

## Lineagården and Trekanten at Frederiksberg

In 1998 Cenergia obtained funding to the so-called SUNVENT project in cooperation with the housing association PrivatBo and the housing fond Frederiksberg Boligfond. The project is about a new type of solar energy ventilation towers in connection with renovation of the Lineagården houses with 167 apartments at Frederiksberg in Copenhagen. At the same time a similar project will be made in Brescia in Italy.

The background for this is that I in 1997 suggested to Frederiksberg Boligfond to work with solar energy ventilation towers as a new element of renovation of old blocks of flats.

I made this suggestion due to experiences from a ventilation project with counter flow heat recovery in the building AAB dept. 23, block F at Østerbro in Copenhagen, which was made in 1994/95. Here we got the problem that exhaust air is always going to be let out above the roof. In the AAB-project placing the exhaust ventilation ducts in connection with the facade insulation facing the courtyard solved this. But when there is no facade insulation you will usually have to install a bulky shaft inside the apartments, which will often be very unpopular. An alternative solution is therefore to make a ventilation tower with exhaust ducts inside and at the same time use this ventilation tower to collect solar energy, e.g. by means of PV-modules.

Shared ventilation system can then be placed in the attic and individual systems can be placed in the apartments. As an alternative it can be placed in the ventilation tower, which will, however, increase the dimensions quite a lot.

It is the idea that the solar energy ventilation towers can be built with all types of solar wall cover. In the winter the solar wall preheats the ventilation air before it is let into the heat recovery ventilation system. In the summer the ventilation tower can function as a solar chimney.

In spring 1999 an adjustment of the solar energy ventilation towers took place and the architectural design was improved by connecting the solar energy ventilation towers to the existing stair turrets, an important part of the architecture of the courtyard facade. In this respect the rather small and light ventilation towers get a basis, which is connected further in a baldachin above the entrance together with an espalier to strengthen the green. It will at the same time be possible to make the ventilation towers higher and this way secure an improved solar effect without introducing measures in the roof. The last thing is important due to the stability of the constructions and the placing of the installations will also be simpler.

Heat exchangers can be placed in two positions:

- As individual systems (per apartment)
- As shared system (per staircase)

If solar energy ventilation towers with individual heat recovery units are used, the ventilation ducts are in the kitchen and the recovery unit is placed above a false ceiling with just a small space to the outer wall. The continuous inspection of the heat exchanger is therefore going to be made from the kitchen.

If a solution with a shared heat recovery unit is chosen, the shared recovery unit will be placed above a false ceiling at the top of the backstairs, which makes it possible to inspect the unit from the upper stair landing. It is necessary to change the filter in the ventilation system 1-2 times per year due to the quality.

During the design of the system it has been important to keep the operation costs down by easy access to make the necessary inspection.

Figure 3.65 shows the solar energy ventilation project in Lineagården, which was suggested in the middle of 1999.

Figure 3.65. Proposal of a solar energy ventilation project for Lineagården.

In addition to this project an adjoining block with 90 apartments, is also part of a joint European EU-Thermie demonstration project about use of PV-modules in connection with renovation, INNOPEX. A project that is coordinated by Cenergia and which also includes projects in Italy and the Netherlands, and also a small project with use of building integrated PV-modules as part of the Sol-300 project in cooperation with the utility company Encon.

The utility company Frederiksberg Elforsyning, which self-finances part of the measuring programmes, does also take part of the INNOPEX project. In Trekanten 2 solar energy ventilation towers have been installed in the end of 1999 (see figure 366). During 2000 PV-modules will be installed on the upper part of the towers and also 190 m<sup>2</sup> PV-modules in the south-facing roof.

Figure 3.66. Stair turret with solar energy ventilation towers in the block of flats Trekanten at Frederiksberg in Copenhagen.