The thermally optimised building envelope makes it possible to operate the passive house swimming pool with higher indoor air humidity without the water condensing on the building components. This means that less water evaporates and both the heating requirement and the need to dehumidify the air in the swimming pool hall are considerably reduced.
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Passive house standard proves itself with indoor swimming pool

The indoor swimming pool in Lünen has pioneered the energy standard. After two years in operation, the scientific monitoring has verified that the concept has been a success. The swimming pool, which has been constructed to the passive house standard, consumes considerably less heat and electricity than a conventional indoor swimming pool. Optimisation could reduce the final energy consumption by a further 25 per cent. The monitoring also enables the energy flows and their interactions in the swimming pool hall to be ascertained more precisely.

The various areas of the indoor swimming pool are thermally separated with glass walls, which also improve the amenity value in terms of the acoustics.
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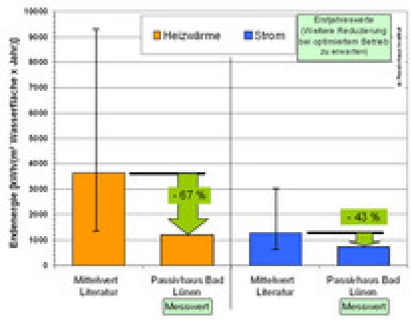

The measured final energy consumption for thermal and electrical energy for the Lünen indoor swimming pool in comparison with values from literature. The black vertical lines mark the fluctuation range of the literature values.
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Many swimming pools are energy wasters and as a consequence place a heavy burden on the public purse. If such a swimming pool is under discussion, a refurbishment or new-build scheme to the passive house standard provides an energy-efficient option. That is proved by the example in Lünen: in relation to the pool size, it requires two thirds less heating energy than the average determined from literature information. 43 per cent less electricity is also used (see graphic).

Passive house swimming pool as pilot project

The basis for the project, which was funded by Deutsche Bundesstiftung Umwelt (DBU), was a study conducted by the Passive House Institute in cooperation with Bädergesellschaft Lünen mbH. As the passive house concept envisages, the success of a passive house indoor swimming pool also depends on having a thermally high quality building envelope. This increases the comfort and lowers the transmission heat losses. In addition, the swimming pool can be operated with higher air humidity without the water condensing on the facade surfaces. With higher indoor air humidity, less water evaporates and both the heating requirement and the need to dehumidify the air in the swimming pool hall are considerably reduced. The comprehensive recycling of filter backwash water during the waste water treatment and highly efficient components for the building and swimming pool technology are further requirements for an energy-efficient indoor swimming pool.

Monitoring confirms considerable influence of the pool hall humidity

As the prototype of a passive house indoor swimming pool, the project was scientifically monitored right from the beginning. In April 2012, six months after the opening, the Passive House Institute began a one-year monitoring programme that was funded by the German Federal Ministry for the Environment. During this phase the complex building technology was still undergoing commissioning. The final energy consumption for heating with 258 kWh/m2 p.a. and for electricity with 156 kWh/m2 p.a. (energy reference area 3,912 m2) was nevertheless in the forecast range.

The heating of the swimming pool water alone consumes almost 50 per cent of the heating energy. By far the largest amount of electricity is consumed by the ventilation technology with 34 per cent. Tests with changed operating conditions confirmed that reducing the pool hall humidity increases both the heating energy and electricity consumption. The maximum possible pool hall humidity has still not been reached.
The monitoring showed that the final energy requirement can still be reduced by an estimated 100 kWh/m2 p.a. This enables 25 per cent of the currently balanced final energy to be saved.

Waste water treatment saves heat energy

The filter backwash treatment system, which was not in operation during most of the monitoring, provides the greatest potential. The system can treat a maximum of around 70 per cent of the filter backwash water and feed it back into the pool water circuit. This enables not just up to 15,000 m^3 of cold water to be saved each year but also the energy to warm it. Following technical adjustments, it is planned to reconnect the system in January 2014. The scientists therefore expect savings between 50 and 60 kWh/m2 p.a.

Proportion of recirculated air can be reduced further

Because of the electricity consumption, the ventilation technology plays a key part in any energy optimised indoor swimming pool. The fresh air exchange system ensures that the building’s swimming pool halls are dehumidified and that the air quality is maintained. The air recirculation system merely supports the mixing of the hall air, whereby the optimum ratio was not yet reached during the commissioning phase: the air recirculation flow rate for all devices is around 70 per cent on average, while the fresh air flow rate is just 30 per cent. The measurement data confirm previous considerations that clever ventilation planning with a lower proportion of recirculating air will save considerable electricity. The passive house concept for indoor swimming pools ultimately aims to achieve an operation without recirculating air.

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