Second remarks on a pilot project of renewing the Oblá 14 house in Brno, Nový Lískovec

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Introduction

Describing my English text made in a hurry as a very crude draft has proven, unfortunately, true. Namely, some new sentences, missing in the Czech draft, have not been printed into the pdf file (due to my error). There have been contained just in the LaTeX source file as parameters of the command `\new`. I repeat them here and add comments on the Lari et al commentary from 2003-4-29 (document AV-513-07.pdf).

I agree with the commentary mostly, so some sections remain empty. Still, I leave them here, to retain the numbering.

A reaction on the proposal concerning the measurement should be included as well, but it remains to be done. Just generally, I consider the measurement proposal as hardly sufficient. A total lack of information of what happens in the already renovated houses Oblá 4 and Kamínky 6 became a grave problem and this should not be repeated. With lots of data, the Oblá 14 project could become an invaluable source of education and an opportunity to become involved for a generation of students and even postdocs. And even for some inhabitants maybe.

1 Ventilation

1.1 Cross-sections of ducts are to be several times larger

I admit that using the whole shaft, divided into halves, as the vertical ducts may not be easy. Still, this is the solution which should be examined, as it brings substantial advantages. The only problem is, if it is possible to made it tight enough, in spite of all the pipes and wires going through its walls. It remains a challenge, which, in case of a success, would affect the future development of passive house technology.

The main advantages are:

- a negligible dynamic pressure loss over the height of the house, making any necessity to install throttle valves and to tune them up so that all the flats would be able to get just the wanted $90\,\mathrm{m}^3/\mathrm{h}$. The fire valves would be needed of course, producing about the same pressure drop.
- due to this negligible loss, the flats would become truly independent, as the air fluxes are regarded (limiting the flux in the top flats would not mean any rise in the flux in the flats below them)
- Of course, the electricity efficiency would rise, detaching itself from the obligatory passive house limiting value
- In the duct, no noise at all would be produced – with the corresponding comfort gain for the flats

The objection, that convection in the ducts could make a problem, can be evaluated from this point: the surface of each duct would be some $35\,\mathrm{m}^2$. With an insulation of just 2 cm, the thermal conductivity of the walls is some $70\,\mathrm{W/m}^2$. Even with the extreme possible difference of the fresh air temperature from the building temperature ($16\,^\circ\mathrm{C}$ compared to $22\,^\circ\mathrm{C}$), the heat flux to the fresh air would be some 400 W. The air going down the duct, some $0.2\,\mathrm{m}^3/\mathrm{s}$, would be heated by less then 2 K. The only result would be, that the availability of a cool air in the bottom floors would be reduced a bit. Of course, just in case that central preheating would be abandoned, otherwise there is no influence at all, even almost no convection. Such a problem simply does not exist at all.

From the old text I quote just one paragraph, where a remark on the pressures have been missing:

“The only condition of the functionality of such solution is a sufficient tightness of the control doors to the shaft in each flat. There should be two doors, to each duct separately, ideally made in such a way that it would not be possible to open both of them at once (a shortcut would result and the ventilation would cease to work, **the wanted pressures in the ducts could not be maintained, what should be indicated by a measuring system**). A switch indicating which door is not properly closed would be suitable, attached to the whole measuring and control system accessible by Internet."

1.2 The ventilation should be adjustable

The case for lowering the ventilation rates and getting much more comfortable humidity has been strengthened by a participant of the seminar in Vienna (and of the broader Austrian team): he and a doctor of medicine, who is interested in the problem, think too, that 60% humidity is much better then just 40% one.

There remains no large controversy – we agree that the ventilation should be adjustable. I would still insist that simple, perfectly visible adjusting devices (doors) at the outlets, are far better than a central adjusting, esp. if it would be electric (and therefore hardly working forever and hard to check how it works). Mechanic device, resembling traditional control of upper ventilation windows (not in this house, but in the old ones everywhere), is understood by everybody, its position visible from the room with the outlet, and is easy to make. Yes, it would be another new, very useful part of passive houses technology. The only reason for an electric control would be, if it would enable easy central monitoring of the positions of the valves.

In the old text, two remarks were missing, so I quote the corresponding paragraphs:

"By lowering the air exchange rate and the subsequent rise of humidity the inhabitants will perceive the interior temperature as suitable even if the air will have just 21 °C instead of 22 °C, thanks to the diminished cooling of the skin by evaporation. Let's stress that even an incidental humidity around sixty per cent (entirely common in summer) cannot, in such a high-quality house, make any hygiene problems in winter, as there will be no cold surfaces where the water could condensate. Aside from getting a higher comfort, the fire risk will diminish**, when the humidity will be kept high**."

"Especially during a longer absence (winter holidays) it is suitable to reduce the ventilation of a flat, say to one tenth or even less, and to let some slight heating (not needed for the given flat, but considerate to the neighbours) to the radiator. The flux-reducing device can be mounted onto the outlets **and definitely on the bathroom exhaust air inlet**, or in need just centrally into the branch from the vertical duct. To put it on the outlets has a large advantage: it enables, e.g. at night, to ventilate generously just those rooms where somebody is sleeping in and to prevent drying another rooms in vain."

As follows from the second one, a mechanic door at one inlet as well, in the bathroom, would be useful.

1.3 Central preheating of the air

The controversy is not visible well in the answer: in my concept, the radiator circuit would be running all the time. Not just as an alternative possibility to heat the building when the ventilation system would not work. Overheating should be excluded by another means – by the measuring and accounting system, or even by controlling the heating water temperature centrally.

The radiator brings some comfort as well: it's nice to have a warm surface at home. To heat the hands, to dry wet shoes.

The problem of a possible condensation of moisture in the shaft is no problem at all. Such a phenomenon can never happen. The Czech air has never a dew point over 22 °C, the minimum possible temperature to which the fresh air could be cooled by the heat recovery system in hot summer. Even if in the future an option to cool it further (e.g. using the cold available in the potable water to be preheated) would be implemented, the condensation would not happen further in the duct, as the walls would be always warmer. Such a cooling is not so important now, but may become in future, as the climate change proceeds.

There is of course another problem of moisture, namely on the entrance filter for the fresh air, as mentioned on the seminar in Prechtlsaal on April 28. Preheating the fresh air just as in the case of anti-freezing measures seems completely reasonable whenever the fresh air humidity is over say 90 %. One kilowatt would do, rising the temperature by 1 K before the filter. Of course, that one kilowatt would give just 0.2 kW useful heat to the building at the end, just one fifth, like the solarwall considered below. Or even less, if the heat recovery would have efficiency over 80 %.

In the old text, one remarks was missing, so I quote the corresponding paragraph:

"One important preheating is missing in the project, namely the anti-freezing measure. The exhaust moisture should not freeze at the recuperator outlet. A bypass for the fresh air is another solution, but preheating can be simpler and more reliable. It's easy to make it by a a register using the freeze-resistant (solar) circuit. **It would have excellent efficiency, as the solar collector could have a working temperature of perhaps zero degrees...**"

1.4 Solarwall

The efficiency of Solarwall is really quite low most of the time, just some 7 per cent, as follows from the old text:

"Preheating (or, sometimes the whole heating) of the air by the solarwall seems to be very low-efficient together with a good heat recovery. Really, from the heat gained by the solar wall just twenty per cent would be used most of the time. The full thermal gain could be used just as an anti-freeze protection of the heat recovery unit."

The Streicher's simulation did not take into account the existence of the heat recovery with the 80% efficiency. So the Solarwall has not the 35% efficiency most of the time, but five times less.

I try to explain it on an example, for non-physicists. If the outer air would have 0 °C and the exhaust air from the house some 21 °C, the heat recovery system itself would rise the temperature of the fresh air by at least 16 K, i.e., to 16 °C. The same increase can be reached by the Solarwall itself, without a heat recovery unit, as Streicher's example says. The heat flux to the fresh air needed to perform this rise of temperature is some $16 \times 0.8 \times 1.3$ kW, i.e., 17 kW. When the Solarwall is in a series with the heat recovery unit, the fresh air is heated 16 K by it at first and then another 4 K by the heat recovery unit (80 % of a 5 K temperature difference of the exhaust and preheated fresh air). The difference between using just the heat recovery unit and a recovery unit with a Solarwall is just those 4 K, i.e., the Solarwall adds just 4 kW.

How is this possible? The exhaust air (Fortluft) is not cooled so much as without the Solarwall, and so 4/5 of the original gain from Solarwall go lost in form of rather warm exhaust air (it escapes into the 0 °Cenvironment with still 17 °C...).

The only full exploitation of the Solarwall gains would happen if the outer temperature would be some -20 °C. Then the preheating by 16 K would be used completely, as an anti-freeze measure. However, this is not very usual situation... 100% use of the solar gain by the Solarwall happens just when the preheating by it rises the temperature of the fresh air just to a couple of degrees below zero. It happens often in winter cloudy days. However, in the sunny days the efficiency sinks to a half, third or even fifth of that (as the outdoor air temperature nears the freezing point).

Anoher full exploitation might be possible using a heat pump for preheating the potable water (like in the well known compact units for passive houses) by cooling the exhaust air further. This is however beyond the scope of the project. Or is it not, perhaps in connection with some PV part of the facade?

I am much in favour of using Solarwall here. Just the area might be not over $50\,\mathrm{m}^2$ – for demonstration purposes it would suffice. And it would not bring (justified) objections by future visitors and interested people: “what an inappropriate use”...

1.5 Humidifying bathroom?

Letting just the door open after showering may do, I agree. However, adding a door to the exhaust air inlet should be a part of the project. Perhaps as an extra option for the inhabitants, if they want to raise their comfort and pay for it as well. Just this comfort-raising option should be offered by somebody.

1.6 Tightness and Blow-door test

I agree with the simplification to ventilate the cupboards just to the kitchen. Simplicity is nice.

In my original text two paragraphs marked as “new” have not been printed, so I repeat them here; they are perhaps not entirely trivial, esp. the recommended value of 0.2 volume/h:

“**HOWEVER, this conventional limit for passive houses (or for a suitability to use heat recovery) is quite insufficient for a multi-storey building like that on Oblá 14! Namely, in a cold winter period, the pressure difference between the outer and the inner air would amount to more than thirty pascals at the bottom floor. Most of the air would go in through the remaining cracks, instead of through the fresh heated air supply. Cold draft, lost of comfort and heat losses would result. Such a high building, with a central ventilation system, is to be at least thrice tighter. So the allowable limit is just *0.2 volume/h at 50 Pa*. It holds both for the bottom storeys (greatest convectional air suction) and for the top ones (largest wind velocities).**”

“**When the ventilation system will be finished, an easy way of a tightness test is possible: by closing the fresh air supply. Just a way of measuring the airflow of the exhaust air should exist, a reasonable option even for the normal operation of the system. (Another airflow measuring device should be in the fresh air – in this way, inferring from the flow differences in freezy periods, any untightness in the bottom half of the building would be apparent.)**”

1.7 Opening windows and inner insulations

A display with two temperatures and humidities would be no excessive technology, but a very relevant information both for the inhabitants and for supervision and publicising the whole project. The outdoor parameters will be measured anyway, according to the project, so why not make them available to the inhabitants. OK, the LEDs may be abandoned.

The remaining paragraphs are just quotations from the old text, containing some sentences which have not been printed before (as the one on outdoor air parameters):

“... A suitable information would be a LED indicating that it’s not suitable to let the windows open, fully or partly. It could be a part of a large display, reporting the middle temperature and humidity of the flat **and the same parameters of the outside air**, see further below. Two degrees of unsuitability could be given – the first saying that the heating runs or that it's too hot outside, the other warning that the energy losses through the untight window become substantial.

One of the reasons for opening the windows has been given already in the part on the disputability of the central heating of the air up to twenty degrees – namely the effort to cool down the bedroom. Apart from abandoning the central preheating, one other measure seems reasonable. It can but needs not be an integral part of the renovation. I mean adding some inner insulation. Up to now, the outer envelope has been so conductive, that the inhabitants of neighbouring flats could keep the inner temperatures quite different, according to their wishes. But by the thorough outer insulation the building will become almost isothermal, the thermal resistance of the ceilings and inner walls will become negligible. **Interestingly, it could lead to a loss of comfort for some people.** The solution is to put some centimetres of insulating material on the walls and ceilings. **Even thick carpets could help a bit.** Another option is insulating just the bedrooms, even from the surrounding rooms of the same flat. These insulations could be acoustic ones, as well.

Modular insulation (as some 1,5 m wide, in the whole height of the rooms) with a wooden frame and filled optimally by sheep wool (there are two certified Czech producers of woolen insulations), with a finished surface in various variants, according to the wish of the inhabitants, would be perhaps the best possibility. The inhabitants should have an offer to order and pay for it themselves. **If they know there are no differences of thermal preferences in the neighbouring flats at the moment, and no wish to have a cold bedroom, there's no need to install them now.**"

1.8 Roof room ventilation

2 Measurement and distributing the heating costs

From the consultation at the May 6 meeting it follows, that as the only measurement of heat consumption in the old project there has been a flow meter on the heating register – for the air flow being constant and also the water temperature being constant the used volume over the season would give the heat supplied this way to the flat. However, the water temperature should be changing over the heating season (and kept as low as possible, to avoid drying the air and enabling better solar gains), so such a measurement would need online flow meters. With the controllable ventilation, this way of measuring fails completely. If the heat supplied to the register should be measured at all, a standard electronic device would be needed.

I guess that the alternative method, just measuring the temperatures of the air (say, of the exhaust air from the flat, which cannot be influenced by the inhabitants) online, would be cheaper, more just and informative. From the computed heat loss from the flat through the building envelope, the energy paid another way (gas, electricity, perhaps even warm water) could be subtracted to get really an amount to be paid for (neglecting the differences in solar gains through windows).

Of course, the best possibility would be to measure both ways... The classic way would favour those ones, who keep lower temperatures and need not heat at all (having all the needed heat from the neighbours). Without knowing the temperatures in all the flats, we would know nothing at all about what the total building consumption consists of, what would be rather bad. Quite inappropriate for a pilot project.

Some measurement method which would favour those, who contribute less to the building thermal losses, should be a part of the realization in any case. The project should specify it of course.

3 I recommend better insulating and sophisticated windows

0.8 W/(m^2K) should be the limit, including all linear thermal bridges. 0.95 W/(m^2K) is not satisfactory. The results from the Utendorfgasse tender show, there are producers which can offer true passive-house windows for a unit price below 250 euro per square metre.

The option to have shading (and still lower night losses) as an integral part of the project, as I propose, seems to be a challenge which should not be missed just because lack of any effort. For the large east and west window area it's an important matter. The inhabitants have Venetian blinds now, at least an option to include them to the windows (the inhabitants can pay perhaps for it, rather then just buy them afterwards) should exist.

The paragraph from the old text, with a sentence missing in its first print:

"Including the blinds into the project is necessary, as the main window area is not precisely southward, but the most inadvantageous eastward and westward one. These orientations causes overheating in summer. The only efficient remedy are just clear aluminium reflection surfaces, installed as outwards as possible. **If we won't choose the expensive possibility of outer "Rollades" (with unpainted Al surfaces again, of course),** the blind should be in the outer cavity of a triple glazing, so that the sun-heated glass (each with a hi-tech layer of a low emissivity is heated a lot by sun) does not heat the interior."

4 Solar system discussion

My proposal for the whole southern facade is: if the money enable it, both sides should be covered by the most hi-tech flat collectors. Just the middle cross-like area should use the Solarwall technology for preheating (or even complete heating) of the fresh air. Some bottom parts (as the eastern, most shadowed corner of the facade, or just the area below the windows) could and should be covered by TWD (e.g., that by Sto).

Such a plan would give the maximum energy yield and would minimise those parts, which are a bit disputable in this case. Solarwall is excellent whenever a mechanical ventilation and NO heat recovery exists, but we will have a heat recovery of at least 80 %. TWD is a costly, but an interesting option, when the facade is not used to heat water. But we will use the facade for this purpose and extending the size of collecting area does not increase the costs so much (or not at all, considering the high price of TWD). The payback times, in current prices, for each added square metre of water collector replacing another solar-using or solar-rejecting insulation are below 20 years.

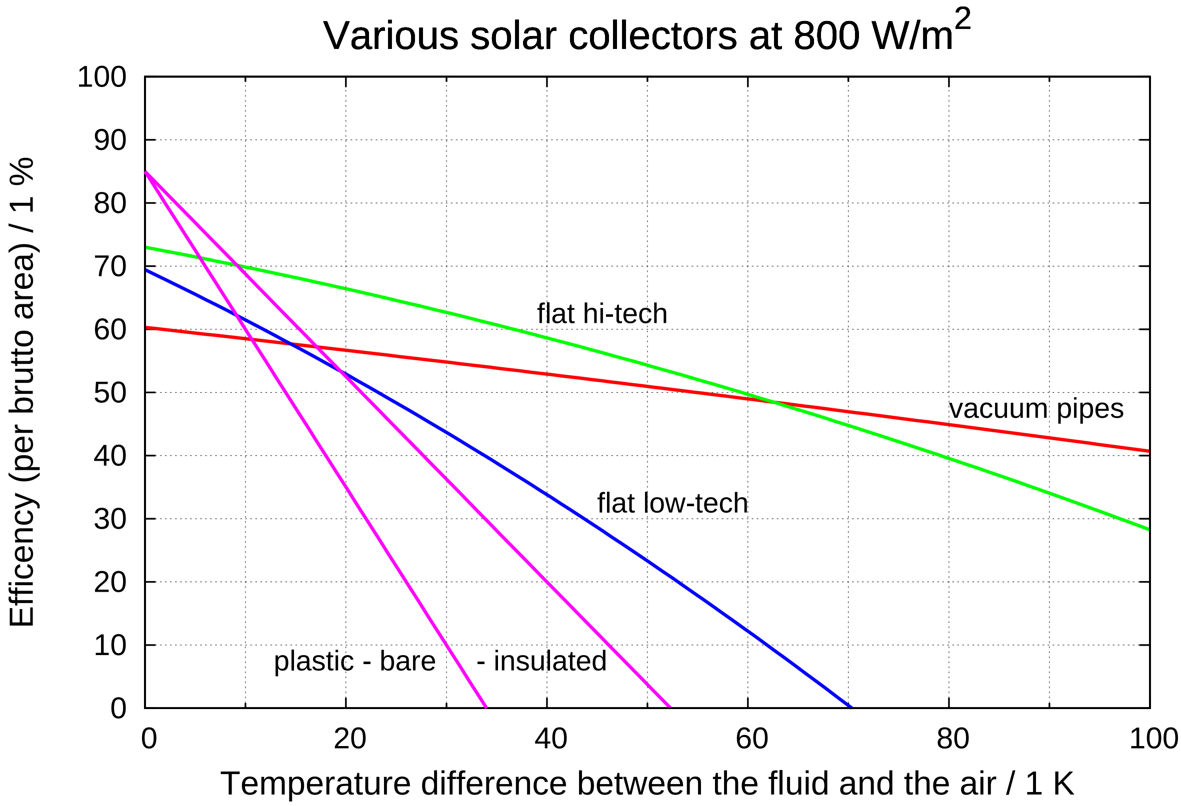
As regards the water collector area, the absorbers should be in series in those cases, when some are shaded in the morning – the shaded should be the first ones. As they will reach stagnation in summer quite often and their contents will evaporate, all the pipes should be enough sloped so that all liquid could be pushed downwards by the produced vapour. Unlike in the Břeclav project, where there is no evaporation (as no low-emissivity absorbers are used), the hydraulic connection of absorbers cannot be changed in the future. The modules should have the absorbers sloped according the wanted hydraulic plan (2 cm per 6 m should do I think, perhaps even 1 cm).

4.1 A substantial part of each building is to be a solar collector

4.2 Costs, “Erträge”, aesthetic kriteria

4.3 Dimensions and using the rest of the facade

4.4 Remark on the collector types



Just a comment for the tender: there is much larger difference between the low- and hi-tech collectors then I’d expect before I made the graph. At the left end, with zero temperature difference, it’s due only to using either a standard or a solar glass (with low iron contents and high transmissivity). At the usual working temperature difference, 30 K, or in case of such a large system rather 40 K, the gain is really substantial – due to the much lower emissivity of the hi-tech absorbers. The best ones reach a value of just some 0.04, and these should be preferred of course over galvanic-treated ones with emissivities of more than 0.1.

4.5 No heating of the warm water over 60 °C is needed

I stress once more: the mixing ventil is obsolete and should be not payed for and installed.

4.6 Remark on glasses

5 Thermal bridges

5.1 Balconies

My remark did not consider geometric thermal bridges. The point bridges have not been evaluated, as far as I know. Neither in case of balconies, nor in case of a lightning conductor. In passive houses such bridges are not present, here they are. I guess they may be neglected, but a quantitative consideration would be useful. And of course all measures to make them lower, as through using the best materials. There is not a word about it in the project.