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Solar Low Energy Building in Denmark

Summary of presentation.

Cenergia has been involved in more than 25 solar low energy demonstration projects in Denmark since 1984, in most cases with EU support as an important incentive.

New Build Housing Projects

In 1992 the Skotteparken solar low demonstration project was realised with 200 housing units. This project won the "World Habitat Award" in 1994 by its impressive strategy to document savings on heating, electricity and water.

Based on the good results with the Skotteparken project the EC in 1993 supported a proposed targeted project with demonstration projects in 7 different EU countries from the new established European Housing Ecology Network housing association co-operation.

In Skotteparken an aimed at 60% saving on heating and DHW use was obtained (from 180 kWh/m², year to 72 kWh/m², year) with a very good total economy for the users. Based on this total economy assessment was introduced as basis of social housing investments in Denmark.

From 1996 to 1997 Cenergia realised solar low energy housing demonstration projects in Agerskrænten (1995), Solsikkehaven (1996), Ullerød (1997) and Farum (1999).

From all the mentioned projects it was clear that it was very important to introduce savings on the ventilation loss by using heat recovery ventilation (HRV), and at the same time keep the electricity use for ventilation low.

Best energy performance was around 50 kWh/m², year for heating and DHW.

In Farum an electricity use for individually balanced HRV ventilation units were monitored as low as 20 W per housing unit. And with a noise level at only 20 dBA.

In 2001 the Munkesøgård project was realised as the first large scale ecological housing project in Denmark with 100 housing units.

This project, together with a sustainable building effort by the Municipality of Roskilde and Glostrup, was supported in the Green Solar Regions Project connected to the European Green Cities co-operation.

And in Glostrup the so-called Green Build system with a check list using energy and environmental points was used with good results demanding a certain minimum energy standard and filling in the check list in connection to sales of land by the municipality.

In 2003 the Dalgasparken housing project in Herning was realised using PV panels to obtain CO₂ neutral balanced HRV ventilation in combination with a very good and documented airtightness. The local energy company documented 50% savings on the heating bills leading to a very good economy for the tenants.

Blowerdoor tests were here performed in 3 rounds.

1. At the time the first housing unit was closed
2. Based on registered failures in (1) when failures had been removed / mended
3. At the finalisation of the project.

As basis of developing a basis of a cost effective “passive house” design in Denmark a CO₂ neutral test house was developed in 2003 using PV panels to match yearly electricity use for operation.

Here an only 22 cm thick low cost heat recovery ventilation (HRV) unit from the Danish company EcoVent was developed and used with success.

In the prefabricated housing project, Solengen in Hillerød (2005), built by Scandibyg and Nielsen & Rubow Architects, the EcoVent HRV unit has been introduced at a total installed cost, including ducting and heating elements, of only 2.000 Euro, equal to only 1.100 Euro in extra costs for the builder.

At the same time Cenergia is using the same technology for the first passive housing project in Denmark, Rønnebækhave in Næstved, where PV panels is used to match electricity use for operation of an energy efficient shared ground coupled heat pump system.

Retrofit housing projects

The Østerbro – solar low energy retrofit housing scheme with 80 apartments was realised in 1994. Here was used solar heating for DHW, solar walls, facade insulation, low energy windows and individual HRV systems. A 51% saving of district heating was documented. The project was selected as a finalist for the World Habitat Award in 1995.

In 1995 the European Green Cities co-operation (EGC) was established in co-operation with Green City Denmark. And in 1996 support was obtained from the EC for a targeted project in the building sector with 11 projects in 9 EU countries.

The Danish EGC demonstration was realised in the Hedebygade housing block with 3 different demonstration projects a part of the largest urban ecology project in Denmark (1998 – 2001).

In connection to the Lundebjerggård housing block renovation in 1999/2000, several types of HRV ventilation designs were tested in combination with PV panels as part of a PV-VENT design where PV is used to match electricity use for ventilation.

At Lineagården and Trekanten, Frederiksberg in Copenhagen, solar low energy ventilation towers were introduced for nearly 200 apartments to hide ventilation ducts and produce solar energy at the same time.

Here shared HRV systems were used with individual user control. But when the HRV units are placed in a cold loft room central after heating of the inlet air proved to be necessary.

At Lauritz Sørensens Gård experience with PV assisted HRV ventilation has been obtained as well as in Havremarken, both at Frederiksberg in Copenhagen.

For the Bistruplund estate in Birkerød near Copenhagen, thin EcoVent HRV units will be introduced at an installed cost of 3.000 Euro per apartment in combination with airtightness measures to obtain a combined improvement of indoor air climate and a reduction of the tenants' heating bills.

Condensate from exhaust air will as always be lead to drains to reduce moisture level in apartments.

The same technology will be introduced at Gyldenrisparken as part of the EU-Demohouse project.

During the summer 2005 a prefabricated CO₂ neutral rooftop apartment will be exhibited at Ørestad Nord in Copenhagen.

It has been developed in a co-operation between Cenergia and the Velux Group, Urban Renewal Copenhagen and Nielsen & Rubow Architects (which are ISO 14.000 certified).
Homepage : www.soltagdanmark.dk (by July 2005).

It is aimed to utilise the developed principles of the CO₂ neutral rooftop apartment for Gyldenrisparken / Demohouse as well as for a demonstration project in Horsens, Jutland.

The here mentioned activities are supporting the Solar City Copenhagen and the Solar City Horsens initiatives which are aiming at high CO₂ reductions for cities in combination with use of energy savings and solar energy. (See also www.solarcitycopenhagen.dk).

Aims for the future

It is expected that the EU-Energy Performance Directive for Buildings and the new energy rules in Denmark from January 2006 will change the situation for cost effective solar low energy building so it will become more like a standard solution in the future.

A barrier here is if it is not possible to document aimed at energy savings in practice. Like in the Västra Hamnen BO-01 project with 11 low energy housing projects in Malmö, Sweden. (Partner in Solar City Copenhagen).

To obtain this it is suggested to introduce “energy quality control” as a common practice in new building and retrofit building projects.

Here e.g. blowerdoor tests, thermo photography and use of energy characteristics / energy signatures should be used during the final year of operation, so possible failures can be identified and corrected in connection to the “First Year Commissary” together with the building contractor.

In Denmark two low energy standards, 1 and 2, will be introduced by January 2006 with a further 25% and 50% energy saving compared to the new minimum standard. This is used as examples for the expected revised standard for year 2010 and 2015 in Denmark.

The idea for this was presented by Cenergia already in January 2003 in connection to the EU-Save project, Green Catalogue (www.greencatalogue.com).

In Denmark an initiative has been made to form a network of cities who will involve themselves in a “sustainable cities campaign” where means to obtain sustainable and energy efficient building will be developed and introduced in practice, also supporting the “EU-Thematic Strategy for the City Environment” (KOM(2004)6039 to illustrate the relevance of this:

“In the EU countries only very few buildings are build or renovated in a sustainable way, even though there exist documented solutions for this. The main barrier is a lack of interest from the contractors and investors who believe that sustainable buildings are expensive and further they are suspicious of new technologies. The long term benefits from sustainable building, like lower maintenance and operation costs, improved durability and a higher value for the building are not visible in the short term and in relation to the original purchase. Due to this it is needed to make a special effort to focus on such benefits, so investors, banks and mortgage banks will be able to spot the difference between buildings realised by normal solutions and sustainable buildings”.

A good example is the city of Stenløse near Copenhagen. Here minimum demands for sustainable building have been introduced in connection to sales of land for 700 housing units.

Here there was requirements for :

1. Reuse of rainwater for flushing of toilets
2. Avoidance of PVC and pressure impregnated wood
3. Use of low energy design which is 35% below the new minimum energy demands from January 2006.

And there was no problems of selling the land at the aimed at prices.