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Energy Management in Hospitality: a Study of the Thessaloniki[1] Hotels

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Abstract

Due to the economic crisis, hoteliers are nowadays more environmentally conscious than ever because it can cost far more to operate a lodging facility if it is not sustainable. Hotels use huge amounts of energy, therefore, investments in more efficient energy use can lead to significant reductions in energy consumption, operating costs and energy bills. Some innovative energy management systems could cut energy costs for hotel owners by up to 65%.

The study included in this paper intended to identify the energy saving systems in the 4 and 5 star hotels of Thessaloniki, Greece as well as explore whether these systems reduce the energy and consequently the operating costs of the hotels. Moreover, the findings were compared against the industry averages and a number of solutions for energy efficiency and cost reduction are suggested. Simple green practices (such as energy-efficient lighting) could contribute in costs controlling, as well as in environmental sustainability. Other cost-effective solutions suggested to facility managers include: the adoption of eco-labelling, use of energy toolkits, participation in projects aiming to reducing energy use and the integration of wireless energy management systems. Training of the hotel managers and their staff can lead to better understanding, energy saving and certainly increased profitability.

Key words: energy, hospitality, hotels, lodgings, sustainability, operating costs, environment, green practices, eco-labelling.

Introduction

Due to the economic crisis, hoteliers are nowadays more environmentally conscious than ever because it can cost far more not only to build a lodging facility but also to operate it if it is not sustainable. The cost of energy has increased so much in recent years that lodging

[1] Thessaloniki is the second largest city of Greece with over a million inhabitants and a very good hotel infrastructure.

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construction now incorporates ways of using natural lighting and constructing energy-efficient buildings (Walker, 2010).

Hotels use significant amounts of energy for daily operations and recreational activities. In many facilities, energy costs are the second-highest operating costs after payroll. Investments in more efficient energy use and improved housekeeping practices can lead to significant reductions in operating costs and energy bills, with relatively short payback periods (Sweeting and Rosenfeld, Tour Operators Initiative).

In simple terms, *energy efficiency* means using less energy to perform the same tasks and functions. For hotels, this could mean reducing the amount of energy needed for heating by improving insulation of the hotel building, by introducing lighting control or also regulate space heating and cooling. Energy efficiency saves energy, costs and reduces emissions of greenhouse gases like CO2 (http://www.mdsideas.com/unwto/).

Renewable energy sources like wind, solar and hydropower are unlimited**,** as they capture energy flows available from the natural environment. Use of renewable energy sources will help secure our future energy supply and lower the human impact on the environment.

Renewable power capacity is increasing worldwide**,** accounting for 280 GW during 2008 (excluding large hydropower), representing an increase of 75% since 2004. Currently renewable energy accounts for 8% of the total energy used in the European Union and targets have been set for this to increase to 20% by 2020.

The EU Action Plan for Energy identifies the tertiary sector, including hotels, as having the potential to achieve 30% savings on energy use by 2020 – higher than savings from households (27%), transport (26%) and the manufacturing industry (25%). EU hotels are in a strong position to access renewable energies as over a third of the world's renewable power capacity is located in the European Union (http://www.hotelenergysolutions.net/).

Hotels can benefit from using renewable energies for example water heating, space heating and air-condition (http://www.mdsideas.com/unwto/). Using renewable energy can reduce local air pollution, maintain destination quality and enhance the guest experience.

Energy efficiency and conservation practices can enhance reputation among guests and others who are concerned about reducing global energy consumption and the effects of climate change (Sweeting and Rosenfeld, Tour Operators Initiative).

Energy management systems

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An energy management system (EMS) is a system that combines monitor and control capabilities to provide optimum efficiency for energy use within the environment managed by the system. Such a system performs tasks such as automatically turning off lights or lowering the temperature during non-demand times (Webster's Online Dictionary).

Building energy management systems are used to improve energy efficiency by monitoring building temperature inside and outside buildings and controlling the boilers and coolers (Levermore, 2000).

The main energy consuming systems in hotels are:

- Heating
- Air conditioning and ventilation
- Hot water production
- Lighting
- Electricity (lifts, etc.)
- Cooking (http://www.inescc.pt/urepe/chose/energy.htm).

Electricity dominates hotels' energy expenses—for heating, air conditioning and ventilation; hot water production; lighting; electrical systems (e.g. lifts); and cooking. Energy consumption accounts for between 3% and 6% of the total operating costs. As the major part of this energy is produced by gas, coal and petroleum products, reducing the energy consumption would also contribute to decreasing greenhouse gas emissions, chiefly CO2 (Zhang, et al., 2010).

Industry studies show that heating, ventilation and air conditioning (HVAC) account for almost 50% of the total energy consumption in most hotel properties. Likewise, they indicate that hotels use between 380 and 760 litres of fresh water per occupied guestroom per day. This averages out to about 138.340 to 276.680 litres of water per room per year (a considerable expense, given that water charges in Greece, for example, range from 0,5 euro to two euro per 1.000 litres). Although the cost of water for the hotels is not as high as for the electricity, water conservation is also important for sustainability reasons given the fact that water supplies are slender is some parts of the planet.

In the high class hotels with food and beverage departments, the sum of energy, water and supply expenses (for maintenance and laundry-linen) has been found equal to almost 19% of revenue per available room (RevPAR), during the last decade (Zhang, et al., 2010).

Technology is used in most hotels in order to extend in-room comfort and at the same time reduce the consumption of energy. At some hotels guests can check-in with their web-enabled personal digital assistants (PDAs) and select the in-room temperature. Moreover,

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technology now allows the deployment of "intelligent thermostats" which – when tied into a room motion sensor – can detect whether or not the room is occupied and maintain either an "occupied" temperature (the one which the guest has set) as well as the right humidity and air quality, or an "unoccupied" temperature (a temperature set by the property management). The resulting reduction in energy consumption using such a system is not only immediate, but significant (www.trust-iis.com).

It has been measured that passive infrared motion sensors and door switches can reduce energy consumption by 30% or more by automatically switching off lights and air-conditioning, thus saving energy when the guest is out of the room (Walker, 2010).

Intelligent energy management software tools used to monitor, control and optimize the performance of generation and transmission systems reduce energy consumption, improve the utilization of the system, increase reliability and predict electrical system performance as well as optimize energy usage to reduce cost.

Some innovative energy management systems could cut energy costs for hotel and commercial building owners by up to 65 per cent. Moreover, they can be customised to meet individual needs and manage energy consumption effectively in one product. They come as either a simple package that turns off all energy supplies to any room once it is vacated, or an on-line system which links to a computer and provides additional information about security, room occupancy rates, cleaning, staff monitoring and employee efficiency levels (http://www.ems-uk.org/solutions/products/hotelstar.asp).

Additional features include: minibar access reporting, guest control amenities, smoke detector alarm reporting. Hospitality operators can save money by utilizing this type of energy-saving software to reduce their energy costs (Walker, 2010).

The system can pay for itself within eight months to just over 1,5 years, depending on the hotel facilities (http://www.ems-uk.org/solutions/products/hotelstar.asp).

Contemporary hotel energy solutions

There are several contemporary tools offering to the hoteliers of today efficient energy solutions and significant cost reduction.

Most solutions promise up to 30% of energy cost savings and return on investment of 20 to 50%. The reference that follows includes those tools considered sustainable, easily adopted and cost-effective.

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1. Eco-labelling. It is a voluntary method of environmental performance certification and labelling that is practised around the world (http://www.globalecolabelling.net/). More than 100 eco-label programs for ecotourism, hospitality and tourism throughout the world have been identified. By far, the majority of eco-labels are for the accommodation sector and are based principally on energy, water and resource conservation and waste management (Buckley, 2001b).

While eco-labels can help to sell tourism products, they also decrease the use of resources such as energy and water, reducing costs for the operator. Eco-labels are thus both a marketing and an environmental management tool (Hamele, 2001), since reducing the consumption of natural resources like energy and water helps towards reducing a property's costs. One of the best tools in Europe is the EU Eco-label that leads the hoteliers to optimized energy management.

2. There are several energy toolkits in the market, increasing the competitiveness and sustainability of the hotel sector. The Hotel Energy Solutions (HES) e-Toolkit is supported by the Intelligent Energy – Europe (IEE) program which is giving a boost to clean and sustainable solutions (http://ec.europa.eu/energy/intelligent/). HES enables Small and Medium Enterprises (SMEs) in the accommodation sector to assess their current energy use and carbon footprint against similar enterprises and provide support in ranking practical and cost-effective energy efficiency and renewable energy investment options.

The toolkit is comprised of an energy benchmarking tool and a decision support sequence which will provide assistance in evaluating carbon emissions and mitigation techniques through energy efficiency and renewable energy investment options. It also includes information on best practices and capacity building materials and a carbon calculator. Benefits for the hotels include: understand how much energy they could save; measure their energy usage; compare their results with similar hotels and measure their progress; and reduce costs and market their activities (http://hes.e-benchmarking.org/overview.stm).

3. RELACS (REnewabLe energy for tourist ACcomodation buildingS) is a IEE project - launched at the end of May 2010. It aims to involve and motivate a significant number of accommodations throughout Europe (at least 60) in implementing renewable energy technologies as well as energy efficiency measures on their buildings.

In order to reach its main goal of reducing energy use and CO_2 emissions, the project will develop appealing marketing tools for hotels, creating:

- a European tourist resort network
- a sustainable energy logo

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- information tools (website, European catalogue, national brochures, etc.) on RELACS itineraries and
- a final prize.

To help the creation of the network, the RELACS Consortium will ensure a set of free energy services to the interested hotels, namely:

- E-mail and hotline assistance.
- "Light" energy audits in their premises.
- Training workshops on sustainable energy use for hotel management and staff, and
- Creation of large purchasing groups to overcome cost barriers associated with technologies.

In order to encourage the tourist-accommodation sector to invest in energy efficiency and renewable measures, the project will produce:

- A network of 110 participating hotels in 10 countries.
- Involvement of the most relevant business contacts (including tourist sector associations) in 10 Advisory Committees.
- Free services provided to at least 60 hotels, including: building energy audits, feasibility studies for Renewable Energy Sources (RES), training and technical advice.
- At least 200 employees and 100 managers of tourist resorts trained to identify energy saving opportunities in both behavioural changes and investment possibilities (http://www.relacs.eu/home.php?lang=en).

4. Wireless energy management. In much the same way a home wireless network can support multiple devices, like a laptop, desktop, printers, and handheld video games, a wireless network system can now be deployed into a commercial building. These wireless networks will support multiple controls for that building's main energy using equipment - HVAC and lighting. The system also allows for real-time wireless monitoring of the total electrical consumption (kWh) for the entire building. More importantly, it takes the entire process straight to the Internet, enabling remote monitoring and control from a central location (Watkins, 2010**)**.

Wireless energy management systems are gaining traction in the hospitality industry due to their capability to effectively reduce guest room utility costs without compromising guest comfort and convenience. Z-Wave[ii] has emerged as the favoured protocol of some hotels because of its ease of use and installation, intelligence and efficiency. Other wireless protocols include the ZigBee[iii] technology and the Spinwave A3 frequency.

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Given the increasing need for the hospitality industry to bring down overhead costs, more and more hotels are integrating energy management systems into their properties. However, the installation of traditional systems typically causes interruptions in hotel operations due to renovations. Using wireless technology enables hotels to successfully integrate an energy management system without disrupting operations.

An effective energy management system can provide 30 to 50% savings on guest room utility costs and return on investment (ROI) in about two years. When used in combination with back-office software for enhanced monitoring and control, hotels can manage their energy consumption more easily. This leads to not just cost savings, but reduced environmental impact as well (Patterson, 2011).

The wireless energy management solutions include: key card system controlling lighting, HVAC system, television and motorized draperies; lighting and automation controllers with LCD programmable displays allowing for a number of functions such as the ability to control each section of a room's lighting levels and on/off status, adjust temperature and call for housekeeping/do not disturb; back-office software that gives the front desk and engineering the ability to monitor and control the lighting and temperature of each room, wing, floor, or the entire facility remotely, in order to maximize both energy savings and customer comfort. This also gives the front desk the ability to preregister guests for VIP treatment, by pre-setting rooms to customer lighting and temperature specifications (http://www.eguestcontrols.com/).

Wireless energy management systems, consisting of flexible configurations of sensors, controls and devices, solve many of the issues that hold facilities managers and owners back from installing an EMS:

- Affordability: Wireless is more affordable to install than a hard-wired solution often reducing costs to a quarter of what a hard-wired installation would run.
- Speed and Convenience: Installations can go forward without having to move people out of their offices or rooms. They can also be completed in a very timely manner.
- Flexibility: With the growth of wireless technology over the past several years, applications can now fit a wide range of buildings and business goals.
- Reliability: Wireless mesh has performed reliably in virtually every type of commercial building, including hotels, restaurants and other facilities (Inge, 2008).

Best practice hotel in Greece

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Hotels represent about 0,26% of the total Greek buildings. Despite their small percentage comparing to the total building stock, they are responsible for the 29% of the energy consumption in the private sector. This is explained by the air conditioning space heating and cooling equipment, hot water needs, facilities and services offered and the number of the tourist arrivals during the hotel's operation (Maleviti, et al., 2011).

As mentioned above, hotels that are using renewable energy sources reduce energy consumption and increase sustainability, as well as profits. Moreover, by applying energy efficiency and investing on renewable energy sources, the Greek hoteliers contribute greatly to the country's economy, currently being in deep recession.

The best practice example that follows (table 1) is a Greek hotel using geothermal energy, which is one of the most environmental-friendly and cost-effective energy resources and has the potential to help mitigate global warming if widely deployed in place of fossil fuel.

1. Title of the best practice	**Hotel "Amalia"**
2. Description of the best practice activities	Hotel "Amalia" with a total area of 8.980 m^2 is located in Peloponnese, Greece. The building was totally renovated during the years 2007-2008 and is heated and cooled by an open-loop heat pump system. The heating/cooling distribution system into the building consists of fan-coil units (floor standing type). The building heating and cooling loads are 704 kWth and 566 kWc respectively. The ground source heat pump (GSHP) system consists of two subsaline groundwater supplying wells (60m depth each one) and two reinjection wells (60m depth each one), two titanium heat exchangers and two electric water source heat pumps placed in cascade.
3. Description of the best practice innovative and demonstrative approach - added value	After two years of operation (2008-2009) the adopted technological choices in the Hotel "Amalia" have allowed important energy and economical savings. Compared to a conventional system, the geothermal system offers 70,5% energy saving and 67,4% cost saving. The total cost savings are 105.081. In addition, the total CO2 savings are 323.328 Kg CO2. According to the calculations, simple pay-back time is estimated to 4,68 years with a system life-span of 30 years. The results have been positive in all respects: the operating cost, the required maintenance, the total independence from traditional fuels and the operation continuity.
4. Description of the best practice background	Geothermal heat pumps are an established and reliable technology which provides high quality indoor comfort. They result in energy savings by 30% compared to air cooled units. The lower CO2 that are succeeded contribute to environmental protection, sustainable energy development and fighting the climate change.
5. Transferability of the best practice	The application can be applied to all commercial buildings in areas with groundwater and with water table close to the surface.

Table 1. Best practice hotel using renewable energy, adapted from: **http://geopower-i4c.eu/**

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Study into energy saving systems in hotels of Thessaloniki

The present study intended to identify the energy saving systems in the 4 and 5 star hotels of Thessaloniki, Greece as well as explore whether these systems reduce the energy and consequently the operating costs of the hotels. Moreover, the findings were compared against the averages of the industry and a number of tools as well as solutions for energy efficiency and cost reduction are suggested.

Data was collected by means of a questionnaire developed specifically for the survey, as well as by structured interviews with personnel at operational, supervisory and management level, during in site visits to 14 five and four star hotels in Thessaloniki. The sampling technique used was the cluster sampling.

The basic characteristics of the sample are:

- Eight properties are 5 star and the remaining six are 4 star hotels.
- One of the hotels belongs to an international chain, eight belong to Greek hotel chains and the remaining five are individual properties.
- All of them are managed directly by the ownership and not by third-party professional companies.
- The hotels are located in both urban (9 properties) and suburban (5 properties) locations of Thessaloniki and are of various sizes and rates.
- All the hotels offer food and beverage services.

A total of 100 questionnaires were distributed to the employees and executives of the hotel sample in spring 2011. Sixty four (64) questionnaires were answered and at the moment they were picked up, the staff members were interviewed about their conceptions of the energy efficiency.

The questions included in the questionnaire can be classified in three basic groups: a. those concerning employee perception of the energy management effectiveness; b. questions about the determination of the property's existing energy policy; and c. questions regarding the impact of the followed energy management on the hotel's operating costs.

The focal points of the interviews were the following:

- The relationship between personnel's environmental perception and the property's performance.
- The importance of green hotels in Greece.
- Benefits of the eco energy management.
- Recycling in the hotels.

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Questions and results of the survey

A. Questions about employee perception of the energy management effectiveness

1. How important is considered for you the greening of your lodging?

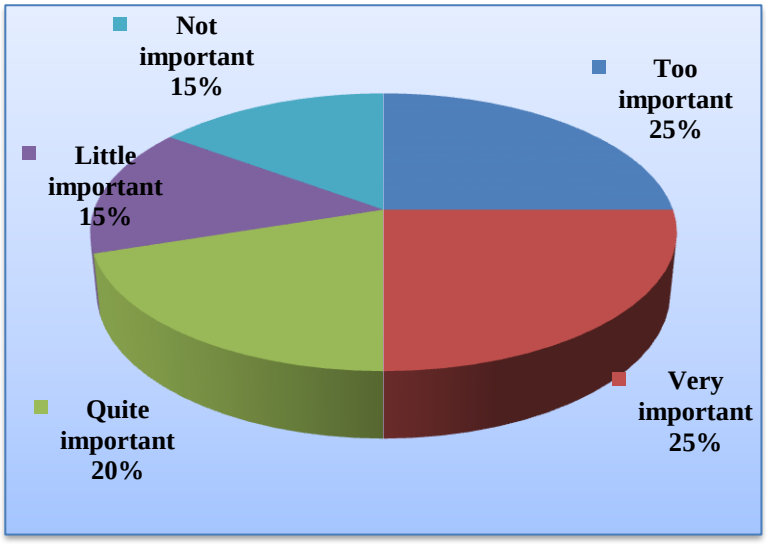

Figure 1. Importance of lodging greening

2. Do you believe the green certifications are useful for your lodging's image?

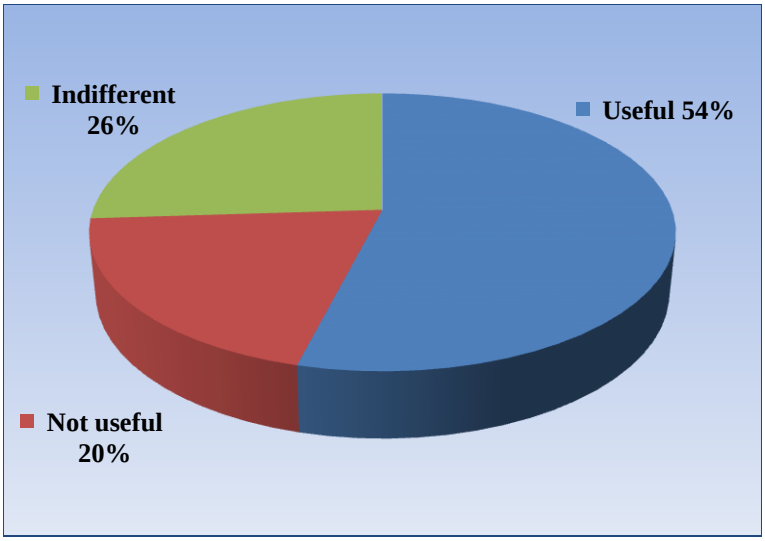

Figure 2. Usefulness of green certifications

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3. How important is for you to be employed by a property friendly to the environment?

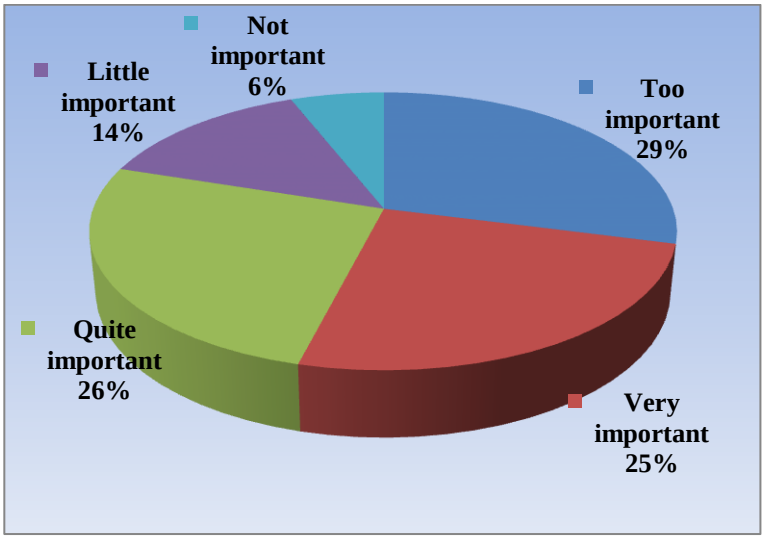

Figure 3. Importance of employment by environmentally friendly property

4. Are you familiar with the energy saving systems?

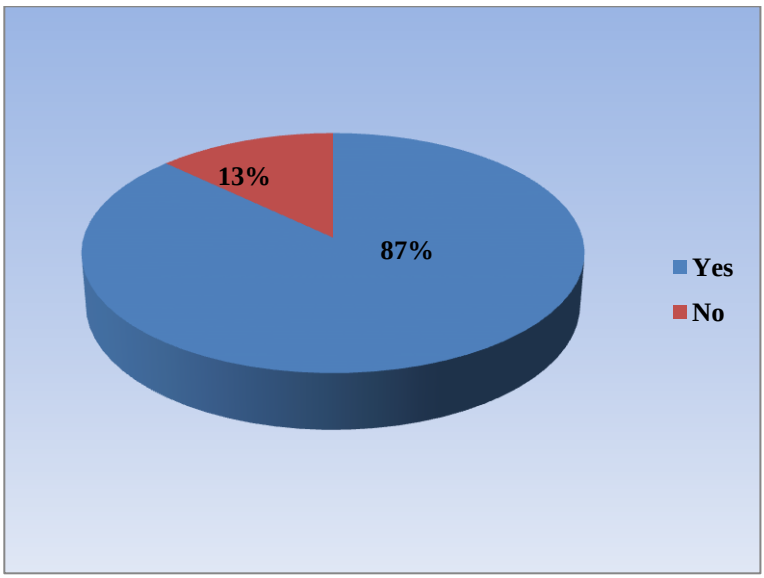

Figure 4. Familiarity with energy saving

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B. Questions about determination of the property's existing energy policy

1. Which energy saving system(s) do you apply in your property?

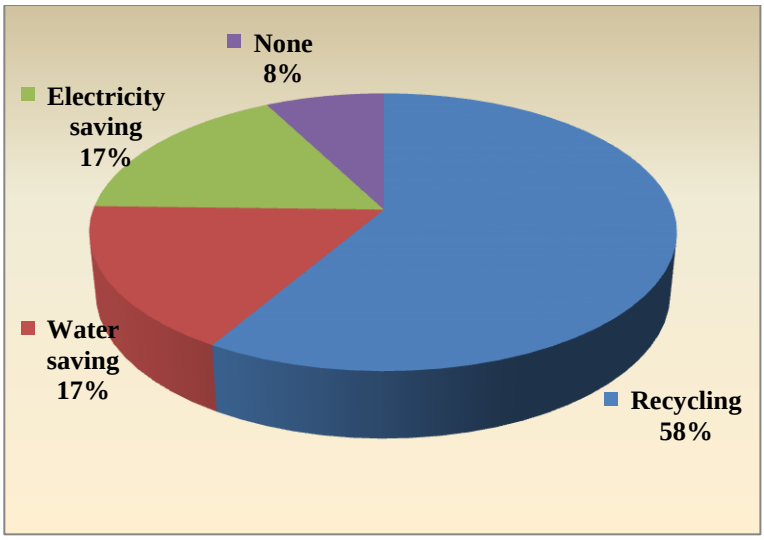

Figure 5. Applied energy saving systems

2. Which system(s) does your lodging use for saving water?

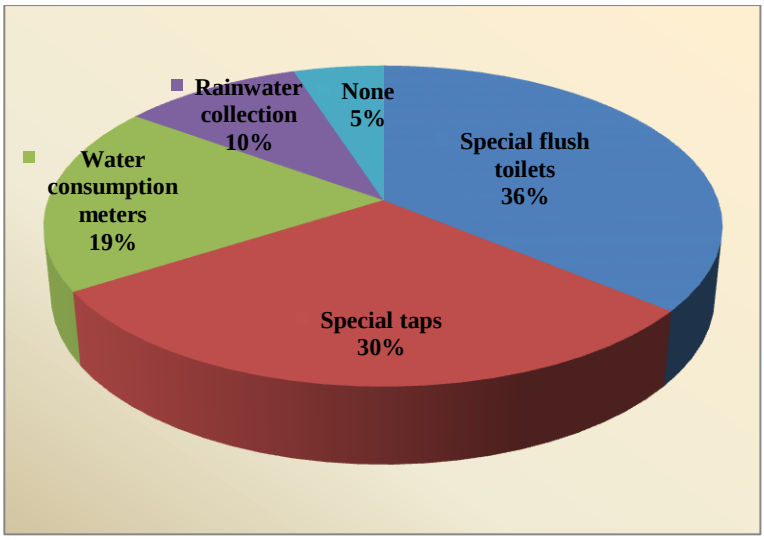

Figure 6. Saving water systems

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3. Which system(s) does your hotel use for saving electricity?

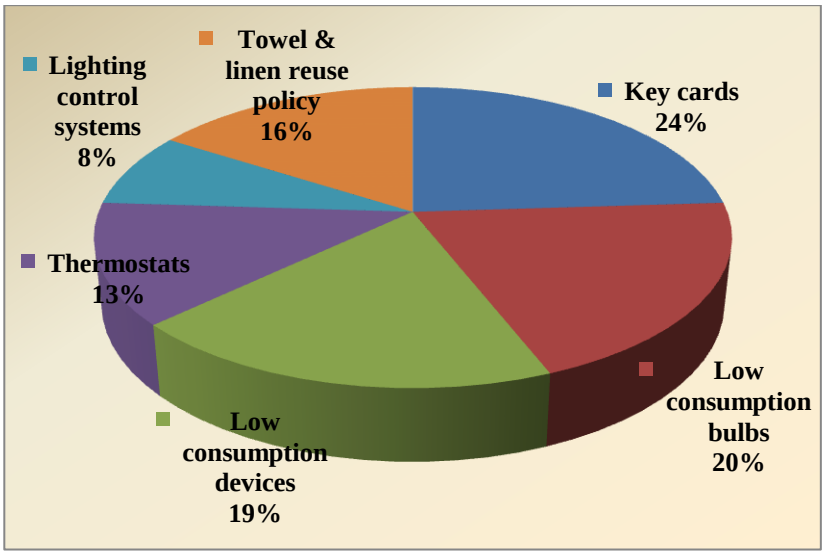

Figure 7. Saving electricity systems

4. Which materials are recycled in your hotel?

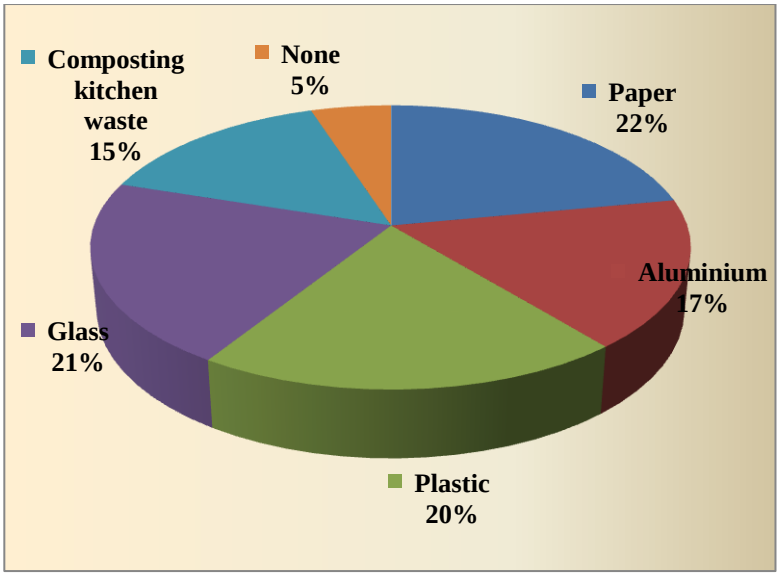

Figure 8. Recycled materials

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5. In which areas of your property are there recycling bins?

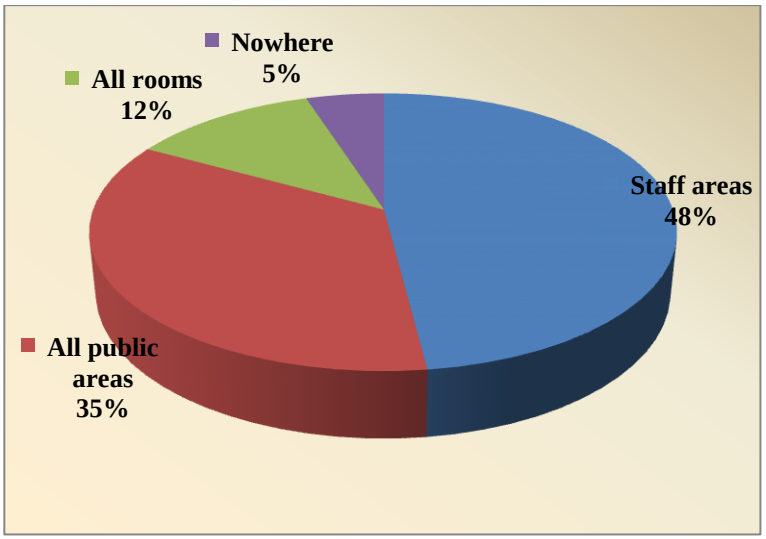

Figure 9. Location of recycling bins

6. Which alternative energy resources do you use in your hotel?

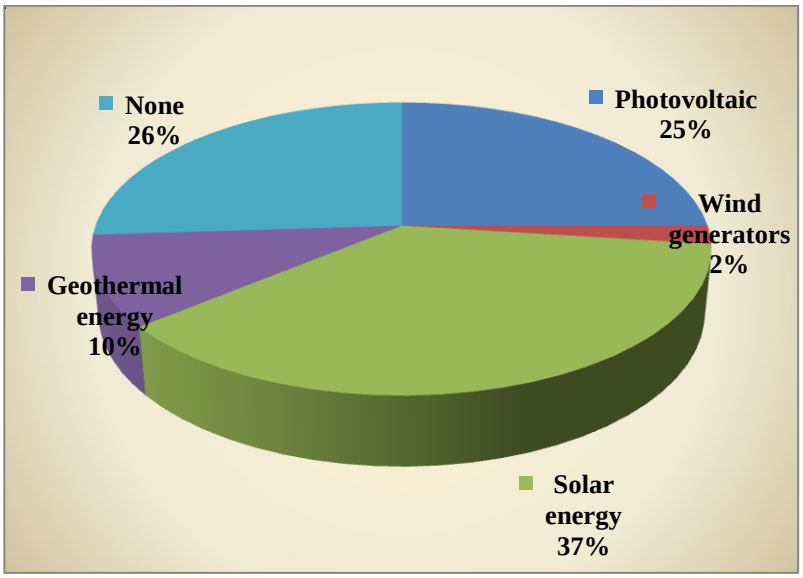

Figure 10. Alternative energy resources used

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C. Questions about impact of the followed energy management on the hotel's operating costs

1. What is the determinant in the selection of an energy saving system for your property?

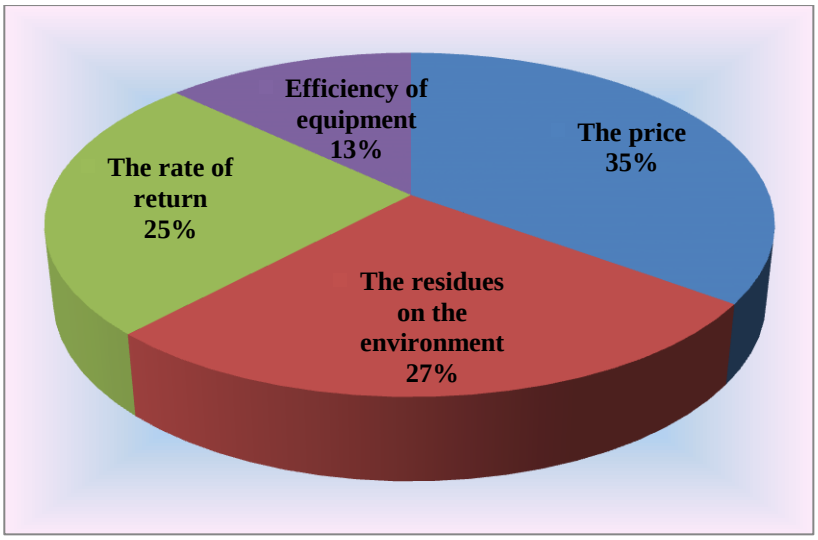

Figure 11. Energy saving system selection determinant

2. How much have your operating costs been reduced by the use of your energy saving system(s)?

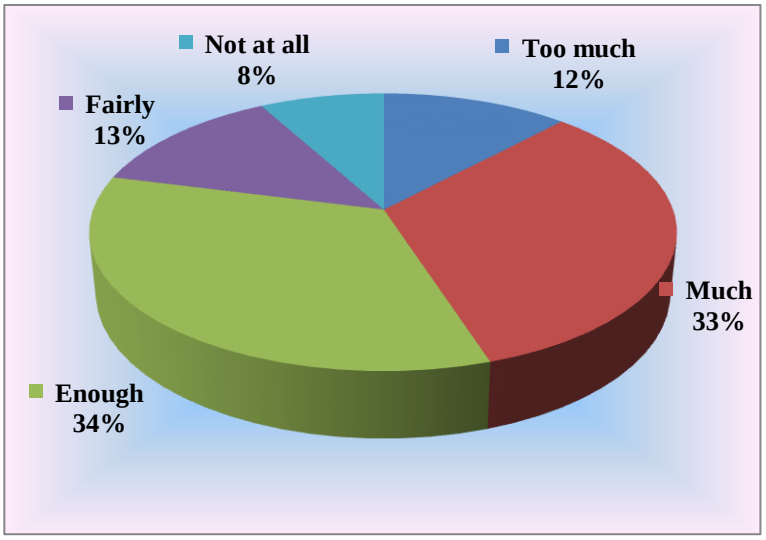

Figure 12. Reduction level of operating costs

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3. What is the drop percentage in your energy costs, concerning:

- Heating and air-conditioning
- Hot water
- Lighting
- Total energy costs.

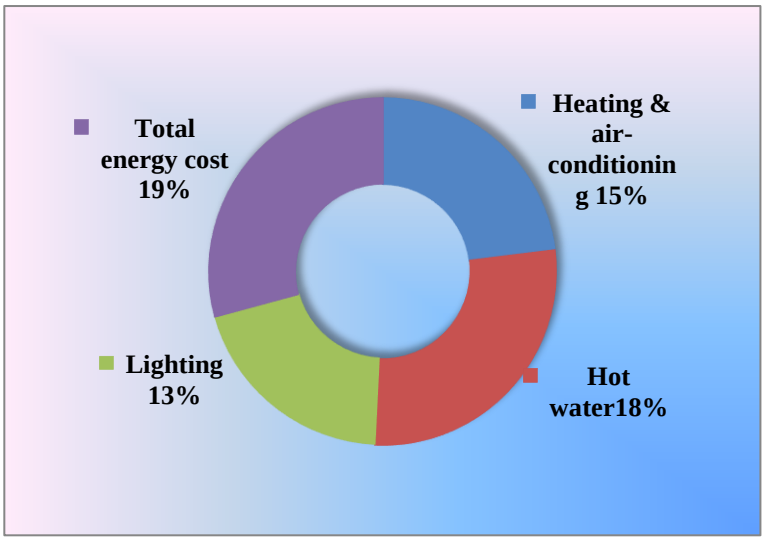

Figure 13. Drop percentage in energy costs

Analysis of the results

- About 50% of the hotel executives and staff members consider the greening of their lodging very important and the green certifications useful. However, a significant part of the sample (30%) think that the greening of their lodging is not important and the 46% believe that green certifications are either not useful or indifferent for the property's image.
- For the 80% of the employees it is important to be employed by an environmentally friendly property and the 87% of the sample is familiar with energy saving systems.
- 92% of the hotels apply some energy saving systems. More specifically, 58% applies recycling, 17% electricity saving and 17% water saving systems.
- For water saving the systems that are used, are: special flush toilets (36%), special taps (30%), water consumption meters (19%) and rainwater collection (10%).

- The electricity saving systems used by the hotels are: key cards (24%), low consumption bulbs, electrical and electronic devices (49%), towel and linen reuse policy[2] (16%), thermostats (13%) and lighting control systems (8%).
- The materials that are mostly recycled in the hotels are paper, glass and plastic (63%), as well as aluminium and composting kitchen waste (32%). The recycling bins are found mainly in the staff and public areas of the hotel and only the 12% are located in the guest rooms.
- Concerning the alternative energy resources, the majority of the hotels use solar energy (37%) since the sun is found in abundance in Greece, 25% use photovoltaic and 10% use geothermal energy. It is remarkable that the 26% of the hotels do not use any alternative energy resources.
- As expected, the purchasing price is the dominant determinant (35%) in the selection of an energy saving system for the hotels. The next determinants are: the residues on the environment (27%), the rate of return (25%) and the efficiency of equipment (13%).
- The use of energy saving systems by the hotels, has contributed to the reduction of their operating costs enough (34%), much (33%), fairly (13%), too much (12%) and not at all (8%).
- The findings concerning the drop *percentage* in energy costs for lighting; hot water; heating and air conditioning; and energy cost in total are, respectively, 13%, 18%, 15% and 19%.

Conclusions

1. A part of the high class hotels in Thessaloniki (percentage 26% of the total sample) does not apply rational energy management.
2. The installed energy systems are relatively few and in their majority they are simple saving measures and not integrated saving energy solutions. Therefore, the suppliers of energy saving systems and more specifically of the alternative energy systems, as well as the organizations offering contemporary hotel energy solutions could find a significant number of potential clients in Thessaloniki.
3. The seen drop in energy costs of those hotels which use energy saving systems, namely a 13%-drop in lighting; 18% in hot water; 15% in heating and air conditioning; and 19% in total energy costs, are not proportional to the typical savings in the hospitality industry. The

[2] The towel and linen reuse policy saves mostly water, detergent and labor costs.

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average energy savings can reach: 30% for lighting, 20% for hot water, 20% for heating and air conditioning and the total saving of energy costs can reach the 30%-50%.

4. Areas that are susceptible of extensive efficiency improvements in the Thessaloniki hotels include: employee awareness about greening procedures, certifications and energy-saving practices; electricity and water consumption reduction; use of alternative energy resources, such as solar energy, biogas and wind; and convergence with the standards of the industry's energy-saving performance by implementing an effective energy management plan.

5. Simple green practices for energy saving to be implemented by the hotels, could also contribute in costs controlling, as well as in realistic resource consumption and environmental sustainability. These practices include: energy-efficient lighting and occupancy sensors, installation of digital thermostats, timers to turn off lights, regular monitoring and service of equipment and implementation of preventive maintenance programs.

6. Other sustainable and cost-effective solutions for reducing energy consumption and costs that can be suggested to facility managers include: the adoption of eco-labelling, use of energy toolkits, participation in EU or international projects aiming to reducing energy use and CO_2 emissions and the integration of wireless energy management systems.

7. Presentations, seminars, conferences and training of the hotel managers and their staff, offered by companies and organizations specialized in energy efficiency and management, as well as in renewable energy and eco-labelling can lead to better understanding, more system installations, rational use of the energy systems, energy saving and certainly increased profitability and sustainability. The Association of Greek Tourism Enterprises, the Hellenic Chamber of Hotels and the local tourism associations in collaboration with the universities can play a significant role towards this direction.

8. In-depth further research is required so that the specific reasons of limited energy savings used in the Thessaloniki hotels to be identified (e.g. insufficient information, lack of education, high cost of purchase and installation, etc.).

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Endnotes

[i] Postal address of workplace: P.O. Box 141, 57400 Thessaloniki, Greece

[ii] **Z-Wave** is a proprietary wireless communications protocol using a low-power radio frequency that is easily transmitted through walls and floors, and can also secure a virtually unlimited signal range, providing wider coverage and higher reliability. It can be embedded or retrofitted into a wide spectrum of devices, including lighting fixtures, thermostats, and even drapery and shades (Wikipedia).

[iii] **ZigBee** is a set of wireless protocols used for data transfer. ZigBee can be used in many applications, from industrial automation, utility metering, and building control to even toys (http://www.squidoo.com/zigbee-modules).