

## Passive House Certified Day Care, Skövde, Sweden.

It's a windy day, really windy and from an easterly direction which is unusual. The sun is blindingly bright, so when I met Björn Adler, HVAC expert from Skövde Borough Council's technical services department, it's difficult to have a decent conversation until we get inside the building and out of the elements.

We have met in Trägårdstaden (*Figure 1. Trägårdsstad dagis*), a new housing development area in Skövde, Västra Götaland, and in a bit of joined-up thinking (which is lacking in so many parts of the world) not only have they built houses, but also a daycare for children up to 6 years old.



*Figure 1. Trägårdsstad dagis*

But this day-care is no ordinary one; it is one of Sweden's first fully certified passive house day care centres. Yes, there have been others before which have been called passive house schools and day care centers in Sweden, but this is one of the first to be fully certified by the Passive House Institute (PHI) complying with the energy analyses in the Passive House Planning Package (PHPP).

We start our visit in the technical room serving the kitchen and where the main energy supply enters the building (*Figure 2. Technical room serving the kitchen*). The first of two air handling units (AHU1) is specified to deliver an air flow from around 700 up to 5 000 m<sup>3</sup>/h to the kitchen premises and the design is dimensioned to maintain a specific fan power (SFP) of 1.5. The large amount of heat generated in the kitchen is interestingly used, i.e. it is not only recovered on the air side by the rotary heat exchanger in the AHU but the excess is delivered to the water-circuit and it can therefore be used to pre-heat the air via the pre-heater coil. The water circuit is also supplied with temperature stability via four bore holes in the ground loop which can be used for topping-up of cooling or heating as the season requires. The preconception is that passive houses do not use water-based heating systems (although in my experience the people from Passive House Institute are not against

this, it more that some of the more fanatical followers are), but in this case the engineer has designed a radiator system, as there were concerns about comfort due to too hot air being blown into the premises. With the bore holes it might seem that this is a perfect candidate for a heat pump solution. However the politicians have decided that the development is to be a district-heating area. The technical discussion as to what would be the better solution was never taken. This is a shame, it may well be that district heating is the right solution, but without a clearly argued case in its favour, the selected solution is in some way soiled by politic basis.



*Figure 2. Technical room serving the kitchen*

The building is now in use, although nowhere near capacity. However considering the weather conditions outside it is really comfortable and quiet indoors. The air tightness is exceptional; probably Sweden's most air-tight building to date. The requirements from PHI stated air tightness of  $1.00 \text{ l/s m}^2$ , the goal for the project was  $0.60 \text{ l/s m}^2$  and the actual measured by the blower-door test was  $0.05 \text{ l/s m}^2$ ; outstanding! The sound level is class 'C' (according to SS 25268:2007), although I wonder if it a better class would have been useful as when the day care is at capacity there will be 5 different departments of pre-school children running and screaming in this building.

Skövde Municipality's first passive day-care has two floors and it is built as a compact structure to reduce heat loss and limited thermal bridges. Load-bearing structure is made from the steel beams, the floors and foundation are casted reinforced concrete and the roof is made of timber elements. The windows are of a good standard, the total U-value for the windows (glass and frames) is  $0.7 \text{ W/m}^2\text{K}$ ; they were just putting the final touches to the cladding around the windows during my visit (*Figure 3. Window frame with the upper part unfinished*). The solar shading is thought through; the design maximizes the winter sun radiation and minimizes summer sun radiation peaks during the middle of the day. Although Björn is concerned with the risk of over-heating in the summer; no doubt he will be looking over the building like a hawk this summer.



*Figure 3. Window frame with the upper part unfinished*

Naturally the whole building is demand-control ventilated with several sensors monitoring temperature, CO<sub>2</sub>, VOC and occupancy. At the moment, the building is of course being supplied with a high air flow rate to all rooms in order to reduce the VOC levels from the newly painted surfaces. And it must be working as the rooms feel air and fresh! All the areas of the building (*Figure 4. Main area on the upper floor*), apart from the kitchen, are supplied by another AHU2 on the 1<sup>st</sup> floor which can deliver from 1800 to 9000 m<sup>3</sup>/h. At the moment, when there is 100% demand for air, it seems that the dimensioned size of the AHU2 is not quite enough. There should be approximately 110 Pa in the supply ducting, but this drops to 80 Pa during full demand. Fortunately it is just a question of a software upgrade and an extra couple of thousand cubic meters of air per hour can be delivered if necessary.



*Figure 4. Main area on the upper floor*

I asked Björn what the budget was for the project. It was 27 million SEK, about 10% more investment due to the PHI requirements. This figure of 10% extra investment seems in line with what I have heard before and I reason with Björn that this is a completely acceptable increase in capital investment costs which I guess would give payback well within a 10-year period. However, Björn is not so convinced. If I had 2.7 million SEK extra in my maintenance budget I could do a lot to improve the energy efficiency of the existing school building stock in the town, but renovation does not have the same political statement value as a brand new day care centre. Naturally I know this to be true, I actually wrote a scolding letter to the head teacher of my children's day care centre a couple of years ago, as the doors and windows of their buildings were, and probably still are, rotting to pieces and wasting huge amounts of energy whilst trying to maintain a suitable indoor environment.

I have to applaud the political policies of the local council for their vision, but seeing that the need to look after our existing building stock ways is so much heavier than new buildings in keeping our energy usage in check, I guess Björn would like to see a bit more balance in his budget between renovation and new builds.

More information at:

[http://www.skovde.se/Trafik--Teknisk-service/Entreprenader/Tradgardstadens-forskola\\_2/](http://www.skovde.se/Trafik--Teknisk-service/Entreprenader/Tradgardstadens-forskola_2/)