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Effects of Dimming on Power Consumption in Lighting

Nikita Kshirsagar, Prajakta Kumbhar, Akanksha Bhagwat, Prof. Sharmila Chougule, Mr. Sudhir Patil

Department of Electrical Engineering

PES Modern College of Engineering, Pune

Abstract: Dimming refers to the control of light intensity, allowing users to create varying lighting conditions and ambiance within a space. A variety of dimming technologies are available, including Phase-Cut, Analog (0-10V), and DALI (Digital Addressable Lighting Interface).

Lighting plays a significant role in the overall energy usage of residential, commercial, and industrial buildings. As there is an increasing emphasis on energy efficiency and sustainability, dimming technologies are being widely adopted to minimize power use and enhance the comfort of users. Common dimming techniques include 0–10V analog control, phase-cut dimming—both leading-edge and trailing-edge—and the Digital Addressable Lighting Interface (DALI). These methods each offer distinct features in terms of performance and compatibility with different lighting loads such as LEDs, CFLs, and incandescent lamps.

However, there is limited research comparing how these dimming techniques affect power consumption across various dimming levels, particularly at lower light outputs. Understanding the relationship between dimming levels and energy consumption for each dimming protocol is vital for:

- Choosing the most energy-efficient dimming approach.
- Designing optimized lighting control systems.
- Supporting the development of energy standards and building regulations..

Keywords: 0-10V Analog Dimming, Phase-Cut Dimming, DALI Dimming, Dimming Methods, Lighting Energy Efficiency



