

Adaptation of Features of Thai-Style Houses to Modern Houses

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Abstract

At present, the situation in Thailand has been changed especially in habitations which are popularly built in the European style. Air-conditioning systems have been used to make residents comfortable. Because the features of European-style houses tend to accumulate heat, they cause high cooling load, using much energy.

Thai-style houses have used a passive cooling technique to make residents comfortable without using electrical energy. Therefore, this concept should be applied to European-style houses to reduce the load of air-conditioning system making energy savings in new habitations.

Key words : Cooling load, Passive cooling, Energy saving

Introduction

The evidence of Thai-style houses since the 18 century BC has not been clear. From the testimony of history, the habitations of Thai residents especially have belonged to those who lived on the Chao Phya River Basin which were thatched houses with high roof structures on high stilts. These high roof structures are the bases of local residents' houses in South-east Asia where the climate is hot and humid.

The roof structure must be a steep sloping roof with a triangle gable made from bamboo or wood, owing to the monsoon in this area making for strong winds and rain. Slightly sloping roofs could not with stand stand the heavy rain and strong wind. If the roofs are slightly sloping roofs, the wind and the rain can make the roofs open and the

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roofs themselves are not able to support the weight of the rain water. Moreover, if the roof structure was damaged by white ants or weevils, the roof could tumble down during the strong winds and rain as shown in figure 1.

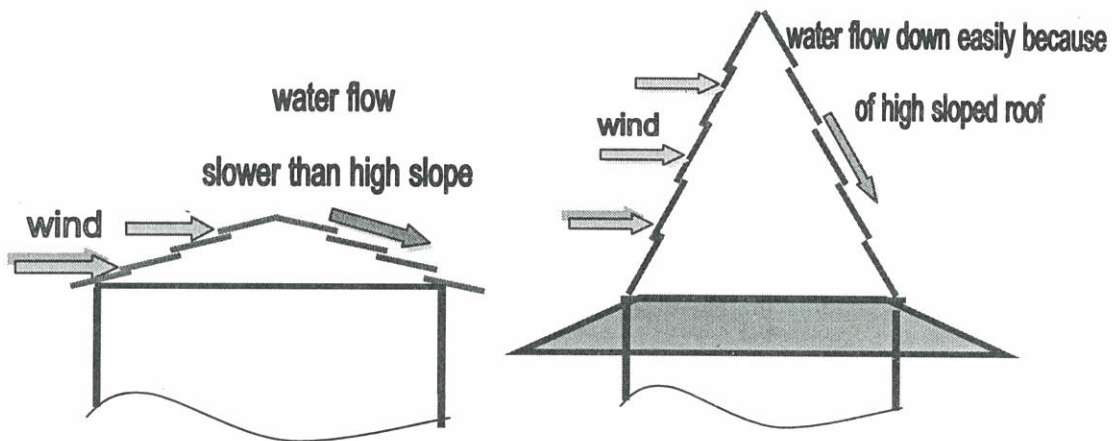


Figure 1. A schematic representation of the steep-sloped and slight-sloped roofs against wind and rain.

In accordance with the living style and livelihood of Thai people in the past, as seen from architecture and archaeology, it was found that the residents in this area have been adopting arts and culture from 11 BC to 18 BC. Their habitations have been in the same models whether in the reigns of Sukhothai, ChiangMai, Ayutthaya or Suphan Buri, using wood for building materials.

In the Ayutthaya era, Thai people began to have contact with foreign countries and to use kiln roof tiles substituting for the old thatched roofs.

The characteristics of Thai style houses are as follows :

1. Houses built high from the ground
2. High curved roofs
3. Airy houses
4. 40% of the area being open floored space and balcony
5. Wood boards of the floors and the walls connected by wooden dowels

1. Houses built high from the ground

Owing to the location of Thailand in the hot and humid climate and in the monsoon area, the general climate is hot and humid alternating with rain and strong winds in the rainy season especially in the southern part of Thailand facing the monsoon wind. Formerly, Thai style houses were built by the canals or the rivers. When it rained, they were flooded. If the houses were built on the ground, they would be damaged from the floodwater. However, the advantages were that in the night time, it could protect the houses from dangerous animals or thieves by removing the ladders as shown in Figure 2

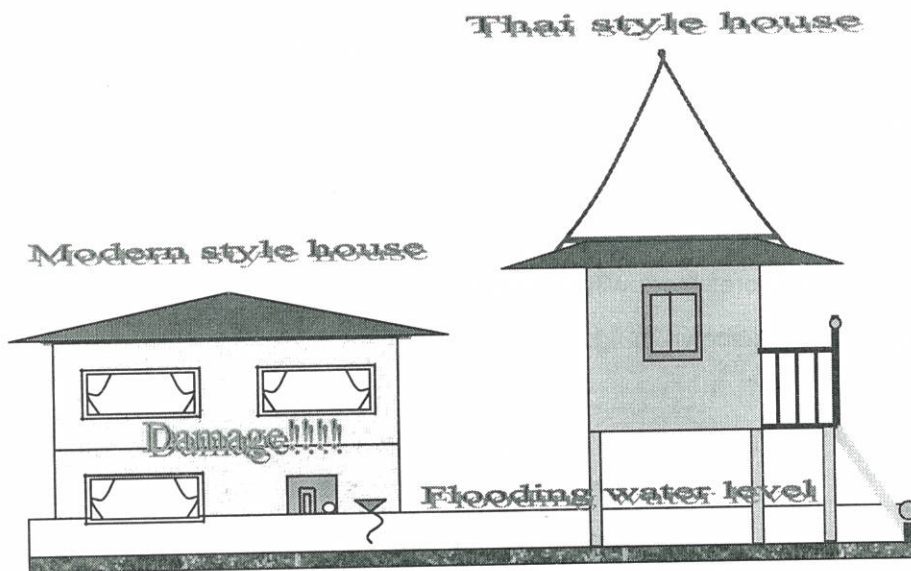


Figure 2. Comparison between a house constructed on the ground and a house constructed high on the ground when flooded.

2. High curved roofs

As mentioned above, Thai style houses have high curved roofs owing to the weather condition. Later, when thatched roofs were changed to kiln tile roofs, the roof forms were not changed. Moreover, the curved roofs make the roofs look soft and beautiful. If they were constructed in a high triangle shape, they would look solid and heavy as shown in figure 3.

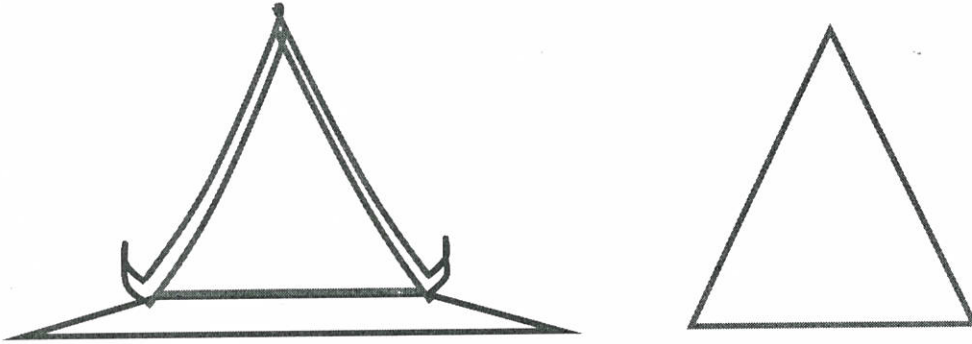


Figure 3. Comparison between a curved roof and a high triangle roof.

3. Alry houses

The setting of windows and doors of Thai style houses is to allow the air to flow through. Even if there are groups of houses, there will not be any blockage of the path of the air. Therefore, there will be air flow all through the houses and the residents will feel comfortable as shown in figure 4 A-C

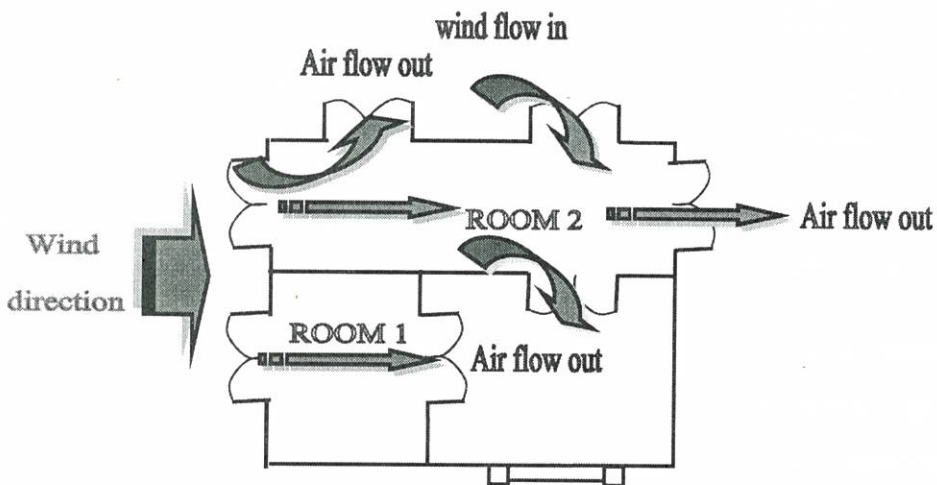


Figure 4 A. Air flow direction passing through two Thai style houses.

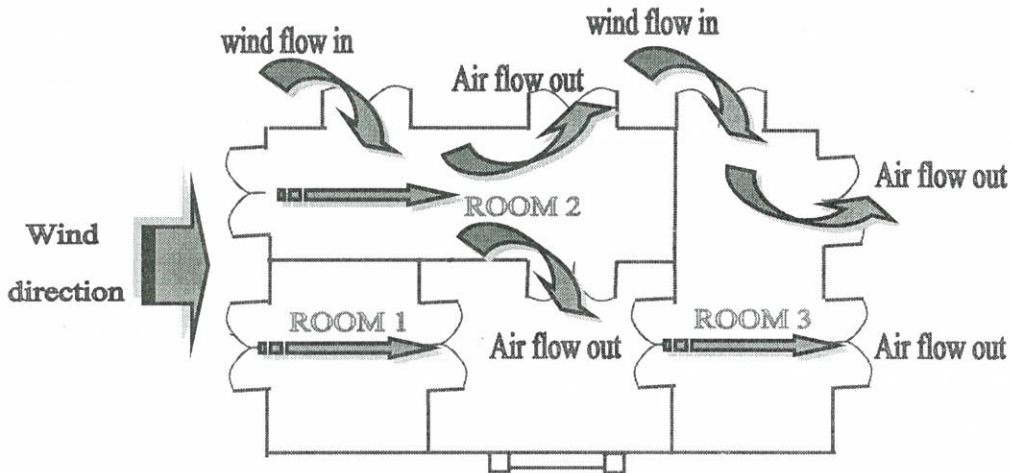


Figure 4 B. Air flow direction passing through three Thai style houses.

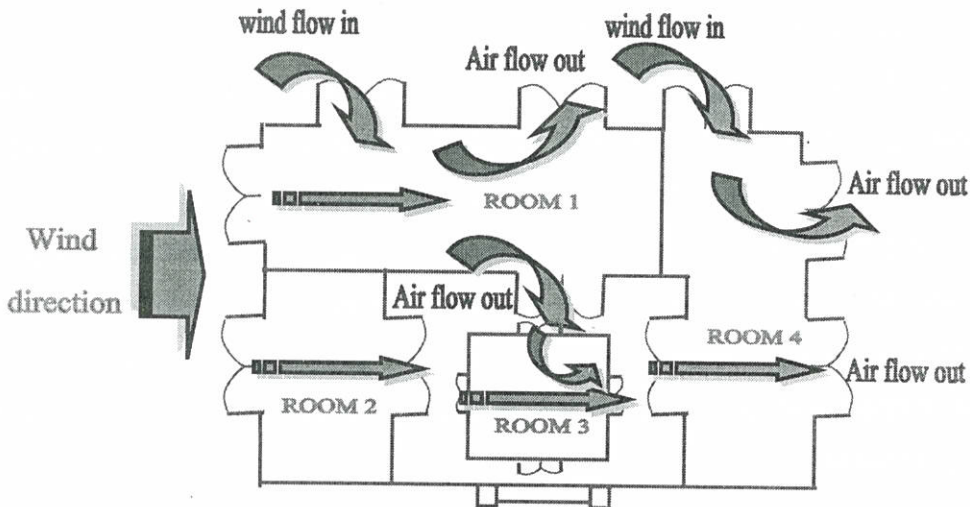


Figure 4 C. Air flow direction passing through a group of big Thai style houses.

4. Forty per cent of the area being open floored space and balcony

If the model of the house which has a long balcony and the house itself is raised high from the ground, it will shade the area underneath the house where the residents can use the area to do their activities. In addition, in the evening the residents can use the balcony as well.

5. Wood boards of the floor and the walls connected by wooden dowels

Wood is of low thermal conductivity and can reduce heat accumulation quickly when the air flow is passing through. Therefore, when houses are made of wood, it can reduce heat accumulation, making the rooms of the houses cooler. Moreover, the construction is simple. Thus, it is wise for Thai people to select wood as a kind of building material.

Thal style houses and energy use

The characteristics of Thai style houses which are suitable for construction in terms of the weather conditions of Thailand are as follows :

- Airy houses
- Protection from sunlight and rain
- Enough area
- Protection from floods, dangerous animals and thieves
- Shading and beautiful environment

The other interesting point is that, in those days, there were not any facilities such as electricity, water supply and other electrical appliances. However, Thai people were able to live in their Thai style houses comfortably.

If comparing with houses at present, residents have to use electrical energy to make themselves comfortable with the air conditioning system. Therefore, in modern houses, electrical energy has been widely used. From all of these reasons there is a concept of adapting old Thai style-houses to reduce the use of electrical energy in modern-style houses.

The concept of how Thai style houses can save energy.

At present, of modern style houses in Thailand are copies of the European. Style In consideration of the changes, it can be concluded as follows :

- People think that European style houses are more modern and luxurious. This change of thought has begun since the reign of King Rama IV when there was communication with foreigners and the acceptance of their culture.

- The development of the country has made the compound area of the habitation smaller and those who can afford to have large compound areas in Bangkok and big cities must be well-to-do.
- The increase of the population has made the living compound smaller, and the construction of housing estates or condominiums have developed.
- The cost of building materials, especially wood, has gone up because of high demand.
- In modern societies, there has been more competition among people.
- There is more dust and pollution in the air, making the airy houses difficult to maintain.
- Architects generally imitate European style houses which look beautiful without thinking about their characteristics. The European style houses need to accumulate heat inside the house to make residents comfortable in winter, but when they are built in Thailand, their residents will feel too warm to be comfortable.
- Air-conditioning technology makes the architects overlook the adjustment of European style houses. They only use air-conditioning system to make residents comfortable. This, of course wastes a lot of energy.

By resorting to old Thai style houses, the residents can live in comfort without any need for outside energy. When considering all components of the houses, we find that the houses can make the residents comfortable by using the concept of air change system which can reduce the heat accumulation and allow the air flow to pass through all the openings. This type of a adaptation can provide comfort and reduce heat accumulation. It is called be called “Passive Cooling Technique”

Ventilation In Thai style houses.

The main concept of Thai style houses was the thought of the houses that can protect the residents from the rain and sunlight by adding the roof angles and lengthening the eaves to make the roofs stand against the strong wind, rain and sunlight.

The construction of this type of roof structure will be an advantage to protect heat accumulation. Owing to the high angles of the roofs, the accumulation of the heat from the sun on the roofs will be decreased. (the best angle for heat acceptance in Thailand is about $10^\circ - 15^\circ$ which is low angle).

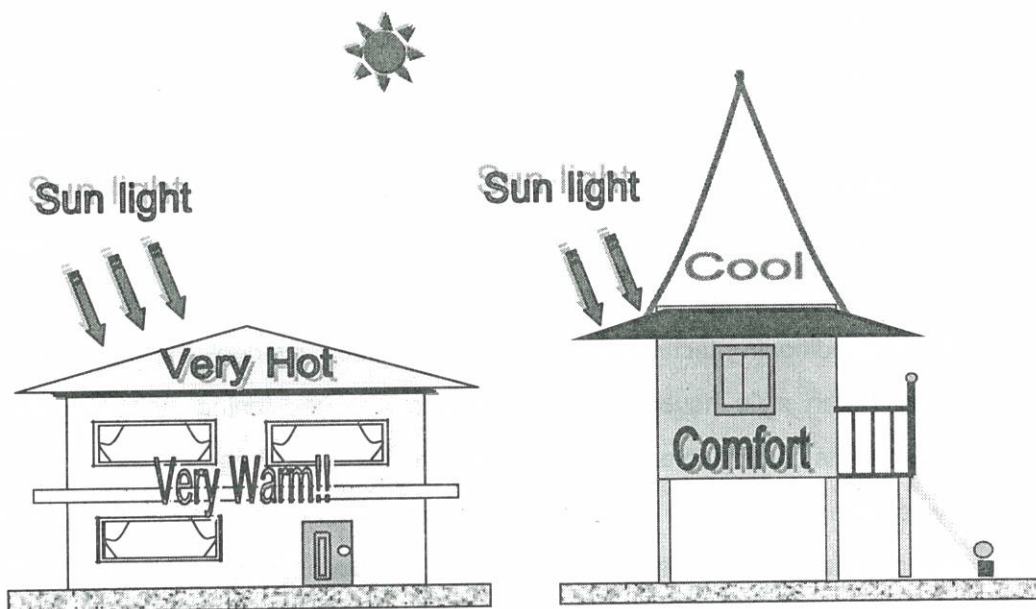


Figure 5. Comparison between low and high angles of the roof facing the sun.

By lifting Thai style houses high above the ground to protect the dangerous animals and the floods in the rainy season, there will be other advantages such as air flow underneath making the floor cool. In the afternoon, residents can make use of the space underneath. The reason of the air flow underneath in the afternoon is that the ground is heated from the sun making the air near the ground hot and float up, and then the cool air will replace it.

The last thing that shows the wisdom of Thai people in designing Thai Style houses is the setting of the direction of the house location, windows and doors. Usually, the front of the gabled roof is in the east and the west sides because in summer there will be southwesterly winds blowing during the afternoon and evening. In order to receive the southwesterly wind the most, it is necessary to place the side of the house to make the wind pass through the windows and doors installed in the same direction. Therefore, Thai style houses must have a lot of windows and doors for the comfort of the residents as shown in figure 6

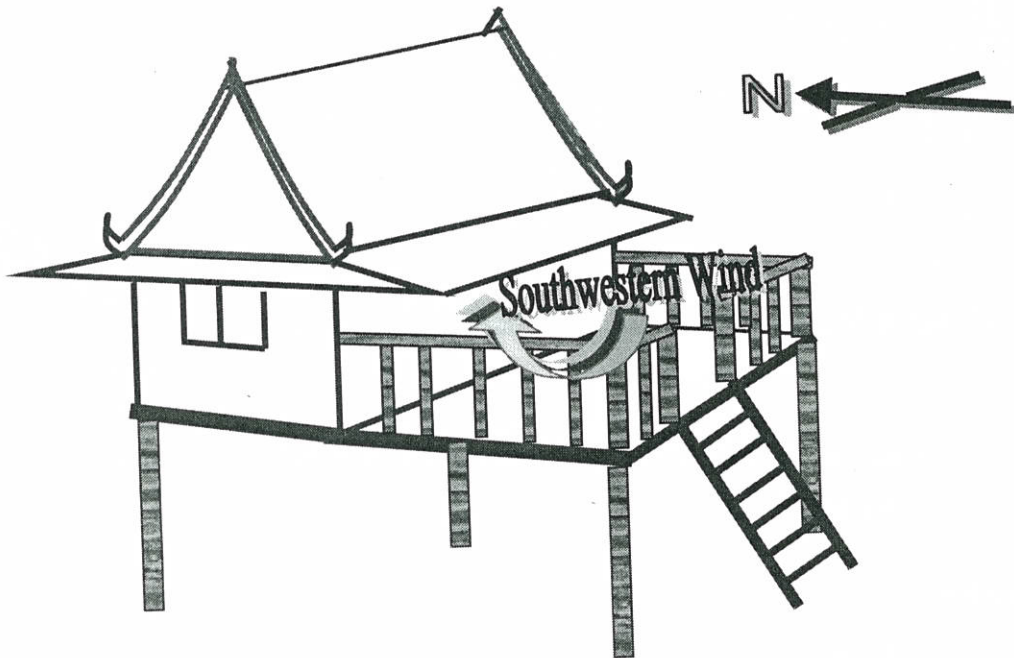


Figure 6 Direction of the Thai style house location.

Most Thai style houses were built along the rivers or canals. When the wind blew across the surface of the water, it would make the houses cool down. All of these reasons are the Passive Cooling Technique. Moreover, Thai people love to plant big aromatic trees to get delicate fragrance and shade the houses as shown in figure 8.

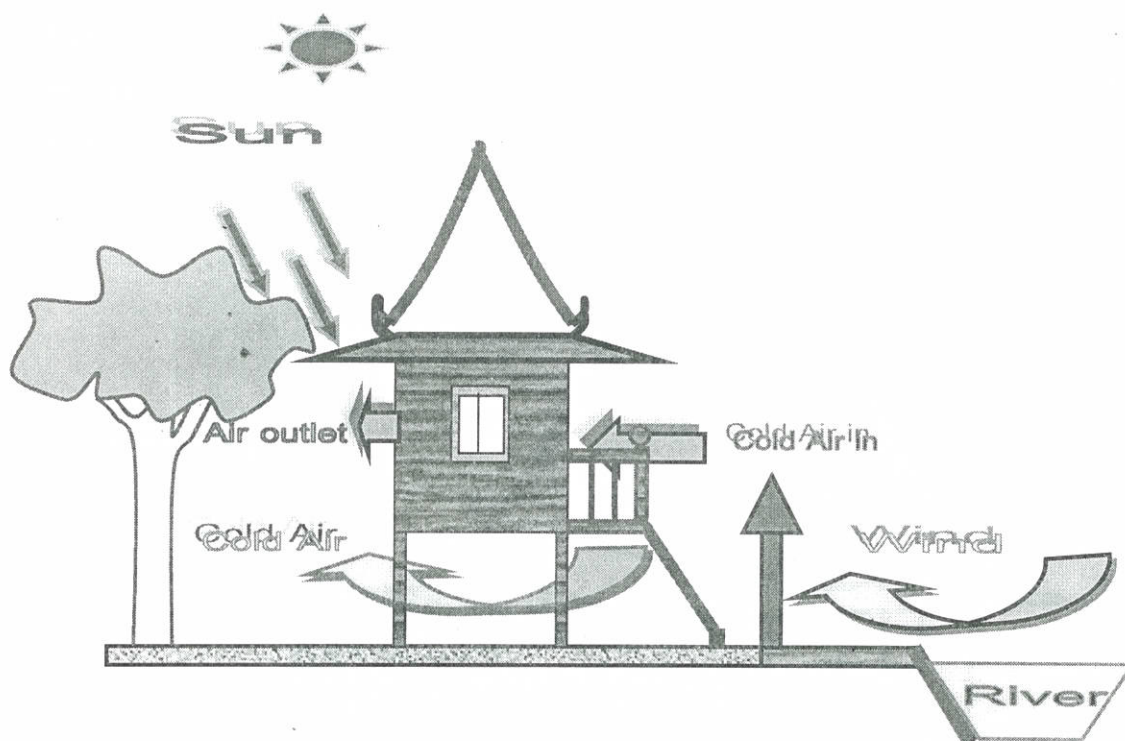


Figure 8. Overall of Passive Solar Cooling used in Thai style houses making residents comfortable.

Conclusion

In the past, Thai style houses were suitable for hot and humid climate in Thailand making residents comfortable by using Passive Cooling technique without using outside energy especially electrical energy. So, this concept should be modified and used with European style houses in Thailand to save the use of energy.

At present, to protect heat accumulation in European style houses, insulators and reflectors are used. The air-conditioning system must be used to make residents comfortable, but this will cause a waste of energy. If the Thai style house concept is used with the European style house, heat accumulation will be decreased because of air

change. Therefore, the heat load of air-conditioning will be decreased; the inside and outside temperature will be nearly the same. In some seasons such as the rainy or cool seasons, it is unnecessary to use air-conditioning units. Energy used in European style houses will be lower, making the overall energy used in habitations of the country decrease. For this reason, the new concept of architects or those who want to build European style houses is that “the houses must be designed to make the air change all day even when all parts of the houses are closed.” This is the main concept for the one type Passive Cooling Techniques.

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