# STUDY OF DAYLIGHTING AND BUILDING PERFORMANCE OF ATRIA BUILDINGS IN MALAYSIA

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Puan,

**KELULUSAN PERUNTUKAN BAGI MEMBIAYAI PROJEK-PROJEK SCIENCEFUND DI BAWAH RMKe-9 *CYCLE* 1/2006**

Dengan hormatnya perkara di atas adalah dirujuk.

Dimaklumkan Jawatankuasa Kelulusan MOSTI telah mempertimbangkan permohonan puan untuk membiayai projek penyelidikan di bawah dana ScienceFund *Cycle* 1/2006 pada 20 Oktober 2006.

Sukacita dimaklumkan bahawa projek penyelidikan puan telah pun diluluskan oleh Jawatankuasa tersebut. Walaubagaimanapun puan diminta untuk mengambil perhatian atas ulasan yang diberikan oleh Jawatankuasa dalam bahagian Catatan.

Puan juga dikehendaki untuk mengemukakan *Research Agreement* (RA) atau *Memorandum of Understanding* (MoU), yang mana berkenaan, yang telah ditandatangani kepada IRDC dalam tempoh 3 hari dari tarikh terima surat ini. Dokumen RA / MoU boleh dimuat turun dari laman web eScienceFund.

Pembiayaan keseluruhan yang diluluskan adalah seperti berikut:

| Kod Projek | Tajuk | Ketua Projek | Tempoh Projek (Bulan) | Peruntukan Keseluruhan (RM) | Catatan |
|---|---|---|---|---|---|
| 04-01-01-SF0038 | Study Of Daylighting And Building Performance Of Atria Buildings In Malaysia | Sabarinah Sh. Ahmad | 24 | 102,000 | In view of the researcher having 2 projects approved under the ScienceFund, he must ensure that he has the capacity to carry through both projects according to plan. |

Sehubungan dengan itu juga kami mengucapkan tahniah kepada puan kerana berjaya mendapatkan peruntukan E-Science ini dan semoga berjaya menyiapkan projek penyelidikan ini dengan cemerlang.



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# 5. Report

## 5.1 Proposed Executive Summary

This project is partly new research as well as an extension to earlier research done by [1, 2] on atria buildings with new emphasis on the building performance (energy, daylighting, thermal) of atria building for energy efficiency. The building typology chosen will differ form previous research with new emphasis on office building rather than shopping malls as done by [2, 3] and naturally ventilated atrium by [4].

More than half of the total energy used in commercial buildings for lighting and air-conditioning. If daylighting is used, less electricity is needed to light the lamps and to run the air-conditioners to cool the buildings, as part of the thermal load is caused by the heat dissipated by the lamps. Innovative daylighting systems can also reduce heat gains and glare. The energy saved through the use of such daylighting systems could be in the order of 20-40 percent of the total energy consumption [1]. In Southeast Asia, studies have shown that the use of daylighting can reduce overall energy consumption by 20 percent and also reduce the sensible heat load on air-conditioning [1]. The energy consumption for lighting in Malaysia is 25-35 percent of the total energy supplied to buildings. Daylight is desirable over artificial light because the quality and colour rendering produced by daylight is far superior. As a result, daylighting can produce architecture of great beauty beside reducing the need for artificial lighting, which generate heat and increase the cooling loads of buildings.

The future of daylighting as e renewable energy resource applied in buildings is therefore, very promising. There are plenty of avenues for research and development in this area and in particular, daylighting systems design and daylighting in architecture [1].

## 5.3 Introduction

The development of atrium buildings in Malaysia is growing in number. This design trend are recognised as one of the most popular and environmentally stimulating spaces of today's architecture, at once shutting out the often harsh natural environment and yet benefiting from its natural light. Incorporated into many forms of buildings, an atrium can be used to stimulate the outdoors and to admit natural light and solar heat into the indoor space. The passive solar features incorporated in atrium is utilising the usage of daylight contribution that can save energy. The daylighting aspects of the atrium need a careful design to accomplish visually attractive as well as energy-efficient building criteria. However, instead of creating the potential for both increased energy savings and an improved indoor environment, if the atrium is only artificially lit or heated it may waste more energy than it saves.

An atrium's characteristic is the roof: a careful design of the roof fenestration systems limits glare, mitigates passive solar heating effects and supplies adequate daylighting and minimizes sunlight. Therefore, atrium roof form and structure are important architectural design elements, where it can influence daylight availability within the space and, therefore, lighting energy consumption. A common feature of most studies were that the atrium roof was left as an open, unobstructed void, which is obviously very different from the conditions existing in real atria [8]. Therefore, this is an area not studied before. Their studies were strongly recommending further analysis on several variations of roof structures and roof glazing and their impact on the distribution of daylight.

Daylighting represents one of the aesthetic values of an atrium and is an essential component of a visually attractive and energy-efficient atrium building. The key issues are daylight availability, distribution and utilisation. There are numerous studies on daylight availability in atria, taking consideration of various forms and shapes of atrium. However, there is still a lack of study on the effect of roof structures and glazing bars on daylight in atria. A common feature of those studies was that no attempt was made to incorporate either the atrium roof structure or glazing in the models. The atrium roof was left as an open, unobstructed void. This is obviously very different from the conditions existing in real atria, where roof daylight losses will be incurred owing to obstruction by glazing bars, transmission losses through the glass and dirt accumulation on the glazing surfaces.

In addition to this research is the justification for specifying tropical sky is that the Malaysian Sky was discovered to be of the intermediate type [1, 9]. This type is very different from the established overcast or clear sky conditions of Europe and North America. Considerable research has been conducted for the temperate climate region under overcast sky conditions, however, the environmental objectives