

Assessing the performance of energy efficient buildings

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Monitoring so-called key performance indicators enables engineers to evaluate whether a newly erect building is as energy efficient as originally planned.

Making buildings more energy efficient is part of the European strategy to combat climate change. One of the aims of the EU-funded project Direction—due to be completed by 2016—is to demonstrate that very low energy buildings can actually be implemented in practice. But to evaluate whether a building achieves the required energy performance, experts need to monitor various data while the building is in use. This is currently the case of the NuOffice in Munich, one of the project's showcases. Here, Jan Kaiser, research associate at the Fraunhofer Institute for Building Physics IBP in Kassel, Germany, tells Direction which indicators are most important to assess a building's performance.

What exactly is meant by building performance?

The performance of a building can be evaluated through two main aspects: comfort and energy

efficiency. A building is made for people. Thus, performance means that we ensure maximum comfort for the users, both in winter and summer. We also want to ensure the simple use of the building. Energy performance includes minimising the energy demand of a building as much as possible. This means as little heating and cooling as possible. We achieve this objective through the way in which the building is constructed. And we use energy efficient technologies, including [renewable energy sources](#), to meet the building's energy demands.

How do you assess the building performance?

During the planning, we set the requirements for the building's performance. Then, we have to evaluate, whether the building actually achieves these targets. We use pre-defined values – so-called key performance indicators – that are calculated during the planning stage. At this stage of our project, we are now collecting data to evaluate whether the building meets the desired requirements. These pre-defined indicators are also necessary to make the data comparable to those of other buildings.

What are the most important key performance indicators?

There are, for example, indicators defining the temperature changes in reference rooms. This includes what is referred to as hours of overheating in summer. If the room temperature exceeds 26 degrees Celsius during more than 10 percent of the hours of use during a year, the room comfort is no longer achieved. Other indicators measure air quality. For example, there are CO2 sensors or so-called VOC-sensors that detect certain scents emitted by the users themselves. If the data exceed certain values, the performance in terms of air quality is not considered as good.

In addition, there are energy performance

indicators, such as an indicator for the overall [energy efficiency](#) of a building. We simply measure the energy that is supplied to the building. We then compare the data to pre-calculated values. We can then evaluate whether the building achieves the desired energy performance. Another indicator is the so-called net energy consumption. This is the energy that users actually have to pay for.

Does the showcase NuOffice building meet the desired energy requirements?

Our first data evaluations show that the energy consumption is actually lower than the pre-calculated demand. However, it usually takes some time until the intended performance is achieved. During the first two years of operations, we often need to adjust the technological equipment. We therefore need to collect a lot of data. But if the facility is managed well—as in the case of the NuOffice—it is not too difficult to achieve the desired performance.

Are the results obtained from monitoring the NuOffice also relevant for other buildings?

Some of our results are specific to this particular building. But others have general implications. For example, what we refer to as thermo active buildings systems are increasingly becoming a standard for the heating and cooling of very low [energy](#) buildings. We measure how the temperature level change in the rooms. We learn from these results and can transfer them to other buildings. And that is also the point of such showcase buildings. Otherwise each new [building](#) would merely be a prototype.

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