Energy Signature

Dalgasparken in Herning, Denmark – Low energy housing project with CO_2 neutral ventilation with heat recovery using PV-modules.

The housing project Dalgasparken in Herning, Jutland, consists of a total of 72 apartments which have been established as joint ownership by the housing association Fruehojgaard, and with the Cobra Architects as architects.

The building project was realised on the basis of an architectural competition which attached much importance to energy and environmental solutions which have been developed by the energy specialist company Cenergia in relation to the EU-Save project Green Catalogue. At the same time the intention was to make a special effort towards implementation of energy-saving ventilation with heat recovery in Dalgasparken as well as in another housing project Hammerthor in Hammerum, Jutland, where a reduced electricity consumption for ventilation was matched by PV electricity resulting in a CO_2 neutral ventilation.

The use of PV in this connection is supported by the EU-Resurgence programme and the SOL-1000 programme.

In Dalgasparken a joint heat recovery ventilation solution with user control has been used, from the company EcoVent, and with a total of 200 m² PV from the company Schüco (20 kWp) which has been mounted on some of the staircase towers facing south.
In connection with the construction of the building much work has been done on securing the airtightness of the building in co-operation with the contractors KPC. This has been done by a number of blowerdoor tests executed by Cenergia.

In addition to an optimisation of the building envelope an optimisation and additional check of the airtightness and cold bridges of a building is important for low energy buildings which use heat recovery of the ventilation air. This is due to a basic wish to preserve the heat in the building by preventing that this escapes uncontrolled.
If the building is not airtight the heat recovery from ventilation air does not function in an optimal way. At the same time the mechanical ventilation secure that a healthy indoor climate with the necessary supply of fresh air is obtained.

The additional tightening of the building also has health qualities. First of all to avoid draft which in winter will be the result of the difference between indoor and outdoor temperatures. Furthermore also possible negative consequences regarding the humidity of the indoor air saturating the building material can be avoided, thus damage by humidity can be avoided. Eventually the necessary ventilation of the building, balanced ventilation with heat recovery, has an energy saving aspect, however, regarding the indoor climate it will also be able to function in a more optimal way regulated as opposed to a user controlled ventilation.

Standard building today generally looses 1/3 of the heating through walls and ceiling, 1/3 through windows and 1/3 through ventilation and leakages.

For late energy saving building the latest mentioned heat loss is approximately 50% of the total heat loss of the building. When testing for airtightness and subsequently mak-

ing the building airtight the necessary basis for large savings can be reached by help of ventilation with heat recovery.

Practically the tightness of a building is tested by a blowerdoor method which tests for possible leakages, and at the same time indicates where possible leakages can be found. The principle of the method is temporary set up of a fan in a door opening which is sealed with a frame which is fixed in the door frame.

An example of the use of the blowerdoor method is demonstrated in figure 1.

The ventilator exhaust the air in the room or apartment which is about to be tested in order to determine the airflow through the ventilator as well as the differential pressure between the inside and the outside of the door opening.
One can work with excess pressure and low pressure and the test can be executed as per an ISO method which indicated how a leakage at ± 50 Pa can be converted into infiltration measured in turnover per hour.

Fig. 1. Blowerdoor test in apartment.

When the air in the room or apartment is exhausted, cracks, air ducts, frames and the like can be tested for leakage's by blowing white smoke to a specific area and then check whether the line of smoke is affected. Please note the example in figure 2.

Figure 2: Example of test of white smoke movement regarding airtightness.

Having identified a leakage the subsequent airproofing is a simple task.
Apart from the aspect of saving energy the method can also help to identify air ducts which can be the cause of humidity problems, unnecessary or unpleasant odours and sounds as well as a possible cause for spreading out in case of fire.

Preliminary test results from the demonstration housing project Dalgasparken in Herning, Jutland with housing association Fruehojgaard as builder – September 2004.

In figure 4 you can find monitoring results and calculations from the Energy Group (Energigruppen), in Jutland, covering the time from the moving in around Christmas 2003.
The measuring period, until September 2004, makes up 57% of a standard year and the results area extrapolated for a whole year.

Based on this the yearly consumption for heat and hot water is estimated to be 206.310 kWh for the occupied 33 apartments, covering an area of 3322 m² which have been occupied in the monitoring period.
This equals a yearly energy consumption of 62 kWh per m² for heating and domestic hot water and equals, according to the Energy Group, an average heat expenditure of 27,90 DKK/m², (approx. 3,70 Euro/m²), compared to a standard expenditure of 55 DKK/m², (approx. 7,30 Euro/m²).

Thus a saving of almost 50% compared to standard has been achieved.
Based on this it indicates that the Energy Group expects a standard consumption of 122 kWh per year for this type of house building.
If it was decided to include solar heat to DHW then a further 17 kWh/m² could be saved reducing the consumption to 45 kWh per m² per year.

All things considered it is a fine result, in fact a little better than the calculated saving of 46% compared to standard.
The greater part of the saving originates from an effort on airtightness of house building in combination with use of ventilation with heat recovery which was implemented with a low electricity consumption corresponding to a similar electricity supplement from 200 m² PV modules. Further a small part of the saving is obtained through the use of energy windows with three-layer glass.

A very thorough follow-up concerning airtightness of the building has been carried out in co-operation with the contractors KPC. Here 3 consecutive blowerdoor tests have been carried out showing that it is possible to reach an infiltration of approximately 0.1 times an hour without special additional changes as compared to standard.
This means a normal building standard is used but just eliminating failures.

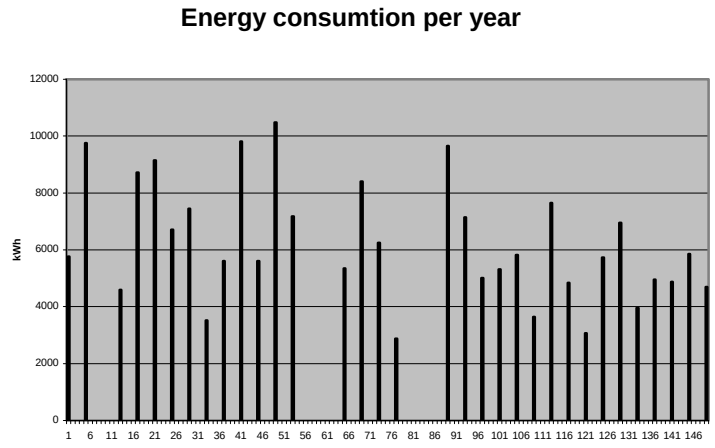
Measuring the electricity consumption has also shown an interesting result. For the joint heat recovery units from the company EcoVent with individual user control and a capacity of approximately 2000 m³ per hour, one measured an electricity consumption of 373 W or approximately 34 W per apartment for a solution with direct current ventilators (in fact these should have had a direct contribution from PV, however, it turned out that the PV-mixers were not mounted correctly).

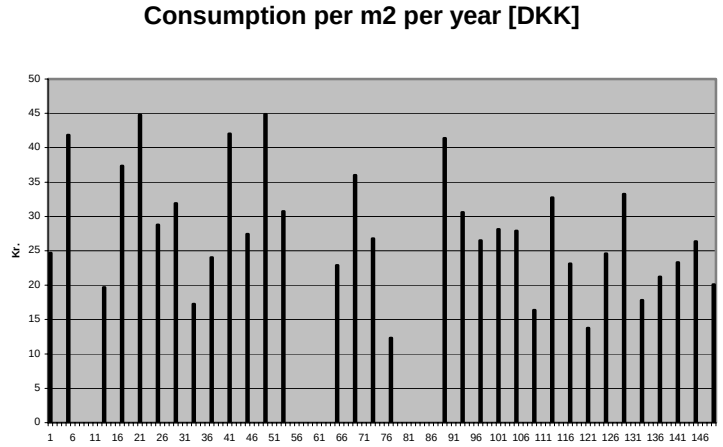
For a solution with alternate current, AC motors, even a good quality, double the electricity consumption was measured namely 748 W or approximately 53 W per apartment.

Compared to this an electricity consumption of approximately 89 W using standard ventilators could be expected.
This equals a yearly electricity saving of 532 kWh and 306 kWh per apartment respectively equal to DKK 692,- (Euro approx. 91,70) and DKK 490,- (Euro approx. 65,-). In all a very sound investment in a more electricity efficient ventilation.

The PV installation totals 20 kWp or approximately 200 m². With an estimated yearly yield of 10.-12.000 kWh a further saving of DKK 400.-500.,- (approx. Euro 53,-66,-) per apartment will be possible.

Figure 3: 200 m² PV modules have been mounted on the towers in the housing project Dalgasparken in Herning with 72 apartments.





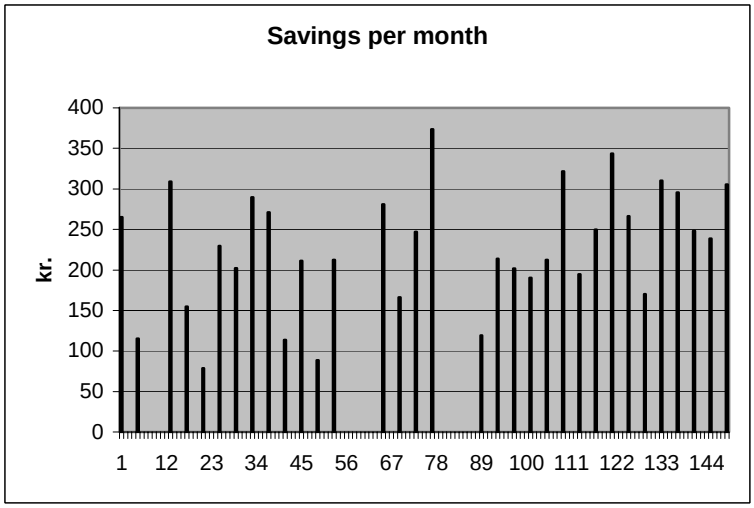


Figure 4. Monitoring results from the Energy Group in Jutland based on 57% of annual consumption of heating and hot water, show a 50% saving compared to normal standard new housing projects.

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Dalgasparken, Herning
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15/1 til 15/8 2004