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Reducing Carbon Footprint in IT Data Closets: A Case Study on the Impact of Installing Lighting Switches with Motion Sensors

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Abstract: The increasing demand for digital services has led to a significant growth in the number of data centers and IT infrastructure. However, this growth has also resulted in a substantial increase in energy consumption, contributing to greenhouse gas emissions and climate change. This paper presents a case study on the impact of installing lighting switches with motion sensors in IT data closets on carbon footprint reduction. Our results show that this simple and cost-effective solution can lead to significant energy savings and a reduction in carbon emissions.

Keywords: *Data Centers; It Infrastructure; Energy Consumption; Greenhouse Gas Emissions; Climate Change; Lighting Switches; Motion Sensors; Carbon Footprint Reduction; Energy Savings.*

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I. INTRODUCTION

Data centers and IT infrastructure are critical components of modern digital infrastructure, providing the necessary computing power and storage for various applications and services. However, the energy consumption of these facilities has become a significant concern, with estimates suggesting that data centers alone account for over 1% of global electricity consumption (Masanet et al., 2020). The lighting systems in IT data closets, in particular, are a significant contributor to energy consumption, with traditional lighting systems often remaining on for extended periods, even when the space is unoccupied. This paper presents a case study on the implementation of light motion sensors in IT data closets and their impact on carbon footprint reduction. Our analysis reveals that this straightforward initiative can lead to substantial energy savings, reduced energy costs, and a lower environmental impact. By sharing our findings, we aim to encourage IT professionals and data center operators to adopt this cost-effective and environmentally friendly solution, contributing to a more sustainable future for the IT industry.

II. METHODOLOGY

This case study was conducted by an IT organization supporting massive number of IT data closets which are dispersed across the country. The total number of data closets target in this case study is around 1,927 closets, each with a traditional lighting system consisting of fluorescent lights. The lighting systems were replaced with new lighting switches with motion sensors, which were designed to turn off the lights when the space was unoccupied. The energy consumption of the lighting systems was calculated before and after the installation of the motion sensors based on average data closet utilization interval, lighting systems power consumption, and local power company rates for industrial facilities.

III. POWER CONSUMPTION CALCULATIONS

A. Tranditional Lighting Switches

IT data closets are lightened with an average of 6 bulbs, each requires an average of 27 watt, resulting in an average demand of 162 watt (0.162 kW) per closet. On the other hand, with no automatic systems to turn-on/off the lights, closets' lights are kept operational 24 hours, 7 days a week, resulting in 8,760 operational hours annually per closet. Using the beforementioned rates, it was found that lighting a single data closet requires around 1,420 kWh; accordingly; lighting 1,927 closets requires around 2.7 GWh; which is equivalent to 1,996 metric ton of CO_2 emission.

B. Motion Sensor Lighting Switches

With motion sensors installed, lights will be turned-on only when the closet is occupied. To calculate the actual occupancy rate of data closets, we revised the access logs and consulted IT staff utilizing the closets, which was

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found to be utilized for an average of 4-5 hours per working day, leading to annual occupational rate of 20%. Hence, the annual power consumption per data closet will be reduced by 80% dropping from 1,420 kWh to 285 kWh; accordingly; lighting 2,300 closets would only require around 0.5 GWh; which is equivalent to 400 metric ton of CO_2 emission.

IV. RESULTS

The results of the study are presented in Table 1. The data shows that the energy consumption of the lighting systems decreased by 80% after the installation of the motion sensors. This reduction in energy consumption translates to a significant decrease in carbon emissions, with an estimated reduction of 1,596 tons of CO2 equivalent emissions per year.

Table 1: Energy Consumption and Related Emissions

	Before Installation	**After Installation**
Energy Consumption (gWh)	3	0.5
Carbon Emissions (tons CO2e)	1,996	400

V. DISCUSSION

The results of this study demonstrate the potential of installing lighting switches with motion sensors in IT data closets to reduce energy consumption and carbon emissions. The motion sensors ensure that the lights are only on when the space is occupied, reducing the energy waste associated with traditional lighting systems. This simple and cost-effective solution can be easily implemented in data centers and IT infrastructure, providing a significant reduction in energy consumption and carbon emissions.

VI. CONCULSION

In conclusion, this case study demonstrates the potential of installing lighting switches with motion sensors in IT data closets to reduce energy consumption and carbon emissions. The results of this study are consistent with previous research on the impact of motion sensors on energy consumption in commercial buildings (Li et al., 2019). The findings of this study suggest that this simple and cost-effective solution can be an effective way to reduce the carbon footprint of data centers and IT infrastructure.

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