

Sustainable architecture and passive housing construction essay



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In the daily life, a lot of people pass by some of these words: sustainable architecture or green buildings; however, they don't know the meaning of it. For that reason, I've decided to write about passive housing, which is a type of sustainable architecture. But before starting discussing the topic, a brief introduction to sustainable architecture will be given.

There are a lot of definitions for sustainable architecture; nevertheless, there are two definitions that give a simple and exact idea about it. The first one is "Environmentally-friendly houses and commercial buildings that are designed and built using sustainable building technologies, sustainable building materials, and sustainable energy systems, that don't burden future generations with environmental and financial debts." (Sustainable Architecture) Another definition was defined by architect Robert Berkebile, "Sustainable Architecture is a design that improves the quality of life today, without diminishing it for the next generation." (Sustainable Architecture) In short, sustainable architecture is a way of building houses and commercial buildings to save the environment for the future.

Sustainable architecture isn't a new technology. It started developing in Europe since almost 500 years ago. It started with a simple idea, which indicates how houses can be cool in summer and warm in winter by using minimum energy. Now days, they have more complicated ideas such as: producing their own electricity and recycling waste. That is because of the new technological advances, humans have been developing over the years. There are three types of sustainable architecture mostly common and they are: zero energy buildings, passive housing and low energy housing.

Is sustainable architecture that important to be developing for all of these years? In fact, it's an important factor of saving the environment from depletion. According to the National American Homebuilder's Association, a typical, (non-sustainable) "stick-built" or wood-frame home was 2,085 square feet and required more than one acre of trees/forest; moreover, the waste created during the construction of this typical home averages between 3 tons to 7 tons, for every new house built. It only saves construction materials, but also reduces the consumption of energy and water.

Passive house have one main principle which is reduce the energy lost in the house. But how can it be done. It's done by isolating the building and using the energy of people and the households. Passive house is very energy efficient because it use only 10% of energy that regular house use. This amount of energy is used for heating, hot water, and household electricity.

In May 1988, Professors Bo Adamson of Lund University, Sweden, and Dr. Wolfgang Feist of the Institut für Wohnen und Umwelt (Institute for Housing and the Environment) had a conversation about the Passive House standard originated. As result of the conversation, they developed the concept of passive housing by doing many research projects which have been supported financially by the German state of Hesse.

The first passive house buildings were built in 1990 in Darmstadt, Germany. The Passivhaus Institut (the passive house institute) was established in September 1996. The concept of passive housing became more commercialized and following the European

Union sponsored CEPHEUS project in winter of 2000-2001. Moreover, in 2003

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the first passive house was built in North America, Urbana, Illinois. Since the institute was founded, 15, 000 passive houses were built worldwide. Most of these houses were built in Germany and Austria.

Figure Time Line of the History of Passive Housing

The Design of Passive Housing

There are mainly two key elements from designing a passive house, which are the orientation of the building and the construction material.

The Orientation of the Building:

The first feature that should be considered before building a passive house is the orientation of the house that is because it is the key of the utmost energy production. Since the solar energy is the most reliable energy for the house, the house should be directed to the sun. On the other hand, the wind also should be considered because it can cool the house during winter. For these reasons, the house is directed to the east-west axis and most of the windows are ought to be on the south wall of the house. In this way, the house will get maximum of sunlight and minimum of wind entering the house. Although, these conditions work perfectly in winter, there is other condition should be thought of in summer which is shading. Shading is important because it reduces the sunlight getting into the house. This is the main technique that passive house uses to heat and cool itself.

The Construction Material:

Figure How passive house works?

As any ordinary house, passive house has the same basic building material, but it is only enhanced to maximize the energy gained and minimize the lost.

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Concrete, bricks and stone are the basic material for building a passive house because they can absorb the energy from the sun fully and gradually. As result of the long period of energy absorbing, a phenomenon which is called lag happens. Lag is the warm sunlight which was absorbed during the day then released slowly during the night. There three types of windows glass and they are: one pane, two pane and three pane windows. One pane and two pane windows are commonly used in normal houses; however, three pane windows are used in passive house. Moreover, they are made from three glass panes which are split by air or Argon gas. This makes the window more insulated that prevents cold air getting in and decreasing the heat getting out. Because of the house is insulated, Mechanical Ventilation is used in the house to proved fresh air and heat. It gets fresh air from and takes out the polluted air from the house while it heat the fresh air by absorbing the heat from the polluted air. Also, all passive houses have solar panels that convert the sun light to electricity that serves the house. Moreover, some of the houses have wind tribunes which also provide it with electricity. The wind tribunes are installed only if the area where the house is built has sufficient amount of wind.

There are many advantages of building house passively. The cost of electricity is very low which is about 100€ a year. Also, it is eco-friendly because it uses less electricity and that lead to less consumption of petroleum product, nature gas, coal and wood. These products release a lot Carbon Dioxide (CO₂) that pollute the air which leads to global warming. In addition, it improved the sustainability of the house. Furthermore, it helps people who have allergies by reducing their symptoms. It is reduced because

the air ventilation system cleans the air from dust and pollution. However, there is one disadvantage of passive housing that is air tightness, so without an efficient air ventilation system that keeps the air clean and preserves an excellent humidity percentage in the house.

Conclusion

To summarize, sustainable architecture is the way of building without harming the environment. There are many ways of sustainable architecture, and one of them is passive housing. It has one key principle which is minimizing the energy lost from the house. Passive housing is a new trend which started in 1988. The standards of passive housing are set by Professors Bo Adamson and Dr. Wolfgang Feist. The standards of passive housing have two main ideas which are the orientation of the building and the construction material. The cost of passive housing is higher than a normal house by 5-15%. Eco friendly and cost efficiency are advantages of passive housing, but air tightness is a disadvantage.