The Parasitic Heat Burden of Inefficient Lumens – Differential Modeling of Lighting-HVAC Interactions for RA 11285 Compliance

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Abstract

In the Philippines, educational institutions are faced with the challenge of meeting the energy conservation requirements of the Philippine government through the implementation of the RA 11285 law while at the same time providing the student with the necessary visual comfort. However, the outdated lighting systems that have low luminious efficacy rates act as double energy devices that impose an unwanted thermal energy load on the system. This study aims to evaluate the condition of the mechanical engineering classroom of the Eulogio 'Amang' Rodriguez Institute of Science and Technology (EARIST) using the Zone-Cavity Grid Method and digital lux meters to determine the relationship between the amount of light and the internal heat gain. The empirical data showed that the average amount of light in the test spaces ranged from 226.88 to 238 Lux. Since the average amount of light was below the minimum of 300 Lux as set by Philippine Department of Energy, the use of the outdated lighting system resulted in the double deficit of poor visual comfort and wasted energy. Moreover, mathematical modeling revealed that the thermal flux generated from these inefficient luminaires causes a temperature increase of 1.3 °C within the space, causing HVAC systems to run at unnecessarily high levels. This is a "double deficit" problem related to poor visual comfort and inefficient thermal energy usage. The research conclusions are that to achieve RA 11285 requirements, lighting and HVAC energy audits must be integrated to address high-efficacy lighting upgrades to address photometric and sensible cooling deficits.

Keywords: Parasitic Heat Burden; HVAC-lighting interaction; Energy Audit; Luminous Efficacy