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Review Paper

THE "NEGATIVE" IMPACT OF A GROWING NUMBER OF TOURISTS ON THE SECURITY OF ENERGY SUPPLY MARKET IN NIŠ REGION

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Abstract. *The basic precondition for the increase in the number of tourists is the improvement of tourism potentials: accommodation capacity; additional contents including arts, entertainment and festival programs; development of infrastructure (roads, railways, airports), etc. Available data indicate that there has been a significant increase in the number of tourists in the last ten years. However, the increase in the number of tourists does not correlate with the increase in the production of total electricity. Considering the constant growth of economic activity and increased number of residents, the analyzed data show that the increase in the number of tourists actually has a negative impact on the security of energy supply market. In this paper, the authors analyze the available data and point to the need for urgent planning of the security of energy supply, bearing in mind that the results indicate a huge increase in electricity consumption directly caused by the growth of consumers, where the growing number of tourists actually represents a variable that is itself a risk to the security of energy supply.*

Key words: *energy security, increased electricity consumption, planning the security of supply.*

1. INTRODUCTION

The security of energy supply is a burning issue of many energy-dependent states. Their needs are estimated at the level of statistical fluctuations of consumption required to meet economic and non-economic activities. The increased activity on the promotion of tourism in the Republic of Serbia leads to the increase in the number of tourists as well

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as electricity consumption in all sectors. Except for the state planning documents, Serbian academic publications rarely provide an overview of the correlation between increased energy consumption and the growth of tourism.

International publications are somewhat more extensive, but there is an impression that the relationship between energy consumption and the growth of tourism has not been sufficiently researched, bearing in mind the strategic significance of the security of energy supply and increased global mobility of the world population. Available sources provide several studies dedicated to the interdependence between energy consumption and tourism.

Becken, Simmons and Frampton (2003: 276-277) pointed to idea that the different choices tourists make regarding their transport, accommodation and attractions affected energy consumption in New Zealand. These authors quantified the impact of tourism on energy consumption and found that the total energy consumption of foreign tourist was four times higher than the energy consumption of domestic tourists. They also concluded that the transportation of domestic and foreign tourists clearly dominated energy consumption (65-73% of total energy). Their research was based on previous experiences (Becken, Frampton, Simmons, 2001: 384-385) gained by examining the impact that hotels, motels and other accommodation facilities had on energy consumption in the same area. The results indicated that hotels were the largest energy consumers with a contribution of 67% of total energy consumption of accommodation facilities and 0.4% of total energy consumption in New Zealand. Tourists are the largest energy and fuel consumers in Hawaii as well, with a contribution of 60% of total energy consumption (Tabatchnaia-Tamirisa *et al*, 1997: 399). The analysis of the correlation between the number of tourists and energy consumption revealed that this relationship was positive, statistically significant and inelastic, that is, the increase in the number of tourists by 1% contributed to the increase in energy consumption by less than 1% (Katircioglu *et al*, 2014: 186-187).

In recent years, research has yielded controversial results. Lee (2013: 91-94) pointed out that foreign tourists had a direct and indirect positive effect on electricity consumption. Unlike him, Bakhat and Rossello (2011: 442), having examined the impact of tourism on electricity consumption in the case of the Balearic Islands in Spain, concluded that tourism cannot be considered an energy intensive sector from the point of view of electricity consumption. They also stated that the increase in consumption was the result of increased electricity consumption of residents rather than tourists. The authors explained that the increase was the result of residents' improved standard of living.

Pablo-Romero and her associates (2017: 7-9) examined the relationship between electricity consumption in accommodation facilities and overnight stays in Spanish provinces in the period from 1999 to 2013 to test the Kuznets Curve hypothesis[1]. The results showed that the Kuznets Curve was not supported, but that there was a positive correlation between electricity consumption and the number of overnight stays. At the same time, the research on the interdependence between electricity consumption in hotels and restaurants and the number of overnight stays in 11 EU members in the period from 2005 to 2012 showed that there was a positive link between the examined phenomena. Lai and his associates (2011: 1134)

[1] According to Kuznets, the increase in income per capita affects the increase in unequal distribution of national income among the residents belonging to underdeveloped economies. However, economic growth affecting the increase in income per capita contributes to reducing inequality in developed economies. The observed interdependence between income per capita and inequality in the distribution of income is known as the Kuznets curve. Nowadays, it has a significant role in studying the interdependence between various variables. (Kuznets, S., Economic Growth and Income Inequality, *American Economic Review*, Vol. 45, No.1, 1955, pp.1–28).

confirmed a positive correlation between electricity consumption and tourism industry on the example of gaming and resort facilities. The results of some studies indicated that floor area affected the consumption of electricity, and that the average electricity consumption was about 342 kWh/m2/year. The survey was conducted over a period of three years in the case of 17 hotels in Hong Kong (Chan *et al*, 2002: 382-389).

On the basis of the above, we can state that tourism has a positive impact on electricity consumption but also that residents, who enjoy higher living standards, stimulate consumption. With this idea in mind, the authors pay special attention to the analysis of the impact of tourism development and the number of residents on electricity consumption, in order to identify whether tourist traffic or the number of residents contribute to the increase in electricity consumption in the City of Niš (and changes at the level of all city municipalities).

In addition to investments in primary funds for the purpose of electricity supply, researchers pay special attention to the factors that influence the increase of investments in order to intensify the production of electricity.

2. METHODS AND HYPOTHESES

The authors employ a correlation and regression analysis in this paper. The correlation analysis is used to examine the interdependence between tourist traffic and electricity consumption, as well as interdependence between the number of residents and electricity consumption. The regression analysis enabled the quantification of the impact of tourist traffic and electricity consumption on investments in primary funds for the purpose of electricity, gas and steam supply in the City of Niš.

The authors tested the following hypotheses:

- H1: There is a statistically significant positive correlation between the number of tourists and electricity consumption;
- H2: There is a statistically significant positive correlation between overnight stays and electricity consumption;
- H3: There is a statistically significant positive correlation between the number of residents and electricity consumption;
- H4: The number of tourists has a statistically significant positive impact on electricity consumption;
- H5: The number of tourists has a statistically significant positive impact on investments in primary funds for the purpose of energy, gas and steam supply in the city of Niš.

3. QUANTITATIVE ANALYSIS (INITIAL VALUES)

3.1. Number of Residents

The City of Niš is the third largest city in the Republic of Serbia. It is estimated to have more than 250,000 residents, with a constant growth due to permanent migrations from other towns in southern Serbia. Table 1 shows quantitative changes in the number of residents in the period from 1953 to 2016. Given that the last population census in the

Republic of Serbia and the City of Niš took place in 2011, for the purpose of this analysis, Table 1 shows the estimated number of residents for 2007, 2008, 2009, 2010, 2012, 2013, 2014, 2015 and 2016.

Table 1 Quantitative characteristics of the residents of Niš

Year	Number of residents
1953	118464
1961	146524
1971	193509
1981	230711
1991	248086
2002	250518
2007*	254970
2008*	255295
2009*	255479
2010*	255699
2011	260237
2012*	259790
2013*	259125
2014*	258500
2015*	257883
2016*	257351

*estimated number of residents
Source: Secretariat for Economy of the City of Niš (2017)

Considering the first and last population census in the City of Niš, it can be concluded that the number of residents has increased. However, the analysis of the qualitative characteristics of the residents indicates that the age structure of the population has changed, that is, the City of Niš is a demographically aging community. This is confirmed by the fact that the share of the population older than 65 years in the total number of residents in Niš was 5,04% in 1953, and 16,81% in 2011 (Secretariat for Economy of the City of Niš, 2017). Population shifts from rural to urban areas contributed to the increased population density in the territory of Niš from 204 res/km2 (in 1953) to 436 res/km2 (in 2011) (Secretariat for Economy of the City of Niš, 2017). If we observe the period after the last census (2012-2016), the estimated number of residents indicates that the number of residents in the City of Niš is continually decreasing.

3.2. Statistical Indicators of Tourism Development

Table 2 shows the characteristics of tourism development in the City of Niš from 1991 to 2016. The data analysis indicates that the highest number of tourists and overnight stays in the City of Niš was recorded in 1991, i.e. that the level of tourist traffic from 1991 has not been reached yet. The greatest number of overnight stays of foreign tourists was recorded in 2016, which is the result of the development of air transport owing to low-cost airlines that connect the City of Niš with other destinations in the world. In the period from 1992 to 1999, the inflow of foreign tourists and the number of their overnight declined. After that, the influx of foreign tourists started to increase.

Table 2 also contains the data related to the total number of overnight says (bed occupancy) in accommodation facilities in the City of Niš. The largest number of beds

was recorded in 1994 while in 2008 the number of beds was the smallest. The highest capacity utilization rate was achieved in 2008 while the years 1997 and 1994 were characterized by the lowest rate of capacity utilization.

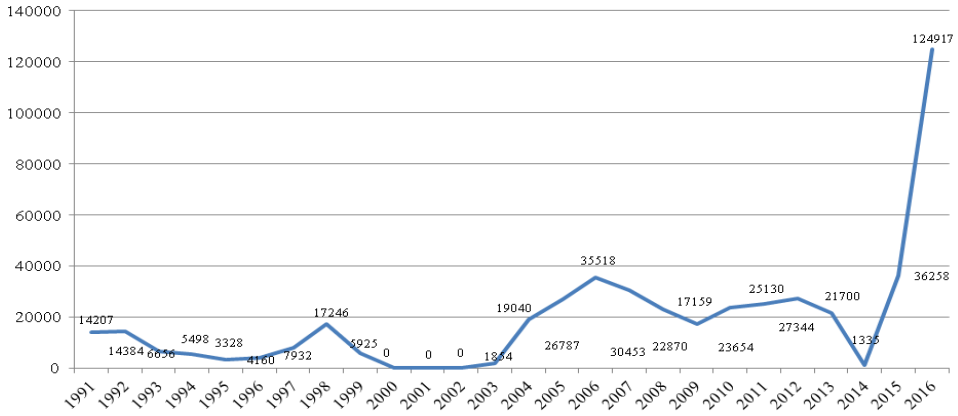
Table 2 Tourist traffic in the City of Niš

Year	Number of tourists			Number of overnight stays			Number of beds in accommodation facilities
	Total	Domestic	Foreign	Total	Domestic	Foreign	
1991	118344	84707	33637	350293	311664	38629	-
1992	92167	85452	6715	403739	392003	11736	-
1993	71017	68470	2547	255929	251994	3935	-
1994	80204	76682	3522	301914	295403	6511	9189
1995	88503	82452	6051	345415	332111	13304	8987
1996	75657	70139	5518	355317	342564	12753	8603
1997	65457	58549	6908	279763	268419	11344	8614
1998	71701	65949	5752	383333	372625	10708	8497
1999	53571	50594	2977	318685	312572	6113	8497
2000	91081	87329	3752	496395	487828	8567	8667
2001	72994	66965	6029	372997	362155	10842	8667
2002	73166	63419	9747	239650	224337	15313	2858
2003	63079	50512	12567	220203	200095	20108	3246
2004	68953	49610	19343	236778	206344	30434	1362
2005	68704	46884	21820	211934	178949	32985	1347
2006	56334	42925	13409	258974	236897	22077	1332
2007	85609	54400	31209	311843	269896	41947	1446
2008	87774	57227	30547	326252	276436	49816	875
2009	85952	51112	34840	309413	259247	50166	1680
2010	88179	51368	36811	309658	254834	54824	2044
2011	88952	52861	36091	295240	244906	50334	2630
2012	77782	45986	31796	286757	235505	51252	1969
2013*	63050	32989	30061	122509	72827	49682	2003
2014*	68688	31297	37391	130246	71714	58532	2258
2015*	75969	34924	41045	148193	83053	65140	2425
2016*	85048	40419	44629	160947	90175	70772	2511

* Starting from 2013, the data on tourist traffic in healthcare institutions where persons reside for medical rehabilitation include only those who pay for their expenses themselves.
Source: Secretariat for Economy of the City of Niš (2017), Statistical Office of the Republic of Serbia (1996-2017).

3.3. Statistical Indicators of Air Traffic

The airport in Niš was opened in 1986. During 1986, a total of 1360 passengers were transported. The smallest number of passengers was recorded in 2000, 2001 and 2002, while the year 2016 marked the highest number of passengers. The airlines that connect the City of Niš with other destinations recorded a decrease in the number of passengers from 1994 to 1996, followed by a slight passenger growth until 1998. In the period from 1999 to 2002, the number of passengers declined. The airline deregulation in the Republic of Serbia in 2009 enabled low-cost airlines to connect Serbian airports with other destinations in the world, which contributed to the increase in the number of passengers at Niš Airport in recent years.



Graph 1 Number of passengers transported from or to Niš Airport from 1991 to 2016.
Source: Secretariat for Economy of the City of Niš (2017).

3.4. Statistical Indicators of Electricity Consumption in the City of Niš

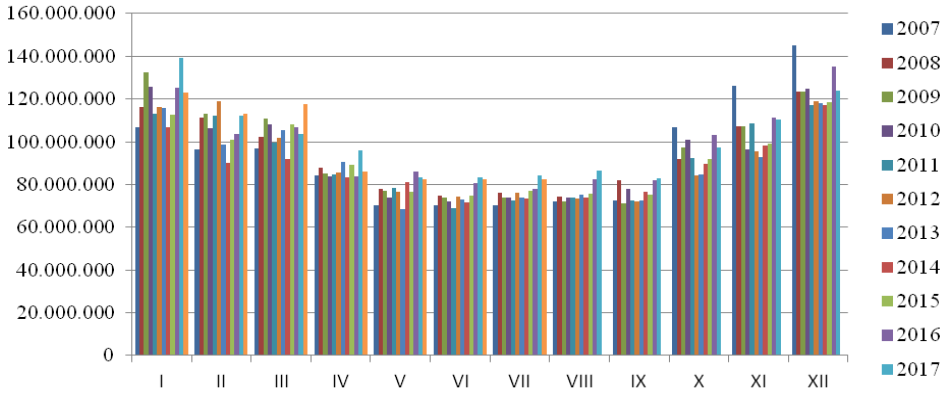
Table 3 shows the tendencies in electricity consumption in the city of Niš from 2007 to 2017. In the city of Niš, the periods from 2007 to 2009 and from 2015 to 2017 were characterized by an increase in electricity consumption while the decline occurred in the period from 2010 to 2014.

Table 3 Electricity consumption in the City of Niš

Year	Electricity in kWh
2007	1,117,970,898
2008	1,125,286,244
2009	1,138,292,729
2010	1,118,248,232
2011	1,094,810,555
2012	1,094,961,101
2013	1,069,935,760
2014	1,054,446,003
2015	1,099,883,590
2016	1,178,302,469
2017	1,202,628,493

Source: Electric Power Distribution Ltd. Belgrade (2018)

Graph 2 shows the tendencies in electricity consumption by month in the period from 2007 to 2018. As for the year 2018, the graph shows the data from January to July 2018.



Graph 2 Electricity consumption by month for the period from 2007 to 2018
Source: Electric Power Distribution Ltd. Belgrade (2018)

Considering electricity consumption by month, it can be noted that the highest average consumption was recorded in December, while the lowest consumption was in June. If we observe the electricity consumption recorded in December in the period from 2007 to 2017, we can state that the highest consumption was in 2007 and it reached its lowest level in 2014. In October, November and December, there was a decline in electricity consumption, while in the remaining months in the period from 2007 to 2017 electricity consumption increased.

3.5. Statistical Indicators of Electricity, Gas and Steam Supply

Table 4 presents investments in primary funds for the purpose of electricity, gas and steam supply in the City of Niš. The analysis covered the period from 2010 to 2015, as the data before 2010 encompassed investments in primary funds for the production of electricity, gas, steam and water in the City of Niš. Based on the data analysis, it can be concluded that the greatest investments were recorded in 2010. However, the year 2011 was characterized by significantly lower investments in the supply of electricity, gas and steam in the City of Niš, compared to the previous year. In the period from 2012 to 2015, a continuous increase in investments was recorded.

Table 4 Investments in primary funds for the purpose of electricity, gas and steam supply in the City of Niš (2010-2015)

Year	Investments
2010	1163900.00
2011	174875.00
2012	207662.00
2013	187423.00
2014	381530.00
2015	519230.00

Source: Statistical Office of the Republic of Serbia (2012-2017). Municipalities and regions in the Republic of Serbia from 2011 to 2016, http://www.stat.gov.rs/publikacije/

4. THE ANALYSIS OF THE IMPACT OF TOURISM AND QUANTITATIVE CHARACTERISTICS OF RESIDENTS ON ELECTRICITY CONSUMPTION IN THE CITY OF NIŠ

Table 5 indicates a statistically significant positive relationship between electricity consumption in the City of Niš and the number of tourists who visited the City of Niš as the Sig-value[2] is less than 0.05. However, there is no statistically significant correlation between electricity consumption and the number of residents, nor between electricity consumption and overnight stays. The results of the correlation analysis confirmed the H1 hypothesis, but the H2 and H3 hypotheses were not confirmed.

Table 5 Pearson Correlation Coefficient[3]– Correlation between electricity consumption, number of tourists, overnight stays and number of residents

		Electricity consumption	Number of tourists	Overnight stays	Number of residents
Electricity consumption	Pearson Correlation	1	.685*	.358	-.539
	Sig. (2-tailed)		.029	.309	.108
	N	10	10	10	10
Number of tourists	Pearson Correlation	.685*	1	.822**	-.481
	Sig. (2-tailed)	.029		.003	.159
	N	10	10	10	10
Overnight stays	Pearson Correlation	.358	.822**	1	-.457
	Sig. (2-tailed)	.309	.003		.184
	N	10	10	10	10
Number of residents	Pearson Correlation	-.539	-.481	-.457	1
	Sig. (2-tailed)	.108	.159	.184	
	N	10	10	10	10

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
Source: *Prepared by the authors (SPSS Statistics 19)*

Within the regression analysis, we applied the backward method[4] to avoid multicollinearity.

Table 6 Joint impact of analyzed variables on electricity consumption in the City of Niš

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.825[a]	.681	.521	24280643.60144
2	.774[b]	.599	.484	25191114.50767
3	.685[c]	.469	.403	27106550.73434

a. Predictors: (Constant), number of residents, overnight stays, number of tourists
b. Predictors: (Constant), overnight stays, number of tourists
c. Predictors: (Constant), number of tourists
d. Dependent Variable: electricity consumption
Source: *Prepared by the authors (SPSS Statistics 19)*

[2] In order for the relationship between two phenomena to be statistically significant, e.g. between electricity consumption and the number of tourists, the Sig-value (significance) must be less than 0.05.
[3] Pallant, J. (2011). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS*, *Allen*&Unwin, Berkshire.
[4] The regression analysis is conducted within the SPSS program. The program provides the possibility to select the enter, backward, or forward method. The backward or forward methods are used to avoid multicollinearity between the analyzed independent variables; that is, these methods select the impact of only those variables among which there is no significant correlation.

The results of the regression analysis show that there is no statistically significant joint impact of the number of residents, number of tourists and overnight stays on electricity consumption (Table 6), because the Sig-value is higher than 0.05. However, it is necessary to point to a statistically significant joint impact of the number of tourists and overnight stays on electricity consumption in the City of Niš.

Table 7 Individual impact of tourist traffic and the number of residents on electricity consumption

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2358081807.566	1237846203.184		1.905	.105
	Number of tourists	3841.493	1449.610	1.099	2.650	.038
	Overnight stays	-265.709	156.187	-.695	-1.701	.140
	Number of residents	-5803.924	4684.833	-.329	-1.239	.262
2	(Constant)	828292411.147	89729478.703		9.231	.000
	Number of tourists	4215.085	1471.065	1.205	2.865	.024
	Overnight stays	-241.906	160.813	-.633	-1.504	.176
3	(Constant)	916975562.234	72787916.277		12.598	.000
	Number of tourists	2395.303	900.632	.685	2.660	.029

a. Dependent Variable: electricity consumption

Source: *Prepared by the authors (SPSS Statistics 19)*

Table 7 indicates that there is a statistically significant impact of the number of tourists on electricity consumption in the City of Niš, but there is no statistically significant impact of overnight stays as well as the number of residents on electricity consumption. The results of the regression analysis did not confirm the H4 hypothesis.

5. The Analysis of the Impact of Tourism and Quantitative Characteristics of Residents on Investments in Primary Funds for the Purpose of Energy, Gas and Steam Supply

In order to avoid multicollinearity, the authors employed the backward model in the regression analysis. The results of the analysis show that there is no statistically significant joint impact of the number of residents, number of tourists and overnight stays on investments. Also, there is no statistically significant impact of the number of residents and number of tourists on investments since the Sig-value is higher than 0.05. Table 8 and Table 9 show that there is a statistically significant impact of the number of tourists on investments in primary funds for the purpose of electricity, gas and steam supply in the City of Niš. The results of the regression analysis confirmed the H5 hypothesis.

Table 8 Joint impact of analyzed variables on investments in primary funds for the purpose of electricity, gas and steam supply in the City of Niš

Model	R	R Square[d]	Adjusted R Square	Std. Error of the Estimate
1	.840[a]	.706	.413	428.86598
2	.839[b]	.705	.557	372.51950
3	.815[c]	.664	.597	355.11135

a. Predictors: number of residents, number of tourists, overnight stays
b. Predictors: number of residents, number of tourists
c. Predictors: number of tourists
d. Dependent Variable: investments
Source: *Prepared by the authors (SPSS Statistics 19)*

Table 9 Individual impact of tourist traffic and the number of residents on investments in primary funds for the purpose of electricity, gas and steam supply in the City of Niš

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Number of tourists	19.290	26.707	2.699	.722	.522
	Overnight stays	-.445	3.316	-.175	-.134	.902
	Number of residents	-3.751	6.251	-1.732	-.600	.591
2	Number of tourists	16.511	14.621	2.310	1.129	.322
	Number of residents	-3.266	4.430	-1.508	-.737	.502
3	Number of tourists	5.826	1.852	.815	3.146	.025

a. Dependent Variable: investments
b. Linear Regression through the Origin
Source: *Prepared by the authors (SPSS Statistics 19)*

6. CONCLUSION

The data analysis indicated that the number of residents in the City of Niš decreased in the period from 2011 to 2016, but that there was an increase in the number of tourists, overnight stays, electricity consumption and investments in primary funds for the purpose of electricity, gas and steam supply. Similar to the studies conducted by Lee (2013: 91), the results of this correlation analysis confirmed a positive correlation between electricity consumption and the number of tourists. The results of the regression analysis showed that there was a statistically significant joint impact of the number of tourists and overnight stays on electricity consumption in the City of Niš. Unlike Pablo-Romero's research results (2017: 9), the results of this study indicated that the number of tourists had a statistically positive impact on electricity consumption, while the number of overnight stays did not have a statistically significant impact on electricity consumption in the City of Niš. At the same time, the results of the regression analysis revealed that residents did not have a significant impact on the increase in electricity consumption.

The results of the regression analysis indicated that the number of tourists represented a significant factor that must be considered when designing a strategy for investing in primary funds for the purpose of electricity, gas and steam supply in the city of Niš. Bearing in mind that tourist traffic in the city of Niš has recorded a significant increase in recent years and that it contributes to the increase in electricity consumption, it is necessary to encourage investments in primary funds in the future in order to ensure the security of energy supply.

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PORAST BROJA TURISTA KAO ''NEGATIVAN'' TREND SA ASPEKTA SIGURNOSTI SNABDEVANJA TRŽIŠTA ENERGENATA U NIŠKOM REGIONU

Podizanje turističkih potencijala: smeštajnih kapaciteta, dodatnih sadržaja, umetničkih, zabavnih, festivalskih programa, razvoj infrastrukture (puteva, železnice, aerodroma), jeste osnovni preduslov za porast broja turista. Dostupni podaci navode na zaključak da je evidentan drastičan porast broja turista u poslednjih 10 godina. Međutim, procenat porasta broja turista nije u korelaciji sa porastom proizvodnje ukupne električne energije. Ako se u obzir uzme konstantan rast privredne aktivnosti, porast broja stanovnika, analizirani podaci pokazuju da porast broja turista zapravo ima negativan trend na sigurnost snabdevanja energetskog tržišta. U radu autori daju analizu dostupnih podataka i ukazuju na potrebu hitnog planiranja sigurnosti energetskog snabdevanja, imajući u vidu da rezultati ukazuju na ogroman porast potrošnje električne energije direktno uzrokovan rastom potrošača, gde stopa rasta broj turista zapravo pretstavlja promenljivu koja je sama po sebi rizik za sigurnost snabdevanja.

Ključne reči: *energetska sigurnost, porast potrošnje električne energije, planiranje sigurnosti snabdevanja*