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# Energy Saving Potential and Visual Comfort of Task Light Usage for Offices in Malaysia

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## HIGHLIGHTS

- Office lighting design has to take lighting control and users' habits into design
- Daylight assisted task light office lighting design saves up to 78% of lighting energy
- Non-Daylight assisted task light office design saves up to 33.39% of lighting energy
- There is no correlation between usage rate of task light and distance to nearest window
- Lighting power budget of daylight assisted task light office can achieve 2.11W/m<sup>2</sup>
- Usage of task light significantly improves users' visual comfort with paperwork

**Abstract.** In the wake of the recent green building aspiration in Malaysia, this article explores the energy saving potential and user behaviour towards task lights in two office spaces in Malaysia; one is daylight assisted, and another is the conventional design of full reliance on the overhead electrical light. The lighting usage patterns were monitored with 5 minutes interval over a month's period during office working hours. Task lights with 8W CFL daylight bulbs were provided after the initial two weeks of measuring period and comparison of lighting power density LPD (W/m<sup>2</sup>) was made. 15 samples of each office space were given visual comfort survey before and after the task lights were distributed to each's workspace. The result reveals that the addition of task lights only contributes to 0.60W/m<sup>2</sup> of LPD. It further concludes the operational LPD of the daylight assisted with task light equipped office space achieves 78% of lighting energy saving (3.04W/m<sup>2</sup>) when compared to the recommended base case of MS1525:2014 (14.00W/m<sup>2</sup>). It also reveals that the provision of task light will not necessarily improve the current LPD if the lighting control system is not responsive to it to create the desirable luminous environment. Interestingly, both offices' occupants show significant improvement in evaluating their satisfaction towards paperwork brightness and colour rendering with the usage of task light. However, this does not apply to computer work. There is no correlation established between the usage rate of task light and the distance of workspace from the nearest window.

**Keywords:** Energy Efficiency, Lighting Power Density, Daylight, Task Light, Visual Comfort

## 1 Introduction

Energy security is a key concern as growing cities support the increasing population and the need for building services, which increases energy demand for our built environment recently [1,2]. This distress degrades the environment by increasing the atmosphere level of greenhouse gasses which drives global warming to be the utmost concern in the international arena [3,4]. In the recent Conference of Parties (COP21), Malaysia submitted its pledge to reduce greenhouse gas emission by 45% by 2030 relative to the emission intensity of GDP in 2005 [5]. Studies have shown that the building sector has the highest potential to save the largest carbon footprint saving given the same mitigation cost across all sectors [6]. In Malaysia, the commercial energy and electricity usage share are at 9.0% and 33.3% respectively [7].

An energy audit on 68 office buildings in Malaysia found that lighting energy consumes 19% of the total building energy consumption [8]. The fundamental of energy security and environmental sustainability issues can be explored with the lighting energy saving potential of using task light in the office space. Moreover, lighting design that allows personal control

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