BUILDING BIOLOGY IN LOW ENERGY AND PASSIVE HOUSES

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Summary

Building biology is a study of the holistic interrelationships between humans and their living environment. Its basic goal is to support whole range of human needs. All the other goals as saving energy, e.g. building passive and law energy houses is important but on the second place. Nature is the guide that gives us vitality and enables us to live in harmony..

Keywords: passive and low energy house, building biology

1 Building biology

Building biology is interdisciplinary science covering architecture, urbanism, ecology, sociology, construction, building physics and other related professions. It also deals with various testing methods including measurement of radioactivity, electric and magnetic fields, chemicals in air, dust and materials.

There are several norms like CSN, DIN, recommendation of WHO. Building biology has created its own recommendations/norms for places with long-term stay. Data in this norm are set to create as natural place as possible, to enable to people to rest and recover. Please see [2] Building Biology Evaluation Guidelines.

Prof. Dr. Anton Schneider Ph.D. is the founder of Institute for Building biology and Ecology in Neubeuern that was founded in 1976. He created 25 principles of Building biology that are with very small change valid till now [3].

Among these principles there are some that might be difficult to fulfill in passive (PH) and law energy houses (LEH). These principles I would like to present in following part.

1.1 Good indoor air quality through natural ventilation (11th Principle)

For achieving low or passive energy standards it is important to use ventilation systems with heat recovery. According to scientists publications (Lajčíková, Jokl) is known that ventilation system in working environment influences the quality of indoor climate. I have initiated some preliminary tests with kind help of Mudr. A. Lajčíková on light negative ion environment in two low energy houses (with heat recovery).

Measurement done 19.3.2010, Instrument: Kathrein MGK 01.

House near Prague
Outside: ~350 negative ions/cm^3

Inside: ~320 negative ions/cm
10 min. after setting up heat recovery: 200-400 negative ions/cm^3
Inlet hollow: ~70 negative ions/cm^3 (warm air 25 °C)

House near Plzeň
Outside: ~400 negative ions/cm^3
Inside: 30-50 negative ions/cm^3
10 min. after setting up heat recovery: 30-50 negative ions/cm^3
Inlet hollow: ~200 negative ions/cm^3 (cold air)

Building biology recommendation (indoor): optimal > 500 negative ions/cm^3, minimal 200-500 negative ions/cm^3.

Influence on level of negative ions (Maes, Lajčíková):
Low level of negative ions is influenced by: outside/inside pollution, electrostatic fields, dust, smoke, central heating (convection), air conditioning.
High level of negative ions is influenced by: clean outside/inside air, radon/gama radiation, opened fire, sun, UV radiation.

Comments:
More detailed tests must be conducted in LEH and PH under comparable conditions.
Important role play materials used in interior, especially its ability to electrostatic charge (Maes). **First house - oiled wooden flooring, clay plasters, all range of natural materials. Second house: laminate flooring, steel staircase in living room, metallic roof.**
Better situation might be in passive houses in comparison to low energy houses due to slower movement of air used only for ventilation (not for heating). Negative ions can then easily arise thanks to natural radioactivity and/or UV radiation. The same is valid in houses with separated ventilation and heating.
Tests must be also conduced in clean places where outside negative ion level is about 1000/cm^3 where the ventilation might have larger effect.
Usual level of negative ions in conditioned offices is about 60-100 negative ions/cm^3 (Lajčíková)
In towns is usually 300-500 negative ions/cm^3, clean nature ~900 negative ions/cm^3 mostly depending on pollution and year cycle (higher values in summer).

Possible alternate ventilation systems to central heat recovery with heating for LEH and PH:
- vacuum exhaust/hybrid ventilation (fresh air goes through special wall/window openings), air volumes controlled by CO^2 measurement e.g. Lunos, Aereco.
- heat recovery into the heating water (fresh air goes through special wall/window openings) air volumes controlled by CO^2 measurement e.g. ventilation heat pump NIBE.
- local heat recovery ventilation (advantage of short supply and easy cleanable channels, e.g. Inventer)

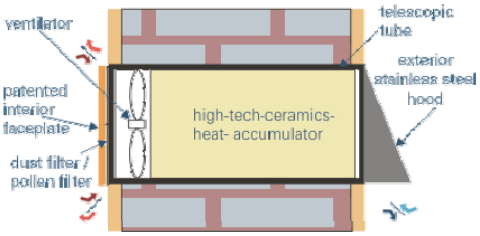

Fig. 1 Inventer

- separated heat recovery ventilation and heating (mostly for LEH)

1.2 Natural conditions of light, lighting and color (13th Principle)

When choosing glazing for PH and LEH architects engage usually only with U (heat transmission) and g (solar heat gain) values. To get as natural (not altered) light from outside as possible is also important to differentiate also among T_L values (light transmission). When visiting PH and LEH I encountered some of them in which you almost can not distinguish if the sun is shining or if there are clouds outside.

For humans is important to get natural sunlight with its infrared and UV portion to support whole range of biology need (e.g. vitamin D synthesis). As we know we spend more than 90% of our time in buildings. About 80% of all our perception is of visual nature. It is important to get as unaltered light as possible. Nevertheless it is also recommended to spend outside minimum one hour a day.

With **special low emission glass** you can reach:
double glazing - T_L 80% (current double glazing 60-75%)
triple glazing - T_L 74% (current triple glazing 50-70%)

with its U and g values unaltered. In the future, after solving some technical issues there will be probably more used vacuum glazing with lower U and higher T_L values.

1.3 Other building biology principles

There are also other building biology principles that are important to achieve: quality architectural and urban design based on personalized, natural, human- and family-oriented housing and settlements, using natural building materials, low human-made electromagnetic and radiofrequency radiation exposure, heating system based on radiant heat, causing no environmental problems and consideration of harmonic measures proportions and shapes. Building biology principles are partially achieved also by Czech architects (Hozman, Brotánek, Polák).

2 Building biology in practice

Fig. 2 Waldorf kindergarten, ing. arch. Vít Polák

Fig. 3 Waldorf kindergarten, ing. arch. Vít Polák

Fig. 4 Family house in Chrustenice, akad. arch. Oldřich Hozman

Fig. 5 Family house with atrium, akad. arch. Oldřich Hozman

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