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

T.E.I. Thessaloniki Greece

Department of Tourism Management

UDC 338.48:620.91](497.5)
Preliminary communication
Received: 04.03.2008

TOURISM AS A PATHWAY FOR RES UTILISATION

Biljana Kulisic
Margareta Zidar
Branka Jelavic
Julije Domac
Velimir Segon
Energy Institute, Croatia[1]

Abstract: Tourism, due its property of being an "invisible export" sector, has a strong multiplier effect over the economy. Tourists boost demand for numerous goods and services, one of them being energy. Unfortunately, energy sources are scarce for most of the countries in the region. Thus, one could think of another solution to the excess demand for energy than import. Namely, for more than a decade, renewable energy sources are in the central focus of the EU energy policy with an aim to ensure security, price stability, availably and affordability of energy to its citizens together with reduction of GHG emissions and making the EU economy more competitive. Combining tourism with renewable energy sources utilisation helps reducing the spill over effect from energy import.
In this paper, the cross-section analysis based on environmental determination of tourism and renewable energy sources potentials is performed in order to indicate a pathway for implementation of renewable energy sources utilisation in the tourism and hotel industry.

Keywords: tourism, renewable energy sources, energy demand.

INTRODUCTION

Harmonisation to the *aquis communautaire* has brought many changes in Croatian legislation where intersectoral effects are difficult to grasp. Energy sector has

[1] **Biljana Kulisic**, MSc., **Margareta Zidar,** BA, **Branka Jelavic,** Ph.D., **Julije Domac,** Ph.D., **Velimir Segon,** MSc., Department for Renewable Energy Sources and Energy Efficiency, Energy Institute, Croatia.

been under the process of liberalisation[2], local governments are becoming responsible for its energy planning and supply, renewable energy sources and cogeneration became of a strategic interest to the Republic of Croatia[3], to number only the few. In 2007, Kyoto protocol has been ratified which brings additional obligations in respect of environmental protection. In *avis* of European Commission, waste management in Croatia has been reported as a largest single problem of environmental protection in Croatia[4].

Tourism, due its property of being an "invisible export" sector, has a strong multiplier effect over the economy. Tourists boost demand for numerous goods and services, one of them being energy. Unfortunately, energy sources are scarce for most of the countries in the region. Thus, one could think of another solution to the excess demand for energy than import. Namely, for more than a decade, renewable energy sources are in the central focus of the EU energy policy with an aim to ensure security, price stability, availably and affordability of energy to its citizens together with reduction of GHG emissions and making the EU economy more competitive. Combining tourism with renewable energy sources utilisation helps reducing the spill over effect from energy import. If combined with municipal waste utilisation, it could also contribute to obligations signed with Kyoto Protocol. Given the high concentration of hotel industry along the Adriatic coast, this paper will investigate a possibility of hotel industry to help local community in energy planning by producing bioenergy from organic kitchen waste.

This paper tries to assess the technical potential of organic waste utilisation coming from tourism and hotel industry.

1. TOURISM IN RELATION TO ENERGY AND WASTE

Most of the energy consumption related to tourism industry, about 90%, falls on energy needed for travel to and from destination[5] while the rest of the energy consumption occurs in the destination itself. If looking closely to the energy consumption of destination, the largest share of energy demand is related to accommodations – hotel industry. Hotels are dominantly using electricity as energy form (heating/cooling, lighting, refrigerators and coolers, lifts, escalators etc.) followed by significantly smaller share of energy forms needed for cooking and water heating such as liquid fuels and natural gas or coal[6]. Croatian hotel industry follows that pattern where service sector is second largest consumer of electric energy in total electric energy demand[7]. Occupancy rate varies from 25 to 29 percent[8] indicating the seasonality of maritime tourism and its dominance as tourist profile. In that period, tourist-resident ratio is 8.4 meaning that, in average; one coastal inhabitant and 8

[2] Energy Community Treaty, OJ 06/06
[3] Energy Law, OJ 68/01, 177/04
[4] Waste Management Strategy for the Republic of Croatia, OJ 130/05
[5] EEA, *Europe's environment; the fourth assessment*, Office for Official Publications of the European Communities, 2007.
[6] Deng, S., "Energy and water uses and their performance explanatory indicators in hotels in Hong Kong", *Energy and Buildings*, Vol. 35, 2000, 775-784
[7] Vuk, B. et al., Energy in Croatia 2006, Ministry of Economy, Labour and Entrepreneurship of Republic of Croatia, 2007.
[8] EUROSTAT, Tourism Statistics – 2007 edition, European Communities, 2007.

tourists are staying in the same destination at the same time. Given the international forecasts, Croatia has been described as a very large, most intensive and fast growing travel and tourism economy with estimated growth of 7.9 percent total tourism demand in next 10 years and current tourism industry and economy contribution of 8.5 percent and 19 percent, respectively[9]. This growth should be facilitated with planning the carrying capacity of a destination not only in number of beds but also in other issues such as water, energy supply and waste management, too. The table below shows the number of overnights stay in Croatia for year 2000 and period 2003 to 2005.

Table 1.: Characteristics of tourism demand in Croatia (domestic and inbound)

Year	Nights spend in collective accommodation					Occupancy rate of bed places
	Total	By residents		By non-residents		
	in 1000	in 1000	as % of total	in 1000	as % of total	Annual average
2000	30 858	4 224	13,7	26 634	86,3	25%
2003	35 246	4 263	12,1	30 983	87,9	28%
2004	35 991	4 240	11,8	31 751	88,2	28%
2005	37 292	4 172	11,2	33 120	88,8	29%
2015*	40 238	4 507	11,2	35 731	88,8	29%

*estimated growth of 7.9%[10] and same rate of occupancy as well as distribution of residents and non-residents
Source: EUROSTAT, *Tourism Statistics – 2007 edition*, European Communities, 2007.

The data from Table 1, especially years 2005 and 2015 will be used as basis for the further calculations.

If assuming that residential tourist will consume the same amount of electricity as in their home, additional electric energy demand generated by foreign tourist could be estimated at 828 and 893 GWh for the years 2005 and 2015, respectively (Table 2) which is 19 and 20 percent of total electricity consumption by service sector in 2005[11].

[9] WTTC, TSA Country Reports: Croatia – the 2007 Travel and Tourism Economic Research, World Travel and Tourism Council, 2007. available at: http://www.wttc.travel/bin/pdf/original_pdf_file/1croatia.pdf
[10] WTTC, TSA Country Reports: Croatia – the 2007 Travel and Tourism Economic Research, World Travel and Tourism Council, 2007. available at: http://www.wttc.travel/bin/pdf/original_pdf_file/1croatia.pdf
[11] Vuk, B. et al., *Energy in Croatia 2006*, Ministry of Economy, Labour and Entrepreneurship of Republic of Croatia, 2007.

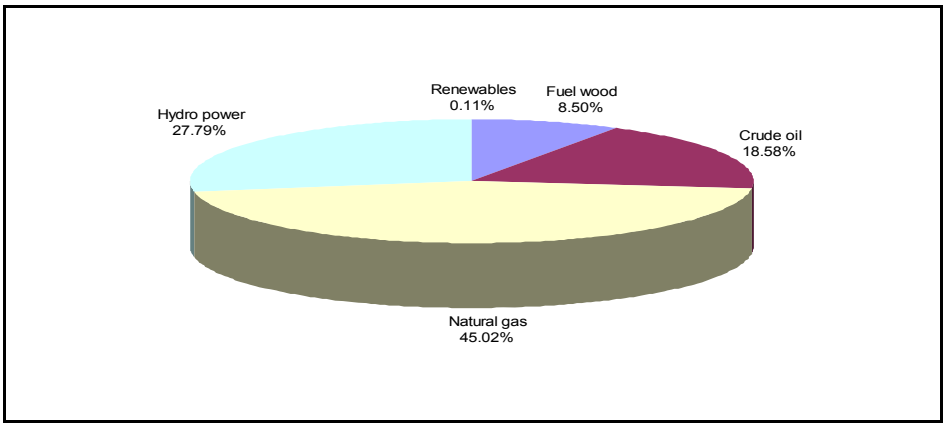
Table 2.: Electricity consumption related to foreign tourist

Year	Nights spent in collective accommodation[12]			Electricity consumed (25 kWh/day/guest[13])	
	Total tourists	By non-residents		Total tourists	By non-residents
	in 1000	in 1000	as % of total	GWh	
2000	30 858	26 634	86	771	666
2003	35 246	30 983	88	881	775
2004	35 991	31 751	88	900	794
2005	37 292	33 120	89	932	828
2015*	40 238	35 731	89	1006	893

*estimated growth of 7.9%
Source: EIHP

In 2006, about half of Croatian demand for energy was supplied from imports and another half from own energy sources. The structure of the total primary energy supply is shown in the Figure1. Some 63 percent are import dependent (crude oil and natural gas) while hydro power depends on the annual precipitation level. The smallest share represents emerging renewable energy sources (RES).

Figure 1.: Shares of energy forms in total primary energy supply (2006)



Source: EIHP

Having a mix of fossil (non-renewables) and RES in national energy portfolio gives energy price stability since national energy sector is more robust to international energy prices changes[14]. RES are, like tourism, site specific and, if properly planned,

[12] EUROSTAT, *Tourism Statistics – 2007 edition*, European Communities, 2007.
[13] ADEME, *Final Report—Green Flag for Greener Hotels*, LIFE, ENV/00038/FR Project, 06/02/2001. and ADEME, *.Interim Report and Annex — Green Flag for Greener Hotels*, European Commission DGXI, LIFE Program,1999.
[14] Awerbuch, S., "Portfolio-Based Electricity Generation Planning: Policy Implications for Renewables and Energy Security," SPRU, U-Sussex, working paper, 2004.

could bring also additional socio-economic benefits to the local community such as added value and employment.

Biogas is one of many forms of bioenergy derived from biomass. Biogas is a mixture of methane and carbon dioxide produced by bacterial degradation of organic matter in anaerobic conditions which can be used as a fuel for production of electricity and heat. Organic matter that can serve as digestate is usually coming from some other activity such agriculture, urban waste, food processing industry or any other activity that generates biodegradable organic matter. Depending on the composition of digestate used, it is possible to use the exhausted substrate after digestion as fertiliser in agriculture. In Europe, anaerobic digestion has become one of the standard technologies in the treatment of organic waste, where countries like Germany, Denmark and Austria are leading the way[15].

2. WASTE MANAGEMENT AND TOURISM

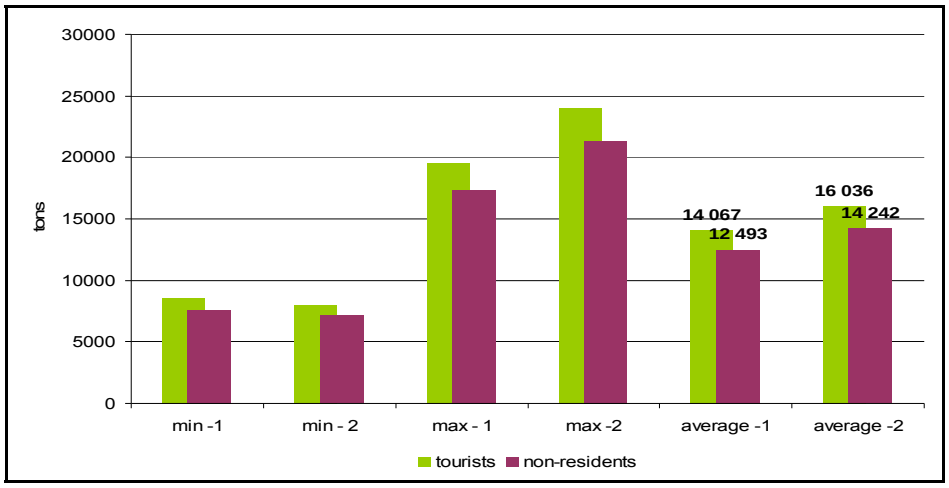
In July 2007, Croatian government has delivered Waste Management Plan for period 2007 to 2015[16] based on the Waste Management Strategy[17] with an aim to establish a self-sufficient waste management system. This is to be achieved by following the principles of sustainable development through decreasing the amount of waste occurring in general, amount of waste disposed on landfills during primary useful waste separation, share of biodegradable waste in total municipal waste disposal while minimising the negative impact of disposed waste on environment, climate and human health. Waste management should seek for utilisation of waste for energy production purposes and should be organised at national and municipal level.

It has been estimated that total waste induced from tourism related activities amounts to 97 700 tons of municipal waste per year[18]. Since waste collection fee is calculated per square meter of a household or spatial area of a hotel or restaurant, it is difficult to provide an exact number for municipal waste generated, let alone the share of its organic component. Figure 2 provides comparison of two methodologies for calculating the biodegradable component of municipal waste suitable for generating energy.

The values designated with parameters assigned with “1” represent calculation of organic component according to numbers provided in the Waste management plan while those parameter designated with “2” are calculated according to the research made within the Intelligent Energy Europe project[19]. It can be seen that both methodologies lead to similar results although European methodology provides more conservative results.

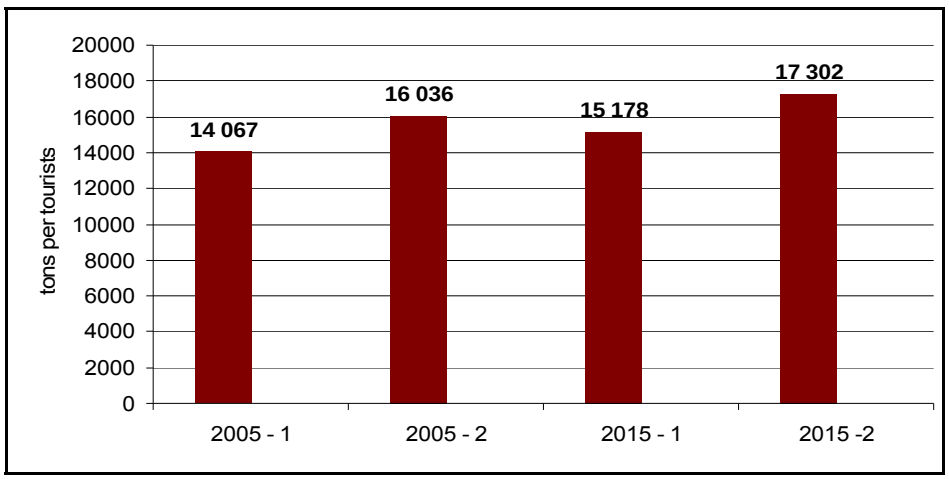
[15] IEA Bioenergy Task 37, http://www.iea-biogas.net/
[16] Waste Management Plan, OJ 85/07
[17] Waste Management Strategy OJ 130/05
[18] Waste Management Plan, OJ 85/07
[19] WIP: *BiG>East- Biogas for Eastern Europe*, Project number: EIE/07/214, duration 2007-2010.

Figure 2.: Estimation of organic waste related to tourist overnight stays in Croatia in 2005



The following figure considers the effect of forecasted growth in tourist arrivals of 7.9% until 2015 on organic waste generation by comparing the estimations for 2005.

Figure 3.: Projected organic waste generation for 2015 according to the forecasted growth



Source: EIHP, WTTC

The bars are representing the average values of organic waste related to preparation and consumption of meals for tourists for years 2005 and 2015. Again, the same annotations as for Figure 2 are made for both years according to the methodology used for calculations. One could conclude that coastal municipalities apart benefiting from tourism could also have a technical potential between 14 000 and 17 000 tons of organic waste to utilise for energy purposes.

3. RES UTILISATION AND TOURISM

Croatian government has set a target of 5.8 percent or 1 139 GWh as the minimal share of electricity generated from RES (RES-E) by year 2010[20]. The table below estimates energy potential of waste generated by preparing and consuming food by tourists, taking the average values for anaerobic digestion of organic waste[21].

Table 3.: Biogas electricity generation related to organic waste coming from tourists and its corresponding shares

Year*	RES-E generated from organic waste (tourists)	Share of total electricity demand from tourists		Share in RES-E target
	GWh	% of total tourist demand	% of non-residents demand	%
2005 - 1	11,35	1,47%	1,70%	1,00%
2005 - 2	12,94	1,47%	1,67%	1,14%
2015 - 1	12,23	1,36%	1,54%	1,07%
2015 - 2	13,96	1,50%	1,69%	1,23%

* according to organic waste calculation methodology

It can be seen that municipalities situated on the coast of the Adriatic Sea are having a technical potential for electricity generation from biogas of 11.35 to 12.94 GWh which is around 1.5 percent of the electricity demand originated from tourist visitations to the same area and little more over 1 percent contribution to the national target for RES-E. The electricity production is related to the occupancy rate and the period of tourist season on the Croatian coast.

4. DISCUSSION

Biogas production could be used for two main reasons – either for decreasing the volume of organic waste in landfills or for production of energy. Since both energy planning and waste management are shifted to local level, a municipality could be interested in possibility of combining biogas as a way for managing municipal waste and for local energy purposes. It could be helpful to the tourism benefiting municipalities to weight the possibilities of new legislation that describes both energy and waste related issues (Table 4). New legislation on RES-E has delivered a tariff system for production of electricity from RES to encourage development of renewables market. Electricity produced from biogas is awarded with 14.20 €c to 16.39 €c per

[20] Ordinance on Minimal Subsidised Share of Electric Energy from Renewable Energy Sources and Cogeneration, OJ 33/07
[21] Monnet, F., *An Introduction to Anaerobic Digestion of Organic Waste* - final report; Remade Scotland, 2003

kWh of electricity produced (depending on the installed power)[22]. On the other hand, waste management plan[23] estimates the costs for thermal processing and disposal of 20 to 60 € per ton of municipal waste (tax included) for Croatia.

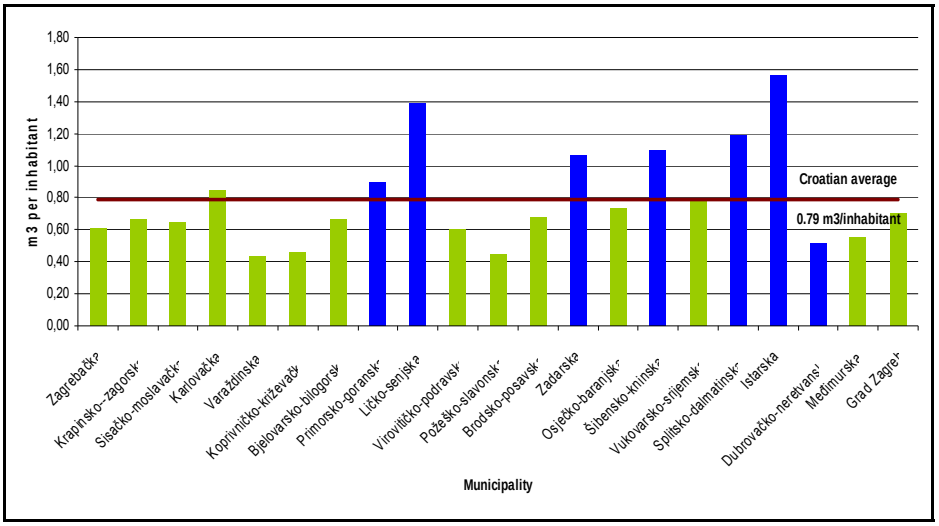
Table 4.: Comparison of waste management possibilities from tourism

Year*	Organic waste generated	Annual cost of disposal		Annual subsidies from biogas produced	
	t	€		€	
		min	max	min	max
2005 - 1	14 067	- 281 331	- 843 993	+ 1 999	+ 2 306
2005 - 2	16 036	- 320 711	- 962 134	+ 2 278	+ 2 629
2015 - 1	15 178	- 303 556	- 910 668	+ 2 156	+ 2 488
2015 - 2	17 302	- 346 047	- 1 038 142	+ 2 458	+ 2 837

* according to organic waste calculation methodology

The values provided in the table 4 are referring to the technical potential of organic waste coming from food preparation and consumption related to tourism with annual cost in case of organic waste disposal and revenues from subsidies on RES-E. These figures would be of interest to municipalities placed on the Adriatic coast (blue bars) where amounts of total disposed waste per inhabitant are all higher, except in Dubrovacko – neretvanska, than the national average.

Figure 4.: Amounts of disposed waste according to the municipalities in 2003



Source: Waste Management Strategy for the Republic of Croatia, OJ 130/05

[22] Tariff System for Production of Electric Energy from Renewable Energy Sources and Cogeneration, OJ 33/07
[23] Waste Management Strategy for the Republic of Croatia, OJ 130/05

Considering that the RES utilisation is replacing the equivalent energy mix for electricity generation of Croatia, the amount of biogas electricity produced out of the technical potential calculated in this paper saves 3 to 4 tons of CO_2 emissions[24] per year. However, the larger significance lays in avoiding the greenhouse gases emissions from land-filling where methane from the organic waste (biogas plant feedstock) was utilised instead of added to the national greenhouse gases emission inventories. Using conservative parameters, biogas utilisation could save some 5 000 to 6 000 tons of CO_{2eq} per year, although new methodology introduced by IPCC suggests figures ten times higher[25]. As this paper investigates technical potential only, the intention here is to provide indicative values for GHG emissions.

CONCLUSIONS

So far, tourism in Croatia has not been investigated as a source for biogas production and this paper deliver its technical potential for electricity generation in respect to electricity demand induced by non-resident visitors. As such, biogas can contribute with little over 1 percent to the national target of RES-E by 2010 and about 1.5 percent of the total electricity demand generated from foreign tourists and save up to 1 million Euros per year for organic waste disposal.

The technical potential of electricity production from biogas using organic kitchen waste originated from food preparation and consumption as anaerobic digestate indicates that those municipalities that are having tourism as integrated economic activity in their local economy, could include biogas as a way of waste and energy management policy. In addition, they could also contribute to meeting the international obligations related to environmental protection by decreasing influence of landfills on air, soil and water degradation and GHG emissions. Moreover, in tourist active areas, scenery plays an important role while tourist could reward sustainable development efforts of a destination, if properly marketed.

However, the technical potential should be further investigated in respect of tourist concentration spots using spatial analyses as well as local possibilities to increase or/and combine the amount of feedstock considering related sources such as food processing industry, agriculture and organic kitchen waste from households. Furthermore, each municipality has different budget available as well as waste management programme and landfill properties. It would be worth investigating what are the economic, environmental and energy possibilities of investing in biogas plant where budget share designated for landfill cost will be transferred to energy investments with waste reduction potential on the local level.

[24] Juric et al., *National Inventory Report for the Period from 1990 to 2003 – Inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol,* EKONERG, LIFE project, Zagreb, 2005.
[25] Juric et al., *National Inventory Report for the Period from 1990 to 2003 – Inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol,* EKONERG, LIFE project, Zagreb, 2005.

REFERENCES

ADEME, .Interim Report and Annex — Green Flag for Greener Hotels, European Commission DGXI, LIFE Program,1999.

ADEME, Final Report—Green Flag for Greener Hotels, LIFE, ENV/00038/FR Project, 06/02/2001.

Awerbuch, S., "Portfolio-Based Electricity Generation Planning: Policy Implications for Renewables and Energy Security," SPRU, U-Sussex, working paper, 2004.

WIP: BiG>East- Biogas for Eastern Europe, Project number: EIE/07/214, duration 2007-2010.

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

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

Energy Community Treaty, OJ 06/06

Energy Law, OJ 68/01, 177/04

EUROSTAT, Tourism Statistics – 2007 edition, European Communities, 2007.

IEA Bioenergy Task 37, http://www.iea-biogas.net/

Juric et al., National Inventory Report for the Period from 1990 to 2003 – Inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, EKONERG, LIFE project, Zagreb, 2005.

Monnet, F., An Introduction to Anaerobic Digestion of Organic Waste - final report; Remade Scotland, 2003.

Ordinance on Minimal Subsidised Share of Electric Energy from Renewable Energy Sources and Cogeneration, OJ 33/07

Tariff System for Production of Electric Energy from Renewable Energy Sources and Cogeneration, OJ 33/07

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

Waste Management Plan, OJ 85/07

Waste Management Strategy for the Republic of Croatia, OJ 130/05

WTTC, TSA Country Reports: Croatia – the 2007 Travel and Tourism Economic Research, World Travel and Tourism Council, 2007. available at: http://www.wttc.travel/bin/pdf/original_pdf_file/1croatia.pdf