УДК 697.7 +697.392 +662.997

SOLAR AND GEOTHERMAL USE IN BUILDING CONSTRUCTION THE «TERRASOLAR»- PASSIVE HOUSE

Kuehnel W.

The author describes possibilities for the use of alternative energy for the heating and cooling of buildings. Connected to that the attention is drawn to the natural recourses and the climate change.

Key words: *solar energy, geothermal energy, climate change, Kyoto convention, passive house*

Energy is, as everybody knows, the basis of all life on earth. As the physical phenomenon it is given in different spheres of the world and appears for us people in varied forms. Energy is not always grasped by our senses immediately and perceptibly often it remains to us first «hidden» in forms. Only on looking more carefully with specific search for her, in our knowledge about her reservoir her potentials of utilization and the difficulties of her development grows. The search for usable energy sources has led in the course of the human history astonishingly to «easy» utilization forms. As in many other examples also, it has become clear nevertheless, that bit by bit «easy» and comfortable solutions of the energy inquiry are optimum only seldom. Only the oil inquiry rises in future massively. The worldwide need in crude oil and gas goes up during the next 25 years around 50 % (1). Therefore, the oil price goes up dramatically (2).

I have turned to these problems in very concrete manner. The fact, that the humanity uses constantly much more energy than they try to regenerate, stood at the center of my considerations. Besides, I dealt with that hotly discussed, negative energy balance and her doubtful results which are branded par excellence as «a waste».

The available energy sources on earth are used insufficiently. Though the people have tried by better and better systems to use possibly a lot of the available energy, however, they have managed this concerning the yearly given solar energy only to approx. 0.05%. This means that still a gigantic volume of not used solar energy is available to the mankind. Still she limits herself till today primarily to only four ecologically problematic energy sources (wood, coal, oil and natural gas) and has proceeded to these in an astonishing economic dependence which leads more and more often to political conflicts as well. Not seldom becomes threatened with the «oil weapon» (export stop) (3) in view of the further rising use (4) a highly sensitive matter. The causes for this development are the decrease becoming more and more clearly of these four energy resources. Today it can be forecast that still in this, but even more clearly next century, the constantly increasing consumption of fossil energy sources on the earth will lead to dramatic results for the next generations and therefore of the whole mankind.

Numerous energy scenarios point not only to the alarming increase of the CO2 concentration in the atmosphere and with it the climate warming, but also determine the continuation of this trend in spite of the lowering agreed in the Kyoto convention of the CO2 issues which the USA has not joined as the worldwide biggest energy squanderer. The unquestionable conclusion from such results of the research exists in the logical demand for basic changes in our energy supply systems. If this is an approved secure level of knowledge about the possibilities of a solution of energy problems of the mankind, which exist primarily in the industrial and urban conurbations of this earth, then more than one of many practical contributions would be the construction of the buildings, which would get by without heatings of conventional kind.

The breath of madness which sticks to all new, innovative ideas at first leads in professional circles also in this case to doubts, because the idea giver still aims at the same time to establish such houses for prices, as they are usual with the conventional construction.

However, such prejudices are groundless. Really I have managed with my employees such «a passive house» in Thun, Switzerland, in the canton Berne, at a concrete example.

What are «passive houses»? An explanation for this can be given relatively briefly and clear: It concerns basically buildings, in which in winter as well as in summer cosy temperatures are reached without separate heating or climate control systems. Accordingly the visitor looks inside in vain for traditional stoves and heaters. The at the same time raised residential comfort in dwelling houses is reached by heating warmth need of less than 15 kWh / mI, by «passive technologies». Such «passive technologies» are:

- Optimized heat insulation of the building cover and the windows.
- Cold spot free constructions.
- Solar energy use by optimum creation of the building.
- Highly efficient warm recovery from the exhaust air and passive preheating of the fresh air by an earth storage.
- Optimum aerial density of the building cover.

With many of the names for the buildings which need little energy the demonstrated kind must be also defined what is understood by a «passive house», nevertheless, it is for me less about abstract definition questions, but rather about the actual construction of power-saving houses. And, besides, I also do not hide certain disadvantages and difficulties which can appear with their establishment. The trend is favorable, because rising consciousness for environmental issues and high fuel oil prices will also arrange in future more and more house owners, to invest in alternative heating forms (5). The phenomen in the energetic operation of a «passive house» is the use of «natural» internal warmth which exist in every inhabited building: People, lighting, computer stations etc. and them (this is valid of course above all for office building) during disuse phases are lost. That is: On Sundays and holidays and during other work-free periods the inside temperature of the building would drop so considerably, that it could be ordinarily compensated only by the application of primary energy.

Around on this, to have to fall back a little comfortable and contra productive possibility, I have tied together different storage possibilities with each other to guarantee pleasant temperature level from consistently 20°C in a «passive house», nevertheless. In my office house which allowed to establish my team and me as «a passive house» in Thun, the solar energy is bound by collectors and then is used about water-leading pipes either for the hot-water preparation or is stored.

A system solution which is based on the basic principle of the early roman air heating –Hypokaustenheizungen but it is not a warm air like in former times, but warm water to transport the energy. Besides, I let the collectors not - as before generally commonly - install on the building roof, but on special bearers above the earth to allow an easier assembly or dismantling. The kind of storage of the solar warmth is very essential for the functionality of the «passive house». It is able either about a high-level short time storage which is heated up to 95°C, or up to 35°C low temperature storage. A special effectiveness of the collectors is reached by such a combination of the use of high and low temperatures. And even excessive solar energy from the summer months can be «interstored» thus in the decentralized earth storage and then be supplied again in cold winter periods to the house inside.

With the ventilation of normal buildings the cold outside air meets warm air inside and cools the latter - the necessary fresh air supply is «bought» therefore partially by a considerable fall in temperature which must be compensated by additional energy supply again: This is, in particular in the colder season an ineffective and costly procedure.

In my «passive office house» appears how one can also solve this problem in original manner:

The cold outside air is not supplied to the inside of the building immediately, but in controlled manner first to an earth register in which a preheating occurs. Recovered exhaust air from the house is available for it.

This «geothermal energy», which is led in the building provokes thus a considerably lower temperature difference than with conventional construction methods and minimizes the costs for their balance. However, already in the planning phase is to be noted, that the earth storage required for it, should be installed only in geologic layers with relatively low water levels. Otherwise his effect can be strongly affected.

Finally the solar energy about a photo voltaic arrangement is used for the necessary circulating pump and heat pump in the future-oriented «passive office house».

And the fact, that for the toilet rinse of course rainwater is used, belongs to - almost natural – to the conception.

A classic example for ecologically straightened construction conscious of energy according to the already mentioned needs, which result from the restrictions of fossil fuels and the climate change? Maybe, but anyway a courageous, hopeful and concrete step, which made high, unusual requests, however, also to his planning and realisation.

I draw the attention to the fact, which for the effective operation of a «passive office house» a lot of climatic, geothermal and meteorological data must be considered and be calculated constantly simultaneous. These data are derived from measurements, which occur in-patient in different points of the building. They serve the topical

statement of the efficiencies of the different storage, in particular of the combined concrete earth storage. To be able to steer constantly his effectiveness, a continuous measurement and evaluation of his temperature and the humidity salary is necessary.

All these and other operations and control functions required planning and constructively comprehensive thinking, high precision and a good combination of all necessary components. However, so new and raised claims were also asserted for an exact calculation of the capital costs. The result is worthy of notice:

Now my team and I have succeeded in building the «passive office house» in the same cost frame as this is given with comparable conventional buildings. With not even more than houses in conventional construction method, taking into account minimized energy and heating costs also young families can afford a «passive house».

All together we have succeeded with the «passive office house» introduced here in Thun obviously in demonstrating an innovative change with the energy supply of buildings which could be formed by friendly costs. Besides, though it still concerns a noteworthy isolated case, however, the pilot project of a building which totally gets by without customary heating systems and fuels, other spreading will find. With it a concrete break through is caused to the minimization of our power demand in a special sector. This the more if the achieved problem solution also transfers on the area of the refurbishment of old buildings. I hope for such a development.

LIST OF BOOKS

1. Die Olnachfrage steigt in Zukunft massiv an // Neue Zuricher Zeitung. – 07.11.2005. – № 76. – P. 11–12.

2. Der Olpreis konnte sich noch einmal verdreifachen // Verlag fur Deutsche Wirtschaft AG. – 04.01.2006. – Newsletter № 7.

3. Der Iran droht im Atomstreit mit Olwaffe // Neue Luzemer Zeitung. – 30.11.2005. – P. 13–14.

4. China wird dieses Jahr 6,5% mehr Ol verbrauchen // Verlag fur Deutsche Wirtschaft AG. – 15.08.2006. – № 51. – P. 3–4.

5. Immer weniger Olheizung // Neue Luzerner Zeitung. – 22.07.2006. – № 7. – P. 6–7.