New Method “Building Design Days + Energy” for sizing of heating and cooling

Dipl.-Phys. Ing. Andreas Lahme
alware GmbH, Germany
E-Mail: andreas.lahme@alware.de

Background
Conventional heating and cooling load calculations, such as those defined in DIN EN 12831 or VDI 2078, rely on peak values that often result in oversized technical systems. This is particularly critical for heat pumps, where oversizing leads to reduced efficiency, higher investment costs, and suboptimal part-load operation. A more realistic and integrated approach is required to ensure efficient design and reliable operation.

Method
The *Building Design Days + Energy (BDD+E)* method introduces a novel framework based on extreme daily climate profiles. Using hourly static heat balances for all 8,760 hours of the year, the method derives load curves for both heating and cooling. These curves are directly linked with manufacturer performance data of heat pumps, allowing detailed assessment of part-load behavior, coefficient of performance (COP), and seasonal energy requirements. In contrast to existing standards, BDD+E integrates load sizing and energy assessment into one consistent process without correction factors or artificial boundary conditions.

Results
Application of BDD+E demonstrates that heating and cooling systems can be dimensioned more precisely and economically by focusing on extreme winter and summer days rather than single peak values. For heat pumps, the method captures dynamic operating characteristics under varying outdoor conditions, enabling accurate prediction of part-load efficiencies and capacity modulation. This provides a transparent basis for comparing system concepts, optimizing automation strategies, and avoiding the widespread oversizing seen in practice.

Conclusion
BDD+E represents a robust alternative to conventional design procedures by unifying heating, cooling, and energy calculations within a single methodological framework. Especially for heat pumps, it delivers verifiable insights into efficiency and operational behavior across the entire year. The approach thus supports cost-effective system design, contributes to improved energy performance in buildings, and offers a flexible foundation for evaluating future climate scenarios.