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CORPORATE ENERGY EFFICIENCY

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Energy Efficiency, Sustainability, Renewable Energy, Electrical Retrofit, Resource Management, LED Lighting, Environmental Impact.

ABSTRACT

This study addresses corporate energy efficiency as a strategic and operational approach to sustainability, focusing on the optimization of lighting systems as a key vector for reducing energy consumption in corporate environments. In the context of increasing environmental pressures and energy cost volatility, the research examines energy efficiency as an organizational asset capable of aligning economic performance with environmental responsibility. The study adopts an applied and analytical approach, grounded in a systematic review of scientific literature, technical standards, and institutional documents related to energy efficiency, lighting retrofit, and corporate sustainability. Rather than concentrating on a specific facility, the analysis considers typical corporate environments and evaluates

comparative scenarios between conventional lighting systems and modern LED-based solutions, emphasizing technical, normative, economic, and operational criteria.

Based on this analytical framework, a conceptual Energy Efficiency Optimization Plan (POEE) is structured, incorporating principles of lighting retrofit, compliance with technical standards, and strategic sustainability management. The proposed framework demonstrates that energy efficiency initiatives, when properly integrated into organizational strategy, can reduce operational costs, enhance environmental performance, and contribute to improved workplace conditions. The results indicate that lighting retrofit strategies based on high-efficiency LED technology represent a viable and scalable solution for corporate energy efficiency. Moreover, the POEE is presented as a replicable reference model capable of supporting decision-making processes and strengthening corporate governance through the integration of energy efficiency and sustainability objectives.

INTRODUCTION

Corporate energy efficiency in today's global landscape has emerged as a strategic and operational necessity that transcends mere cost optimization, representing a proactive sustainable action for the planet. Given the increasing urgency of sustainability issues, the limitations of traditional energy generation models and rising operational costs have become prominent. Consequently, the effective management of energy consumption has established itself as a central pillar for corporate competitiveness and longevity.

In the current global landscape, driven by the widespread expansion of communications, the growth of international business, significant technological advancements, and the urban expansion of major metropolises, the economy has begun to evolve within a more sustainable and technological market (FITZSIMMONS; FITZSIMMONS, 2011). Within this context, it is essential to understand the level of photovoltaic energy efficiency and its significance regarding the impacts it has on daily corporate activities. Based on these factors, this research addresses the problem of how corporate lighting energy efficiency is applied.

In the current global perspective, marked by climate change and volatility in traditional electricity prices, effective consumption management transcends simple cost reduction, becoming a strategic necessity within the corporate environment. Integrating organizations into sustainable development aims not only to mitigate environmental impacts but also to align operations with the planet's needs. This is achieved through the management of renewable resources and projects focused on sustainable management policies that respect the regeneration rate of natural resources, thereby ensuring the well-being of present and future generations.

Currently, the rational use of energy focuses on shifting loads to off-peak hours and increasing consumer awareness, while the operational axis seeks to reduce thermal and mechanical losses within systems. Working in tandem, these efforts aim to deliver the same level of service with the minimum possible energy waste, supported by continuous large-scale investment in distribution structures and supply stations. Given this context, organizations must remain cognizant and well-positioned regarding these aspects, employing high-level resource management and knowledge. This facilitates the achievement of positive results, serving as the primary basis of this research, which views the transformation of energy efficiency into a central pillar for corporate longevity.

It is understood, therefore, that energy demand entails not merely reducing consumption, but rather maximizing the utility of each unit of energy consumed in a conscious manner. As Viana (2014) indicates, the optimization of electrical systems requires the integration of high-efficiency technologies, the utilization of renewable resources, and, fundamentally, rigorous operational management. Such a framework is indispensable for minimizing waste at every stage—from primary conversion to the end-use of electricity—thereby transforming resource savings into a driver of economic sustainability and corporate longevity.

According to Smil (2021), the historical dependence on fossil fuels has created such an extensive and integrated infrastructure that complete replacement requires not only technological innovation but also decades of economic and physical restructuring. This global energy transition is not a simple event; it is a gradual process involving the overhaul of power grid transmission structures. For an organization to develop a sustainable purpose beyond mere social responsibility, it is proposed that sustainability serves as the driver for internal cultural change and innovation in revenue generation. Furthermore, Freeman (2018) emphasizes that a sustainable purpose requires organizations to abandon the narrow view of short-term profit maximization in favor of a long-term value creation perspective for customers, employees, suppliers, communities, and the environment.

Within this visionary context of long-term positive results, a revitalization project focused on LED lighting retrofitting demonstrates high economic viability, supported by its strong potential for financial forecasting and a rapid return on investment (ROI). Beyond direct savings on electricity bills, this technological transition is justified by reduced maintenance costs—due to the longer lifespan of LEDs—and by a decrease in the thermal load within environments, which subsequently lowers the energy consumption of HVAC systems. Furthermore, this modernization of the lighting system is justified by the reduction of the building's carbon footprint and the elimination of hazardous waste, such as the mercury found in fluorescent lamps, thereby directly contributing to environmental health.

Lighting accounts for approximately 15% of global electricity consumption and is responsible for about 5% of the planet's greenhouse gas emissions (IEA, 2023). It is important to note that, unlike traditional lamps which simply burn out, LEDs undergo a gradual process of lumen depreciation. Consequently, their lifespan is not defined by the moment they cease to function, but rather by the time it takes for them to lose a specific

percentage of their initial brightness. According to Hodapp (2018), the operating temperature at the LED junction is the primary factor in determining longevity; therefore, efficient thermal management is essential to ensure lumen maintenance over time and to achieve a longer service life.

Considering the physical environment and the performance of human activities, techniques are employed based on the fact that efficient lighting must balance energy savings with the provision of adequate light for the specific visual tasks required by each business setting. According to ABNT (2013), lighting systems in indoor workplaces must prioritize uniformity and glare control, ensuring that employees maintain high levels of concentration without compromising ocular health.



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Research Objectives

1. Analyze the energy efficiency of LED lighting systems.
2. Optimize electrical energy consumption.
3. Evaluate the application of retrofitting for energy efficiency gains.

Research Questions

1. How can installed power mapping determine the optimal lighting type and luminous flux for organizational environments?

2. What is the specific energy consumption of the current lighting system, and how can it establish a baseline for efficiency analysis?
3. What retrofitting and modernization measures can be proposed for the lighting system, and what are the projected financial outcomes of these actions?

LITERATURE REVIEW

Various authors have conceptualized ideas regarding energy efficiency within the corporate service environment. Under this theme, this study aims to analyze the qualitative level of energy consumption from renewable sources within an organization's service provision setting. This analysis considers that the quality of lighting in service environments influences consumers' perception of well-being, which in turn impacts their acquisition of products or services. In corporate environments, productivity and health are interconnected factors that compel organizations to manage the need for glare control and excessive contrast—elements that cause visual fatigue and reduce employee productivity. According to Hultén (2015), color temperature influences both temporal perception and the consumer's energy level. Consequently, warm tones invite lingering and the consumption of experiences, whereas cool tones are effective for convenience settings and quick-purchase environments.

These two factors must work in tandem to meet both consumer and biological needs, seeking a color rendering index (CRI) that approximates natural light to promote a healthier and safer work environment. Consequently, Stefanotto (2021) defines sustainable lighting based on a threefold approach: maximizing the use of natural light, leveraging the benefits of high-luminous efficacy sources, and implementing intelligent control systems. These systems ensure that artificial light is utilized only when and where it is strictly necessary.

In this context, it is considered relevant to explore the sustainable actions that the organization practices within its current service provision activities. This involves examining a culture of continuous improvement and a business vision oriented toward environmental stewardship and social responsibility, aiming to leave positive results for future generations. Energy efficiency is defined as a strategy that seeks to obtain benefits or results through the use of a smaller amount of energy—that is, by optimizing and maximizing resources. The primary goal is to promote awareness regarding the rational use of energy to provide services with minimum energy expenditure (MARQUES et al., 2007, p. 19). Therefore, for an organization to develop and outline its purposes, its strategies must be clear, and its actions must be well-defined regarding the goals to be achieved and the long-term benefits to be realized both internally and externally as a society. A genuinely sustainable purpose for an organization must incorporate its strategic guidelines and visions so that its activities are defined and characterized by a commitment to sustainable development. This approach, known as the Triple Bottom Line, argues that a company must manage and report economic, environmental, and social results in an integrated manner, under the premise that long-term financial success depends on the health of the communities and ecosystems in which it operates (ELKINGTON, 1998).

Every organization plays a social role within the community in which it is embedded; therefore, the vision of growth and profit must strategically align with social and environmental actions designed to sustainably offset the impacts caused by its economic activities. An organization's purpose, when aligned with sustainability, should not merely aim to mitigate social or environmental harm, but rather to generate economic value in a way that also produces value for society by addressing its needs and challenges (PORTER; KRAMER, 2011, p. 64).

In light of these actions, developing strategies focused on managing these resources becomes a distinct competitive advantage within the corporate market. These are not merely isolated sustainable initiatives; they are actions that humanize organizations and demonstrate their commitment to fulfilling their role and managing their responsibility regarding impacts on society's daily life. Sustainability actions aimed at renewable resource management require that the rate of utilization or harvest of a natural asset does not exceed its regeneration rate. The central challenge lies in determining the maximum exploitation limits for each type of material extracted from the environment, designed for long-term production—such as the maximum sustainable yield for biological resources, which represents the point at which a stock can regenerate at its fastest rate (PEARCE; TURNER, 1990).

Sustainable purpose differs from mere corporate social responsibility in that it constitutes the core reason for a company's existence, guiding all its decisions and innovations. It requires a long-term vision and the integration of sustainability goals into the core business, transforming how the organization generates revenue and engages with its stakeholders. Leadership engagement is fundamental to this process, as purpose must emerge from management and be communicated authentically to foster internal cultural change. In light of these cultural shifts, a sustainable natural resource management policy must focus on maintaining intergenerational well-being. This implies that a society's total wealth (natural and man-made capital) must be preserved over time, with the income derived from the exploitation of renewable resources being reinvested into other forms of capital or into enhancing natural capital to ensure its permanence (TIETENBERG; LEWIS, 2016).

The planning and shifting of internal culture can stem from small-scale investment actions, such as a simple efficient lighting system project capable of balancing or providing adequate light for specific visual tasks while minimizing energy consumption. Redesigning an

organizational lighting project aims to optimize light distribution, control glare and contrast, and select the most efficient light source and control system for the environment, thereby ensuring visual comfort and task performance (ABNT, 2017).

The primary technical requirement of a lighting system is to provide adequate illuminance levels for the environment and for specific tasks. Lighting needs vary significantly: a hallway requires much less light than a drafting table or a precision laboratory. The lighting design must meet the minimum requirements established by technical standards, such as NBR ISO/CIE 8995-1, to ensure visual performance and user safety (ABNT, 2017).

The requirements for an effective lighting system are not only quantitative but fundamentally qualitative. It is essential to control glare and excessive contrast, which cause visual fatigue and diminish productivity. Furthermore, the light must have a high Color Rendering Index (CRI) so that object colors are perceived accurately, satisfying the biological and psychological need for illumination that approximates natural light. The system must also consider the non-visual impact of light—the so-called circadian effect—which affects hormonal regulation and alertness levels (FISCHER, 2018).

In the 21st century, the need for an efficient lighting system is inseparable from sustainability. The choice of light source must be primarily based on luminous efficacy and lifespan to reduce both energy consumption and the need for maintenance and disposal. Consequently, the system must be designed for the rational use of energy, aiming to provide service with minimum energy expenditure (MARQUES, 2007, p. 19).

Driven by the need to keep pace with contemporary sustainable benefits, lighting retrofitting consists of replacing obsolete components or systems with more efficient versions—such as replacing discharge or fluorescent lamps with LEDs. This represents one of the energy

efficiency actions with the most significant economic forecasts. The primary objective is to optimize electrical energy use in existing installations, which often exhibit high consumption and poor lighting quality, resulting in a rapid return on investment (FISCHER; SCHEID, 2018, p. 147).

Although replacing the light source with LEDs is the most common retrofitting method, proper project management must analyze the luminous efficacy of the system as a whole, rather than the lamp alone. It is essential to verify electrical compatibility, the necessity of removing obsolete ballasts, and the impact of the new light source on the original optical behavior—such as light distribution and glare control—to ensure that lighting standards and quality are maintained or improved (MARQUES et al., 2007). Failure to observe these factors can lead to efficiency losses or the compromise of light quality.

A crucial operational benefit of updating a lighting system through retrofitting with technologies such as LED is the dramatic increase in the light source's lifespan, which leads to a reduction in replacement frequency and costs associated with labor and replacement materials. Furthermore, more efficient light sources like LEDs emit significantly less radiant heat than previous-generation incandescent and fluorescent lamps. This reduction in thermal load contributes to energy savings by decreasing the demand and energy consumption of air conditioning systems (FISCHER; SCHEID, 2018).

Lighting system retrofitting is frequently the energy efficiency measure with the shortest payback period in buildings, owing to the high luminous efficacy and longevity of new technologies such as LEDs. This benefit stems from the combination of direct energy demand reduction and decreased maintenance costs resulting from the extended lifespan of the installed technology, leading to substantial overall savings (MARQUES, 2007, p. 235).

The environmental impacts of lighting modernization are highly significant, as they translate into a reduction in the carbon footprint of buildings; a lower demand for electricity directly decreases the greenhouse gas emissions associated with power generation. Furthermore, replacing fluorescent and discharge lamps with LEDs eliminates the disposal of hazardous materials, such as mercury, from the facilities, directly contributing to waste management and environmental health (DUARTE, 2012).

METHODOLOGY

The present research is characterized as an applied study with a qualitative and analytical approach. Its objective is to examine energy efficiency within the corporate environment, considering the lighting system as a strategic element for reducing energy consumption and consolidating sustainable practices in organizations. This scope of investigation is not limited to a specific building; rather, it addresses corporate energy efficiency as a broad technical and organizational landscape. This scenario is representative of service-oriented environments characterized by long operating hours, high demand for artificial lighting, and the significant impact of energy costs on economic performance.

The methodology was structured based on a systematic literature review, encompassing scientific literature, technical standards, and institutional documents related to energy efficiency, corporate sustainability, lighting system retrofitting, and energy resource management. The study was grounded in reference authors in the field as well as normative guidelines, with particular emphasis on NBR ISO/CIE 8995-1, which establishes requirements for illuminance, uniformity, and glare control in indoor workplaces. This study

was structured by integrating the scientific literature review, compliance with technical standards, and the analysis of institutional documents, as synthesized in Figure 1.

Figure 1: Foundations of the methodological composition.



Source: Elaborated by the author (2026).

It is observed that the integration of literature, technical standards, and institutional documents ensures methodological coherence and technical rigor in the analysis of corporate energy efficiency, avoiding fragmented or exclusively theoretical approaches. As an analytical procedure, a comparative assessment of typical scenarios was adopted, contrasting conventional (legacy) lighting systems with modernized systems based on high-efficiency LED technology. This comparison considered technical parameters widely used in the industry, such as installed power, luminous efficacy, light source lifespan, thermal impact, and maintenance requirements, enabling the identification of the potential for energy consumption reduction and improvements in lighting quality.

Based on the comparative assessment of typical scenarios, it was possible to structure the Energy Efficiency Optimization Plan (EEOP) as a technical-conceptual instrument broadly applicable to the corporate context. The lighting retrofitting proposal was conceived based on normative and functional criteria, ensuring that the replacement of conventional systems with LED technology was not restricted to energy consumption reduction but also promoted the maintenance or improvement of the lighting quality within the environments. In this regard, the requirements established by NBR ISO/CIE 8995-1 were considered to guarantee adequate levels of illuminance, uniformity, and glare control compatible with the demands of occupational activities in indoor workplaces.

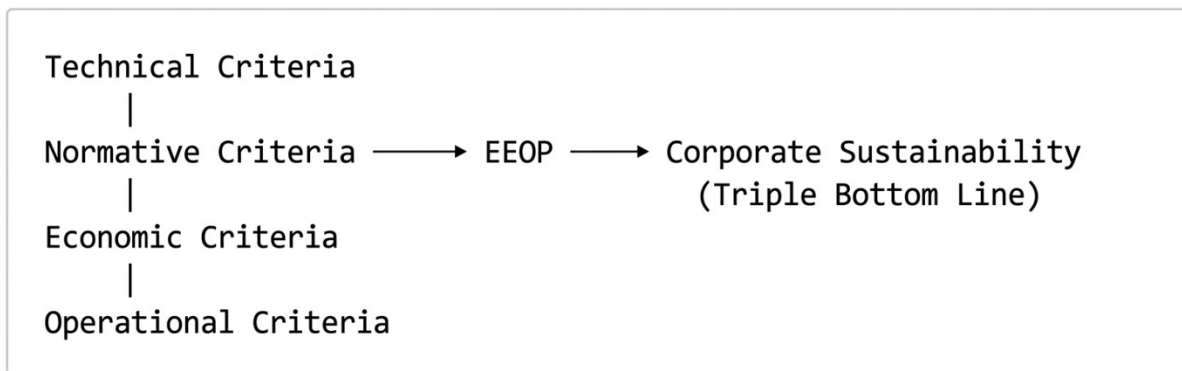
Within this context, the integrated analysis of technical and normative parameters made it possible to interpret energy efficiency as a strategic—rather than merely operational—vector for organizations. The adoption of high-efficiency LED systems, coupled with the reduction in thermal load and the enhanced durability of light sources, highlights a potential for indirect gains, such as lower maintenance costs and reduced demand on climate control systems. Consequently, the adopted method allowed for the correlation of the technical benefits of lighting retrofitting with broader economic and social impacts, reinforcing corporate energy efficiency as a structural component of organizational sustainability and responsible resource management.

The development of the Energy Efficiency Optimization Plan (EEOP) was carried out both conceptually and technically, grounded in consolidated lighting retrofitting practices applicable to the corporate environment. The plan was structured by integrating technical, normative, economic, and operational criteria to ensure that energy efficiency proposals would not compromise visual comfort, occupational health, or the performance of labor activities. In this context, the synergy between long-term strategic thinking and the technical

execution of the retrofit positions energy efficiency as one of the structural pillars of corporate sustainability.

The energy transition, when initiated within organizations through the modernization of their systems, demonstrates that the sustainability principles advocated by Elkington and Porter are feasible from both engineering and operational management perspectives. Thus, the EEOP transcends the status of a strictly technical project to establish itself as an instrument capable of aligning energy performance, environmental responsibility, and organizational competitiveness, transforming conscious consumption into a strategic asset. Figure 2 presents a synthesis of the conceptual structure of the Energy Efficiency Optimization Plan (EEOP), highlighting its technical and strategic foundations within the context of corporate sustainability.

Figure 2 – Conceptual framework of the Energy Efficiency Optimization Plan (EEOP)



Source: Elaborated by the author (2026).

The conceptual synthesis presented in Figure 2 demonstrates that the effectiveness of the EEOP is contingent upon the integration of organizational strategy and technical performance parameters. In this context, compliance with normative requirements plays a fundamental role, as it establishes the operational boundaries within which energy efficiency actions can be implemented safely and functionally. The implementation of electrical retrofitting in lighting systems, although oriented toward reducing energy consumption, cannot be dissociated from the normative requirements that ensure the functionality and safety of work environments. As established by NBR ISO/CIE 8995-1, lighting systems must meet strict criteria for illuminance, uniformity, and glare control. Compliance with these guidelines ensures that energy efficiency actions are compatible with operational demands, establishing a technical threshold where energy savings converge with safety and visual performance.

Beyond normative compliance, specialized literature indicates that lighting quality exerts a direct influence on productivity and occupational health. Fischer and Scheid (2018) emphasize that obsolete or inadequately designed lighting systems can cause visual fatigue and reduced user performance. Thus, the adoption of LED technologies with a high color rendering index and appropriate color temperature contributes not only to energy optimization but also to the creation of environments that respect human comfort, integrating technical efficiency with the promotion of occupant well-being.

The analysis of the results adopted an interpretive character, relating the technical and economic benefits of lighting retrofitting to the principles of corporate sustainability and the Triple Bottom Line concept, assessing the impacts of energy efficiency across environmental,

economic, and social dimensions. This approach allowed for the consolidation of energy efficiency not merely as a technological solution, but as a strategic instrument for governance and organizational competitiveness.

The interpretation of the results highlights that the consolidation of this model requires a paradigm shift in corporate management, where leaders act as facilitators in disseminating values that prioritize the rational use of energy. The comparison between the theory of creating shared value and organizational practice demonstrates that companies incorporating the Energy Efficiency Optimization Plan (EEOP) as a strategic guideline tend to exhibit higher engagement from employees and partners by aligning technical operations with the brand's sustainability goals.

The effects of this cultural integration manifest in the strengthening of the corporate image and the enhancement of organizational resilience against the challenges of the contemporary global market. As energy efficiency becomes internalized, the reduction of thermal and lighting waste is monitored as an indicator of financial health and ethical responsibility. Consequently, the use of renewable energy and intelligent system controls are no longer perceived as additional costs; instead, they are understood as assets that add value to the brand and ensure compliance with the expectations of an increasingly demanding society.

In summary, the synergy between long-term organizational strategy, the technical rigor of lighting retrofitting, and the focus on human well-being consolidates sustainability as a pillar of corporate governance. The analysis, grounded in the dialogue between literature and technical standards, demonstrates that the viability of energy efficiency is fully achievable when supported by clear purposes and consistent technical execution. Based on this evidence, the foundation is established for developing the final considerations, in which the expected

impacts will be synthesized and recommendations presented for the continuity and expansion of this management model to other operational units.

DISCUSSION OF RESULTS

Direct observation of corporate daily routines reveals that electrical energy is still treated by operations as a passive input—almost as a resulting tax on the activity. This mindset creates a barrier to innovation, as it prevents leadership from recognizing lighting and thermal waste as a direct loss of profitability. During the analysis, it became clear that the lack of energy performance indicators masks inefficiencies that, when accumulated over a fiscal year, represent a specific financial amount that could otherwise be reinvested.

The implementation of the EEOP (Energy Efficiency Optimization Plan) was established as the necessary breaking point for this outdated culture. By transforming raw consumption data into sustainability targets, management gains control over its environmental impact that was previously nonexistent. The realization that it is possible to maintain the same production capacity with lower maintenance and energy costs changes how the business plans its future, placing energy efficiency investment at the center of organizational strategic decisions. These shifts result in the positive impacts presented in the table below:

Table 1: Performance and Feasibility Comparison: Legacy System vs. EEOP Proposal

Category	Situação Atual (Legado)	Proposta (Retrofit LED / POEE)	Impacto Observado
Energy	High (Thermal Load)	Reduced (-50% to	Energy Efficiency

Consumption		-70%)	
Heat Emission	Oscillating (Visual Fatigue)	Low / Negligible	HVAC Relief
Lighting Quality	Oscillating (Visual Fatigue)	Stable (Visual Comfort)	Occupational Health
Maintenance	Frequent Corrective	Predictive / Long Service Life	Operational Cost Reduction
Predominant Technology	Fluorescent / Mercury Vapor	High-Performance LED	Technical Modernization
Management Outlook	Operational Expense	Return on Investment	Profitability

Source: Elaborated by the author (2026).

It should be noted that the true gain lies not only in the replacement of equipment but in the behavioral change that this modernization demands. When the board of directors takes control of its energy demand, it sends a clear signal to all levels of the company regarding the value of resource preservation. This alignment reduces the gap between what the company states in its sustainability reports and what it effectively practices in its day-to-day operations.

Therefore, the discussion of these results points toward an update in facilities management. The project's success proves that economic choices are the engine that enables environmental awareness. By treating energy as a finite and manageable resource, the organization protects itself against market fluctuations and ensures a leaner operation, better prepared for the demands of an increasingly competitive global scenario.

In a technical context, the results prove that internal modernization is the most efficient response to the pressure for sustainability. While large-scale structural changes in the national power grid are slow and dependent on complex public policies, lighting retrofitting offers the

company immediate autonomy. The agility to replace obsolete systems with modern technology allows the organization to take concrete steps toward reducing its carbon footprint in real-time, without waiting for external solutions with long implementation lead times.

A technical analysis revealed that a simple replacement with high-efficiency LED lamps generates a ripple effect of benefits within the corporate environment. Beyond the direct reduction in kilowatt-hour consumption, a drastic decrease in the heat emitted by the fixtures was observed, which directly relieves the air conditioning system. This hidden gain is fundamental to the results analysis, as it demonstrates that efficiency in one area enhances savings in others, optimizing the infrastructure as a whole.

The use of measurement tools, such as a light meter, makes it possible to confirm the high quality of lighting, even with a significantly lower installed power capacity. This demystifies the idea that saving energy means working in darker environments. On the contrary, modern technology allows for a more intelligent light distribution focused on the specific needs of each area.

Consequently, the project's technical execution translates into a more modern and reliable infrastructure. The reduction in the need for constant corrective maintenance—common in legacy systems—frees up the infrastructure team for more strategic tasks. Therefore, the internal energy transition validates the company's capacity for technological renewal, ensuring that the physical facilities keep pace with the modernity of the market.

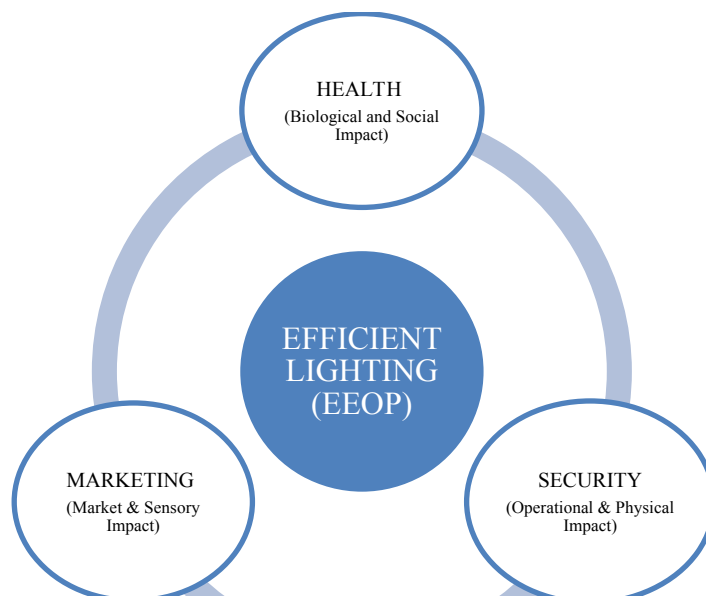
One of the most rewarding results identified in this analysis is the direct impact of the new lighting system on improving human well-being. It became evident that light plays a fundamental role in how employees perceive fatigue and energy levels. Environments that previously suffered from light flickering or inadequate color temperatures generated a silent

visual fatigue that, by the end of a work shift, impacted the productivity and mood of both technical and administrative teams.

The discussion of the data shows that providing an environment with precise illuminance levels, in compliance with technical standards, leads employees to feel that the company has invested in their quality of life at work. Lighting that respects color rendering and prevents glare not only avoids execution errors in complex tasks but also makes the environment more stimulating and welcoming, reflecting positively on customer service—whether internal or external.

It should also be observed that the aesthetics of the environments take on a new dimension. Proper lighting enhances the design of the spaces and creates an atmosphere of modernity that supports the organizational production process. This connection between technical efficiency and sensory marketing proves that the project achieves the ideal balance: it conserved natural resources while heightening human senses, creating a high-standard workspace and consumer environment.

Mapa 1: Inter-relação entre Iluminação Eficiente e a Valorização do Capital Humano.



| Source: Elaborated by the author (2026).
|

Thus, a discussion on occupational health concludes that investing in energy efficiency is, in reality, an investment in human capital. By ensuring that the physical environment respects biological limits and human needs, the upgrade strengthens the bond with employees. The result is a positive cycle where sustainability techniques translate into social recognition and internal satisfaction.

To conclude the analysis, the results indicate that sustainability is established as a governance asset for supply chains and the capacity to report real savings and waste reduction, positioning the company at a distinct level within the market. Efficiency ceases to be mere "green talk" and becomes material proof of administrative competence and professional ethics in resource management.

Within the scope of governance, the transparency obtained through the monitoring of the EEOP facilitates evidence-based decision-making. Knowing exactly where and how energy is being consumed allows for fine-tuning that traditional systems do not offer to end-users. This control specifically reflects a modern management approach that understands both social-environmental responsibility and the financial health of the organization.

The integration of these results into the organizational culture is the most lasting gain. It is noted that the modernization of the infrastructure awakened a greater awareness among employees regarding other forms of waste, such as water consumption and waste generation. Energy sustainability served as a gateway to a more conscious mindset throughout the entire operation, proving that the example set by the physical infrastructure holds enormous

pedagogical power.

In concluding this discussion, the results validated that the path paved by energy efficiency is the only sustainable one in the long term. The company emerges from this project not only with lower electricity bills but with more robust governance, a more satisfied team, and a stronger brand in the market. The success of this analysis confirms that the union between technical proposals and sustainable purpose is the key to corporate success in the new economy.

CONCLUSION

The present investigation allowed for the conclusion that energy efficiency in corporate environments should not be viewed merely as an isolated cost-reduction measure, but rather as a vital strategy for the sustainability and resilience of organizations in the contemporary market. Through the dialogue between management theory and engineering practice, it became evident that optimizing resource use is a determining factor for competitiveness and business longevity in the face of global climate challenges.

Regarding the technical dimension, the study validated that lighting retrofitting with high-performance LED technology represents the most agile solution for mitigating immediate daily energy waste. While major transitions in the global energy matrix occur gradually and slowly, the modernization of internal systems offers a high-impact tactical response, allowing the organization to reduce its carbon footprint independently and swiftly.

From an economic perspective, the analysis based on Porter and Kramer's concepts demonstrated that investing in efficiency generates shared value. The attractive Return on Investment (ROI) of the technologies proposed in the Energy Efficiency Optimization Plan (EEOP) confirms that financial sustainability is perfectly compatible with environmental

preservation, transforming conscious consumption into a strategic asset rather than an operational liability for organizations.

Regarding human capital, the research reinforced that technical efficiency must coexist with employee well-being. Strict compliance with technical standards and guidelines ensures that optimized lighting contributes to visual comfort and occupational health. The integration of sensory marketing concepts and luminous ergonomics proves that an energy-efficient environment is, consequently, a more productive and healthy space.

Another fundamental point of this analysis was the identification that technology, in itself, is insufficient if it is not integrated and strategically supported by a change in organizational culture. The transition to a sustainable model requires that leadership and employees internalize the purpose of rational resource management. When integrated into the brand identity, energy efficiency ceases to be a regulatory obligation and becomes an ethical value shared across all levels of the hierarchy.

The study points out that the application of an EEOP is an effective diagnostic and action tool, capable of organizing the technological and operational transition in a structured manner. This model establishes a benchmark that can be easily replicated in any sector, bringing energy excellence at a corporate scale.

As a limitation of this research, it is recognized that the focus was primarily on the lighting system, leaving opportunities to deepen the analysis of other high-consumption systems, such as HVAC (Heating, Ventilation, and Air Conditioning). However, the path set forth establishes the necessary methodological foundation for future energy audits to expand their scope of action, ensuring a holistic view of efficiency throughout the organization's entire physical infrastructure.

Finally, it is recommended that organizations maintain a cycle of continuous monitoring of energy performance indicators to ensure the sustainability of the gains achieved. It is further suggested that future work explore the integration of renewable microgeneration sources, such as solar photovoltaic energy, aiming for full energy autonomy. This step will definitively consolidate the company as an agent of active transformation within the global energy transition landscape.



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