HVAC System Efficiencies for EPBD Calculations

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Introduction

In integrated energy performance calculations, HVAC and lighting system choices are as important as building envelope decisions.

Calculation procedures need to satisfy a number of somewhat contradictory requirements:

- Credibility
  - Technically sound calculation process
  - Produce realistic results
- Discrimination
  - More efficient systems should give better figures
- Repeatability
  - Different users should get the same results
- Transparency
  - Both the data and the process should be auditable
- Ease of use and manageable data requirements
  - To reduce errors and cost

It is far from clear how best to reconcile these, especially for HVAC system efficiency calculation.

This paper describes the approach adopted in the UK.

Definitions of System Performance Parameters

Auxiliary Energy AuxE

Is the energy used by the fans pumps and controls of a system, irrespective of whether this supports heating, cooling or ventilation.

System Coefficient of Performance SCoP

Is the ratio of the total heating demand in spaces served by a particular system divided by the energy input into the heat generator(s).

System Energy Efficiency Ratio SEER

Is the ratio of the total cooling demand in spaces served by a particular system divided by the energy input into the cold generator(s).

Calculation options

HVAC system efficiency calculations can be

- Simple - may miss out important factors
- Complex - can be time-consuming and data-intensive

We need to find a practical balance.

Heating and cooling demands can be often be adequately calculated monthly, typically using the monthly heat balance and utilisation factor approach of EN13790.

For most HVAC systems, calculations using hourly (or shorter) time-steps are more natural, since they are more in step with the inherent time constants of the systems.

European Standards

Draft standard prEN15243 does not prescribe specific calculation procedures for HVAC system efficiencies. It does provide a framework that can be used to assess whether particular methods are appropriate to particular circumstances.

It identifies nearly 40 mechanisms that can affect the system performance parameters. These are mapped against 20 or so types of HVAC system to show which mechanisms may apply to which system types.

It then requires any calculation procedure to declare:

- which system types it claims to cover
- how it addresses each of the applicable mechanisms

UK Approach

The UK Simplified Building Energy model (SBEM) contains an intermediate level of system modelling, used with monthly demand calculations.

The model can be downloaded from www.ncm.bre.co.uk