Measuring the thermal performances of the building envelope? This will soon be possible!

Measuring the thermal performances of the building envelope would make it easier to assess the actual impact of certain design or execution choices and to determine the crucial points that could improve the actual thermal performances of buildings. In view of the numerous possible applications, research is currently being conducted in order to develop a reliable method of measurement that could be applied on a large scale.

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Why carry out this measurement?

The so-called theoretical consumption can be calculated on the basis of the energy performances assessed during the design phase. When the building is completed and commissioned, this **theoretical consumption** is often compared to the **measured consumption**. However, there are various factors which can distort this comparison, namely:

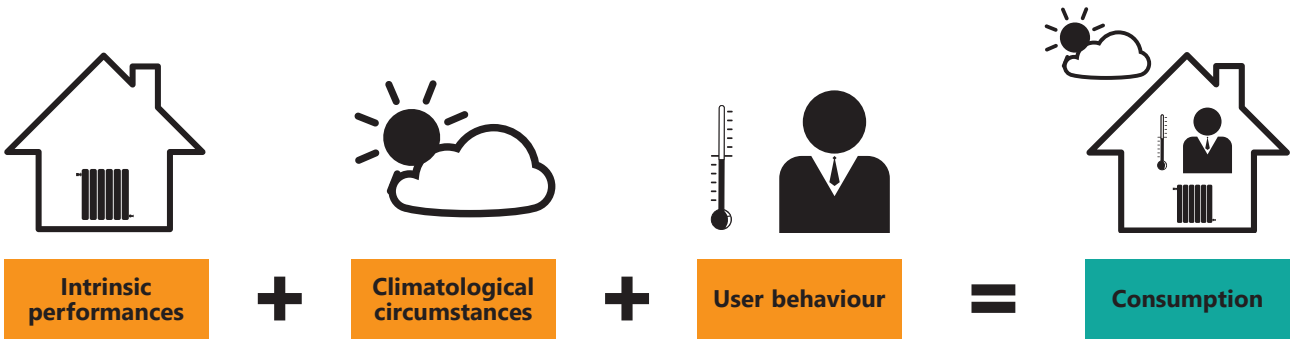
- the actual use of the building and the climate (when they differ from the hypotheses used for the calculations)
- the quality of execution
- the setting and the maintenance of the systems.

As the intention is to reduce not only the theoretical consumption but also the actual energy consumption in particular, it may be useful to measure the intrinsic performances of the building (the building envelope, without or in combination with the systems), i.e. to measure the performances regardless of the climate and of the use of the building.

The **heat loss coefficient** is the indicator that results from the measurement of the thermal performances of the building envelope. This coefficient takes the heat losses due to transmission (via the walls) and infiltration (via air leaks) into account.

This measurement offers numerous benefits. For instance, it can:

- help the building professionals to better assess the impact of certain choices (relating to design and execution)
- provide an indication of the quality of the work carried out, which could increase the confidence between clients and construction companies
- in the long term, guarantee performances, regardless of the behaviour of users.



In pictures

Scan this QR code by using the camera on your smart phone or a specific application to watch a short video on the co-heating test. The video was made within the framework of the CoDyNi project, subsidized by the FPS Economy and the NBN.

Which test protocol should be followed?

Today, the heat loss coefficient can be obtained by applying the protocol of the **classic co-heating test**. This test consists of keeping the indoor temperature of the building at approximately 25 °C with the help of an electrical heating system specifically for the test, and to maintain a difference of at least 10 °C compared with the outdoor temperature.

In order to guarantee a reliable and reproducible result, the test must be carried out in an empty building over a fifteen-day period during the heating season, i.e. when there is little solar radiation. The basic principles of the co-heating test are explained in a short video that you can watch by scanning the QR code in the box above.

A draft standard is being elaborated in order to be able to standardise this measurement method at a later stage. An initial study has shown that the degree of uncertainty concerning the result is approximately 15 % if the entire protocol is followed.

What are the existing options for improvement?

Various options for improvement are currently being investigated in order to make the scope of application of this measurement method as broad as possible:

- the reduction of the test duration (dynamic co-heating)
- the use of the heating system of the building itself (integrated co-heating; see the above-mentioned video)
- the use of connected and wireless measuring devices
- performing measurements, regardless of the season.

Which aspects are currently being investigated?

A lot of research has been carried out in order to respond to these challenges. For instance, the BBRI and the KU Leuven have been studying the possibilities to reduce the test duration as part of the CoDyNi project (dynamic co-heating). Currently, there are two possible options:

- vary the measuring conditions by subjecting the heating system to on/off cycles (instead of setting the indoor temperature at 25 °C)
- apply advanced data analysis methods.

Especially the combination of these two options seems very interesting as it would allow the **test duration to be reduced to 4 days** (rather than 15 days for a classic co-heating test).

Although the initial results are promising, the dynamic co-heating tests have not yet been standardised. In addition, the reproducibility of the results still heavily depends on the analysis of data. This however, requires a high level of expertise of the 'operators'.

Regardless of the investigated options for improvement, our research objectives are:

- to establish various measurement protocols for all types of co-heating (classic, dynamic, integrated ...) on the one hand
- and to reduce the required level of expertise of future operators as much as possible, without jeopardising the reliability of the result on the other hand.

Conclusion

In order to enable co-heating tests to be performed on a large scale, the **right balance needs to be found between the cost of the test, its duration and the reliability of the results.**

Since these measurements are not yet fully developed, it is not desirable to generalise these measurements in their current form. However, carrying out such measurements on a large number of buildings could provide feedback on experience.

It will certainly be possible to learn from this process, not only in respect of the applicability of the measurement but especially also regarding the use of the results to improve the calculation methods or to identify the main points of interest during the execution.

Are you interested in carrying out such measurements and would you like to make your own contribution towards our research on this subject? Please do not hesitate to contact us if you would like to put one of these test protocols into practice. ⬟

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