Presentation from Ashrae 140-2007 with VIP-Energy version 4

Ashrae Standard 140-2007 contains a validation method designed to compare results from different energy program systems.

It is a valuable tool for developing energy calculation programs and also works as a quality check system.

Even if it only gives a comparison between programs, it still is a certain guarantee that the program manages the calculation cases included in the test. The reference programs, which are a part of the standard, are even compared towards a large number of test projects worldwide where significant deviations from the real function are revealed.

Ashrae is administering the standard, but a number of institutions around the world take part in the development of the standard that are constantly evolving along with the software.

In several countries it is a requirement that the software, used for verifying that buildings meet the building energy code, are validated according to some international system and in many cases requirement are specified to Ashrae 140.

Authorities in Sweden have no perspective on what software is used for Swedish building code. Responsibility for the buildings comply with the applicable requirements in Sweden rests on the developer and quality Manager.

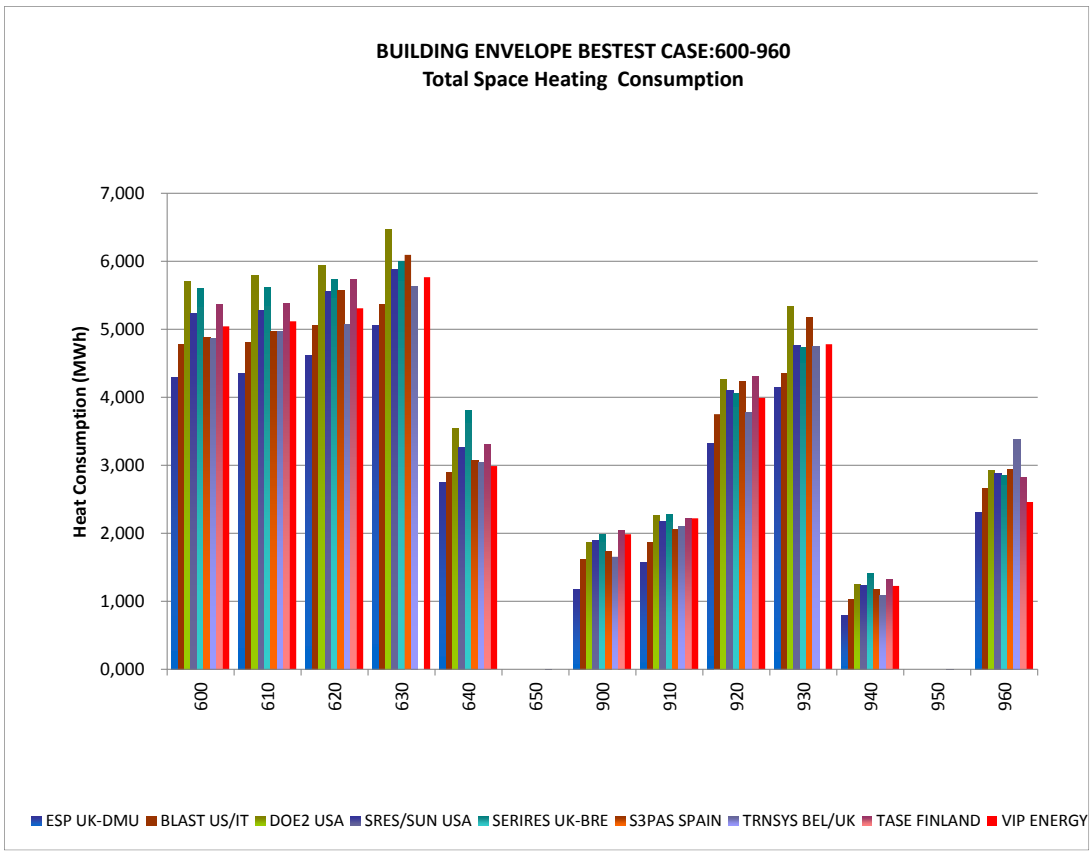
Climate envelope Basic test

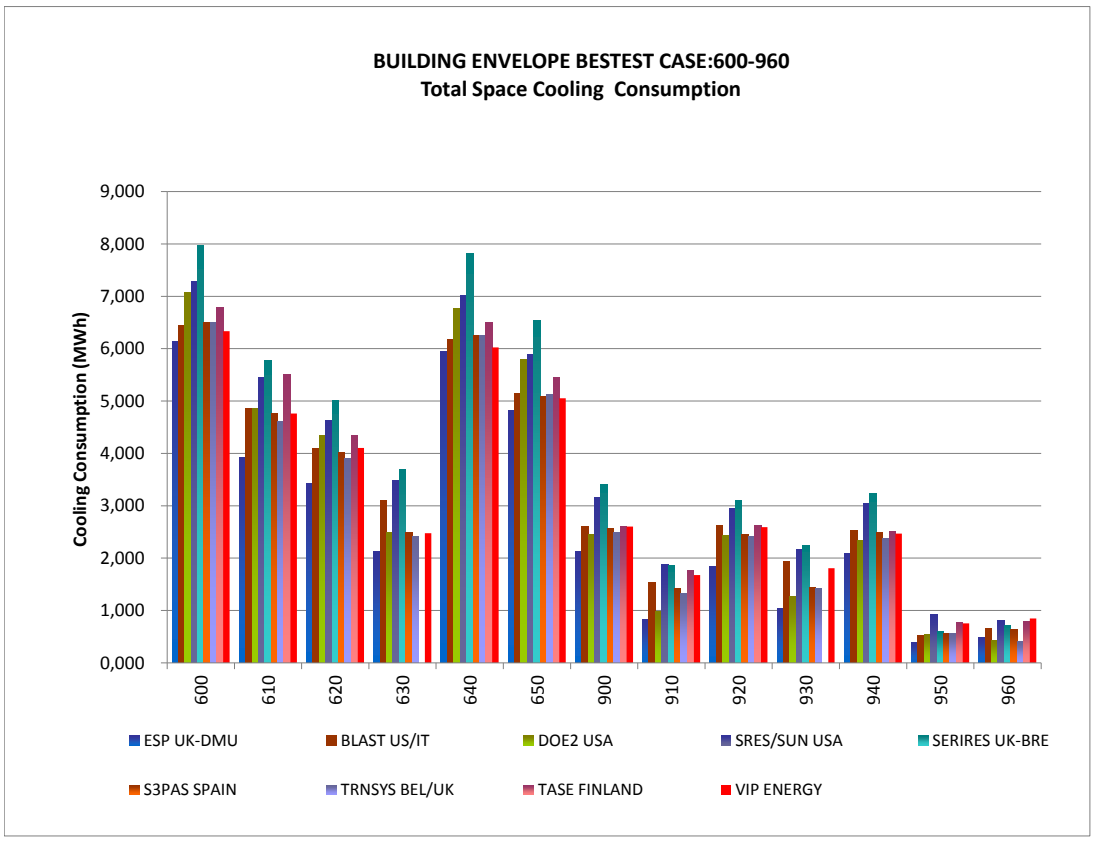
The calculation cases are treating building envelope functions. The 600 series is a building with relatively low heat capacity, and in the 900 series is a building with a bit higher heat capacity.

The building contains in most of the cases, no engineering system and air circulation is simulated as constant air infiltration with no use of fans and electric power. In two cases night ventilation I used to cool down the building.

The graphs show the main calculation cases. In addition, there are a number of diagnose cases, that more specifically examines the impact of separate processes such as solar radiation impact, heat capacity, heat of transfer, etc.

The test cases are designed to magnify small discrepancies in input to large output difference.


BUILDING ENVELOPE BESTEST CASE:600-960
Total Space Heating Consumption
Heat Consumption (MWh)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0,000
600
610
620
630
640
650
900
910
920
930
940
950
960
ESP UK-DMU
BLAST US/IT
DOE2 USA
SRES/SUN USA
SERIRES UK-BRE
S3PAS SPAIN
TRNSYS BEL/UK
TASE FINLAND
VIP ENERGY


BUILDING ENVELOPE BESTEST CASE:600-960
Total Space Cooling Consumption
Cooling Consumption (MWh)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0,000
600
610
620
630
640
650
900
910
920
930
940
950
960
ESP UK-DMU
BLAST US/IT
DOE2 USA
SRES/SUN USA
SERIRES UK-BRE
S3PAS SPAIN
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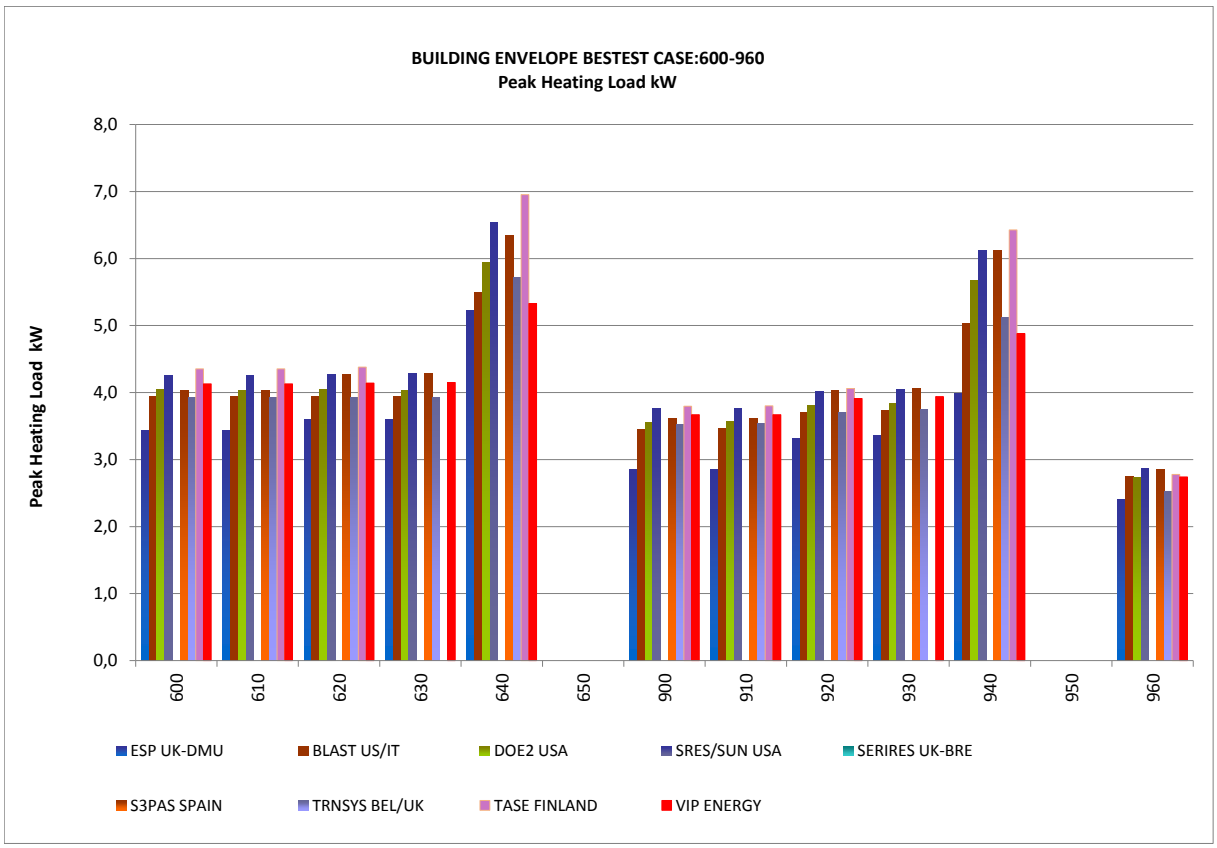
BUILDING ENVELOPE BESTEST CASE:600-960
Peak Heating Load kW
Peak Heating Load kW
8,0
7,0
6,0
5,0
4,0
3,0
2,0
1,0
0,0
600
610
620
630
640
650
900
910
920
930
940
950
960
ESP UK-DMU
BLAST US/IT
DOE2 USA
SRES/SUN USA
SERIRES UK-BRE
S3PAS SPAIN
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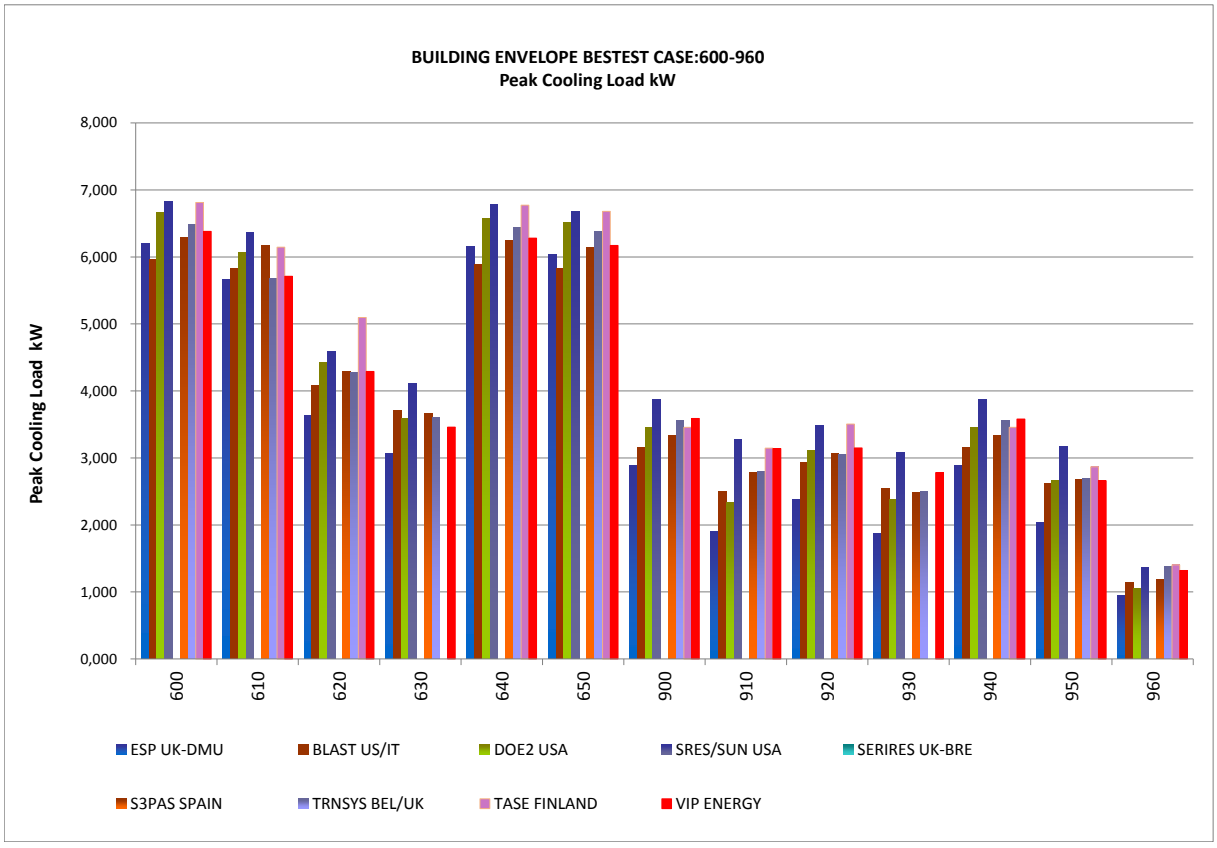
BUILDING ENVELOPE BESTEST CASE:600-960
Peak Cooling Load kW
Peak Cooling Load kW
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0,000
600
610
620
630
640
650
900
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Cooling equipment with intermittent operation constant load

The calculation cases treat essentially DX cooling equipment with single stage compressor. It is more complicated than a regulated cooling with cooling power following the cooling demand.

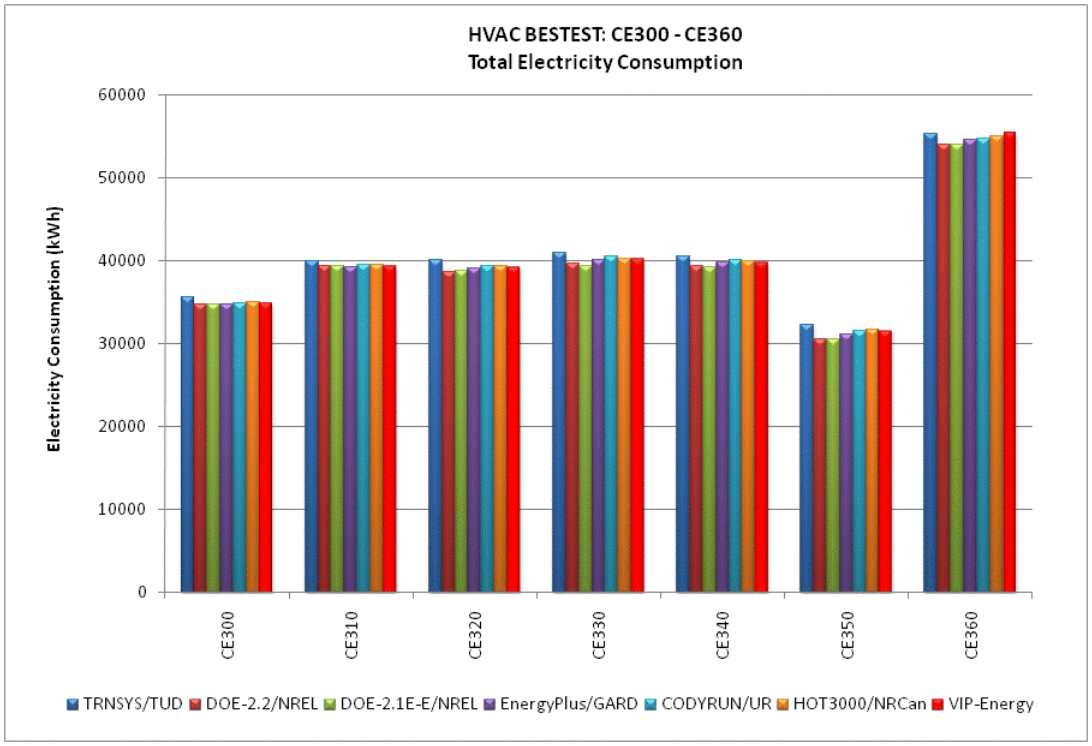
The building is well insulated to focus the test at cooling equipment functions without interference of any deviations in the simulation of envelope functions. For the same reason, there is no air exchange to the outdoor air.

Heat and moisture are added to the building.

The calculations are carried out with constant climatic conditions.

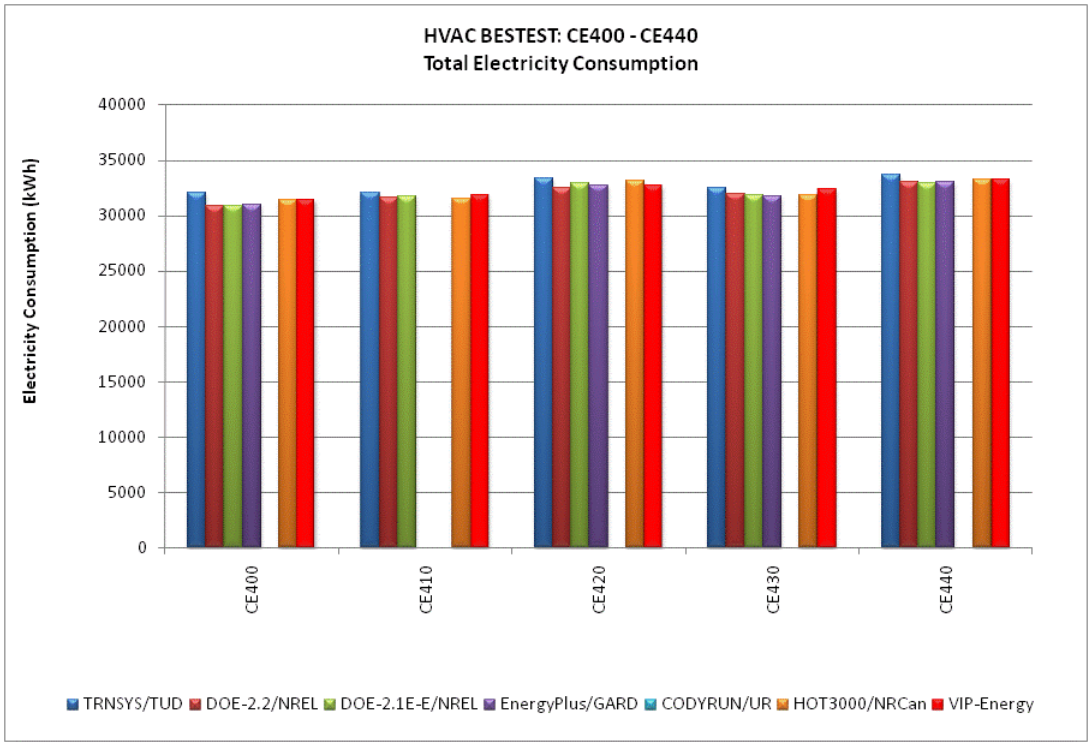
Cooling equipment in combination with air recirculation and varied outdoor climate

The calculation cases deals with cooling equipment in combination with air recirculation. The cooling coil is located in the supply air. The building is well insulated and heat exchange to environment impacts marginally. There is a variation in sensitive and latent internal loads, infiltration, recirculation rate and temperature demand.



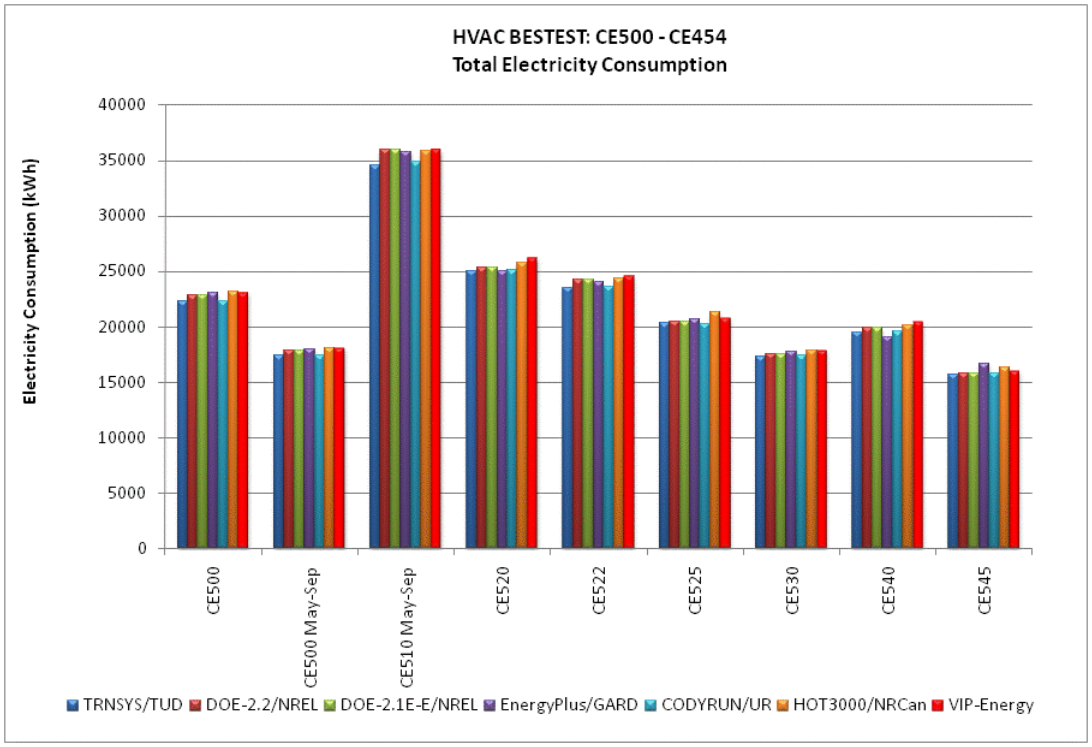
Control of recirculation damper in combination with cooling equipment

The cases are dealing with cooperation between controlling of the recirculation dampers and cooling equipment. The cooling machine with single stage compressor is running with intermittent operation. Cooling coil is placed in the air supply flow. The recirculation rate is varied based on indoor and outdoor temperature and enthalpy.



Cooling equipment with intermittent operation and dynamic load

Air Exchange to the surroundings is turned off and the test applies only to the cooling equipment with varied internal heat and humidity load. Demand on room temperature is varied from case to cas but is constant throughout the year.



Heat source with intermittent operation and part load operation

The cases treat in essence the calculation of efficiency and functionality in general to a gas-fired boiler. The boiler is running with constant power. Efficiency is dependent on the heating demand and operating time.

To a certain extent, the test also includes the heat loss from the building but the model is simple compared to the envelope test cases. The first cases in 100 series are calculated with constant conditions. In the 200 series cases are realistic weather conditions used.