

# Development of evaluation procedures for the consideration of properties of PCM products in context of DIN V 18599 and DIN V 4108 part 2

## Summary

In the present building practice Phase Change Materials (PCM) are already used in different system configurations. The range of application includes passive systems (building panel) and active or hybrid systems (cooling ceiling and wall, mechanical ventilation and storages).

The **quantitative assessment** of the effects of PCM on energy demand and thermal comfort can be done by usage of thermal simulation calculations on hourly basis. Within the scope of legally required verification processes

- Energy Saving Regulation EnEV or future Building Energy Law GEG (DIN V 18599) as well as
- minimum requirements to summer thermal insulation (DIN 41408-2)

thermal simulation calculations are only used in exceptional cases (EnEV) or not as standard procedure (DIN 4108-2). The possibility to implement the application of PCM in **standards-related calculation methods** would be desirable in order to enable the assessment of energy efficiency for these systems within the verification process, e.g. for widespread application.

The main task here is to identify and verify suitable **interfaces and algorithms** (approaches). The verification process is made by comparison of calculation results from building simulation and standards-related calculation, both basing on consistent and adjusted models and boundary conditions. It is not possible to formulate congruent boundary conditions for all cases due to the differences between Simulation and Standard, e.g. hourly values on the one hand and daily and monthly mean values on the other.

General recommendations are derived from the definition of **congruent boundary conditions** developed within the project, which as an example can be included in DIN 4108-2 (chapter calculation boundary conditions for thermal building simulations).

Through the successful validation process of all three studied types of systems, it was shown in this project that the dynamic, thermal-energy **simulation of PCM-based systems** is reliably possible according to the current state of the art.

Especially in the field of **active** and/or hybrid systems with mechanical ventilation technique and cooling ceiling it is needed to formulate assumptions on the

overall concept, media paths (air or cooling water) and relevant control strategies. Difficulties occur within the processing of the research issue regarding the combination of simulation and standard, since even the modeling of the respective HVAC-systems without PCM is problematic. Without a corresponding reliable model of the systems in the reference case without PCM, a reliable statement about the potentials of comparable systems including PCM is not meaningfully possible.

It could be shown that both for the evaluation of the summer thermal insulation according to DIN 4108-2 as well as for the calculation of the net energy demand on the basis of DIN V 18599 a **need for revision** of the standards can be identified. This relates to various individual aspects in the calculation approaches (e.g. ventilation approach for cooling mode) but also to the completeness of the definition of boundary conditions to be assumed (e.g. for thermal simulations for summer heat protection).