

ENERGY EFFICIENCY IN THE SERBIAN HOTEL INDUSTRY: THE CASE OF *SAINT TEN HOTEL*

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Abstract

The aim of this article is to point out the possibilities for increasing energy efficiency available to hotels in Serbia, as well as to determine business segments in which significant energy savings can be achieved, but not to the detriment of service quality and hotel guest satisfaction. Starting from the hypothesis that the growth of energy efficiency leads to significant savings in operating costs, we analyse energy savings opportunities on the example of *Saint Ten Hotel* from Belgrade. The conducted research confirmed that significant savings could be achieved in the segments of air extraction from guest rooms, air conditioning, lighting and sanitation hot water. Using the observed example, the article proposes the following measures to improve energy efficiency: (1) reduction of fresh air intake; (2) reduction of airflow; (3) reduction of temperature and transmission losses in certain premises; (4) use of renewables; and (5) energy and electricity savings.

Key words: energy efficiency, hotels, energy consumption, air conditioning, Serbia

INTRODUCTION

Sustainable development and the green economy are increasingly influencing the growth and specialization in the hospitality industry, especially in the hotel industry as a very important segment of contemporary tourism. Therefore, energy efficiency in the hotel industry is a very important area to which more attention has been paid lately. In the past three decades, the hospitality industry has grown into one of the most important global sectors, employing around 173 million people in 2019 alone (Condor Ferries, 2022). After its significant decline in 2020 (by as much as 58.5%) caused by the *Covid-19* coronavirus pandemic, the global hotel and resort market was projected to recover, with its estimated value of 950 billion U.S. dollars in 2021 (Lock, 2021). Although it makes a significant contribution to the development of many local and national economies, business and leisure tourism also pose a significant environmental and socio-cultural risk, especially because the hospitality industry typically irrationally uses large quantities of energy. Negative externalities of these types of tourism usually include greenhouse gas (GHG) emissions, pollution of water resources, land, air and waste generation,

as well as noise and overuse of food, water, energy, natural and other resources. More precisely, the rapid expansion of the hotel industry is increasingly endangering the environment because hotel services of different levels of comfort, luxury and entertainment require the consumption of huge amounts of energy (Milojković et al., 2012). The issue of increasing the energy efficiency of the hotel industry is becoming even more important in the era of global warming, climate change and ongoing global energy crisis in which there is an urgent need to move to a sustainable economy with low carbon content and efficient use of available resources. The International Paris Climate Agreement from the end of 2015 is also dedicated to solving this problem, which already directs many countries to a mandatory revision of their business models and practices. Given that tourism currently accounts for about 5% of global GHG emissions, of which hotels are responsible for about 20% of that share, the hotel industry will obviously have to adapt to this new reality (Hospitality Europe, 2019).

The initial intention of the authors of this article is to answer how and in which segments energy efficiency can affect more efficient hotel operations, but without causing negative effects on the quality of hotel offer, i.e. on guest comfort and satisfaction. To confirm this hypothesis, the case of the *Saint Ten Hotel* from Belgrade was analysed. This luxury five-star hotel is located in the very centre of the city. In general, efficient energy management is based on the requirements of the International Standard 50001 (Energy management), which, in addition to quality, ensures the satisfaction of tourists and hotel guests, guaranteeing the survival of modern hotels in the highly competitive tourism marketplace (ISO, 2022). Contemporary technologies, implemented and built into processes based on the requirements of several international standards, make a great contribution to the realization of numerous goals in this domain. Energy efficiency in the hotel industry refers to rational energy management, while it can in no way be perceived just as a sacrifice or an energy saving, since the efficient use of energy must not disrupt the desired working and living conditions. In the hotel industry, efficient use of energy implies the implementation of numerous processes related to determining the final consumers of energy, its sources and distribution flows, as well as defining measures and activities that contribute to reducing energy consumption. These processes should ensure optimal energy consumption that will contribute to the full satisfaction and meeting the needs of its end-users. It is therefore necessary to identify factors that may lead to a reduction in energy consumption, on the one hand, as well as to apply the available alternative technologies to diminish energy consumption, on the other hand.

The aim of this article is to point out the possibilities for increasing energy efficiency that are available to hotels in Serbia, as well as to determine business segments in which significant energy savings can be achieved, without compromising the quality of services and unique experience of hotel guests. These possibilities were explored on the example of Belgrade's *Saint Ten Hotel*,

where a survey of managers, employees and Hotel superintendent was conducted in order to determine useful ways to reduce energy consumption, and thus the operating costs of the Hotel. From this follows the importance of this article for contemporary hospitality science and practice of rationalizing energy use and operating costs.

LITERATURE REVIEW

Recently, a growing body of literature has been developed that is devoted to this challenging topic. The implementation of energy efficiency measures in the hotel industry aims to adapt tourism companies and destinations to the requirements of climate change, as well as to mitigate GHG emissions by supporting investments in energy efficient solutions. Their objective is also to enable the use of renewable energy sources and clean technologies (World Tourism Organization, 2022). Due to the persistent recent economic, energy, health and war crises, the hotel industry is today much more interested in environmentally friendly and cost-effective business than has ever been the case. Namely, in the light of the current energy crisis caused by the *Covid-19* coronavirus pandemic and the Ukrainian war, there was a dramatic increase in energy prices, which introduced the imperative for conducting more energy efficient business operations in the hotel industry. Today, hotels use huge amounts of energy for their daily operations and the provision of professional and recreational services, which is why in many hotel facilities energy costs are one of the largest items in their operating costs. Therefore, in addition to the use of energy efficient lighting, Soultana T. Kapiki (2010), while studying 4 and 5 star hotels in Thessaloniki, proposes the adoption of eco-labelling, the use of energy toolkits, participation in special energy saving projects, integration of wireless energy management systems and training of hotel managers and staff in order to increase profitability in this sector.

With the aim of more rational use of electricity in hotels, some authors (Barjaktarović et al., 2017) suggest regular control of electricity consumption and heating in all rooms, monitoring the consumption of HVAC (heating, ventilation and air conditioning) systems, as well as finding sources of atypical consumption and its reduction to a minimum. These authors also suggest the implementation of certain measures such as thermal insulation installation of heated spaces, reduction of ventilation and heating temperature, replacement of dilapidated windows, replacement of energy inefficient consumers with the more efficient ones, regular servicing and maintenance of HVAC systems, the use of modern systems for drip irrigation, as well as the installation of quality sanitary and air conditioners. This article has just served as a basis for conceptualizing survey questions when conducting interviews with the hotel staff of the *Saint Ten Hotel* from Belgrade. While studying the phenomenon of commodification of hotel services, Damir Pavlović (2008) points out that it is necessary to look for solutions to reduce input costs, including the growth of

energy efficiency. This author advocates the installation of insulation, design of hotel buildings with sufficient daylight, segmentation of energy supply according to established priorities, introduction of energy quotas for each floor, sensor automation, careful selection of energy sources, as well as careful monitoring of energy consumption in all hotel's business segments. He also suggests a careful calculation of the hotel service price, which should internalize the costs of environmental protection. Finally, energy efficiency in the hospitality industry can be encouraged by the increased use of renewable energy technologies and the application of passive HVAC and lighting systems, with careful and proper planning, design and management of hotel facilities (Bohdanowicz et al., 2001).

APPLIED RESEARCH METHODS

The aim of this paper is to point out the great importance of energy efficiency management, especially in the period of energy crisis. In considering the selected research subject, the desk research method was first applied in order to compare and propose concrete measures for hospitality and hotel companies. In that sense, the paper considered the sources of relevant professional literature, as well as official publications and documents, so it was necessary to perform adequate selection, processing and analysis of appropriate theoretical materials and results of previous research in this area. This is all the more important if we take into account the fact that, according to some estimates, electricity accounts for about 40% of energy consumption in contemporary hotels, of which on average about 45% is used for lighting, 26% for HVAC, 6% for water heating, 5% for food preparation and 18% for other purposes (European Commission, 2017).

After the outbreak of the *Covid-19* crisis, *Saint Ten Hotel* faced a sharp decline in the number of overnight stays, as a result of which it was forced to rationalize its business operations. This rationalization included, among other things, the reduction of energy costs. Field research was conducted by interviewing employees of the Hotel, with a working experience of more than 5 years. The manager, the hotel janitor and the employee from the Reception took part in the survey. The questionnaire included open and closed questions about the effects of energy consumption, as well as statements that the employees had to rate on a Likert scale from 1 to 10. In doing so, the authors, if necessary, clarified the questions asked to the respondents. The questions mainly related to the description of the total energy consumption in the Hotel and its segments; the Hotel standard, comfort and previous practice; the segments with the highest and lowest energy consumption; the average occupancy of the Hotel capacities; the intensity of the pool heating; the applied energy saving measures, and the corporate (management and employees) awareness of this issue. The special attention was paid to the role of education in these processes since education of managers, but also of all employees in the field of energy efficiency can

encourage reducing energy consumption in hotels. At the same time, an interview was held with them, taking into account their experience in managing this Hotel. In addition, an insight into the relevant available documentation such as electricity bills, utility bills, cost accounting records, the building's energy efficiency report and the specifications of the building's thermo-technical system (condition of installations, plants and HVAC equipment) was provided. Finally, the use of analysis and synthesis method determined those business segments in which the highest consumption of electricity was observed, but also in which there was a plenty of room for improvements.

RESULTS AND DISCUSSIONS

The current analysis of rational energy use management in the hotel industry was based on the example of the *Saint Ten Hotel* from Belgrade. The Hotel contains five bigger spaces, ideal for business meetings or conferences, which meet the highest requirements of its business guests. As a creative alternative, intended for special occasions, this hotel offers a multifunctional space on the top floor, with an open terrace. The detected areas with the highest energy consumption in this hotel included: extraction of air from guest rooms; open windows and doors of terraces in guest rooms during heating or cooling; lighting in guest rooms and major hotel premises; air conditioning of all major hotel rooms, halls and lounges in the basement, ground floor and top of the building with the negative impacts of open doors and windows, including a swimming pool; kitchen ventilation; operation of kitchen appliances; and heating of sanitary water. These findings are consistent with the conclusions of the professional literature, which argues that air conditioning, lighting, water heating, cooling, pool maintenance and cooking are the biggest energy consumers in modern hotels (Said et al., 2016). Ekechukwu and Sam-Amobi (2011) also state that hotels are among the largest energy consumers in the tertiary sector, attempting to provide their guests with a higher level of comfort and service. Unlike other commercial buildings, hotel buildings operate 24 hours a day, cover a large number of functional areas and therefore require quality installation systems that will provide appropriate thermal, visual, air quality, ambient and other benefits. Analysing the example of the observed hotel, and in accordance with the recommended literature (Barjaktarović, & Knežević, 2021), the following seven modalities and ways to improve energy efficiency in modern hotels were detected: (1) reducing the amount of fresh air through better quality control and use of timers and access sensors; (2) reducing the use of electricity for the operation of air fans; (3) space heating by reducing energy transmission losses; (4) reducing consumption and dependence on conventional fossil fuels through the use of renewables; (5) decreasing of cooling through better control and maintenance of the air conditioning system and the use of alternative cooling systems; (6) servicing, maintenance, regular cleaning and replacement of filters; and (7) focusing on *green* and

environmentally sound business modalities. The proposed solutions are also aligned with energy-efficient measures suggested by other literature sources. In this sense, Milojković et al. (2012) also advocate for the appropriate insulation of the hotel building, the use of solar, bio-thermal and biomass energy, the minimization of heat losses through adequate insulation, the maximum use of passive HVAC systems and natural lighting, as well as the application of new energy-efficient technological solutions such as heat pumps, sensors, efficient lighting etc.

The conducted analysis also pointed to the efforts of hoteliers to change this situation and thereby to increase employment, reduce operating costs, decrease waste generation and make significant improvements in preserving the environment through the appropriate treatment of energy use. Another important segment in energy management is the necessity of proactive action and education through formal and informal training programs (Petrović & Pavlović, 2018). In other words, it is necessary to educate the existing staff in the catering and hotel industry, both those who perform tasks and the hotel management, as well as to engage external professionals and experts occasionally. The importance of hotel staff education becomes all the greater if we take into account the fact that, in addition to other energy efficiency measures, it can reduce energy costs by 2% to 10%, as well as that appropriate training enables employees to detect drafts, hot water leaks, unnecessary lighting and other types of energy wastage (Cingoski & Petrevska, 2018). A number of other factors can also lead to a reduction in energy consumption in contemporary hotels. They include, for example, the following ones (Barjaktarović, et al., 2017): (1) use of appropriate user friendly automatic or manual switches; (2) application of energy consumption monitoring techniques; (3) integration of existing systems for optimal transparency; (4) conducting negotiations regarding the prices when paying for gas/oil/electricity/district heating; and (5) switching to cheaper energy sources. Additionally, Maleviti et al. (2011), while studying the problem of the high energy-intensive hotel sector in Greece, indicate that electricity is still mostly used for air conditioning, heating, lighting, operation of elevators, meal preparation and the operation of other devices. Therefore, these authors advocate for the application of broader measures and the use of wider energy sources such as the use of diesel fuel, natural gas and renewables, which would replace electricity in hotel consumption patterns.

From the consultations with the Hotel management and staff, the idea of increasing energy efficiency can be shown on the example of a specific guest room. The ideal situation could be described as follows: (1) if the room is not used, the temperature is kept in low *night* mode, while fresh air supply and TV are turned off; (2) when the guest checks in, the room is maintained at *stand by* temperature and a minimum amount of fresh air is introduced; (3) when the presence of a guest is detected (either by means of a presence sensor or a hotel card) a normal supply of fresh air is provided, the temperature is at its normal

level of comfort, while the light will turn on if it is too dark outside; (4) the exhaust fan in the bathroom will automatically increase the speed if the humidity in the bathroom is increased or if the guest turned it on manually (by way of a five-minute timer); (5) the room switches to *stand by* temperature and minimum amount of fresh air, if the guest opens the window; (6) the room switches to *stand by* temperature and the minimum amount of fresh air if the guest leaves the room, while the light and all appliances are turned off; and (7) the room eventually switches to *night* temperature and zero fresh air mode when the guest checks out and pays the bill. Relevant literature sources also recommend (Hotel Energy Solutions, 2011) the use of a "room control" mechanism that reduces energy use in rooms based on actual room occupancy, along with regulation of heating and cooling systems, the use of HVAC motors with variable frequency command, optimization and lighting control, thermal insulation of the hot water system, doors and windows, renovation of the facade, etc. The "room control" mechanism is based on the intelligent use of a "smart control room" system that connects floor and ceiling heating with Smart Home service providers. These systems enable the monitoring of all connected devices, as well as the detection of unusual levels of energy consumption, while the room temperature is regulated automatically, reliably and independently of the human factor (Betterspace, 2022). Managers from the observed Hotel believe in that cost-saving calculations indicate that a simple time program to heat a room can save even more than 40% of energy compared to a radiator valve. Standby/presence automation can reduce costs by an additional 5-10%, depending on set temperatures and standby times. Smart integration of room automation into the hotel reservation system, as provided in e.g., CentraLine HVAC, would reduce staff workload to zero, due to the automatic link between the two systems. These reservation systems are connected in different ways with CentraLine HVAC building automation systems, not only for air conditioning control, but also for power supply and shutters (UNICOM, 2022). Thus, energy consumption monitoring in itself does not achieve direct savings but allows hoteliers to perceive where and when energy is consumed, thus enabling certain improvements to be made.

In accordance with the recommendations of UNICOM staff (UNICOM, 2022), the monitoring techniques applied in the observed hotel include the following situations: (1) energy consumption is monitored from time to time in various parts of the hotel, such as swimming pool, kitchen, restaurant, guest rooms, etc.; (2) heat consumption is controlled by rooms individually to detect open doors or windows; (3) hot water consumption is observed to detect valve leaks in guest rooms or other locations; (4) the amount of cooling energy consumed in conference halls and guest rooms can be measured, for possible charging from the customer; (5) day-to-day consumption curve comparisons can lead to the identification of irregular events, all of which can lead to a reduction in energy consumption; and (6) detecting basic consumers and minimizing them.

Applying all the recommended measures in terms of reducing lighting, mechanical equipment, maintaining the HVAC system, reducing water consumption, installing control devices and insulating the building, the Hotel staff managed to achieve an average energy savings of about 20% annually (with monthly fluctuations depending on (non)heating season). In addition to all these savings, it should be borne in mind that such measures also bring improvements in the aesthetics of content and comfort levels that encourage guests to the next visit, which should certainly bring higher revenues. It is also important to note that all the implemented measures, with the exception of Hotel staff training, were fully aligned with the cited literature sources. The objective limitation of this research relates to the fact that the possibilities for increasing energy efficiency were analysed only on the example of one hotel. In addition, the staff of the *Saint Ten Hotel* from Belgrade, with the exception of the worker who works on the maintenance of the hotel facility, did not undergo training and were not sufficiently familiar with this issue. Therefore, a comparative analysis of the detected problems and ways to increase energy efficiency in a number of domestic hotels could be the subject of some other further research.

CONCLUSIONS

Research on energy use worldwide shows that only about half of the hotel facilities have operational management that rationally manages the use of this resource. It is indisputable that guests love a comfortable hotel, and therefore special care should be taken about the ways and modalities of energy use. In exchange for the money paid for their room, guests expect to have hot bath water, a fully illuminated room, and to be able to open the window, even in winter. Therefore, in hotels, energy efficiency can be related to several segments in which it comes to the fore, but not to the detriment of comfort, quality and guest satisfaction.

Analysis of the business operations of *Saint Ten Hotel* showed that energy efficiency can be improved in several ways, while this requires the several control techniques implementation that are available to hotel management. These techniques include air quality control, smart control systems' implementation in individual rooms, automatic *step back* function, frequency control for fans, low-temperature heating systems, warm air curtains for lobbies and other parts of the hotel with open doors, renewable energy for heating, cooling, enthalpy, the use of gas lamps in glazed rooms, etc. This also confirmed the initial hypothesis that the growth in energy efficiency leads to significant savings in operating costs, thus fulfilling the goal of this research. In the future, based on the current example, the hotel industry should also reorient to alternative technologies, which are available in order to reduce energy consumption, and these are: (1) solar heating/cooling plants; (2) heat pumps; (3) CHP (combined heat and power) aggregates for basic consumption; (4)

absorption cooling; and (5) the use of *free* energy sources such as wind, solar and water. The economic benefits for each of these options need to be considered and analysed individually.

The management of "Saint Ten Hotel" from Belgrade applied modern relevant available approaches to reducing energy consumption, such as monitoring the consumption of heating and cooling energy and hot water, air quality control, appropriate maintenance of the HVAC system, reducing lighting, installing control devices, fans and thermal insulation, using warm air curtains, and renewable energy. Contemporary research also points to a variety of ways to reduce energy consumption in modern hotels. Zhao et al. (2012) propose the application of special energy saving technologies such as ground source heat pumps, water and ice storage systems, and heat recovery in central air conditioners, smart energy saving technologies, green lighting technologies, and special energy saving building materials. These technologies have recently been widely used in global practice, bringing significant environmental benefits and operating cost savings. However, in addition to the application of necessary technological solutions, it is necessary to work on encouraging pro-environmental and pro-energy efficient attitudes among hotel managers, as well as on the preparation of appropriate energy management plans (EMPs) that would lead to the initiation and monitoring of energy savings. Cingoski and Petrevska (2018) especially advocate for the application of upgraded and more efficient energy saving technologies, training and changing the behaviour of employees and hotel guests, as well as for organizational change with regard to the introduction of new rules, procedures and practices that can contribute to reducing the costs of energy and utility services. In this sense, the management of *Saint Ten Hotel* itself should apply some of these recommendations on its way to a more environmentally and energetically responsible business entity.

The feasible energy savings option will be different for each hotel building because its consumption also varies depending on the size and category of the hotel, number of rooms, age and condition of the hotel building, its location, climate zone and the type of services it offers. Certain techniques, such as optimizing fresh air intake, could provide one of the shortest payback periods in most hotels. Other possible measures will vary a lot, especially for buildings whose parts are used for special purposes, such as gambling, health and recreation, and music parties. In this sense, more environmentally friendly alternatives are emerging that are based on more intensive use of renewables, passive air conditioning, energy-saving lighting methods and more sustainable practices in meeting the increasingly complex needs of contemporary hotel guests. Despite everything, energy consumption in various contemporary hotels is very diversified, which makes it difficult to define a generally acceptable method for increasing their energy efficiency. In any case, the selection of such an optimal energy efficient strategy requires a careful process of planning, analysis, design and monitoring in order to optimize energy management in the hospitality industry. Improving energy efficiency in the hotel industry brings

numerous benefits such as reduced consumption of raw materials and GHG emissions, protection of biodiversity and the environment, achieving financial and other savings, increasing competitiveness, and improving the aesthetics, comfort and unique atmosphere of the observed hotel.

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