THE EFFECTS OF VEGETATION ON THE THERMAL PERFORMANCE OF HOUSING IN A TROPICAL ENVIRONMENT

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2. Letter of Offer (Research Grant)

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Puan

GERAN PENYELIDIKAN FRGS
TAJUK PROJEK: EFFECTS OF VEGETATION IN THE THERMAL PERFORMANCE OF HOUSING IN A TROPICAL ENVIRONMENT

Dengan hormatnya perkara diatas adalah dirujuk.

Selaras dengan keputusan dari Jawatankuasa Induk Penilaian Geran Penyelidikan Fundamental IPTA (FRGS) Fasa 1/2007 Kementerian Pengajian Tinggi, pihak IRDC bersetuju meluluskan geran penyelidikan FRGS sebanyak RM20,000.00.

Walaubagaimana pun puan diperlukan mengemukakan perkara berikut:

1. Membuat semula proposal penyelidikan. Sila berjumpa Prof. Madya Dr. Rodzyah Mohd Yunus Ketua Penyelidikan (Sains Sosial & Pengurusan) untuk mendapat bantuan dalam penulisan proposal tersebut.
2. Mendapatkan seorang penyelidik tambahan.

Sehubungan dengan itu, pihak IRDC akan memberi surat tawaran dengan syarat proposal yang akan dikemukakan adalah memuaskan.

Sekian, harap maklum

Yang benar,

PROF. DR. AZNI ZAIN AHMED
Penolong Naib Canselor (Penyelidikan)

s/k 1. Dekan
Fakulti Senibina, Perancangan & Ukur

2. Koordinator URDC
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HM/ laila

5. Report

5.1 Proposed Executive Summary

In tropical cities, the exterior environment is extremely warm due to the high temperature especially during dry seasons. Solar heat passing through windows and being absorbed through the walls and roofs is the major reason for air-conditioner use. Air-conditioning is the only way to create and maintain a comfortable interior temperature. It has been found that a majority of household spend more than 36.7% of electricity power for cooling and which increases every year. Strategically placed vegetation around a building has long been recognised as a means of cooling. Vegetation can reduce temperature and humidity through shading, evapotranspiration and wind channelling. The appropriate amount, type and placement of vegetation can save the residential cooling demand on a hot and humid day. However the effect of the immediate surrounding vegetation on the cooling load and costs of single dwellings in tropical environment has not been widely recognized and quantified. Monitoring of household electricity use in the two study areas has shown that night time is when most of the air conditioning energy is used, because most households only spend their time at home at night. The critical building envelope surfaces of the house are in east and west side where the sun moves and creates the highest temperature and heat gain to the building in morning and afternoon, and retains the heat until night time. Proper placement of trees, shrubs, vines, groundcover, and turf can greatly reduce the temperature gain to the building and the energy use. The study will determine the potential for energy saving for a single-family house located in a hot and humid tropical environment, through the strategic planting of vegetation.

5.3 Introduction

The role of landscaping in moderating microclimate has been explored all over the world during recent years. Landscaping is an ecological measure used to combat the problems of heavy urban built environments [1]. Vegetation has the potential to increase environmental value by reducing energy consumption in individual buildings and increasing the energy efficiency of the community as a whole. Vegetation has a particularly effective influence on a building's microclimate and its thermal performance [2]. Therefore, landscaping has significant role to play in providing a cool microclimate, and can directly influence the comfort level of interior space.

Vegetation includes all the plant life in a particular region, such as trees, shrubs, grasses and lawns. Vegetation can influence solar radiation, air temperature, humidity and air flow. While there are a number of landscape strategies that can be implemented to modify the microclimate, the three main functions of vegetation used to do this are: shade, evapotranspiration, and wind control.

Using strategically placed shade trees of the right species and form around a building can potentially modify its microclimate and the building's energy use. The shading they provide can reduce the amount of radiant energy absorbed and stored by buildings and other built surfaces.

Evapotranspiration is the process of transferring moisture from the earth to the atmosphere by evaporation of water and transpiration from plants [3]. Evaporation and transpiration through vegetation contributes to lowering urban temperatures. In this process, the plant draws moisture from the ground, uses what it needs to grow, and moderates its own temperature and transpires the excess. This process cools the surrounding air. Therefore, vegetation that is appropriately placed around a building can provide a cooling effect on buildings and its microclimate.

Vegetation can also be used to control wind as a barrier or windbreaks, or by providing more effective ventilation and convective cooling of building surfaces by channelling or directing the flow of air.

However, there is a lack of data on the effects of vegetation on the thermal performance of buildings and their microclimates, and the methods for predicting the effect from shade, evapotranspiration, and channelling wind to reduce hot temperatures and energy use. Qualitative research are needed to better predict the impacts of vegetation and other landscape elements on buildings, microclimate and energy use [2]. With quantitative evidence of energy savings the likelihood of its use in the design of landscaping could greatly increase.

In turn policy makers will have a basis for implementing new landscaping requirements. Architects will have alternative methods and ideas for complying with energy saving guidelines and integrating the building with its site. Developers will be able to entice buyers with the future long-term benefits of energy-efficient houses, with only a potentially minimal increase in the early stage cost of construction of landscaping around the building.