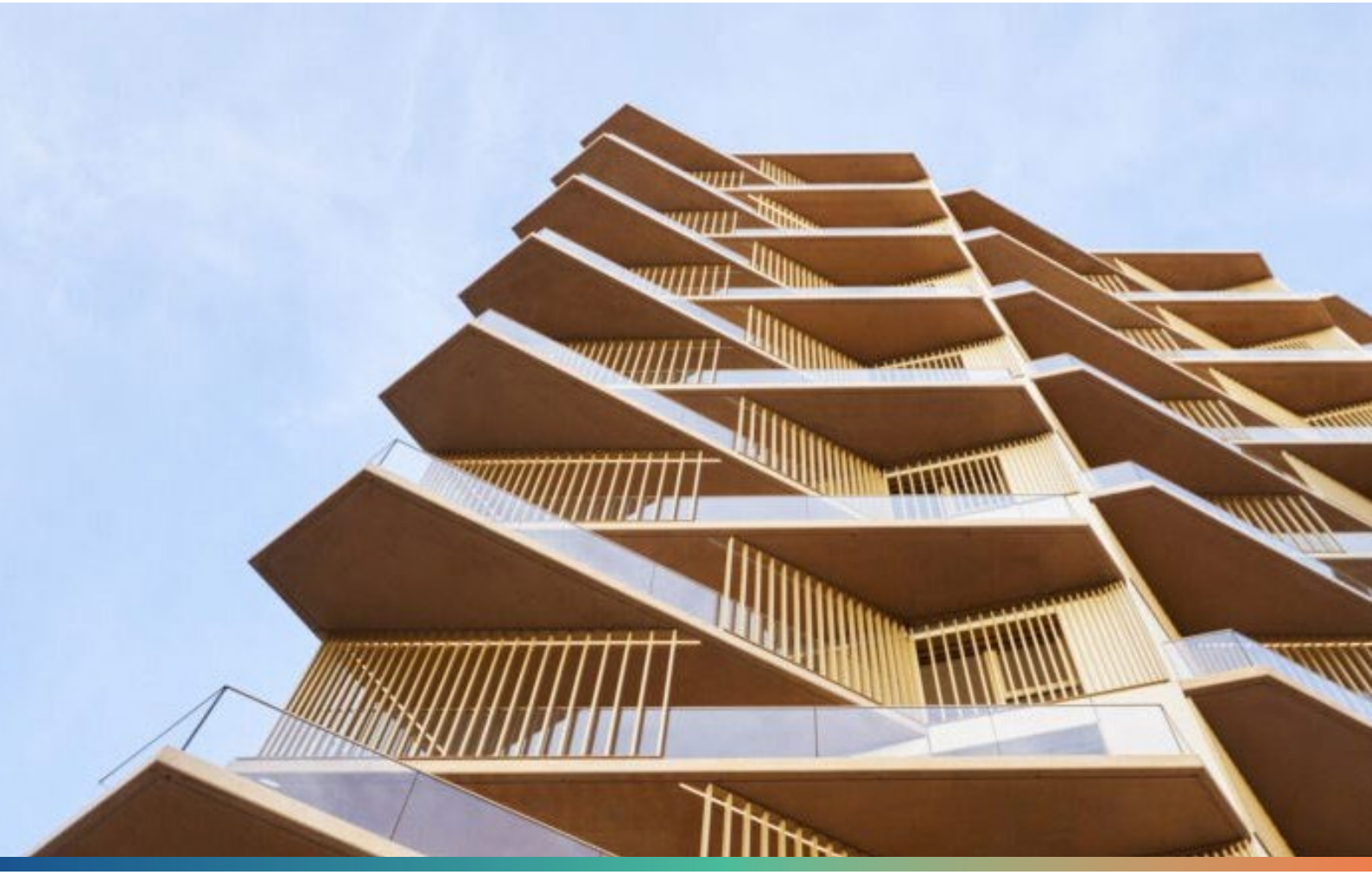

Aligning standards with real-life operation

The compensation method for heat pumps

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Heat pumps and buildings decarbonisation

Heat pumps are the star appliance to decarbonise the heating systems in buildings, as they are highly efficient, adaptive to any climate, and cost-effective in the medium run compared to fossil fuel counterparts.

However, their efficiencies are tested against a methodology that currently does not consider all the real-life use conditions that consumers normally experience when using these appliances at home, resulting in missing energy savings and misinformation to end users. Real-life representativeness of test methods is key to secure the anticipated energy savings, to provide consumers with reliable information, and to ensure fair competition among manufacturers[1]. Because of the massive rollout of heat pumps in EU households, to install at least 10 million additional heat pumps by 2027, it will be key to match laboratory tests with real performances as much as possible, also to enable accurate compliance by market surveillance authorities.

The existing performance standards for heat pumps have been the backbone of the energy efficiency calculation in the Ecodesign and Energy Labelling regulations for heating appliances[2]. The European Commission identified issues with the methods and requested the review for a new testing methodology, called the compensation method.

Existing test methods for heat pumps: the flaws

The test methodology to establish the performance of heat pumps is set out in the technical standards EN 14825:2022 in combination with the EN 14511:2022 series. These methods specify the test conditions and calculation methods for determining the Seasonal Coefficient of Performance (SCOP)[3].

In these existing methods, the heat pump is tested in a way that the (native) onboard control of the heat pump, an integral part of the appliance which is crucial to its efficiency measurements, is bypassed. According to the standards, the manufacturer provides the software to define the compressor's frequency settings (and, potentially, other settings) in order

[1] The risk of inadequate test methods in standards is addressed here.
[2] Commission Regulation (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters.
[3] A full list of other issues on heat pump standards is available here.

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to create a steady state for each test condition. Whereas in real life, the heat pump controller adjusts the compressor speed dynamically.
Basically, the manufacturer provides various (self)'declared' parameters to the test laboratories, who cannot check those. We believe that enabling the manufacturer to prescribe artificial test settings for parameters (such as the frequency settings, expansion valve opening, fan speed, etc.) risks those being optimised as there is no option for verification, which is a major problem for independent testing facilities[4].

This may **cause a major mismatch** between the test results and the real operation in households once installed, potentially resulting in lower comfort levels for the users and a higher energy bill, estimated to be around 10% in energy efficiency terms.

In addition, the European Commission intends to set requirements for all products on operational software updates: "the performance should not be reduced due to an update in the software" (Article 6). For heat pumps, should the existing test continue to be used, this would be an ineffective requirement as the operational software originally installed is not tested, and only manufacturers have the means to evaluate the operational software modification against the test software and potential updates.

For full reference, information on the list of issues on heat pump standards is available here.

Compensation method: the way forward

The compensation method, also known as load-based methodology, has been developed by the German Federal Institute for Materials Research and Testing (BAM) to measure the performance of a heat pumps' operation when installed in households.
With the compensation method, the (native) onboard control responds to the load instead of using the artificial test settings provided. Having a load-based methodology is beneficial because it better measures the overall dynamic performance of heat pumps, in a laboratory setting, enabling to respond to real-life conditions.

As is already the case with water heaters (EN 16147:2017+A1:2022), with the compensation method, central heating appliances will be able to be tested by applying load-based testing, emulating the real behaviour of the appliance in buildings. The heat pump must respond to a load applied to the

[4] Note that the word 'declared' is used more than 140 times in EN 14825!

heat pump via the test bench. The heating load simulates a standardised representative building based on the design capacity of the heat pump under test.
The compensation test method will allow the test laboratory to verify the 'declared' values independently with the heat pump controls in operation. With the adoption of the compensation method, heat pumps will be finally tested against state-of-the-art technologies, which have no longer fixed speed compressors.

The compensation method not only solves the abovementioned issues but also allows to:

- Better evaluate the operation of the heat pumps installed in real-life conditions, assessing real-life operation since the controller is active, allowing the heat pump to go into on/off behaviour and showing defrost as at home.
- Ensure independent testing from the manufacturer (competitor or market surveillance testing).
- Better comparability among heat pumps under the same test conditions and rewarding good performance.
- Incentivise innovation in heat pump controllers.

Conclusion and next steps

Test methods and standards should, to the extent possible, take into account the real-life usage of a given product, reflect average consumer behaviour and be robust.[5]

The extensive tests performed by the German Federal Institute for Materials Research and Testing (BAM) and other independent test facilities have shown good repeatability and reproducibility (matching the results of the current standards in place) of the compensation method. The method has proved mature, more representative of real-life and a clear opportunity to solve the issue identified by the European Commission concerning the existing standards.

The next steps shall involve the following:

1. A new Standardization Request from the European Commission to CEN mandating the development of the harmonised European standard on the compensation method.

[5] Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU

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2. The mandatory introduction of the compensation method as Tier 2 in the revised Ecodesign regulation for space and water heaters[6].

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[6] Note that this request has also been put forward by the German delegation to the Consultation Forum in 2025.

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