

## CHAPTER I

### INTRODUCTION

Energy is a property of matter that can be converted into work or heat. It is fundamental to all economic systems and supports social and economic development. World energy consumption is growing very fast in the past decades. Impose great pressure on energy resource developmental friendly energy sources. Energy efficiency in buildings is important 30%-50% total energy requirements of a society.

A consultancy study in 1991 found that if the envelope of a building was constructed to a suitable Overall Thermal Transfer Value (OTTV), electricity demand from air-conditioning and thus the emission of greenhouse gases from power generation could be reduced. The Government's aim is to establish a comprehensive building energy code to control the total energy consumption of a building, of which OTTV controls would form a part.

General principles of control of OTTV, for the design and planning of energy-efficient buildings, Government developing a comprehensive energy code to cover inter alias lighting and air-conditioning. OTTV is one aspect of energy conservation. An OTTV is a measure of the energy consumption of a building envelope. Its formulation allows authorized persons, registered structural engineers and other persons responsible for the design and construction of buildings freedom to innovate and vary important envelope components such as type of glazing, window size, external shading to windows, wall color and wall type to meet the maximum OTTV criteria. Any measure to improve energy efficiency or to save energy should be considered in planning a building. Sitting a building to avoid extensive glazed facades with a southerly aspects or introducing shades to window areas can reduce solar heat gain. Appropriate choice of windows with a low thermal transmittance characteristic will also minimize solar heat transmission. Artificial lighting consumes electricity and creates heat. This increases the cooling load of a building and in turn increases energy consumption. Consequently,

when determining the size and location of windows as well as choice of glass in the envelope of a building, efforts should be made to provide as much natural lighting into the building as possible. For example, with glazing, the visible lighting transmittance should be acknowledged in addition to its thermal transmittance properties; daylight can supplement artificial lighting and consequently reduce the cooling load. Other measures include more extensive use of energy-efficient building services equipment and appliances, e.g. energy-saving lamps, low-loss luminaires and high-efficiency air-conditioning and more sophisticated building services control systems.

### **Objectives**

1. To design the new energy saving houses.
2. Developing the computer program for calculating OTTV and RTTV to modify houses in parts of insulator and energy consumption.
3. To analyze the payback period of accessories for modified houses.

### **Scope of Work**

1. The energy saving house in this thesis has the specification as follows:
  - 1.1 Using area is  $171.24 \text{ m}^2$
  - 1.2 The energy saving house has 2 floors.
  - 1.3 The energy saving house has 3 bedrooms, 3 bathrooms, 1 living room, 1 parlor, 1 kitchen and 1 car park.
  - 1.4 The direction of parlor is in the north, living room in the southeast, bathroom in the west, kitchen in the west, car park in the north, one bedroom in the north, one bedroom in the east and one bedroom in the southeast.
  - 1.5 The brick masonry walls (brick with cement coat both sides of wall) have thickness 10 cm.
  - 1.6 The roof use asbestos cement tile that have pitched roofs  $30^\circ$ .
  - 1.7 Windows and doors use clear glass.
  - 1.8 Ratio of areas between glasses and walls are more than 0.17

2. The materials for design energy saving houses in this thesis has the specification as follows:

- 2.1 These houses have to use brick masonry walls and thickness 10 cm.
- 2.2 The tile used for roofs are asbestos cement tiles.
- 2.3 The windows and the doors use clear glass.
- 2.4 The color of roof is medium brown paint and wall is white semi-gloss
- 2.5 The directions of houses have 8 directions: north, northeast, northwest, south, southeast, southwest, east and west.

3. The result of mathematical model is based on OTTV and RTTV from standards stipulated by law in Thailand

Current OTTV and RTTV limit are

- For new building,  $OTTV \leq 45 \text{ W/m}^2$
- For old building,  $OTTV \leq 55 \text{ W/m}^2$
- For roof,  $RTTV \leq 25 \text{ W/m}^2$

4. The solar radiation value used in the computer programme is the average radiation value of the Thailand based on model of solar radiation maps of Thailand from Silpakorn University

### **Benefits of This Thesis**

- 1. To have a new concept of a small energy saving houses.
- 2. To have a computer program that use for finding the OTTV and RTTV and the suitable thickness of insulator that used for modify houses is base on OTTV and RTTV for new building.
- 3. To have a designing tool for structural engineers, architects and others persons responsible for the design and construction of buildings.
- 4. From these advantages, it makes efficient energy using for saving energy in the future. It can reduce energy consumption and save environment in the world.