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Eliminating the Carbon Emissions in Hotels due to Energy Use in the Island of Crete, Greece: A SWOT Analysis

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Abstract
Hotel buildings utilize large amounts of energy meeting their energy needs in heat, cooling and electricity. They mainly utilize fossil fuels and grid electricity while the use of renewable energies is rather limited. Tourism industry is well developed in Crete, Greece hosting an increasing number of visitors every year. The elimination of carbon emissions in hotel buildings improves their environmental sustainability and increases their attractiveness to environmentally conscious tourists. Solar energy is abundant in Crete, Greece while it is currently used for heat production with solar thermal systems and for electricity generation with solar photovoltaic systems. The combined use of solar thermal energy, solar photovoltaic energy and high efficiency heat pumps can meet all the energy requirements in Cretan hotels eliminating their carbon emissions due to energy use. Additionally, offsetting any remaining carbon emissions can assist in their complete decarbonization. A SWOT analysis regarding the decarbonization of the hotel industry in Crete has been implemented indicating its strengths and opportunities revealing also its weaknesses and threats. The results of the current study could be useful to hotel owners, to public authorities in Crete and to energy companies dealing with installation of benign energy systems.

Keywords: Carbon Emissions, Carbon Offsetting, Crete-Greece, Energy, Renewable Energies, SWOT Analysis

1. Introduction

Hotels like other tourism enterprises utilize energy in their daily operations emitting undesired and harmfull greenhouses gases (GHG). The need to mitigate climate change requires the elimination of GHG emissions in hotels [1, 2, 3]. This can be achieved with the reduction of their energy consumption and the replacement of fossil fuels with zero-carbon energy sources [4, 5]. Several energy saving techniques and renewable energy technologies can be used in hotels for covering their energy requirements [6, 7, 8]. Additionally, the offsetting of carbon emissions with the existing mechnisms can help hotels to eliminate their total carbon emissions [9, 10]. The tourism industry in the island of Crete, Greece is nowadays well-developed and growing. However, it mainly uses conventional fuels for meeting their energy requirements while the use of renewable energies is rather limited. Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis is a methodological tool which helps organizations to make strategic decisions. In several cases SWOT analysis has been used in tourism industry [11, 12, 13].

The aim of the current work is to conduct a SWOT analysis regarding the elimination of carbon emissions due to energy use in hotels in the island of Crete, Greece.

The text is structured as follows: After the literature survey the tourism industry in Crete is stated followed by a short survey of energy consumption and carbon emissions in hotels. In the next three sections the energy saving technologies, the use of renewable energies and the possibility of offsetting carbon emissions in hotels are mentioned. After that the elimination of carbon emissions in hotels and a SWOT analysis regarding hotels' initiative to eliminate their carbon emissions are presented. The text ends with discussion of the findings, the conclusions drawn and the citation of the references used.

The text is innovative since there are limitied studies so far regarding SWOT analysis in hotels in Crete while it fills the gap regarding the elimination of carbon emissions in Cretan hotels. The results could be useful to hotel owners, to policy makers, to energy companies and to stakeholders of the local tourism industry.

2. Literature survey

A report related to decarbonization of hotels has been published [1]. The report stated that hotels should reduce their carbon footprint by 66% until 2030 and by 90% until 2050. It is also mentioned that the energy cost in hotels represents around 3-6% of their operating cost while the energy consumption contributes at around 60% in their carbon footprint. A report regarding the decrease in GHG emissions in the hotel sector in EU has been published [2]. The report stated that tourism can be considered as an economic sector highly sensitive to climate change while it contributes in GHG emissions which are one of climate change causes. Tourism has significant contribution to GHG emissions especially due to transportation and accommodation. The development of hotels with net-zero carbon emissions in the Mediterranean region has been studied [3]. The author stated that hotels using solar thermal energy, solar photovoltaic (solar-PV) energy and high efficiency heat pumps can eliminate all their carbon emissions due to energy use. The energy consumption and the carbon emissions in three small-size hotels in Crete, Greece have been evaluated [4]. The author stated that their annual energy consumption was in the range of 37.80 kWh/m^2 to 120 kWh/m^2. He also mentioned that one hotel had negative carbon emissions, the other zero carbon emissions while the third had low carbon emissions. The difficullties in reducing the carbon footprint in hotels have been examined [5]. The author conducted interviews with hotel executives to understand their opinion on this issue. He identified several barriers related to the reduction of carbon footprint in hotels including: lack of understanding, lack of owner initiative, difficulties with measurement, lack of stakeholders' coordination and support, lack of a strong mediator, balancing interests and risky investment. The use of renewable energies in hotels has been explored [6]. The authors stated that many hotels have adopted renewable energies and green practices to promote their sustainability. The adoption of renewable energy innovations among hoteliers in Portugal has been studied [7]. The authors stated that the adoption level of renewable energies in hotels is low due to unfavorable market factors. They mentioned that the most important factor for installing renewable energy systems in hotels is the market conditions. The use of renewable energies in hotels through the EU funded project HOTRESS has been investigated [8]. The authors examined the use of five renewable energy technologies including solar thermal, solar-PV, solar passive, biomass and geothermal energy in five EU regions. The role of carbon offsets in achieving carbon neutrality in hotels has been studied [9]. The author stated that carbon markets assist organizations to reduce their carbon foorprint by purchacing carbon credits. She mentioned that hotels' claims regarding carbon neutrality can be exaggerbated. A carbon offsetting program used in a hotel has been examined [10]. The authors stated that hotels can offset their carbon emissions. They mentioned that carbon offsetting programs in hotels include their participation in reforestation and renewable energy projects in developing countries. The methodology to conduct a SWOT analysis in hotels has been described [11]. It is stated that the core elements of an effective SWOT analysis in hotels comprise: a) physical attributes, b) customer service operations, c) technology stack, and d) future initiatives. A SWOT analysis in state-owned hotels in Egypt has been conducted [12]. The authors stated that governmental hotels are facing a lot of obstacles. Studying Mansure University hotel and using SWOT methodology the authors proposed several improvements to enhance their services and operability. The SWOT analysis and the competition approach in hotels in Guangzhou, China have been studied [13]. The authors stated that the commonly used competition methods include: a) strategicall alliances, b) creation and innovation, c) hotel expansion, d) human resources enhancement, e) quality imoprovement, f) marketing strategy, and g) social awareness. A report regarding the energy use in EU hotels has been published [14]. The report stated that in most hotels the annual energy use falls in the range 200-400 kWh/m^2 while their average annual energy consumption is in the range 305-330 kWh/m^2. The acceptance of carbon offsetting progarms among hospitality consumers has been investigated [15]. The authors using questioning surveys stated that carbon offsetting programs are effective in hospitality industry for achieving carbon neutrality. They mentioned that threat and efficacy variables have significant impacts on the acceptance of carbon offsetting programs. The gap between carbon offsetting attitudes and behaviors has been examined [16]. The authors stated that knowledge, trust and credibility are andecendents of carbon offsetting behavior. They mentioned that objective knowledge is more influential in forming attitudes that subjective knowledge. The evolutionary game of carbon offsets involving several tourism stakeholders has been studied [17]. The authors stated that carbon offsetting is a crucial pathway to achieve carbon neutrality in tourism industry. They mentioned that under governmental costraint mechanisms tourism enterprises and tourists can participate in carbon offsetting initiatives. The energy efficiency in hotels has been examined [18]. The authors stated that managers have high positive perception on environmental protection issues and pose high awarenes on these issues. The energy consumption in five summer operating hotels in Crete has been evaluated [19]. The author stated that the average annual energy consumption in these hotels was 149 kWh/m^2 while their average CO_2 emissions were 12.1 kgCO_2 per night spent. The behavior-based carbon footprint levy in hotels has been studied [20]. The author proposed several methodologies related to willingness of tourists to pay according to their behavior for compensating their carbon footprint. The carbon reduction strategies in tourism in Global South have been explored [21]. The author surveyed 165 randomly selected accommodation establishments in Zimbabue stating that the major sources in GHG emissions were the diesel-powered generators, the electricity use and the transportation. The possibility of reducing carbon emissions from tourism accommodations with reference the island Rhodos, Greece has been explored [22]. The authors stated that in a non-interconnected islands, like Rhodos, the carbon emissions due to energy use in hotels can be reduced up to 31% by installing solar-PV systems with net-metering regulations. The energy consumption in hotels has been estimated [23]. The author stated that luxury hotels have higher specific energy consumption than lower rate accommodation facilities. She also mentioned that key drivers in energy consumption in hotels include heat, ventilation and air-conditioning (HVAC) systems, lighting and hot water production. The energy use in hotel chains has been analyzed [24]. The authors stated that hotels should renovate their energy systems for achieving a more sustainable future. The energy

efficiency opportunities in hotels in Egypt have been studied [25]. The authors stated that the main activities requiring electricity in these hotels are air-conditioning, lighting, water heating and refrigeration. They also mentioned several measures for reducing the energy consumption in hotels. The energy consumption in hotels in the post-epidemic era has been evaluated [26]. The authors stated that hotels preventing the Covid-19 pandemic can reduce their energy consumption by about 16-29% and the average carbon emissions by about 33-39%. The enhancement of energy efficiency in hotels has been examined [27]. The authors stated that the main energy consuming operations in hotels are the HVAC system, the lighting, the hot water production and the operation of the kitchen and the swimming pool. They also stated that adopting smart technologies such as Internet of Things systems and smart HVAC control hotels can improve their energy efficiency. The literature regarding sustainable energy management in tourism industry has been reviewed [28]. The authors reviewed 201 articles published between 1977 and 2024. They stated that various guidelines have been proposed to improve energy efficiency in tourism such as the use of renewable energies while they mentioned that future research should be focused towards the use of deep learning algorithms for promoting autonomous energy management systems. An energy management model for sustainable development in hotels has been studied [29]. The authors stated that the model is based on a plan-do-check-act cycle and it is useful for service organizations. They also mentioned that their model is based on ISO-50001 standard and it was developed in sub-categories. The factors contributing in the carbon footprint of hotels in the island of Mauritius have been identified [30]. The authors analyzed data from four hotels with different ratings. They stated that the carbon footprint in 4-star and 5-star hotels was lower compared with hotels with similar rating in other countries while for 3-star hotels it was higher. The reduction of carbon emissions during green transformation in hotels has been analyzed [31]. The authors stated that the construction phase in hotels is the stage with the most life-cycle carbon emissions while high-star hotels have larger emissions than low-star hotels.

3. The Tourism Industry in Crete: A Pillar of Economic and Cultural Vitality

Crete, the largest of the Greek islands, holds a unique position in the Mediterranean not only for its rich history and stunning landscapes but also as a major hub for tourism. The island has become one of Greece's most popular travel destinations, drawing more than six millions of visitors annually. Its tourism industry plays a central role in the island's economy, supporting thousands of jobs and businesses while also preserving and promoting Cretan culture and heritage. Crete's historical and cultural richness is another cornerstone of its tourism appeal. As the center of the ancient Minoan civilization, the island boasts archaeological wonders such as the Palace of Knossos and Phaistos. Museums, monasteries, and traditional villages offer glimpses into Crete's layered past and vibrant folk traditions. Culinary tourism has also become increasingly popular, with Cretan cuisine—rooted in olive oil, fresh produce, and time-honored recipes—being celebrated for its health benefits and authentic flavors. The economic impact of tourism on Crete is profound. It contributes at around 50% of the island's Gross Domestic Product and provides employment opportunities in sectors such as hospitality, transport, retail, and food services. Many local communities rely heavily on tourism income, especially in coastal and resort areas. The industry has also spurred infrastructure development, including improvements in transportation, accommodation, and public services. However, the rapid growth of tourism in Crete has not come without challenges. Issues such as overdevelopment and overtourism in certain areas, environmental degradation, and the seasonal nature of tourism can place stress on local ecosystems and economies. During peak months, popular sites can become overcrowded, affecting both the visitor experience and the quality of life for residents. In response, there has been a growing emphasis on sustainable tourism practices. Initiatives are being introduced to protect natural areas, promote off-season travel and encourage more responsible tourist behavior. In recent years, there has also been a push to diversify Crete's tourism offerings. Agrotourism, ecotourism, and cultural tourism are gaining momentum as travelers seek more meaningful and environmentally friendly experiences. These efforts align with global trends and reflect a broader understanding that tourism should not only generate profit but also respect and enhance the local heritage and the environment. By balancing growth with sustainability, the island can continue to thrive as a leading destination while preserving its unique character for generations to come. Table 1 indicates some characteristics of the tourism industry in Crete.

Table 1: Characteristics of the tourism industry in Crete

Surface of Crete	8,336 kM^2
Length of coastline	1,040 kM
Residents in Crete (Census 2021)	617,360
Hotels in Crete (2021)	1,644
Rooms in Crete (2021)	98,547
Beds in Crete (2021)	193,928
Beds in Crete/ beds in Greece (2021)	22.1 %
Average revenue per bed (2021)	13,943 Euro
Arrivals in Crete (2023)	6,327,366 tourists
Arrivals to Crete/arrivals to Greece (2023)	17.7 %
Overnight staying in Crete (2023)	34,342,891 bed-nights
Overnight staying in Crete/overnight staying in Greece (2023)	23.3%
Average days staying in Crete (2023)	5.43 days
Number of airports for tourists' arrivals	3
Tourism intensity (2023)	55.63 bed-nights per resident
Tourism density (2023)	4,000 bed-nights per kM^2

Sources: [4]

4. Energy Consumption and Carbon Emissions in Hotels

The hospitality industry, particularly hotels, plays a significant role in global energy consumption and carbon emissions. As demand for travel and accommodation continues to rise, so does the environmental impact of hotel operations. From lighting and HVAC systems to laundry and food services, the energy demands of hotels are substantial and directly contribute to greenhouse gas emissions. Hotels are among the most energy-intensive commercial buildings, with energy used for heating, cooling, ventilation, water heating, and lighting accounting for the majority of their consumption. In luxury and full-service hotels, energy use per square meter can be significantly higher than low-rate hotels due to additional

services like spas, swimming pools, and on-site restaurants. Several studies suggest that average energy use by hotels is in the range 305-330 kWh/m^2 yr [14]. It has been reported that the annual carbon emissions in hotels is in the range of 60-70 kgCO_2/m^2 [2]. According to various studies, energy costs can represent up to 6% of a hotel's total operating budget, yet they also account for 60% of its carbon footprint [2]. Carbon emissions from hotels stem primarily from the burning of fossil fuels to generate electricity and heat. In regions where the electricity grid is powered predominantly by coal or gas, indirect emissions can be particularly high. As awareness of climate change grows, travelers are increasingly seeking eco-friendly accommodations. Therefore, adopting sustainable practices is not only a responsible choice but also a competitive advantage in the hospitality market. The transition to greener operations is essential for the industry's long-term viability and for the planet's future.

5. The Use of Energy-Saving Technologies in Hotels

Energy-saving technologies are becoming increasingly important in hotel industry as operators strive to reduce costs, improve efficiency, and promote environmental responsibility. Hotels consume large amounts of energy for lighting, heating, cooling, water heating, and operation of various appliances. By adopting modern technologies, hotels can significantly cut down on energy consumption while enhancing the guest experience. One of the most widely used energy-saving technologies in hotels is LED lighting. Compared to traditional incandescent bulbs, LED lights consume up to 80% less electricity and last much longer. Many hotels have replaced all their lighting systems with LEDs, including lobby lights, room lamps, and outdoor fixtures. Motion sensors and smart lighting systems are also being installed to automatically turn lights off in unoccupied areas. Heating, ventilation, and air conditioning systems are another major area for energy optimization. Modern HVAC systems are designed to be more efficient and can be connected to smart thermostats that adjust temperature settings based on occupancy. For example, a smart system can reduce heating or cooling in a room when it is unoccupied, saving significant amounts of energy. Water-saving technologies also play a role in energy conservation. Low-flow showerheads, faucets, and toilets reduce water consumption, which in turn lowers the energy needed to heat water. Energy management systems (EMS) are becoming popular in larger hotels. These systems monitor and control energy use throughout the building, providing real-time data and analytics. With this information, hotel managers can identify areas of waste and optimize operations. Not only do these technologies help reduce a hotel's environmental impact, but they also lower operating costs in the long term. Moreover, energy-efficient practices are increasingly valued by guests, especially those who prefer environmentally friendly accommodations. Therefore, energy-saving technologies are essential tools for hotels aiming to become more sustainable and cost-efficient. As technology continues to evolve, the integration of smart, energy-efficient solutions will become a standard in the hospitality industry. Table 2 indicates several energy saving techniques that can be used in Cretan hotels.

Table 2: Energy saving techniques that can be used in Cretan hotels

1	Passive solar techniques including green roofs
2	LED lighting
3	Motion sensors
4	Smart HVAC systems
5	Heat recovery and reuse from several equipment
6	Energy management systems
7	Double-glazed doors and windows
8	Insulation of the buildings' envelope

Sources: own estimations

6. The Use of Renewable Energies in Hotels: A Step Toward Sustainable Hospitality

As concerns about climate change and environmental sustainability continue to rise, the hospitality industry is under increasing pressure to reduce its carbon footprint. Hotels, in particular, are large consumers of energy due to heating, cooling, lighting, and operation of several devices. In response, many are turning to renewable energy sources such as biomass, solar, wind, and geothermal energy to power their operations more sustainably. The adoption of renewable energies not only helps hotels to reduce their environmental impacts but also enhances their public image and long-term profitability. One of the most common renewable energy technologies used in hotels is solar energy. Solar panels can be installed on rooftops or nearby land to generate electricity or heat water. In sunny regions, solar thermal systems can provide a significant portion of a hotel's hot water needs, reducing reliance on fossil fuels. Some hotels have even invested in photovoltaic systems large enough to meet a substantial percentage of their total energy demands. Additionally, they can install electric batteries for storing solar electricity when it is not needed in the hotel and the grid. These installations often pay for themselves over time through savings on electricity bills and can be supported by government incentives or subsidies. Wind energy, though less common than solar in the hospitality sector, is also gaining traction in areas with consistent wind conditions. Some coastal or rural hotels have installed small-scale wind turbines to supplement their energy supply. While the upfront costs and regulatory challenges can be significant, the long-term environmental and economic benefits are appealing for eco-conscious hotel operators. Geothermal energy is another renewable option, particularly for heating and cooling systems. By using the earth's constant underground temperature, geothermal heat pumps can efficiently regulate indoor climates with minimal environmental impact. Though installation requires an initial investment, the efficiency and durability of geothermal systems make them a cost-effective solution in the long run, especially for larger hotel complexes. Solid biomass can be also used in hotels located in rural areas for heat production. The benefits of using renewable energies in hotels extend beyond environmental concerns. Increasingly, travelers are seeking eco-friendly accommodations and are willing to pay a premium for sustainability. Many international hotel chains now promote their green initiatives as a key part of their marketing strategies, highlighting their use of clean energy, water-saving measures, and waste-reduction programs. However, challenges remain. The initial capital required for renewable energy systems can be a barrier,

especially for smaller or independent hotels. There may also be technical limitations depending on location, weather conditions, and building infrastructure. To overcome these obstacles, hotels can explore options such as leasing renewable energy systems, joining local green energy cooperatives, or partnering with governmental programs aimed at promoting sustainability in tourism. Table 3 indicates the renewable and low-carbon energy technologies that can be used in Cretan hotels.

Table 3: Renewable and low carbon emission technologies which can be used in Cretan hotels

S. No	Energy used	Generated energy	Energy system
1	Solar thermal energy	Heat	Solar thermal collectors
2	Solar-PV energy	Electricity	Solar photovoltaic modules
3	Wind energy	Electricity	Wind tourbines
4	Solid biomass	Heat	Burning systems
5	Ambient heat and electricity	Heat, cooling	Heat pumps
6	Electricity	Electricity	Electric batteries
7	LPG	Heat, electricity	Co-generation systems

Source: Own estimations

Therefore, the use of renewable energies in hotels represents a vital step toward creating a more sustainable and responsible tourism industry. While there are challenges to implementation, the long-term benefits—for the environment, for business operations, and for public image-are considerable. As technology advances and awareness grows, renewable energy is poised to become a standard feature in the hotels of the future.

7. Offsetting Carbon Emissions in Hotels: A Step Toward Sustainable Hospitality

One of the key strategies now being adopted is carbon offsetting—a method of compensating for emissions by investing in environmental projects that reduce or capture greenhouse gases elsewhere. Carbon offsetting allows hotels to balance their unavoidable emissions by supporting initiatives such as reforestation, renewable energy projects, or methane capture programs. These efforts do not eliminate emissions at the source, but they contribute to an overall reduction of carbon in the atmosphere. For example, a hotel that calculates its annual carbon output can purchase certified carbon credits that go toward planting trees or building wind farms. Many hotels now offer guests the opportunity to offset the carbon footprint of their stay. This might involve adding a small optional fee during booking, which is then directed toward environmental projects. These initiatives not only help reduce the hotel's overall environmental impact but also engage environmentally conscious travelers who want to make more sustainable choices. Offsetting programs are most effective when combined with direct reduction strategies, such as energy efficiency, renewable energy use, and sustainable sourcing. Leading hotel chains are taking a comprehensive approach—reducing emissions where possible and offsetting the rest. Transparency and third-party verification are also crucial to ensure that carbon offset funds are used effectively and credibly. Despite some criticism that offsetting can be a way to avoid real change, when implemented responsibly, it can play an important role in the transition toward greener hospitality. It allows hotels to take immediate action while longer-term sustainability efforts are being developed. Therefore, carbon offsetting offers a practical and impactful way for hotels to mitigate their environmental impact. While not a complete solution, it is a valuable part of a broader sustainability strategy, helping the hotel industry move toward a low-carbon future. Table 4 indicates several types of projects that can be partly financed by Cretan hotels offsetting their carbon emissions.

Table 4: Several types of projects that can be partly financed by Cretan hotels offsetting their carbon emissions

	Type of Project
1	Development of a large solar-PV system
2	Development of a large wind farm
3	Development of a large hydro-electricity system
4	Development of a forest conservation project
5	Development of a reforestation project
6	Development of a methane capture projecrt
7	Development of an energy efficiency project

Source: own estimations

8. Eliminating Carbon Emissions from Energy Use in Hotels: A Path to Net-Zero Hospitality

In the face of climate change and growing environmental awareness, eliminating carbon emissions has become a central goal for sustainable hospitality. The achievement of net-zero emissions due to energy use in hotels requires:

1. The reduction of their energy consumption,
2. The production of carbon-free green energy at least equal to the energy consumed by conventional fuels. The green energy can be generated either on-site or off-site by renewable energies and low-carbon emission technologies, and
3. The offsetting of any remaining carbon emissions via the existing carbon offsetting mechanisms.

8.1 Energy Efficiency Measures

Reducing energy consumption through efficient technologies is another key step. Modern HVAC systems, LED lighting, motion sensors, and energy-efficient appliances can dramatically cut electricity use without compromising comfort. Smart thermostats and building management systems allow hotels to monitor and optimize energy usage in real time. By using less energy, hotels reduce both emissions and operating costs that is a win-win game for business and the environment.

8.2 Green Building and Retrofitting

Hotels can further reduce emissions by adopting green building practices. New constructions are increasingly being designed to meet international green standards, such as LEED (Leadership in Energy and Environmental Design). Older buildings can be retrofitted with insulation, double-glazed windows, and energy-efficient infrastructure to minimize energy waste. These investments lead to long-term environmental and financial benefits.

8.3 Transitioning to Renewable Energy Sources

One of the most effective ways to eliminate carbon emissions related to energy use is by transitioning to renewable energy sources. Solar power is increasingly popular among hotels, especially in sunny regions such as Crete. Photovoltaic panels can generate clean electricity, while solar thermal systems can provide hot water for

showers, pools, and laundry. Some hotels also purchase green energy directly from renewable energy providers or invest in wind and geothermal technologies where feasible. Additionally, they can participate in local energy cooperatives generating green electricity offsetting the grid electricity use. These clean energy options replace fossil fuel-based electricity and significantly reduce carbon footprints.

8.4 On-Site energy Generation and Storage

Some hotels are going beyond simply purchasing clean energy by generating and storing energy on-site. Installing battery storage systems allows hotels to store solar energy for use during peak hours or cloudy days. Combined with smart energy management, on-site electricity generation and storage help hotels become more self-sufficient and less reliant on carbon-intensive grids.

8.5 Offsetting as a Short-Term Measure

While the goal is to fully eliminate carbon emissions from energy use, offsetting remains a short-term tool to bridge the gap. Carbon offsets involve investing in environmental projects that remove or reduce greenhouse gases elsewhere, such as reforestation or renewable energy projects. Though offsets are not a long-term solution, they can help hotels take immediate action while they transition to cleaner energy sources.

Eliminating carbon emissions from energy use in hotels is both a moral responsibility and a business imperative. As travelers increasingly seek sustainable accommodations, hotels that invest in clean energy, efficiency, and innovation will not only protect the environment but also gain a competitive edge. By embracing renewable energy, optimizing consumption, and planning for long-term sustainability, the hotel industry can lead the way toward a net-zero carbon future without compromising the quality of guest experiences.

9. SWOT Analysis of Hotels Initiative to Eliminate Carbon Emissions

Hotels planning to eliminate their carbon emissions due to energy use by developing energy-saving technologies, transitioning to renewable energy, and offsetting residual emissions demonstrates a forward-thinking approach. A SWOT analysis can provide a structured evaluation of this initiative, helping hotels navigate the clean energy transition more effectively.

9.1 Strengths

One of the key strengths of this initiative is improved brand image and customer loyalty. As environmental consciousness grows among travelers, hotels committed to carbon neutrality can attract eco-minded guests. This can differentiate the hotel in a competitive market and lead to increased bookings, especially from environmentally conscious consumers, corporate clients, and travel groups seeking sustainable accommodation. Another strength is the potential for long-term cost savings. Although the upfront investment in energy-efficient technologies and renewable systems like solar or wind is high, they significantly reduce energy bills over time. Furthermore, this initiative supports regulatory compliance and risk management. As governments tighten environmental regulations, being proactive in sustainability ensures the hotel stays ahead of compliance requirements. It also positions the hotel favorably in potential ESG (Environmental, Social, and Governance) assessments, making it more appealing to investors and partners. The clean energy transition in hotels contributes in the increase of investments and in new jobs creation affecting positevely the local stakeholders and society. Additionally, hotels eliminating their net carbon emissions contribute positevely to climate change mitigation while reducing their dependence in fossil fuels and in grid electricity increases their resilience in unexpected and harmful climate catastrophes.

9.2 Weaknesses

However, the plan is not without weaknesses. The most prominent is the high initial capital expenditure. Retrofitting buildings, installing renewable energy systems, and developing energy-saving technologies require substantial investments. For small or independent hotels, accessing the necessary funds might be a challenge. Technological and operational complexity is another potential weakness. Managing the shift to carbon neutrality involves multiple layers: energy audits, procurement of green technology, staff training, and maintenance. Without proper expertise or external consultancy, implementation may face delays or inefficiencies. Additionally, carbon offsetting, while useful, can be controversial if not handled transparently. Offsets must be credible and verifiable; otherwise, hotels risk accusations of greenwashing, which could damage their reputation.

9.3 Opportunities

The initiative opens numerous opportunities for hotels. First, there's a growing market for green tourism. Travelers, especially from younger generations, prioritize sustainable choices. By achieving carbon neutrality, hotels can market themselves as eco-friendly destinations, tapping into this expanding segment. Moreover, there are government incentives and grants available for green building upgrades, renewable energy installations, and carbon reduction projects. Taking advantage of these can reduce financial burdens and improve the return on investment. The project also fosters innovation and leadership. By adopting and potentially developing new energy-saving technologies, hotels can position themselves as industry leaders in sustainability. This leadership can result in partnerships with green technology firms, certifications from environmental bodies, and recognition in sustainability awards, all contributing to greater visibility and prestige. Reducing their energy consumption and generating their own green energy hotels will not be affected by future increases in grid electricity's and fuels' prices. Finally, the shift aligns with global movements toward the United Nations Sustainable Development Goals (SDGs), particularly SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action). This alignment can enhance hotels' appeal to global travelers, Non Governmental Organizations, and multinational companies seeking SDG-compliant service providers.

9.4 Threats

Despite the positives, several external threats could impact the success of this initiative. The most notable is market volatility in renewable energy and technology costs. If equipment prices rise or supply chains are disrupted, implementation may be delayed or become more expensive.

Changing regulations and certification standards also pose a threat. As definitions of carbon neutrality evolve, especially regarding carbon offset credibility, hotels may need to continuously update their practices to remain compliant and trustworthy. Another concern is resistance to change—both from within the organization and from customers. Staff may need retraining, and there may be disruptions during retrofits. Guests might also resist some sustainability changes, like altered air conditioning settings or the absence of certain amenities to reduce energy use. Finally, greenwashing skepticism presents a reputational threat. Without clear communication, third-party verification, and transparency, even well-intentioned efforts can be misunderstood or mistrusted by the public. Table 5 indicates the SWOT analysis for the clean energy transition of Cretan hotels.

Table 5: SWOT analysis for the clean energy transition of Cretan hotels

Strengths	Weaknesses
a) Improved brand image and customer loyalty b) Long-term cost savings in energy bills c) Regulatory compliance in ESG assessment and risk management d) Contribution in the mitigation of climate change e) Improvement of their adaptation to climate change f) Improvement of their image in the local society due to increase in energy investments and in new jobs creation	a) High initial capital expenditure b) Technological and operational complexity c) Lack of qualified personnel to supervize and maintain the green energy systems d) Carbon offsetting can be controversial if not handled transparently
Opportunities	**Threats**
a) Benefits from the growing market for green tourism b) Benefits from government incentives and grants regarding green energy investments c) Promotion of innovation and leadership d) Hotels will not be affected by future increases in fuels' and electricity's price e) Compliance with United Nations Sustainable Development Goals	a) There is market volatility in the cost of renewable energy equipment and technologies b) Changing regulations and certification standards c) Resistance to change in organizations and clients d) There is greenwashing skepticism presenting a reputational threat

Source: own estimations

10. Discussion

The elimination of the carbon footprint in hotels in Crete has been studied and the strengths, weaknesses, opportunities and threats have been analyzed. Several opportunities have been identified as well as the benefits regarding the elimination of their carbon footprint due to energy use. The steps for the clean energy transition in Cretan hotels were presented including the use of energy saving techniques and renewable energy technologies as well as the offsetting of any remaining carbon emissions. The internal barriers hindering the adoption of clean energy technologies in hotels have been also mentioned. The abundance of solar energy in Crete facilitates its use for heat and electricity generation in hotels. Additionally, heat pumps powered with solar electricity can be used for heat and cooling generation. Eliminating carbon emissions in hotel operations is both a challenging and rewarding endeavor. Through energy-saving technologies, renewable energy adoption, and credible offsetting, hotels can enhance their reputation, reduce costs, and contribute positively to global climate goals. However, to ensure the initiative's success, hotels must strategically manage financial, operational, and reputational risks. A clear roadmap, stakeholder engagement, and transparent reporting will be essential as it transitions toward a carbon-neutral future. Our results are subjective dependent on our personal view and our bias while the activities for the clean energy transition in hotels are not prioritized. Future work should be focused on a PESTEL analysis regarding the elimination of carbon emissions in Cretan hotels and compare the results with the results of the present study.

11. Conclusions

A SWOT analysis regarding the elimination of carbon emissions due to energy use in hotels in the island of Crete, Greece has been conducted. The energy saving techniques, the use of renewable energies and the offsetting of any remaining carbon emissions have been examined. The achievement of net-zero emissions due to energy use in hotels requires:

1. The reduction of their energy consumption,
2. The production of carbon-free green energy at least equal to the energy consumed by conventional fuels. The green energy can be generated either on-site or off-site by renewable energies and low-carbon emission technologies, and
3. The offsetting of any remaining carbon emissions via the existing carbon offsetting mechanisms.

During the SWOT analysis the strenghts, weaknessses, opportunities and threats related to the elimination of the carbon footprint due to energy use in Cretan hotels were analyzed. It is concluded that there are several strengths and opportunities for the achievement of carbon neutrality in hotels while there are also various weaknesses and threats hindering the elimination of their carbon footprint.

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