

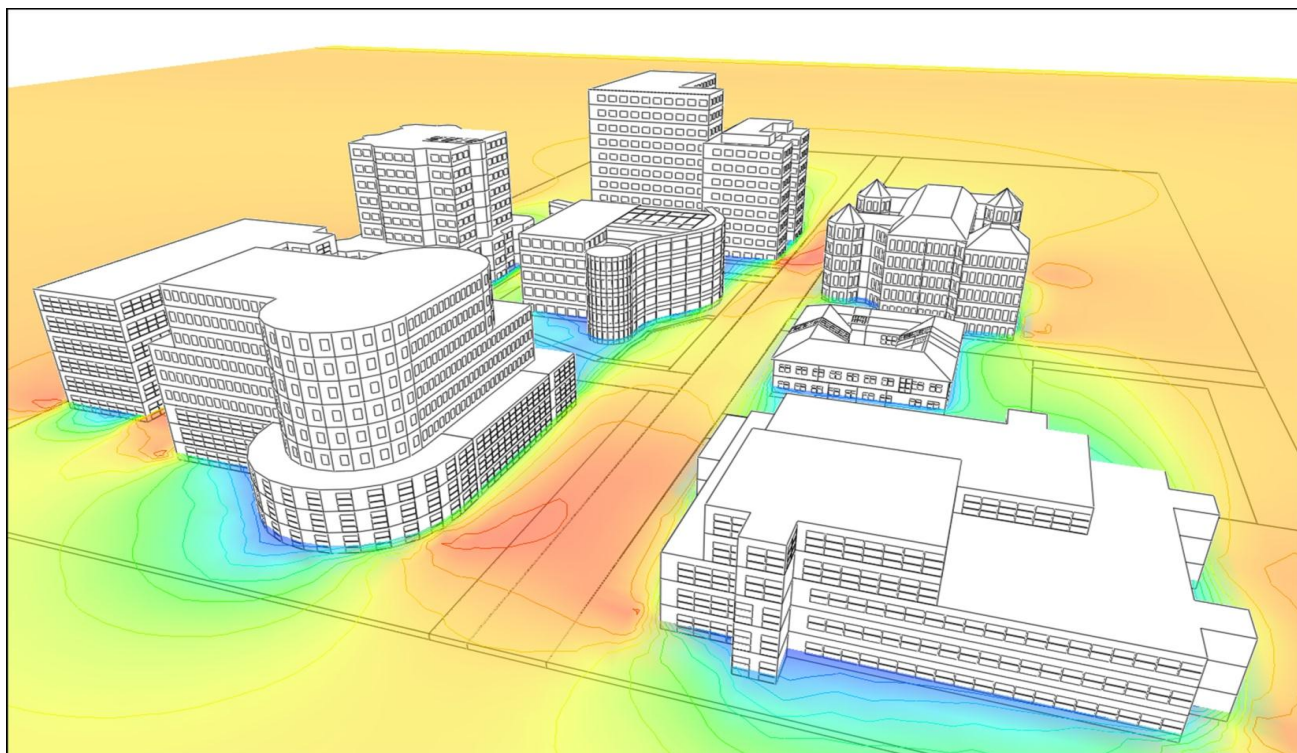


**INTEGRATED
ENVIRONMENTAL
SOLUTIONS**

Space-Cooling Equipment Performance Tests performed on ApacheSim in accordance with ANSI/ASHRAE Standard 140-2007

**ApacheSim Version <VE>2013
June 2013**

Integrated Environmental Solutions
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References

- [1:ASHRAE 140-2007] ANSI/ASHRAE Standard 140-2007, Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs.
ASHRAE, Inc., 1791 Tullie Circle NE, Atlanta, GA 30329.
www.ashrea.org
- [2:ApacheSim] ApacheSim Building Thermal Simulation Program.
Integrated Environmental Solutions (IES) Ltd., Helix Building,
Kelvin Campus, West of Scotland Science Park, Glasgow.
G20 0SP.
www.iesve.com
- [3:Results5-3A] Excel workbook, "RESULTS5-3A_ies.xls", supplied by
ASHRAE and populated with simulation results from
ApacheSim.
Contains results/tables/charts for cases CE100 to CE200.
- [4:Results5-3B] Excel workbook, "RESULTS5-3B_ies.xls", supplied by
ASHRAE and populated with simulation results from
ApacheSim.
Contains results/tables/charts for cases CE300 to CE545.

1 Introduction

ANSI/ASHRAE Standard 140-2007, Standard Method of Test (SMOT) for the Evaluation of Building Energy Analysis Computer Programs [1:ASHRAE 140-2007], defines a series of tests for building energy simulation programs. The tests fall into three categories: building envelope and fabric load tests, space-cooling equipment performance tests and space-heating performance tests.

This report covers the space-cooling equipment performance tests, described in [1:ASHRAE 140-2007], section 5.3.

The space-cooling tests require the simulation of a number of variants of a unitary air conditioning system installed in a test building.

The aim of the tests is to identify and diagnose differences in predictions that may be caused by software errors. The ways in which they can be used are listed in [1:ASHRAE 140-2007]:

- a. comparing the predictions from other building energy programs to the example results provided in the informational Annex B8 and/or to other results that were generated using this SMOT,
- b. checking a program against a previous version of itself after internal code modifications to ensure that only the intended changes actually resulted,
- c. checking a program against itself after a single algorithmic change to understand the sensitivity between algorithms,
- d. diagnosing the algorithmic sources of prediction differences; diagnostic logic flow diagrams are included in the informational Annex B9.

While the text of the Standard emphasizes that all building models are simplifications of reality, and full validation cannot be achieved by a single series of tests, the ASHRAE 140 tests provide a valuable benchmark by which the predictions of a simulation program may be compared with those of its peers, as means to establishing a degree of confidence in the correctness of its algorithms and their implementation.

This report presents the results of the space-cooling tests applied to the simulation program ApacheSim [2:ApacheSim].

A brief outline of the tests is provided. This is followed by a description of the modelling assumptions and settings used to run the tests in the ApacheSim program. The ApacheSim results are presented and discussed.

2 Overview of Tests

A full description of the tests, including input data, output reporting conventions and terminology, is provided in the ASHRAE Standard. Here it will suffice to enumerate and briefly describe the cases.

2.1 Analytical Verification Tests

The configuration of the base-case (CE100) building is a near adiabatic rectangular single zone with only user-specified internal gains to drive steady-state cooling load. Mechanical equipment specifications represent a simple unitary vapor compression cooling system or, more precisely, a split-system, air-cooled condensing unit with an indoor evaporator coil. Performance of this equipment is typically modelled using manufacturer design data presented in the form of empirically derived performance maps. This case is presented in detail in [1:ASHRAE 140-2007], section 5.3.1.

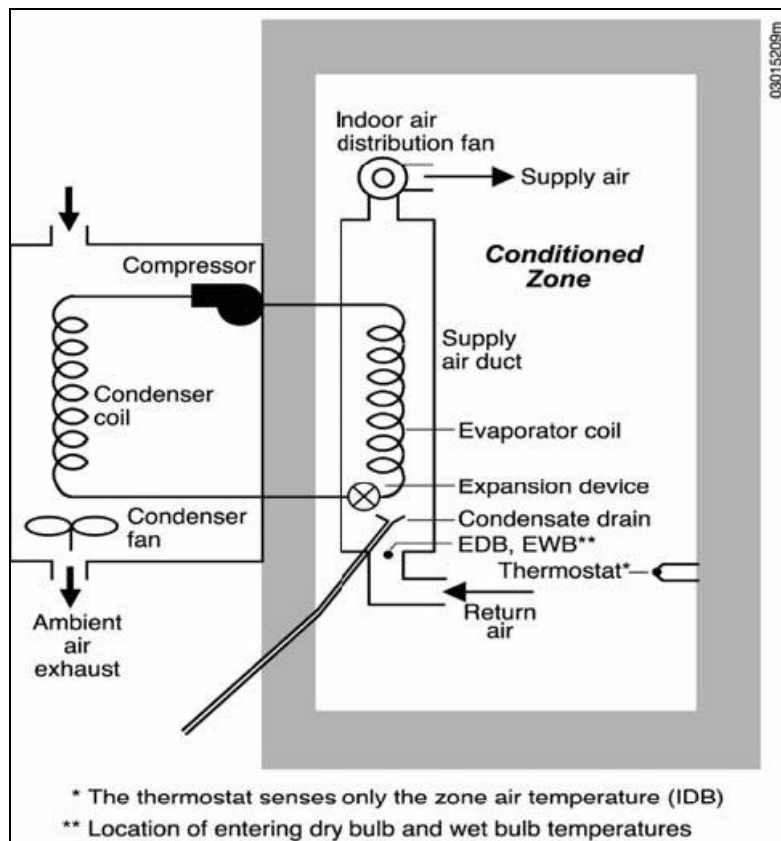


Figure 2.1 – Unitary split air-conditioning system consisting of an air-cooled condensing unit and indoor evaporator coil.

Case CE100 provides the base for a further 13 cases. Each case test permutations of the following variables.

- sensible internal gains
- latent internal gains
- thermostat set-point
- weather data (outside dry-bulb)

Table 2.1 summaries the 14 different cases that form the set of space-cooling analytical verification tests. More detailed description of the cases can be found in the in [1:ASHRAE 140-2007], section 5.3.2.

Case	Zone			Weather		Comments
	Internal Gains*		Set-point	ODB (°C)		
	Sensible (W)	Latent (W)	EDB (°C)			
Dry zone series						
CE100	5400	0	22.2	46.1	Base case, dry coil. High PLR.	
CE110	5400	0	22.2	29.4	High PLR. Test low ODB vs CE100.	
CE120	5400	0	26.7	29.4	High PLR. Test high EDB vs CE110.	
CE130	270	0	22.2	46.1	Test ODB & EDB interaction vs CE100.	
CE149	270	0	22.2	29.4	Low PLR test versus CE100.	
Humid zone series						
CE150	5400	1100	22.2	29.4	Tests ODB at low PLR vs CE130.	
CE160	5400	1100	26.7	29.4	Tests PLR at low ODB vs CE110.	
CE165	5400	1100	23.3	40.6	High PLR. High SHR.	
CE170	2100	1100	22.2	29.4	Tests latent load vs CE110.	
CE180	2100	4400	22.2	29.4	High PLR. High SHR. Tests EDB vs CE110.	
CE185	2100	4400	22.2	46.1	High PLR. High SHR. Tests ODB & EDB interaction with latent load vs CE160.	
CE190	270	550	22.2	29.4	High PLR. Mid SHR.	
CE195	270	550	22.2	46.1	Tests low sensible load vs CE150.	
Full load test at ARI conditions						
CE200	6120	1817	26.7	35.0	High PLR. Low SHR.	
Tests for ARI indoor wet-bulb temperature at full sensible and latent loads.						
Abbreviations: PLR = part load ratio, ODB = outdoor dry-bulb temperature, EDB = entering dry-bulb temperature, vs = versus, SHR = sensible heat ratio, ARI = Air Conditioning and Refrigeration Institute.						
* internal gains are internally generated sources of heat and humidity that are not related to operation of the mechanical cooling system or its air distribution fan.						

Table 2.1- Space-cooling equipment BESTEST analytical verification test case descriptions (SI).

2.2 Comparative Tests

The configuration of the base case (CE300) is a near adiabatic rectangular single zone with user-defined internal gains and outside air temperature to drive dynamic (hourly varying) loads. The cases apply realistic, hourly varying annual weather data for a hot and humid climate.

The mechanical system is a vapor compression cooling system similar to that used in the analytical verification tests. In these test the input data has been expanded to include a wider set of operating conditions.

In addition an air mixing system is defined so that outside air mixing and economizer control models can be tested. Figure 2.2 shows the configuration of this system.

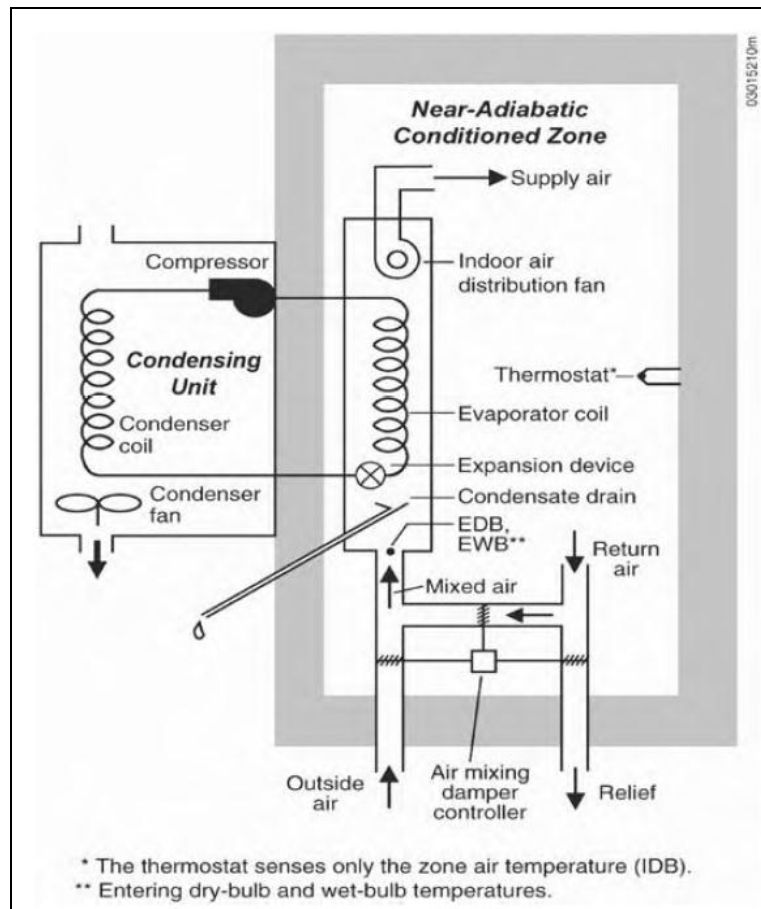


Figure 2.2 – Unitary split air-conditioning system consisting of an air-cooled condensing unit and indoor evaporator coil, and with an outside-air mixing system.

Case CE300 provides the base model for a further 19 cases. More details of these can be found in [1:ASHRAE 140-2007], section 5.3.4., table 2.2 provides an overview of each one.

In these cases (CE310 through CE545), which apply the same weather data as CE300, the following parameters are varied.

- sensible internal gains
- latent internal gains
- infiltration rate

- outside air fraction
- thermostat set points
- economizer control settings

Dynamic tests – Hot and humid weather (New Orleans, LA), Near-Adiabatic Envelope.							
Case		Internal gains		Cooling setpoint	Infil.	Outside Air	Comments
		Sensible	Latent	(°C)	(ACH)	(ACH)	
Preliminary Series							
CE300	Base case (15% OA)	mid	mid	25	0	1.734	Supply fan runs continuously, compressor cycles as needed, expanded performance data. Tests outside air vs CE500
CE310	High latent load	mid	high	25	0	1.734	Tests high latent load vs CE300.
CE320	Infiltration	mid	mid	25	11.558 ^a	0	Tests high infiltration vs CE300, CE330.
CE330	Outside Air	mid	mid	25	0	11.558 ^a	Tests high OA vs CE300, CE320.
CE340	Infiltration/OA interaction	mid	mid	25	5.779 ^a	5.779 ^a	Tests infiltration/OA interaction vs CE300, CE320 or CE330.
CE350	Thermostat set up	mid	mid	25/35	0	1.734	Tests thermostat setup control vs CE300.
CE360	Undersize	high	mid	25	0	1.734	Test overloaded system vs CE300
Economizer Series						Min OA	Temp control:CE400,CE410,CE420
CE400	Temperature control	mid	mid	25	0	1.734	Tests temperature economizer vs CE300.
CE410	Compressor lockout	mid	mid	25	0	1.734	Tests CE400 with compressor lockout vs CE300.
CE420	ODB limit	mid	mid	25	0	1.734	Test ODB limit (20°C) control vs CE300.
CE430	Enthalpy control	mid	mid	25	0	1.734	Enthalpy control: CE430, CE440 Tests enthalpy control vs CE300.
CE440	Outdoor enthalpy limit	mid	mid	25	0	1.734	Tests outdoor enthalpy limit control vs CE300.
0% OA cases						OA	Wet coils: CE500 – CE525
CE500	Base case (0% OA)	mid2	mid2	25	0	0 ^b	Like CE100 but dynamic & expanded performance data. Supply fan cycles ON/OFF with compressor. Hourly output tests COP f(ODB). High PLR. SHR same as CE500. Tests PLR vs CE500.
CE510	High PLR	high2	high2	25	0	0 ^b	Tests EDB = 15°C vs CE500.
CE520	Low EDB = 15°C	mid2	mid2	15	0	0 ^b	Tests EDB = 20°C vs CE500.
CE522	Low EDB = 20°C	mid2	mid2	20	0	0 ^b	Tests EDB = 35°C vs CE500, CE520.
CE525	High EDB	mid2	mid2	35	0	0 ^b	Dry coils: CE530 – CE545 Tests dynamic dry-coil expanded performance vs CE500. Hourly output tests COP f(ODB). Tests EDB = 15°C vs CE530.
CE530	Dry coil	mid2	0	25	0	0 ^b	Tests EDB = 35°C vs CE530.
CE540	Dry coil, low EDB	mid2	0	15	0	0 ^b	
CE545	Dry coil, high EDB	mid2	0	35	0	0 ^b	
Abbreviations: ACH = air changes per hour, COP = coefficient of performance, EDB = entering dry-bulb temperature, Infil. = infiltration, OA = outside air, ODB = outdoor dry-bulb temperature, PLR = part load ratio, SHR = sensible heat ratio.							
Notes :							
“mid” internal gains schedules are relatively high daytime and low nighttime periodically/seasonally adjusted values.							
“mid2” is similar to “mid” but with 0 cooler-month internal gains to get 0 cooling at ODB < 55°F for 0 OA.							
“high” and “high2” are greater loads relative to “mid” and “mid2”, respectively.							
^a Apr. 21 – Oct. 12, 8:00 – 20:00 only							
^b OA = 0 implies fan cycles ON/OFF with compressor.							

Table 2.2 – Space-cooling equipment BESTEST comparative test case descriptions.

3 ApacheSim Settings

STANDARD 140 OUTPUT FORM - MODELING NOTES

INSTRUCTIONS: See [1:ASHRAE 140-2007], Annex A2.

SOFTWARE: *ApacheSim*

VERSION: <VE>2013

Simulated Effect:

Solar radiation model.

Optional Settings or Modeling Capabilities:

Off, Anisotropic (default), Isotropic.

Setting or Capability Used:

Anisotropic.

Physical Meaning of Option Used:

Anisotropic short-wave sky model.

Simulated Effect:

Internal Heat Transfer.

Optional Settings or Modeling Capabilities:

CIBSE fixed values (default), Alamdari & Hammond, CIBSE variable values

Setting or Capability Used:

CIBSE fixed values

Physical Meaning of Option Used:

Internal convection coefficients are fixed at values given in CIBSE Guide A. Note: external convective heat transfer is treated using a wind-speed dependent algorithm.

Simulated Effect:

Initial temperature.

Optional Settings or Modeling Capabilities:

Any temperature (default 18°C)

Setting or Capability Used:

18°C

Physical Meaning of Option Used:

Temperature at which building is initialised before simulation. Has minimal effect provided there is sufficient preconditioning.

Simulated Effect:

Time step.

Optional Settings or Modeling Capabilities:

1, 2, 6, 10 or 30 minutes

Setting or Capability Used:

1 minute / 2 minutes

Physical Meaning of Option Used:

Simulation time step. A small time step was used for optimal accuracy.

Simulated Effect:

Reporting interval.

Optional Settings or Modeling Capabilities:

6, 10, 30 or 60 minutes

Setting or Capability Used:

6 minutes

Physical Meaning of Option Used:

Time interval over which simulation results are averaged for output.

Simulated Effect:

Preconditioning period.

Optional Settings or Modeling Capabilities:

Between 0 and 365 days (default 10 days)

Setting or Capability Used:

10 days

Physical Meaning of Option Used:

Number of days simulated in the run-up to the start of the specified simulation period. Has minimal effect, provided the number of days is sufficiently large in relation to the response time of the building.

Simulated Effect:

Direct solar shading and internal solar tracking calculated by the SunCast program.

Optional Settings or Modeling Capabilities:

SunCast shading can be included or not, at the user's option

Setting or Capability Used:

SunCast shading was not used.

Physical Meaning of Option Used:

No solar tracking was employed in the tests. As the model had no shading or glazing, SunCast would not have contributed to the accuracy of the simulation.

Simulated Effect:

Diffuse shading calculated by the SunCast program.

Optional Settings or Modeling Capabilities:

SunCast diffuse shading can be included or not, at the user's option

Setting or Capability Used:

SunCast shading was not used.

Physical Meaning of Option Used:

The effects on external surfaces were not taken into account in the space cooling tests. As the model had no shading or glazing, SunCast would not have contributed to the accuracy of the simulation.

Simulated Effect:

Plant Performance.

Optional Settings or Modeling Capabilities:

Apache Systems, Apache HVAC

Setting or Capability Used:

Apache HVAC

Physical Meaning of Option Used:

Apache HVAC is a module within the software that enables detailed plant analysis. This module is required in the HVAC tests for analysis of the Unitary Cooling System.

4 Notes on ApacheSim Results

The results in this report are contained in the Excel Workbooks “RESULTS5-3A_ies.xls”, [3:Results5-3A], and “RESULTS5-3B_ies.xls”, [3:Results5-3B].

Section 5 presents the ApacheSim results graphically. The charts follow the same style and ordering as those in the ASHRAE standard.

Section 6 gives the numerical values obtained from ApacheSim. In addition, the tables contain a “Within Range” column. This column provides a first indication of values that differ from the values published in the ASHRAE standard.

If the *discrepancy* in the ApacheSim result is less than the *range*, the “Within Range” column contains a “yes”, otherwise it contains a “no”.

The *range* represents the spread of the published results. It is based on the difference between the maximum and minimum of the published results and is reported as a percentage of the mean of the published results (or analytical results if this is available).

The *discrepancy* in the ApacheSim results is calculated from the difference between the Apache result and the mean of the published results (or analytical value if that is known) expressed as a percentage of the mean (or analytical value).

5 Results – Graphical

5.1 Analytical Verification Test Results - CE100 to CE200

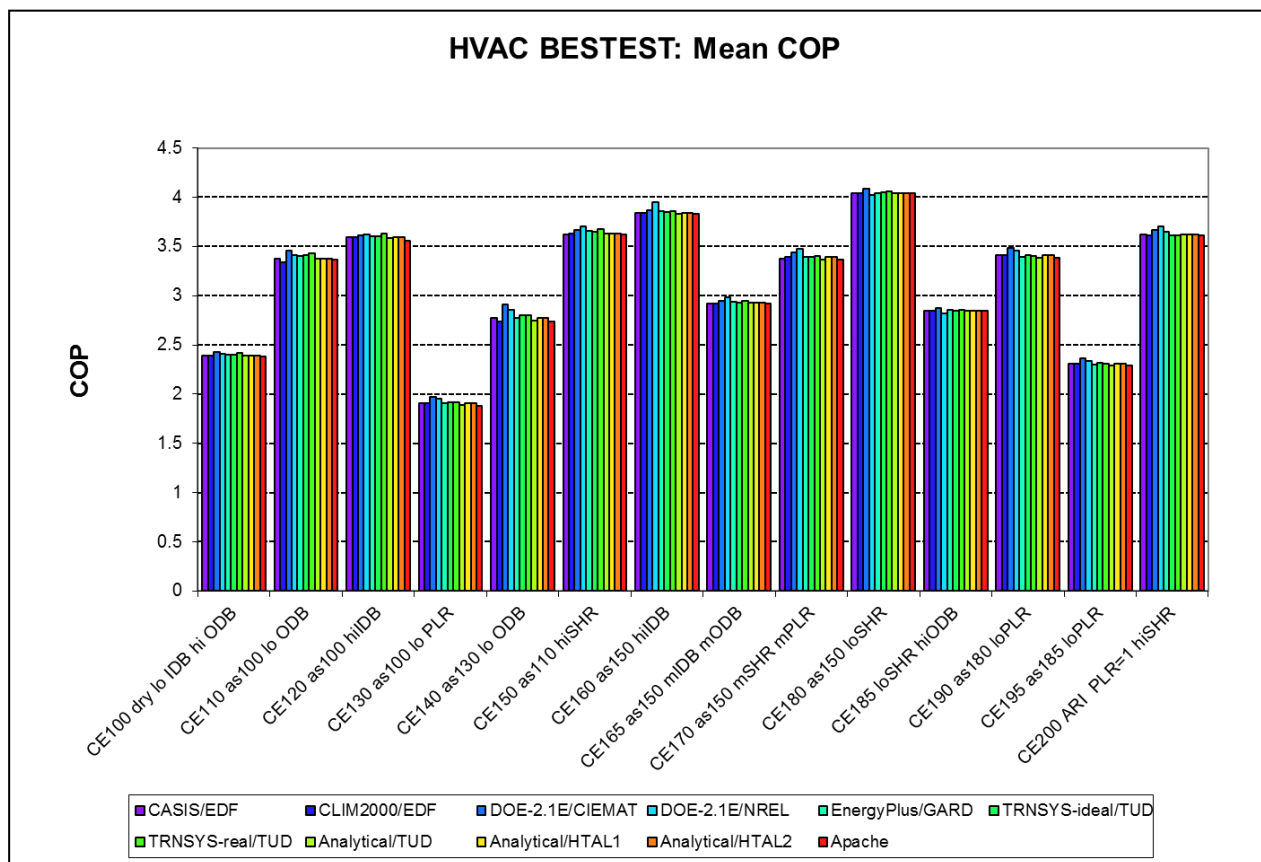


Figure 5.1 – HVAC BESTEST: Mean COP.

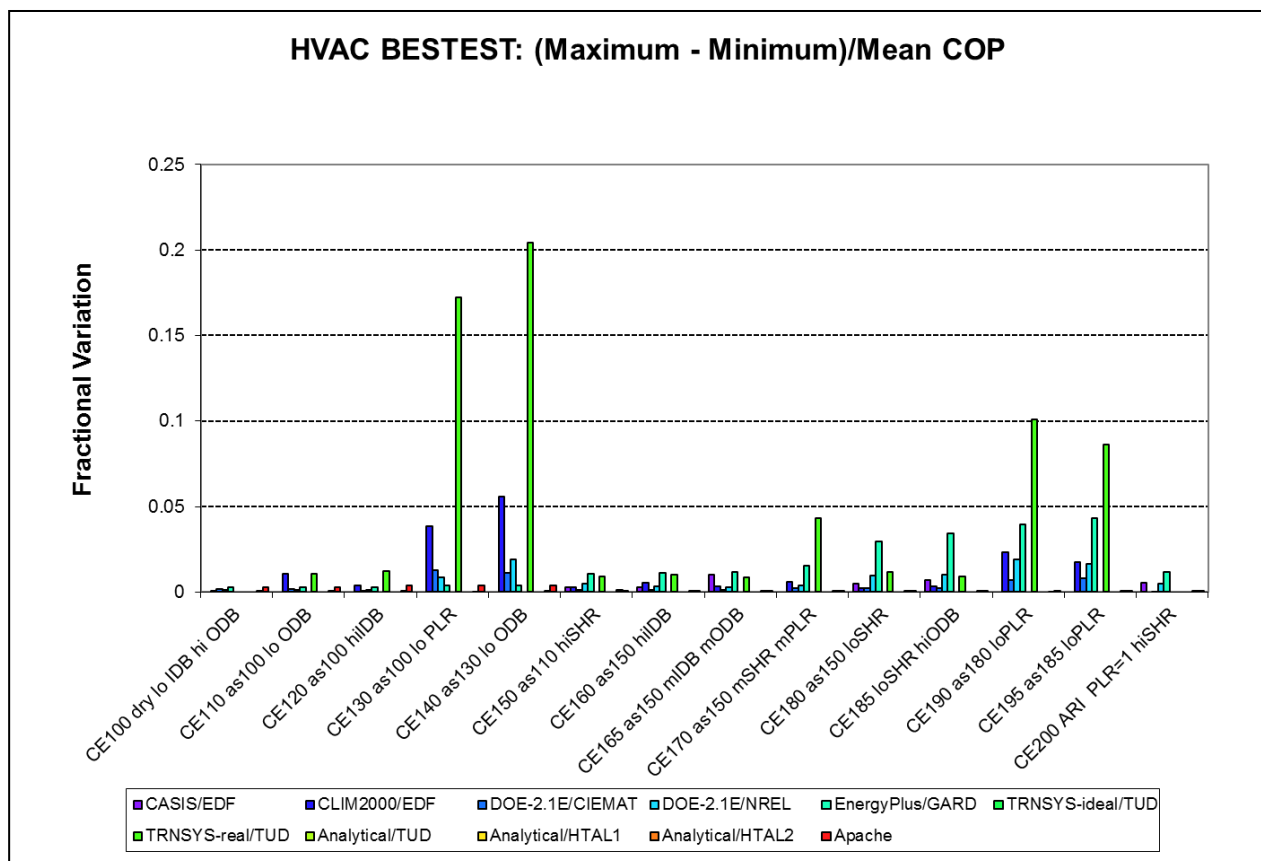


Figure 5.2 – HVAC BESTEST: (Maximum – Minimum)/Mean COP.

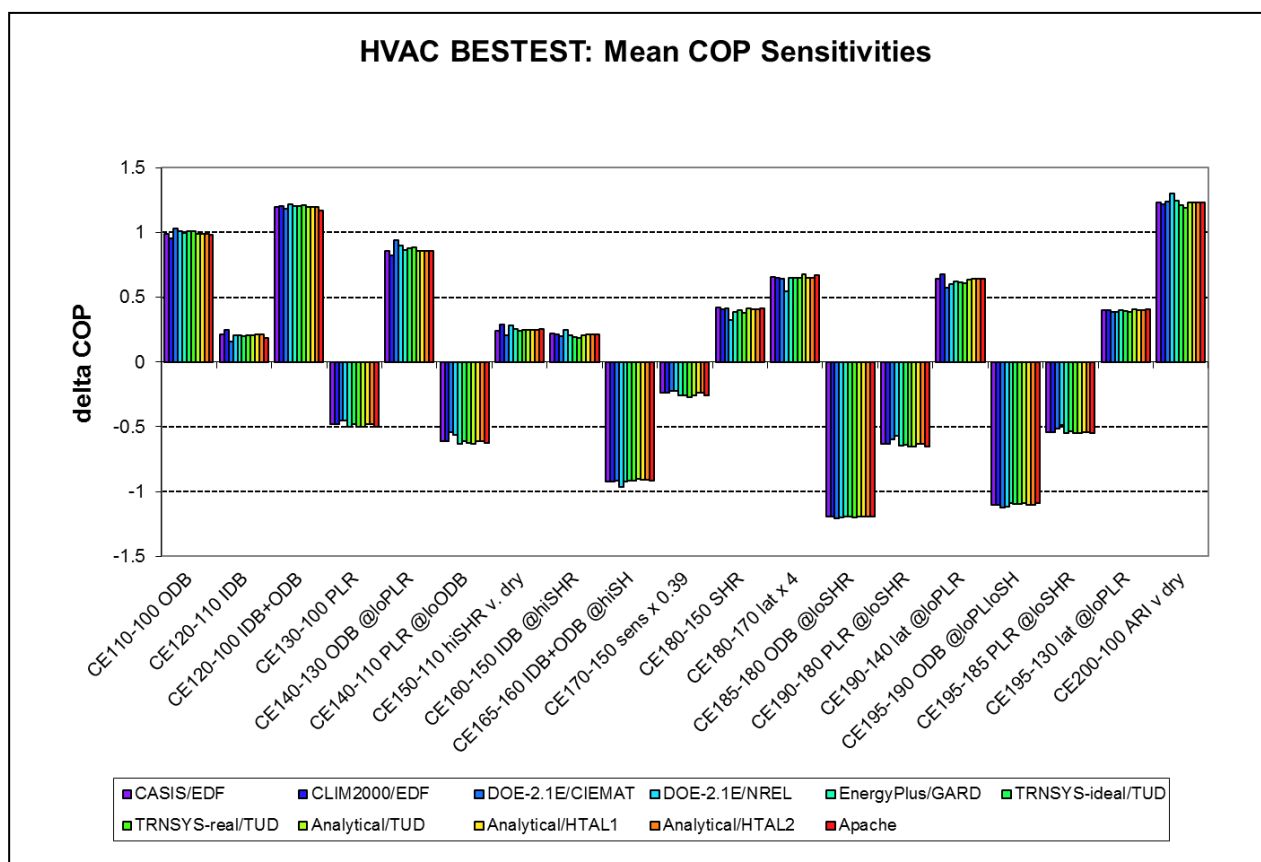


Figure 5.3 – HVAC BESTEST: Mean COP Sensitivities.

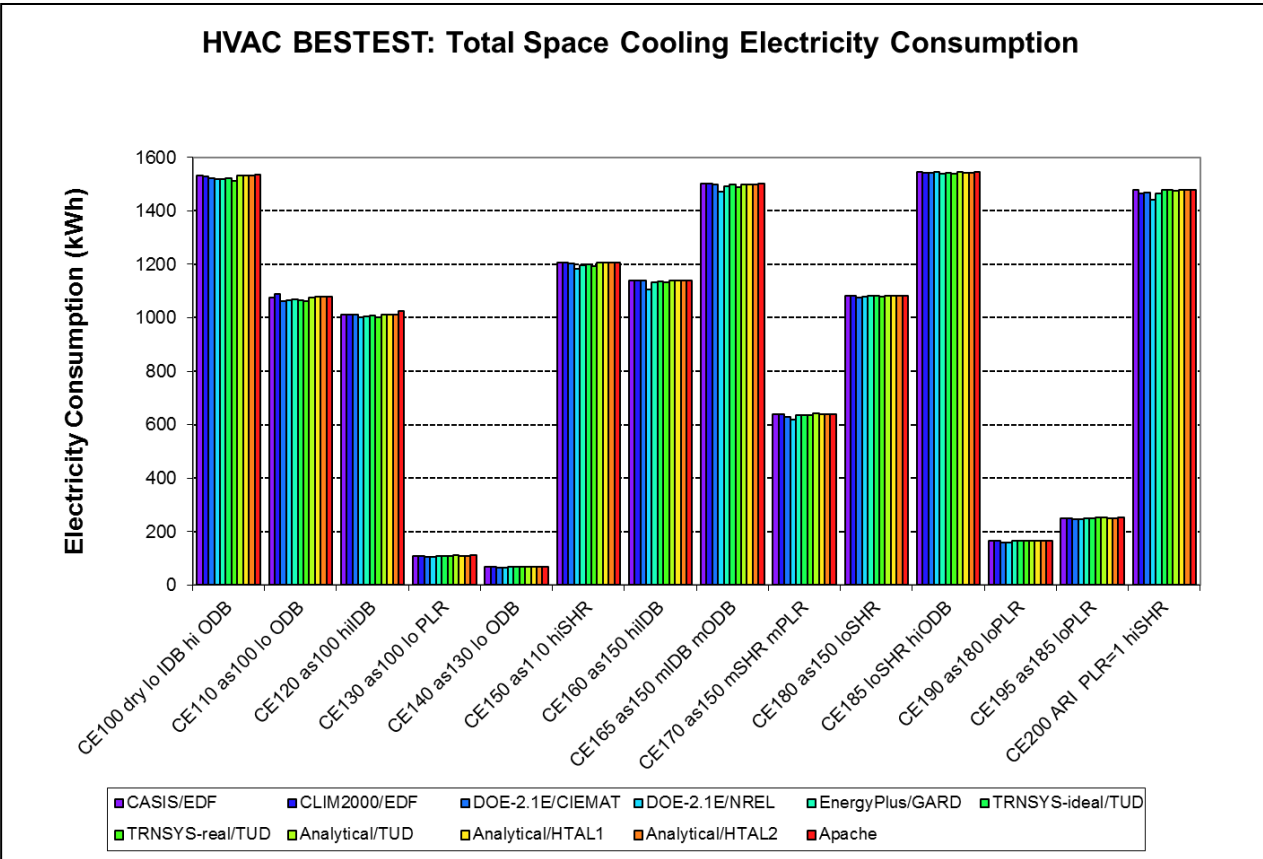


Figure 5.4 – HVAC BESTEST: Total Space Cooling Electricity Consumption.

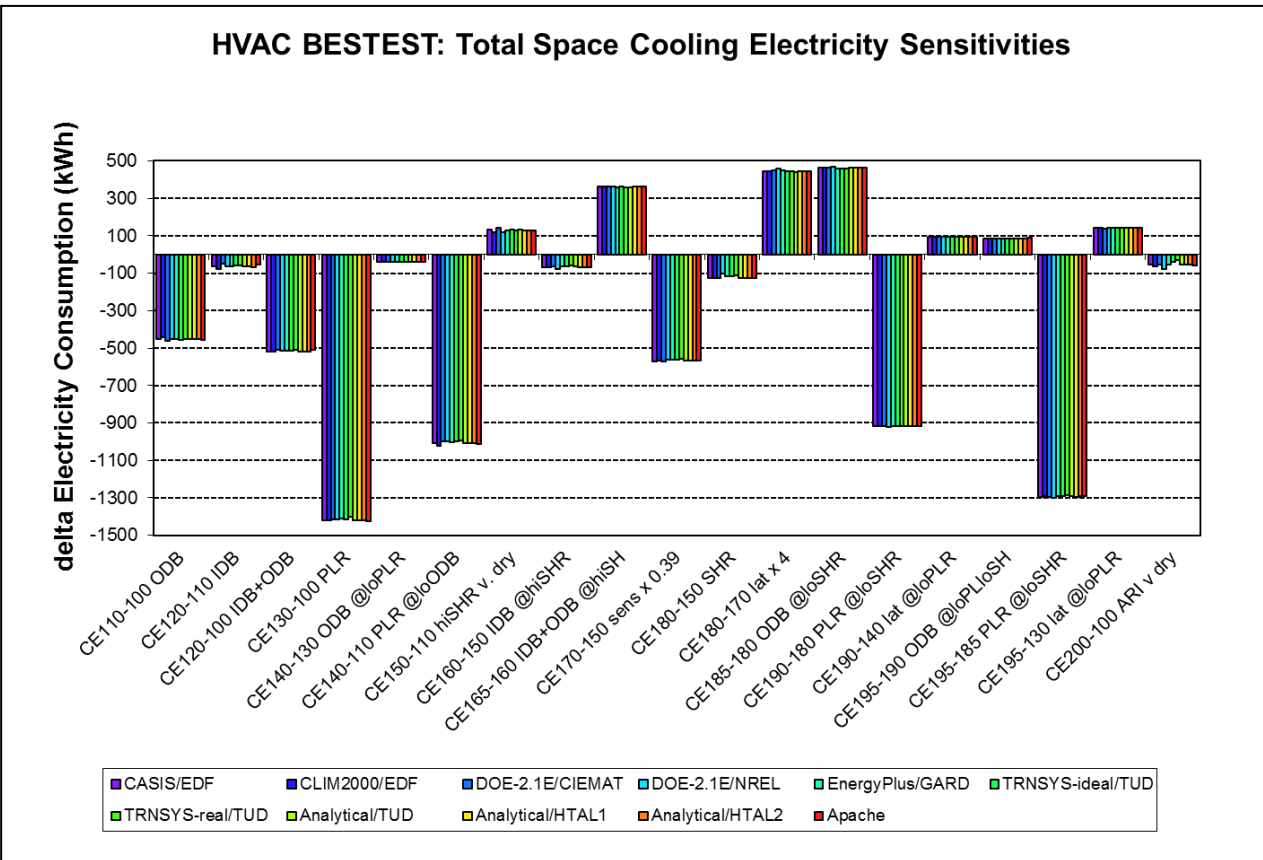


Figure 5.5 – HVAC BESTEST: Total Space Cooling Electricity Sensitivities.

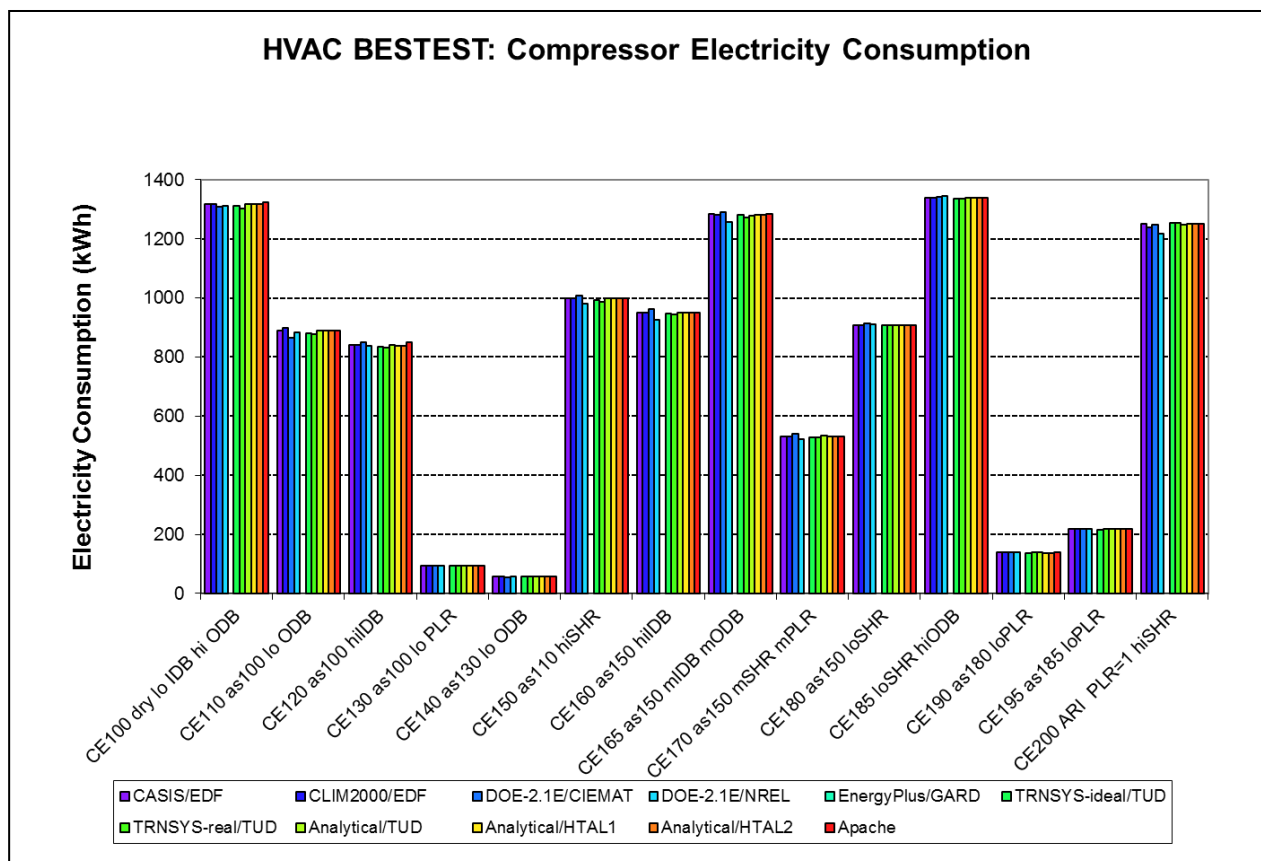


Figure 5.6 – HVAC BESTEST: Compressor Electricity Consumption.

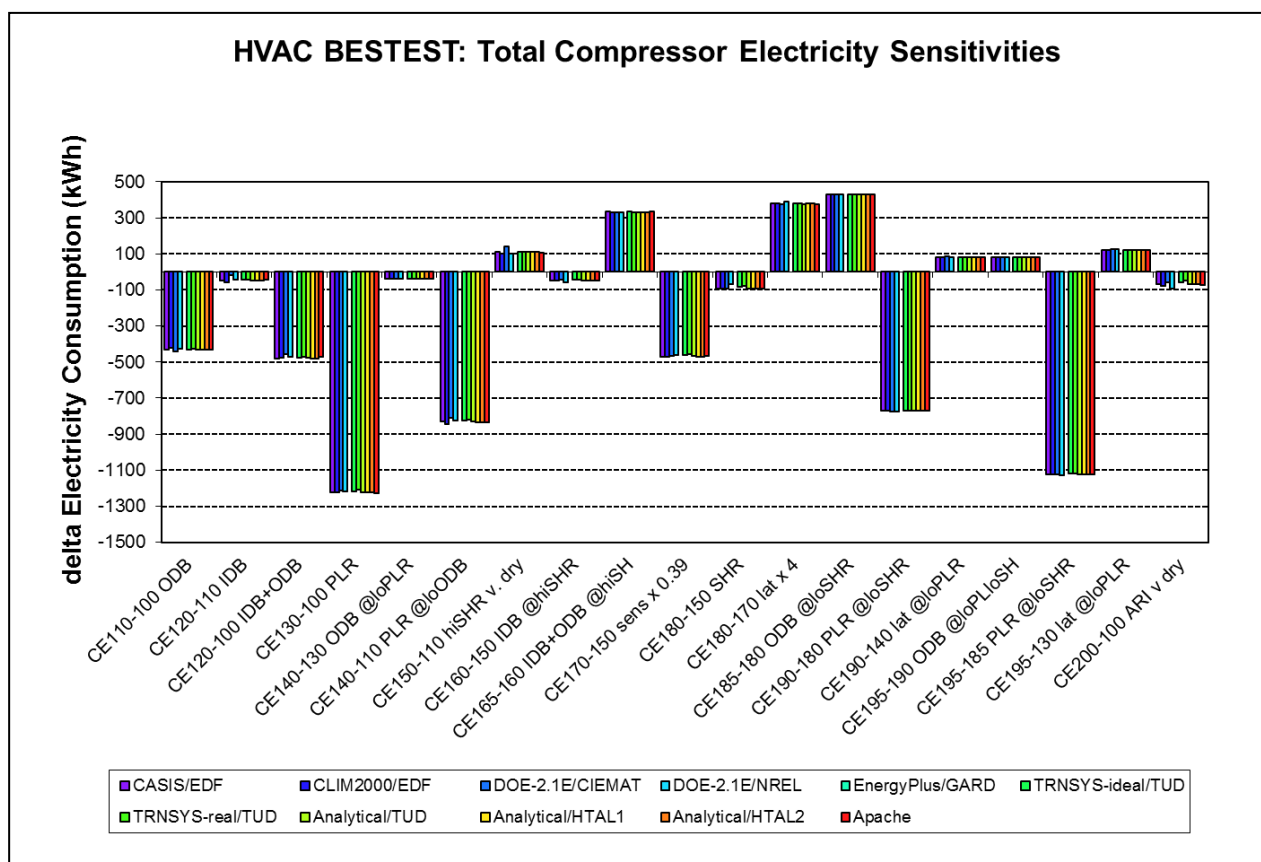


Figure 5.7 – HVAC BESTEST: Total Compressor Electricity Sensitivities.

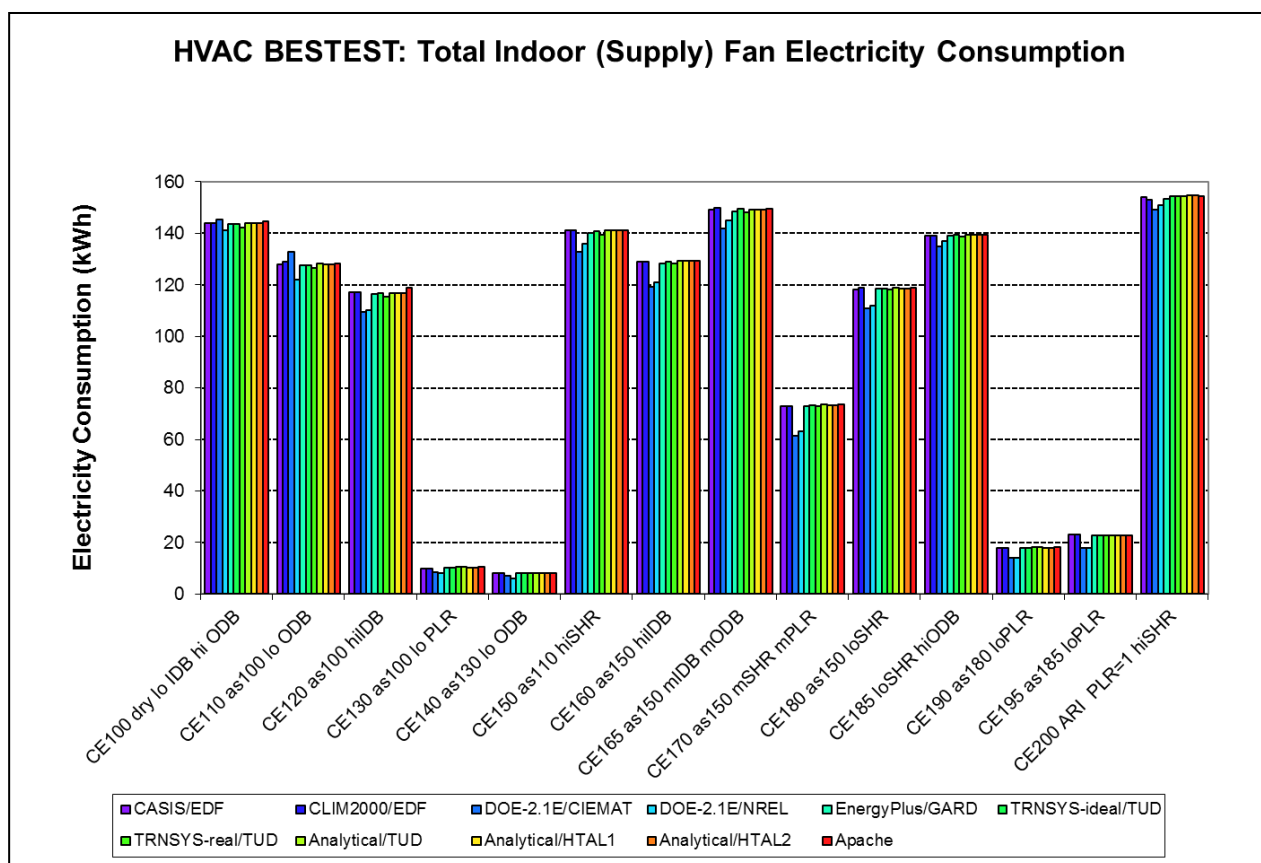


Figure 5.8 – HVAC BESTEST: Total Indoor (Supply) Fan Electricity Consumption.

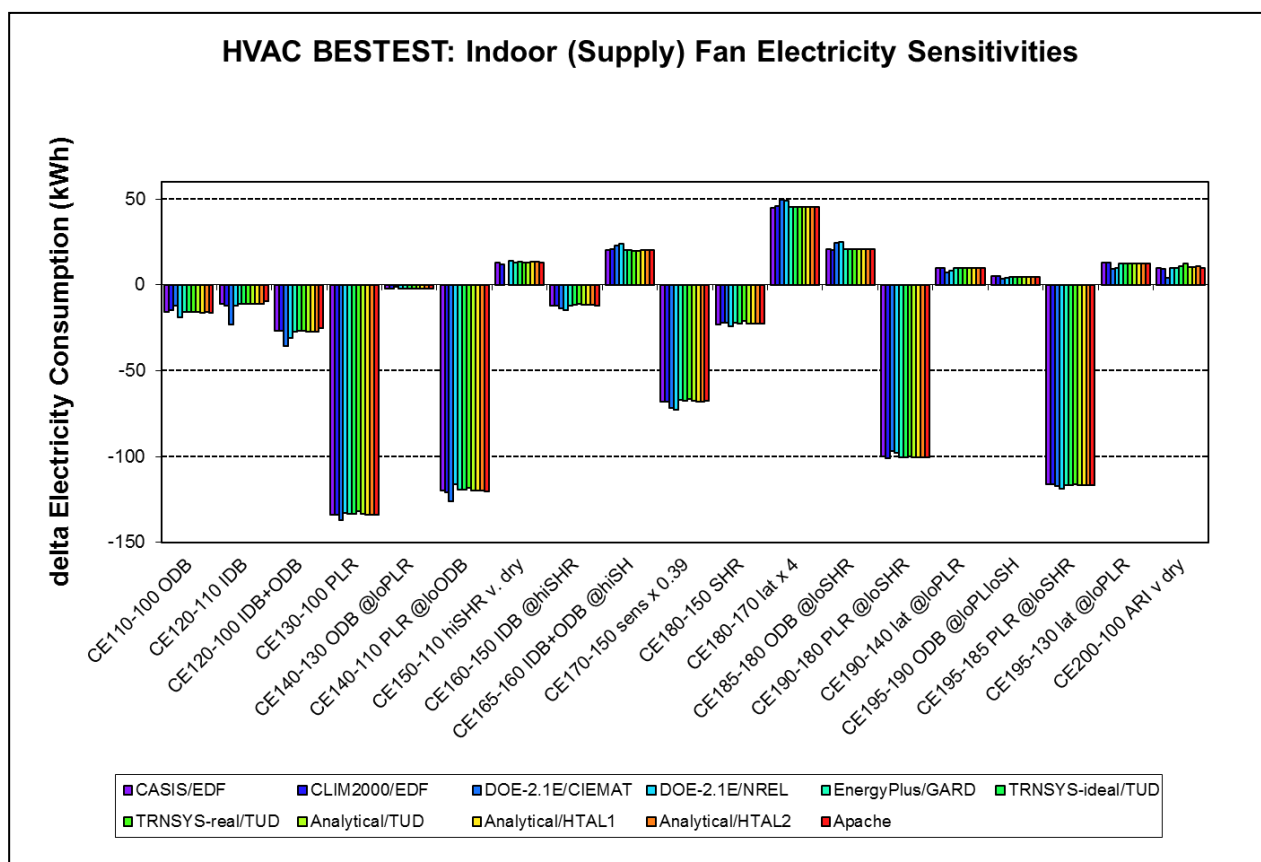


Figure 5.9 – HVAC BESTEST: Total Indoor (Supply) Fan Electricity Sensitivities.

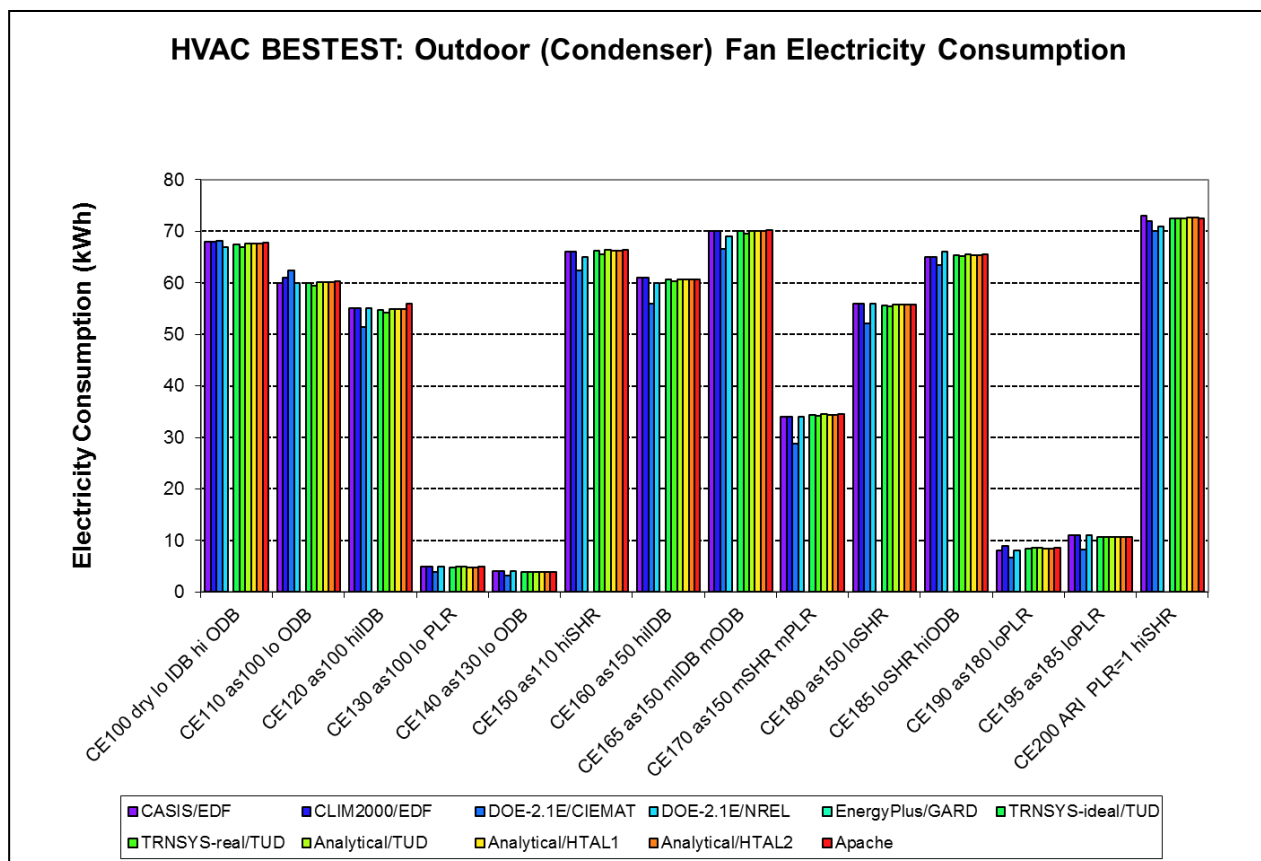


Figure 5.10 – HVAC BESTEST: Outdoor (Condenser) Fan Electricity Consumption.

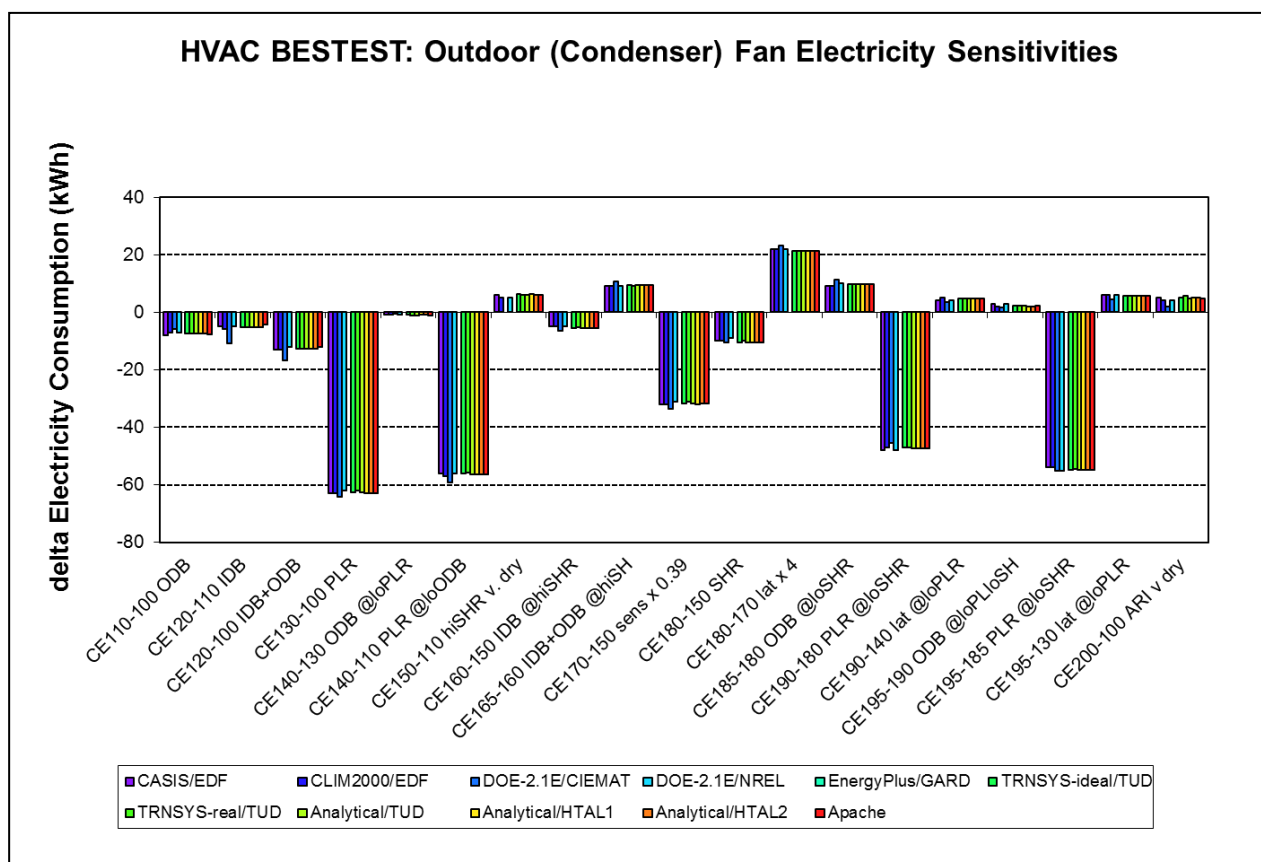


Figure 5.11 – HVAC BESTEST: Outdoor (Condenser) Fan Electricity Sensitivities.

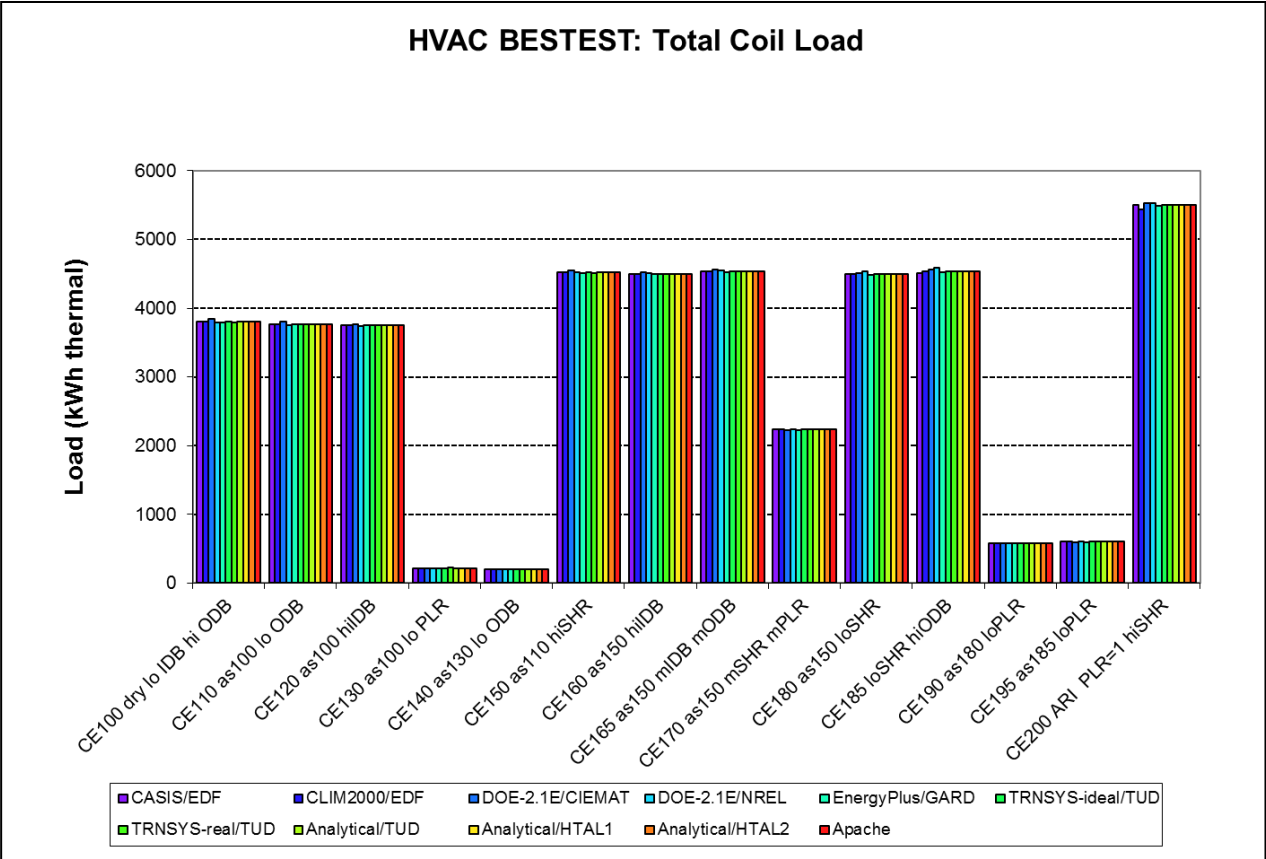


Figure 5.12 – HVAC BESTEST: Total Coil Load.

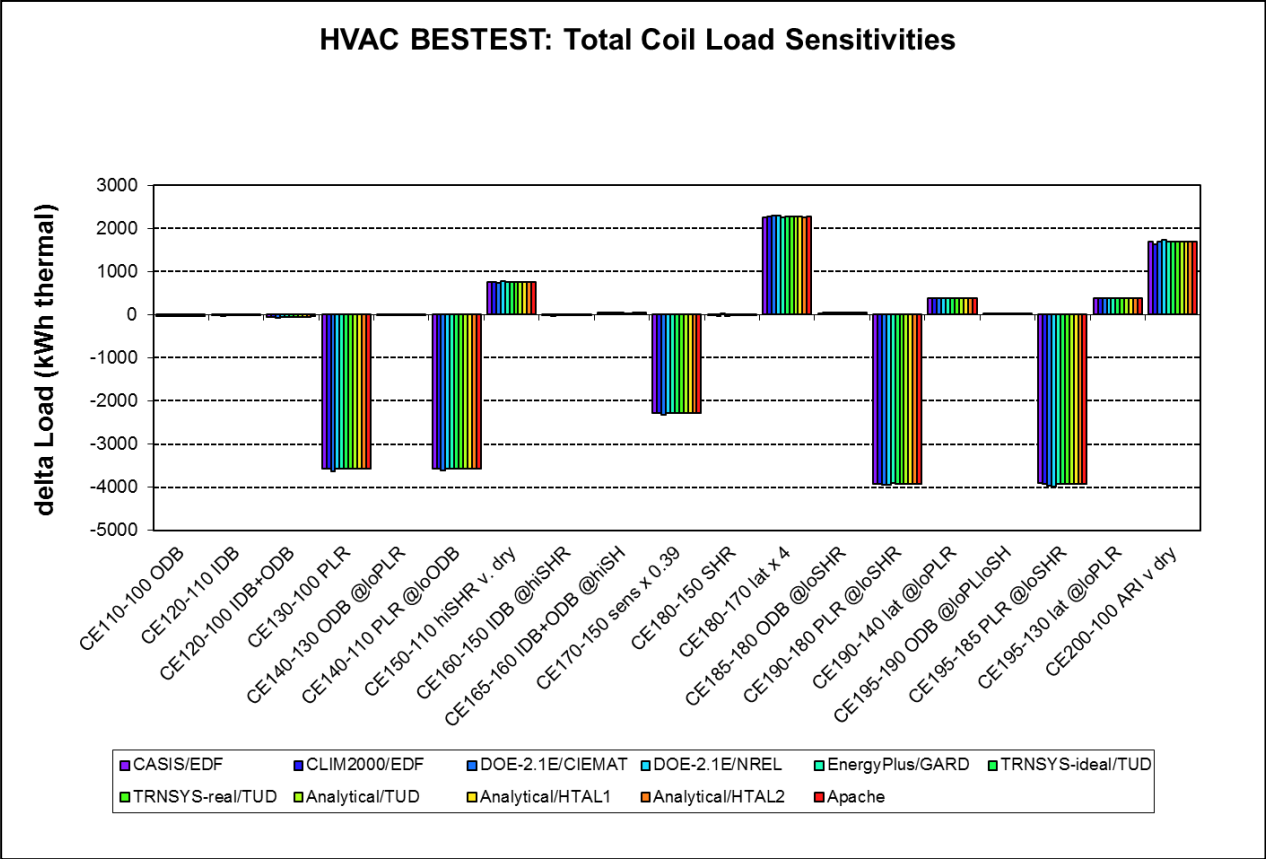


Figure 5.13 – HVAC BESTEST: Total Coil Load Sensitivities.

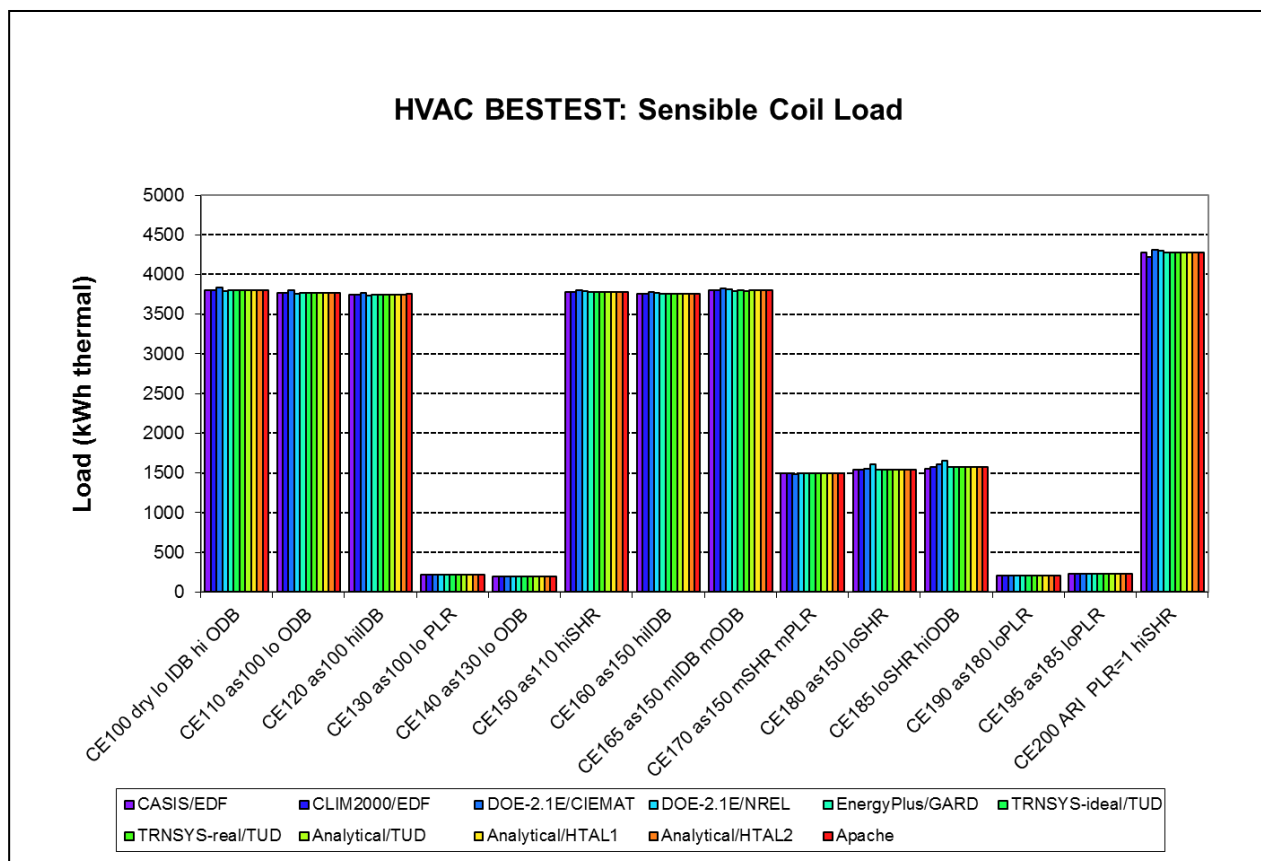


Figure 5.14 – HVAC BESTEST: Sensible Coil Load.

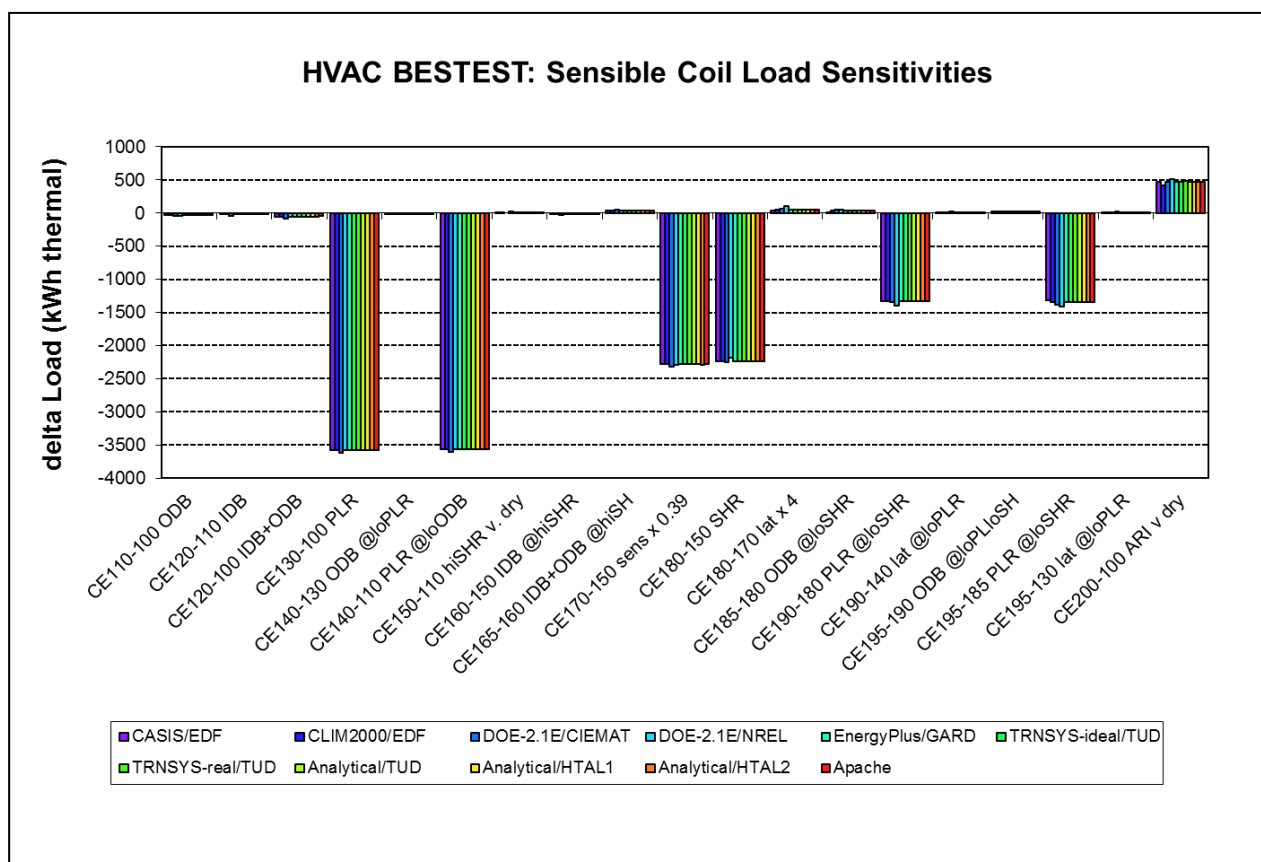


Figure 5.15 – HVAC BESTEST: Sensible Coil Load Sensitivities.

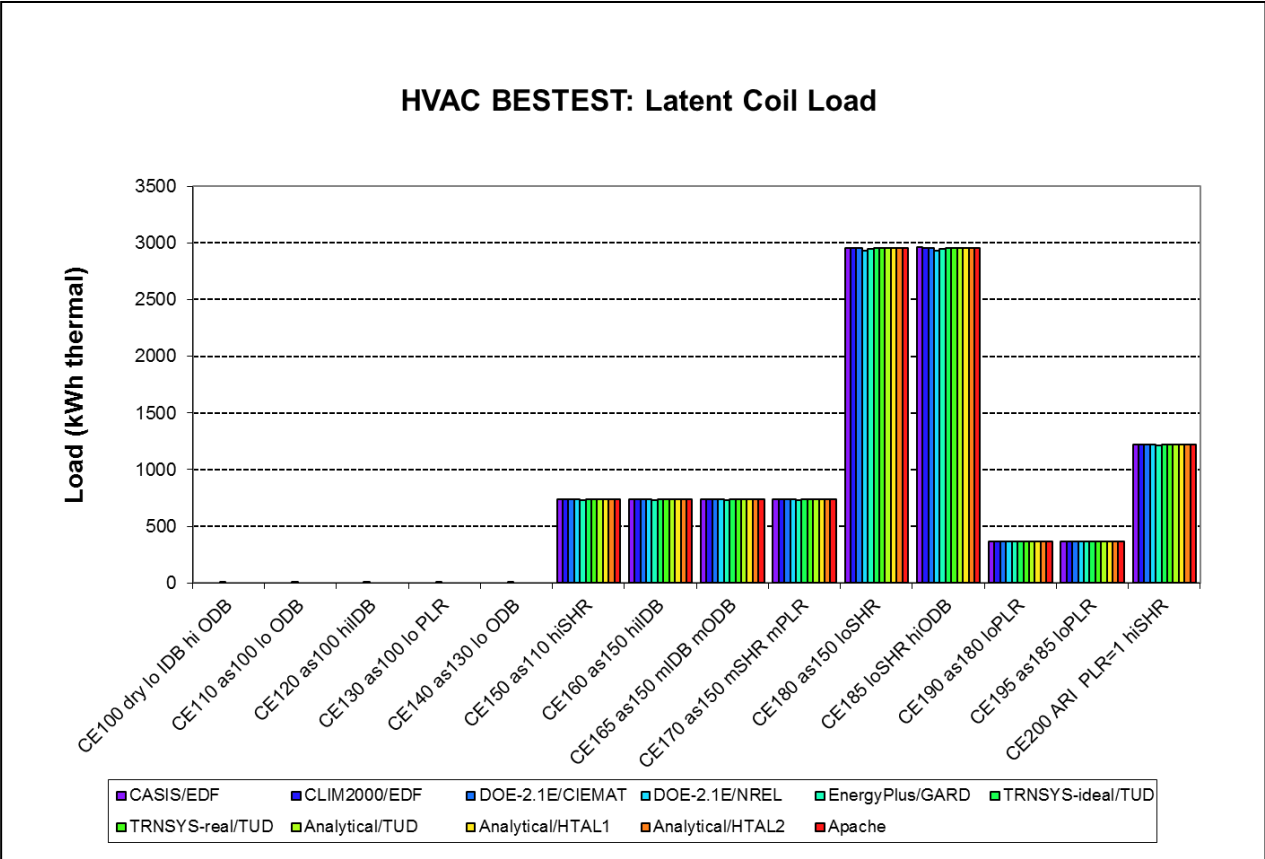


Figure 5.16 – HVAC BESTEST: Latent Coil Load.

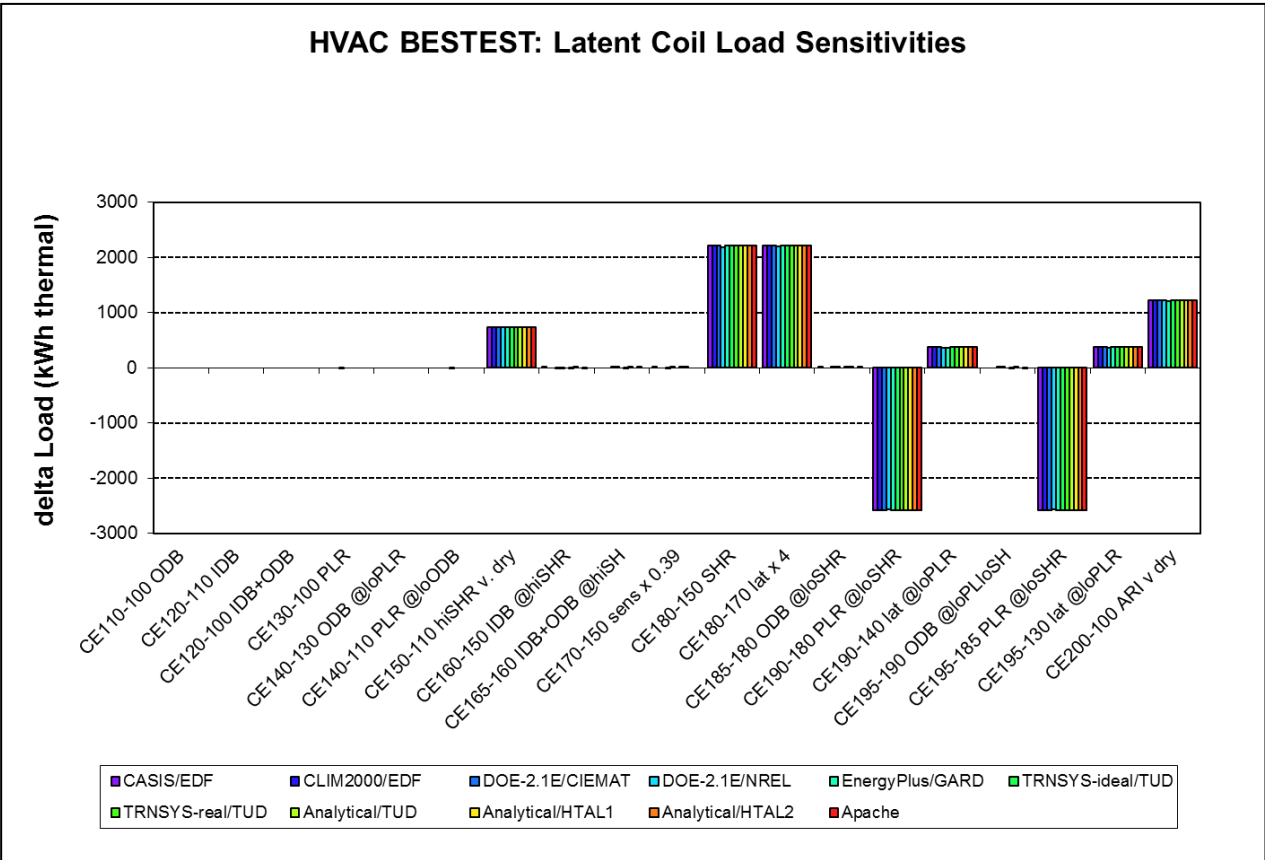


Figure 5.17 – HVAC BESTEST: Latent Coil Load Sensitivities.

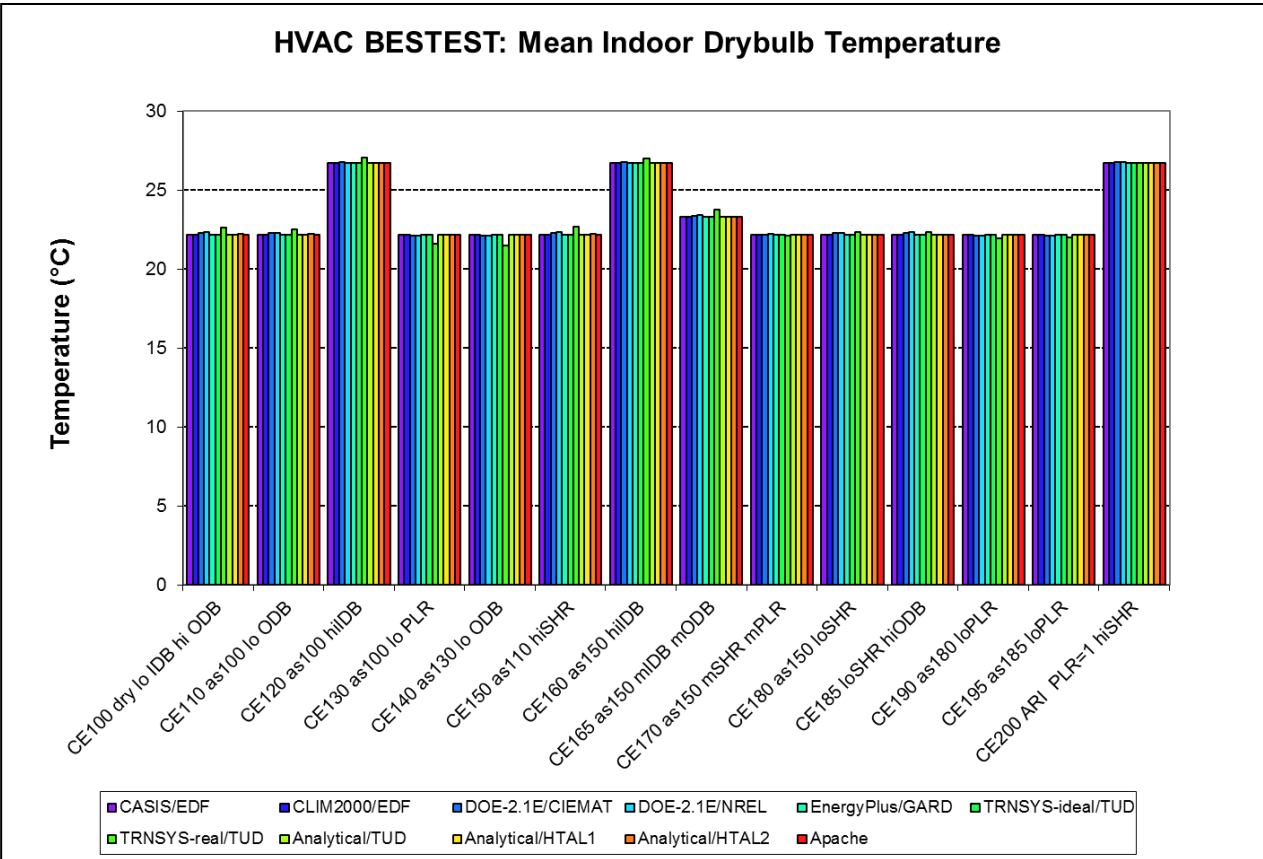


Figure 5.18 – HVAC BESTEST: Mean Indoor Drybulb Temperature.

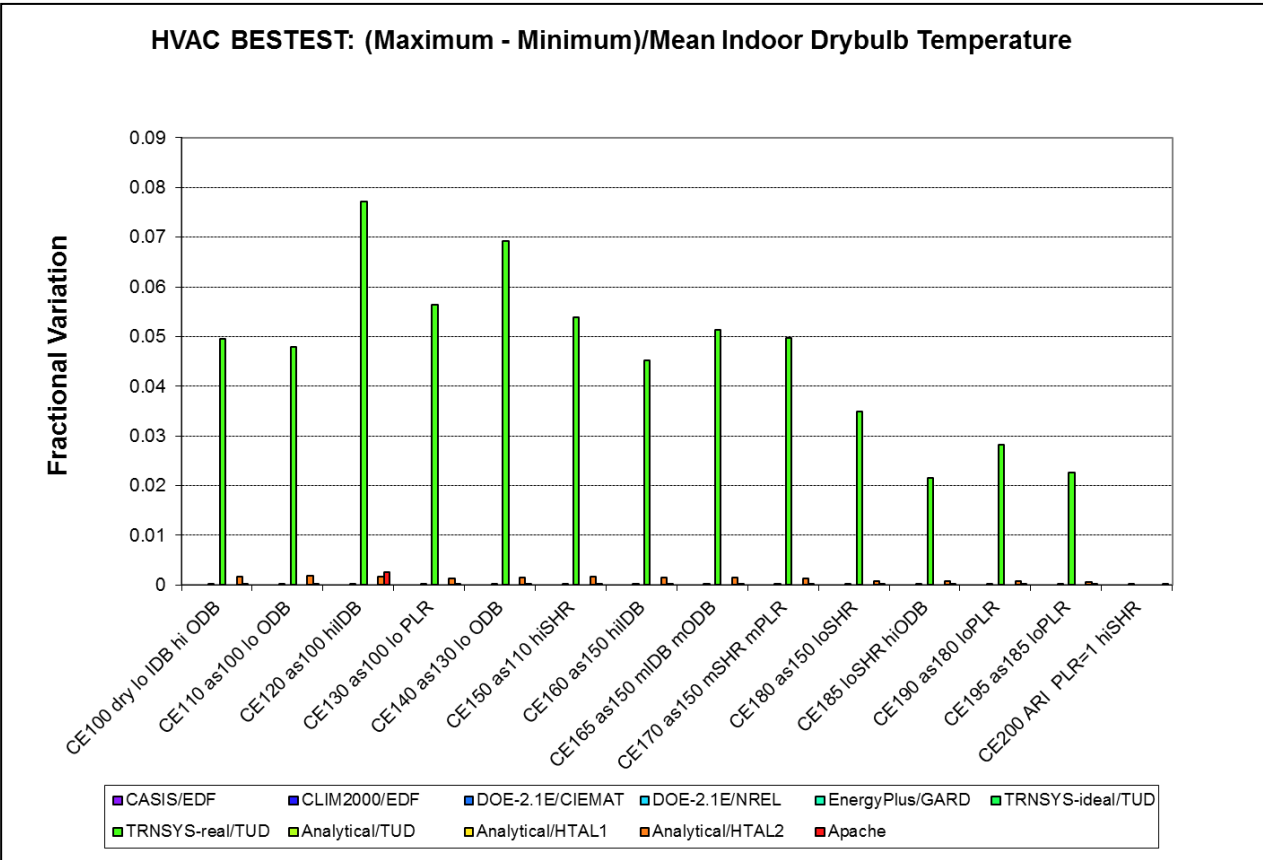


Figure 5.19 – HVAC BESTEST: (Maximum – Minimum)/Mean Indoor Drybulb Temperature.

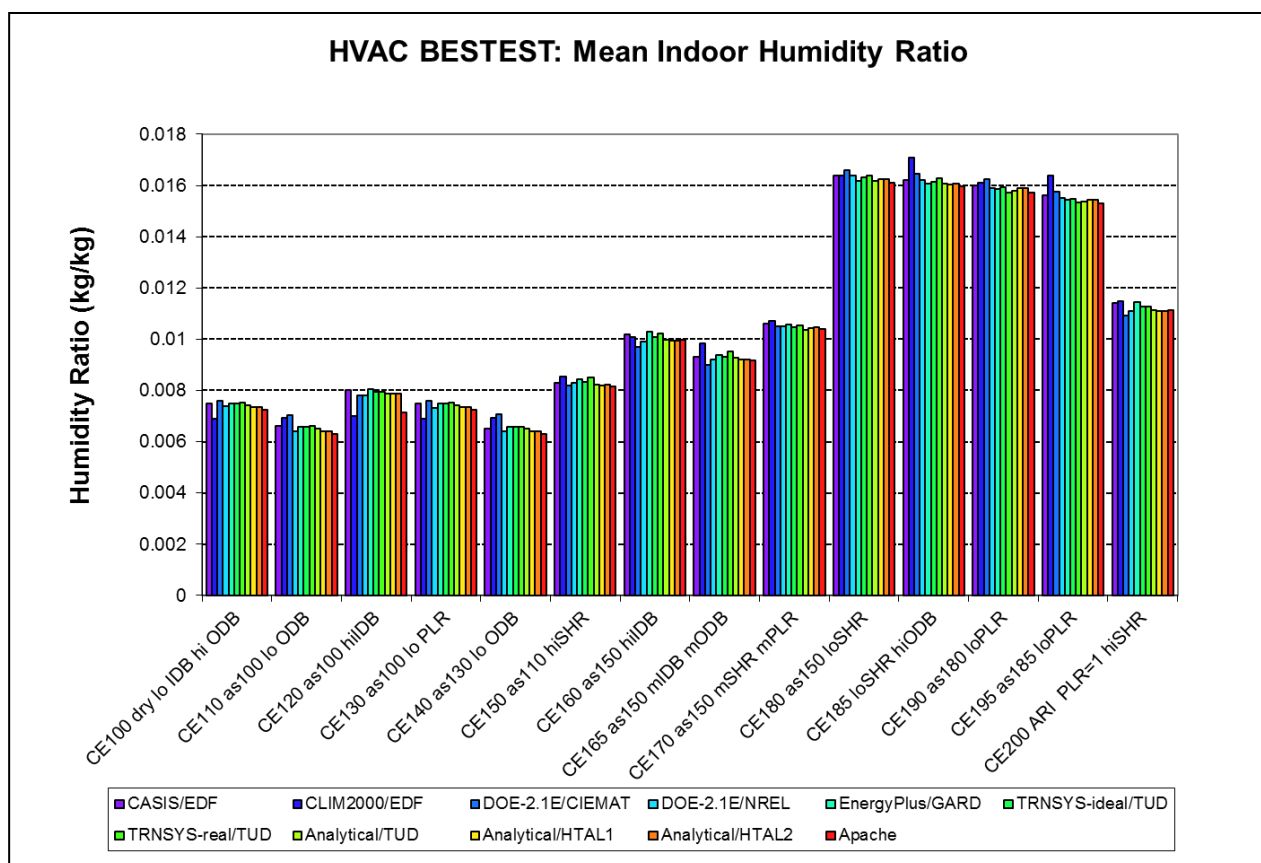


Figure 5.20 – HVAC BESTEST: Mean Indoor Humidity Ratio.

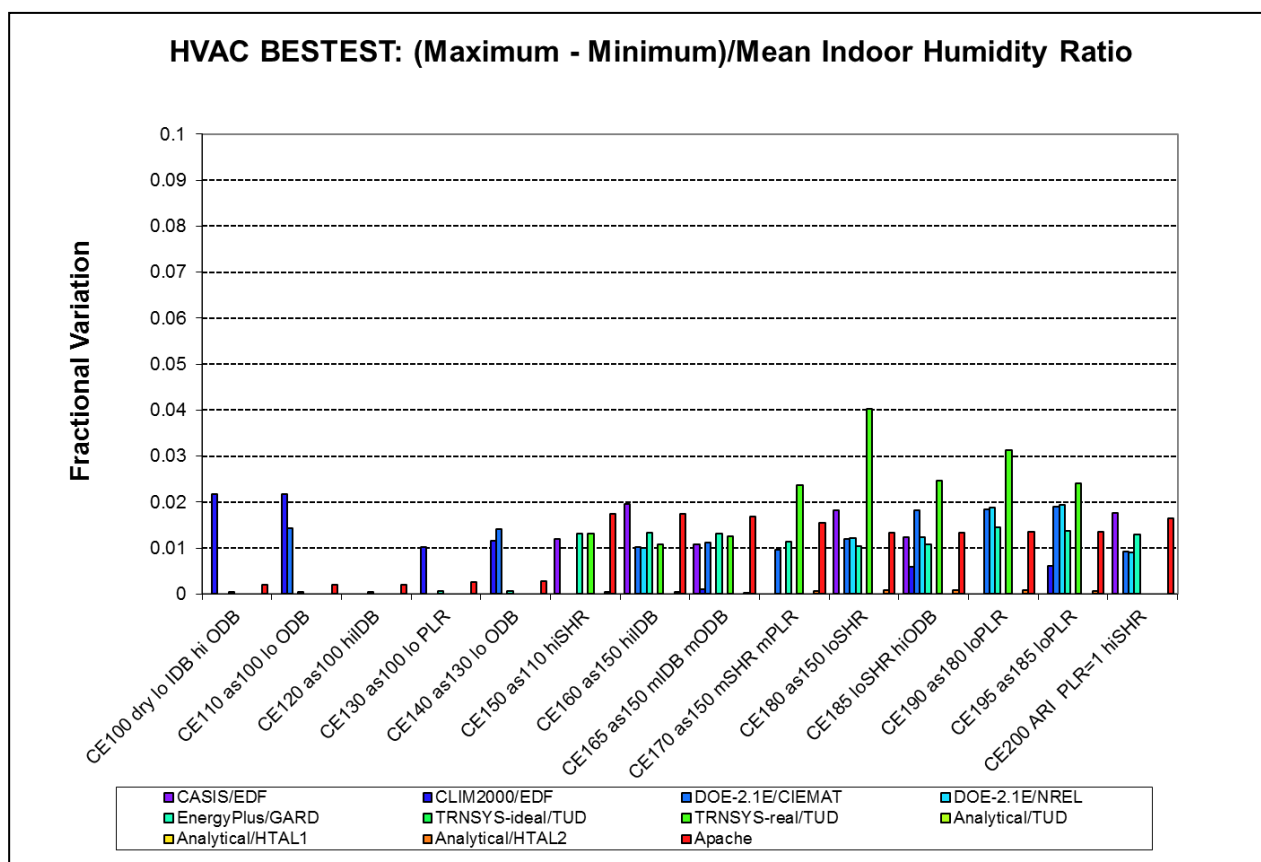


Figure 5.21 – HVAC BESTEST: (Maximum – Minimum)/Mean Indoor Humidity Ratio.

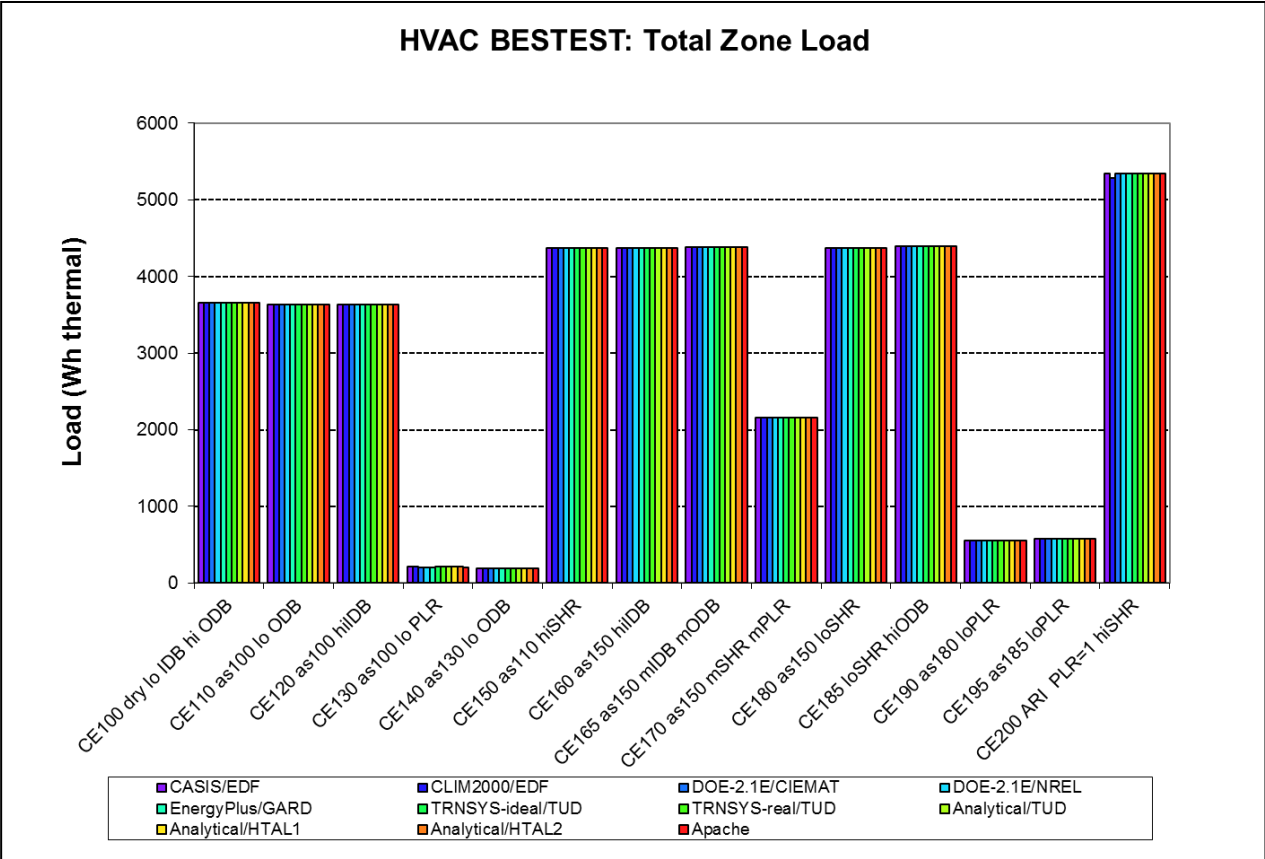


Figure 5.22 – HVAC BESTEST: Total Zone Load.

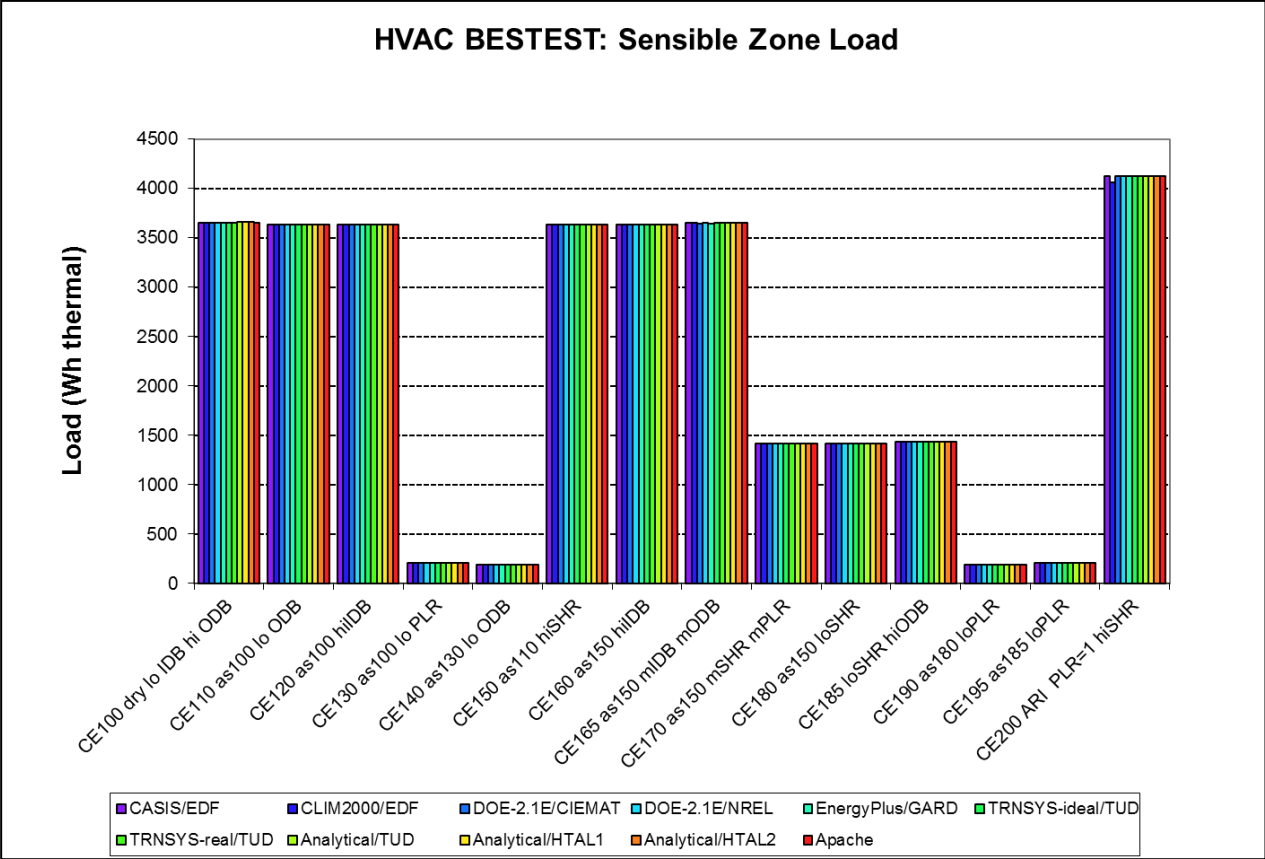


Figure 5.23 – HVAC BESTEST: Sensible Zone Load.

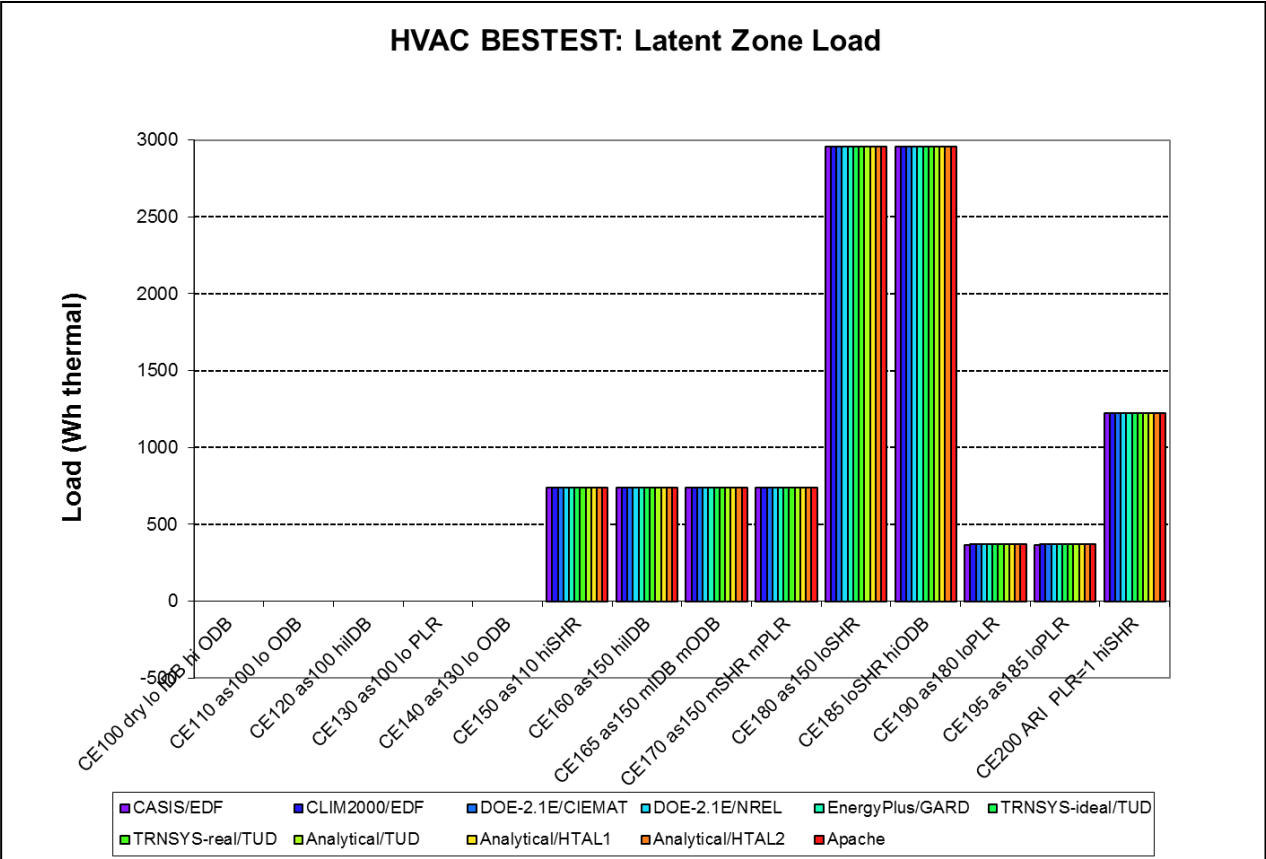


Figure 5.24 – HVAC BESTEST: Latent Zone Load.

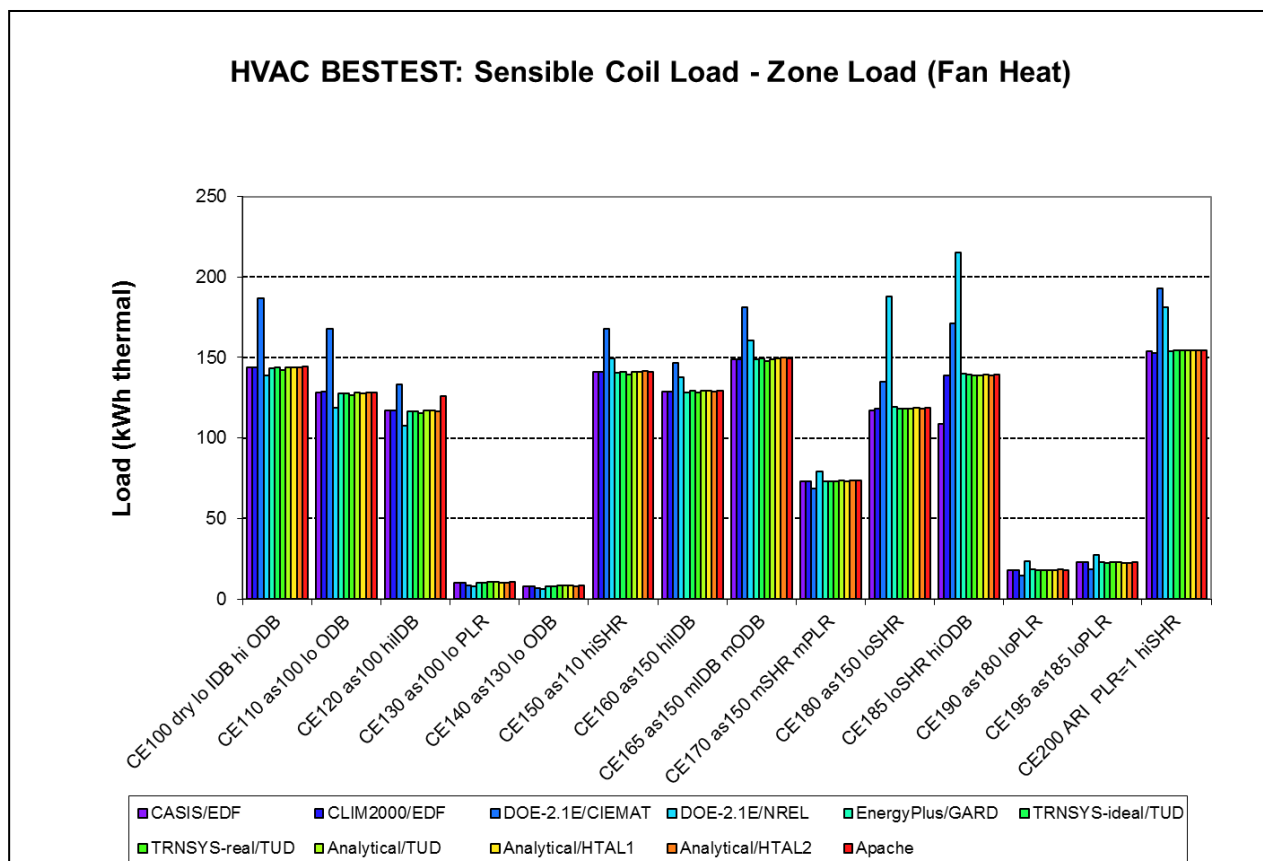


Figure 5.25 – HVAC BESTEST: Sensible Coil Load – Zone Load (Fan Heat).

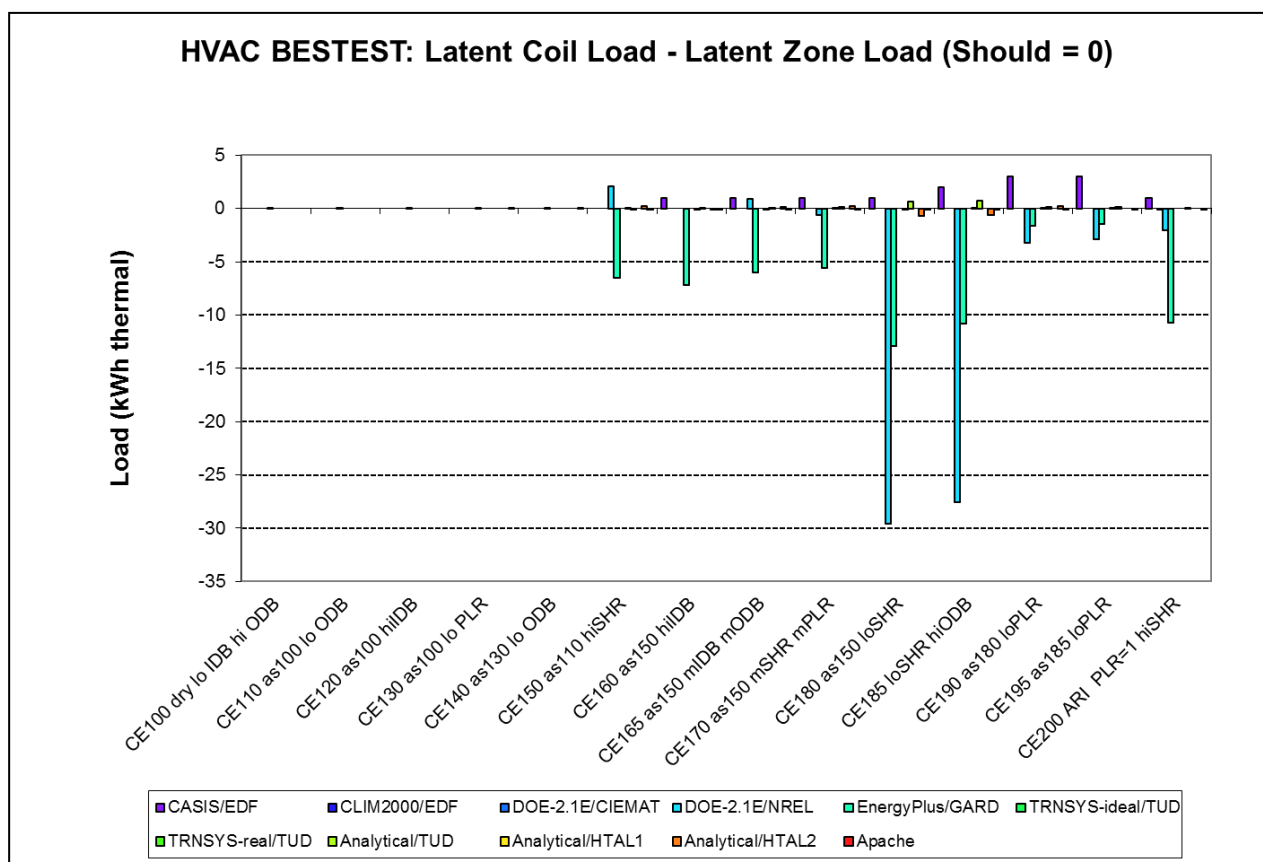


Figure 5.26 – HVAC BESTEST: Latent Coil Load – Latent Zone Load.

5.2 Comparative Test Results - CE300 to CE545

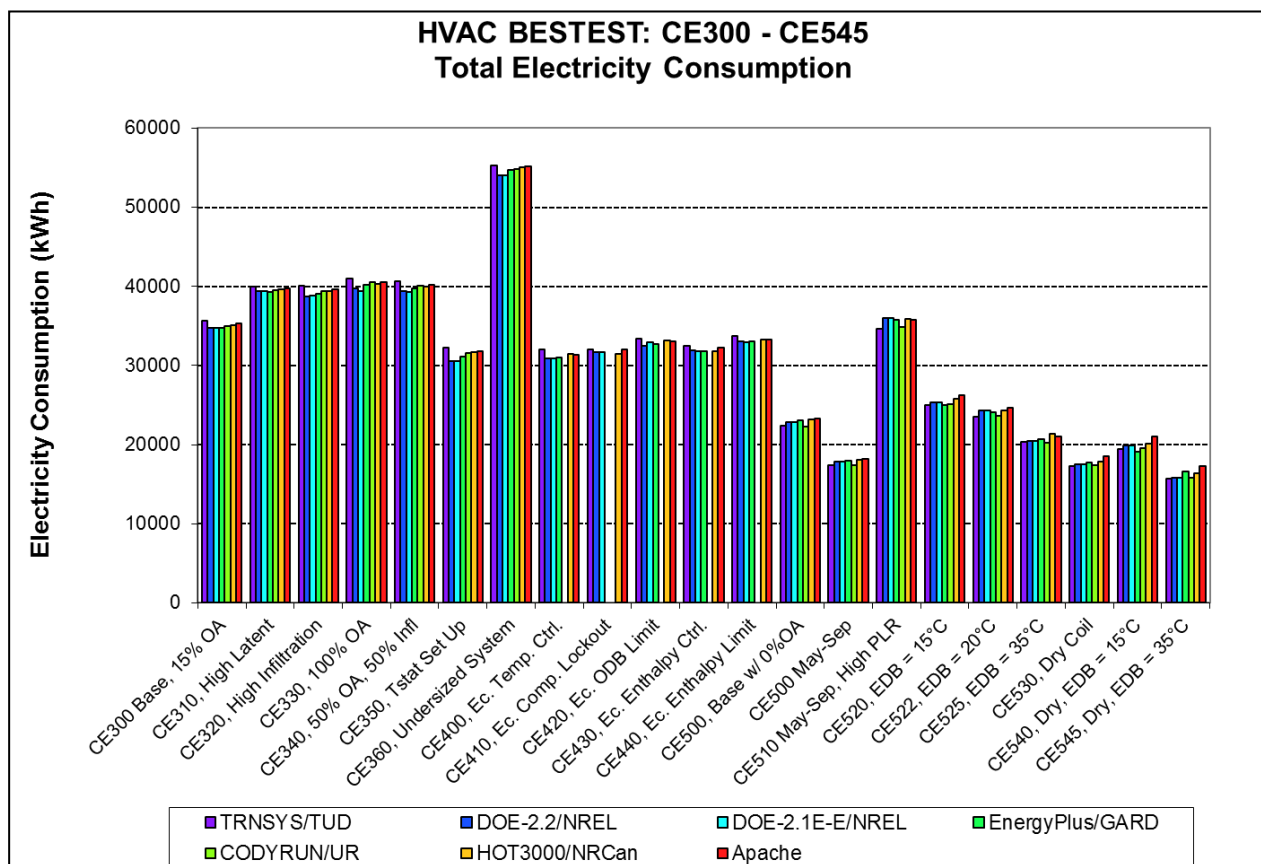


Figure 5.27 – HVAC BESTEST: CE300 – CE545 Total Electricity Consumption.

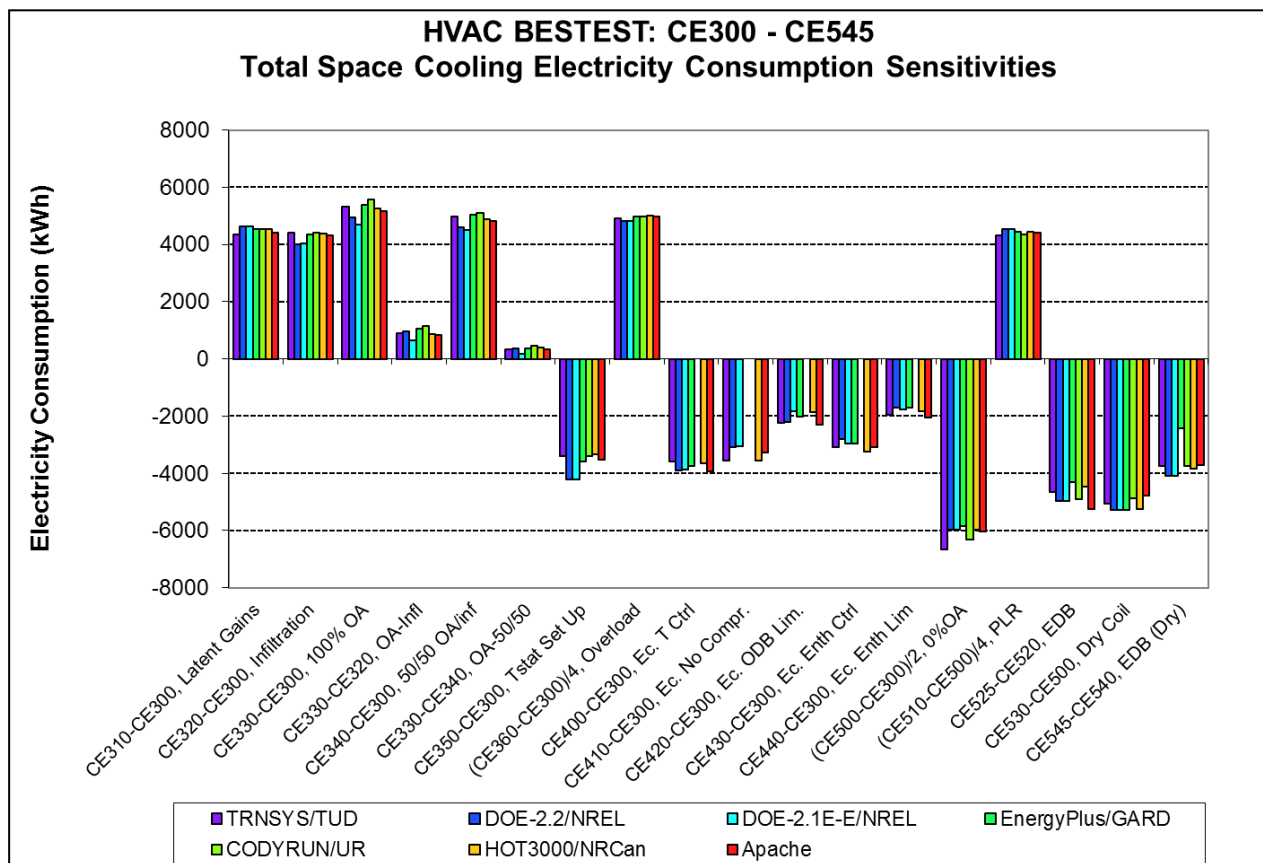


Figure 5.28 – HVAC BESTEST: CE300 – CE545 Total Space Cooling Electricity Consumption Sensitivities.

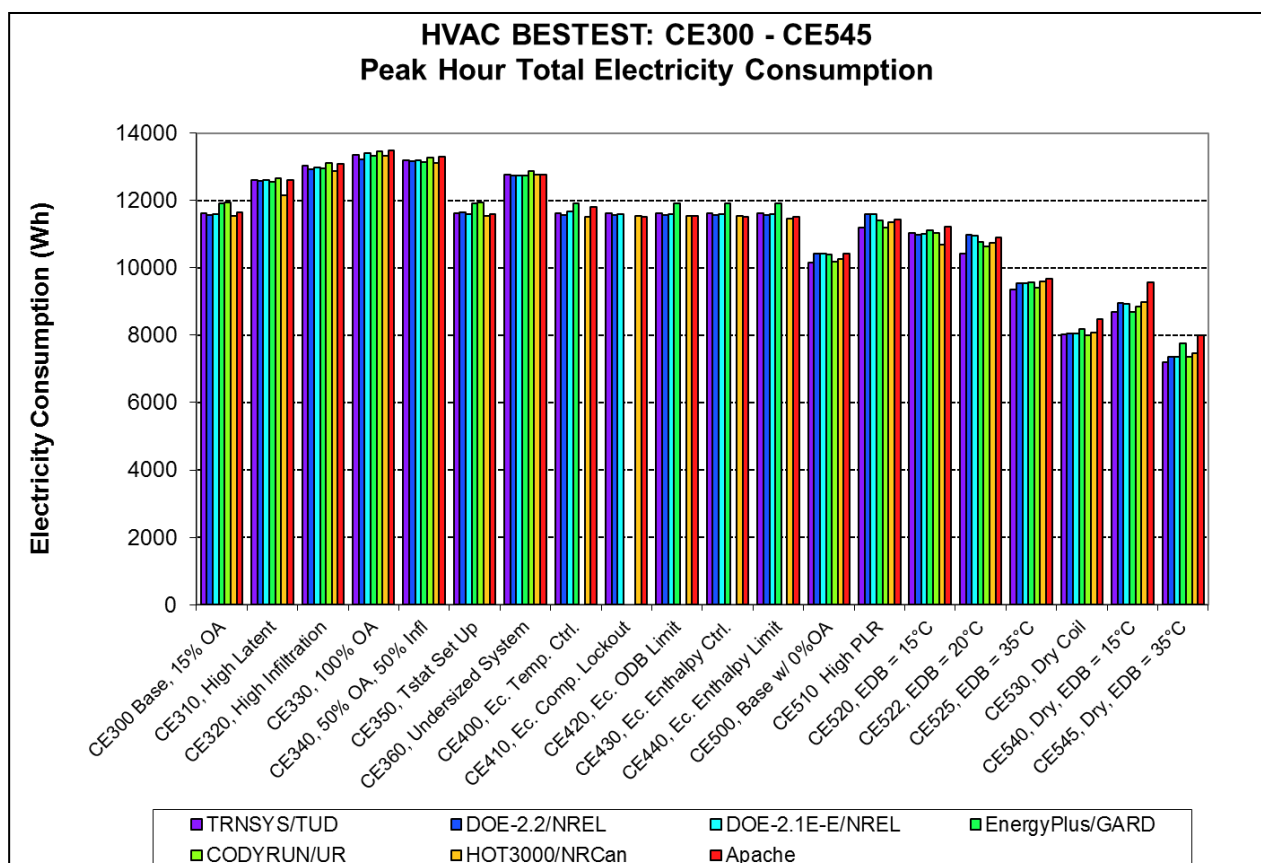


Figure 5.29 – HVAC BESTEST: CE300 – CE545 Peak Hour Total Electricity Consumption.

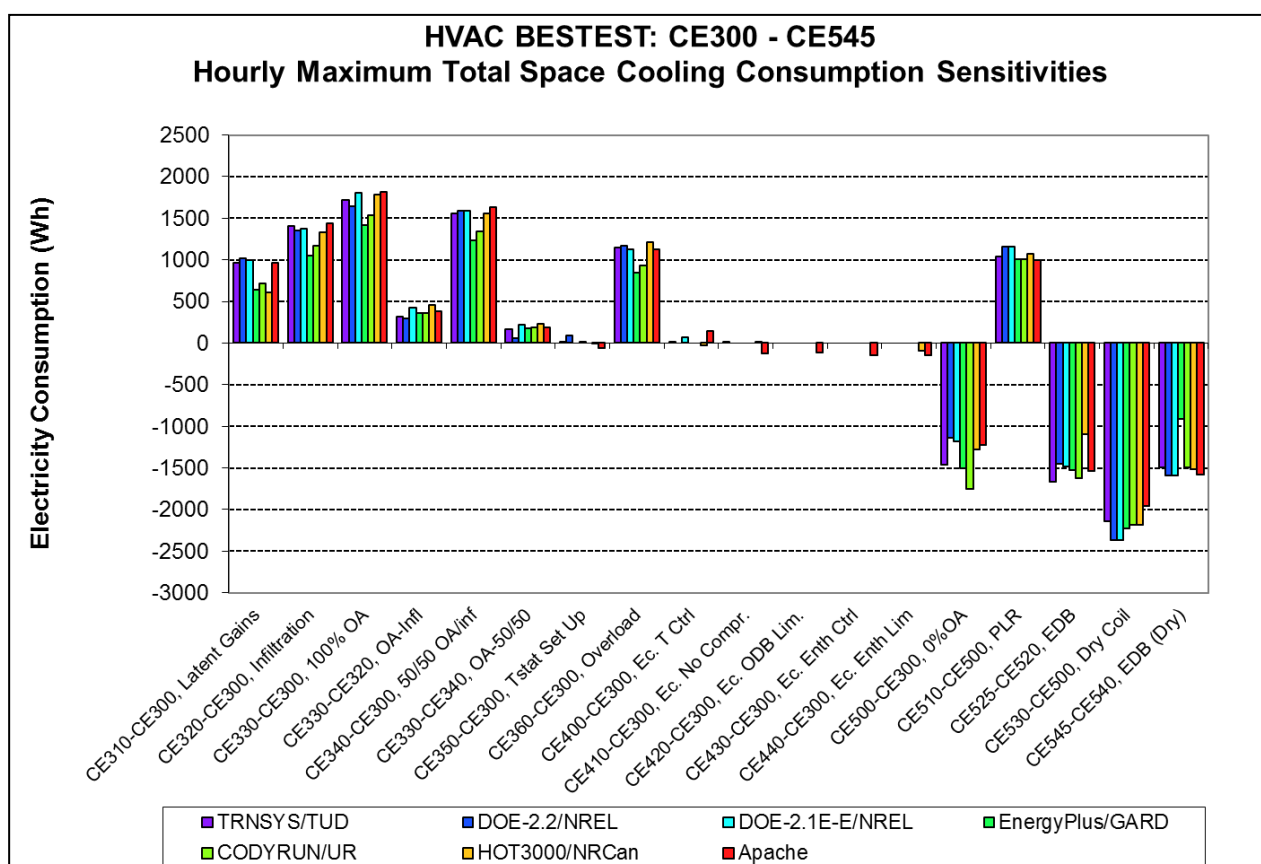


Figure 5.30 – HVAC BESTEST: CE300 – CE545 Hourly Maximum Total Space Cooling Consumption Sensitivities.

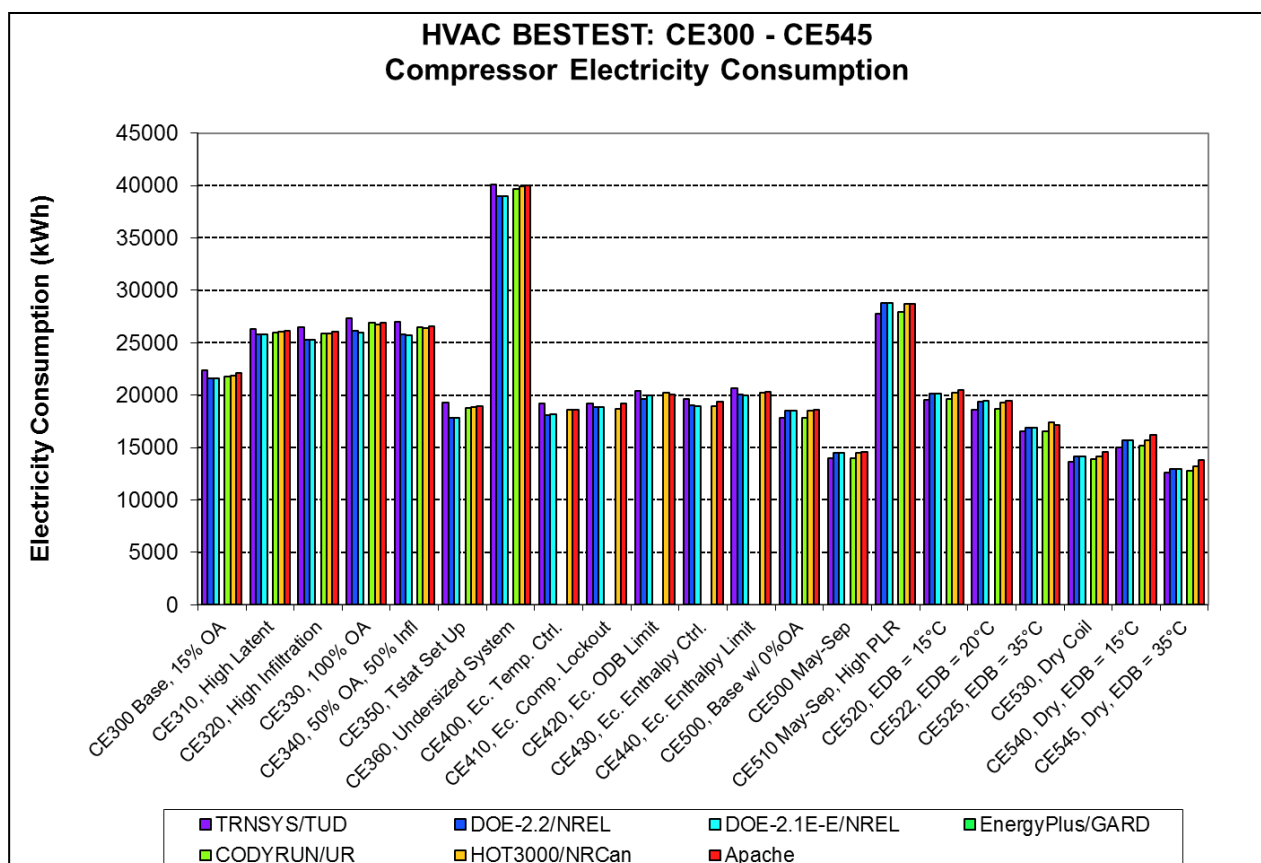


Figure 5.31 – HVAC BESTEST: CE300 – CE545 Compressor Electricity Consumption.

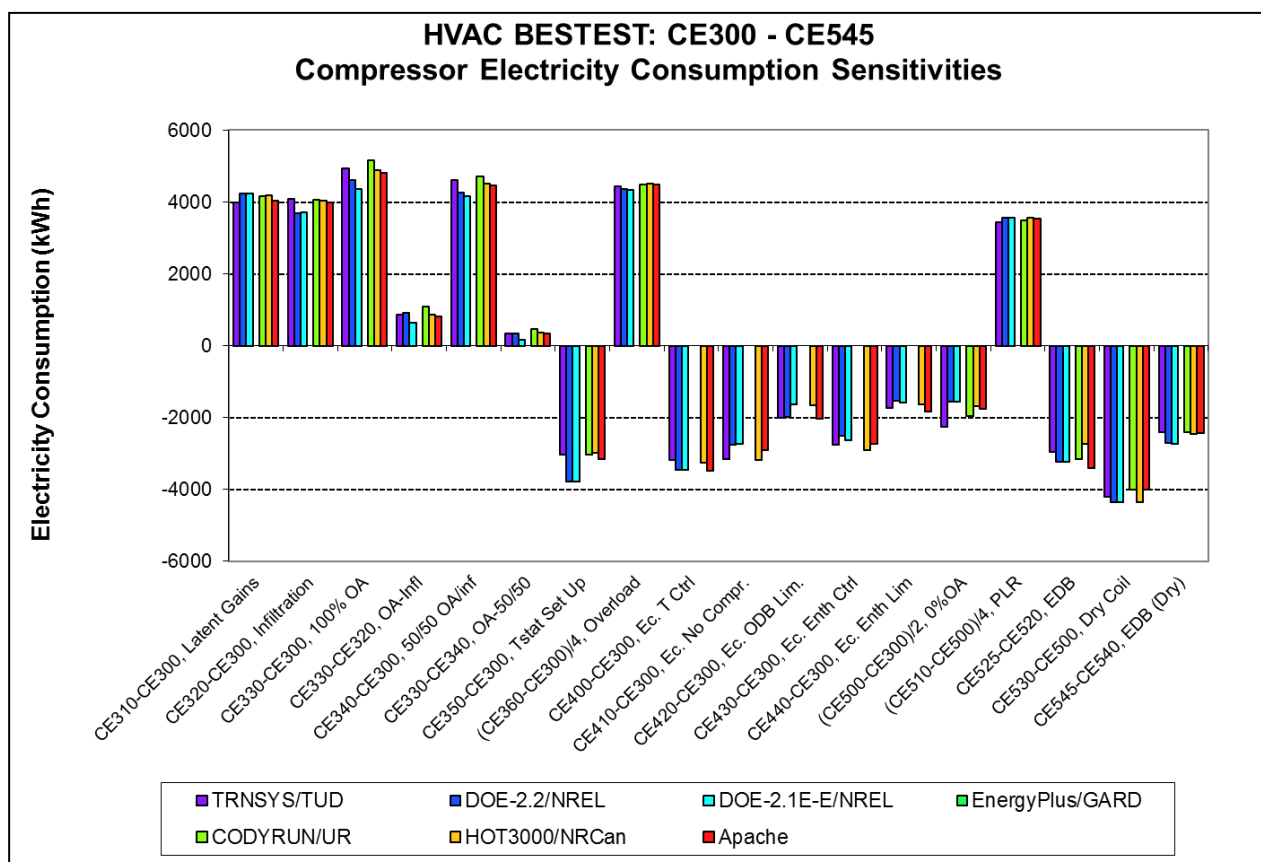


Figure 5.32 – HVAC BESTEST: CE300 – CE545 Compressor Electricity Consumption Sensitivities.

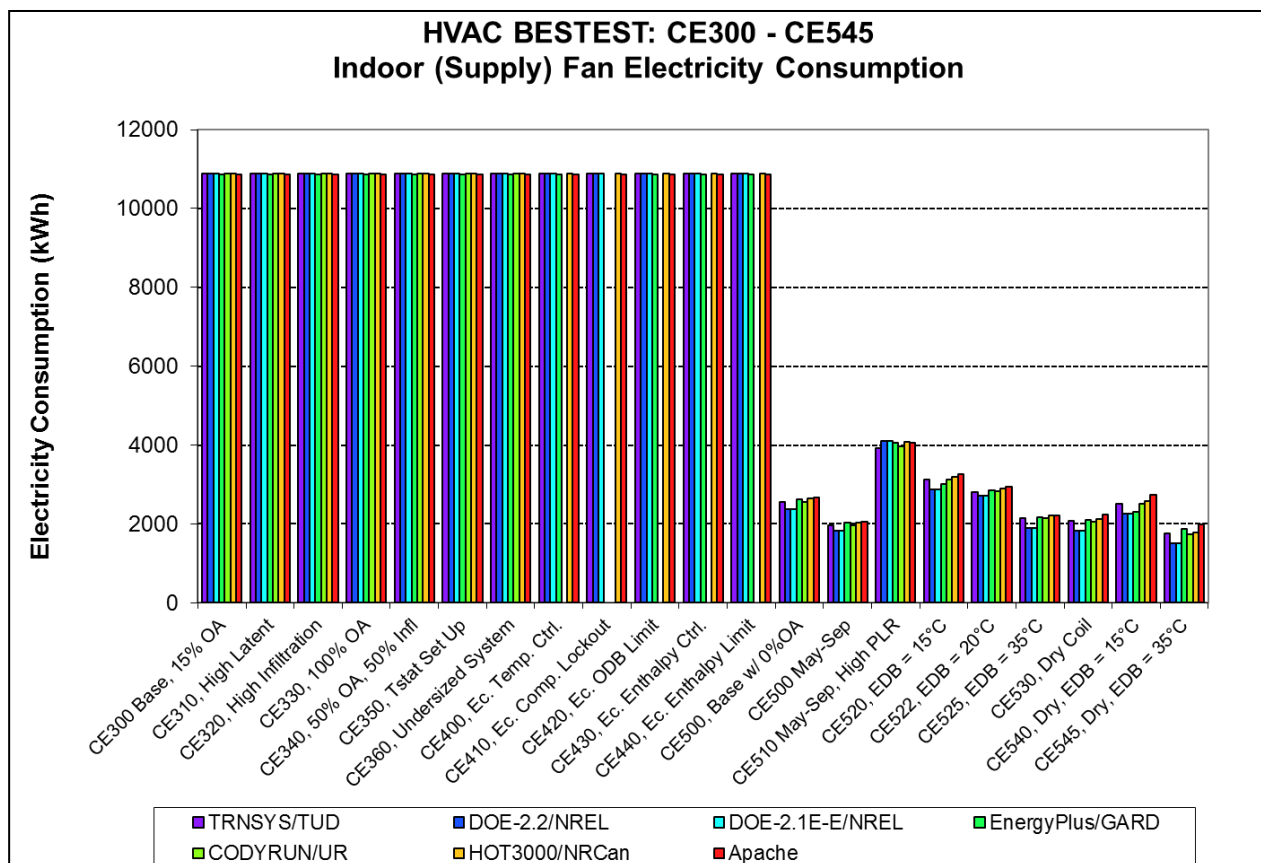


Figure 5.33 – HVAC BESTEST: CE300 – CE545 Indoor (Supply) Fan Electricity Consumption.

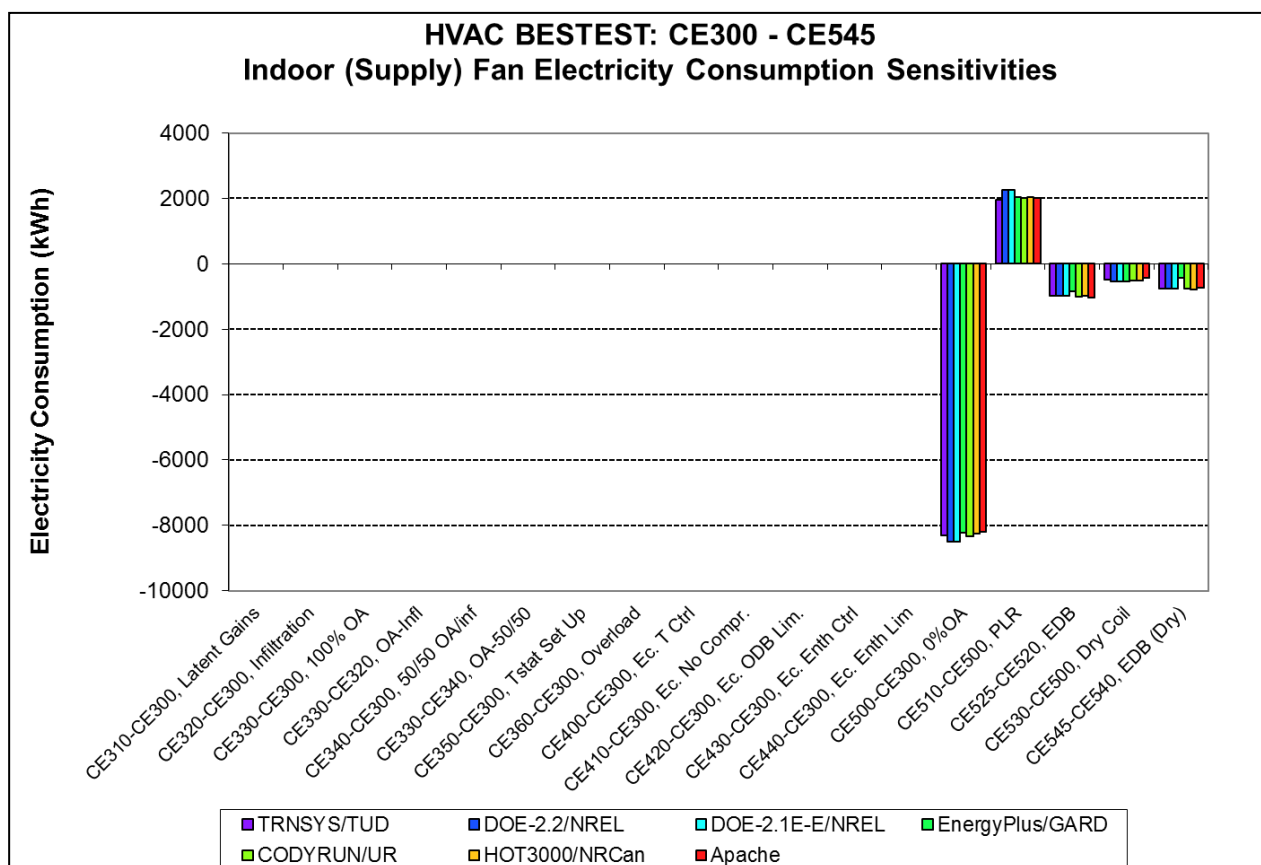


Figure 5.34 – HVAC BESTEST: CE300 – CE545 Indoor (Supply) Fan Electricity Consumption Sensitivities.

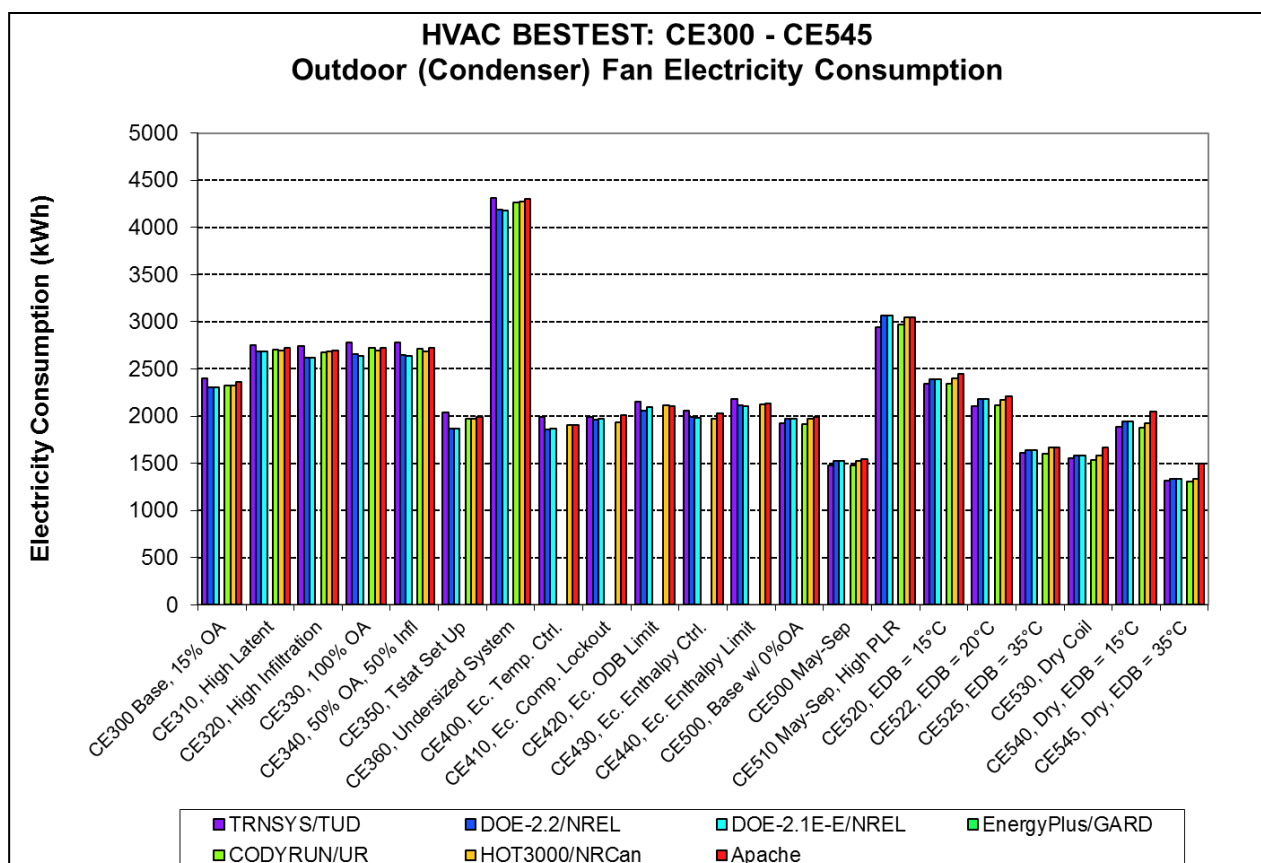


Figure 5.35 – HVAC BESTEST: CE300 – CE545 Outdoor (Condenser) Fan Electricity Consumption.

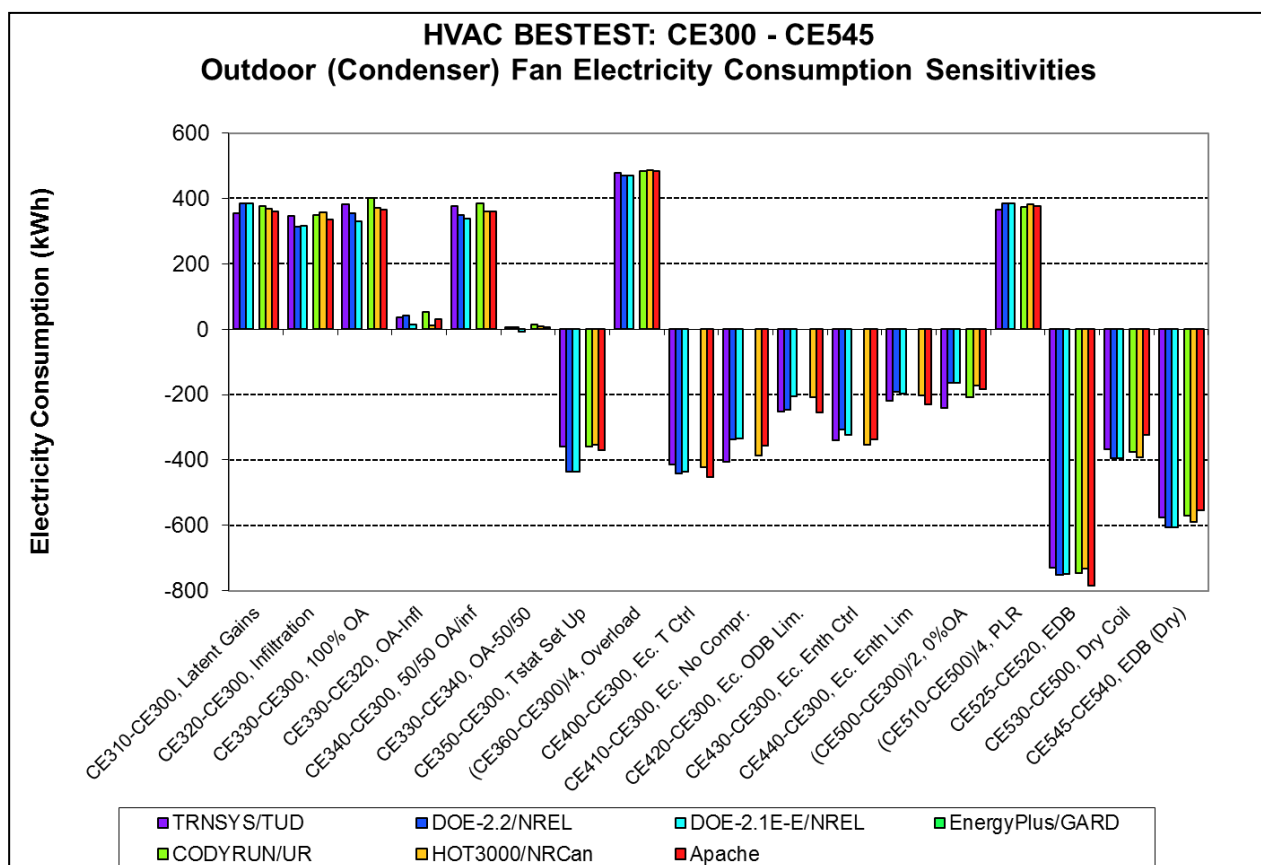


Figure 5.36 – HVAC BESTEST: CE300 – CE545 Outdoor (Condenser) Fan Electricity Consumption Sensitivities.

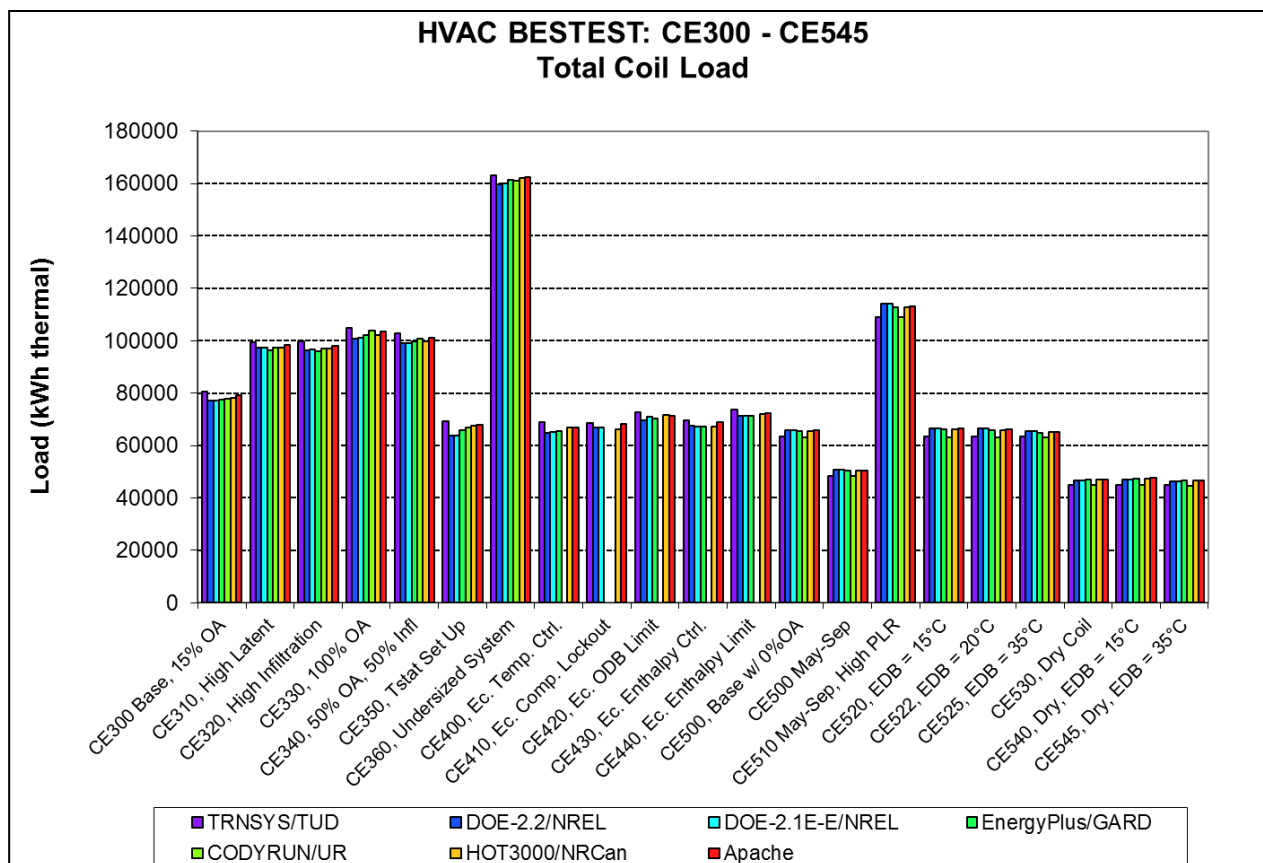


Figure 5.37 – HVAC BESTEST: CE300 – CE545 Total Coil Load.

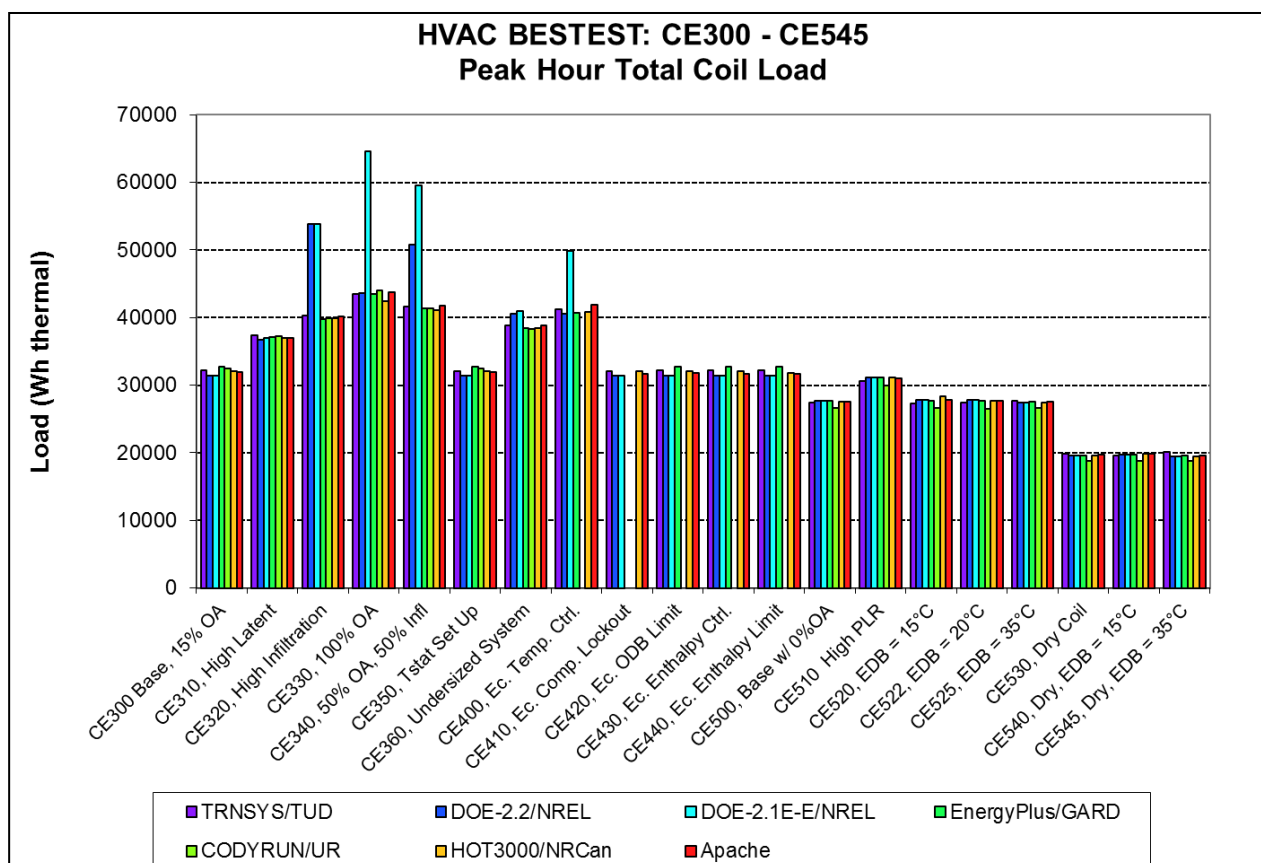


Figure 5.38 – HVAC BESTEST: CE300 – CE545 Peak Hour Total Coil Load.

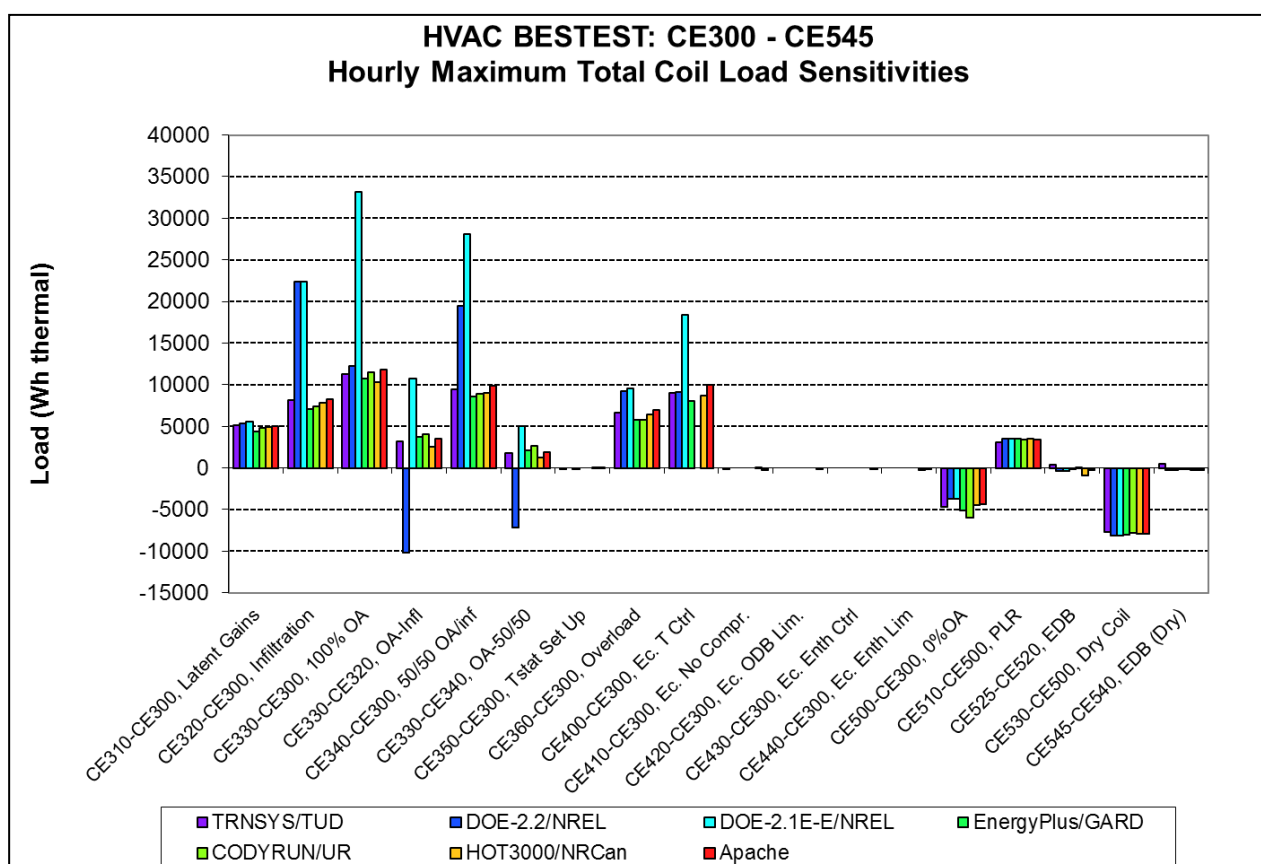


Figure 5.39 – HVAC BESTEST: CE300 – CE545 Hourly Maximum Coil Load Sensitivities.

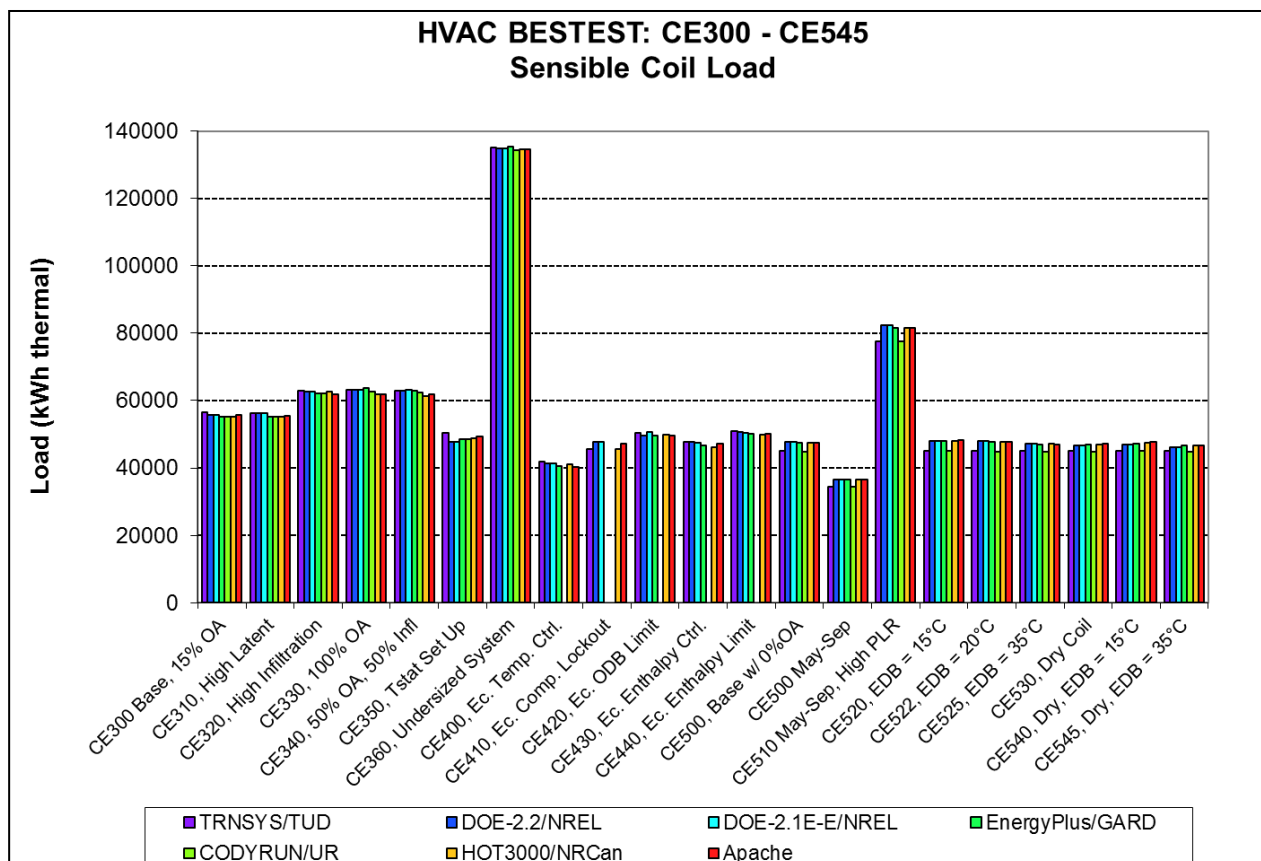


Figure 5.40 – HVAC BESTEST: CE300 – CE545 Sensible Coil Load.

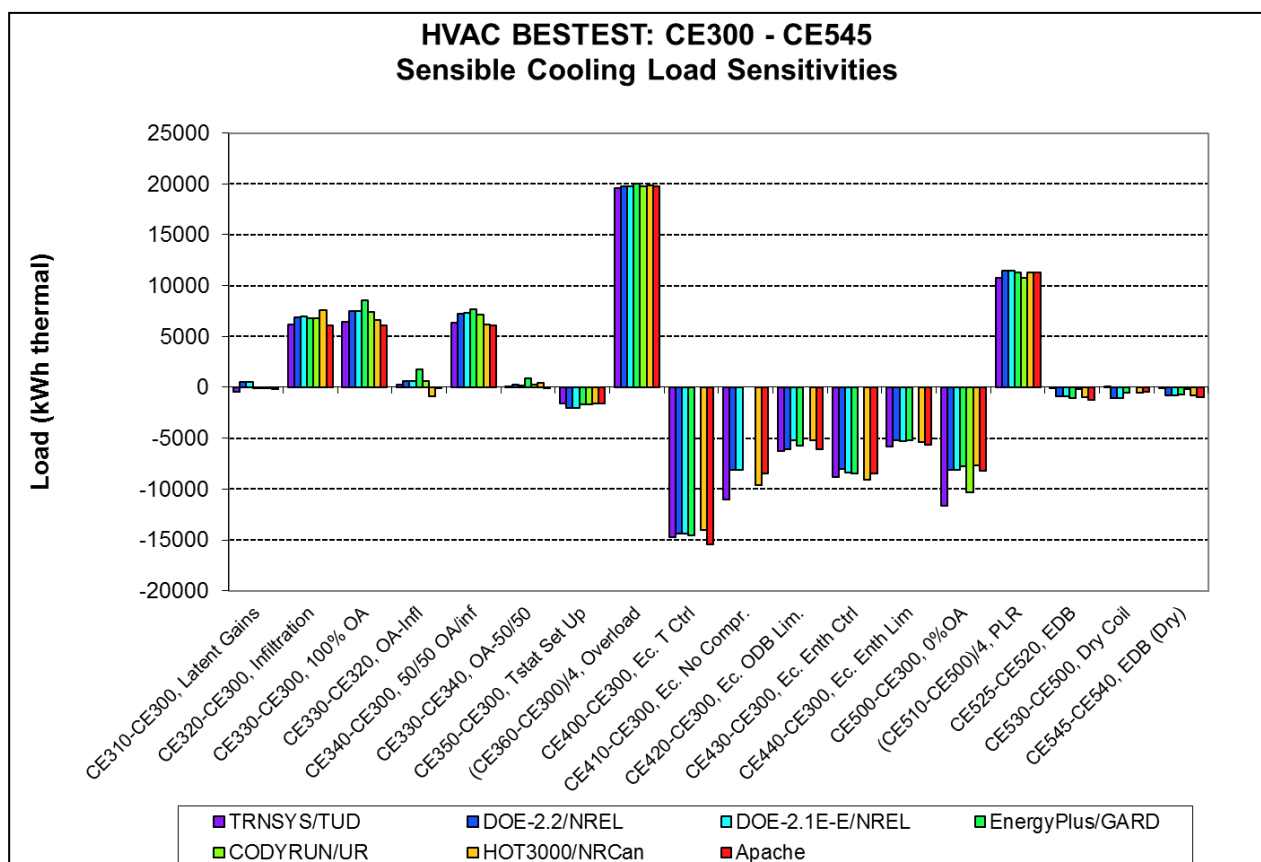


Figure 5.41 – HVAC BESTEST: CE300 – CE545 Sensible Cooling Load Sensitivities.

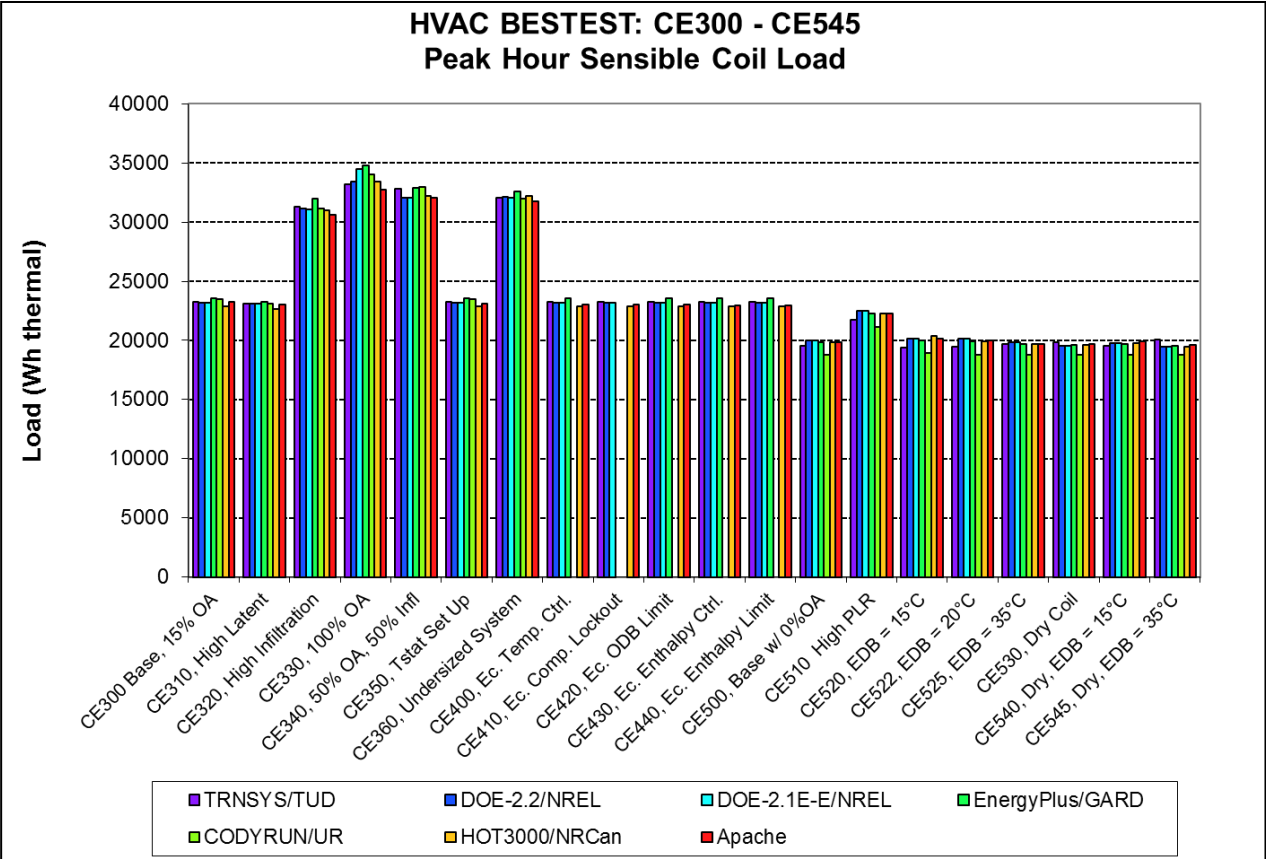


Figure 5.42 – HVAC BESTEST: CE300 – CE545 Peak Hour Sensible Coil Load.

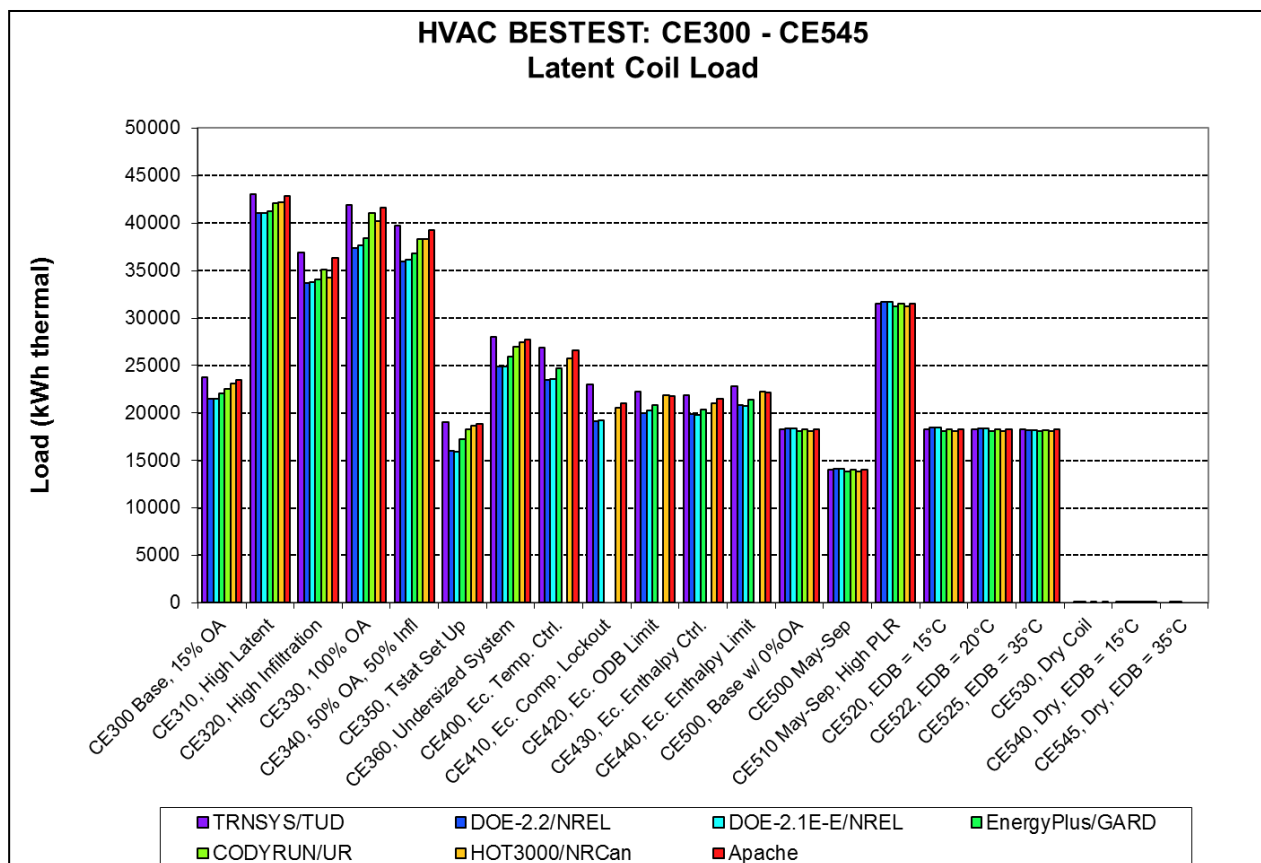


Figure 5.43 – HVAC BESTEST: CE300 – CE545 Latent Coil Load.

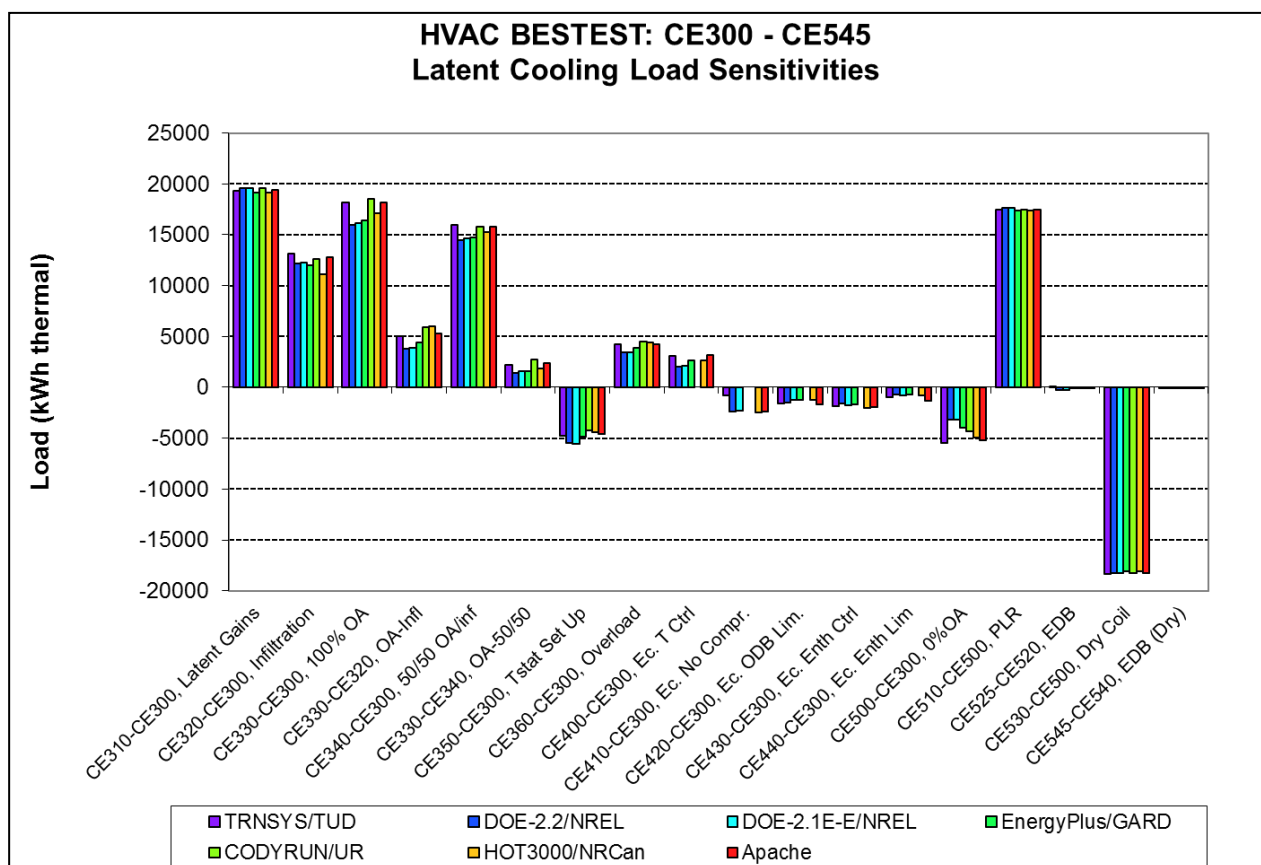


Figure 5.44 – HVAC BESTEST: Latent Cooling Load Sensitivities.

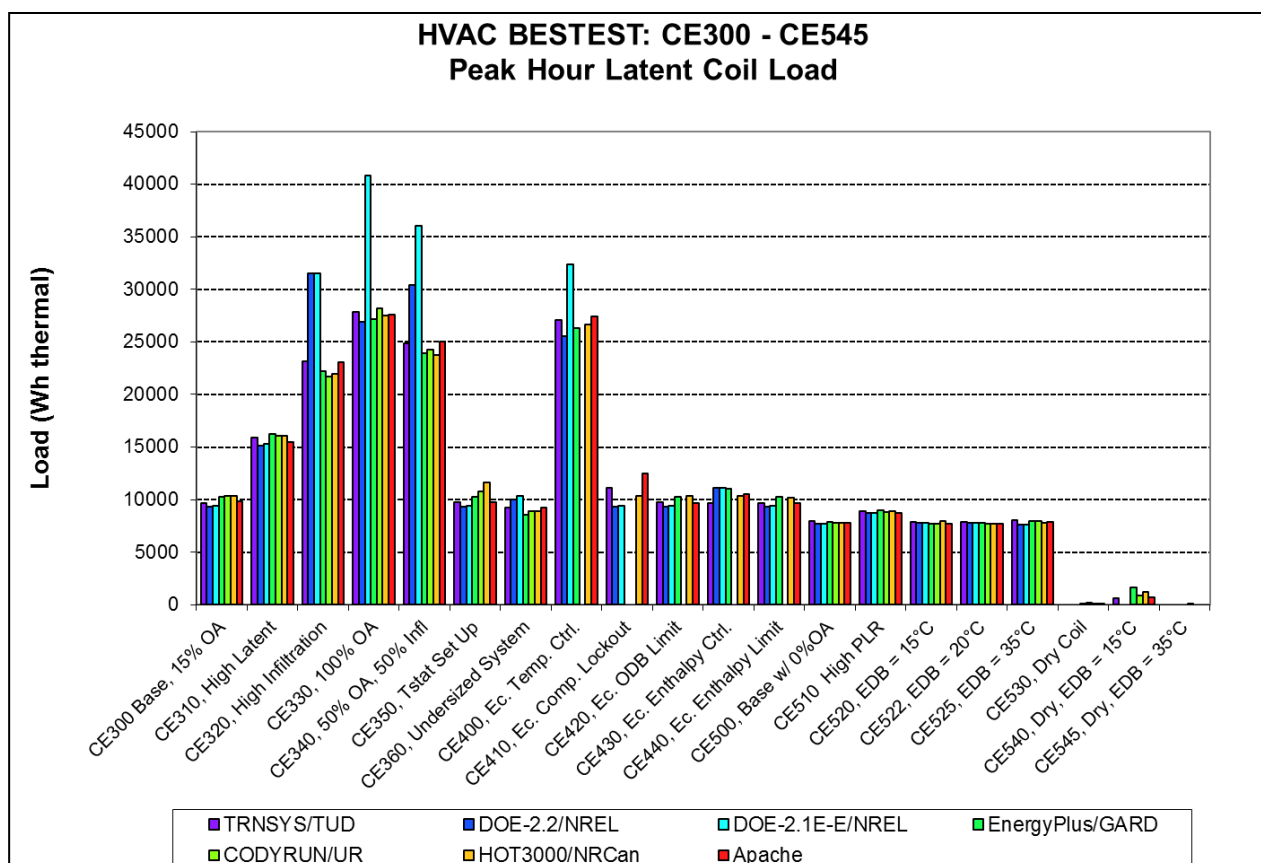


Figure 5.45 – HVAC BESTEST: Peak Hour Latent Coil Load.

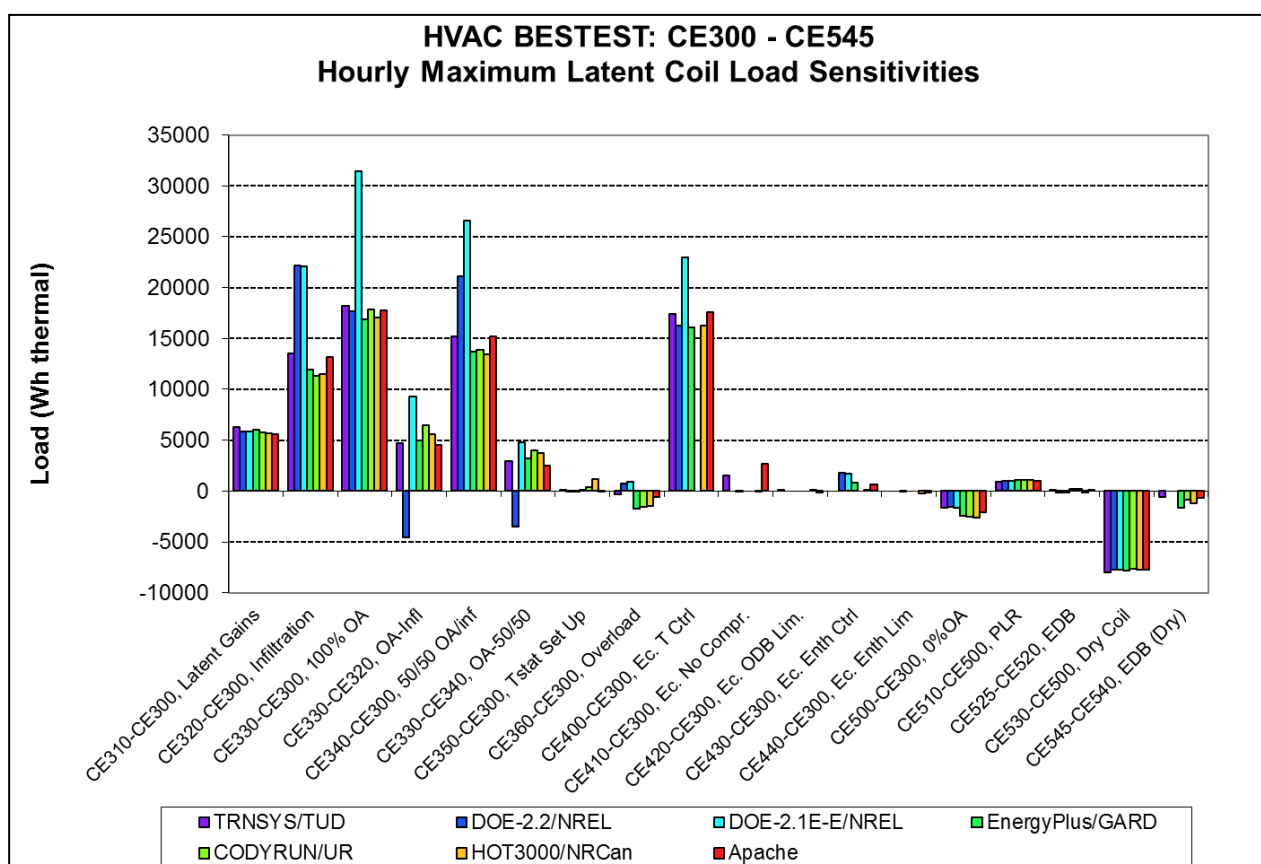


Figure 5.46 – HVAC BESTEST: CE300 – CE545 Hourly Maximum Latent Coil Load Sensitivities.

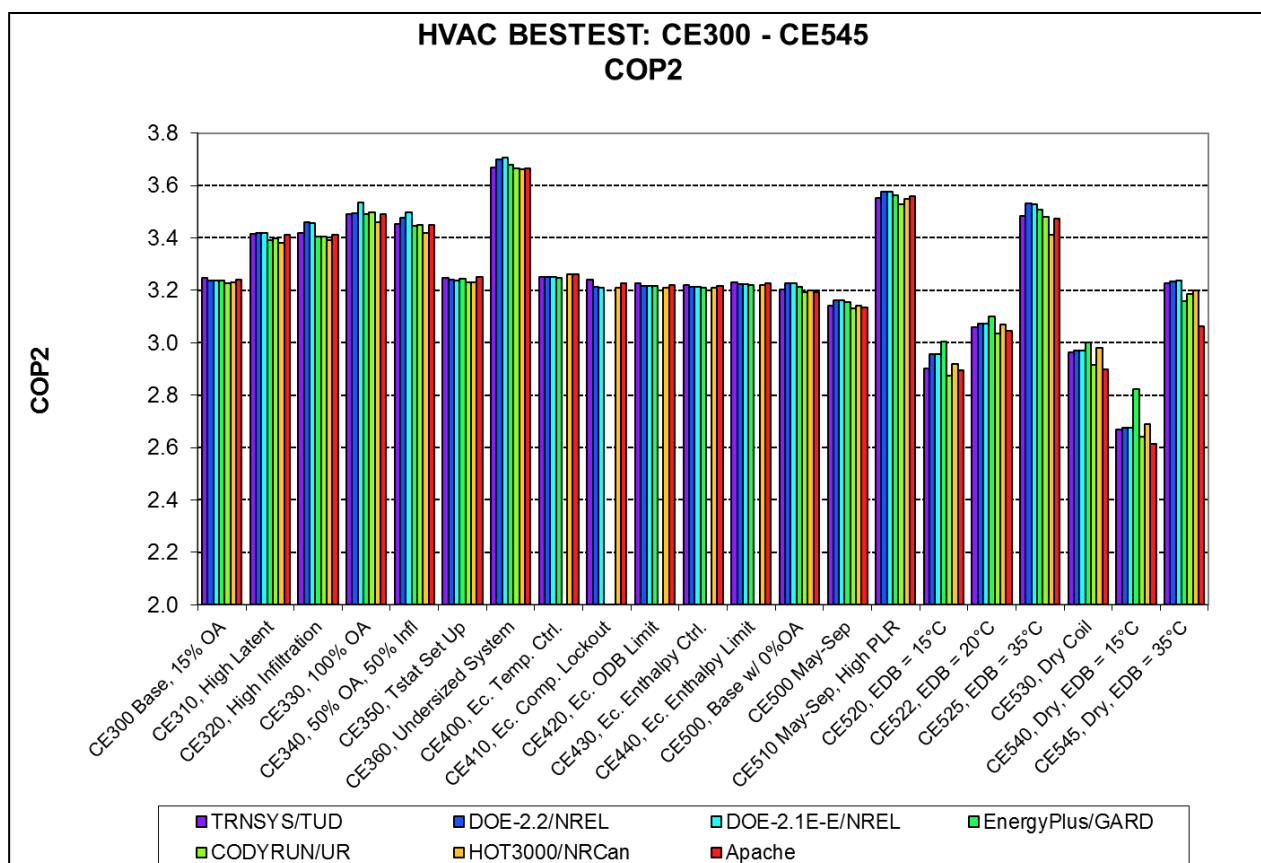


Figure 5.47 – HVAC BESTEST: CE300 – CE545 COP2.

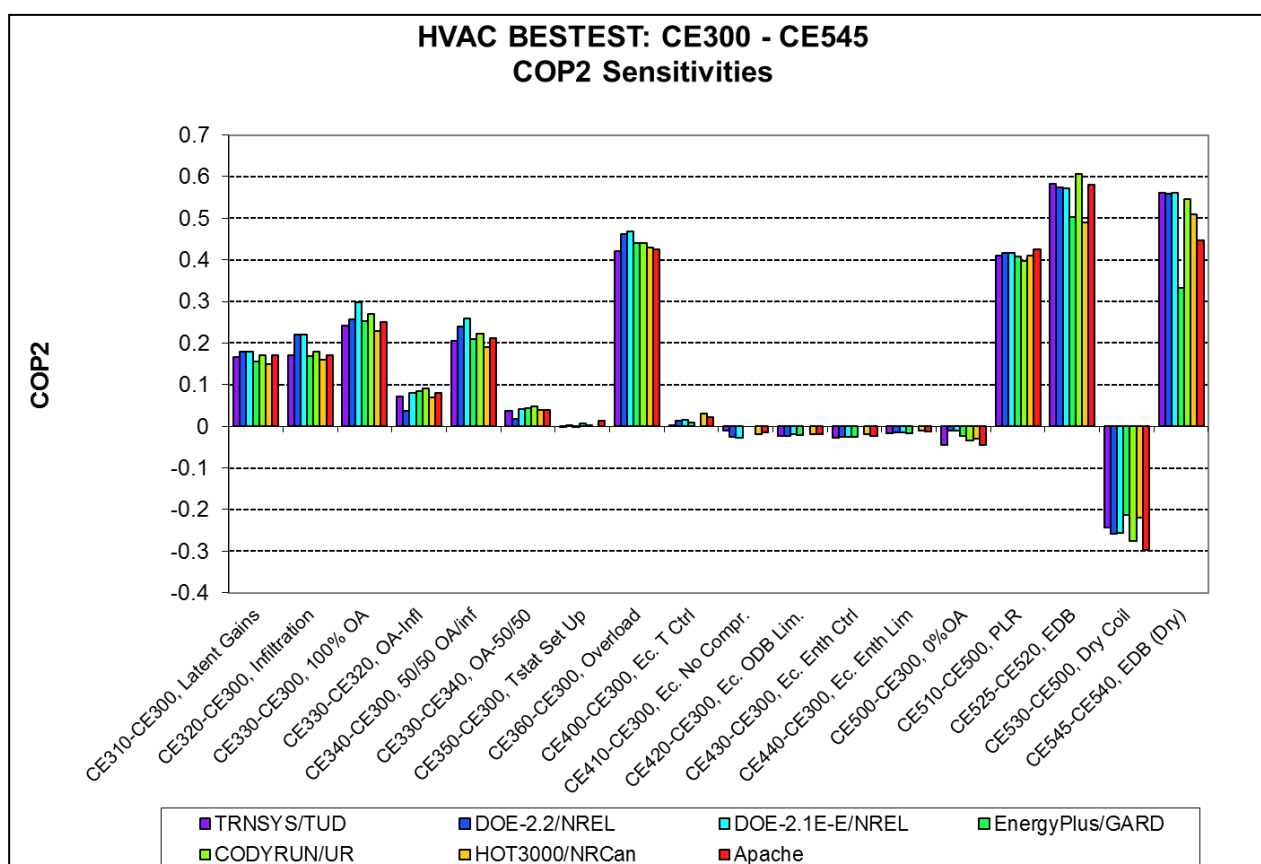


Figure 5.48 – HVAC BESTEST: CE300 – CE545 COP2 Sensitivities.

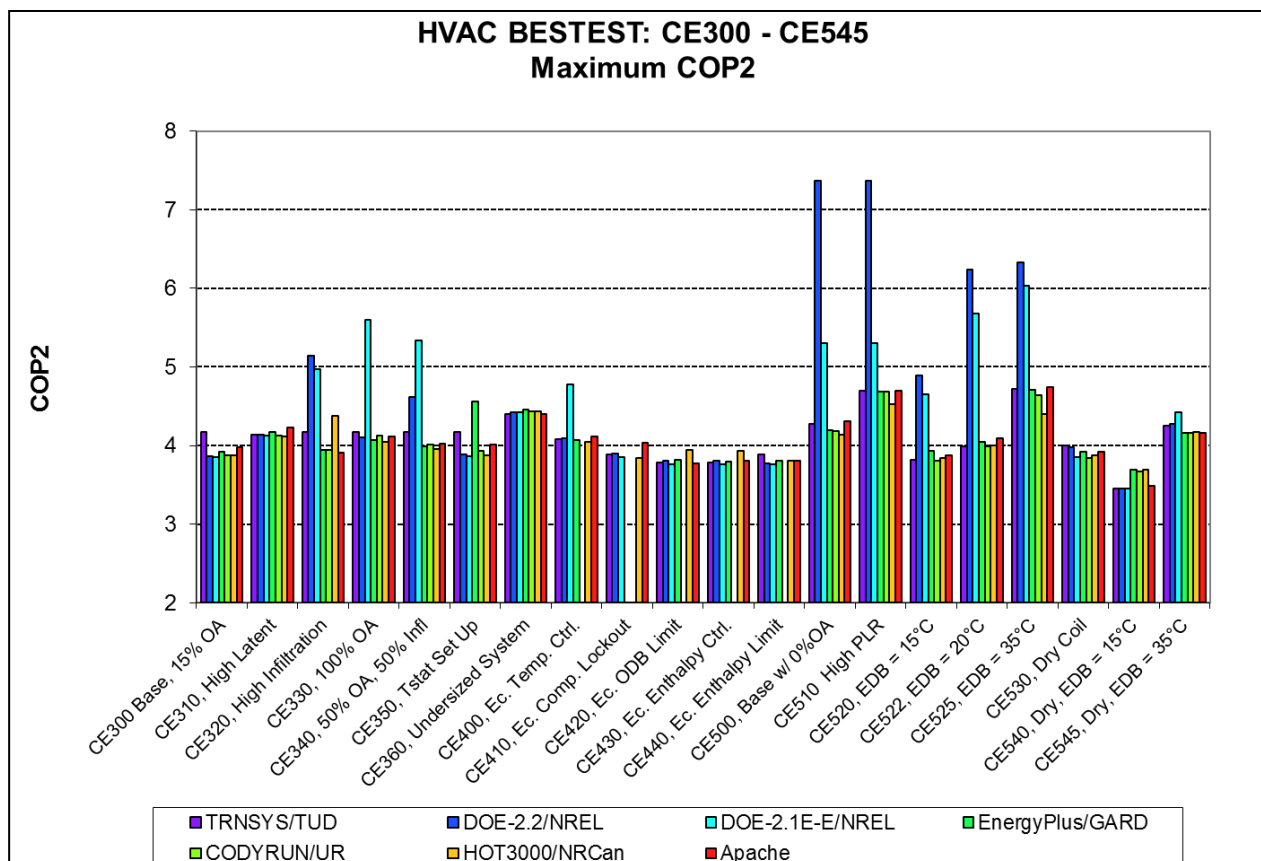


Figure 5.49 – HVAC BESTEST: CE300 – CE545 Maximum COP2.

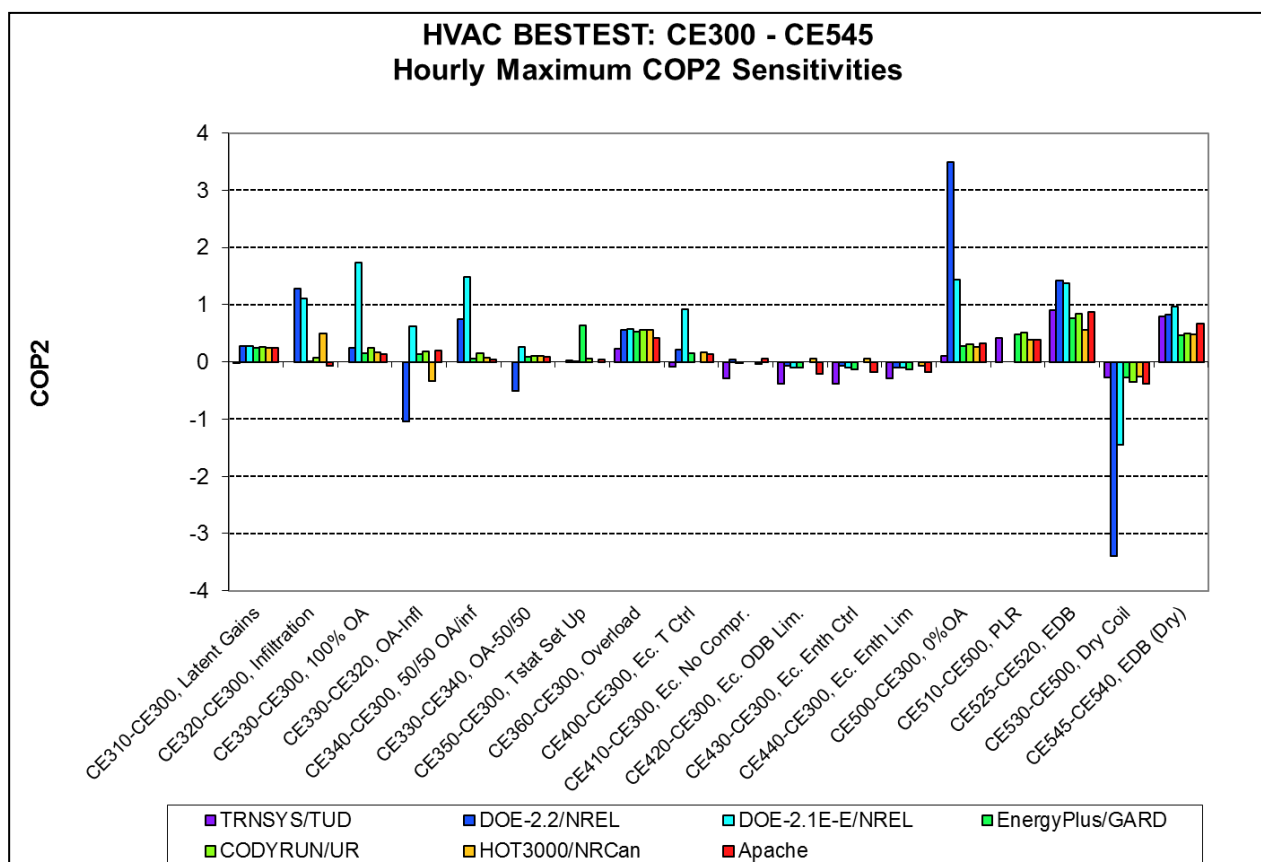


Figure 5.50 – HVAC BESTEST: CE300 – CE545 Hourly Maximum COP2 Sensitivities.

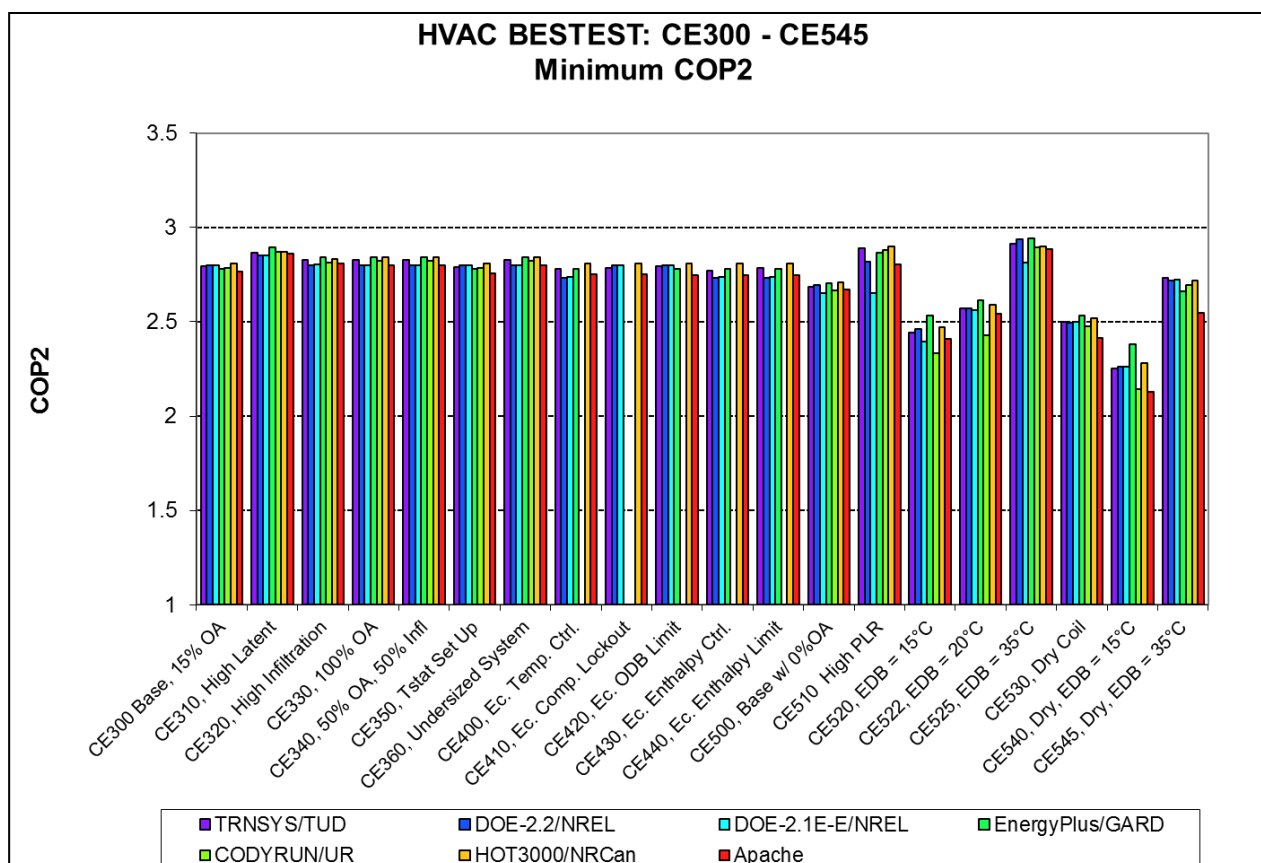


Figure 5.51 – HVAC BESTEST: CE300 – CE545 Minimum COP2.

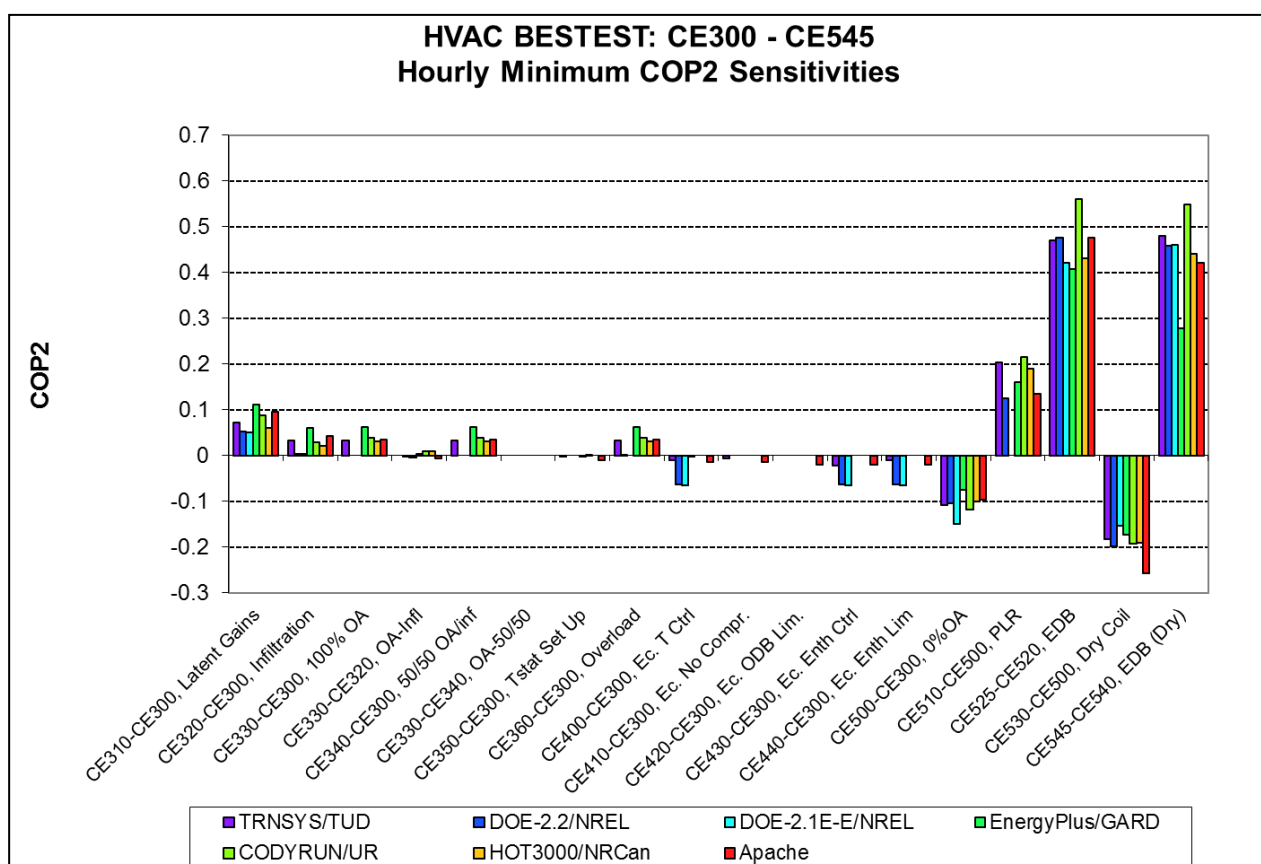


Figure 5.52 – HVAC BESTEST: CE300 – CE545 Hourly Minimum COP2 Sensitivities.

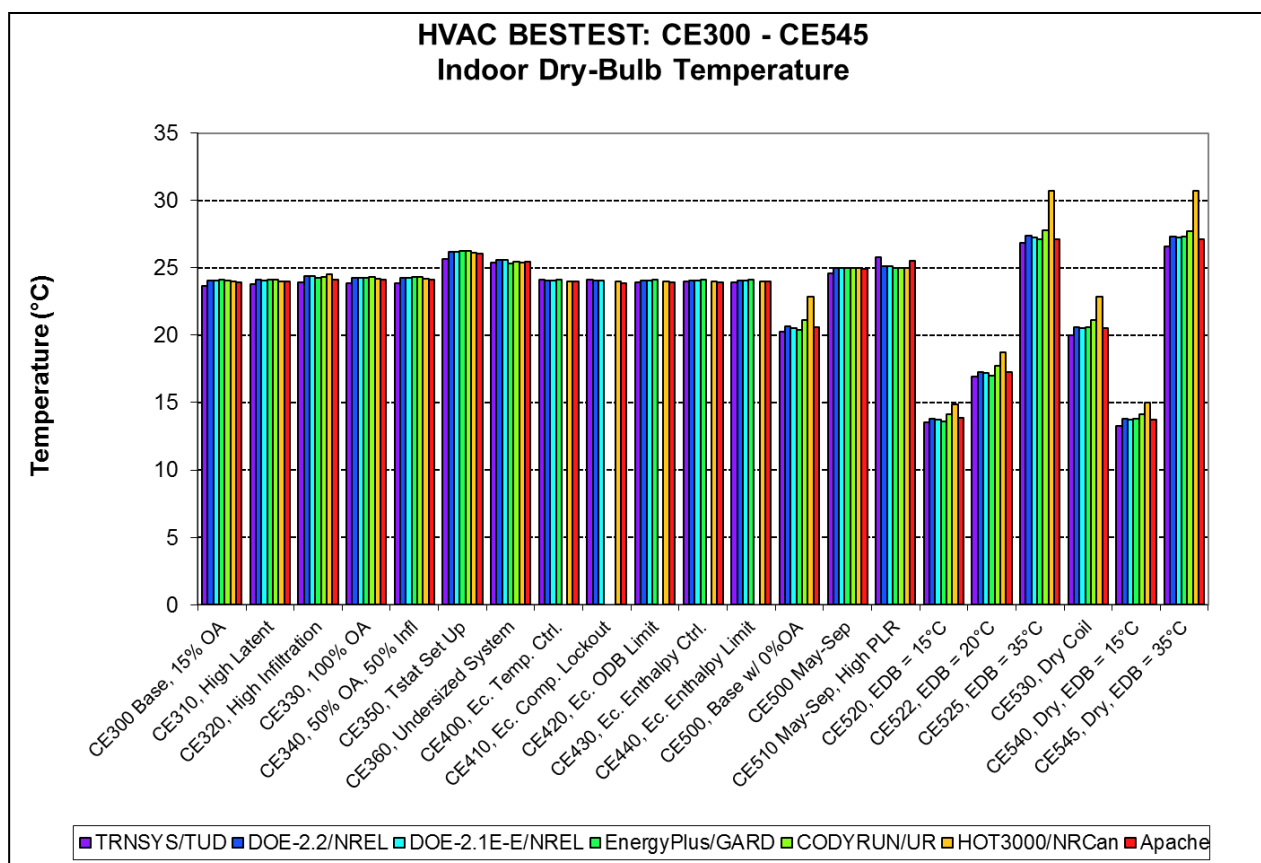


Figure 5.53 – HVAC BESTEST: CE300 – CE545 Indoor Dry-Bulb Temperature.

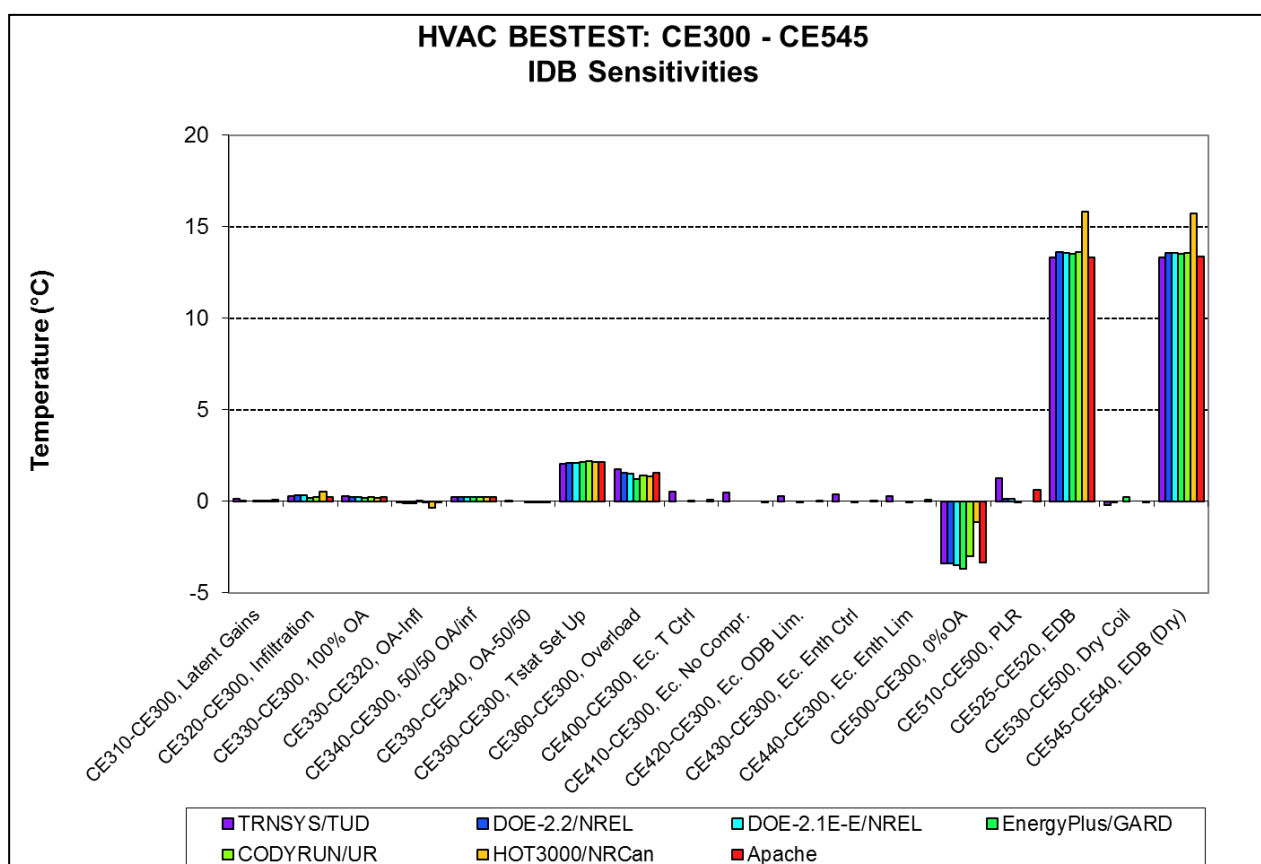


Figure 5.54 – HVAC BESTEST: CE300 – CE545 IDB Sensitivities.

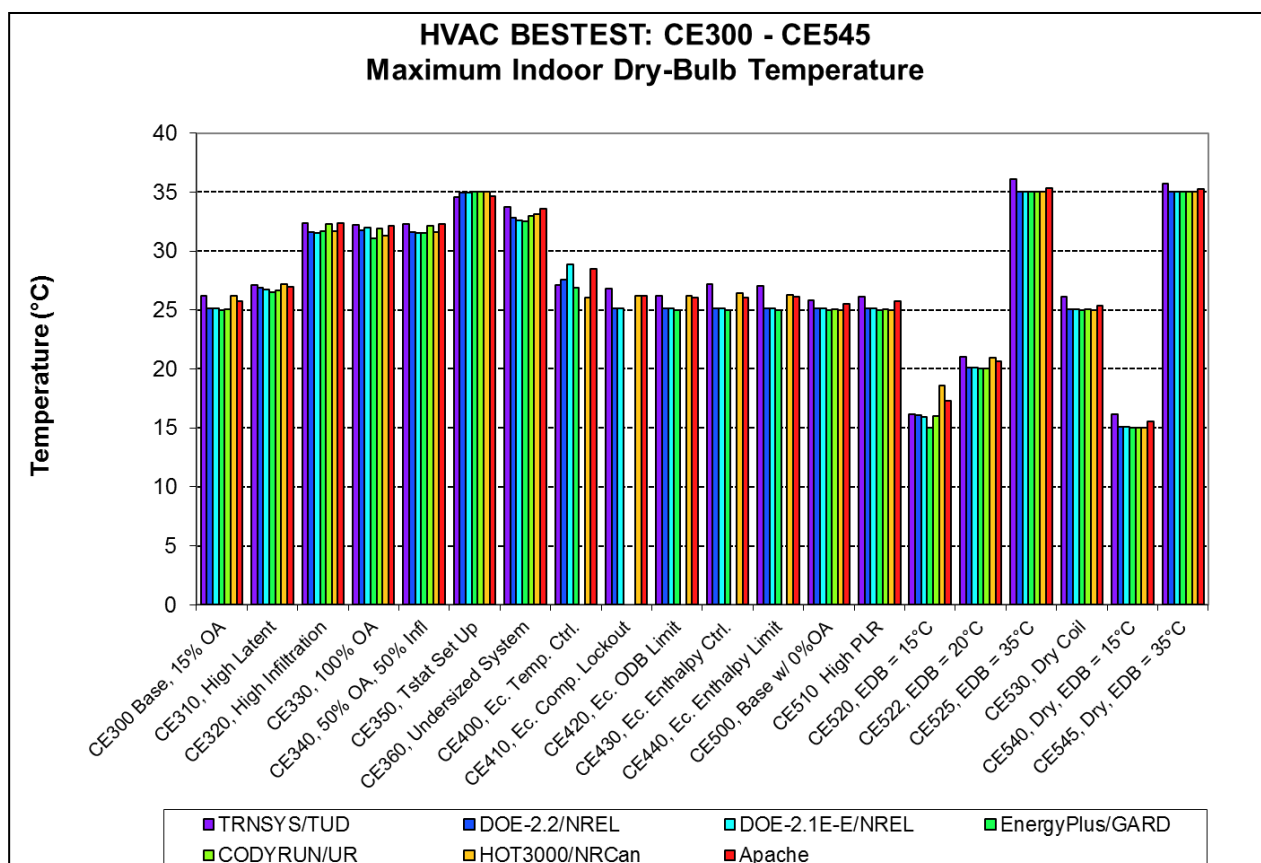


Figure 5.55 – HVAC BESTEST: CE300 – CE545 Maximum Indoor Dry-Bulb Temperature.

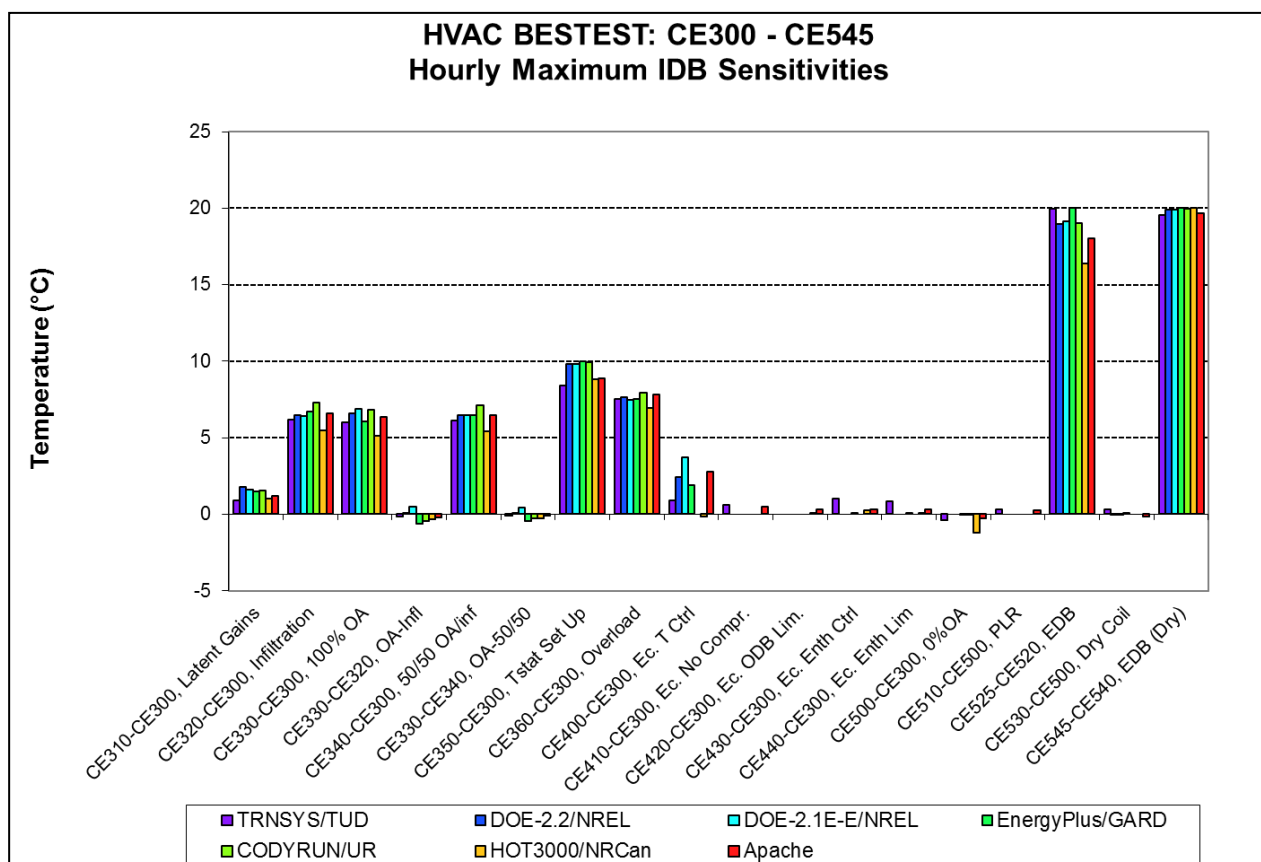


Figure 5.56 – HVAC BESTEST: CE300 – CE545 Hourly Maximum IDB Sensitivities.

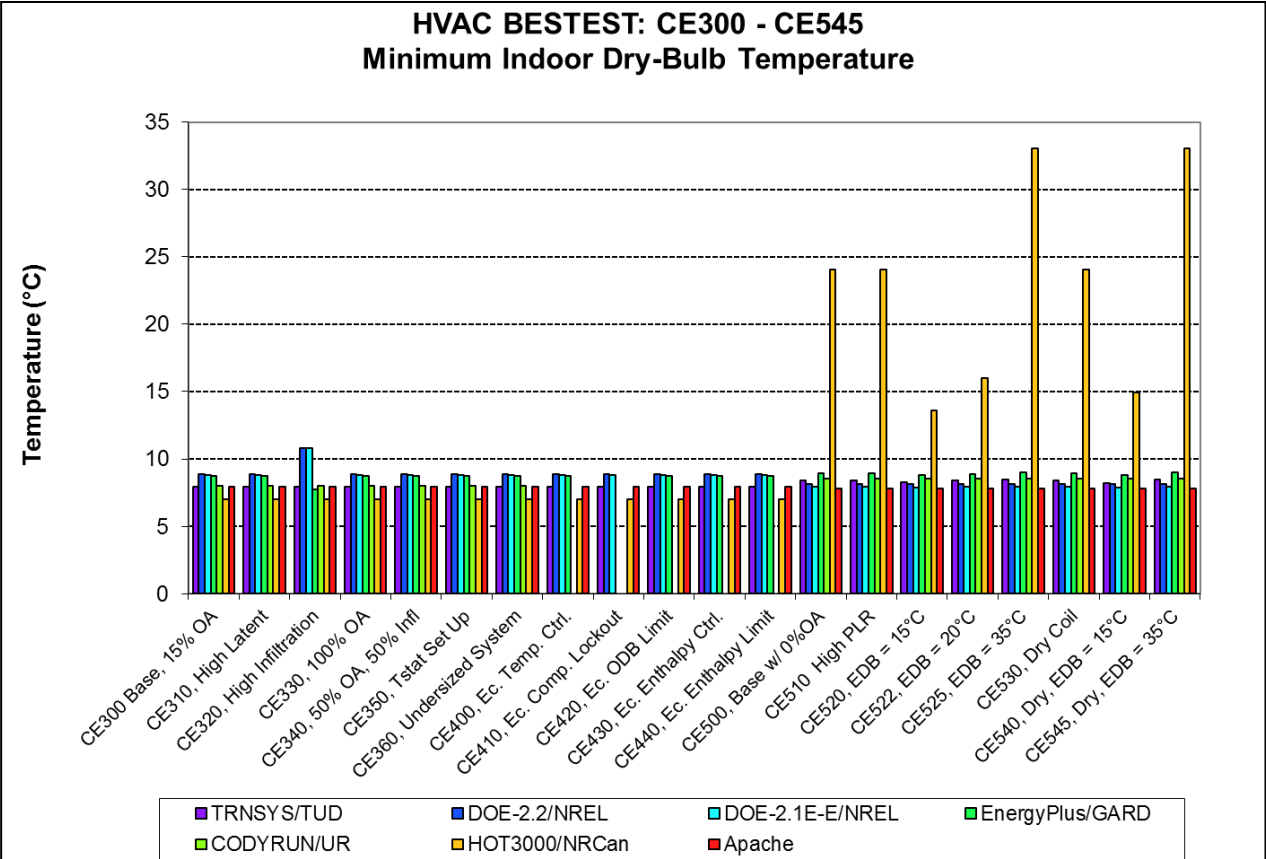


Figure 5.57 – HVAC BESTEST: CE300 – CE545 Minimum Indoor Dry-Bulb Temperature.

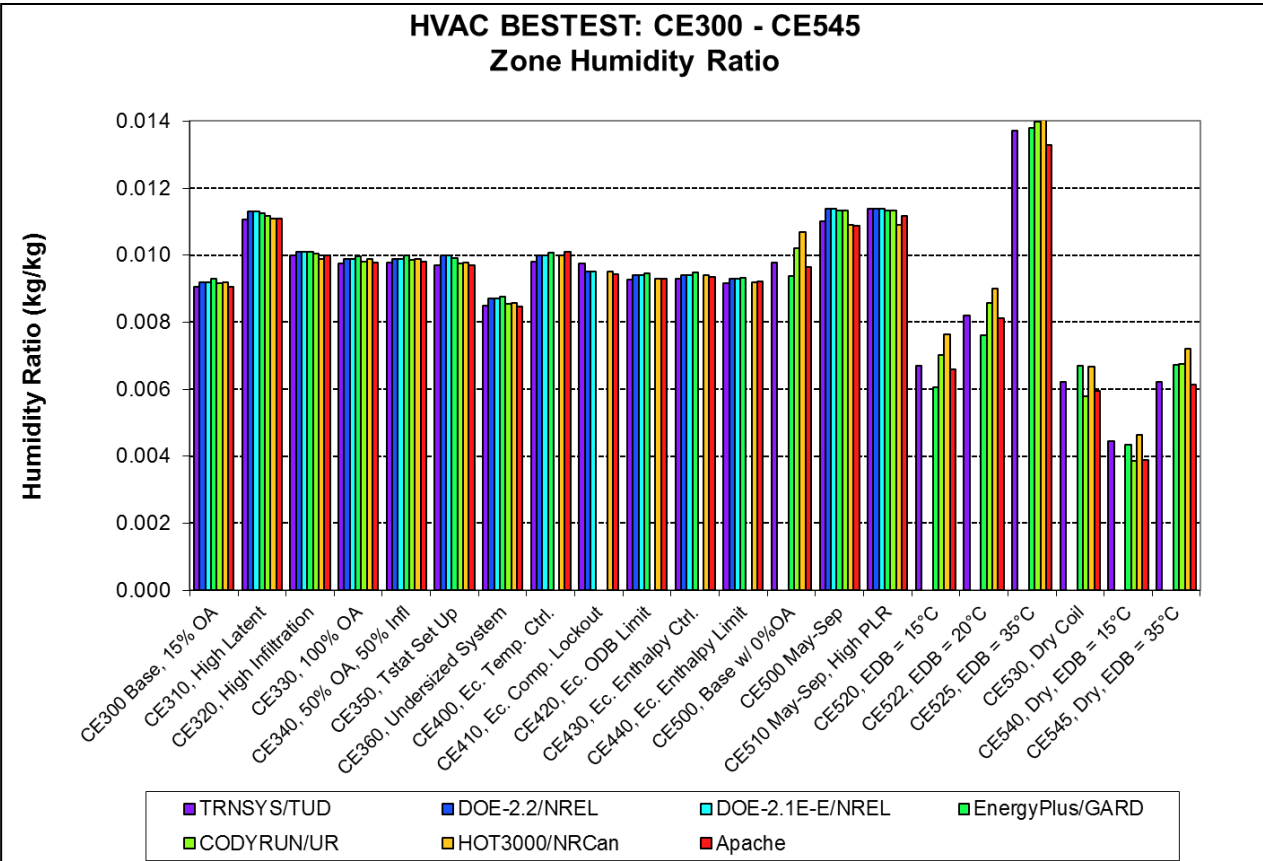


Figure 5.58 – HVAC BESTEST: CE300 – CE545 Zone Humidity Ratio.

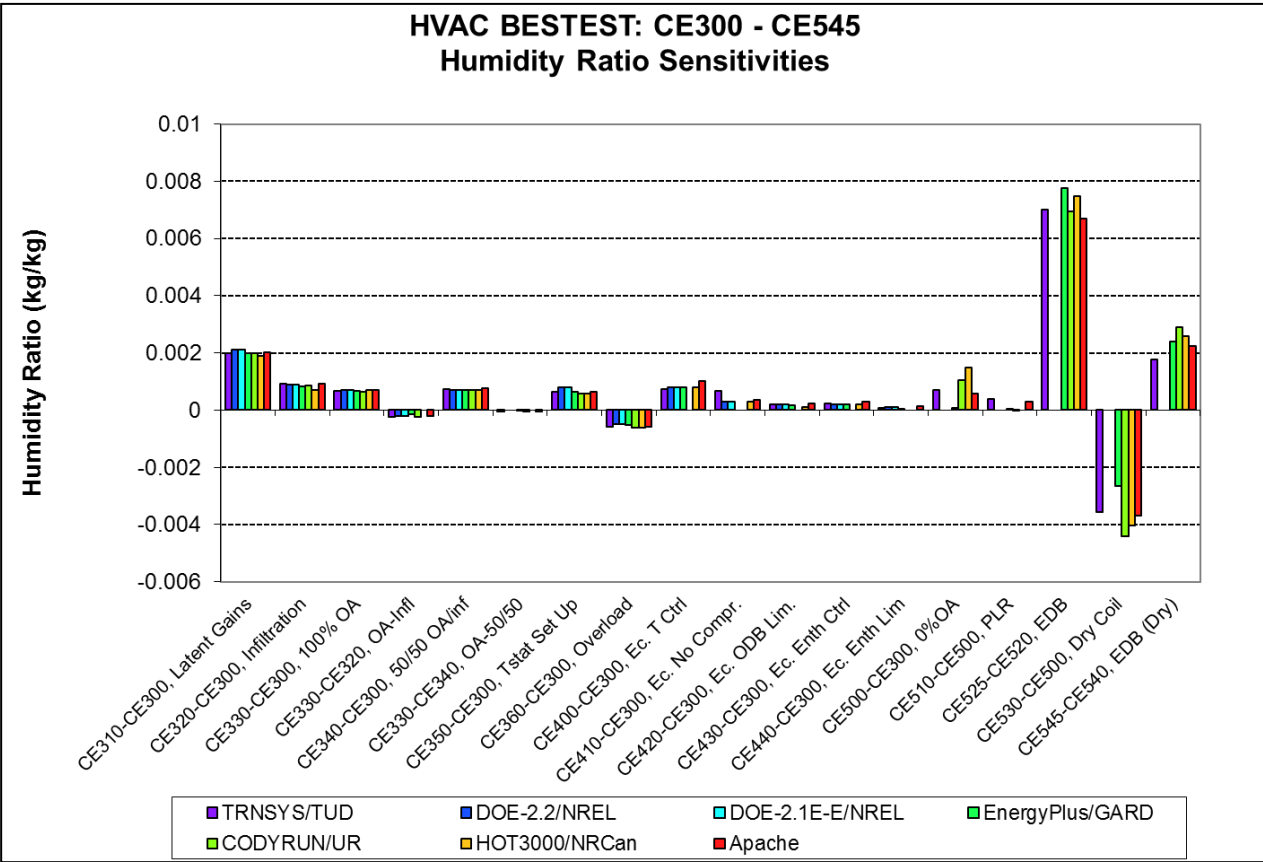


Figure 5.59 – HVAC BESTEST: CE300 – CE545 Humidity Ratio Sensitivities.

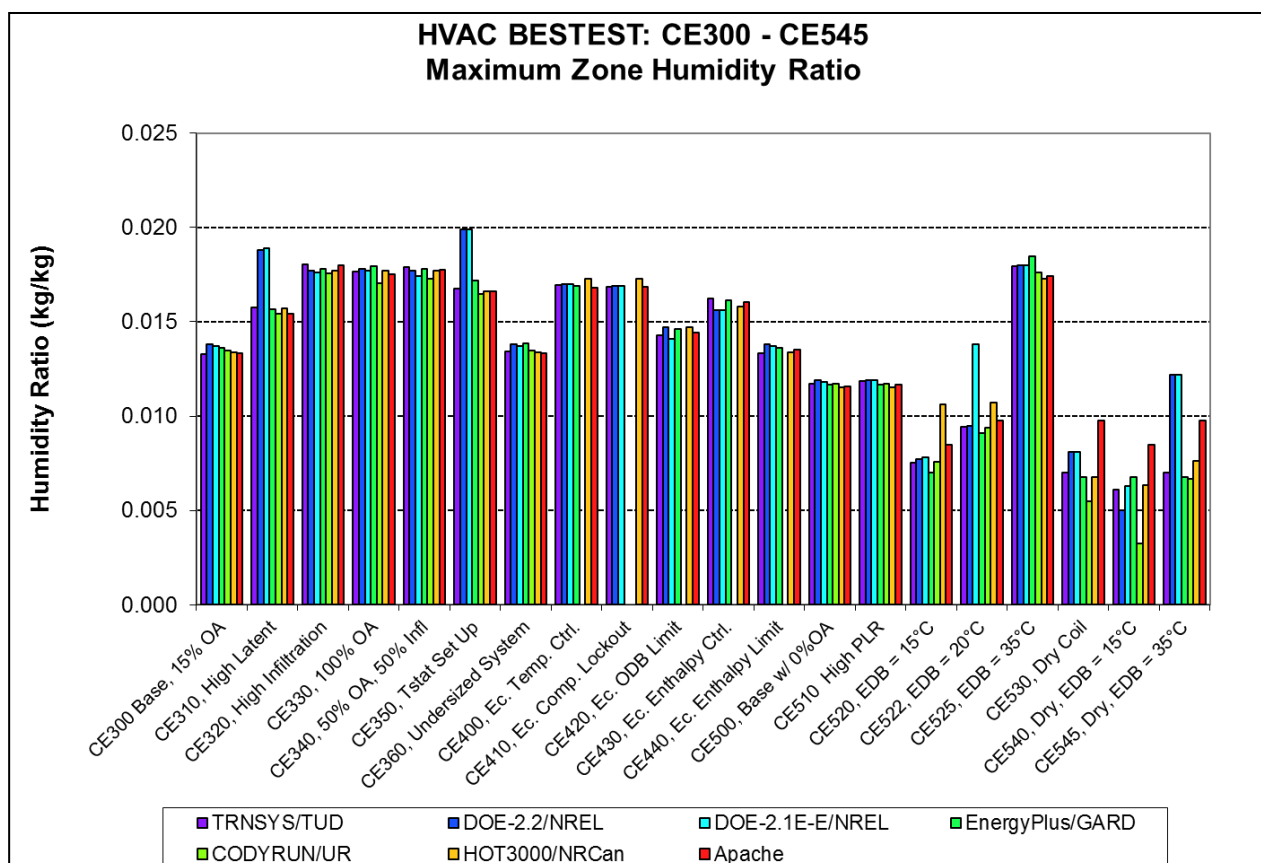


Figure 5.60 – HVAC BESTEST: CE300 – CE545 Maximum Zone Humidity Ratio.

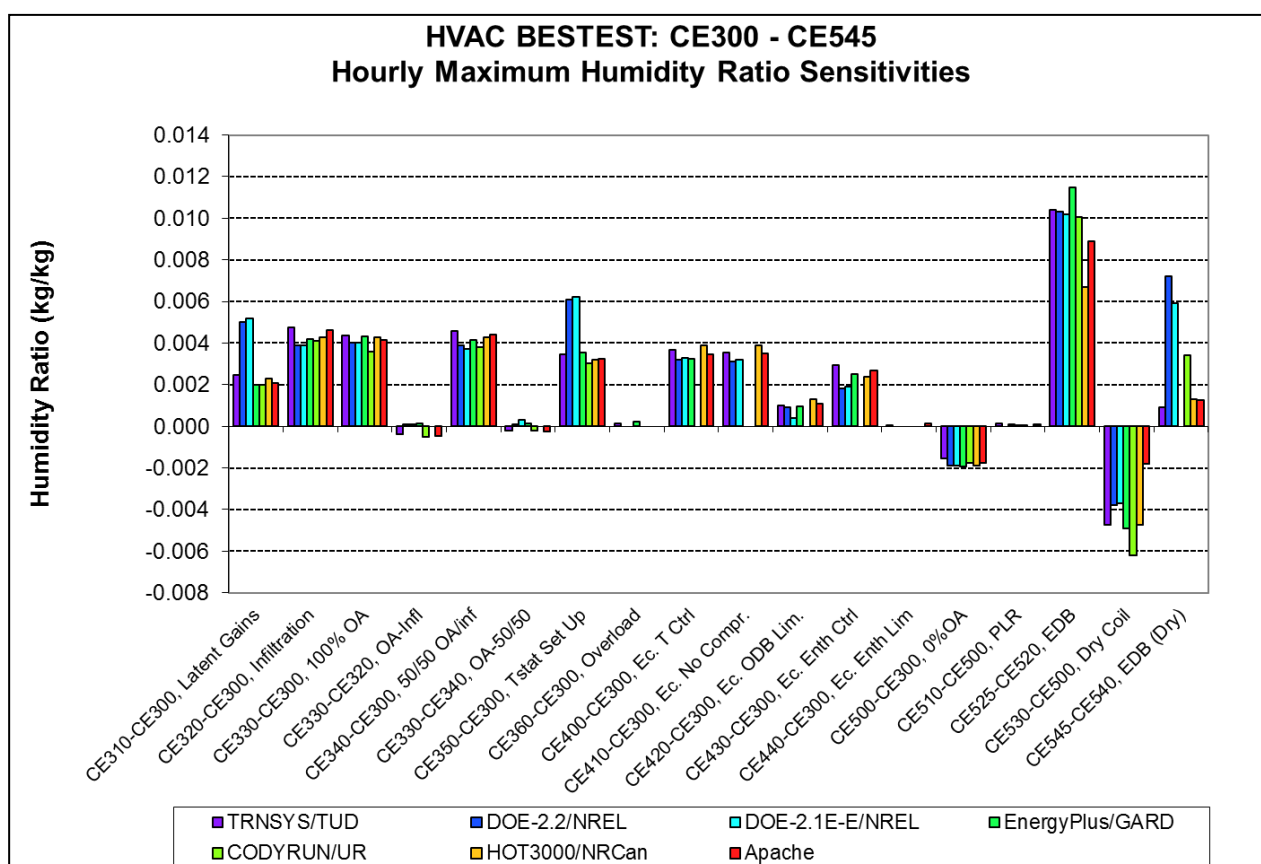


Figure 5.61 – HVAC BESTEST: CE300 – CE545 Hourly Maximum Humidity Ratio Sensitivities.

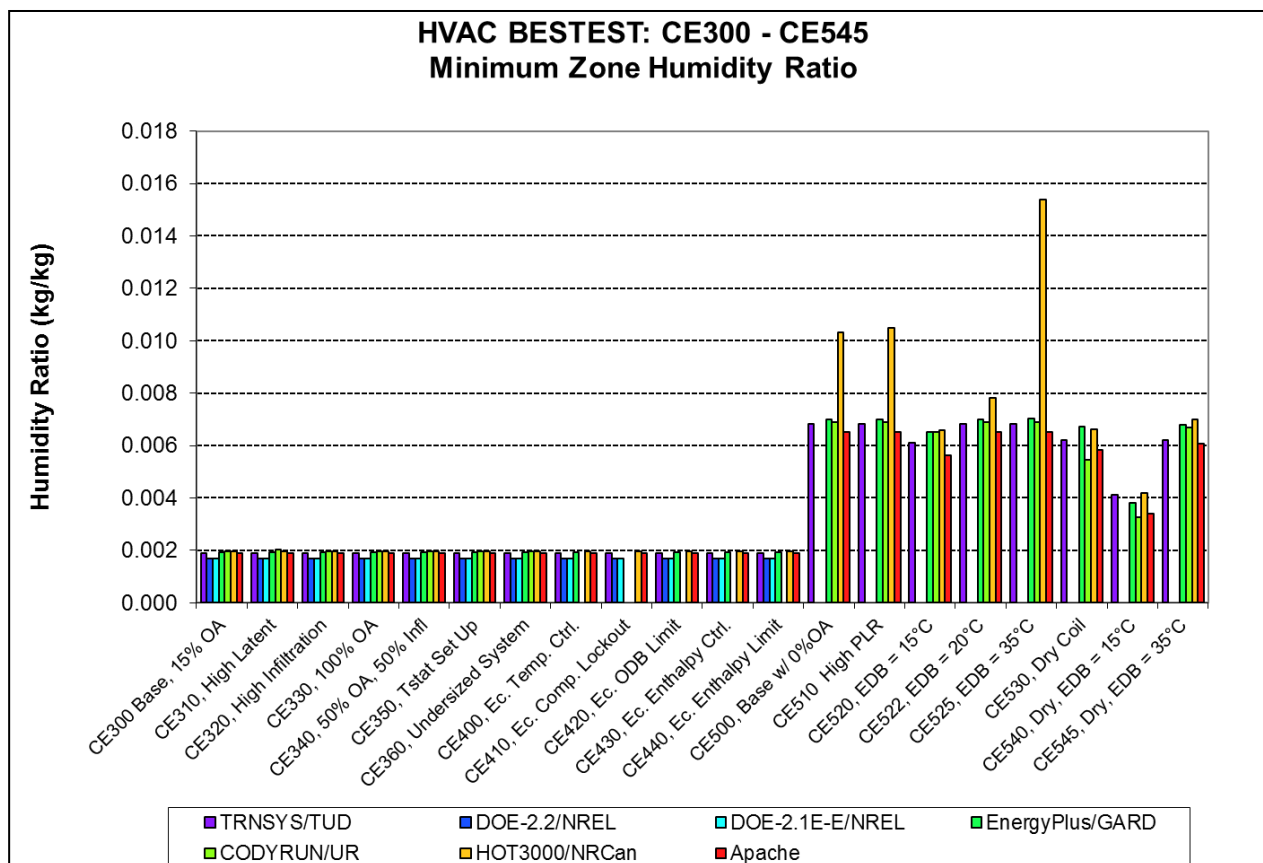


Figure 5.62 – HVAC BESTEST: CE300 – CE545 Minimum Zone Humidity Ratio.

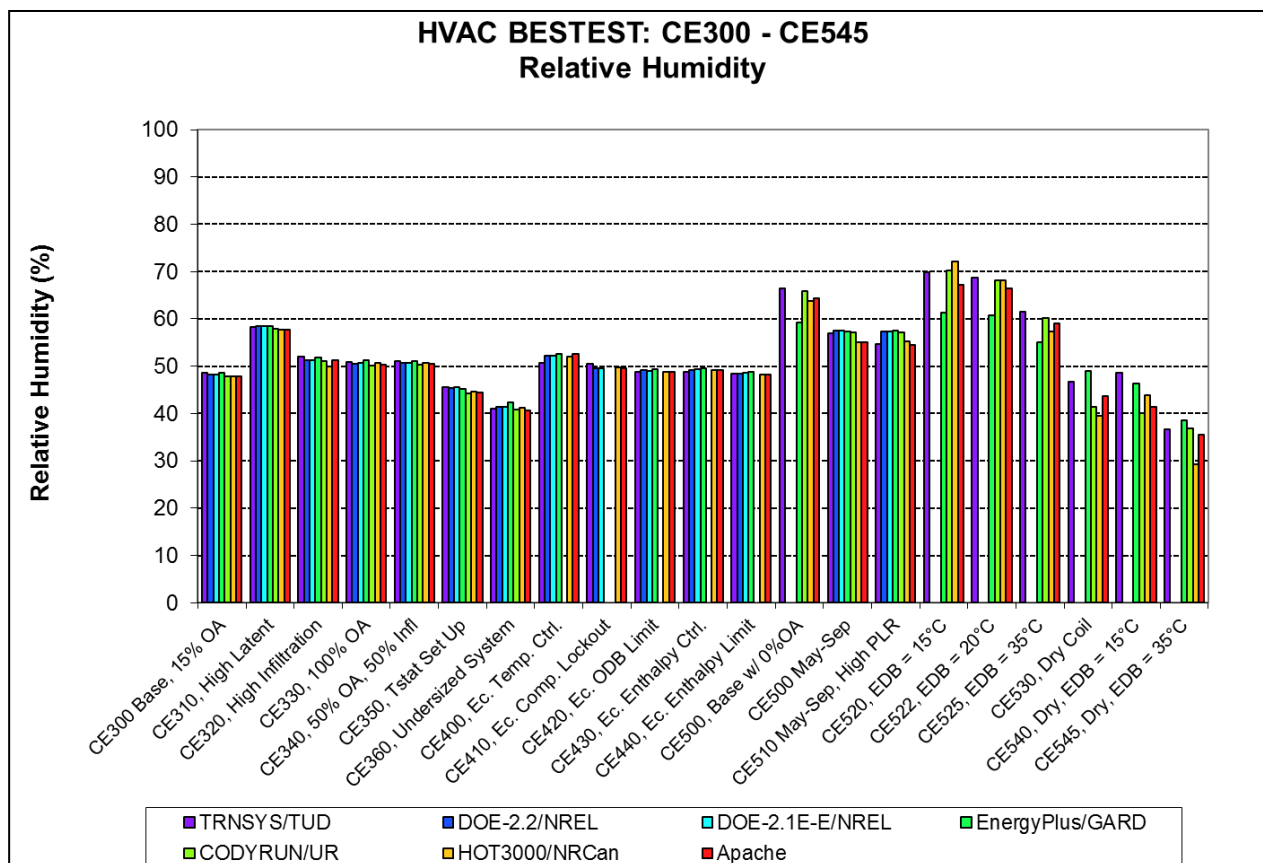


Figure 5.63 – HVAC BESTEST: CE300 – CE545 Relative Humidity.

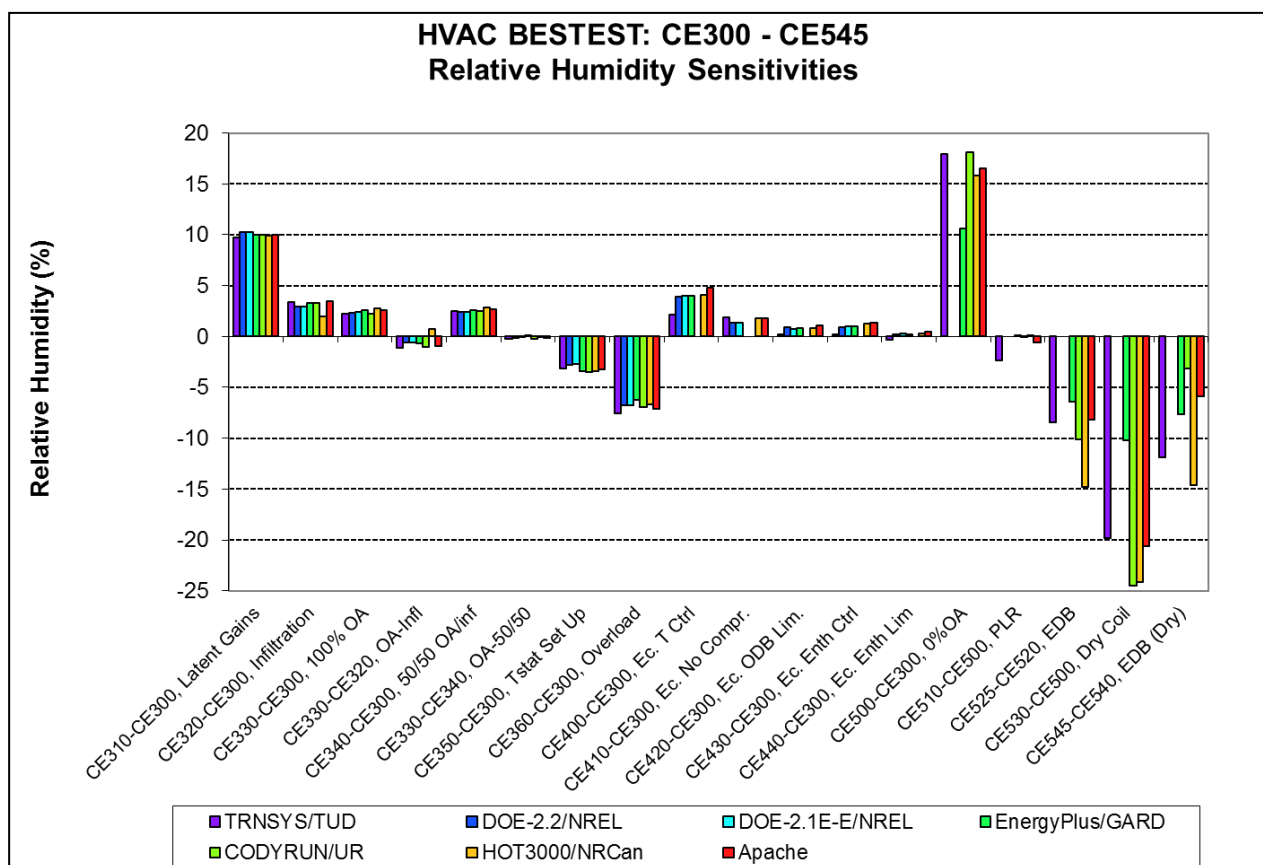


Figure 5.64 – HVAC BESTEST: CE300 – CE545 Relative Humidity Sensitivities.

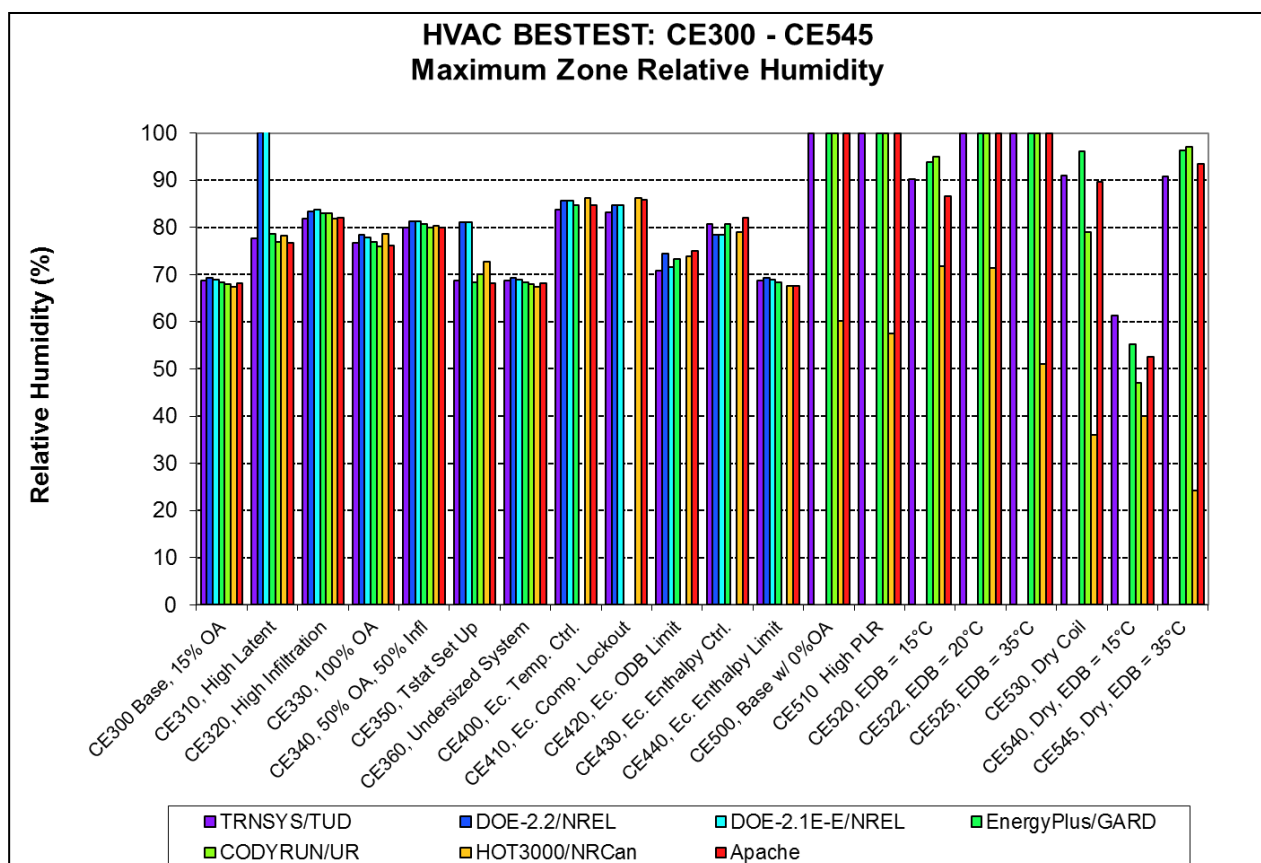


Figure 5.65 – HVAC BESTEST: CE300 – CE545 Maximum Zone Relative Humidity.

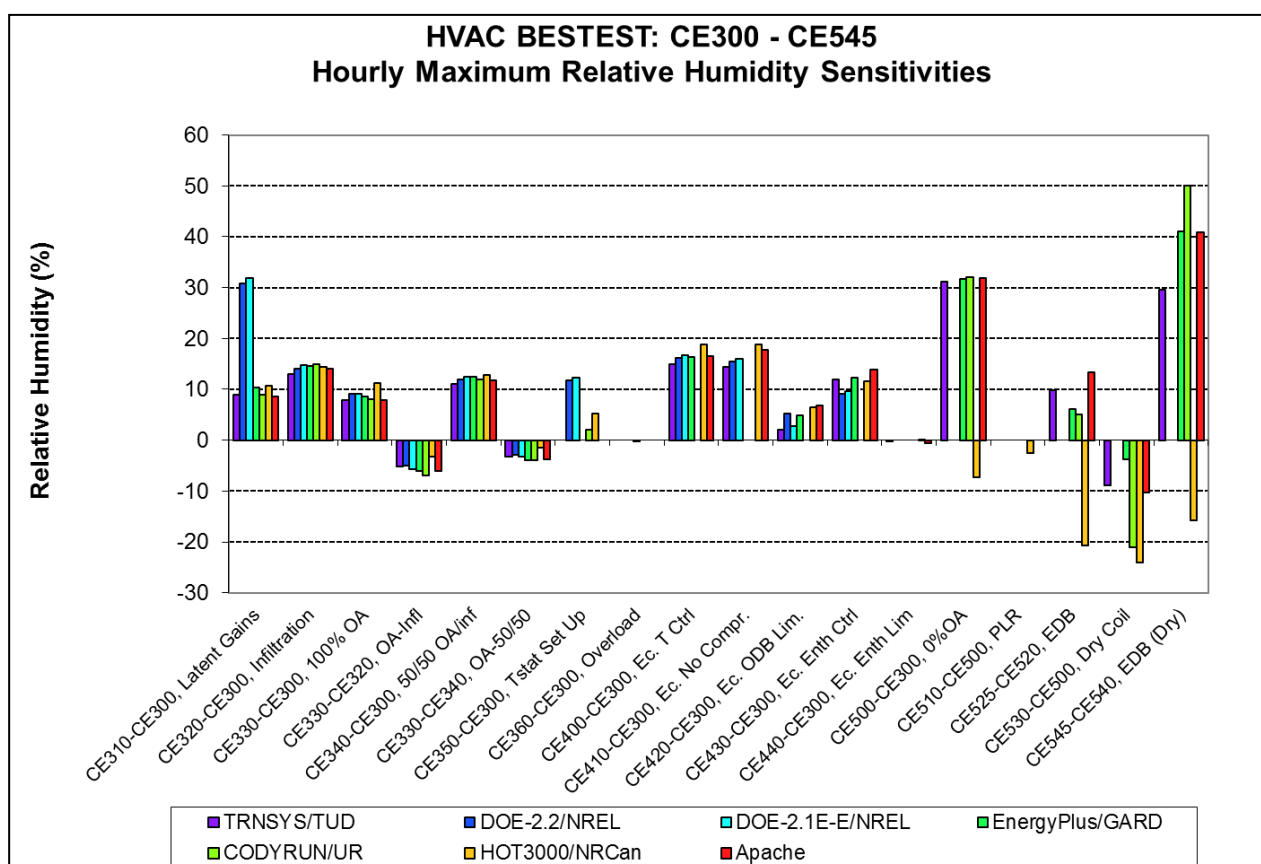


Figure 5.66 – HVAC BESTEST: CE300 – CE545 Hourly Maximum Relative Humidity Sensitivities.

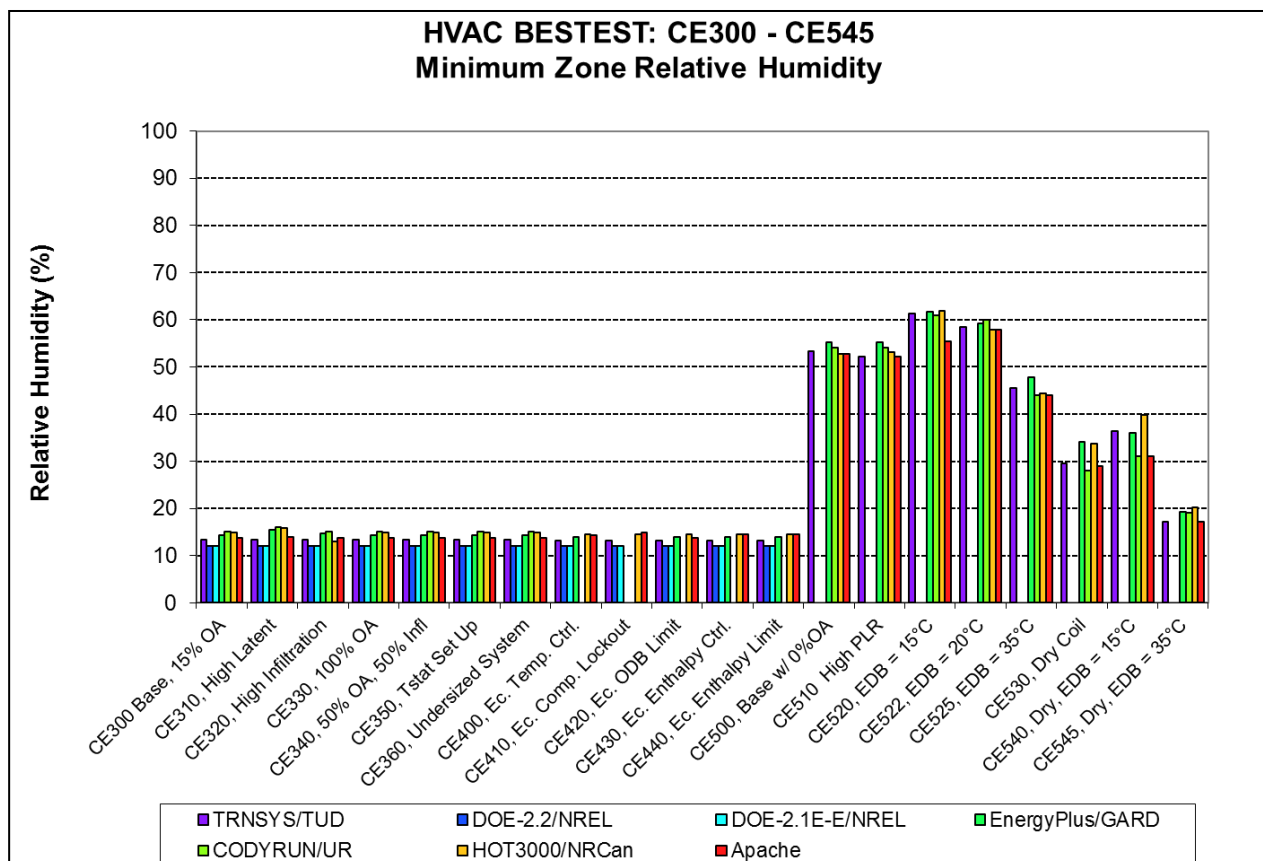


Figure 5.67 – HVAC BESTEST: CE300 – CE545 Minimum Zone Relative Humidity.

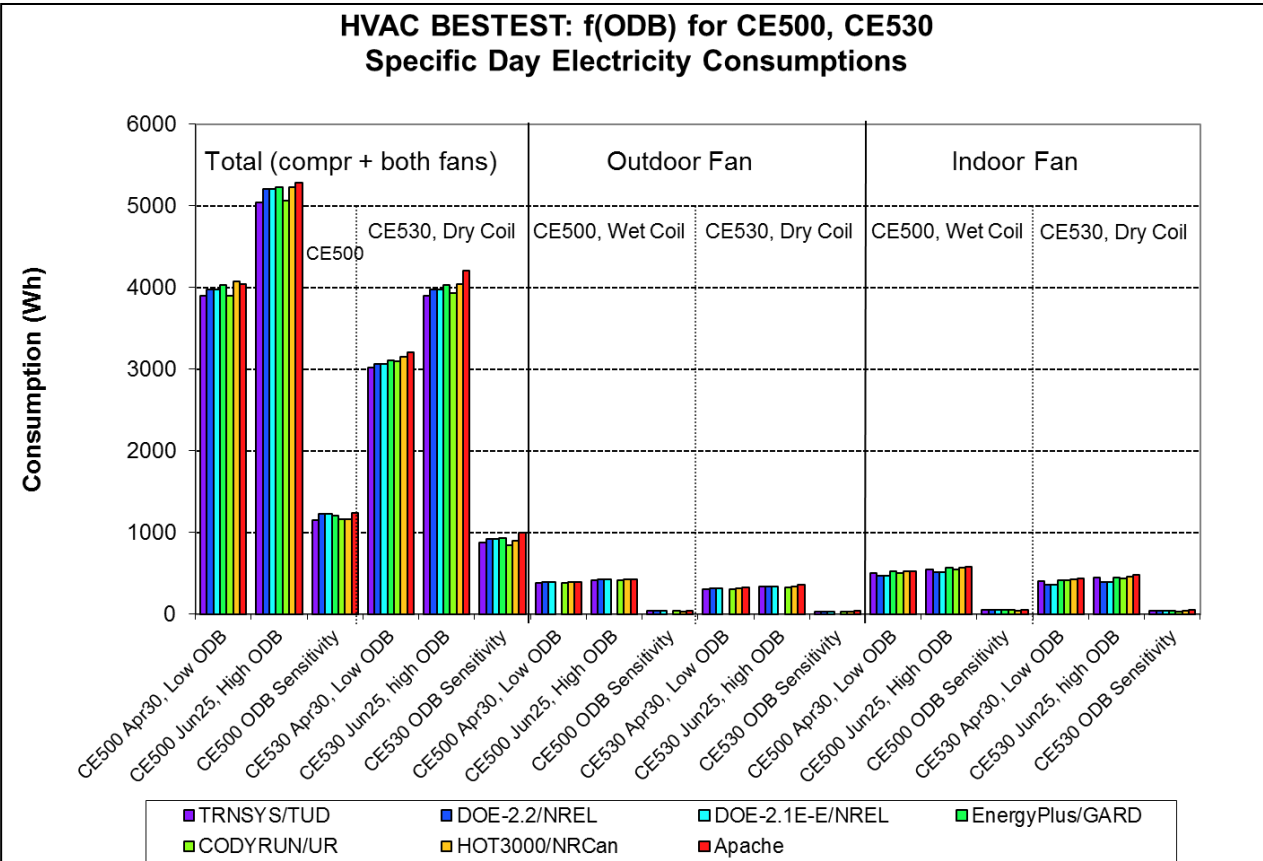


Figure 5.68 – HVAC BESTEST: f(ODB) for CE500, CE530 Specific Day Electricity Consumptions.

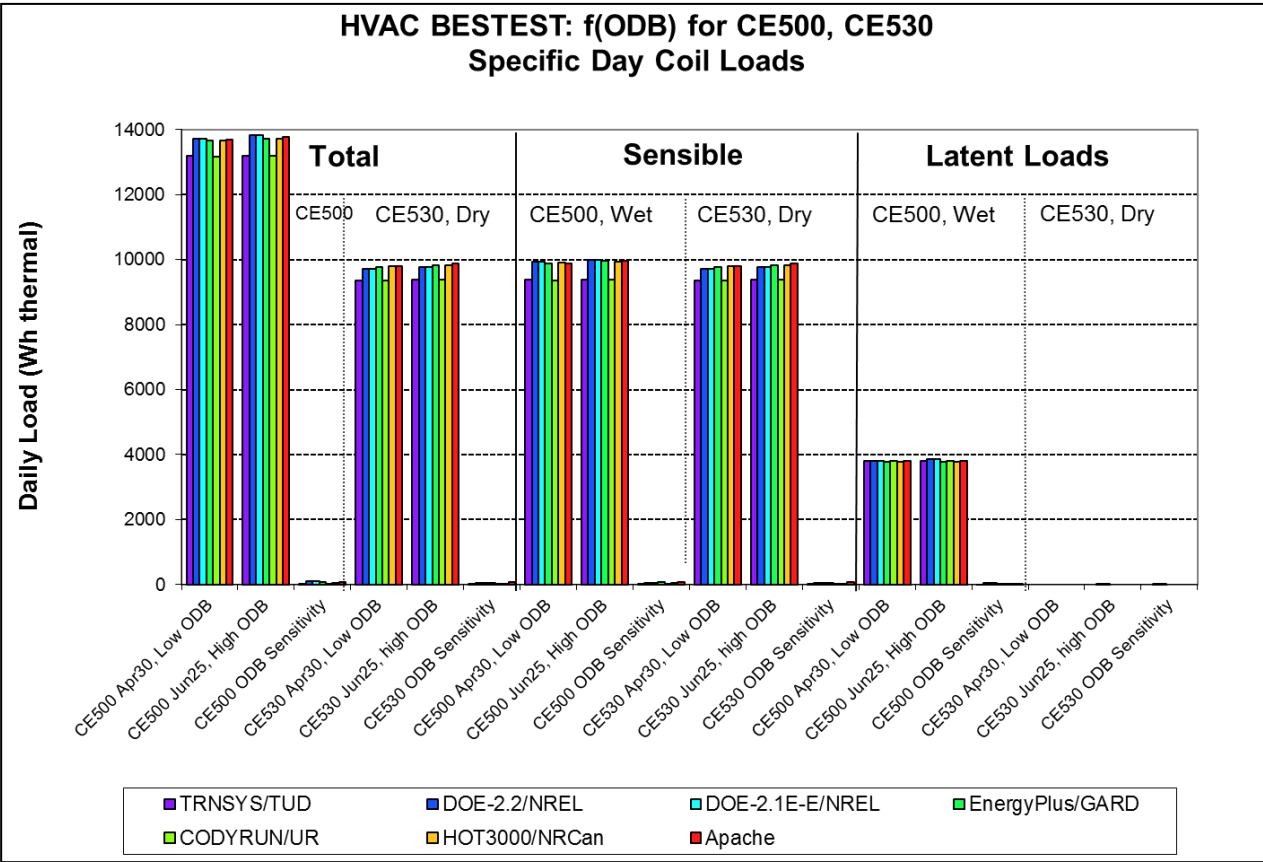


Figure 5.69 – HVAC BESTEST: f(ODB) for CE500, CE530 Specific Day Loads.

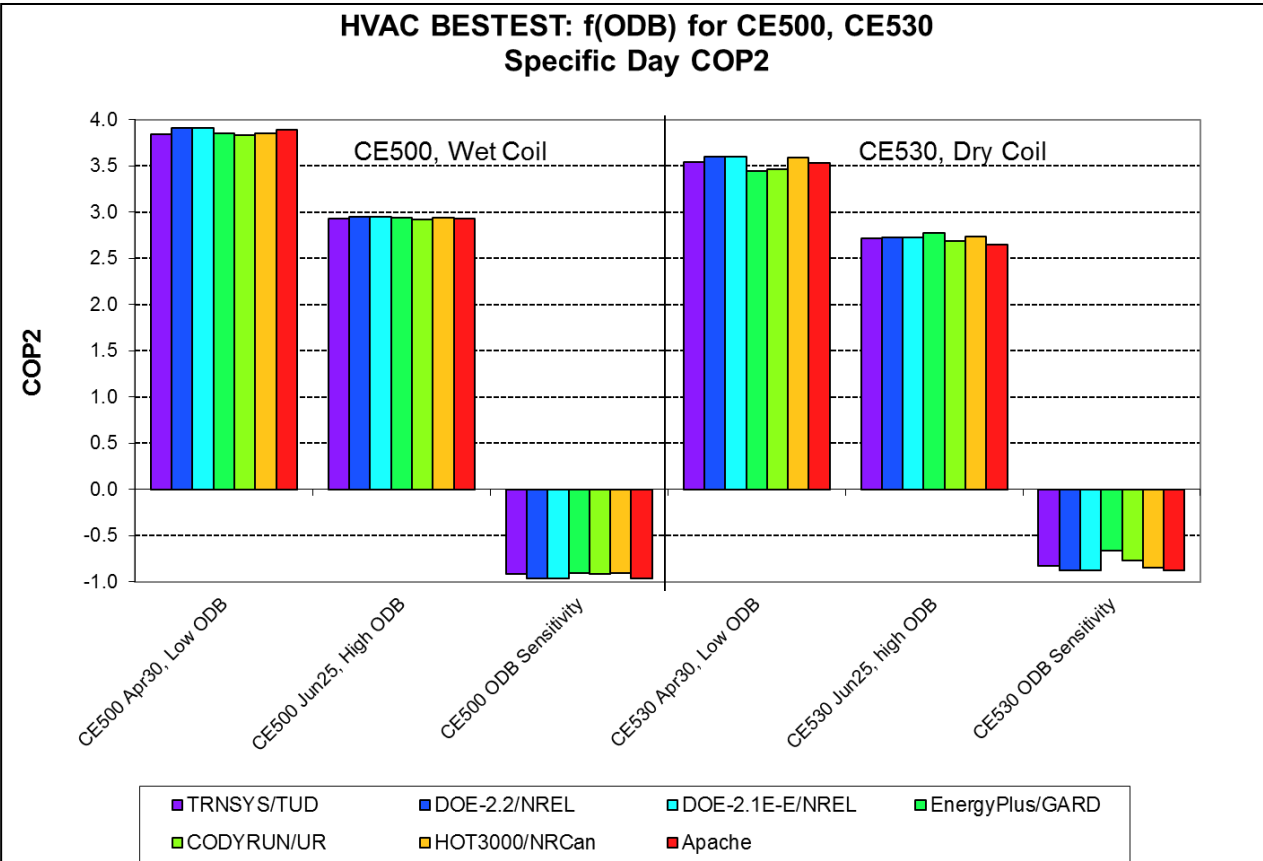


Figure 5.70 – HVAC BESTEST: f(ODB) for CE500, CE530 Specific Day COP2.

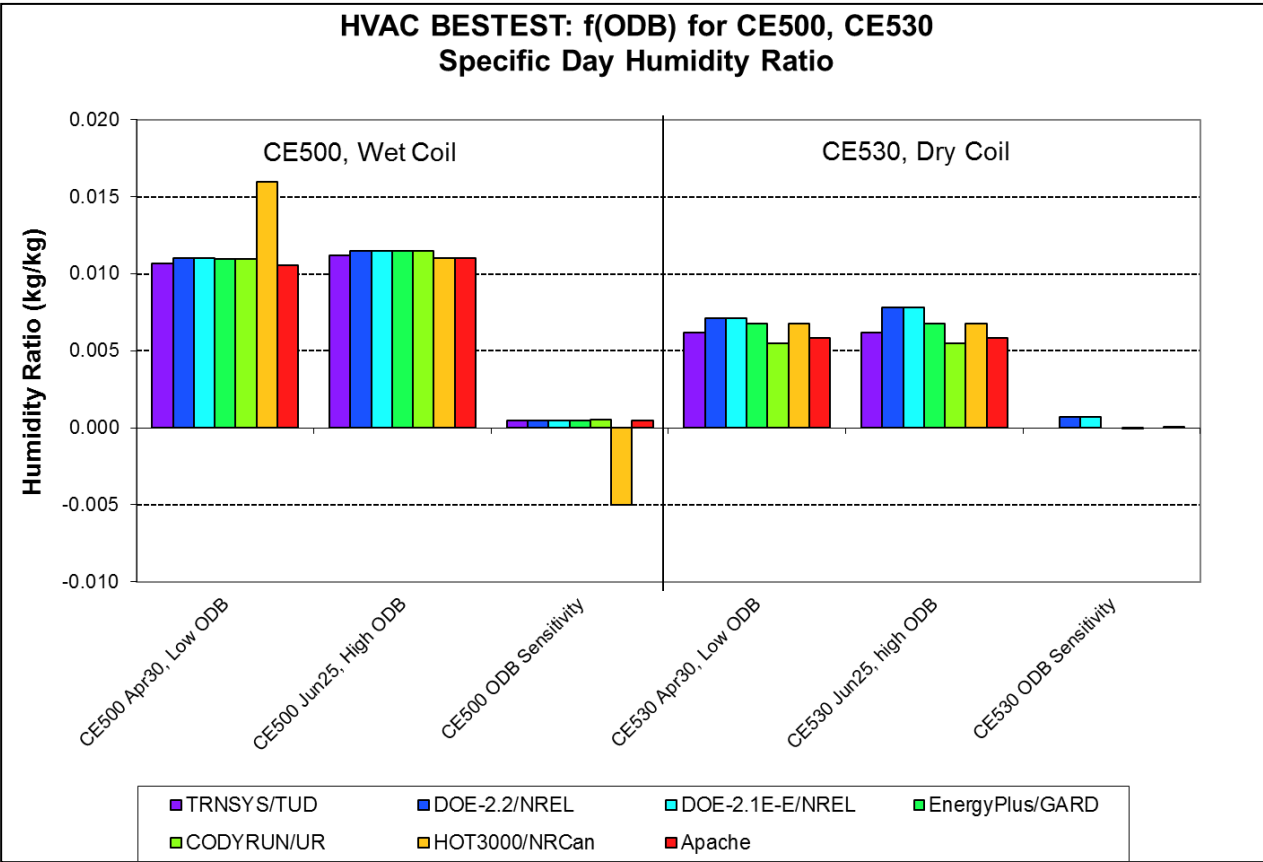


Figure 5.71 – HVAC BESTEST: f(ODB) for CE500, CE530 Specific Day Humidity Ratio.

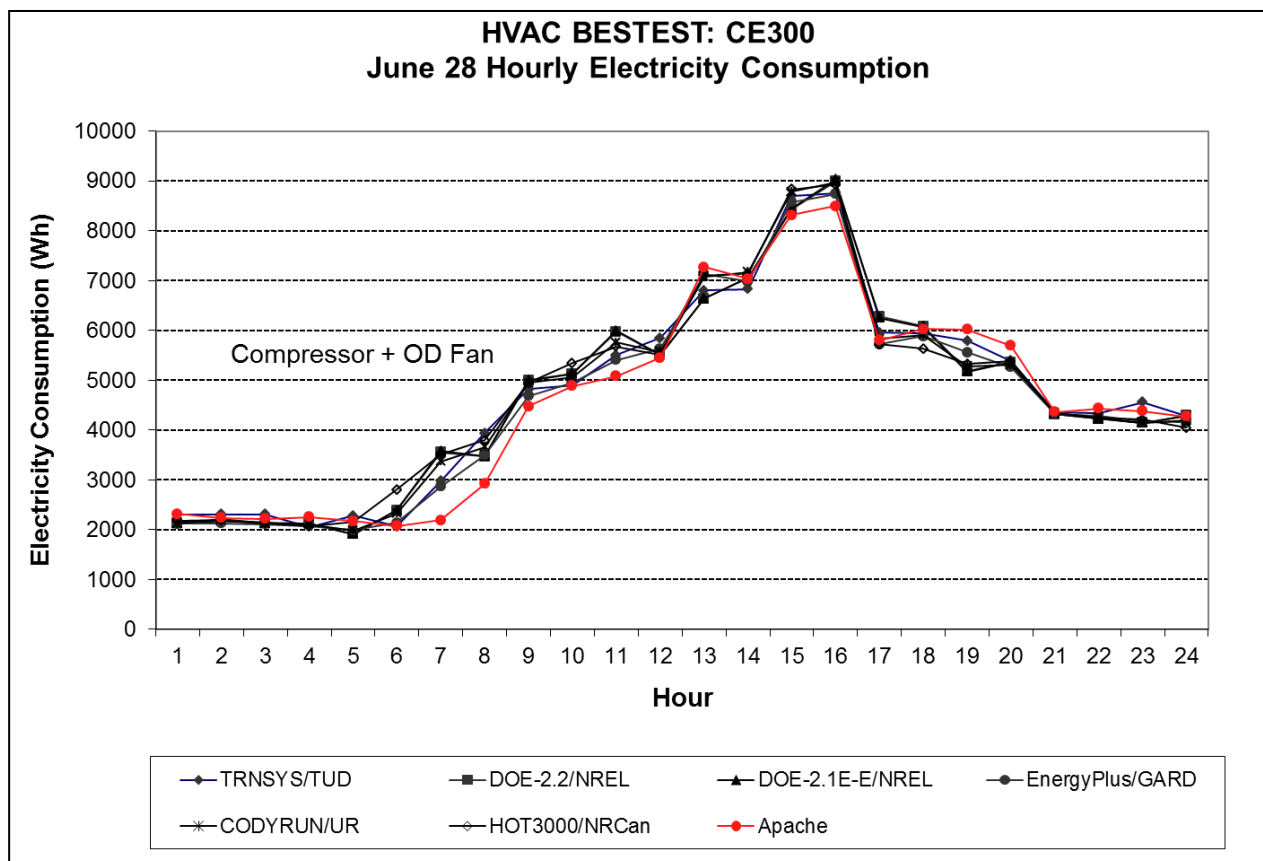


Figure 5.72 – HVAC BESTEST: CE300 June 28 Hourly Electricity Consumption.

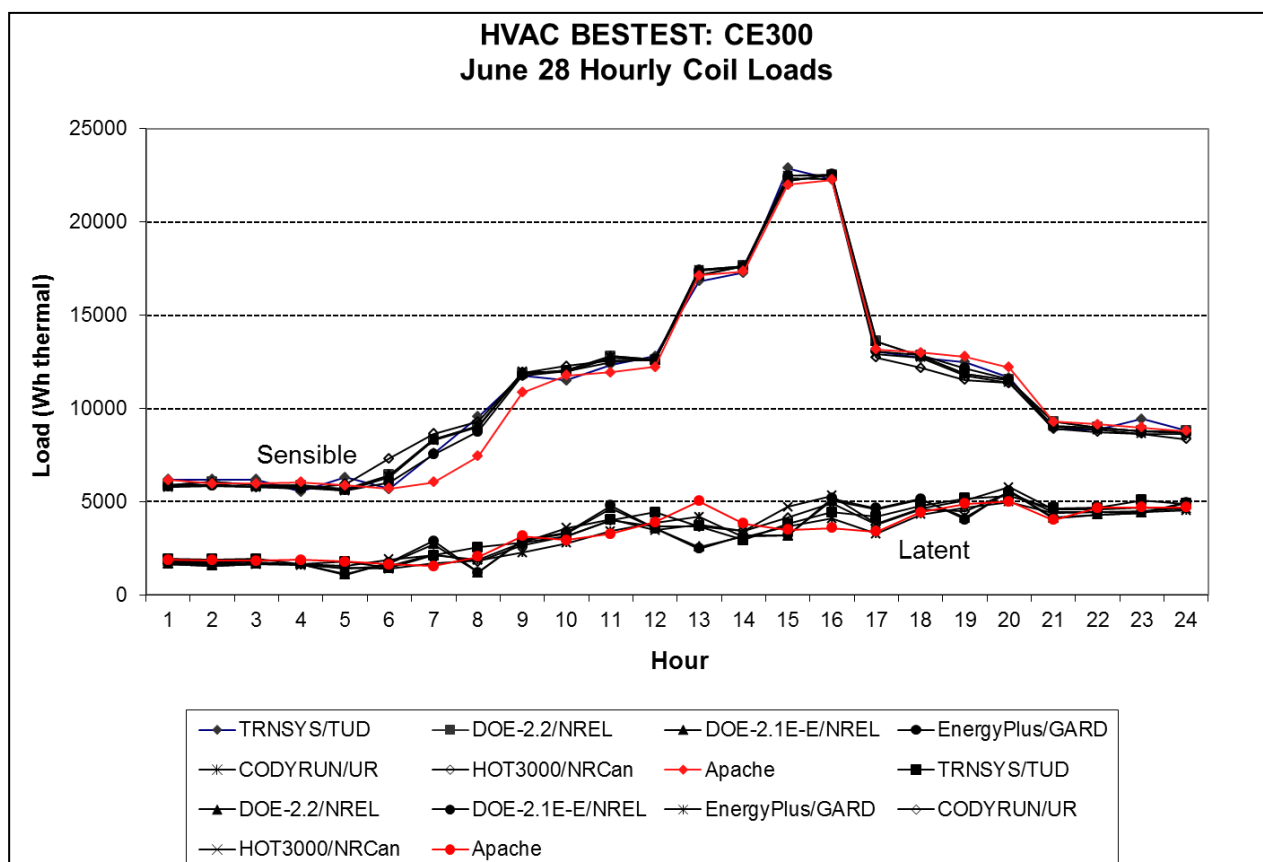


Figure 5.73 – HVAC BESTEST: CE300 June 28 Hourly Coil Loads.

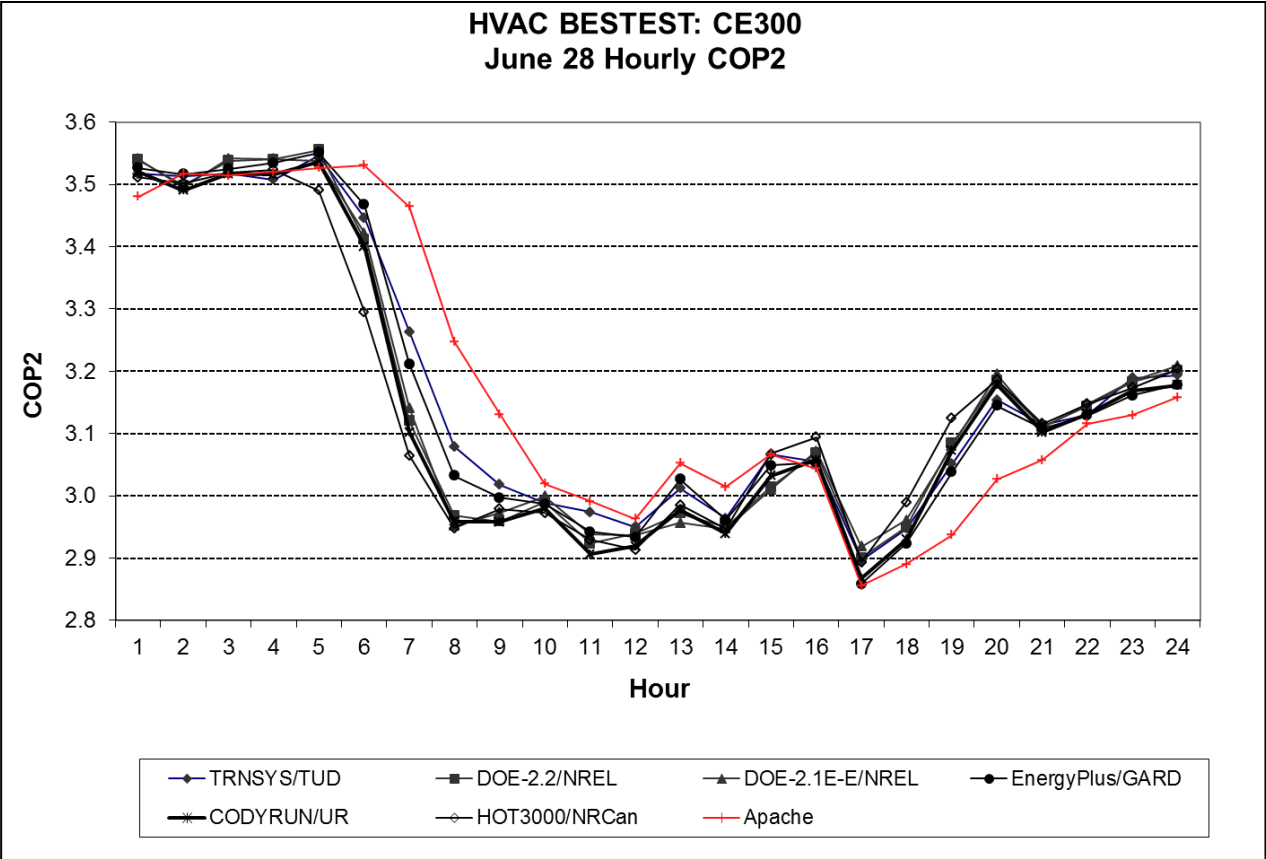


Figure 5.74 – HVAC BESTEST: CE300 June 28 Hourly COP2.

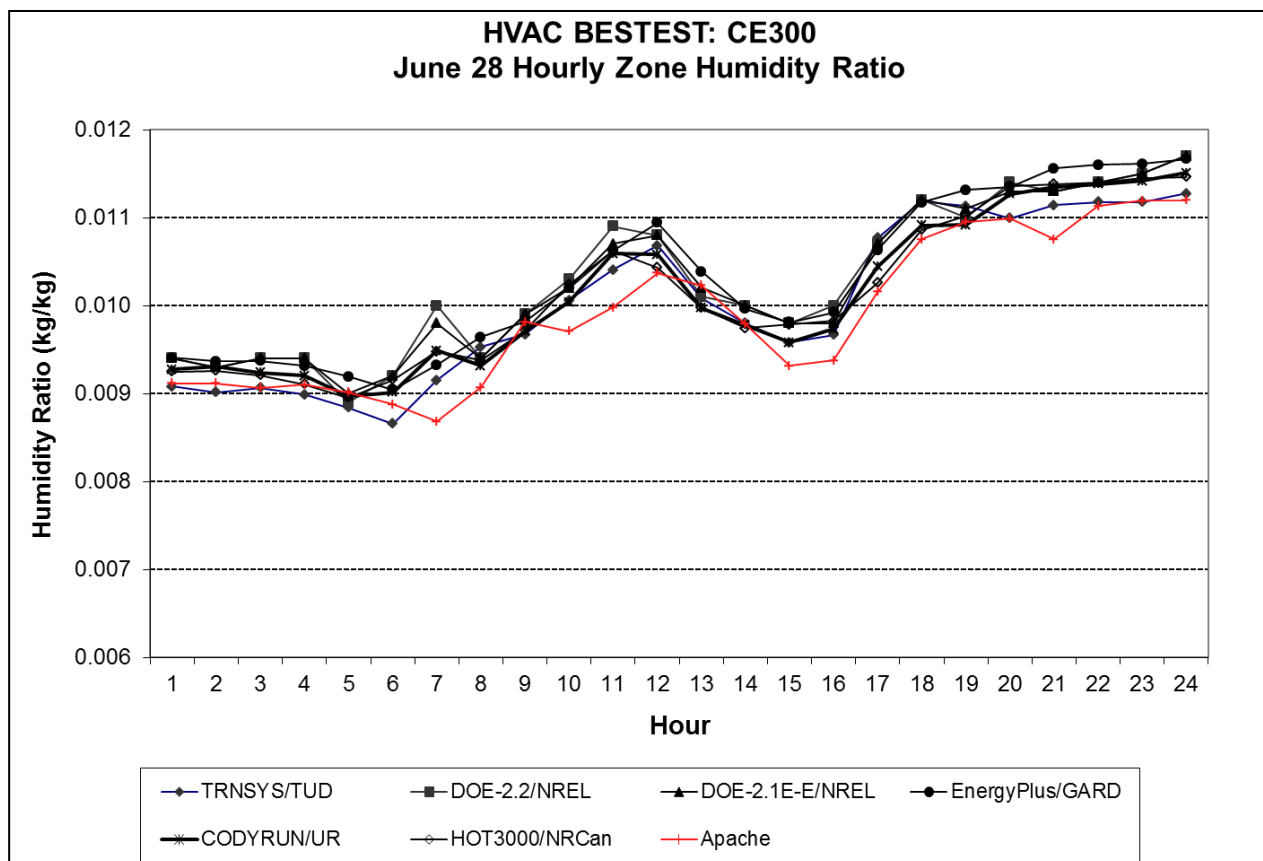


Figure 5.75 – HVAC BESTEST: CE300 June 28 Hourly Zone Humidity Ratio.

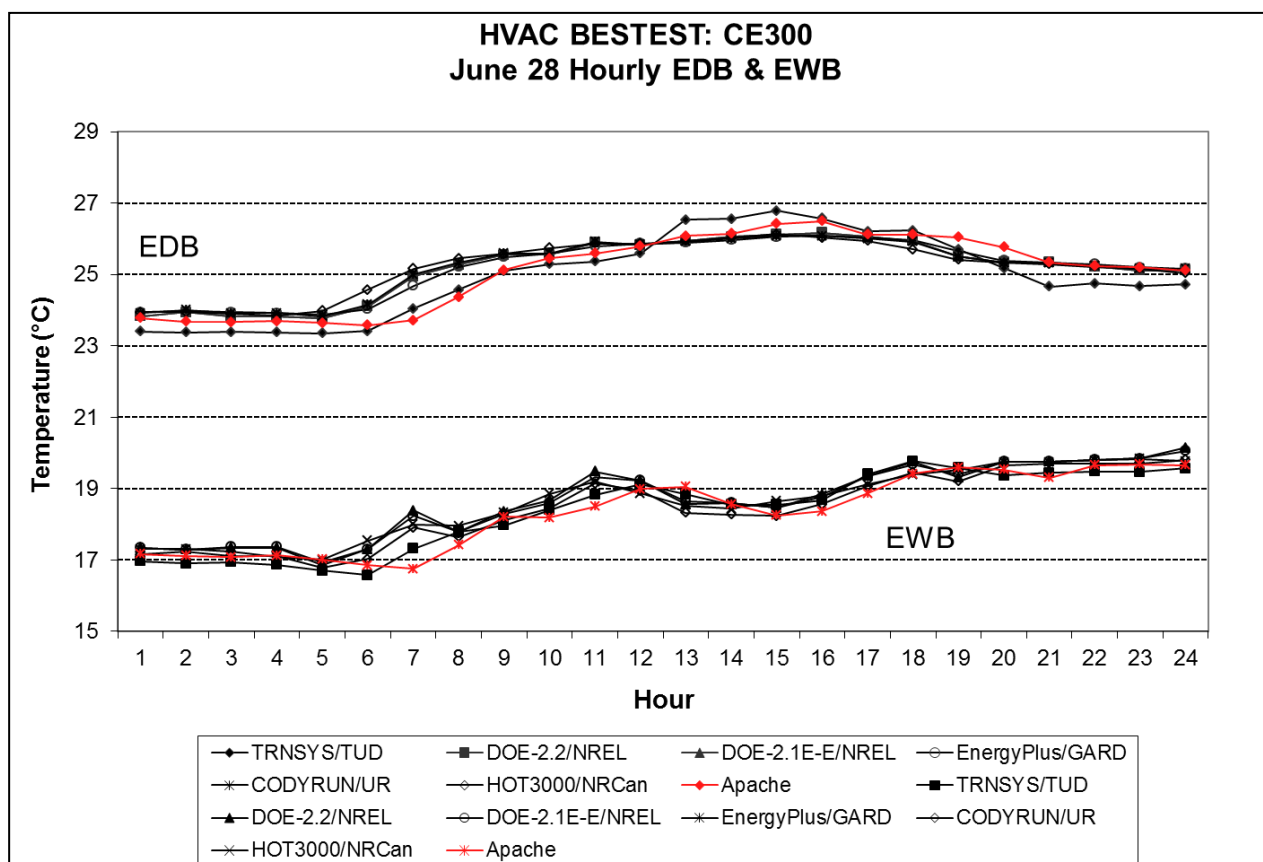


Figure 5.76 – HVAC BESTEST: CE300 June 28 Hourly EDB and EWB.

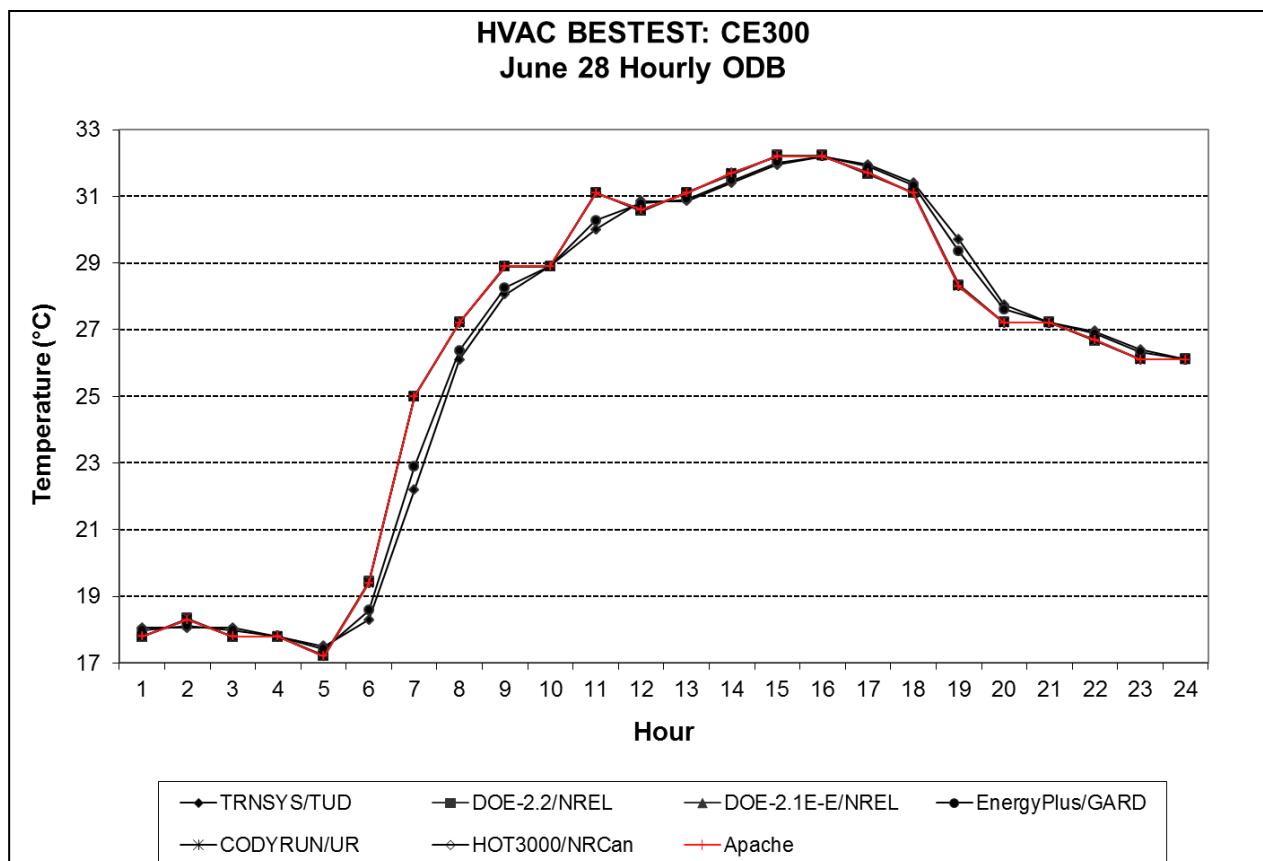


Figure 5.77 – HVAC BESTEST: CE300 June 28 Hourly ODB.

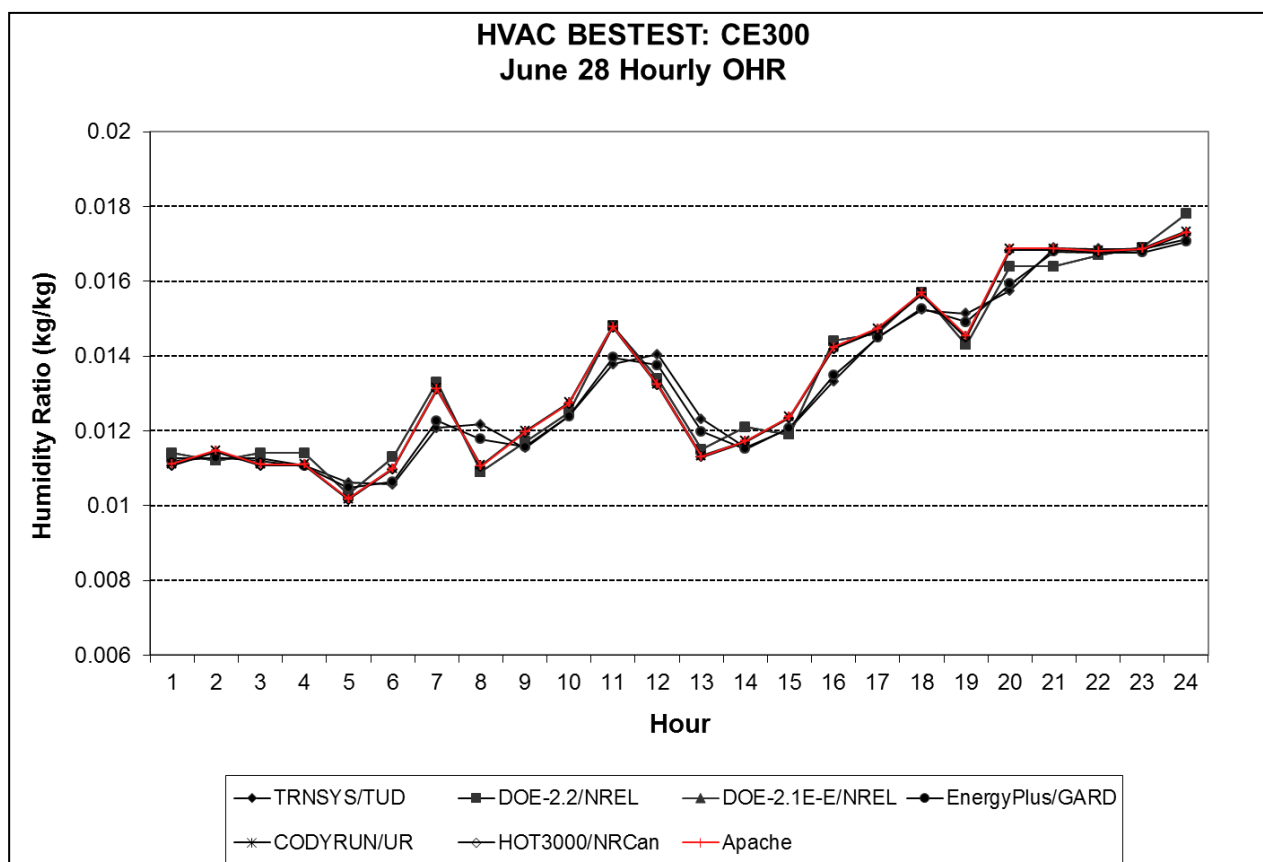


Figure 5.78 – HVAC BESTEST: CE300 June 28 Hourly OHR.

6 Results – Tabulated

6.1 Analytical Verification Test Results - CE100 to CE200

Space Cooling Electricity Consumption

Energy Consumption, Total (kWh,e)								Statistics, All Results			Analytical			Apache	Ap-An /An	Within Range
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD		Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2			
CE100	1531	1530	1521	1519	1520	1522	1512	1531	1.2%		1531	1531	1531	1535	0.3%	yes
CE110	1077	1089	1061	1065	1069	1067	1061	1089	2.6%		1076	1077	1077	1080	0.2%	yes
CE120	1012	1012	1011	1003	1006	1007	1002	1012	1.0%		1013	1011	1011	1024	1.2%	no
CE130	110	109	105	106	109	109	110	110	4.2%		111	110	110	110	0.6%	yes
CE140	68	69	65	66	68	68	69	69	5.8%		69	69	68	69	0.3%	yes
CE150	1208	1207	1202	1183	1197	1199	1183	1208	2.1%		1206	1207	1207	1207	0.1%	yes
CE160	1140	1139	1138	1107	1132	1137	1107	1140	2.9%		1140	1139	1139	1140	0.0%	yes
CE165	1502	1501	1499	1470	1491	1500	1470	1502	2.1%		1498	1500	1500	1503	0.3%	yes
CE170	638	638	629	620	635	636	620	638	2.8%		641	638	638	641	0.3%	yes
CE180	1083	1082	1077	1080	1082	1081	1077	1083	0.5%		1083	1082	1082	1083	0.1%	yes
CE185	1544	1543	1541	1547	1540	1542	1538	1547	0.6%		1545	1543	1543	1545	0.1%	yes
CE190	164	164	160	160	164	164	165	165	3.1%		165	164	164	165	0.3%	yes
CE195	250	250	245	246	250	250	252	252	2.6%		252	250	250	252	0.5%	yes
CE200	1477	1464	1468	1440	1465	1480	1440	1480	2.7%		1476	1477	1477	1477	0.0%	yes

Energy Consumption, Compressor (kWh,e)								Statistics, All Results			Analytical			Apache	Ap-An /An	Within Range
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD		Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2			
CE100	1319	1318	1307	1311	1311	1303	1303	1319	1.2%		1319	1319	1319	1322	0.3%	yes
CE110	889	899	866	883	879	876	866	899	3.7%		888	889	889	891	0.2%	yes
CE120	840	840	850	838	836	832	832	850	2.2%		841	839	839	849	1.1%	yes
CE130	95	94	93	93	94	95	93	95	2.1%		95	94	94	95	0.6%	yes
CE140	57	57	55	56	56	57	55	57	3.9%		57	57	56	57	0.4%	yes
CE150	1000	999	1007	982	992	987	982	1007	2.5%		999	999	999	1000	0.1%	yes
CE160	950	949	963	926	947	944	926	963	3.9%		950	949	949	950	0.0%	yes
CE165	1283	1281	1291	1256	1280	1272	1256	1291	2.8%		1279	1280	1280	1283	0.3%	yes
CE170	531	530	539	523	528	529	523	539	3.0%		533	530	530	532	0.2%	yes
CE180	909	908	914	912	907	906	906	914	0.9%		908	908	908	909	0.1%	yes
CE185	1340	1339	1343	1344	1337	1334	1334	1344	0.7%		1340	1339	1338	1340	0.1%	yes
CE190	138	138	139	138	138	138	138	139	1.4%		138	138	138	138	0.3%	yes
CE195	217	217	219	217	216	218	216	219	1.1%		219	217	217	218	0.5%	yes
CE200	1250	1239	1249	1218	1253	1253	1218	1253	2.8%		1249	1250	1250	1250	0.0%	yes

Energy Consumption, Supply Fan (kWh,e)								Statistics, All Results			Analytical			Apache	Ap-An /An	Within Range
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD		Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2			
CE100	144	144	145	141	144	144	141	145	2.9%		144	144	144	144	0.3%	yes
CE110	128	129	133	122	128	128	122	133	8.5%		128	128	128	128	0.3%	yes
CE120	117	117	110	110	116	117	110	117	6.3%		117	117	117	119	1.8%	yes
CE130	10	10	8	8	10	10	8	10	23.0%		10	10	10	10	0.6%	yes
CE140	8	8	7	6	8	8	6	8	26.9%		8	8	8	8	0.6%	yes
CE150	141	141	133	136	140	141	133	141	5.7%		141	141	141	141	0.1%	yes
CE160	129	129	119	121	128	129	119	129	7.8%		129	129	129	129	0.1%	yes
CE165	149	150	142	145	149	149	142	150	5.6%		149	149	149	150	0.2%	yes
CE170	73	73	61	63	73	73	61	73	16.1%		74	73	73	74	0.4%	yes
CE180	118	119	111	112	118	118	111	119	6.9%		119	119	119	119	0.2%	yes
CE185	139	139	135	137	139	139	135	139	3.0%		139	139	139	140	0.1%	yes
CE190	18	18	14	14	18	18	14	18	22.8%		18	18	18	18	0.4%	yes
CE195	23	23	18	18	23	23	18	23	23.1%		23	23	23	23	0.6%	yes
CE200	154	153	149	151	153	155	149	155	3.5%		154	155	155	155	0.0%	yes

Energy Consumption, Condenser Fan (kWh,e)								Statistics, All Results			Analytical			Apache	Ap-An /An	Within Range
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD		Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2			
CE100	68	68	68	67	67	67	67	68	2.0%		68	68	68	68	0.3%	yes
CE110	60	61	62	60	60	59	59	62	4.9%		60	60	60	60	0.3%	yes
CE120	55	55	51	55	55	54	51	55	6.5%		55	55	55	56	1.8%	yes
CE130	5	5	4	5	5	5	4	5	22.4%		5	5	5	5	1.1%	yes
CE140	4	4	3	4	4	4	3	4	19.1%		4	4	4	4	0.6%	yes
CE150	66	66	62	65	66	65	62	66	5.6%		66	66	66	66	0.1%	yes
CE160	61	61	56	60	61	60	56	61	8.4%		61	61	61	61	0.0%	yes
CE165	70	70	67	69	70	69	67	70	5.2%		70	70	70	70	0.3%	yes
CE170	34	34	29	34	34	34	29	34	16.1%		35	34	34	35	0.4%	yes
CE180	56	56	52	56	56	55	52	56	7.1%		56	56	56	56	0.1%	yes
CE185	65	65	63	66	65	65	63	66	3.9%		65	65	65	66	0.2%	yes
CE190	8	9	7	8	8	9	7	9	27.6%		9	9	9	9	0.1%	yes
CE195	11	11	8	11	11	11	8	11	25.0%		11	11	11	11	0.7%	yes
CE200	73	72	70	71	73	73	70	73	4.1%		73	73	73	73	0.0%	yes

Table 6.1 – Space Cooling Electricity Consumption.

COP: Mean, and (Max-Min)/Mean

Mean COP								Statistics, All Results			Analytical					
	CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD	Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2	Apache	[Ap-An] /An	Within Range
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	2.38	0.3%	yes
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	3.37	0.4%	yes
CE120	3.59	3.59	3.61	3.62	3.61	3.61	3.63	3.59	3.63	1.2%	3.59	3.59	3.59	3.55	1.0%	yes
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	1.88	1.1%	yes
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	2.74	0.8%	yes
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	3.62	0.1%	yes
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	3.83	0.1%	yes
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	2.92	0.4%	yes
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	3.37	0.4%	yes
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	0.1%	yes
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	2.84	0.1%	yes
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	3.38	0.5%	yes
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	2.29	0.5%	yes
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	0.1%	yes
(Max - Min)/Mean COP								Statistics, All Results			Analytical					
	CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD	Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2	Apache	[Ap-An] /An	Within Range
CE100	0.000	0.001	0.002	0.001	0.003	0.000	0.000	0.000	0.003		0.000	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	0.000	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	0.000	0.004		
CE130	0.000	0.038	0.013	0.009	0.004	0.000	0.172	0.000	0.172		0.000	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	0.000	0.004		
CE150	0.003	0.003	0.001	0.005	0.011	0.000	0.009	0.000	0.011		0.000	0.000	0.001	0.000		
CE160	0.003	0.005	0.001	0.003	0.011	0.000	0.010	0.000	0.011		0.000	0.000	0.000	0.000		
CE165	0.010	0.003	0.001	0.003	0.012	0.000	0.008	0.000	0.012		0.000	0.000	0.000	0.000		
CE170	0.000	0.006	0.002	0.004	0.015	0.000	0.043	0.000	0.043		0.000	0.000	0.000	0.001		
CE180	0.005	0.002	0.002	0.010	0.029	0.000	0.012	0.000	0.029		0.000	0.000	0.000	0.000		
CE185	0.007	0.004	0.002	0.010	0.034	0.000	0.009	0.000	0.034		0.000	0.000	0.000	0.000		
CE190	0.000	0.023	0.007	0.019	0.040	0.000	0.101	0.000	0.101		0.000	0.000	0.000	0.001		
CE195	0.000	0.017	0.008	0.017	0.043	0.000	0.086	0.000	0.086		0.000	0.000	0.000	0.001		
CE200	0.006	0.000	0.000	0.005	0.012	0.000	0.000	0.000	0.012		0.000	0.000	0.000	0.000		

Table 6.2 – COP: Mean, and (Max-Min)/Mean.

Coil Loads: Total, Sensible, and Latent

Coil Load, Total (kWh,thermal)									Statistics, All Results									
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re	(Max-Min)			Analytical			Apache	Ap-An	Within			
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD	Min	Max	/Analytical	TUD	HTAL1	HTAL2						
CE100	3800	3800	3841	3794	3798	3800	3794	3841	1.3%	3800	3800	3800	3800	0.0%	yes			
CE110	3765	3766	3804	3756	3763	3765	3756	3804	1.3%	3765	3765	3765	3764	0.0%	yes			
CE120	3749	3749	3763	3739	3747	3748	3739	3763	0.6%	3749	3749	3749	3757	0.2%	yes			
CE130	219	219	216	215	217	219	215	220	2.1%	219	219	219	218	0.4%	yes			
CE140	198	198	196	195	196	198	195	199	2.0%	198	198	197	197	0.5%	yes			
CE150	4517	4517	4543	4528	4509	4517	4509	4543	0.8%	4518	4517	4518	4516	0.0%	yes			
CE160	4501	4500	4516	4508	4491	4500	4491	4516	0.6%	4501	4500	4500	4499	0.0%	yes			
CE165	4538	4538	4567	4549	4529	4537	4529	4567	0.9%	4537	4537	4538	4536	0.0%	yes			
CE170	2233	2232	2226	2237	2225	2232	2225	2237	0.5%	2232	2232	2233	2231	0.0%	yes			
CE180	4495	4495	4510	4535	4481	4495	4481	4535	1.2%	4495	4495	4494	4494	0.0%	yes			
CE185	4507	4535	4565	4583	4523	4535	4507	4583	1.7%	4535	4535	4534	4534	0.0%	yes			
CE190	578	577	573	579	574	577	573	579	1.0%	578	577	578	576	0.2%	yes			
CE195	602	601	595	602	598	601	595	602	1.1%	601	601	601	600	0.1%	yes			
CE200	5498	5436	5534	5522	5484	5498	5436	5534	1.8%	5498	5498	5498	5497	0.0%	yes			

Coil Load, Sensible (kWh,thermal)									Statistics, All Results									
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re	(Max-Min)			Analytical			Apache	Ap-An	Within			
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD	Min	Max	/Analytical	TUD	HTAL1	HTAL2						
CE100	3800	3800	3841	3794	3798	3800	3794	3841	1.3%	3800	3800	3800	3800	0.0%	yes			
CE110	3765	3766	3804	3756	3763	3765	3756	3804	1.3%	3765	3765	3765	3764	0.0%	yes			
CE120	3749	3749	3763	3739	3747	3748	3739	3763	0.6%	3749	3749	3749	3757	0.2%	yes			
CE130	219	219	216	215	217	219	215	220	2.1%	219	219	219	218	0.4%	yes			
CE140	198	198	196	195	196	198	195	199	2.0%	198	198	197	197	0.5%	yes			
CE150	3778	3778	3804	3786	3776	3778	3776	3804	0.7%	3778	3778	3779	3777	0.0%	yes			
CE160	3761	3761	3777	3769	3759	3761	3759	3777	0.5%	3761	3761	3761	3760	0.0%	yes			
CE165	3798	3798	3828	3809	3795	3798	3795	3828	0.9%	3798	3798	3799	3797	0.0%	yes			
CE170	1493	1493	1487	1498	1491	1492	1487	1498	0.7%	1493	1493	1493	1492	0.1%	yes			
CE180	1537	1538	1553	1607	1537	1538	1537	1607	4.5%	1538	1538	1538	1537	0.0%	yes			
CE185	1548	1578	1608	1653	1577	1578	1548	1653	6.6%	1578	1578	1578	1577	0.0%	yes			
CE190	208	208	203	212	206	208	203	212	4.4%	208	208	208	207	0.5%	yes			
CE195	232	232	226	235	230	231	226	235	4.1%	232	232	232	231	0.3%	yes			
CE200	4276	4215	4313	4303	4274	4277	4215	4313	2.3%	4277	4277	4277	4276	0.0%	yes			

Coil Load, Latent (kWh,thermal)									Statistics, All Results									
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re	(Max-Min)			Analytical			Apache	Ap-An	Within			
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD	Min	Max	/Analytical	TUD	HTAL1	HTAL2						
CE100	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					
CE120	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					
CE140	0	0	0	0	0	0	0	0		0	0	0	0					
CE150	739	739	739	742	733	739	733	742	1.2%	739	739	739	739	0.0%	yes			
CE160	740	739	739	739	732	739	732	740	1.1%	739	739	739	739	0.0%	yes			
CE165	740	739	739	740	733	739	733	740	1.0%	739	739	739	739	0.0%	yes			
CE170	740	739	739	739	734	739	734	740	0.9%	739	739	739	739	0.0%	yes			
CE180	2958	2957	2957	2928	2944	2957	2928	2958	1.0%	2957	2957	2956	2957	0.0%	yes			
CE185	2959	2957	2957	2930	2946	2957	2930	2959	1.0%	2958	2957	2956	2957	0.0%	yes			
CE190	370	370	370	366	368	370	366	370	1.0%	370	370	370	370	0.0%	yes			
CE195	370	370	370	367	368	370	367	370	0.9%	370	370	370	370	0.0%	yes			
CE200	1222	1221	1221	1219	1210	1221	1210	1222	1.0%	1221	1221	1221	1221	0.0%	yes			

Table 6.3 – Coil Loads: Total, Sensible, and Latent.

Sensible Coil - Zone Load, (Fan Heat) (kWh,thermal)								Statistics, All Results			Analytical					
	CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re	Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2	Apache	Ap-An /An	Within Range
	EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD									
CE100	144	144	187	139	144	144	142	139	187	33.6%	144	144	144	144	0.3%	yes
CE110	128	129	168	119	128	128	127	119	168	38.2%	128	128	128	128	0.2%	yes
CE120	117	117	133	108	116	117	115	108	133	21.8%	117	117	117	126	7.8%	yes
CE130	10	10	8	8	10	10	10	8	10	26.7%	10	10	10	10	1.0%	yes
CE140	8	8	7	6	8	8	8	6	8	25.0%	8	8	8	8	2.2%	yes
CE150	141	141	168	149	140	141	139	139	168	20.2%	141	141	142	141	0.1%	yes
CE160	129	129	147	137	129	129	128	128	147	14.3%	129	129	129	129	0.1%	yes
CE165	149	149	181	161	149	149	148	148	181	22.4%	149	149	150	150	0.1%	yes
CE170	73	73	69	79	73	73	73	69	79	14.2%	74	73	74	74	0.3%	yes
CE180	117	118	135	188	119	118	118	117	188	60.2%	118	119	118	119	0.4%	yes
CE185	109	139	171	215	140	139	139	109	215	76.6%	139	139	139	140	0.3%	yes
CE190	18	18	15	24	18	18	18	15	24	51.1%	18	18	18	18	0.3%	yes
CE195	23	23	18	28	23	23	23	18	28	40.7%	23	23	23	23	0.8%	yes
CE200	154	153	193	181	154	155	155	153	193	25.7%	154	155	155	155	0.0%	yes

Table 6.4 – Coil Loads: Total, Sensible, and Latent (continued).

Zone Loads: Total, Sensible, and Latent

Zone Load, Total (kWh,thermal)								Statistics, All Results			Analytical			Ap-An Within		
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max	(Max-Min)	TUD	HTAL1	HTAL2	Apache	/An	Range
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD				/Analytical						
CE100	3656	3656	3654	3655	3654	3656	3656	3654	3656	0.1%	3656	3656	3656	3655	0.0%	yes
CE110	3637	3637	3636	3637	3636	3637	3637	3636	3637	0.0%	3637	3637	3637	3636	0.0%	yes
CE120	3632	3632	3630	3632	3631	3632	3631	3630	3632	0.0%	3632	3632	3632	3631	0.0%	yes
CE130	209	209	207	208	207	209	209	207	209	1.3%	209	209	209	208	0.5%	yes
CE140	190	190	189	188	188	190	190	188	190	1.1%	190	190	190	189	0.6%	yes
CE150	4376	4376	4375	4376	4375	4376	4376	4375	4376	0.0%	4376	4376	4376	4375	0.0%	yes
CE160	4371	4371	4370	4371	4370	4371	4371	4370	4371	0.0%	4371	4371	4371	4370	0.0%	yes
CE165	4388	4388	4386	4387	4386	4388	4387	4386	4388	0.0%	4388	4388	4388	4387	0.0%	yes
CE170	2159	2159	2157	2158	2157	2159	2159	2157	2159	0.1%	2159	2159	2159	2158	0.1%	yes
CE180	4376	4376	4375	4376	4375	4376	4376	4375	4376	0.0%	4376	4376	4376	4375	0.0%	yes
CE185	4396	4396	4394	4395	4393	4395	4395	4393	4396	0.1%	4396	4396	4396	4395	0.0%	yes
CE190	557	559	558	558	558	559	559	557	559	0.4%	559	559	559	558	0.2%	yes
CE195	576	579	577	577	576	578	579	576	579	0.5%	579	579	579	578	0.2%	yes
CE200	5343	5283	5342	5343	5342	5343	5343	5283	5343	1.1%	5343	5343	5343	5342	0.0%	yes
Zone Load, Sensible (kWh,thermal)								Statistics, All Results			Analytical			Ap-An Within		
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max	(Max-Min)	TUD	HTAL1	HTAL2	Apache	/An	Range
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD				/Analytical						
CE100	3656	3656	3654	3655	3654	3656	3656	3654	3656	0.1%	3656	3656	3656	3655	0.0%	yes
CE110	3637	3637	3636	3637	3636	3637	3637	3636	3637	0.0%	3637	3637	3637	3636	0.0%	yes
CE120	3632	3632	3630	3632	3631	3632	3631	3630	3632	0.0%	3632	3632	3632	3631	0.0%	yes
CE130	209	209	207	208	207	209	209	207	209	1.3%	209	209	209	208	0.5%	yes
CE140	190	190	189	188	188	190	190	188	190	1.1%	190	190	190	189	0.6%	yes
CE150	3637	3637	3636	3637	3636	3637	3636	3636	3637	0.0%	3637	3637	3637	3636	0.0%	yes
CE160	3632	3632	3630	3632	3631	3632	3631	3630	3632	0.0%	3632	3632	3632	3631	0.0%	yes
CE165	3649	3649	3647	3648	3647	3649	3648	3647	3649	0.1%	3649	3649	3649	3648	0.0%	yes
CE170	1420	1420	1418	1419	1418	1419	1419	1418	1420	0.1%	1420	1420	1420	1418	0.1%	yes
CE180	1420	1420	1418	1419	1418	1419	1419	1418	1420	0.1%	1420	1420	1420	1418	0.1%	yes
CE185	1439	1439	1437	1437	1437	1438	1438	1437	1439	0.2%	1439	1439	1439	1438	0.1%	yes
CE190	190	190	188	188	188	190	190	188	190	1.0%	190	190	190	189	0.6%	yes
CE195	209	209	207	208	207	209	209	207	209	1.1%	209	209	209	208	0.5%	yes
CE200	4122	4062	4121	4122	4121	4122	4122	4062	4122	1.5%	4122	4122	4122	4121	0.0%	yes
Zone Load, Latent (kWh,thermal)								Statistics, All Results			Analytical			Ap-An Within		
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max	(Max-Min)	TUD	HTAL1	HTAL2	Apache	/An	Range
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD				/Analytical						
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	739	0.0%	yes
CE160	739	739	739	739	739	739	739	739	739	0.1%	739	739	739	739	0.0%	yes
CE165	739	739	739	739	739	739	739	739	739	0.1%	739	739	739	739	0.0%	yes
CE170	739	739	739	739	739	739	739	739	739	0.1%	739	739	739	739	0.0%	yes
CE180	2957	2957	2957	2958	2957	2957	2957	2957	2958	0.0%	2957	2957	2957	2957	0.0%	yes
CE185	2957	2957	2957	2958	2957	2957	2957	2957	2958	0.0%	2957	2957	2957	2957	0.0%	yes
CE190	367	370	370	370	370	370	370	367	370	0.8%	370	370	370	370	0.0%	yes
CE195	367	370	370	370	370	370	370	367	370	0.8%	370	370	370	370	0.0%	yes
CE200	1221	1221	1221	1221	1221	1221	1221	1221	1221	0.0%	1221	1221	1221	1221	0.0%	yes

Table 6.5 – Zone Loads: Total, Sensible, and Latent.

Latent Coil - Zone Load, (Should be 0) (kWh,thermal)								Statistics, All Results			Analytical			[Ap-An]		Within Range
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max	(Max-Min)	TUD	HTAL1	HTAL2	Apache	/An	
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD				/Analytical						
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	0		
CE185	2	0	0	-28	-11	0	0	-28	2		1	0	-1	0		
CE190	3	0	0	-3	-2	0	0	-3	3		0	0	0	0		
CE195	3	0	0	-3	-1	0	0	-3	3		0	0	0	0		
CE200	1	0	0	-2	-11	0	0	-11	1		0	0	0	0		

Table 6.6 – Zone Loads: Total, Sensible, and Latent (continued).

Sensitivities for Space Cooling Electricity Consumption

Delta Q _{tot} (kWh,e)								Statistics, All Results			Analytical			Apache		
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max		TUD	HTAL1	HTAL2	Apache	[Ap-An]	Within
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD									/[An]	Range
CE110-CE100	-454	-441	-460	-454	-451	-455	-450	-460	-441	4.1%	-454	-454	-453	-455	0.3%	yes
CE120-CE110	-65	-77	-50	-62	-63	-60	-60	-77	-50	42.3%	-64	-66	-66	-56	14.4%	yes
CE120-CE100	-519	-518	-510	-516	-514	-515	-510	-519	-510	1.8%	-518	-520	-520	-511	1.6%	yes
CE130-CE100	-1421	-1421	-1415	-1413	-1411	-1414	-1402	-1421	-1402	1.4%	-1420	-1421	-1421	-1424	0.2%	yes
CE140-CE130	-42	-40	-40	-40	-41	-41	-41	-42	-40	4.8%	-42	-41	-41	-42	0.9%	yes
CE140-CE110	-1009	-1020	-996	-999	-1001	-999	-993	-1020	-993	2.6%	-1007	-1009	-1009	-1011	0.2%	yes
CE150-CE110	131	118	141	118	128	132	130	118	141	17.8%	130	129	129	128	1.5%	yes
CE160-CE150	-68	-68	-65	-76	-65	-62	-59	-76	-59	26.1%	-66	-67	-68	-68	1.1%	yes
CE165-CE160	362	362	362	363	359	363	357	357	363	1.7%	357	360	361	363	1.1%	yes
CE170-CE150	-570	-569	-573	-563	-562	-563	-556	-573	-556	3.1%	-565	-569	-569	-567	0.2%	yes
CE180-CE150	-125	-125	-125	-103	-115	-118	-112	-125	-103	18.0%	-124	-124	-125	-124	0.3%	yes
CE180-CE170	445	444	448	460	447	445	444	444	460	3.6%	442	445	444	443	0.1%	yes
CE185-CE180	461	461	464	467	458	460	458	458	467	1.9%	462	461	461	461	0.0%	yes
CE190-CE180	-919	-918	-917	-920	-918	-917	-915	-920	-915	0.6%	-917	-918	-918	-918	0.1%	yes
CE190-CE140	96	95	95	94	96	96	96	94	96	2.6%	96	96	96	96	0.2%	yes
CE195-CE190	86	86	85	86	86	86	86	85	86	2.0%	87	86	86	87	0.9%	yes
CE195-CE185	-1294	-1293	-1296	-1301	-1290	-1292	-1287	-1301	-1287	1.1%	-1292	-1293	-1293	-1293	0.0%	yes
CE195-CE130	140	141	140	140	142	141	141	140	142	1.5%	142	141	141	142	0.5%	yes
CE200-CE100	-54	-66	-53	-79	-55	-42	-32	-79	-32	86.0%	-55	-53	-54	-58	7.1%	yes
Del Q _{comp} (kWh,e)								Statistics, All Results			Analytical			Apache		
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max		TUD	HTAL1	HTAL2	Apache	[Ap-An]	Within
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD									/[An]	Range
CE110-CE100	-430	-419	-442	-428	-432	-427	-427	-442	-419	5.2%	-431	-430	-430	-431	0.3%	yes
CE120-CE110	-49	-59	-16	-45	-43	-44	-44	-59	-16	91.8%	-47	-50	-50	-42	14.1%	yes
CE120-CE100	-479	-478	-457	-473	-475	-471	-471	-479	-457	4.5%	-478	-480	-480	-474	1.2%	yes
CE130-CE100	-1224	-1224	-1214	-1218	-1218	-1208	-1208	-1224	-1208	1.3%	-1224	-1225	-1225	-1227	0.2%	yes
CE140-CE130	-38	-37	-38	-37	-38	-38	-38	-38	-37	3.6%	-38	-38	-38	-38	0.8%	yes
CE140-CE110	-832	-842	-811	-827	-823	-819	-819	-842	-811	3.7%	-831	-833	-833	-834	0.2%	yes
CE150-CE110	111	100	141	99	113	111	111	99	141	38.0%	111	110	110	109	1.5%	yes
CE160-CE150	-50	-50	-44	-56	-45	-42	-42	-56	-42	28.0%	-49	-50	-50	-50	1.2%	yes
CE165-CE160	333	332	329	330	333	328	328	328	333	1.6%	328	331	331	334	1.0%	yes
CE170-CE150	-469	-469	-468	-459	-464	-458	-458	-469	-458	2.3%	-466	-469	-469	-467	0.2%	yes
CE180-CE150	-91	-91	-93	-70	-85	-80	-80	-93	-70	25.1%	-91	-91	-92	-91	0.3%	yes
CE180-CE170	378	378	375	389	379	378	378	375	389	3.7%	375	378	378	376	0.1%	yes
CE185-CE180	431	431	428	432	430	428	428	428	432	0.9%	432	431	431	431	0.0%	yes
CE190-CE180	-771	-770	-775	-774	-770	-768	-768	-775	-768	0.9%	-770	-770	-770	-770	0.1%	yes
CE190-CE140	81	81	85	82	82	82	82	81	85	4.4%	82	81	81	81	0.2%	yes
CE195-CE190	79	79	79	79	79	80	80	79	80	0.8%	80	79	79	80	0.9%	no
CE195-CE185	-1123	-1122	-1124	-1127	-1120	-1116	-1116	-1127	-1116	1.0%	-1121	-1122	-1121	-1121	0.0%	yes
CE195-CE130	122	123	126	124	123	123	123	122	126	3.0%	123	122	123	123	0.4%	yes
CE200-CE100	-69	-79	-58	-93	-58	-50	-50	-93	-50	61.6%	-70	-69	-69	-72	4.6%	yes
Del Q _{IDfan} (kWh,e)								Statistics, All Results			Analytical			Apache		
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max		TUD	HTAL1	HTAL2	Apache	[Ap-An]	Within
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD									/[An]	Range
CE110-CE100	-16	-15	-12	-19	-16	-16	-16	-19	-12	42.3%	-16	-16	-16	-16	0.3%	yes
CE120-CE110	-11	-12	-23	-12	-11	-11	-11	-23	-11	110.0%	-11	-11	-11	-9	15.4%	yes
CE120-CE100	-27	-12	-36	-31	-27	-27	-27	-36	-27	32.2%	-27	-27	-27	-25	6.1%	yes
CE130-CE100	-134	-134	-137	-133	-133	-133	-132	-137	-132	3.7%	-134	-134	-134	-134	0.3%	yes
CE140-CE130	-2	-2	-1	-2	-2	-2	-2	-2	-1	36.8%	-2	-2	-2	-2	0.9%	yes
CE140-CE110	-120	-121	-126	-116	-119	-120	-118	-126	-116	8.3%	-120	-120	-120	-120	0.3%	yes
CE150-CE110	13	12	0	14	13	13	13	0	14	107.0%	13	13	13	13	1.9%	yes
CE160-CE150	-12	-12	-14	-15	-12	-12	-11	-15	-11	32.6%	-12	-12	-12	-12	0.5%	yes
CE165-CE160	20	21	23	24	20	20	20	20	24	21.8%	20	20	20	20	1.4%	yes
CE170-CE150	-68	-68	-72	-73	-67	-68	-66	-73	-66	9.7%	-68	-68	-68	-68	0.2%	yes
CE180-CE150	-23	-22	-22	-24	-22	-22	-21	-24	-21	12.1%	-22	-23	-23	-22	0.2%	yes
CE180-CE170	45	46	49	49	45	45	45	45	49	9.9%	45	45	45	45	0.3%	yes
CE185-CE180	21	20	24	25	21	21	21	20	25	24.3%	21	21	21	21	0.2%	yes
CE190-CE180	-100	-101	-97	-98	-100	-100	-100	-101	-97	4.3%	-101	-101	-101	-101	0.1%	yes
CE190-CE140	10	10	7	8	10	10	10	7	10	28.1%	10	10	10	10	0.4%	yes
CE195-CE190	5	5	4	4	5	5	5	4	5	30.6%	5	5	5	5	1.3%	yes
CE195-CE185	-116	-116	-117	-119	-116	-117	-116	-119	-116	2.6%	-117	-117	-117	-117	0.0%	yes
CE195-CE130	13	13	9	10	12	12	12	9	13	28.9%	12	12	12	12	0.6%	yes
CE200-CE100	10	9	4	10	10	11	12	4	12	79.1%	10	11	11	10	4.6%	yes
Del Q _{ODfan} (kWh,e)								Statistics, All Results			Analytical			Apache		
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max		TUD	HTAL1	HTAL2	Apache	[Ap-An]	Within
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD									/[An]	Range
CE110-CE100	-8	-7	-6	-7	-7	-7	-7	-8	-6	29.9%	-7	-7	-7	-8	1.1%	yes
CE120-CE110	-5	-6	-11	-5	-5	-5	-5	-11	-5	113.1%	-5	-5	-5	-4	15.7%	yes
CE120-CE100	-13	-13	-17	-12	-13	-13	-13	-17	-12	37.0%	-13	-13	-13	-12	5.8%	yes
CE130-CE100	-63	-63	-64	-62	-63	-62	-62	-64	-62	3.7%	-63	-63	-63	-63	0.3%	yes
CE140-CE130	-1	-1	-1	-1	-1	-1	-1	-1	-1	36.8%	-1	-1	-1	-1	3.1%	yes
CE140-CE110	-56	-57	-59	-56	-56	-56	-56	-59	-56	6.3%	-56	-56	-56	-56	0.2%	yes
CE150-CE110	6	5	0	5	6	6	6	0	6	100.8%	6	6	6	6	1.4%	yes
CE160-CE150	-5	-5	-7	-5	-6	-5	-5	-7	-5	27.0%	-6	-6	-6	-6	0.9%	yes
CE165-CE160	9	9	11	9	10	9	9	9	11	17.5%	9	9	9	10	1.7%	yes
CE170-CE150	-32	-32	-34	-31	-32	-31	-31	-34	-31	8.2%	-32	-32	-32	-32	0.2%	yes
CE180-CE150	-10	-10	-10	-9	-11	-10	-10	-11	-9	14.3%	-11	-11	-11	-11	0.0%	yes
CE180-CE170	22	22	23	22	21	21	21	21	23	9.6%	21	21	21	21	0.3%	yes
CE185-CE180	9	9	11	10	10	10	10	9	11	24.6%	10	10	10	10	0.3%	yes
CE190-CE180	-48	-47	-45	-48	-47	-47	-47	-48	-45	5.5%	-47	-47	-47	-47	0.1%	yes
CE190-CE140	4	5	3	4	5	5	5	3	5	34.6%	5	5	5	5	0.4%	yes
CE195-CE190	3	2	2	3	2	2	2	2	3	60.5%	2	2	2	2	3.2%	yes
CE195-CE185	-54	-54	-55	-55	-55	-54	-54	-55	-54	2.0%	-55	-55	-55	-55	0.0%	yes
CE195-CE130	6	6	4	6	6	6	6	4	6	27.1%	6	6	6	6	0.3%	yes
CE200-CE100	5	4	2	4	5	6	6	2	6	79.1%	5	5	5	5	5.2%	yes

Table 6.7 – Sensitivities for Space Cooling Electricity Consumption.

Sensitivities for COP and Coil Loads

Delta COP (kWh,t)									Statistics, All Results			Analytical			[Ap-An] /[An]			Within Range
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD	Min	Max	TUD	HTAL1	HTAL2	Apache	[Ap-An] /[An]	Within Range				
CE110-CE100	0.99	0.95	1.03	1.01	1.00	1.01	0.95	1.03	7.6%	0.99	0.99	0.99	0.99	0.4%	yes			
CE120-CE110	0.21	0.25	0.16	0.21	0.21	0.20	0.16	0.25	44.9%	0.21	0.21	0.21	0.19	11.2%	yes			
CE120-CE100	1.20	1.20	1.18	1.22	1.20	1.20	1.18	1.22	2.8%	1.20	1.20	1.20	1.17	2.3%	yes			
CE130-CE100	-0.48	-0.48	-0.46	-0.45	-0.50	-0.48	-0.50	-0.45	9.8%	-0.50	-0.48	-0.48	-0.50	2.6%	yes			
CE140-CE130	0.86	0.83	0.94	0.90	0.87	0.88	0.83	0.94	13.3%	0.86	0.86	0.86	0.86	0.3%	yes			
CE140-CE110	-0.61	-0.61	-0.54	-0.56	-0.63	-0.61	-0.63	-0.54	13.6%	-0.63	-0.61	-0.61	-0.63	1.8%	yes			
CE150-CE110	0.24	0.29	0.21	0.29	0.25	0.24	0.21	0.29	32.0%	0.25	0.25	0.25	0.26	2.8%	yes			
CE160-CE150	0.22	0.21	0.20	0.25	0.21	0.20	0.19	0.25	30.9%	0.21	0.21	0.21	0.21	1.0%	yes			
CE165-CE160	-0.92	-0.92	-0.91	-0.96	-0.92	-0.92	-0.96	-0.91	5.6%	-0.90	-0.91	-0.91	-0.92	0.9%	yes			
CE170-CE150	-0.24	-0.24	-0.23	-0.22	-0.26	-0.26	-0.27	-0.22	18.1%	-0.26	-0.24	-0.24	-0.26	3.7%	yes			
CE180-CE150	0.42	0.41	0.42	0.33	0.39	0.40	0.38	0.42	22.6%	0.42	0.41	0.41	0.41	0.7%	yes			
CE180-CE170	0.66	0.65	0.64	0.55	0.65	0.65	0.55	0.66	16.4%	0.68	0.65	0.65	0.67	1.8%	yes			
CE185-CE180	-1.19	-1.19	-1.21	-1.20	-1.19	-1.20	-1.21	-1.19	1.7%	-1.20	-1.19	-1.19	-1.19	0.1%	yes			
CE190-CE180	-0.63	-0.63	-0.60	-0.57	-0.65	-0.64	-0.65	-0.57	12.4%	-0.66	-0.63	-0.63	-0.65	2.4%	yes			
CE190-CE140	0.64	0.68	0.57	0.60	0.62	0.61	0.57	0.68	16.4%	0.64	0.64	0.64	0.64	0.8%	yes			
CE195-CE190	-1.10	-1.10	-1.13	-1.12	-1.09	-1.09	-1.13	-1.09	3.3%	-1.09	-1.10	-1.10	-1.09	0.5%	yes			
CE195-CE185	-0.54	-0.54	-0.51	-0.49	-0.55	-0.54	-0.55	-0.49	12.0%	-0.55	-0.54	-0.54	-0.55	1.6%	yes			
CE195-CE130	0.40	0.40	0.38	0.38	0.40	0.40	0.38	0.40	4.2%	0.40	0.40	0.40	0.41	1.9%	yes			
CE200-CE100	1.23	1.22	1.24	1.30	1.24	1.21	1.19	1.30	8.9%	1.23	1.23	1.23	1.24	0.4%	yes			
Del Q coil,t (kWh,t)									Statistics, All Results			Analytical			[Ap-An] /[An]			Within Range
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD	Min	Max	TUD	HTAL1	HTAL2	Apache	[Ap-An] /[An]	Within Range				
CE110-CE100	-35	-34	-38	-38	-35	-35	-38	-34	12.5%	-35	-35	-35	-35	0.8%	yes			
CE120-CE110	-16	-17	-40	-16	-16	-16	-40	-16	147.5%	-16	-16	-17	-8	52.4%	yes			
CE120-CE100	-51	-51	-78	-55	-51	-51	-78	-51	52.9%	-51	-52	-52	-43	16.1%	yes			
CE130-CE100	-3581	-3581	-3626	-3579	-3581	-3581	-3626	-3578	1.3%	-3581	-3581	-3581	-3581	0.0%	yes			
CE140-CE130	-21	-21	-20	-21	-21	-21	-21	-20	5.0%	-21	-21	-22	-22	0.1%	yes			
CE140-CE110	-3567	-3568	-3608	-3561	-3567	-3567	-3608	-3561	1.3%	-3567	-3567	-3568	-3568	0.0%	yes			
CE150-CE110	752	751	739	772	746	752	739	772	4.4%	752	752	753	752	0.1%	yes			
CE160-CE150	-16	-17	-26	-19	-18	-17	-26	-16	61.3%	-17	-17	-18	-17	2.1%	yes			
CE165-CE160	37	38	51	40	38	37	36	51	40.8%	36	37	38	37	0.1%	yes			
CE170-CE150	-2284	-2285	-2317	-2291	-2284	-2285	-2317	-2283	1.5%	-2285	-2286	-2286	-2285	0.0%	yes			
CE180-CE150	-22	-22	-33	7	-28	-22	-33	7	178.9%	-22	-23	-25	-22	2.7%	yes			
CE180-CE170	2262	2263	2284	2298	2256	2263	2256	2298	1.8%	2263	2263	2261	2263	0.0%	yes			
CE185-CE180	12	40	55	48	41	40	12	55	107.7%	40	40	40	40	0.2%	yes			
CE190-CE180	-3917	-3918	-3937	-3956	-3907	-3917	-3956	-3907	1.3%	-3918	-3918	-3916	-3918	0.0%	yes			
CE190-CE140	380	379	377	384	378	380	377	384	1.8%	380	379	380	380	0.1%	yes			
CE195-CE190	24	24	23	23	23	24	23	24	5.7%	24	24	24	24	1.3%	yes			
CE195-CE185	-3905	-3934	-3970	-3981	-3925	-3934	-3981	-3905	1.9%	-3934	-3934	-3933	-3934	0.0%	yes			
CE195-CE130	383	382	379	387	381	382	379	387	1.9%	382	382	382	382	0.0%	yes			
CE200-CE100	1698	1636	1693	1728	1687	1698	1636	1728	5.4%	1697	1697	1697	1697	0.0%	yes			
Del Q coil,s (kWh,t)									Statistics, All Results			Analytical			[Ap-An] /[An]			Within Range
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD	Min	Max	TUD	HTAL1	HTAL2	Apache	[Ap-An] /[An]	Within Range				
CE110-CE100	-35	-34	-38	-38	-35	-35	-38	-34	12.5%	-35	-35	-35	-35	0.8%	yes			
CE120-CE110	-16	-17	-40	-16	-16	-16	-40	-16	147.5%	-16	-16	-17	-8	52.4%	yes			
CE120-CE100	-51	-51	-78	-55	-51	-51	-78	-51	52.9%	-51	-52	-52	-43	16.1%	yes			
CE130-CE100	-3581	-3581	-3626	-3579	-3581	-3581	-3626	-3578	1.3%	-3581	-3581	-3581	-3581	0.0%	yes			
CE140-CE130	-21	-21	-20	-21	-21	-21	-21	-20	5.0%	-21	-21	-22	-22	0.1%	yes			
CE140-CE110	-3567	-3568	-3608	-3561	-3567	-3567	-3608	-3561	1.3%	-3567	-3567	-3568	-3568	0.0%	yes			
CE150-CE110	13	12	0	30	13	13	0	30	232.9%	13	13	14	13	3.1%	yes			
CE160-CE150	-17	-17	-26	-17	-17	-17	-26	-16	60.3%	-17	-17	-18	-17	1.8%	yes			
CE165-CE160	37	37	51	40	36	37	36	51	40.8%	36	37	38	37	0.1%	yes			
CE170-CE150	-2285	-2285	-2317	-2288	-2285	-2285	-2317	-2283	1.5%	-2285	-2286	-2286	-2285	0.0%	yes			
CE180-CE150	-2241	-2240	-2250	-2179	-2239	-2240	-2250	-2179	3.2%	-2241	-2240	-2241	-2240	0.0%	yes			
CE180-CE170	44	45	66	109	46	45	44	109	145.3%	45	45	45	45	0.6%	yes			
CE185-CE180	11	40	55	46	39	40	11	55	110.3%	40	40	40	40	0.3%	yes			
CE190-CE180	-1329	-1330	-1350	-1394	-1331	-1330	-1394	-1329	4.9%	-1330	-1330	-1330	-1330	0.0%	yes			
CE190-CE140	10	10	7	18	10	10	7	18	102.7%	10	10	11	10	1.3%	yes			
CE195-CE190	24	24	23	23	23	24	23	24	5.7%	24	24	24	24	1.0%	yes			
CE195-CE185	-1316	-1346	-1382	-1418	-1347	-1346	-1418	-1316	7.6%	-1346	-1347	-1346	-1346	0.0%	yes			
CE195-CE130	13	13	10	20	13	12	10	20	81.9%	12	12	12	12	0.8%	yes			
CE200-CE100	476	415	472	509	477	477	415	509	19.7%	476	476	476	476	0.1%	yes			
Del Qcoil,lat (kWh,t)									Statistics, All Results			Analytical			[Ap-An] /[An]			Within Range
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD	Min	Max	TUD	HTAL1	HTAL2	Apache	[Ap-An] /[An]	Within Range				
CE110-CE100	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					
CE120-CE100	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					
CE140-CE130	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					
CE150-CE110	739	739	739	742	733	739	733	742	1.2%	739	739	739	739	0.0%	yes			
CE160-CE150	1	0	0	-2	-1	0	-2	1		0	0	0	0					
CE165-CE160	0	0	0	1	1	0	0	1		0	0	0	0					
CE170-CE150	1	0	0	-3	1	0	-3	1		0	0	0	0					
CE180-CE150	2219	2218	2218	2186	2211	2218	2186	2219	1.5%	2218	2218	2217	2218	0.0%	yes			
CE180-CE170	2218	2218	2218	2189	2210	2218	2189	2218	1.3%	2218	2218	2217	2218	0.0%	yes			
CE185-CE180	1	0	0	2	2	0	0	2		0	0	0	0					
CE190-CE180	-2588	-2587	-2587	-2562	-2576	-2587	-2588	-2562	1.0%	-2588	-2587	-2586	-2587	0.0%	yes			
CE190-CE140	370	370	370	366	368	370	366	370	1.0%	370	370	370	370	0.0%	yes			
CE195-CE190	0	0	0	0	0	0	0	0		0	0	0	0					
CE195-CE185	-2589	-258																

Indoor Drybulb Temperature: Mean and (Max-Min)/Mean

Mean IDB (°C)								Statistics, All Results			Analytical					
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2	Apache	Ap-An /An	Within Range
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD										
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	0.0%	yes
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	26.7	0.0%	yes
(Max - Min)/Mean IDB (°C)								Statistics, All Results			Analytical					
CA-SIS	CLM2000	DOE21E	DOE21E	E+	TRN-id	TRN-re		Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2	Apache	Ap-An /An	Within Range
EDF	EDF	CIEMAT	NREL	GARD	TUD	TUD										
CE100	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.000	0.049		0.000	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	0.000	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	0.000	0.002	0.003		
CE130	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.056		0.000	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	0.000	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	0.000	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	0.000	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	0.000	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	0.000	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	0.000	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	0.000	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	0.000	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	0.000	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	0.000	0.000		

Table 6.9 – Indoor Drybulb Temperature: Mean and (Max-Min)/Mean.

Humidity Ratio: Mean and (Max-Min)/Mean

Mean Humidity Ratio								Statistics, All Results			Analytical					
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD		Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2	Apache	Ap-An /An	Within Range
CE100	0.0075	0.0069	0.0076	0.0074	0.0075	0.0075	0.0075	0.0069	0.0076	9.3%	0.0074	0.0073	0.0073	0.0073	1.6%	yes
CE110	0.0066	0.0069	0.0070	0.0064	0.0066	0.0066	0.0066	0.0064	0.0070	9.7%	0.0065	0.0064	0.0064	0.0063	2.4%	yes
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	0.0071	9.3%	yes
CE130	0.0075	0.0069	0.0076	0.0073	0.0075	0.0075	0.0075	0.0069	0.0076	9.3%	0.0074	0.0073	0.0073	0.0073	1.5%	yes
CE140	0.0065	0.0069	0.0071	0.0064	0.0066	0.0066	0.0066	0.0064	0.0071	10.1%	0.0065	0.0064	0.0064	0.0063	2.1%	yes
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	0.0082	0.6%	yes
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	0.0100	0.2%	yes
CE165	0.0093	0.0099	0.0090	0.0092	0.0094	0.0093	0.0095	0.0090	0.0099	9.1%	0.0093	0.0092	0.0092	0.0092	0.5%	yes
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	0.0104	0.2%	yes
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	0.8%	yes
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	0.6%	yes
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	0.0157	0.8%	yes
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	0.0153	0.8%	yes
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	0.4%	yes
(Max - Min)/Mean Humidity Ratio								Statistics, All Results			Analytical					
CA-SIS EDF	CLM2000 EDF	DOE21E CIEMAT	DOE21E NREL	E+ GARD	TRN-id TUD	TRN-re TUD		Min	Max	(Max-Min) /Analytical	TUD	HTAL1	HTAL2	Apache	Ap-An /An	Within Range
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	0.002		
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	0.002		
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	0.002		
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	0.003		
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	0.003		
CE150	0.012	0.000	0.000	0.000	0.013	0.000	0.013	0.0000	0.0132		0.000	0.000	0.000	0.017		
CE160	0.020	0.000	0.010	0.010	0.013	0.000	0.011	0.0000	0.0196		0.000	0.000	0.000	0.017		
CE165	0.011	0.001	0.011	0.000	0.013	0.000	0.013	0.0000	0.0131		0.000	0.000	0.000	0.017		
CE170	0.000	0.000	0.010	0.000	0.011	0.000	0.024	0.0000	0.0238		0.000	0.000	0.001	0.015		
CE180	0.018	0.000	0.012	0.012	0.010	0.000	0.040	0.0000	0.0402		0.000	0.000	0.001	0.013		
CE185	0.012	0.006	0.018	0.012	0.011	0.000	0.025	0.0000	0.0246		0.000	0.000	0.001	0.013		
CE190	0.000	0.000	0.018	0.019	0.014	0.000	0.031	0.0000	0.0312		0.000	0.000	0.001	0.013		
CE195	0.000	0.006	0.019	0.019	0.014	0.000	0.024	0.0000	0.0241		0.000	0.000	0.001	0.014		
CE200	0.018	0.000	0.009	0.009	0.013	0.000	0.000	0.0000	0.0175		0.000	0.000	0.000	0.017		

Table 6.10 – Humidity Ratio: Mean and (Max-Min)/Mean.

6.2 Comparative Test Results - CE300 to CE545

Space Cooling Electricity Consumption

Energy Consumption, Total (kWh,e)							Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range
CE300	35634	34750	34755	34746	34976	35070	34746	35634	2.5%	35317	0.9%	yes
CE310	39973	39379	39384	39290	39520	39608	39290	39973	1.7%	39722	0.5%	yes
CE320	40060	38745	38792	39079	39401	39457	38745	40060	3.3%	39636	1.0%	yes
CE330	40963	39708	39438	40143	40535	40330	39438	40963	3.8%	40486	0.7%	yes
CE340	40619	39358	39265	39783	40065	39947	39265	40619	3.4%	40150	0.8%	yes
CE350	32237	30547	30548	31145	31587	31742	30547	32237	5.4%	31789	1.6%	yes
CE360	55299	54064	54016	54705	54843	55068	54016	55299	2.3%	55176	0.9%	yes
CE400	32045	30846	30876	31013		31413	30846	32045	3.8%	31376	0.4%	yes
CE410	32078	31668	31699			31503	31503	32078	1.8%	32057	1.0%	yes
CE420	33387	32530	32910	32736		33208	32530	33387	2.6%	33030	0.2%	yes
CE430	32538	31932	31811	31772		31818	31772	32538	2.4%	32248	0.9%	yes
CE440	33691	33032	32973	33032		33248	32973	33691	2.2%	33267	0.2%	yes
CE500	22338	22817	22822	23035	22323	23138	22323	23138	3.6%	23249	2.2%	yes
CE500 May-Sep	17391	17872	17870	17996	17435	18051	17391	18051	3.7%	18169	2.3%	yes
CE510 May-Sep	34609	35971	35970	35732	34849	35845	34609	35971	3.8%	35823	0.9%	yes
CE520	24987	25389	25390	25017	25131	25781	24987	25781	3.1%	26230	3.7%	no
CE522	23544	24293	24307	24078	23620	24360	23544	24360	3.4%	24635	2.5%	yes
CE525	20321	20408	20421	20702	20242	21323	20242	21323	5.3%	20991	2.0%	yes
CE530	17281	17540	17537	17742	17442	17875	17281	17875	3.4%	18482	5.2%	no
CE540	19430	19878	19874	19061	19537	20164	19061	20164	5.6%	20977	6.7%	no
CE545	15687	15802	15791	16636	15791	16339	15687	16636	5.9%	17264	7.9%	no

Energy Consumption, Compressor (kWh,e)							Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range
CE300	22354	21569	21573		21770	21876	21569	22354	3.6%	22091	1.2%	yes
CE310	26340	25813	25817		25937	26053	25813	26340	2.0%	26137	0.6%	yes
CE320	26433	25250	25294		25846	25912	25250	26433	4.6%	26075	1.3%	yes
CE330	27300	26172	25925		26928	26775	25925	27300	5.2%	26896	1.0%	yes
CE340	26963	25829	25745		26473	26400	25745	26963	4.6%	26565	1.1%	yes
CE350	19317	17802	17801		18738	18891	17801	19317	8.2%	18932	2.3%	yes
CE360	40106	38999	38955		39697	39941	38955	40106	2.9%	40011	1.2%	yes
CE400	19179	18106	18131			18629	18106	19179	5.8%	18602	0.5%	yes
CE410	19204	18823	18850			18685	18685	19204	2.8%	19188	1.6%	yes
CE420	20359	19596	19934			20214	19596	20359	3.8%	20060	0.2%	yes
CE430	19599	19059	18951			18966	18951	19599	3.4%	19359	1.1%	yes
CE440	20629	20042	19989			20249	19989	20629	3.2%	20270	0.2%	yes
CE500	17854	18473	18478		17858	18522	17854	18522	3.7%	18594	2.0%	yes
CE500 May-Sep	13942	14508	14506		13989	14491	13942	14508	4.0%	14576	2.0%	yes
CE510 May-Sep	27748	28811	28810		27902	28721	27748	28811	3.7%	28713	1.1%	yes
CE520	19521	20121	20126		19655	20185	19521	20185	3.3%	20515	3.0%	yes
CE522	18620	19407	19418		18690	19281	18620	19418	4.2%	19487	2.1%	yes
CE525	16558	16880	16893		16507	17443	16507	17443	5.6%	17106	1.5%	yes
CE530	13657	14127	14124		13856	14172	13657	14172	3.7%	14582	4.3%	no
CE540	15021	15680	15677		15164	15664	15021	15680	4.3%	16205	5.0%	no
CE545	12622	12967	12957		12751	13215	12622	13215	4.6%	13784	6.8%	no

Table 6.11 – Space Cooling Electricity Consumption.

Space Cooling Electricity Consumption

Energy Consumption, Supply Fan (kWh,e)							Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE300	10880	10880	10880	10862	10880	10880	10862	10880	0.2%	10864	0.1%	yes
CE310	10880	10880	10880	10862	10880	10880	10862	10880	0.2%	10864	0.1%	yes
CE320	10880	10880	10880	10862	10880	10880	10862	10880	0.2%	10864	0.1%	yes
CE330	10880	10880	10880	10862	10880	10880	10862	10880	0.2%	10864	0.1%	yes
CE340	10880	10880	10880	10862	10880	10880	10862	10880	0.2%	10864	0.1%	yes
CE350	10880	10880	10880	10862	10880	10880	10862	10880	0.2%	10864	0.1%	yes
CE360	10880	10880	10880	10862	10880	10880	10862	10880	0.2%	10864	0.1%	yes
CE400	10880	10880	10880	10862		10880	10862	10880	0.2%	10864	0.1%	yes
CE410	10880	10880	10880			10880	10880	10880	0.0%	10864	0.1%	no
CE420	10880	10880	10880	10862		10880	10862	10880	0.2%	10864	0.1%	yes
CE430	10880	10880	10880	10862		10880	10862	10880	0.2%	10864	0.1%	yes
CE440	10880	10880	10880	10862		10880	10862	10880	0.2%	10864	0.1%	yes
CE500	2564	2369	2369	2628	2553	2639	2369	2639	10.7%	2660	5.5%	yes
CE500 May-Sep	1972	1837	1837	2029	1970	2035	1837	2035	10.2%	2053	5.5%	yes
CE510 May-Sep	3923	4099	4099	4063	3972	4073	3923	4099	4.4%	4063	0.6%	yes
CE520	3125	2874	2871	3019	3131	3200	2871	3200	10.8%	3266	7.6%	yes
CE522	2816	2704	2707	2843	2819	2904	2704	2904	7.1%	2942	5.1%	yes
CE525	2152	1886	1885	2180	2136	2221	1885	2221	16.2%	2220	6.9%	yes
CE530	2072	1833	1833	2090	2051	2117	1833	2117	14.2%	2228	11.4%	yes
CE540	2522	2258	2258	2309	2500	2573	2258	2573	13.1%	2727	13.5%	no
CE545	1753	1501	1501	1871	1739	1786	1501	1871	21.9%	1989	17.6%	yes
Energy Consumption, Condenser Fan (kWh,e)							Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE300	2400	2301	2302		2326	2323	2301	2400	4.3%	2362	1.3%	yes
CE310	2754	2686	2687		2703	2691	2686	2754	2.5%	2721	0.6%	yes
CE320	2747	2615	2618		2675	2681	2615	2747	4.9%	2696	1.1%	yes
CE330	2784	2656	2633		2727	2693	2633	2784	5.6%	2726	1.0%	yes
CE340	2776	2649	2640		2713	2684	2640	2776	5.1%	2721	1.1%	yes
CE350	2040	1865	1867		1969	1970	1865	2040	9.0%	1993	2.6%	yes
CE360	4313	4185	4181		4266	4272	4181	4313	3.1%	4300	1.3%	yes
CE400	1986	1860	1865			1902	1860	1986	6.6%	1909	0.3%	yes
CE410	1994	1965	1969			1936	1936	1994	3.0%	2005	2.0%	yes
CE420	2149	2054	2096			2115	2054	2149	4.5%	2106	0.1%	yes
CE430	2059	1993	1980			1970	1970	2059	4.5%	2025	1.2%	yes
CE440	2182	2110	2104			2120	2104	2182	3.7%	2133	0.2%	yes
CE500	1920	1975	1975		1912	1976	1912	1976	3.3%	1995	2.2%	yes
CE500 May-Sep	1477	1527	1527		1476	1524	1476	1527	3.4%	1540	2.2%	yes
CE510 May-Sep	2938	3061	3061		2974	3050	2938	3061	4.1%	3047	1.0%	yes
CE520	2340	2394	2393		2345	2396	2340	2396	2.4%	2449	3.2%	no
CE522	2108	2182	2182		2111	2174	2108	2182	3.4%	2206	2.5%	yes
CE525	1611	1642	1643		1599	1663	1599	1663	3.9%	1665	2.0%	yes
CE530	1552	1580	1580		1536	1585	1536	1585	3.1%	1671	6.7%	no
CE540	1888	1940	1939		1872	1926	1872	1940	3.5%	2045	6.9%	no
CE545	1312	1334	1333		1302	1337	1302	1337	2.7%	1491	12.7%	no

Table 6.12 – Space Cooling Electricity Consumption (continued).

Weather Data Checks, CE300 Only

							Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
Annual Mean Output												
ODB	19.91	19.89	19.89	19.91	19.91	19.91	20	20	0.1%	19.91	0.0%	yes
OHR	0.01164	0.01160	0.01160	0.01159	0.01165	0.01160	0.01159	0.01165	0.5%	0.01165	0.3%	yes
Annual Hourly Integrated Maxima												
ODB	34.70	35.00	35.00	34.78	35.00	35.00	35	35	0.9%	35.00	0.3%	yes
OHR	0.02188	0.02250	0.02250	0.02184	0.02241	0.02230	0.02184	0.02250	3.0%	0.02235	0.5%	yes

Table 6.13 – Weather Checks, CE300 only.

Space Cooling Coil Loads												
Total Sensible + Latent (kWh,th)							Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE300	80427	77283	77292	77318	77745	78257	77283	80427	4.0%	79219	1.5%	yes
CE310	99342	97395	97412	96448	97296	97261	96448	99342	3.0%	98413	0.9%	yes
CE320	99792	96356	96493	96084	97141	96957	96084	99792	3.8%	98157	1.0%	yes
CE330	105013	100730	100993	102211	103713	102008	100730	105013	4.2%	103404	0.9%	yes
CE340	102728	99028	99223	99709	100676	99753	99028	102728	3.7%	101061	0.9%	yes
CE350	69388	63736	63635	65790	66860	67389	63635	69388	8.7%	68055	2.9%	yes
CE360	162974	159807	159854	161248	161200	162168	159807	162974	2.0%	162384	0.7%	yes
CE400	68793	64918	65025	65414		66898	64918	68793	5.9%	66902	1.0%	yes
CE410	68673	66780	66844			66175	66175	68673	3.7%	68351	1.8%	yes
CE420	72609	69611	70882	70349		71803	69611	72609	4.2%	71410	0.5%	yes
CE430	69756	67641	67219	67141		67200	67141	69756	3.9%	68786	1.5%	yes
CE440	73711	71380	71181	71417		72029	71181	73711	3.5%	72276	0.5%	yes
CE500	63357	65996	65992	65571	63105	65614	63105	65996	4.5%	65765	1.3%	yes
CE500 May-Sep	48443	50693	50690	50354	48440	50357	48440	50693	4.5%	50488	1.3%	yes
CE510 May-Sep	108974	114018	114015	112793	108979	112781	108974	114018	4.5%	113024	1.0%	yes
CE520	63422	66571	66565	66088	63212	66146	63212	66571	5.1%	66474	1.7%	yes
CE522	63389	66373	66372	65851	63157	65900	63157	66373	4.9%	66096	1.4%	yes
CE525	63293	65399	65395	64973	63002	65155	63002	65399	3.7%	65223	1.1%	yes
CE530	45046	46634	46631	46944	44875	47002	44875	47002	4.6%	47102	2.0%	yes
CE540	45113	47130	47126	47297	44980	47462	44980	47462	5.3%	47703	2.5%	yes
CE545	44981	46240	46236	46612	44775	46668	44775	46668	4.1%	46766	1.8%	yes
Sensible Coil Load (kWh,th)							Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE300	56662	55797	55805	55252	55209	55191	55191	56662	2.6%	55748	0.2%	yes
CE310	56256	56301	56313	55225	55185	55083	55083	56313	2.2%	55542	0.3%	yes
CE320	62859	62697	62747	62043	62009	62734	62009	62859	1.4%	61867	1.0%	yes
CE330	63083	63311	63328	63779	62649	61822	61822	63779	3.1%	61801	1.9%	yes
CE340	63033	63053	63111	62886	62381	61406	61406	63111	2.7%	61820	1.3%	yes
CE350	50371	47684	47677	48545	48589	48768	47677	50371	5.5%	49217	1.3%	yes
CE360	134977	134920	134940	135287	134206	134697	134206	135287	0.8%	134648	0.1%	yes
CE400	41952	41419	41437	40688		41181	40688	41952	3.1%	40280	2.6%	yes
CE410	45677	47659	47660			45585	45585	47660	4.4%	47286	1.4%	yes
CE420	50390	49666	50612	49524		49984	49524	50612	2.2%	49623	0.8%	yes
CE430	47863	47731	47454	46739		46143	46143	47863	3.6%	47292	0.2%	yes
CE440	50876	50593	50492	50060		49785	49785	50876	2.2%	50090	0.5%	yes
CE500	45044	47650	47646	47491	44874	47530	44874	47650	5.9%	47532	1.8%	yes
CE500 May-Sep	34443	36596	36593	36476	34448	36480	34443	36596	6.0%	36498	1.8%	yes
CE510 May-Sep	77489	82306	82303	81566	77499	81563	77489	82306	6.0%	81547	1.4%	yes
CE520	45110	48102	48096	47986	44977	48059	44977	48102	6.6%	48239	2.5%	yes
CE522	45076	47962	47961	47758	44924	47795	44924	47962	6.5%	47863	2.0%	yes
CE525	44979	47218	47213	46930	44775	47110	44775	47218	5.3%	46993	1.3%	yes
CE530	45046	46574	46570	46944	44874	47002	44874	47002	4.6%	47101	2.0%	yes
CE540	45112	47023	47019	47288	44977	47460	44977	47460	5.3%	47702	2.6%	yes
CE545	44981	46214	46210	46612	44775	46668	44775	46668	4.1%	46766	1.9%	yes
Latent Coil Load(kWh,th)							Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE300	23765	21487	21487	22066	22535	23067	21487	23765	10.2%	23471	4.8%	yes
CE310	43086	41094	41099	41222	42111	42178	41094	43086	4.8%	42871	2.6%	yes
CE320	36932	33659	33746	34040	35133	34224	33659	36932	9.5%	36289	4.8%	yes
CE330	41929	37419	37666	38433	41063	40186	37419	41929	11.4%	41603	5.5%	yes
CE340	39695	35974	36113	36823	38296	38346	35974	39695	9.9%	39241	4.5%	yes
CE350	19017	16052	15958	17245	18271	18621	15958	19017	17.5%	18839	7.5%	yes
CE360	27997	24887	24914	25961	26994	27470	24887	27997	11.8%	27737	5.2%	yes
CE400	26840	23498	23588	24726		25717	23498	26840	13.4%	26622	7.0%	yes
CE410	22996	19121	19184			20590	19121	22996	18.9%	21065	2.9%	yes
CE420	22219	19945	20270	20826		21855	19945	22219	10.8%	21787	3.6%	yes
CE430	21893	19909	19765	20403		21057	19765	21893	10.3%	21494	4.3%	yes
CE440	22835	20788	20689	21357		22244	20689	22835	9.9%	22186	2.8%	yes
CE500	18313	18346	18346	18080	18231	18084	18080	18346	1.5%	18233	0.0%	yes
CE500 May-Sep	14000	14097	14097	13879	13991	13877	13877	14097	1.6%	13990	0.0%	yes
CE510 May-Sep	31485	31712	31712	31226	31480	31217	31217	31712	1.6%	31477	0.0%	yes
CE520	18312	18470	18470	18101	18235	18087	18087	18470	2.1%	18234	0.2%	yes
CE522	18313	18411	18410	18093	18233	18104	18093	18411	1.7%	18233	0.2%	yes
CE525	18314	18182	18182	18044	18227	18045	18044	18314	1.5%	18230	0.4%	yes
CE530	0	61	61	0	1	0	0	61	297.1%	0	99.4%	yes
CE540	1	107	107	9	3	2	1	107	278.2%	1	96.4%	yes
CE545	0	25	25	0	0	0	0	25	300.0%	0	100.0%	yes

Table 6.14 – Space Cooling Coil Loads.

Various Annual Means (COP2, IDB)

COP2	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE300	3.249	3.238	3.237	3.237	3.226	3.230	3.226	3.249	0.7%	3.240	0.1%	yes
CE310	3.415	3.417	3.417	3.393	3.397	3.380	3.380	3.417	1.1%	3.410	0.2%	yes
CE320	3.420	3.458	3.457	3.405	3.406	3.390	3.390	3.458	2.0%	3.412	0.3%	yes
CE330	3.491	3.494	3.536	3.491	3.497	3.460	3.460	3.536	2.2%	3.491	0.1%	yes
CE340	3.454	3.477	3.496	3.448	3.450	3.420	3.420	3.496	2.2%	3.451	0.2%	yes
CE350	3.249	3.241	3.235	3.244	3.229	3.230	3.229	3.249	0.6%	3.252	0.4%	yes
CE360	3.669	3.701	3.706	3.678	3.667	3.660	3.660	3.706	1.2%	3.665	0.4%	yes
CE400	3.250	3.251	3.252	3.246		3.260	3.246	3.260	0.4%	3.262	0.3%	yes
CE410	3.240	3.212	3.211			3.210	3.210	3.240	0.9%	3.225	0.2%	yes
CE420	3.226	3.215	3.218	3.216		3.210	3.210	3.226	0.5%	3.222	0.1%	yes
CE430	3.221	3.213	3.211	3.211		3.210	3.210	3.221	0.3%	3.217	0.1%	yes
CE440	3.231	3.222	3.222	3.221		3.220	3.220	3.231	0.4%	3.226	0.1%	yes
CE500	3.204	3.227	3.227	3.213	3.192	3.200	3.192	3.227	1.1%	3.194	0.5%	yes
CE500 May-Sep	3.142	3.161	3.162	3.154	3.132	3.140	3.132	3.162	0.9%	3.133	0.5%	yes
CE510 May-Sep	3.551	3.577	3.577	3.562	3.530	3.550	3.530	3.577	1.3%	3.559	0.0%	yes
CE520	2.901	2.957	2.956	3.004	2.873	2.920	2.873	3.004	4.5%	2.895	1.4%	yes
CE522	3.058	3.074	3.073	3.101	3.036	3.070	3.036	3.101	2.1%	3.047	0.7%	yes
CE525	3.484	3.531	3.528	3.508	3.480	3.410	3.410	3.531	3.5%	3.475	0.4%	yes
CE530	2.962	2.969	2.969	2.999	2.916	2.980	2.916	2.999	2.8%	2.898	2.3%	yes
CE540	2.668	2.675	2.675	2.823	2.640	2.690	2.640	2.823	6.8%	2.614	3.0%	yes
CE545	3.228	3.233	3.236	3.157	3.186	3.200	3.157	3.236	2.5%	3.062	4.5%	no

IDB (°C)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE300	23.62	24.06	24.06	24.09	24.08	23.99	23.62	24.09	1.9%	23.90	0.4%	yes
CE310	23.76	24.11	24.06	24.09	24.09	24.01	23.76	24.11	1.5%	23.97	0.2%	yes
CE320	23.90	24.39	24.39	24.25	24.33	24.53	23.90	24.53	2.6%	24.15	0.6%	yes
CE330	23.88	24.28	24.28	24.27	24.30	24.18	23.88	24.30	1.7%	24.11	0.4%	yes
CE340	23.88	24.28	24.28	24.30	24.31	24.21	23.88	24.31	1.8%	24.13	0.3%	yes
CE350	25.66	26.17	26.17	26.24	26.27	26.15	25.66	26.27	2.3%	26.04	0.3%	yes
CE360	25.36	25.61	25.56	25.32	25.48	25.37	25.32	25.61	1.1%	25.47	0.1%	yes
CE400	24.13	24.06	24.06	24.09		23.99	23.99	24.13	0.6%	23.98	0.3%	yes
CE410	24.12	24.06	24.06			23.99	23.99	24.12	0.5%	23.88	0.7%	no
CE420	23.93	24.06	24.06	24.09		23.99	23.93	24.09	0.7%	23.93	0.4%	yes
CE430	23.99	24.06	24.06	24.09		23.99	23.99	24.09	0.4%	23.91	0.5%	no
CE440	23.91	24.06	24.06	24.09		23.99	23.91	24.09	0.7%	23.96	0.3%	yes
CE500	20.23	20.67	20.56	20.38	21.10	22.86	20.23	22.86	12.5%	20.57	1.9%	yes
CE500 May-Sep	24.57	25.00	25.00	24.98	25.00	25.00	24.57	25.00	1.7%	24.93	0.0%	yes
CE510 May-Sep	25.82	25.11	25.11	24.96	25.00	25.00	24.96	25.82	3.4%	25.55	1.5%	yes
CE520	13.52	13.78	13.72	13.58	14.14	14.89	13.52	14.89	9.9%	13.83	0.7%	yes
CE522	16.95	17.28	17.22	17.00	17.73	18.70	16.95	18.70	10.0%	17.29	1.1%	yes
CE525	26.84	27.39	27.28	27.10	27.77	30.69	26.84	30.69	13.8%	27.13	2.6%	yes
CE530	20.03	20.61	20.56	20.59	21.10	22.86	20.03	22.86	13.5%	20.51	2.1%	yes
CE540	13.29	13.78	13.72	13.79	14.14	14.98	13.29	14.98	12.1%	13.75	1.4%	yes
CE545	26.61	27.33	27.28	27.31	27.72	30.69	26.61	30.69	14.7%	27.10	2.6%	yes

Table 6.15 – Various Annual Means (COP2,IDB).

Various Annual Means (Humidity Ratio, Zone Relative Humidity)												
Humidity Ratio (kg/kg)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	[Ap-Mean] /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE300	0.0091	0.0092	0.0092	0.0093	0.0092	0.0092	0.0091	0.0093	2.4%	0.0091	1.3%	yes
CE310	0.0111	0.0113	0.0113	0.0113	0.0112	0.0111	0.0111	0.0113	2.0%	0.0111	0.9%	yes
CE320	0.0100	0.0101	0.0101	0.0101	0.0100	0.0099	0.0099	0.0101	2.1%	0.0100	0.5%	yes
CE330	0.0097	0.0099	0.0099	0.0100	0.0098	0.0099	0.0097	0.0100	2.3%	0.0098	1.0%	yes
CE340	0.0098	0.0099	0.0099	0.0100	0.0099	0.0099	0.0098	0.0100	1.9%	0.0098	0.7%	yes
CE350	0.0097	0.0100	0.0100	0.0099	0.0098	0.0098	0.0097	0.0100	3.0%	0.0097	1.6%	yes
CE360	0.0085	0.0087	0.0087	0.0088	0.0086	0.0086	0.0085	0.0088	3.1%	0.0085	1.8%	yes
CE400	0.0098	0.0100	0.0100	0.0101		0.0100	0.0098	0.0101	2.9%	0.0101	1.2%	yes
CE410	0.0097	0.0095	0.0095			0.0095	0.0095	0.0097	2.5%	0.0094	1.4%	yes
CE420	0.0093	0.0094	0.0094	0.0094		0.0093	0.0093	0.0094	2.0%	0.0093	0.6%	yes
CE430	0.0093	0.0094	0.0094	0.0095		0.0094	0.0093	0.0095	1.9%	0.0094	0.5%	yes
CE440	0.0092	0.0093	0.0093	0.0093		0.0092	0.0092	0.0093	1.9%	0.0092	0.5%	yes
CE500	0.0098			0.0094	0.0102	0.0107	0.0094	0.0107	13.2%	0.0096	3.8%	yes
CE500 May-Sep	0.0110	0.0114	0.0114	0.0113	0.0113	0.0109	0.0109	0.0114	4.5%	0.0109	3.1%	yes
CE510 May-Sep	0.0114	0.0114	0.0114	0.0113	0.0113	0.0109	0.0109	0.0114	4.4%	0.0112	1.2%	yes
CE520	0.0067			0.0060	0.0070	0.0076	0.0060	0.0076	23.1%	0.0066	3.7%	yes
CE522	0.0082			0.0076	0.0086	0.0090	0.0076	0.0090	16.8%	0.0081	2.8%	yes
CE525	0.0137			0.0138	0.0140	0.0151	0.0137	0.0151	9.8%	0.0133	6.0%	yes
CE530	0.0062			0.0067	0.0058	0.0067	0.0058	0.0067	14.4%	0.0059	6.4%	yes
CE540	0.0045			0.0043	0.0039	0.0046	0.0039	0.0046	17.9%	0.0039	9.9%	yes
CE545	0.0062			0.0067	0.0067	0.0072	0.0062	0.0072	14.8%	0.0061	8.9%	yes
Relative Humidity (%)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	[Ap-Mean] /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE300	48.61	48.26	48.28	48.59	47.83	47.93	47.83	48.61	1.6%	47.77	1.0%	yes
CE310	58.33	58.51	58.53	58.55	57.84	57.80	57.80	58.55	1.3%	57.78	0.8%	yes
CE320	52.01	51.21	51.25	51.84	51.10	49.94	49.94	52.01	4.0%	51.25	0.0%	yes
CE330	50.84	50.58	50.65	51.18	50.08	50.70	50.08	51.18	2.2%	50.32	0.7%	yes
CE340	51.09	50.69	50.73	51.15	50.30	50.78	50.30	51.15	1.7%	50.46	0.6%	yes
CE350	45.48	45.45	45.55	45.17	44.32	44.56	44.32	45.55	2.7%	44.49	1.3%	yes
CE360	41.03	41.49	41.49	42.37	40.87	41.21	40.87	42.37	3.6%	40.65	1.8%	yes
CE400	50.77	52.21	52.25	52.55		52.01	50.77	52.55	3.4%	52.52	1.1%	yes
CE410	50.50	49.65	49.63			49.75	49.63	50.50	1.7%	49.57	0.6%	yes
CE420	48.78	49.14	48.97	49.40		48.76	48.76	49.40	1.3%	48.83	0.4%	yes
CE430	48.82	49.17	49.30	49.60		49.17	48.82	49.60	1.6%	49.11	0.2%	yes
CE440	48.33	48.46	48.57	48.83		48.23	48.23	48.83	1.2%	48.24	0.5%	yes
CE500	66.53			59.20	65.94	63.73	59.20	66.53	11.5%	64.34	0.8%	yes
CE500 May-Sep	57.05	57.47	57.47	57.32	57.07	55.13	55.13	57.47	4.1%	55.01	3.4%	yes
CE510 May-Sep	54.70	57.36	57.36	57.44	57.06	55.24	54.70	57.44	4.8%	54.40	3.8%	yes
CE520	69.87			61.40	70.23	72.17	61.40	72.17	15.7%	67.22	1.8%	yes
CE522	68.68			60.75	68.23	68.11	60.75	68.68	11.9%	66.47	0.0%	yes
CE525	61.47			54.99	60.14	57.37	54.99	61.47	11.1%	59.01	0.9%	yes
CE530	46.73			48.97	41.45	39.60	39.60	48.97	21.2%	43.70	1.1%	yes
CE540	48.52			46.31	40.05	43.82	40.05	48.52	19.0%	41.43	7.3%	yes
CE545	36.62			38.63	36.87	29.20	29.20	38.63	26.7%	35.56	0.6%	yes

Table 6.16 – Various Annual Means (Humidity Ratio, Zone Relative Humidity).

f(ODB) Sensitivity CE500 and CE530, April 30 and June 25

							Statistics, All Results					
	TRNSYS	DOE-2.2	DOE21E-E	EnergyPlus	CODYRUN	HOT3000	Min	Max	(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range
	TUD	NREL	NREL	GARD	UR	NRCan						
Energy Consumption, Compr. + Both Fans (Wh,e)												
CE500Apr30	3893	3975	3975	4029	3901	4073	3893	4073	4.5%	4042.55	1.7%	yes
CE500Jun25	5045	5204	5204	5229	5067	5230	5045	5230	3.6%	5277.68	2.2%	yes
Del CE500	1152	1229	1229	1200	1165	1157	1152	1229	6.5%	1235.13	3.9%	yes
CE530Apr30	3023	3062	3062	3101	3092	3144	3023	3144	3.9%	3206.98	4.1%	no
CE530Jun25	3894	3978	3978	4029	3935	4043	3894	4043	3.7%	4207.24	5.8%	no
Del CE530	871	916	916	927	843	899	843	927	9.4%	1000.25	11.7%	no
Energy Consumption, Compressor (Wh,e)												
CE500Apr30	3015	3120	3120		3020	3159	3015	3159	4.7%	3125.77	1.3%	yes
CE500Jun25	4084	4264	4263		4106	4239	4084	4264	4.3%	4275.66	2.0%	yes
Del CE500	1069	1144	1144		1086	1080	1069	1144	6.7%	1149.89	4.1%	yes
CE530Apr30	2311	2390	2390		2378	2411	2311	2411	4.2%	2449.18	3.1%	yes
CE530Jun25	3118	3243	3243		3166	3248	3118	3248	4.1%	3361.87	4.9%	no
Del CE530	807	853	853		787	837	787	853	8.0%	912.691	10.3%	no
Energy Consumption, Condenser Fan (Wh,e)												
CE500Apr30	376	389	389		377	391	376	391	3.9%	392.865	2.2%	yes
CE500Jun25	411	426	426		411	424	411	426	3.6%	429.392	2.3%	yes
Del CE500	35	37	37		34	33	33	37	12.0%	36.5264	3.2%	yes
CE530Apr30	305	311	311		305	314	305	314	3.1%	324.741	5.0%	no
CE530Jun25	332	340	340		329	340	329	340	3.2%	362.264	7.8%	no
Del CE530	28	28	29		24	26	24	29	17.0%	37.523	39.4%	no
Energy Consumption, Supply Fan (Wh,e)												
CE500Apr30	502	467	466	519	504	522	466	522	11.2%	523.913	5.5%	yes
CE500Jun25	550	514	514	566	549	566	514	566	9.5%	572.624	5.4%	yes
Del CE500	47	48	48	47	45	44	44	48	8.5%	48.7106	4.7%	yes
CE530Apr30	407	361	361	412	408	419	361	419	14.8%	433.065	9.8%	yes
CE530Jun25	444	396	396	450	440	454	396	454	13.6%	483.105	12.4%	yes
Del CE530	37	35	35	38	32	35	32	38	16.0%	50.0396	42.1%	no
Sensible + Latent Coil Load (Wh,th)												
CE500Apr30	13186	13733	13733	13655	13170	13673	13170	13733	4.2%	13694.2	1.3%	yes
CE500Jun25	13188	13838	13837	13733	13198	13727	13188	13838	4.8%	13769.3	1.3%	yes
Del CE500	2	105	104	78	29	54	2	105	165.3%	75.0885	21.1%	yes
CE530Apr30	9353	9721	9721	9775	9365	9798	9353	9798	4.6%	9796.52	1.8%	yes
CE530Jun25	9376	9761	9761	9835	9388	9834	9376	9835	4.8%	9870.43	2.2%	yes
Del CE530	23	40	39	60	22	36	22	60	102.8%	73.9097	101.4%	yes
Sensible Coil Load (Wh,th)												
CE500Apr30	9375	9925	9925	9884	9365	9902	9365	9925	5.8%	9887	1.6%	yes
CE500Jun25	9378	9981	9981	9953	9388	9946	9378	9981	6.2%	9960	1.9%	yes
Del CE500	3	56	56	69	22	44	3	69	158.2%	72	73.2%	yes
CE530Apr30	9353	9721	9721	9775	9365	9798	9353	9798	4.6%	9797	1.8%	yes
CE530Jun25	9376	9761	9761	9835	9388	9834	9376	9835	4.8%	9870	2.2%	yes
Del CE530	23	40	39	60	22	36	22	60	102.9%	74	101.5%	yes
Latent Coil Load (Wh,th)												
CE500Apr30	3811	3808	3808	3772	3804	3770	3770	3811	1.1%	3807	0.3%	yes
CE500Jun25	3810	3856	3856	3781	3810	3780	3780	3856	2.0%	3810	0.2%	yes
Del CE500	-1	48	48	9	6	10	-1	48	242.3%	3	86.3%	yes
CE530Apr30	0	0	0	0	0	0	0	0	28464.8%	0	100.0%	yes
CE530Jun25	0	0	0	0	0	0	0	0	300.0%	0	100.0%	yes
Del CE530	0	0	0	0	0	0	0	0	300.0%	0	100.0%	yes

Table 6.17 – f(ODB) Sensitivity CE500 and CE530, April 30 and June 25.

f(ODB) Sensitivity CE500 and CE530, April 30 and June 25

	EnergyPlus						Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range
Humidity Ratio (kg/kg)												
CE500Apr30	0.0107	0.0110	0.0110	0.0110	0.0109	0.0160	0.011	0.016	45.3%	0.0105	10.4%	yes
CE500Jun25	0.0112	0.0115	0.0115	0.0115	0.0115	0.0110	0.011	0.012	4.4%	0.0110	3.0%	yes
Del CE500	0.0005	0.0005	0.0005	0.0005	0.0005	-0.0050	-0.005	0.001	-1334.8%	0.0005	-212.8%	yes
CE530Apr30	0.0062	0.0071	0.0071	0.0068	0.0055	0.0067	0.005	0.007	24.6%	0.0059	10.7%	yes
CE530Jun25	0.0062	0.0078	0.0078	0.0068	0.0055	0.0067	0.005	0.008	34.2%	0.0059	13.8%	yes
Del CE530	0.0000	0.0007	0.0007	0.0000	0.0000	0.0000	0.000	0.001	304.5%	0.0000	99.9%	yes
COP2												
CE500Apr30	3.845	3.914	3.914	3.850	3.837	3.850	3.837	3.914	2.0%	3.892	0.6%	yes
CE500Jun25	2.931	2.951	2.951	2.943	2.921	2.940	2.921	2.951	1.0%	2.926	0.4%	yes
Del CE500	-0.914	-0.963	-0.963	-0.907	-0.916	-0.910	-0.963	-0.907	-6.1%	-0.965	-3.9%	yes
CE530Apr30	3.543	3.599	3.599	3.441	3.460	3.590	3.441	3.599	4.5%	3.532	0.2%	yes
CE530Jun25	2.720	2.724	2.724	2.780	2.690	2.740	2.690	2.780	3.3%	2.650	2.9%	yes
Del CE530	-0.823	-0.874	-0.875	-0.662	-0.770	-0.850	-0.875	-0.662	-26.3%	-0.881	-8.9%	yes
ODB (°C)												
CE500Apr30	16.79	16.83	16.83	16.81	16.88	16.96	16.79	16.96	1.0%	16.88	0.2%	yes
CE500Jun25	29.52	29.50	29.50	29.52	29.52	29.50	29.50	29.52	0.1%	29.52	0.0%	yes
Del CE500	12.73	12.67	12.67	12.70	12.63	12.54	12.54	12.73	1.5%	12.63	0.2%	yes
CE530Apr30	16.79	16.83	16.83	16.81	16.88	16.96	16.79	16.96	1.0%	16.88	0.2%	yes
CE530Jun25	29.52	29.50	29.50	29.52	29.52	29.50	29.50	29.52	0.1%	29.52	0.0%	yes
Del CE530	12.73	12.67	12.67	12.70	12.63	12.54	12.54	12.73	1.5%	12.63	0.2%	yes
EDB (°C)												
CE500Apr30	24.64	24.94	24.94	24.98	25.00	25.00	24.64	25.00	1.4%	16.62	33.3%	no
CE500Jun25	24.55	25.00	25.00	24.98	25.00	25.00	24.55	25.00	1.8%	29.53	18.5%	no
Del CE500	-0.09	0.06	0.06	0.00	0.00	0.00	-0.09	0.06	4740.8%	12.91	411170%	no
CE530Apr30	24.37	24.94	24.67	25.00	25.00	25.00	24.37	25.00	2.6%	16.62	33.1%	no
CE530Jun25	24.35	24.94	24.94	25.00	25.00	25.00	24.35	25.00	2.6%	29.53	18.7%	no
Del CE530	-0.01	0.00	0.28	0.00	0.00	0.00	-0.01	0.28	651.2%	12.91	28981%	no

Table 6.18 – f(ODB) Sensitivity CE500 and CE530, April 30 and June 25.

Hourly Integrated Maxima (Total Cooling System Energy Consumption and Total Coil Load)

Energy Consumption, Compressor + Both Fans (Wh,e)									
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour	
	Min	Max							
CE300	11548	11932	3.3%	11653	0.4%	yes	20-Jul	16	
CE310	12162	12653	3.9%	12614	0.7%	yes	20-Jul	16	
CE320	12875	13104	1.8%	13092	0.9%	yes	20-Jul	16	
CE330	13212	13467	1.9%	13474	0.9%	yes	20-Jul	16	
CE340	13101	13277	1.3%	13284	0.8%	yes	20-Jul	16	
CE350	11546	11932	3.3%	11598	1.0%	yes	20-Jul	16	
CE360	12726	12863	1.1%	12777	0.1%	yes	20-Jul	16	
CE400	11519	11900	3.3%	11803	1.2%	yes	05-Aug	16	
CE410	11549	11628	0.7%	11525	0.5%	yes	20-Jul	16	
CE420	11548	11900	3.0%	11544	0.9%	yes	20-Jul	16	
CE430	11548	11900	3.0%	11510	1.2%	yes	20-Jul	16	
CE440	11461	11900	3.8%	11510	1.0%	yes	20-Jul	16	
CE500	10166	10431	2.6%	10424	1.1%	yes	20-Jul	16	
CE510	11186	11590	3.5%	11425	0.3%	yes	20-Jul	16	
CE520	10684	11101	3.8%	11210	2.1%	yes	20-Jul	16	
CE522	10431	10972	5.0%	10903	1.4%	yes	20-Jul	16	
CE525	9367	9585	2.3%	9674	1.8%	yes	20-Jul	16	
CE530	7992	8171	2.2%	8470	5.0%	no	20-Jul	16	
CE540	8677	8985	3.5%	9577	8.2%	no	20-Jul	16	
CE545	7205	7763	7.5%	8002	7.9%	no	20-Jul	16	
Sensible + Latent Coil Load (Wh,th)									
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour	
	Min	Max							
CE300	31401	32733	4.2%	31922	0.4%	yes	10-Jul	15	
CE310	36750	37328	1.6%	36966	0.3%	yes	15-Aug	16	
CE320	39765	53823	31.5%	40192	9.9%	yes	02-Oct	11	
CE330	42415	64572	47.2%	43707	6.9%	yes	02-Oct	10	
CE340	41132	59549	40.1%	41807	9.1%	yes	02-Oct	10	
CE350	31401	32733	4.2%	31926	0.4%	yes	08-Jul	15	
CE360	38322	41019	6.9%	38884	1.0%	yes	02-Oct	11	
CE400	40543	49838	21.8%	41865	1.8%	yes	05-Aug	16	
CE410	31401	32092	2.2%	31686	0.2%	yes	01-Oct	15	
CE420	31401	32733	4.2%	31810	0.5%	yes	01-Oct	15	
CE430	31401	32733	4.2%	31716	0.8%	yes	08-Jul	15	
CE440	31401	32733	4.2%	31716	0.6%	yes	08-Jul	15	
CE500	26567	27707	4.2%	27589	0.5%	yes	17-Jun	15	
CE510	29948	31188	4.0%	31002	0.4%	yes	17-Jun	15	
CE520	26675	28343	6.0%	27810	0.7%	yes	20-Aug	16	
CE522	26514	27868	4.9%	27658	0.6%	yes	17-Jun	15	
CE525	26683	27740	3.9%	27511	0.4%	yes	17-Jun	15	
CE530	18776	19834	5.4%	19724	1.1%	yes	29-Jul	15	
CE540	18794	19799	5.1%	19912	1.7%	yes	29-Jul	15	
CE545	18764	20075	6.7%	19621	0.8%	yes	29-Jul	15	

Table 6.19 – Hourly Integrated Maxima (Total Cooling System Energy Consumption and Total Coil Load).

Hourly Integrated Maxima (Sensible Coil Load and Latent Coil Load)

Sensible Coil Load (Wh,th)								
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour
	Min	Max						
CE300	22908	23531	2.7%	23240	0.1%	yes	20-Jul	16
CE310	22649	23276	2.7%	23009	0.2%	yes	11-Jul	16
CE320	30967	31972	3.2%	30629	2.0%	yes	24-Apr	16
CE330	33226	34765	4.5%	32766	3.3%	yes	14-Jun	15
CE340	32086	32940	2.6%	32090	1.3%	yes	24-Apr	15
CE350	22876	23531	2.8%	23080	0.8%	yes	20-Jul	16
CE360	31981	32621	2.0%	31738	1.3%	yes	24-Apr	17
CE400	22877	23531	2.8%	23045	0.7%	yes	20-Jul	16
CE410	22893	23266	1.6%	23032	0.5%	yes	20-Jul	16
CE420	22893	23531	2.7%	23039	0.8%	yes	20-Jul	16
CE430	22893	23531	2.7%	22975	1.1%	yes	07-Sep	16
CE440	22875	23531	2.8%	22975	1.0%	yes	07-Sep	16
CE500	18776	20009	6.3%	19859	1.0%	yes	29-Jul	15
CE510	21121	22513	6.3%	22285	1.0%	yes	20-Jul	17
CE520	18969	20378	7.1%	20110	1.3%	yes	20-Aug	16
CE522	18785	20137	6.9%	19963	1.2%	yes	29-Jul	15
CE525	18759	19850	5.6%	19689	0.5%	yes	29-Jul	15
CE530	18776	19834	5.4%	19724	1.1%	yes	29-Jul	15
CE540	18794	19799	5.1%	19912	1.7%	yes	29-Jul	15
CE545	18759	20075	6.8%	19621	0.8%	yes	29-Jul	15
Latent Coil Load (Wh,th)								
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour
	Min	Max						
CE300	9304	10392	11.0%	9834	0.6%	yes	10-Jul	13
CE310	15139	16275	7.2%	15461	2.1%	yes	04-Aug	15
CE320	21697	31503	38.7%	23049	9.0%	yes	02-Oct	10
CE330	26941	40809	46.6%	27569	7.3%	yes	02-Oct	10
CE340	23794	36011	44.9%	25042	8.0%	yes	02-Oct	10
CE350	9303	11603	22.6%	9789	3.8%	yes	10-Jul	13
CE360	8520	10336	19.5%	9208	1.3%	yes	02-Oct	11
CE400	25578	32396	24.7%	27449	0.6%	yes	18-Sep	16
CE410	9304	11139	18.3%	12508	24.4%	no	22-Apr	9
CE420	9304	10394	11.1%	9645	1.7%	yes	10-Jul	13
CE430	9636	11105	13.8%	10522	1.3%	yes	24-Oct	13
CE440	9304	10235	9.6%	9673	0.7%	yes	10-Jul	13
CE500	7733	7965	3.0%	7769	0.5%	yes	17-Jun	15
CE510	8723	8955	2.6%	8763	0.8%	yes	17-Jun	15
CE520	7699	7964	3.4%	7703	1.4%	yes	17-Jun	15
CE522	7743	7907	2.1%	7737	0.6%	yes	17-Jun	15
CE525	7663	8037	4.8%	7853	0.1%	yes	17-Jun	15
CE530	0	179	497.3%	67	87.1%	yes	16-Mar	10
CE540	0	1655	230.5%	705	1.8%	yes	11-Mar	10
CE545	0	4	600.0%	0	100.0%	yes	01-Jan	1

Table 6.20 – Hourly Integrated Maxima (Sensible Coil Load and Latent Coil Load).

Hourly Integrated Maxima and Minima (COP2)

Maximum COP2									
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour	
	Min	Max							
CE300	3.857	4.168	7.9%	3.983	1.4%	yes	30-Apr	15	
CE310	4.120	4.173	1.3%	4.231	2.2%	no	30-Apr	15	
CE320	3.940	5.143	27.2%	3.908	11.7%	yes	18-Sep	16	
CE330	4.050	5.595	35.5%	4.114	5.5%	yes	16-Sep	15	
CE340	3.950	5.339	32.0%	4.019	7.5%	yes	16-Sep	16	
CE350	3.863	4.555	17.1%	4.018	0.7%	yes	22-Oct	1	
CE360	4.401	4.455	1.2%	4.402	0.6%	yes	05-Oct	1	
CE400	4.050	4.776	17.2%	4.113	2.4%	yes	16-Sep	15	
CE410	3.840	3.903	1.6%	4.033	4.2%	no	30-Apr	15	
CE420	3.759	3.940	4.7%	3.773	1.3%	yes	21-May	16	
CE430	3.759	3.930	4.5%	3.807	0.2%	yes	21-May	15	
CE440	3.759	3.883	3.3%	3.805	0.0%	yes	21-May	15	
CE500	4.140	7.367	65.7%	4.306	12.3%	yes	14-Oct	9	
CE510	4.530	7.367	54.4%	4.699	9.8%	yes	05-Oct	2	
CE520	3.802	4.896	26.3%	3.870	6.9%	yes	30-Apr	15	
CE522	3.986	6.233	48.3%	4.088	12.2%	yes	14-Oct	9	
CE525	4.400	6.325	37.5%	4.742	7.7%	yes	14-Oct	9	
CE530	3.840	4.006	4.2%	3.921	0.2%	yes	14-Oct	9	
CE540	3.455	3.696	6.7%	3.484	2.4%	yes	14-Oct	9	
CE545	4.156	4.428	6.4%	4.158	2.0%	yes	14-Oct	9	
Minimum COP2									
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour	
	Min	Max							
CE300	2.782	2.810	1.0%	2.765	1.1%	no	24-Apr	17	
CE310	2.850	2.893	1.5%	2.860	0.2%	yes	01-Dec	15	
CE320	2.801	2.842	1.4%	2.807	0.4%	yes	01-Dec	15	
CE330	2.798	2.844	1.6%	2.800	0.8%	yes	01-Dec	15	
CE340	2.798	2.844	1.6%	2.800	0.8%	yes	01-Dec	15	
CE350	2.782	2.810	1.0%	2.755	1.4%	no	24-Apr	17	
CE360	2.799	2.844	1.6%	2.800	0.8%	yes	01-Dec	15	
CE400	2.734	2.810	2.7%	2.752	0.6%	yes	24-Apr	17	
CE410	2.786	2.810	0.9%	2.751	1.7%	no	03-Dec	13	
CE420	2.782	2.810	1.0%	2.745	1.8%	no	06-Nov	15	
CE430	2.734	2.810	2.7%	2.745	0.8%	yes	06-Nov	15	
CE440	2.734	2.810	2.7%	2.745	0.8%	yes	06-Nov	15	
CE500	2.652	2.710	2.2%	2.669	0.6%	yes	16-Aug	17	
CE510	2.652	2.900	8.8%	2.802	1.1%	yes	31-Mar	17	
CE520	2.333	2.532	8.1%	2.408	1.3%	yes	16-Nov	14	
CE522	2.429	2.613	7.2%	2.545	0.4%	yes	16-Aug	17	
CE525	2.814	2.940	4.3%	2.884	0.5%	yes	16-Aug	17	
CE530	2.473	2.532	2.3%	2.412	3.7%	no	04-Jun	17	
CE540	2.143	2.383	10.6%	2.126	6.1%	yes	04-Jun	17	
CE545	2.660	2.733	2.7%	2.548	5.9%	no	04-Jun	17	

Table 6.21 – Hourly Integrated Maxima and Minima (COP2).

Hourly Integrated Maxima and Minima (IDB)

Maximum IDB (°C)									
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour	
	Min	Max							
CE300	25.00	26.20	4.7%	25.76	1.3%	yes	08-Jul	15	
CE310	26.47	27.19	2.7%	26.96	0.5%	yes	20-Jul	16	
CE320	31.50	32.36	2.7%	32.34	1.5%	yes	20-Jul	16	
CE330	31.07	32.23	3.7%	32.14	1.4%	yes	20-Jul	16	
CE340	31.50	32.31	2.5%	32.25	1.5%	yes	20-Jul	16	
CE350	34.58	35.00	1.2%	34.66	0.7%	yes	01-Aug	22	
CE360	32.51	33.76	3.8%	33.58	1.9%	yes	10-Jul	14	
CE400	26.04	28.83	10.2%	28.52	4.5%	yes	05-Aug	16	
CE410	25.11	26.83	6.6%	26.23	1.6%	yes	08-Jul	15	
CE420	25.00	26.23	4.8%	26.07	2.1%	yes	12-Aug	15	
CE430	25.00	27.20	8.5%	26.07	1.2%	yes	12-Aug	15	
CE440	25.00	27.05	7.9%	26.08	1.5%	yes	01-Oct	15	
CE500	25.00	25.81	3.2%	25.50	1.3%	yes	29-Jul	15	
CE510	25.00	26.10	4.4%	25.76	2.1%	yes	21-Apr	1	
CE520	15.00	18.62	22.2%	17.30	6.1%	yes	20-Jul	16	
CE522	20.00	21.01	5.0%	20.61	1.2%	yes	29-Jul	15	
CE525	35.00	36.08	3.1%	35.32	0.3%	yes	29-Jul	15	
CE530	25.00	26.12	4.4%	25.34	0.5%	yes	20-Jul	15	
CE540	15.00	16.15	7.5%	15.55	2.0%	yes	20-Jul	15	
CE545	35.00	35.67	1.9%	35.24	0.4%	yes	20-Jul	15	
Minimum IDB (°C)									
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour	
	Min	Max							
CE300	6.99	8.89	23.1%	7.92	3.8%	yes	06-Jan	6	
CE310	6.99	8.89	23.1%	7.92	3.8%	yes	06-Jan	6	
CE320	6.99	10.83	44.1%	7.93	9.0%	yes	06-Jan	6	
CE330	6.99	8.89	23.1%	7.92	3.7%	yes	06-Jan	6	
CE340	6.99	8.89	23.1%	7.92	3.7%	yes	06-Jan	6	
CE350	6.99	8.89	23.1%	7.92	3.8%	yes	06-Jan	6	
CE360	6.99	8.89	23.1%	7.92	3.8%	yes	06-Jan	6	
CE400	6.99	8.89	23.0%	7.92	4.3%	yes	06-Jan	6	
CE410	6.99	8.89	23.3%	7.92	3.0%	yes	06-Jan	6	
CE420	6.99	8.89	23.0%	7.92	4.3%	yes	06-Jan	6	
CE430	6.99	8.89	23.0%	7.92	4.3%	yes	06-Jan	6	
CE440	7.00	8.89	22.8%	7.92	4.3%	yes	06-Jan	6	
CE500	7.94	24.04	146.2%	7.82	29.0%	yes	20-Dec	22	
CE510	7.94	24.04	146.2%	7.82	29.0%	yes	20-Dec	22	
CE520	7.89	13.57	61.7%	7.78	15.4%	yes	20-Dec	22	
CE522	7.94	15.98	83.3%	7.81	19.1%	yes	20-Dec	22	
CE525	7.94	33.01	200.2%	7.82	37.6%	yes	20-Dec	22	
CE530	7.94	24.04	146.3%	7.81	29.0%	yes	20-Dec	22	
CE540	7.89	14.95	74.9%	7.78	17.4%	yes	20-Dec	22	
CE545	7.94	33.01	200.2%	7.82	37.6%	yes	20-Dec	22	

Table 6.22 – Hourly Integrated Maxima and Minima (IDB).

Hourly Integrated Maxima and Minima (Zone Humidity Ratio)

Maximum Humidity Ratio								
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour
	Min	Max						
CE300	0.0133	0.0138	3.8%	0.0133	1.5%	yes	16-Nov	17
CE310	0.0154	0.0189	20.8%	0.0154	7.5%	yes	02-Oct	1
CE320	0.0175	0.0180	2.7%	0.0180	1.5%	yes	10-Jul	13
CE330	0.0170	0.0179	5.0%	0.0175	0.8%	yes	10-Jul	14
CE340	0.0173	0.0179	3.4%	0.0178	0.8%	yes	10-Jul	13
CE350	0.0165	0.0199	19.2%	0.0166	6.8%	yes	02-Oct	1
CE360	0.0134	0.0139	3.4%	0.0133	1.9%	yes	16-Nov	17
CE400	0.0169	0.0173	2.5%	0.0168	1.3%	yes	05-Apr	23
CE410	0.0168	0.0173	2.7%	0.0168	0.9%	yes	05-Apr	23
CE420	0.0141	0.0147	4.1%	0.0144	0.4%	yes	02-Apr	2
CE430	0.0156	0.0162	4.0%	0.0160	1.1%	yes	02-Apr	6
CE440	0.0133	0.0138	3.6%	0.0135	0.5%	yes	16-Nov	17
CE500	0.0115	0.0119	3.4%	0.0116	1.3%	yes	04-Jun	16
CE510	0.0115	0.0119	3.4%	0.0116	1.0%	yes	04-Jun	17
CE520	0.0070	0.0106	44.5%	0.0085	5.8%	yes	01-Jan	4
CE522	0.0091	0.0138	45.4%	0.0097	5.6%	yes	01-Jan	4
CE525	0.0173	0.0185	6.6%	0.0174	2.7%	yes	04-Jun	16
CE530	0.0055	0.0081	37.1%	0.0097	38.5%	no	01-Jan	4
CE540	0.0033	0.0068	62.6%	0.0085	51.1%	yes	01-Jan	4
CE545	0.0067	0.0122	63.0%	0.0097	11.4%	yes	01-Jan	4
Minimum Humidity Ratio								
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour
	Min	Max						
CE300	0.0017	0.0020	14.5%	0.0019	1.2%	yes	11-Jan	3
CE310	0.0017	0.0020	17.1%	0.0019	0.7%	yes	11-Jan	3
CE320	0.0017	0.0020	14.5%	0.0019	1.2%	yes	11-Jan	3
CE330	0.0017	0.0020	14.5%	0.0019	1.2%	yes	11-Jan	3
CE340	0.0017	0.0020	14.5%	0.0019	1.2%	yes	11-Jan	3
CE350	0.0017	0.0020	14.5%	0.0019	1.2%	yes	11-Jan	3
CE360	0.0017	0.0020	14.5%	0.0019	1.2%	yes	11-Jan	3
CE400	0.0017	0.0020	14.7%	0.0019	2.5%	yes	11-Jan	3
CE410	0.0017	0.0020	14.9%	0.0019	3.8%	yes	11-Jan	3
CE420	0.0017	0.0020	14.7%	0.0019	2.5%	yes	11-Jan	3
CE430	0.0017	0.0020	14.7%	0.0019	2.5%	yes	11-Jan	3
CE440	0.0017	0.0020	14.7%	0.0019	2.5%	yes	11-Jan	3
CE500	0.0068	0.0103	44.7%	0.0065	16.2%	yes	30-Dec	24
CE510	0.0068	0.0105	47.0%	0.0065	16.8%	yes	30-Dec	24
CE520	0.0061	0.0066	7.3%	0.0056	12.6%	no	30-Dec	24
CE522	0.0068	0.0078	14.1%	0.0065	8.9%	yes	30-Dec	24
CE525	0.0068	0.0154	94.7%	0.0065	28.1%	yes	30-Dec	24
CE530	0.0055	0.0067	20.5%	0.0058	6.7%	yes	30-Dec	24
CE540	0.0033	0.0042	24.6%	0.0034	11.5%	yes	30-Dec	24
CE545	0.0062	0.0070	11.9%	0.0061	8.8%	yes	12-Sep	22

Table 6.23 – Hourly Integrated Maxima and Minima (Zone Humidity Ratio).

Hourly Integrated Maxima and Minima (Relative Humidity)

Maximum Relative Humidity								
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour
	Min	Max						
CE300	67.44	69.35	2.8%	68.14	0.5%	yes	16-Nov	17
CE310	77.00	100.70	27.8%	76.70	10.2%	yes	02-Oct	2
CE320	81.84	83.67	2.2%	82.13	0.8%	yes	18-Sep	10
CE330	76.00	78.70	3.5%	76.09	1.7%	yes	18-Sep	10
CE340	79.93	81.37	1.8%	79.91	0.9%	yes	18-Sep	10
CE350	68.37	81.12	17.3%	68.14	7.5%	yes	16-Nov	17
CE360	67.44	69.35	2.8%	68.14	0.5%	yes	16-Nov	17
CE400	83.75	86.31	3.0%	84.71	0.5%	yes	05-Apr	23
CE410	83.22	86.18	3.5%	85.92	1.4%	yes	06-Apr	5
CE420	70.84	74.51	5.0%	75.01	3.0%	yes	02-Apr	2
CE430	78.43	80.74	2.9%	82.05	3.3%	no	02-Apr	6
CE440	67.51	69.35	2.7%	67.54	1.5%	yes	16-Nov	17
CE500	60.08	100.00	44.3%	99.96	11.0%	yes	21-Nov	21
CE510	57.51	100.00	47.5%	99.96	11.8%	yes	21-Nov	21
CE520	71.77	95.00	26.5%	86.66	1.2%	yes	20-Dec	13
CE522	71.32	100.00	30.9%	99.95	7.7%	yes	16-Dec	6
CE525	51.12	100.00	55.7%	99.98	13.9%	yes	11-Nov	19
CE530	36.01	96.16	79.6%	89.71	18.7%	yes	20-Dec	13
CE540	39.96	61.28	41.9%	52.64	3.5%	yes	20-Dec	13
CE545	24.14	97.00	94.5%	93.45	21.3%	yes	20-Dec	13
Minimum Relative Humidity								
	ASHRAE, All Results		(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range	Date	Hour
	Min	Max						
CE300	11.97	15.00	22.3%	13.84	1.7%	yes	06-Nov	6
CE310	11.97	16.00	28.5%	13.86	1.9%	yes	06-Nov	6
CE320	11.97	15.00	22.8%	13.85	4.1%	yes	06-Nov	6
CE330	11.97	15.00	22.3%	13.84	1.7%	yes	06-Nov	6
CE340	11.97	15.00	22.3%	13.84	1.7%	yes	06-Nov	6
CE350	11.97	15.00	22.3%	13.84	1.7%	yes	06-Nov	6
CE360	11.97	15.00	22.3%	13.84	1.7%	yes	06-Nov	6
CE400	11.97	14.57	19.8%	14.38	9.5%	yes	06-Nov	6
CE410	11.97	14.58	20.2%	14.81	14.5%	yes	06-Nov	7
CE420	11.97	14.59	19.9%	13.82	5.3%	yes	06-Nov	6
CE430	11.97	14.58	19.9%	14.52	10.6%	yes	06-Nov	5
CE440	11.97	14.54	19.6%	14.52	10.6%	yes	06-Nov	5
CE500	52.83	55.17	4.3%	52.78	2.0%	yes	05-Oct	2
CE510	52.09	55.29	6.0%	52.16	2.7%	yes	05-Oct	2
CE520	61.00	61.90	1.5%	55.49	9.7%	no	28-Nov	2
CE522	57.97	60.00	3.4%	57.95	1.6%	yes	13-Oct	10
CE525	44.00	47.85	8.5%	43.94	3.3%	yes	05-Oct	2
CE530	28.00	34.03	19.2%	28.99	7.5%	yes	28-Sep	15
CE540	31.00	39.74	24.4%	31.03	13.3%	yes	04-Jun	16
CE545	17.12	20.14	16.0%	17.08	9.5%	yes	28-Sep	15

Table 6.24 – Hourly Integrated Maxima and Minima (Relative Humidity).

Apache	Energy Consumption		Evaporator Coil Load			Zone Hum.	COP2	ODB (°C)	EDB (°C)	EWB (°C)	OHR (kg/kg)
Hour	Compressor (Wh)	Cond Fan (Wh)	Total (Wh)	Sensible (Wh)	Latent (Wh)	Ratio (kg/kg)					
1	2059	254	8050	6155	1895	0.0091	3.480	17.80	23.78	17.17	0.0111
2	1984	247	7849	5981	1868	0.0091	3.517	18.30	23.68	17.12	0.0115
3	1973	246	7796	5964	1832	0.0091	3.514	17.80	23.67	17.08	0.0111
4	2002	250	7923	6041	1882	0.0091	3.520	17.80	23.69	17.12	0.0111
5	1933	242	7672	5889	1784	0.0090	3.526	17.20	23.64	17.02	0.0102
6	1845	233	7336	5704	1632	0.0089	3.531	19.40	23.58	16.86	0.0110
7	1947	243	7589	6039	1550	0.0087	3.465	25.00	23.72	16.75	0.0131
8	2619	302	9488	7445	2043	0.0091	3.248	27.20	24.38	17.42	0.0111
9	4041	434	14012	10848	3165	0.0098	3.131	28.90	25.12	18.21	0.0120
10	4417	462	14731	11784	2947	0.0097	3.019	28.90	25.45	18.18	0.0127
11	4612	474	15212	11944	3268	0.0100	2.991	31.10	25.58	18.51	0.0148
12	4953	497	16151	12240	3911	0.0104	2.963	30.60	25.79	18.98	0.0132
13	6615	655	22192	17145	5047	0.0102	3.052	31.10	26.08	19.05	0.0113
14	6394	638	21195	17365	3830	0.0098	3.014	31.70	26.15	18.56	0.0117
15	7560	753	25497	22010	3487	0.0093	3.067	32.20	26.41	18.24	0.0124
16	7732	763	25854	22263	3592	0.0094	3.043	32.20	26.49	18.36	0.0142
17	5287	516	16569	13171	3398	0.0102	2.855	31.70	26.11	18.87	0.0147
18	5494	533	17420	12998	4422	0.0108	2.890	31.10	26.12	19.41	0.0157
19	5483	534	17671	12792	4879	0.0110	2.937	28.30	26.04	19.60	0.0145
20	5173	516	17218	12195	5022	0.0110	3.026	27.20	25.76	19.53	0.0169
21	3953	407	13329	9299	4031	0.0108	3.057	27.20	25.33	19.31	0.0169
22	4019	415	13817	9143	4674	0.0111	3.116	26.70	25.24	19.66	0.0168
23	3967	411	13699	8990	4709	0.0112	3.129	26.10	25.20	19.68	0.0169
24	3866	404	13488	8798	4690	0.0112	3.158	26.10	25.11	19.66	0.0173

Table 6.25 – June 28 Hourly Output – Case CE300.

Delta Annual Space Cooling Electricity Consumptions

Total (kWh,e)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	[Ap-Mean] /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	4340	4629	4629	4545	4543	4538	4340	4629	6.4%	4405	2.9%	yes
CE320-CE300	4426	3995	4037	4333	4424	4387	3995	4426	10.1%	4319	1.2%	yes
CE330-CE300	5330	4958	4683	5398	5559	5260	4683	5559	16.8%	5169	0.5%	yes
CE330-CE320	904	963	646	1064	1134	873	646	1134	52.5%	850	8.7%	yes
CE340-CE300	4986	4608	4510	5037	5089	4877	4510	5089	11.9%	4833	0.4%	yes
CE330-CE340	344	350	173	360	470	383	173	470	85.6%	336	3.1%	yes
CE350-CE300	-3397	-4203	-4207	-3601	-3390	-3328	-4207	-3328	-23.8%	-3528	-4.3%	yes
CE360-CE300	19665	19314	19261	19959	19867	19998	19261	19998	3.7%	19859	0.9%	yes
CE400-CE300	-3589	-3904	-3879	-3733		-3657	-3904	-3589	-8.4%	-3941	-5.0%	yes
CE410-CE300	-3555	-3082	-3056			-3567	-3567	-3056	-15.4%	-3260	-1.7%	yes
CE420-CE300	-2247	-2220	-1845	-2010		-1862	-2247	-1845	-19.7%	-2287	-12.3%	yes
CE430-CE300	-3096	-2818	-2944	-2973		-3252	-3252	-2818	-14.4%	-3069	-1.7%	yes
CE440-CE300	-1942	-1718	-1782	-1714		-1822	-1942	-1714	-12.7%	-2050	-14.2%	no
CE500-CE300	-13296	-11933	-11933	-11711	-12653	-11932	-13296	-11711	-12.9%	-12068	-1.4%	yes
CE510-CE500	17218	18099	18100	17736	17414	17794	17218	18100	5.0%	17654	0.4%	yes
CE525-CE520	-4666	-4981	-4969	-4316	-4889	-4458	-4981	-4316	-14.1%	-5240	-11.2%	yes
CE530-CE500	-5057	-5277	-5285	-5293	-4880	-5263	-5293	-4880	-8.0%	-4767	-7.9%	yes
CE545-CE540	-3743	-4076	-4083	-2425	-3745	-3825	-4083	-2425	-45.4%	-3713	-1.7%	yes
Compressor (kWh,e)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	[Ap-Mean] /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	3986	4244	4244		4167	4177	3986	4244	6.2%	4046	2.8%	yes
CE320-CE300	4080	3681	3721		4076	4036	3681	4080	10.2%	3985	1.7%	yes
CE330-CE300	4946	4603	4352		5158	4899	4352	5158	16.8%	4805	0.3%	yes
CE330-CE320	867	922	631		1082	863	631	1082	51.6%	820	6.0%	yes
CE340-CE300	4609	4260	4172		4703	4524	4172	4703	11.9%	4474	0.5%	yes
CE330-CE340	337	343	180		455	375	180	455	81.4%	331	2.0%	yes
CE350-CE300	-3037	-3767	-3772		-3032	-2985	-3772	-2985	-23.7%	-3159	-4.8%	yes
CE360-CE300	17752	17430	17382		17927	18065	17382	18065	3.9%	17921	1.2%	yes
CE400-CE300	-3175	-3463	-3442			-3247	-3463	-3175	-8.7%	-3489	-4.7%	yes
CE410-CE300	-3149	-2746	-2723			-3191	-3191	-2723	-15.9%	-2903	-1.7%	yes
CE420-CE300	-1995	-1973	-1639			-1662	-1995	-1639	-19.6%	-2031	-11.7%	yes
CE430-CE300	-2755	-2510	-2622			-2910	-2910	-2510	-14.8%	-2732	-1.2%	yes
CE440-CE300	-1724	-1527	-1584			-1627	-1724	-1527	-12.2%	-1821	-12.7%	no
CE500-CE300	-4499	-3096	-3095		-3912	-3354	-4499	-3095	-39.1%	-3497	-2.6%	yes
CE510-CE500	13806	14303	14304		13913	14230	13806	14304	3.5%	14137	0.2%	yes
CE525-CE520	-2963	-3241	-3233		-3148	-2742	-3241	-2742	-16.3%	-3409	-11.2%	yes
CE530-CE500	-4197	-4346	-4354		-4002	-4350	-4354	-4002	-8.3%	-4012	-5.6%	yes
CE545-CE540	-2399	-2713	-2720		-2413	-2449	-2720	-2399	-12.6%	-2422	-4.6%	yes

Table 6.26 – Delta Annual Space Cooling Electricity Consumption.

Delta Annual Space Cooling Electricity Consumptions (ctd.)

Supply Fan (kWh,e)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE320-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE330-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE330-CE320	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE340-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE330-CE340	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE350-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE360-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE400-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE410-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE420-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE430-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE440-CE300	0	0	0	0	0	0	0	0	0.0%	0	0.0%	yes
CE500-CE300	-8316	-8511	-8511	-8234	-8327	-8241	-8511	-8234	-3.3%	-8204	-1.8%	yes
CE510-CE500	1951	2262	2262	2034	2002	2038	1951	2262	14.9%	2010	3.9%	yes
CE525-CE520	-973	-988	-986	-839	-996	-979	-996	-839	-16.3%	-1046	-9.0%	yes
CE530-CE500	-491	-536	-536	-538	-502	-522	-538	-491	-9.0%	-432	-17.1%	no
CE545-CE540	-769	-757	-757	-438	-762	-787	-787	-438	-49.0%	-738	-3.7%	yes
Condenser Fan (kWh,e)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	354	385	385		376	368	354	385	8.4%	359	3.9%	yes
CE320-CE300	346	314	316		348	358	314	358	13.1%	335	0.6%	yes
CE330-CE300	383	355	331		401	370	331	401	19.0%	364	1.0%	yes
CE330-CE320	37	41	15		53	12	12	53	128.8%	30	5.4%	yes
CE340-CE300	376	348	338		386	361	338	386	13.3%	360	0.6%	yes
CE330-CE340	7	7	-7		15	9	-7	15	352.1%	5	22.4%	yes
CE350-CE300	-360	-436	-435		-358	-353	-436	-353	-21.4%	-369	-4.9%	yes
CE360-CE300	1913	1884	1879		1940	1949	1879	1949	3.7%	1938	1.3%	yes
CE400-CE300	-414	-441	-437			-421	-441	-414	-6.3%	-453	-5.7%	yes
CE410-CE300	-406	-336	-333			-387	-406	-333	-20.1%	-357	-2.4%	yes
CE420-CE300	-252	-247	-206			-208	-252	-206	-20.1%	-256	-12.2%	yes
CE430-CE300	-341	-308	-322			-353	-353	-308	-13.6%	-337	-1.9%	yes
CE440-CE300	-218	-191	-198			-203	-218	-191	-13.4%	-229	-13.2%	yes
CE500-CE300	-481	-326	-327		-415	-347	-481	-326	-40.8%	-367	-3.1%	yes
CE510-CE500	1461	1534	1534		1499	1526	1461	1534	4.8%	1507	0.3%	yes
CE525-CE520	-729	-752	-750		-746	-733	-752	-729	-3.1%	-785	-5.8%	no
CE530-CE500	-368	-395	-395		-376	-391	-395	-368	-7.0%	-324	-15.9%	no
CE545-CE540	-576	-606	-606		-571	-589	-606	-571	-6.0%	-553	-6.1%	no

Table 6.27 – Delta Annual Space Cooling Electricity Consumption (continued).

Delta Cooling Coil Loads

Sensible Coil Load (kWh,th)								Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan		Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE310-CE300	-405	504	508	-27	-24	-108		-405	508	1224.5%	-206	376.7%	yes
CE320-CE300	6197	6900	6942	6791	6799	7543		6197	7543	19.6%	6119	10.8%	yes
CE330-CE300	6422	7514	7523	8527	7440	6631		6422	8527	28.7%	6052	17.6%	yes
CE330-CE320	224	614	581	1735	641	-912		-912	1735	550.9%	-67	113.9%	yes
CE340-CE300	6371	7257	7306	7634	7171	6215		6215	7634	20.3%	6072	13.2%	yes
CE330-CE340	51	258	217	893	269	416		51	893	240.2%	-19	105.5%	yes
CE350-CE300	-6291	-8112	-8128	-6707	-6621	-6423		-8128	-6291	-26.1%	-6531	-7.3%	yes
CE360-CE300	78315	79123	79135	80035	78996	79506		78315	80035	2.2%	78900	0.4%	yes
CE400-CE300	-14709	-14378	-14368	-14564		-14010		-14709	-14010	-4.9%	-15468	-7.4%	no
CE410-CE300	-10985	-8138	-8145			-9606		-10985	-8138	-30.9%	-8462	-8.2%	yes
CE420-CE300	-6272	-6131	-5193	-5728		-5207		-6272	-5193	-18.9%	-6125	-7.3%	yes
CE430-CE300	-8798	-8066	-8351	-8513		-9048		-9048	-8066	-11.5%	-8456	-1.2%	yes
CE440-CE300	-5786	-5204	-5313	-5192		-5406		-5786	-5192	-11.0%	-5658	-5.2%	yes
CE500-CE300	-11618	-8147	-8159	-7761	-10335	-7661		-11618	-7661	-44.2%	-8216	-8.2%	yes
CE510-CE500	43046	45710	45710	45091	43051	45083		43046	45710	6.0%	45049	1.0%	yes
CE525-CE520	-131	-884	-882	-1057	-202	-949		-1057	-131	-135.4%	-1247	-82.3%	yes
CE530-CE500	2	-1076	-1076	-547	0	-528		-1076	2	-200.6%	-430	-19.9%	yes
CE545-CE540	-130	-809	-809	-676	-202	-792		-809	-130	-119.1%	-936	-64.3%	yes
Latent Coil Load(kWh,th)								Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan		Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE310-CE300	19321	19607	19612	19156	19576	19111		19111	19612	2.6%	19400	0.0%	yes
CE320-CE300	13167	12173	12259	11974	12597	11157		11157	13167	16.4%	12818	4.9%	yes
CE330-CE300	18164	15932	16179	16367	18528	17119		15932	18528	15.2%	18132	6.4%	yes
CE330-CE320	4997	3760	3919	4393	5931	5962		3760	5962	45.6%	5314	10.1%	yes
CE340-CE300	15930	14488	14625	14757	15760	15279		14488	15930	9.5%	15770	4.2%	yes
CE330-CE340	2234	1445	1553	1610	2768	1840		1445	2768	69.3%	2362	23.8%	yes
CE350-CE300	-4748	-5435	-5529	-4821	-4264	-4446		-5529	-4264	-26.0%	-4632	-4.9%	yes
CE360-CE300	4232	3401	3427	3895	4459	4403		3401	4459	26.7%	4266	7.5%	yes
CE400-CE300	3075	2012	2101	2660		2650		2012	3075	42.5%	3151	26.0%	yes
CE410-CE300	-769	-2366	-2303			-2477		-2477	-769	-86.3%	-2406	-21.6%	yes
CE420-CE300	-1546	-1542	-1217	-1240		-1212		-1546	-1212	-24.7%	-1685	-24.7%	yes
CE430-CE300	-1872	-1577	-1722	-1663		-2010		-2010	-1577	-24.5%	-1977	-11.8%	yes
CE440-CE300	-930	-699	-798	-709		-823		-930	-699	-29.1%	-1285	-62.3%	no
CE500-CE300	-5452	-3141	-3141	-3986	-4304	-4983		-5452	-3141	-55.5%	-5238	-25.7%	yes
CE510-CE500	17485	17615	17615	17348	17488	17340		17340	17615	1.6%	17487	0.0%	yes
CE525-CE520	2	-288	-288	-58	-9	-42		-288	2	-255.0%	-4	-96.6%	yes
CE530-CE500	-18313	-18285	-18286	-18080	-18230	-18084		-18313	-18080	-1.3%	-18233	-0.1%	yes
CE545-CE540	-1	-81	-81	-9	-3	-2		-81	-1	-272.0%	-1	-95.4%	yes

Table 6.28 – Delta Cooling Coil Loads.

Delta Various Annual Means (COP2, IDB)

COP2	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	0.166	0.180	0.180	0.155	0.171	0.150	0.150	0.180	18.0%	0.171	2.2%	yes
CE320-CE300	0.171	0.220	0.220	0.168	0.180	0.160	0.160	0.220	32.3%	0.172	7.8%	yes
CE330-CE300	0.242	0.256	0.299	0.253	0.271	0.230	0.230	0.299	26.7%	0.251	2.9%	yes
CE330-CE320	0.071	0.036	0.079	0.086	0.091	0.070	0.036	0.091	76.3%	0.079	9.7%	yes
CE340-CE300	0.205	0.240	0.258	0.210	0.223	0.190	0.190	0.258	30.9%	0.211	4.5%	yes
CE330-CE340	0.036	0.017	0.041	0.043	0.048	0.040	0.017	0.048	82.5%	0.040	6.6%	yes
CE350-CE300	0.000	0.003	-0.002	0.006	0.003	0.000	-0.002	0.006	498.6%	0.013	669.2%	no
CE360-CE300	0.420	0.463	0.468	0.441	0.440	0.430	0.420	0.468	10.9%	0.425	4.2%	yes
CE400-CE300	0.001	0.014	0.015	0.009		0.030	0.001	0.030	210.3%	0.022	60.6%	yes
CE410-CE300	-0.010	-0.025	-0.027			-0.020	-0.027	-0.010	-84.0%	-0.015	-28.7%	yes
CE420-CE300	-0.023	-0.022	-0.020	-0.021		-0.020	-0.023	-0.020	-14.9%	-0.018	-14.8%	yes
CE430-CE300	-0.028	-0.025	-0.026	-0.026		-0.020	-0.028	-0.020	-33.0%	-0.023	-8.5%	yes
CE440-CE300	-0.018	-0.015	-0.015	-0.016		-0.010	-0.018	-0.010	-51.9%	-0.013	-9.5%	yes
CE500-CE300	-0.045	-0.010	-0.011	-0.024	-0.034	-0.030	-0.045	-0.010	-135.4%	-0.046	-76.9%	yes
CE510-CE500	0.409	0.416	0.416	0.408	0.397	0.410	0.397	0.416	4.6%	0.426	4.0%	yes
CE525-CE520	0.582	0.574	0.572	0.504	0.606	0.490	0.490	0.606	21.0%	0.580	4.6%	yes
CE530-CE500	-0.242	-0.258	-0.257	-0.214	-0.276	-0.220	-0.276	-0.214	-25.5%	-0.296	-21.0%	yes
CE545-CE540	0.560	0.559	0.560	0.334	0.546	0.510	0.334	0.560	44.3%	0.448	12.5%	yes
IDB (°C)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	0.13	0.06	0.00	0.00	0.01	0.02	0.00	0.13	364.3%	0.07	89.7%	yes
CE320-CE300	0.28	0.33	0.33	0.16	0.25	0.54	0.16	0.54	119.3%	0.25	19.7%	yes
CE330-CE300	0.26	0.22	0.22	0.18	0.21	0.19	0.18	0.26	34.0%	0.21	2.9%	yes
CE330-CE320	-0.02	-0.11	-0.11	0.02	-0.03	-0.35	-0.35	0.02	-365.4%	-0.04	-55.6%	yes
CE340-CE300	0.25	0.22	0.22	0.21	0.23	0.22	0.21	0.25	19.5%	0.23	2.7%	yes
CE330-CE340	0.00	0.00	0.00	-0.02	-0.01	-0.03	-0.03	0.00	-319.0%	-0.02	-114.6%	yes
CE350-CE300	2.04	2.11	2.11	2.15	2.19	2.16	2.04	2.19	7.1%	2.14	0.8%	yes
CE360-CE300	1.74	1.56	1.50	1.23	1.40	1.38	1.23	1.74	34.6%	1.58	7.3%	yes
CE400-CE300	0.50	0.00	0.00	0.00		0.00	0.00	0.50	498.8%	0.08	18.5%	yes
CE410-CE300	0.50	0.00	0.00			0.00	0.00	0.50	400.0%	-0.02	115.1%	yes
CE420-CE300	0.30	0.00	0.00	0.00		0.00	0.00	0.30	500.3%	0.03	45.2%	yes
CE430-CE300	0.37	0.00	0.00	0.00		0.00	0.00	0.37	500.3%	0.01	81.7%	yes
CE440-CE300	0.29	0.00	0.00	0.00		0.00	0.00	0.29	500.2%	0.06	1.3%	yes
CE500-CE300	-3.39	-3.39	-3.50	-3.71	-2.98	-1.13	-3.71	-1.13	-85.5%	-3.33	-10.4%	yes
CE510-CE500	1.24	0.11	0.11	-0.02	0.00	0.00	-0.02	1.24	526.6%	0.62	156.8%	yes
CE525-CE520	13.33	13.61	13.56	13.53	13.63	15.80	13.33	15.80	17.8%	13.29	4.4%	yes
CE530-CE500	-0.21	-0.06	0.00	0.21	0.00	0.00	-0.21	0.21	-4302.5%	-0.06	-504.1%	yes
CE545-CE540	13.32	13.56	13.56	13.52	13.58	15.71	13.32	15.71	17.3%	13.35	3.8%	yes

Table 6.29 – Delta Various Annual Means (COP2,IDB).

Delta Various Annual Means (Zone Humidity)

Humidity Ratio (kg/kg)	TRNSYS	DOE-2.2	DOE21E-E	EnergyPlus	CODYRUN	HOT3000	Statistics, All Results			Apache	[Ap-Mean] /Mean	Within Range
	TUD	NREL	NREL	GARD	UR	NRCan	Min	Max	(Max-Min) /Mean			
CE310-CE300	0.0020	0.0021	0.0021	0.0020	0.0020	0.0019	0.0019	0.0021	9.9%	0.0020	1.1%	yes
CE320-CE300	0.0009	0.0009	0.0009	0.0008	0.0009	0.0007	0.0007	0.0009	25.7%	0.0009	8.5%	yes
CE330-CE300	0.0007	0.0007	0.0007	0.0007	0.0006	0.0007	0.0006	0.0007	9.3%	0.0007	3.5%	yes
CE330-CE320	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002	0.0000	-0.0002	0.0000	-143.9%	-0.0002	-28.2%	yes
CE340-CE300	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	4.1%	0.0008	7.1%	no
CE330-CE340	-0.0001	0.0000	0.0000	0.0000	-0.0001	0.0000	-0.0001	0.0000	-277.9%	0.0000	-125.9%	yes
CE350-CE300	0.0006	0.0008	0.0008	0.0006	0.0006	0.0006	0.0006	0.0008	34.2%	0.0006	5.2%	yes
CE360-CE300	-0.0006	-0.0005	-0.0005	-0.0005	-0.0006	-0.0006	-0.0006	-0.0005	-22.0%	-0.0006	-5.3%	yes
CE400-CE300	0.0007	0.0008	0.0008	0.0008		0.0008	0.0007	0.0008	8.7%	0.0010	31.2%	no
CE410-CE300	0.0007	0.0003	0.0003			0.0003	0.0003	0.0007	94.5%	0.0004	7.1%	yes
CE420-CE300	0.0002	0.0002	0.0002	0.0002		0.0001	0.0001	0.0002	58.3%	0.0002	42.1%	yes
CE430-CE300	0.0002	0.0002	0.0002	0.0002		0.0002	0.0002	0.0002	19.7%	0.0003	37.8%	no
CE440-CE300	0.0001	0.0001	0.0001	0.0000		0.0000	0.0000	0.0001	148.5%	0.0001	116.7%	yes
CE500-CE300	0.0007			0.0001	0.0010	0.0015	0.0001	0.0015	169.4%	0.0006	31.4%	yes
CE510-CE500	0.0004			0.0000	0.0000	0.0000	0.0000	0.0004	394.2%	0.0003	200.4%	yes
CE525-CE520	0.0070			0.0078	0.0070	0.0075	0.0070	0.0078	10.9%	0.0067	8.2%	yes
CE530-CE500	-0.0035			-0.0027	-0.0044	-0.0040	-0.0044	-0.0027	-48.0%	-0.0037	-0.8%	yes
CE545-CE540	0.0018			0.0024	0.0029	0.0026	0.0018	0.0029	46.8%	0.0022	7.1%	yes
Relative Humidity (%)	TRNSYS	DOE-2.2	DOE21E-E	EnergyPlus	CODYRUN	HOT3000	Statistics, All Results			Apache	[Ap-Mean] /Mean	Within Range
	TUD	NREL	NREL	GARD	UR	NRCan	Min	Max	(Max-Min) /Mean			
CE310-CE300	9.72	10.25	10.25	9.96	10.01	9.87	9.72	10.25	5.3%	10.01	0.0%	yes
CE320-CE300	3.39	2.95	2.97	3.25	3.28	2.01	2.01	3.39	46.4%	3.47	16.8%	yes
CE330-CE300	2.23	2.32	2.37	2.59	2.26	2.77	2.23	2.77	22.3%	2.55	5.3%	yes
CE330-CE320	-1.16	-0.63	-0.60	-0.66	-1.02	0.76	-1.16	0.76	-347.8%	-0.92	-67.5%	yes
CE340-CE300	2.47	2.43	2.45	2.56	2.47	2.85	2.43	2.85	16.5%	2.69	5.8%	yes
CE330-CE340	-0.24	-0.11	-0.08	0.03	-0.21	-0.08	-0.24	0.03	-232.7%	-0.14	-17.6%	yes
CE350-CE300	-3.13	-2.81	-2.73	-3.42	-3.51	-3.37	-3.51	-2.73	-24.7%	-3.28	-3.8%	yes
CE360-CE300	-7.58	-6.77	-6.79	-6.22	-6.96	-6.72	-7.58	-6.22	-19.9%	-7.12	-4.2%	yes
CE400-CE300	2.16	3.95	3.97	3.96		4.08	2.16	4.08	53.1%	4.75	31.1%	yes
CE410-CE300	1.88	1.39	1.35			1.82	1.35	1.88	33.0%	1.79	11.4%	yes
CE420-CE300	0.16	0.88	0.69	0.81		0.83	0.16	0.88	106.1%	1.06	57.4%	yes
CE430-CE300	0.21	0.91	1.02	1.01		1.24	0.21	1.24	117.8%	1.34	52.6%	yes
CE440-CE300	-0.29	0.20	0.29	0.24		0.30	-0.29	0.30	394.1%	0.47	214.5%	yes
CE500-CE300	17.91			10.61	18.12	15.80	10.61	18.12	48.1%	16.56	6.1%	yes
CE510-CE500	-2.35			0.11	-0.01	0.11	-2.35	0.11	-461.4%	-0.61	-14.2%	yes
CE525-CE520	-8.41			-6.41	-10.09	-14.80	-14.80	-6.41	-84.5%	-8.21	-17.3%	yes
CE530-CE500	-19.80			-10.22	-24.49	-24.13	-24.49	-10.22	-72.6%	-20.64	-5.0%	yes
CE545-CE540	-11.90			-7.68	-3.18	-14.62	-14.62	-3.18	-122.5%	-5.87	-37.2%	yes

Table 6.30 – Delta Various Annual Means (Zone Humidity).

Delta Hourly Integrated Maximum Total Consumptions												
Total Consumption (Wh,e)	Total Consumption (Wh,e)						Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean	Apache	Ap-Mean /Mean	Within Range
CE310-CE300	968	1019	993	641	721	614	614	1019	49.0%	961	16.3%	yes
CE320-CE300	1402	1352	1379	1055	1172	1327	1055	1402	27.1%	1438	12.3%	yes
CE330-CE300	1721	1648	1805	1414	1535	1787	1414	1805	23.7%	1820	10.2%	yes
CE330-CE320	319	296	426	360	363	460	296	460	44.3%	382	3.1%	yes
CE340-CE300	1555	1594	1588	1234	1345	1553	1234	1594	24.3%	1631	10.3%	yes
CE330-CE340	166	54	217	180	190	234	54	234	103.8%	189	9.1%	yes
CE350-CE300	1	90	0	0	0	-2	-2	90	621.2%	-55	472.3%	yes
CE360-CE300	1143	1172	1124	844	931	1214	844	1214	34.5%	1124	4.9%	yes
CE400-CE300	2	0	75	0		-29	-29	75	1087.2%	150	1468.2%	no
CE410-CE300	2	0	0			1	0	2	258.7%	-128	18243.2%	no
CE420-CE300	0	0	0	0		0	0	0	0.0%	-109		
CE430-CE300	0	0	0	0		0	0	0	-500.0%	-143		
CE440-CE300	0	0	0	0		-87	-87	0	-500.0%	-143	-720.3%	no
CE500-CE300	-1460	-1133	-1177	-1501	-1755	-1274	-1755	-1133	-45.0%	-1230	-11.1%	yes
CE510-CE500	1038	1159	1162	1011	1009	1070	1009	1162	14.2%	1002	6.8%	yes
CE525-CE520	-1669	-1451	-1483	-1531	-1625	-1099	-1669	-1099	-38.6%	-1536	-4.0%	yes
CE530-CE500	-2138	-2372	-2370	-2228	-2185	-2185	-2372	-2138	-10.4%	-1953	-13.1%	no
CE545-CE540	-1494	-1593	-1593	-915	-1495	-1514	-1593	-915	-47.3%	-1575	-9.8%	yes

Table 6.31 – Delta Hourly Integrated Maximum Total Consumptions.

Delta Hourly Integrated Maximum Coil Loads

Sensible + Latent Coil Load (Wh,th)								Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan		Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE310-CE300	5154	5349	5578	4393	4759	4919		4393	5578	23.6%	5044	0.4%	yes
CE320-CE300	8144	22412	22368	7032	7402	7848		7032	22412	122.7%	8271	34.0%	yes
CE330-CE300	11318	12227	33117	10712	11476	10343		10343	33117	153.2%	11785	20.7%	yes
CE330-CE320	3174	-10185	10749	3680	4074	2495		-10185	10749	898.0%	3514	50.7%	yes
CE340-CE300	9478	19418	28094	8595	8864	9060		8595	28094	140.1%	9885	29.0%	yes
CE330-CE340	1840	-7191	5023	2117	2612	1283		-7191	5023	1289.3%	1899	100.5%	yes
CE350-CE300	-82	0	-1	0	0	5		-82	5	-669.0%	5	-135.2%	yes
CE360-CE300	6683	9212	9564	5726	5820	6379		5726	9564	53.1%	6962	3.7%	yes
CE400-CE300	9005	9142	18383	7995		8702		7995	18383	97.6%	9943	6.6%	yes
CE410-CE300	-82	0	0	0		1		-82	1	-409.8%	-235	-1057.6%	no
CE420-CE300	0	0	0	0		0		0	0	#DIV/0!	-112		
CE430-CE300	0	0	0	0		0		0	0	-500.0%	-206		
CE440-CE300	0	0	0	0		-295		-295	0	-500.0%	-206	-249.2%	yes
CE500-CE300	-4689	-3694	-3749	-5087	-5935	-4517		-5935	-3694	-48.6%	-4333	-6.0%	yes
CE510-CE500	3108	3481	3482	3531	3381	3542		3108	3542	12.7%	3413	0.2%	yes
CE525-CE520	410	-412	-412	-76	8	-881		-881	410	-568.4%	-299	-31.6%	yes
CE530-CE500	-7651	-8131	-8131	-8008	-7791	-7929		-8131	-7651	-6.0%	-7865	-0.9%	yes
CE545-CE540	500	-291	-292	-187	-30	-302		-302	500	-800.3%	-291	-190.3%	yes
Sensible Coil Load (Wh,th)								Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan		Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE310-CE300	-183	-123	-86	-254	-379	-259		-379	-86	-136.9%	-231	-7.8%	yes
CE320-CE300	8038	7916	7867	8441	7677	8059		7677	8441	9.6%	7389	7.6%	yes
CE330-CE300	9949	10207	11285	11234	10540	10513		9949	11285	12.6%	9526	10.3%	yes
CE330-CE320	1911	2291	3418	2793	2863	2454		1911	3418	57.5%	2137	18.5%	yes
CE340-CE300	9552	8883	8881	9357	9483	9272		8881	9552	7.3%	8851	4.2%	yes
CE330-CE340	397	1324	2404	1877	1057	1241		397	2404	145.1%	675	51.2%	yes
CE350-CE300	0	0	0	0	0	-32		-32	0	-603.8%	-160	-2902.4%	no
CE360-CE300	8783	8908	8860	9090	8524	9271		8524	9271	8.4%	8499	4.6%	yes
CE400-CE300	0	0	0	0		-31		-31	0	-503.2%	-195	-3052.2%	no
CE410-CE300	-12	0	0	0		-15		-15	0	-224.7%	-208	-3009.2%	no
CE420-CE300	0	0	0	0		-15		-15	0	-500.0%	-200	-6580.8%	no
CE430-CE300	0	0	0	0		-15		-15	0	-500.0%	-265	-8731.8%	no
CE440-CE300	0	0	0	0		-33		-33	0	-500.0%	-265	-3914.4%	no
CE500-CE300	-3728	-3194	-3197	-3682	-4681	-3090		-4681	-3090	-44.3%	-3380	-6.0%	yes
CE510-CE500	2180	2504	2505	2441	2345	2451		2180	2505	13.5%	2425	0.9%	yes
CE525-CE520	287	-309	-304	-336	-210	-717		-717	287	-379.1%	-421	-59.1%	yes
CE530-CE500	285	-433	-433	-211	0	-192		-433	285	-437.9%	-136	-17.2%	yes
CE545-CE540	500	-291	-292	-187	-35	-302		-302	500	-793.7%	-291	-187.9%	yes
Latent Coil Load (Wh,th)								Statistics, All Results					
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan		Min	Max	(Max-Min) /Mean	Apache	[Ap-Mean] /Mean	Within Range
CE310-CE300	6271	5835	5876	6040	5737	5685		5685	6271	9.9%	5627	4.7%	yes
CE320-CE300	13512	22193	22109	11961	11322	11537		11322	22193	70.4%	13215	14.4%	yes
CE330-CE300	18190	17637	31415	16899	17809	17096		16899	31415	73.2%	17735	10.6%	yes
CE330-CE320	4678	-4556	9306	4939	6487	5559		-4556	9306	314.9%	4520	2.7%	yes
CE340-CE300	15213	21147	26617	13676	13850	13402		13402	26617	76.3%	15208	12.2%	yes
CE330-CE340	2977	-3510	4798	3223	3959	3694		-3510	4798	329.2%	2527	0.1%	yes
CE350-CE300	116	-1	-1	1	380	1211		-1	1211	426.5%	-45	115.7%	yes
CE360-CE300	-361	722	942	-1715	-1516	-1458		-1715	942	-470.9%	-626	-11.0%	yes
CE400-CE300	17440	16274	23002	16082		16253		16082	23002	38.9%	17615	1.1%	yes
CE410-CE300	1503	0	-3	0		-15		-15	1503	408.9%	2674	620.2%	no
CE420-CE300	115	0	0	0		2		0	115	491.5%	-190	907.7%	no
CE430-CE300	0	1801	1707	839		2		0	1801	207.1%	688	20.8%	yes
CE440-CE300	0	0	-3	0		-253		-253	0	-494.1%	-161	-214.0%	yes
CE500-CE300	-1670	-1571	-1661	-2396	-2570	-2630		-2630	-1571	-50.8%	-2065	-0.8%	yes
CE510-CE500	927	990	990	1116	1045	1112		927	1116	18.3%	994	3.5%	yes
CE525-CE520	123	-122	-122	249	212	-144		-144	249	1201.2%	150	357.2%	yes
CE530-CE500	-7965	-7733	-7733	-7838	-7626	-7726		-7965	-7626	-4.4%	-7701	-0.9%	yes
CE545-CE540	-627	0	0	-1655	-841	-1181		-1655	0	-230.7%	-705	-1.7%	yes

Table 6.32 – Delta Hourly Integrated Maximum Coil Loads.

Delta Hourly Integrated Maximum and Minimum COP2

Maximum COP2	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	-0.025	0.272	0.271	0.248	0.257	0.240	-0.025	0.272	141.1%	0.248	17.7%	yes
CE320-CE300	0.000	1.274	1.110	0.014	0.073	0.500	0.000	1.274	257.3%	-0.075	115.1%	yes
CE330-CE300	0.000	0.240	1.738	0.146	0.251	0.170	0.000	1.738	409.6%	0.131	69.1%	yes
CE330-CE320	0.000	-1.034	0.628	0.132	0.179	-0.330	-1.034	0.628	-2344.2%	0.206	-390.6%	yes
CE340-CE300	0.000	0.752	1.482	0.061	0.147	0.070	0.000	1.482	354.0%	0.036	91.3%	yes
CE330-CE340	0.000	-0.512	0.256	0.085	0.105	0.100	-0.512	0.256	13685.7%	0.095	1587.7%	yes
CE350-CE300	0.000	0.020	0.006	0.630	0.061	0.000	0.000	0.630	526.8%	0.035	70.9%	yes
CE360-CE300	0.233	0.559	0.570	0.530	0.561	0.560	0.233	0.570	67.2%	0.419	16.6%	yes
CE400-CE300	-0.091	0.219	0.919	0.146		0.170	-0.091	0.919	370.7%	0.130	52.5%	yes
CE410-CE300	-0.280	0.034	-0.002			-0.040	-0.280	0.034	-436.1%	0.050	-169.8%	yes
CE420-CE300	-0.387	-0.062	-0.098	-0.104		0.060	-0.387	0.060	-378.3%	-0.210	-77.4%	yes
CE430-CE300	-0.387	-0.064	-0.098	-0.133		0.050	-0.387	0.050	-346.0%	-0.176	-39.5%	yes
CE440-CE300	-0.285	-0.095	-0.098	-0.123		-0.070	-0.285	-0.070	-160.0%	-0.178	-32.3%	yes
CE500-CE300	0.107	3.498	1.444	0.273	0.314	0.260	0.107	3.498	345.1%	0.323	67.1%	yes
CE510-CE500	0.417	0.000	0.000	0.487	0.505	0.390	0.000	0.505	168.4%	0.393	31.0%	yes
CE525-CE520	0.904	1.429	1.379	0.766	0.836	0.560	0.560	1.429	88.8%	0.873	10.9%	yes
CE530-CE500	-0.269	-3.386	-1.451	-0.273	-0.345	-0.260	-3.386	-0.260	-313.5%	-0.385	-61.4%	yes
CE545-CE540	0.794	0.819	0.973	0.470	0.490	0.480	0.470	0.973	74.9%	0.674	0.4%	yes
Minimum COP2	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	0.072	0.052	0.050	0.111	0.087	0.060	0.050	0.111	84.8%	0.095	32.2%	yes
CE320-CE300	0.032	0.003	0.004	0.060	0.029	0.020	0.003	0.060	231.0%	0.042	70.8%	yes
CE330-CE300	0.032	0.000	0.000	0.063	0.038	0.030	0.000	0.063	231.1%	0.035	29.6%	yes
CE330-CE320	0.000	-0.003	-0.004	0.003	0.009	0.010	-0.004	0.010	584.2%	-0.007	393.8%	yes
CE340-CE300	0.032	0.000	0.000	0.063	0.038	0.030	0.000	0.063	231.1%	0.035	29.6%	yes
CE330-CE340	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0%	0.000	0.0%	yes
CE350-CE300	-0.003	0.000	0.000	0.000	0.000	0.000	-0.003	0.000	-742.2%	-0.010	-2463.5%	no
CE360-CE300	0.032	0.001	0.000	0.063	0.038	0.030	0.000	0.063	229.7%	0.035	28.8%	yes
CE400-CE300	-0.011	-0.064	-0.066	0.000		0.000	-0.066	0.000	-233.8%	-0.013	-52.2%	yes
CE410-CE300	-0.007	0.000	0.000			0.000	-0.007	0.000	-400.0%	-0.014	-700.1%	no
CE420-CE300	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.0%	-0.020	100.0%	no
CE430-CE300	-0.022	-0.064	-0.066	0.000		0.000	-0.066	0.000	-217.2%	-0.020	-34.6%	yes
CE440-CE300	-0.011	-0.064	-0.066	0.000		0.000	-0.066	0.000	-234.7%	-0.020	-29.4%	yes
CE500-CE300	-0.108	-0.105	-0.149	-0.076	-0.119	-0.100	-0.149	-0.076	-66.6%	-0.096	-12.0%	yes
CE510-CE500	0.203	0.124	0.000	0.160	0.215	0.190	0.000	0.215	144.8%	0.134	10.0%	yes
CE525-CE520	0.469	0.476	0.420	0.408	0.561	0.430	0.408	0.561	33.2%	0.476	3.3%	yes
CE530-CE500	-0.184	-0.198	-0.154	-0.173	-0.193	-0.190	-0.198	-0.154	-24.2%	-0.257	-41.0%	no
CE545-CE540	0.479	0.459	0.460	0.277	0.549	0.440	0.277	0.549	61.2%	0.422	5.1%	yes

Table 6.33 – Delta Hourly Integrated Maximum and Minimum COP2.

Delta Hourly Integrated Maximum and Minimum IDB

Maximum IDB (°C)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	0.88	1.78	1.61	1.47	1.57	1.00	0.88	1.78	65.1%	1.20	13.3%	yes
CE320-CE300	6.16	6.50	6.39	6.71	7.27	5.46	5.46	7.27	28.2%	6.58	2.6%	yes
CE330-CE300	6.03	6.61	6.89	6.07	6.85	5.11	5.11	6.89	28.4%	6.37	1.8%	yes
CE330-CE320	-0.13	0.11	0.50	-0.64	-0.42	-0.35	-0.64	0.50	-736.8%	-0.21	-33.2%	yes
CE340-CE300	6.11	6.50	6.45	6.50	7.10	5.39	5.39	7.10	27.0%	6.49	2.3%	yes
CE330-CE340	-0.07	0.11	0.44	-0.43	-0.25	-0.28	-0.43	0.44	-1078.3%	-0.12	-43.0%	yes
CE350-CE300	8.38	9.83	9.83	10.00	9.95	8.81	8.38	10.00	17.1%	8.90	6.0%	yes
CE360-CE300	7.56	7.67	7.45	7.51	7.95	6.94	6.94	7.95	13.4%	7.81	4.0%	yes
CE400-CE300	0.91	2.45	3.72	1.91		-0.15	-0.15	3.72	218.8%	2.75	55.6%	yes
CE410-CE300	0.63	0.00	0.00			0.00	0.00	0.63	400.0%	0.47	199.5%	yes
CE420-CE300	0.00	0.00	0.00	0.00		0.04	0.00	0.04	500.0%	0.31	3779.5%	no
CE430-CE300	1.00	0.00	0.00	0.00		0.26	0.00	1.00	396.6%	0.31	23.2%	yes
CE440-CE300	0.85	0.00	0.00	0.00		0.07	0.00	0.85	461.5%	0.32	74.6%	yes
CE500-CE300	-0.39	0.00	0.00	0.00	-0.03	-1.19	-1.19	0.00	-441.5%	-0.26	-2.3%	yes
CE510-CE500	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.29	600.0%	0.26	428.7%	yes
CE525-CE520	19.96	18.95	19.12	20.00	19.02	16.38	16.38	20.00	19.1%	18.02	4.7%	yes
CE530-CE500	0.31	-0.05	-0.05	0.00	0.00	0.00	-0.05	0.31	1025.2%	-0.16	558.2%	yes
CE545-CE540	19.53	19.89	19.89	20.00	19.95	20.00	19.53	20.00	2.4%	19.69	0.9%	yes
Minimum IDB (°C)	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Statistics, All Results			Apache	Ap-Mean /Mean	Within Range
							Min	Max	(Max-Min) /Mean			
CE310-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-600.0%	0.00	-107.8%	yes
CE320-CE300	0.00	1.94	1.95	-0.96	0.00	0.00	-0.96	1.95	597.5%	0.01	97.0%	yes
CE330-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-600.0%	0.00	-100.0%	yes
CE330-CE320	0.00	-1.94	-1.95	0.96	0.00	0.00	-1.95	0.96	-596.8%	-0.01	-97.0%	yes
CE340-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-600.0%	0.00	-100.0%	yes
CE330-CE340	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%	0.00	0.0%	yes
CE350-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%	0.00	0.0%	yes
CE360-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	600.0%	0.00	100.0%	yes
CE400-CE300	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	0.0%	0.00	100.0%	no
CE420-CE300	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	-500.0%	0.00		
CE440-CE300	0.00	0.00	0.00	0.00		0.01	0.00	0.01	500.0%	0.00	100.2%	yes
CE500-CE300	0.50	-0.72	-0.89	0.22	0.54	17.05	-0.89	17.05	644.6%	-0.10	103.7%	yes
CE510-CE500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	600.0%	0.00	100.0%	
CE525-CE520	0.14	0.06	0.05	0.18	0.03	19.44	0.03	19.44	585.3%	0.03	99.0%	yes
CE530-CE500	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	-533.6%	0.00	-56.1%	yes
CE545-CE540	0.22	0.06	0.05	0.18	0.03	18.06	0.03	18.06	581.6%	0.03	98.9%	yes

Table 6.34 – Delta Hourly Integrated Maximum and Minimum IDB.

Delta Hourly Integrated Maximum and Minimum Zone Humidity Ratio

Maximum Humidity Ratio (kg/kg)							Statistics, All Results			Apache	[Ap-Mean] /Mean	Within Range
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCAN	Min	Max	(Max-Min) /Mean			
CE310-CE300	0.0025	0.0050	0.0052	0.0020	0.0020	0.0023	0.0020	0.0052	102.1%	0.0021	33.6%	yes
CE320-CE300	0.0047	0.0039	0.0039	0.0042	0.0041	0.0043	0.0039	0.0047	19.9%	0.0046	10.9%	yes
CE330-CE300	0.0044	0.0040	0.0040	0.0043	0.0036	0.0043	0.0036	0.0044	19.0%	0.0042	1.6%	yes
CE330-CE320	-0.0004	0.0001	0.0001	0.0001	-0.0005	0.0000	-0.0005	0.0001	-696.5%	-0.0005	-435.5%	yes
CE340-CE300	0.0046	0.0039	0.0037	0.0042	0.0038	0.0043	0.0037	0.0046	21.8%	0.0044	8.3%	yes
CE330-CE340	-0.0002	0.0001	0.0003	0.0001	-0.0002	0.0000	-0.0002	0.0003	3174.2%	-0.0003	1649.3%	yes
CE350-CE300	0.0035	0.0061	0.0062	0.0036	0.0030	0.0032	0.0030	0.0062	74.6%	0.0033	23.6%	yes
CE360-CE300	0.0001	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0002	366.5%	0.0000	100.0%	yes
CE400-CE300	0.0037	0.0032	0.0033	0.0033		0.0039	0.0032	0.0039	20.2%	0.0035	0.1%	yes
CE410-CE300	0.0036	0.0031	0.0032			0.0039	0.0031	0.0039	23.3%	0.0035	1.5%	yes
CE420-CE300	0.0010	0.0009	0.0004	0.0010		0.0013	0.0004	0.0013	98.3%	0.0011	16.5%	yes
CE430-CE300	0.0029	0.0018	0.0019	0.0025		0.0024	0.0018	0.0029	49.6%	0.0027	16.9%	yes
CE440-CE300	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	500.0%	0.0002	2646.3%	no
CE500-CE300	-0.0016	-0.0019	-0.0019	-0.0019	-0.0017	-0.0019	-0.0019	-0.0016	-20.6%	-0.0018	-2.5%	yes
CE510-CE500	0.0002	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0002	352.6%	0.0001	81.7%	yes
CE525-CE520	0.0104	0.0103	0.0102	0.0115	0.0101	0.0067	0.0067	0.0115	48.3%	0.0089	9.7%	yes
CE530-CE500	-0.0047	-0.0038	-0.0037	-0.0049	-0.0062	-0.0047	-0.0062	-0.0037	-53.9%	-0.0018	-61.1%	no
CE545-CE540	0.0009	0.0072	0.0059	0.0000	0.0034	0.0013	0.0000	0.0072	230.7%	0.0012	60.2%	yes
Minimum Humidity Ratio (kg/kg)							Statistics, All Results			Apache	[Ap-Mean] /Mean	Within Range
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCAN	Min	Max	(Max-Min) /Mean			
CE310-CE300	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	646.4%	0.0000	96.0%	yes
CE320-CE300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	600.0%	0.0000	26.5%	yes
CE330-CE300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-600.0%	0.0000	-100.0%	yes
CE330-CE320	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-600.0%	0.0000	-26.7%	yes
CE340-CE300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-600.0%	0.0000	-100.0%	yes
CE330-CE340	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%	0.0000	0.0%	yes
CE350-CE300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%	0.0000	0.0%	yes
CE360-CE300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-600.0%	0.0000	-100.0%	yes
CE400-CE300	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	0.0%	0.0000		
CE420-CE300	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	500.0%	0.0000		
CE440-CE300	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	58.2%	0.0046	20.7%	yes
CE510-CE500	0.0000			0.0000	0.0000	0.0002	0.0000	0.0002	400.0%	0.0000	100.0%	yes
CE525-CE520	0.0007			0.0005	0.0004	0.0088	0.0004	0.0088	322.8%	0.0009	66.4%	yes
CE530-CE500	-0.0006			-0.0003	-0.0015	-0.0037	-0.0037	-0.0003	-226.1%	-0.0007	-55.7%	yes
CE545-CE540	0.0021			0.0030	0.0034	0.0028	0.0021	0.0034	47.3%	0.0027	5.2%	yes

Table 6.35 – Delta Hourly Integrated Maximum and Minimum Zone Humidity Ratio.

Delta Hourly Integrated Maximum and Minimum Zone Relative Humidity

Maximum Relative Humidity (%)							Statistics, All Results						
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean		Apache	Ap-Mean /Mean	Within Range
CE310-CE300	8.91	30.83	31.85	10.28	9.00	10.75	8.91	31.85	135.4%		8.56	49.4%	yes
CE320-CE300	13.05	14.06	14.82	14.60	15.00	14.44	13.05	15.00	13.6%		14.00	2.3%	yes
CE330-CE300	7.87	9.11	9.09	8.51	8.00	11.26	7.87	11.26	37.8%		7.96	11.3%	yes
CE330-CE320	-5.18	-4.95	-5.73	-6.09	-7.00	-3.18	-7	-3	-71.3%		-6.04	-12.9%	yes
CE340-CE300	11.14	12.02	12.41	12.43	12.00	12.81	11	13	13.8%		11.78	2.9%	yes
CE330-CE340	-3.27	-2.91	-3.32	-3.92	-4.00	-1.55	-4	-2	-77.5%		-3.82	-21.0%	yes
CE350-CE300	0.00	11.77	12.27	0.00	2.00	5.21	0.00	12.27	235.6%		0.00	100.0%	yes
CE360-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-600.0%		0.00	-100.0%	yes
CE400-CE300	14.96	16.22	16.72	16.27		18.87	14.96	18.87	23.5%		16.57	0.2%	yes
CE410-CE300	14.44	15.44	15.94			18.74	14.44	18.74	26.7%		17.78	10.2%	yes
CE420-CE300	2.05	5.16	2.68	4.92		6.41	2.05	6.41	102.7%		6.87	61.9%	yes
CE430-CE300	11.92	9.08	9.58	12.38		11.50	9.08	12.38	30.3%		13.91	27.8%	yes
CE440-CE300	-0.06	0.00	0.00	0.00		0.07	-0.06	0.07	13500.0%		-0.59	59402.0%	no
CE500-CE300	31.21			31.63	32.00	-7.36	-7.36	32.00	180.0%		31.83	45.5%	yes
CE510-CE500	0.00			0.00	0.00	-2.57	-2.57	0.00	-400.0%		0.00	-100.0%	yes
CE525-CE520	9.77			6.19	5.00	-20.65	-20.65	9.77	39706.5%		13.32	17281.1%	yes
CE530-CE500	-8.96			-3.84	-21.00	-24.07	-24.07	-3.84	-139.8%		-10.25	-29.1%	yes
CE545-CE540	29.60			41.06	50.00	-15.82	-15.82	50.00	251.1%		40.81	55.7%	yes
Minimum Relative Humidity (%)							Statistics, All Results						
	TRNSYS TUD	DOE-2.2 NREL	DOE21E-E NREL	EnergyPlus GARD	CODYRUN UR	HOT3000 NRCan	Min	Max	(Max-Min) /Mean		Apache	Ap-Mean /Mean	Within Range
CE310-CE300	0.06	0.00	0.00	1.10	1.00	0.99	0.00	1.10	209.6%		0.03	94.6%	yes
CE320-CE300	0.00	0.00	0.00	0.24	0.00	-2.02	-2.02	0.24	-761.2%		0.01	-103.6%	yes
CE330-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	600.0%		0.00	100.0%	yes
CE330-CE320	0.00	0.00	0.00	-0.24	0.00	2.02	-0.24	2.02	761.1%		-0.01	103.6%	yes
CE340-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	600.0%		0.00	100.0%	yes
CE330-CE340	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%		0.00	0.0%	yes
CE350-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%		0.00	0.0%	yes
CE360-CE300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-600.0%		0.00	-100.0%	yes
CE400-CE300	-0.12	0.00	0.00	-0.48		-0.37	-0.48	0.00	-246.0%		0.54	-378.8%	no
CE410-CE300	-0.12	0.00	0.00			-0.36	-0.36	0.00	-298.7%		0.97	-907.7%	no
CE420-CE300	-0.12	0.00	0.00	-0.48		-0.35	-0.48	0.00	-251.4%		-0.01	-93.3%	yes
CE430-CE300	-0.12	0.00	0.00	-0.48		-0.36	-0.48	0.00	-248.3%		0.68	-454.7%	no
CE440-CE300	-0.12	0.00	0.00	-0.48		-0.40	-0.48	0.00	-238.1%		0.68	-440.2%	no
CE500-CE300	40.07			40.76	39.00	37.89	37.89	40.76	7.3%		38.95	1.2%	yes
CE510-CE500	-1.32			0.12	0.00	0.32	-1.32	0.32	-747.8%		-0.62	-185.0%	yes
CE525-CE520	-15.74			-13.87	-17.00	-17.50	-17.50	-13.87	-22.6%		-11.55	-27.9%	no
CE530-CE500	-23.81			-21.14	-26.00	-19.15	-26.00	-19.15	-30.4%		-23.79	-5.6%	yes
CE545-CE540	-19.35			-16.77	-12.00	-19.60	-19.60	-12.00	-44.9%		-13.95	-17.6%	yes

Table 6.36 – Delta Hourly Integrated Maximum and Minimum Zone Relative Humidity.