Tourism and Hospitality Management, Vol. 14, No. 2, pp. 349-358, 2008
Z. Hrs Borkovic, B. Kulisic, M. Zidar: ENERGY AUDIT – METHOD FOR ENERGY CONSERVATION ...

Institut for Economic Promotion, Austrian Economic Chamber, Vienna, Austria

T.E.I. Thessaloniki Greece

Department of Tourism Management

UDC 640.4:620.91](497.5)
Rewiev
Received: 04.03.2008

ENERGY AUDIT – METHOD FOR ENERGY CONSERVATION IN HOTELS

Zeljka Hrs Borkovic
Biljana Kulisic
Margareta Zidar
Energy Institute, Croatia[1]

Abstract: In the very near future, energy efficient hotels will cease to be the exception but will be the rule. Energy conservation and the intelligent utilization of renewable energy sources are prerequisite for sustainable development of tourism.
Due to global warming and increased standards in hotel industry, there is an increasing demand for energy for cooling in general, although this is especially reflected in hotel industry peaking in summer period. Furthermore, energy demand for hot water and food and beverages preparation in a hotel increases proportionally with the number of tourists. All these energy issues are overburdening the ever competing hotel industry.
Hotels, in order to optimize their energy costs and implementation of renewable energy sources utilization, have to perform energy audit - an analysis of thermal performance and energy systems of building with the purpose to determent its energy efficiency or non-efficiency.
This paper combines energy audit methodology with properties of energy consumption in hotel industry with an aim to provide guidelines for modern hotel energy management.

Keywords: hotel, energy management, energy audit, sustainable development, renewable energy sources.

[1]**Zeljka Hrs Borkovic**, BSc., **Biljana Kulisic**, MSc., **Margareta Zidar**, MSc., Department for Renewable Energy Sources and Energy Efficiency, Energy Institute Hrvoje Pozar, Zagreb, Croatia

INTRODUCTION

In 2006, Croatia fell below 50 percent in energy self sufficiency, which is estimated to continue its downward trend along with depletion of its fossil fuel supplies and growing trend in energy consumption to end to 80 percent of energy imports by 2030[2]. The national energy issue gets another dimension when energy production and, consequently, consumption, are linked with GHG emissions and international agreements (Kyoto Protocol, Barcelona Convention etc.) obliging reductions of anthropogenic impact on the environment. Buildings in Croatia account for highest final energy consumption (39.5%), higher than transport and industry and contribute to high level of greenhouse gas emissions. In the same time, the contribution of service sector has been estimated to some 10 percent[3].

From a hotel management's perspective, energy represents a significant but one of many cost items in their balance sheets that could influence on hotel's "bottom-line" profits[4]. Energy bills of a hotel could be divided into electricity, heat and transportation fuel bills. Hotels are dominantly using electricity as energy form (heating/cooling, lighting, refrigerators and coolers, lighting, escalators etc.) followed by significantly smaller share of energy forms needed for cooking and water heating such as liquid fuels and natural gas, coal and other energy forms[5].

Tourists' behaviour in energy consumption is different that their non-tourist at-home pattern for two main reasons. Firstly, as energy consumers, tourists are paying a flat rate for their stay in an accommodation facility without common rationale for energy saving (higher bills). Secondly, tourism offers an "escape" from common life and, while on vacations; tourists tend to indulge themselves[6].

Research in the Mediterranean climate type destinations (Greece[7], Tunisia[8] and Turkey[9]) provided a span between 273 kWh/m^2 (overall Greece) and 389 kWh/m^2 (Antalya, Turkey) for average annual electricity consumption per square meters in

[2] Vuk, B. et al., *Energy in Croatia 2006*, Ministry of Economy, Labour and Entrepreneurship of Republic of Croatia, 2007.
[3] Vuk, B. et al., *Energy in Croatia 2006*, Ministry of Economy, Labour and Entrepreneurship of Republic of Croatia, 2007.
[4] UNEP, *Switched on: renewable energy opportunities in the tourism industry*, UNEP Division of Technology, Industry and Economics, Production and Consumption Branch, United Nations Publication, 2000. available at: www.uneptie.org/tourism
[5] Deng, S., "*Energy and water uses and their performance explanatory indicators in hotels in Hong Kong*", *Energy and Buildings*, Vol. 35, 2000, 775-784
[6] Warnken, J., Bradley, M., Guilding, Ch., "Exploring *methods and practicalities of conducting sector-wide energy consumption accounting in the tourist accommodation industry*", *Ecological Economics*, Vol. 48, 2004, 125-141.
[7] Santamouris, M., Balaras, C. A., Dascalaki, E., Arigiriou, A., Galia. A., "*Energy conservation and retrofitting potential in Hellenic hotels*", *Energy and Buildings*, Vol. 24, 1996, 65-75.
[8] Khemiri, A., Hassairi, M., "*Development of energy efficiency improvement in the Tunisian hotel sector: a case study*". *Renewable Energy*, Vol.30, 2005, 903-911
[9] Önüt, S.; Soner, S., "*Energy efficiency assessment for the Antalya Region hotels in Turkey*", *Energy and Buildings*, Vol.38, 2006, 964-971

hotels. UNEP[10] has delivered a more flexible measure for electricity consumption in hotels linking the consumption with occupancy rate of an average of 25 kWh per guest per day in European hotels. Data of energy consumption in Croatia is available only on highly aggregated level of service sector which amounted to 4 455 GWh in 2006[11] as the latest study[12] on energy consumption in hotel industry was written in 2001 for a private client. Buildings are recognised as a field with the greatest potential for reducing total energy consumption as approximately 40 percent of European energy consumption where demand for lighting, heating and cooling, and hot water in households, offices and leisure facility exceeds the energy consumption coming from transport or industry[13].

Research shows that more than one-fifth of the present energy consumption and up to 30-45 MT of CO_2 per year could be saved by 2010 by applying more ambitious standards to new and when refurbishing buildings[14]. By promoting energy and ecologically sustainable building, energy efficiency aims to[15]:

- Reduce heat losses from buildings by improving thermal protection of external envelope and by securing an adequate relationship between area of building's envelope and a buildings volume,
- Increase heat gains by favourable orientation of the building and by use of solar energy,
- Utilise renewable energy sources in buildings – sun energy, wind energy, biomass, geothermal,
- Improve energy efficiency of thermal power systems.

1. NEW LEGISLATION FRAMEWORK

In 2005, Croatian government has delivered "New technical regulation on heat energy savings and thermal protection of buildings"[16] that became mandatory from the 1st of July, 2006. This regulation consists of:

- Technical demands on heat energy savings and thermal protection to achieve in design of new buildings and refurbishment and reconstruction of existing ones which are heated on space temperature higher than 12°C,
- Project content regarding heat energy savings and thermal protection,
- Statement of required heat energy for heating,

[10]UNEP, Switched on: renewable energy opportunities in the tourism industry, UNEP Division of Technology, Industry and Economics, Production and Consumption Branch, United Nations Publication, 2000. available at: www.uneptie.org/tourism

[11] Vuk, B. et al., Energy in Croatia 2006, Ministry of Economy, Labour and Entrepreneurship of Republic of Croatia, 2007.

[12] Krstulovic, V. et. al., Energy efficiency investement potentials in hotels on the Croatian coast, Energy institute Hrvoje Pozar, 2001.

[13] Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings

[14] EC, Directorate – General for Energy and Transport, 2007., available at: http://ec.europa.eu/energy/demand/legislation/buildings_en.htm

[15] Kolega, V., et al., KUEN building – Energy efficiency in buildings: Preliminary results and future activities, Energy institute Hrvoje Pozar, Zagreb, 1998.

[16] Official Gazette 79/2005

- Building maintenance regarding heat energy savings and thermal protection,
- Technical demands for building products,
- Other technical demands on heat energy savings and thermal protection.

The new aforementioned technical rule determines the maximum allowed annual heat demand per square meter or cubic meter of the building Q_h (expressed in kWh/m^{2}a or kWh/m^{3}a), depending on the form factor of the building, i.e. the ratio between the area of the building's envelope (heated space) and the building's volume. The heat transfer coefficient for windows and balcony doors in buildings heated to the temperature of 18°C and above is limited to a maximum of U=1.80 W/m^{2}K.

Building energy balance according to HRN EN 832:2000 + HRN EN 932/AC: 2004 includes:

- Transmission and ventilation losses through windows from inside to outside area,
- Transmission and ventilation losses through ventilation and heat gains from boarding zones,
- Useful internal heat gains from internal heat sources,
- Useful heat gains from sun,
- Heating system losses,
- Energy for heating.

Based on calculations of the thermal performance of a building, a certificate on the required heat energy for heating will be made. This energy certificate includes notice of the required heat energy for heating stated by the designer in the main design on heat energy savings and thermal protection and verified by the contractor. The statement of the contractor confirms that the work performed in the building, or a part of the building, has been carried out in accordance with technical solutions and conditions of construction relating to the heat energy savings and thermal protection and with rules of the Technical regulation. The contractor's statement is signed by the head engineer of the building site. This energy statement is enclosed with technical documentation required for the technical inspection of a building, or a part of the building, and it makes an integral part of documentation on maintaining and improving the essential requirements on the building. It should be available to prospective buyers, tenants and other authorised customers of a building or its part. This legislation is a good beginning to future energy certification of buildings.

Tourist accommodation in Croatia can be divided in major groups according to the period of construction: in the late 19th century, in the 1970-ies with mass tourism destinations and at the turn of the 20th century with major reconstruction and renovation of existing and building new capacities. By the period of their construction, it is possible to conclude the majority of them do not meet prerequisites of indoor comfort on account of low level of thermal insulation of external envelope. The reasoning behind this statement is rather rational as the insulation materials at that time were poor and the existing building regulations were not considering energy consumption in buildings as an issue.

In Europe there are many initiatives for promotion of efficient use of energy, energy demand management and promotion of production of renewable energy,

starting from Directive 2006/32/EC Energy end-use efficiency and energy services. Main goal of this Directive is to save 1% of energy distributed to final users per year. Improved energy end-use efficiency will also contribute to the reduction of primary energy consumption, mitigation of CO_2 and other greenhouse gas emissions and prevention of dangerous climate changes.

The Directive 2002/91/EC on energy performance of buildings promotes energy performance of buildings taking into account outdoor climatic conditions as well as indoor climate requirements and cost-effectiveness. The main goal of the Directive is to oblige member states to necessary reduction of final energy consumption in new and existing buildings.

Essential requirement is development of methodology of calculation of the integrated energy performance of buildings.

Member states need to provide trained experts for building certification, boilers inspection, ventilation and air conditioning systems and drafting of recommendations for system improvements in respect to energy saving and limiting carbon dioxide emissions.

For existing buildings with useful area larger than 1 000 m^2 for which refurbishment is planed, improvement of minimum energy characteristics is asked when ever is technically, functionally and economically feasible. New buildings must be constructed to meet required minimum energy conditions. For new buildings, with useful area larger than 1 000 m^2 technical, environmental and economic feasibility of alternative systems such as: decentralised energy supply systems based on renewable energy, cogeneration, district heating or cooling, heat pumps, etc. is considered and taken into account before construction starts.

2. ENERGY AUDIT

To determine energy performance of a building, both constructional elements and energy production and consumption systems need to be evaluated. Depending on the purpose of the building aforementioned elements and systems have different contribution and a various methodology is needed for precise energy performance calculation.

Energy audit is an analysis of thermal performance and energy systems of building with the purpose to determent its energy efficiency or non-efficiency. Energy audit also helps getting new conclusions and suggestions on how to increase the energy efficiency. Main goal of energy audit is to access and process collected data, and to get as much accurate present energy performance of building, concerning construction characteristics in terms of thermal protection, quality and efficiency of heating, ventilation and cooling systems, quality and efficiency of lighting and household appliances and building management.

In 1998, Energy Institute Hrvoje Pozar (EIHP)[17] has made a survey in order to retrieve data important for execution of different energy audits in residential and public buildings. The survey was consisted of following data sets:

- General data about the building – its type, purpose, year of the construction, year of the reconstruction, climate data, ownership,
- Constructions characteristic – total surface and heated area, window frame type and glazing, external wall, roof and floor type
- Energy indicators – energy consumption for heating and cooling on a monthly basis, electricity consumption, characteristics of the heating, hot water and cooling systems, ventilation system and all other energy demand, including passive heat gains
- Living comfort annotations from the occupants or management of the building
- Final conclusion and suggestion measures in at least two categories
- Smaller investment expenses and fast implementation
- More expensive investment with obligation to conduct detailed energy audit and feasibility study.

Depending on the data level and its accuracy, the audits could be divided into preliminary or walk through energy audit and detailed energy audit with feasibility study. Preliminary energy audit includes short input of energy condition in the building and its main objective is to determine its potential to increase the energy efficiency and to execute detailed energy audit. Visual observation of the buildings´ envelope and its energy systems with short analysis of collected data shows the key problems and gives recommendations for improving energy efficiency. If the preliminary energy audit indicates more complex energy saving possibilities, the audit can continue with a detailed energy audit and investment study. It comprises a detailed energy analysis of the building and identification of potential measures of energy efficiency, through conversation with owners or management of the building and review into existing documents related to energy consumption.

Conducting a detailed energy audit provides complete insight in existing energy issues and suggestions on future needs. Since a building is composed of various construction and energy systems various experts are needed in an energy audit team. Nevertheless, most of the energy efficiency measures suggested after the audit could be managed by few persons already employed in the hotel (i.e. maintenance manager).

Energy efficiency measures can always be implemented in a building to improve energy systems. They vary from simple measures of energy efficiency with no additional costs, measures with small expenses and fast pay back period (up to 3 years) to those measures with higher expenses, longer pay back period (more than 3 years) which are connected to reconstruction activities[18].

[17] Kolega, V., et al., *KUEN building – Energy efficiency in buildings: Preliminary results and future activities*, Energy institute Hrvoje Pozar, Zagreb, 1998.
[18] Hrs Borkovic, Z., et. al. *Guide to energy efficient building*, Ministry of Environmental Protection, Physical Planning and Construction, Zagreb, 2005.

Croatian experiences in residential buildings energy auditing have shown that energy efficiency measures, when applied in initial building investment or in refurbishment, make additional 10% to 30% to the investment with pay back period 6 to 12 years[19]. Energy audit provides substantial long term energy savings in case of refurbishment and/or reconstruction or in the early stages of accommodation facilities construction planning, too[20].

Energy audit in hotels differs from those executed in other buildings mostly in the part of suggestion measures. The difference is induced by the actual consumers of energy and their motivation to conserve energy. The hotel manager or the owner could have motivation in energy cost reduction but only up to the level that will not affect the level of services provided. The actual consumer, a tourist, does not share the same economic rationale as one pays a flat rate for the services enjoyed. Even more, if tourists' expectations from holiday facilities are not met, they do not tend to improve it but move to another which is contradictory to their own home improvements[21]. Therefore, a maintenance manager has to balance on the profitability line between the energy costs and guests' satisfaction. Thus, the suggested methods from an energy audit of a hotel should provide passive measures for energy conservation (magnetic card that is both key of the room and room energy switch is the energy conservation examples widely applied in hotels around Europe) where tourists' pleasure will not be jeopardised either by sustaining from energy intensive services such as wellness – whirlpool or asking additional effort such as closing windows while the air-conditioning is on.

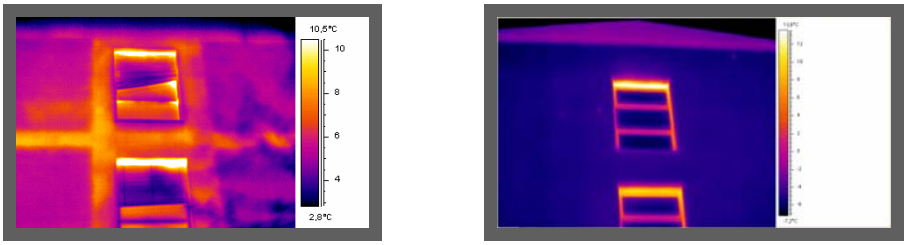
2.1. Importance of infrared thermography in future certification of buildings

Major part of overall energy consumption in buildings is a indoor comfort assessment both in summer and winter period. Infrared (IR) thermography is shown as especially useful method for visualisation of heat losses through constructional elements in improving energy efficiency of buildings survey.[22] Thermography inspection of buildings and expert interpretation of possible construction defects, are located and refurbishment actions directed to improve energy efficiency. Construction defect displayed by thermography are non homogeneous wall material, incorrect or non existing thermal insulation, damp in construction, flat roof problems, thermal bridges, open air ducts and ventilation, slots, installations in walls and floors, etc. Wireless and distance temperature field scanning of the building has major advantages for common construction analysis. Introduction of IR thermography in buildings is equally useful in

[19] Jelavic, B., Hrs Borkovic, Z., Zidar, M., "*Removing barrieirs to improve energy efficiency in Croatia*", in International Conference World Sustainable Energy Days 2007; Proceedings, O.Oe. Energiesparverband Wels, 2007.
[20] Warnken, J., Bradley, M., Guilding, Ch., "*Eco-resorts vs. mainstream accommodation providers: an investigation of the viability of benchmarking environmental performance*", Tourism Management, Vol. 26, 2005, 367-379
[21] Fortuny, M., Soler, R. Canovas, C., Sanchez, A., "*Technical approach for a sustainable tourism development.* Case study in the Balearic Islands", Journal of Cleaner Production¸ 2007, doi.10.1016/j.jclepro.2007.05.003, article in press
[22] Andrassy, M. et.al., Infrared thermography – education of thermographers, Faculty of Mechanical Engineering and Naval Architecture in Zagreb, Laboratory for heat and thermal power systems, Zagreb 2007.

energy auditing of existing buildings, historic buildings under protection, as in quality control of new buildings. Based on this, in developed countries IR thermography is implemented as obligatory method in technical characteristics quality control, building maintenance and management of public buildings in particular. In numerous energy certificates as calculated analyses control an IR scan is attached to visualise quality or defects of a building.

Figure 1 and 2: Comparison of infrared thermography picture in energy auditing before reconstruction and after reconstruction according to energy efficiency measures



Source: EIHP

Introducing energy certification of buildings in the future a significant use of IR thermography is expected, as in energy certification of existing buildings and quality control of new buildings.

3. DISCUSSION

Several studies on energy efficiency in the hotels with the Mediterranean type of climate showed discrepancies in methodologies and very few of them had comparable results[23]. In order to formulate an effective policy measures, it is necessary to have reliable and harmonised statistical information and this is the area where energy efficiency in hotels still has to improve[24]. Some studies[25] were dealing with successfulness of energy consumption accounting methods where mandatory reporting method showed the most promising results. In the Mediterranean region, the EU has developed a Mediterranean Action Plan for sustainable development of tourism and introduced eco-labelling of hotels that had, so far, little response[26]. Large hotel groups tend to believe that energy savings will adversely affect the level of service promised to

[23] Önüt, S.; Soner, S., "*Energy efficiency assessment for the Antalya Region hotels in Turkey*", Energy and Buildings, Vol.38, 2006, 964-971
[24] EEA, "*Europe's environment; the fourth assessment*", Office for Official Publications of the European Communities, 2007
[25] Warnken, J., Bradley, M., Guilding, Ch., "*Exploring methods and practicalities of conducting sector-wide energy consumption accounting in the tourist accommodation industry*", Ecological Economics, Vol. 48, 2004, 125-141.
[26] EEA, "*Europe's environment; the third assessment*", Office for Official Publications of the European Communities, 2003.

their guests[27]. Indeed, there is a geometrical link between electricity consumption and luxury level of a hotel with a 142 percent increase in electricity consumption from one to four stars Accor hotels[28]. However, recent surveys suggest that many people would pay extra for accommodation that was part of a green accreditation scheme[29]. Nevertheless, appliance of some energy conservation methods could significantly contribute to profitability performance of a hotel due to less energy costs while other methods where larger investment is needed for energy conservation, could have some drawbacks in short-term profitability of a hotel. Energy conservation in buildings has been recognised as an important issue in numerous countries, especially in the EU, where governments provide harsh legislation framework[30] from the one side and substantial financial support for energy conservation from the other side. This is also the case with Croatia where, besides legislation[31] that has been harmonising to the *acquis communitare*, financial support is provided by both international (WB; UNDP; UNEP, OECD, EU, etc.) and national (EEEPF, ESCo concept, HBOR) institutions for energy audits, programmes and measures.

CONCLUSION

So far, methodology for energy audits has been developed for residential and public buildings for there is possible to determine a pattern of use. Due to heterogeneity of accommodation facilities in size, age, construction material, energy appliances, luxury level, location, etc. that affect the consumption pattern, it is difficult to apply common methods of energy consumption analyses such as energy auditing in hotels without some adjustments. This induces another problem for evaluating energy efficiency in hotel industry which is deciding on what is the "industry best practice" and lack of benchmarking[32]. Although it is difficult to benchmark energy audits in overall hotel industry, a successfulness of the suggestion measures could be individually evaluated by the same quality of service provided and pleasure of guests achieved in the hotel while having lower energy bills than before the energy efficiency measures applied.

[27] Dalton, G. J., Lockington, D. A., Baldock, T. E., "*A survey of tourist operator attitudes to renewable energy supply in Queensland; Australia*", Renewable Energy, Vol. 32, 2007, 567-586

28 IFEN, "Tourisme, environnement, territoires: les indicateurs", Institut Français de l'Enivronnement, Les indicateurs - Edition 2000.

[29] EEA, *Europe's environment; the fourth assessment*, Office for Official Publications of the European Communities, 2007.

[30] Directive 2002/91/EC on energy performance of buildings; Directive 2006/32/EC on energy end-use efficiency and energy services

[31] Technical regulation concerning heat energy savings and thermal protection (OG 79/05); Law on physical planning and construction (OG 76/07)

[32] Warnken, J., Bradley, M., Guilding, Ch., "Eco-resorts vs. mainstream accommodation providers: an investigation of the viability of benchmarking environmental performance", *Tourism Management*, Vol. 26, 2005, 367-379

REFERENCES

Andrassy, M., et al., Infrared thermography – education of thermographers, Faculty of Mechanical Engineering and Naval Architecture in Zagreb, Laboratory for Heat and Thermal Power Systems, Zagreb, 2007.

Dalton, G. J., Lockington, D. A., Baldock, T. E., "A survey of tourist operator attitudes to renewable energy supply in Queensland; Australia", Renewable Energy, Vol. 32, 2007, 567-586

Deng, S., "Energy and water uses and their performance explanatory indicators in hotels in Hong Kong", Energy and Buildings, Vol. 35, 2000, 775-784

Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings

Directive 2006/32/EC of the European Parliament and of the Council on the energy end-use efficiency and energy services

Directorate – General for Energy and Transport, 2007., available at: http://ec.europa.eu/energy/demand/legislation/buildings_en.htm

EEA, Europe's environment; the third assessment, Office for Official Publications of the European Communities, 2003.

EEA, Europe's environment; the fourth assessment, Office for Official Publications of the European Communities, 2007.

Fortuny, M., Soler, R. Canovas, C., Sanchez, A., "Technical approach for a sustainable tourism development. Case study in the Balearic Islands", Journal of Cleaner Production¸ 2007, doi.10.1016/j.jclepro.2007.05.003, article in press

Hrs Borkovic, Z., et. al. Guide to energy efficient building, Ministry of Environmental Protection, Physical Planning and Construction, Zagreb, 2005.

IFEN, Tourisme, environnement, territoires: les indicateurs**",** Institut Français de l'Enivronnement, Les indicateurs - Edition 2000, France, 2000.

Jelavic, B., Hrs Borkovic, Z., Zidar, M., "Removing barrieirs to improve energy efficiency in Croatia", in International Conference World Sustainable Energy Days 2007; Proceedings, O.Oe. Energiesparverband Wels, 2007.

Khemiri, A., Hassairi, M., "Development of energy efficiency improvement in the Tunisian hotel sector: a case study". Renewable Energy, Vol.30, 2005, 903-911

Kolega, V., et al., KUEN building – Energy efficiency in buildings: Preliminary results and future activities, Energy institute Hrvoje Pozar, Zagreb, 1998.

Krstulovic, V. et. al., Energy efficiency investement potentials in hotels on the Croatian coast, Energy institute Hrvoje Pozar, 2001.

Official Gazette 79/2005 Technical regulation concerning heat energy savings and thermal protection

Official Gazette 76/2007 Law on physical planning and construction

Önüt, S.; Soner, S., "Energy efficiency assessment for the Antalya Region hotels in Turkey", Energy and Buildings, Vol.38, 2006, 964-971

Santamouris, M., Balaras, C. A., Dascalaki, E., Arigiriou, A., Galia. A., "Energy conservation and retrofitting potential in Hellenic hotels", Energy and Buildings, Vol. 24, 1996, 65-75.

UNEP, Switched on: renewable energy opportunities in the tourism industry, UNEP Division of Technology, Industry and Economics, Production and Consumption Branch, United Nations Publication, 2000. available at: www.uneptie.org/tourismVuk, B. et al., Energy in Croatia 2006, Ministry of Economy, Labour and Entrepreneurship of Republic of Croatia, 2007.

Warnken, J., Bradley, M., Guilding, Ch., "Exploring methods and practicalities of conducting sector-wide energy consumption accounting in the tourist accommodation industry", Ecological Economics, Vol. 48, 2004, 125-141.

Warnken, J., Bradley, M., Guilding, Ch., "Eco-resorts vs. mainstream accommodation providers: an investigation of the viability of benchmarking environmental performance", Tourism Management, Vol. 26, 2005, 367-379