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of the International scientific and practical conference

CURRENT TRENDS AND PROSPECTS OF INTERNATIONAL TOURISM

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ENERGY EFFICIENCY IN HOTELS – CASE STUDY HOTEL “MANASTIR BEROVO“

Abstract

This paper gives a brief overview of the current status in hotel industry in Macedonia, with particular emphasis on environmental awareness for increasing energy efficiency, presenting how hotels can become "green". A case study of the Hotel “Manastir” in Berovo presents an analysis of energy consumption and its reduction.

Guidelines are given on how appropriate implementation of the proposed measures and methodologies can significantly reduce energy costs and financial burden, indirectly reduce the production of electricity from conventional-fossil energy sources and reduce emission of harmful gases. Through several methodological approaches, this paper concludes that the concept of "green hotel" is well-known in the hotel industry in Macedonia. Good management, keeping regular records of consumption and costs over a long period of time and comparing data, can identify gaps and take appropriate measures to improve the efficiency of the hotel, thus making a benefit to the hotel and the environment, both.

Keywords: *Energy efficiency, Green hotel, Hotel “Manastir”*

INTRODUCTION

Increased demand for energy, great technological development, declining energy resources, rising energy prices or its deficit, emissions (greenhouse gases), contribute to paying special attention to energy savings. Energy efficiency occupies an important place in modern energy

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trends not only because of the limited energy resources and the increased need for them, but also because of the negative environmental impacts of the excessive use of fossil fuels. Replacement of the fossil fuels with renewable energy sources leads to a reduction in environmental pollution.

Renewable energy sources are identified as the best for achieving energy independence and environmental development. In 2015 the share of renewable energy sources was 15.9%, which is twice as much as in 2004 (Observ'Er, 2015:8). Although EU countries are investing in increasing that percentage, Macedonia is facing major problems. Macedonia is still in its initial stage when it comes to the development of alternative energy sources and the concept of sustainable development.

In order to assess how much the countries are protecting the ecosystem, the Environmental Performance Index (EPI) is calculated. According to data in 2016, Finland is at the top, Slovenia is 5th, Somalia is last, and Macedonia is ranked 50th out of 180 countries. Compared to the neighboring countries in the region, with the exception of Albania (61) and Bosnia and Herzegovina (120), all others are better ranked: Greece (21), Bulgaria (33), Montenegro (47) and Serbia (48). From 81st place in 2014, Macedonia moved to the first third of the table, which leads to the conclusion that serious measures and activities have been taken to improve the impact on the environment.

Hotels belong to the group of buildings that are one of the largest consumers of energy, which results in high operating costs. They belong to the first 5 categories of electricity consumers (food services, sales, health care and other office services are before them). Therefore, there is an inextricable link between the hotel industry and energy efficiency, so the main priority of hotel management is to focus much of its activities on reducing costs by introducing methods to increase energy efficiency and new renewable energy sources. This will protect the environment and hotels will be more environmentally friendly.

The hotel industry is currently facing a number of problems and challenges. Globalization brings new destinations and brands that compete with the existing ones. Online communication leads to strong pressure on prices that are increasingly becoming a criterion in choosing a hotel and destination. Increasing energy efficiency and reducing costs represent a necessary choice, as they can bring additional positive benefits. As hotels are one of the largest energy consumers, special attention should be paid to achieving their energy efficiency, i.e. moving to the category of "green hotels".

Tourism and the hotel business are interrelated and they are old phenomena, but the concept of a "green hotel" is quite new. Some scholars define the green hotel as an environmentally sensitive hotel that operates its business in a way that minimizes environmental degradation (Iwanowski, 2003). In the same direction, Manakotla and Jahuari (2007) define a green hotel as an accommodation facility dedicated to environmental practices, such as: savings in water, energy, waste. The adjective "green" has a double meaning - it is good for the environment and for the pockets of hotel owners.

The main goal of energy efficient hotels is to leave as little environmental impact as possible. The so-called "green hotels" cover a number of projects, such as: recycling up to 94% of waste; installation of energy efficient equipment; reducing water consumption with efficient showers; installation of solar panels; procurement of biodegradable materials, etc.

Hotels in the field of tourism have high and expensive energy requirements, especially for space heating and cooling. Lighting is the second largest energy consumer in hotels, and is probably the easiest and most economical area to reduce energy costs. Fluorescent bulbs produce four times more light per watt than ordinary bulbs and last eight to ten times longer. Solar energy is an unlimited natural resource with economic and environmental benefits. Today it is used in many new heating and lighting systems. The Sanga Saby Hotel in Sweden has solar panels installed on the roof, where the sauna is located, which provides additional heat for the pool and sauna. One of the most common ways to harness solar energy is through photovoltaic panels. Photovoltaic systems reduce electricity bills, do not emit pollutants and their maintenance is minimal.

This paper emphasizes the need for increased use of renewable energy sources and appropriate technologies for heating/cooling, lighting e.t.c. in order to meet the energy needs of hotel facilities. The development and operation of sustainable hotels requires the close and continuous collaboration of specialists from a wide range of disciplines, including civil engineers, architects, tourism specialists, mechanical engineers for systems, as well as environmental and marketing specialists.

To assess the potential energy savings in a building, one must first provide an overview of the existing energy consumption and its energy efficiency. On the other hand, the saved energy can not be estimated only from the basic analysis of energy consumed in a building, because it primarily depends on the size of the building. Therefore, the calculations with energy consumption in kWh per m^2 heated area per year give a better picture of energy efficiency. Of course, the type of building (residential building, hospital, school, hotel), climatic conditions, location of the building, which affect the energy quality of the building itself, also have an impact.

The energy balance is made based on several factors: heating, ventilation, lighting, sanitary hot water, fans and pumps, cooling systems, lighting and various other appliances.

Unlike residential buildings, hotels have a different approach, i.e. it is more useful to divide the building into separate energy zones. For example, guest rooms can be energy zone 1, office space can be energy zone 2, energy zone 3 can include cafeteria and kitchen areas, energy zone 4 can be the rooms for washing and drying of hotel equipment.

This paper, based on a specific research of a medium-sized hotel and facilities in Macedonia, points out the most appropriate methods and measures for energy conservation and energy efficiency, provides guidelines for monitoring results and savings, which can correct the methods and allows forming new ideas for hotel sustainability. Hotels as one of the main energy consumers should be treated responsibly by all structures involved in the process of maintaining life expectancy and quality of life in them.

HOTEL INDUSTRY IN MACEDONIA

According to the data from the State Statistical Office, a Census of trade capacities was made on the entire territory of the Republic of Macedonia, in order to provide data on number, type, size, structure, space and employees in the catering facilities. According to the first results, a total of 4,948 facilities were listed, of which 4,378 catering facilities - shops and 570 facilities for accommodation of guests. The Skopje region is at the top with the highest concentration of catering facilities, with 1314 or 26.6% of the total number of listed facilities.

The largest concentration of catering facilities have: Tetovo with 10.2%, Municipality of Centar with 7.8%, Kumanovo 5.2%, Gostivar 4.9%, Ohrid 4.8%, Bitola 4.2%, Struga 3.8 %, Karpos 3.5%, Chair 3.2% and Prilep 2.9%,

Energy consumption in the hotel sector is very diverse and is rarely considered in detail. Nowadays, most hotel facilities only track total energy costs without paying close attention to different consumers. Detailed monitoring and documentation are generally considered too complex and expensive. Table 1 shows the energy efficiency for different types of hotels.

Table 1. Rating of energy efficiency of different types of hotels

Efficiency rating	**excellent**	**good**	**poor**	**very poor**
I Big hotels (over 150 rooms) with air conditioning, laundry and indoor pools				
Electricity (kWh/m^2 annually)	< 165	165 - 200	200 - 250	> 250
Fuel (kWh/m^2 annually)	< 200	200 - 240	240 - 300	> 300
Total (kWh/m^2 annually)	< 365	356 - 440	440 - 550	> 550
Hot water (kWh/m^2 annually)	< 220	230 - 280	280 - 320	> 320
II Middle hotels (50-150 rooms) without laundries, with heating and air conditioning in certain rooms				
Electricity (kWh/m^2 annually)	< 70	70 - 90	90 - 120	> 120
Fuel (kWh/m^2 annually)	< 190	190 - 230	230 - 260	> 260
Total (kWh/m^2 annually)	< 260	260 - 320	320 - 380	> 380
Hot water (kWh/m^2 annually)	< 160	160 - 185	165 - 185	> 220
B) Small hotels (up to 50 rooms) without laundries, with heating and air conditioning in certain rooms				
Electricity (kWh/m^2 annually)	< 60	60 - 80	80 - 100	> 100
Fuel (kWh/m^2 annually)	< 180	180 -210	210 - 240	> 240
Total (kWh/m^2 annually)	< 240	240 - 290	290 - 340	> 340
Hot water (kWh/m^2 annually)	< 120	120 - 140	140 - 160	> 160

ENERGY CONSUMPTION AND ENERGY BALANCE IN A HOTEL BUILDING

The largest consumers of energy in hotels are: space heating, air conditioning and ventilation, hot water, lighting and other consumers. Figure 1 represents that heating of the space and hot water, with total of 48% (31% + 17%), cooling with 15 % and lighting with 12%, represent the largest part of the energy consumption.

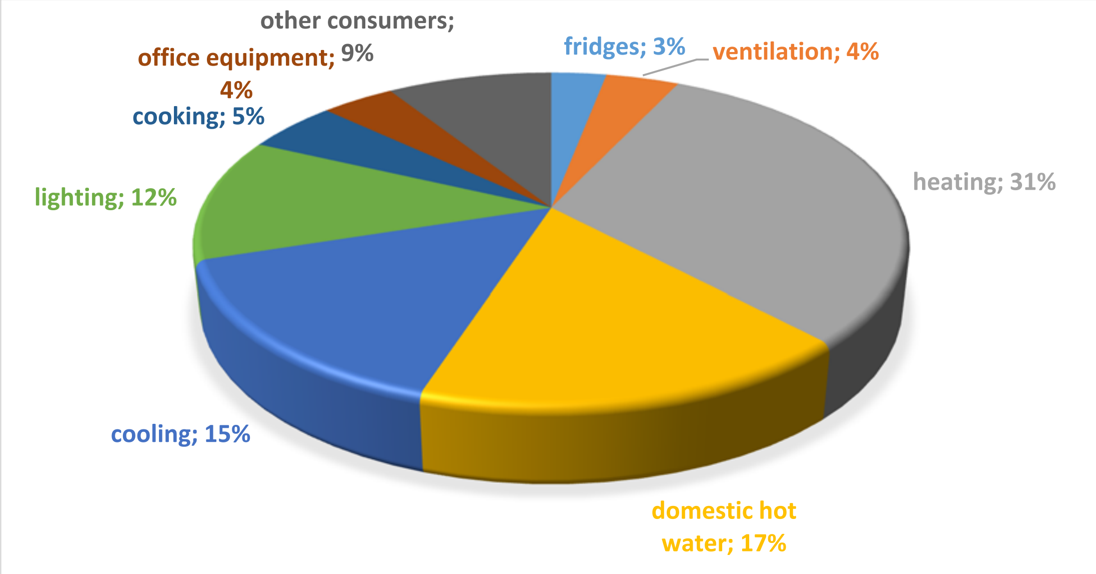

Figure 1. Energy consumption in percentage in hotels

About 40% of the total energy consumption belongs to electricity, 60% is from natural gas or oil fuels. These energy sources are purchased by hotels and afterwards converted through various systems into the most needed energy - heat, cooling, electricity.

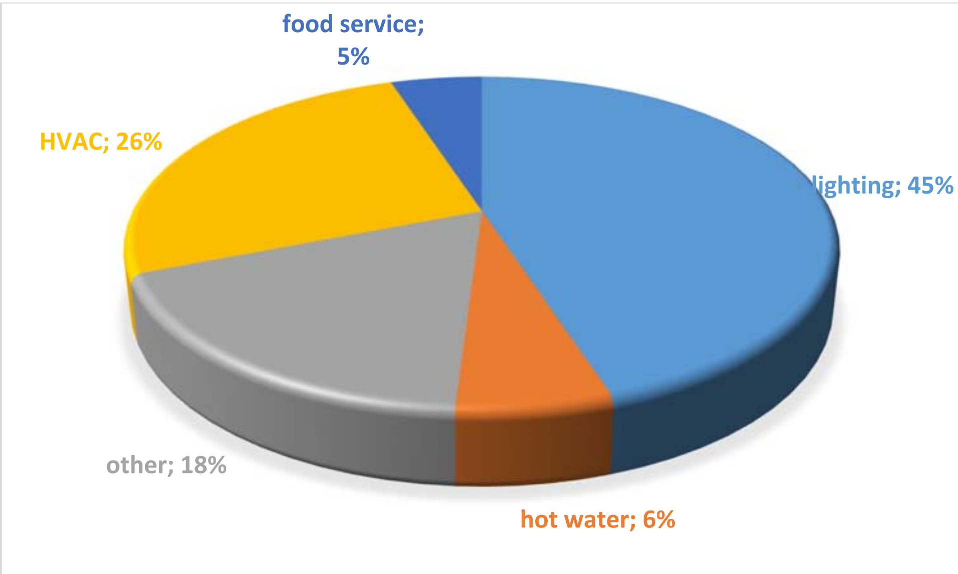

Figure 2. Consumption of electricity in percentage in hotels

The energy balance of a building should contain the amounts for heating and cooling, air conditioning, lighting, sanitary hot water, auxiliary energy and technical losses in the systems. The total energy demand of the building is:

$$Q = Q_{H,nd} + Q_{C,nd} + Q_{V,nd} + Q_{W,nd} + W_{A,nd} + W_{L,nd} - Q_{rvd} \quad [Wh]$$

where:

$Q_{H,nd}$ – total energy demand for heating
$Q_{C,nd}$ – total energy demand for cooling
$Q_{V,nd}$ – energy for air conditioning
$Q_{W,nd}$ – total energy demand for sanitary hot water
$W_{A,nd}$ – demand for auxiliary energy
$W_{L,nd}$ – energy for lighting
Q_{rvd} – returned energy

CASE STUDY – HOTEL "MANASTIR BEROVO"

Hotel "Manastir", Berovo was founded in 2004 and since then has been successfully building its story. With its offer it is a pioneer for alternative forms of tourism in Macedonia, it is also the first investment of this type in the Eastern part of the country. In 2009, it has been named "the most authentic hotel in the country" by the Agency for Promotion and Support of Tourism in R. Macedonia.

In July 2018, a project was developed to improve energy efficiency of "Hotel Manastir" by using natural renewable environmental resources, in order to contribute to the maintenance of high standards and progress. By saving the funds of the reduction in the consumed electricity produced from renewable energy sources and replacing the old appliances with new ones, it can be invested in expanding the existing capacities and improving the quality of services (which will strengthen the culture of services, will attract more guests and create new jobs and market competitiveness).

Figure 3. Hotel Manastir: a) view of the hotel in winter, b) cross section of the building

In order to realize energy efficiency, the hotel must adapt to new energy sources and ways of energy saving. An appropriate energy audit of the building is firstly made, assessing the energy consumption of the building.

There are many softwares for conducting the calculation of energy consumption and analysis of proposed energy efficiency measures of buildings. ENSI software is used for the purpose of this paper. ENSI-software is adapted to the Macedonian climatic conditions, with entered data for five representative cities in Macedonia, which differ according to the minimum and average annual temperatures, solar radiation, the required number of degree-days etc. Berovo with 2932 degree-days belongs to the third climate zone in Macedonia. The table of holidays and working days is selected, as well as the heating/cooling regime for the hotel. Data is entered for all four facades: northeast, southeast, southwest and northwest, as well as for the roof and for the floor. The relevant data are the net surfaces of the walls of the facades with the appropriate calculated *U*-values and the surface of the windows with the corresponding coefficients and the degree of insolation.

In summary, the proposed measures to reduce heat transfer losses through the hotel building envelope are:

- thickness of the thermal insulation layer of rock wool in the floor is increased from 30 mm to 50 mm - additional 20 mm;
- thickness of the rock wool in the roof is increased from 100 mm to 150 mm - additional 50 mm;
- 30 mm rock wool and 12.5 mm plasterboard is added to the internal side of the facade walls, in order to maintain the authentic external appearance of the hotel.
- In order to improve the energy efficiency of the hotel, previous windows have been replaced with new “Geneo” windows with significantly better characteristics. *U*-value of the new windows is 1 W/m^{2}K, instead of the old one of 2.65 W/m^{2}K.

Table 2 represents the calculated *U*-values of the parts of the building envelope in the existing real conditions and after the proposed measures.

Table 2. *U* – values of the building envelope in existing condition and after the measures

U **- value**	**Existing condition**	**After measures**
U**roof**	0.33	0.23
U**wall**	0.45	0.33
Ufloor	0.42	0.34
U**window**	2.65	1

Important parameters that influence the energy consumption are also: the conditioned (heated) surface and volume, the heat capacity which depends on the type of construction of the building envelope, the metabolic heat from people, the schedule of use for people (continuous use of all rooms, 24/7 is provided), and the schedule of heating are also entered.

As a part of the energy conservation measures, a solar system for preparation of sanitary hot water has been proposed, which uses solar flat panels-collectors. The collectors will be fixed on the roof of the hotel. They absorb heat from the sun and use it to heat water, which in turn is stored in a heater tank. The conventional water heater is used only in the case of water heating, i.e. to increase its temperature. Maintenance of solar collectors is cheap. Most solar systems come with a 5 to 10 year warranty, so the costs are small. In addition to saving energy, these systems also reduce the release of CO_2 into the air.

Solar collectors should be used in combination with a heat distribution system and an additional electric heater. The system should be designed so that solar energy will be used to the maximum (primary heat source) and energy from the distribution system will be a secondary source. The introduction of this system will significantly reduce the consumption of sanitary hot water.

Furthermore, no measures are provided for fans and pumps. In terms of lighting, the existing classic light bulbs in the hotel have been replaced with energy-saving LED lighting. Replacing old light bulbs with LED bulbs, which are incredibly long-lasting and most cost-effective, uses up to 90% less energy than standard bulbs. They are a great choice for hotels that aim to reduce energy consumption and increase energy efficiency.

The software outputs are given in the following Figure 4 and Table 3. The difference in the values for the existing real situation and after the proposed undertaken measures can be clearly seen, which results in a more economical object and greater savings.

Table 3. Energy consumption by individual items

Category of consumer	**Real condition**		**After measures**	
	KWh/m²	**kWh/a**	**KWh/m²**	**kWh/a**
Heating	42	14810	9,5	3359
Ventilation	17,6	6201	15,1	5342
Hot water	201,6	71150	80,6	28460
Fans and pumps	6,0	2128	6,0	2128
Lighting	8,1	2864	4,1	1432
Various equip.	14,1	4995	14,1	4995
Cooling	10	3530	10	3530
Total	**299,4**	**105678**	**139,5**	**49246**

According to the calculations, the total heating energy is 42 kWh/m^2 annually in real condition, and with the measures it is reduced by 77.4%, i.e. to 9.5 kWh/m^2 annually. The energy for sanitary hot water is 201.6 kWh/m^2 annually before the measures. After the measures with the combined system of solar collectors, distribution system for thermal energy and additional electric heater, it is reduced to 80.6 kWh/m^2 annually, which is about 60% savings. Energy consumption for ventilation is reduced by 14.2%, and for lighting, by replacing the old lamps with LED lighting, the consumption is reduced by about 50%, more precisely 49.4%.

After all the undertaken energy conservation measures, the energy consumption is reduced from 299.4 kWh/m^2 annually to 139.5 kWh/m^2 annually. This reduction represents a decrease of 53.4%, which is an excellent result and huge energy savings. Only for the item "heating" of the building, savings were achieved from 42 kWh/m^2 annually to 9.5 kWh/m^2 annually, which is a reduction of the required energy for heating the building by a huge 77%.

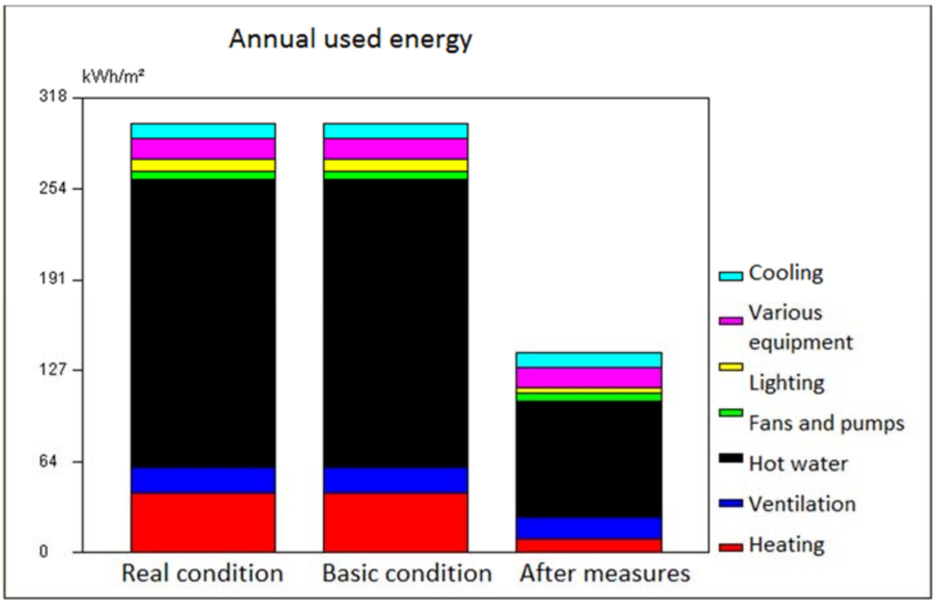

Figure 4. Annual used energy before and after the measures

In the "heat loss" section, Table 4 shows the heat losses through the various components of the building envelope, where H is the coefficient of heat loss and H' is the coefficient of specific heat loss.

Table 4. Heat losses in the building envelope before and after the measures

Heat losses in building components	Real condition		After measures	
	H [W/K]	H' [W/m²K]	H [W/K]	H' [W/m²K]
Net walls	185	0.52	136	0.38
Windows and doors	254	0.72	96	0.27
Roof	64	0.18	44	0.13
Floor	72	0.20	58	0.17
Infiltration	150	0.43	150	0.43
Ventilation (of heating)	70	0.20	70	0,20
Total	**796**	**2,25**	**555**	**1,57**

CONCLUSION

Public buildings in Macedonia are serious consumers of energy, because some of them were built in the post-earthquake period, when energy efficiency was not treated properly and there was no legal obligation for energy efficient design and building. The buildings should be designed, constructed and used in a way that will ensure optimal consumption and costs during the operation period.

This paper gives a brief overview of the current status of the hotel industry in Macedonia with special emphasis on environmental awareness and recommendations for increasing energy efficiency and presents the way for hotels to become "green". Through several methodological approaches, such as literature review, research and direct audit of the hotel, the study concludes that the concept of "green hotel" is known in the hotel industry in Macedonia. Namely, Hotel “Manastir Berovo” has obtained huge energy savings in the total demand of energy. This reduction represents a decrease of significant 53.4%, compared to the consumption before the undertaken measures for energy efficiency.

The development of a methodology for determining the energy class of hotel buildings can be used and applied to any similar building. Increasing energy efficiency and reducing hospitality costs is important for more customers. Participation in the energy management program of the specific hotel "Manastir" would increase its competitiveness and profitability, by reducing the funds for maintenance and environmental protection.

However, due to established practices, insufficiently trained staff and lack of adequate investment, many hotel managers are often conservative and unprepared when considering further investment in environmentally beneficial programs and improving the eco-friendly appearance of their hotel facility.

Efficient hotel and accommodation buildings are more competitive globally, able to employ more workers and increase the balance of payments. In addition, pollution and greenhouse gases are reduced. Properly planned, designed and operated hotel facilities offer compelling environmental and socio-cultural benefits as well as attractive opportunities for sustainable business. The development of innovative sustainable and efficient tourism facilities will enable the development of tourism and entrepreneurship, as well as regional development in Macedonia.

REFERENCES

1. Bohdanowicz P., Martinac I., Simanic B. (2005), *"Sustainable hotels - Enviromental reporting according to Green Globe 21, Green Globes Canada/ GEM UK, IHEI Benchmarkhotel and Hilton Enviromental Reporting"*, the 2006 World Sustainable Building Conference, Tokyo;
2. Bohdanowicz P., Martinac I. (2002), *"Thermal Comfort and energy saving in the hotel industry"*, Royal Institute of Technology;
3. Cingoski V., Petrevska B. (2015), *"Environmental protection and Energy Efficiency Concept in Five Star Hotels in Macedonia"*, 6th International Symposium on Industrial Engineering - SIE 2015, Proceedings;
4. Dimitrovska Ana, (2020), “*Energy saving methods and measures in hotels*”, MSc thesis under supervision of prof, Samardzioska T., faculty of Civil Engineering, Ss. Cyril and Methodius University in Skopje, Macedonia;
5. Dvorak B., Kelly N., Samuelson C., Conger A. (2015), *"Hotel energy efficiency",* supported by Minesota Department of Commerce, Division of Energy Resources;
6. Elyza R., Hulaiyah Y., Salim N., Iswarayoga N. (2005), *"Guidebook on Energy Efficiency for Hotels";*
7. Hendrikx N. (2008), *"Power Quality and Utilization Guide for Hotels";*
8. Ishmael M. (2013), *"Hotel Energy Efficiency towards Sustainable Tourism",* Department of Hospitality and Tourism Management, University of Cape Coast, Ghana;

9. Kang-Ting T., Tzu-Ping L., Ruey-Lung H., Yu- Jing H. (2014), *"Carbon dioxide emissions generated by energy consumption of hotels and homestay facilities in Taiwan"*, Tourism Management (journal homepage: www.elsevier.com/locate/tourman);
10. Nauber J. (2010), *"Energy Efficiency in Thai Hotels - a Pracitcal Guide"*, 2010 World Tourism Organization (UNWTO);
11. Petrevsska B., Cingoski V. (2016), *"Can Macedonian Hotels be Green: the Evidence of Hotel "Flamingo" - Gevgelija, Macedonia"*, Mechanical Engineering Scientific Journal;
12. Petrevska B., Cingoski V. (2018), *"Green Soulution for Clean Environment: the Case of Skopje, Macedonia"*, Journal of Applied Economics and Business;
13. Sarah Alexander (September 2002), *"GREEN HOTELS: Opportunities and Resources for Success"*, Zero Waste Alliance (www.zerowaste.org);
14. Shwn-Meei L., Hiroshi Chris H., Gui R. Yu-Chen L. (2016*), "The Implementation of Green Tourism and Hospitality"*, Journal of Tourism and Hospitality;
15. Sumedha N. (2014), *"Hotel Industry and Environmental Issues"*, Environmental Issues and Social Exclusion - Seminar;
16. Xu W., NaiQi W., Yan Q., QingBin S. (2018), *"Assessment of Energy-Saving Practices of the Hospitality Industry in Macau",* Institute of Systems Engineering, Macau Univeristy of Science and Technology;
17. Hotel Energy Solution (2011), *"Analysis on energy use by European hotels: online survey and desk research"* , Hotel Energy Solutions project publications;
18. ADEME - ARCS - CRES - ICAEN - IER - SOFTECH, 2001, *"Green Flag for Greener Hotels"*, project ENV98/338;
19. IEA- International Energy Agency, 2016, *"Energy Efficiendy Market Report 2016"*, IEA Secure Sustainable Together;
20. ENERGY STAR program, *"Hotels: An Overview of Energy Use and Energy Efficiency Opportunities"*, (energystar.gov);
21. Department of Energy and Climate Change (April 2014), *"UK National Energy Efficiency Action Plan"*, UK Energy Efficiency Action Plan;