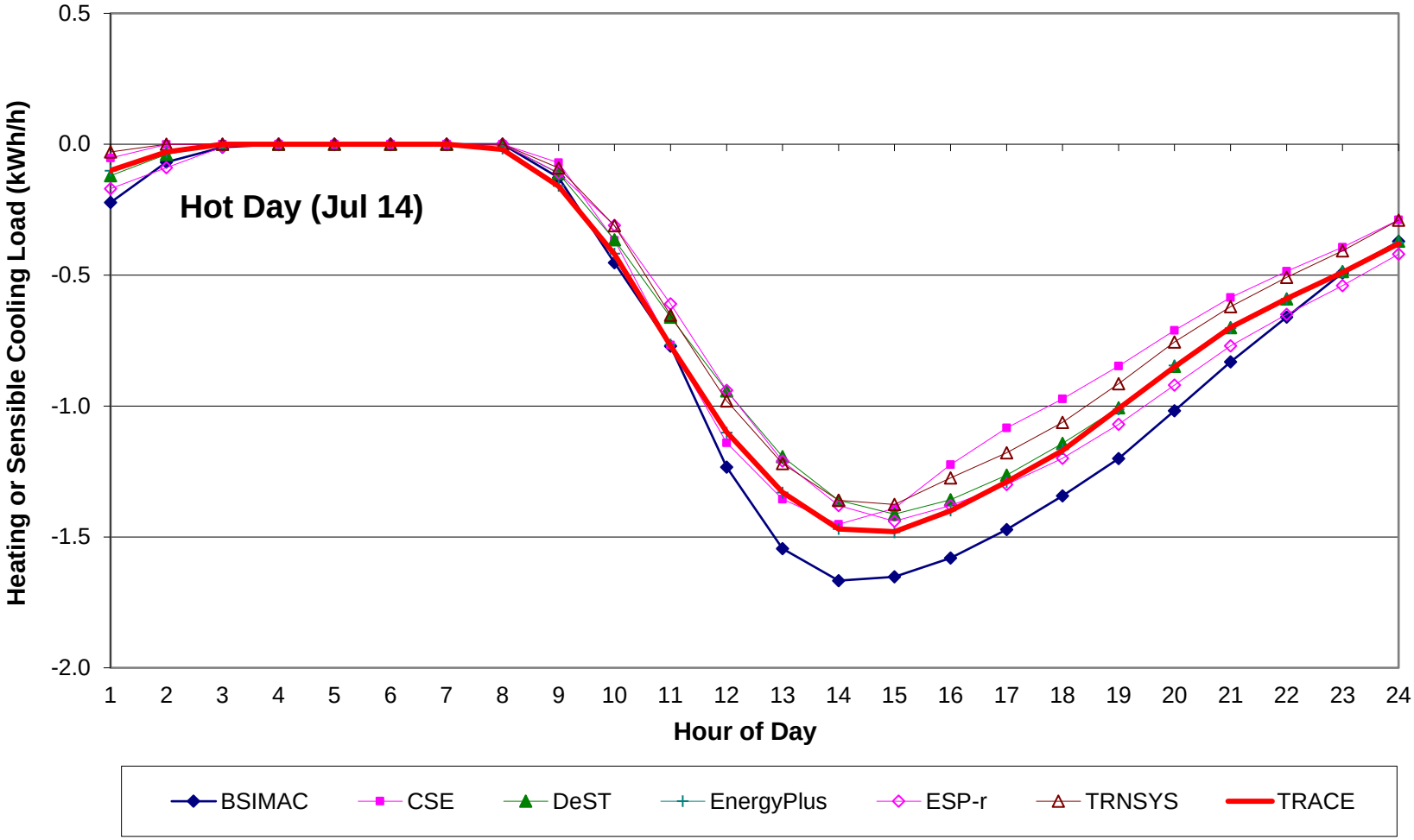
# Figure B8-H30. Hourly Loads
# Clear Hot Day, Case 695 (20/20, Insulation)
# Heating (+), Sensible Cooling (-)



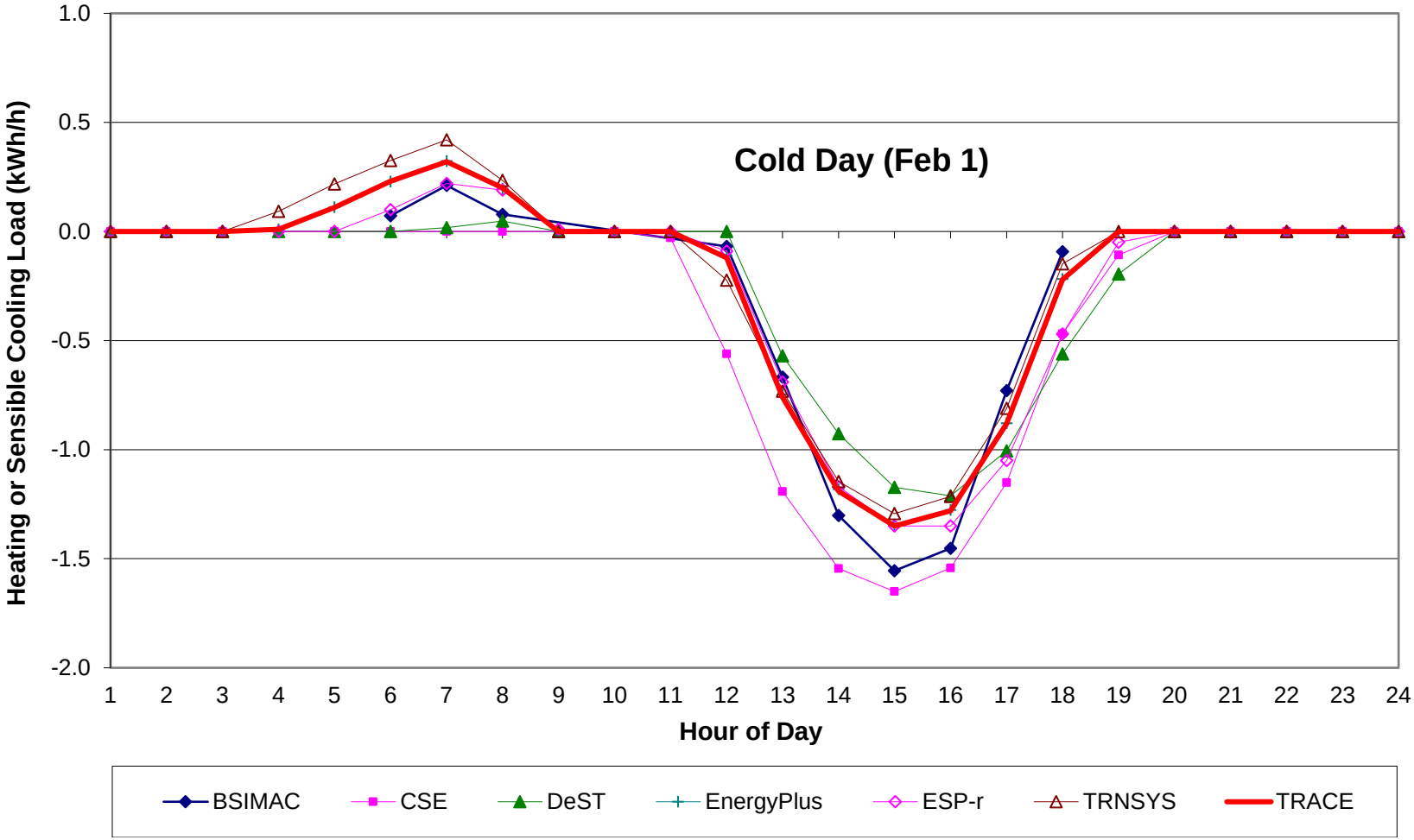
# Figure B8-H31. Hourly Loads
# Clear Cold Day, Case 900 (High Mass)
# Heating (+), Sensible Cooling (-)



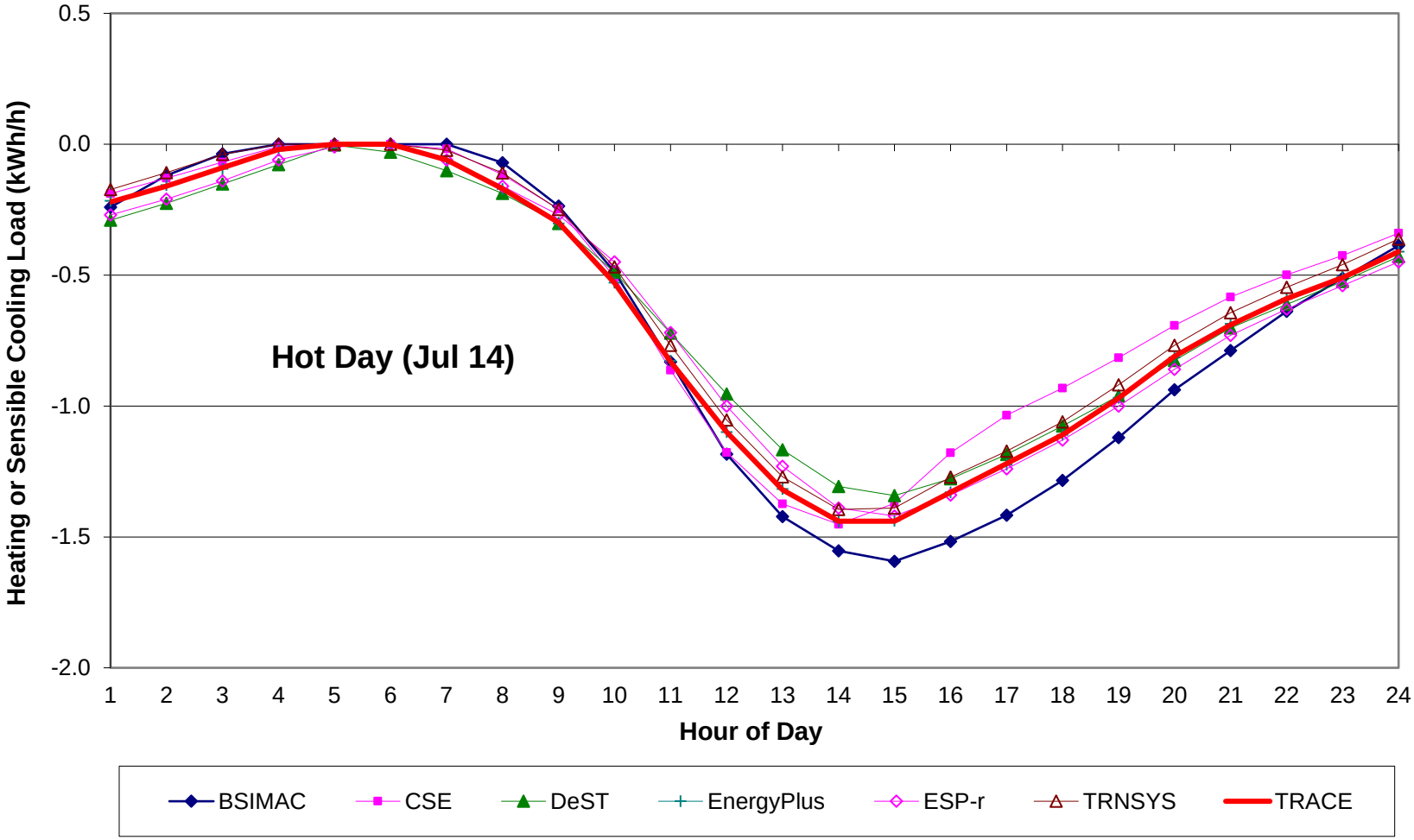
# Figure B8-H32. Hourly Loads
# Clear Hot Day, Case 900 (High Mass)
# Heating (+), Sensible Cooling (-)



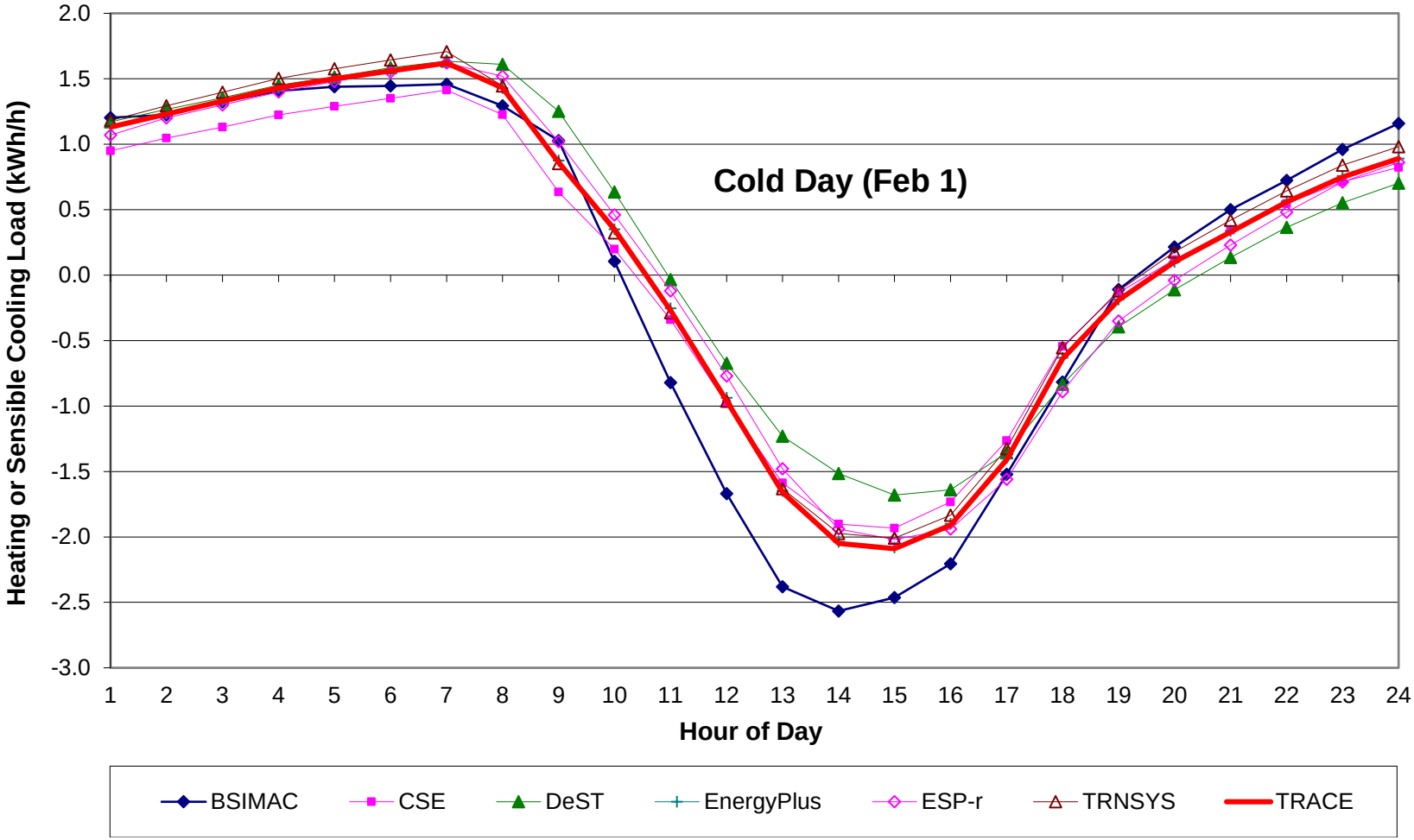
# Figure B8-H33. Hourly Loads
# Clear Cold Day, Case 980 (High Mass, Insulation)
# Heating (+), Sensible Cooling (-)



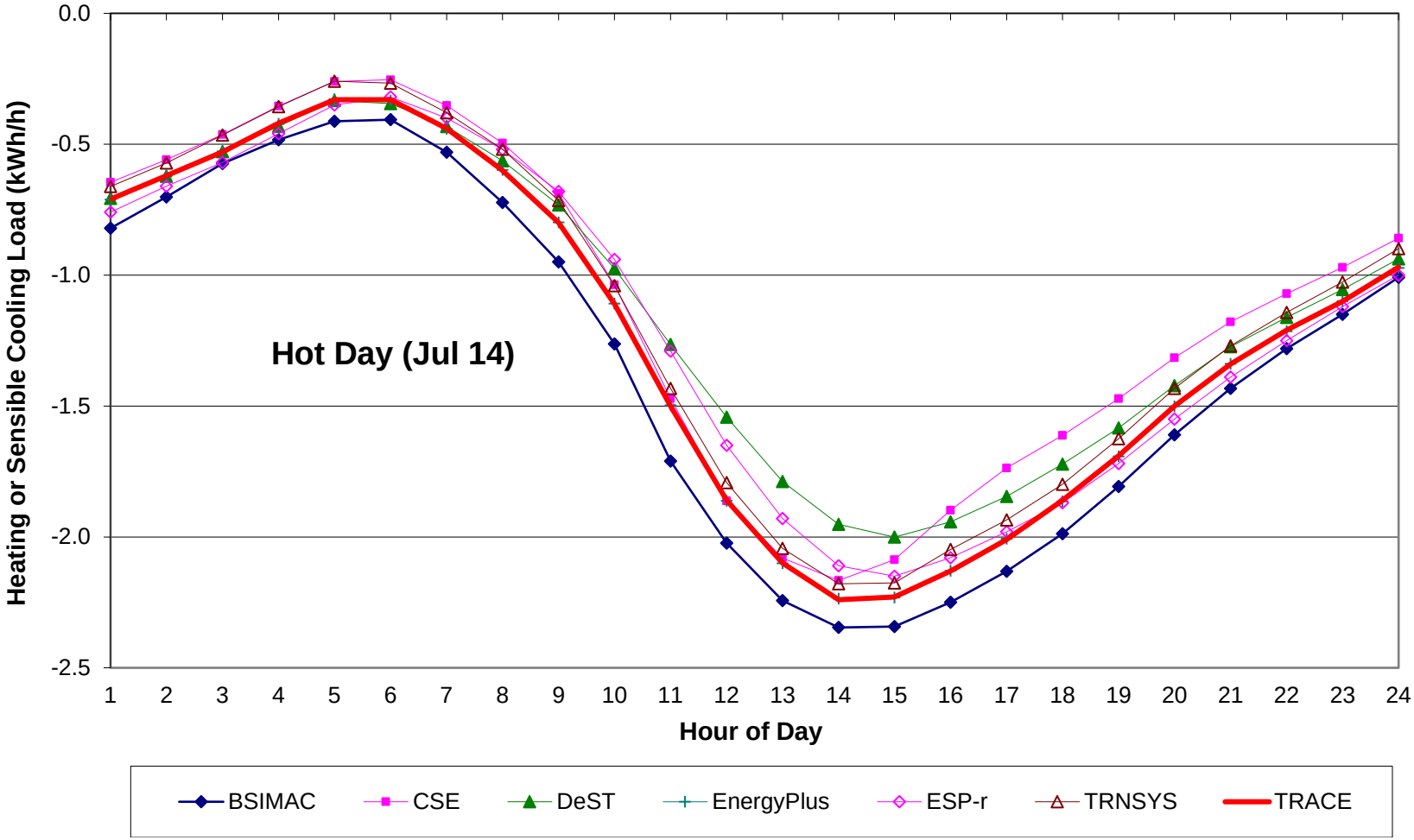
# Figure B8-H34. Hourly Loads
# Clear Hot Day, Case 980 (High Mass, Insulation)
# Heating (+), Sensible Cooling (-)



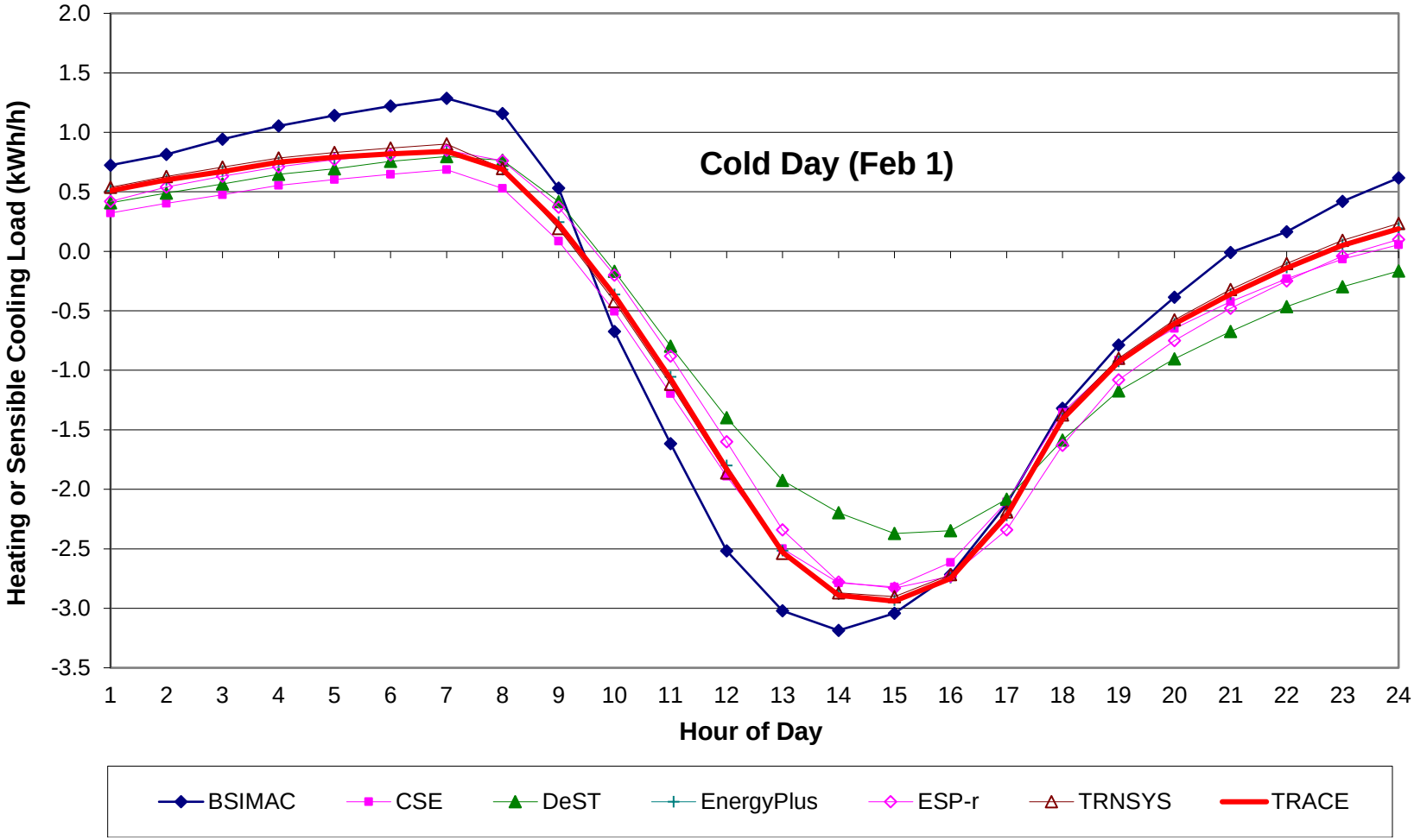
# Figure B8-H35. Hourly Loads
# Clear Cold Day, Case 985 (High Mass, 20/20 Tstat)
# Heating (+), Sensible Cooling (-)



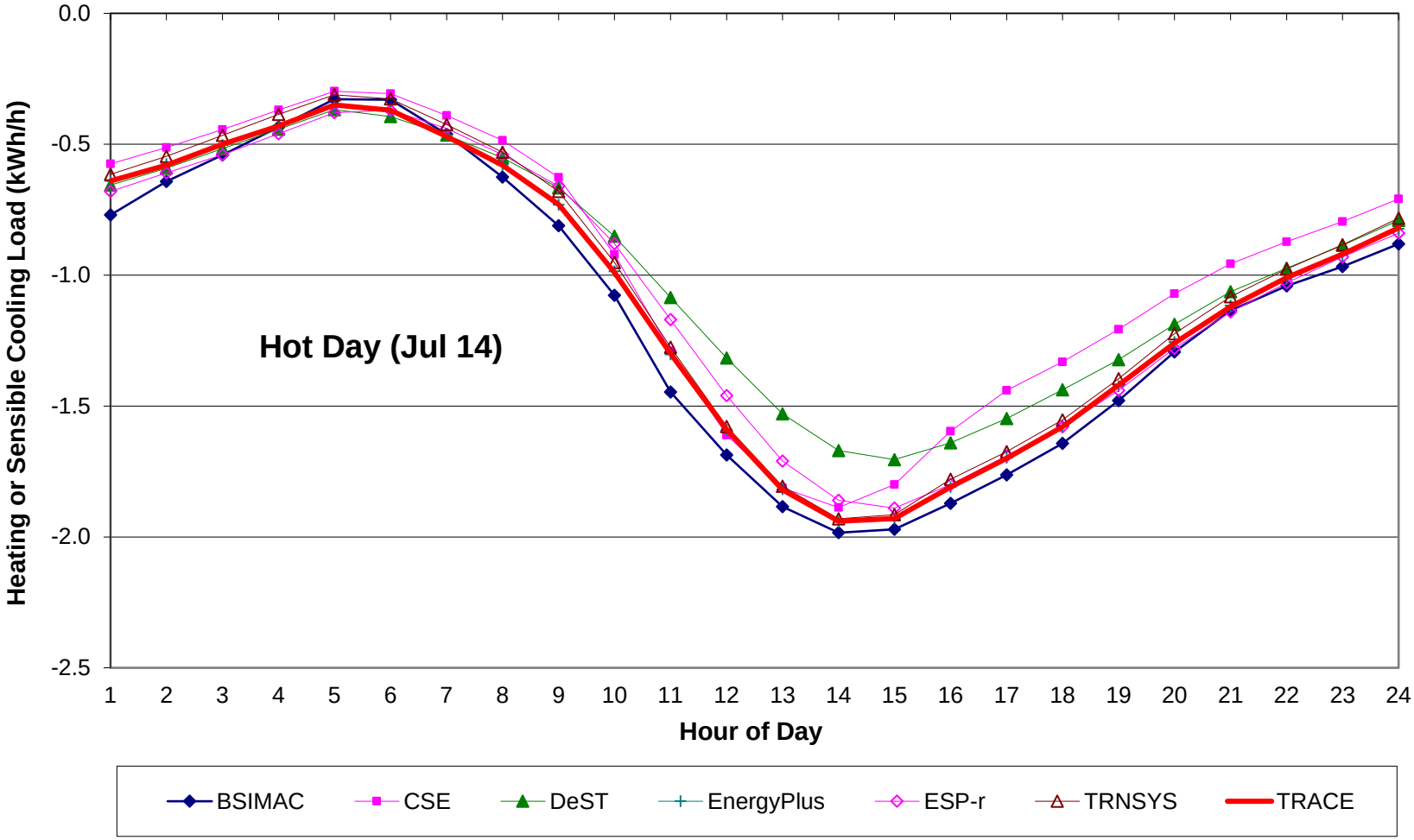
## Figure B8-H36. Hourly Loads
## Clear Hot Day, Case 985 (High Mass, 20/20 Tstat)
## Heating (+), Sensible Cooling (-)



# Figure B8-H37. Hourly Loads
# Clear Cold Day, Case 995 (High Mass, 20/20, Insulation)
# Heating (+), Sensible Cooling (-)



# Figure B8-H38. Hourly Loads
# Clear Hot Day, Case 995 (High Mass, 20/20, Insulation)
# Heating (+), Sensible Cooling (-)



# ASHRAE Standard 140-2020

## Informative Annex B16, Section B16.5.1

## Example Results
## for
## Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200

# ASHRAE Standard 140-2020
# Participating Organizations and Computer Programs for
# Quasi-analytical Solutions and Example Simulation Results
# Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200

The quasi-analytical solutions and programs used to generate the example simulation results are described in Table B17-1. The first column of Table B17-1 ("Model"), indicates the proper program name and version number, or indicates a quasi-analytical solution.

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

The third column ("Implemented By") indicates the national research facility, university, or industry organization with expertise in building science that performed the simulations or did the quasi-analytical solutions.

The entries in the fourth column are the abbreviations for the simulations and quasi-analytical solutions generally used in the tables and charts which follow.

See Standard 140, Annex B17 for further details.

## TABLE B17-1
## Participating Organizations and Computer Programs

| Model | Authoring Organization | Implemented By | Abbreviation |
|---|---|---|---|
| Quasi-Analytical solution with ideal controller model | Hochschule Technik & Architektur Luzern, Switzerland (HTAL) | Hochschule Technik & Architektur Luzern, Switzerland | HTAL1 |
| Quasi-Analytical solution with realistic controller model | Hochschule Technik & Architektur Luzern, Switzerland | Hochschule Technik & Architektur Luzern, Switzerland | HTAL2 |
| Quasi-Analytical Solution with ideal controller model | Technische Universität Dresden, Germany (TUD) | Technische Universität Dresden, Germany | TUD |
| CA-SIS V1 | Electricité de France, France (EDF) | Electricité de France, France | CA-SIS |
| CLIM2000 2.1.6 | Electricité de France, France | Electricité de France, France | CLM2000 |
| DOE-2.1E-088 | LANL/LBNL/ESTSC,[a,b,c] USA | CIEMAT,[d] Spain | DOE21E/CIEMAT<br>DOE2.1-E/CIEMAT |
| DOE-2.1E-133 | LANL/LBNL/JJH,[a,b,e] USA | NREL/JNA,[f] USA | DOE21E/NREL<br>DOE2.1-E/NREL |
| ENERGYPLUS 1.0.0.023 | LBNL/UIUC/CERL/OSU/GARD Analytics/FSEC/DOE-OBT,[a,g,h,i,j,k] | GARD Analytics, USA | E+<br>EnergyPlus |
| TRNSYS 14.2-TUD with ideal controller model | University of Wisconsin, USA; Technische Universität Dresden, Ger. | Technische Universität Dresden, Germany | TRN-id<br>TRNSYS-ideal |
| TRNSYS 14.2-TUD with real controller model | University of Wisconsin, USA; Technische Universität Dresden, Ger. | Technische Universität Dresden, Germany | TRN-re<br>TRNSYS-real |

[a]LANL: Los Alamos National Laboratory, United States
[b]LBNL: Lawrence Berkeley National Laboratory, United States
[c]ESTSC: Energy Science and Technology Software Center (at Oak Ridge National Laboratory), United States
[d]CIEMAT: Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Spain
[e]JJH: James J. Hirsch & Associates, United States
[f]NREL/JNA: National Renewable Energy Laboratory/J. Neymark & Associates, United States
[g]UIUC: University of Illinois Urbana/Champaign, United States
[h]CERL: U.S. Army Corps of Engineers, Construction Engineering Research Laboratories, United States
[i]OSU: Oklahoma State University, United States
[j]FSEC: University of Central Florida, Florida Solar Energy Center, United States
[k]DOE-OBT: U.S. Department of Energy, Office of Building Technology, State and Community Programs, Energy Efficiency and Renewable Energy, United States

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

# List of Tables

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

# List of Figures

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

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 B16.5.1-1. Space Cooling Electricity Consumption

| **Energy Consumption, Total (kWh,e)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 1531 | 1530 | 1521 | 1519 | 1520 | 1522 | 1512 | 1512 | 1531 | 1.2% | 1531 | 1531 | 1531 | 1520 |
| CE110 | 1077 | 1089 | 1061 | 1065 | 1069 | 1067 | 1062 | 1061 | 1089 | 2.6% | 1076 | 1077 | 1077 | 1070 |
| CE120 | 1012 | 1012 | 1011 | 1003 | 1006 | 1007 | 1002 | 1002 | 1012 | 1.0% | 1013 | 1011 | 1011 | 1009 |
| CE130 | 110 | 109 | 105 | 106 | 109 | 109 | 110 | 105 | 110 | 4.3% | 111 | 110 | 110 | 108 |
| CE140 | 68 | 69 | 65 | 66 | 68 | 68 | 69 | 65 | 69 | 5.8% | 69 | 69 | 68 | 68 |
| CE150 | 1208 | 1207 | 1202 | 1183 | 1197 | 1199 | 1192 | 1183 | 1208 | 2.1% | 1206 | 1207 | 1207 | 1198 |
| CE160 | 1140 | 1139 | 1138 | 1107 | 1132 | 1137 | 1133 | 1107 | 1140 | 2.9% | 1140 | 1139 | 1139 | 1132 |
| CE165 | 1502 | 1501 | 1499 | 1470 | 1491 | 1500 | 1490 | 1470 | 1502 | 2.1% | 1498 | 1500 | 1500 | 1492 |
| CE170 | 638 | 638 | 629 | 620 | 635 | 636 | 636 | 620 | 638 | 2.8% | 641 | 638 | 638 | 636 |
| CE180 | 1083 | 1082 | 1077 | 1080 | 1082 | 1081 | 1080 | 1077 | 1083 | 0.5% | 1083 | 1082 | 1082 | 1081 |
| CE185 | 1544 | 1543 | 1541 | 1547 | 1540 | 1542 | 1538 | 1538 | 1547 | 0.6% | 1545 | 1543 | 1543 | 1537 |
| CE190 | 164 | 164 | 160 | 160 | 164 | 164 | 165 | 160 | 165 | 3.1% | 165 | 164 | 164 | 164 |
| CE195 | 250 | 250 | 245 | 246 | 250 | 250 | 252 | 245 | 252 | 2.7% | 252 | 250 | 250 | 250 |
| CE200 | 1477 | 1464 | 1468 | 1440 | 1465 | 1480 | 1480 | 1440 | 1480 | 2.7% | 1476 | 1477 | 1477 | 1473 |

| **Energy Consumption, Compressor (kWh,e)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 1319 | 1318 | 1307 | 1311 | | 1311 | 1303 | 1303 | 1319 | 1.2% | 1319 | 1319 | 1319 | |
| CE110 | 889 | 899 | 866 | 883 | | 879 | 876 | 866 | 899 | 3.7% | 888 | 889 | 889 | |
| CE120 | 840 | 840 | 850 | 838 | | 836 | 832 | 832 | 850 | 2.2% | 841 | 839 | 839 | |
| CE130 | 95 | 94 | 93 | 93 | | 94 | 95 | 93 | 95 | 2.1% | 95 | 94 | 94 | |
| CE140 | 57 | 57 | 55 | 56 | | 56 | 57 | 55 | 57 | 3.9% | 57 | 57 | 56 | |
| CE150 | 1000 | 999 | 1007 | 982 | | 992 | 987 | 982 | 1007 | 2.5% | 999 | 999 | 999 | |
| CE160 | 950 | 949 | 963 | 926 | | 947 | 944 | 926 | 963 | 3.9% | 950 | 949 | 949 | |
| CE165 | 1283 | 1281 | 1291 | 1256 | | 1280 | 1272 | 1256 | 1291 | 2.8% | 1279 | 1280 | 1280 | |
| CE170 | 531 | 530 | 539 | 523 | | 528 | 529 | 523 | 539 | 3.0% | 533 | 530 | 530 | |
| CE180 | 909 | 908 | 914 | 912 | | 907 | 906 | 906 | 914 | 0.9% | 908 | 908 | 908 | |
| CE185 | 1340 | 1339 | 1343 | 1344 | | 1337 | 1334 | 1334 | 1344 | 0.7% | 1340 | 1339 | 1338 | |
| CE190 | 138 | 138 | 139 | 138 | | 138 | 138 | 138 | 139 | 1.4% | 138 | 138 | 138 | |
| CE195 | 217 | 217 | 219 | 217 | | 216 | 218 | 216 | 219 | 1.1% | 219 | 217 | 217 | |
| CE200 | 1250 | 1239 | 1249 | 1218 | | 1253 | 1253 | 1218 | 1253 | 2.8% | 1249 | 1250 | 1250 | |

| **Energy Consumption, Supply Fan (kWh,e)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 144 | 144 | 145 | 141 | 144 | 144 | 142 | 141 | 145 | 2.9% | 144 | 144 | 144 | 144 |
| CE110 | 128 | 129 | 133 | 122 | 128 | 128 | 127 | 122 | 133 | 8.5% | 128 | 128 | 128 | 128 |
| CE120 | 117 | 117 | 110 | 110 | 116 | 117 | 115 | 110 | 117 | 6.3% | 117 | 117 | 117 | 117 |
| CE130 | 10 | 10 | 8 | 8 | 10 | 10 | 10 | 8 | 10 | 23.1% | 10 | 10 | 10 | 10 |
| CE140 | 8 | 8 | 7 | 6 | 8 | 8 | 8 | 6 | 8 | 27.2% | 8 | 8 | 8 | 8 |
| CE150 | 141 | 141 | 133 | 136 | 140 | 141 | 139 | 133 | 141 | 5.7% | 141 | 141 | 141 | 140 |
| CE160 | 129 | 129 | 119 | 121 | 128 | 129 | 128 | 119 | 129 | 7.8% | 129 | 129 | 129 | 128 |
| CE165 | 149 | 150 | 142 | 145 | 149 | 149 | 148 | 142 | 150 | 5.6% | 149 | 149 | 149 | 149 |
| CE170 | 73 | 73 | 61 | 63 | 73 | 73 | 73 | 61 | 73 | 16.1% | 74 | 73 | 73 | 73 |
| CE180 | 118 | 119 | 111 | 112 | 118 | 118 | 118 | 111 | 119 | 6.9% | 119 | 119 | 119 | 118 |
| CE185 | 139 | 139 | 135 | 137 | 139 | 139 | 139 | 135 | 139 | 3.0% | 139 | 139 | 139 | 139 |
| CE190 | 18 | 18 | 14 | 14 | 18 | 18 | 18 | 14 | 18 | 22.9% | 18 | 18 | 18 | 18 |
| CE195 | 23 | 23 | 18 | 18 | 23 | 23 | 23 | 18 | 23 | 23.3% | 23 | 23 | 23 | 23 |
| CE200 | 154 | 153 | 149 | 151 | 153 | 155 | 155 | 149 | 155 | 3.5% | 154 | 155 | 155 | 155 |

| **Energy Consumption, Condenser Fan (kWh,e)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 68 | 68 | 68 | 67 | | 67 | 67 | 67 | 68 | 2.0% | 68 | 68 | 68 | |
| CE110 | 60 | 61 | 62 | 60 | | 60 | 59 | 59 | 62 | 4.9% | 60 | 60 | 60 | |
| CE120 | 55 | 55 | 51 | 55 | | 55 | 54 | 51 | 55 | 6.5% | 55 | 55 | 55 | |
| CE130 | 5 | 5 | 4 | 5 | | 5 | 5 | 4 | 5 | 22.7% | 5 | 5 | 5 | |
| CE140 | 4 | 4 | 3 | 4 | | 4 | 4 | 3 | 4 | 19.3% | 4 | 4 | 4 | |
| CE150 | 66 | 66 | 62 | 65 | | 66 | 65 | 62 | 66 | 5.6% | 66 | 66 | 66 | |
| CE160 | 61 | 61 | 56 | 60 | | 61 | 60 | 56 | 61 | 8.4% | 61 | 61 | 61 | |
| CE165 | 70 | 70 | 67 | 69 | | 70 | 69 | 67 | 70 | 5.1% | 70 | 70 | 70 | |
| CE170 | 34 | 34 | 29 | 34 | | 34 | 34 | 29 | 34 | 16.1% | 35 | 34 | 34 | |
| CE180 | 56 | 56 | 52 | 56 | | 56 | 55 | 52 | 56 | 7.1% | 56 | 56 | 56 | |
| CE185 | 65 | 65 | 63 | 66 | | 65 | 65 | 63 | 66 | 3.9% | 65 | 65 | 65 | |
| CE190 | 8 | 9 | 7 | 8 | | 8 | 9 | 7 | 9 | 27.7% | 9 | 9 | 9 | |
| CE195 | 11 | 11 | 8 | 11 | | 11 | 11 | 8 | 11 | 25.2% | 11 | 11 | 11 | |
| CE200 | 73 | 72 | 70 | 71 | | 73 | 73 | 70 | 73 | 4.1% | 73 | 73 | 73 | |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

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 B16.5.1-2. COP: Mean, and (Max-Min)/Mean

| **Mean COP** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | Analytical | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 2.39 | 2.39 | 2.43 | 2.41 | 2.40 | 2.40 | 2.42 | 2.39 | 2.43 | 1.7% | 2.39 | 2.39 | 2.39 | 2.40 |
| CE110 | 3.38 | 3.34 | 3.46 | 3.41 | 3.40 | 3.41 | 3.43 | 3.34 | 3.46 | 3.5% | 3.38 | 3.38 | 3.38 | 3.40 |
| CE120 | 3.59 | 3.59 | 3.61 | 3.62 | 3.61 | 3.61 | 3.63 | 3.59 | 3.63 | 1.1% | 3.59 | 3.59 | 3.59 | 3.60 |
| CE130 | 1.91 | 1.91 | 1.98 | 1.95 | 1.90 | 1.92 | 1.92 | 1.90 | 1.98 | 3.8% | 1.89 | 1.91 | 1.91 | 1.90 |
| CE140 | 2.77 | 2.73 | 2.92 | 2.85 | 2.77 | 2.80 | 2.80 | 2.73 | 2.92 | 6.6% | 2.75 | 2.77 | 2.77 | 2.77 |
| CE150 | 3.62 | 3.63 | 3.67 | 3.70 | 3.65 | 3.65 | 3.67 | 3.62 | 3.70 | 2.2% | 3.63 | 3.63 | 3.63 | 3.65 |
| CE160 | 3.84 | 3.84 | 3.87 | 3.95 | 3.86 | 3.85 | 3.86 | 3.84 | 3.95 | 2.9% | 3.83 | 3.84 | 3.84 | 3.85 |
| CE165 | 2.92 | 2.92 | 2.95 | 2.99 | 2.94 | 2.93 | 2.94 | 2.92 | 2.99 | 2.2% | 2.93 | 2.93 | 2.93 | 2.94 |
| CE170 | 3.38 | 3.39 | 3.44 | 3.48 | 3.40 | 3.39 | 3.40 | 3.38 | 3.48 | 2.9% | 3.37 | 3.39 | 3.39 | 3.38 |
| CE180 | 4.04 | 4.04 | 4.08 | 4.03 | 4.04 | 4.05 | 4.06 | 4.03 | 4.08 | 1.4% | 4.04 | 4.04 | 4.04 | 4.04 |
| CE185 | 2.85 | 2.85 | 2.87 | 2.82 | 2.85 | 2.85 | 2.86 | 2.82 | 2.87 | 1.8% | 2.85 | 2.85 | 2.85 | 2.85 |
| CE190 | 3.41 | 3.41 | 3.49 | 3.46 | 3.39 | 3.41 | 3.40 | 3.39 | 3.49 | 2.7% | 3.39 | 3.41 | 3.41 | 3.39 |
| CE195 | 2.31 | 2.31 | 2.36 | 2.34 | 2.30 | 2.32 | 2.31 | 2.30 | 2.36 | 2.5% | 2.29 | 2.31 | 2.31 | 2.30 |
| CE200 | 3.62 | 3.61 | 3.67 | 3.71 | 3.65 | 3.61 | 3.61 | 3.61 | 3.71 | 2.7% | 3.62 | 3.62 | 3.62 | 3.62 |

| **(Max - Min)/Mean COP** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | Analytical | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 0.000 | 0.001 | 0.002 | 0.001 | 0.003 | 0.000 | 0.000 | 0.000 | 0.003 | ---- | 0.000 | | 0.000 | 0.003 |
| CE110 | 0.000 | 0.010 | 0.002 | 0.001 | 0.003 | 0.000 | 0.011 | 0.000 | 0.011 | ---- | 0.000 | | 0.000 | 0.003 |
| CE120 | 0.000 | 0.004 | 0.001 | 0.001 | 0.003 | 0.000 | 0.012 | 0.000 | 0.012 | ---- | 0.000 | | 0.000 | 0.002 |
| CE130 | 0.000 | 0.038 | 0.013 | 0.009 | 0.004 | 0.000 | 0.172 | 0.000 | 0.172 | ---- | 0.000 | | 0.000 | 0.004 |
| CE140 | 0.000 | 0.056 | 0.011 | 0.019 | 0.004 | 0.000 | 0.204 | 0.000 | 0.204 | ---- | 0.000 | | 0.000 | 0.004 |
| CE150 | 0.003 | 0.003 | 0.001 | 0.005 | 0.011 | 0.000 | 0.009 | 0.000 | 0.011 | ---- | 0.000 | | 0.001 | 0.003 |
| CE160 | 0.003 | 0.005 | 0.001 | 0.003 | 0.011 | 0.000 | 0.010 | 0.000 | 0.011 | ---- | 0.000 | | 0.000 | 0.003 |
| CE165 | 0.010 | 0.003 | 0.001 | 0.003 | 0.012 | 0.000 | 0.008 | 0.000 | 0.012 | ---- | 0.000 | | 0.000 | 0.003 |
| CE170 | 0.000 | 0.006 | 0.002 | 0.004 | 0.015 | 0.000 | 0.043 | 0.000 | 0.043 | ---- | 0.000 | | 0.000 | 0.003 |
| CE180 | 0.005 | 0.002 | 0.002 | 0.010 | 0.029 | 0.000 | 0.012 | 0.000 | 0.029 | ---- | 0.000 | | 0.000 | 0.007 |
| CE185 | 0.007 | 0.004 | 0.002 | 0.010 | 0.034 | 0.000 | 0.009 | 0.000 | 0.034 | ---- | 0.000 | | 0.000 | 0.011 |
| CE190 | 0.000 | 0.023 | 0.007 | 0.019 | 0.040 | 0.000 | 0.101 | 0.000 | 0.101 | ---- | 0.000 | | 0.000 | 0.009 |
| CE195 | 0.000 | 0.017 | 0.008 | 0.017 | 0.043 | 0.000 | 0.086 | 0.000 | 0.086 | ---- | 0.000 | | 0.000 | 0.015 |
| CE200 | 0.006 | 0.000 | 0.000 | 0.005 | 0.012 | 0.000 | 0.000 | 0.000 | 0.012 | ---- | 0.000 | | 0.000 | 0.002 |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

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 B16.5.1-3. Coil Loads: Total, Sensible, and Latent

| **Coil Load, Total (kWh,thermal)** | | | | | | | | Statistics, All Results | | | | Analytical | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 3800 | 3800 | 3841 | 3794 | 3798 | 3800 | 3798 | 3794 | 3841 | 1.3% | 3800 | 3800 | 3800 | 3797 |
| CE110 | 3765 | 3766 | 3804 | 3756 | 3763 | 3765 | 3763 | 3756 | 3804 | 1.3% | 3765 | 3765 | 3765 | 3763 |
| CE120 | 3749 | 3749 | 3763 | 3739 | 3747 | 3748 | 3747 | 3739 | 3763 | 0.6% | 3749 | 3749 | 3749 | 3748 |
| CE130 | 219 | 219 | 216 | 215 | 217 | 219 | 220 | 215 | 220 | 2.1% | 219 | 219 | 219 | 217 |
| CE140 | 198 | 198 | 196 | 195 | 196 | 198 | 199 | 195 | 199 | 2.0% | 198 | 198 | 197 | 196 |
| CE150 | 4517 | 4517 | 4543 | 4528 | 4509 | 4517 | 4515 | 4509 | 4543 | 0.8% | 4518 | 4517 | 4518 | 4509 |
| CE160 | 4501 | 4500 | 4516 | 4508 | 4491 | 4500 | 4499 | 4491 | 4516 | 0.6% | 4501 | 4500 | 4500 | 4491 |
| CE165 | 4538 | 4538 | 4567 | 4549 | 4529 | 4537 | 4535 | 4529 | 4567 | 0.9% | 4537 | 4537 | 4538 | 4528 |
| CE170 | 2233 | 2232 | 2226 | 2237 | 2225 | 2232 | 2232 | 2225 | 2237 | 0.5% | 2232 | 2232 | 2233 | 2225 |
| CE180 | 4495 | 4495 | 4510 | 4535 | 4481 | 4495 | 4494 | 4481 | 4535 | 1.2% | 4495 | 4495 | 4494 | 4473 |
| CE185 | 4507 | 4535 | 4565 | 4583 | 4523 | 4535 | 4534 | 4507 | 4583 | 1.7% | 4535 | 4535 | 4534 | 4508 |
| CE190 | 578 | 577 | 573 | 579 | 574 | 577 | 578 | 573 | 579 | 1.0% | 578 | 577 | 578 | 573 |
| CE195 | 602 | 601 | 595 | 602 | 598 | 601 | 601 | 595 | 602 | 1.1% | 601 | 601 | 601 | 596 |
| CE200 | 5498 | 5436 | 5534 | 5522 | 5484 | 5498 | 5498 | 5436 | 5534 | 1.8% | 5498 | 5498 | 5498 | 5486 |
| **Coil Load, Sensible (kWh,thermal)** | | | | | | | | Statistics, All Results | | | | Analytical | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 3800 | 3800 | 3841 | 3794 | 3798 | 3800 | 3798 | 3794 | 3841 | 1.3% | 3800 | 3800 | 3800 | 3797 |
| CE110 | 3765 | 3766 | 3804 | 3756 | 3763 | 3765 | 3763 | 3756 | 3804 | 1.3% | 3765 | 3765 | 3765 | 3763 |
| CE120 | 3749 | 3749 | 3763 | 3739 | 3747 | 3748 | 3747 | 3739 | 3763 | 0.6% | 3749 | 3749 | 3749 | 3748 |
| CE130 | 219 | 219 | 216 | 215 | 217 | 219 | 220 | 215 | 220 | 2.1% | 219 | 219 | 219 | 217 |
| CE140 | 198 | 198 | 196 | 195 | 196 | 198 | 199 | 195 | 199 | 2.0% | 198 | 198 | 197 | 196 |
| CE150 | 3778 | 3778 | 3804 | 3786 | 3776 | 3778 | 3776 | 3776 | 3804 | 0.7% | 3778 | 3778 | 3779 | 3776 |
| CE160 | 3761 | 3761 | 3777 | 3769 | 3759 | 3761 | 3760 | 3759 | 3777 | 0.5% | 3761 | 3761 | 3761 | 3759 |
| CE165 | 3798 | 3798 | 3828 | 3809 | 3795 | 3798 | 3796 | 3795 | 3828 | 0.9% | 3798 | 3798 | 3799 | 3795 |
| CE170 | 1493 | 1493 | 1487 | 1498 | 1491 | 1492 | 1492 | 1487 | 1498 | 0.7% | 1493 | 1493 | 1493 | 1491 |
| CE180 | 1537 | 1538 | 1553 | 1607 | 1537 | 1538 | 1537 | 1537 | 1607 | 4.5% | 1538 | 1538 | 1538 | 1537 |
| CE185 | 1548 | 1578 | 1608 | 1653 | 1577 | 1578 | 1577 | 1548 | 1653 | 6.6% | 1578 | 1578 | 1578 | 1576 |
| CE190 | 208 | 208 | 203 | 212 | 206 | 208 | 208 | 203 | 212 | 4.4% | 208 | 208 | 208 | 206 |
| CE195 | 232 | 232 | 226 | 235 | 230 | 231 | 232 | 226 | 235 | 4.1% | 232 | 232 | 232 | 229 |
| CE200 | 4276 | 4215 | 4313 | 4303 | 4274 | 4277 | 4277 | 4215 | 4313 | 2.3% | 4277 | 4277 | 4277 | 4276 |
| **Coil Load, Latent (kWh,thermal)** | | | | | | | | Statistics, All Results | | | | Analytical | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE150 | 739 | 739 | 739 | 742 | 733 | 739 | 739 | 733 | 742 | 1.2% | 739 | 739 | 739 | 733 |
| CE160 | 740 | 739 | 739 | 739 | 732 | 739 | 739 | 732 | 740 | 1.1% | 739 | 739 | 739 | 732 |
| CE165 | 740 | 739 | 739 | 740 | 733 | 739 | 739 | 733 | 740 | 1.0% | 739 | 739 | 739 | 733 |
| CE170 | 740 | 739 | 739 | 739 | 734 | 739 | 739 | 734 | 740 | 0.9% | 739 | 739 | 739 | 734 |
| CE180 | 2958 | 2957 | 2957 | 2928 | 2944 | 2957 | 2957 | 2928 | 2958 | 1.0% | 2957 | 2957 | 2956 | 2936 |
| CE185 | 2959 | 2957 | 2957 | 2930 | 2946 | 2957 | 2957 | 2930 | 2959 | 1.0% | 2958 | 2957 | 2956 | 2932 |
| CE190 | 370 | 370 | 370 | 366 | 368 | 370 | 370 | 366 | 370 | 1.0% | 370 | 370 | 370 | 367 |
| CE195 | 370 | 370 | 370 | 367 | 368 | 370 | 370 | 367 | 370 | 0.9% | 370 | 370 | 370 | 367 |
| CE200 | 1222 | 1221 | 1221 | 1219 | 1210 | 1221 | 1221 | 1210 | 1222 | 1.0% | 1221 | 1221 | 1221 | 1210 |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

## Table B16.5.1-4. Sensible Coil Load minus Zone Load (Fan Heat)

| **Sensible Coil - Zone Load, (Fan Heat) (kWh,thermal)** | | | | | | | | Statistics, All Results | | | | Analytical | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 144 | 144 | 187 | 139 | 144 | 144 | 142 | 139 | 187 | 33.6% | 144 | 144 | 144 | 144 |
| CE110 | 128 | 129 | 168 | 119 | 128 | 128 | 127 | 119 | 168 | 38.2% | 128 | 128 | 128 | 128 |
| CE120 | 117 | 117 | 133 | 108 | 116 | 117 | 115 | 108 | 133 | 21.8% | 117 | 117 | 117 | 117 |
| CE130 | 10 | 10 | 8 | 8 | 10 | 10 | 10 | 8 | 10 | 27.0% | 10 | 10 | 10 | 10 |
| CE140 | 8 | 8 | 7 | 6 | 8 | 8 | 8 | 6 | 8 | 25.6% | 8 | 8 | 8 | 8 |
| CE150 | 141 | 141 | 168 | 149 | 140 | 141 | 139 | 139 | 168 | 20.2% | 141 | 141 | 142 | 141 |
| CE160 | 129 | 129 | 147 | 137 | 129 | 129 | 128 | 128 | 147 | 14.3% | 129 | 129 | 129 | 129 |
| CE165 | 149 | 149 | 181 | 161 | 149 | 149 | 148 | 148 | 181 | 22.4% | 149 | 149 | 150 | 149 |
| CE170 | 73 | 73 | 69 | 79 | 73 | 73 | 73 | 69 | 79 | 14.2% | 74 | 73 | 74 | 73 |
| CE180 | 117 | 118 | 135 | 188 | 119 | 118 | 118 | 117 | 188 | 60.1% | 118 | 119 | 118 | 119 |
| CE185 | 109 | 139 | 171 | 215 | 140 | 139 | 139 | 109 | 215 | 76.5% | 139 | 139 | 139 | 140 |
| CE190 | 18 | 18 | 15 | 24 | 18 | 18 | 18 | 15 | 24 | 51.0% | 18 | 18 | 18 | 18 |
| CE195 | 23 | 23 | 18 | 28 | 23 | 23 | 23 | 18 | 28 | 40.8% | 23 | 23 | 23 | 23 |
| CE200 | 154 | 153 | 193 | 181 | 154 | 155 | 155 | 153 | 193 | 25.7% | 154 | 155 | 155 | 155 |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

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 B16.5.1-5. Zone Loads: Total, Sensible, and Latent

| **Zone Load, Total (kWh,thermal)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | Analytical | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 3656 | 3656 | 3654 | 3655 | 3654 | 3656 | 3656 | 3654 | 3656 | 0.1% | 3656 | 3656 | 3656 | 3654 |
| CE110 | 3637 | 3637 | 3636 | 3637 | 3636 | 3637 | 3637 | 3636 | 3637 | 0.0% | 3637 | 3637 | 3637 | 3635 |
| CE120 | 3632 | 3632 | 3630 | 3632 | 3631 | 3632 | 3631 | 3630 | 3632 | 0.0% | 3632 | 3632 | 3632 | 3630 |
| CE130 | 209 | 209 | 207 | 208 | 207 | 209 | 209 | 207 | 209 | 1.3% | 209 | 209 | 209 | 206 |
| CE140 | 190 | 190 | 189 | 188 | 188 | 190 | 190 | 188 | 190 | 1.1% | 190 | 190 | 190 | 188 |
| CE150 | 4376 | 4376 | 4375 | 4376 | 4375 | 4376 | 4376 | 4375 | 4376 | 0.0% | 4376 | 4376 | 4376 | 4368 |
| CE160 | 4371 | 4371 | 4370 | 4371 | 4370 | 4371 | 4371 | 4370 | 4371 | 0.0% | 4371 | 4371 | 4371 | 4362 |
| CE165 | 4388 | 4388 | 4386 | 4387 | 4386 | 4388 | 4387 | 4386 | 4388 | 0.0% | 4388 | 4388 | 4388 | 4380 |
| CE170 | 2159 | 2159 | 2157 | 2158 | 2157 | 2159 | 2159 | 2157 | 2159 | 0.1% | 2159 | 2159 | 2159 | 2152 |
| CE180 | 4376 | 4376 | 4375 | 4376 | 4375 | 4376 | 4376 | 4375 | 4376 | 0.0% | 4376 | 4376 | 4376 | 4362 |
| CE185 | 4396 | 4396 | 4394 | 4395 | 4393 | 4395 | 4395 | 4393 | 4396 | 0.1% | 4396 | 4396 | 4396 | 4383 |
| CE190 | 557 | 559 | 558 | 558 | 558 | 559 | 559 | 557 | 559 | 0.4% | 559 | 559 | 559 | 556 |
| CE195 | 576 | 579 | 577 | 577 | 576 | 578 | 579 | 576 | 579 | 0.5% | 579 | 579 | 579 | 574 |
| CE200 | 5343 | 5283 | 5342 | 5343 | 5342 | 5343 | 5343 | 5283 | 5343 | 1.1% | 5343 | 5343 | 5343 | 5331 |
| **Zone Load, Sensible (kWh,thermal)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | Analytical | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 3656 | 3656 | 3654 | 3655 | 3654 | 3656 | 3656 | 3654 | 3656 | 0.1% | 3656 | 3656 | 3656 | 3654 |
| CE110 | 3637 | 3637 | 3636 | 3637 | 3636 | 3637 | 3637 | 3636 | 3637 | 0.0% | 3637 | 3637 | 3637 | 3635 |
| CE120 | 3632 | 3632 | 3630 | 3632 | 3631 | 3632 | 3631 | 3630 | 3632 | 0.0% | 3632 | 3632 | 3632 | 3630 |
| CE130 | 209 | 209 | 207 | 208 | 207 | 209 | 209 | 207 | 209 | 1.3% | 209 | 209 | 209 | 206 |
| CE140 | 190 | 190 | 189 | 188 | 188 | 190 | 190 | 188 | 190 | 1.1% | 190 | 190 | 190 | 188 |
| CE150 | 3637 | 3637 | 3636 | 3637 | 3636 | 3637 | 3636 | 3636 | 3637 | 0.0% | 3637 | 3637 | 3637 | 3635 |
| CE160 | 3632 | 3632 | 3630 | 3632 | 3631 | 3632 | 3631 | 3630 | 3632 | 0.0% | 3632 | 3632 | 3632 | 3630 |
| CE165 | 3649 | 3649 | 3647 | 3648 | 3647 | 3649 | 3648 | 3647 | 3649 | 0.1% | 3649 | 3649 | 3649 | 3646 |
| CE170 | 1420 | 1420 | 1418 | 1419 | 1418 | 1419 | 1419 | 1418 | 1420 | 0.1% | 1420 | 1420 | 1420 | 1418 |
| CE180 | 1420 | 1420 | 1418 | 1419 | 1418 | 1419 | 1419 | 1418 | 1420 | 0.1% | 1420 | 1420 | 1420 | 1418 |
| CE185 | 1439 | 1439 | 1437 | 1437 | 1437 | 1438 | 1438 | 1437 | 1439 | 0.2% | 1439 | 1439 | 1439 | 1436 |
| CE190 | 190 | 190 | 188 | 188 | 188 | 190 | 190 | 188 | 190 | 1.0% | 190 | 190 | 190 | 188 |
| CE195 | 209 | 209 | 207 | 208 | 207 | 209 | 209 | 207 | 209 | 1.1% | 209 | 209 | 209 | 206 |
| CE200 | 4122 | 4062 | 4121 | 4122 | 4121 | 4122 | 4122 | 4062 | 4122 | 1.5% | 4122 | 4122 | 4122 | 4121 |
| **Zone Load, Latent (kWh,thermal)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | Analytical | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE150 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 0.1% | 739 | 739 | 739 | 733 |
| CE160 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 0.1% | 739 | 739 | 739 | 732 |
| CE165 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 0.1% | 739 | 739 | 739 | 733 |
| CE170 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 0.1% | 739 | 739 | 739 | 734 |
| CE180 | 2957 | 2957 | 2957 | 2958 | 2957 | 2957 | 2957 | 2957 | 2958 | 0.0% | 2957 | 2957 | 2957 | 2945 |
| CE185 | 2957 | 2957 | 2957 | 2958 | 2957 | 2957 | 2957 | 2957 | 2958 | 0.0% | 2957 | 2957 | 2957 | 2947 |
| CE190 | 367 | 370 | 370 | 370 | 370 | 370 | 370 | 367 | 370 | 0.8% | 370 | 370 | 370 | 368 |
| CE195 | 367 | 370 | 370 | 370 | 370 | 370 | 370 | 367 | 370 | 0.8% | 370 | 370 | 370 | 368 |
| CE200 | 1221 | 1221 | 1221 | 1221 | 1221 | 1221 | 1221 | 1221 | 1221 | 0.0% | 1221 | 1221 | 1221 | 1211 |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

## Table B16.5.1-6. Latent Coil Load minus Zone Load ( Should be 0 )

| **Latent Coil - Zone Load, (Should be 0) (kWh,thermal)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | | Analytical | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE150 | 0 | 0 | 0 | 2 | -7 | 0 | 0 | -7 | 2 | ---- | 0 | 0 | 0 | 0 |
| CE160 | 1 | 0 | 0 | 0 | -7 | 0 | 0 | -7 | 1 | ---- | 0 | 0 | 0 | 0 |
| CE165 | 1 | 0 | 0 | 1 | -6 | 0 | 0 | -6 | 1 | ---- | 0 | 0 | 0 | 0 |
| CE170 | 1 | 0 | 0 | -1 | -6 | 0 | 0 | -6 | 1 | ---- | 0 | 0 | 0 | 0 |
| CE180 | 1 | 0 | 0 | -30 | -13 | 0 | 0 | -30 | 1 | ---- | 1 | 0 | -1 | -9 |
| CE185 | 2 | 0 | 0 | -28 | -11 | 0 | 0 | -28 | 2 | ---- | 1 | 0 | -1 | -15 |
| CE190 | 3 | 0 | 0 | -3 | -2 | 0 | 0 | -3 | 3 | ---- | 0 | 0 | 0 | -1 |
| CE195 | 3 | 0 | 0 | -3 | -1 | 0 | 0 | -3 | 3 | ---- | 0 | 0 | 0 | -1 |
| CE200 | 1 | 0 | 0 | -2 | -11 | 0 | 0 | -11 | 1 | ---- | 0 | 0 | 0 | 0 |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

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 B16.5.1-7. Sensitivities for Space Cooling Electricity Consumption

| **Delta Qtot (kWh,e)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE110-CE100 | -454 | -441 | -460 | -454 | -451 | -455 | -450 | -460 | -441 | 4.1% | -454 | -454 | -453 | -451 |
| CE120-CE110 | -65 | -77 | -50 | -62 | -63 | -60 | -60 | -77 | -50 | 41.2% | -64 | -66 | -66 | -60 |
| CE120-CE100 | -519 | -518 | -510 | -516 | -514 | -515 | -510 | -519 | -510 | 1.8% | -518 | -520 | -520 | -511 |
| CE130-CE100 | -1421 | -1421 | -1415 | -1413 | -1411 | -1414 | -1402 | -1421 | -1402 | 1.3% | -1420 | -1421 | -1421 | -1412 |
| CE140-CE130 | -42 | -40 | -40 | -40 | -41 | -41 | -41 | -42 | -40 | 4.8% | -42 | -41 | -41 | -40 |
| CE140-CE110 | -1009 | -1020 | -996 | -999 | -1001 | -999 | -993 | -1020 | -993 | 2.6% | -1007 | -1009 | -1009 | -1002 |
| CE150-CE110 | 131 | 118 | 141 | 118 | 128 | 132 | 130 | 118 | 141 | 17.9% | 130 | 129 | 129 | 128 |
| CE160-CE150 | -68 | -68 | -65 | -76 | -65 | -62 | -59 | -76 | -59 | 25.8% | -66 | -67 | -68 | -65 |
| CE165-CE160 | 362 | 362 | 362 | 363 | 359 | 363 | 357 | 357 | 363 | 1.7% | 357 | 360 | 361 | 359 |
| CE170-CE150 | -570 | -569 | -573 | -563 | -562 | -563 | -556 | -573 | -556 | 3.1% | -565 | -569 | -569 | -562 |
| CE180-CE150 | -125 | -125 | -125 | -103 | -115 | -118 | -112 | -125 | -103 | 18.0% | -124 | -124 | -125 | -117 |
| CE180-CE170 | 445 | 444 | 448 | 460 | 447 | 445 | 444 | 444 | 460 | 3.6% | 442 | 445 | 444 | 445 |
| CE185-CE180 | 461 | 461 | 464 | 467 | 458 | 460 | 458 | 458 | 467 | 1.9% | 462 | 461 | 461 | 456 |
| CE190-CE180 | -919 | -918 | -917 | -920 | -918 | -917 | -915 | -920 | -915 | 0.6% | -917 | -918 | -918 | -917 |
| CE190-CE140 | 96 | 95 | 95 | 94 | 96 | 96 | 96 | 94 | 96 | 2.6% | 96 | 96 | 96 | 96 |
| CE195-CE190 | 86 | 86 | 85 | 86 | 86 | 86 | 86 | 85 | 86 | 2.0% | 87 | 86 | 86 | 86 |
| CE195-CE185 | -1294 | -1293 | -1296 | -1301 | -1290 | -1292 | -1287 | -1301 | -1287 | 1.1% | -1292 | -1293 | -1293 | -1287 |
| CE195-CE130 | 140 | 141 | 140 | 140 | 142 | 141 | 141 | 140 | 142 | 1.5% | 142 | 141 | 141 | 141 |
| CE200-CE100 | -54 | -66 | -53 | -79 | -55 | -42 | -32 | -79 | -32 | 87.3% | -55 | -53 | -54 | -47 |

| **Del Qcomp (kWh,e)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE110-CE100 | -430 | -419 | -442 | -428 | | -432 | -427 | -442 | -419 | 5.3% | -431 | -430 | -430 | |
| CE120-CE110 | -49 | -59 | -16 | -45 | | -43 | -44 | -59 | -16 | 87.9% | -47 | -50 | -50 | |
| CE120-CE100 | -479 | -478 | -457 | -473 | | -475 | -471 | -479 | -457 | 4.5% | -478 | -480 | -480 | |
| CE130-CE100 | -1224 | -1224 | -1214 | -1218 | | -1218 | -1208 | -1224 | -1208 | 1.3% | -1224 | -1225 | -1225 | |
| CE140-CE130 | -38 | -37 | -38 | -37 | | -38 | -38 | -38 | -37 | 3.7% | -38 | -38 | -38 | |
| CE140-CE110 | -832 | -842 | -811 | -827 | | -823 | -819 | -842 | -811 | 3.7% | -831 | -833 | -833 | |
| CE150-CE110 | 111 | 100 | 141 | 99 | | 113 | 111 | 99 | 141 | 38.3% | 111 | 110 | 110 | |
| CE160-CE150 | -50 | -50 | -44 | -56 | | -45 | -42 | -56 | -42 | 27.5% | -49 | -50 | -50 | |
| CE165-CE160 | 333 | 332 | 329 | 330 | | 333 | 328 | 328 | 333 | 1.6% | 328 | 331 | 331 | |
| CE170-CE150 | -469 | -469 | -468 | -459 | | -464 | -458 | -469 | -458 | 2.3% | -466 | -469 | -469 | |
| CE180-CE150 | -91 | -91 | -93 | -70 | | -85 | -80 | -93 | -70 | 25.0% | -91 | -91 | -92 | |
| CE180-CE170 | 378 | 378 | 375 | 389 | | 379 | 378 | 375 | 389 | 3.6% | 375 | 378 | 378 | |
| CE185-CE180 | 431 | 431 | 428 | 432 | | 430 | 428 | 428 | 432 | 0.9% | 432 | 431 | 431 | |
| CE190-CE180 | -771 | -770 | -775 | -774 | | -770 | -768 | -775 | -768 | 0.9% | -770 | -770 | -770 | |
| CE190-CE140 | 81 | 81 | 85 | 82 | | 82 | 82 | 81 | 85 | 4.5% | 82 | 81 | 81 | |
| CE195-CE190 | 79 | 79 | 79 | 79 | | 79 | 80 | 79 | 80 | 0.8% | 80 | 79 | 79 | |
| CE195-CE185 | -1123 | -1122 | -1124 | -1127 | | -1120 | -1116 | -1127 | -1116 | 1.0% | -1121 | -1122 | -1121 | |
| CE195-CE130 | 122 | 123 | 126 | 124 | | 123 | 123 | 122 | 126 | 3.0% | 123 | 122 | 123 | |
| CE200-CE100 | -69 | -79 | -58 | -93 | | -58 | -50 | -93 | -50 | 62.3% | -70 | -69 | -69 | |

| **Del Q IDfan (kWh,e)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE110-CE100 | -16 | -15 | -12 | -19 | -16 | -16 | -16 | -19 | -12 | 41.9% | -16 | -16 | -16 | -16 |
| CE120-CE110 | -11 | -12 | -23 | -12 | -11 | -11 | -11 | -23 | -11 | 111.4% | -11 | -11 | -11 | -10 |
| CE120-CE100 | -27 | -27 | -36 | -31 | -27 | -27 | -27 | -36 | -27 | 32.2% | -27 | -27 | -27 | -26 |
| CE130-CE100 | -134 | -134 | -137 | -133 | -133 | -133 | -132 | -137 | -132 | 3.7% | -134 | -134 | -134 | -133 |
| CE140-CE130 | -2 | -2 | -1 | -2 | -2 | -2 | -2 | -2 | -1 | 36.7% | -2 | -2 | -2 | -2 |
| CE140-CE110 | -120 | -121 | -126 | -116 | -119 | -120 | -118 | -126 | -116 | 8.3% | -120 | -120 | -120 | -120 |
| CE150-CE110 | 13 | 12 | 0 | 14 | 13 | 13 | 13 | 0 | 14 | 106.4% | 13 | 13 | 13 | 13 |
| CE160-CE150 | -12 | -12 | -14 | -15 | -12 | -12 | -11 | -15 | -11 | 32.6% | -12 | -12 | -12 | -12 |
| CE165-CE160 | 20 | 21 | 23 | 24 | 20 | 20 | 20 | 20 | 24 | 21.6% | 20 | 20 | 20 | 20 |
| CE170-CE150 | -68 | -68 | -72 | -73 | -67 | -68 | -66 | -73 | -66 | 9.7% | -68 | -68 | -68 | -67 |
| CE180-CE150 | -23 | -22 | -22 | -24 | -22 | -22 | -21 | -24 | -21 | 12.1% | -22 | -23 | -23 | -22 |
| CE180-CE170 | 45 | 46 | 49 | 49 | 45 | 45 | 45 | 45 | 49 | 9.9% | 45 | 45 | 45 | 45 |
| CE185-CE180 | 21 | 20 | 24 | 25 | 21 | 21 | 21 | 20 | 25 | 24.1% | 21 | 21 | 21 | 21 |
| CE190-CE180 | -100 | -101 | -97 | -98 | -100 | -100 | -100 | -101 | -97 | 4.3% | -101 | -101 | -101 | -100 |
| CE190-CE140 | 10 | 10 | 7 | 8 | 10 | 10 | 10 | 7 | 10 | 28.2% | 10 | 10 | 10 | 10 |
| CE195-CE190 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 30.8% | 5 | 5 | 5 | 5 |
| CE195-CE185 | -116 | -116 | -117 | -119 | -116 | -117 | -116 | -119 | -116 | 2.6% | -117 | -117 | -117 | -116 |
| CE195-CE130 | 13 | 13 | 9 | 10 | 12 | 12 | 12 | 9 | 13 | 29.1% | 12 | 12 | 12 | 12 |
| CE200-CE100 | 10 | 9 | 4 | 10 | 10 | 11 | 12 | 4 | 12 | 78.4% | 10 | 11 | 11 | 11 |

| **Del Q ODfan (kWh,e)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE110-CE100 | -8 | -7 | -6 | -7 | | -7 | -7 | -8 | -6 | 29.9% | -7 | -7 | -7 | |
| CE120-CE110 | -5 | -6 | -11 | -5 | | -5 | -5 | -11 | -5 | 114.1% | -5 | -5 | -5 | |
| CE120-CE100 | -13 | -13 | -17 | -12 | | -13 | -13 | -17 | -12 | 37.1% | -13 | -13 | -13 | |
| CE130-CE100 | -63 | -63 | -64 | -62 | | -63 | -62 | -64 | -62 | 3.7% | -63 | -63 | -63 | |
| CE140-CE130 | -1 | -1 | -1 | -1 | | -1 | -1 | -1 | -1 | 37.5% | -1 | -1 | -1 | |
| CE140-CE110 | -56 | -57 | -59 | -56 | | -56 | -56 | -59 | -56 | 6.3% | -56 | -56 | -56 | |
| CE150-CE110 | 6 | 5 | 0 | 5 | | 6 | 6 | 0 | 6 | 100.7% | 6 | 6 | 6 | |
| CE160-CE150 | -5 | -5 | -7 | -5 | | -6 | -5 | -7 | -5 | 27.1% | -6 | -6 | -6 | |
| CE165-CE160 | 9 | 9 | 11 | 9 | | 10 | 9 | 9 | 11 | 17.3% | 9 | 9 | 9 | |
| CE170-CE150 | -32 | -32 | -34 | -31 | | -32 | -31 | -34 | -31 | 8.2% | -32 | -32 | -32 | |
| CE180-CE150 | -10 | -10 | -10 | -9 | | -11 | -10 | -11 | -9 | 14.3% | -11 | -11 | -11 | |
| CE180-CE170 | 22 | 22 | 23 | 22 | | 21 | 21 | 21 | 23 | 9.6% | 21 | 21 | 21 | |
| CE185-CE180 | 9 | 9 | 11 | 10 | | 10 | 10 | 9 | 11 | 24.6% | 10 | 10 | 10 | |
| CE190-CE180 | -48 | -47 | -45 | -48 | | -47 | -47 | -48 | -45 | 5.5% | -47 | -47 | -47 | |
| CE190-CE140 | 4 | 5 | 3 | 4 | | 5 | 5 | 3 | 5 | 34.5% | 5 | 5 | 5 | |
| CE195-CE190 | 3 | 2 | 2 | 3 | | 2 | 2 | 2 | 3 | 62.1% | 2 | 2 | 2 | |
| CE195-CE185 | -54 | -54 | -55 | -55 | | -55 | -54 | -55 | -54 | 2.0% | -55 | -55 | -55 | |
| CE195-CE130 | 6 | 6 | 4 | 6 | | 6 | 6 | 4 | 6 | 27.2% | 6 | 6 | 6 | |
| CE200-CE100 | 5 | 4 | 2 | 4 | | 5 | 6 | 2 | 6 | 77.9% | 5 | 5 | 5 | |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

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 B16.5.1-8. Sensitivities for COP and Coil Loads

| **Delta COP (kWh,t)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE110-CE100 | 0.99 | 0.95 | 1.03 | 1.01 | 1.00 | 1.01 | 1.01 | 0.95 | 1.03 | 7.6% | 0.99 | 0.99 | 0.99 | 1.00 |
| CE120-CE110 | 0.21 | 0.25 | 0.16 | 0.21 | 0.21 | 0.20 | 0.20 | 0.16 | 0.25 | 44.5% | 0.21 | 0.21 | 0.21 | 0.20 |
| CE120-CE100 | 1.20 | 1.20 | 1.18 | 1.22 | 1.20 | 1.20 | 1.21 | 1.18 | 1.22 | 2.8% | 1.20 | 1.20 | 1.20 | 1.19 |
| CE130-CE100 | -0.48 | -0.48 | -0.46 | -0.45 | -0.50 | -0.48 | -0.50 | -0.50 | -0.45 | 10.0% | -0.50 | -0.48 | -0.48 | -0.50 |
| CE140-CE130 | 0.86 | 0.83 | 0.94 | 0.90 | 0.87 | 0.88 | 0.88 | 0.83 | 0.94 | 13.4% | 0.86 | 0.86 | 0.86 | 0.87 |
| CE140-CE110 | -0.61 | -0.61 | -0.54 | -0.56 | -0.63 | -0.61 | -0.63 | -0.63 | -0.54 | 13.9% | -0.63 | -0.61 | -0.61 | -0.63 |
| CE150-CE110 | 0.24 | 0.29 | 0.21 | 0.29 | 0.25 | 0.24 | 0.25 | 0.21 | 0.29 | 31.9% | 0.25 | 0.25 | 0.25 | 0.25 |
| CE160-CE150 | 0.22 | 0.21 | 0.20 | 0.25 | 0.21 | 0.20 | 0.19 | 0.19 | 0.25 | 30.4% | 0.21 | 0.21 | 0.21 | 0.21 |
| CE165-CE160 | -0.92 | -0.92 | -0.91 | -0.96 | -0.92 | -0.92 | -0.92 | -0.96 | -0.91 | 5.5% | -0.90 | -0.91 | -0.91 | -0.92 |
| CE170-CE150 | -0.24 | -0.24 | -0.23 | -0.22 | -0.26 | -0.26 | -0.27 | -0.27 | -0.22 | 19.1% | -0.26 | -0.24 | -0.24 | -0.26 |
| CE180-CE150 | 0.42 | 0.41 | 0.42 | 0.33 | 0.39 | 0.40 | 0.38 | 0.33 | 0.42 | 22.8% | 0.42 | 0.41 | 0.41 | 0.39 |
| CE180-CE170 | 0.66 | 0.65 | 0.64 | 0.55 | 0.65 | 0.65 | 0.65 | 0.55 | 0.66 | 16.9% | 0.68 | 0.65 | 0.65 | 0.65 |
| CE185-CE180 | -1.19 | -1.19 | -1.21 | -1.20 | -1.19 | -1.20 | -1.20 | -1.21 | -1.19 | 1.7% | -1.20 | -1.19 | -1.19 | -1.19 |
| CE190-CE180 | -0.63 | -0.63 | -0.60 | -0.57 | -0.65 | -0.64 | -0.65 | -0.65 | -0.57 | 12.7% | -0.66 | -0.63 | -0.63 | -0.65 |
| CE190-CE140 | 0.64 | 0.68 | 0.57 | 0.60 | 0.62 | 0.61 | 0.61 | 0.57 | 0.68 | 16.4% | 0.64 | 0.64 | 0.64 | 0.62 |
| CE195-CE190 | -1.10 | -1.10 | -1.13 | -1.12 | -1.09 | -1.09 | -1.10 | -1.13 | -1.09 | 3.3% | -1.09 | -1.10 | -1.10 | -1.09 |
| CE195-CE185 | -0.54 | -0.54 | -0.51 | -0.49 | -0.55 | -0.54 | -0.55 | -0.55 | -0.49 | 12.1% | -0.55 | -0.54 | -0.54 | -0.55 |
| CE195-CE130 | 0.40 | 0.40 | 0.38 | 0.38 | 0.40 | 0.40 | 0.39 | 0.38 | 0.40 | 4.2% | 0.40 | 0.40 | 0.40 | 0.40 |
| CE200-CE100 | 1.23 | 1.22 | 1.24 | 1.30 | 1.24 | 1.21 | 1.19 | 1.19 | 1.30 | 8.9% | 1.23 | 1.23 | 1.23 | 1.22 |
| **Del Q coil,t (kWh,t)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE110-CE100 | -35 | -34 | -38 | -38 | -35 | -35 | -35 | -38 | -34 | 12.5% | -35 | -35 | -35 | -34 |
| CE120-CE110 | -16 | -17 | -40 | -16 | -16 | -16 | -16 | -40 | -16 | 146.5% | -16 | -16 | -17 | -15 |
| CE120-CE100 | -51 | -51 | -78 | -55 | -51 | -51 | -51 | -78 | -51 | 52.7% | -51 | -52 | -52 | -50 |
| CE130-CE100 | -3581 | -3581 | -3626 | -3579 | -3581 | -3581 | -3578 | -3626 | -3578 | 1.3% | -3581 | -3581 | -3581 | -3581 |
| CE140-CE130 | -21 | -21 | -20 | -21 | -21 | -21 | -21 | -21 | -20 | 4.9% | -21 | -21 | -22 | -20 |
| CE140-CE110 | -3567 | -3568 | -3608 | -3561 | -3567 | -3567 | -3565 | -3608 | -3561 | 1.3% | -3567 | -3567 | -3568 | -3567 |
| CE150-CE110 | 752 | 751 | 739 | 772 | 746 | 752 | 752 | 739 | 772 | 4.4% | 752 | 752 | 753 | 745 |
| CE160-CE150 | -16 | -17 | -26 | -19 | -18 | -17 | -16 | -26 | -16 | 59.5% | -17 | -17 | -18 | -18 |
| CE165-CE160 | 37 | 38 | 51 | 40 | 38 | 37 | 36 | 36 | 51 | 40.0% | 36 | 37 | 38 | 37 |
| CE170-CE150 | -2284 | -2285 | -2317 | -2291 | -2284 | -2285 | -2283 | -2317 | -2283 | 1.5% | -2285 | -2286 | -2286 | -2284 |
| CE180-CE150 | -22 | -22 | -33 | 7 | -28 | -22 | -21 | -33 | 7 | 172.5% | -22 | -23 | -25 | -36 |
| CE180-CE170 | 2262 | 2263 | 2284 | 2298 | 2256 | 2263 | 2262 | 2256 | 2298 | 1.8% | 2263 | 2263 | 2261 | 2248 |
| CE185-CE180 | 12 | 40 | 55 | 48 | 41 | 40 | 40 | 12 | 55 | 107.3% | 40 | 40 | 40 | 35 |
| CE190-CE180 | -3917 | -3918 | -3937 | -3956 | -3907 | -3917 | -3916 | -3956 | -3907 | 1.3% | -3918 | -3918 | -3916 | -3899 |
| CE190-CE140 | 380 | 379 | 377 | 384 | 378 | 380 | 379 | 377 | 384 | 1.8% | 380 | 379 | 380 | 377 |
| CE195-CE190 | 24 | 24 | 23 | 23 | 23 | 24 | 24 | 23 | 24 | 5.8% | 24 | 24 | 24 | 23 |
| CE195-CE185 | -3905 | -3934 | -3970 | -3981 | -3925 | -3934 | -3933 | -3981 | -3905 | 1.9% | -3934 | -3934 | -3933 | -3912 |
| CE195-CE130 | 383 | 382 | 379 | 387 | 381 | 382 | 382 | 379 | 387 | 1.9% | 382 | 382 | 382 | 380 |
| CE200-CE100 | 1698 | 1636 | 1693 | 1728 | 1687 | 1698 | 1700 | 1636 | 1728 | 5.4% | 1697 | 1697 | 1697 | 1689 |
| **Del Q coil,s (kWh,t)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE110-CE100 | -35 | -34 | -38 | -38 | -35 | -35 | -35 | -38 | -34 | 12.5% | -35 | -35 | -35 | -34 |
| CE120-CE110 | -16 | -17 | -40 | -16 | -16 | -16 | -16 | -40 | -16 | 146.5% | -16 | -16 | -17 | -15 |
| CE120-CE100 | -51 | -51 | -78 | -55 | -51 | -51 | -51 | -78 | -51 | 52.8% | -51 | -52 | -52 | -50 |
| CE130-CE100 | -3581 | -3581 | -3626 | -3579 | -3581 | -3581 | -3578 | -3626 | -3578 | 1.3% | -3581 | -3581 | -3581 | -3581 |
| CE140-CE130 | -21 | -21 | -20 | -21 | -21 | -21 | -21 | -21 | -20 | 4.9% | -21 | -21 | -22 | -20 |
| CE140-CE110 | -3567 | -3568 | -3608 | -3561 | -3567 | -3567 | -3565 | -3608 | -3561 | 1.3% | -3567 | -3567 | -3568 | -3567 |
| CE150-CE110 | 13 | 12 | 0 | 30 | 13 | 13 | 13 | 0 | 30 | 228.7% | 13 | 13 | 14 | 13 |
| CE160-CE150 | -17 | -17 | -26 | -17 | -17 | -17 | -16 | -26 | -16 | 58.9% | -17 | -17 | -18 | -17 |
| CE165-CE160 | 37 | 37 | 51 | 40 | 36 | 37 | 36 | 36 | 51 | 40.1% | 36 | 37 | 38 | 36 |
| CE170-CE150 | -2285 | -2285 | -2317 | -2288 | -2285 | -2285 | -2283 | -2317 | -2283 | 1.5% | -2285 | -2286 | -2286 | -2285 |
| CE180-CE150 | -2241 | -2240 | -2250 | -2179 | -2239 | -2240 | -2239 | -2250 | -2179 | 3.2% | -2241 | -2240 | -2241 | -2239 |
| CE180-CE170 | 44 | 45 | 66 | 109 | 46 | 45 | 45 | 44 | 109 | 144.8% | 45 | 45 | 45 | 46 |
| CE185-CE180 | 11 | 40 | 55 | 46 | 39 | 40 | 40 | 11 | 55 | 110.0% | 40 | 40 | 40 | 39 |
| CE190-CE180 | -1329 | -1330 | -1350 | -1394 | -1331 | -1330 | -1329 | -1394 | -1329 | 4.9% | -1330 | -1330 | -1330 | -1331 |
| CE190-CE140 | 10 | 10 | 7 | 18 | 10 | 10 | 9 | 7 | 18 | 100.3% | 10 | 10 | 11 | 10 |
| CE195-CE190 | 24 | 24 | 23 | 23 | 23 | 24 | 24 | 23 | 24 | 5.7% | 24 | 24 | 24 | 23 |
| CE195-CE185 | -1316 | -1346 | -1382 | -1418 | -1347 | -1346 | -1345 | -1418 | -1316 | 7.6% | -1346 | -1347 | -1346 | -1347 |
| CE195-CE130 | 13 | 13 | 10 | 20 | 13 | 12 | 12 | 10 | 20 | 81.6% | 12 | 12 | 12 | 12 |
| CE200-CE100 | 476 | 415 | 472 | 509 | 477 | 477 | 479 | 415 | 509 | 19.7% | 476 | 476 | 476 | 479 |
| **Del Qcoil,lat (kWh,t)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE110-CE100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE120-CE110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE120-CE100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE130-CE100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE140-CE130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE140-CE110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE150-CE110 | 739 | 739 | 739 | 742 | 733 | 739 | 739 | 733 | 742 | 1.2% | 739 | 739 | 739 | 733 |
| CE160-CE150 | 1 | 0 | 0 | -2 | -1 | 0 | 0 | -2 | 1 | ---- | 0 | 0 | 0 | -1 |
| CE165-CE160 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | ---- | 0 | 0 | 0 | 1 |
| CE170-CE150 | 1 | 0 | 0 | -3 | 1 | 0 | 0 | -3 | 1 | ---- | 0 | 0 | 0 | 1 |
| CE180-CE150 | 2219 | 2218 | 2218 | 2186 | 2211 | 2218 | 2218 | 2186 | 2219 | 1.5% | 2218 | 2218 | 2217 | 2203 |
| CE180-CE170 | 2218 | 2218 | 2218 | 2189 | 2210 | 2218 | 2218 | 2189 | 2218 | 1.3% | 2218 | 2218 | 2217 | 2202 |
| CE185-CE180 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | ---- | 0 | 0 | 0 | -4 |
| CE190-CE180 | -2588 | -2587 | -2587 | -2562 | -2576 | -2587 | -2587 | -2588 | -2562 | ---- | -2588 | -2587 | -2586 | -2568 |
| CE190-CE140 | 370 | 370 | 370 | 366 | 368 | 370 | 370 | 366 | 370 | 1.0% | 370 | 370 | 370 | 367 |
| CE195-CE190 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 |
| CE195-CE185 | -2589 | -2587 | -2587 | -2563 | -2578 | -2587 | -2587 | -2589 | -2563 | ---- | -2588 | -2587 | -2587 | -2565 |
| CE195-CE130 | 370 | 370 | 370 | 367 | 368 | 370 | 370 | 367 | 370 | 0.9% | 370 | 370 | 370 | 367 |
| CE200-CE100 | 1222 | 1221 | 1221 | 1219 | 1210 | 1221 | 1221 | 1210 | 1222 | 1.0% | 1221 | 1221 | 1221 | 1210 |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200**

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 B16.5.1-9. Indoor Drybulb Temperature: Mean and (Max-Min)/Mean

| **Mean IDB (°C)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 22.2 | 22.2 | 22.3 | 22.3 | 22.2 | 22.2 | 22.6 | 22.2 | 22.6 | 2.0% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE110 | 22.2 | 22.2 | 22.3 | 22.3 | 22.2 | 22.2 | 22.5 | 22.2 | 22.5 | 1.5% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE120 | 26.7 | 26.7 | 26.8 | 26.7 | 26.7 | 26.7 | 27.1 | 26.7 | 27.1 | 1.4% | 26.7 | 26.7 | 26.7 | 26.7 |
| CE130 | 22.2 | 22.2 | 22.1 | 22.1 | 22.2 | 22.2 | 21.6 | 21.6 | 22.2 | 2.5% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE140 | 22.2 | 22.2 | 22.1 | 22.1 | 22.2 | 22.2 | 21.5 | 21.5 | 22.2 | 3.1% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE150 | 22.2 | 22.2 | 22.3 | 22.3 | 22.2 | 22.2 | 22.7 | 22.2 | 22.7 | 2.1% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE160 | 26.7 | 26.7 | 26.8 | 26.7 | 26.7 | 26.7 | 27.0 | 26.7 | 27.0 | 1.1% | 26.7 | 26.7 | 26.7 | 26.7 |
| CE165 | 23.3 | 23.3 | 23.4 | 23.4 | 23.3 | 23.3 | 23.8 | 23.3 | 23.8 | 2.1% | 23.3 | 23.3 | 23.3 | 23.3 |
| CE170 | 22.2 | 22.2 | 22.2 | 22.2 | 22.2 | 22.2 | 22.1 | 22.1 | 22.2 | 0.5% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE180 | 22.2 | 22.2 | 22.3 | 22.3 | 22.2 | 22.2 | 22.3 | 22.2 | 22.3 | 0.6% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE185 | 22.2 | 22.2 | 22.3 | 22.3 | 22.2 | 22.2 | 22.4 | 22.2 | 22.4 | 0.8% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE190 | 22.2 | 22.2 | 22.1 | 22.1 | 22.2 | 22.2 | 21.9 | 21.9 | 22.2 | 1.1% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE195 | 22.2 | 22.2 | 22.1 | 22.1 | 22.2 | 22.2 | 22.0 | 22.0 | 22.2 | 0.9% | 22.2 | 22.2 | 22.2 | 22.2 |
| CE200 | 26.7 | 26.7 | 26.8 | 26.8 | 26.7 | 26.7 | 26.7 | 26.7 | 26.8 | 0.4% | 26.7 | 26.7 | 26.7 | 26.2 |
| **(Max - Min)/Mean IDB (°C)** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.049 | 0.000 | 0.049 | ---- | 0.000 | | 0.002 | 0.000 |
| CE110 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.048 | 0.000 | 0.048 | ---- | 0.000 | | 0.002 | 0.000 |
| CE120 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.077 | 0.000 | 0.077 | ---- | 0.000 | | 0.002 | 0.000 |
| CE130 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.056 | 0.000 | 0.056 | ---- | 0.000 | | 0.001 | 0.000 |
| CE140 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.069 | 0.000 | 0.069 | ---- | 0.000 | | 0.002 | 0.000 |
| CE150 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.054 | 0.000 | 0.054 | ---- | 0.000 | | 0.002 | 0.000 |
| CE160 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.045 | 0.000 | 0.045 | ---- | 0.000 | | 0.002 | 0.000 |
| CE165 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.051 | 0.000 | 0.051 | ---- | 0.000 | | 0.002 | 0.000 |
| CE170 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.050 | 0.000 | 0.050 | ---- | 0.000 | | 0.001 | 0.000 |
| CE180 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.035 | 0.000 | 0.035 | ---- | 0.000 | | 0.001 | 0.000 |
| CE185 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.021 | 0.000 | 0.021 | ---- | 0.000 | | 0.001 | 0.000 |
| CE190 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.028 | 0.000 | 0.028 | ---- | 0.000 | | 0.001 | 0.000 |
| CE195 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.023 | 0.000 | 0.023 | ---- | 0.000 | | 0.001 | 0.000 |
| CE200 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | ---- | 0.000 | | 0.000 | 0.007 |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

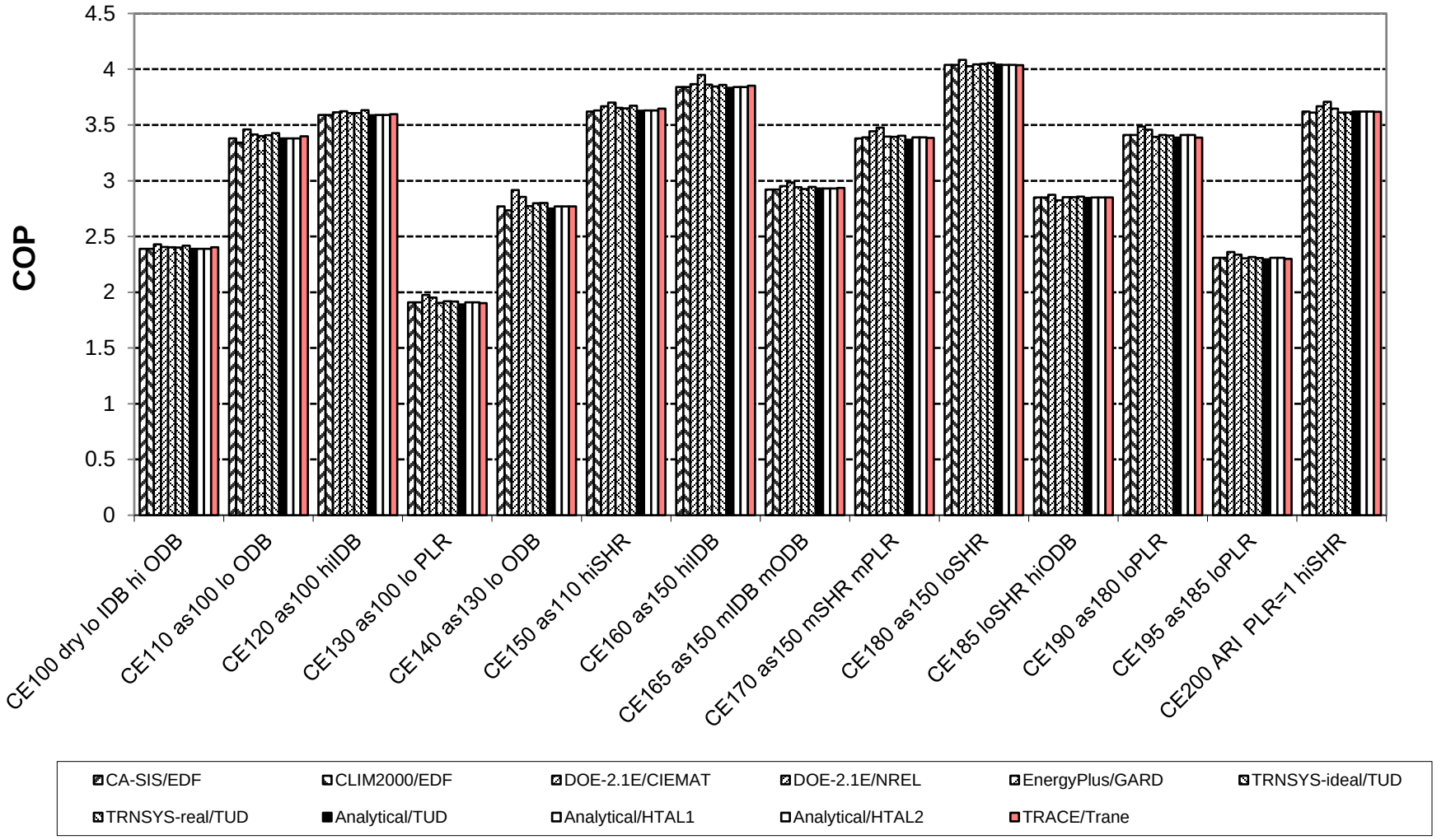
## Table B16.5.1-10. Humidity Ratio: Mean and (Max-Min)/Mean

| **Mean Humidity Ratio** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 0.0075 | 0.0069 | 0.0076 | 0.0074 | 0.0075 | 0.0075 | 0.0075 | 0.0069 | 0.0076 | 9.4% | 0.0074 | 0.0073 | 0.0073 | 0.0074 |
| CE110 | 0.0066 | 0.0069 | 0.0070 | 0.0064 | 0.0066 | 0.0066 | 0.0066 | 0.0064 | 0.0070 | 9.8% | 0.0065 | 0.0064 | 0.0064 | 0.0065 |
| CE120 | 0.0080 | 0.0070 | 0.0078 | 0.0078 | 0.0080 | 0.0080 | 0.0080 | 0.0070 | 0.0080 | 13.2% | 0.0079 | 0.0079 | 0.0079 | 0.0077 |
| CE130 | 0.0075 | 0.0069 | 0.0076 | 0.0073 | 0.0075 | 0.0075 | 0.0075 | 0.0069 | 0.0076 | 9.4% | 0.0074 | 0.0073 | 0.0073 | 0.0074 |
| CE140 | 0.0065 | 0.0069 | 0.0071 | 0.0064 | 0.0066 | 0.0066 | 0.0066 | 0.0064 | 0.0071 | 10.2% | 0.0065 | 0.0064 | 0.0064 | 0.0065 |
| CE150 | 0.0083 | 0.0085 | 0.0082 | 0.0083 | 0.0084 | 0.0083 | 0.0085 | 0.0082 | 0.0085 | 4.0% | 0.0082 | 0.0082 | 0.0082 | 0.0084 |
| CE160 | 0.0102 | 0.0101 | 0.0097 | 0.0099 | 0.0103 | 0.0101 | 0.0102 | 0.0097 | 0.0103 | 5.8% | 0.0100 | 0.0099 | 0.0099 | 0.0102 |
| CE165 | 0.0093 | 0.0099 | 0.0090 | 0.0092 | 0.0094 | 0.0093 | 0.0095 | 0.0090 | 0.0099 | 9.2% | 0.0093 | 0.0092 | 0.0092 | 0.0093 |
| CE170 | 0.0106 | 0.0107 | 0.0105 | 0.0105 | 0.0106 | 0.0105 | 0.0105 | 0.0105 | 0.0107 | 2.2% | 0.0104 | 0.0105 | 0.0105 | 0.0105 |
| CE180 | 0.0164 | 0.0164 | 0.0166 | 0.0164 | 0.0162 | 0.0163 | 0.0164 | 0.0162 | 0.0166 | 2.6% | 0.0162 | 0.0162 | 0.0162 | 0.0161 |
| CE185 | 0.0162 | 0.0171 | 0.0164 | 0.0162 | 0.0161 | 0.0162 | 0.0163 | 0.0161 | 0.0171 | 6.4% | 0.0161 | 0.0161 | 0.0161 | 0.0160 |
| CE190 | 0.0160 | 0.0161 | 0.0163 | 0.0159 | 0.0159 | 0.0159 | 0.0157 | 0.0157 | 0.0163 | 3.5% | 0.0158 | 0.0159 | 0.0159 | 0.0158 |
| CE195 | 0.0156 | 0.0164 | 0.0158 | 0.0155 | 0.0154 | 0.0155 | 0.0153 | 0.0153 | 0.0164 | 7.0% | 0.0154 | 0.0154 | 0.0154 | 0.0154 |
| CE200 | 0.0114 | 0.0115 | 0.0109 | 0.0111 | 0.0115 | 0.0113 | 0.0113 | 0.0109 | 0.0115 | 5.1% | 0.0111 | 0.0111 | 0.0111 | 0.0111 |
| **(Max - Min)/Mean Humidity Ratio** | | | | | | | | Statistics, All Results | | | | | | MM/DD/YY |
| | CA-SIS | CLM2000 | DOE21E | DOE21E | E+ | TRN-id | TRN-re | | | (Max-Min) | Analytical | | | TRACE |
| Case | EDF | EDF | CIEMAT | NREL | GARD | TUD | TUD | Min | Max | /Analytical* | TUD | HTAL1 | HTAL2 | Trane |
| CE100 | 0.000 | 0.022 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.0000 | 0.0217 | ---- | 0.000 | | 0.000 | 0.000 |
| CE110 | 0.000 | 0.022 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.0000 | 0.0217 | ---- | 0.000 | | 0.000 | 0.000 |
| CE120 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.0000 | 0.0005 | ---- | 0.000 | | 0.000 | 0.000 |
| CE130 | 0.000 | 0.010 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.0000 | 0.0101 | ---- | 0.000 | | 0.000 | 0.000 |
| CE140 | 0.000 | 0.012 | 0.014 | 0.000 | 0.001 | 0.000 | 0.000 | 0.0000 | 0.0142 | ---- | 0.000 | | 0.000 | 0.000 |
| CE150 | 0.012 | 0.000 | 0.000 | 0.000 | 0.013 | 0.000 | 0.013 | 0.0000 | 0.0132 | ---- | 0.000 | | 0.000 | 0.011 |
| CE160 | 0.020 | 0.000 | 0.010 | 0.010 | 0.013 | 0.000 | 0.011 | 0.0000 | 0.0196 | ---- | 0.000 | | 0.000 | 0.011 |
| CE165 | 0.011 | 0.001 | 0.011 | 0.000 | 0.013 | 0.000 | 0.013 | 0.0000 | 0.0131 | ---- | 0.000 | | 0.000 | 0.011 |
| CE170 | 0.000 | 0.000 | 0.010 | 0.000 | 0.011 | 0.000 | 0.024 | 0.0000 | 0.0238 | ---- | 0.000 | | 0.001 | 0.011 |
| CE180 | 0.018 | 0.000 | 0.012 | 0.012 | 0.010 | 0.000 | 0.040 | 0.0000 | 0.0402 | ---- | 0.000 | | 0.001 | 0.010 |
| CE185 | 0.012 | 0.006 | 0.018 | 0.012 | 0.011 | 0.000 | 0.025 | 0.0000 | 0.0246 | ---- | 0.000 | | 0.001 | 0.012 |
| CE190 | 0.000 | 0.000 | 0.018 | 0.019 | 0.014 | 0.000 | 0.031 | 0.0000 | 0.0312 | ---- | 0.000 | | 0.001 | 0.026 |
| CE195 | 0.000 | 0.006 | 0.019 | 0.019 | 0.014 | 0.000 | 0.024 | 0.0000 | 0.0241 | ---- | 0.000 | | 0.001 | 0.040 |
| CE200 | 0.018 | 0.000 | 0.009 | 0.009 | 0.013 | 0.000 | 0.000 | 0.0000 | 0.0175 | ---- | 0.000 | | 0.000 | 0.014 |

* ABS[ (Max-Min) / (Mean of Analytical Solutions) ]

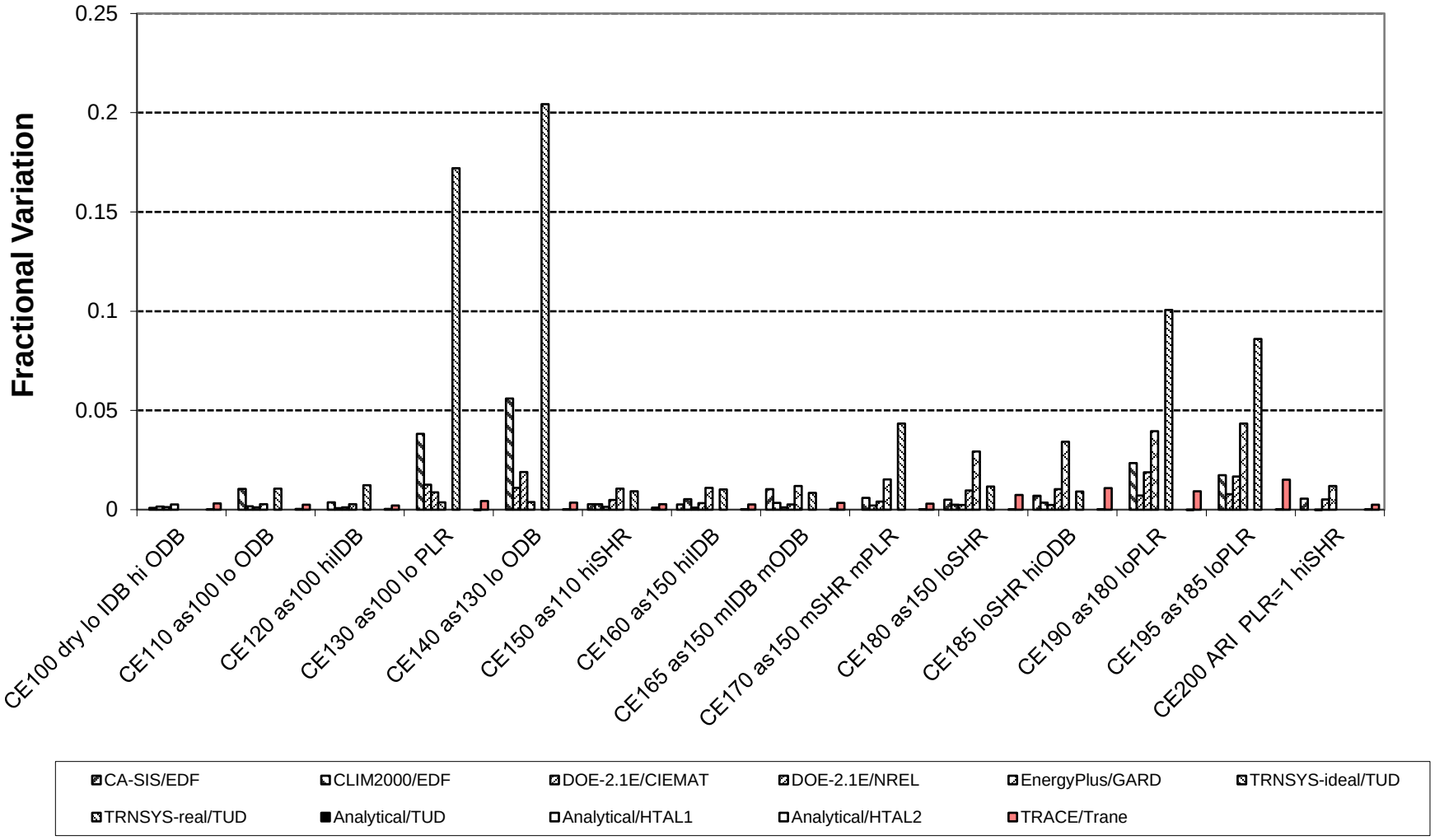
ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1
Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200

# Figure B16.5.1-1.
# HVAC BESTEST: Mean COP



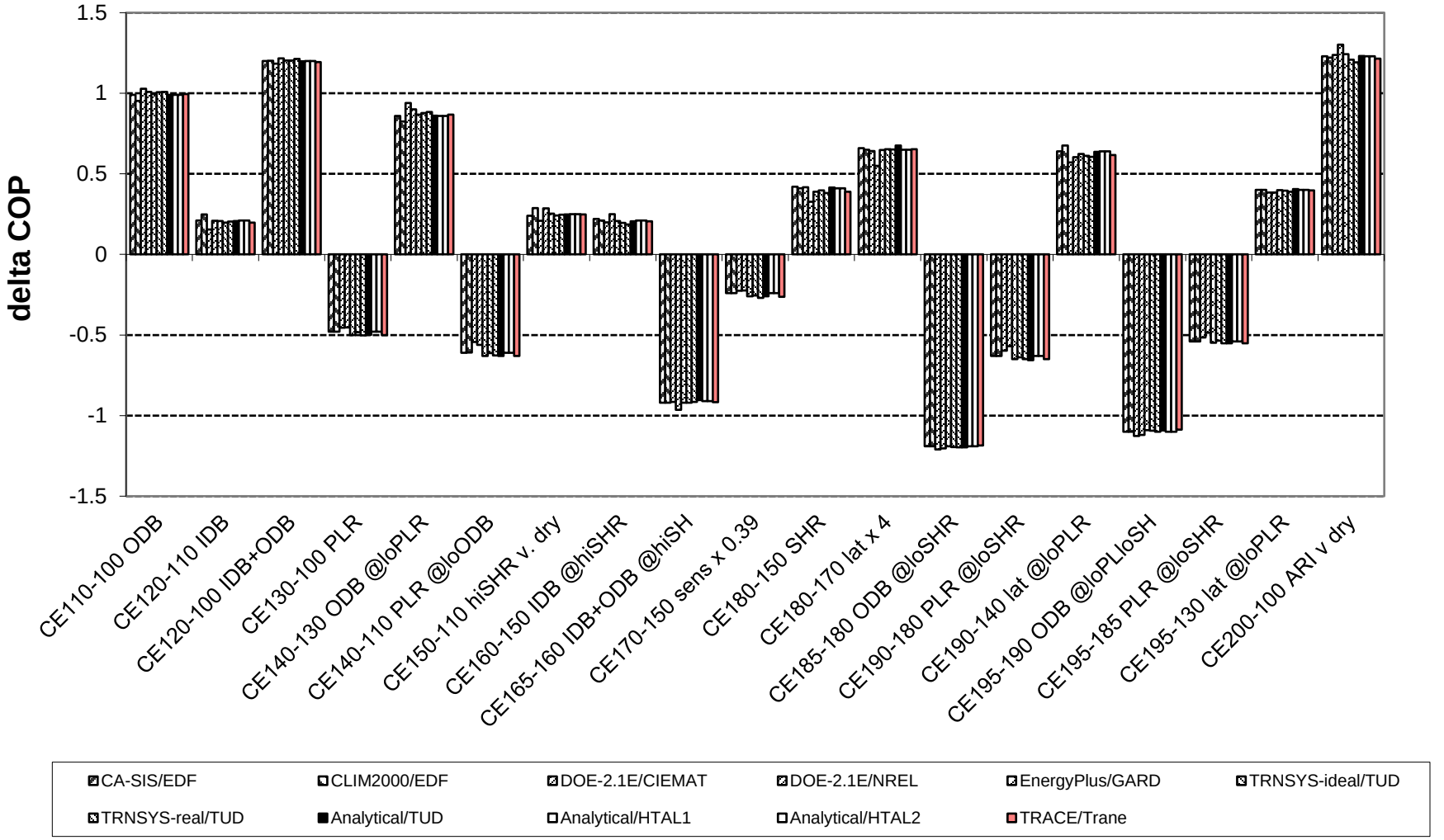
ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1
Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200

# Figure B16.5.1-2.
# HVAC BESTEST: (Maximum - Minimum)/Mean COP

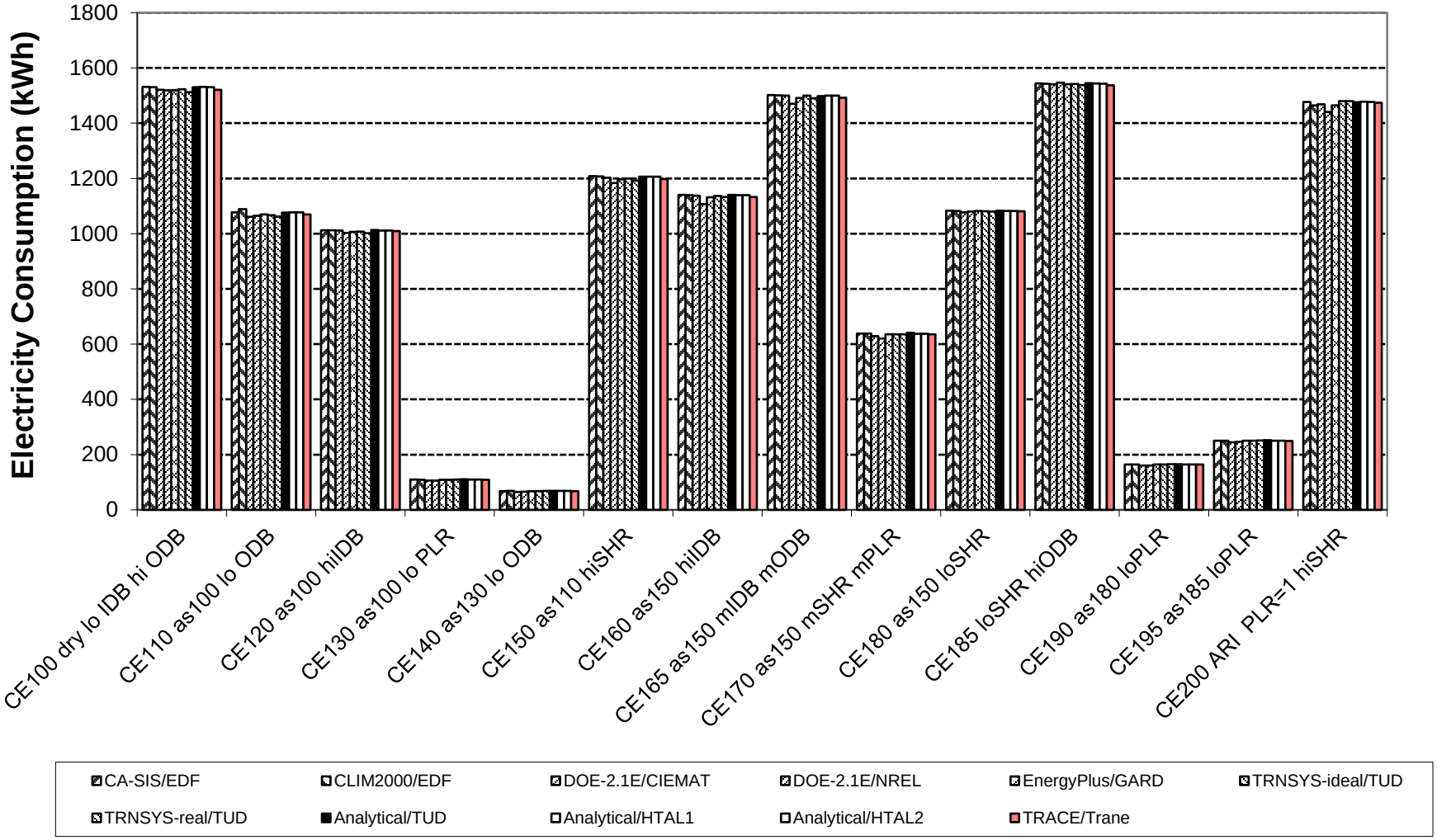


ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1
Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200

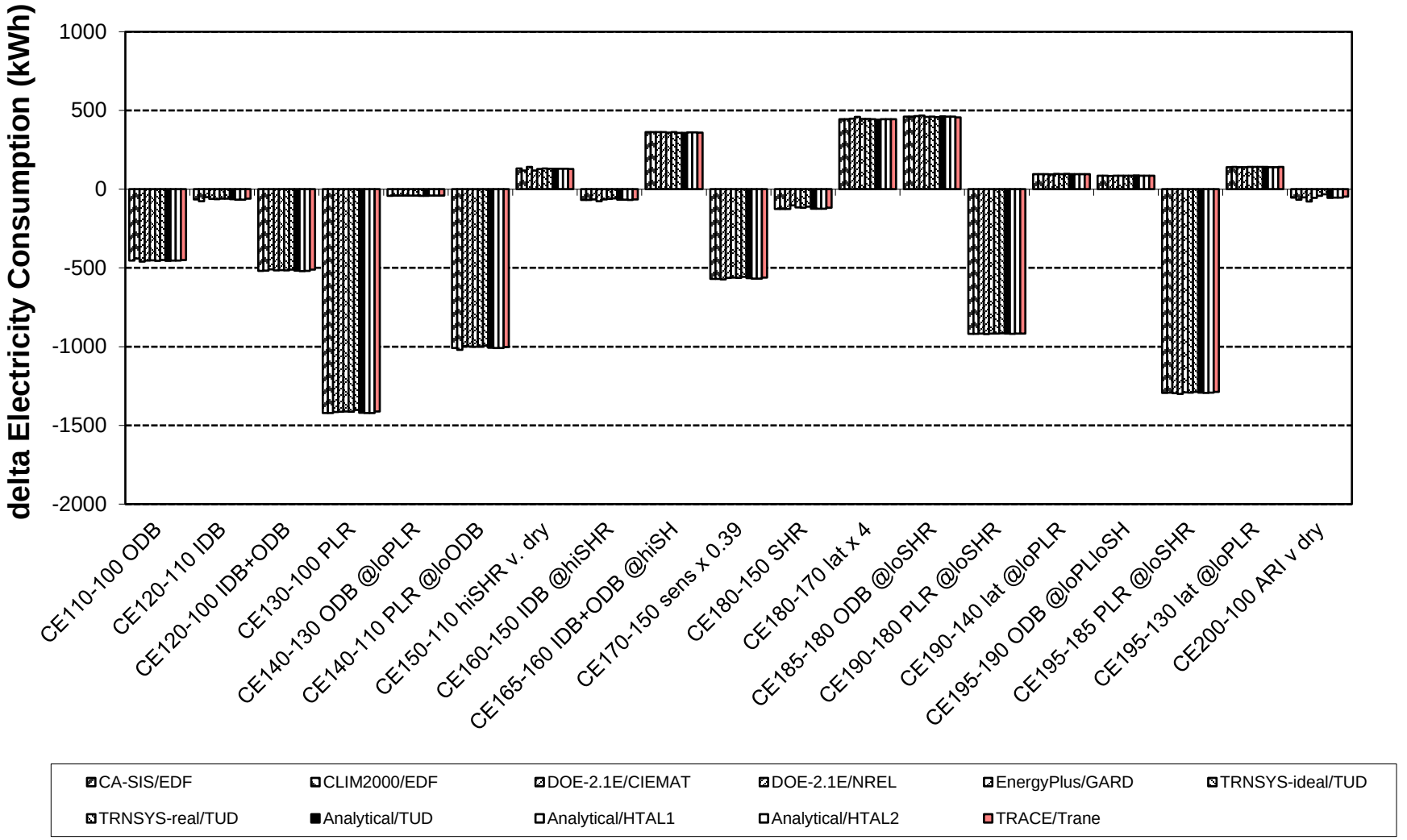
# Figure B16.5.1-3.
# HVAC BESTEST: Mean COP Sensitivities



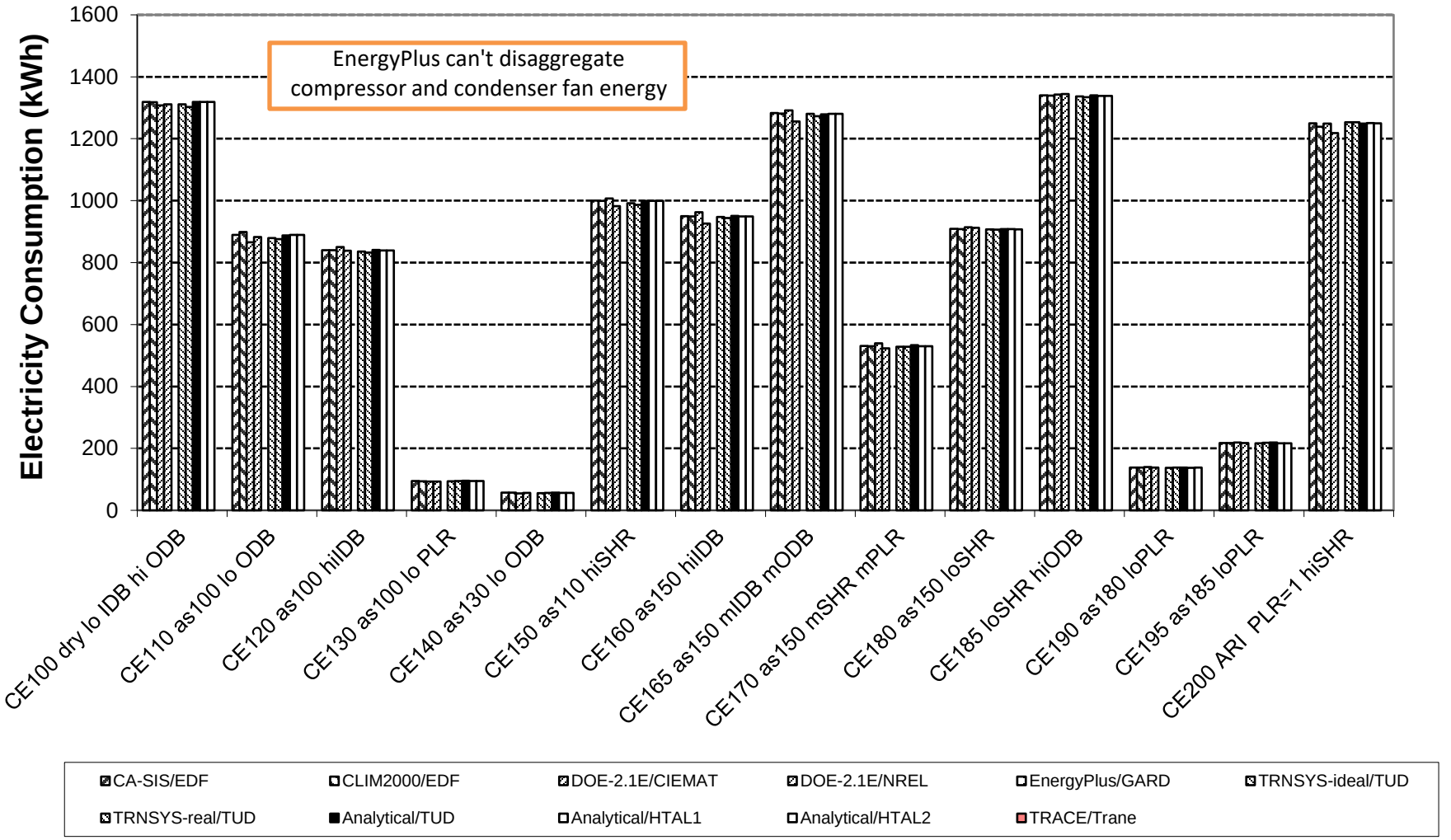
# Figure B16.5.1-4.
# HVAC BESTEST: Total Space Cooling Electricity Consumption



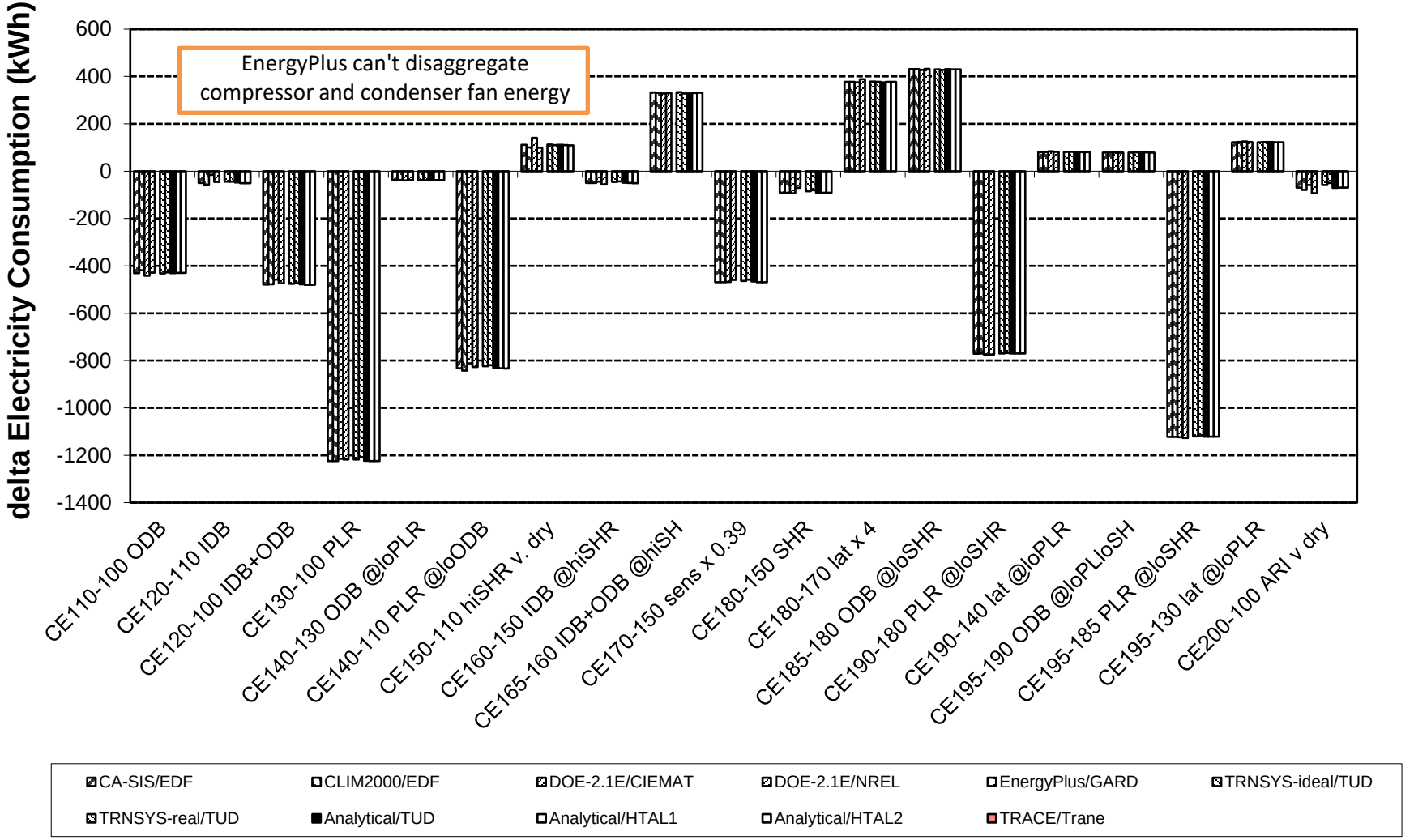
# Figure B16.5.1-5.
# HVAC BESTEST: Total Space Cooling Electricity Sensitivities



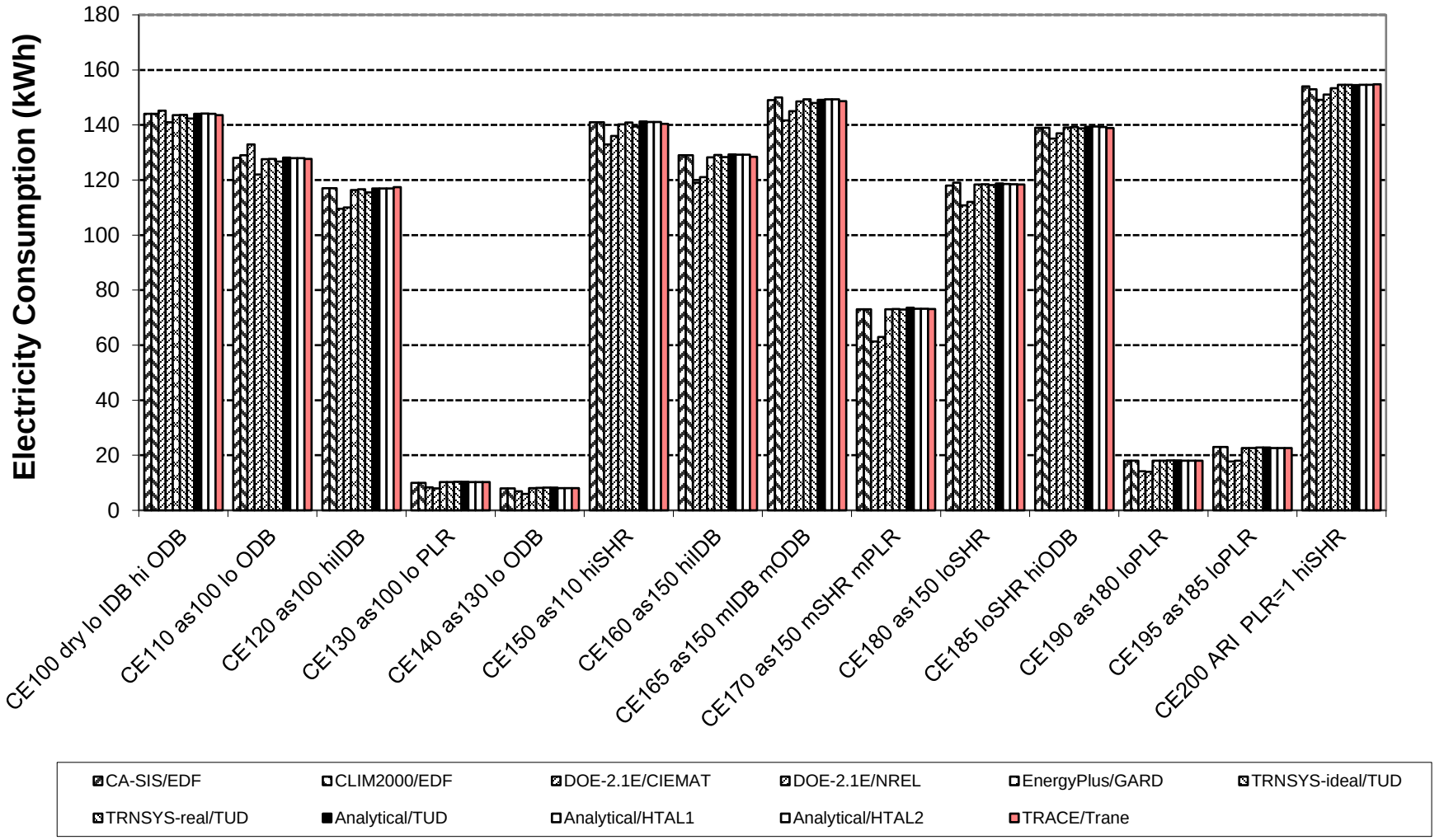
# Figure B16.5.1-6.
# HVAC BESTEST: Compressor Electricity Consumption



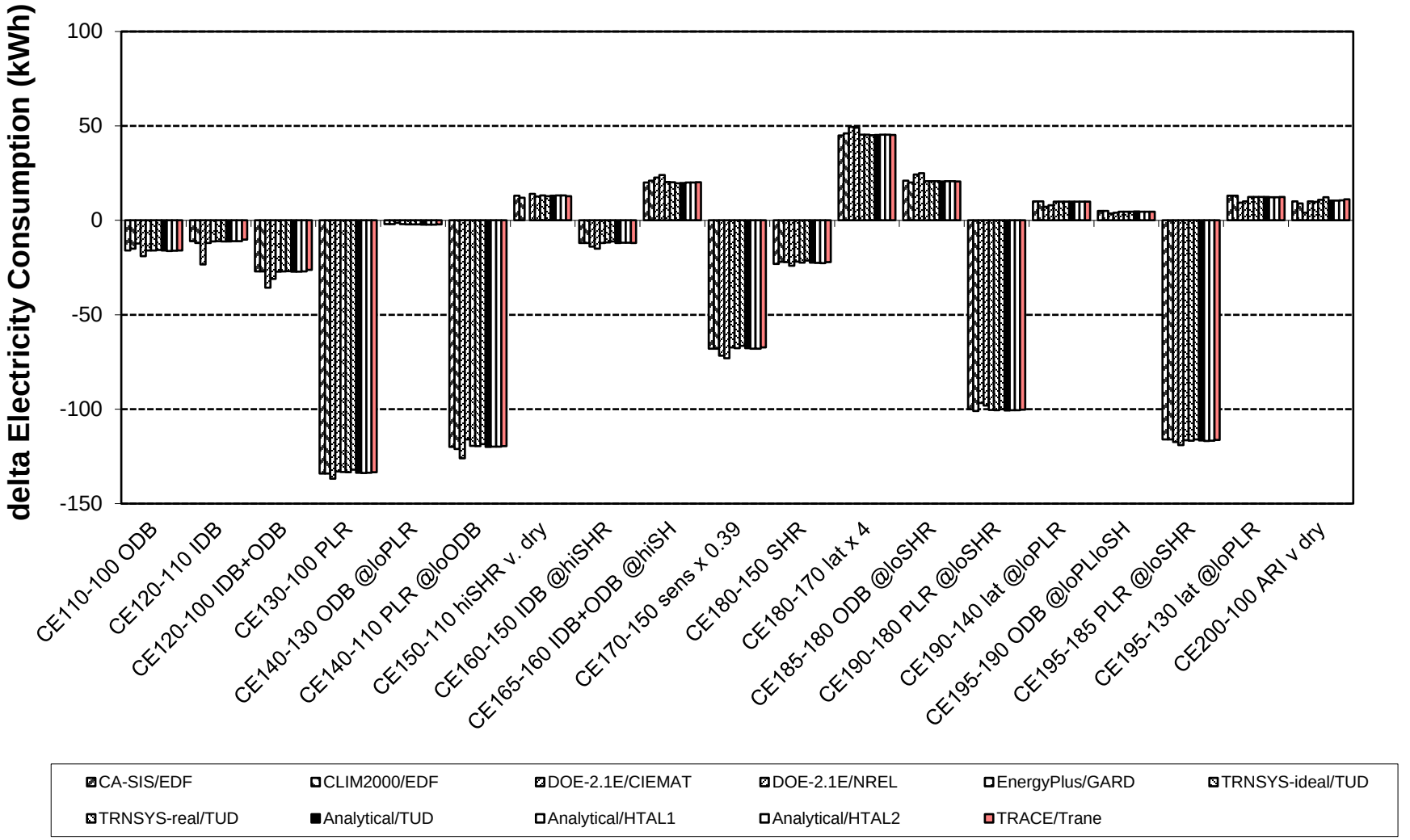
# Figure B16.5.1-7.
# HVAC BESTEST: Total Compressor Electricity Sensitivities



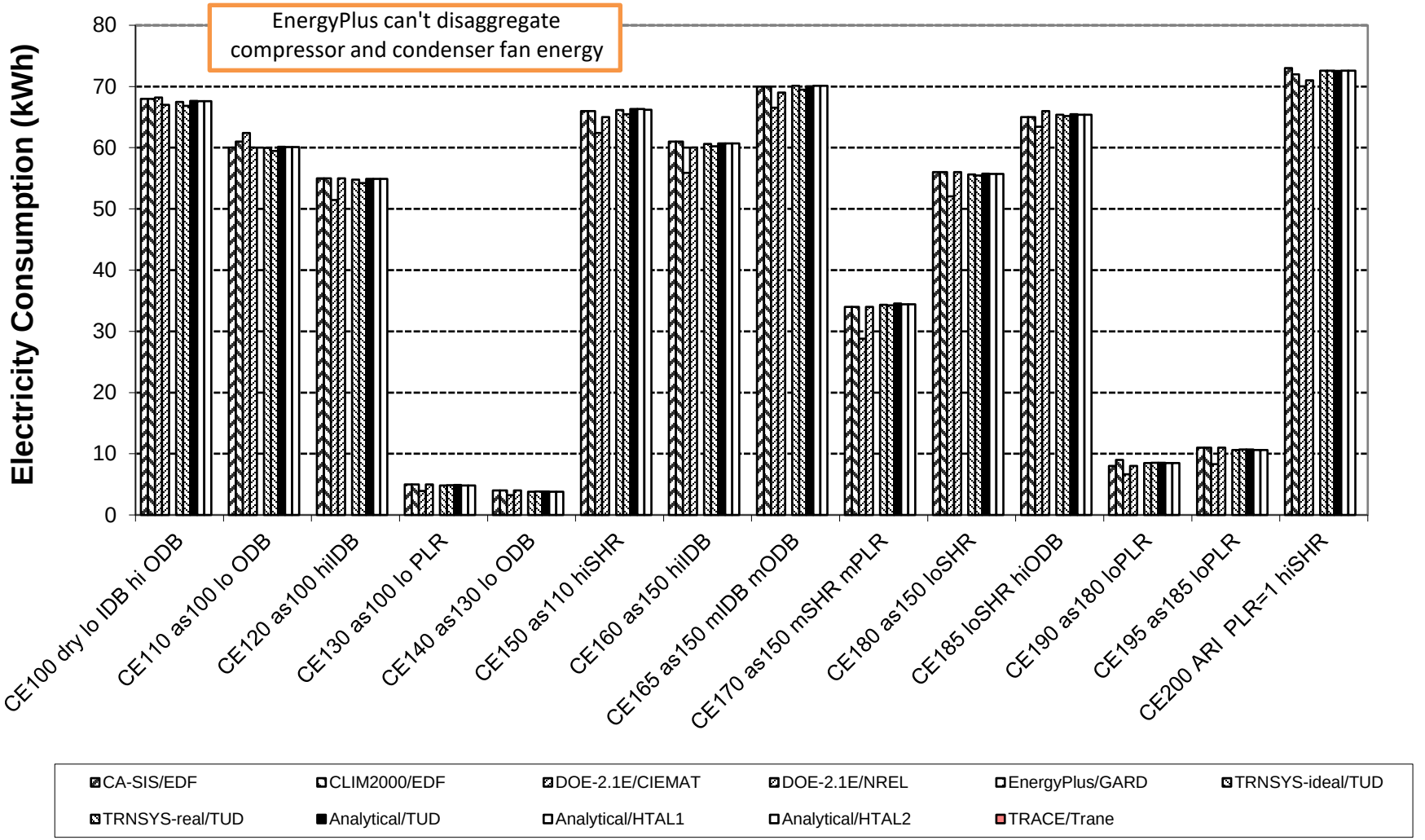
# Figure B16.5.1-8.
# HVAC BESTEST: Total Indoor (Supply) Fan Electricity Consumption



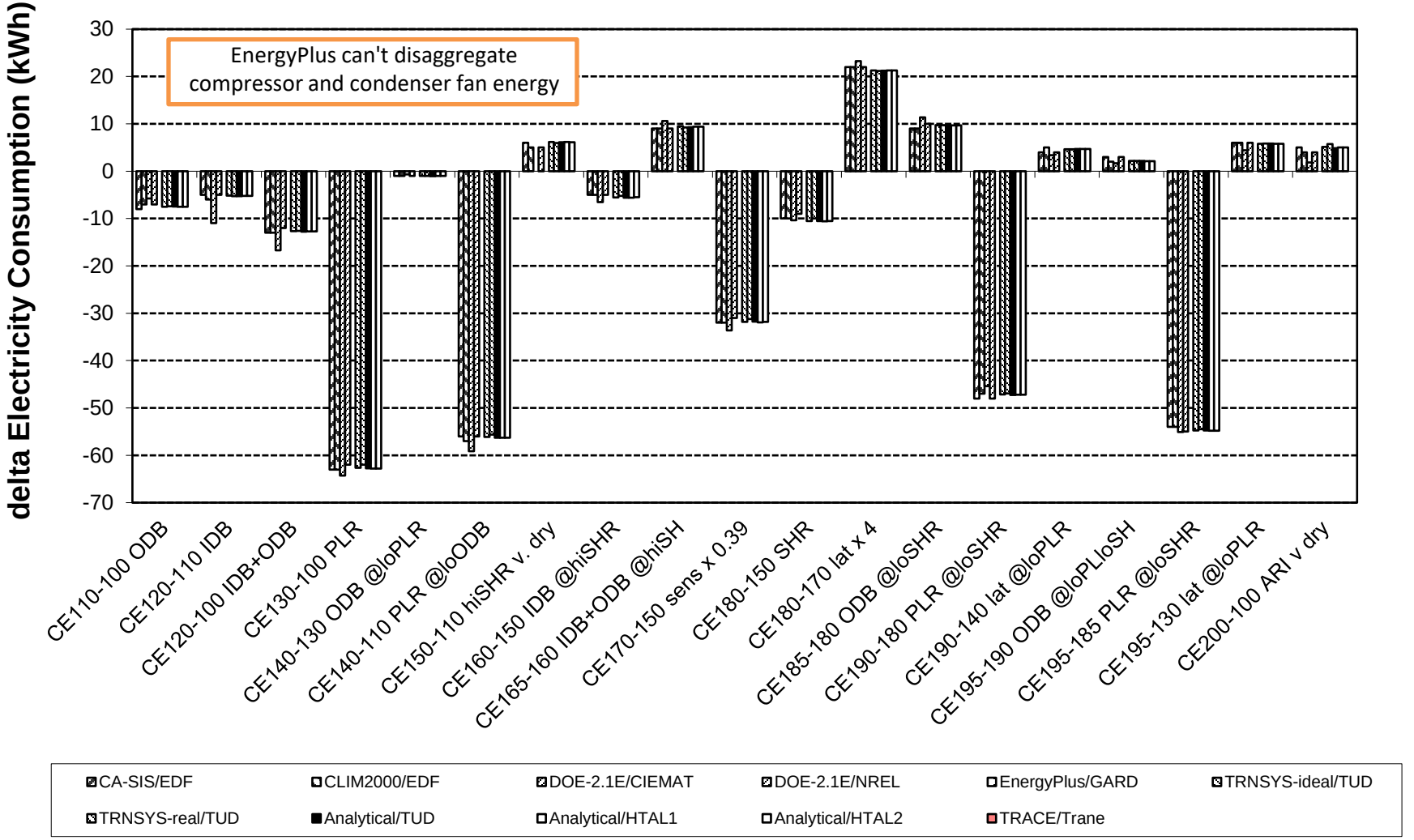
# Figure B16.5.1-9.
# HVAC BESTEST: Indoor (Supply) Fan Electricity Sensitivities



## Figure B16.5.1-10.
## HVAC BESTEST: Outdoor (Condenser) Fan Electricity Consumption

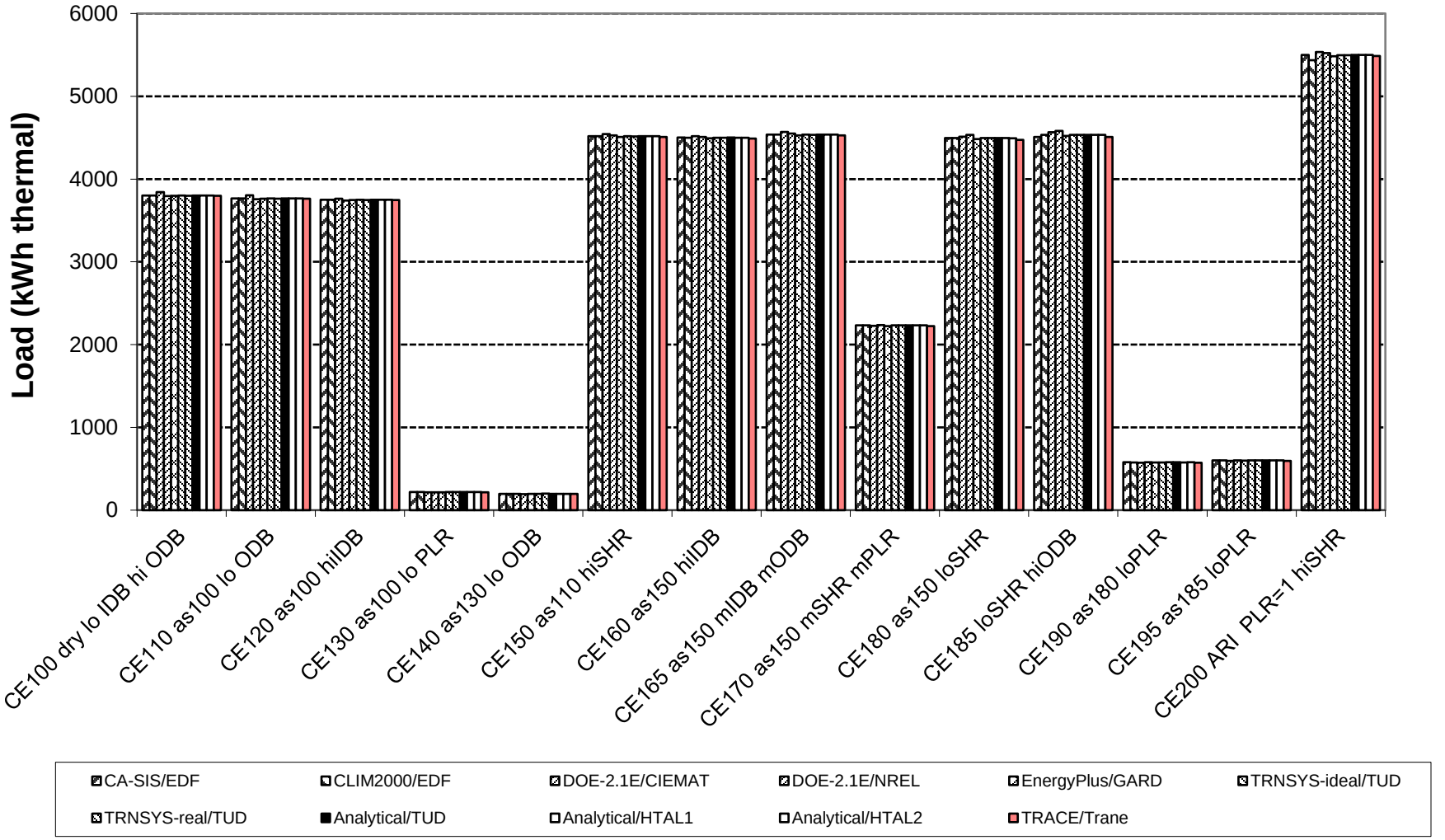


# Figure B16.5.1-11.
# HVAC BESTEST: Outdoor (Condenser) Fan Electricity Sensitivities

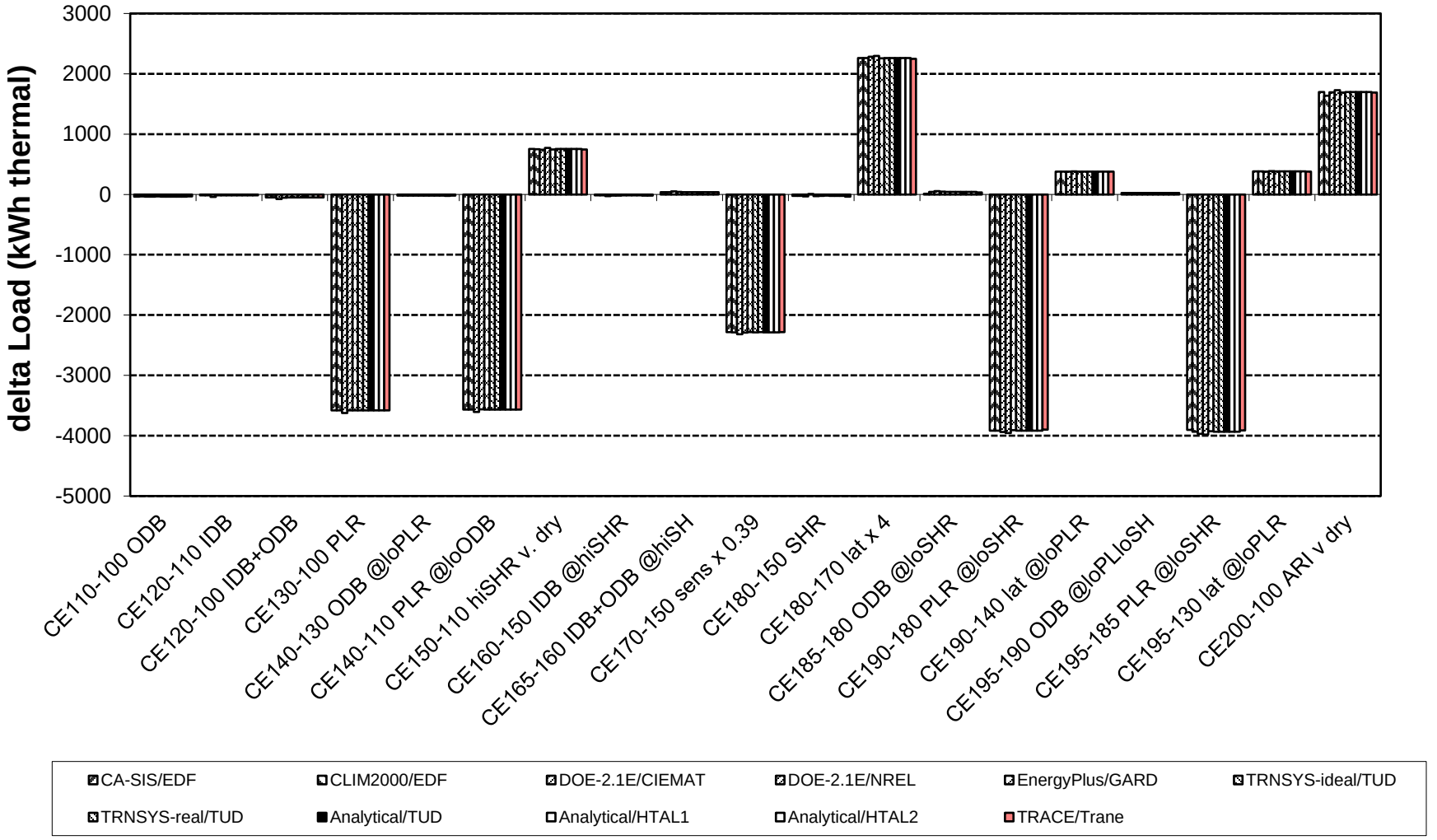


ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.1
Example Results for Section 5.3 - HVAC Equipment Performance Tests CE100 through CE200

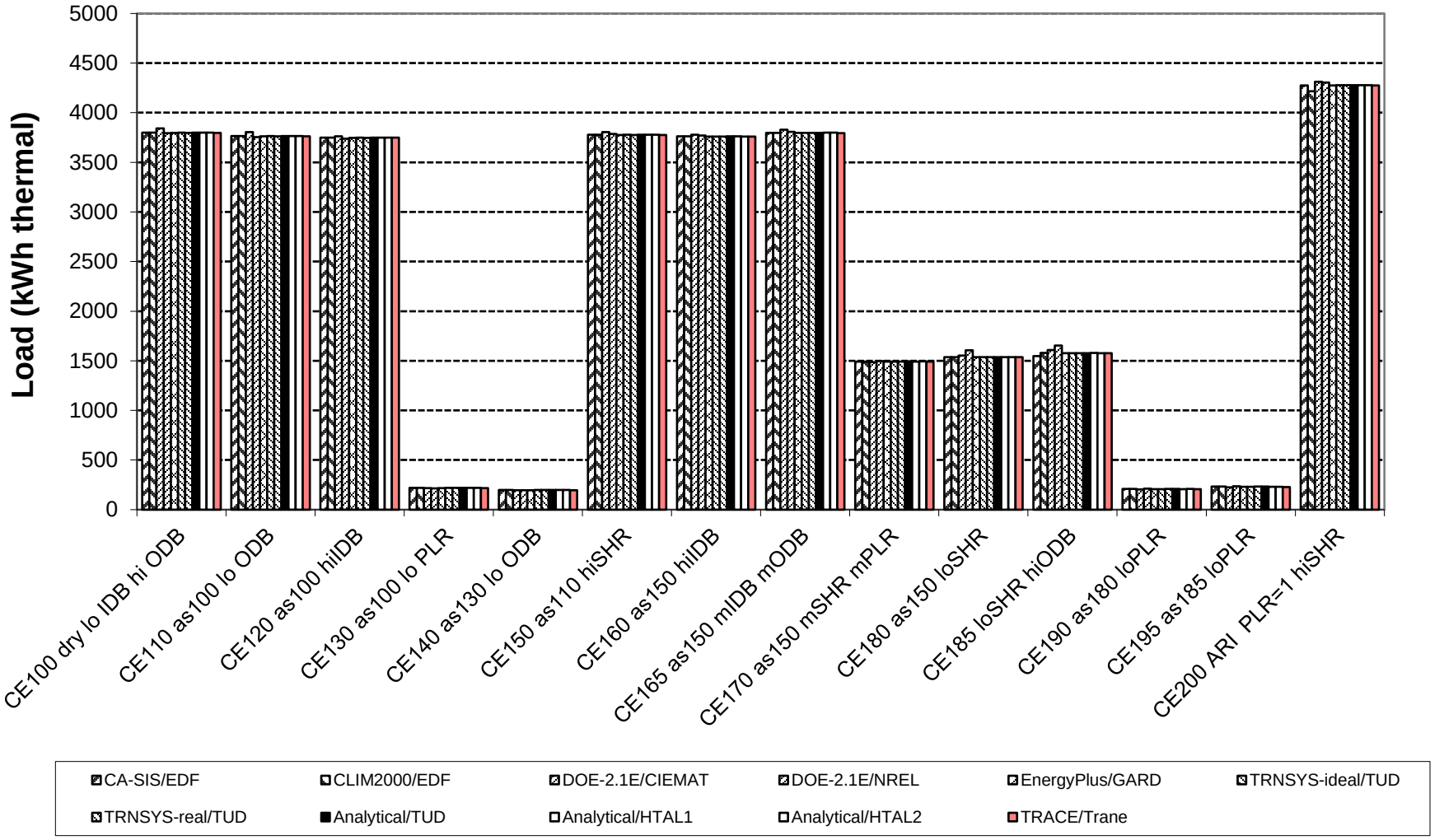
# Figure B16.5.1-12.
# HVAC BESTEST: Total Coil Load



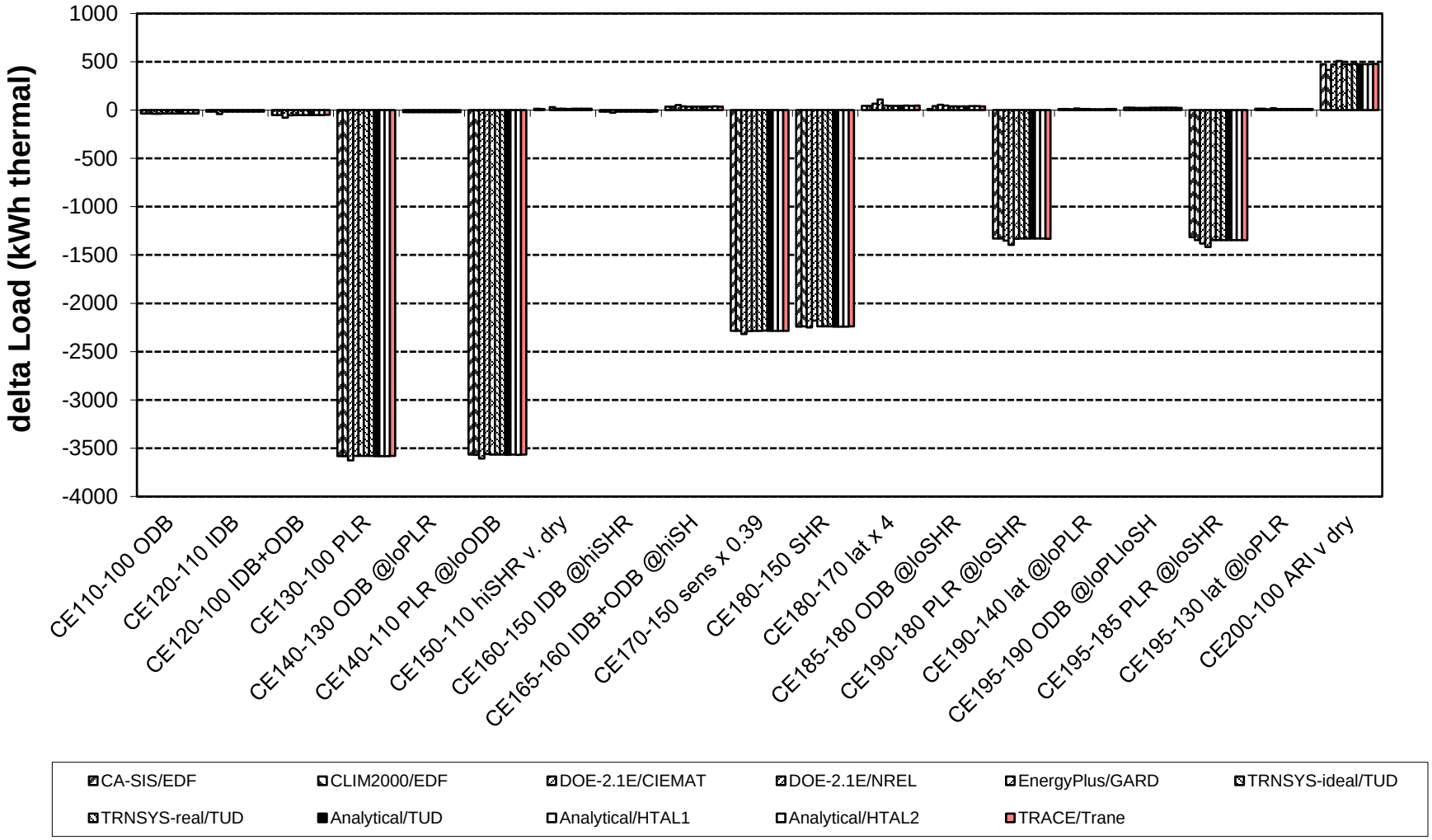
# Figure B16.5.1-13.
# HVAC BESTEST: Total Coil Load Sensitivities



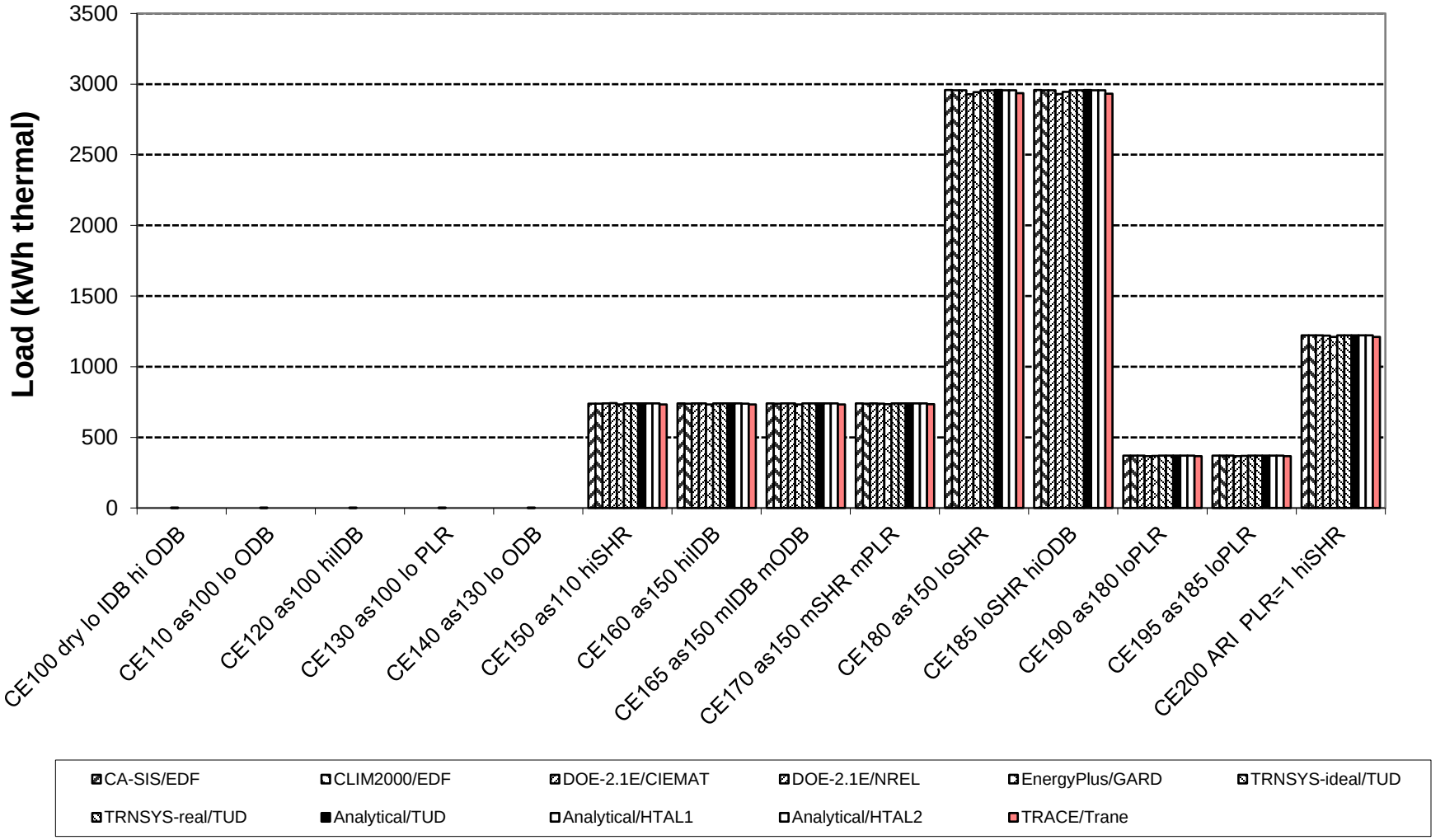
# Figure B16.5.1-14.
# HVAC BESTEST: Sensible Coil Load



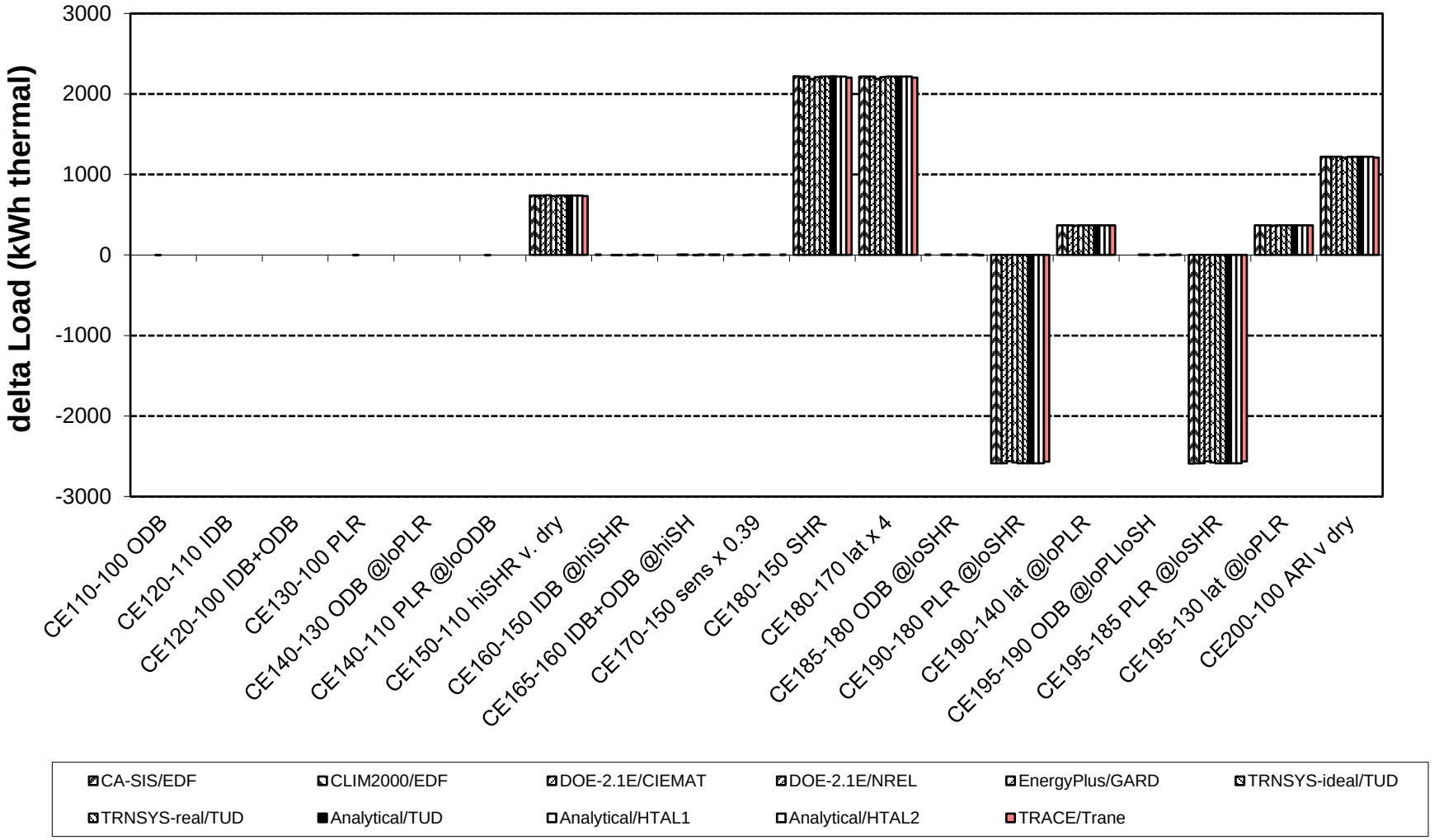
# Figure B16.5.1-15.
# HVAC BESTEST: Sensible Coil Load Sensitivities



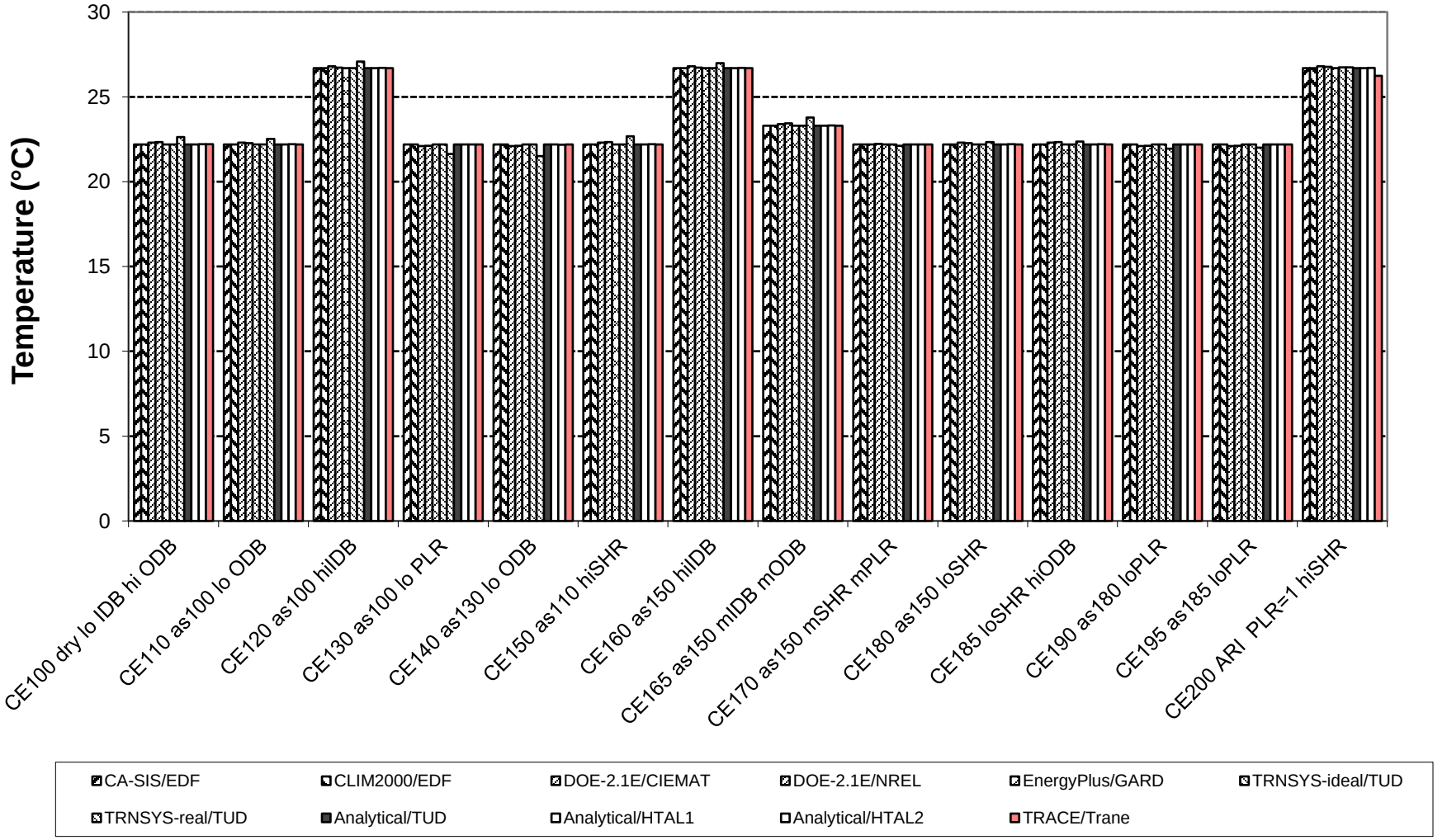
# Figure B16.5.1-16.
# HVAC BESTEST: Latent Coil Load



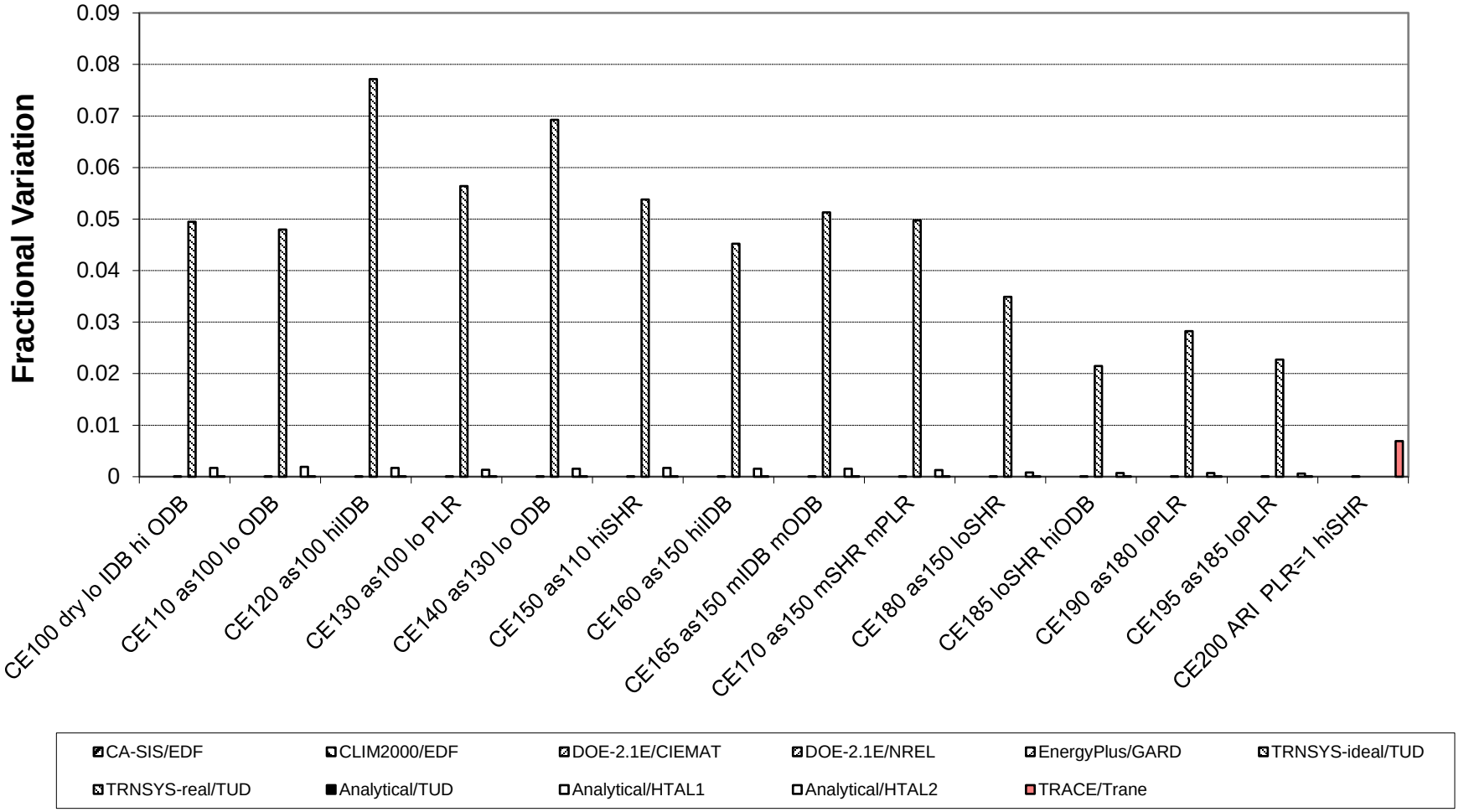
# Figure B16.5.1-17.
# HVAC BESTEST: Latent Coil Load Sensitivities



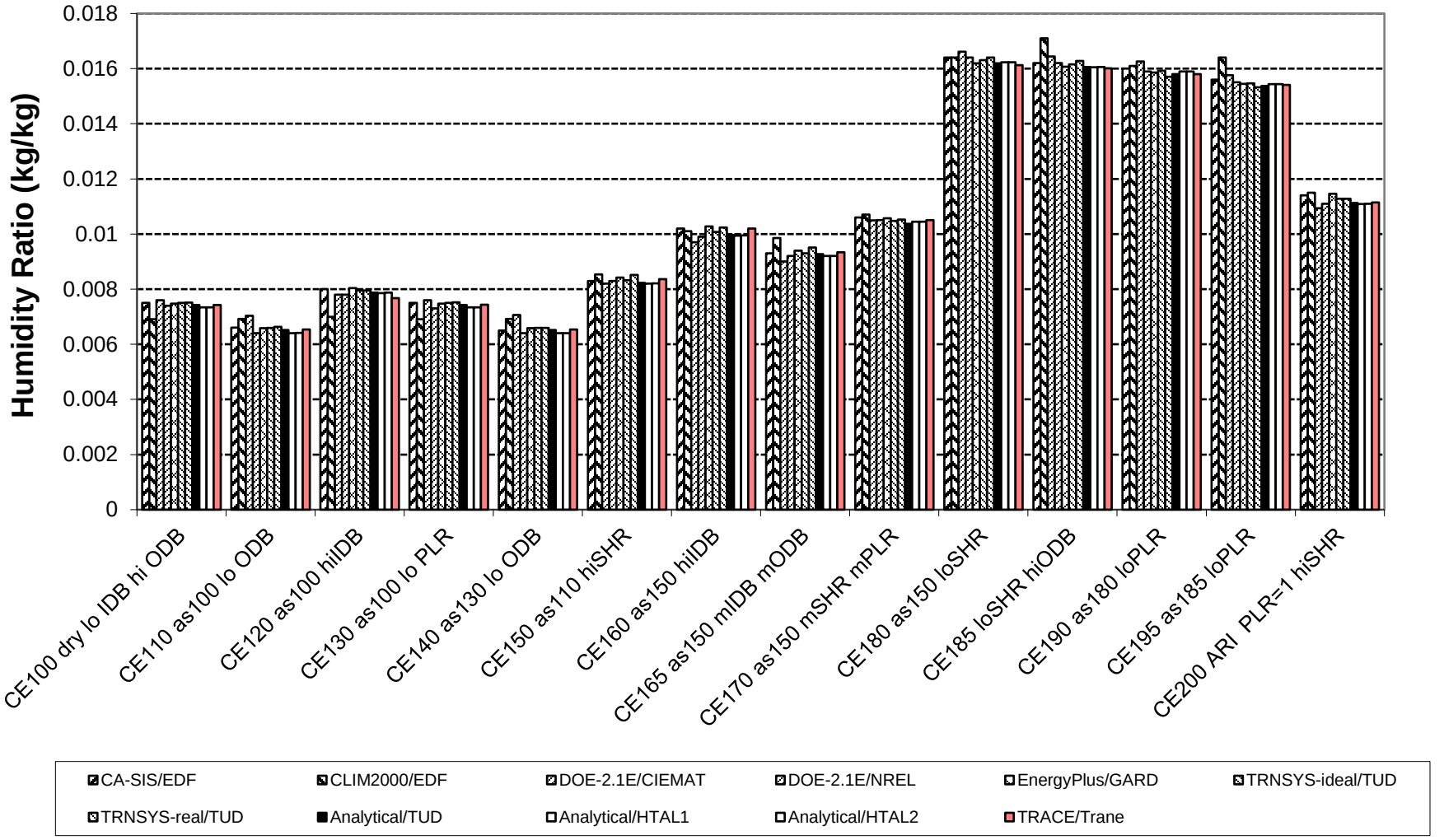
# Figure B16.5.1-18.
# HVAC BESTEST: Mean Indoor Drybulb Temperature



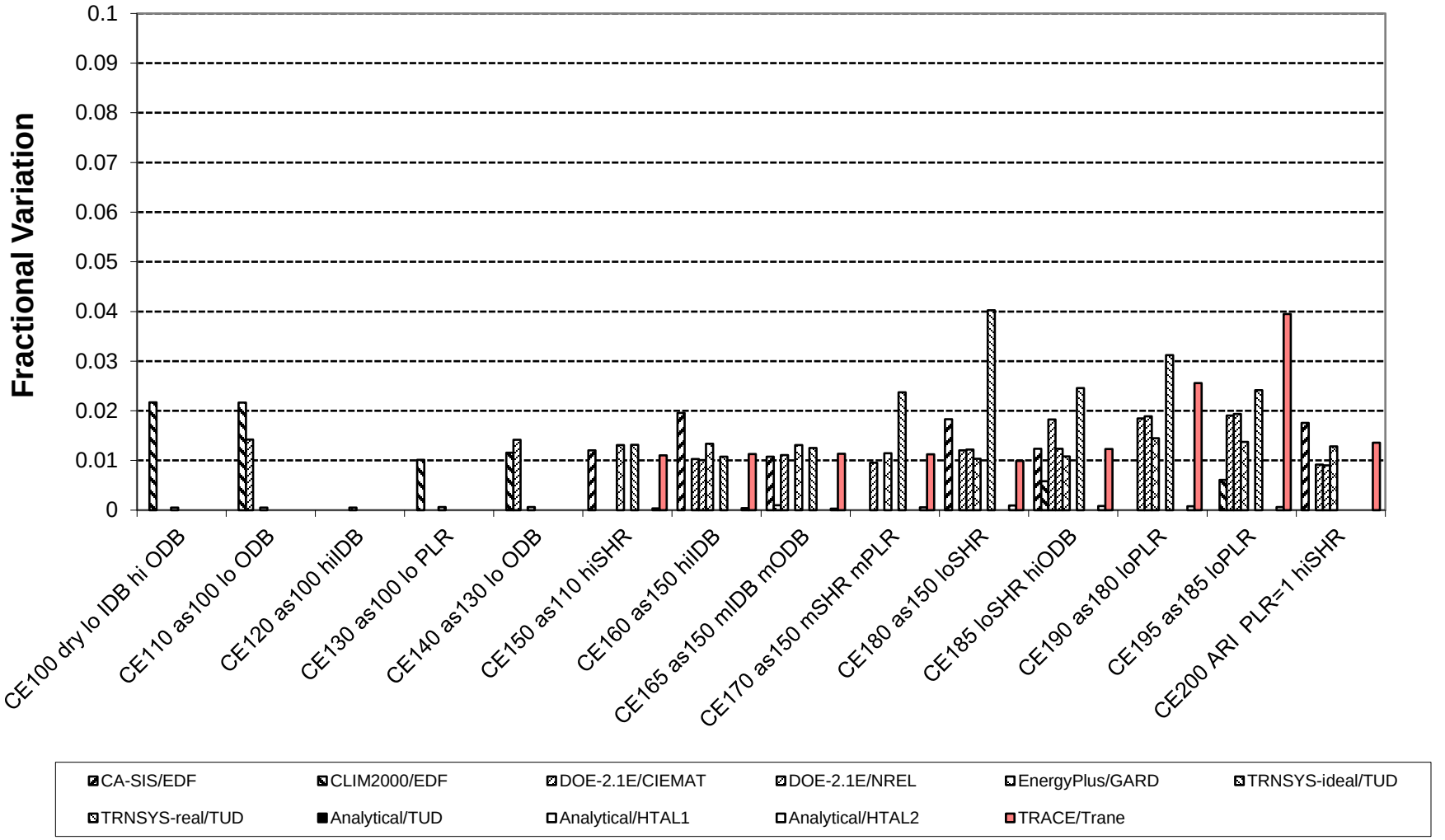
# Figure B16.5.1-19.
# HVAC BESTEST: (Maximum - Minimum)/Mean Indoor Drybulb Temperature



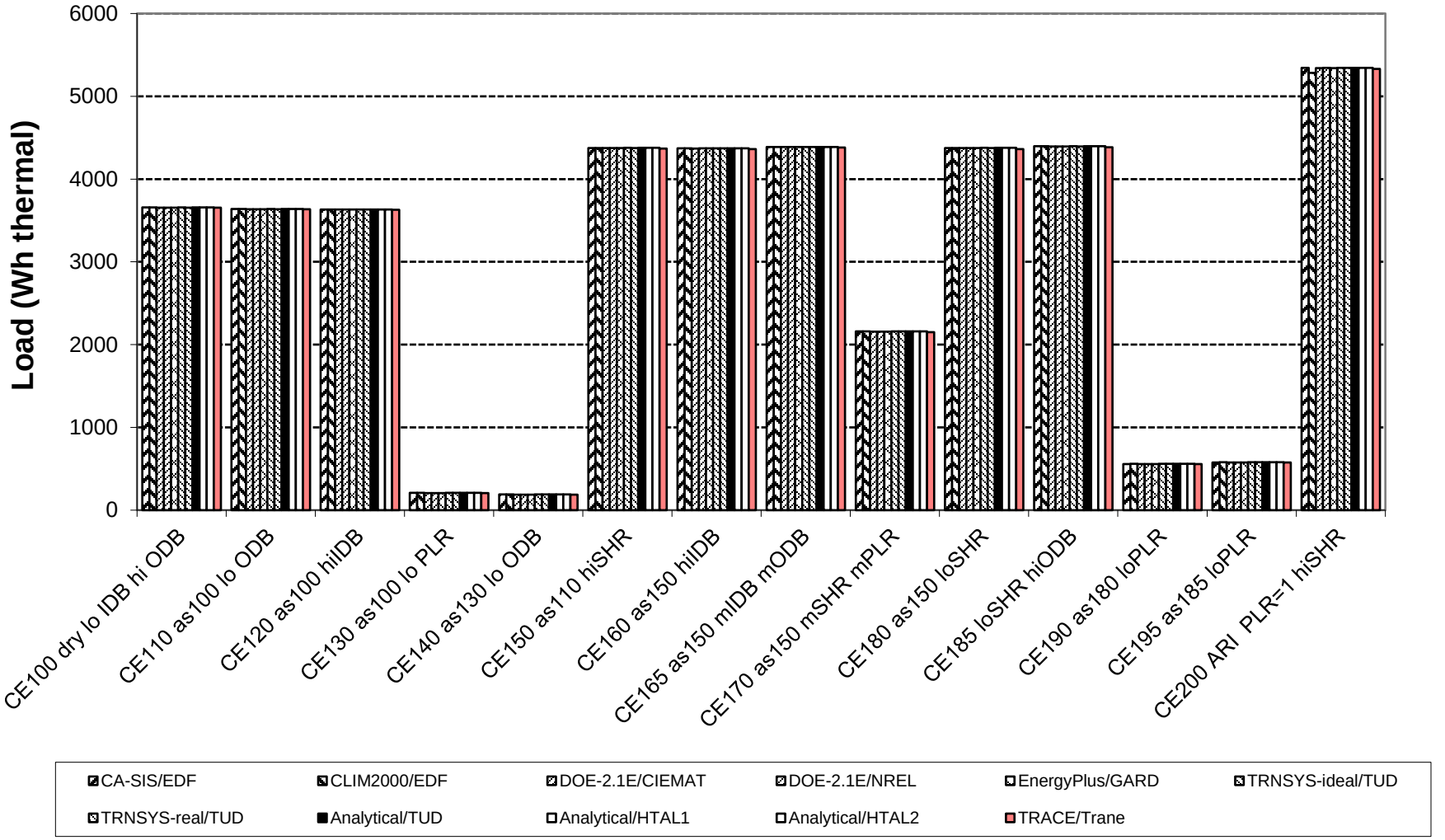
# Figure B16.5.1-20.
# HVAC BESTEST: Mean Indoor Humidity Ratio



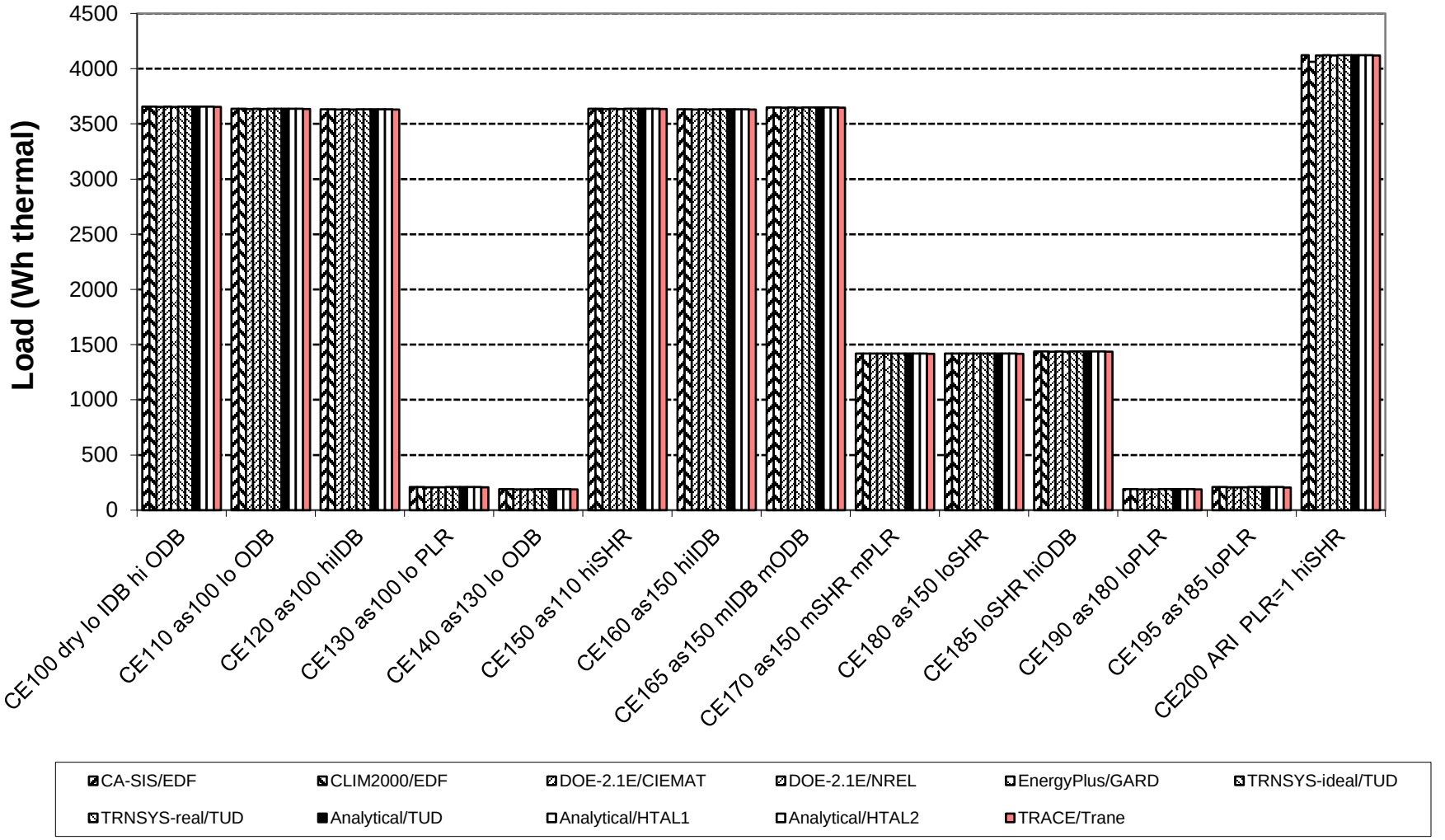
# Figure B16.5.1-21.
# HVAC BESTEST: (Maximum - Minimum)/Mean Indoor Humidity Ratio



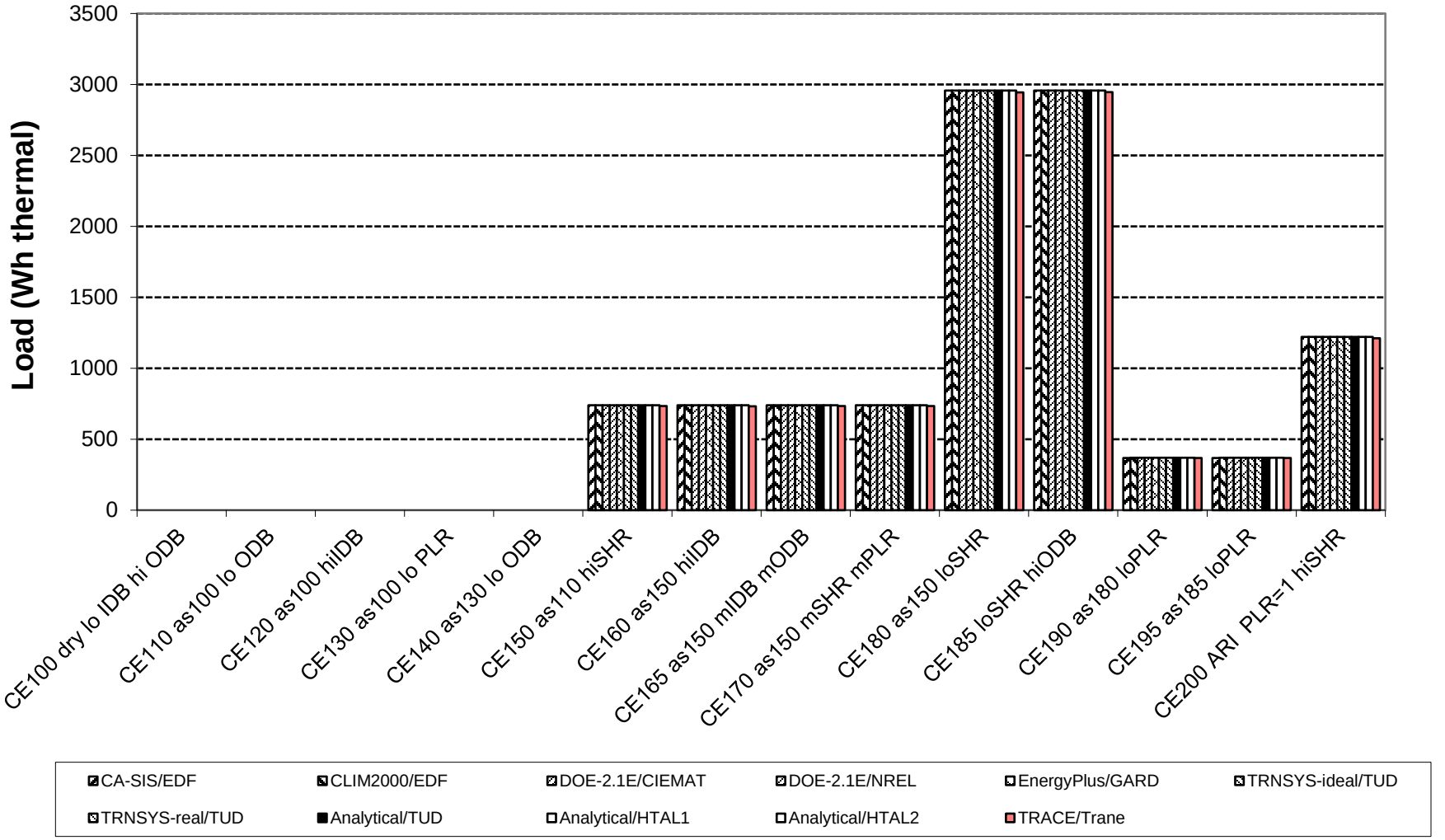
# Figure B16.5.1-22.
# HVAC BESTEST: Total Zone Load



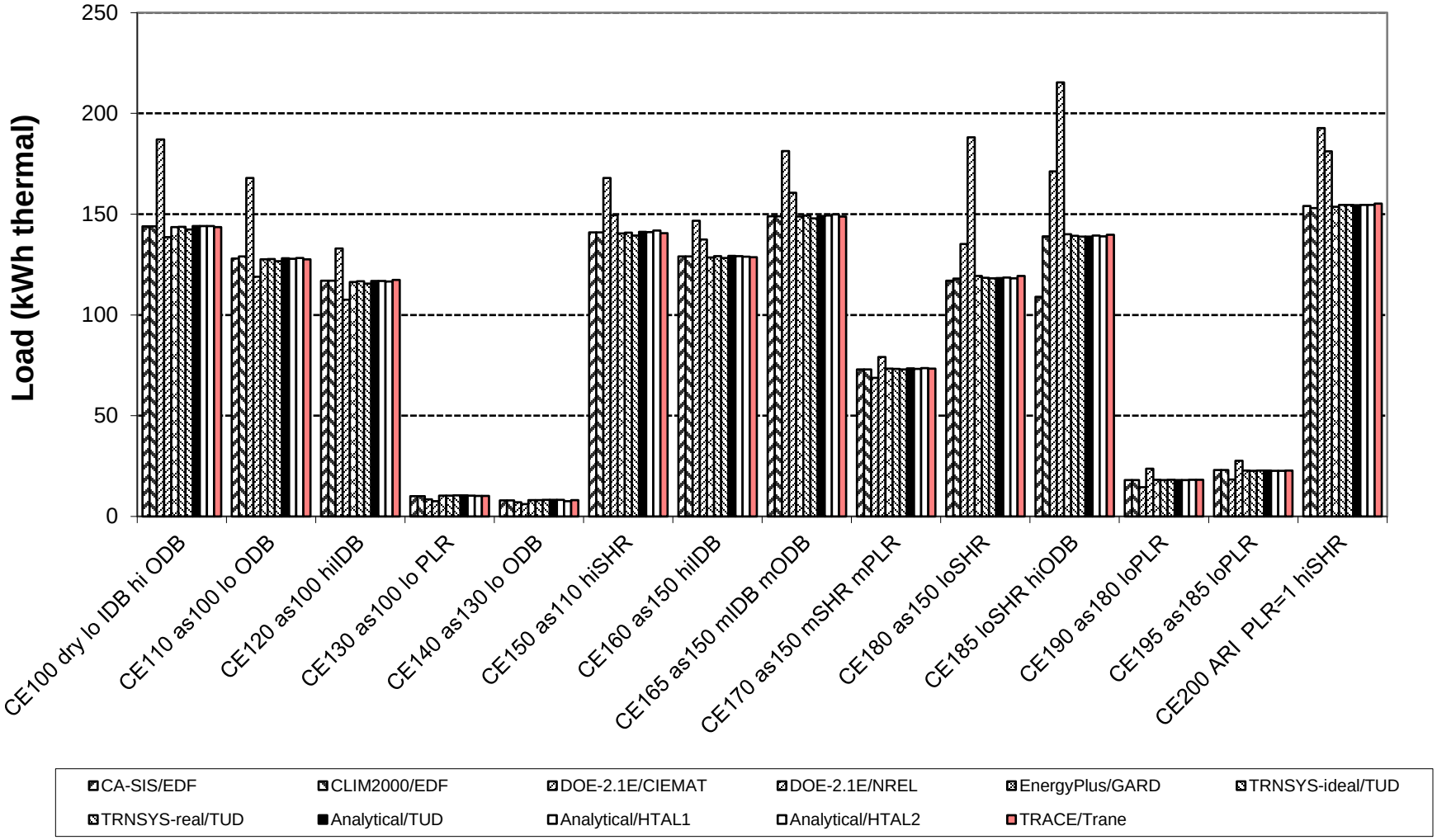
# Figure B16.5.1-23.
# HVAC BESTEST: Sensible Zone Load



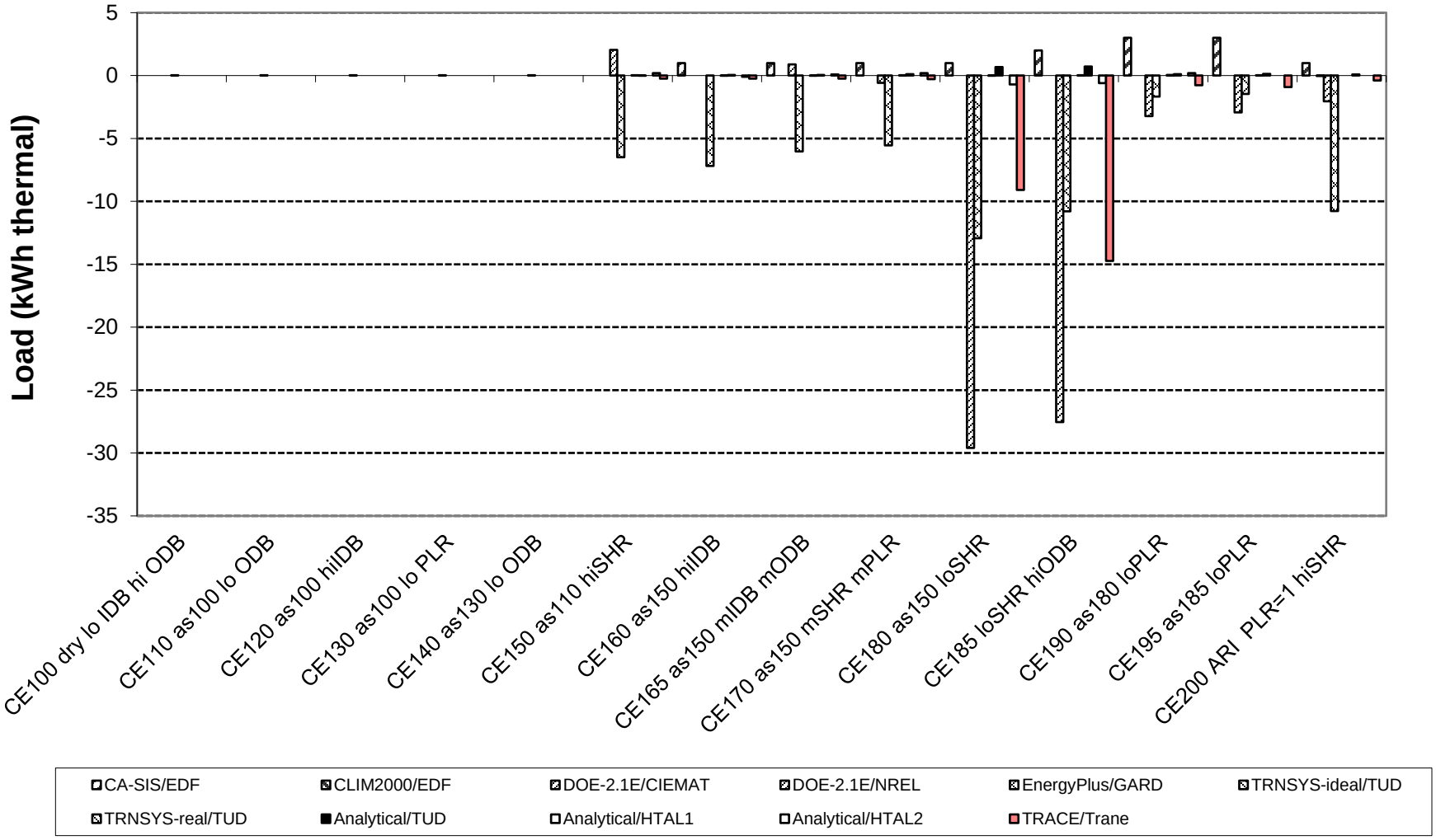
# Figure B16.5.1-24.
# HVAC BESTEST: Latent Zone Load



# Figure B16.5.1-25.
# HVAC BESTEST: Sensible Coil Load - Zone Load (Fan Heat)



# Figure B16.5.1-26.
# HVAC BESTEST: Latent Coil Load - Latent Zone Load (Should = 0)



# ASHRAE Standard 140-2020

## Informative Annex B16, Section B16.5.2

## Example Results
## for
## Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545

# ASHRAE Standard 140-2020
# Participating Organizations and Computer Programs for
# Quasi-analytical Solutions and Example Simulation Results
# Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545

The quasi-analytical solutions and programs used to generate the example simulation results are described in Table B17-2. The first column of Table B17-2 ("Model"), indicates the proper program name and version number, or indicates a quasi-analytical solution.

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

The third column ("Implemented By") indicates the national research facility, university, or industry organization with expertise in building science that performed the simulations or did the quasi-analytical solutions.

The entries in the fourth column are the abbreviations for the simulations and quasi-analytical solutions generally used in the tables and charts which follow.

See Standard 140, Annex B17 for further details.

## TABLE B17-2
## Participating Organizations and Computer Programs

| Model | Authoring Organization | Implemented By | Abbreviation |
|---|---|---|---|
| CODYRUN/LGIMAT | Université de la Reunion Island, France | Université de la Reunion Island, France | CODYRUN/UR |
| DOE-2.1E version 120 (ESTSC release) | LANL/LBNL/ESTSC/JJH,[a,b,c,d] United States | NREL/JNA,[e] United States | DOE-2.1E-E/NREL DOE21E-E |
| DOE-2.2 NT42j | LBNL/JJH,[b,d] United States | NREL/JNA,[e] United States | DOE-2.2/NREL |
| EnergyPlus 1.1.0.020 | LBNL/UIUC/CERL/OSU/GARD Analytics/FSEC/DOE-BT,[b,f,g,h,i,j] United States | GARD Analytics, United States | EnergyPlus/GARD |
| HOT3000/ESP-r | CETC/ESRU,[k,l] Canada/United Kingdom | CETC,[k] Canada | HOT3000/NRCan |
| TRNSYS 14.2-TUD with real controller model | University of Wisconsin, USA; Technische Universität Dresden, Germany | Technische Universität Dresden, Germany | TRNSYS/TUD |

[a]LANL: Los Alamos National Laboratory, United States
[b]LBNL: Lawrence Berkeley National Laboratory, United States
[c]ESTSC: Energy Science and Technology Software Center (at Oak Ridge National Laboratory), United States
[d]JJH: James J. Hirsch & Associates, United States
[e]NREL/JNA: National Renewable Energy Laboratory/J. Neymark & Associates, United States
[f]UIUC: University of Illinois Urbana/Champaign, United States
[g]CERL: U.S. Army Corps of Engineers, Construction Engineering Research Laboratories, United States
[h]OSU: Oklahoma State University, United States
[i]FSEC: University of Central Florida, Florida Solar Energy Center, United States
[j]DOE-BT: U.S. Department of Energy, Office of Building Technologies, Energy Efficiency and Renewable Energy, United States
[k]CETC:CANMET Energy Technology Centre, Natural Resources Canada, Canada
[l]ESRU: Energy Systems Research Unit, University of Strathclyde, Scotland, United Kingdom

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**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-1. Annual Space Cooling Electricity Consumption (Total, Compressor)

| **Energy Consumption, Total (kWh,e)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 35634 | 34750 | 34755 | 34746 | 34976 | 35070 | 34746 | 35634 | 34988 | 2.5% | 35035 |
| CE310 | 39973 | 39379 | 39384 | 39290 | 39520 | 39608 | 39290 | 39973 | 39526 | 1.7% | 39446 |
| CE320 | 40060 | 38745 | 38792 | 39079 | 39401 | 39457 | 38745 | 40060 | 39256 | 3.3% | 39299 |
| CE330 | 40963 | 39708 | 39438 | 40143 | 40535 | 40330 | 39438 | 40963 | 40186 | 3.8% | 40440 |
| CE340 | 40619 | 39358 | 39265 | 39783 | 40065 | 39947 | 39265 | 40619 | 39840 | 3.4% | 40056 |
| CE350 | 32237 | 30547 | 30548 | 31145 | 31587 | 31742 | 30547 | 32237 | 31301 | 5.4% | 31420 |
| CE360 | 55299 | 54064 | 54016 | 54705 | 54843 | 55068 | 54016 | 55299 | 54666 | 2.3% | 54930 |
| CE400 | 32045 | 30846 | 30876 | 31013 | | 31413 | 30846 | 32045 | 31239 | 3.8% | 30670 |
| CE410 | 32078 | 31668 | 31699 | | | 31503 | 31503 | 32078 | 31737 | 1.8% | 30670 |
| CE420 | 33387 | 32530 | 32910 | 32736 | | 33208 | 32530 | 33387 | 32954 | 2.6% | 32983 |
| CE430 | 32538 | 31932 | 31811 | 31772 | | 31818 | 31772 | 32538 | 31974 | 2.4% | 32127 |
| CE440 | 33691 | 33032 | 32973 | 33032 | | 33248 | 32973 | 33691 | 33195 | 2.2% | 33302 |
| CE500 | 22338 | 22817 | 22822 | 23035 | 22323 | 23138 | 22323 | 23138 | 22745 | 3.6% | 23054 |
| CE500 May-Sep | 17391 | 17872 | 17870 | 17996 | 17435 | 18051 | 17391 | 18051 | 17769 | 3.7% | 18031 |
| CE510 May-Sep | 34609 | 35971 | 35970 | 35732 | 34849 | 35845 | 34609 | 35971 | 35496 | 3.8% | 35785 |
| CE520 | 24987 | 25389 | 25390 | 25017 | 25131 | 25781 | 24987 | 25781 | 25282 | 3.1% | 25794 |
| CE522 | 23544 | 24293 | 24307 | 24078 | 23620 | 24360 | 23544 | 24360 | 24034 | 3.4% | 24366 |
| CE525 | 20321 | 20408 | 20421 | 20702 | 20242 | 21323 | 20242 | 21323 | 20569 | 5.3% | 20759 |
| CE530 | 17281 | 17540 | 17537 | 17742 | 17442 | 17875 | 17281 | 17875 | 17570 | 3.4% | 18454 |
| CE540 | 19430 | 19878 | 19874 | 19061 | 19537 | 20164 | 19061 | 20164 | 19657 | 5.6% | 20237 |
| CE545 | 15687 | 15802 | 15791 | 16636 | 15791 | 16339 | 15687 | 16636 | 16008 | 5.9% | 17044 |
| **Energy Consumption, Compressor (kWh,e)** | | | | | | | Statistics, All Results | | | | |
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 22354 | 21569 | 21573 | | 21770 | 21876 | 21569 | 22354 | 21828 | 3.6% | |
| CE310 | 26340 | 25813 | 25817 | | 25937 | 26053 | 25813 | 26340 | 25992 | 2.0% | |
| CE320 | 26433 | 25250 | 25294 | | 25846 | 25912 | 25250 | 26433 | 25747 | 4.6% | |
| CE330 | 27300 | 26172 | 25925 | | 26928 | 26775 | 25925 | 27300 | 26620 | 5.2% | |
| CE340 | 26963 | 25829 | 25745 | | 26473 | 26400 | 25745 | 26963 | 26282 | 4.6% | |
| CE350 | 19317 | 17802 | 17801 | | 18738 | 18891 | 17801 | 19317 | 18510 | 8.2% | |
| CE360 | 40106 | 38999 | 38955 | | 39697 | 39941 | 38955 | 40106 | 39540 | 2.9% | |
| CE400 | 19179 | 18106 | 18131 | | | 18629 | 18106 | 19179 | 18511 | 5.8% | |
| CE410 | 19204 | 18823 | 18850 | | | 18685 | 18685 | 19204 | 18891 | 2.8% | |
| CE420 | 20359 | 19596 | 19934 | | | 20214 | 19596 | 20359 | 20026 | 3.8% | |
| CE430 | 19599 | 19059 | 18951 | | | 18966 | 18951 | 19599 | 19144 | 3.4% | |
| CE440 | 20629 | 20042 | 19989 | | | 20249 | 19989 | 20629 | 20227 | 3.2% | |
| CE500 | 17854 | 18473 | 18478 | | 17858 | 18522 | 17854 | 18522 | 18237 | 3.7% | |
| CE500 May-Sep | 13942 | 14508 | 14506 | | 13989 | 14491 | 13942 | 14508 | 14287 | 4.0% | |
| CE510 May-Sep | 27748 | 28811 | 28810 | | 27902 | 28721 | 27748 | 28811 | 28398 | 3.7% | |
| CE520 | 19521 | 20121 | 20126 | | 19655 | 20185 | 19521 | 20185 | 19922 | 3.3% | |
| CE522 | 18620 | 19407 | 19418 | | 18690 | 19281 | 18620 | 19418 | 19083 | 4.2% | |
| CE525 | 16558 | 16880 | 16893 | | 16507 | 17443 | 16507 | 17443 | 16856 | 5.6% | |
| CE530 | 13657 | 14127 | 14124 | | 13856 | 14172 | 13657 | 14172 | 13987 | 3.7% | |
| CE540 | 15021 | 15680 | 15677 | | 15164 | 15664 | 15021 | 15680 | 15441 | 4.3% | |
| CE545 | 12622 | 12967 | 12957 | | 12751 | 13215 | 12622 | 13215 | 12902 | 4.6% | |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-2. Annual Space Cooling Electricity Consumption (Supply Fan, Condenser Fan)

| **Energy Consumption, Supply Fan (kWh,e)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 10880 | 10880 | 10880 | 10862 | 10880 | 10880 | 10862 | 10880 | 10877 | 0.2% | 10862 |
| CE310 | 10880 | 10880 | 10880 | 10862 | 10880 | 10880 | 10862 | 10880 | 10877 | 0.2% | 10862 |
| CE320 | 10880 | 10880 | 10880 | 10862 | 10880 | 10880 | 10862 | 10880 | 10877 | 0.2% | 10862 |
| CE330 | 10880 | 10880 | 10880 | 10862 | 10880 | 10880 | 10862 | 10880 | 10877 | 0.2% | 10862 |
| CE340 | 10880 | 10880 | 10880 | 10862 | 10880 | 10880 | 10862 | 10880 | 10877 | 0.2% | 10862 |
| CE350 | 10880 | 10880 | 10880 | 10862 | 10880 | 10880 | 10862 | 10880 | 10877 | 0.2% | 10862 |
| CE360 | 10880 | 10880 | 10880 | 10862 | 10880 | 10880 | 10862 | 10880 | 10877 | 0.2% | 10862 |
| CE400 | 10880 | 10880 | 10880 | 10862 | | 10880 | 10862 | 10880 | 10876 | 0.2% | 10862 |
| CE410 | 10880 | 10880 | 10880 | | | 10880 | 10880 | 10880 | 10880 | 0.0% | 10862 |
| CE420 | 10880 | 10880 | 10880 | 10862 | | 10880 | 10862 | 10880 | 10876 | 0.2% | 10862 |
| CE430 | 10880 | 10880 | 10880 | 10862 | | 10880 | 10862 | 10880 | 10876 | 0.2% | 10862 |
| CE440 | 10880 | 10880 | 10880 | 10862 | | 10880 | 10862 | 10880 | 10876 | 0.2% | 10862 |
| CE500 | 2564 | 2369 | 2369 | 2628 | 2553 | 2639 | 2369 | 2639 | 2520 | 10.7% | 2629 |
| CE500 May-Sep | 1972 | 1837 | 1837 | 2029 | 1970 | 2035 | 1837 | 2035 | 1947 | 10.2% | 2031 |
| CE510 May-Sep | 3923 | 4099 | 4099 | 4063 | 3972 | 4073 | 3923 | 4099 | 4038 | 4.4% | 4064 |
| CE520 | 3125 | 2874 | 2871 | 3019 | 3131 | 3200 | 2871 | 3200 | 3037 | 10.8% | 3140 |
| CE522 | 2816 | 2704 | 2707 | 2843 | 2819 | 2904 | 2704 | 2904 | 2799 | 7.1% | 2878 |
| CE525 | 2152 | 1886 | 1885 | 2180 | 2136 | 2221 | 1885 | 2221 | 2077 | 16.2% | 2191 |
| CE530 | 2072 | 1833 | 1833 | 2090 | 2051 | 2117 | 1833 | 2117 | 1999 | 14.2% | 2320 |
| CE540 | 2522 | 2258 | 2258 | 2309 | 2500 | 2573 | 2258 | 2573 | 2403 | 13.1% | 2561 |
| CE545 | 1753 | 1501 | 1501 | 1871 | 1739 | 1786 | 1501 | 1871 | 1692 | 21.9% | 2107 |
| **Energy Consumption, Condenser Fan (kWh,e)** | | | | | | | Statistics, All Results | | | | |
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 2400 | 2301 | 2302 | | 2326 | 2323 | 2301 | 2400 | 2331 | 4.3% | |
| CE310 | 2754 | 2686 | 2687 | | 2703 | 2691 | 2686 | 2754 | 2704 | 2.5% | |
| CE320 | 2747 | 2615 | 2618 | | 2675 | 2681 | 2615 | 2747 | 2667 | 4.9% | |
| CE330 | 2784 | 2656 | 2633 | | 2727 | 2693 | 2633 | 2784 | 2699 | 5.6% | |
| CE340 | 2776 | 2649 | 2640 | | 2713 | 2684 | 2640 | 2776 | 2692 | 5.1% | |
| CE350 | 2040 | 1865 | 1867 | | 1969 | 1970 | 1865 | 2040 | 1942 | 9.0% | |
| CE360 | 4313 | 4185 | 4181 | | 4266 | 4272 | 4181 | 4313 | 4243 | 3.1% | |
| CE400 | 1986 | 1860 | 1865 | | | 1902 | 1860 | 1986 | 1903 | 6.6% | |
| CE410 | 1994 | 1965 | 1969 | | | 1936 | 1936 | 1994 | 1966 | 3.0% | |
| CE420 | 2149 | 2054 | 2096 | | | 2115 | 2054 | 2149 | 2103 | 4.5% | |
| CE430 | 2059 | 1993 | 1980 | | | 1970 | 1970 | 2059 | 2001 | 4.5% | |
| CE440 | 2182 | 2110 | 2104 | | | 2120 | 2104 | 2182 | 2129 | 3.7% | |
| CE500 | 1920 | 1975 | 1975 | | 1912 | 1976 | 1912 | 1976 | 1952 | 3.3% | |
| CE500 May-Sep | 1477 | 1527 | 1527 | | 1476 | 1524 | 1476 | 1527 | 1506 | 3.4% | |
| CE510 May-Sep | 2938 | 3061 | 3061 | | 2974 | 3050 | 2938 | 3061 | 3017 | 4.1% | |
| CE520 | 2340 | 2394 | 2393 | | 2345 | 2396 | 2340 | 2396 | 2374 | 2.4% | |
| CE522 | 2108 | 2182 | 2182 | | 2111 | 2174 | 2108 | 2182 | 2151 | 3.4% | |
| CE525 | 1611 | 1642 | 1643 | | 1599 | 1663 | 1599 | 1663 | 1632 | 3.9% | |
| CE530 | 1552 | 1580 | 1580 | | 1536 | 1585 | 1536 | 1585 | 1567 | 3.1% | |
| CE540 | 1888 | 1940 | 1939 | | 1872 | 1926 | 1872 | 1940 | 1913 | 3.5% | |
| CE545 | 1312 | 1334 | 1333 | | 1302 | 1337 | 1302 | 1337 | 1324 | 2.7% | |

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

## Table B16.5.2-3. Weather Data Checks, CE300 Only

| | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| **Annual Mean Output** | | | | | | | | | | | |
| ODB (°C) | 19.91 | 19.89 | 19.89 | 19.91 | 19.91 | 19.91 | 19.89 | 19.91 | 19.91 | 0.1% | 19.91 |
| OHR (kg/kg) | 0.01164 | 0.01160 | 0.01160 | 0.01159 | 0.01165 | 0.01160 | 0.01159 | 0.01165 | 0.01161 | 0.5% | 0.01161 |
| **Annual Hourly Integrated Maxima** | | | | | | | | | | | |
| ODB (°C) | 34.70 | 35.00 | 35.00 | 34.78 | 35.00 | 35.00 | 34.70 | 35.00 | 34.91 | 0.9% | 34.78 |
| OHR (kg/kg) | 0.02188 | 0.02250 | 0.02250 | 0.02184 | 0.02241 | 0.02230 | 0.02184 | 0.02250 | 0.02224 | 3.0% | 0.02187 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-4. Annual Space Cooling Coil Loads ( Total, Sensible )

| **Total Sensible + Latent (kWh,thermal)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 80427 | 77283 | 77292 | 77318 | 77745 | 78257 | 77283 | 80427 | 78054 | 4.0% | 78394 |
| CE310 | 99342 | 97395 | 97412 | 96448 | 97296 | 97261 | 96448 | 99342 | 97526 | 3.0% | 97415 |
| CE320 | 99792 | 96356 | 96493 | 96084 | 97141 | 96957 | 96084 | 99792 | 97137 | 3.8% | 97199 |
| CE330 | 105013 | 100730 | 100993 | 102211 | 103713 | 102008 | 100730 | 105013 | 102445 | 4.2% | 103718 |
| CE340 | 102728 | 99028 | 99223 | 99709 | 100676 | 99753 | 99028 | 102728 | 100186 | 3.7% | 101107 |
| CE350 | 69388 | 63736 | 63635 | 65790 | 66860 | 67389 | 63635 | 69388 | 66133 | 8.7% | 66913 |
| CE360 | 162974 | 159807 | 159854 | 161248 | 161200 | 162168 | 159807 | 162974 | 161209 | 2.0% | 162208 |
| CE400 | 68793 | 64918 | 65025 | 65414 | | 66898 | 64918 | 68793 | 66209 | 5.9% | 63745 |
| CE410 | 68673 | 66780 | 66844 | | | 66175 | 66175 | 68673 | 67118 | 3.7% | 63745 |
| CE420 | 72609 | 69611 | 70882 | 70349 | | 71803 | 69611 | 72609 | 71051 | 4.2% | 71284 |
| CE430 | 69756 | 67641 | 67219 | 67141 | | 67200 | 67141 | 69756 | 67792 | 3.9% | 68455 |
| CE440 | 73711 | 71380 | 71181 | 71417 | | 72029 | 71181 | 73711 | 71944 | 3.5% | 72443 |
| CE500 | 63357 | 65996 | 65992 | 65571 | 63105 | 65614 | 63105 | 65996 | 64939 | 4.5% | 65570 |
| CE500 May-Sep | 48443 | 50693 | 50690 | 50354 | 48440 | 50357 | 48440 | 50693 | 49830 | 4.5% | 50356 |
| CE510 May-Sep | 108974 | 114018 | 114015 | 112793 | 108979 | 112781 | 108974 | 114018 | 111927 | 4.5% | 112795 |
| CE520 | 63422 | 66571 | 66565 | 66088 | 63212 | 66146 | 63212 | 66571 | 65334 | 5.1% | 66212 |
| CE522 | 63389 | 66373 | 66372 | 65851 | 63157 | 65900 | 63157 | 66373 | 65174 | 4.9% | 65887 |
| CE525 | 63293 | 65399 | 65395 | 64973 | 63002 | 65155 | 63002 | 65399 | 64536 | 3.7% | 64990 |
| CE530 | 45046 | 46634 | 46631 | 46944 | 44875 | 47002 | 44875 | 47002 | 46189 | 4.6% | 47173 |
| CE540 | 45113 | 47130 | 47126 | 47297 | 44980 | 47462 | 44980 | 47462 | 46518 | 5.3% | 47521 |
| CE545 | 44981 | 46240 | 46236 | 46612 | 44775 | 46668 | 44775 | 46668 | 45919 | 4.1% | 46851 |
| **Sensible Coil Load (kWh,thermal)** | | | | | | | Statistics, All Results | | | | |
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 56662 | 55797 | 55805 | 55252 | 55209 | 55191 | 55191 | 56662 | 55653 | 2.6% | 55297 |
| CE310 | 56256 | 56301 | 56313 | 55225 | 55185 | 55083 | 55083 | 56313 | 55727 | 2.2% | 55268 |
| CE320 | 62859 | 62697 | 62747 | 62043 | 62009 | 62734 | 62009 | 62859 | 62515 | 1.4% | 61674 |
| CE330 | 63083 | 63311 | 63328 | 63779 | 62649 | 61822 | 61822 | 63779 | 62995 | 3.1% | 63044 |
| CE340 | 63033 | 63053 | 63111 | 62886 | 62381 | 61406 | 61406 | 63111 | 62645 | 2.7% | 62454 |
| CE350 | 50371 | 47684 | 47677 | 48545 | 48589 | 48768 | 47677 | 50371 | 48606 | 5.5% | 48674 |
| CE360 | 134977 | 134920 | 134940 | 135287 | 134206 | 134697 | 134206 | 135287 | 134838 | 0.8% | 134896 |
| CE400 | 41952 | 41419 | 41437 | 40688 | | 41181 | 40688 | 41952 | 41335 | 3.1% | 41580 |
| CE410 | 45677 | 47659 | 47660 | | | 45585 | 45585 | 47660 | 46645 | 4.4% | 41580 |
| CE420 | 50390 | 49666 | 50612 | 49524 | | 49984 | 49524 | 50612 | 50035 | 2.2% | 49549 |
| CE430 | 47863 | 47731 | 47454 | 46739 | | 46143 | 46143 | 47863 | 47186 | 3.6% | 47107 |
| CE440 | 50876 | 50593 | 50492 | 50060 | | 49785 | 49785 | 50876 | 50361 | 2.2% | 50149 |
| CE500 | 45044 | 47650 | 47646 | 47491 | 44874 | 47530 | 44874 | 47650 | 46706 | 5.9% | 47489 |
| CE500 May-Sep | 34443 | 36596 | 36593 | 36476 | 34448 | 36480 | 34443 | 36596 | 35839 | 6.0% | 36478 |
| CE510 May-Sep | 77489 | 82306 | 82303 | 81566 | 77499 | 81563 | 77489 | 82306 | 80454 | 6.0% | 81569 |
| CE520 | 45110 | 48102 | 48096 | 47986 | 44977 | 48059 | 44977 | 48102 | 47055 | 6.6% | 48107 |
| CE522 | 45076 | 47962 | 47961 | 47758 | 44924 | 47795 | 44924 | 47962 | 46913 | 6.5% | 47792 |
| CE525 | 44979 | 47218 | 47213 | 46930 | 44775 | 47110 | 44775 | 47218 | 46371 | 5.3% | 46941 |
| CE530 | 45046 | 46574 | 46570 | 46944 | 44874 | 47002 | 44874 | 47002 | 46168 | 4.6% | 47173 |
| CE540 | 45112 | 47023 | 47019 | 47288 | 44977 | 47460 | 44977 | 47460 | 46480 | 5.3% | 47521 |
| CE545 | 44981 | 46214 | 46210 | 46612 | 44775 | 46668 | 44775 | 46668 | 45910 | 4.1% | 46851 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-5. Annual Space Cooling Coil Loads ( Latent )

| Latent Coil Load(kWh,thermal) | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 23765 | 21487 | 21487 | 22066 | 22535 | 23067 | 21487 | 23765 | 22401 | 10.2% | 23096 |
| CE310 | 43086 | 41094 | 41099 | 41222 | 42111 | 42178 | 41094 | 43086 | 41798 | 4.8% | 42147 |
| CE320 | 36932 | 33659 | 33746 | 34040 | 35133 | 34224 | 33659 | 36932 | 34622 | 9.5% | 35525 |
| CE330 | 41929 | 37419 | 37666 | 38433 | 41063 | 40186 | 37419 | 41929 | 39449 | 11.4% | 40674 |
| CE340 | 39695 | 35974 | 36113 | 36823 | 38296 | 38346 | 35974 | 39695 | 37541 | 9.9% | 38653 |
| CE350 | 19017 | 16052 | 15958 | 17245 | 18271 | 18621 | 15958 | 19017 | 17527 | 17.5% | 18239 |
| CE360 | 27997 | 24887 | 24914 | 25961 | 26994 | 27470 | 24887 | 27997 | 26371 | 11.8% | 27312 |
| CE400 | 26840 | 23498 | 23588 | 24726 | | 25717 | 23498 | 26840 | 24874 | 13.4% | 22165 |
| CE410 | 22996 | 19121 | 19184 | | | 20590 | 19121 | 22996 | 20473 | 18.9% | 22165 |
| CE420 | 22219 | 19945 | 20270 | 20826 | | 21855 | 19945 | 22219 | 21023 | 10.8% | 21735 |
| CE430 | 21893 | 19909 | 19765 | 20403 | | 21057 | 19765 | 21893 | 20605 | 10.3% | 21347 |
| CE440 | 22835 | 20788 | 20689 | 21357 | | 22244 | 20689 | 22835 | 21583 | 9.9% | 22294 |
| CE500 | 18313 | 18346 | 18346 | 18080 | 18231 | 18084 | 18080 | 18346 | 18233 | 1.5% | 18081 |
| CE500 May-Sep | 14000 | 14097 | 14097 | 13879 | 13991 | 13877 | 13877 | 14097 | 13990 | 1.6% | 13878 |
| CE510 May-Sep | 31485 | 31712 | 31712 | 31226 | 31480 | 31217 | 31217 | 31712 | 31472 | 1.6% | 31226 |
| CE520 | 18312 | 18470 | 18470 | 18101 | 18235 | 18087 | 18087 | 18470 | 18279 | 2.1% | 18105 |
| CE522 | 18313 | 18411 | 18410 | 18093 | 18233 | 18104 | 18093 | 18411 | 18261 | 1.7% | 18095 |
| CE525 | 18314 | 18182 | 18182 | 18044 | 18227 | 18045 | 18044 | 18314 | 18165 | 1.5% | 18049 |
| CE530 | 0 | 61 | 61 | 0 | 1 | 0 | 0 | 61 | 20 | 297.1% | 0 |
| CE540 | 1 | 107 | 107 | 9 | 3 | 2 | 1 | 107 | 38 | 278.2% | 0 |
| CE545 | 0 | 25 | 25 | 0 | 0 | 0 | 0 | 25 | 9 | 300.0% | 0 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-6. Various Annual Means (COP2, IDB)

| COP2 | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 3.249 | 3.238 | 3.237 | 3.237 | 3.226 | 3.230 | 3.226 | 3.249 | 3.236 | 0.7% | 3.243 |
| CE310 | 3.415 | 3.417 | 3.417 | 3.393 | 3.397 | 3.380 | 3.380 | 3.417 | 3.403 | 1.1% | 3.408 |
| CE320 | 3.420 | 3.458 | 3.457 | 3.405 | 3.406 | 3.390 | 3.390 | 3.458 | 3.423 | 2.0% | 3.418 |
| CE330 | 3.491 | 3.494 | 3.536 | 3.491 | 3.497 | 3.460 | 3.460 | 3.536 | 3.495 | 2.2% | 3.507 |
| CE340 | 3.454 | 3.477 | 3.496 | 3.448 | 3.450 | 3.420 | 3.420 | 3.496 | 3.457 | 2.2% | 3.463 |
| CE350 | 3.249 | 3.241 | 3.235 | 3.244 | 3.229 | 3.230 | 3.229 | 3.249 | 3.238 | 0.6% | 3.255 |
| CE360 | 3.669 | 3.701 | 3.706 | 3.678 | 3.667 | 3.660 | 3.660 | 3.706 | 3.680 | 1.2% | 3.681 |
| CE400 | 3.250 | 3.251 | 3.252 | 3.246 | | 3.260 | 3.246 | 3.260 | 3.252 | 0.4% | 3.218 |
| CE410 | 3.240 | 3.212 | 3.211 | | | 3.210 | 3.210 | 3.240 | 3.218 | 0.9% | 3.218 |
| CE420 | 3.226 | 3.215 | 3.218 | 3.216 | | 3.210 | 3.210 | 3.226 | 3.217 | 0.5% | 3.222 |
| CE430 | 3.221 | 3.213 | 3.211 | 3.211 | | 3.210 | 3.210 | 3.221 | 3.213 | 0.3% | 3.219 |
| CE440 | 3.231 | 3.222 | 3.222 | 3.221 | | 3.220 | 3.220 | 3.231 | 3.223 | 0.4% | 3.228 |
| CE500 | 3.204 | 3.227 | 3.227 | 3.213 | 3.192 | 3.200 | 3.192 | 3.227 | 3.211 | 1.1% | 3.210 |
| CE500 May-Sep | 3.142 | 3.161 | 3.162 | 3.154 | 3.132 | 3.140 | 3.132 | 3.162 | 3.148 | 0.9% | 3.147 |
| CE510 May-Sep | 3.551 | 3.577 | 3.577 | 3.562 | 3.530 | 3.550 | 3.530 | 3.577 | 3.558 | 1.3% | 3.556 |
| CE520 | 2.901 | 2.957 | 2.956 | 3.004 | 2.873 | 2.920 | 2.873 | 3.004 | 2.935 | 4.5% | 2.923 |
| CE522 | 3.058 | 3.074 | 3.073 | 3.101 | 3.036 | 3.070 | 3.036 | 3.101 | 3.069 | 2.1% | 3.066 |
| CE525 | 3.484 | 3.531 | 3.528 | 3.508 | 3.480 | 3.410 | 3.410 | 3.531 | 3.490 | 3.5% | 3.500 |
| CE530 | 2.962 | 2.969 | 2.969 | 2.999 | 2.916 | 2.980 | 2.916 | 2.999 | 2.966 | 2.8% | 2.924 |
| CE540 | 2.668 | 2.675 | 2.675 | 2.823 | 2.640 | 2.690 | 2.640 | 2.823 | 2.695 | 6.8% | 2.688 |
| CE545 | 3.228 | 3.233 | 3.236 | 3.157 | 3.186 | 3.200 | 3.157 | 3.236 | 3.207 | 2.5% | 3.137 |
| **IDB (°C)** | | | | | | | Statistics, All Results | | | | |
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 23.62 | 24.06 | 24.06 | 24.09 | 24.08 | 23.99 | 23.62 | 24.09 | 23.98 | 1.9% | 24.09 |
| CE310 | 23.76 | 24.11 | 24.06 | 24.09 | 24.09 | 24.01 | 23.76 | 24.11 | 24.02 | 1.5% | 24.10 |
| CE320 | 23.90 | 24.39 | 24.39 | 24.25 | 24.33 | 24.53 | 23.90 | 24.53 | 24.30 | 2.6% | 24.27 |
| CE330 | 23.88 | 24.28 | 24.28 | 24.27 | 24.30 | 24.18 | 23.88 | 24.30 | 24.20 | 1.7% | 24.31 |
| CE340 | 23.88 | 24.28 | 24.28 | 24.30 | 24.31 | 24.21 | 23.88 | 24.31 | 24.21 | 1.8% | 24.32 |
| CE350 | 25.66 | 26.17 | 26.17 | 26.24 | 26.27 | 26.15 | 25.66 | 26.27 | 26.11 | 2.3% | 26.22 |
| CE360 | 25.36 | 25.61 | 25.56 | 25.32 | 25.48 | 25.37 | 25.32 | 25.61 | 25.45 | 1.1% | 25.43 |
| CE400 | 24.13 | 24.06 | 24.06 | 24.09 | | 23.99 | 23.99 | 24.13 | 24.06 | 0.6% | 24.09 |
| CE410 | 24.12 | 24.06 | 24.06 | | | 23.99 | 23.99 | 24.12 | 24.06 | 0.5% | 24.09 |
| CE420 | 23.93 | 24.06 | 24.06 | 24.09 | | 23.99 | 23.93 | 24.09 | 24.02 | 0.7% | 24.09 |
| CE430 | 23.99 | 24.06 | 24.06 | 24.09 | | 23.99 | 23.99 | 24.09 | 24.04 | 0.4% | 24.09 |
| CE440 | 23.91 | 24.06 | 24.06 | 24.09 | | 23.99 | 23.91 | 24.09 | 24.02 | 0.7% | 24.09 |
| CE500 | 20.23 | 20.67 | 20.56 | 20.38 | 21.10 | 22.86 | 20.23 | 22.86 | 20.97 | 12.5% | 20.58 |
| CE500 May-Sep | 24.57 | 25.00 | 25.00 | 24.98 | 25.00 | 25.00 | 24.57 | 25.00 | 24.93 | 1.7% | 25.00 |
| CE510 May-Sep | 25.82 | 25.11 | 25.11 | 24.96 | 25.00 | 25.00 | 24.96 | 25.82 | 25.17 | 3.4% | 25.00 |
| CE520 | 13.52 | 13.78 | 13.72 | 13.58 | 14.14 | 14.89 | 13.52 | 14.89 | 13.94 | 9.9% | 13.71 |
| CE522 | 16.95 | 17.28 | 17.22 | 17.00 | 17.73 | 18.70 | 16.95 | 18.70 | 17.48 | 10.0% | 17.16 |
| CE525 | 26.84 | 27.39 | 27.28 | 27.10 | 27.77 | 30.69 | 26.84 | 30.69 | 27.85 | 13.8% | 27.39 |
| CE530 | 20.03 | 20.61 | 20.56 | 20.59 | 21.10 | 22.86 | 20.03 | 22.86 | 20.96 | 13.5% | 20.58 |
| CE540 | 13.29 | 13.78 | 13.72 | 13.79 | 14.14 | 14.98 | 13.29 | 14.98 | 13.95 | 12.1% | 13.71 |
| CE545 | 26.61 | 27.33 | 27.28 | 27.31 | 27.72 | 30.69 | 26.61 | 30.69 | 27.82 | 14.7% | 27.39 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-7. Various Annual Means (Humidity Ratio, Zone Relative Humidity)

| **Humidity Ratio (kg/kg)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 0.0091 | 0.0092 | 0.0092 | 0.0093 | 0.0092 | 0.0092 | 0.0091 | 0.0093 | 0.0092 | 2.4% | 0.0091 |
| CE310 | 0.0111 | 0.0113 | 0.0113 | 0.0113 | 0.0112 | 0.0111 | 0.0111 | 0.0113 | 0.0112 | 2.0% | 0.0111 |
| CE320 | 0.0100 | 0.0101 | 0.0101 | 0.0101 | 0.0100 | 0.0099 | 0.0099 | 0.0101 | 0.0100 | 2.1% | 0.0100 |
| CE330 | 0.0097 | 0.0099 | 0.0099 | 0.0100 | 0.0098 | 0.0099 | 0.0097 | 0.0100 | 0.0099 | 2.3% | 0.0099 |
| CE340 | 0.0098 | 0.0099 | 0.0099 | 0.0100 | 0.0099 | 0.0099 | 0.0098 | 0.0100 | 0.0099 | 1.9% | 0.0099 |
| CE350 | 0.0097 | 0.0100 | 0.0100 | 0.0099 | 0.0098 | 0.0098 | 0.0097 | 0.0100 | 0.0099 | 3.0% | 0.0098 |
| CE360 | 0.0085 | 0.0087 | 0.0087 | 0.0088 | 0.0086 | 0.0086 | 0.0085 | 0.0088 | 0.0086 | 3.1% | 0.0086 |
| CE400 | 0.0098 | 0.0100 | 0.0100 | 0.0101 | | 0.0100 | 0.0098 | 0.0101 | 0.0100 | 2.9% | 0.0098 |
| CE410 | 0.0097 | 0.0095 | 0.0095 | | | 0.0095 | 0.0095 | 0.0097 | 0.0096 | 2.5% | 0.0098 |
| CE420 | 0.0093 | 0.0094 | 0.0094 | 0.0094 | | 0.0093 | 0.0093 | 0.0094 | 0.0094 | 2.0% | 0.0093 |
| CE430 | 0.0093 | 0.0094 | 0.0094 | 0.0095 | | 0.0094 | 0.0093 | 0.0095 | 0.0094 | 1.9% | 0.0094 |
| CE440 | 0.0092 | 0.0093 | 0.0093 | 0.0093 | | 0.0092 | 0.0092 | 0.0093 | 0.0093 | 1.9% | 0.0092 |
| CE500 | 0.0098 | | | 0.0094 | 0.0102 | 0.0107 | 0.0094 | 0.0107 | 0.0100 | 13.2% | 0.0092 |
| CE500 May-Sep | 0.0110 | 0.0114 | 0.0114 | 0.0113 | 0.0113 | 0.0109 | 0.0109 | 0.0114 | 0.0112 | 4.5% | 0.0110 |
| CE510 May-Sep | 0.0114 | 0.0114 | 0.0114 | 0.0113 | 0.0113 | 0.0109 | 0.0109 | 0.0114 | 0.0113 | 4.4% | 0.0110 |
| CE520 | 0.0067 | | | 0.0060 | 0.0070 | 0.0076 | 0.0060 | 0.0076 | 0.0068 | 23.1% | 0.0060 |
| CE522 | 0.0082 | | | 0.0076 | 0.0086 | 0.0090 | 0.0076 | 0.0090 | 0.0083 | 16.8% | 0.0075 |
| CE525 | 0.0137 | | | 0.0138 | 0.0140 | 0.0151 | 0.0137 | 0.0151 | 0.0141 | 9.8% | 0.0135 |
| CE530 | 0.0062 | | | 0.0067 | 0.0058 | 0.0067 | 0.0058 | 0.0067 | 0.0064 | 14.4% | 0.0029 |
| CE540 | 0.0045 | | | 0.0043 | 0.0039 | 0.0046 | 0.0039 | 0.0046 | 0.0043 | 17.9% | 0.0029 |
| CE545 | 0.0062 | | | 0.0067 | 0.0067 | 0.0072 | 0.0062 | 0.0072 | 0.0067 | 14.8% | 0.0029 |

| **Relative Humidity (%)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE300 | 48.61 | 48.26 | 48.28 | 48.59 | 47.83 | 47.93 | 47.83 | 48.61 | 48.25 | 1.6% | 47.85 |
| CE310 | 58.33 | 58.51 | 58.53 | 58.55 | 57.84 | 57.80 | 57.80 | 58.55 | 58.26 | 1.3% | 57.81 |
| CE320 | 52.01 | 51.21 | 51.25 | 51.84 | 51.10 | 49.94 | 49.94 | 52.01 | 51.22 | 4.0% | 51.34 |
| CE330 | 50.84 | 50.58 | 50.65 | 51.18 | 50.08 | 50.70 | 50.08 | 51.18 | 50.67 | 2.2% | 50.49 |
| CE340 | 51.09 | 50.69 | 50.73 | 51.15 | 50.30 | 50.78 | 50.30 | 51.15 | 50.79 | 1.7% | 50.56 |
| CE350 | 45.48 | 45.45 | 45.55 | 45.17 | 44.32 | 44.56 | 44.32 | 45.55 | 45.09 | 2.7% | 44.60 |
| CE360 | 41.03 | 41.49 | 41.49 | 42.37 | 40.87 | 41.21 | 40.87 | 42.37 | 41.41 | 3.6% | 41.28 |
| CE400 | 50.77 | 52.21 | 52.25 | 52.55 | | 52.01 | 50.77 | 52.55 | 51.96 | 3.4% | 51.16 |
| CE410 | 50.50 | 49.65 | 49.63 | | | 49.75 | 49.63 | 50.50 | 49.88 | 1.7% | 51.16 |
| CE420 | 48.78 | 49.14 | 48.97 | 49.40 | | 48.76 | 48.76 | 49.40 | 49.01 | 1.3% | 48.76 |
| CE430 | 48.82 | 49.17 | 49.30 | 49.60 | | 49.17 | 48.82 | 49.60 | 49.21 | 1.6% | 48.94 |
| CE440 | 48.33 | 48.46 | 48.57 | 48.83 | | 48.23 | 48.23 | 48.83 | 48.48 | 1.2% | 48.18 |
| CE500 | 66.53 | | | 59.20 | 65.94 | 63.73 | 59.20 | 66.53 | 63.85 | 11.5% | 57.57 |
| CE500 May-Sep | 57.05 | 57.47 | 57.47 | 57.32 | 57.07 | 55.13 | 55.13 | 57.47 | 56.92 | 4.1% | 55.48 |
| CE510 May-Sep | 54.70 | 57.36 | 57.36 | 57.44 | 57.06 | 55.24 | 54.70 | 57.44 | 56.53 | 4.8% | 55.58 |
| CE520 | 69.87 | | | 61.40 | 70.23 | 72.17 | 61.40 | 72.17 | 68.42 | 15.7% | 60.74 |
| CE522 | 68.68 | | | 60.75 | 68.23 | 68.11 | 60.75 | 68.68 | 66.44 | 11.9% | 59.37 |
| CE525 | 61.47 | | | 54.99 | 60.14 | 57.37 | 54.99 | 61.47 | 58.49 | 11.1% | 53.33 |
| CE530 | 46.73 | | | 48.97 | 41.45 | 39.60 | 39.60 | 48.97 | 44.19 | 21.2% | 21.40 |
| CE540 | 48.52 | | | 46.31 | 40.05 | 43.82 | 40.05 | 48.52 | 44.67 | 19.0% | 30.19 |
| CE545 | 36.62 | | | 38.63 | 36.87 | 29.20 | 29.20 | 38.63 | 35.33 | 26.7% | 16.87 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-8. f(ODB) Sensitivity CE500 and CE530, April 30 and June 25 (Energy, Coil Loads)

| | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| **Energy Consumption, Compr. + Both Fans (Wh,e)** | | | | | | | | | | | |
| CE500Apr30 | 3893 | 3975 | 3975 | 4029 | 3901 | 4073 | 3893 | 4073 | 3974 | 4.5% | 4019 |
| CE500Jun25 | 5045 | 5204 | 5204 | 5229 | 5067 | 5230 | 5045 | 5230 | 5163 | 3.6% | 5244 |
| Del CE500 | 1152 | 1229 | 1229 | 1200 | 1165 | 1157 | 1152 | 1229 | 1189 | 6.5% | 1225 |
| CE530Apr30 | 3023 | 3062 | 3062 | 3101 | 3092 | 3144 | 3023 | 3144 | 3081 | 3.9% | 3221 |
| CE530Jun25 | 3894 | 3978 | 3978 | 4029 | 3935 | 4043 | 3894 | 4043 | 3976 | 3.7% | 4196 |
| Del CE530 | 871 | 916 | 916 | 927 | 843 | 899 | 843 | 927 | 896 | 9.4% | 975 |
| **Energy Consumption, Compressor (Wh,e)** | | | | | | | | | | | |
| CE500Apr30 | 3015 | 3120 | 3120 | | 3020 | 3159 | 3015 | 3159 | 3087 | 4.7% | |
| CE500Jun25 | 4084 | 4264 | 4263 | | 4106 | 4239 | 4084 | 4264 | 4191 | 4.3% | |
| Del CE500 | 1069 | 1144 | 1144 | | 1086 | 1080 | 1069 | 1144 | 1105 | 6.7% | |
| CE530Apr30 | 2311 | 2390 | 2390 | | 2378 | 2411 | 2311 | 2411 | 2376 | 4.2% | |
| CE530Jun25 | 3118 | 3243 | 3243 | | 3166 | 3248 | 3118 | 3248 | 3204 | 4.1% | |
| Del CE530 | 807 | 853 | 853 | | 787 | 837 | 787 | 853 | 827 | 8.0% | |
| **Energy Consumption, Condenser Fan (Wh,e)** | | | | | | | | | | | |
| CE500Apr30 | 376 | 389 | 389 | | 377 | 391 | 376 | 391 | 385 | 3.9% | |
| CE500Jun25 | 411 | 426 | 426 | | 411 | 424 | 411 | 426 | 420 | 3.6% | |
| Del CE500 | 35 | 37 | 37 | | 34 | 33 | 33 | 37 | 35 | 12.0% | |
| CE530Apr30 | 305 | 311 | 311 | | 305 | 314 | 305 | 314 | 309 | 3.1% | |
| CE530Jun25 | 332 | 340 | 340 | | 329 | 340 | 329 | 340 | 336 | 3.2% | |
| Del CE530 | 28 | 28 | 29 | | 24 | 26 | 24 | 29 | 27 | 17.0% | |
| **Energy Consumption, Supply Fan (Wh,e)** | | | | | | | | | | | |
| CE500Apr30 | 502 | 467 | 466 | 519 | 504 | 522 | 466 | 522 | 497 | 11.2% | 518 |
| CE500Jun25 | 550 | 514 | 514 | 566 | 549 | 566 | 514 | 566 | 543 | 9.5% | 567 |
| Del CE500 | 47 | 48 | 48 | 47 | 45 | 44 | 44 | 48 | 47 | 8.5% | 49 |
| CE530Apr30 | 407 | 361 | 361 | 412 | 408 | 419 | 361 | 419 | 395 | 14.8% | 453 |
| CE530Jun25 | 444 | 396 | 396 | 450 | 440 | 454 | 396 | 454 | 430 | 13.6% | 502 |
| Del CE530 | 37 | 35 | 35 | 38 | 32 | 35 | 32 | 38 | 35 | 16.0% | 49 |
| **Sensible + Latent Coil Load (Wh,th)** | | | | | | | | | | | |
| CE500Apr30 | 13186 | 13733 | 13733 | 13655 | 13170 | 13673 | 13170 | 13733 | 13525 | 4.2% | 13653 |
| CE500Jun25 | 13188 | 13838 | 13837 | 13733 | 13198 | 13727 | 13188 | 13838 | 13587 | 4.8% | 13734 |
| Del CE500 | 2 | 105 | 104 | 78 | 29 | 54 | 2 | 105 | 62 | 165.3% | 81 |
| CE530Apr30 | 9353 | 9721 | 9721 | 9775 | 9365 | 9798 | 9353 | 9798 | 9622 | 4.6% | 9816 |
| CE530Jun25 | 9376 | 9761 | 9761 | 9835 | 9388 | 9834 | 9376 | 9835 | 9659 | 4.8% | 9888 |
| Del CE530 | 23 | 40 | 39 | 60 | 22 | 36 | 22 | 60 | 37 | 102.8% | 72 |
| **Sensible Coil Load (Wh,th)** | | | | | | | | | | | |
| CE500Apr30 | 9375 | 9925 | 9925 | 9884 | 9365 | 9902 | 9365 | 9925 | 9729 | 5.8% | 9882 |
| CE500Jun25 | 9378 | 9981 | 9981 | 9953 | 9388 | 9946 | 9378 | 9981 | 9771 | 6.2% | 9954 |
| Del CE500 | 3 | 56 | 56 | 69 | 22 | 44 | 3 | 69 | 42 | 158.2% | 71 |
| CE530Apr30 | 9353 | 9721 | 9721 | 9775 | 9365 | 9798 | 9353 | 9798 | 9622 | 4.6% | 9816 |
| CE530Jun25 | 9376 | 9761 | 9761 | 9835 | 9388 | 9834 | 9376 | 9835 | 9659 | 4.8% | 9888 |
| Del CE530 | 23 | 40 | 39 | 60 | 22 | 36 | 22 | 60 | 37 | 102.9% | 72 |
| **Latent Coil Load (Wh,th)** | | | | | | | | | | | |
| CE500Apr30 | 3811 | 3808 | 3808 | 3772 | 3804 | 3770 | 3770 | 3811 | 3795 | 1.1% | 3771 |
| CE500Jun25 | 3810 | 3856 | 3856 | 3781 | 3810 | 3780 | 3780 | 3856 | 3816 | 2.0% | 3780 |
| Del CE500 | -1 | 48 | 48 | 9 | 6 | 10 | -1 | 48 | 20 | 242.3% | 9 |
| CE530Apr30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE530Jun25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| Del CE530 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-9. f(ODB) Sensitivity CE500 and CE530, April 30 and June 25 (COP2, Zone Conditions)

| | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| **Humidity Ratio (kg/kg)** | | | | | | | | | | | |
| CE500Apr30 | 0.0107 | 0.0110 | 0.0110 | 0.0110 | 0.0109 | 0.0160 | 0.0107 | 0.0160 | 0.0118 | 45.3% | 0.0106 |
| CE500Jun25 | 0.0112 | 0.0115 | 0.0115 | 0.0115 | 0.0115 | 0.0110 | 0.0110 | 0.0115 | 0.0114 | 4.4% | 0.0111 |
| Del CE500 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | -0.0050 | -0.0050 | 0.0005 | -0.0004 | 1334.8% | 0.0005 |
| CE530Apr30 | 0.0062 | 0.0071 | 0.0071 | 0.0068 | 0.0055 | 0.0067 | 0.0055 | 0.0071 | 0.0066 | 24.6% | 0.0029 |
| CE530Jun25 | 0.0062 | 0.0078 | 0.0078 | 0.0068 | 0.0055 | 0.0067 | 0.0055 | 0.0078 | 0.0068 | 34.2% | 0.0029 |
| Del CE530 | 0.0000 | 0.0007 | 0.0007 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0007 | 0.0002 | 304.5% | 0.0000 |
| **COP2** | | | | | | | | | | | |
| CE500Apr30 | 3.845 | 3.914 | 3.914 | 3.850 | 3.837 | 3.850 | 3.837 | 3.914 | 3.868 | 2.0% | 3.899 |
| CE500Jun25 | 2.931 | 2.951 | 2.951 | 2.943 | 2.921 | 2.940 | 2.921 | 2.951 | 2.939 | 1.0% | 2.936 |
| Del CE500 | -0.914 | -0.963 | -0.963 | -0.907 | -0.916 | -0.910 | -0.963 | -0.907 | -0.929 | 6.1% | -0.963 |
| CE530Apr30 | 3.543 | 3.599 | 3.599 | 3.441 | 3.460 | 3.590 | 3.441 | 3.599 | 3.539 | 4.5% | 3.546 |
| CE530Jun25 | 2.720 | 2.724 | 2.724 | 2.780 | 2.690 | 2.740 | 2.690 | 2.780 | 2.730 | 3.3% | 2.677 |
| Del CE530 | -0.823 | -0.874 | -0.875 | -0.662 | -0.770 | -0.850 | -0.875 | -0.662 | -0.809 | 26.3% | -0.869 |
| **ODB (°C)** | | | | | | | | | | | |
| CE500Apr30 | 16.79 | 16.83 | 16.83 | 16.81 | 16.88 | 16.96 | 16.79 | 16.96 | 16.85 | 1.0% | 16.81 |
| CE500Jun25 | 29.52 | 29.50 | 29.50 | 29.52 | 29.52 | 29.50 | 29.50 | 29.52 | 29.51 | 0.1% | 29.52 |
| Del CE500 | 12.73 | 12.67 | 12.67 | 12.70 | 12.63 | 12.54 | 12.54 | 12.73 | 12.66 | 1.5% | 12.70 |
| CE530Apr30 | 16.79 | 16.83 | 16.83 | 16.81 | 16.88 | 16.96 | 16.79 | 16.96 | 16.85 | 1.0% | 16.81 |
| CE530Jun25 | 29.52 | 29.50 | 29.50 | 29.52 | 29.52 | 29.50 | 29.50 | 29.52 | 29.51 | 0.1% | 29.52 |
| Del CE530 | 12.73 | 12.67 | 12.67 | 12.70 | 12.63 | 12.54 | 12.54 | 12.73 | 12.66 | 1.5% | 12.70 |
| **EDB (°C)** | | | | | | | | | | | |
| CE500Apr30 | 24.64 | 24.94 | 24.94 | 24.98 | 25.00 | 25.00 | 24.64 | 25.00 | 24.92 | 1.4% | 25.00 |
| CE500Jun25 | 24.55 | 25.00 | 25.00 | 24.98 | 25.00 | 25.00 | 24.55 | 25.00 | 24.92 | 1.8% | 18.88 |
| Del CE500 | -0.09 | 0.06 | 0.06 | 0.00 | 0.00 | 0.00 | -0.09 | 0.06 | 0.00 | 4740.8% | -6.12 |
| CE530Apr30 | 24.37 | 24.94 | 24.67 | 25.00 | 25.00 | 25.00 | 24.37 | 25.00 | 24.83 | 2.6% | 25.00 |
| CE530Jun25 | 24.35 | 24.94 | 24.94 | 25.00 | 25.00 | 25.00 | 24.35 | 25.00 | 24.87 | 2.6% | 11.45 |
| Del CE530 | -0.01 | 0.00 | 0.28 | 0.00 | 0.00 | 0.00 | -0.01 | 0.28 | 0.04 | 651.2% | -13.55 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-10. Hourly Integrated Maxima (Total Cooling System Energy Consumption and Total Coil Load)

**Energy Consumption, Compressor + Both Fans (Wh,e)**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | (Max-Min) | | | |
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 11626 | 20-Jul | 15 | 11564 | 20-Jul | 15 | 11602 | 20-Jul | 15 | 11900 | 20-Jul | 15 | 11932 | 20-Jul | 15 | 11548 | 20-Jul | 15 | 11548 | 11932 | 11695 | 3.3% | 12000 | 20-Jul | 15 |
| CE310 | 12594 | 20-Jul | 15 | 12583 | 20-Jul | 15 | 12595 | 20-Jul | 15 | 12541 | 20-Jul | 15 | 12653 | 20-Jul | 15 | 12162 | 16-Aug | 16 | 12162 | 12653 | 12521 | 3.9% | 12564 | 20-Jul | 15 |
| CE320 | 13028 | 20-Jul | 15 | 12916 | 20-Jul | 15 | 12981 | 20-Jul | 15 | 12954 | 20-Jul | 15 | 13104 | 20-Jul | 15 | 12875 | 20-Jul | 14 | 12875 | 13104 | 12976 | 1.8% | 12975 | 20-Jul | 15 |
| CE330 | 13347 | 20-Jul | 15 | 13212 | 20-Jul | 15 | 13407 | 20-Jul | 15 | 13314 | 20-Jul | 15 | 13467 | 20-Jul | 15 | 13335 | 20-Jul | 15 | 13212 | 13467 | 13347 | 1.9% | 13358 | 20-Jul | 15 |
| CE340 | 13181 | 20-Jul | 15 | 13158 | 20-Jul | 15 | 13190 | 20-Jul | 15 | 13134 | 20-Jul | 15 | 13277 | 20-Jul | 15 | 13101 | 20-Jul | 14 | 13101 | 13277 | 13174 | 1.3% | 13169 | 20-Jul | 15 |
| CE350 | 11627 | 20-Jul | 15 | 11654 | 20-Jul | 15 | 11602 | 20-Jul | 15 | 11900 | 20-Jul | 15 | 11932 | 20-Jul | 15 | 11546 | 20-Jul | 15 | 11546 | 11932 | 11710 | 3.3% | 12000 | 20-Jul | 15 |
| CE360 | 12770 | 20-Jul | 15 | 12736 | 20-Jul | 15 | 12726 | 20-Jul | 15 | 12744 | 20-Jul | 15 | 12863 | 20-Jul | 15 | 12762 | 20-Jul | 14 | 12726 | 12863 | 12767 | 1.1% | 12778 | 20-Jul | 15 |
| CE400 | 11628 | 20-Jul | 15 | 11564 | 20-Jul | 15 | 11677 | 18-Sep | 15 | 11900 | 20-Jul | 15 | | | | 11519 | 20-Jul | 15 | 11519 | 11900 | 11658 | 3.3% | 12000 | 20-Jul | 15 |
| CE410 | 11628 | 20-Jul | 15 | 11564 | 20-Jul | 15 | 11602 | 20-Jul | 15 | | | | | | | 11549 | 20-Jul | 15 | 11549 | 11628 | 11586 | 0.7% | 12000 | 20-Jul | 15 |
| CE420 | 11626 | 20-Jul | 15 | 11564 | 20-Jul | 15 | 11602 | 20-Jul | 15 | 11900 | 20-Jul | 15 | | | | 11548 | 20-Jul | 15 | 11548 | 11900 | 11648 | 3.0% | 12000 | 20-Jul | 15 |
| CE430 | 11626 | 20-Jul | 15 | 11564 | 20-Jul | 15 | 11602 | 20-Jul | 15 | 11900 | 20-Jul | 15 | | | | 11548 | 20-Jul | 15 | 11548 | 11900 | 11648 | 3.0% | 12000 | 20-Jul | 15 |
| CE440 | 11626 | 20-Jul | 15 | 11564 | 20-Jul | 15 | 11602 | 20-Jul | 15 | 11900 | 20-Jul | 15 | | | | 11461 | 16-Aug | 16 | 11461 | 11900 | 11631 | 3.8% | 12000 | 20-Jul | 15 |
| CE500 | 10166 | 20-Jul | 15 | 10431 | 20-Jul | 15 | 10425 | 20-Jul | 15 | 10399 | 20-Jul | 15 | 10177 | 20-Jul | 15 | 10274 | 4-Jun | 15 | 10166 | 10431 | 10312 | 2.6% | 10433 | 20-Jul | 15 |
| CE510 | 11205 | 20-Jul | 15 | 11590 | 20-Jul | 15 | 11587 | 20-Jul | 15 | 11410 | 20-Jul | 15 | 11186 | 20-Jul | 15 | 11344 | 20-Jul | 14 | 11186 | 11590 | 11387 | 3.5% | 11449 | 20-Jul | 15 |
| CE520 | 11035 | 20-Jul | 15 | 10989 | 20-Jul | 15 | 11014 | 20-Jul | 15 | 11101 | 20-Jul | 15 | 11044 | 20-Jul | 15 | 10684 | 4-Jun | 15 | 10684 | 11101 | 10978 | 3.8% | 11262 | 20-Jul | 15 |
| CE522 | 10431 | 20-Jul | 15 | 10972 | 20-Jul | 15 | 10966 | 20-Jul | 15 | 10762 | 20-Jul | 15 | 10639 | 20-Jul | 15 | 10747 | 16-Aug | 15 | 10431 | 10972 | 10753 | 5.0% | 10898 | 20-Jul | 15 |
| CE525 | 9367 | 20-Jul | 15 | 9538 | 20-Jul | 15 | 9531 | 20-Jul | 15 | 9570 | 20-Jul | 15 | 9419 | 20-Jul | 15 | 9585 | 16-Aug | 15 | 9367 | 9585 | 9502 | 2.3% | 9582 | 20-Jul | 15 |
| CE530 | 8028 | 20-Jul | 15 | 8059 | 20-Jul | 15 | 8055 | 20-Jul | 15 | 8171 | 20-Jul | 15 | 7992 | 20-Jul | 15 | 8089 | 16-Aug | 15 | 7992 | 8171 | 8066 | 2.2% | 8433 | 20-Jul | 15 |
| CE540 | 8699 | 20-Jul | 15 | 8943 | 20-Jul | 15 | 8939 | 20-Jul | 15 | 8677 | 20-Jul | 15 | 8846 | 20-Jul | 15 | 8985 | 16-Aug | 15 | 8677 | 8985 | 8848 | 3.5% | 9110 | 20-Jul | 15 |
| CE545 | 7205 | 20-Jul | 15 | 7350 | 20-Jul | 15 | 7346 | 20-Jul | 15 | 7763 | 20-Jul | 15 | 7351 | 20-Jul | 15 | 7471 | 4-Jun | 15 | 7205 | 7763 | 7414 | 7.5% | 7891 | 20-Jul | 15 |

**Senstible + Latent Coil Load (Wh,th)**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | (Max-Min) | | | |
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 32174 | 08-Jul | 15 | 31401 | 20-Jul | 15 | 31455 | 20-Jul | 15 | 32733 | 20-Jul | 15 | 32502 | 20-Jul | 15 | 32072 | 20-Jul | 15 | 31401 | 32733 | 32056 | 4.2% | 33073 | 20-Jul | 15 |
| CE310 | 37328 | 03-Sep | 15 | 36750 | 3-Sep | 16 | 37033 | 3-Sep | 16 | 37126 | 17-Sep | 15 | 37261 | 3-Sep | 15 | 36991 | 3-Sep | 16 | 36750 | 37328 | 37082 | 1.6% | 37371 | 17-Sep | 15 |
| CE320 | 40318 | 03-Sep | 16 | 53813 | 2-Oct | 9 | 53823 | 2-Oct | 9 | 39765 | 3-Sep | 16 | 39904 | 3-Sep | 16 | 39920 | 3-Sep | 16 | 39765 | 53823 | 44590 | 31.5% | 40009 | 2-Oct | 10 |
| CE330 | 43492 | 02-Oct | 9 | 43628 | 2-Oct | 9 | 64572 | 2-Oct | 9 | 43445 | 2-Oct | 9 | 43978 | 2-Oct | 9 | 42415 | 10-Jul | 11 | 42415 | 64572 | 46922 | 47.2% | 43602 | 2-Oct | 9 |
| CE340 | 41652 | 02-Oct | 10 | 50819 | 2-Oct | 9 | 59549 | 2-Oct | 9 | 41328 | 2-Oct | 10 | 41366 | 3-Sep | 15 | 41132 | 3-Sep | 16 | 41132 | 59549 | 45974 | 40.1% | 41629 | 2-Oct | 10 |
| CE350 | 32092 | 08-Jul | 15 | 31401 | 20-Jul | 15 | 31454 | 20-Jul | 15 | 32733 | 20-Jul | 15 | 32502 | 20-Jul | 15 | 32077 | 20-Jul | 15 | 31401 | 32733 | 32043 | 4.2% | 33074 | 20-Jul | 15 |
| CE360 | 38857 | 02-Oct | 10 | 40613 | 2-Oct | 9 | 41019 | 2-Oct | 9 | 38460 | 2-Oct | 11 | 38322 | 2-Oct | 10 | 38451 | 2-Oct | 10 | 38322 | 41019 | 39287 | 6.9% | 38665 | 3-Sep | 13 |
| CE400 | 41179 | 16-Sep | 15 | 40543 | 18-Sep | 14 | 49838 | 18-Sep | 15 | 40728 | 16-Sep | 15 | | | | 40774 | 16-Sep | 14 | 40543 | 49838 | 42612 | 21.8% | 37854 | 25-Oct | 16 |
| CE410 | 32092 | 08-Jul | 15 | 31401 | 20-Jul | 15 | 31455 | 20-Jul | 15 | | | | | | | 32073 | 20-Jul | 15 | 31401 | 32092 | 31755 | 2.2% | 37854 | 25-Oct | 16 |
| CE420 | 32174 | 08-Jul | 15 | 31401 | 20-Jul | 15 | 31455 | 20-Jul | 15 | 32733 | 20-Jul | 15 | | | | 32072 | 20-Jul | 15 | 31401 | 32733 | 31967 | 4.2% | 33073 | 20-Jul | 15 |
| CE430 | 32174 | 08-Jul | 15 | 31401 | 20-Jul | 15 | 31455 | 20-Jul | 15 | 32733 | 20-Jul | 15 | | | | 32072 | 20-Jul | 15 | 31401 | 32733 | 31967 | 4.2% | 33073 | 20-Jul | 15 |
| CE440 | 32174 | 08-Jul | 15 | 31401 | 20-Jul | 15 | 31455 | 20-Jul | 15 | 32733 | 20-Jul | 15 | | | | 31777 | 8-Jul | 16 | 31401 | 32733 | 31908 | 4.2% | 33073 | 20-Jul | 15 |
| CE500 | 27486 | 28-Oct | 15 | 27707 | 16-Aug | 16 | 27706 | 16-Aug | 16 | 27646 | 29-Jun | 16 | 26567 | 29-Jun | 16 | 27555 | 29-Jun | 15 | 26567 | 27707 | 27444 | 4.2% | 27656 | 29-Jun | 16 |
| CE510 | 30593 | 29-Apr | 19 | 31188 | 20-Jul | 15 | 31188 | 20-Jul | 15 | 31178 | 17-Jun | 14 | 29948 | 17-Jun | 14 | 31097 | 17-Jun | 13 | 29948 | 31188 | 30865 | 4.0% | 31223 | 27-Apr | 1 |
| CE520 | 27330 | 28-Sep | 15 | 27878 | 14-Aug | 16 | 27878 | 23-Jul | 16 | 27653 | 29-Jun | 16 | 26675 | 20-Jul | 16 | 28343 | 23-May | 15 | 26675 | 28343 | 27626 | 6.0% | 27731 | 29-Jun | 16 |
| CE522 | 27384 | 12-Mai | 15 | 27868 | 16-Aug | 16 | 27866 | 16-Aug | 16 | 27659 | 29-Jun | 16 | 26514 | 29-Jun | 16 | 27636 | 29-Jun | 15 | 26514 | 27868 | 27488 | 4.9% | 27699 | 29-Jun | 16 |
| CE525 | 27740 | 26-Jul | 16 | 27466 | 8-Jul | 16 | 27466 | 8-Jul | 16 | 27577 | 29-Jun | 16 | 26683 | 29-Jun | 16 | 27462 | 29-Jun | 15 | 26683 | 27740 | 27399 | 3.9% | 27565 | 29-Jun | 16 |
| CE530 | 19834 | 29-Mai | 15 | 19576 | 24-Apr | 16 | 19575 | 24-Apr | 16 | 19639 | 20-Jul | 15 | 18776 | 4-Jun | 15 | 19626 | 8-Jul | 15 | 18776 | 19834 | 19504 | 5.4% | 19737 | 20-Jul | 15 |
| CE540 | 19575 | 30-Aug | 16 | 19766 | 24-Apr | 16 | 19766 | 24-Apr | 16 | 19726 | 20-Jul | 15 | 18794 | 4-Jun | 15 | 19799 | 16-Aug | 15 | 18794 | 19799 | 19571 | 5.1% | 19842 | 20-Jul | 15 |
| CE545 | 20075 | 17-Jun | 16 | 19475 | 24-Apr | 16 | 19474 | 24-Apr | 16 | 19540 | 20-Jul | 15 | 18764 | 20-Jul | 15 | 19497 | 4-Jun | 15 | 18764 | 20075 | 19471 | 6.7% | 19639 | 20-Jul | 15 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-11. Hourly Integrated Maxima (Sensible Coil Load and Latent Coil Load)

**Sensible Coil Load (Wh,th)**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results (Max-Min) | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 23277 | 20-Jul | 16 | 23203 | 20-Jul | 15 | 23205 | 20-Jul | 15 | 23531 | 20-Jul | 15 | 23457 | 20-Jul | 15 | 22908 | 4-Jun | 15 | 22908 | 23531 | 23264 | 2.7% | 23533 | 20-Jul | 15 |
| CE310 | 23094 | 10-Sep | 15 | 23080 | 10-Sep | 16 | 23119 | 4-Jun | 16 | 23276 | 11-Jul | 16 | 23078 | 10-Sep | 15 | 22649 | 13-Jun | 16 | 22649 | 23276 | 23049 | 2.7% | 23222 | 11-Jul | 16 |
| CE320 | 31316 | 24-Apr | 16 | 31119 | 24-Apr | 16 | 31072 | 24-Apr | 16 | 31972 | 24-Apr | 15 | 31134 | 3-Jun | 16 | 30967 | 24-Apr | 15 | 30967 | 31972 | 31263 | 3.2% | 31405 | 24-Apr | 16 |
| CE330 | 33226 | 14-Jun | 14 | 33410 | 14-Jun | 14 | 34490 | 14-Jun | 15 | 34765 | 14-Jun | 15 | 33997 | 24-Apr | 16 | 33421 | 9-Sep | 14 | 33226 | 34765 | 33885 | 4.5% | 34701 | 14-Jun | 14 |
| CE340 | 32829 | 24-Apr | 15 | 32086 | 16-May | 16 | 32086 | 16-May | 16 | 32888 | 24-Apr | 15 | 32940 | 24-Apr | 16 | 32180 | 24-Apr | 15 | 32086 | 32940 | 32501 | 2.6% | 32651 | 16-May | 16 |
| CE350 | 23278 | 29-Jul | 15 | 23203 | 20-Jul | 15 | 23205 | 20-Jul | 15 | 23531 | 20-Jul | 15 | 23457 | 20-Jul | 15 | 22876 | 10-Jul | 15 | 22876 | 23531 | 23258 | 2.8% | 23535 | 20-Jul | 15 |
| CE360 | 32061 | 24-Apr | 16 | 32111 | 24-Apr | 16 | 32065 | 24-Apr | 16 | 32621 | 24-Apr | 16 | 31981 | 24-Apr | 16 | 32179 | 24-Apr | 15 | 31981 | 32621 | 32170 | 2.0% | 32420 | 24-Apr | 16 |
| CE400 | 23278 | 29-Jul | 15 | 23203 | 20-Jul | 15 | 23205 | 20-Jul | 15 | 23531 | 20-Jul | 15 | | | | 22877 | 8-Jul | 16 | 22877 | 23531 | 23219 | 2.8% | 23533 | 20-Jul | 15 |
| CE410 | 23266 | 10-Sep | 16 | 23203 | 20-Jul | 15 | 23205 | 20-Jul | 15 | | | | | | | 22893 | 29-Jul | 15 | 22893 | 23266 | 23142 | 1.6% | 23533 | 20-Jul | 15 |
| CE420 | 23277 | 20-Jul | 16 | 23203 | 20-Jul | 15 | 23205 | 20-Jul | 15 | 23531 | 20-Jul | 15 | | | | 22893 | 29-Jul | 15 | 22893 | 23531 | 23222 | 2.7% | 23533 | 20-Jul | 15 |
| CE430 | 23277 | 20-Jul | 16 | 23203 | 20-Jul | 15 | 23205 | 20-Jul | 15 | 23531 | 20-Jul | 15 | | | | 22893 | 29-Jul | 15 | 22893 | 23531 | 23222 | 2.7% | 23533 | 20-Jul | 15 |
| CE440 | 23277 | 20-Jul | 16 | 23203 | 20-Jul | 15 | 23205 | 20-Jul | 15 | 23531 | 20-Jul | 15 | | | | 22875 | 16-Aug | 16 | 22875 | 23531 | 23218 | 2.8% | 23533 | 20-Jul | 15 |
| CE500 | 19549 | 28-Oct | 15 | 20009 | 4-Jun | 16 | 20008 | 10-Sep | 16 | 19849 | 20-Jul | 15 | 18776 | 4-Jun | 15 | 19818 | 29-Jul | 15 | 18776 | 20009 | 19668 | 6.3% | 19845 | 20-Jul | 15 |
| CE510 | 21729 | 29-Apr | 19 | 22513 | 11-Jul | 15 | 22513 | 11-Jul | 15 | 22290 | 20-Jul | 15 | 21121 | 4-Jun | 13 | 22269 | 20-Jul | 14 | 21121 | 22513 | 22073 | 6.3% | 22294 | 29-Jul | 17 |
| CE520 | 19416 | 28-Sep | 15 | 20159 | 26-May | 16 | 20154 | 26-May | 16 | 19999 | 20-Jul | 15 | 18969 | 20-Jul | 16 | 20378 | 23-May | 15 | 18969 | 20378 | 19846 | 7.1% | 20059 | 20-Jul | 16 |
| CE522 | 19489 | 12-Mai | 15 | 20137 | 11-Jul | 16 | 20135 | 11-Jul | 16 | 19934 | 20-Jul | 15 | 18785 | 4-Jun | 15 | 19920 | 16-Aug | 15 | 18785 | 20137 | 19733 | 6.9% | 19947 | 20-Jul | 15 |
| CE525 | 19703 | 26-Jul | 16 | 19850 | 24-Apr | 16 | 19850 | 24-Apr | 16 | 19664 | 20-Jul | 15 | 18759 | 4-Jun | 15 | 19661 | 4-Jun | 15 | 18759 | 19850 | 19581 | 5.6% | 19659 | 20-Jul | 15 |
| CE530 | 19834 | 29-Mai | 15 | 19576 | 24-Apr | 16 | 19575 | 24-Apr | 16 | 19639 | 20-Jul | 15 | 18776 | 4-Jun | 15 | 19626 | 8-Jul | 15 | 18776 | 19834 | 19504 | 5.4% | 19737 | 20-Jul | 15 |
| CE540 | 19575 | 30-Aug | 16 | 19766 | 24-Apr | 16 | 19766 | 24-Apr | 16 | 19726 | 20-Jul | 15 | 18794 | 4-Jun | 15 | 19799 | 16-Aug | 15 | 18794 | 19799 | 19571 | 5.1% | 19842 | 20-Jul | 15 |
| CE545 | 20075 | 17-Jun | 16 | 19475 | 24-Apr | 16 | 19474 | 24-Apr | 16 | 19540 | 20-Jul | 15 | 18759 | 4-Jun | 15 | 19497 | 4-Jun | 15 | 18759 | 20075 | 19470 | 6.8% | 19639 | 20-Jul | 15 |

**Latent Coil Load (Wh,th)**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results (Max-Min) | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 9636 | 03-Sep | 16 | 9304 | 3-Sep | 15 | 9394 | 3-Sep | 15 | 10235 | 10-Jul | 13 | 10375 | 3-Sep | 15 | 10392 | 3-Sep | 15 | 9304 | 10392 | 9889 | 11.0% | 10537 | 10-Jul | 13 |
| CE310 | 15907 | 03-Sep | 15 | 15139 | 3-Sep | 15 | 15270 | 3-Sep | 15 | 16275 | 4-Aug | 15 | 16112 | 4-Aug | 15 | 16077 | 3-Sep | 16 | 15139 | 16275 | 15797 | 7.2% | 16552 | 4-Aug | 15 |
| CE320 | 23147 | 02-Oct | 10 | 31497 | 2-Oct | 9 | 31503 | 2-Oct | 9 | 22195 | 2-Oct | 10 | 21697 | 17-Sep | 12 | 21929 | 1-Oct | 20 | 21697 | 31503 | 25328 | 38.7% | 22660 | 2-Oct | 10 |
| CE330 | 27825 | 18-Sep | 16 | 26941 | 18-Sep | 15 | 40809 | 2-Oct | 9 | 27134 | 18-Sep | 16 | 28184 | 18-Sep | 15 | 27488 | 18-Sep | 15 | 26941 | 40809 | 29730 | 46.6% | 27596 | 18-Sep | 16 |
| CE340 | 24848 | 02-Oct | 9 | 30451 | 2-Oct | 9 | 36011 | 2-Oct | 9 | 23911 | 2-Oct | 10 | 24225 | 3-Sep | 17 | 23794 | 1-Oct | 20 | 23794 | 36011 | 27207 | 44.9% | 24431 | 2-Oct | 10 |
| CE350 | 9751 | 01-Oct | 13 | 9303 | 3-Sep | 15 | 9393 | 3-Sep | 15 | 10235 | 10-Jul | 13 | 10755 | 2-Oct | 8 | 11603 | 3-Aug | 7 | 9303 | 11603 | 10173 | 22.6% | 10538 | 10-Jul | 13 |
| CE360 | 9275 | 02-Oct | 10 | 10026 | 2-Oct | 9 | 10336 | 2-Oct | 9 | 8520 | 2-Oct | 11 | 8859 | 3-Sep | 17 | 8934 | 3-Sep | 17 | 8520 | 10336 | 9325 | 19.5% | 8815 | 2-Oct | 11 |
| CE400 | 27075 | 16-Sep | 15 | 25578 | 18-Sep | 14 | 32396 | 18-Sep | 15 | 26317 | 16-Sep | 14 | | | | 26645 | 16-Sep | 14 | 25578 | 32396 | 27602 | 24.7% | 22849 | 17-Jun | 16 |
| CE410 | 11139 | 16-Sep | 15 | 9304 | 3-Sep | 15 | 9391 | 3-Sep | 15 | | | | | | | 10377 | 9-Sep | 15 | 9304 | 11139 | 10053 | 18.3% | 22849 | 17-Jun | 16 |
| CE420 | 9751 | 01-Oct | 13 | 9304 | 3-Sep | 15 | 9394 | 3-Sep | 15 | 10235 | 10-Jul | 13 | | | | 10394 | 3-Sep | 15 | 9304 | 10394 | 9816 | 11.1% | 10537 | 10-Jul | 13 |
| CE430 | 9636 | 03-Sep | 16 | 11105 | 24-Oct | 14 | 11101 | 21-May | 15 | 11074 | 24-Oct | 13 | | | | 10394 | 3-Sep | 15 | 9636 | 11105 | 10662 | 13.8% | 11377 | 24-Oct | 13 |
| CE440 | 9636 | 03-Sep | 16 | 9304 | 3-Sep | 15 | 9391 | 3-Sep | 15 | 10235 | 10-Jul | 13 | | | | 10139 | 3-Sep | 15 | 9304 | 10235 | 9741 | 9.6% | 10537 | 10-Jul | 13 |
| CE500 | 7965 | 06-Oct | 15 | 7733 | 3-Sep | 15 | 7733 | 3-Sep | 15 | 7839 | 29-Jun | 16 | 7805 | 29-Jun | 16 | 7762 | 29-Jun | 15 | 7733 | 7965 | 7806 | 3.0% | 7849 | 29-Jun | 16 |
| CE510 | 8893 | 15-Sep | 11 | 8723 | 2-Oct | 9 | 8723 | 2-Oct | 9 | 8955 | 17-Jun | 14 | 8850 | 17-Jun | 14 | 8874 | 17-Jun | 13 | 8723 | 8955 | 8836 | 2.6% | 9223 | 27-Apr | 1 |
| CE520 | 7914 | 28-Sep | 15 | 7785 | 3-Sep | 15 | 7785 | 3-Sep | 15 | 7699 | 29-Jun | 16 | 7726 | 30-Jun | 16 | 7964 | 23-May | 15 | 7699 | 7964 | 7812 | 3.4% | 7736 | 29-Jun | 16 |
| CE522 | 7907 | 02-Mai | 15 | 7760 | 3-Sep | 15 | 7760 | 3-Sep | 15 | 7770 | 29-Jun | 16 | 7743 | 29-Jun | 16 | 7745 | 29-Jun | 15 | 7743 | 7907 | 7781 | 2.1% | 7796 | 29-Jun | 16 |
| CE525 | 8037 | 26-Jul | 16 | 7663 | 3-Sep | 15 | 7663 | 3-Sep | 15 | 7947 | 29-Jun | 16 | 7938 | 29-Jun | 16 | 7820 | 29-Jun | 15 | 7663 | 8037 | 7845 | 4.8% | 7934 | 29-Jun | 16 |
| CE530 | 0 | 18-Jun | 16 | 0 | 0-Jan | 0 | 0 | 0-Jan | 0 | 1 | 16-Mar | 10 | 179 | 11-Mar | 11 | 36 | 1-Nov | 20 | 0 | 179 | 36 | 497.3% | 0 | 1-Jan | 1 |
| CE540 | 627 | 11-Mar | 10 | 0 | 0-Jan | 0 | 0 | 0-Jan | 0 | 1655 | 11-Mar | 10 | 845 | 11-Mar | 10 | 1181 | 11-Mar | 10 | 0 | 1655 | 718 | 230.5% | 0 | 1-Jan | 1 |
| CE545 | 0 | 01-Jul | 16 | 0 | 0-Jan | 0 | 0 | 0-Jan | 0 | 0 | 23-May | 15 | 4 | 20-Jul | 15 | 0 | 1-Jan | 1 | 0 | 4 | 1 | 600.0% | 0 | 1-Jan | 1 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-12. Hourly Integrated Maxima and Minima (COP2)

**Maximum COP2**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | (Max-Min) | | | |
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 4.168 | 16-Apr | 3 | 3.869 | 30-Apr | 16 | 3.857 | 30-Apr | 16 | 3.925 | 30-Apr | 15 | 3.871 | 30-Apr | 16 | 3.880 | 30-Apr | 16 | 3.857 | 4.168 | 3.928 | 7.9% | 4.105 | 18-Oct | 6 |
| CE310 | 4.143 | 30-Apr | 15 | 4.141 | 30-Apr | 16 | 4.128 | 30-Apr | 16 | 4.173 | 30-Apr | 15 | 4.128 | 30-Apr | 15 | 4.120 | 30-Apr | 15 | 4.120 | 4.173 | 4.139 | 1.3% | 4.467 | 18-Oct | 6 |
| CE320 | 4.168 | 16-Apr | 3 | 5.143 | 2-Oct | 9 | 4.967 | 2-Oct | 9 | 3.940 | 16-Sep | 15 | 3.943 | 16-Sep | 15 | 4.380 | 18-Dec | 3 | 3.940 | 5.143 | 4.424 | 27.2% | 4.171 | 18-Oct | 6 |
| CE330 | 4.168 | 16-Apr | 3 | 4.109 | 17-Jun | 16 | 5.595 | 2-Oct | 9 | 4.071 | 16-Sep | 14 | 4.122 | 17-Jun | 16 | 4.050 | 17-Jun | 16 | 4.050 | 5.595 | 4.353 | 35.5% | 4.105 | 18-Oct | 6 |
| CE340 | 4.168 | 16-Apr | 3 | 4.621 | 2-Oct | 9 | 5.339 | 2-Oct | 9 | 3.987 | 16-Sep | 15 | 4.017 | 16-Sep | 16 | 3.950 | 16-Sep | 16 | 3.950 | 5.339 | 4.347 | 32.0% | 4.105 | 18-Oct | 6 |
| CE350 | 4.168 | 16-Apr | 3 | 3.889 | 27-Apr | 5 | 3.863 | 5-Oct | 3 | 4.555 | 13-Oct | 1 | 3.932 | 4-Oct | 24 | 3.880 | 30-Apr | 16 | 3.863 | 4.555 | 4.048 | 17.1% | 3.992 | 30-Apr | 8 |
| CE360 | 4.401 | 05-Oct | 1 | 4.428 | 4-Oct | 24 | 4.427 | 4-Oct | 24 | 4.455 | 4-Oct | 24 | 4.432 | 4-Oct | 24 | 4.440 | 4-Oct | 24 | 4.401 | 4.455 | 4.431 | 1.2% | 4.839 | 18-Oct | 6 |
| CE400 | 4.077 | 16-Sep | 15 | 4.088 | 17-Jun | 16 | 4.776 | 18-Sep | 15 | 4.071 | 16-Sep | 14 | | | | 4.050 | 17-Jun | 16 | 4.050 | 4.776 | 4.212 | 17.2% | 4.094 | 17-Jun | 16 |
| CE410 | 3.888 | 30-Apr | 15 | 3.903 | 30-Apr | 15 | 3.855 | 30-Apr | 16 | | | | | | | 3.840 | 21-May | 15 | 3.840 | 3.903 | 3.871 | 1.6% | 4.094 | 17-Jun | 16 |
| CE420 | 3.781 | 27-Sep | 16 | 3.807 | 21-May | 15 | 3.759 | 27-Sep | 15 | 3.821 | 21-May | 15 | | | | 3.940 | 21-May | 13 | 3.759 | 3.940 | 3.822 | 4.7% | 4.013 | 18-Oct | 6 |
| CE430 | 3.781 | 27-Sep | 16 | 3.805 | 24-Oct | 15 | 3.759 | 27-Sep | 15 | 3.793 | 21-May | 16 | | | | 3.930 | 30-Apr | 13 | 3.759 | 3.930 | 3.814 | 4.5% | 4.013 | 18-Oct | 6 |
| CE440 | 3.883 | 12-Dez | 7 | 3.774 | 27-Sep | 15 | 3.759 | 27-Sep | 15 | 3.802 | 21-May | 15 | | | | 3.810 | 30-Apr | 15 | 3.759 | 3.883 | 3.806 | 3.3% | 4.013 | 18-Oct | 6 |
| CE500 | 4.275 | 13-Oct | 1 | 7.367 | 11-Mar | 10 | 5.301 | 13-Oct | 9 | 4.198 | 16-Mar | 10 | 4.185 | 16-Mar | 10 | 4.140 | 30-Apr | 16 | 4.140 | 7.367 | 4.911 | 65.7% | 4.424 | 11-Apr | 9 |
| CE510 | 4.693 | 05-Oct | 1 | 7.367 | 11-Mar | 10 | 5.301 | 13-Oct | 9 | 4.685 | 5-Oct | 1 | 4.690 | 4-Oct | 24 | 4.530 | 4-May | 3 | 4.530 | 7.367 | 5.211 | 54.4% | 4.994 | 20-Apr | 5 |
| CE520 | 3.814 | 30-Apr | 15 | 4.896 | 16-Mar | 10 | 4.652 | 16-Mar | 10 | 3.938 | 30-Apr | 15 | 3.802 | 30-Apr | 16 | 3.840 | 30-Apr | 16 | 3.802 | 4.896 | 4.157 | 26.3% | 3.991 | 11-Apr | 9 |
| CE522 | 3.986 | 16-Mar | 10 | 6.233 | 11-Mar | 10 | 5.678 | 11-Mar | 10 | 4.042 | 30-Apr | 15 | 3.986 | 30-Apr | 16 | 4.000 | 30-Apr | 16 | 3.986 | 6.233 | 4.654 | 48.3% | 4.218 | 11-Apr | 9 |
| CE525 | 4.718 | 13-Oct | 1 | 6.325 | 12-Apr | 9 | 6.031 | 16-Mar | 10 | 4.704 | 16-Mar | 10 | 4.638 | 16-Mar | 10 | 4.400 | 16-Mar | 10 | 4.400 | 6.325 | 5.136 | 37.5% | 4.865 | 11-Apr | 9 |
| CE530 | 4.006 | 02-Nov | 1 | 3.981 | 11-Mar | 10 | 3.850 | 13-Oct | 9 | 3.925 | 16-Mar | 10 | 3.840 | 16-Mar | 10 | 3.880 | 16-Mar | 10 | 3.840 | 4.006 | 3.914 | 4.2% | 3.996 | 11-Apr | 9 |
| CE540 | 3.456 | 30-Apr | 15 | 3.456 | 30-Apr | 16 | 3.455 | 30-Apr | 16 | 3.696 | 16-Mar | 10 | 3.667 | 11-Mar | 22 | 3.690 | 17-Oct | 5 | 3.455 | 3.696 | 3.570 | 6.7% | 3.666 | 11-Apr | 9 |
| CE545 | 4.250 | 16-Mar | 10 | 4.275 | 16-Mar | 10 | 4.428 | 16-Mar | 10 | 4.166 | 16-Mar | 10 | 4.156 | 16-Mar | 10 | 4.170 | 16-Mar | 10 | 4.156 | 4.428 | 4.241 | 6.4% | 4.315 | 11-Apr | 9 |

**Minimum COP2**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | (Max-Min) | | | |
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 2.793 | 24-Apr | 17 | 2.798 | 1-Dec | 14 | 2.801 | 1-Dec | 12 | 2.782 | 13-Jun | 17 | 2.786 | 13-Jun | 17 | 2.810 | 14-Jun | 12 | 2.782 | 2.810 | 2.795 | 1.0% | 2.775 | 13-Jun | 17 |
| CE310 | 2.865 | 01-Dec | 15 | 2.850 | 1-Dec | 14 | 2.851 | 1-Dec | 12 | 2.893 | 1-Dec | 15 | 2.873 | 1-Dec | 15 | 2.870 | 1-Dec | 14 | 2.850 | 2.893 | 2.867 | 1.5% | 2.815 | 15-Mar | 15 |
| CE320 | 2.825 | 31-Mar | 14 | 2.801 | 1-Dec | 14 | 2.805 | 1-Dec | 15 | 2.842 | 31-Mar | 15 | 2.815 | 31-Mar | 15 | 2.830 | 31-Mar | 14 | 2.801 | 2.842 | 2.820 | 1.4% | 2.781 | 15-Mar | 15 |
| CE330 | 2.825 | 31-Mar | 14 | 2.798 | 1-Dec | 14 | 2.801 | 1-Dec | 12 | 2.844 | 31-Mar | 15 | 2.823 | 31-Mar | 15 | 2.840 | 31-Mar | 14 | 2.798 | 2.844 | 2.822 | 1.6% | 2.781 | 15-Mar | 15 |
| CE340 | 2.825 | 31-Mar | 14 | 2.798 | 1-Dec | 14 | 2.801 | 1-Dec | 12 | 2.844 | 31-Mar | 15 | 2.823 | 31-Mar | 15 | 2.840 | 31-Mar | 14 | 2.798 | 2.844 | 2.822 | 1.6% | 2.781 | 15-Mar | 15 |
| CE350 | 2.790 | 24-Apr | 17 | 2.798 | 1-Dec | 14 | 2.801 | 1-Dec | 12 | 2.782 | 13-Jun | 17 | 2.786 | 13-Jun | 17 | 2.810 | 14-Jun | 12 | 2.782 | 2.810 | 2.794 | 1.0% | 2.775 | 13-Jun | 17 |
| CE360 | 2.825 | 31-Mar | 14 | 2.799 | 1-Dec | 14 | 2.801 | 1-Dec | 12 | 2.844 | 31-Mar | 15 | 2.823 | 31-Mar | 15 | 2.840 | 31-Mar | 14 | 2.799 | 2.844 | 2.822 | 1.6% | 2.781 | 15-Mar | 15 |
| CE400 | 2.782 | 31-Mar | 19 | 2.734 | 3-Dec | 15 | 2.735 | 3-Dec | 13 | 2.782 | 13-Jun | 17 | | | | 2.810 | 14-Jun | 12 | 2.734 | 2.810 | 2.768 | 2.7% | 2.775 | 13-Jun | 17 |
| CE410 | 2.786 | 24-Apr | 17 | 2.798 | 1-Dec | 14 | 2.801 | 1-Dec | 12 | | | | | | | 2.810 | 14-Jun | 12 | 2.786 | 2.810 | 2.799 | 0.9% | 2.775 | 13-Jun | 17 |
| CE420 | 2.793 | 24-Apr | 17 | 2.798 | 1-Dec | 14 | 2.801 | 1-Dec | 12 | 2.782 | 13-Jun | 17 | | | | 2.810 | 14-Jun | 12 | 2.782 | 2.810 | 2.797 | 1.0% | 2.775 | 13-Jun | 17 |
| CE430 | 2.771 | 30-Mar | 19 | 2.734 | 3-Dec | 13 | 2.735 | 3-Dec | 13 | 2.782 | 13-Jun | 17 | | | | 2.810 | 14-Jun | 12 | 2.734 | 2.810 | 2.766 | 2.7% | 2.775 | 13-Jun | 17 |
| CE440 | 2.782 | 31-Mar | 19 | 2.734 | 3-Dec | 13 | 2.735 | 3-Dec | 13 | 2.782 | 13-Jun | 17 | | | | 2.810 | 8-Apr | 13 | 2.734 | 2.810 | 2.769 | 2.7% | 2.775 | 13-Jun | 17 |
| CE500 | 2.685 | 30-Jul | 12 | 2.693 | 29-Jul | 12 | 2.652 | 30-Mar | 17 | 2.705 | 30-Jul | 12 | 2.666 | 30-Jul | 12 | 2.710 | 29-Jul | 12 | 2.652 | 2.710 | 2.685 | 2.2% | 2.694 | 26-Apr | 18 |
| CE510 | 2.888 | 31-Mar | 15 | 2.817 | 5-Apr | 17 | 2.652 | 30-Mar | 17 | 2.865 | 31-Mar | 18 | 2.882 | 31-Mar | 15 | 2.900 | 31-Mar | 14 | 2.652 | 2.900 | 2.834 | 8.8% | 2.694 | 26-Apr | 18 |
| CE520 | 2.442 | 30-Jul | 12 | 2.463 | 5-Apr | 17 | 2.394 | 5-Apr | 17 | 2.532 | 30-Jul | 12 | 2.333 | 29-Jan | 10 | 2.470 | 30-Jul | 12 | 2.333 | 2.532 | 2.439 | 8.1% | 2.406 | 26-Apr | 18 |
| CE522 | 2.569 | 08-Jul | 17 | 2.572 | 29-Jul | 12 | 2.562 | 31-Mar | 17 | 2.613 | 30-Jul | 12 | 2.429 | 30-Mar | 17 | 2.590 | 29-Jul | 12 | 2.429 | 2.613 | 2.556 | 7.2% | 2.555 | 26-Apr | 18 |
| CE525 | 2.911 | 14-Jul | 17 | 2.939 | 30-Jul | 12 | 2.814 | 31-Mar | 17 | 2.940 | 30-Jul | 12 | 2.894 | 29-Jul | 12 | 2.900 | 29-Jul | 12 | 2.814 | 2.940 | 2.900 | 4.3% | 2.933 | 30-Jul | 12 |
| CE530 | 2.501 | 30-Jul | 12 | 2.495 | 29-Jul | 12 | 2.498 | 29-Jul | 12 | 2.532 | 30-Jul | 12 | 2.473 | 29-Jul | 12 | 2.520 | 29-Jul | 12 | 2.473 | 2.532 | 2.503 | 2.3% | 2.464 | 30-Jul | 12 |
| CE540 | 2.253 | 30-Jul | 12 | 2.261 | 29-Jul | 12 | 2.262 | 30-Jul | 12 | 2.383 | 30-Jul | 12 | 2.143 | 5-Apr | 20 | 2.280 | 29-Jul | 12 | 2.143 | 2.383 | 2.264 | 10.6% | 2.275 | 30-Jul | 12 |
| CE545 | 2.733 | 14-Jul | 17 | 2.720 | 29-Jul | 12 | 2.722 | 30-Jul | 12 | 2.660 | 30-Jul | 12 | 2.692 | 29-Jul | 12 | 2.720 | 29-Jul | 12 | 2.660 | 2.733 | 2.708 | 2.7% | 2.636 | 30-Jul | 12 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-13. Hourly Integrated Maxima and Minima (IDB)

**Maximum IDB (°C)**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results (Max-Min) | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 26.20 | 07-Jul | 15 | 25.11 | 22-Apr | 15 | 25.11 | 22-Apr | 15 | 25.00 | 23-Sep | 8 | 25.05 | 21-Feb | 17 | 26.19 | 3-Nov | 15 | 25.00 | 26.20 | 25.44 | 4.7% | 25.01 | 11-Oct | 16 |
| CE310 | 27.08 | 20-Jul | 15 | 26.89 | 20-Jul | 16 | 26.72 | 20-Jul | 16 | 26.47 | 20-Jul | 16 | 26.62 | 20-Jul | 15 | 27.19 | 8-Jul | 15 | 26.47 | 27.19 | 26.83 | 2.7% | 26.55 | 20-Jul | 16 |
| CE320 | 32.36 | 20-Jul | 15 | 31.61 | 8-Jul | 16 | 31.50 | 8-Jul | 16 | 31.71 | 20-Jul | 15 | 32.32 | 20-Jul | 15 | 31.65 | 8-Jul | 15 | 31.50 | 32.36 | 31.86 | 2.7% | 31.81 | 20-Jul | 15 |
| CE330 | 32.23 | 20-Jul | 15 | 31.72 | 8-Jul | 16 | 32.00 | 20-Jul | 16 | 31.07 | 8-Jul | 16 | 31.90 | 20-Jul | 15 | 31.30 | 8-Jul | 15 | 31.07 | 32.23 | 31.70 | 3.7% | 31.56 | 20-Jul | 15 |
| CE340 | 32.31 | 20-Jul | 15 | 31.61 | 8-Jul | 16 | 31.56 | 8-Jul | 16 | 31.50 | 20-Jul | 15 | 32.15 | 20-Jul | 15 | 31.58 | 8-Jul | 15 | 31.50 | 32.31 | 31.78 | 2.5% | 31.74 | 20-Jul | 15 |
| CE350 | 34.58 | 01-Oct | 24 | 34.94 | 23-Jun | 24 | 34.94 | 24-Jun | 24 | 35.00 | 1-Oct | 2 | 35.00 | 21-Apr | 1 | 35.00 | 21-Apr | 2 | 34.58 | 35.00 | 34.91 | 1.2% | 35.00 | 11-Oct | 3 |
| CE360 | 33.76 | 10-Jul | 13 | 32.78 | 20-Jul | 15 | 32.56 | 20-Jul | 16 | 32.51 | 10-Jul | 13 | 33.00 | 20-Jul | 15 | 33.13 | 10-Jul | 12 | 32.51 | 33.76 | 32.96 | 3.8% | 32.81 | 10-Jul | 13 |
| CE400 | 27.11 | 16-Sep | 15 | 27.56 | 16-Sep | 16 | 28.83 | 18-Sep | 16 | 26.91 | 16-Sep | 16 | | | | 26.04 | 15-Aug | 15 | 26.04 | 28.83 | 27.29 | 10.2% | 25.07 | 25-Oct | 15 |
| CE410 | 26.83 | 23-Oct | 15 | 25.11 | 22-Apr | 15 | 25.11 | 22-Apr | 15 | | | | | | | 26.19 | 3-Nov | 15 | 25.11 | 26.83 | 25.81 | 6.6% | 25.07 | 25-Oct | 15 |
| CE420 | 26.20 | 07-Jul | 15 | 25.11 | 22-Apr | 15 | 25.11 | 22-Apr | 15 | 25.00 | 23-Sep | 8 | | | | 26.23 | 20-Oct | 15 | 25.00 | 26.23 | 25.53 | 4.8% | 25.01 | 11-Oct | 16 |
| CE430 | 27.20 | 01-Nov | 16 | 25.11 | 22-Apr | 15 | 25.11 | 22-Apr | 15 | 25.00 | 18-May | 19 | | | | 26.45 | 23-Oct | 15 | 25.00 | 27.20 | 25.77 | 8.5% | 25.01 | 11-Oct | 16 |
| CE440 | 27.05 | 28-Apr | 15 | 25.11 | 22-Apr | 15 | 25.11 | 22-Apr | 15 | 25.00 | 24-Apr | 19 | | | | 26.26 | 23-Oct | 15 | 25.00 | 27.05 | 25.71 | 7.9% | 25.01 | 11-Oct | 16 |
| CE500 | 25.81 | 30-Apr | 15 | 25.11 | 21-Apr | 16 | 25.11 | 21-Apr | 16 | 25.00 | 31-Mar | 18 | 25.02 | 30-Mar | 17 | 25.00 | 11-Mar | 11 | 25.00 | 25.81 | 25.17 | 3.2% | 25.01 | 18-Apr | 19 |
| CE510 | 26.10 | 09-Jul | 15 | 25.11 | 21-Apr | 3 | 25.11 | 21-Apr | 3 | 25.00 | 31-Mar | 18 | 25.02 | 30-Mar | 17 | 25.00 | 24-Apr | 12 | 25.00 | 26.10 | 25.22 | 4.4% | 25.01 | 29-Jul | 16 |
| CE520 | 16.12 | 15-Aug | 15 | 16.11 | 16-Aug | 16 | 15.94 | 10-Jul | 16 | 15.00 | 16-Apr | 1 | 15.98 | 20-Jul | 15 | 18.62 | 4-Jun | 16 | 15.00 | 18.62 | 16.30 | 22.2% | 15.28 | 20-Jul | 16 |
| CE522 | 21.01 | 16-Jul | 15 | 20.11 | 21-Apr | 15 | 20.11 | 21-Apr | 15 | 20.00 | 16-Apr | 20 | 20.05 | 13-Mar | 22 | 20.93 | 21-Apr | 15 | 20.00 | 21.01 | 20.37 | 5.0% | 20.01 | 1-Apr | 23 |
| CE525 | 36.08 | 10-Mai | 16 | 35.06 | 21-Apr | 16 | 35.06 | 21-Apr | 16 | 35.00 | 11-Mar | 12 | 35.00 | 11-Mar | 10 | 35.00 | 11-Mar | 11 | 35.00 | 36.08 | 35.20 | 3.1% | 35.00 | 29-Jul | 18 |
| CE530 | 26.12 | 04-Jun | 15 | 25.06 | 21-Apr | 16 | 25.06 | 21-Apr | 16 | 25.00 | 30-Mar | 17 | 25.02 | 30-Mar | 17 | 25.00 | 11-Mar | 11 | 25.00 | 26.12 | 25.21 | 4.4% | 25.01 | 18-Apr | 19 |
| CE540 | 16.15 | 21-Sep | 16 | 15.11 | 31-May | 16 | 15.11 | 31-May | 16 | 15.00 | 25-Mar | 8 | 15.05 | 28-Jan | 20 | 15.00 | 11-Mar | 10 | 15.00 | 16.15 | 15.24 | 7.5% | 15.01 | 15-Apr | 24 |
| CE545 | 35.67 | 20-Jul | 15 | 35.00 | 21-Apr | 15 | 35.00 | 21-Apr | 15 | 35.00 | 9-Jul | 22 | 35.00 | 11-Mar | 10 | 35.00 | 11-Mar | 11 | 35.00 | 35.67 | 35.11 | 1.9% | 35.00 | 14-Jul | 18 |

**Minimum IDB (°C)**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results (Max-Min) | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | 8.00 | 6-Jan | 5 | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.23 | 23.1% | 8.77 | 6-Jan | 6 |
| CE310 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | 8.00 | 6-Jan | 5 | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.23 | 23.1% | 8.77 | 6-Jan | 6 |
| CE320 | 7.93 | 06-Jan | 6 | 10.83 | 6-Jan | 7 | 10.78 | 6-Jan | 7 | 7.75 | 6-Jan | 6 | 8.00 | 6-Jan | 5 | 6.99 | 6-Jan | 5 | 6.99 | 10.83 | 8.71 | 44.1% | 7.80 | 6-Jan | 6 |
| CE330 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | 8.00 | 6-Jan | 5 | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.23 | 23.1% | 8.77 | 6-Jan | 6 |
| CE340 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | 8.00 | 6-Jan | 5 | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.23 | 23.1% | 8.77 | 6-Jan | 6 |
| CE350 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | 8.00 | 6-Jan | 5 | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.23 | 23.1% | 8.77 | 6-Jan | 6 |
| CE360 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | 8.00 | 6-Jan | 5 | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.23 | 23.1% | 8.77 | 6-Jan | 6 |
| CE400 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | | | | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.27 | 23.0% | 8.77 | 6-Jan | 6 |
| CE410 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | | | | | | | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.16 | 23.3% | 8.77 | 6-Jan | 6 |
| CE420 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | | | | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.27 | 23.0% | 8.77 | 6-Jan | 6 |
| CE430 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | | | | 6.99 | 6-Jan | 5 | 6.99 | 8.89 | 8.27 | 23.0% | 8.77 | 6-Jan | 6 |
| CE440 | 7.93 | 06-Jan | 6 | 8.89 | 6-Jan | 6 | 8.83 | 6-Jan | 6 | 8.72 | 6-Jan | 6 | | | | 7.00 | 6-Jan | 5 | 7.00 | 8.89 | 8.27 | 22.8% | 8.77 | 6-Jan | 6 |
| CE500 | 8.43 | 20-Dec | 22 | 8.17 | 20-Dec | 12 | 7.94 | 20-Dec | 11 | 8.94 | 21-Dec | 2 | 8.54 | 20-Dec | 20 | 24.04 | 15-Apr | 5 | 7.94 | 24.04 | 11.01 | 146.2% | 9.08 | 21-Dec | 2 |
| CE510 | 8.43 | 20-Dec | 22 | 8.17 | 20-Dec | 12 | 7.94 | 20-Dec | 11 | 8.94 | 21-Dec | 2 | 8.54 | 20-Dec | 20 | 24.04 | 15-Apr | 5 | 7.94 | 24.04 | 11.01 | 146.2% | 9.08 | 21-Dec | 2 |
| CE520 | 8.31 | 20-Dec | 22 | 8.11 | 20-Dec | 12 | 7.89 | 20-Dec | 12 | 8.83 | 21-Dec | 1 | 8.51 | 20-Dec | 20 | 13.57 | 1-Nov | 7 | 7.89 | 13.57 | 9.20 | 61.7% | 8.94 | 21-Dec | 2 |
| CE522 | 8.41 | 20-Dec | 22 | 8.17 | 20-Dec | 12 | 7.94 | 20-Dec | 11 | 8.90 | 21-Dec | 1 | 8.54 | 20-Dec | 20 | 15.98 | 12-Apr | 19 | 7.94 | 15.98 | 9.66 | 83.3% | 9.02 | 21-Dec | 2 |
| CE525 | 8.44 | 20-Dec | 22 | 8.17 | 20-Dec | 13 | 7.94 | 20-Dec | 12 | 9.01 | 21-Dec | 2 | 8.54 | 20-Dec | 20 | 33.01 | 1-Apr | 8 | 7.94 | 33.01 | 12.52 | 200.2% | 9.18 | 21-Dec | 2 |
| CE530 | 8.42 | 20-Dec | 22 | 8.17 | 20-Dec | 12 | 7.94 | 20-Dec | 11 | 8.94 | 21-Dec | 2 | 8.54 | 20-Dec | 20 | 24.04 | 15-Apr | 5 | 7.94 | 24.04 | 11.01 | 146.3% | 9.08 | 21-Dec | 2 |
| CE540 | 8.23 | 20-Dec | 22 | 8.11 | 20-Dec | 12 | 7.89 | 20-Dec | 12 | 8.83 | 21-Dec | 1 | 8.51 | 20-Dec | 20 | 14.95 | 19-Dec | 1 | 7.89 | 14.95 | 9.42 | 74.9% | 8.94 | 21-Dec | 2 |
| CE545 | 8.45 | 20-Dec | 22 | 8.17 | 20-Dec | 13 | 7.94 | 20-Dec | 12 | 9.01 | 21-Dec | 2 | 8.54 | 20-Dec | 20 | 33.01 | 1-Apr | 8 | 7.94 | 33.01 | 12.52 | 200.2% | 9.17 | 21-Dec | 2 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-14. Hourly Integrated Maxima and Minima (Zone Humidity Ratio)

**Maximum Humidity Ratio**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | (Max-Min) | | | |
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 0.0133 | 16-Nov | 17 | 0.0138 | 16-Nov | 16 | 0.0137 | 16-Nov | 16 | 0.0136 | 16-Nov | 17 | 0.0135 | 16-Nov | 16 | 0.0134 | 16-Nov | 16 | 0.0133 | 0.0138 | 0.0135 | 3.8% | 0.0135 | 16-Nov | 17 |
| CE310 | 0.0158 | 01-Oct | 23 | 0.0188 | 15-Oct | 9 | 0.0189 | 15-Oct | 9 | 0.0156 | 1-Oct | 8 | 0.0154 | 2-Oct | 8 | 0.0157 | 2-Oct | 8 | 0.0154 | 0.0189 | 0.0167 | 20.8% | 0.0155 | 1-Oct | 8 |
| CE320 | 0.0180 | 10-Jul | 13 | 0.0177 | 10-Jul | 12 | 0.0176 | 10-Jul | 12 | 0.0178 | 10-Jul | 13 | 0.0175 | 10-Jul | 12 | 0.0177 | 10-Jul | 12 | 0.0175 | 0.0180 | 0.0177 | 2.7% | 0.0177 | 1-Oct | 11 |
| CE330 | 0.0177 | 10-Jul | 12 | 0.0178 | 2-Oct | 9 | 0.0177 | 10-Jul | 13 | 0.0179 | 10-Jul | 12 | 0.0170 | 10-Jul | 13 | 0.0177 | 10-Jul | 12 | 0.0170 | 0.0179 | 0.0176 | 5.0% | 0.0178 | 10-Jul | 12 |
| CE340 | 0.0179 | 10-Jul | 13 | 0.0177 | 10-Jul | 12 | 0.0174 | 10-Jul | 12 | 0.0178 | 10-Jul | 12 | 0.0173 | 10-Jul | 13 | 0.0177 | 10-Jul | 12 | 0.0173 | 0.0179 | 0.0176 | 3.4% | 0.0177 | 10-Jul | 12 |
| CE350 | 0.0168 | 01-Oct | 24 | 0.0199 | 2-Aug | 22 | 0.0199 | 2-Aug | 22 | 0.0172 | 2-Oct | 1 | 0.0165 | 2-Oct | 2 | 0.0166 | 2-Oct | 1 | 0.0165 | 0.0199 | 0.0178 | 19.2% | 0.0169 | 2-Oct | 1 |
| CE360 | 0.0134 | 10-Jul | 13 | 0.0138 | 16-Nov | 16 | 0.0137 | 16-Nov | 16 | 0.0139 | 10-Jul | 13 | 0.0135 | 16-Nov | 16 | 0.0134 | 16-Nov | 16 | 0.0134 | 0.0139 | 0.0136 | 3.4% | 0.0135 | 16-Nov | 17 |
| CE400 | 0.0169 | 05-Apr | 22 | 0.0170 | 5-Apr | 21 | 0.0170 | 5-Apr | 21 | 0.0169 | 5-Apr | 22 | | | | 0.0173 | 22-Apr | 6 | 0.0169 | 0.0173 | 0.0170 | 2.5% | 0.0169 | 5-Apr | 22 |
| CE410 | 0.0168 | 05-Apr | 22 | 0.0169 | 2-Apr | 5 | 0.0169 | 2-Apr | 5 | | | | | | | 0.0173 | 22-Apr | 6 | 0.0168 | 0.0173 | 0.0170 | 2.7% | 0.0169 | 5-Apr | 22 |
| CE420 | 0.0143 | 02-Apr | 10 | 0.0147 | 1-Apr | 21 | 0.0141 | 17-Apr | 3 | 0.0146 | 2-Apr | 18 | | | | 0.0147 | 2-Apr | 18 | 0.0141 | 0.0147 | 0.0145 | 4.1% | 0.0146 | 2-Apr | 18 |
| CE430 | 0.0162 | 02-Apr | 5 | 0.0156 | 2-Apr | 4 | 0.0156 | 2-Apr | 4 | 0.0161 | 2-Apr | 5 | | | | 0.0158 | 2-Apr | 5 | 0.0156 | 0.0162 | 0.0159 | 4.0% | 0.0161 | 2-Apr | 5 |
| CE440 | 0.0133 | 16-Nov | 17 | 0.0138 | 16-Nov | 16 | 0.0137 | 16-Nov | 16 | 0.0136 | 16-Nov | 17 | | | | 0.0134 | 16-Nov | 16 | 0.0133 | 0.0138 | 0.0136 | 3.6% | 0.0135 | 16-Nov | 17 |
| CE500 | 0.0117 | 11-Jul | 15 | 0.0119 | 20-Jul | 15 | 0.0118 | 6-Apr | 10 | 0.0117 | 20-Jul | 15 | 0.0117 | 20-Jul | 15 | 0.0115 | 11-Mar | 10 | 0.0115 | 0.0119 | 0.0117 | 3.4% | 0.0114 | 20-Jul | 15 |
| CE510 | 0.0119 | 07-Sep | 15 | 0.0119 | 20-Jul | 15 | 0.0119 | 20-Jul | 15 | 0.0117 | 20-Jul | 15 | 0.0117 | 20-Jul | 15 | 0.0115 | 11-Mar | 10 | 0.0115 | 0.0119 | 0.0118 | 3.4% | 0.0114 | 20-Jul | 15 |
| CE520 | 0.0075 | 07-Sep | 15 | 0.0077 | 10-Jul | 16 | 0.0078 | 29-Mar | 10 | 0.0070 | 20-Jul | 15 | 0.0076 | 20-Jul | 15 | 0.0106 | 5-Jan | 16 | 0.0070 | 0.0106 | 0.0080 | 44.5% | 0.0071 | 20-Jul | 16 |
| CE522 | 0.0094 | 20-Jul | 16 | 0.0095 | 4-Jun | 15 | 0.0138 | 6-Apr | 10 | 0.0091 | 20-Jul | 15 | 0.0094 | 20-Jul | 15 | 0.0107 | 1-Jan | 2 | 0.0091 | 0.0138 | 0.0103 | 45.4% | 0.0090 | 20-Jul | 15 |
| CE525 | 0.0179 | 10-Mai | 16 | 0.0180 | 20-Jul | 15 | 0.0180 | 20-Jul | 15 | 0.0185 | 20-Jul | 15 | 0.0176 | 20-Jul | 15 | 0.0173 | 20-Jul | 15 | 0.0173 | 0.0185 | 0.0179 | 6.6% | 0.0178 | 20-Jul | 15 |
| CE530 | 0.0070 | 01-Jan | 1 | 0.0081 | 20-Jul | 15 | 0.0081 | 20-Jul | 15 | 0.0068 | 11-Mar | 1 | 0.0055 | 1-Apr | 1 | 0.0068 | 26-Oct | 9 | 0.0055 | 0.0081 | 0.0070 | 37.1% | 0.0029 | 31-Dec | 8 |
| CE540 | 0.0061 | 01-Jan | 1 | 0.0050 | 4-Jun | 13 | 0.0063 | 8-Apr | 8 | 0.0068 | 11-Mar | 1 | 0.0033 | 1-Apr | 1 | 0.0063 | 11-Mar | 9 | 0.0033 | 0.0068 | 0.0056 | 62.6% | 0.0029 | 31-Dec | 4 |
| CE545 | 0.0070 | 01-Jan | 1 | 0.0122 | 20-Jul | 15 | 0.0122 | 20-Jul | 15 | 0.0068 | 31-Dec | 7 | 0.0067 | 1-Apr | 1 | 0.0076 | 5-Nov | 9 | 0.0067 | 0.0122 | 0.0087 | 63.0% | 0.0029 | 28-Dec | 11 |

**Minimum Humidity Ratio**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | (Max-Min) | | | |
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | /Mean* | Trane | Date | Hour |
| CE300 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | 0.0020 | 11-Jan | 3 | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0019 | 14.5% | 0.0019 | 11-Jan | 3 |
| CE310 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 5-Jan | 7 | 0.0020 | 5-Jan | 7 | 0.0020 | 5-Jan | 7 | 0.0017 | 0.0020 | 0.0019 | 17.1% | 0.0019 | 5-Jan | 7 |
| CE320 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | 0.0020 | 11-Jan | 3 | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0019 | 14.5% | 0.0019 | 11-Jan | 3 |
| CE330 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | 0.0020 | 11-Jan | 3 | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0019 | 14.5% | 0.0019 | 11-Jan | 3 |
| CE340 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | 0.0020 | 11-Jan | 3 | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0019 | 14.5% | 0.0019 | 11-Jan | 3 |
| CE350 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | 0.0020 | 11-Jan | 3 | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0019 | 14.5% | 0.0019 | 11-Jan | 3 |
| CE360 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | 0.0020 | 11-Jan | 3 | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0019 | 14.5% | 0.0019 | 11-Jan | 3 |
| CE400 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | | | | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0018 | 14.7% | 0.0019 | 11-Jan | 3 |
| CE410 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | | | | | | | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0018 | 14.9% | 0.0019 | 11-Jan | 3 |
| CE420 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | | | | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0018 | 14.7% | 0.0019 | 11-Jan | 3 |
| CE430 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | | | | 0.0020 | 5-Jan | 6 | 0.0017 | 0.0020 | 0.0018 | 14.7% | 0.0019 | 11-Jan | 3 |
| CE440 | 0.0019 | 11-Jan | 3 | 0.0017 | 4-Jan | 24 | 0.0017 | 4-Jan | 24 | 0.0019 | 11-Jan | 3 | | | | 0.0020 | 5-Jan | 7 | 0.0017 | 0.0020 | 0.0018 | 14.7% | 0.0019 | 11-Jan | 3 |
| CE500 | 0.0068 | 20-Dec | 22 | | | | | | | 0.0070 | 20-Dec | 12 | 0.0069 | 20-Dec | 20 | 0.0103 | 2-Nov | 2 | 0.0068 | 0.0103 | 0.0078 | 44.7% | 0.0071 | 20-Dec | 12 |
| CE510 | 0.0068 | 20-Dec | 22 | | | | | | | 0.0070 | 20-Dec | 12 | 0.0069 | 20-Dec | 20 | 0.0105 | 2-Apr | 22 | 0.0068 | 0.0105 | 0.0078 | 47.0% | 0.0071 | 20-Dec | 12 |
| CE520 | 0.0061 | 26-Nov | 2 | | | | | | | 0.0065 | 10-Nov | 9 | 0.0065 | 27-Nov | 23 | 0.0066 | 1-Nov | 7 | 0.0061 | 0.0066 | 0.0064 | 7.3% | 0.0065 | 28-Nov | 2 |
| CE522 | 0.0068 | 20-Dec | 22 | | | | | | | 0.0070 | 20-Dec | 12 | 0.0069 | 20-Dec | 20 | 0.0078 | 2-Apr | 21 | 0.0068 | 0.0078 | 0.0071 | 14.1% | 0.0070 | 20-Dec | 12 |
| CE525 | 0.0068 | 20-Dec | 22 | | | | | | | 0.0070 | 20-Dec | 12 | 0.0069 | 20-Dec | 20 | 0.0154 | 2-Nov | 2 | 0.0068 | 0.0154 | 0.0090 | 94.7% | 0.0071 | 20-Dec | 12 |
| CE530 | 0.0062 | 01-Apr | 1 | | | | | | | 0.0067 | 18-Oct | 12 | 0.0055 | 1-Nov | 21 | 0.0066 | 1-Apr | 5 | 0.0055 | 0.0067 | 0.0063 | 20.5% | 0.0029 | 31-Mar | 24 |
| CE540 | 0.0041 | 05-Oct | 3 | | | | | | | 0.0038 | 18-Oct | 9 | 0.0033 | 29-Apr | 23 | 0.0042 | 15-Oct | 5 | 0.0033 | 0.0042 | 0.0038 | 24.6% | 0.0029 | 31-Mar | 22 |
| CE545 | 0.0062 | 01-Apr | 1 | | | | | | | 0.0068 | 1-Apr | 2 | 0.0067 | 20-Jul | 15 | 0.0070 | 1-Apr | 8 | 0.0062 | 0.0070 | 0.0067 | 11.9% | 0.0029 | 31-Mar | 18 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-15. Hourly Integrated Maxima and Minima (Relative Humidity)

**Maximum Relative Humidity**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TUD | Date | Hour | NREL | Date | Hour | NREL | Date | Hour | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | (Max-Min) /Mean* | Trane | Date | Hour |
| CE300 | 68.79 | 16-Nov | 17 | 69.35 | 16-Nov | 16 | 68.85 | 16-Nov | 16 | 68.37 | 16-Nov | 17 | 68.00 | 16-Nov | 16 | 67.44 | 16-Nov | 16 | 67.44 | 69.35 | 68.47 | 2.8% | 67.65 | 16-Nov | 17 |
| CE310 | 77.70 | 02-Oct | 4 | 100.18 | 15-Oct | 9 | 100.70 | 15-Oct | 9 | 78.64 | 2-Oct | 8 | 77.00 | 12-Jun | 8 | 78.19 | 2-Oct | 8 | 77.00 | 100.70 | 85.40 | 27.8% | 77.67 | 2-Oct | 8 |
| CE320 | 81.84 | 18-Sep | 10 | 83.41 | 2-Oct | 9 | 83.67 | 22-Apr | 18 | 82.97 | 18-Sep | 10 | 83.00 | 3-Sep | 17 | 81.88 | 16-Sep | 20 | 81.84 | 83.67 | 82.79 | 2.2% | 82.61 | 18-Sep | 10 |
| CE330 | 76.66 | 22-Sep | 20 | 78.46 | 2-Oct | 9 | 77.94 | 18-Sep | 9 | 76.88 | 3-Sep | 10 | 76.00 | 10-Jun | 18 | 78.70 | 2-Sep | 12 | 76.00 | 78.70 | 77.44 | 3.5% | 76.52 | 22-Sep | 20 |
| CE340 | 79.93 | 18-Sep | 10 | 81.37 | 18-Sep | 9 | 81.26 | 22-Apr | 18 | 80.80 | 18-Sep | 10 | 80.00 | 3-Sep | 17 | 80.25 | 16-Sep | 20 | 79.93 | 81.37 | 80.60 | 1.8% | 80.40 | 18-Sep | 10 |
| CE350 | 68.79 | 16-Nov | 17 | 81.12 | 7-Aug | 21 | 81.12 | 7-Aug | 21 | 68.37 | 16-Nov | 17 | 70.00 | 2-Oct | 8 | 72.65 | 3-Aug | 7 | 68.37 | 81.12 | 73.67 | 17.3% | 67.65 | 16-Nov | 17 |
| CE360 | 68.79 | 16-Nov | 17 | 69.35 | 16-Nov | 16 | 68.85 | 16-Nov | 16 | 68.37 | 16-Nov | 17 | 68.00 | 16-Nov | 16 | 67.44 | 16-Nov | 16 | 67.44 | 69.35 | 68.47 | 2.8% | 67.65 | 16-Nov | 17 |
| CE400 | 83.75 | 05-Apr | 22 | 85.57 | 5-Apr | 21 | 85.57 | 5-Apr | 21 | 84.64 | 5-Apr | 22 | | | | 86.31 | 22-Apr | 6 | 83.75 | 86.31 | 85.17 | 3.0% | 84.56 | 5-Apr | 22 |
| CE410 | 83.22 | 05-Apr | 22 | 84.79 | 2-Apr | 5 | 84.79 | 2-Apr | 5 | | | | | | | 86.18 | 22-Apr | 6 | 83.22 | 86.18 | 84.75 | 3.5% | 84.56 | 5-Apr | 22 |
| CE420 | 70.84 | 02-Apr | 10 | 74.51 | 17-Apr | 7 | 71.53 | 17-Apr | 3 | 73.28 | 2-Apr | 18 | | | | 73.85 | 2-Apr | 18 | 70.84 | 74.51 | 72.80 | 5.0% | 73.28 | 2-Apr | 18 |
| CE430 | 80.71 | 02-Apr | 5 | 78.43 | 2-Apr | 4 | 78.43 | 2-Apr | 4 | 80.74 | 2-Apr | 5 | | | | 78.94 | 2-Apr | 5 | 78.43 | 80.74 | 79.45 | 2.9% | 80.72 | 2-Apr | 5 |
| CE440 | 68.72 | 16-Nov | 17 | 69.35 | 16-Nov | 16 | 68.85 | 16-Nov | 16 | 68.37 | 16-Nov | 17 | | | | 67.51 | 16-Nov | 16 | 67.51 | 69.35 | 68.56 | 2.7% | 67.65 | 16-Nov | 17 |
| CE500 | 100.00 | 21-Nov | 24 | | | | | | | 100.00 | 21-Nov | 9 | 100.00 | 14-Nov | 5 | 60.08 | 1-Apr | 5 | 60.08 | 100.00 | 90.02 | 44.3% | 100.00 | 22-Nov | 8 |
| CE510 | 100.00 | 21-Nov | 24 | | | | | | | 100.00 | 21-Nov | 9 | 100.00 | 14-Nov | 5 | 57.51 | 1-Apr | 5 | 57.51 | 100.00 | 89.38 | 47.5% | 100.00 | 22-Nov | 8 |
| CE520 | 90.23 | 20-Dec | 22 | | | | | | | 93.81 | 20-Dec | 11 | 95.00 | 20-Dec | 17 | 71.77 | 16-Aug | 17 | 71.77 | 95.00 | 87.70 | 26.5% | 92.93 | 20-Dec | 11 |
| CE522 | 100.00 | 18-Dec | 8 | | | | | | | 100.00 | 15-Dec | 22 | 100.00 | 15-Dec | 1 | 71.32 | 5-Apr | 17 | 71.32 | 100.00 | 92.83 | 30.9% | 100.00 | 16-Dec | 5 |
| CE525 | 100.00 | 12-Nov | 20 | | | | | | | 100.00 | 12-Nov | 19 | 100.00 | 11-Nov | 23 | 51.12 | 1-Apr | 8 | 51.12 | 100.00 | 87.78 | 55.7% | 100.00 | 17-Nov | 8 |
| CE530 | 91.04 | 20-Dec | 22 | | | | | | | 96.16 | 20-Dec | 11 | 79.00 | 20-Dec | 8 | 36.01 | 20-Apr | 21 | 36.01 | 96.16 | 75.55 | 79.6% | 40.81 | 20-Dec | 11 |
| CE540 | 61.28 | 20-Dec | 22 | | | | | | | 55.18 | 20-Dec | 11 | 47.00 | 20-Dec | 6 | 39.96 | 18-Apr | 18 | 39.96 | 61.28 | 50.85 | 41.9% | 41.21 | 20-Dec | 11 |
| CE545 | 90.88 | 20-Dec | 22 | | | | | | | 96.23 | 20-Dec | 11 | 97.00 | 20-Dec | 4 | 24.14 | 24-Dec | 1 | 24.14 | 97.00 | 77.06 | 94.5% | 40.54 | 20-Dec | 11 |

**Minimum Relative Humidity**

| | TRNSYS | | | DOE-2.2 | | | DOE21E-E | | | EnergyPlus | | | CODYRUN | | | HOT3000 | | | Statistics, All Results | | | | TRACE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TUD | Date | Hour | | | | | | | GARD | Date | Hour | UR | Date | Hour | NRCan | Date | Hour | Min | Max | Mean | (Max-Min) /Mean* | Trane | Date | Hour |
| CE300 | 13.33 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 14.40 | 6-Nov | 6 | 15.00 | 6-Nov | 5 | 14.94 | 6-Nov | 8 | 11.97 | 15.00 | 13.60 | 22.3% | 14.38 | 6-Nov | 6 |
| CE310 | 13.39 | 06-Nov | 6 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 15.50 | 6-Nov | 8 | 16.00 | 6-Nov | 8 | 15.93 | 6-Nov | 8 | 11.97 | 16.00 | 14.13 | 28.5% | 14.42 | 6-Nov | 6 |
| CE320 | 13.33 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 14.64 | 6-Nov | 6 | 15.00 | 6-Nov | 5 | 12.92 | 20-Dec | 5 | 11.97 | 15.00 | 13.31 | 22.8% | 14.60 | 6-Nov | 6 |
| CE330 | 13.33 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 14.40 | 6-Nov | 6 | 15.00 | 6-Nov | 5 | 14.94 | 6-Nov | 8 | 11.97 | 15.00 | 13.60 | 22.3% | 14.38 | 6-Nov | 6 |
| CE340 | 13.33 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 14.40 | 6-Nov | 6 | 15.00 | 6-Nov | 5 | 14.94 | 6-Nov | 8 | 11.97 | 15.00 | 13.60 | 22.3% | 14.38 | 6-Nov | 6 |
| CE350 | 13.33 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 14.40 | 6-Nov | 6 | 15.00 | 6-Nov | 5 | 14.94 | 6-Nov | 8 | 11.97 | 15.00 | 13.60 | 22.3% | 14.38 | 6-Nov | 6 |
| CE360 | 13.33 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 14.40 | 6-Nov | 6 | 15.00 | 6-Nov | 5 | 14.94 | 6-Nov | 8 | 11.97 | 15.00 | 13.60 | 22.3% | 14.38 | 6-Nov | 6 |
| CE400 | 13.21 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 13.93 | 6-Nov | 6 | | | | 14.57 | 6-Nov | 5 | 11.97 | 14.57 | 13.13 | 19.8% | 14.04 | 6-Nov | 6 |
| CE410 | 13.21 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | | | | | | | 14.58 | 6-Nov | 5 | 11.97 | 14.58 | 12.93 | 20.2% | 14.04 | 6-Nov | 6 |
| CE420 | 13.21 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 13.93 | 6-Nov | 6 | | | | 14.59 | 6-Nov | 5 | 11.97 | 14.59 | 13.13 | 19.9% | 14.04 | 6-Nov | 6 |
| CE430 | 13.21 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 13.93 | 6-Nov | 6 | | | | 14.58 | 6-Nov | 5 | 11.97 | 14.58 | 13.13 | 19.9% | 14.04 | 6-Nov | 6 |
| CE440 | 13.21 | 06-Nov | 5 | 11.97 | 6-Nov | 4 | 11.97 | 6-Nov | 4 | 13.93 | 6-Nov | 6 | | | | 14.54 | 6-Nov | 5 | 11.97 | 14.54 | 13.12 | 19.6% | 14.04 | 6-Nov | 6 |
| CE500 | 53.41 | 30-Apr | 15 | | | | | | | 55.17 | 30-Apr | 4 | 54.00 | 4-Oct | 24 | 52.83 | 5-Oct | 1 | 52.83 | 55.17 | 53.85 | 4.3% | 52.66 | 20-Apr | 6 |
| CE510 | 52.09 | 04-Oct | 23 | | | | | | | 55.29 | 4-May | 3 | 54.00 | 4-Oct | 23 | 53.15 | 4-May | 4 | 52.09 | 55.29 | 53.63 | 6.0% | 52.70 | 20-Apr | 6 |
| CE520 | 61.27 | 25-Nov | 24 | | | | | | | 61.73 | 27-Nov | 24 | 61.00 | 27-Nov | 22 | 61.90 | 20-Jul | 15 | 61.00 | 61.90 | 61.47 | 1.5% | 61.45 | 28-Nov | 3 |
| CE522 | 58.51 | 30-Apr | 15 | | | | | | | 59.18 | 30-Apr | 4 | 60.00 | 4-Oct | 23 | 57.97 | 5-Oct | 1 | 57.97 | 60.00 | 58.91 | 3.4% | 57.17 | 20-Apr | 6 |
| CE525 | 45.53 | 30-Apr | 15 | | | | | | | 47.85 | 5-Oct | 2 | 44.00 | 4-May | 4 | 44.40 | 5-Oct | 1 | 44.00 | 47.85 | 45.45 | 8.5% | 45.31 | 20-Apr | 6 |
| CE530 | 29.59 | 04-Jun | 15 | | | | | | | 34.03 | 18-Apr | 18 | 28.00 | 1-Apr | 10 | 33.68 | 1-Apr | 13 | 28.00 | 34.03 | 31.33 | 19.2% | 14.53 | 18-Apr | 19 |
| CE540 | 36.47 | 21-Sep | 16 | | | | | | | 36.00 | 28-Sep | 16 | 31.00 | 1-Apr | 1 | 39.74 | 5-Oct | 1 | 31.00 | 39.74 | 35.80 | 24.4% | 27.01 | 28-Sep | 18 |
| CE545 | 17.12 | 20-Jul | 15 | | | | | | | 19.23 | 18-Apr | 17 | 19.00 | 1-Apr | 10 | 20.14 | 1-Apr | 12 | 17.12 | 20.14 | 18.87 | 16.0% | 8.18 | 18-Apr | 17 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-16. June 28 Hourly Output - Case CE300

| TRNSYS-TUD | Energy Consumption | | Evaporator Coil Load | | | Zone Hum. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Compressor | Cond Fan | Total | Sensible | Latent | Ratio | COP2 | ODB | EDB | EWB | OHR |
| Hour | (Wh) | (Wh) | (Wh) | (Wh) | (Wh) | (kg/kg) | | (°C) | (°C) | (°C) | (kg/kg) |
| **1** | 2056 | 257 | 8132 | 6189 | 1942 | 0.0091 | 3.517 | 18.05 | 23.41 | 16.96 | 0.0113 |
| **2** | 2054 | 257 | 8116 | 6202 | 1914 | 0.0090 | 3.513 | 18.05 | 23.37 | 16.90 | 0.0113 |
| **3** | 2054 | 257 | 8128 | 6194 | 1934 | 0.0091 | 3.517 | 18.05 | 23.38 | 16.94 | 0.0113 |
| **4** | 1830 | 230 | 7224 | 5549 | 1676 | 0.0090 | 3.507 | 17.80 | 23.37 | 16.86 | 0.0111 |
| **5** | 2029 | 256 | 8105 | 6319 | 1786 | 0.0088 | 3.546 | 17.50 | 23.35 | 16.70 | 0.0106 |
| **6** | 1839 | 230 | 7131 | 5686 | 1445 | 0.0087 | 3.447 | 18.30 | 23.42 | 16.57 | 0.0106 |
| **7** | 2667 | 309 | 9711 | 7597 | 2115 | 0.0092 | 3.263 | 22.20 | 24.04 | 17.32 | 0.0121 |
| **8** | 3553 | 384 | 12121 | 9558 | 2563 | 0.0095 | 3.079 | 26.10 | 24.57 | 17.79 | 0.0122 |
| **9** | 4365 | 458 | 14556 | 11758 | 2798 | 0.0097 | 3.018 | 28.05 | 25.09 | 17.97 | 0.0115 |
| **10** | 4441 | 458 | 14639 | 11506 | 3133 | 0.0101 | 2.988 | 28.90 | 25.28 | 18.40 | 0.0124 |
| **11** | 5000 | 506 | 16374 | 12342 | 4032 | 0.0104 | 2.974 | 30.00 | 25.36 | 18.82 | 0.0138 |
| **12** | 5317 | 529 | 17248 | 12810 | 4438 | 0.0107 | 2.950 | 30.85 | 25.59 | 19.12 | 0.0140 |
| **13** | 6189 | 617 | 20498 | 16816 | 3682 | 0.0101 | 3.012 | 30.85 | 26.53 | 18.84 | 0.0123 |
| **14** | 6211 | 616 | 20234 | 17284 | 2951 | 0.0098 | 2.964 | 31.40 | 26.56 | 18.55 | 0.0115 |
| **15** | 7922 | 781 | 26687 | 22882 | 3805 | 0.0096 | 3.066 | 31.95 | 26.78 | 18.55 | 0.0121 |
| **16** | 7965 | 781 | 26723 | 22285 | 4438 | 0.0097 | 3.055 | 32.20 | 26.56 | 18.67 | 0.0133 |
| **17** | 5421 | 529 | 17231 | 13048 | 4183 | 0.0108 | 2.896 | 31.95 | 26.20 | 19.40 | 0.0145 |
| **18** | 5410 | 529 | 17506 | 12721 | 4785 | 0.0112 | 2.947 | 31.40 | 26.23 | 19.77 | 0.0152 |
| **19** | 5260 | 529 | 17662 | 12491 | 5171 | 0.0111 | 3.051 | 29.70 | 25.70 | 19.58 | 0.0151 |
| **20** | 4880 | 506 | 16990 | 11655 | 5335 | 0.0110 | 3.154 | 27.75 | 25.17 | 19.37 | 0.0157 |
| **21** | 3939 | 409 | 13540 | 8882 | 4658 | 0.0111 | 3.114 | 27.20 | 24.65 | 19.44 | 0.0169 |
| **22** | 3924 | 410 | 13565 | 8880 | 4684 | 0.0112 | 3.130 | 26.95 | 24.74 | 19.48 | 0.0169 |
| **23** | 4123 | 434 | 14531 | 9449 | 5082 | 0.0112 | 3.189 | 26.40 | 24.67 | 19.47 | 0.0169 |
| **24** | 3877 | 410 | 13692 | 8807 | 4885 | 0.0113 | 3.194 | 26.10 | 24.73 | 19.57 | 0.0171 |

| DOE-2.2 | Energy Consumption | | Evaporator Coil Load | | | Zone Hum. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Compressor | Cond Fan | Total | Sensible | Latent | Ratio | COP2 | ODB | EDB | EWB | OHR |
| Hour | (Wh) | (Wh) | (Wh) | (Wh) | (Wh) | (kg/kg) | | (°C) | (°C) | (°C) | (kg/kg) |
| **1** | 1897 | 237 | 7552 | 5889 | 1663 | 0.0094 | 3.539 | 17.78 | 23.83 | 17.34 | 0.0114 |
| **2** | 1941 | 240 | 7630 | 6070 | 1560 | 0.0093 | 3.499 | 18.33 | 23.94 | 17.29 | 0.0112 |
| **3** | 1897 | 237 | 7550 | 5881 | 1669 | 0.0094 | 3.538 | 17.78 | 23.83 | 17.34 | 0.0114 |
| **4** | 1891 | 237 | 7534 | 5878 | 1656 | 0.0094 | 3.540 | 17.78 | 23.83 | 17.34 | 0.0114 |
| **5** | 1697 | 215 | 6798 | 5675 | 1123 | 0.0089 | 3.555 | 17.22 | 23.78 | 16.85 | 0.0103 |
| **6** | 2126 | 259 | 8136 | 6439 | 1698 | 0.0092 | 3.411 | 19.44 | 24.11 | 17.30 | 0.0113 |
| **7** | 3198 | 352 | 11076 | 8342 | 2734 | 0.0100 | 3.120 | 25.00 | 24.94 | 18.39 | 0.0133 |
| **8** | 3135 | 332 | 10291 | 9070 | 1221 | 0.0094 | 2.968 | 27.22 | 25.28 | 17.78 | 0.0109 |
| **9** | 4528 | 469 | 14786 | 11873 | 2913 | 0.0099 | 2.959 | 28.89 | 25.56 | 18.36 | 0.0117 |
| **10** | 4651 | 479 | 15340 | 12039 | 3301 | 0.0103 | 2.990 | 28.89 | 25.56 | 18.68 | 0.0125 |
| **11** | 5434 | 537 | 17455 | 12812 | 4643 | 0.0109 | 2.923 | 31.11 | 25.89 | 19.48 | 0.0148 |
| **12** | 5019 | 498 | 16215 | 12612 | 3603 | 0.0108 | 2.939 | 30.56 | 25.83 | 19.23 | 0.0134 |
| **13** | 6040 | 597 | 19723 | 17139 | 2584 | 0.0101 | 2.972 | 31.11 | 25.94 | 18.56 | 0.0115 |
| **14** | 6420 | 633 | 20808 | 17638 | 3170 | 0.0100 | 2.950 | 31.67 | 26.06 | 18.60 | 0.0121 |
| **15** | 7671 | 751 | 25387 | 22196 | 3191 | 0.0098 | 3.014 | 32.22 | 26.11 | 18.46 | 0.0119 |
| **16** | 8190 | 800 | 27581 | 22528 | 5053 | 0.0100 | 3.068 | 32.22 | 26.17 | 18.84 | 0.0144 |
| **17** | 5715 | 561 | 18205 | 13599 | 4605 | 0.0107 | 2.901 | 31.67 | 26.06 | 19.35 | 0.0146 |
| **18** | 5536 | 544 | 17933 | 12830 | 5103 | 0.0112 | 2.950 | 31.11 | 25.94 | 19.75 | 0.0157 |
| **19** | 4711 | 481 | 16012 | 11876 | 4137 | 0.0110 | 3.084 | 28.33 | 25.50 | 19.32 | 0.0143 |
| **20** | 4859 | 504 | 17082 | 11532 | 5550 | 0.0114 | 3.185 | 27.22 | 25.33 | 19.76 | 0.0164 |
| **21** | 3913 | 405 | 13435 | 9302 | 4133 | 0.0113 | 3.111 | 27.22 | 25.33 | 19.76 | 0.0164 |
| **22** | 3825 | 399 | 13280 | 8974 | 4307 | 0.0114 | 3.144 | 26.67 | 25.22 | 19.80 | 0.0167 |
| **23** | 3750 | 395 | 13192 | 8787 | 4404 | 0.0115 | 3.183 | 26.11 | 25.11 | 19.84 | 0.0169 |
| **24** | 3880 | 407 | 13724 | 8799 | 4925 | 0.0117 | 3.201 | 26.11 | 25.11 | 20.14 | 0.0178 |

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-16. June 28 Hourly Output - Case CE300 (continued)

| DOE-2.1E-E | Energy Consumption | | Evaporator Coil Load | | | Zone Hum. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Compressor | Cond Fan | Total | Sensible | Latent | Ratio | COP2 | ODB | EDB | EWB | OHR |
| Hour | (Wh) | (Wh) | (Wh) | (Wh) | (Wh) | (kg/kg) | | (°C) | (°C) | (°C) | (kg/kg) |
| **1** | 1894 | 237 | 7545 | 5887 | 1658 | 0.0094 | 3.541 | 17.78 | 23.83 | 17.34 | 0.0114 |
| **2** | 1941 | 241 | 7627 | 6067 | 1560 | 0.0093 | 3.495 | 18.33 | 23.94 | 17.29 | 0.0112 |
| **3** | 1894 | 237 | 7546 | 5878 | 1668 | 0.0094 | 3.541 | 17.78 | 23.83 | 17.37 | 0.0114 |
| **4** | 1890 | 236 | 7528 | 5873 | 1655 | 0.0094 | 3.541 | 17.78 | 23.83 | 17.37 | 0.0114 |
| **5** | 1694 | 215 | 6753 | 5672 | 1081 | 0.0090 | 3.537 | 17.22 | 23.78 | 16.94 | 0.0103 |
| **6** | 2133 | 259 | 8185 | 6439 | 1747 | 0.0092 | 3.422 | 19.44 | 24.11 | 17.30 | 0.0113 |
| **7** | 3223 | 353 | 11233 | 8348 | 2885 | 0.0098 | 3.141 | 25.00 | 24.94 | 18.23 | 0.0133 |
| **8** | 3145 | 335 | 10272 | 9069 | 1203 | 0.0094 | 2.952 | 27.22 | 25.28 | 17.78 | 0.0109 |
| **9** | 4526 | 467 | 14844 | 11875 | 2969 | 0.0099 | 2.973 | 28.89 | 25.56 | 18.28 | 0.0117 |
| **10** | 4655 | 478 | 15393 | 12041 | 3352 | 0.0102 | 2.999 | 28.89 | 25.56 | 18.60 | 0.0125 |
| **11** | 5456 | 536 | 17605 | 12818 | 4787 | 0.0107 | 2.938 | 31.11 | 25.89 | 19.33 | 0.0148 |
| **12** | 5015 | 498 | 16188 | 12611 | 3577 | 0.0108 | 2.936 | 30.56 | 25.83 | 19.23 | 0.0134 |
| **13** | 6036 | 600 | 19621 | 17135 | 2486 | 0.0102 | 2.957 | 31.11 | 25.94 | 18.64 | 0.0115 |
| **14** | 6429 | 635 | 20819 | 17639 | 3180 | 0.0100 | 2.947 | 31.67 | 26.06 | 18.60 | 0.0121 |
| **15** | 7683 | 754 | 25393 | 22197 | 3196 | 0.0098 | 3.010 | 32.22 | 26.11 | 18.46 | 0.0119 |
| **16** | 8222 | 803 | 27721 | 22533 | 5188 | 0.0098 | 3.072 | 32.22 | 26.17 | 18.76 | 0.0144 |
| **17** | 5696 | 556 | 18245 | 13600 | 4644 | 0.0107 | 2.918 | 31.67 | 26.06 | 19.35 | 0.0146 |
| **18** | 5531 | 541 | 17978 | 12832 | 5146 | 0.0112 | 2.961 | 31.11 | 25.94 | 19.68 | 0.0157 |
| **19** | 4689 | 479 | 15914 | 11871 | 4043 | 0.0111 | 3.079 | 28.33 | 25.50 | 19.40 | 0.0143 |
| **20** | 4855 | 503 | 17120 | 11534 | 5586 | 0.0113 | 3.195 | 27.22 | 25.33 | 19.76 | 0.0164 |
| **21** | 3918 | 406 | 13445 | 9303 | 4142 | 0.0113 | 3.109 | 27.22 | 25.33 | 19.76 | 0.0164 |
| **22** | 3823 | 399 | 13285 | 8974 | 4311 | 0.0114 | 3.147 | 26.67 | 25.22 | 19.80 | 0.0167 |
| **23** | 3748 | 394 | 13192 | 8787 | 4405 | 0.0115 | 3.185 | 26.11 | 25.11 | 19.84 | 0.0169 |
| **24** | 3880 | 407 | 13754 | 8800 | 4955 | 0.0117 | 3.208 | 26.11 | 25.11 | 20.06 | 0.0178 |

| EnergyPlus | Energy Consumption | | Evaporator Coil Load | | | Zone Hum. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Compressor | Cond Fan | Total | Sensible | Latent | Ratio | COP2 | ODB | EDB | EWB | OHR |
| Hour | (Wh) * | (Wh) * | (Wh) | (Wh) | (Wh) | (kg/kg) | | (°C) | (°C) | (°C) | (kg/kg) |
| **1** | 2119 | | 7472 | 5811 | 1661 | 0.0094 | 3.527 | 17.99 | 23.95 | | 0.0112 |
| **2** | 2131 | | 7494 | 5853 | 1641 | 0.0094 | 3.516 | 18.11 | 23.96 | | 0.0113 |
| **3** | 2113 | | 7447 | 5809 | 1637 | 0.0094 | 3.525 | 17.99 | 23.95 | | 0.0112 |
| **4** | 2075 | | 7332 | 5744 | 1588 | 0.0093 | 3.534 | 17.80 | 23.92 | | 0.0111 |
| **5** | 1997 | | 7091 | 5614 | 1477 | 0.0092 | 3.550 | 17.43 | 23.86 | | 0.0105 |
| **6** | 2142 | | 7425 | 6015 | 1410 | 0.0090 | 3.467 | 18.58 | 24.03 | | 0.0106 |
| **7** | 2870 | | 9216 | 7532 | 1684 | 0.0093 | 3.212 | 22.90 | 24.68 | | 0.0123 |
| **8** | 3499 | | 10609 | 8757 | 1853 | 0.0096 | 3.033 | 26.38 | 25.21 | | 0.0118 |
| **9** | 4682 | | 14032 | 11767 | 2265 | 0.0098 | 2.997 | 28.26 | 25.49 | | 0.0116 |
| **10** | 4948 | | 14778 | 11996 | 2781 | 0.0102 | 2.987 | 28.90 | 25.59 | | 0.0124 |
| **11** | 5407 | | 15905 | 12488 | 3417 | 0.0106 | 2.942 | 30.28 | 25.79 | | 0.0140 |
| **12** | 5632 | | 16522 | 12671 | 3851 | 0.0109 | 2.933 | 30.79 | 25.87 | | 0.0138 |
| **13** | 7133 | | 21588 | 17401 | 4187 | 0.0104 | 3.027 | 30.91 | 25.88 | | 0.0120 |
| **14** | 6983 | | 20678 | 17592 | 3086 | 0.0100 | 2.961 | 31.48 | 25.97 | | 0.0115 |
| **15** | 8572 | | 26133 | 22481 | 3652 | 0.0098 | 3.049 | 32.01 | 26.05 | | 0.0121 |
| **16** | 8733 | | 26665 | 22557 | 4107 | 0.0099 | 3.053 | 32.20 | 26.08 | | 0.0135 |
| **17** | 5718 | | 16345 | 13061 | 3283 | 0.0106 | 2.858 | 31.89 | 26.04 | | 0.0145 |
| **18** | 5881 | | 17193 | 12870 | 4324 | 0.0112 | 2.924 | 31.33 | 25.95 | | 0.0153 |
| **19** | 5555 | | 16878 | 12170 | 4708 | 0.0113 | 3.038 | 29.35 | 25.65 | | 0.0149 |
| **20** | 5259 | | 16536 | 11556 | 4981 | 0.0113 | 3.144 | 27.61 | 25.39 | | 0.0159 |
| **21** | 4326 | | 13445 | 9063 | 4383 | 0.0116 | 3.108 | 27.20 | 25.33 | | 0.0168 |
| **22** | 4279 | | 13387 | 8953 | 4434 | 0.0116 | 3.129 | 26.89 | 25.29 | | 0.0168 |
| **23** | 4173 | | 13191 | 8753 | 4437 | 0.0116 | 3.161 | 26.33 | 25.20 | | 0.0168 |
| **24** | 4152 | | 13196 | 8674 | 4522 | 0.0117 | 3.178 | 26.10 | 25.17 | | 0.0171 |

* For EnergyPlus results, the reported compressor energy includes the condenser fan energy.

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-16. J u n e 2 8 H o u r l y O u t p u t - C a s e C E 3 0 0 (continued)

| CODYRUN | Energy Consumption | | Evaporator Coil Load | | | Zone Hum. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Compressor | Cond Fan | Total | Sensible | Latent | Ratio | COP2 | ODB | EDB | EWB | OHR |
| Hour | (Wh) | (Wh) | (Wh) | (Wh) | (Wh) | (kg/kg) | | (°C) | (°C) | (°C) | (kg/kg) |
| **1** | 1886 | 237 | 7472 | 5788 | 1684 | 0.0093 | 3.520 | 17.80 | 23.92 | 17.16 | 0.0111 |
| **2** | 1964 | 244 | 7707 | 5961 | 1747 | 0.0093 | 3.490 | 18.30 | 24.00 | 17.24 | 0.0115 |
| **3** | 1881 | 236 | 7445 | 5788 | 1657 | 0.0092 | 3.517 | 17.80 | 23.92 | 17.12 | 0.0111 |
| **4** | 1878 | 236 | 7432 | 5788 | 1644 | 0.0092 | 3.516 | 17.80 | 23.92 | 17.10 | 0.0111 |
| **5** | 1756 | 224 | 7000 | 5580 | 1420 | 0.0090 | 3.535 | 17.20 | 23.83 | 16.79 | 0.0102 |
| **6** | 2075 | 253 | 7915 | 6341 | 1574 | 0.0090 | 3.400 | 19.40 | 24.16 | 17.03 | 0.0110 |
| **7** | 3035 | 334 | 10450 | 8277 | 2173 | 0.0095 | 3.102 | 25.00 | 25.00 | 17.91 | 0.0131 |
| **8** | 3303 | 352 | 10813 | 9038 | 1775 | 0.0093 | 2.958 | 27.20 | 25.33 | 17.65 | 0.0111 |
| **9** | 4483 | 463 | 14631 | 11971 | 2660 | 0.0097 | 2.958 | 28.90 | 25.59 | 18.12 | 0.0120 |
| **10** | 4594 | 472 | 15099 | 11971 | 3128 | 0.0100 | 2.980 | 28.90 | 25.59 | 18.44 | 0.0128 |
| **11** | 5238 | 516 | 16722 | 12731 | 3991 | 0.0106 | 2.906 | 31.10 | 25.91 | 19.14 | 0.0148 |
| **12** | 5066 | 504 | 16258 | 12559 | 3699 | 0.0106 | 2.919 | 30.60 | 25.84 | 18.94 | 0.0133 |
| **13** | 6442 | 642 | 21090 | 17422 | 3669 | 0.0100 | 2.977 | 31.10 | 25.91 | 18.33 | 0.0113 |
| **14** | 6523 | 645 | 21067 | 17629 | 3438 | 0.0098 | 2.939 | 31.70 | 26.00 | 18.27 | 0.0117 |
| **15** | 8000 | 785 | 26636 | 22491 | 4145 | 0.0096 | 3.032 | 32.20 | 26.08 | 18.24 | 0.0124 |
| **16** | 8169 | 799 | 27416 | 22491 | 4925 | 0.0097 | 3.057 | 32.20 | 26.08 | 18.56 | 0.0142 |
| **17** | 5306 | 519 | 16702 | 12939 | 3763 | 0.0104 | 2.867 | 31.70 | 26.00 | 19.06 | 0.0147 |
| **18** | 5381 | 528 | 17312 | 12729 | 4582 | 0.0109 | 2.930 | 31.10 | 25.91 | 19.46 | 0.0157 |
| **19** | 4791 | 492 | 16232 | 11761 | 4470 | 0.0109 | 3.072 | 28.30 | 25.50 | 19.20 | 0.0145 |
| **20** | 4809 | 498 | 16867 | 11381 | 5486 | 0.0113 | 3.178 | 27.20 | 25.33 | 19.65 | 0.0169 |
| **21** | 3939 | 408 | 13484 | 9036 | 4447 | 0.0113 | 3.102 | 27.20 | 25.33 | 19.71 | 0.0169 |
| **22** | 3852 | 402 | 13322 | 8864 | 4459 | 0.0114 | 3.132 | 26.70 | 25.25 | 19.70 | 0.0168 |
| **23** | 3752 | 395 | 13139 | 8656 | 4482 | 0.0114 | 3.168 | 26.10 | 25.16 | 19.69 | 0.0169 |
| **24** | 3794 | 399 | 13323 | 8656 | 4666 | 0.0115 | 3.177 | 26.10 | 25.16 | 19.81 | 0.0173 |

| HOT3000 | Energy Consumption | | Evaporator Coil Load | | | Zone Hum. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Compressor | Cond Fan | Total | Sensible | Latent | Ratio | COP2 | ODB | EDB | EWB | OHR |
| Hour | (Wh) | (Wh) | (Wh) | (Wh) | (Wh) | (kg/kg) | | (°C) | (°C) | (°C) | (kg/kg) |
| **1** | 1943 | 241 | 7668 | 5870 | 1798 | 0.0093 | 3.511 | 17.80 | 23.94 | 17.30 | 0.0111 |
| **2** | 1951 | 241 | 7674 | 5872 | 1803 | 0.0093 | 3.502 | 18.30 | 23.94 | 17.31 | 0.0114 |
| **3** | 1902 | 237 | 7528 | 5783 | 1745 | 0.0092 | 3.519 | 17.80 | 23.90 | 17.24 | 0.0111 |
| **4** | 1845 | 231 | 7317 | 5683 | 1634 | 0.0091 | 3.524 | 17.80 | 23.84 | 17.08 | 0.0111 |
| **5** | 1914 | 239 | 7514 | 5955 | 1559 | 0.0090 | 3.490 | 17.20 | 23.98 | 17.01 | 0.0102 |
| **6** | 2507 | 293 | 9223 | 7312 | 1911 | 0.0092 | 3.295 | 19.40 | 24.58 | 17.54 | 0.0110 |
| **7** | 3171 | 343 | 10770 | 8647 | 2123 | 0.0095 | 3.065 | 25.00 | 25.16 | 17.99 | 0.0131 |
| **8** | 3434 | 361 | 11186 | 9299 | 1888 | 0.0094 | 2.948 | 27.20 | 25.45 | 17.96 | 0.0110 |
| **9** | 4489 | 461 | 14744 | 11923 | 2821 | 0.0097 | 2.979 | 28.90 | 25.58 | 18.33 | 0.0120 |
| **10** | 4853 | 489 | 15882 | 12287 | 3595 | 0.0102 | 2.973 | 28.90 | 25.74 | 18.85 | 0.0127 |
| **11** | 5164 | 508 | 16615 | 12562 | 4053 | 0.0106 | 2.929 | 31.10 | 25.86 | 19.19 | 0.0148 |
| **12** | 5005 | 497 | 16030 | 12561 | 3468 | 0.0104 | 2.914 | 30.60 | 25.86 | 18.87 | 0.0132 |
| **13** | 6455 | 639 | 21180 | 17431 | 3749 | 0.0100 | 2.986 | 31.10 | 25.94 | 18.52 | 0.0113 |
| **14** | 6503 | 640 | 21055 | 17609 | 3447 | 0.0097 | 2.948 | 31.70 | 26.02 | 18.44 | 0.0117 |
| **15** | 8041 | 785 | 27070 | 22350 | 4719 | 0.0098 | 3.067 | 32.20 | 26.13 | 18.65 | 0.0123 |
| **16** | 8134 | 794 | 27623 | 22292 | 5331 | 0.0098 | 3.094 | 32.20 | 26.03 | 18.80 | 0.0142 |
| **17** | 5212 | 510 | 16551 | 12739 | 3812 | 0.0103 | 2.893 | 31.70 | 25.94 | 19.11 | 0.0147 |
| **18** | 5122 | 507 | 16830 | 12181 | 4649 | 0.0109 | 2.990 | 31.10 | 25.70 | 19.39 | 0.0156 |
| **19** | 4832 | 493 | 16635 | 11541 | 5095 | 0.0110 | 3.124 | 28.30 | 25.41 | 19.53 | 0.0145 |
| **20** | 4875 | 501 | 17131 | 11359 | 5772 | 0.0114 | 3.187 | 27.20 | 25.33 | 19.74 | 0.0168 |
| **21** | 3936 | 406 | 13525 | 8931 | 4593 | 0.0114 | 3.115 | 27.20 | 25.29 | 19.74 | 0.0168 |
| **22** | 3844 | 399 | 13356 | 8747 | 4609 | 0.0114 | 3.148 | 26.70 | 25.21 | 19.79 | 0.0168 |
| **23** | 3807 | 397 | 13343 | 8647 | 4697 | 0.0114 | 3.173 | 26.10 | 25.16 | 19.84 | 0.0168 |
| **24** | 3664 | 386 | 12973 | 8360 | 4613 | 0.0115 | 3.203 | 26.10 | 25.04 | 19.77 | 0.0173 |

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-16. June 28 Hourly Output - Case CE300 (continued)

| TRACE | Energy Consumption | | Evaporator Coil Load | | | Zone Hum. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Compressor | Cond Fan | Total | Sensible | Latent | Ratio | COP2 | ODB | EDB | EWB | OHR |
| Hour | (Wh) | (Wh) | (Wh) | (Wh) | (Wh) | (kg/kg) | | (°C) | (°C) | (°C) | (kg/kg) |
| **1** | 2156 | | 7614 | 5823 | 1790 | 0.0092 | 3.531 | 17.99 | 23.95 | 17.27 | 0.0112 |
| **2** | 2170 | | 7640 | 5866 | 1774 | 0.0092 | 3.521 | 18.11 | 23.96 | 17.25 | 0.0113 |
| **3** | 2151 | | 7591 | 5822 | 1769 | 0.0092 | 3.529 | 17.99 | 23.95 | 17.25 | 0.0112 |
| **4** | 2113 | | 7475 | 5756 | 1719 | 0.0092 | 3.538 | 17.80 | 23.92 | 17.19 | 0.0111 |
| **5** | 2034 | | 7228 | 5625 | 1603 | 0.0090 | 3.554 | 17.43 | 23.86 | 17.03 | 0.0105 |
| **6** | 2184 | | 7573 | 6027 | 1546 | 0.0089 | 3.467 | 18.58 | 24.03 | 16.99 | 0.0106 |
| **7** | 2930 | | 9406 | 7546 | 1860 | 0.0092 | 3.210 | 22.90 | 24.68 | 17.52 | 0.0123 |
| **8** | 3575 | | 10831 | 8769 | 2062 | 0.0095 | 3.030 | 26.38 | 25.21 | 17.94 | 0.0118 |
| **9** | 4775 | | 14292 | 11781 | 2511 | 0.0096 | 2.993 | 28.26 | 25.49 | 18.05 | 0.0116 |
| **10** | 5033 | | 15021 | 12012 | 3008 | 0.0100 | 2.984 | 28.90 | 25.59 | 18.42 | 0.0124 |
| **11** | 5491 | | 16148 | 12507 | 3642 | 0.0104 | 2.941 | 30.28 | 25.80 | 18.91 | 0.0139 |
| **12** | 5714 | | 16760 | 12688 | 4072 | 0.0107 | 2.933 | 30.79 | 25.87 | 19.19 | 0.0138 |
| **13** | 7232 | | 21872 | 17406 | 4465 | 0.0101 | 3.024 | 30.91 | 25.89 | 18.76 | 0.0120 |
| **14** | 7085 | | 20932 | 17600 | 3332 | 0.0097 | 2.955 | 31.48 | 25.98 | 18.33 | 0.0115 |
| **15** | 8690 | | 26437 | 22487 | 3950 | 0.0095 | 3.042 | 32.01 | 26.06 | 18.30 | 0.0121 |
| **16** | 8845 | | 26956 | 22566 | 4390 | 0.0096 | 3.048 | 32.20 | 26.09 | 18.48 | 0.0135 |
| **17** | 5799 | | 16552 | 13084 | 3468 | 0.0103 | 2.854 | 31.89 | 26.04 | 18.95 | 0.0145 |
| **18** | 5960 | | 17432 | 12890 | 4542 | 0.0109 | 2.925 | 31.33 | 25.96 | 19.46 | 0.0153 |
| **19** | 5624 | | 17103 | 12189 | 4914 | 0.0111 | 3.041 | 29.35 | 25.66 | 19.50 | 0.0149 |
| **20** | 5323 | | 16768 | 11579 | 5190 | 0.0111 | 3.150 | 27.61 | 25.39 | 19.52 | 0.0160 |
| **21** | 4377 | | 13637 | 9086 | 4551 | 0.0113 | 3.115 | 27.20 | 25.33 | 19.77 | 0.0168 |
| **22** | 4331 | | 13586 | 8975 | 4610 | 0.0114 | 3.137 | 26.89 | 25.29 | 19.80 | 0.0168 |
| **23** | 4223 | | 13389 | 8776 | 4613 | 0.0114 | 3.170 | 26.33 | 25.20 | 19.79 | 0.0168 |
| **24** | 4202 | | 13396 | 8697 | 4699 | 0.0114 | 3.188 | 26.10 | 25.17 | 19.84 | 0.0171 |

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-17. Delta Annual Space Cooling Electricity Consumptions (Total, Compressor)

| **Total (kWh,e)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 4340 | 4629 | 4629 | 4545 | 4543 | 4538 | 4340 | 4629 | 4537 | 6.4% | 4410 |
| CE320-CE300 | 4426 | 3995 | 4037 | 4333 | 4424 | 4387 | 3995 | 4426 | 4267 | 10.1% | 4263 |
| CE330-CE300 | 5330 | 4958 | 4683 | 5398 | 5559 | 5260 | 4683 | 5559 | 5198 | 16.8% | 5405 |
| CE330-CE320 | 904 | 963 | 646 | 1064 | 1134 | 873 | 646 | 1134 | 931 | 52.5% | 1142 |
| CE340-CE300 | 4986 | 4608 | 4510 | 5037 | 5089 | 4877 | 4510 | 5089 | 4851 | 11.9% | 5021 |
| CE330-CE340 | 344 | 350 | 173 | 360 | 470 | 383 | 173 | 470 | 347 | 85.6% | 384 |
| CE350-CE300 | -3397 | -4203 | -4207 | -3601 | -3390 | -3328 | -4207 | -3328 | -3688 | 23.8% | -3615 |
| CE360-CE300 | 19665 | 19314 | 19261 | 19959 | 19867 | 19998 | 19261 | 19998 | 19677 | 3.7% | 19895 |
| CE400-CE300 | -3589 | -3904 | -3879 | -3733 | | -3657 | -3904 | -3589 | -3752 | 8.4% | -4365 |
| CE410-CE300 | -3555 | -3082 | -3056 | | | -3567 | -3567 | -3056 | -3315 | 15.4% | -4365 |
| CE420-CE300 | -2247 | -2220 | -1845 | -2010 | | -1862 | -2247 | -1845 | -2037 | 19.7% | -2052 |
| CE430-CE300 | -3096 | -2818 | -2944 | -2973 | | -3252 | -3252 | -2818 | -3017 | 14.4% | -2908 |
| CE440-CE300 | -1942 | -1718 | -1782 | -1714 | | -1822 | -1942 | -1714 | -1796 | 12.7% | -1733 |
| CE500-CE300 | -13296 | -11933 | -11933 | -11711 | -12653 | -11932 | -13296 | -11711 | -12243 | 12.9% | -11981 |
| CE510-CE500 | 17218 | 18099 | 18100 | 17736 | 17414 | 17794 | 17218 | 18100 | 17727 | 5.0% | 17754 |
| CE525-CE520 | -4666 | -4981 | -4969 | -4316 | -4889 | -4458 | -4981 | -4316 | -4713 | 14.1% | -5035 |
| CE530-CE500 | -5057 | -5277 | -5285 | -5293 | -4880 | -5263 | -5293 | -4880 | -5176 | 8.0% | -4600 |
| CE545-CE540 | -3743 | -4076 | -4083 | -2425 | -3745 | -3825 | -4083 | -2425 | -3650 | 45.4% | -3193 |

| **Compressor (kWh,e)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 3986 | 4244 | 4244 | | 4167 | 4177 | 3986 | 4244 | 4164 | 6.2% | |
| CE320-CE300 | 4080 | 3681 | 3721 | | 4076 | 4036 | 3681 | 4080 | 3919 | 10.2% | |
| CE330-CE300 | 4946 | 4603 | 4352 | | 5158 | 4899 | 4352 | 5158 | 4792 | 16.8% | |
| CE330-CE320 | 867 | 922 | 631 | | 1082 | 863 | 631 | 1082 | 873 | 51.6% | |
| CE340-CE300 | 4609 | 4260 | 4172 | | 4703 | 4524 | 4172 | 4703 | 4454 | 11.9% | |
| CE330-CE340 | 337 | 343 | 180 | | 455 | 375 | 180 | 455 | 338 | 81.4% | |
| CE350-CE300 | -3037 | -3767 | -3772 | | -3032 | -2985 | -3772 | -2985 | -3319 | 23.7% | |
| CE360-CE300 | 17752 | 17430 | 17382 | | 17927 | 18065 | 17382 | 18065 | 17711 | 3.9% | |
| CE400-CE300 | -3175 | -3463 | -3442 | | | -3247 | -3463 | -3175 | -3332 | 8.7% | |
| CE410-CE300 | -3149 | -2746 | -2723 | | | -3191 | -3191 | -2723 | -2952 | 15.9% | |
| CE420-CE300 | -1995 | -1973 | -1639 | | | -1662 | -1995 | -1639 | -1817 | 19.6% | |
| CE430-CE300 | -2755 | -2510 | -2622 | | | -2910 | -2910 | -2510 | -2699 | 14.8% | |
| CE440-CE300 | -1724 | -1527 | -1584 | | | -1627 | -1724 | -1527 | -1616 | 12.2% | |
| CE500-CE300 | -4499 | -3096 | -3095 | | -3912 | -3354 | -4499 | -3095 | -3591 | 39.1% | |
| CE510-CE500 | 13806 | 14303 | 14304 | | 13913 | 14230 | 13806 | 14304 | 14111 | 3.5% | |
| CE525-CE520 | -2963 | -3241 | -3233 | | -3148 | -2742 | -3241 | -2742 | -3066 | 16.3% | |
| CE530-CE500 | -4197 | -4346 | -4354 | | -4002 | -4350 | -4354 | -4002 | -4250 | 8.3% | |
| CE545-CE540 | -2399 | -2713 | -2720 | | -2413 | -2449 | -2720 | -2399 | -2539 | 12.6% | |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-18. Delta Annual Space Cooling Electricity Consumptions (Fans)

| **Supply Fan (kWh,e)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE320-CE300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE330-CE300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE330-CE320 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE340-CE300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE330-CE340 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE350-CE300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE360-CE300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ---- | 0 |
| CE400-CE300 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | ---- | 0 |
| CE410-CE300 | 0 | 0 | 0 | | | 0 | 0 | 0 | 0 | ---- | 0 |
| CE420-CE300 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | ---- | 0 |
| CE430-CE300 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | ---- | 0 |
| CE440-CE300 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | ---- | 0 |
| CE500-CE300 | -8316 | -8511 | -8511 | -8234 | -8327 | -8241 | -8511 | -8234 | -8357 | 3.3% | -8233 |
| CE510-CE500 | 1951 | 2262 | 2262 | 2034 | 2002 | 2038 | 1951 | 2262 | 2092 | 14.9% | 2034 |
| CE525-CE520 | -973 | -988 | -986 | -839 | -996 | -979 | -996 | -839 | -960 | 16.3% | -949 |
| CE530-CE500 | -491 | -536 | -536 | -538 | -502 | -522 | -538 | -491 | -521 | 9.0% | -309 |
| CE545-CE540 | -769 | -757 | -757 | -438 | -762 | -787 | -787 | -438 | -712 | 49.0% | -453 |

| **Condenser Fan (kWh,e)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 354 | 385 | 385 | | 376 | 368 | 354 | 385 | 374 | 8.4% | |
| CE320-CE300 | 346 | 314 | 316 | | 348 | 358 | 314 | 358 | 337 | 13.1% | |
| CE330-CE300 | 383 | 355 | 331 | | 401 | 370 | 331 | 401 | 368 | 19.0% | |
| CE330-CE320 | 37 | 41 | 15 | | 53 | 12 | 12 | 53 | 32 | 128.8% | |
| CE340-CE300 | 376 | 348 | 338 | | 386 | 361 | 338 | 386 | 362 | 13.3% | |
| CE330-CE340 | 7 | 7 | -7 | | 15 | 9 | -7 | 15 | 6 | 352.1% | |
| CE350-CE300 | -360 | -436 | -435 | | -358 | -353 | -436 | -353 | -388 | 21.4% | |
| CE360-CE300 | 1913 | 1884 | 1879 | | 1940 | 1949 | 1879 | 1949 | 1913 | 3.7% | |
| CE400-CE300 | -414 | -441 | -437 | | | -421 | -441 | -414 | -428 | 6.3% | |
| CE410-CE300 | -406 | -336 | -333 | | | -387 | -406 | -333 | -366 | 20.1% | |
| CE420-CE300 | -252 | -247 | -206 | | | -208 | -252 | -206 | -228 | 20.1% | |
| CE430-CE300 | -341 | -308 | -322 | | | -353 | -353 | -308 | -331 | 13.6% | |
| CE440-CE300 | -218 | -191 | -198 | | | -203 | -218 | -191 | -203 | 13.4% | |
| CE500-CE300 | -481 | -326 | -327 | | -415 | -347 | -481 | -326 | -379 | 40.8% | |
| CE510-CE500 | 1461 | 1534 | 1534 | | 1499 | 1526 | 1461 | 1534 | 1511 | 4.8% | |
| CE525-CE520 | -729 | -752 | -750 | | -746 | -733 | -752 | -729 | -742 | 3.1% | |
| CE530-CE500 | -368 | -395 | -395 | | -376 | -391 | -395 | -368 | -385 | 7.0% | |
| CE545-CE540 | -576 | -606 | -606 | | -571 | -589 | -606 | -571 | -589 | 6.0% | |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-19. Delta Annual Cooling Coil Loads

| **Sensible Coil Load (kWh,th)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | -405 | 504 | 508 | -27 | -24 | -108 | -405 | 508 | 75 | 1224.5% | -30 |
| CE320-CE300 | 6197 | 6900 | 6942 | 6791 | 6799 | 7543 | 6197 | 7543 | 6862 | 19.6% | 6376 |
| CE330-CE300 | 6422 | 7514 | 7523 | 8527 | 7440 | 6631 | 6422 | 8527 | 7343 | 28.7% | 7746 |
| CE330-CE320 | 224 | 614 | 581 | 1735 | 641 | -912 | -912 | 1735 | 480 | 550.9% | 1370 |
| CE340-CE300 | 6371 | 7257 | 7306 | 7634 | 7171 | 6215 | 6215 | 7634 | 6992 | 20.3% | 7157 |
| CE330-CE340 | 51 | 258 | 217 | 893 | 269 | 416 | 51 | 893 | 351 | 240.2% | 590 |
| CE350-CE300 | -6291 | -8112 | -8128 | -6707 | -6621 | -6423 | -8128 | -6291 | -7047 | 26.1% | -6623 |
| CE360-CE300 | 78315 | 79123 | 79135 | 80035 | 78996 | 79506 | 78315 | 80035 | 79185 | 2.2% | 79598 |
| CE400-CE300 | -14709 | -14378 | -14368 | -14564 | | -14010 | -14709 | -14010 | -14406 | 4.9% | -13717 |
| CE410-CE300 | -10985 | -8138 | -8145 | | | -9606 | -10985 | -8138 | -9219 | 30.9% | -13717 |
| CE420-CE300 | -6272 | -6131 | -5193 | -5728 | | -5207 | -6272 | -5193 | -5706 | 18.9% | -5748 |
| CE430-CE300 | -8798 | -8066 | -8351 | -8513 | | -9048 | -9048 | -8066 | -8555 | 11.5% | -8190 |
| CE440-CE300 | -5786 | -5204 | -5313 | -5192 | | -5406 | -5786 | -5192 | -5380 | 11.0% | -5149 |
| CE500-CE300 | -11618 | -8147 | -8159 | -7761 | -10335 | -7661 | -11618 | -7661 | -8947 | 44.2% | -7809 |
| CE510-CE500 | 43046 | 45710 | 45710 | 45091 | 43051 | 45083 | 43046 | 45710 | 44615 | 6.0% | 45091 |
| CE525-CE520 | -131 | -884 | -882 | -1057 | -202 | -949 | -1057 | -131 | -684 | 135.4% | -1166 |
| CE530-CE500 | 2 | -1076 | -1076 | -547 | 0 | -528 | -1076 | 2 | -538 | 200.6% | -316 |
| CE545-CE540 | -130 | -809 | -809 | -676 | -202 | -792 | -809 | -130 | -570 | 119.1% | -670 |

| **Latent Coil Load(kWh,th)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 19321 | 19607 | 19612 | 19156 | 19576 | 19111 | 19111 | 19612 | 19397 | 2.6% | 19051 |
| CE320-CE300 | 13167 | 12173 | 12259 | 11974 | 12597 | 11157 | 11157 | 13167 | 12221 | 16.4% | 12429 |
| CE330-CE300 | 18164 | 15932 | 16179 | 16367 | 18528 | 17119 | 15932 | 18528 | 17048 | 15.2% | 17578 |
| CE330-CE320 | 4997 | 3760 | 3919 | 4393 | 5931 | 5962 | 3760 | 5962 | 4827 | 45.6% | 5149 |
| CE340-CE300 | 15930 | 14488 | 14625 | 14757 | 15760 | 15279 | 14488 | 15930 | 15140 | 9.5% | 15557 |
| CE330-CE340 | 2234 | 1445 | 1553 | 1610 | 2768 | 1840 | 1445 | 2768 | 1908 | 69.3% | 2021 |
| CE350-CE300 | -4748 | -5435 | -5529 | -4821 | -4264 | -4446 | -5529 | -4264 | -4874 | 26.0% | -4857 |
| CE360-CE300 | 4232 | 3401 | 3427 | 3895 | 4459 | 4403 | 3401 | 4459 | 3970 | 26.7% | 4216 |
| CE400-CE300 | 3075 | 2012 | 2101 | 2660 | | 2650 | 2012 | 3075 | 2500 | 42.5% | -932 |
| CE410-CE300 | -769 | -2366 | -2303 | | | -2477 | -2477 | -769 | -1979 | 86.3% | -932 |
| CE420-CE300 | -1546 | -1542 | -1217 | -1240 | | -1212 | -1546 | -1212 | -1351 | 24.7% | -1361 |
| CE430-CE300 | -1872 | -1577 | -1722 | -1663 | | -2010 | -2010 | -1577 | -1769 | 24.5% | -1749 |
| CE440-CE300 | -930 | -699 | -798 | -709 | | -823 | -930 | -699 | -792 | 29.1% | -802 |
| CE500-CE300 | -5452 | -3141 | -3141 | -3986 | -4304 | -4983 | -5452 | -3141 | -4168 | 55.5% | -5015 |
| CE510-CE500 | 17485 | 17615 | 17615 | 17348 | 17488 | 17340 | 17340 | 17615 | 17482 | 1.6% | 17348 |
| CE525-CE520 | 2 | -288 | -288 | -58 | -9 | -42 | -288 | 2 | -114 | 255.0% | -56 |
| CE530-CE500 | -18313 | -18285 | -18286 | -18080 | -18230 | -18084 | -18313 | -18080 | -18213 | 1.3% | -18081 |
| CE545-CE540 | -1 | -81 | -81 | -9 | -3 | -2 | -81 | -1 | -30 | 272.0% | 0 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-20. Delta Various Annual Means (COP2, IDB)

| **COP2** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.166 | 0.180 | 0.180 | 0.155 | 0.171 | 0.150 | 0.150 | 0.180 | 0.167 | 18.0% | 0.165 |
| CE320-CE300 | 0.171 | 0.220 | 0.220 | 0.168 | 0.180 | 0.160 | 0.160 | 0.220 | 0.186 | 32.3% | 0.175 |
| CE330-CE300 | 0.242 | 0.256 | 0.299 | 0.253 | 0.271 | 0.230 | 0.230 | 0.299 | 0.259 | 26.7% | 0.264 |
| CE330-CE320 | 0.071 | 0.036 | 0.079 | 0.086 | 0.091 | 0.070 | 0.036 | 0.091 | 0.072 | 76.3% | 0.088 |
| CE340-CE300 | 0.205 | 0.240 | 0.258 | 0.210 | 0.223 | 0.190 | 0.190 | 0.258 | 0.221 | 30.9% | 0.220 |
| CE330-CE340 | 0.036 | 0.017 | 0.041 | 0.043 | 0.048 | 0.040 | 0.017 | 0.048 | 0.037 | 82.5% | 0.043 |
| CE350-CE300 | 0.000 | 0.003 | -0.002 | 0.006 | 0.003 | 0.000 | -0.002 | 0.006 | 0.002 | 498.6% | 0.012 |
| CE360-CE300 | 0.420 | 0.463 | 0.468 | 0.441 | 0.440 | 0.430 | 0.420 | 0.468 | 0.444 | 10.9% | 0.438 |
| CE400-CE300 | 0.001 | 0.014 | 0.015 | 0.009 | | 0.030 | 0.001 | 0.030 | 0.014 | 210.3% | -0.025 |
| CE410-CE300 | -0.010 | -0.025 | -0.027 | | | -0.020 | -0.027 | -0.010 | -0.020 | 84.0% | -0.025 |
| CE420-CE300 | -0.023 | -0.022 | -0.020 | -0.021 | | -0.020 | -0.023 | -0.020 | -0.021 | 14.9% | -0.021 |
| CE430-CE300 | -0.028 | -0.025 | -0.026 | -0.026 | | -0.020 | -0.028 | -0.020 | -0.025 | 33.0% | -0.024 |
| CE440-CE300 | -0.018 | -0.015 | -0.015 | -0.016 | | -0.010 | -0.018 | -0.010 | -0.015 | 51.9% | -0.015 |
| CE500-CE300 | -0.045 | -0.010 | -0.011 | -0.024 | -0.034 | -0.030 | -0.045 | -0.010 | -0.026 | 135.4% | -0.033 |
| CE510-CE500 | 0.409 | 0.416 | 0.416 | 0.408 | 0.397 | 0.410 | 0.397 | 0.416 | 0.409 | 4.6% | 0.409 |
| CE525-CE520 | 0.582 | 0.574 | 0.572 | 0.504 | 0.606 | 0.490 | 0.490 | 0.606 | 0.555 | 21.0% | 0.577 |
| CE530-CE500 | -0.242 | -0.258 | -0.257 | -0.214 | -0.276 | -0.220 | -0.276 | -0.214 | -0.245 | 25.5% | -0.286 |
| CE545-CE540 | 0.560 | 0.559 | 0.560 | 0.334 | 0.546 | 0.510 | 0.334 | 0.560 | 0.511 | 44.3% | 0.448 |

| **IDB (°C)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.13 | 0.06 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.13 | 0.04 | 364.3% | 0.01 |
| CE320-CE300 | 0.28 | 0.33 | 0.33 | 0.16 | 0.25 | 0.54 | 0.16 | 0.54 | 0.32 | 119.3% | 0.17 |
| CE330-CE300 | 0.26 | 0.22 | 0.22 | 0.18 | 0.21 | 0.19 | 0.18 | 0.26 | 0.21 | 34.0% | 0.22 |
| CE330-CE320 | -0.02 | -0.11 | -0.11 | 0.02 | -0.03 | -0.35 | -0.35 | 0.02 | -0.10 | 365.4% | 0.04 |
| CE340-CE300 | 0.25 | 0.22 | 0.22 | 0.21 | 0.23 | 0.22 | 0.21 | 0.25 | 0.23 | 19.5% | 0.23 |
| CE330-CE340 | 0.00 | 0.00 | 0.00 | -0.02 | -0.01 | -0.03 | -0.03 | 0.00 | -0.01 | 319.0% | -0.01 |
| CE350-CE300 | 2.04 | 2.11 | 2.11 | 2.15 | 2.19 | 2.16 | 2.04 | 2.19 | 2.13 | 7.1% | 2.13 |
| CE360-CE300 | 1.74 | 1.56 | 1.50 | 1.23 | 1.40 | 1.38 | 1.23 | 1.74 | 1.47 | 34.6% | 1.34 |
| CE400-CE300 | 0.50 | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.50 | 0.10 | 498.8% | 0.00 |
| CE410-CE300 | 0.50 | 0.00 | 0.00 | | | 0.00 | 0.00 | 0.50 | 0.12 | 400.0% | 0.00 |
| CE420-CE300 | 0.30 | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.30 | 0.06 | 500.3% | 0.00 |
| CE430-CE300 | 0.37 | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.37 | 0.07 | 500.3% | 0.00 |
| CE440-CE300 | 0.29 | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.29 | 0.06 | 500.2% | 0.00 |
| CE500-CE300 | -3.39 | -3.39 | -3.50 | -3.71 | -2.98 | -1.13 | -3.71 | -1.13 | -3.02 | 85.5% | -3.51 |
| CE510-CE500 | 1.24 | 0.11 | 0.11 | -0.02 | 0.00 | 0.00 | -0.02 | 1.24 | 0.24 | 526.6% | 0.00 |
| CE525-CE520 | 13.33 | 13.61 | 13.56 | 13.53 | 13.63 | 15.80 | 13.33 | 15.80 | 13.91 | 17.8% | 13.69 |
| CE530-CE500 | -0.21 | -0.06 | 0.00 | 0.21 | 0.00 | 0.00 | -0.21 | 0.21 | -0.01 | 4302.5% | 0.00 |
| CE545-CE540 | 13.32 | 13.56 | 13.56 | 13.52 | 13.58 | 15.71 | 13.32 | 15.71 | 13.87 | 17.3% | 13.69 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-21. Delta Various Annual Means (Zone Humidity, Relative Humidity)

| **Humidity Ratio (kg/kg)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.0020 | 0.0021 | 0.0021 | 0.0020 | 0.0020 | 0.0019 | 0.0019 | 0.0021 | 0.0020 | 9.9% | 0.0020 |
| CE320-CE300 | 0.0009 | 0.0009 | 0.0009 | 0.0008 | 0.0009 | 0.0007 | 0.0007 | 0.0009 | 0.0009 | 25.7% | 0.0009 |
| CE330-CE300 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0006 | 0.0007 | 0.0006 | 0.0007 | 0.0007 | 9.3% | 0.0007 |
| CE330-CE320 | -0.0002 | -0.0002 | -0.0002 | -0.0001 | -0.0002 | 0.0000 | -0.0002 | 0.0000 | -0.0002 | 143.9% | -0.0002 |
| CE340-CE300 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 4.1% | 0.0007 |
| CE330-CE340 | -0.0001 | 0.0000 | 0.0000 | 0.0000 | -0.0001 | 0.0000 | -0.0001 | 0.0000 | 0.0000 | 277.9% | 0.0000 |
| CE350-CE300 | 0.0006 | 0.0008 | 0.0008 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0008 | 0.0007 | 34.2% | 0.0006 |
| CE360-CE300 | -0.0006 | -0.0005 | -0.0005 | -0.0005 | -0.0006 | -0.0006 | -0.0006 | -0.0005 | -0.0006 | 22.0% | -0.0006 |
| CE400-CE300 | 0.0007 | 0.0008 | 0.0008 | 0.0008 | | 0.0008 | 0.0007 | 0.0008 | 0.0008 | 8.7% | 0.0007 |
| CE410-CE300 | 0.0007 | 0.0003 | 0.0003 | | | 0.0003 | 0.0003 | 0.0007 | 0.0004 | 94.5% | 0.0007 |
| CE420-CE300 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 58.3% | 0.0002 |
| CE430-CE300 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 19.7% | 0.0002 |
| CE440-CE300 | 0.0001 | 0.0001 | 0.0001 | 0.0000 | | 0.0000 | 0.0000 | 0.0001 | 0.0001 | 148.5% | 0.0001 |
| CE500-CE300 | 0.0007 | | | 0.0001 | 0.0010 | 0.0015 | 0.0001 | 0.0015 | 0.0008 | 169.4% | 0.0000 |
| CE510-CE500 | 0.0004 | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0004 | 0.0001 | 394.2% | 0.0000 |
| CE525-CE520 | 0.0070 | | | 0.0078 | 0.0070 | 0.0075 | 0.0070 | 0.0078 | 0.0073 | 10.9% | 0.0074 |
| CE530-CE500 | -0.0035 | | | -0.0027 | -0.0044 | -0.0040 | -0.0044 | -0.0027 | -0.0037 | 48.0% | -0.0063 |
| CE545-CE540 | 0.0018 | | | 0.0024 | 0.0029 | 0.0026 | 0.0018 | 0.0029 | 0.0024 | 46.8% | 0.0000 |

| **Relative Humidity (%)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 9.72 | 10.25 | 10.25 | 9.96 | 10.01 | 9.87 | 9.72 | 10.25 | 10.01 | 5.3% | 9.96 |
| CE320-CE300 | 3.39 | 2.95 | 2.97 | 3.25 | 3.28 | 2.01 | 2.01 | 3.39 | 2.97 | 46.4% | 3.49 |
| CE330-CE300 | 2.23 | 2.32 | 2.37 | 2.59 | 2.26 | 2.77 | 2.23 | 2.77 | 2.42 | 22.3% | 2.64 |
| CE330-CE320 | -1.16 | -0.63 | -0.60 | -0.66 | -1.02 | 0.76 | -1.16 | 0.76 | -0.55 | 347.8% | -0.84 |
| CE340-CE300 | 2.47 | 2.43 | 2.45 | 2.56 | 2.47 | 2.85 | 2.43 | 2.85 | 2.54 | 16.5% | 2.71 |
| CE330-CE340 | -0.24 | -0.11 | -0.08 | 0.03 | -0.21 | -0.08 | -0.24 | 0.03 | -0.12 | 232.7% | -0.07 |
| CE350-CE300 | -3.13 | -2.81 | -2.73 | -3.42 | -3.51 | -3.37 | -3.51 | -2.73 | -3.16 | 24.7% | -3.25 |
| CE360-CE300 | -7.58 | -6.77 | -6.79 | -6.22 | -6.96 | -6.72 | -7.58 | -6.22 | -6.84 | 19.9% | -6.57 |
| CE400-CE300 | 2.16 | 3.95 | 3.97 | 3.96 | | 4.08 | 2.16 | 4.08 | 3.62 | 53.1% | 3.31 |
| CE410-CE300 | 1.88 | 1.39 | 1.35 | | | 1.82 | 1.35 | 1.88 | 1.61 | 33.0% | 3.31 |
| CE420-CE300 | 0.16 | 0.88 | 0.69 | 0.81 | | 0.83 | 0.16 | 0.88 | 0.67 | 106.1% | 0.91 |
| CE430-CE300 | 0.21 | 0.91 | 1.02 | 1.01 | | 1.24 | 0.21 | 1.24 | 0.88 | 117.8% | 1.09 |
| CE440-CE300 | -0.29 | 0.20 | 0.29 | 0.24 | | 0.30 | -0.29 | 0.30 | 0.15 | 394.1% | 0.33 |
| CE500-CE300 | 17.91 | | | 10.61 | 18.12 | 15.80 | 10.61 | 18.12 | 15.61 | 48.1% | 9.72 |
| CE510-CE500 | -2.35 | | | 0.11 | -0.01 | 0.11 | -2.35 | 0.11 | -0.53 | 461.4% | 0.10 |
| CE525-CE520 | -8.41 | | | -6.41 | -10.09 | -14.80 | -14.80 | -6.41 | -9.93 | 84.5% | -7.41 |
| CE530-CE500 | -19.80 | | | -10.22 | -24.49 | -24.13 | -24.49 | -10.22 | -19.66 | 72.6% | -36.17 |
| CE545-CE540 | -11.90 | | | -7.68 | -3.18 | -14.62 | -14.62 | -3.18 | -9.34 | 122.5% | -13.31 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-22. Delta Hourly Integrated Maximum Total Consumptions

| **Total Consumption (Wh,e)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 968 | 1019 | 993 | 641 | 721 | 614 | 614 | 1019 | 826 | 49.0% | 564 |
| CE320-CE300 | 1402 | 1352 | 1379 | 1055 | 1172 | 1327 | 1055 | 1402 | 1281 | 27.1% | 975 |
| CE330-CE300 | 1721 | 1648 | 1805 | 1414 | 1535 | 1787 | 1414 | 1805 | 1652 | 23.7% | 1358 |
| CE330-CE320 | 319 | 296 | 426 | 360 | 363 | 460 | 296 | 460 | 371 | 44.3% | 384 |
| CE340-CE300 | 1555 | 1594 | 1588 | 1234 | 1345 | 1553 | 1234 | 1594 | 1478 | 24.3% | 1169 |
| CE330-CE340 | 166 | 54 | 217 | 180 | 190 | 234 | 54 | 234 | 173 | 103.8% | 190 |
| CE350-CE300 | 1 | 90 | 0 | 0 | 0 | -2 | -2 | 90 | 15 | 621.2% | 0 |
| CE360-CE300 | 1143 | 1172 | 1124 | 844 | 931 | 1214 | 844 | 1214 | 1071 | 34.5% | 778 |
| CE400-CE300 | 2 | 0 | 75 | 0 | | -29 | -29 | 75 | 10 | 1087.2% | 0 |
| CE410-CE300 | 2 | 0 | 0 | | | 1 | 0 | 2 | 1 | 258.7% | 0 |
| CE420-CE300 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | ---- | 0 |
| CE430-CE300 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 500.0% | 0 |
| CE440-CE300 | 0 | 0 | 0 | 0 | | -87 | -87 | 0 | -17 | 500.0% | 0 |
| CE500-CE300 | -1460 | -1133 | -1177 | -1501 | -1755 | -1274 | -1755 | -1133 | -1383 | 45.0% | -1566 |
| CE510-CE500 | 1038 | 1159 | 1162 | 1011 | 1009 | 1070 | 1009 | 1162 | 1075 | 14.2% | 1015 |
| CE525-CE520 | -1669 | -1451 | -1483 | -1531 | -1625 | -1099 | -1669 | -1099 | -1476 | 38.6% | -1680 |
| CE530-CE500 | -2138 | -2372 | -2370 | -2228 | -2185 | -2185 | -2372 | -2138 | -2246 | 10.4% | -2000 |
| CE545-CE540 | -1494 | -1593 | -1593 | -915 | -1495 | -1514 | -1593 | -915 | -1434 | 47.3% | -1219 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-23. Delta Hourly Integrated Maximum Coil Loads ( Total, Sensible)

| **Sensible + Latent Coil Load (Wh,th)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 5154 | 5349 | 5578 | 4393 | 4759 | 4919 | 4393 | 5578 | 5025 | 23.6% | 4298 |
| CE320-CE300 | 8144 | 22412 | 22368 | 7032 | 7402 | 7848 | 7032 | 22412 | 12534 | 122.7% | 6936 |
| CE330-CE300 | 11318 | 12227 | 33117 | 10712 | 11476 | 10343 | 10343 | 33117 | 14865 | 153.2% | 10529 |
| CE330-CE320 | 3174 | -10185 | 10749 | 3680 | 4074 | 2495 | -10185 | 10749 | 2331 | 898.0% | 3593 |
| CE340-CE300 | 9478 | 19418 | 28094 | 8595 | 8864 | 9060 | 8595 | 28094 | 13918 | 140.1% | 8555 |
| CE330-CE340 | 1840 | -7191 | 5023 | 2117 | 2612 | 1283 | -7191 | 5023 | 947 | 1289.3% | 1974 |
| CE350-CE300 | -82 | 0 | -1 | 0 | 0 | 5 | -82 | 5 | -13 | 669.0% | 1 |
| CE360-CE300 | 6683 | 9212 | 9564 | 5726 | 5820 | 6379 | 5726 | 9564 | 7231 | 53.1% | 5592 |
| CE400-CE300 | 9005 | 9142 | 18383 | 7995 | | 8702 | 7995 | 18383 | 10645 | 97.6% | 4780 |
| CE410-CE300 | -82 | 0 | 0 | | | 1 | -82 | 1 | -20 | 409.8% | 4780 |
| CE420-CE300 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | ---- | 0 |
| CE430-CE300 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 500.0% | 0 |
| CE440-CE300 | 0 | 0 | 0 | 0 | | -295 | -295 | 0 | -59 | 500.0% | 0 |
| CE500-CE300 | -4689 | -3694 | -3749 | -5087 | -5935 | -4517 | -5935 | -3694 | -4612 | 48.6% | -5417 |
| CE510-CE500 | 3108 | 3481 | 3482 | 3531 | 3381 | 3542 | 3108 | 3542 | 3421 | 12.7% | 3566 |
| CE525-CE520 | 410 | -412 | -412 | -76 | 8 | -881 | -881 | 410 | -227 | 568.4% | -166 |
| CE530-CE500 | -7651 | -8131 | -8131 | -8008 | -7791 | -7929 | -8131 | -7651 | -7940 | 6.0% | -7919 |
| CE545-CE540 | 500 | -291 | -292 | -187 | -30 | -302 | -302 | 500 | -100 | 800.3% | -202 |

| **Sensible Coil Load (Wh,th)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | -183 | -123 | -86 | -254 | -379 | -259 | -379 | -86 | -214 | 136.9% | -312 |
| CE320-CE300 | 8038 | 7916 | 7867 | 8441 | 7677 | 8059 | 7677 | 8441 | 8000 | 9.6% | 7872 |
| CE330-CE300 | 9949 | 10207 | 11285 | 11234 | 10540 | 10513 | 9949 | 11285 | 10621 | 12.6% | 11168 |
| CE330-CE320 | 1911 | 2291 | 3418 | 2793 | 2863 | 2454 | 1911 | 3418 | 2622 | 57.5% | 3296 |
| CE340-CE300 | 9552 | 8883 | 8881 | 9357 | 9483 | 9272 | 8881 | 9552 | 9238 | 7.3% | 9118 |
| CE330-CE340 | 397 | 1324 | 2404 | 1877 | 1057 | 1241 | 397 | 2404 | 1383 | 145.1% | 2050 |
| CE350-CE300 | 0 | 0 | 0 | 0 | 0 | -32 | -32 | 0 | -5 | 603.8% | 1 |
| CE360-CE300 | 8783 | 8908 | 8860 | 9090 | 8524 | 9271 | 8524 | 9271 | 8906 | 8.4% | 8886 |
| CE400-CE300 | 0 | 0 | 0 | 0 | | -31 | -31 | 0 | -6 | 503.2% | 0 |
| CE410-CE300 | -12 | 0 | 0 | | | -15 | -15 | 0 | -7 | 224.7% | 0 |
| CE420-CE300 | 0 | 0 | 0 | 0 | | -15 | -15 | 0 | -3 | 500.0% | 0 |
| CE430-CE300 | 0 | 0 | 0 | 0 | | -15 | -15 | 0 | -3 | 500.0% | 0 |
| CE440-CE300 | 0 | 0 | 0 | 0 | | -33 | -33 | 0 | -7 | 500.0% | 0 |
| CE500-CE300 | -3728 | -3194 | -3197 | -3682 | -4681 | -3090 | -4681 | -3090 | -3595 | 44.3% | -3688 |
| CE510-CE500 | 2180 | 2504 | 2505 | 2441 | 2345 | 2451 | 2180 | 2505 | 2404 | 13.5% | 2448 |
| CE525-CE520 | 287 | -309 | -304 | -336 | -210 | -717 | -717 | 287 | -265 | 379.1% | -400 |
| CE530-CE500 | 285 | -433 | -433 | -211 | 0 | -192 | -433 | 285 | -164 | 437.9% | -108 |
| CE545-CE540 | 500 | -291 | -292 | -187 | -35 | -302 | -302 | 500 | -101 | 793.7% | -202 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-24. Delta Hourly Integrated Maximum Coil Loads ( Latent)

| Latent Coil Load (Wh,th) | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 6271 | 5835 | 5876 | 6040 | 5737 | 5685 | 5685 | 6271 | 5907 | 9.9% | 6015 |
| CE320-CE300 | 13512 | 22193 | 22109 | 11961 | 11322 | 11537 | 11322 | 22193 | 15439 | 70.4% | 12123 |
| CE330-CE300 | 18190 | 17637 | 31415 | 16899 | 17809 | 17096 | 16899 | 31415 | 19841 | 73.2% | 17059 |
| CE330-CE320 | 4678 | -4556 | 9306 | 4939 | 6487 | 5559 | -4556 | 9306 | 4402 | 314.9% | 4936 |
| CE340-CE300 | 15213 | 21147 | 26617 | 13676 | 13850 | 13402 | 13402 | 26617 | 17318 | 76.3% | 13894 |
| CE330-CE340 | 2977 | -3510 | 4798 | 3223 | 3959 | 3694 | -3510 | 4798 | 2523 | 329.2% | 3165 |
| CE350-CE300 | 116 | -1 | -1 | 1 | 380 | 1211 | -1 | 1211 | 284 | 426.5% | 1 |
| CE360-CE300 | -361 | 722 | 942 | -1715 | -1516 | -1458 | -1715 | 942 | -564 | 470.9% | -1722 |
| CE400-CE300 | 17440 | 16274 | 23002 | 16082 | | 16253 | 16082 | 23002 | 17810 | 38.9% | 12312 |
| CE410-CE300 | 1503 | 0 | -3 | | | -15 | -15 | 1503 | 371 | 408.9% | 12312 |
| CE420-CE300 | 115 | 0 | 0 | 0 | | 2 | 0 | 115 | 23 | 491.5% | 0 |
| CE430-CE300 | 0 | 1801 | 1707 | 839 | | 2 | 0 | 1801 | 870 | 207.1% | 840 |
| CE440-CE300 | 0 | 0 | -3 | 0 | | -253 | -253 | 0 | -51 | 494.1% | 0 |
| CE500-CE300 | -1670 | -1571 | -1661 | -2396 | -2570 | -2630 | -2630 | -1571 | -2083 | 50.8% | -2687 |
| CE510-CE500 | 927 | 990 | 990 | 1116 | 1045 | 1112 | 927 | 1116 | 1030 | 18.3% | 1374 |
| CE525-CE520 | 123 | -122 | -122 | 249 | 212 | -144 | -144 | 249 | 33 | 1201.2% | 197 |
| CE530-CE500 | -7965 | -7733 | -7733 | -7838 | -7626 | -7726 | -7965 | -7626 | -7770 | 4.4% | -7849 |
| CE545-CE540 | -627 | 0 | 0 | -1655 | -841 | -1181 | -1655 | 0 | -717 | 230.7% | 0 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-25. Delta Hourly Integrated Maximum and Minimum COP2

| **Maximum COP2** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | -0.025 | 0.272 | 0.271 | 0.248 | 0.257 | 0.240 | -0.025 | 0.272 | 0.210 | 141.1% | 0.361 |
| CE320-CE300 | 0.000 | 1.274 | 1.110 | 0.014 | 0.073 | 0.500 | 0.000 | 1.274 | 0.495 | 257.3% | 0.066 |
| CE330-CE300 | 0.000 | 0.240 | 1.738 | 0.146 | 0.251 | 0.170 | 0.000 | 1.738 | 0.424 | 409.6% | 0.000 |
| CE330-CE320 | 0.000 | -1.034 | 0.628 | 0.132 | 0.179 | -0.330 | -1.034 | 0.628 | -0.071 | 2344.2% | -0.066 |
| CE340-CE300 | 0.000 | 0.752 | 1.482 | 0.061 | 0.147 | 0.070 | 0.000 | 1.482 | 0.419 | 354.0% | 0.000 |
| CE330-CE340 | 0.000 | -0.512 | 0.256 | 0.085 | 0.105 | 0.100 | -0.512 | 0.256 | 0.006 | 13685.7% | 0.000 |
| CE350-CE300 | 0.000 | 0.020 | 0.006 | 0.630 | 0.061 | 0.000 | 0.000 | 0.630 | 0.120 | 526.8% | -0.113 |
| CE360-CE300 | 0.233 | 0.559 | 0.570 | 0.530 | 0.561 | 0.560 | 0.233 | 0.570 | 0.502 | 67.2% | 0.734 |
| CE400-CE300 | -0.091 | 0.219 | 0.919 | 0.146 | | 0.170 | -0.091 | 0.919 | 0.273 | 370.7% | -0.012 |
| CE410-CE300 | -0.280 | 0.034 | -0.002 | | | -0.040 | -0.280 | 0.034 | -0.072 | 436.1% | -0.012 |
| CE420-CE300 | -0.387 | -0.062 | -0.098 | -0.104 | | 0.060 | -0.387 | 0.060 | -0.118 | 378.3% | -0.092 |
| CE430-CE300 | -0.387 | -0.064 | -0.098 | -0.133 | | 0.050 | -0.387 | 0.050 | -0.126 | 346.0% | -0.092 |
| CE440-CE300 | -0.285 | -0.095 | -0.098 | -0.123 | | -0.070 | -0.285 | -0.070 | -0.134 | 160.0% | -0.092 |
| CE500-CE300 | 0.107 | 3.498 | 1.444 | 0.273 | 0.314 | 0.260 | 0.107 | 3.498 | 0.983 | 345.1% | 0.319 |
| CE510-CE500 | 0.417 | 0.000 | 0.000 | 0.487 | 0.505 | 0.390 | 0.000 | 0.505 | 0.300 | 168.4% | 0.569 |
| CE525-CE520 | 0.904 | 1.429 | 1.379 | 0.766 | 0.836 | 0.560 | 0.560 | 1.429 | 0.979 | 88.8% | 0.874 |
| CE530-CE500 | -0.269 | -3.386 | -1.451 | -0.273 | -0.345 | -0.260 | -3.386 | -0.260 | -0.997 | 313.5% | -0.429 |
| CE545-CE540 | 0.794 | 0.819 | 0.973 | 0.470 | 0.490 | 0.480 | 0.470 | 0.973 | 0.671 | 74.9% | 0.649 |

| **Minimum COP2** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.072 | 0.052 | 0.050 | 0.111 | 0.087 | 0.060 | 0.050 | 0.111 | 0.072 | 84.8% | 0.040 |
| CE320-CE300 | 0.032 | 0.003 | 0.004 | 0.060 | 0.029 | 0.020 | 0.003 | 0.060 | 0.025 | 231.0% | 0.006 |
| CE330-CE300 | 0.032 | 0.000 | 0.000 | 0.063 | 0.038 | 0.030 | 0.000 | 0.063 | 0.027 | 231.1% | 0.006 |
| CE330-CE320 | 0.000 | -0.003 | -0.004 | 0.003 | 0.009 | 0.010 | -0.004 | 0.010 | 0.002 | 584.2% | 0.000 |
| CE340-CE300 | 0.032 | 0.000 | 0.000 | 0.063 | 0.038 | 0.030 | 0.000 | 0.063 | 0.027 | 231.1% | 0.006 |
| CE330-CE340 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | ---- | 0.000 |
| CE350-CE300 | -0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.003 | 0.000 | 0.000 | 742.2% | 0.000 |
| CE360-CE300 | 0.032 | 0.001 | 0.000 | 0.063 | 0.038 | 0.030 | 0.000 | 0.063 | 0.027 | 229.7% | 0.006 |
| CE400-CE300 | -0.011 | -0.064 | -0.066 | 0.000 | | 0.000 | -0.066 | 0.000 | -0.028 | 233.8% | 0.000 |
| CE410-CE300 | -0.007 | 0.000 | 0.000 | | | 0.000 | -0.007 | 0.000 | -0.002 | 400.0% | 0.000 |
| CE420-CE300 | 0.000 | 0.000 | 0.000 | 0.000 | | 0.000 | 0.000 | 0.000 | 0.000 | ---- | 0.000 |
| CE430-CE300 | -0.022 | -0.064 | -0.066 | 0.000 | | 0.000 | -0.066 | 0.000 | -0.030 | 217.2% | 0.000 |
| CE440-CE300 | -0.011 | -0.064 | -0.066 | 0.000 | | 0.000 | -0.066 | 0.000 | -0.028 | 234.7% | 0.000 |
| CE500-CE300 | -0.108 | -0.105 | -0.149 | -0.076 | -0.119 | -0.100 | -0.149 | -0.076 | -0.110 | 66.6% | -0.081 |
| CE510-CE500 | 0.203 | 0.124 | 0.000 | 0.160 | 0.215 | 0.190 | 0.000 | 0.215 | 0.149 | 144.8% | 0.000 |
| CE525-CE520 | 0.469 | 0.476 | 0.420 | 0.408 | 0.561 | 0.430 | 0.408 | 0.561 | 0.461 | 33.2% | 0.527 |
| CE530-CE500 | -0.184 | -0.198 | -0.154 | -0.173 | -0.193 | -0.190 | -0.198 | -0.154 | -0.182 | 24.2% | -0.230 |
| CE545-CE540 | 0.479 | 0.459 | 0.460 | 0.277 | 0.549 | 0.440 | 0.277 | 0.549 | 0.444 | 61.2% | 0.362 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-26. Delta Hourly Integrated Maximum and Minimum IDB

| **Maximum IDB (°C)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.88 | 1.78 | 1.61 | 1.47 | 1.57 | 1.00 | 0.88 | 1.78 | 1.39 | 65.1% | 1.54 |
| CE320-CE300 | 6.16 | 6.50 | 6.39 | 6.71 | 7.27 | 5.46 | 5.46 | 7.27 | 6.41 | 28.2% | 6.80 |
| CE330-CE300 | 6.03 | 6.61 | 6.89 | 6.07 | 6.85 | 5.11 | 5.11 | 6.89 | 6.26 | 28.4% | 6.55 |
| CE330-CE320 | -0.13 | 0.11 | 0.50 | -0.64 | -0.42 | -0.35 | -0.64 | 0.50 | -0.15 | 736.8% | -0.24 |
| CE340-CE300 | 6.11 | 6.50 | 6.45 | 6.50 | 7.10 | 5.39 | 5.39 | 7.10 | 6.34 | 27.0% | 6.73 |
| CE330-CE340 | -0.07 | 0.11 | 0.44 | -0.43 | -0.25 | -0.28 | -0.43 | 0.44 | -0.08 | 1078.3% | -0.18 |
| CE350-CE300 | 8.38 | 9.83 | 9.83 | 10.00 | 9.95 | 8.81 | 8.38 | 10.00 | 9.47 | 17.1% | 9.99 |
| CE360-CE300 | 7.56 | 7.67 | 7.45 | 7.51 | 7.95 | 6.94 | 6.94 | 7.95 | 7.51 | 13.4% | 7.80 |
| CE400-CE300 | 0.91 | 2.45 | 3.72 | 1.91 | | -0.15 | -0.15 | 3.72 | 1.77 | 218.8% | 0.06 |
| CE410-CE300 | 0.63 | 0.00 | 0.00 | | | 0.00 | 0.00 | 0.63 | 0.16 | 400.0% | 0.06 |
| CE420-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | | 0.04 | 0.00 | 0.04 | 0.01 | 500.0% | 0.00 |
| CE430-CE300 | 1.00 | 0.00 | 0.00 | 0.00 | | 0.26 | 0.00 | 1.00 | 0.25 | 396.6% | 0.00 |
| CE440-CE300 | 0.85 | 0.00 | 0.00 | 0.00 | | 0.07 | 0.00 | 0.85 | 0.18 | 461.5% | 0.00 |
| CE500-CE300 | -0.39 | 0.00 | 0.00 | 0.00 | -0.03 | -1.19 | -1.19 | 0.00 | -0.27 | 441.5% | 0.00 |
| CE510-CE500 | 0.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.29 | 0.05 | 600.0% | 0.01 |
| CE525-CE520 | 19.96 | 18.95 | 19.12 | 20.00 | 19.02 | 16.38 | 16.38 | 20.00 | 18.90 | 19.1% | 19.72 |
| CE530-CE500 | 0.31 | -0.05 | -0.05 | 0.00 | 0.00 | 0.00 | -0.05 | 0.31 | 0.04 | 1025.2% | 0.00 |
| CE545-CE540 | 19.53 | 19.89 | 19.89 | 20.00 | 19.95 | 20.00 | 19.53 | 20.00 | 19.88 | 2.4% | 19.99 |

| **Minimum IDB (°C)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE320-CE300 | 0.00 | 1.94 | 1.95 | -0.96 | 0.00 | 0.00 | -0.96 | 1.95 | 0.49 | 597.5% | -0.97 |
| CE330-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE330-CE320 | 0.00 | -1.94 | -1.95 | 0.96 | 0.00 | 0.00 | -1.95 | 0.96 | -0.49 | 596.8% | 0.97 |
| CE340-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE330-CE340 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ---- | 0.00 |
| CE350-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ---- | 0.00 |
| CE360-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE400-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 500.0% | 0.00 |
| CE410-CE300 | 0.00 | 0.00 | 0.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | ---- | 0.00 |
| CE420-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 500.0% | 0.00 |
| CE430-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 500.0% | 0.00 |
| CE440-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | | 0.01 | 0.00 | 0.01 | 0.00 | 500.0% | 0.00 |
| CE500-CE300 | 0.50 | -0.72 | -0.89 | 0.22 | 0.54 | 17.05 | -0.89 | 17.05 | 2.78 | 644.6% | 0.31 |
| CE510-CE500 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE525-CE520 | 0.14 | 0.06 | 0.05 | 0.18 | 0.03 | 19.44 | 0.03 | 19.44 | 3.32 | 585.3% | 0.24 |
| CE530-CE500 | -0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.01 | 0.00 | 0.00 | 533.6% | 0.00 |
| CE545-CE540 | 0.22 | 0.06 | 0.05 | 0.18 | 0.03 | 18.06 | 0.03 | 18.06 | 3.10 | 581.6% | 0.24 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-27. Delta Hourly Integrated Maximum and Minimum Zone Humidity Ratio

| **Maximum Humidity Ratio (kg/kg)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.0025 | 0.0050 | 0.0052 | 0.0020 | 0.0020 | 0.0023 | 0.0020 | 0.0052 | 0.0032 | 102.1% | 0.0020 |
| CE320-CE300 | 0.0047 | 0.0039 | 0.0039 | 0.0042 | 0.0041 | 0.0043 | 0.0039 | 0.0047 | 0.0042 | 19.9% | 0.0042 |
| CE330-CE300 | 0.0044 | 0.0040 | 0.0040 | 0.0043 | 0.0036 | 0.0043 | 0.0036 | 0.0044 | 0.0041 | 19.0% | 0.0043 |
| CE330-CE320 | -0.0004 | 0.0001 | 0.0001 | 0.0001 | -0.0005 | 0.0000 | -0.0005 | 0.0001 | -0.0001 | 696.5% | 0.0001 |
| CE340-CE300 | 0.0046 | 0.0039 | 0.0037 | 0.0042 | 0.0038 | 0.0043 | 0.0037 | 0.0046 | 0.0041 | 21.8% | 0.0042 |
| CE330-CE340 | -0.0002 | 0.0001 | 0.0003 | 0.0001 | -0.0002 | 0.0000 | -0.0002 | 0.0003 | 0.0000 | 3174.2% | 0.0001 |
| CE350-CE300 | 0.0035 | 0.0061 | 0.0062 | 0.0036 | 0.0030 | 0.0032 | 0.0030 | 0.0062 | 0.0043 | 74.6% | 0.0034 |
| CE360-CE300 | 0.0001 | 0.0000 | 0.0000 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0002 | 0.0001 | 366.5% | 0.0000 |
| CE400-CE300 | 0.0037 | 0.0032 | 0.0033 | 0.0033 | | 0.0039 | 0.0032 | 0.0039 | 0.0035 | 20.2% | 0.0034 |
| CE410-CE300 | 0.0036 | 0.0031 | 0.0032 | | | 0.0039 | 0.0031 | 0.0039 | 0.0034 | 23.3% | 0.0034 |
| CE420-CE300 | 0.0010 | 0.0009 | 0.0004 | 0.0010 | | 0.0013 | 0.0004 | 0.0013 | 0.0009 | 98.3% | 0.0011 |
| CE430-CE300 | 0.0029 | 0.0018 | 0.0019 | 0.0025 | | 0.0024 | 0.0018 | 0.0029 | 0.0023 | 49.6% | 0.0027 |
| CE440-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 500.0% | 0.0000 |
| CE500-CE300 | -0.0016 | -0.0019 | -0.0019 | -0.0019 | -0.0017 | -0.0019 | -0.0019 | -0.0016 | -0.0018 | 20.6% | -0.0021 |
| CE510-CE500 | 0.0002 | 0.0000 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0002 | 0.0000 | 352.6% | 0.0000 |
| CE525-CE520 | 0.0104 | 0.0103 | 0.0102 | 0.0115 | 0.0101 | 0.0067 | 0.0067 | 0.0115 | 0.0099 | 48.3% | 0.0107 |
| CE530-CE500 | -0.0047 | -0.0038 | -0.0037 | -0.0049 | -0.0062 | -0.0047 | -0.0062 | -0.0037 | -0.0047 | 53.9% | -0.0085 |
| CE545-CE540 | 0.0009 | 0.0072 | 0.0059 | 0.0000 | 0.0034 | 0.0013 | 0.0000 | 0.0072 | 0.0031 | 230.7% | 0.0000 |

| **Minimum Humidity Ratio (kg/kg)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 | 0.0000 | 0.0001 | 0.0000 | 646.4% | 0.0000 |
| CE320-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 600.0% | 0.0000 |
| CE330-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 600.0% | 0.0000 |
| CE330-CE320 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 600.0% | 0.0000 |
| CE340-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 600.0% | 0.0000 |
| CE330-CE340 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | ---- | 0.0000 |
| CE350-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | ---- | 0.0000 |
| CE360-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 600.0% | 0.0000 |
| CE400-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 500.0% | 0.0000 |
| CE410-CE300 | 0.0000 | 0.0000 | 0.0000 | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | ---- | 0.0000 |
| CE420-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 500.0% | 0.0000 |
| CE430-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 500.0% | 0.0000 |
| CE440-CE300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 500.0% | 0.0000 |
| CE500-CE300 | 0.0050 | | | 0.0051 | 0.0049 | 0.0083 | 0.0049 | 0.0083 | 0.0058 | 58.2% | 0.0052 |
| CE510-CE500 | 0.0000 | | | 0.0000 | 0.0000 | 0.0002 | 0.0000 | 0.0002 | 0.0001 | 400.0% | 0.0000 |
| CE525-CE520 | 0.0007 | | | 0.0005 | 0.0004 | 0.0088 | 0.0004 | 0.0088 | 0.0026 | 322.8% | 0.0006 |
| CE530-CE500 | -0.0006 | | | -0.0003 | -0.0015 | -0.0037 | -0.0037 | -0.0003 | -0.0015 | 226.1% | -0.0042 |
| CE545-CE540 | 0.0021 | | | 0.0030 | 0.0034 | 0.0028 | 0.0021 | 0.0034 | 0.0028 | 47.3% | 0.0000 |

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

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2**
**Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545**

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 B16.5.2-28. Delta Hourly Integrated Maximum and Minimum Zone Relative Humidity

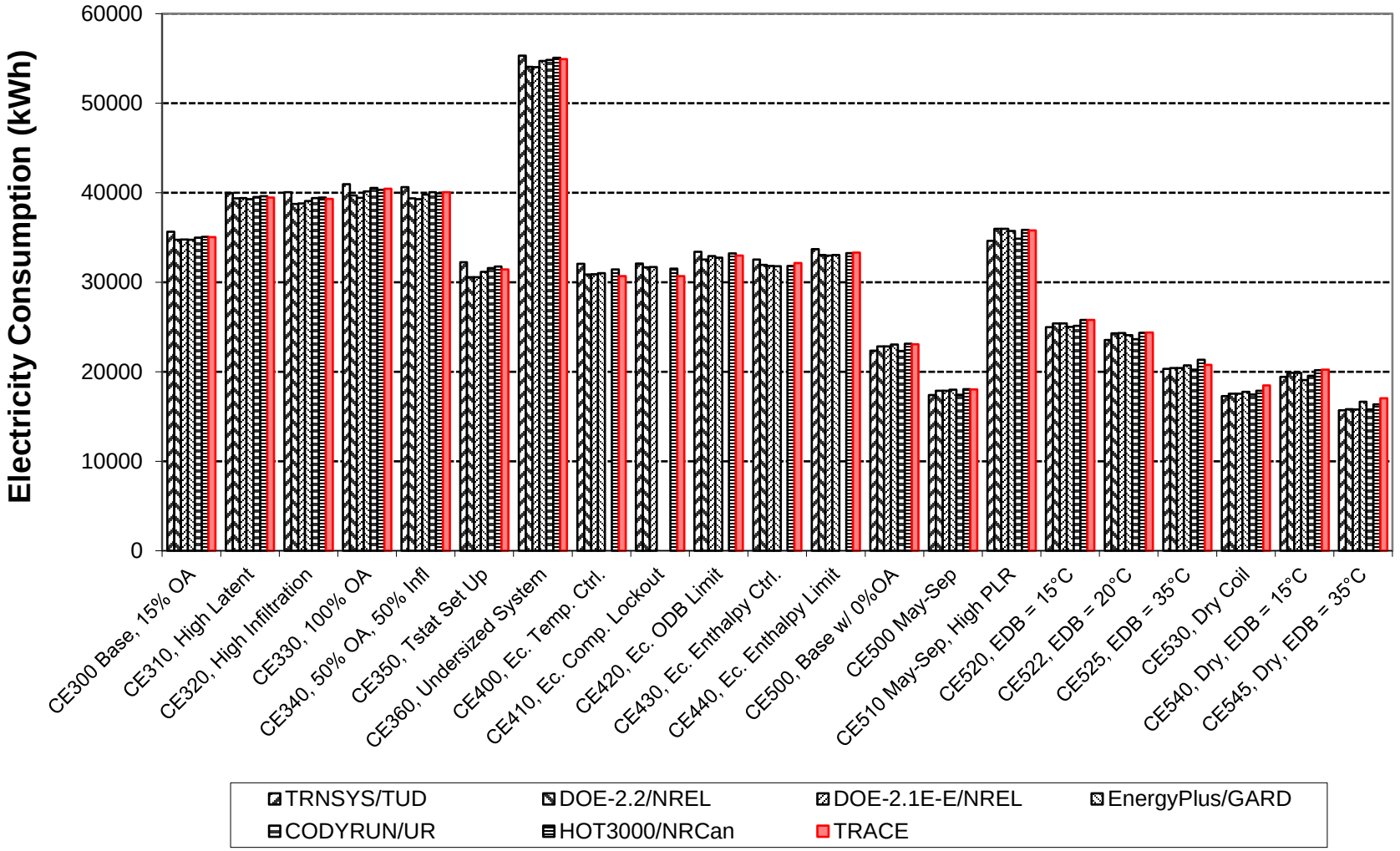
| **Maximum Relative Humidity (%)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 8.91 | 30.83 | 31.85 | 10.28 | 9.00 | 10.75 | 8.91 | 31.85 | 16.94 | 135.4% | 10.02 |
| CE320-CE300 | 13.05 | 14.06 | 14.82 | 14.60 | 15.00 | 14.44 | 13.05 | 15.00 | 14.33 | 13.6% | 14.96 |
| CE330-CE300 | 7.87 | 9.11 | 9.09 | 8.51 | 8.00 | 11.26 | 7.87 | 11.26 | 8.97 | 37.8% | 8.87 |
| CE330-CE320 | -5.18 | -4.95 | -5.73 | -6.09 | -7.00 | -3.18 | -7 | -3 | -5.35 | 71.3% | -6.09 |
| CE340-CE300 | 11.14 | 12.02 | 12.41 | 12.43 | 12.00 | 12.81 | 11 | 13 | 12.13 | 13.8% | 12.75 |
| CE330-CE340 | -3.27 | -2.91 | -3.32 | -3.92 | -4.00 | -1.55 | -4 | -2 | -3.16 | 77.5% | -3.88 |
| CE350-CE300 | 0.00 | 11.77 | 12.27 | 0.00 | 2.00 | 5.21 | 0.00 | 12.27 | 5.21 | 235.6% | 0.00 |
| CE360-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE400-CE300 | 14.96 | 16.22 | 16.72 | 16.27 | | 18.87 | 14.96 | 18.87 | 16.61 | 23.5% | 16.92 |
| CE410-CE300 | 14.44 | 15.44 | 15.94 | | | 18.74 | 14.44 | 18.74 | 16.14 | 26.7% | 16.92 |
| CE420-CE300 | 2.05 | 5.16 | 2.68 | 4.92 | | 6.41 | 2.05 | 6.41 | 4.24 | 102.7% | 5.63 |
| CE430-CE300 | 11.92 | 9.08 | 9.58 | 12.38 | | 11.50 | 9.08 | 12.38 | 10.89 | 30.3% | 13.07 |
| CE440-CE300 | -0.06 | 0.00 | 0.00 | 0.00 | | 0.07 | -0.06 | 0.07 | 0.00 | 13500.0% | 0.00 |
| CE500-CE300 | 31.21 | | | 31.63 | 32.00 | -7.36 | -7.36 | 32.00 | 21.87 | 180.0% | 32.35 |
| CE510-CE500 | 0.00 | | | 0.00 | 0.00 | -2.57 | -2.57 | 0.00 | -0.64 | 400.0% | 0.00 |
| CE525-CE520 | 9.77 | | | 6.19 | 5.00 | -20.65 | -20.65 | 9.77 | 0.08 | 39706.5% | 7.07 |
| CE530-CE500 | -8.96 | | | -3.84 | -21.00 | -24.07 | -24.07 | -3.84 | -14.47 | 139.8% | -59.19 |
| CE545-CE540 | 29.60 | | | 41.06 | 50.00 | -15.82 | -15.82 | 50.00 | 26.21 | 251.1% | -0.67 |

| **Minimum Relative Humidity (%)** | | | | | | | Statistics, All Results | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | TRNSYS TUD | DOE-2.2 NREL | DOE21E-E NREL | EnergyPlus GARD | CODYRUN UR | HOT3000 NRCan | Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
| CE310-CE300 | 0.06 | 0.00 | 0.00 | 1.10 | 1.00 | 0.99 | 0.00 | 1.10 | 0.52 | 209.6% | 0.04 |
| CE320-CE300 | 0.00 | 0.00 | 0.00 | 0.24 | 0.00 | -2.02 | -2.02 | 0.24 | -0.30 | 761.2% | 0.22 |
| CE330-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE330-CE320 | 0.00 | 0.00 | 0.00 | -0.24 | 0.00 | 2.02 | -0.24 | 2.02 | 0.30 | 761.1% | -0.22 |
| CE340-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE330-CE340 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ---- | 0.00 |
| CE350-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ---- | 0.00 |
| CE360-CE300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 600.0% | 0.00 |
| CE400-CE300 | -0.12 | 0.00 | 0.00 | -0.48 | | -0.37 | -0.48 | 0.00 | -0.19 | 246.0% | -0.34 |
| CE410-CE300 | -0.12 | 0.00 | 0.00 | | | -0.36 | -0.36 | 0.00 | -0.12 | 298.7% | -0.34 |
| CE420-CE300 | -0.12 | 0.00 | 0.00 | -0.48 | | -0.35 | -0.48 | 0.00 | -0.19 | 251.4% | -0.34 |
| CE430-CE300 | -0.12 | 0.00 | 0.00 | -0.48 | | -0.36 | -0.48 | 0.00 | -0.19 | 248.3% | -0.34 |
| CE440-CE300 | -0.12 | 0.00 | 0.00 | -0.48 | | -0.40 | -0.48 | 0.00 | -0.20 | 238.1% | -0.34 |
| CE500-CE300 | 40.07 | | | 40.76 | 39.00 | 37.89 | 37.89 | 40.76 | 39.43 | 7.3% | 38.28 |
| CE510-CE500 | -1.32 | | | 0.12 | 0.00 | 0.32 | -1.32 | 0.32 | -0.22 | 747.8% | 0.05 |
| CE525-CE520 | -15.74 | | | -13.87 | -17.00 | -17.50 | -17.50 | -13.87 | -16.03 | 22.6% | -16.15 |
| CE530-CE500 | -23.81 | | | -21.14 | -26.00 | -19.15 | -26.00 | -19.15 | -22.53 | 30.4% | -38.13 |
| CE545-CE540 | -19.35 | | | -16.77 | -12.00 | -19.60 | -19.60 | -12.00 | -16.93 | 44.9% | -18.82 |

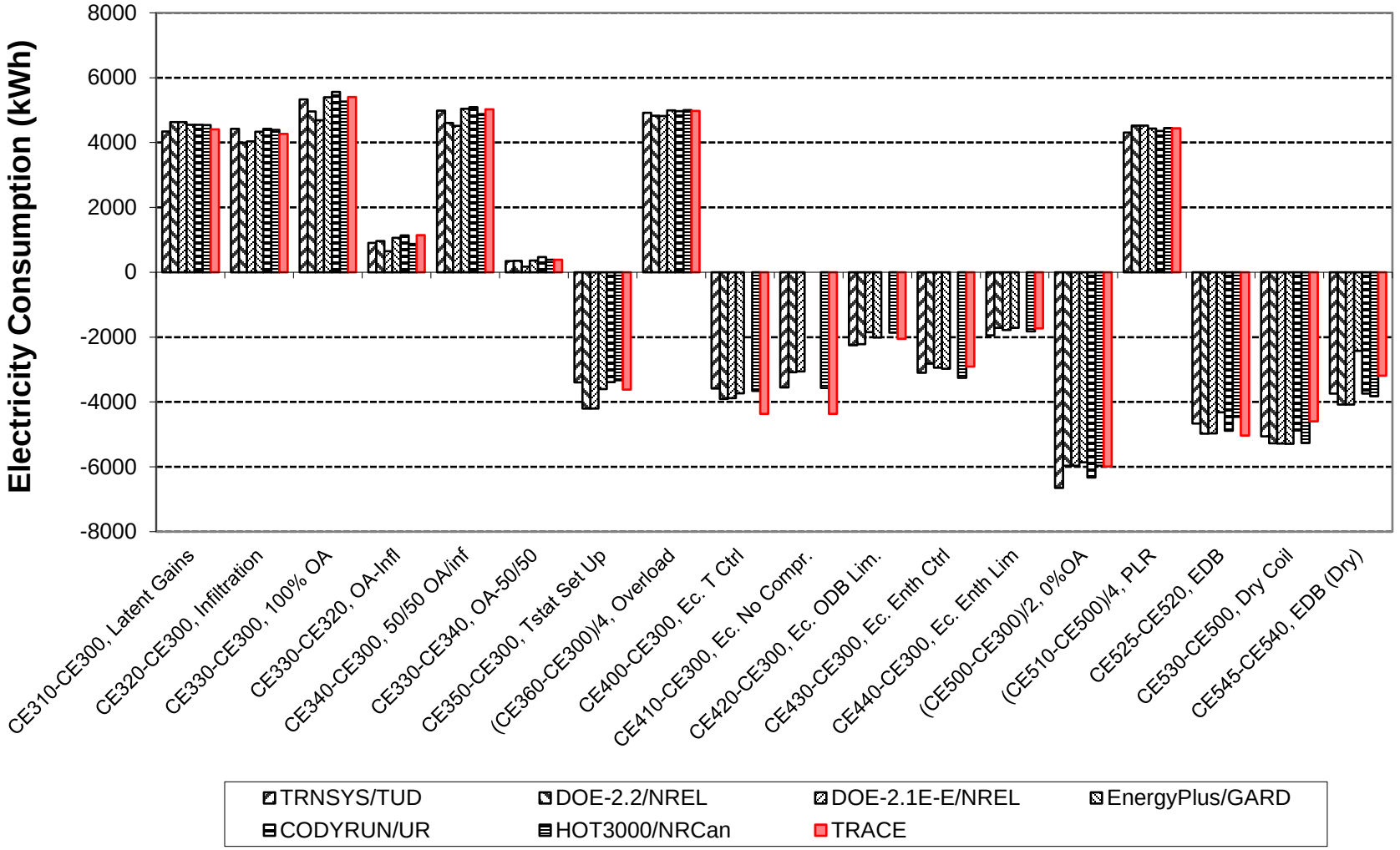
* ABS[ (Max-Min) / (Mean of Example Simulation Results) ]

ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2
Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545

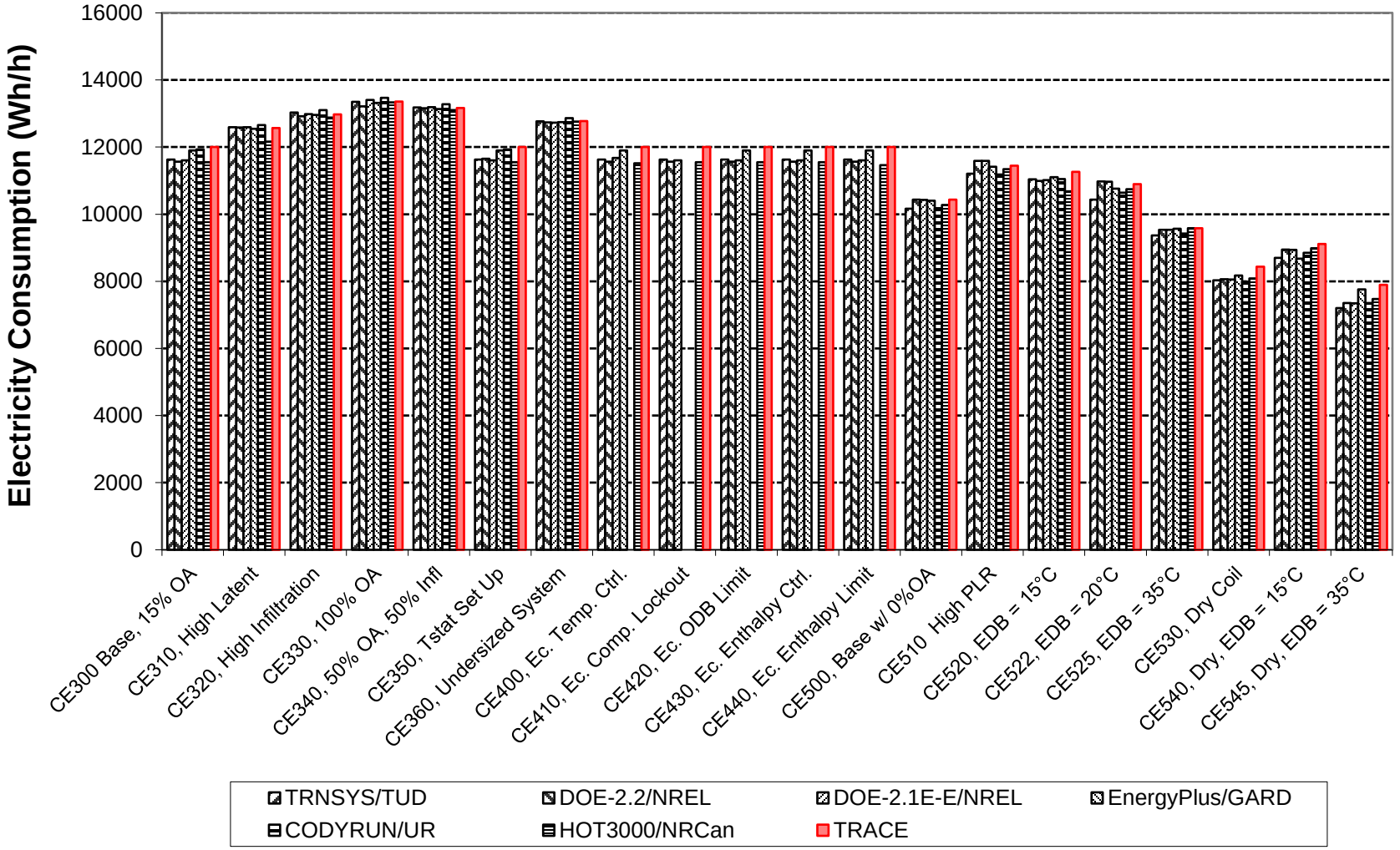
## Figure B16.5.2-1. HVAC BESTEST: CE300 - CE545 Annual Total Electricity Consumption



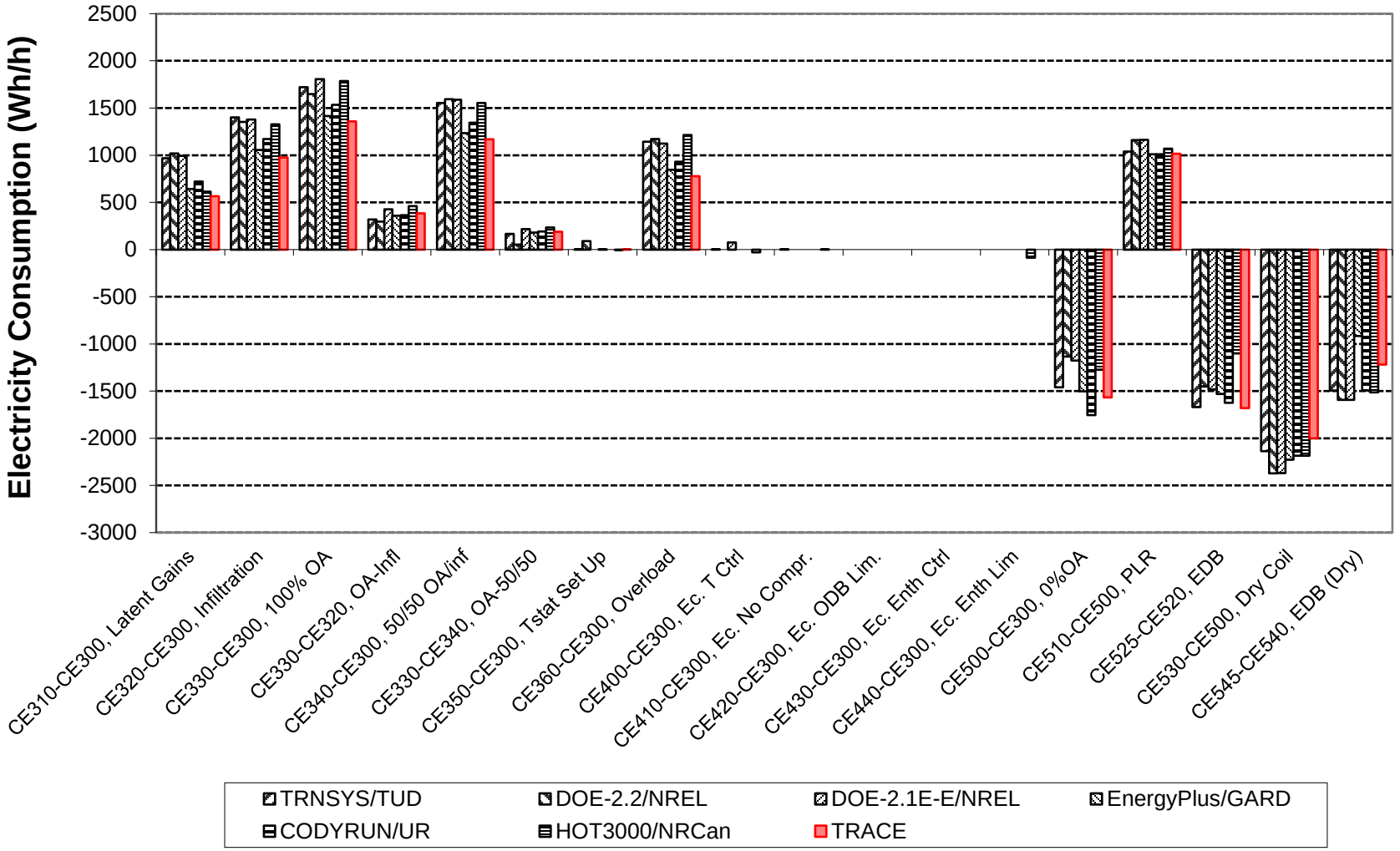
# Figure B16.5.2-2. HVAC BESTEST: CE300 - CE545 Annual Total Space Cooling Electricity Consumption Sensitivities



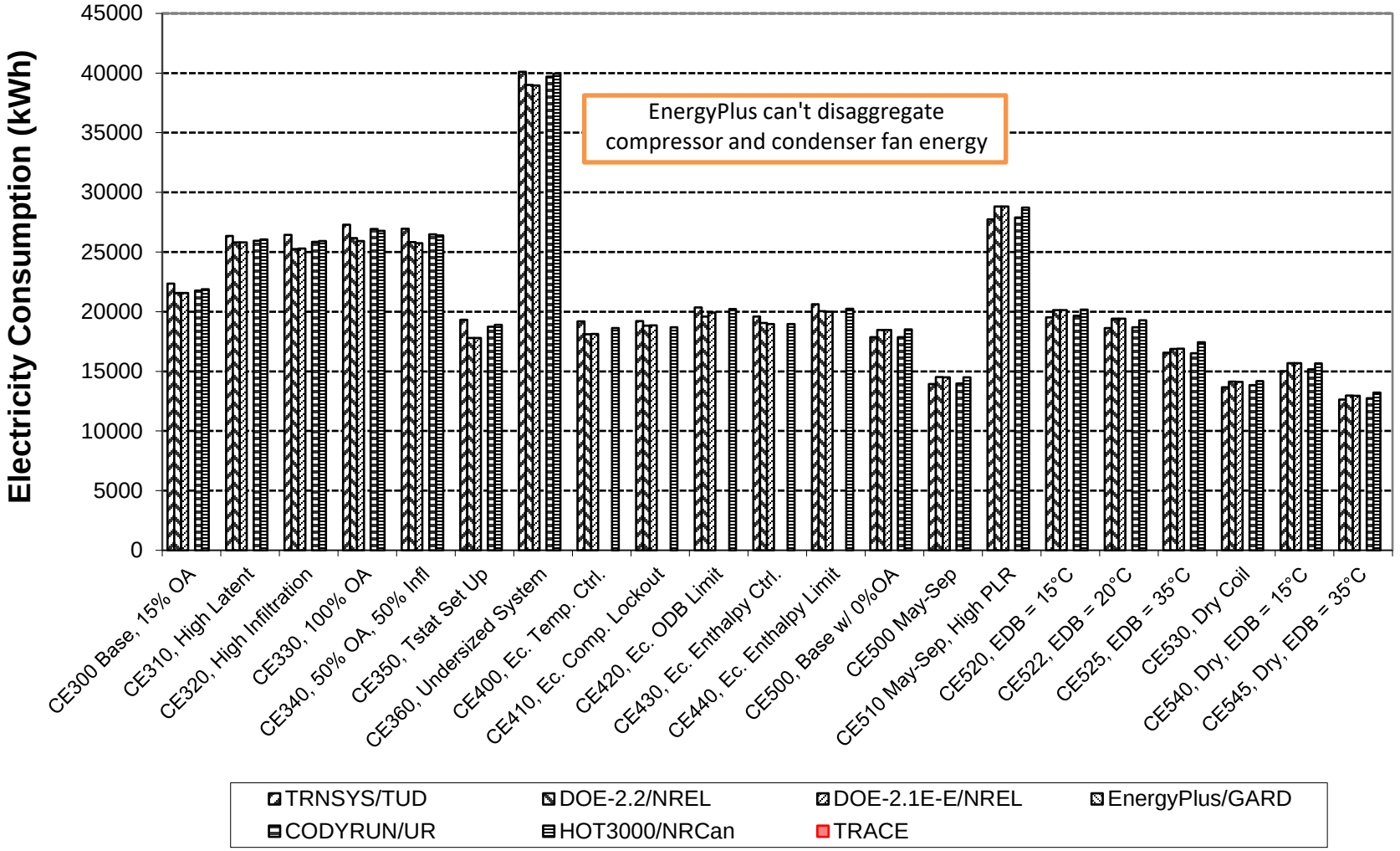
# Figure B16.5.2-3. HVAC BESTEST: CE300 - CE545 Peak Hour Total Electricity Consumption



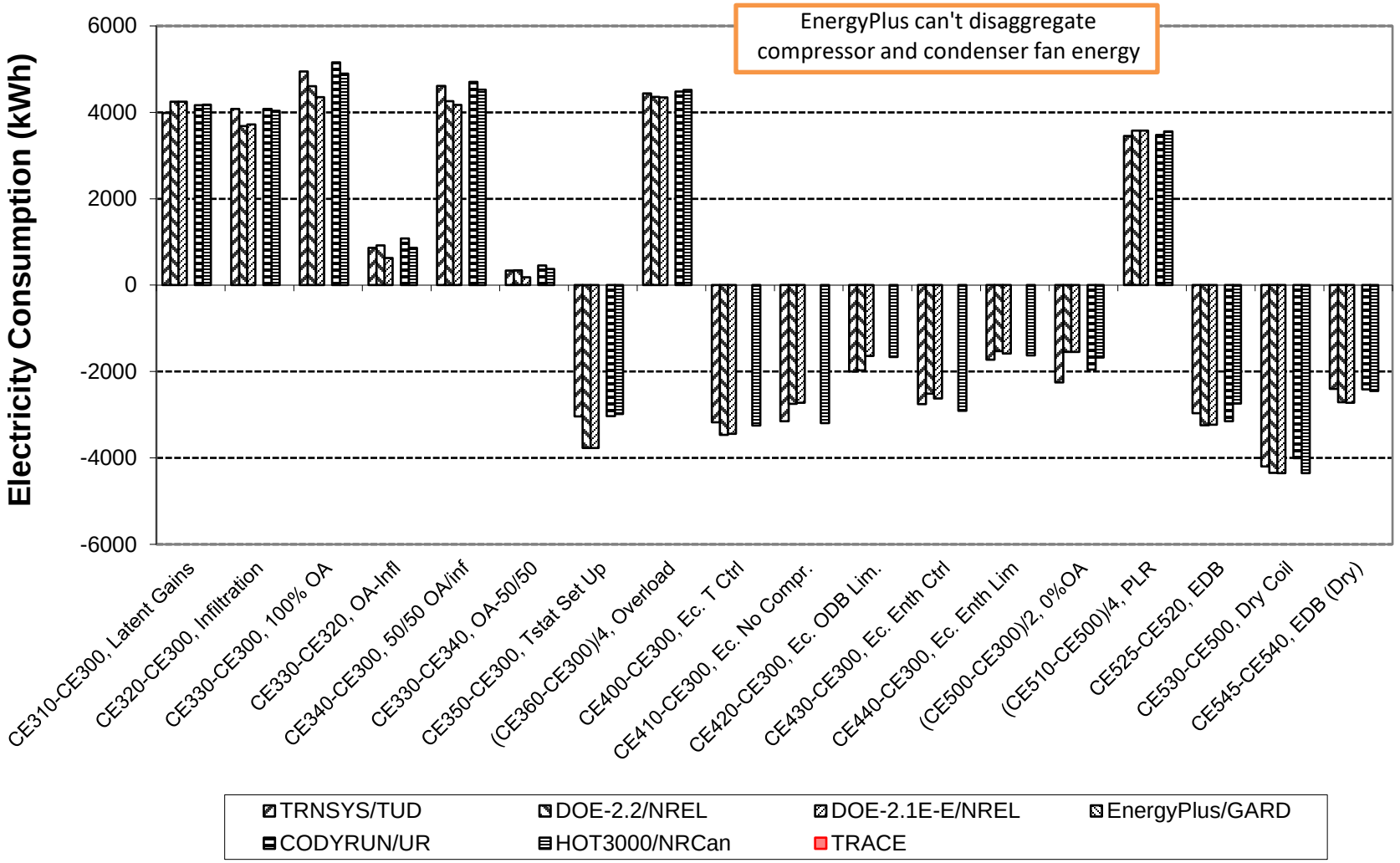
# Figure B16.5.2-4. HVAC BESTEST: CE300 - CE545 Hourly Maximum Total Space Cooling Consumption Sensitivities



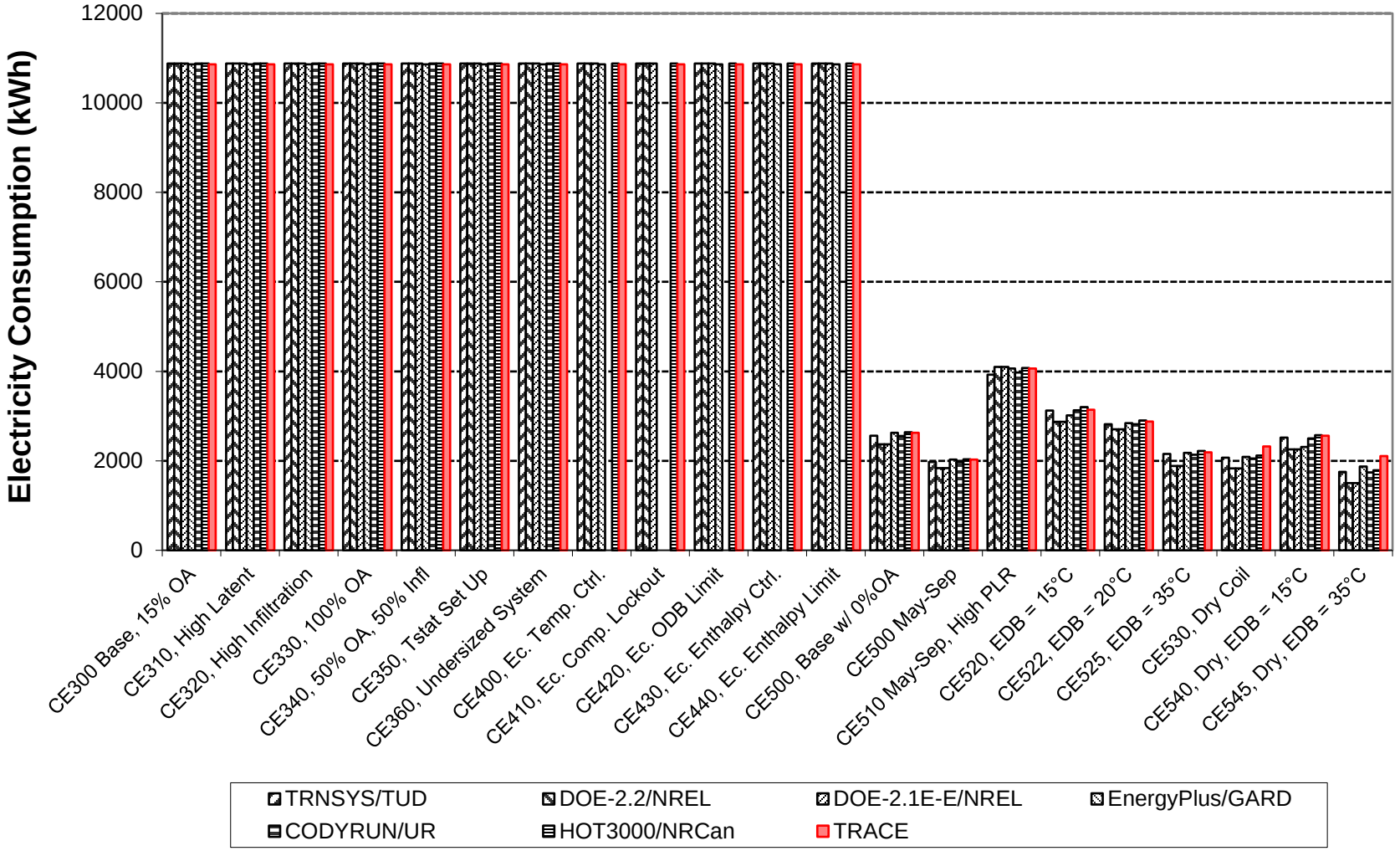
# Figure B16.5.2-5. HVAC BESTEST: CE300 - CE545 Annual Compressor Electricity Consumption



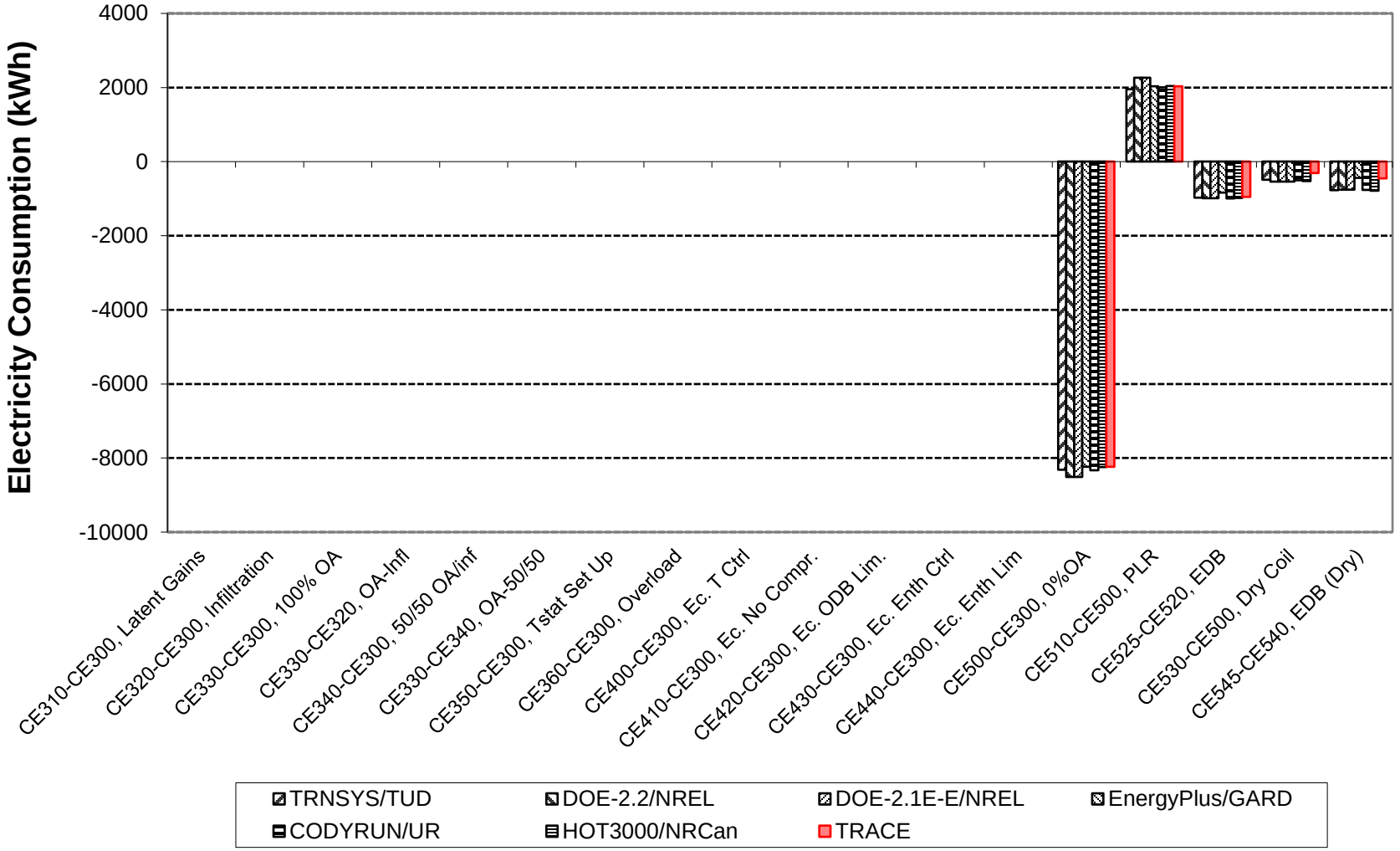
# Figure B16.5.2-6. HVAC BESTEST: CE300 - CE545 Annual Compressor Electricity Consumption Sensitivities



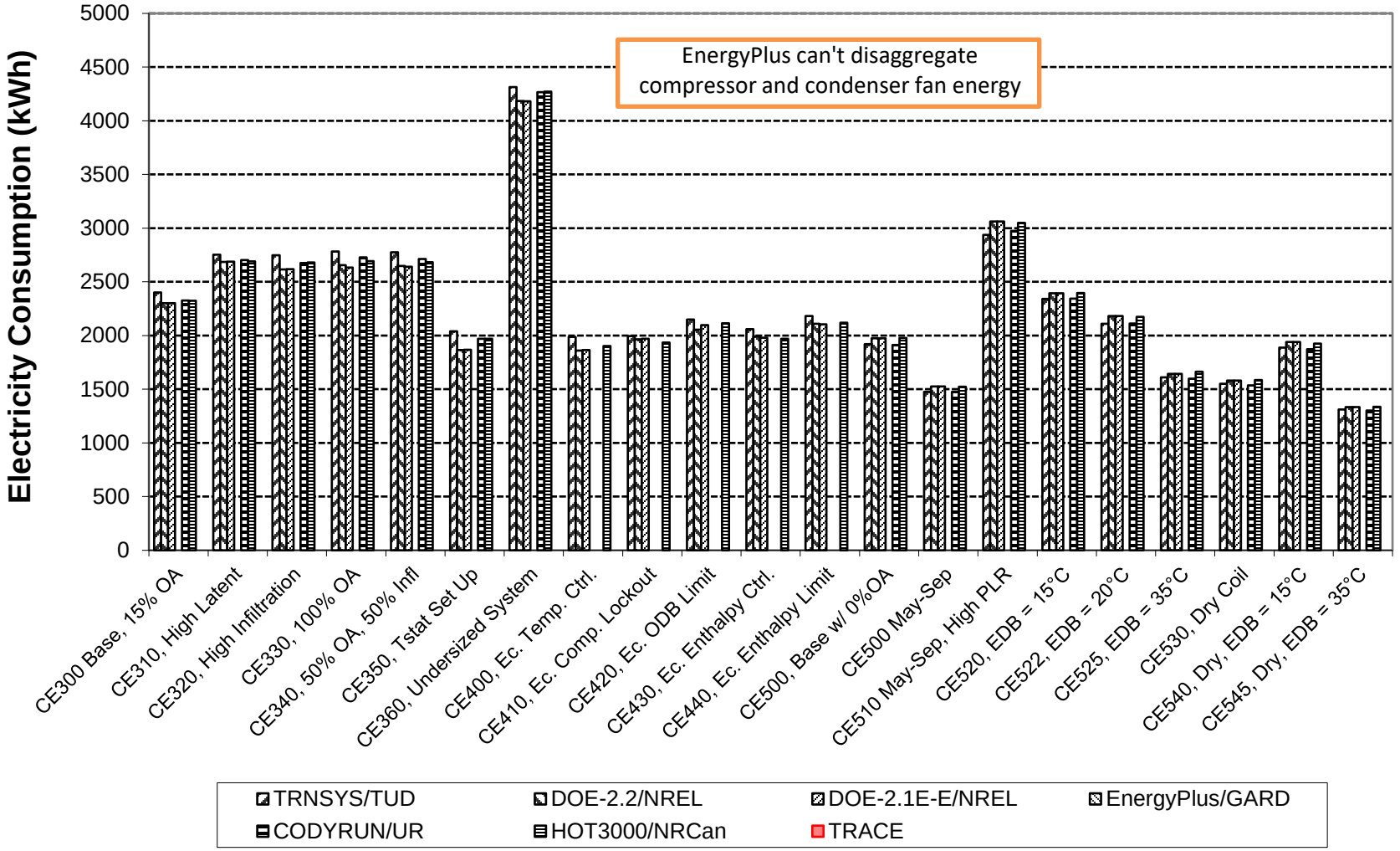
## Figure B16.5.2-7. HVAC BESTEST: CE300 - CE545 Annual Indoor (Supply) Fan Electricity Consumption



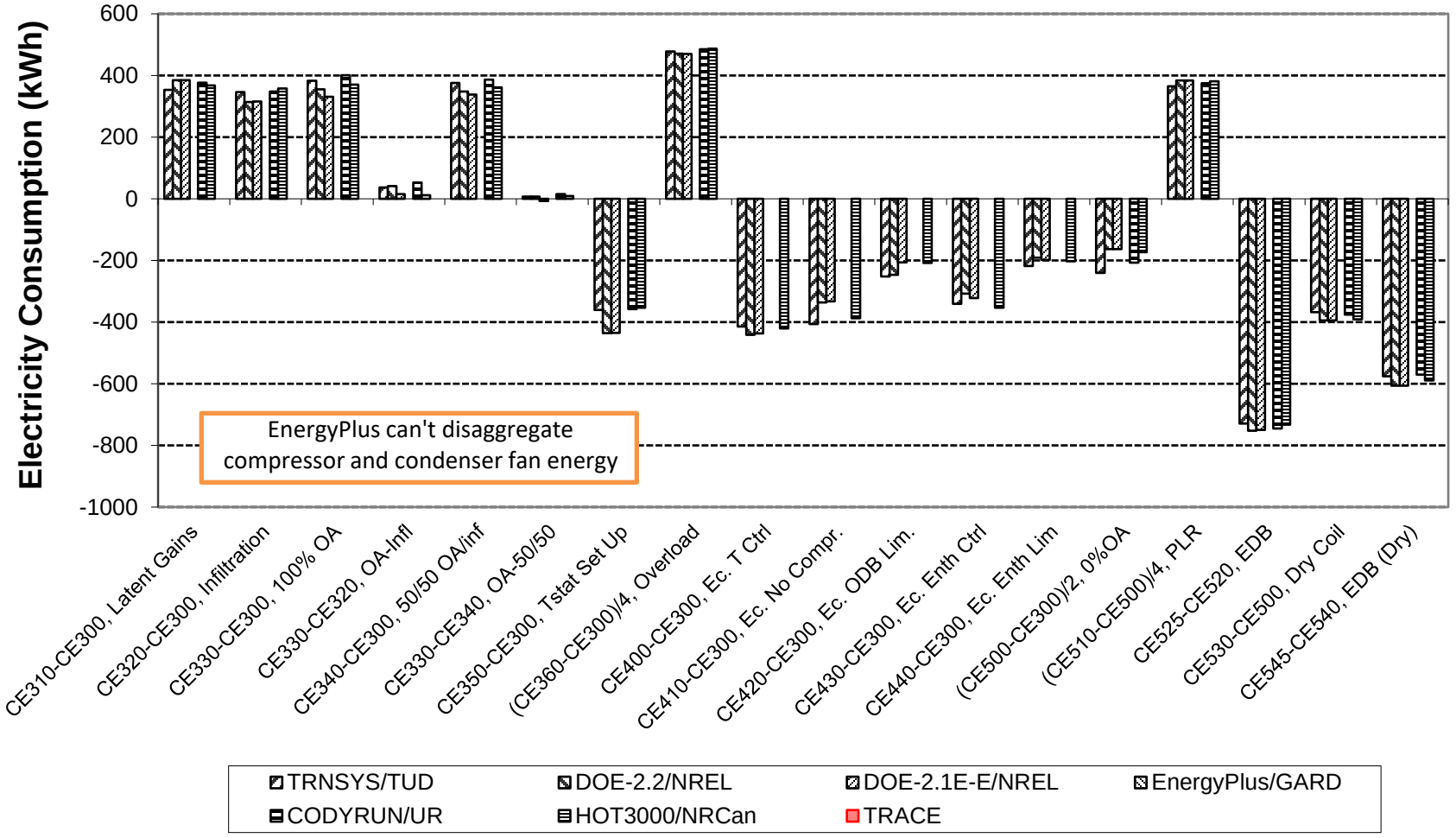
# Figure B16.5.2-8. HVAC BESTEST: CE300 - CE545 Annual Indoor (Supply) Fan Electricity Consumption Sensitivities



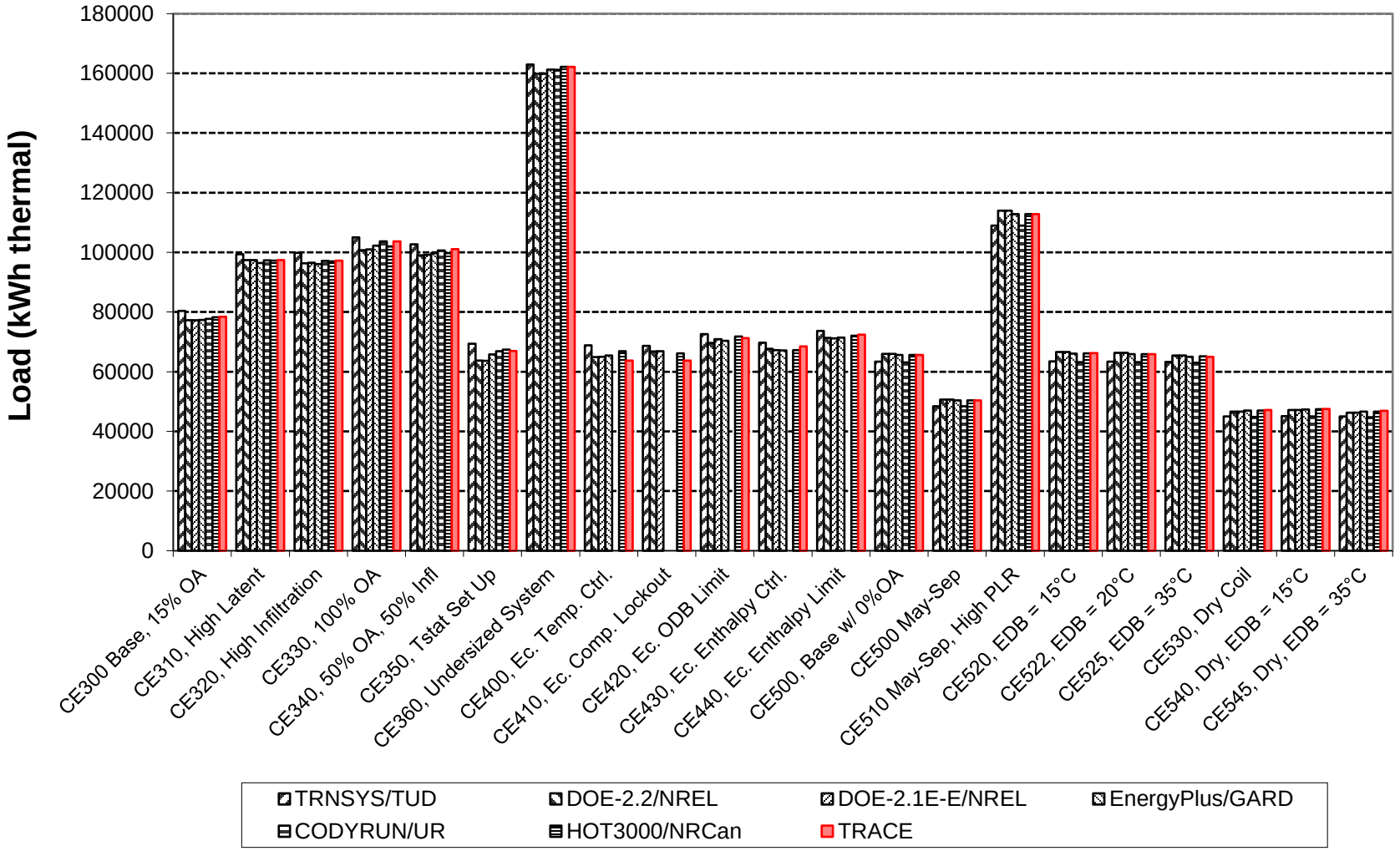
# Figure B16.5.2-9. HVAC BESTEST: CE300 - CE545 Annual Outdoor (Condenser) Fan Electricity Consumption



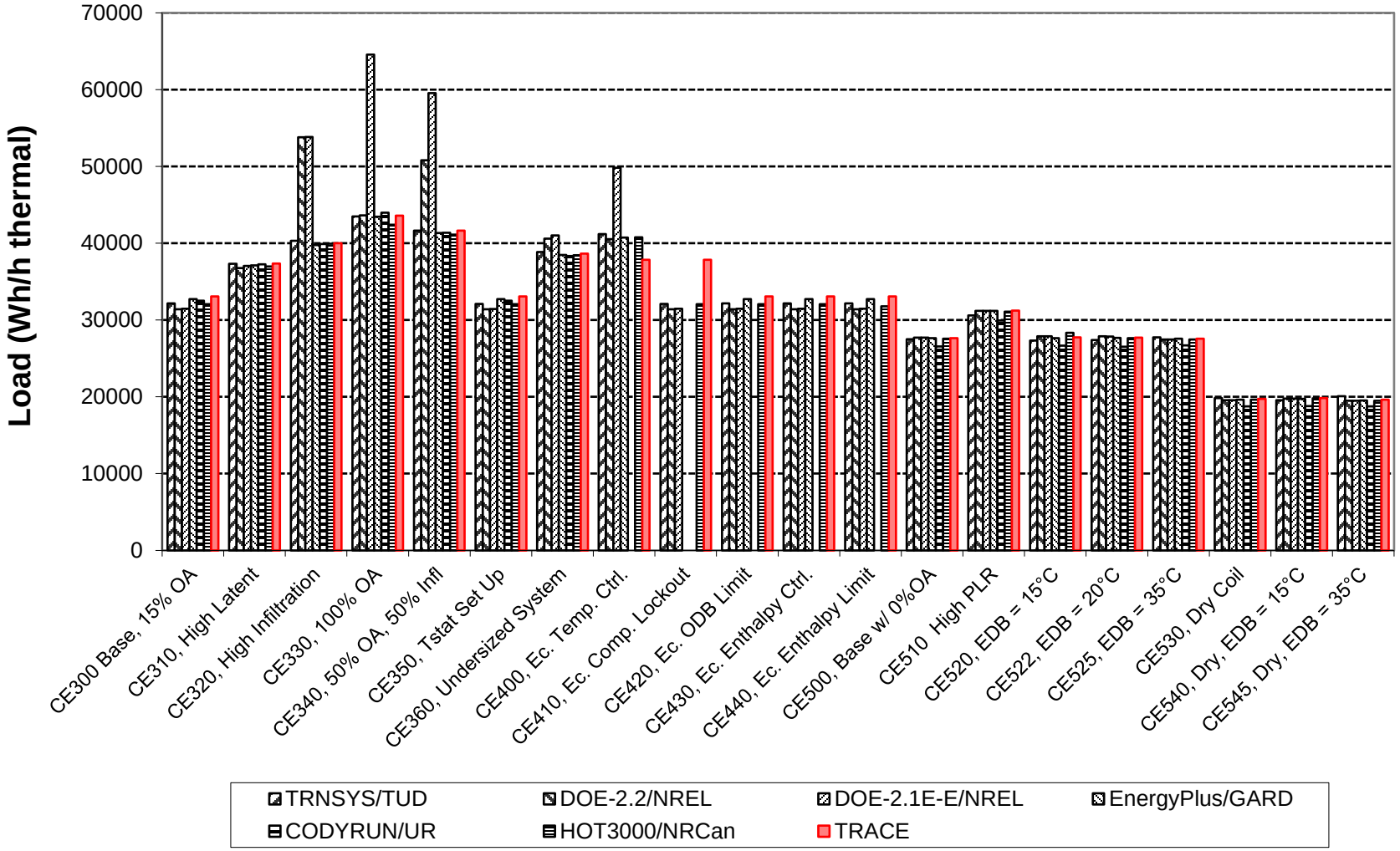
# Figure B16.5.2-10. HVAC BESTEST: CE300 - CE545 Annual Outdoor (Condenser) Fan Electricity Consumption Sensitivities



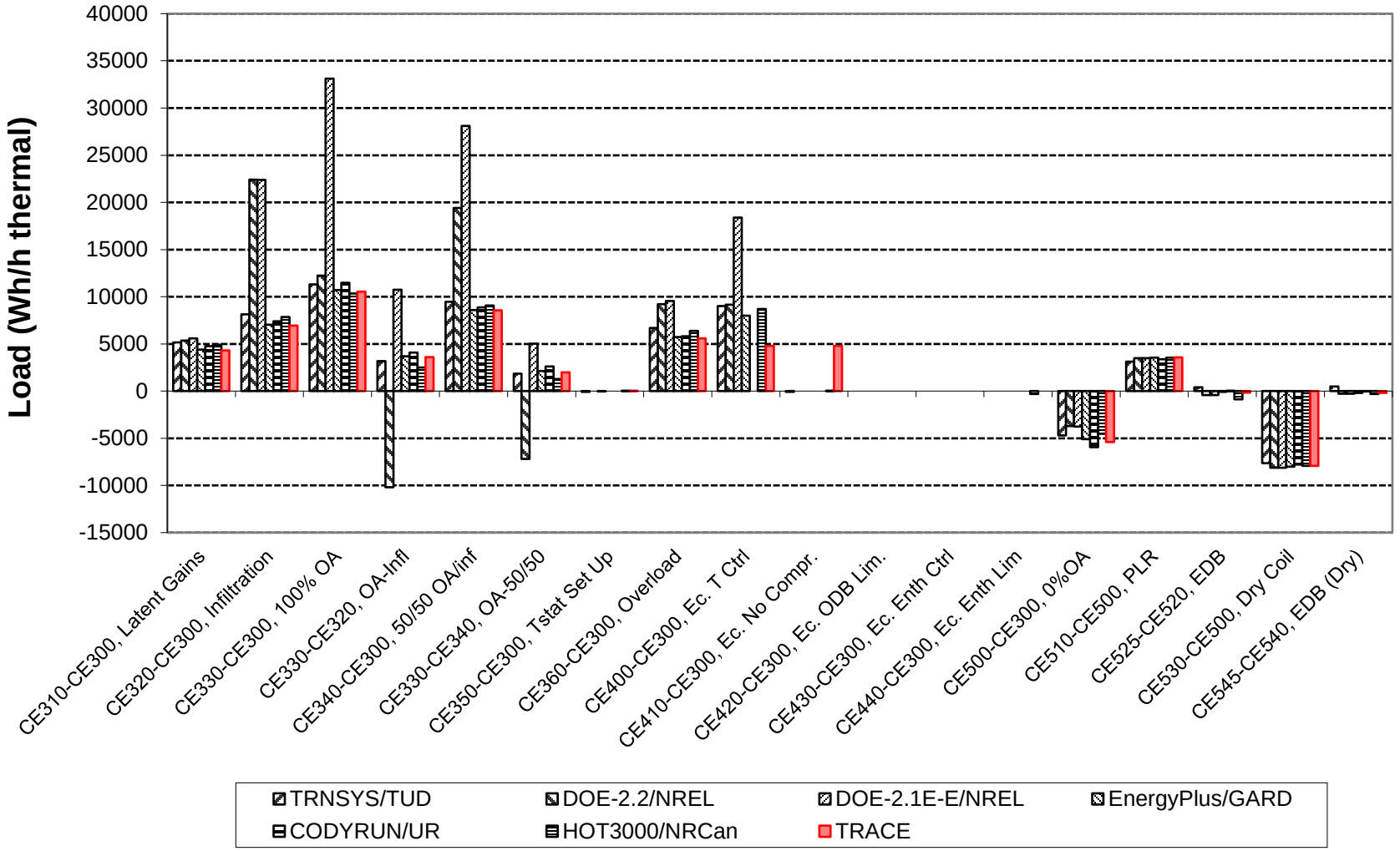
# Figure B16.5.2-11. HVAC BESTEST: CE300 - CE545 Annual Total Coil Load



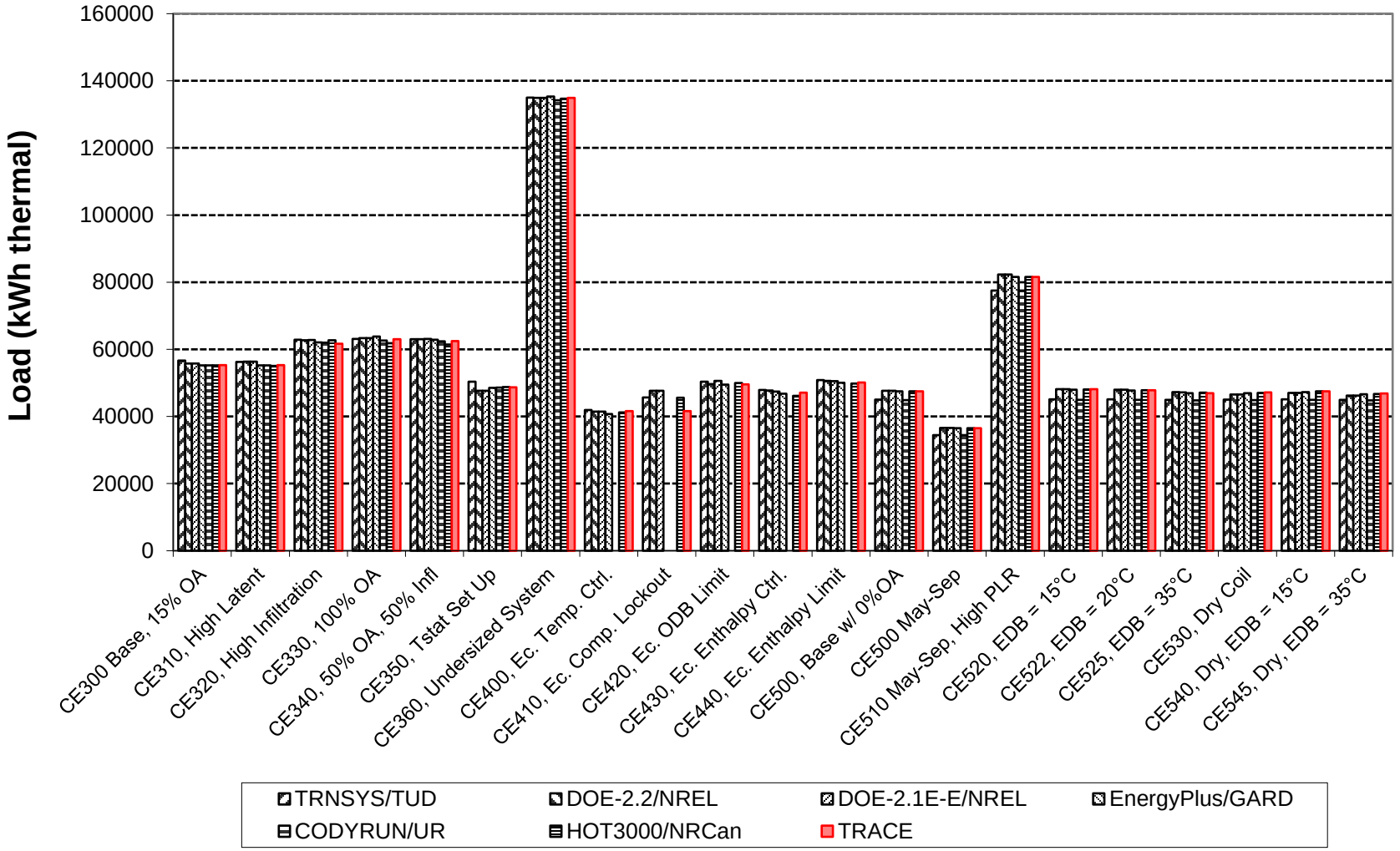
# Figure B16.5.2-12. HVAC BESTEST: CE300 - CE545 Peak Hour Total Coil Load



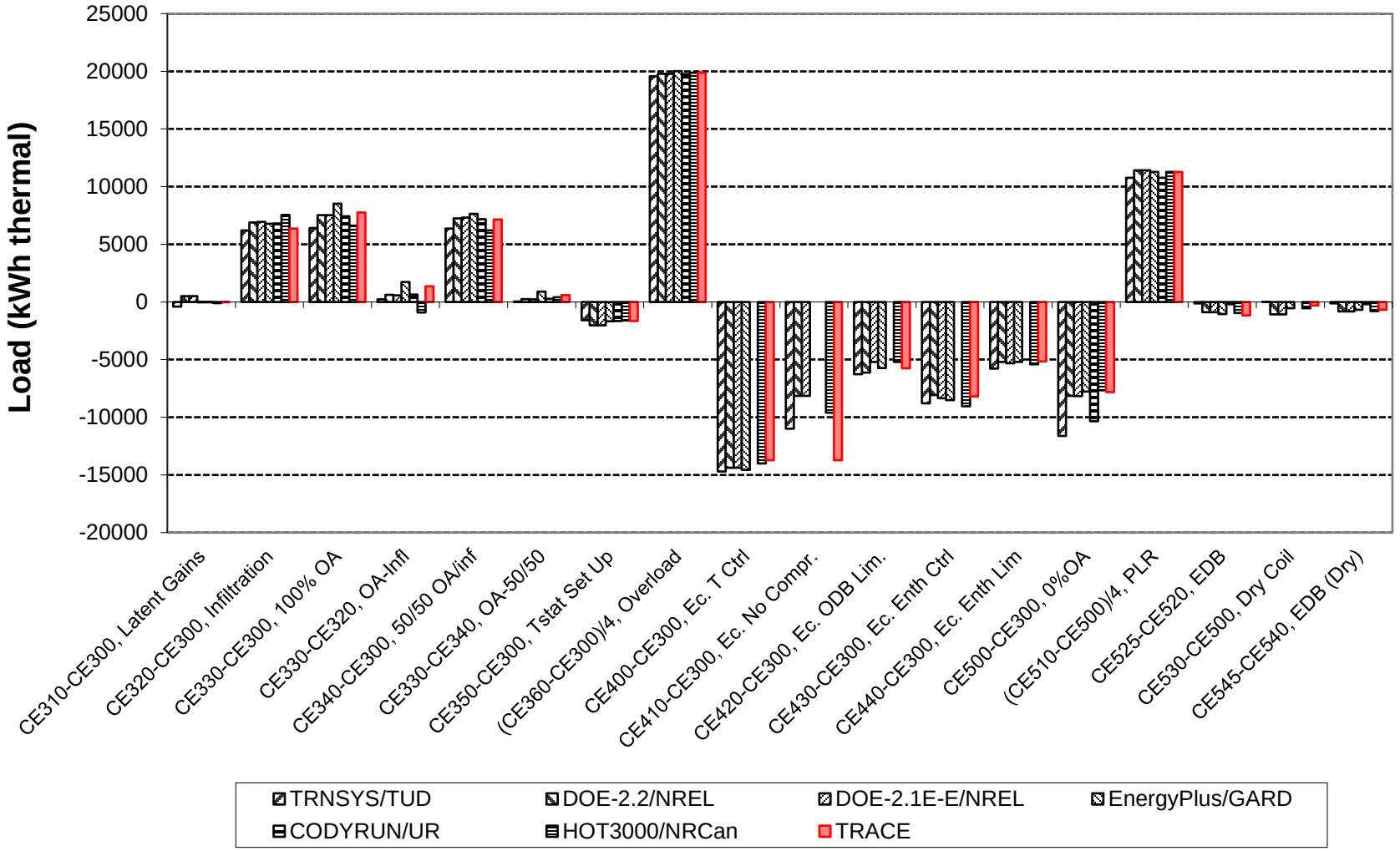
# Figure B16.5.2-13. HVAC BESTEST: CE300 - CE545 Hourly Maximum Total Coil Load Sensitivities



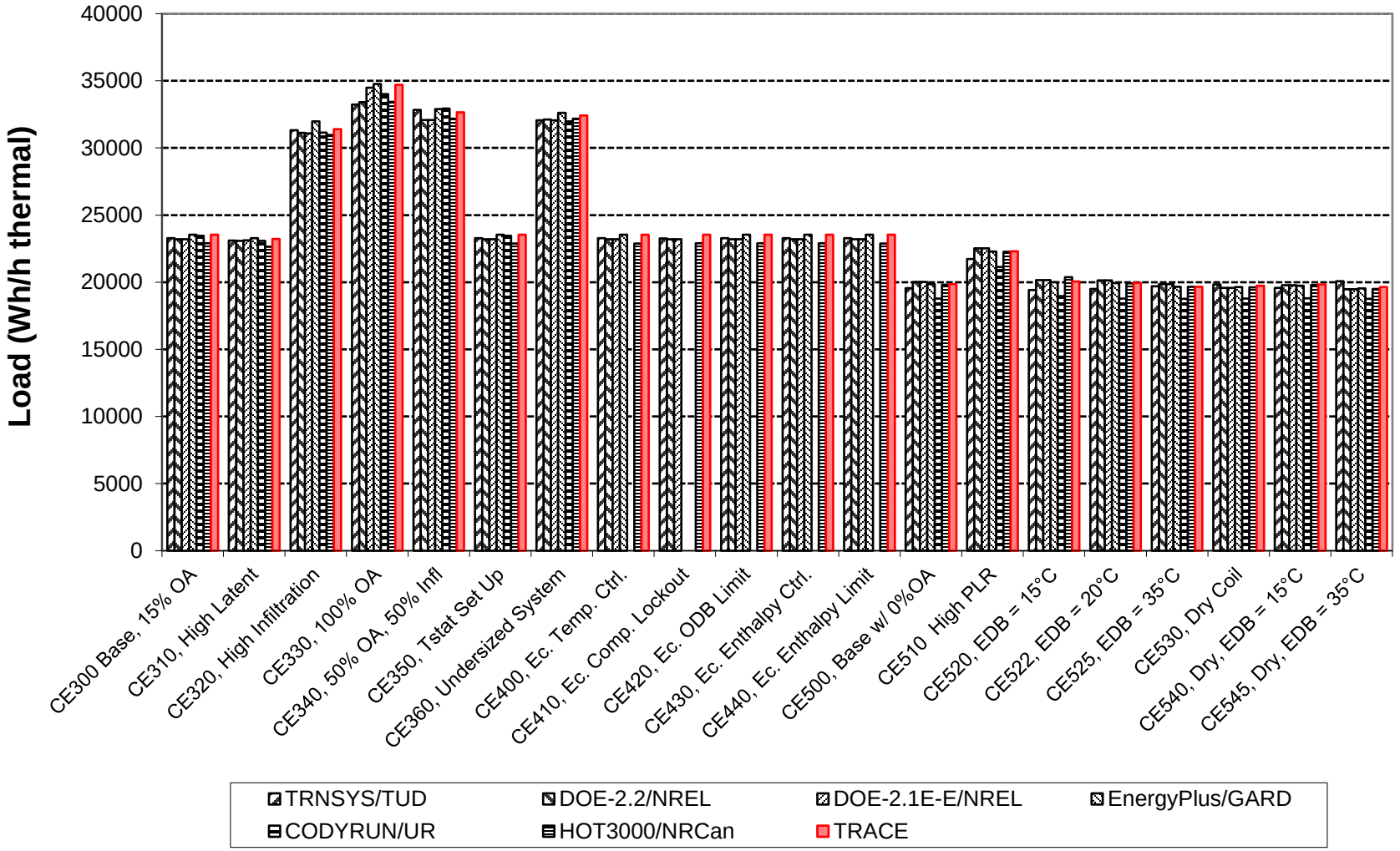
# Figure B16.5.2-14. HVAC BESTEST: CE300 - CE545 Annual Sensible Coil Load



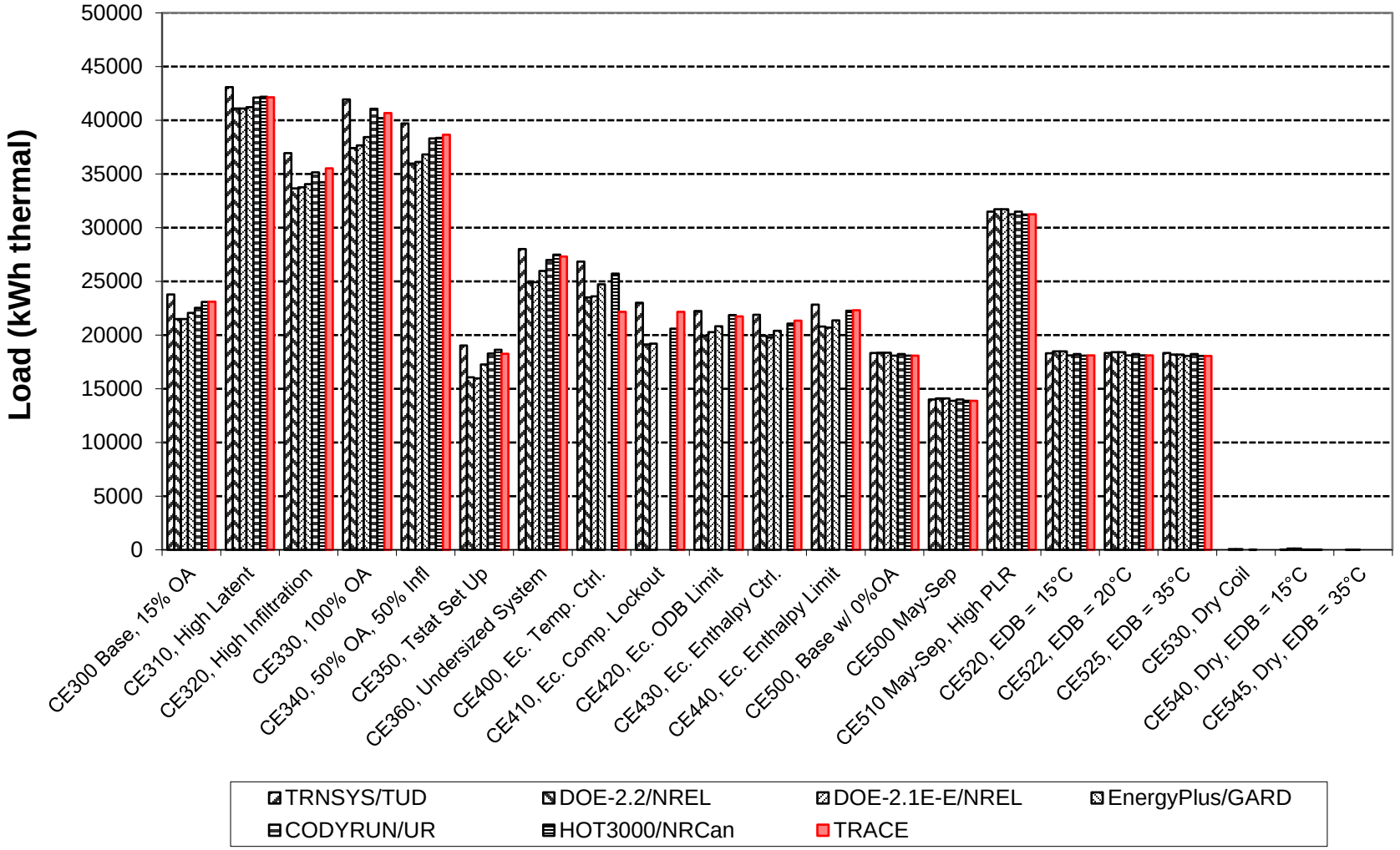
# Figure B16.5.2-15. HVAC BESTEST: CE300 - CE545 Annual Sensible Cooling Load Sensitivities



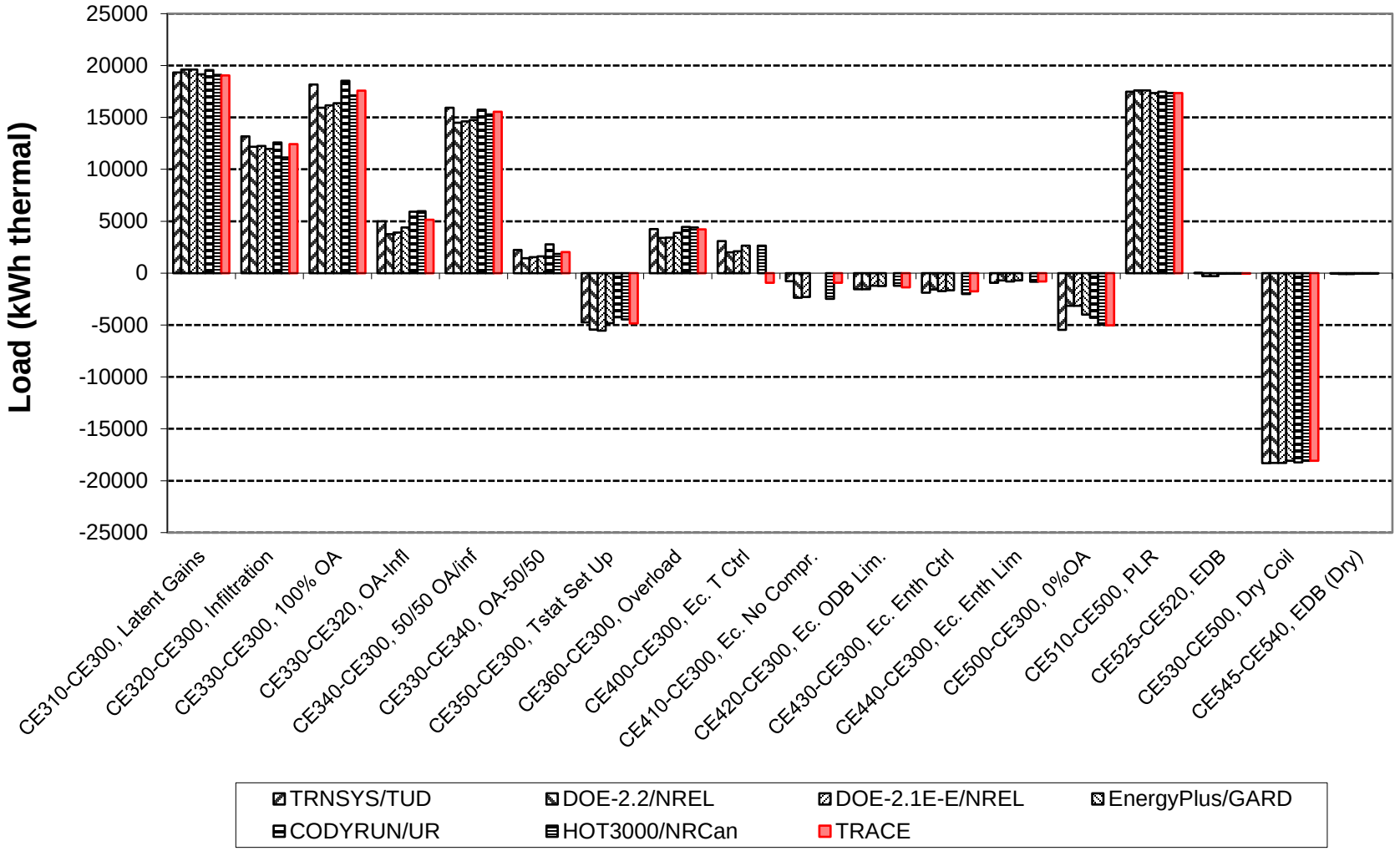
# Figure B16.5.2-16. HVAC BESTEST: CE300 - CE545 Peak Hour Sensible Coil Load



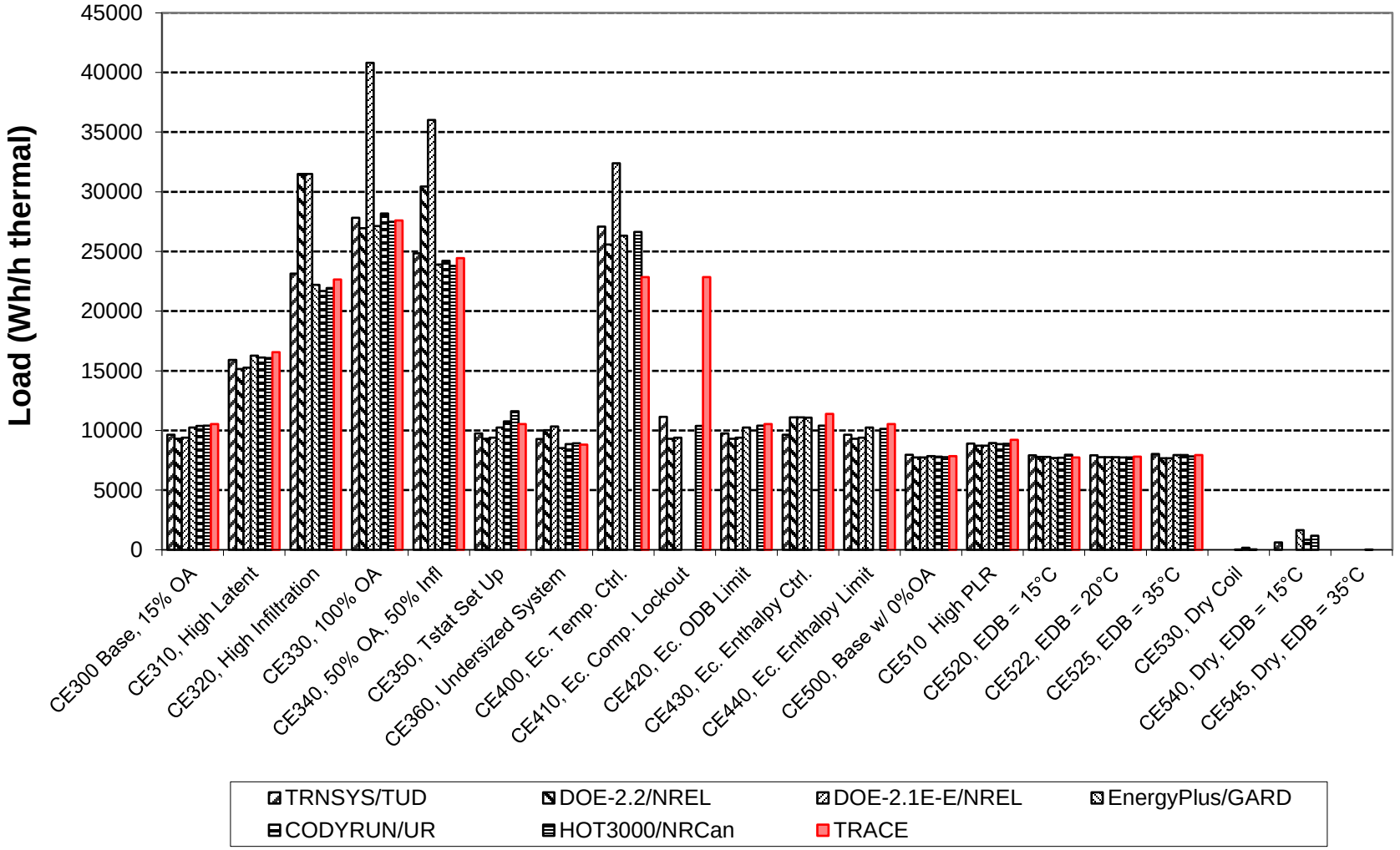
# Figure B16.5.2-17. HVAC BESTEST: CE300 - CE545 Annual Latent Coil Load



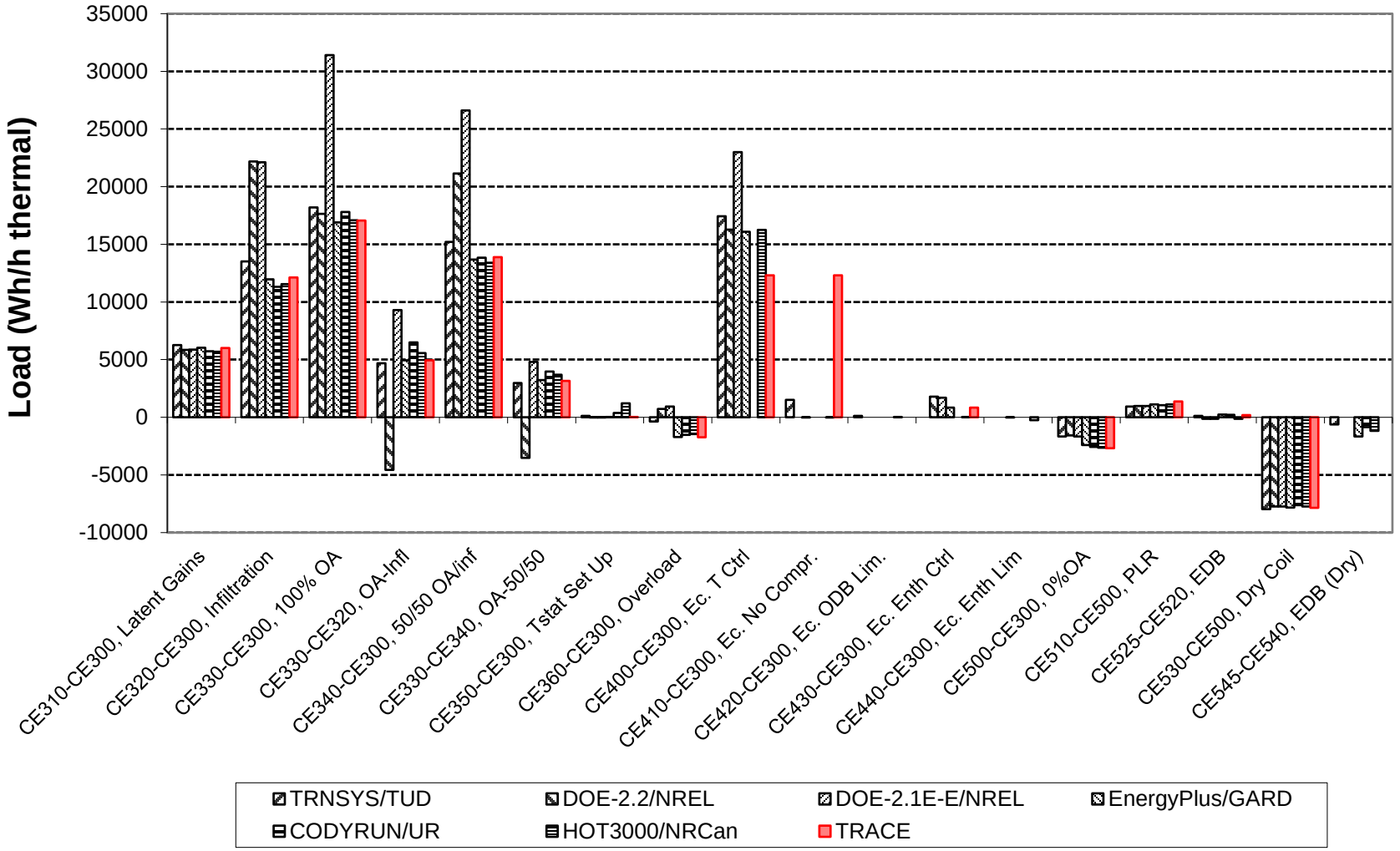
# Figure B16.5.2-18. HVAC BESTEST: CE300 - CE545 Annual Latent Cooling Load Sensitivities



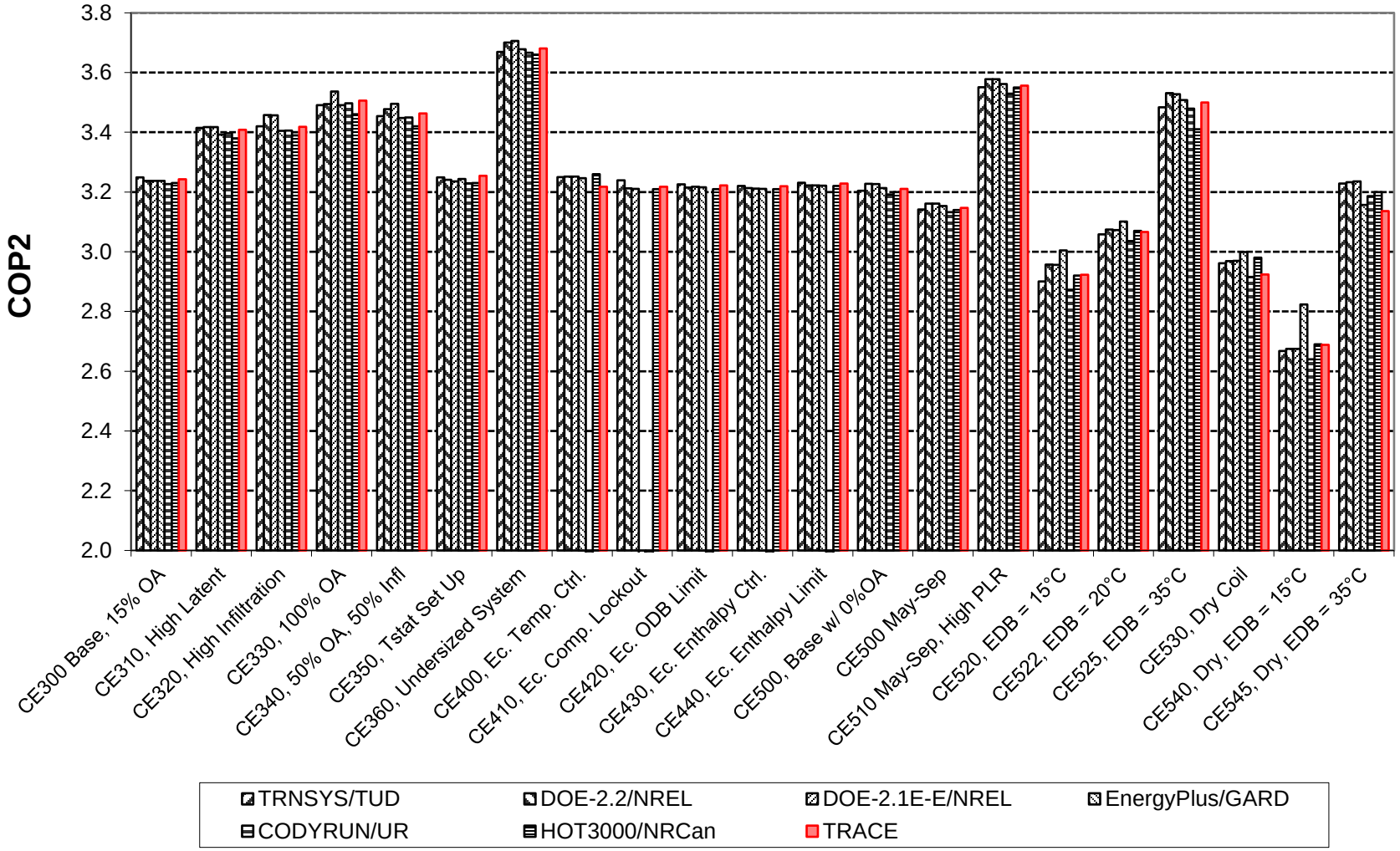
# Figure B16.5.2-19. HVAC BESTEST: CE300 - CE545 Peak Hour Latent Coil Load



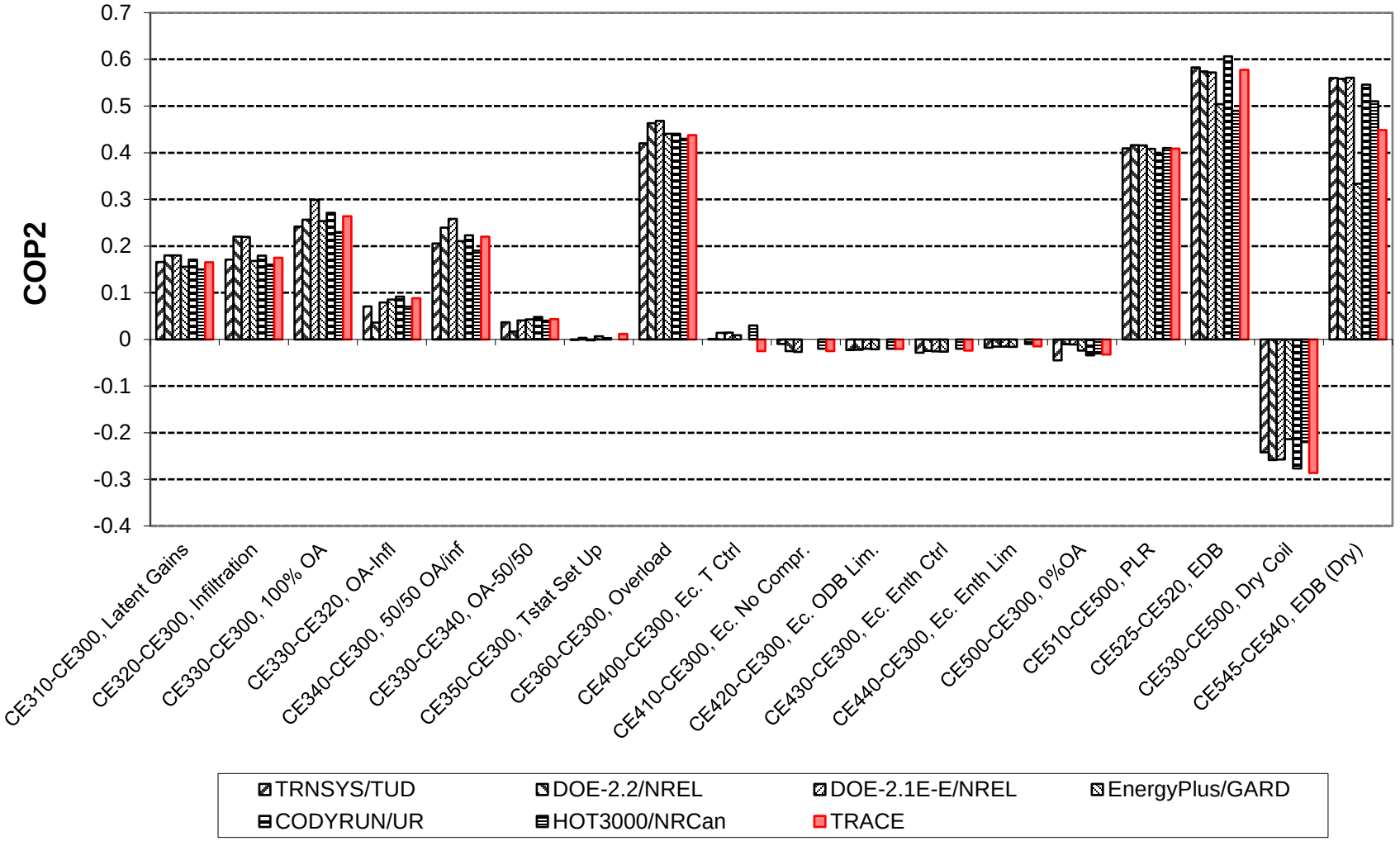
# Figure B16.5.2-20. HVAC BESTEST: CE300 - CE545 Hourly Maximum Latent Coil Load Sensitivities



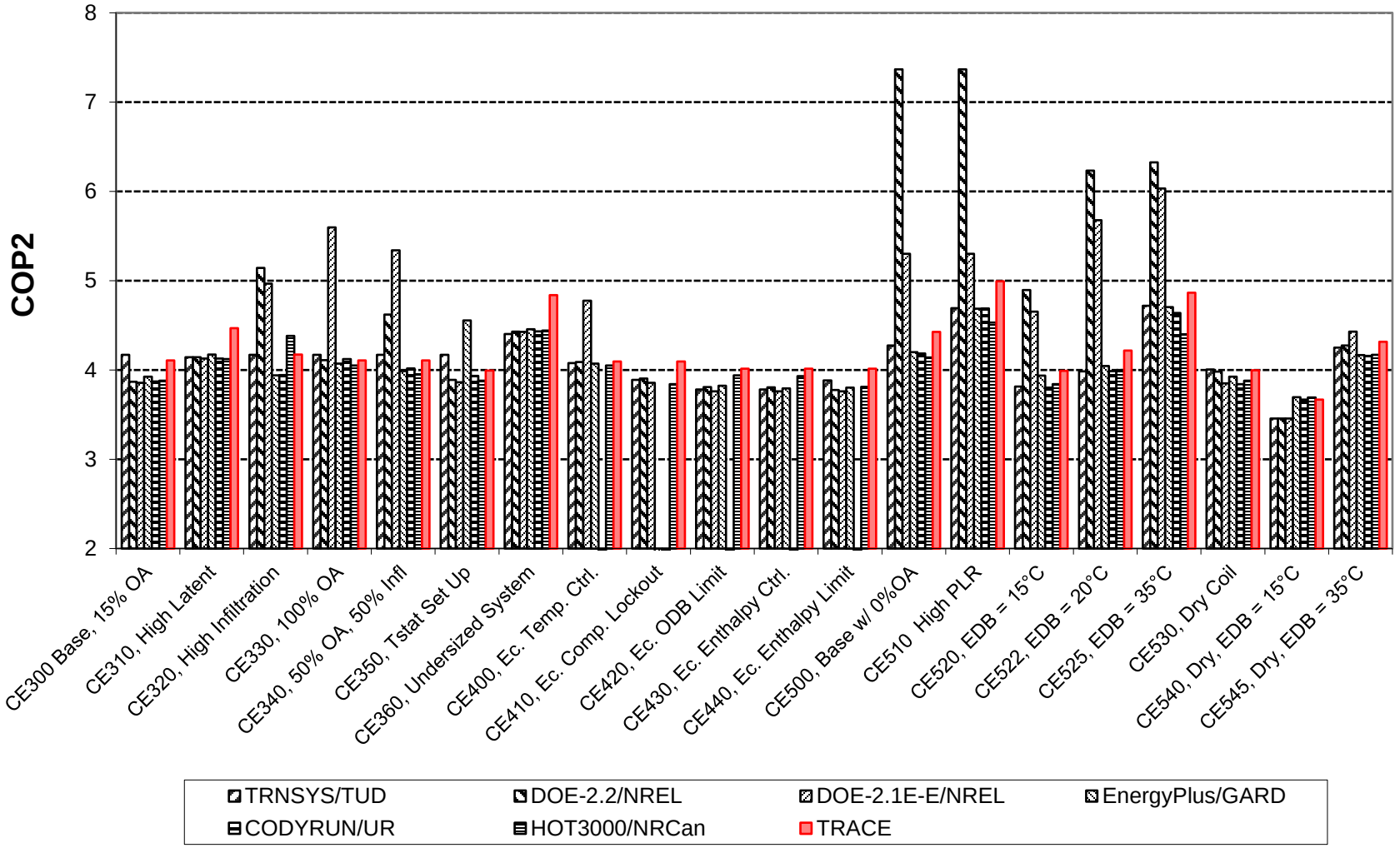
# Figure B16.5.2-21. HVAC BESTEST: CE300 - CE545 Annual Mean COP2



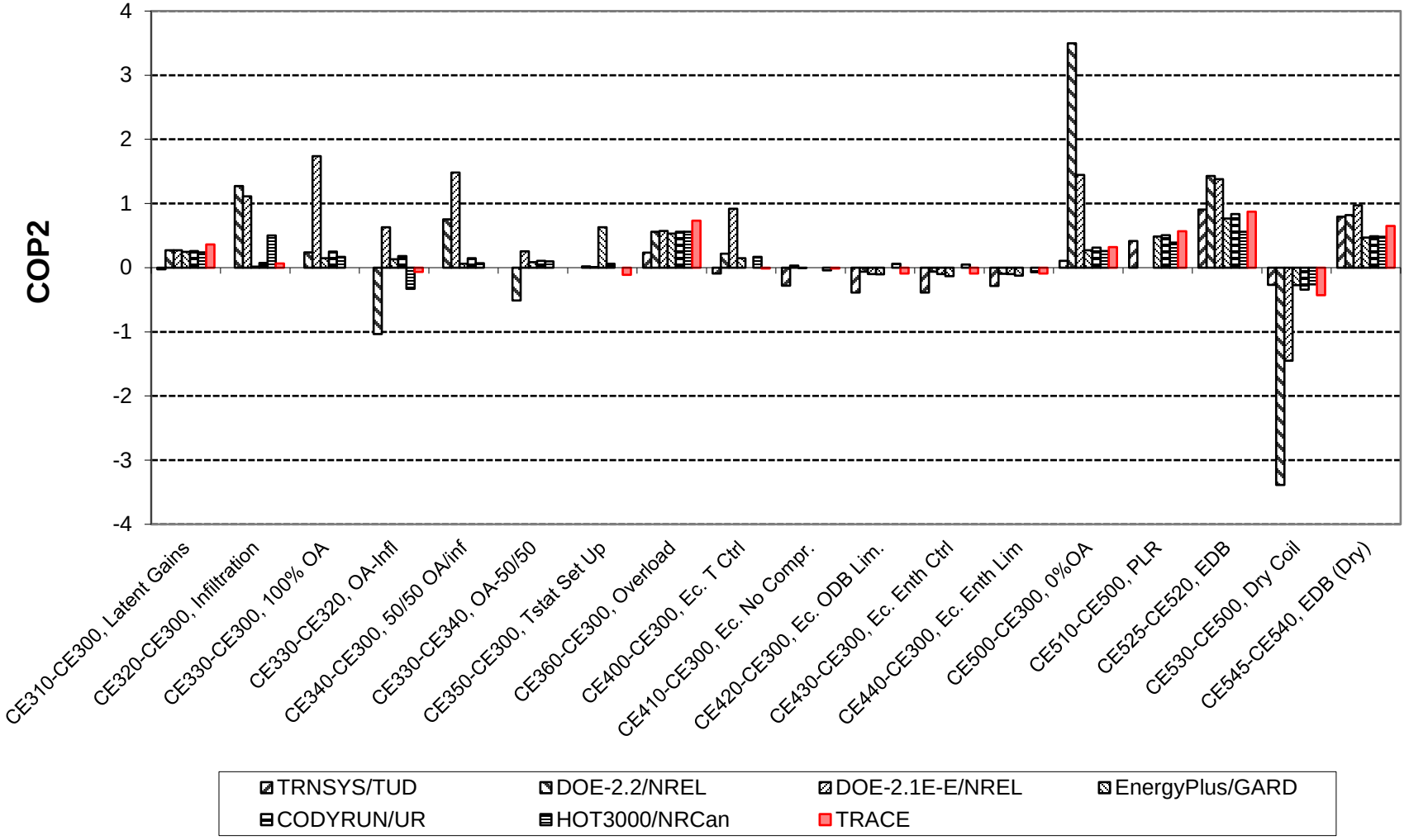
# Figure B16.5.2-22. HVAC BESTEST: CE300 - CE545 Annual Mean COP2 Sensitivities



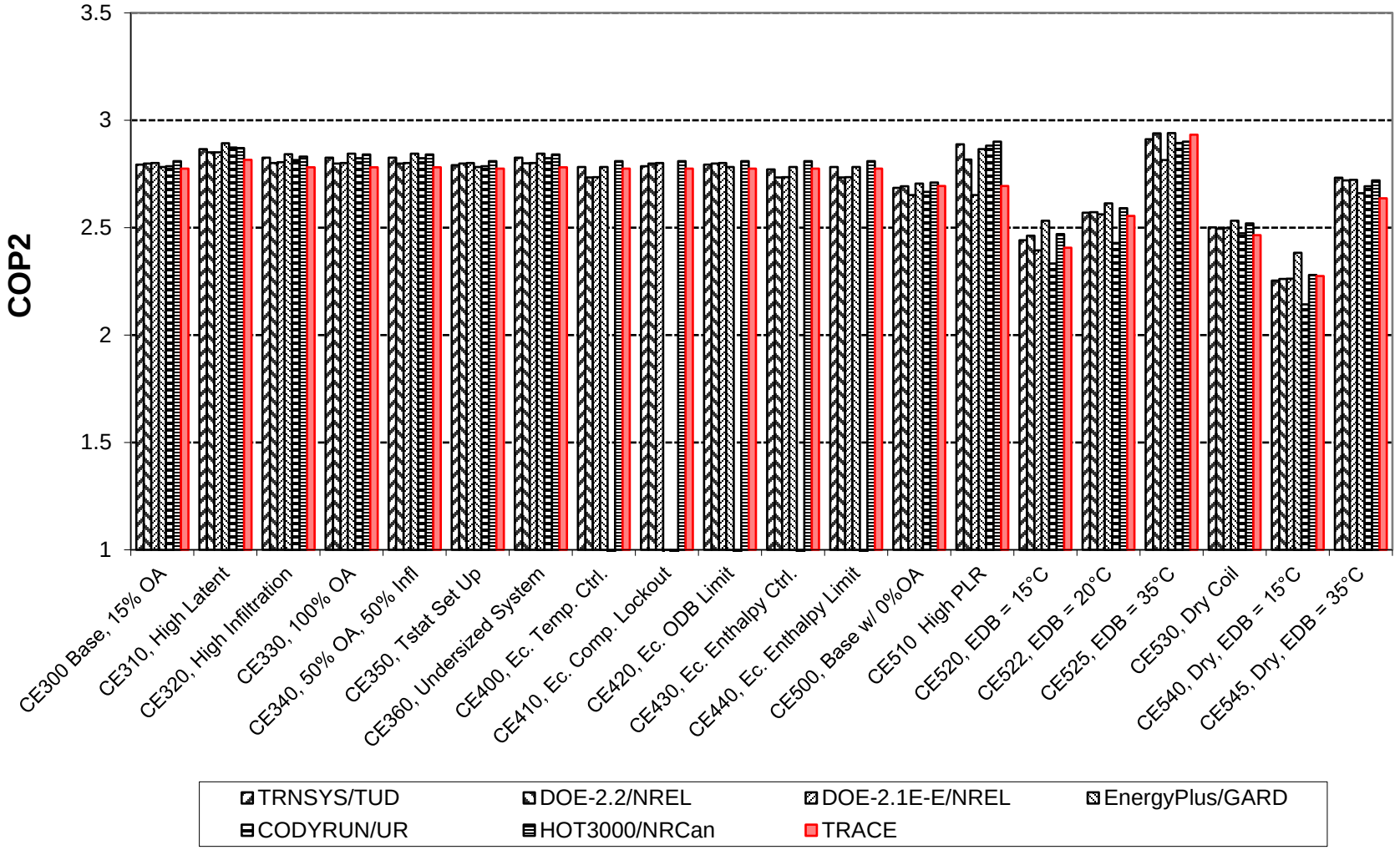
# Figure B16.5.2-23. HVAC BESTEST: CE300 - CE545 Hourly Maximum COP2



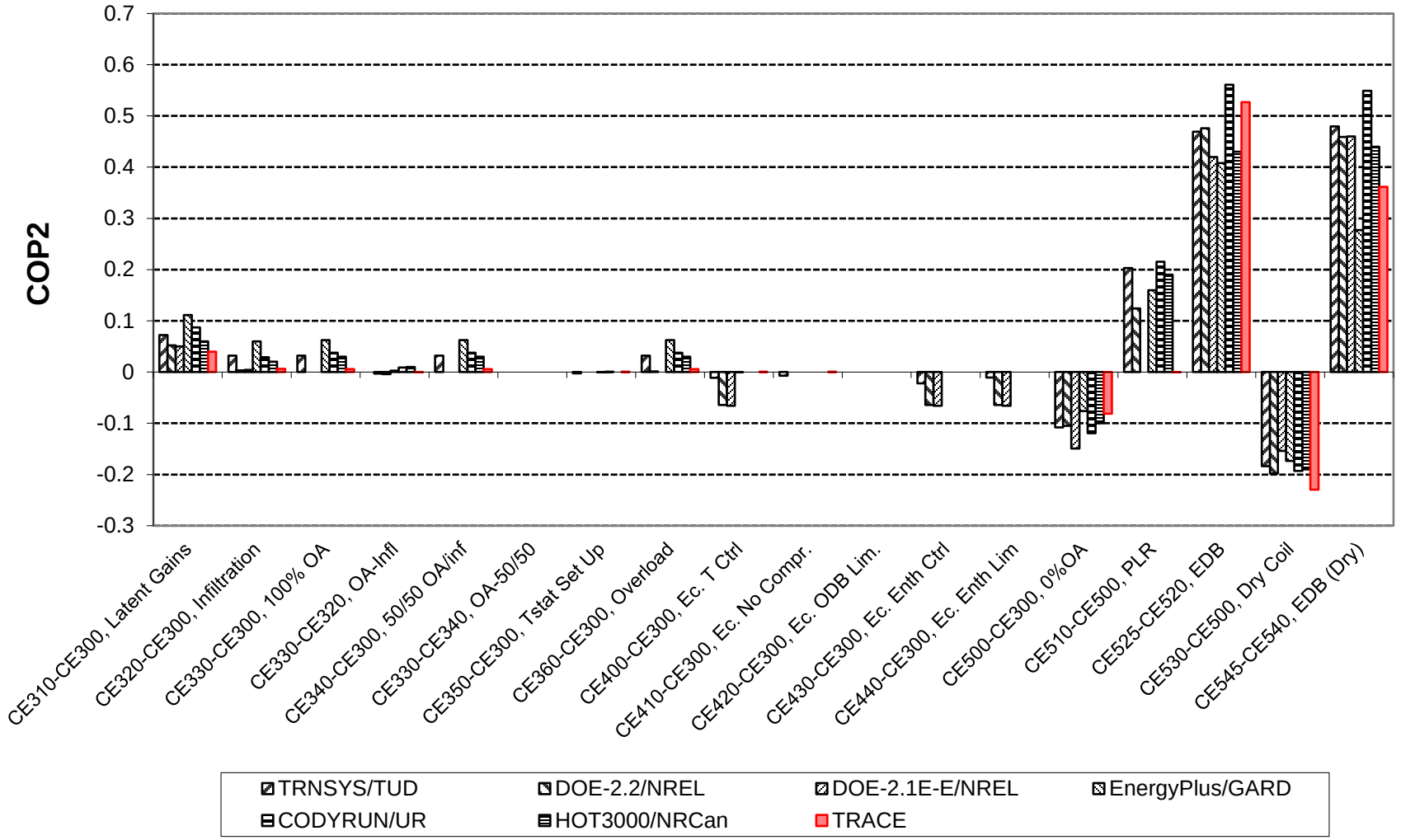
# Figure B16.5.2-24. HVAC BESTEST: CE300 - CE545 Hourly Maximum COP2 Sensitivities



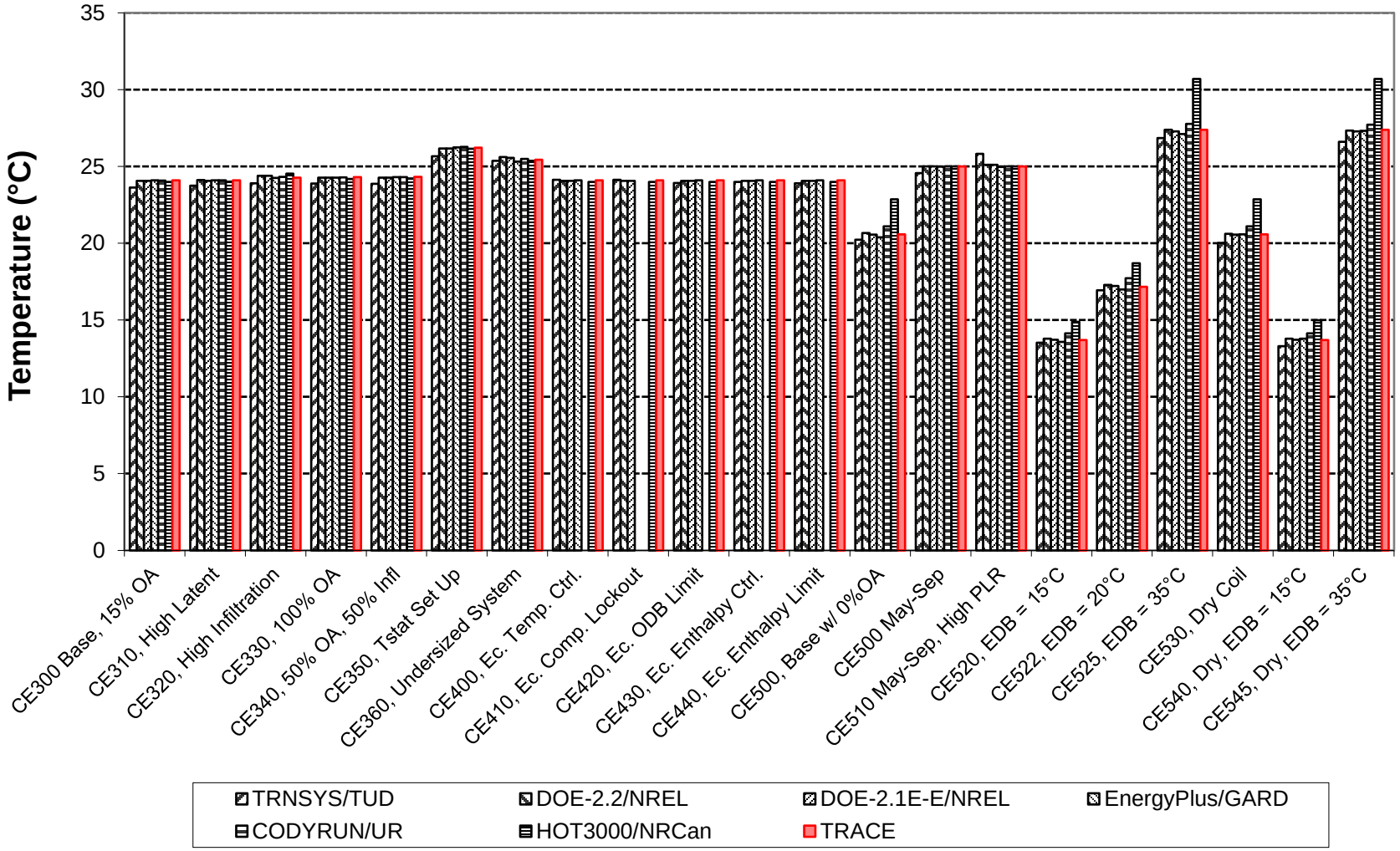
# Figure B16.5.2-25. HVAC BESTEST: CE300 - CE545 Hourly Minimum COP2



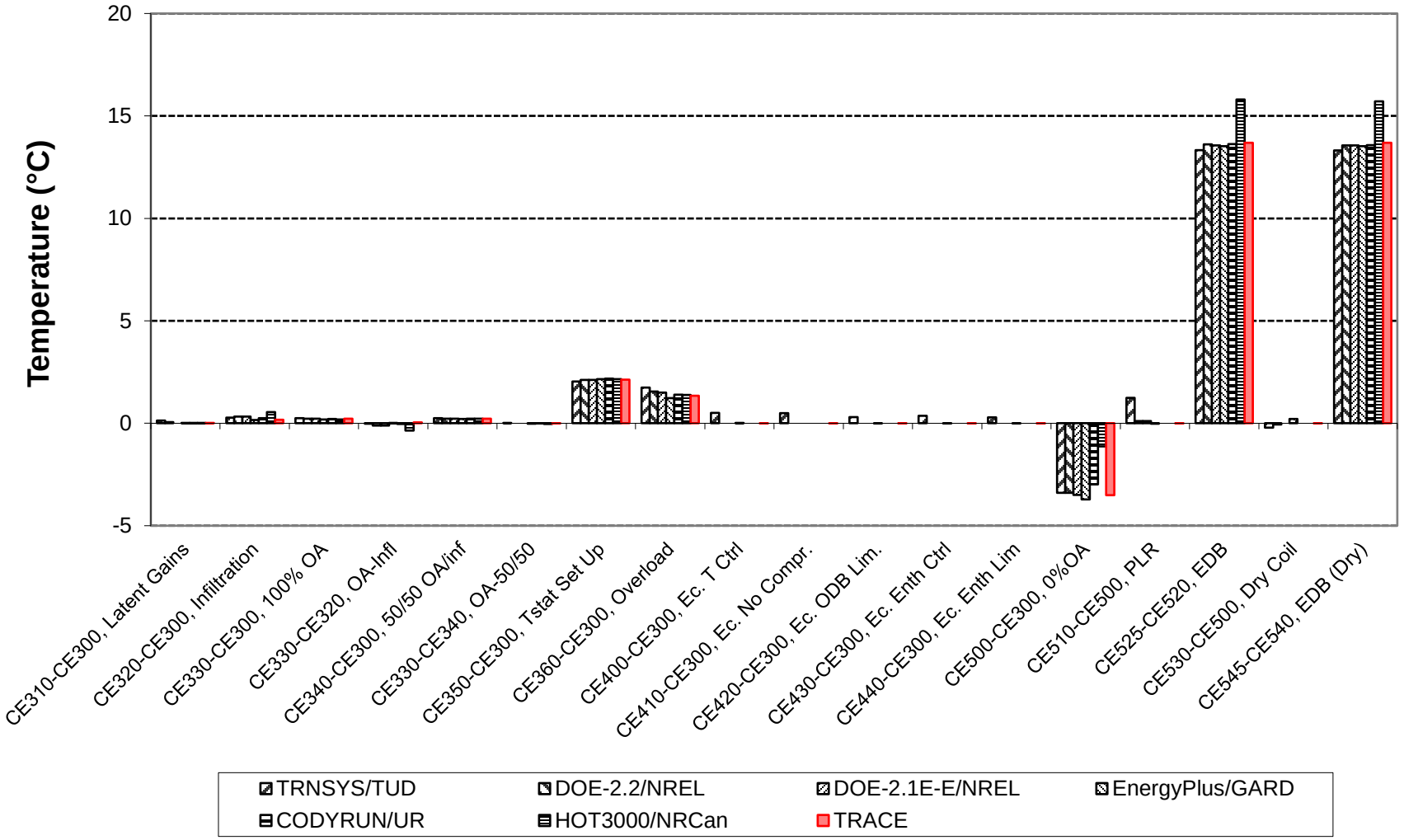
# Figure B16.5.2-26. HVAC BESTEST: CE300 - CE545 Hourly Minimum COP2 Sensitivities



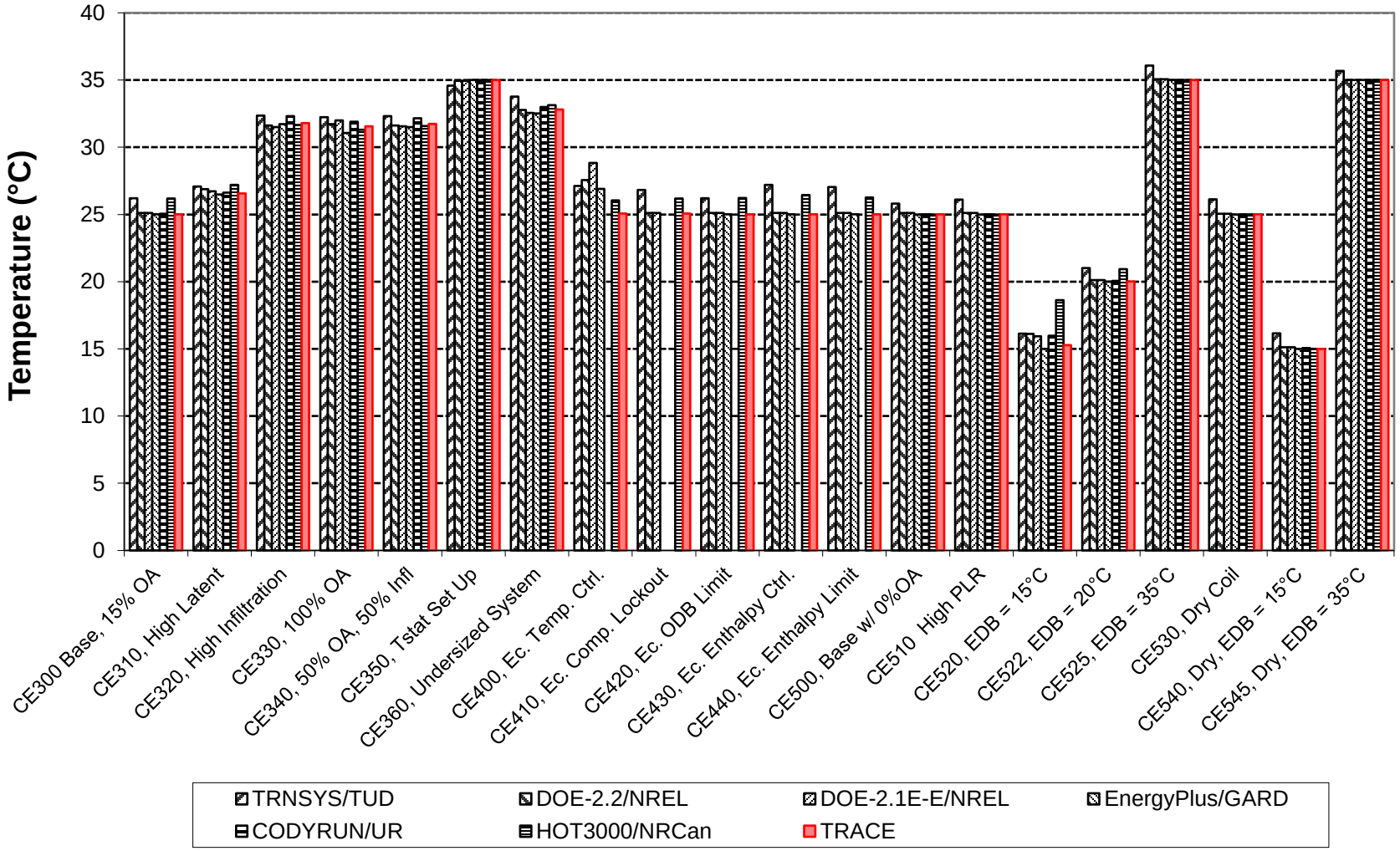
# Figure B16.5.2-27. HVAC BESTEST: CE300 - CE545 Annual Mean Indoor Dry-Bulb Temperature



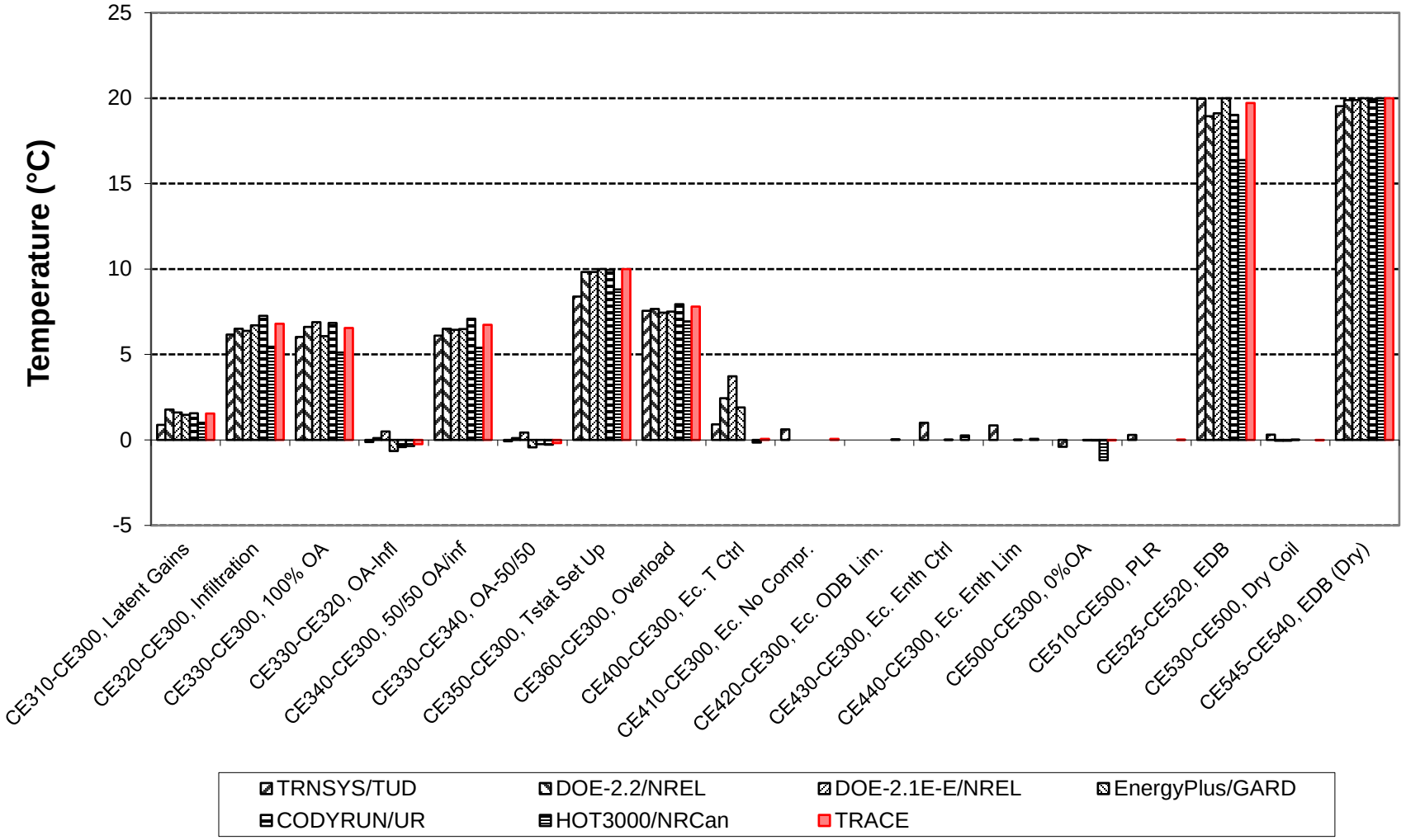
# Figure B16.5.2-28. HVAC BESTEST: CE300 - CE545 Annual Mean IDB Sensitivities



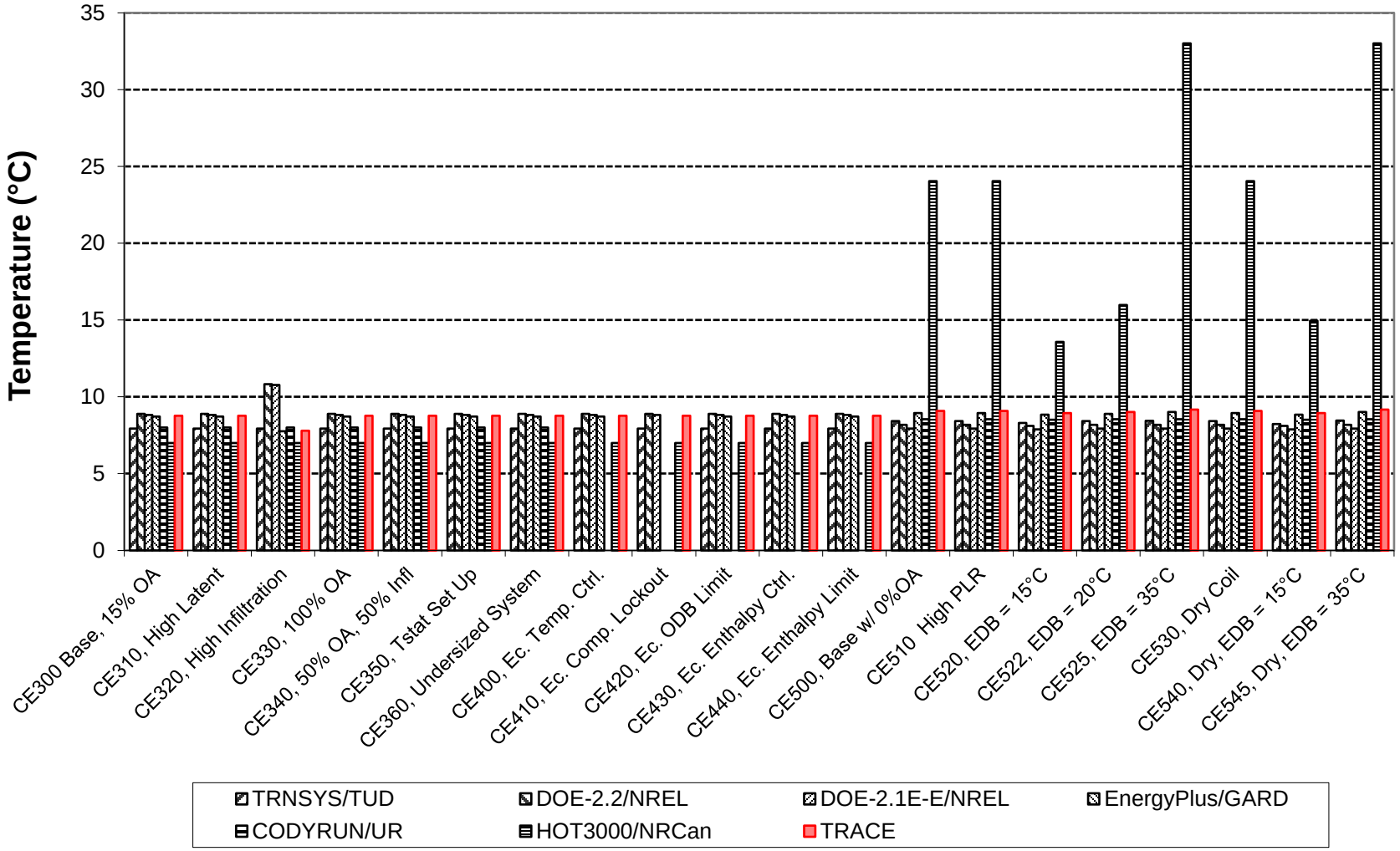
# Figure B16.5.2-29. HVAC BESTEST: CE300 - CE545 Hourly Maximum Indoor Dry-Bulb Temperature



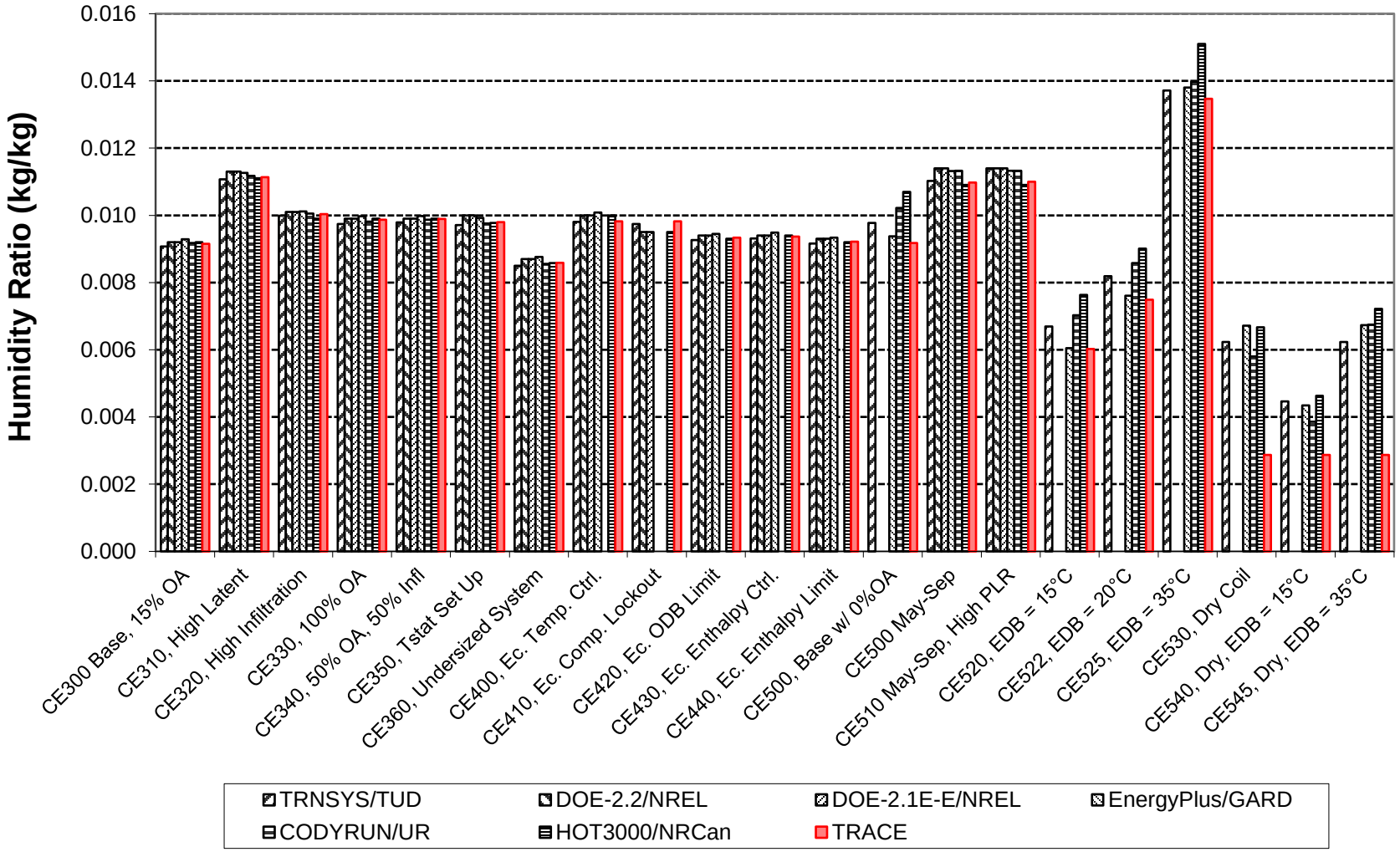
# Figure B16.5.2-30. HVAC BESTEST: CE300 - CE545 Hourly Maximum IDB Sensitivities



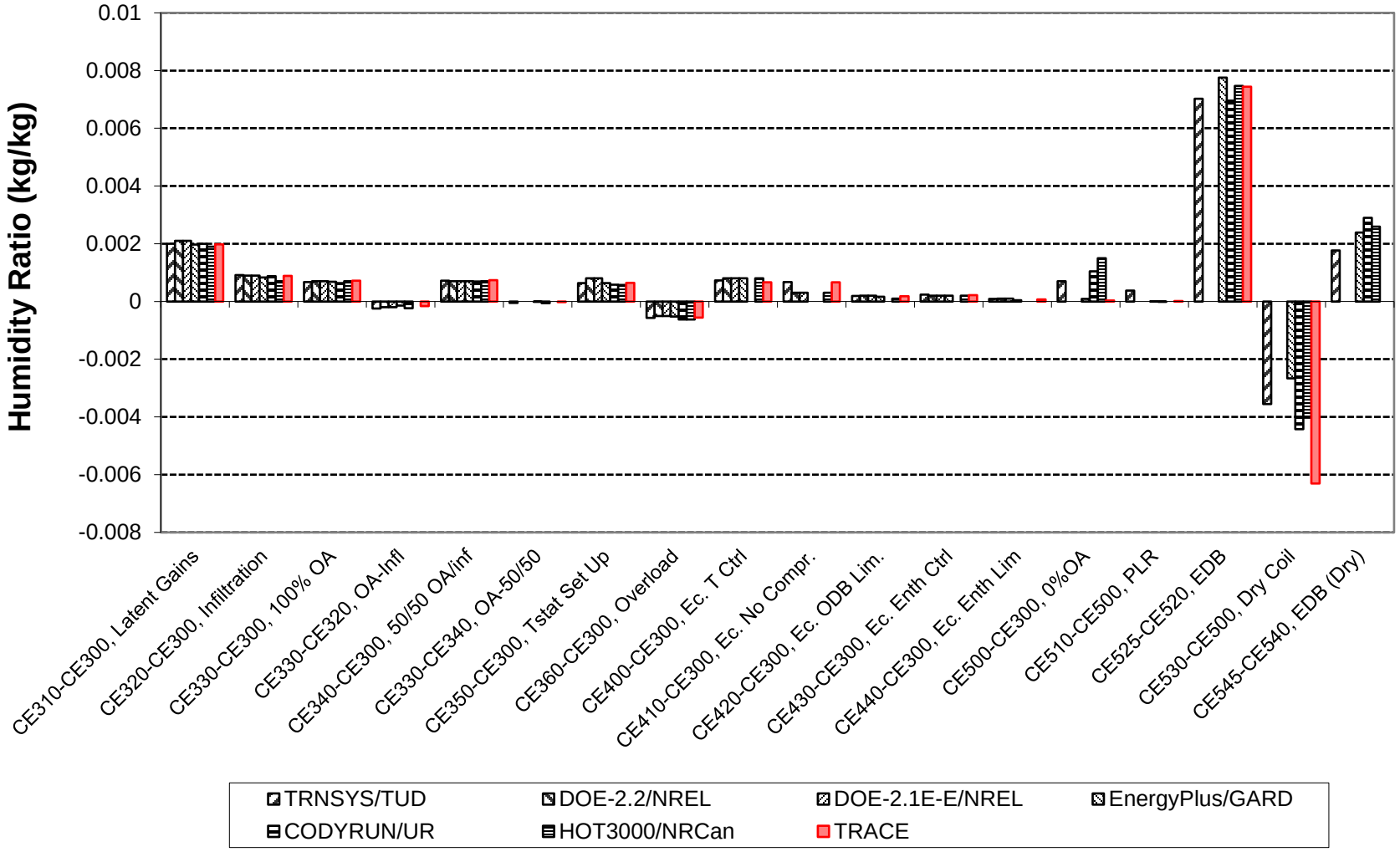
# Figure B16.5.2-31. HVAC BESTEST: CE300 - CE545 Hourly Minimum Indoor Dry-Bulb Temperature



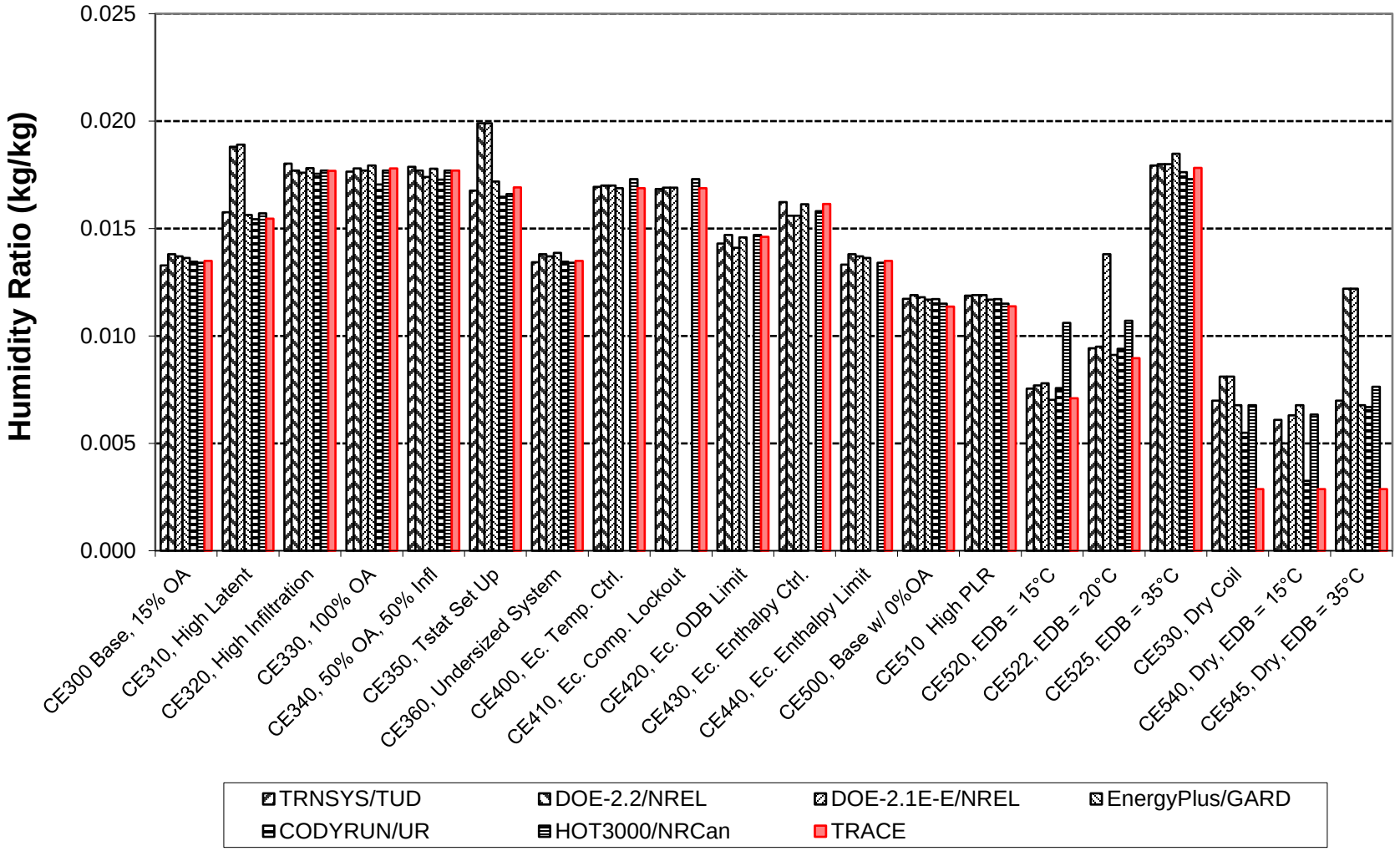
# Figure B16.5.2-32. HVAC BESTEST: CE300 - CE545 Annual Mean Zone Humidity Ratio



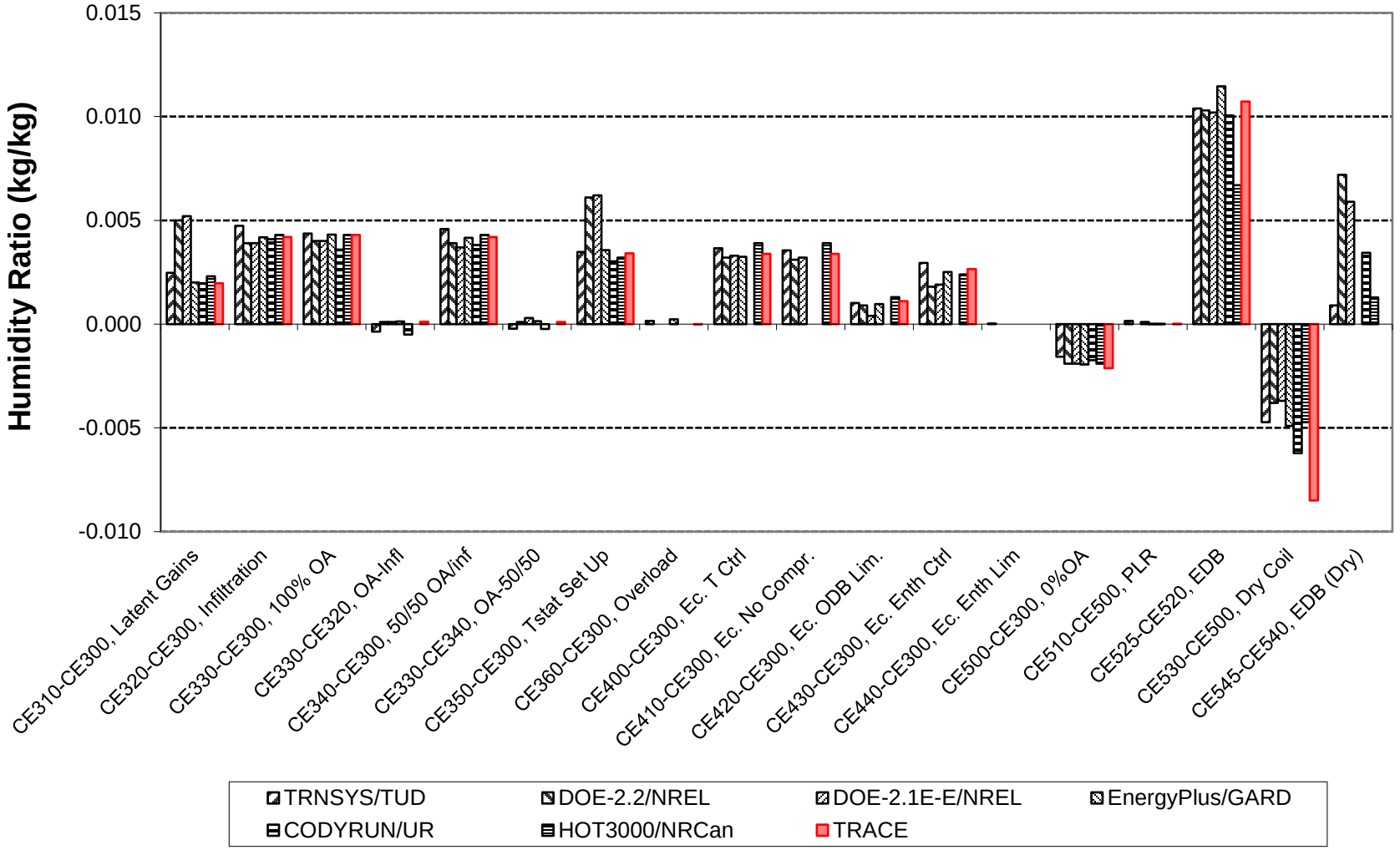
# Figure B16.5.2-33. HVAC BESTEST: CE300 - CE545 Annual Mean Humidity Ratio Sensitivities



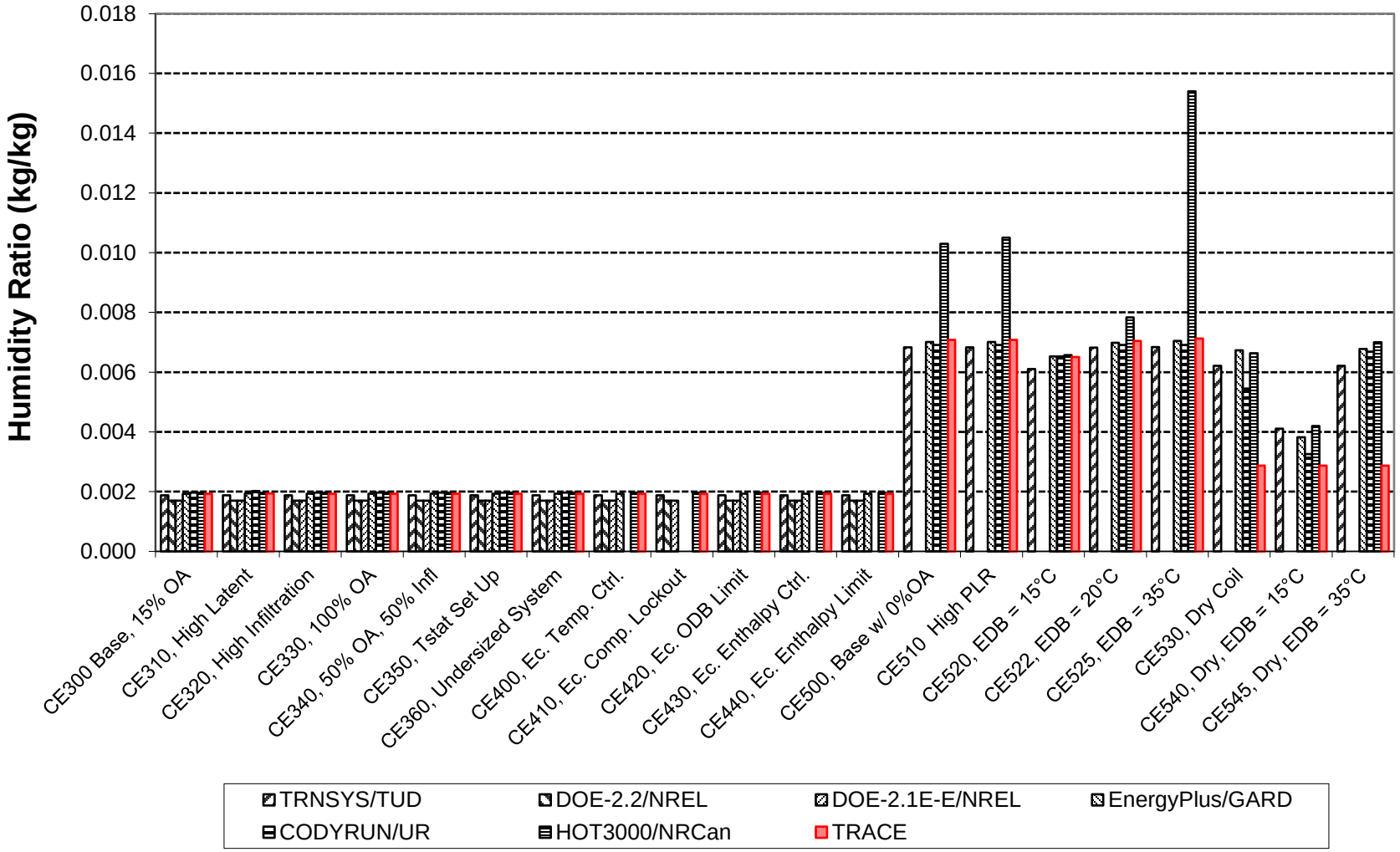
# Figure B16.5.2-34. HVAC BESTEST: CE300 - CE545 Hourly Maximum Zone Humidity Ratio



# Figure B16.5.2-35. HVAC BESTEST: CE300 - CE545 Hourly Maximum Humidity Ratio Sensitivities

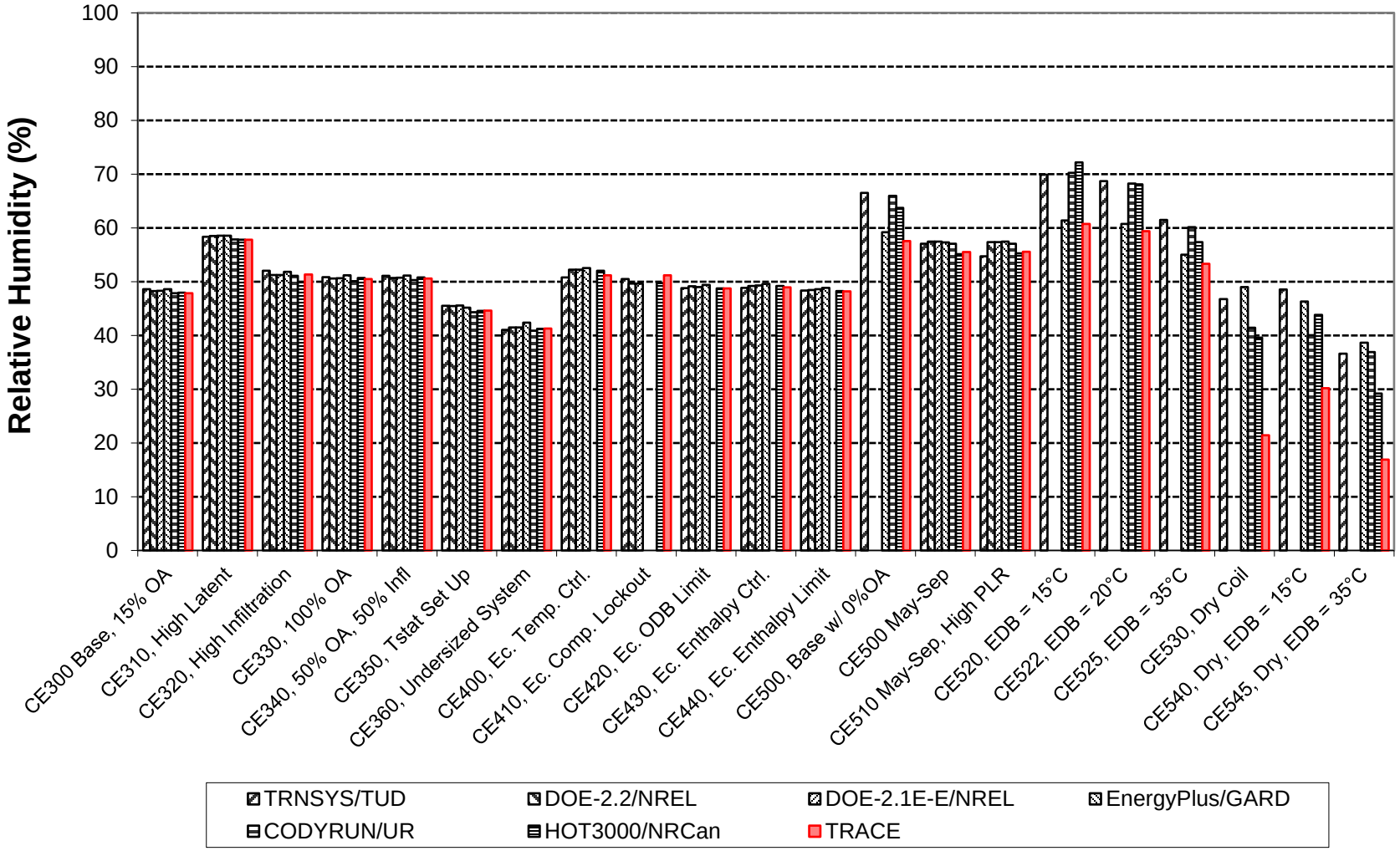


# Figure B16.5.2-36. HVAC BESTEST: CE300 - CE545 Hourly Minimum Zone Humidity Ratio

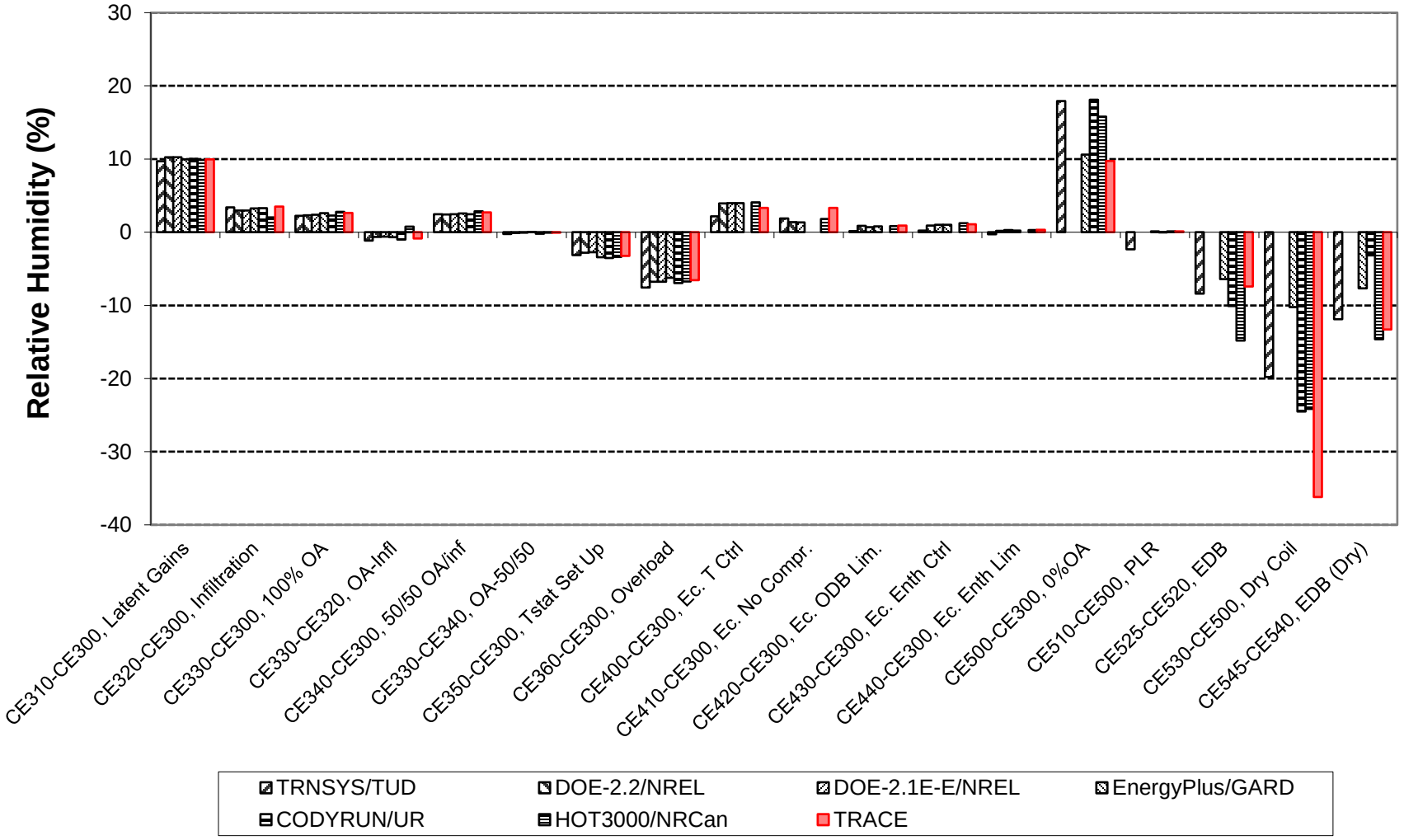


ASHRAE Standard 140-2020, Informative Annex B16, Section B16.5.2
Example Results for Section 5.3 - HVAC Equipment Performance Tests CE300 through CE545

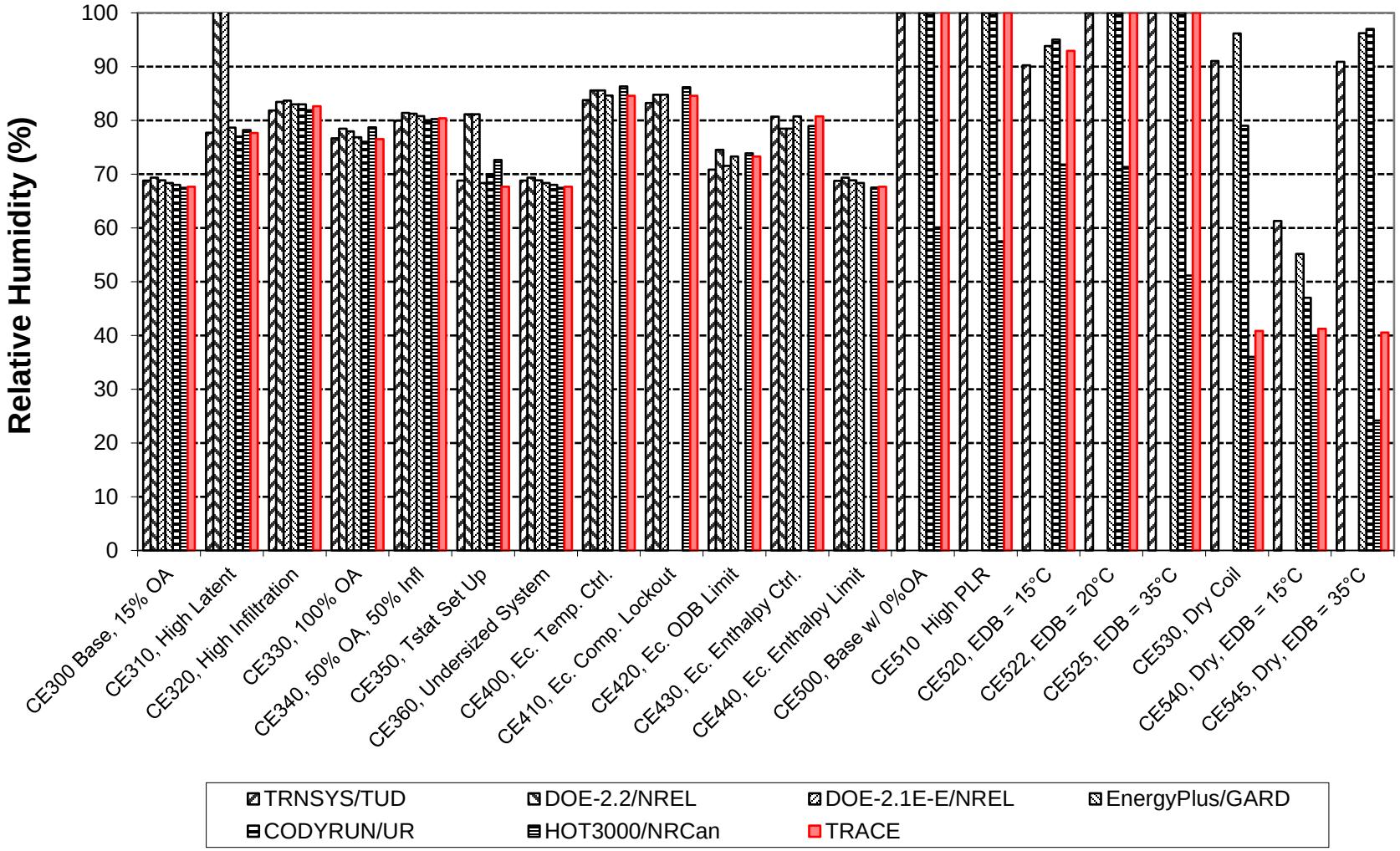
# Figure B16.5.2-37. HVAC BESTEST: CE300 - CE545 Annual Mean Relative Humidity



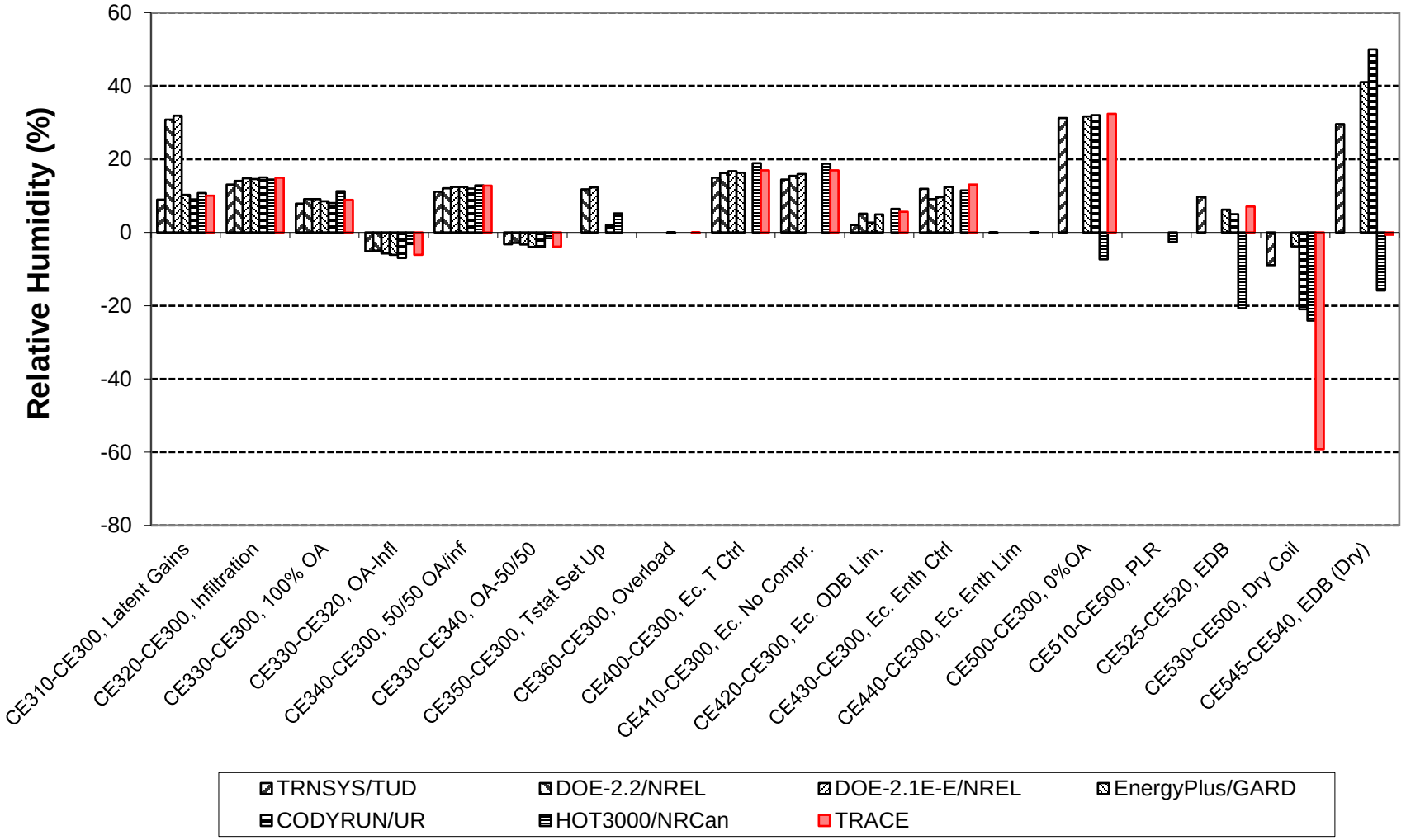
# Figure B16.5.2-38. HVAC BESTEST: CE300 - CE545 Annual Mean Relative Humidity Sensitivities



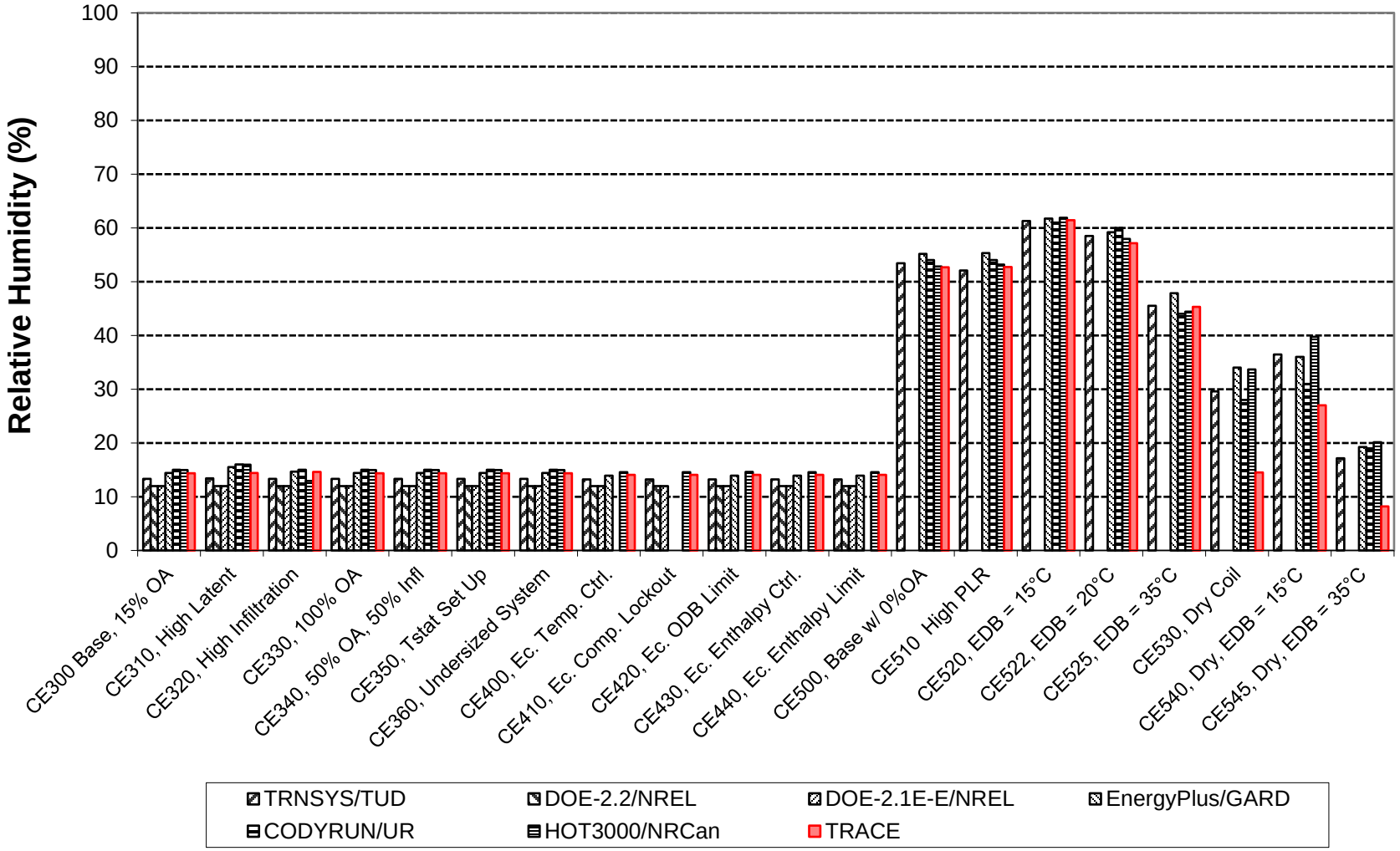
# Figure B16.5.2-39. HVAC BESTEST: CE300 - CE545 Hourly Maximum Zone Relative Humidity



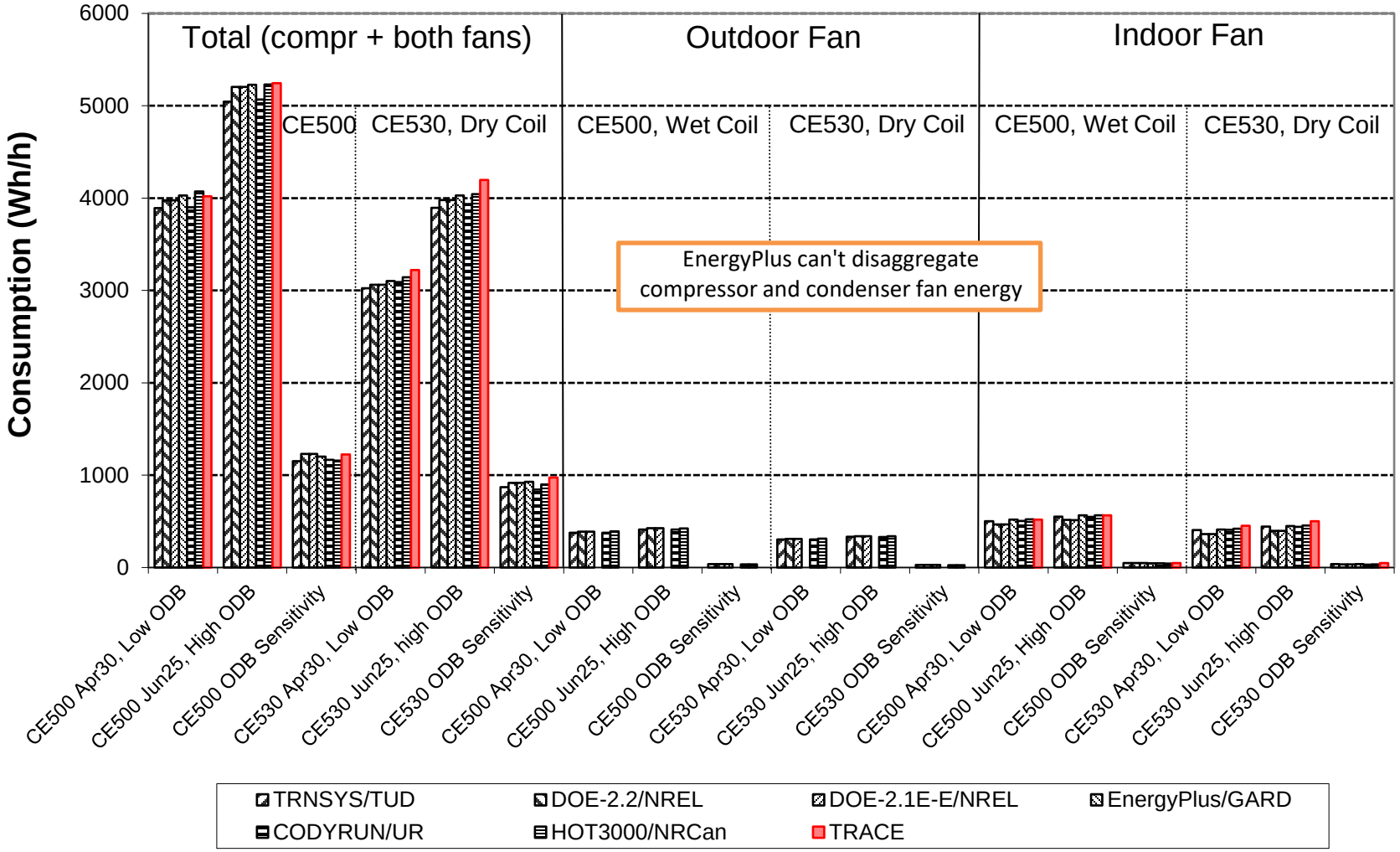
# Figure B16.5.2-40. HVAC BESTEST: CE300 - CE545 Hourly Maximum Relative Humidity Sensitivities



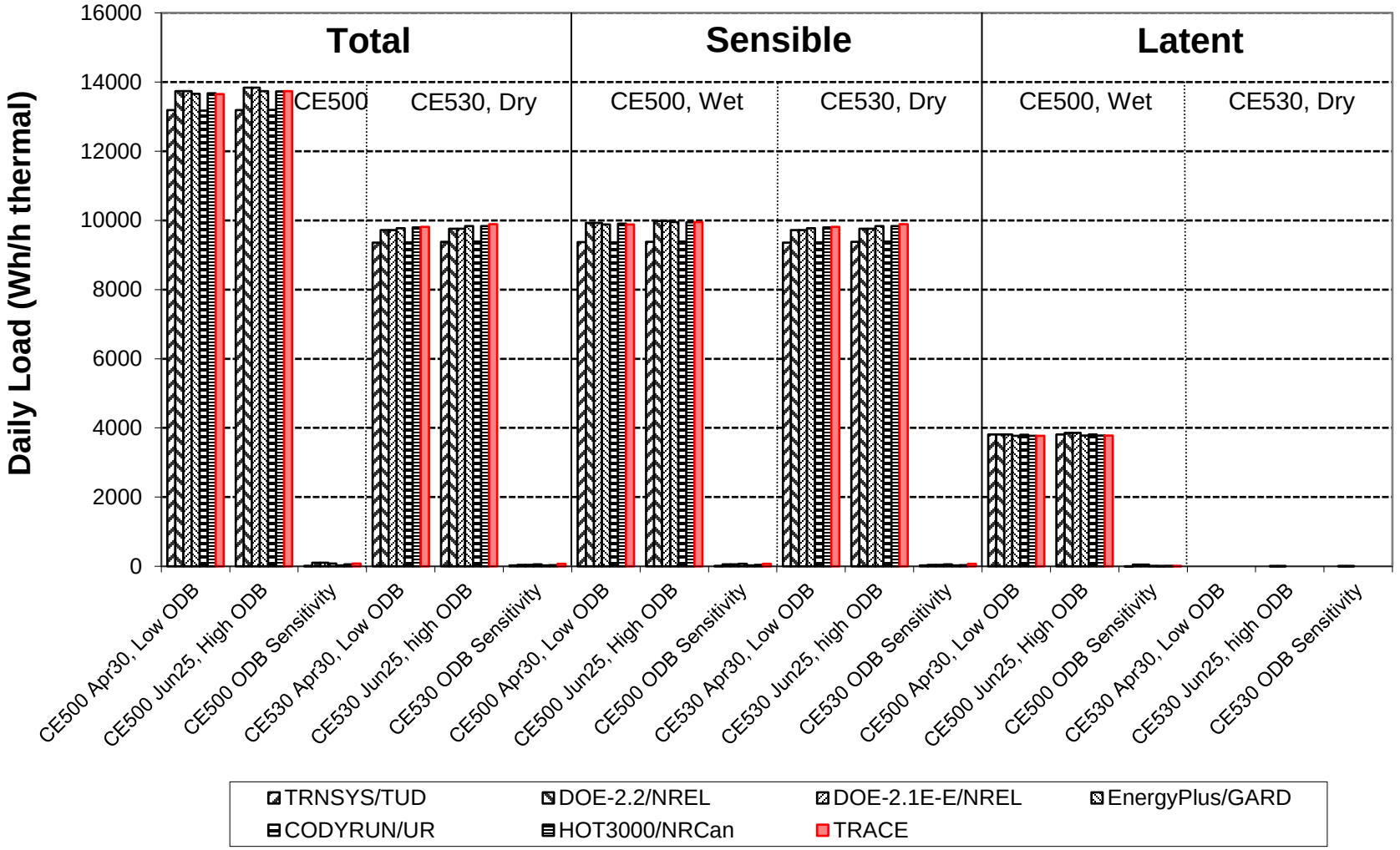
# Figure B16.5.2-41. HVAC BESTEST: CE300 - CE545 Hourly Minimum Zone Relative Humidity



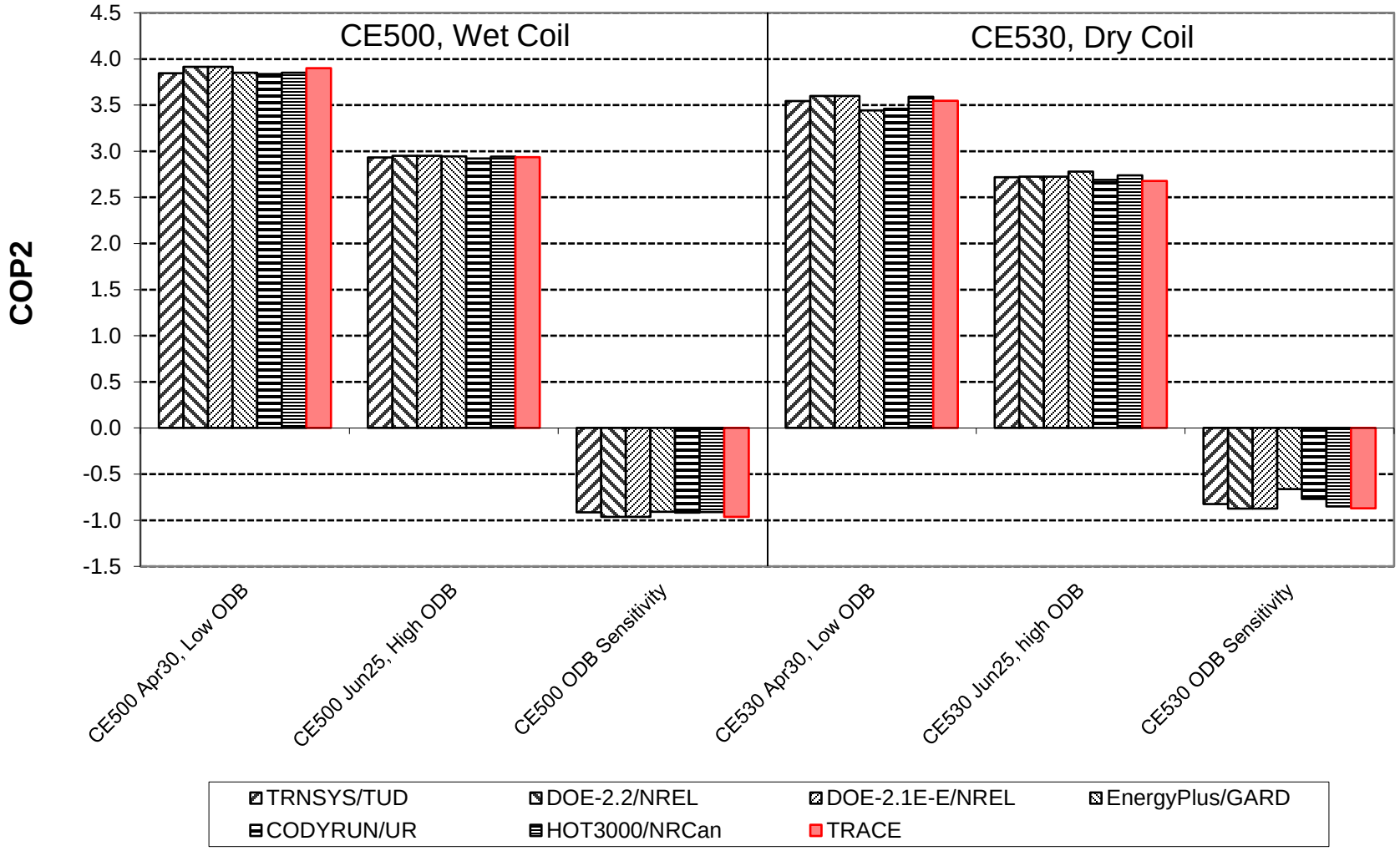
# Figure B16.5.2-42. HVAC BESTEST: f(ODB) for CE500, CE530 Specific Day Electricity Consumptions



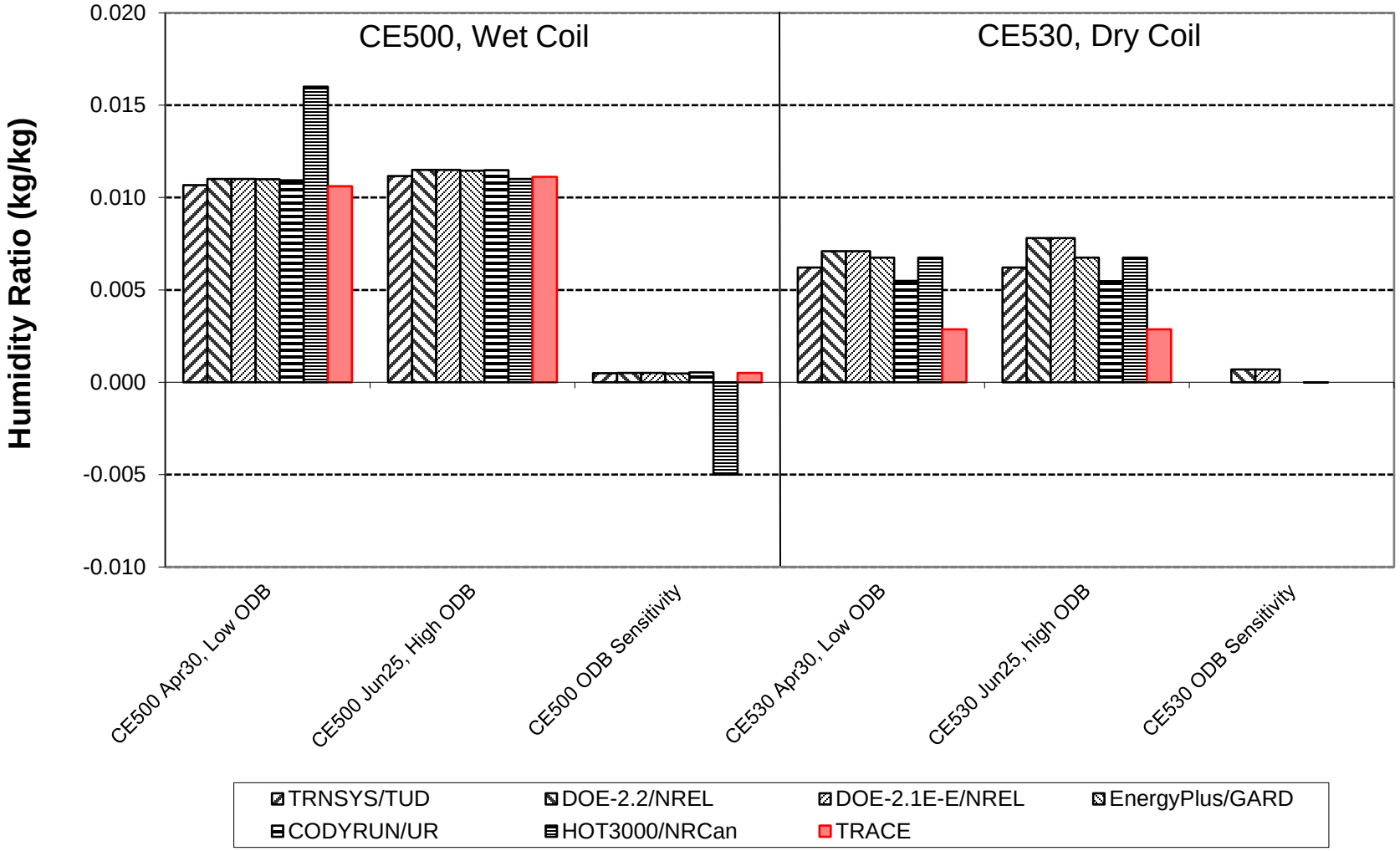
# Figure B16.5.2-43. HVAC BESTEST: f(ODB) for CE500, CE530 Specific Day Coil Loads



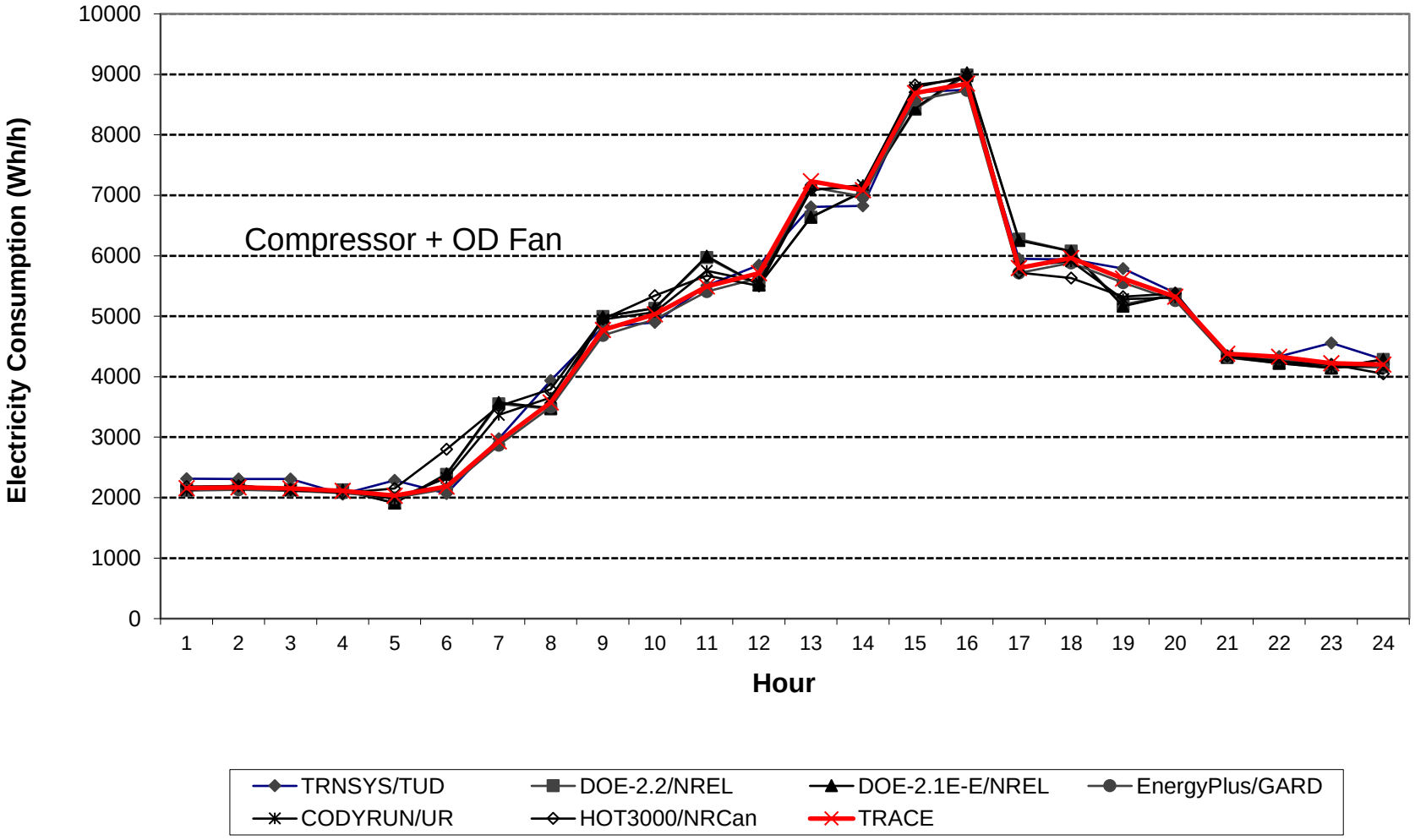
# Figure B16.5.2-44. HVAC BESTEST: f(ODB) for CE500, CE530 Specific Day COP2



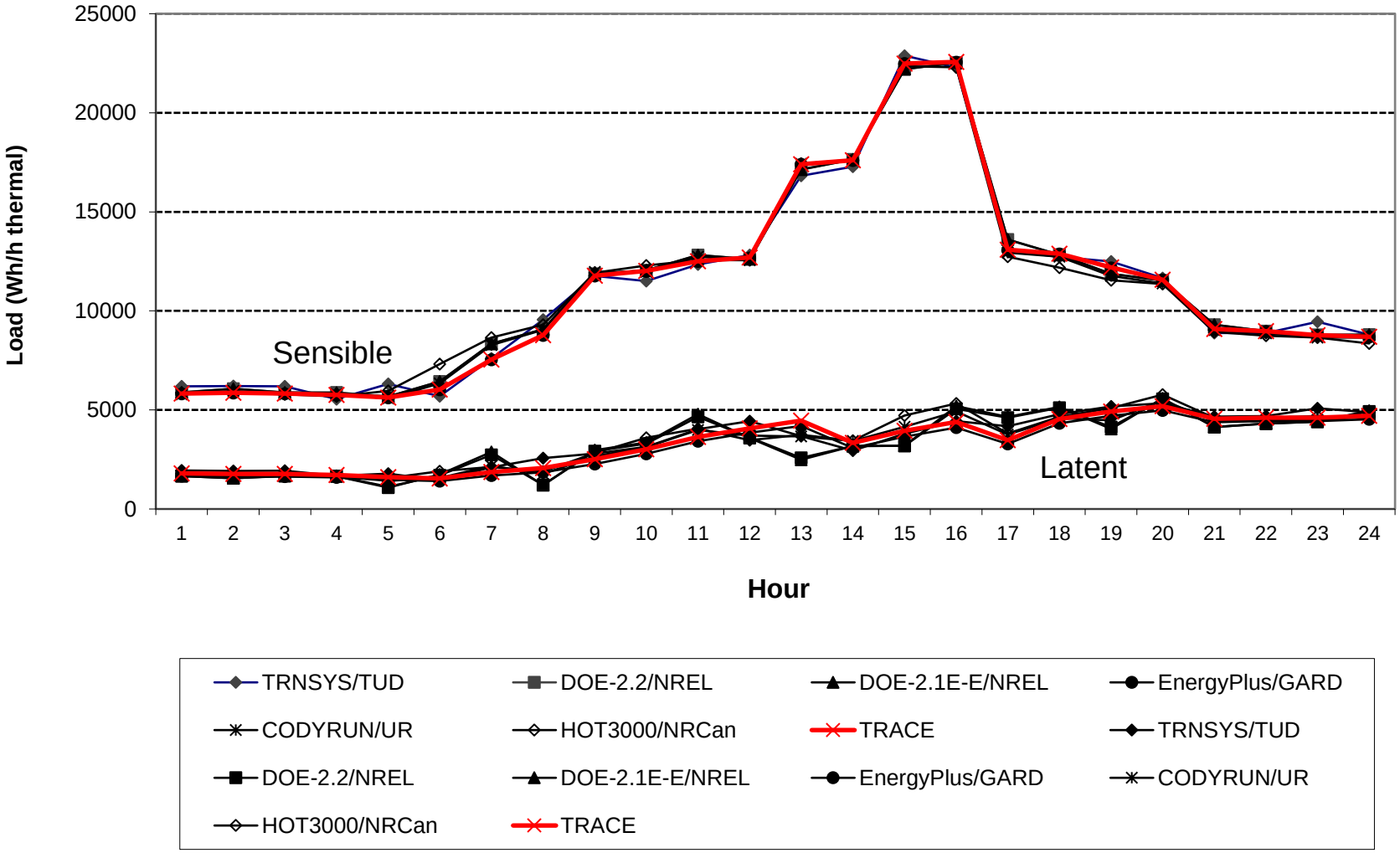
# Figure B16.5.2-45. HVAC BESTEST: f(ODB) for CE500, CE530 Specific Day Humidity Ratio



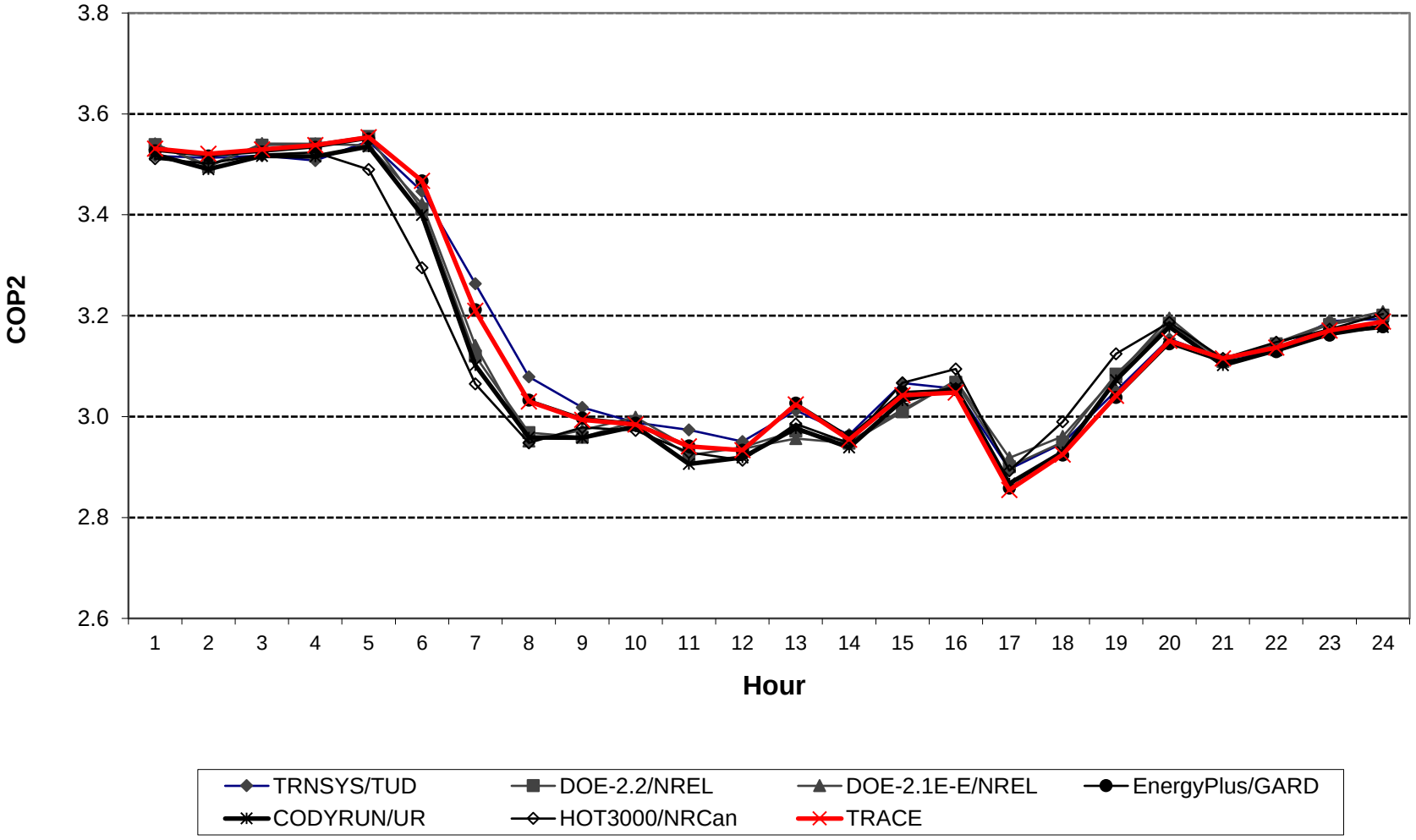
# Figure B16.5.2-46. HVAC BESTEST: CE300 June 28 Hourly Electricity Consumption



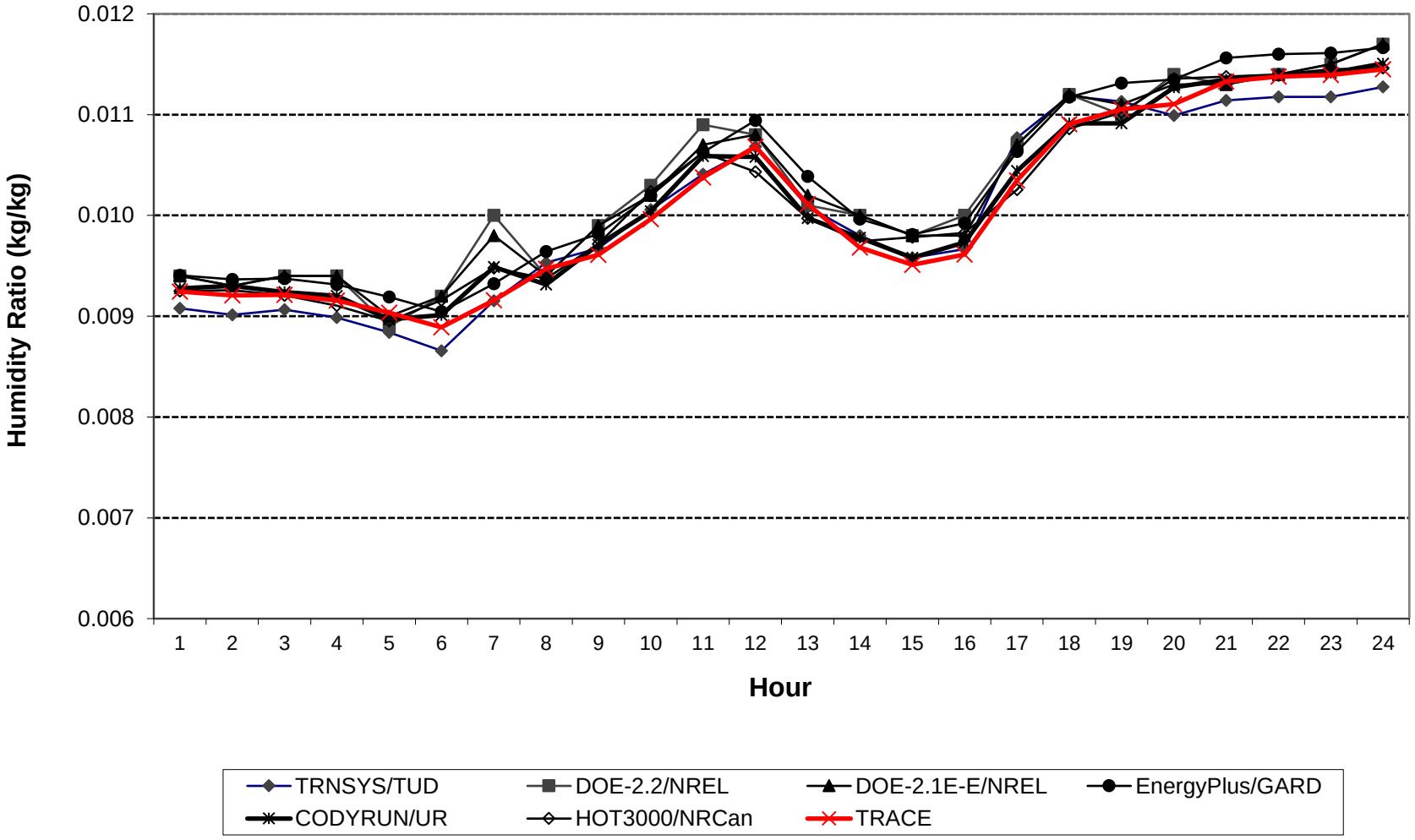
# Figure B16.5.2-47. HVAC BESTEST: CE300 June 28 Hourly Coil Loads



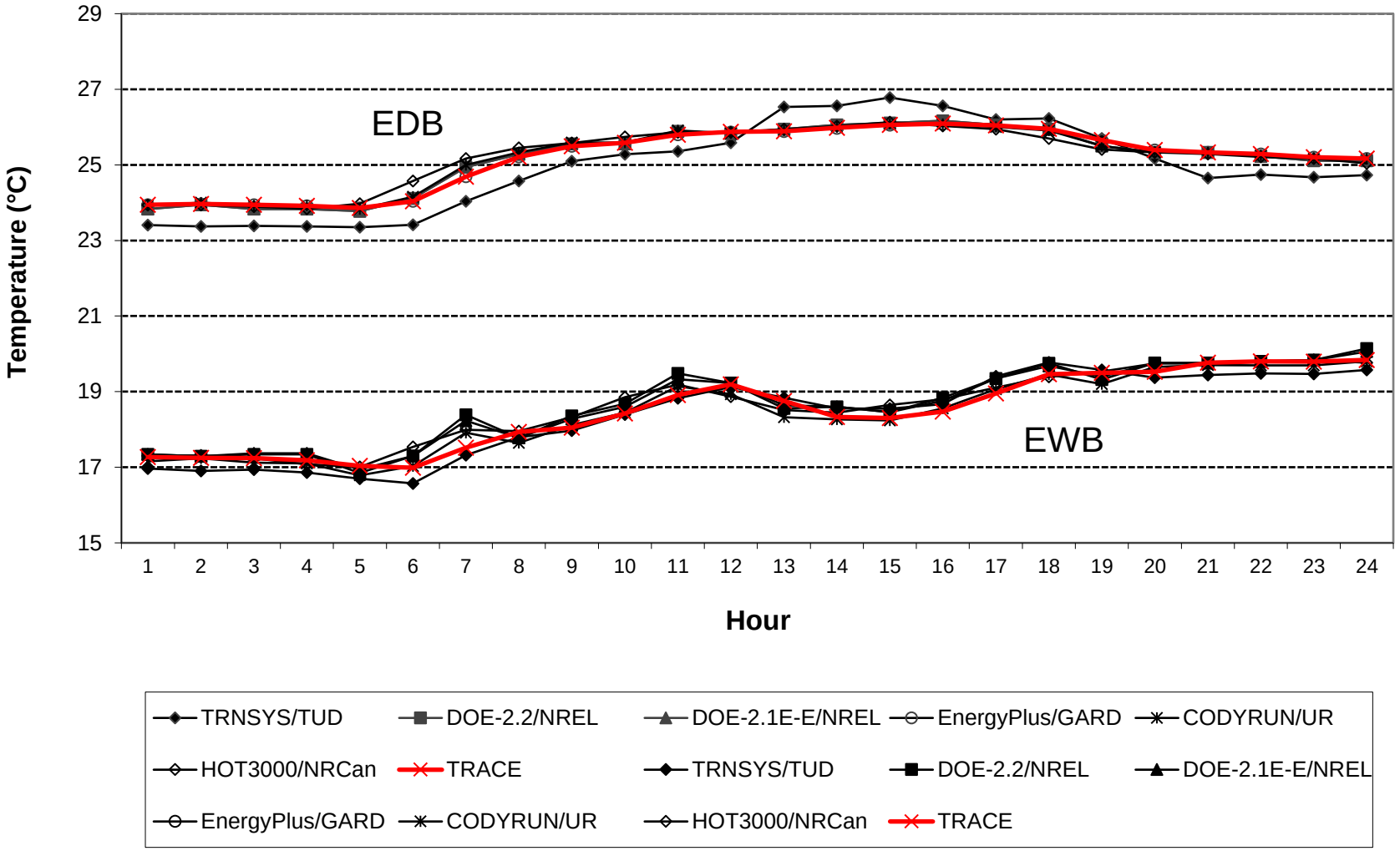
# Figure B16.5.2-48. HVAC BESTEST: CE300 June 28 Hourly COP2



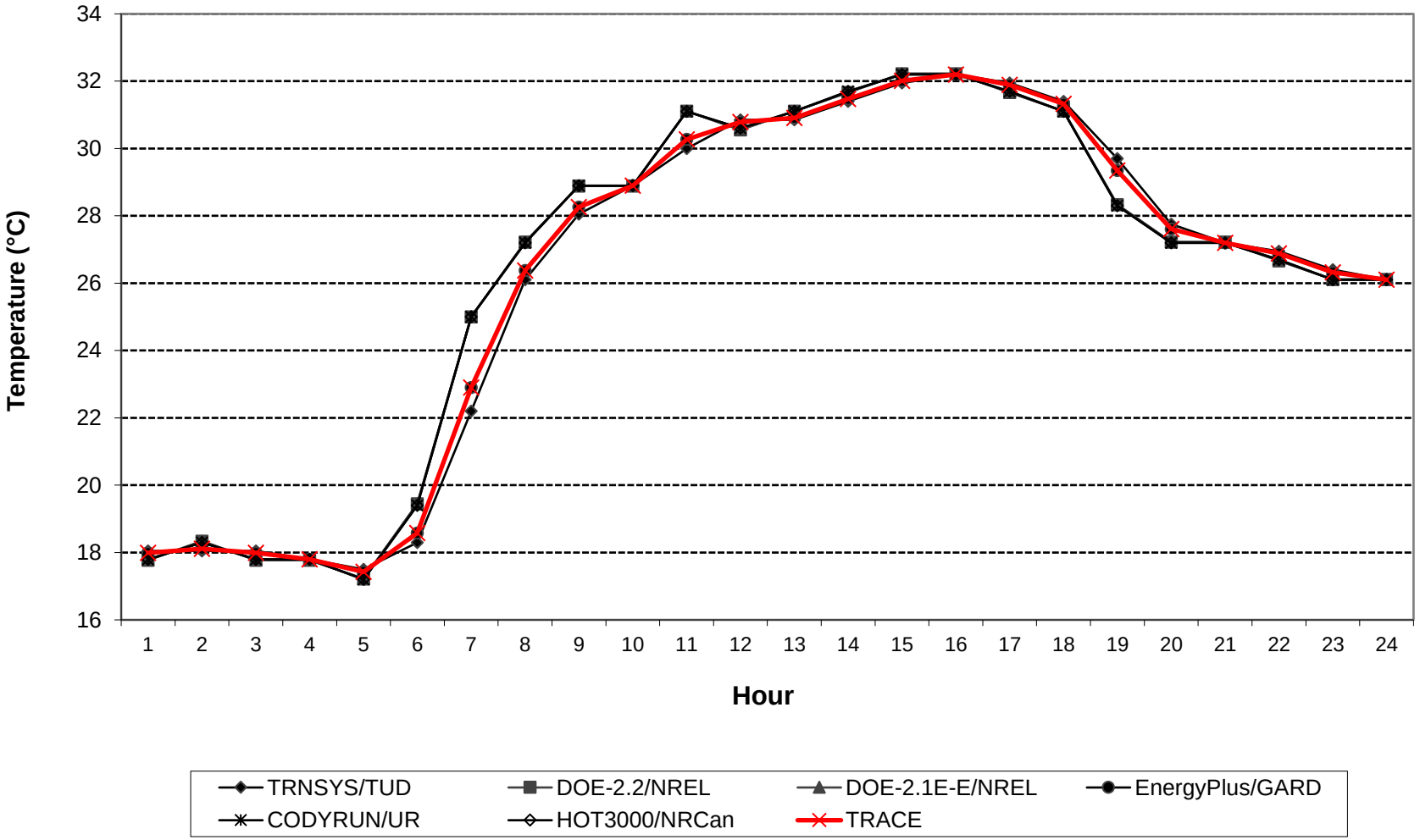
# Figure B16.5.2-49. HVAC BESTEST: CE300 June 28 Hourly Zone Humidity Ratio



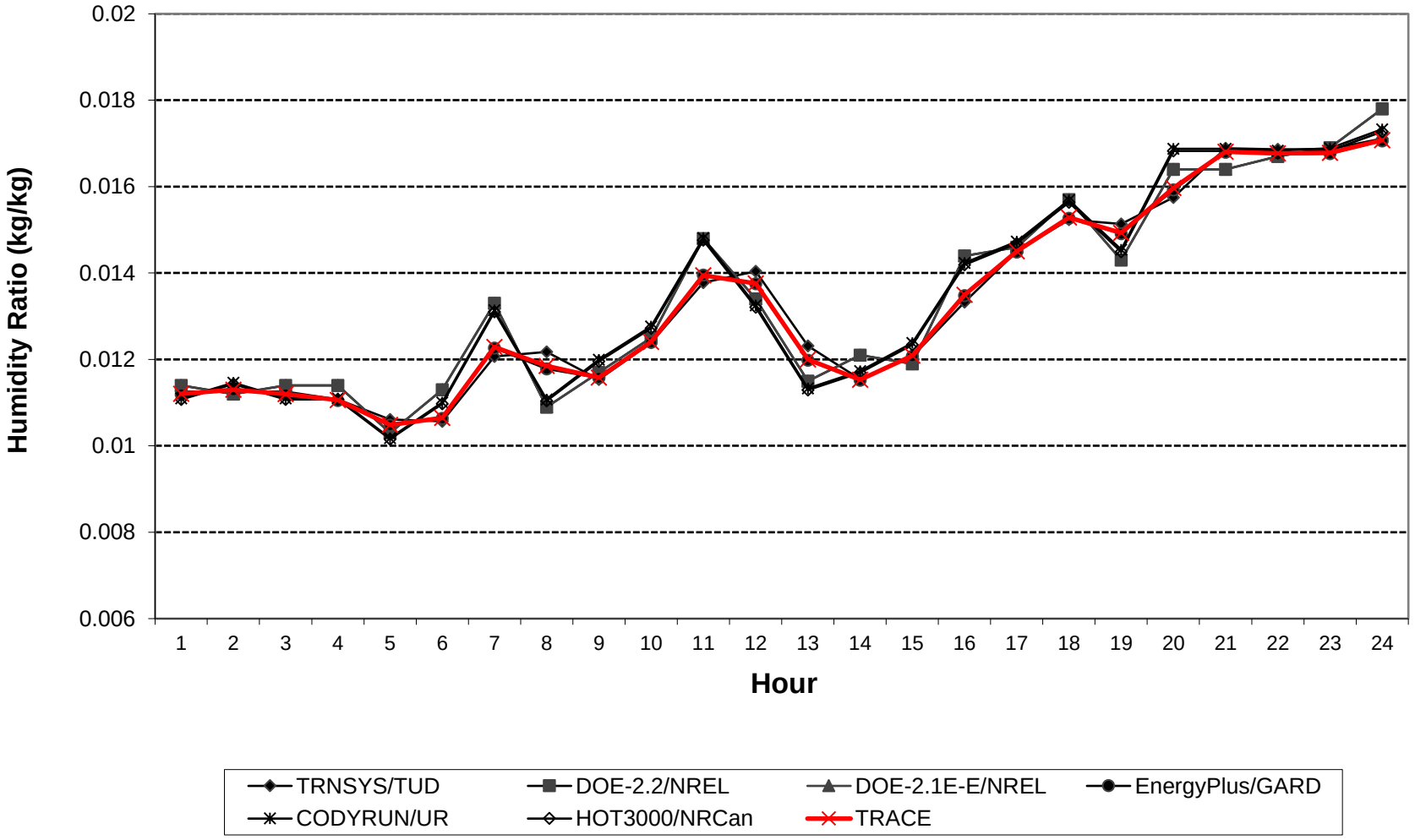
# Figure B16.5.2-50. HVAC BESTEST: CE300 June 28 Hourly EDB & EWB



# Figure B16.5.2-51. HVAC BESTEST: CE300 June 28 Hourly ODB



# Figure B16.5.2-52. HVAC BESTEST: CE300 June 28 Hourly OHR



# ASHRAE Standard 140-2020

## Informative Annex B16, Section B16.6

## Example Results
## for
## Section 5.4 - HVAC Equipment Performance Tests HE100 through HE230

# ASHRAE Standard 140-2020
# Participating Organizations and Computer Programs for
# Quasi-Analytical Solutions and Example Simulation Results
# Section 5.4 - HVAC Equipment Performance Tests HE100 through HE230

The quasi-analytical solutions and programs used to generate the example simulation results are described below.
The first column ("Model"), indicates the proper program name and version number, or indicates a quasi-analytical solution.

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

The third column ("Implemented By") indicates the national research facility, university, or industry organization with expertise in building science that performed the simulations or did the quasi-analytical solutions.

The entries in the fourth column are the abbreviations for the simulations and quasi-analytical solutions generally used in the tables and charts which follow.

See Standard 140, Annex B17 for further details.

## Participating Organizations and Computer Programs

| Model | Authoring Organization | Implemented By | Abbreviation |
|---|---|---|---|
| ESP-r/HOT3000<br>Tier 1 tests - version 1.1<br>Tier 2 tests - version 1.7 | CETC/ESRU,[a,b] Canada/United Kingdom | CETC,[a] Canada | ESP-r/HOT3000/CETC |
| EnergyPlus 1.0.2.008 | LBNL/UIUC/CERL/OSU/GARD Analytics/FSEC/DOE-OBT,[c,d,e,f,g,h] | GARD Analytics, USA | EnergyPlus/GARD |
| DOE-2.1E version c133 | LANL/LBNL/JJH,[i,c,j] USA | CETC,[a] Canada | DOE-2.1E/CETC |
| Analytical/Quasi-Analytical | CETC[a] | CETC[a] | Analytical/Quasi-Analytical |

[a]CETC CANMET Energy Technology Centre, Natural Resources Canada, Canada
[b]ESRU: Energy Systems Research Unit, University of Strathclyde, Scotland, United Kingdom
[c]LBNL: Lawrence Berkeley National Laboratory, United States
[d]UIUC: University of Illinois Urbana/Champaign, United States
[e]CERL: U.S. Army Corps of Engineers, Construction Engineering Research Laboratories, United States
[f]OSU: Oklahoma State University, United States
[g]FSEC: University of Central Florida, Florida Solar Energy Center, United States
[h]DOE-OBT: U.S. Department of Energy, Office of Building Technology, State and Community Programs, Energy Efficiency and Renewable Energy, United States
[i]LANL: Los Alamos National Laboratory, United States
[j]JJH: James J. Hirsch & Associates, United States

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.6**
**Example Results for Section 5.4 - HVAC Equipment Performance Tests HE100 through HE230**

# List of Tables



# List of Figures

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.6**
**Example Results for Section 5.4 - HVAC Equipment Performance Tests HE100 through HE230**

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 B16.6-1. Total Furnace Load (GJ)

| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Statistics, All Results Min | Max | (Max-Min) /Analytical* | Analytical/ Quasi-Analytical | TRACE Trane |
|---|---|---|---|---|---|---|---|---|
| HE100: 100% eff. | 77.94 | 77.75 | 77.76 | 77.75 | 77.94 | 0.2% | 77.74 | 77.76 |
| HE110: 80% eff. | 77.94 | 77.75 | 77.76 | 77.75 | 77.94 | 0.2% | 77.74 | 77.76 |
| HE120: 80% eff., PLR=0.4 | 31.25 | 31.10 | 31.13 | 31.10 | 31.25 | 0.5% | 31.10 | 31.22 |
| HE130: No Load | 0.00 | 0.00 | 0.16 | 0.00 | 0.16 | ---- | 0.00 | 0.04 |
| HE140: Periodic PLR | 31.26 | 31.10 | 31.12 | 31.10 | 31.26 | 0.5% | 31.10 | 31.22 |
| HE150: Continuous Circ. Fan | 29.88 | 29.59 | 29.57 | 29.57 | 29.88 | 1.1% | 29.65 | 31.23 |
| HE160: Cycling Circ. Fan | 31.26 | 30.46 | 30.49 | 30.46 | 31.26 | 2.6% | 31.10 | 31.22 |
| HE170: Draft Fan | 29.88 | 29.59 | 29.57 | 29.57 | 29.88 | 1.1% | 29.65 | 31.23 |
| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Min | Max | Mean | (Max-Min) /Mean** | Analytical/ Quasi-Analytical | TRACE Trane |
| HE210: Realistic Weather | 41.36 | 42.04 | 42.06 | 41.36 | 42.06 | 41.82 | 1.7% | - | 43.06 |
| HE220: Setback Thermostat | 39.41 | 39.87 | 39.76 | 39.41 | 39.87 | 39.68 | 1.2% | - | 40.76 |
| HE230: Undersized Furnace | 34.32 | 34.59 | 34.37 | 34.32 | 34.59 | 34.43 | 0.8% | - | 35.81 |

* Abs[ (Max-Min) / (Analytic Solution) ] **Abs[ (Max-Min) / (Mean of Example Results) ]

## Table B16.6-2. Total Furnace Input (GJ)

| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Statistics, All Results Min | Max | (Max-Min) /Analytical* | Analytical/ Quasi-Analytical | TRACE Trane |
|---|---|---|---|---|---|---|---|---|
| HE100: 100% eff. | 77.74 | 77.71 | 78.42 | 77.71 | 78.42 | 0.9% | 77.71 | 77.76 |
| HE110: 80% eff. | 96.92 | 97.22 | 98.02 | 96.92 | 98.02 | 1.1% | 97.22 | 97.20 |
| HE120: 80% eff., PLR=0.4 | 38.41 | 38.27 | 38.56 | 38.27 | 38.56 | 0.8% | 38.27 | 38.42 |
| HE130: No Load | 0.00 | 0.00 | 0.14 | 0.00 | 0.14 | ---- | 0.00 | 0.05 |
| HE140: Periodic PLR | 39.00 | 39.00 | 38.76 | 38.76 | 39.00 | 0.6% | 39.00 | 39.06 |
| HE150: Continuous Circ. Fan | 37.23 | 36.94 | 36.82 | 36.82 | 37.23 | 1.1% | 37.02 | 37.37 |
| HE160: Cycling Circ. Fan | 38.12 | 38.12 | 37.96 | 37.96 | 38.12 | 0.4% | 38.09 | 38.35 |
| HE170: Draft Fan | 37.23 | 36.94 | 36.82 | 36.82 | 37.23 | 1.1% | 37.02 | 37.37 |
| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Min | Max | Mean | (Max-Min) /Mean** | Analytical/ Quasi-Analytical | TRACE Trane |
| HE210: Realistic Weather | 50.53 | 52.01 | 52.37 | 50.53 | 52.37 | 51.64 | 3.6% | - | 52.81 |
| HE220: Setback Thermostat | 47.87 | 49.35 | 49.47 | 47.87 | 49.47 | 48.89 | 3.3% | - | 50.08 |
| HE230: Undersized Furnace | 41.37 | 42.55 | 43.22 | 41.37 | 43.22 | 42.38 | 4.4% | - | 43.44 |

* Abs[ (Max-Min) / (Analytic Solution) ] **Abs[ (Max-Min) / (Mean of Example Results) ]

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.6**
**Example Results for Section 5.4 - HVAC Equipment Performance Tests HE100 through HE230**

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 B16.6-3. Fuel Consumption ($m^3/s$)

| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Statistics, All Results Min | Max | | (Max-Min) /Analytical* | Analytical/ Quasi-Analytical | TRACE Trane |
|---|---|---|---|---|---|---|---|---|---|
| HE100: 100% eff. | 0.000263 | 0.000263 | 0.000265 | 0.000263 | 0.000265 | | 0.9% | 0.000263 | 0.000263 |
| HE110: 80% eff. | 0.000328 | 0.000329 | 0.000332 | 0.000328 | 0.000332 | | 1.1% | 0.000329 | 0.000329 |
| HE120: 80% eff., PLR=0.4 | 0.000130 | 0.000130 | 0.000131 | 0.000130 | 0.000131 | | 0.8% | 0.000130 | 0.000130 |
| HE130: No Load | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | | ---- | 0.000000 | 0.000000 |
| HE140: Periodic PLR | 0.000132 | 0.000132 | 0.000131 | 0.000131 | 0.000132 | | 0.6% | 0.000132 | 0.000132 |
| HE150: Continuous Circ. Fan | 0.000126 | 0.000125 | 0.000125 | 0.000125 | 0.000126 | | 1.1% | 0.000125 | 0.000126 |
| HE160: Cycling Circ. Fan | 0.000129 | 0.000129 | 0.000129 | 0.000129 | 0.000129 | | 0.4% | 0.000129 | 0.000130 |
| HE170: Draft Fan | 0.000126 | 0.000125 | 0.000125 | 0.000125 | 0.000126 | | 1.1% | 0.000125 | 0.000126 |
| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Min | Max | Mean | (Max-Min) /Mean** | Analytical/ Quasi-Analytical | TRACE Trane |
| HE210: Realistic Weather | 0.000171 | 0.000176 | 0.000177 | 0.000171 | 0.000177 | 0.000175 | 3.5% | - | 0.000179 |
| HE220: Setback Thermostat | 0.000162 | 0.000167 | 0.000167 | 0.000162 | 0.000167 | 0.000165 | 3.3% | - | 0.000169 |
| HE230: Undersized Furnace | 0.000140 | 0.000144 | 0.000146 | 0.000140 | 0.000146 | 0.000143 | 4.3% | - | 0.000147 |

* Abs[ (Max-Min) / (Analytic Solution) ] **Abs[ (Max-Min) / (Mean of Example Results) ]

## Table B16.6-4. Fan Energy, both fans (kWh)

| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Statistics, All Results Min | Max | | (Max-Min) /Analytical* | Analytical/ Quasi-Analytical | TRACE Trane |
|---|---|---|---|---|---|---|---|---|---|
| HE150: Continuous Circ. Fan | 432.0 | 433.3 | 432.1 | 432.0 | 433.3 | | 0.3% | 432.0 | 419.4 |
| HE160: Cycling Circ. Fan | 170.2 | 172.2 | 172.4 | 170.2 | 172.4 | | 1.3% | 172.8 | 172.2 |
| HE170: Draft Fan | 473.4 | 473.1 | 473.1 | 473.1 | 473.4 | | 0.1% | 473.2 | 461.1 |
| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Min | Max | Mean | (Max-Min) /Mean** | Analytical/ Quasi-Analytical | TRACE Trane |
| HE210: Realistic Weather | 281.6 | 291.4 | 298.9 | 281.6 | 298.9 | 290.6 | 6.0% | - | 294.4 |
| HE220: Setback Thermostat | 268.3 | 276.1 | 281.2 | 268.3 | 281.2 | 275.2 | 4.7% | - | 280.6 |
| HE230: Undersized Furnace | 458.3 | 431.4 | 478.4 | 431.4 | 478.4 | 456.0 | 10.3% | - | 483.3 |

* Abs[ (Max-Min) / (Analytic Solution) ] **Abs[ (Max-Min) / (Mean of Example Results) ]

**ASHRAE Standard 140-2020, Informative Annex B16, Section B16.6**
**Example Results for Section 5.4 - HVAC Equipment Performance Tests HE100 through HE230**

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 B16.6-5. Mean Zone Temperature (°C)

| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Statistics, All Results Min | Max | Mean | (Max-Min) /Mean** | TRACE Trane |
|---|---|---|---|---|---|---|---|---|
| HE210: Realistic Weather | 20.01 | 20.00 | 19.98 | 19.98 | 20.01 | 20.00 | 0.2% | 20.00 |
| HE220: Setback Thermostat | 18.75 | 18.53 | 18.53 | 18.53 | 18.75 | 18.60 | 1.2% | 18.52 |
| HE230: Undersized Furnace | 15.48 | 15.17 | 15.64 | 15.17 | 15.64 | 15.43 | 3.0% | 15.35 |

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

## Table B16.6-6. Maximum Zone Temperature (°C)

| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Statistics, All Results Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
|---|---|---|---|---|---|---|---|---|
| HE210: Realistic Weather | 21.45 | 20.00 | 20.06 | 20.00 | 21.45 | 20.50 | 7.1% | 20.00 |
| HE220: Setback Thermostat | 22.70 | 20.00 | 20.11 | 20.00 | 22.70 | 20.94 | 12.9% | 20.00 |
| HE230: Undersized Furnace | 20.14 | 20.00 | 20.06 | 20.00 | 20.14 | 20.07 | 0.7% | 20.00 |

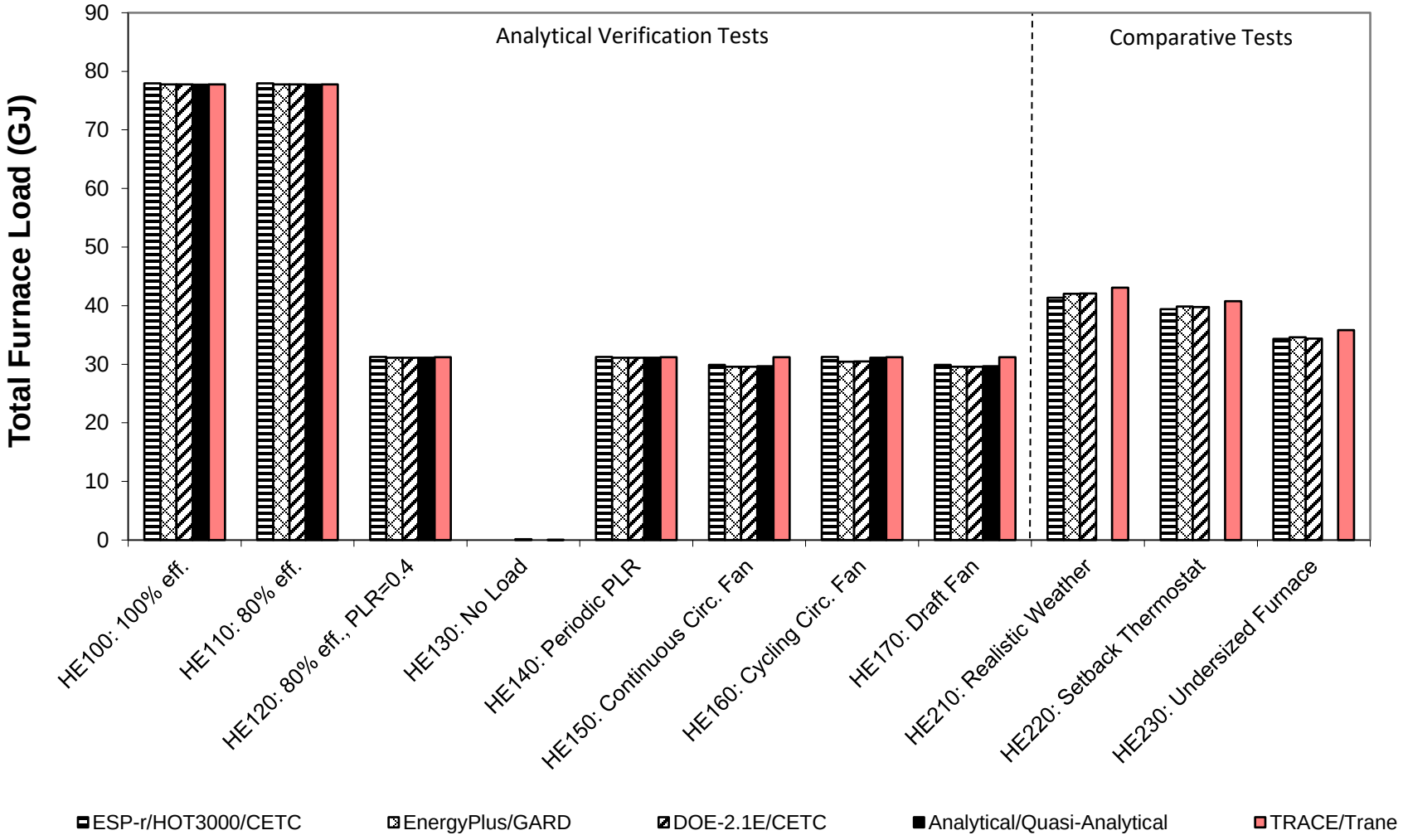
**Abs[ (Max-Min) / (Mean of Example Results) ]

## Table B16.6-7. Minimum Zone Temperature (°C)

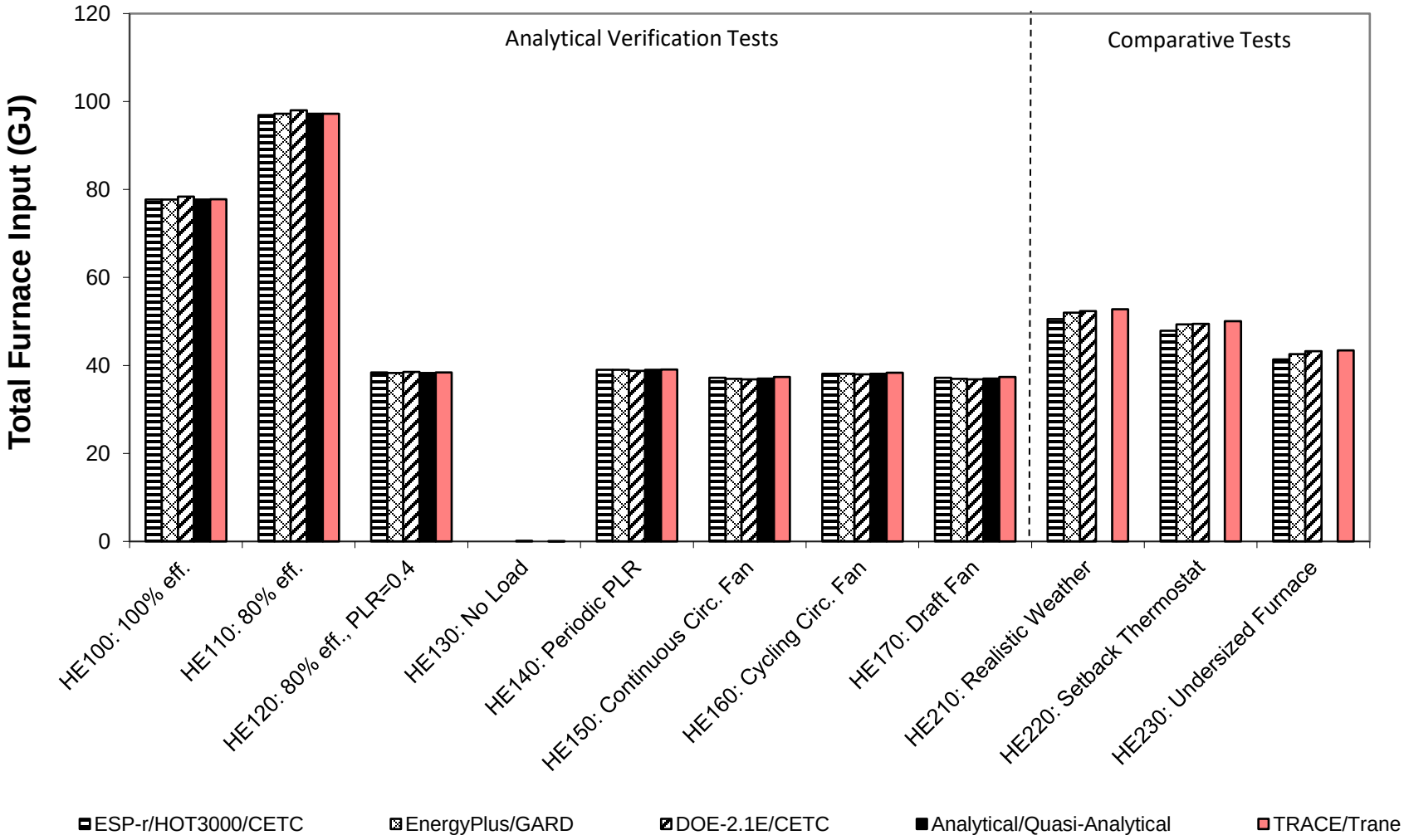
| Cases | ESP-r/HOT3000 CETC | EnergyPlus GARD | DOE-2.1E CETC | Statistics, All Results Min | Max | Mean | (Max-Min) /Mean* | TRACE Trane |
|---|---|---|---|---|---|---|---|---|
| HE210: Realistic Weather | 20.00 | 20.00 | 19.89 | 19.89 | 20.00 | 19.96 | 0.6% | 20.00 |
| HE220: Setback Thermostat | 15.00 | 15.00 | 14.94 | 14.94 | 15.00 | 14.98 | 0.4% | 15.00 |
| HE230: Undersized Furnace | 1.45 | 4.48 | 3.22 | 1.45 | 4.48 | 3.05 | 99.3% | 1.85 |

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

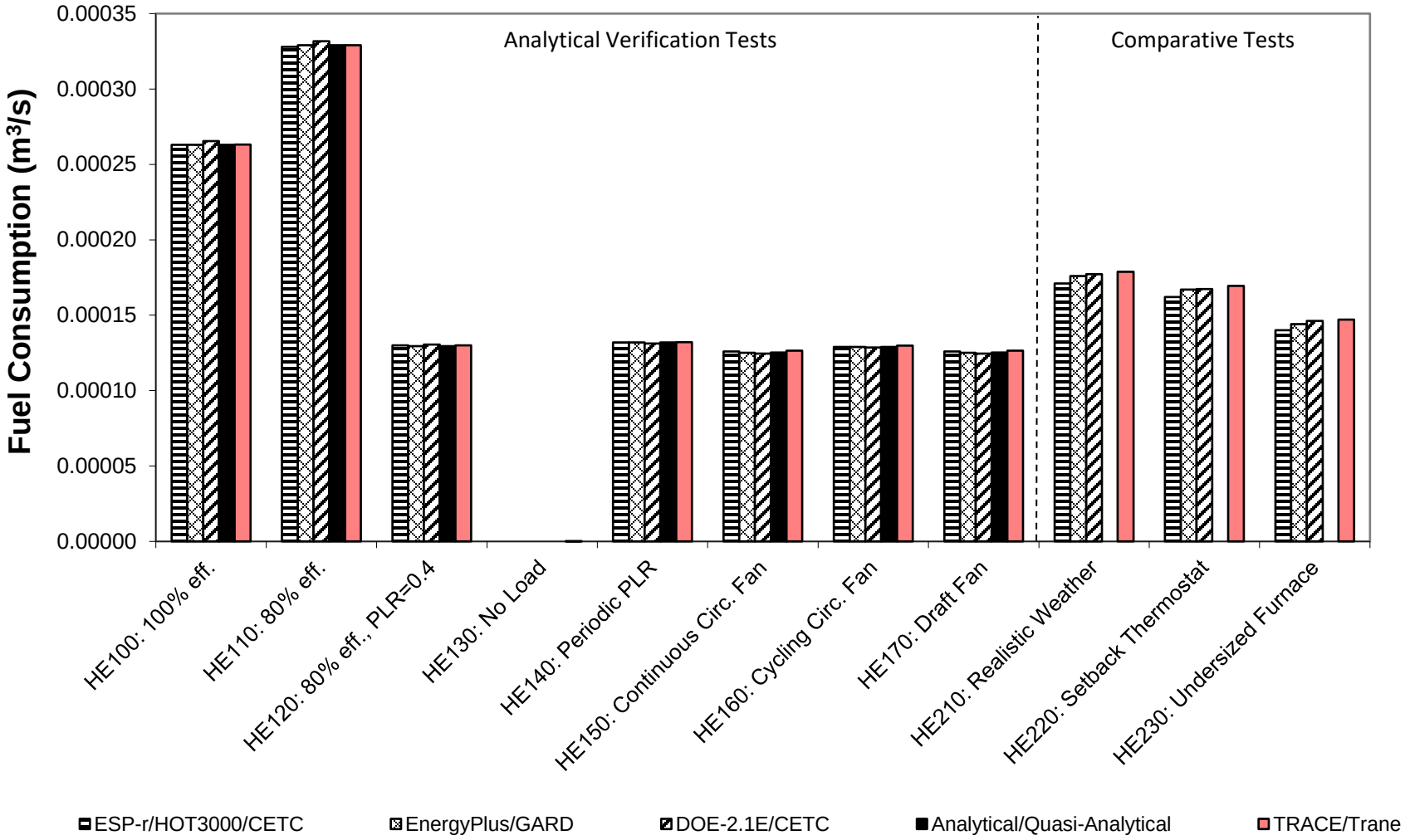
# Figure B16.6-1. Comparison of the Energy Delivered for the Fuel-Fired Furnace Test Cases



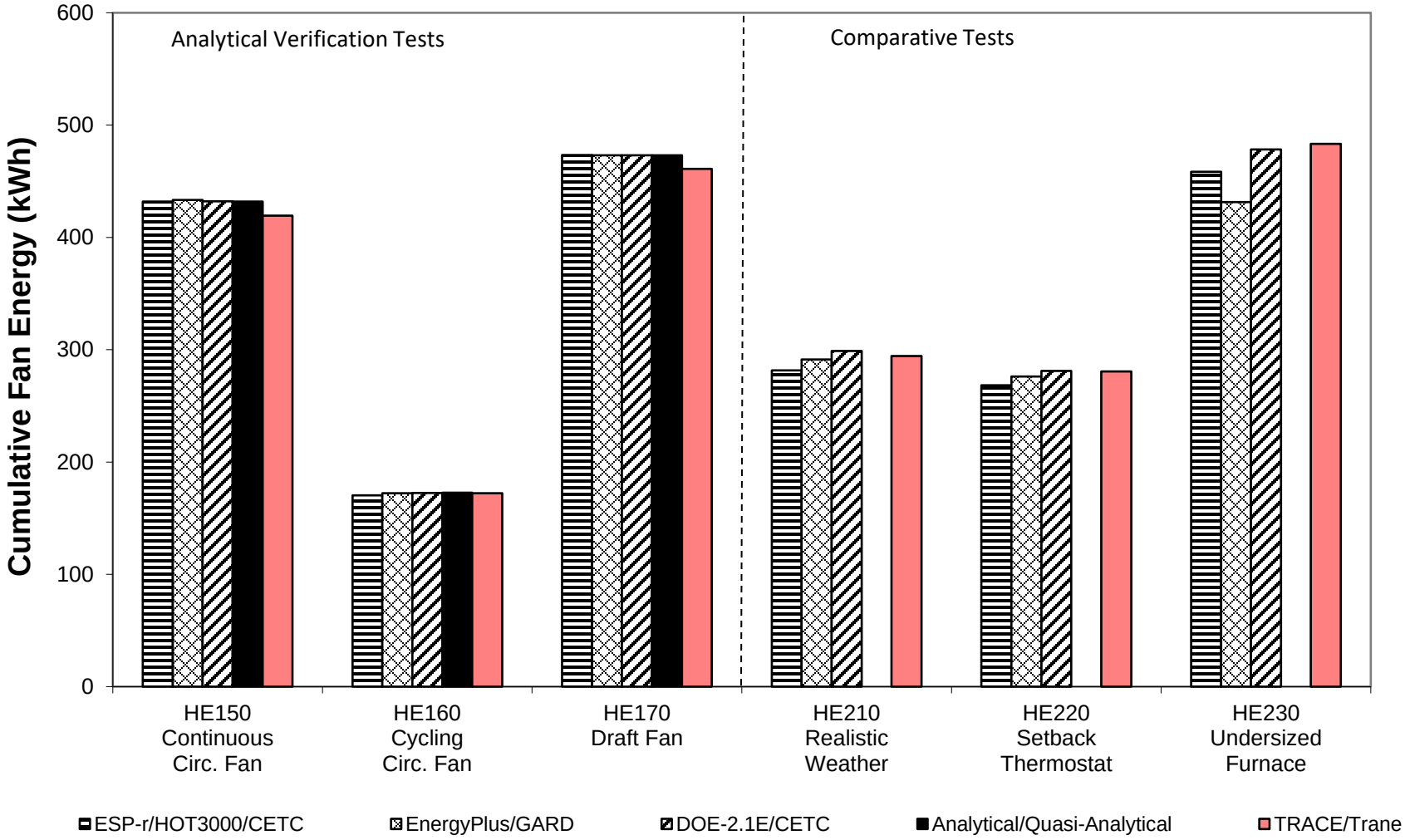
# Figure B16.6-2. Comparison of the Energy Consumed for the Fuel-Fired Furnace Test Cases



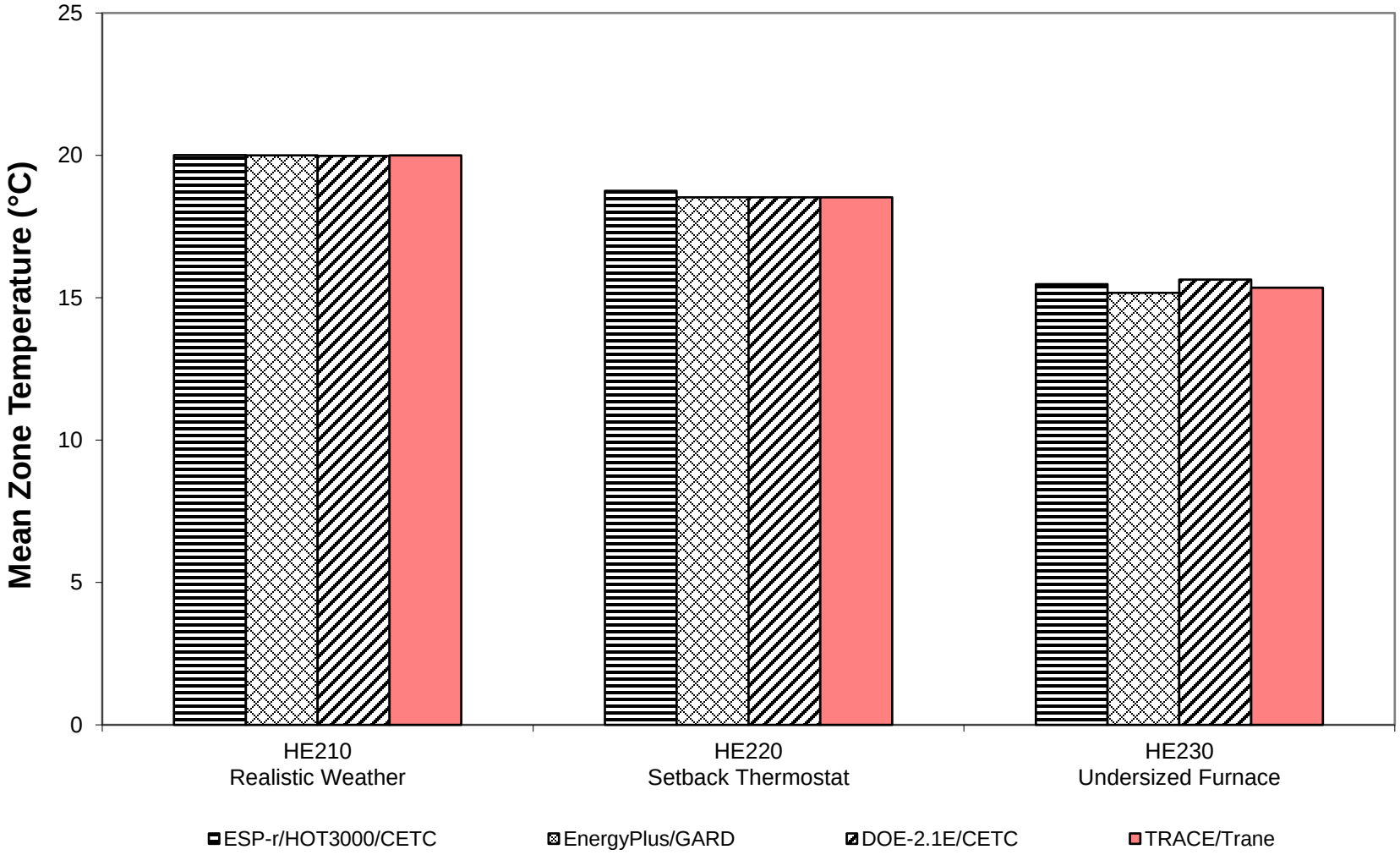
# Figure B16.6-3. Comparison of the Fuel Consumed for the Fuel-Fired Furnace Test Cases



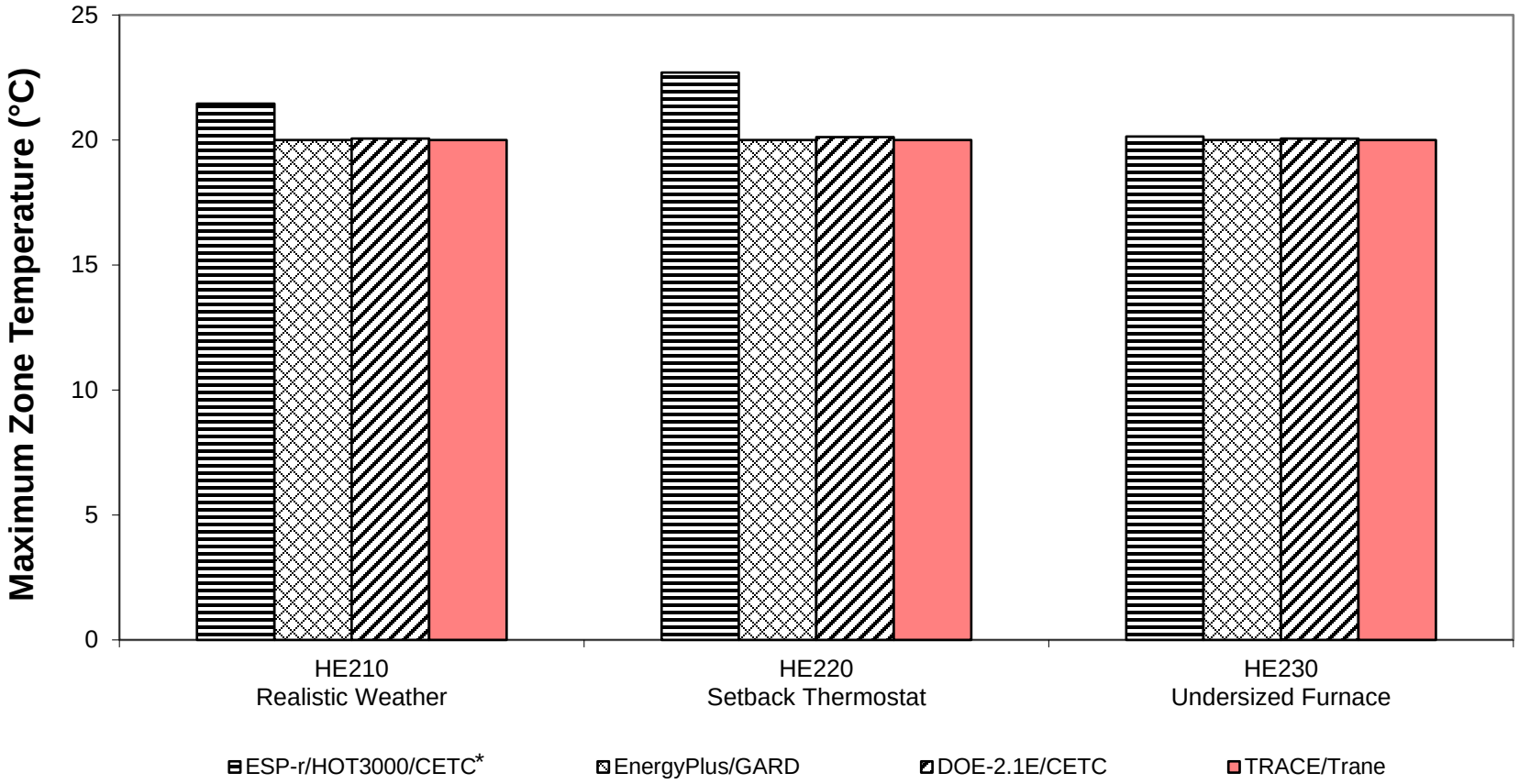
# Figure B16.6-4. Comparison of the Fan Energy for the Fuel-Fired Furnace Test Cases



# Figure B16.6-5. Comparison of the Mean Zone Temperature for the Fuel-Fired Furnace Comparative Test Cases



# Figure B16.6-6. Comparison of the Maximum Zone Temperature for the Fuel-Fired Furnace Comparative Test Cases




* ESP-r's finite-difference discretization scheme with respect to time can be fully explicit, fully implicit, or any weighting in between. The program's default 50/50 weighting was employed for the simulations reported here and was found to produce some temperature solution oscillations for particular cases. However, subsequent analysis revealed that these oscillations had no effect upon the predicted fuel and electricity consumptions, the metrics of primary interest in these test cases.

# Figure B16.6-7. Comparison of the Minimum Zone Temperature for the Fuel-Fired Furnace Comparative Test Cases