THERMAL EARTH INERTIA SUCH A SOURCE OF ENERGY FOR BIO-SUSTAINABLE HOUSE

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Keywords: underground energy, underground chamber, underground tubes, Heat breaks transfer system

Abstract

The earth is our sustainer, the chain of ecologic survival. Renew ability is the key to our human continuum and our prime resource for architecture. Earth sheltering earth handling and earth escaping are more clearly pronounced in the vocabulary of architectural planning and design. Many of us had percept the positive effect in underground tunnels by traveling through the metro. The vital and efficient sustainable energy which can be used by us is underground thermal inertia; we can become aware of that, the earth can serve in many climates as a heating or cooling source. Its high thermal capacity keeps the soil temperature, below a certain depth, considerably lower than the ambient air temperature during summer and higher than the ambient air temperature during winter. Seasonal variation of the earth temperature decreases with increase of depth, moisture content of soil and soil conductivity. It is estimated that a small number of meters below the earth surface, the earth temperature remains constant during the year. In regions with temperate climate such as Denmark, the temperature of the soil at depth of 2-3 meters can be low enough during summer or high enough during winter, to serve as a cooling or heating source. Using of the underground constant temperature can be useful for architects and designer because the temperature is between 8ºC-13ºC, and2- 3 m above the earth, can help us to find a competent solution which help us to controlled thermal comfort in houses.

1. Underground thermal inertia such a source of energy

Underground temperatures can be very beneficial in balancing the thermal comfort of the house. Normally we think more about the above ground temperatures and other climatic elements in designing a house for thermal comfort. On of the important problem which architect must thinking on when he start to create an efficient cooling system by using earth inertia is the amount of heat conducted and who widely it is diffused varies from one soil type to another. The devises of earth cooling or heating solutions, take place by a vary system in form and size, some system have underground chamber ,others with tubes in parallel terminating in a header, and some used a radial prototype collecting in a central sump, some were only a single tube. It is important to design the energy source system so as to minimize the cost (negative effects) and to maximize the heating /or cooling effects. Underground temperatures can be very beneficial in balancing the thermal comfort of the house. Normally we think more about the above ground temperatures and other climatic elements in designing a sustainable house for thermal comfort. On of the important problem which architect must think on when he start to create an efficient energetically systems is by using thermal earth inertia such a sustainable energy for bio-sustainable house.

1.1. Underground chamber

It is necessary to appreciate that using of this space must be limited which means just in occasionally cases, because this space must be healthy so it must be isolate from all negative exterior agent such dust, pollute air, humidity, etc. At the same time this space must be tightly to the house interior or/and exterior, and the connection must be just through the terminals, which have air filters against, dust, bacteria, humidity, and ionizer effects. This space is partial contact with earth ground, just in the floors.

1.2. Rock bed on underground spaces

This includes a layer of thermal mass such as rock bed, where is the earth temperature transferred from/ to the rock bed, in this time thermal mass become as source of cooling in summer season. The cooling of Living spaces can occurs by radiation effect or by using of air such as cool transporter element, in which can be coordinate in corresponding of living space area and thermal mass cool capacity. For optimal working of system, we must take in evidence;

- velocity of airflow must correspond the thermal internal comfort
- airflow circulation must be tightly to the exterior
- existing of air filter such healthy element in both terminals input/output
- easily to reparation and maintenance of the system

This system can be used in correspondences with other types of cooling, all such as an intelligent complex system.

1.3. Underground earth tubes

The devises of underground tubes, take place by a vary system in size and form, some system have tubes in parallel terminating in a header, and some used a radial prototype collecting in a central sump (to make moisture removal easier), some were only a single tube. It is important to design the system so as to minimize the cost and maximize the benefits. The tube length over 10 m for example is inefficient. The conclusion say that; the small diameter tubes are more effective per unit than large tubes, the long tube is unnecessary, tubes should be placed as deeply as possible, closed loop systems are more effective than open loop systems, and the tube thermal resistance is unimportant the ground thermal resistance dominates. Pipes must be with wings to easier the energy transferred and the interior of pipes must have perforate obstacles to slow of the fluids speed circulation, for occurs the optimal exchange of energy between the air or water and the soil (earth). The dark and humid atmosphere of the cooling tubes may be a breeding ground for odor-producing mold and fungi. Furthermore, condensation or ground water escape may accumulate in the tubes and encourage the growth of bacteria. Good construction and drainage could eliminate some of these problems. Insects and rodents may enter the tube inlet to deter potential intruders. The underground tube system uses either an open- or closed-loop design.

- In an open loop system, the outdoor air is drawn into the tubes and transported directly to the inside of the house. This system provides ventilation while optimistically cooling the house's interior.

- In a closed-loop system interior air circulates through the earth cooling tubes. A closed loop system is more efficient than an open loop design. It does not exchange air with the outside. There are two types of earth cool systems;

1.3.1. Vertical closed- loop

In the vertical closed-loop ground heat exchanger, an air can circulated through preserved pipe loops covered in vertical bore holes. The bore holes are typically 40-50 meters deep. Heat is transferred, from the ground during the winter and to the ground during the summer. A vertical heat exchanger can be installed on smaller lots somewhat than the horizontal system.

1.3.2. Horizontal closed- loop

In horizontal closed-loop ground heat exchanger, an air is circulated through sealed pipe loops buried horizontally, about 2 meters underground. During cold weather the pipe lops absorb heat from the earth and deliver it the house. In the summer the processes is reversed for air conditioning, and the system transfers the heat from the house to the ground.

The outer piping system is able to be either an open system or closed-loop.

- An open system takes advantage of the heat retained in an underground body of air. The air or water is drawn up through a well directly to the heat exchanger, where its heat is extracted. The air is discharged either to an above-ground body of air or water, such as a stream or pond, or back to the underground air or water body through a separate well.

- Closed-loop systems collect heat from the ground by means of a continuous loop of piping buried underground.

2. Underground energy such thermal insulation (improvement of energy saving concept)

2.1. Heat breaks transfer system

The concept of heat break transfer consist of occurring a thermal layer between exterior and interior to stop or decrease the transfer's flux of energy from interior to exterior in winter. Architect can employ of break heat transfer concept by move a flux of convenient air from the underground space by means of the insulate ducts canals to generate a thermal obstacle, to stop or annihilate the transfer of energy interior-exterior and inverse. This lay or intermediary space must be tightly to the house interior or/and exterior, and the connection must be just through the terminals.

An energy break system is used especially to reduce the conductive transfer of external walls, roofs, and windows. Their resulting

- Separation of the thermal inner spaces of the outer.
- Limitation of energy losses /gains from the outside.
- Minimization the possibility of condensation on exterior surfaces framing.

The majority of insulating materials and energy loss break method used in the houses makes use of the low thermal conductivity in still air and try to avoid creating thermal bridges. For optimal working of this system, we must take in evidence;

- Airflow velocity of must correspond the thermal internal comfort
- Airflow circulation must be tightly to the exterior
- Existing of air filter such healthy element in both terminals input/output
- Easily to reparation and maintenance of the system

This system can be used in correspondences with other types of heating systems, all such as an intelligent complex system.

- For exterior walls
- For windows
- For roofs

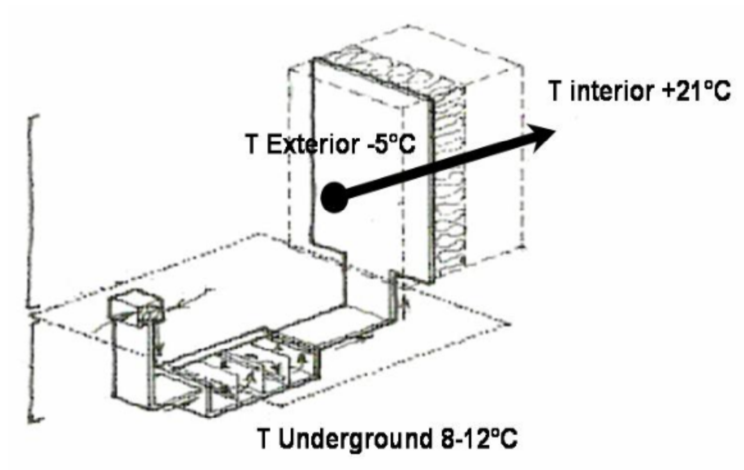

Fig.1. Heat breaks transfer system

2.2. Ventilation with heat recovery systems

Fresh air is essential for the "well-being" of building occupants, the highest standards of luxury and comfort are achieved by introducing controlled ventilation with heat recovery; health and thermal comfort being once again the most significant factors for planning a project.

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