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ARAŞTIRMA MAKALESİ | RESEARCH ARTICLE

THE EFFECT OF GREEN ENERGY USE ON PROFITABILITY IN HOSPITALITY ORGANIZATIONS: THE PERSPECTIVE OF SAVING ENERGY COSTS

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Abstract
Although profit is often regarded as the primary reason for the existence of businesses, sustainability is, in fact, the most critical factor ensuring their long-term survival. With the growing environmental awareness worldwide, businesses are placing greater emphasis on environmental protection initiatives and aligning their production processes accordingly. In this context, efforts to use limited resources efficiently have led to the widespread adoption of practices aimed at environmental protection and energy conservation in daily life. These efforts have also resulted in the implementation of more effective energy efficiency solutions in the accommodation sector, as in many other industries. The primary objective of this study is to demonstrate the potential savings that can be achieved by reducing energy consumption and resource waste through environmentally friendly practices. To this end, scenarios were developed for the installation of 200 Wh, 250 Wh, and 1000 Wh solar panels on the roof of an accommodation facility. The results of these scenarios indicate that installing 200 Wh solar panels on the roof can meet approximately 7.46% of the energy consumed; installing 250 Wh solar panels can meet approximately 9.32% of the energy consumed; and installing 1000 Wh solar panels can provide 37.3% of the average energy consumption.

Keywords: Environmental Management Accounting, Renewable Energy, Energy Efficiency

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YEŞIL ENERJI KULLANIMININ KONAKLAMA İŞLETMELERINDE KÂRLILIĞA OLAN ETKISI: ENERJI MALIYETLERINDEN TASARRUF PERSPEKTIFI

Öz

İşletmelerin varlık nedeni olarak kâr gösteriliyor olsa da aslında en önemli faktör işletmelerin varlıklarının devamlılığını sağlayan sürdürülebilirliktir. İşletmeler tüm dünyada artan çevre duyarlılığını göz önünde bulundurarak çevre koruma faaliyetlerine daha fazla önem vermekte ve buna uygun üretim gerçekleştirmektedir. Bu doğrultuda sınırlı kaynakların verimli şekilde kullanılmasına yönelik çabalar, çevreyi korumaya ve günlük hayatımızda enerji tasarrufuna yönelik uygulamaların yaygınlaşmasına neden olmuştur. Enerji tasarrufu ve çevre koruma çabaları, birçok farklı sektörde olduğu gibi konaklama sektöründe de enerji verimliliği açısından daha etkili çözümlerin benimsenmesine yol açmıştır. Bu çalışmanın temel amacı, çevre dostu uygulamalar ile kullanılan enerji miktarını ve kaynak israfını azaltarak, sağlanabilecek tasarrufu ortaya çıkarmaktır. Bu bağlamda çalışmada bir konaklama işletmesinin çatısına 200 wh, 250 wh ve 1000 wh güneş paneli kurulmasına yönelik senaryolar geliştirilmiştir. Bu senaryolarla elde edilen sonuca bakıldığında, çatıya 200 wh güneş paneli kurulduğunda tüketilen enerjinin yaklaşık %7,46'sını karşılayacak, 250 wh güneş paneli kurulduğunda tüketilen enerjinin yaklaşık %9,32'si karşılanacak ve en son 1000 wh güneş paneli kurulduğunda ise ortalama tüketilen enerjinin %37,3'ü sağlanmış olacağına dair bulgular elde edilmiştir.

Anahtar Kelimeler: Çevresel Yönetim Muhasebesi, Yenilenebilir Enerji, Enerji Verimliliği

INTRODUCTION

Energy conservation, the integration of smart technologies into daily life, and growing concerns about environmental protection have become increasingly prominent in recent years, particularly in the context of maximizing the efficient use of limited resources. These concerns have significantly reshaped the environment in which organizations operate, both in domestic and international markets. Furthermore, consumer preferences across all sectors have shifted toward more environmentally friendly products and services, leading to heightened public awareness and sensitivity on these issues. Consequently, society, governments, and stakeholders now demand that companies address ecological problems and take substantial measures to protect the biophysical environment. It is evident that environmental issues have become a focal point of attention for the international community. This is further demonstrated by the increasing number of companies, particularly in developed countries, that engage in environmentally friendly activities to gain a competitive advantage and strengthen their financial positions.

Economic development and growth, coupled with technological advancements, rapid industrialization, and population growth, have contributed to environmental problems such as water, air, and soil pollution. These escalating environmental challenges have fostered greater environmental awareness. In response, environmental awareness has driven significant advancements in environmentally friendly management practices and environmental management accounting. By leveraging the benefits of environmental management accounting, businesses can minimize their negative impact on the environment. For a sustainable future, environmental management accounting is particularly crucial for accommodation businesses and other industries. Through environmentally friendly management practices and environmental management accounting, businesses can monitor and mitigate the environmental damage they cause, while simultaneously generating profits and reducing their negative environmental impact.

The tourism sector is one of the most significant contributors to national economies. The desire of individuals working in today's demanding business environments to fulfill both their basic needs, such as food and drink, and their social needs, such as travel and entertainment, has increased the importance of this sector. Accommodation establishments play a vital role in meeting these social needs. The desire of individuals to travel to different locations to satisfy

these needs often results in increased spending. Accommodation establishments that provide high-quality and safe services to their guests are consistently preferred and generate profits. However, another way to increase profitability is by reducing costs without compromising customer expectations. While personnel and food and beverage costs are among the most significant expenses for accommodation businesses, energy costs also represent a substantial cost item. In this regard, energy consumption plays a critical role in the services provided to customers staying in accommodation establishments.

The realization of basic needs such as lighting, ventilation, heating, cooling, and cleaning in accommodation establishments directly impacts energy consumption. As energy consumption increases during these service activities, so do costs. Therefore, to ensure the sustainability of services in accommodation establishments and to obtain energy more cost-effectively, renewable energy sources should be utilized. Renewable energy sources, which do not require raw materials, involve only an initial installation cost. The fact that renewable energy systems can amortize their costs in a relatively short period highlights the importance and necessity of their use. Accordingly, accommodation establishments should invest in renewable energy sources to conduct their operations more economically.

This study examines the contribution of solar energy, as a renewable energy source, to energy conservation. The aim is to evaluate the issue from an economic perspective by analyzing the current situation. To this end, the economic contributions of solar energy investments to the sustainability of tourism have been explored, focusing on efficient and low-cost energy use, which is one of the key goals of sustainable tourism. The study investigates the economic benefits that can arise from the effective use of solar energy by accommodation establishments and provides recommendations. In this context, the study emphasizes the importance of understanding the impact of energy savings on business profitability and fostering awareness on this issue. Therefore, this research paper aims to evaluate the current state of the hospitality sector in terms of sustainability through an in-depth analysis of environmentally friendly practices and efforts to reduce energy consumption and resource waste.

1. THEORETICAL FRAMEWORK

Although environmental studies have predominantly focused on manufacturing companies, the hospitality sector within the service industry also warrants special attention in this context. Examining the green business practices of the hospitality sector is particularly critical due to the significant environmental impact of its operations. Hospitality businesses typically consume substantial amounts of resources, such as electricity, water, and fossil fuels, which can have detrimental effects on the environment. Moreover, these businesses must consider the ecological aspects of the products and services they offer to ensure customer satisfaction. To remain competitive and compliant, they are also required to integrate more sustainability-focused elements into their operations in response to increasingly stringent environmental regulations imposed by local, regional, and national governments (Alvarez-Gil et al., 2001).

In this regard, this study examines key topics such as environmental management accounting, energy management in accommodation enterprises, the effects of energy savings in accommodation enterprises, the efficient use of energy in accommodation enterprises, and environmental assessment in accommodation enterprises.

1.1. Environmental Management Accounting

Environmental management accounting is an accounting system that enables managers to make more informed decisions regarding product design, pricing, and other business activities by reporting and clarifying the costs and benefits associated with environmental protection, cleaning, and recycling (Yereli & Yakın, 2009). In brief, environmental management accounting

is defined as a set of processes that include profit and loss calculations made by enterprises while considering all environmental factors. It also describes a sustainable program within the financial budget of the institution, allowing for final accounting adjustments by evaluating changes observed as a result of the implemented program. These adjustments are made through inventory calculations within the framework of the enterprise's balance sheets (TÜSİAD, 2005).

While management accounting generally involves the use of a broad set of cost and performance data by managers to make decisions about the business, environmental management accounting specifically focuses on the use of data related to environmental costs and performance for decision-making regarding the business's activities (Özbirecikli, 2000). Environmental management accounting supports business management by preventing managers from making decisions that could harm both the business and the environment (Sendroiu et al., 2006). According to Bennett and James (1998), environmental management accounting collects, compiles, and analyzes environmental information, presenting it to managers in meaningful reports, thereby contributing to the decision-making process of business management. Environmental management accounting is increasingly important not only for making environmentally conscious managerial decisions but also for routine management activities such as product design, cost control and allocation, capital budgeting, purchasing, supply chain management, product pricing, and performance evaluation (Sendroiu et al., 2006).

Accommodation management, as one of the fundamental components of tourism, interacts with the natural environment in various ways. For this reason, when the accommodation sector is poorly managed, as in many other sectors, the natural environment suffers as a result of this interaction. Today, environmentally friendly management practices play a crucial role in ensuring a sustainable future. In this context, the application of environmental management accounting in accommodation enterprises can significantly minimize negative impacts on the environment (Büyükipekçi & Şimşek, 2018).

1.2. Energy Management in Accommodation Businesses

Energy management plays a crucial role in transforming industrial energy systems to enhance sustainability and energy efficiency. The serious adoption of energy management practices reflects a comprehensive management perspective and serves as an effective indicator of future profitability. Effective energy management leads to reduced energy consumption and costs, improved company image, and minimized environmental impact. In hospitality organizations, achieving a high level of energy management requires monitoring energy use, conducting energy audits, and involving both staff and guests by providing information on how they can contribute to energy management and the potential impact of their participation (Mardani et al., 2016).

In many accommodation establishments in Turkey, operations are particularly intensive during the summer season. During this period of high energy consumption, urgent issues such as energy maintenance, repairs, and breakdowns may arise. These situations must be resolved promptly to avoid negatively affecting customer service quality. Therefore, it is essential for accommodation establishments to have an expert team in place to address such challenges effectively.

According to data from the Turkish Statistical Institute (TUIK), approximately 56,693,837 tourists visited Turkey in 2023, with around 30 million of them preferring accommodation establishments during the summer season (May–September) (TUIK, 2023). Given the intense activity during the summer season, accommodation establishments must make quick and accurate decisions regarding energy management to maintain perceptions of comfort and quality while staying competitive. The primary reasons for making such decisions can be summarized as follows:

a. Preservation of leadership in tourism: Reducing energy consumption in accommodation establishments within the tourism sector, which significantly contributes to the national economy, can yield substantial economic returns. This, in turn, can position the sector as a leader in terms of economic performance. Effective energy management in accommodation businesses can have a profound impact, potentially making them leaders in the industry (Ünlüel, 2019).

b. Uncertainty of energy prices: Energy in Turkey is not used efficiently or in a planned manner, and the country is among the most expensive in the world in terms of electricity costs. High energy prices negatively affect the cost structure, service quality, and competitiveness of accommodation establishments. Therefore, businesses must take proactive measures to mitigate the risks associated with energy price fluctuations (Öztürk, 2004).

c. The necessity to increase profits: With the emergence of new competitors, accommodation businesses are increasingly reviewing their costs to minimize them. Although energy costs account for approximately 12% of the total costs of accommodation businesses during a season, savings in this area can have a significant impact on overall profitability (Ünlüel, 2019).

A significant portion of energy consumption in hospitality businesses results from unnecessary losses and waste. This is because customers typically have full control over energy consumption units and adjust them without concern for energy conservation. Many rooms remain unoccupied for extended periods (approximately 60–65% of the day), yet heating, ventilation, and air conditioning systems are often left on or in standby mode. As a result, energy in guest rooms is frequently consumed 24 hours a day throughout the year, regardless of occupancy (HES, 2011). To prevent such unnecessary losses and waste, a successful energy management program must be implemented. The key elements of a successful energy management program are outlined in Table 1 below.

Table 1. Basic Managerial and Technical Elements of A Successful Energy Management Program In Accommodation Businesses

Basic Administrative Elements	Technical Elements
Energy management should be fully integrated into the overall management framework of a hotel and treated as a management function as important as others such as human resources and financial management.	Authorize a portion of the total annual operating budget for the refurbishment of existing building energy system installations, with particular emphasis on the refurbishment/replacement of energy-intensive equipment such as water chillers, cooling towers, or air handling units and lighting installations.
An environmental manager or energy manager must be appointed to the hotel's management team.	Education and training of technical staff, so that each staff member is aware that everything they do can have a significant impact on the energy consumption in a hotel.
There should be a clearly defined energy management and utilization policy and action plan; responsibility for implementation should be assigned to a senior manager or, if appointed, an energy manager.	A well-defined operation and maintenance program should be established for technical staff to follow in order to avoid wastage due to oversupply and to reduce low operational efficiency through good maintenance work. Preventive maintenance should also be considered before an operational problem arises.
Where possible, hotel guests should be encouraged to participate in the hotel's energy management program, for example, by adjusting the indoor air temperature to a higher but comfortable level, switching off interior lights as necessary, etc.	High-efficiency, technically advanced equipment should be used, including energy-saving lamps, variable-speed water chillers, low-energy consumption motors, etc.

Source: Adapted from Deng & Chan, 2018: 861.

According to HES (2011), accommodation businesses have the potential to save at least 10 to 15 percent of the energy they consume, depending on their age and size. Additionally, the

primary motivations for energy savings in accommodation businesses include reducing operating costs, meeting customer demand, improving the business's image, and minimizing environmental impact. Hospitality managers have access to a variety of tools and practices to reduce energy consumption, which can be easily implemented depending on the specific circumstances of the hotel.

Space conditioning is the largest energy consumer in hospitality establishments, accounting for approximately half of total energy consumption. Outdoor weather conditions and floor surfaces are widely recognized as key factors influencing energy consumption in accommodation establishments. Hot water usage is typically the second-largest energy consumer, accounting for up to 15 percent of total energy demand. Lighting contributes between 12–18 percent and, in some cases, up to 40 percent of total energy consumption, depending on the category of the establishment. Other services, such as catering and laundry, also represent significant portions of energy consumption, while sports and health facilities are generally large energy consumers (HES, 2011).

1.3. Effects of Energy Saving in Accommodation Businesses

Tourism enterprises have an energy-saving potential of over 40 percent. Considering that customer satisfaction can be achieved alongside providing guests with a safe, peaceful, and comfortable environment, energy savings should be ensured without compromising the comfort offered (Öztürk et al., 2018). The effects of energy savings in accommodation businesses can be examined from two perspectives: environmental impacts and financial impacts.

1.3.1. Environmental impacts of energy saving

As environmental degradation continues to increase globally, the adoption of environmentally friendly practices to mitigate these impacts is also on the rise. Since the environment is a critical factor in the tourism sector, environmentally friendly practices hold significant importance. Tourism businesses, particularly accommodation establishments, operate in close proximity to natural and cultural attractions and require intensive energy use to meet customer demands and needs. The use of fossil fuels, starting from the construction phase of accommodation businesses and continuing throughout their operation, results in carbon and greenhouse gas emissions. These emissions harm local biodiversity and quality of life on a micro level and contribute to global warming on a macro level.

Accommodation businesses are increasingly seeking to reduce their dependence on fossil fuels while meeting their energy needs. They are also exploring alternative ways to lower energy costs. Additionally, tourists are showing a preference for socially responsible and environmentally conscious accommodation businesses, which further compels the sector to adopt renewable energy sources. To reduce the damage caused by fossil fuels and ensure the sustainability of the natural environment, it is essential to save energy and promote sustainable energy use (Aydın & Aydın, 2016). Energy-saving and resource management practices in accommodation businesses aim to achieve advanced environmental sustainability (Sert, 2017). By implementing energy management programs, accommodation businesses can reduce resource consumption and costs, improve customer loyalty and public image, avoid environmental sanctions, and enhance their competitiveness in global markets. In this respect, energy saving and management have become vital requirements for sustainable development (Ali et al., 2008).

1.3.2. Impact of energy saving on financial structure

Cost determination and reduction are critical for all businesses. For accommodation establishments, which often operate on a large scale, it is essential to accurately calculate costs and take necessary measures to manage them effectively. The costs of operating an accommodation facility can be divided into three components: energy costs, operating costs, and maintenance costs. An efficient cost management system is required to reduce these components. Through an energy management program, costs and potential savings can be identified, and employees can be involved in an action plan to achieve these savings (Önüt & Soner, 2006).

While measures to protect the environment may initially increase costs, such as the installation of renewable energy systems, they offer long-term benefits. For example, the Green Star project in Turkey and energy efficiency practices have highlighted the importance of renewable energy in the accommodation sector. Public institutions have introduced initiatives to encourage private sector investments in renewable energy systems. In the European Union, the transition to net-zero energy buildings is mandatory under the 2020–2050 project framework. Within the accommodation sector, projects are underway to transition to renewable energy sources as part of the "Almost Zero Energy Hotels" initiative. Zero-energy buildings, which require no net fossil-based energy and produce no carbon emissions, reduce long-term operational and maintenance costs for accommodation businesses. Pilot projects under this initiative aim to demonstrate the feasibility and profitability of achieving near-zero energy hotel standards (Aydın & Aydın, 2016).

1.4. Efficient Use of Energy in Accommodation Businesses

Accommodation businesses, like other enterprises, are significant energy consumers. To provide guests with comfortable and high-quality services, energy consumption in these establishments tends to be high. Therefore, it is crucial for accommodation businesses to focus on using energy efficiently rather than excessively.

Three primary energy sources—electricity, gas, and diesel fuel—are required for the efficient operation of hospitality businesses. In accommodation establishments, energy is primarily consumed for temperature control, which accounts for an average of 69 percent of total energy consumption (63 percent for heating and hot water, and 6 percent for air conditioning) (Vadam, 2015). Electricity is often the primary energy source for building systems, domestic hot water heating, and cooking. Diesel and gas are used for specific purposes, such as producing steam, heating buildings, or cooking in kitchens. Electricity typically accounts for over 50 percent of total energy consumption in accommodation establishments. However, the share of energy used for air conditioning or space heating depends on the climatic conditions of the hotel's location. For instance, in cold climates, space heating may dominate energy consumption, while in temperate regions, air conditioning may account for the largest share (Deng and Chan, 2018).

To use energy efficiently, it is necessary to access real-time energy data. This involves monitoring different buildings and floors within the establishment, measuring consumption in each room, and collecting energy data for specific areas such as laundry, kitchens, and activity rooms. With this data, managers can make more informed and feasible decisions about energy consumption and efficiency. Passive consumption areas, such as heating, ventilation, air conditioning systems, and lighting, should also be identified and controlled. These areas are often the largest sources of uncontrolled expenses in accommodation establishments (Ünlüel, 2019).

To address these issues, the following measures should be implemented:

- Staff responsible for changing and repairing lamps should be trained on where and what types of lamps to use. Poor-quality lamps that consume excessive energy should be replaced with energy-efficient alternatives.

- Lobbies, corridors, and support areas, which require extensive lighting, should prioritize energy-saving solutions.

- Air conditioners, refrigerators, washing machines, and dishwashers should be regularly maintained and repaired. Outdated and inefficient machines should be replaced with energy-efficient models (Öztürk, 2004).

On average, a room in an accommodation business remains unoccupied about 70 percent of the time during a day. Energy consumed during these periods is wasted. Measuring such consumption data accurately and taking appropriate measures can significantly reduce energy waste (Ünlüel, 2019). Additional steps to reduce energy consumption in accommodation businesses are outlined by KİTOB (2021).

- Switching off devices in standby mode,
- Using devices with low energy consumption,
- Utilization of solar energy in lighting,
- Paying attention to corridor lighting, using photocells if necessary,
- Insulation is made to provide heat saving.

In the light of this information, the actions that will increase energy efficiency in accommodation enterprises and the cost level that the enterprise will incur as a result of these actions are given in Table 2.

Table 2. Actions For Increasing The Energy Efficiency of An Accommodation Organization

Actions to increase energy efficiency	Level of cost to be incurred
An efficient building form	Average
Effective insulation	Average
Room thermostat	High
Cooling temperature drop	Low
Reduced cooling in the absence of guests	Low
Windows that let in natural light	High
Motion sensors	High
Low-consumption bulbs	Average
Energy-saving minibar, TV	High
Conversion of edible oils into biodynamic fuel	Average
Low-energy devices	High
Energy-Efficient Laundry Equipment	High
Limited use of electronic devices	Low
Energy-saving ventilation system	High
Staff awareness	Low
Awareness of hotel guests	Low
Energy monitoring	Low

Source: Adapted from Vadam: 2015, p.3.

1.4.1. Barriers affecting accommodation business İnvestments in energy efficiency

Lack of knowledge about energy efficiency systems is recognized as a significant barrier to investment in the hospitality sector. Additional obstacles include unskilled personnel working in existing energy installations, confusion arising from measures and costs, and poor building designs that lead to energy losses. According to the International Energy Agency (IEA) report, *"Energy Efficiency Requirements in Building Regulations: Energy Efficiency Policies for New Buildings"* (2008), the following barriers to energy efficiency in new buildings were identified:

a. Focusing on incremental costs without considering the operating costs of a building and a lack of awareness among decision-makers regarding best practices for whole-life cost or energy efficiency;

b. Limited awareness among decision-makers about energy efficiency issues, potential benefits, and best practices;

c. Challenges in implementing energy efficiency measures in specific markets due to the unavailability of specialized equipment or skills;

d. Divided responsibilities and interests between building owners, who must pay for efficiency investments, and building occupants, who benefit from reduced energy operating costs;

e. The perception among hotels that high energy consumption is necessary to ensure guest comfort;

f. Misunderstandings caused by slogans such as "energy-efficient buildings" or "low-energy buildings," which are often associated only with new buildings meeting minimum energy standards;

g. Reluctance to implement energy efficiency measures that exceed the minimum standards set in building codes, even though these standards rarely represent the best efficiency practices.

1.5. Environmental Assessment in Accommodation Businesses

It is evident that environmental awareness is growing within the global hospitality industry. In addition to stricter legal regulations, increasing demand for environmentally friendly practices from customers is a key driver of this trend. Green tourists, in particular, are more likely to choose accommodations that demonstrate an environmentally conscious attitude. However, despite this growing demand, factors such as location, service quality, and price remain the primary determinants of customer choice. As a result, environmental concerns are often considered secondary to these factors.

To address this issue, Deng and Chan (2018) note that an increasing number of hospitality managers have recognized the importance of environmentally responsible actions. Consequently, many have begun implementing environmental management systems, adopting green practices, and observing their benefits. However, hospitality managers often struggle to find objective and systematic approaches to measure the effectiveness and profitability of their green initiatives.

In this context, Sanchez-Ollero et al. (2021) identify three main reasons for the increasing environmental awareness among tourism businesses:

1. The idea that consumers are willing to pay more for environmentally friendly services, prompting businesses to explore the relationship between environmental actions and economic performance;

2. The need to control and optimize operational costs while providing services that meet consumer expectations;

3. The guilt associated with tourism activities due to the significant use of water and material resources, some of which are not environmentally friendly (e.g., non-disposable plastic containers, non-recyclable packaging).

These factors are closely linked to the environmental actions of businesses. It is concluded that reducing energy consumption not only results in cost savings for companies but also demonstrates greater respect for the environment.

2. LITERATURE REVIEW

In today's world, where renewable energy sources have become increasingly important for countries, research on this topic has accelerated. In recent years, Turkey has made significant progress in the energy sector, with numerous studies conducted to improve the industry. Given Turkey's substantial potential in renewable energy resources, particularly solar energy, this potential has become a focal point. A review of the literature reveals several studies examining the impact of solar energy, as a form of green energy, on the savings achieved by businesses:

Şenol (2012) analyzed the amount of water that could be pumped using solar energy-assisted pumps instead of diesel pumps for agricultural irrigation, based on regions and total dynamic heights. A life-cycle cost analysis revealed that the system's payback period was six years, with an investment savings rate of approximately 4.6% compared to diesel systems.

Yılmaz et al. (2016) installed a solar energy system to replace electrical energy for irrigation water in an orchard. The system's investment cost was calculated at 9,029 TL, and it was estimated to produce 2,071.8 kWh of electricity annually, excluding irrigation. The surplus energy could be used for other purposes or sold to the grid, generating an additional income of 621 TL at 2014 prices.

Güven (2017) examined the optimization and cost analysis of meeting the energy needs of the Istanbul Bahçelievler municipal building using solar and wind systems. It was determined that 16% of the building's annual energy needs could be met with a solar energy system, with a payback period of approximately six years. A net present value analysis calculated the payback period to be around nine years.

Şanlı and Dilsel (2018) designed an absorption cooling system using a solar energy-assisted single-effect water-lithium bromide mixture to cool a 40-bed hotel in Mersin. The system was designed based on August data, when temperatures are highest. It was determined that a 359.5 m² vacuum tube collector with 61.5% efficiency was required to meet the hotel's cooling needs.

Özbay and Sarıışık (2020) investigated the use of solar energy systems to meet the energy needs of blue flag yachts, a key component of marine tourism. They concluded that solar energy systems increase environmental awareness and recommended state support and privileges for yachts using renewable energy sources.

İnce (2021) examined the production of electrical energy required by SMEs in Istanbul and Izmir using solar energy systems, with surplus energy transferred to the grid. Although the initial installation cost of the solar energy system was high, it was found to provide long-term financial

benefits, reduce foreign dependency, and serve as an environmentally clean energy source. The gain after 20 years was calculated to be substantial, depending on sunshine duration.

Şahin et al. (2022) simulated a grid-connected solar energy system to meet the daily energy needs of a four-person household. The system produced 3,167 kWh/year, with 2,920 kWh used for self-consumption and 247 kWh sold to the energy distribution company.

Maka and Alabid (2022) emphasized the role of solar energy in achieving sustainable energy solutions. They highlighted that solar energy applications meet energy needs, create job opportunities, and contribute to sustainable development by enhancing environmental protection.

Sezen (2024) conducted a technical and economic feasibility study for a solar garage at Kocaeli University Uzunçiftlik Nuh Çimento Vocational School. The system was projected to generate approximately 55 MWh of electricity annually, resulting in a total income or savings of 183,967 TL.

Martin (2024) simulated the installation of a rooftop solar energy system at Kahramanmaraş İstiklal University Elbistan Vocational School. The system was estimated to produce 225,459 kWh of electricity annually, with a payback period of approximately seven years.

Bağrıaçık and Altınoluk (2024) designed and simulated a solar house in Muğla using the PvSol program. The system met the house's average daily energy requirement of 6.4 kWh using 14 half-cut monocrystalline panels.

When we look at the literature, it is seen that solar energy system installation makes a significant contribution to savings in the medium and long term for businesses. In our study, we focused on determining the probability of solar panel installation to meet the energy consumed with various scenarios and compared it with the electricity costs previously consumed by the enterprise.

3. MATERIAL AND METHOD

In this section, information on the research of the saving effect of the solar energy system to be installed in an accommodation business in terms of environmental management accounting application is included.

3.1. Purpose and Importance of The Research

The purpose of this study, within the framework of environmental management accounting practices, is to determine the extent to which investments in green energy and the resulting energy savings will impact the profitability of an accommodation business. The scarcity of energy resources has driven businesses to focus on energy savings. Green energy management has emerged as a management approach that not only encourages businesses to adopt a green business model but also aligns with social responsibility principles.

In this context, the findings of this study aim to serve as a guide for academics conducting research on green energy in the hospitality sector and to provide significant contributions to the industry by demonstrating the importance and positive returns of green energy investments. The results will highlight how such investments can enhance both environmental sustainability and financial performance in the accommodation sector.

3.2. Research Methodology

The study employs the case study method, a quantitative research approach, and the data used pertain to an accommodation business located in the Kemer district of Antalya, Turkey. Due to commercial ethics, the specific details of the business are not disclosed.

The case study method, which is one of the quantitative research methods, is a technique that aims to analyze a specific phenomenon in depth and systematically. In this method, the researcher usually focuses on a limited number of case and analyzes these cases through quantitative data (Yıldırım & Şimşek, 2021).

4. APPLICATION

The accommodation business analyzed in this study is a five-star facility operating in the Kemer district of Antalya. The roof area of the facility, which is designated for the solar energy system installation, is 1,000 m². Solar panels with capacities of 200 Wh, 250 Wh, and 1,000 Wh will be installed on this roof.

Solar energy, which serves as the foundation for many renewable energy sources, is the radiant energy produced by the fusion process occurring in the sun's core. The energy production of a solar module depends not only on its structural design but also on external factors. Key factors influencing the efficiency of solar modules include solar radiation, cell temperature, and shading values (Çelikdemir & Özdemir, 2023). These factors must be carefully considered during the design phase to optimize energy production.

The table below presents the solar radiation values for the Kemer region in Antalya, which are critical for evaluating the potential efficiency of the solar energy system.

Table 3. Solar Radiation Values of The Region

Installed power	200 kWp-250 kWp-1000 kWp
DNI (Direct Normal Irradiation)	1782.8
GHI (Global Horizontal Irradiation)	1764.5
DIF (Diffuse Horizontal Irradiation)	660.9
GTI_opta (Global Tilted Irradiation at optimum angle)	1989.7

Based on the values in the table, the amount of energy to be obtained annually from a solar module is estimated using the following equation (Çelikdemir and Özdemir, 2023: 102).

$$E_e = A_{tp} \cdot A_v \cdot \eta_f \cdot P_R \cdot GHI$$

Here is the annual electricity production of the solar module (kWh/year), te total area of the solar module (m2), the vailability of the solar module, the effciency of the solar module, the losse (tmperature, shading, transmission, etc.), and the annualglobl horizontal radiation (kWh/m2). The annual efficiency of solar modules varies regionally. The hourly variation of the direct normal irradiation value per unit square meter of the operating location examined in the study was obtained as shown in Table 4. Three different scenario situations were analyzed for the determined location. The calculated data in this table are important in determining the amount of energy to be produced by solar panels.

Table 4. Hourly Variation of Direct Normal Irradiation Per Unit Area (Wh/M2)

Hour/Month	January	February	March	April	May	June	July	August	September	October	November	December
0 - 1												
1 - 2												
2 - 3												
3 - 4												
4 - 5												
5 - 6				11	86	150	85	17				
6 - 7			39	182	286	374	343	255	190	64	6	
7 - 8	66	145	278	335	411	509	496	448	445	348	218	78
8 - 9	303	349	407	424	494	606	603	564	560	475	404	313
9 - 10	402	429	473	464	540	660	679	638	621	534	485	409
10 - 11	447	453	492	483	544	677	720	677	642	555	507	441
11 - 12	447	451	482	479	530	669	729	686	633	537	498	439
12 - 13	421	434	460	464	507	640	712	665	609	520	488	416
13 - 14	393	415	433	445	496	620	682	637	581	495	456	388
14 - 15	361	388	411	410	470	590	647	597	536	453	401	349
15 - 16	296	338	352	359	428	539	594	545	472	371	285	214
16 - 17	63	198	288	293	354	467	513	451	362	114	30	6
17 - 18			55	156	249	366	389	285	59			
18 - 19					36	102	105					
19 - 20												
20 - 21												
21 - 22												
22 - 23												
23 - 24												

Using the data in Table 4, the amount of energy to be produced in the region using solar panels with different installed power values is calculated. In this context, 3 different scenario situations were analyzed for the location determined in the study. These scenario situations were determined as (Scenario 1- S1) 200 kWp, (Scenario 2- S2) 250 kWp, and (Scenario 3- S3) 1000 kWp, respectively. In this case, the amounts of energy to be produced in the region for each scenario are given in Figure 1, Figure 2 and Figure 3 according to the months, respectively.

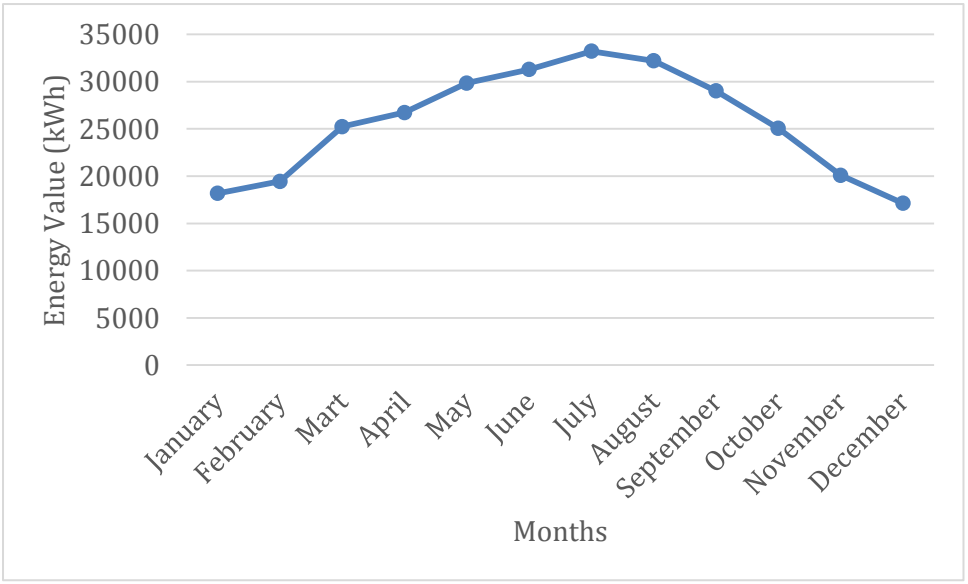

Figure 1. Graph of monthly average energy produced (S1-200Wh)

According to Scenario 1 (S1), the lowest direct normal radiation value is 17121.8 kWh in December and the highest energy production is 33217.8 kWh in July.

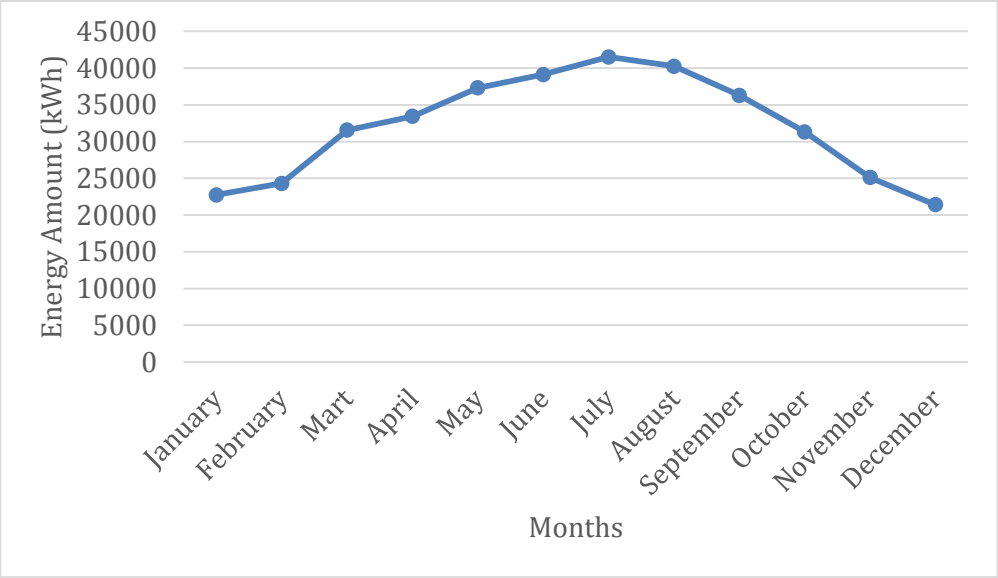

Figure 2. Graph of monthly average energy produced (S2-250Wh)

According to Scenario 2 (S2), the lowest direct normal irradiation value is 21402.3 kWh in December and the highest energy production is 41522.3 kWh in July.

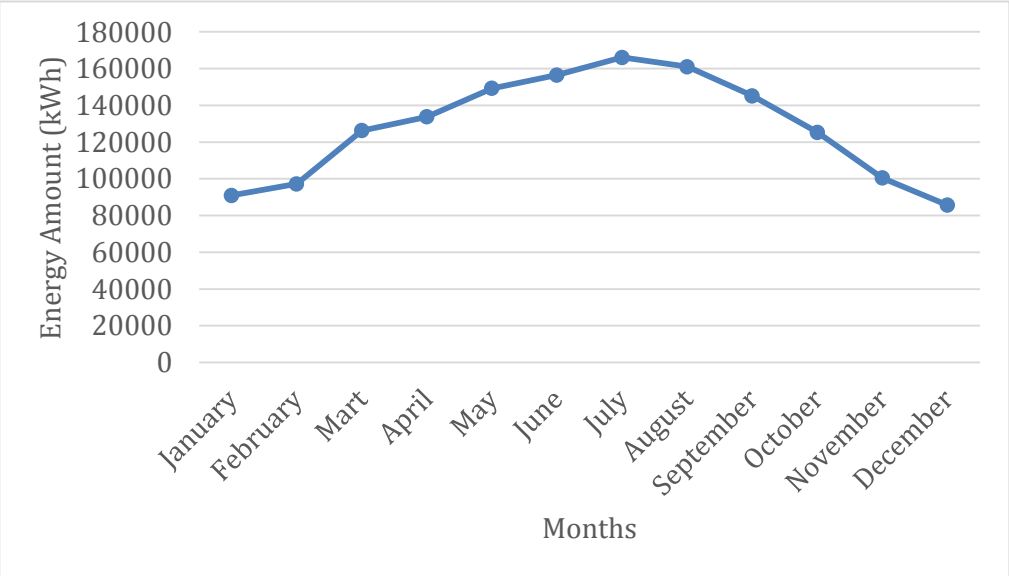

Figure 3. Graph of monthly average energy produced (S3-1000Wh)

According to Scenario 3 (S3), the lowest direct normal irradiation value is 85609.2 kWh in December and the highest energy production is 166089 kWh in July. The total realised electricity consumption amounts and amounts for the months of June, July and August between 2018-2022 are given in Table 5.

Table 5. Realized Electricity Consumption Values of The Enterprise By Years

Years	Months	Total Consumption Amount (Kwh)	Total Amount (TL)	Number of Accommodation (Person)
2018	June	808,920	356.978	45.118
	July	1.002.960	442.460	51.199
	August	1.038.240	498.409	51.691
2019	June	834.120	579.405	46.091
	July	982.800	670.039	51.764
	August	1.027.368	666.983	52.787
2020	June	56.991	47.021	0
	July	342.358	281.280	4.228
	August	843.551	602.154	25.150
2021	June	589.419	546.992	27.627
	July	990.046	1.032.635	40.721
	August	1.026.017	1.100.499	37.383
2022	June	773.931	2.538.169	39.081
	July	948.447	3.164.664	44.228
	August	998.604	4.267.029	45.604

In Table 5, consumption values are given by year, and this information was obtained from the electricity invoices for the months of June, July, and August between 2018 and 2022, and the information obtained from the company and added to the table. According to Table 5, it is seen that there has been an increase in invoice amounts over the years. In the 2020 pandemic year, it was observed that there were serious decreases in consumption values compared to the same months of the previous year. This is due to the serious decrease in the number of accommodation during the pandemic period.

The investment costs related to the solar energy modules to be installed on the roof of the existing accommodation business are calculated as follows. The Turkish Lira equivalent of this calculated investment cost was calculated based on the dollar exchange rate on 7 October 2024 (1$ = 34.25 TL).

Table 6: Solar Module Investment Cost

Module	Amount (Dollar)	Amount (TL)
S1- 200wh	13.000	445.250
S2- 250wh	16.250	556.562,5
S3- 1000wh	65.000	2.226.250

After calculating the total production amounts to be obtained from the solar modules to be installed in the enterprise, the ratios to the energy amounts consumed in the holiday seasons in 2018-2022 were calculated. These calculated values are given in column 4 and TL equivalent in column 5 of Table 7 for S1, similarly in column 7 and TL equivalent in column 8 of Table 7 for S2 and finally in column 10 and TL equivalent in column 11 of Table 7 for S3.

Table 7. Coverage Values of Realized Energy Consumption According to Scenarios

Years	Months	S1	Ratio	TL	S2	Ratio	TL	S3	Ratio	TL
2018	June	31428,1	3,89	13869,28	39285,1	4,85	17336,59	157140	19,42	69346,37
	July	33276,7	3,32	14680,16	41595,8	4,147	18350,16	166383	16,58	73400,69
	August	32331,5	3,11	15520,80	40414,4	3,89	19401,01	161658	15,57	77604,07
2019	June	31428,1	3,77	21830,91	39285,1	4,70	27288,62	157140	18,83	109154,5
	July	33276,7	3,39	22686,90	41595,8	4,23	28358,58	166383	16,92	113434,4
	August	32331,5	3,15	20990,10	40414,4	3,93	26237,65	161658	15,73	104950,6
2020	June	31428,1	55,15	25930,07	39285,1	68,93	32412,57	157140	275,72	129650,3
	July	33276,7	9,72	27340,01	41595,8	12,14	34174,95	166383	48,59	136699,9
	August	32331,5	3,83	23079,27	40414,4	4,79	28849,11	161658	19,16	115396,5
2021	June	31428,1	5,33	29165,87	39285,1	6,66	36457,32	157140	26,66	145829,3
	July	33276,7	3,36	34708,17	41595,8	4,20	43385,13	166383	16,80	173540,6
	August	32331,5	3,15	34678,55	40414,4	3,93	43348,22	161658	15,75	173393
2022	June	31428,1	4,06	103070,98	39285,1	5,07	128838,6	157140	20,30	515354,6
	July	33276,7	3,51	111033,69	41595,8	4,38	138791,9	166383	17,54	555167,8
	August	32331,5	3,24	138152,31	40414,4	4,04	172690,5	161658	16,18	690762,4
Average			**7,46**			**9,32**			**37,3**	

For Scenario 1, approximately 7.46% of the energy consumed by the enterprise during the holiday season (2018–2022) can be met through solar power plants. This corresponds to a cost saving of 636,737.1 TL. Similarly, for Scenario 2, 9.32% of the energy consumed during the same period can be met through solar power plants, resulting in a saving of 795,920.9 TL. Finally, for Scenario 3, 37.3% of the energy consumed during the holiday season can be met through solar power plants, corresponding to a saving of 3,183,685 TL. These results demonstrate that significant savings can be achieved by the enterprise when these rates are taken into consideration.

CONCLUSION AND DISCUSSION

Businesses incur various environmental costs during their operations, which place an additional burden on their operating budgets. These costs, particularly those associated with mitigating the negative environmental impacts caused by the business, can adversely affect profitability. As a result, businesses have sought ways to reduce environmental costs. Efforts to use limited resources more efficiently have led to the widespread adoption of energy-saving practices. In this context, businesses have increasingly participated in green energy programs. Through these programs, enterprises aim to reduce energy costs and minimize resource waste.

In the tourism sector, environmental activities hold greater importance compared to other industries. Neglecting environmental practices in this sector can result in significant economic damage. If environmental concerns are not prioritized, accommodation businesses are likely to suffer the most.

This study aimed to evaluate the potential savings from meeting the energy needs of an accommodation business in Antalya's Kemer district using solar energy systems. Additionally, the applicability and cost analysis of the solar energy system were conducted. The energy

consumption data required for the calculations were obtained from the enterprise, and the calculations were performed and modeled using the Matlab 2023a program.

The study evaluated the installation of solar energy panels, a renewable energy source, on the roof of an accommodation business and analyzed the resulting savings. Scenarios were developed for installing 200 Wh, 250 Wh, and 1000 Wh solar panels on the roof of the business. The cost savings achieved under these scenarios were compared with the electricity costs previously incurred by the enterprise. Based on the findings, the following results were obtained:

- The average percentage of energy consumption covered during the holiday season (2018–2022) was calculated as approximately 7.46% for the 200 Wh solar panel installation, 9.32% for the 250 Wh solar panel installation, and 37.3% for the 1000 Wh solar panel installation.

- In monetary terms, the savings achieved from 2018 to 2022 were approximately 636,737.1 TL for the 200 Wh solar panel, 795,920.9 TL for the 250 Wh solar panel, and 3,183,685 TL for the 1000 Wh solar panel.

The results indicate that the installation of solar energy panels can provide significant cost savings for the enterprise. In this context, the use of such renewable energy resources is expected to yield substantial savings in the short and medium term. Therefore, it is recommended that accommodation establishments take full advantage of this resource and that senior managers adopt a more proactive and sensitive approach to this issue.

Furthermore, when similar studies are conducted using more precise data, it is anticipated that even greater savings can be achieved. For instance, the integration of smart systems or hybrid renewable energy systems (e.g., wind turbines combined with solar panels) is predicted to result in higher levels of energy efficiency and cost savings. It should not be overlooked that solar energy efficiency can vary depending on geographical location, climatic conditions, and the duration of sunlight throughout the year. Therefore, the results obtained from applications in different climates and regions may differ.

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