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Economic development and the energy consumption nexus in developing countries: evidence from five South Asian countries

Abstract: This paper investigates the relationship between energy use and economic development in five South-Asian countries using national-level panel data from 1990 to 2014. Although many studies have already addressed the nexus between energy consumption and economic growth, there is a mixed finding. According to many researchers, South Asian countries have expanded energy consumption since the 1990s. Therefore, energy consumption as a variable for a specific period is considered for the countries of Bangladesh, India, Nepal, Pakistan and Sri Lanka. Furthermore, foreign direct investment (FDI) and international trade (IT) are also considered to be related variables in this study. Pooled ordinary least squares, random effects, and fixed effects estimation

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techniques are used to provide a reliable estimation, offsetting the country fixed effects. The fixed effect model is the most effective model that reveals the association between electricity usage and growth factors, as per the specification test and Hausman test. A statistically significant correlation was found between international trade, FDI, economic growth, and power usage. FDI has the highest impact on the rising power demand, followed by global commerce and per capita GDP (gross domestic product). More specifically, the study findings reveal that increased power consumption causes more investment, which results in increased economic growth in South Asian countries. The findings of the study further show that FDI significantly impacted upon power consumption and the area of SAARC's energy demand, resulting in the entry of new technology and an increase in both economic growth and energy consumption. Future policies may focus on investment in the energy sector to promote economic development.

Keywords: electricity consumption, energy, GDP per capita, FDI, international trade, panel data, SAARC region

Introduction

Energy is a crucial component of the infrastructure needed for economic growth. The demand for electricity is widespread throughout all economies, homes, and businesses. In addition, electricity is essential for many processes, including the development of agriculture. Since the early nineteen-seventies, electricity usage and income have had a significant positive correlation (Alberini et al. 2011). By analyzing datasets between 1947 and 1974 in the United States, it is found that there is a uni-directional causal connection between energy and GNP (Kalyoncu et al. 2013). Energy consumption that uses electricity is referred to as electricity consumption (Bozkaya 2022). Additionally, it facilitates consistent societal advancement and simplifies long-term economic growth (Yıldırım Durmuş et al. 2019). Once more, the core of any economy is the attraction and maintenance of large inflows of foreign investment through FDI and other international trade procedures. International trade positively affects economic growth and may increase the power demand (Siddika and Ahmad 2022).

Among the South Asian countries, Bangladesh's per capita energy usage is deemed modest. From 1990 to 2014, per capita electricity usage ranged from between 0.05 and 0.31 MWh in Bangladesh. In July 2018, a survey by the BPDB (Bangladesh Power Development Board) revealed that 90% of people have access to power (BPDB 2020). Despite being a country fighting poverty and other development challenges (Ara et al. 2015), Bangladesh's power sector has flourished since its independence.

In India, the electricity sector has a total installed capacity of 228.7 GW. This is insufficient to satisfy the internal demand (Garg et al. 2015). Despite having excess power-generating capability from resources such as biofuels, waste, and nuclear, it lacks enough infrastructure to distribute electricity to someone in need. India is both the world's third-largest manufacturer and user of electricity. By contrast, Pakistan's electricity generation is mostly based on petroleum, coal, gasoline, biofuels, and nuclear power. Per capita, electricity usage is quite modest, at 0.48 megawatts in 2014. Pakistan's power sector is still in its early stages. For years, harmonizing the country's supply and demand for power has remained a mostly unsolvable issue. As a result, the country faced enormous challenges in modernizing its electrical supply infrastructure. In the case of Sri Lanka, the major electricity generation is thermal and hydropower energy, with some solar and wind power being used in the early stages of development. Even though potential locations are being discovered, the state grid's power generation system does not use additional power sources like nuclear, geothermal, solar thermal, peat, or wave power. In 2014, the overall electricity usage in Sri Lanka exceeded 11.04 terawatt hours in 2014, with per capita consumption at 0.53 megawatts.

Nepal's power usage has been significantly growing for many years. Consumer growth is accelerating as a result of the development of many firms and the use of electrical equipment. Nepal's average capita consumption has remained practically constant for the last twenty years, although the consumption of neighboring countries such as India, Sri Lanka, and Pakistan are rising.

Given the energy generation and consumption scenario, the present study is aimed at the examination of the relationships between economic growth (GDP), foreign direct investment (FDI), energy consumption (EC), and global trade (TR) in a panel of five South Asian nations from 1990 to 2014, namely Pakistan, India, Bangladesh, Sri Lanka, and Nepal. Although there are lot of studies focused on this issue, very few studies cover South Asian countries. This study contributes to the literature by generating new evidence in the context of South Asian countries. Moreover, the existing literature as discussed in the literature review section shows mixed findings relating energy consumption to economic development.

The following sections, section two and three of the article, discuss the literature review and the methodology, respectively. After that, the results of the study are presented and interpreted, followed by a brief discussion. The article ends with some recommendations and concluding remarks.

1. Literature review

Mozumder and Marathe (2007) conducted a Granger causality study to explore the relationship between GDP and electricity use. They found that the GDP seemed to have an impact on power use but that there was no relationship between the two. Cheng-Lang et al. (2010), however, found a bidirectional causal connection between electricity use in industry, real GDP, and Total Electricity Usage in Taiwan from 1971–2006. To determine the causation between Bangladesh's GDP per capita and power usage, Mozumder and Marathe (2007) used the vector and cointegration error correction model. Their finding shows a correlation between GDP per capita and electricity use, but only in one direction. Numerous researchers from all corners of the globe have looked at the correlation between electricity use and economic growth. In a recent study, Jha (2021) utilized the same technique as Jumbe (2004) and found that the increase in GDP has an effect on the amount of electricity used as well as employment in the short term. However, Bozkaya et al. (2022) found a mixed relationship between energy consumption and economic growth.

Mozumder and Marathe (2007) utilized an investigation that employed a technique known as Granger causality to determine which way the correlation runs between total annual power usage and GDP. Electricity use was affected by the GDP, and there was no correlation between GDP and electricity consumption discovered by him. The total power used, industrial electricity used, and real GDP in Taiwan were shown to be interconnected in two ways by Cheng-Lang et al. (2010), who analyzed data ranging over 35 years between 1971 and 2006. Employing cointegration and vector error correction, Mozumder and Marathe (2007) investigated the link between Bangladesh's per capita power usage and per unit GDP. The result shows that GDP per capita is causally related to per unit electricity use but only in one direction.

In order to analyze highly predictive economic growth conclusions, Shahbaz et al. (2017) additionally considered the general connection between electricity use and the price of oil. The information is broken down into income and OECD, and geographical categories using long-run estimates of parameters, panel cointegration, and Pool Mean Group analyses of the short-term and long-term connections and cointegration of the factors. The empirical findings point to the cointegration of the variables.

There are undeniable feedback effects between the consumption of energy and the development of wealth, including oil price and economic expansion. These numbers show that, despite oil prices, rising nations heavily rely upon electricity usage to increase productivity. Saidi et al. (2017) evaluated the correlation between economic growth and energy use across a sample of fifty-three nations using data ranging from 1990 to 2014. The findings demonstrate a lengthy symbiotic link between power use and economic expansion. There exists a short-term in addition to a long-term Granger causality between foreign direct investment and economic growth and also between energy use and economic development, as shown by the results of the causality research conducted by such a worldwide panel. Identical outcomes are displayed separately for the American nations. There exists a correlation between economic development and energy consumption in Africa and the Middle East in both the short-term and the long-term. Moreover, In both the short term and long term, there is linear causation between energy use and economic development in European nations. Both the short-term and the long-term causality relationship between FDI and economic development is demonstrated for nations in Europe, Africa, and the Middle East.

Another paper from Jha (2021) looks at the link between GDP, export and power usage for a selection of Middle Eastern nations. When looking at the whole panel, we discover statistically significant feedback effects between some of these components. Sacko (2004) found that rising energy use significantly affects economic expansion. Moreover, using yearly data from 1950–1951 to 1996–1997 for India, Ghosh (2002) attempts to evaluate the Granger causation between per capita power usage and GDP per capita for India. This analysis reveals a lack of a long-term stability relationship between the variables, despite the existence of uni-directional Granger causation from economic growth to energy usage with no feedback effect. In another study, Attinay and Karagol (2005) analyzed the causality relationship between electricity use and gross domestic product in Turkey from 1950 to 2000. Both the Dolado-Lutkepohl test, which uses VARs in levels, and the standard Granger causality test, which employs discriminant function data, were subjected to the Granger non-causality test for comparison in the study. A strong correlation between electricity use and income was discovered in both tests.

Wolde-Rufael (2006) uses a newly developed cointegration test provided by Pesaran et al. (2001) and uses data from seventeen African countries covering the years 1971–2001. They examine the long-term and causal relationship between real GDP per capita and electricity consumption per capita. Only twelve nations showed Granger causality, and only nine showed a long-run link between real GDP per capita and electricity consumption per capita. There was positive uni-directional causation between real GDP per capita and electricity consumption per capita in six countries, negative bidirectional causality in three countries, and no correlation at all in the other three countries.

Using Granger causality and ECM tests, Bäker and Goodall (2020) looked into the connection between income, energy usage, FDI, and population. They used information from 1970 to 2005 and established a bidirectional causal link between short-term energy usage, income and FDI. By contrast, Chandran et al. (2010) used ARDL analysis to examine the causal link between the variables and reached the same conclusion. Ibrahiem (2015) investigated the link between renewable energy usage, FDI and Egyptian economic growth. The research used an Auto Regressive Distributed Lag (ARDL) bound testing strategy on time series data spanning 1980–2011. The empirical results show that the research variables are co-integrated, indicating a long-lasting link between them. Furthermore, the Granger causality test demonstrates a two-way link between economic growth and the use of renewable energy sources, as well as a one-way causal association between foreign direct investment and economic development.

Bäker and Goodall (2020) employed a multivariate approach to establish the causal connection between energy usage, economic growth, relative pricing, financial development (FD) and foreign investment in Malaysia from 1972 to 2009. The variables perfectly correlate with the limits test and the Johansen-Juselius cointegration test. The data demonstrated that in both the short and long term, Granger's power consumption and economic expansion are mutually causal. By contrast, Bekhet and Othman (2011) used a consumer price index (CPI), electricity consumption (EC), foreign direct investment (FDI), and GDP (gross domestic product) from 1971 to 2009 using the VECM model. Cointegration analysis showed that all variables are related over the long term and are all co-integrated. Furthermore, strong long-run causation from power use to FDI, GDP growth, and inflation was discovered. According to the results, energy consumption is both a key factor in determining Malaysia's economic development and a powerful tool for enforcing the government's energy-saving goals. Long-term economic development is dependent on a reliable energy supply, which policymakers must acknowledge.

Using data from 1960 until 2011, Bento and Moutinho (2016) used an autoregressive distributed lag (ARDL) bounds testing approach for Italy. The findings of the study show that there is a long-run uni-directional Granger causation link between GDP per capita and the production of renewable energy per capita and between non-renewable power generation per capita and the production of renewable energy per capita. Moreover, Rafindadi and Ozturk (2016) looked at how past energy crises in Japan have affected the country's short- and long-run capital, imports, exports, economic expansion, and financial development decisions. The research found that for every percentage point increase in GDP, financial development, imports, and exports in Japan, electricity consumption drops by 0.2429, 0.504, 0.092 and 0.219%. However, it was found that the capital used less energy in every tangible aspect. The research found that an increase of 1% in Japan's growth in the economy, financial development, imports, and exports would increase the country's electrical difficulties by 0.2031, 0.584, 0.0521 and 0.22109%, respectively. Another study by Katırcıoğlu et al. (2016) showed that Canadian energy conservation laws are probably going to hurt output and international trade. In Malaysia, Bhatti et al. (2019) discovered evidence of a uni-directional causal link between power use and exports. In a related analysis, Bhatti et al. (2019) found no causative link between exports and energy generation but found a uni-directional causality linkage between power generation and GDP growth. Using information spanning 1970–2008, claims that export growth in Malaysia was spurred by economic expansion have been disproved.

To summarise, there are mixed findings in existing research. Studies conducted in both developed and developing countries reveal that energy consumption and growth have a strong relationship. However, the direction of the dependency varies. Moreover, in the case of South Asian countries, such studies are very limited in number. Eventually, a new study using panel data may contribute to the existing body of knowledge and guide policymakers.

2. Methodology

2.1. Data sources

This research spans the years 1990–2014 and focuses on five South Asian countries that are part of the South Asian Association for Regional Cooperation (SAARC): Bangladesh, India, Nepal, Pakistan, and Sri Lanka. Furthermore, we consider Electricity consumption as the dependent variable, whereas foreign direct investment, the GDP per capita, and international trade are the control variables in this estimation.

We extracted all data from The World Bank's World Development Indicators and International Trade (Average of Exports of Goods and Services as a Percentage of GDP) publications provide data on five economic indicators: electricity consumption (kWh per capita), net inflows (percent of GDP), foreign direct investment, GDP per capita (constant 2010 US$), and imports of goods and services.

Table 1. Variable description

Tabela 1. Opis zmiennej

Variable	Description	Source (WDI 2016)
EC	Electricity consumption is defined as power plant and combined power and heat plant output minus transmission, distribution, and transformation losses, as well as heat and power plant own usage.	WDI
GDP	By dividing the gross domestic output by the mid-year population, the GDP per capita is determined. GDP is calculated by summing the gross value of all resident producers' contributions to the economy, removing any product taxation, and adding back any incentives not represented in the product value. It is computed without taking depletion and the degradation of natural resources or the deterioration of produced goods into account. The amounts are in US dollars of constant 2010 value.	WDI
FDI	Foreign direct investment (FDI) in Bangladesh, which is defined as direct investment equity flows. It includes the reinvestment of profits, equity capital, as well as other short- and long-term capital. The World Bank provides statistics as a percentage of GDP.	WDI
TR	The term "international trade" (TR) refers to the combined value of a nation's exports of goods and services and its imports of goods and services (percent of GDP). The consolidated worth of kinds of services and goods that a country receives from the entire world is represented by its total imports, whereas the total worth of taxable goods and services that a country exports to the entire world is represented by its export earnings.	WDI

2.2. Model specification

During the research period, each of the n elements or participants in the panel data set has T observations and a rating of 1. As a result, in the data set, there are $n \cdot T$ total observations. This research examines the factors of electricity consumption in India, Bangladesh, Pakistan, Nepal, and Sri Lanka from 1990 to 2014 across five SAARC nations: India, Bangladesh, Pakistan, Nepal, and Sri Lanka. The data set is referred to as being balanced if all the data across countries and times are available for the study. However, in this research, some cross-sectional unit observations are overlooked, which is why this research deals with unbalanced data. Total observations are $n \cdot T$. whereas $n = 5$ countries and $T = 25$ time periods. Thus, the total number of observations should be $5 \cdot 25 = 125$. However, unbalanced data suggests a total of 121 observations in the study. In order to assess the influence of variables on energy consumption, the study considers the growth in the economy, foreign direct investment, and international trade statistics for a panel of five South Asian nations.

For the study, the initiating model is:

$$LEC_{it} = \beta_0 + \beta_1 LGDP_{it} + \beta_2 LFDI_{it} + \beta_3 LTR_{it} + \varepsilon_{it} \tag{1}$$

where:

LEC	–	*Ln* (electricity consumption),
LGDP	–	*Ln* (gross domestic product),
LFDI	–	*Ln* (foreign direct investment),
LTR	–	*Ln* (international trade),
β_1, β_2, and β_3	–	slope coefficient of the variables,
ε_{it}	–	error terms,
β_0	–	intercept term.

The variable data is logarithmically converted. Following modification, the model is subjected to three estimation methods (the pooled regression method, the fixed effects method, and the random effects method).

2.3. Panel estimation techniques

The Pooled Regression Method [PRM]: When independent time series are combined with data from many persons, a pooled model is produced. When OLS [ordinary least square] is applied to a pooled model, pooled least square estimation is performed. Whenever data are prior homogeneous, it is employed. To estimate the constant slope and intercept, the pooled regression method analyses the model's data, regardless of the time or cross-sectional unit. In other circumstances, it was anticipated that all countries and years would have the same slope and intercept. The random and fixed effects are ignored in this combined estimate.

In the study, the pooled model is Equation 1.

Note that in Equation 1, β_0 is the intercept, β_1 is the slope (coefficient or parameter estimate) of economic growth, β_2 is the slope of foreign direct investment, β_3 is the slope of international trade, and ε_i is the error term.

The explanation of the variables is the same as before. In the model, the i^{th} denotes the i^{th} countries for the period. The independent and dependent variables are varied over time and countries, but the intercept and slope coefficient is the same for all the countries and time and is assumed to ignore individual heterogeneity. If individual effect α_i (cross-sectional or time -specific effect) does not exist ($\alpha_i = 0$), ordinary least squares (OLS) produce efficiency, and the parameters are unbiased and consistent.

OLS consists of five key assumptions (Ababneh 2020; Kennedy 2008).

a) The dependent variable is expressed as just a linear function of the response variable and the error (disturbance) term, as required by linearity.

b) When a disturbance is said to be homogeneous, it means that its expected value is zero or that it is not connected to any regressors.

c) Disturbances are unrelated to one another and have the same variance (3.a homoskedasticity) (3.b non-autocorrelation).

d) The independent variable's observations are stable in repeated samples without measurement mistakes rather than stochastic.

e) The full rank assumption asserts that independent variables do not have a perfect linear connection (no multicollinearity).

For pooled least square estimation, the error term assumptions are:

a) Zero mean of the error term $E(\varepsilon_{it}) = 0$.

b) The variance of the error terms is the same i.e. homoscedasticity $var.(\varepsilon_{it}) = \delta^2$.

c) Uncorrelated error terms $\text{cov}(\varepsilon_{it}\varepsilon_{js}) = 0$, where, $i \neq j$, and $t \neq s$.

d) Uncorrelated errors term and explanatory variables $\text{cov}(\varepsilon_{it}x_{it}) = 0$.

It is assumed that there exists unobserved heterogeneity among the individuals detected by α_i. The main query is whether the regressors and the individual-specific effects α_i are correlates. We have a fixed effects model if they are correlated. We have a random effects model if they are not correlated.

The Fixed Effects Method [FEM]: Individual variations in intercepts are studied in a fixed effect model, considering uniform slopes and variance. Individual particular effects are regarded as an element of the intercept because they are time-invariant, α_i maybe related to other regressors. This FE model is calculated by least squares dummy variable (*LSDV*) regression (*OLS* with a set of dummies).

The FE model permits correlations between the individual-specific effects α_i and the regressors x. This research involves intercepts as α_i. Every individual has a unique intercept term and identical slope parameters.

$$y_{it} = \alpha_i + x_{it}^{'} + \beta + \varepsilon_{it} \tag{2}$$

This study can retrieve the particular individual impacts after assessment as:

$$\widehat{\alpha_i} = \overline{y_i} - \overline{x_i}\hat{\beta} \tag{3}$$

To put it another way, the leftover variation of the dependent variable that the regressors are unable to explain is called individual-specific effects. In the regressors x, time dummies can be included.

The fixed effects model for the study is:

$$LEC_{it} = \beta_{0i} + \beta_1 LGDP_{it} + \beta_2 LFDI_{it} + \beta_3 LTR_{it} + \varepsilon_{it} \tag{4}$$

if there is a constant slope coefficient across all individuals and time. However, the intercept term β_{0i} varies depending on the country, not depending on the individuals' different time periods. The individual intercept term, often known as the *FE*, captures the individual heterogeneity (the unique characteristics of each country regardless of time).

The Random Effects Method [REM]: Since the premise of a random effect model is that individual effect (heterogeneity) is unrelated to any regressor, the study assumes error variance on a group-by-group basis (or times). Therefore, is a part of the overall erratic heterogeneity or the combined error term. It is for this reason that a random effect model is also referred to as an error component model. There is no variation in the regressors' intercepts or slopes when compared. Individual specific errors, not intercepts, distinguish individuals (or time intervals) from one another.

The random effects model for the study is:

$$LEC_{it} = \beta_{0i} + \beta_1 LGDP_{it} + \beta_2 LFDI_{it} + \beta_3 LTR_{it} + \varepsilon_{it} \quad (5)$$

where $\beta_{0i} = \beta_0 + \alpha_i$

or

$$LEC_{it} = \beta_0 + \alpha_i + \beta_1 LGDP_{it} + \beta_2 LFDI_{it} + \beta_3 LTR_{it} + \varepsilon_{it}$$

If the composite error term is defined as $v_{it} = \alpha_i + \varepsilon_{it}$, then the above equation may be rewritten as follows:

$$LEC_{it} = \beta_0 + \beta_1 LGDP_{it} + \beta_2 LFDI_{it} + \beta_3 LTR_{it} + \varepsilon_{it}$$

α_i is in the composite error in each time period, the v_{it} serially correlated across time.

The errors take the following assumptions:

a) Zero mean of the error term [$E(\alpha_i) = 0$].

b) The variance of the error terms are the same i.e. homoscedasticity [$var(\alpha_i) = \delta^2$].

c) Uncorrelated error terms [$cov(\alpha_i, \alpha_j) = 0$] where $i \neq j$.

All of the fixed effects assertions as well as the extra condition that is independent of all independent variables across all time periods make up an ideal random effect's assumption. Use first differencing or fixed effects initially if it is believed that the unobserved impact α_i is associated with any explanatory factors.

Hausman specification Test: The Durbin–Wu–Hausman test (sometimes referred to as the Hausman specification test) is a statistical hypothesis test in econometrics that is named after James Durbin, De-Min Wu, and Jerry A. Hausman**.** The test assesses the consistency of an estimate in comparison to an alternative, less efficient estimator that is acknowledged to be consistent. This helps in determining whether or not a given statistical model adequately describes the data. The Hausman test is used to choose the appropriate effect between the *RE* and *FE* model. It's being used to evaluate the estimated coefficient of the *FE* model to that of the *RE* model.

The hypothesis for the Hausman is:

H_0 = *the suitable effect is a Random effect* [*i.e., consistent and efficient RE*].

H_1 = *the Fixed effect is appropriate* [*i.e., inconsistent RE*].

If the probability of the cross-sectional chi-square is more than 5% level, we do not reject the Null hypothesis. This means that the Random effect estimators would be proper to explain the model. In the case of a chi-square value of less than 5%, we reject the Null hypothesis, which stands for using fixed effect estimators.

3. Results

Table 2. The results of all pooled least square, and fixed and random effect models (dependent Variable: L(EC))

Tabela 2. Wyniki wszystkich połączonych modeli najmniejszych kwadratów oraz modeli z efektami stałymi i losowymi (zmienna zależna: L(EC))

Variable	Pooled OLS	FE	RE
C	218.5321*** (31.99)	–76.87483*** (25.76)	–45.47315*** (39.68)
GDP	0.081013*** (0.02)	0.186621*** (0.01)	0.172996*** (0.01)
FDI	160.2319*** (16.12)	23.82336*** (8.09)	33.69695*** (7.93)
TR	–7.638074*** (1.74)	5.662425*** (1.03)	4.187515*** (0.99)

Table 2 presents the results of all pooled least square, fixed and random effect models where dependent variable: *LEC*. Here, the slope coefficient of International Trade *Ln*(*TR*) is negative (–7.638074) which implies that as international trade increased by 1%, electricity consumption decreased by 7.63%, but it is extremely significant at a significance level compared with fewer than 1%. However, from the above result, it's clear that Electricity Consumption *Ln*(*EC*) is highly influenced by the Foreign Direct Investment *Ln*(*FDI*) and the Economic Growth *Ln*(*GDP*) with a positive slope coefficients of 160.2319 and 0.081013, respectively, as well as being very significant at the 1% significance level.

In the fixed effect model, all of the variables' coefficients have positive values that are statistically significant at the 1% level or below. The coefficient value of *Ln*(*GDP*), *Ln*(*FDI*), *Ln*(*TR*) are 0.186621, 23.82336, and 5.662425, respectively.

This indicates that electricity consumption (*EC*) increases by 0.18, 23.82 and 5.66% as *GDP*, *FDI* and *TR* are increased by 1%. Although all the coefficients of the variables shows a positive relationship, Electricity Consumption *Ln*(*EC*) is more influenced by *Ln*(*FDI*).

The results of the random effect model are shown in Table 2, where all coefficients of the variables are positive attributes, and all of them are statistically significant at the 1% level. The coefficient values of *Ln*(*GDP*), *Ln*(*FDI*), *Ln*(*TR*) are 0.172996, 33.69695 and 4.187515, respectively. However, the coefficient values of all variables mean that a 1% increase in *GDP* trends increases the *EC* by 0.17%. Furthermore, if *FDI* and *TR* increase by 1%, then *EC* increases by 33.69% and 4.18%, respectively. Foreign Direct *Ln*(*FDI*) is a highly influencing matter of electricity consumption.

From the results in Table 2, it is clear that Electricity Consumption *Ln*(*EC*) is highly influenced by the Foreign Direct Investment *Ln*(*FDI*) and the Economic Growth *Ln*(*GDP*) with a positive slope.

Hausman Specification Test

To investigate the appropriate model between the fixed and random effect models, the Hausment Test is commonly used in empirical studies. Here we consider:

Null hypothesis (H_0): *the random effect model is appropriate, and*

Alternative hypothesis (H_A): *the random effect model is not appropriate.*

Table 3 reports the results of the Hausman specification test.

Table 3. Hausman specification test

Tabela 3. Test specyfikacji Hausmana

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob
Cross-section random	40.453126	3	0.0000

The test reports that the p-value for the chi-square statistic is 0.00, which is less than 5%; so we can't accept the null hypothesis indicating rejection of the of the Hausman test. This means that we accept the alternative hypothesis. As a result, the fixed effect model is the most appropriate because it consistently and effectively explains the variables.

Thus, we conclude that according to the fixed effect model, *FDI* is the most influential indicator to increase EC; however, the rest of the model supports the fixed effect model.

4. Discussion

The average of the pooled OLS results of the study shows that the SAARC region's energy consumption is significantly and favorably impacted by *GDP* per capita, *FDI*, and international trade (*TR*). More specifically, Electricity Consumption *Ln*(*EC*) is highly influenced by the Foreign Direct Investment *Ln*(*FDI*) and the Economic Growth *Ln*(*GDP*). This finding is common in the context of developing countries. For instance, in the case of Bangladesh, Ahamed (2014) argued how nuclear energy production can contribute to growth. Many other studies also support this study. For instance, Rabab Mudakkar et al. (2013) found a significant correlation between *EC* and *FDI* for SAARC countries in both the short and long term. Alam et al. (2015) investigate that after accelerating the *FDI* inflow, *GDP* per capita increases and thus energy demand increases rapidly over time. Furthermore, Mudakkar et al. (2013), Khan et al. (2014), Mozahid et al. (2022) and many other empirical studies have investigated a positive relation *EC*, *GDP*, *FDI* and *TR* but *FDI* inflow increases the energy demand radically. The uniqueness of the findings of the study relies on the context of developing countries. Specifically, in the SAARC countries, such findings as those similar to previous studies making the existing body of knowledge regarding energy consumption and economic development nexus.

5. Recommendations and conclusions

5.1. Recommendations

1. As FDI is an influencing matter to boost electricity consumption, more emphasis should be given to promoting this sector. For this, the rate of tariff-based FDI should be simple to attract foreigners.
2. To foster international trade, trade creation among the South Asia region should be built up.
3. As has already been mentioned, the study's findings emphasize that increased electricity consumption is necessary for South Asia to experience higher economic growth. As a result, the government should give high priority to issues relating to proper electricity distribution systems and management solutions in addition to power generation in its short- and medium-term plans.
4. The power structure may change as a result of the use of alternative and renewable energy sources. The SAARC region's electricity crisis has a lot of room for improvement. The energy that the sun provides (such as solar energy) is considerably more than what is currently needed in terms of electricity. There is also a lot of potential in the wind, waves, and tides. It is important to realize that traditional energy sources like gas and fuel are running out, whereas renewable energy sources might be one of the most important sources of electricity in the future.

As a result of the above findings, the focus should be placed on producing more power and increasing investment. The answer to the issue of whether power consumption alone might encourage economic expansion; the answer is definitely no since one of the determining elements is the utilization of power. The government should promote a business-friendly climate in addition to increasing electricity production to attract more foreign and domestic firms. Only in such a scenario will having more power result in more economic activity, otherwise it would be expensive. In this context, the government may implement legislative measures to boost power production and entice domestic and international investors to invest in energy and other industries.

5.2. Concluding remarks

The goal of this study was to inspect the association between *FDI*, *GDP* per capita, and international trade (*TR*) on energy consumption (*EC*) of SAARC nations for the data from 1990 to 2014. In order to evaluate the energy-growth nexus, which includes *GDP* per capita, *FDI*, and international trade (*TR*) metrics in the SAARC area, this study has employed a variety of panel data methodologies, including pooled OLS, a fixed effects model, and a random effects model. Additionally, the Hausman test, a statistical test for model specification, is used to compare several options, such as whether the fixed effect model is superior to the random effect model. The average of the pooled OLS results show that the SAARC region's energy consumption is significantly and favorably impacted by *GDP* per capita, *FDI*, and international trade (*TR*).

The majority of the exogenous variables generally have a considerable impact on the region of SAARC's energy consumption, according to the analysis of a fixed effect model. The findings support the region's high prevalence of energy-led growth, energy-led foreign direct investment, and energy-led total returns. This suggests that increased power consumption causes more investment, which results in increased economic growth. The study's random effect model indicates that every variable has a significant impact on the region's power consumption, meaning that SAARC nations will face more challenging difficulties than before and will need robust policy measures to protect themselves. Our findings show that FDI had a significant impact upon power consumption and the area of SAARC's energy demand, resulting in the entry of new technology and an increase in both economic growth and energy consumption. The fixed effect model is regarded as the optimum model for examining the relationship between variables, according to a model specification test.

According to the findings of the analysis, it is necessary to execute policies to enhance investment in the commercial and industrial sectors to build big, medium, and small-scale enterprises and increase production in order to keep up with the SAARC nations' economic growth.

Appendix

Załącznik

ID	Year	ELEC	GDP	FDI	TR
1	2	3	4	5	6
Bangladesh	1990	48.36675	399.4839	0.01025	9.483251
Bangladesh	1991	48.96648	403.7538	0.004491	9.444913
Bangladesh	1992	58.6485	416.1805	0.011738	9.967003
Bangladesh	1993	65.20947	426.3094	0.042362	11.56079
Bangladesh	1994	68.96922	433.4123	0.033012	11.43293
Bangladesh	1995	75.90125	445.9189	0.004998	14.10475
Bangladesh	1996	79.49228	456.2377	0.029135	13.03804
Bangladesh	1997	81.24847	466.7725	0.288897	13.16276
Bangladesh	1998	86.16983	480.8688	0.380236	13.94003
Bangladesh	1999	94.27288	493.2552	0.350421	14.19397
Bangladesh	2000	101.4886	509.2934	0.525362	14.66086
Bangladesh	2001	111.6943	525.0721	0.145444	16.04901
Bangladesh	2002	119.2747	535.2467	0.095579	14.48369
Bangladesh	2003	125.4577	550.8628	0.445961	13.82894
Bangladesh	2004	160.2534	570.3367	0.689472	13.42912
Bangladesh	2005	170.6813	598.6174	1.09515	17.19847
Bangladesh	2006	190.9155	630.0482	0.635657	19.05596
Bangladesh	2007	199.8312	666.4014	0.817754	19.97119
Bangladesh	2008	201.2489	698.5649	1.449748	21.31046
Bangladesh	2009	219.2421	725.7663	0.879495	20.0464
Bangladesh	2010	239.8305	757.6718	1.068935	18.90142
Bangladesh	2011	257.6344	797.4117	0.983167	23.71042
Bangladesh	2012	274.872	839.5137	1.188103	24.05546
Bangladesh	2013	292.75	879.582	1.735419	23.1482
Bangladesh	2014	310.3912	922.1611	1.468713	22.25704
India	1990	273.0466	536.1628	0.074737	7.837261
India	1991	291.9538	530.8947	0.027594	8.585788
India	1992	305.5359	548.8958	0.097239	9.316414
India	1993	321.7115	563.7497	0.19972	9.932107
India	1994	342.4618	589.7088	0.301407	10.14777
India	1995	360.0471	622.3037	0.60303	11.55765
India	1996	361.0925	656.6971	0.625827	11.08359

1	2	3	4	5	6
India	1997	376.8007	670.6101	0.871838	11.43229
India	1998	387.1969	699.0689	0.63374	11.97824
India	1999	393.3732	747.252	0.479035	12.54239
India	2000	394.9638	762.3133	0.775558	13.59617
India	2001	395.1048	785.3446	1.07066	13.13742
India	2002	411.9674	801.5079	1.025248	14.91417
India	2003	431.8411	850.2933	0.614081	15.46187
India	2004	453.0102	902.9058	0.775952	18.95513
India	2005	469.4539	971.2298	0.898677	21.24265
India	2006	510.7516	1,044.894	2.176329	23.29601
India	2007	543.3586	1,130.09	2.100366	23.07933
India	2008	562.8992	1,156.933	3.656951	26.88169
India	2009	600.2017	1,237.34	2.687536	23.38851
India	2010	642.1116	1,345.77	1.653785	24.84445
India	2011	698.5478	1,416.403	2.002066	27.81194
India	2012	724.7912	1,474.968	1.312934	27.89686
India	2013	765.5638	1,550.142	1.516276	26.92207
India	2014	805.5992	1,645.326	1.695659	24.46109
Pakistan	1990	277.3531	741.8014	0.612998	19.45475
Pakistan	1991	297.3167	757.8689	0.568544	17.77734
Pakistan	1992	333.8897	794.621	0.691845	18.94393
Pakistan	1993	334.8963	787.7941	0.677095	19.37367
Pakistan	1994	345.3632	796.6306	0.811304	17.66353
Pakistan	1995	357.9281	815.3359	1.191753	18.06638
Pakistan	1996	359.4696	833.7471	1.456056	19.16506
Pakistan	1997	362.9955	821.6618	1.147229	18.42613
Pakistan	1998	344.2562	822.443	0.81361	17.00586
Pakistan	1999	356.167	832.6978	0.844795	16.15998
Pakistan	2000	372.3995	848.6318	0.416484	14.0648
Pakistan	2001	378.1883	846.6424	0.522751	15.18577
Pakistan	2002	384.7868	855.4985	1.142354	15.26881
Pakistan	2003	409.8213	878.4415	0.641482	16.42225
Pakistan	2004	429.1078	923.9233	1.141075	15.15006
Pakistan	2005	463.0573	974.5373	2.010007	17.62665
Pakistan	2006	486.7914	1,013.765	3.112978	17.84086

1	2	3	4	5	6
Pakistan	2007	480.9865	1,041.289	3.668323	16.49521
Pakistan	2008	442.7094	1,037.575	3.19736	17.7971
Pakistan	2009	458.8398	1,045.208	1.390402	16.03592
Pakistan	2010	465.1613	1,040.142	1.139753	16.43446
Pakistan	2011	455.3224	1,046.494	0.620823	16.46995
Pakistan	2012	450.3811	1,060.501	0.382827	16.40275
Pakistan	2013	481.8763	1,083.967	0.576511	16.6668
Pakistan	2014	471.0416	1,111.196	0.764443	15.45062
Sri Lanka	1990	151.4162	1,189.441	0.539743	34.12196
Sri Lanka	1991	157.643	1,229.264	0.537191	33.79796
Sri Lanka	1992	166.0594	1,268.811	1.263792	36.40188
Sri Lanka	1993	182.5019	1,342.142	1.878357	38.57376
Sri Lanka	1994	199.6315	1,404.006	1.420196	39.7154
Sri Lanka	1995	215.7053	1,469.15	0.429754	40.81752
Sri Lanka	1996	204.4402	1,514.602	0.862546	39.43698
Sri Lanka	1997	229.7512	1,602.513	2.84958	40.06878
Sri Lanka	1998	249.1021	1,669.296	1.227252	39.24749
Sri Lanka	1999	262.9478	1,731.908	1.122778	39.37574
Sri Lanka	2000	294.7513	1,824.794	1.042074	44.31822
Sri Lanka	2001	290.8044	1,784.138	1.090747	40.4493
Sri Lanka	2002	303.1591	1,840.641	1.188278	38.16757
Sri Lanka	2003	326.4064	1,934.148	1.211327	37.66812
Sri Lanka	2004	354.6257	2,022.911	1.126677	39.74147
Sri Lanka	2005	400.5212	2,132.442	1.116129	36.80199
Sri Lanka	2006	403.6065	2,278.97	1.697007	35.63059
Sri Lanka	2007	420.9827	2,416.589	1.863919	34.30326
Sri Lanka	2008	427.207	2,543.044	1.847465	31.68452
Sri Lanka	2009	426.1501	2,616.087	0.96035	24.57457
Sri Lanka	2010	461.1267	2,808.546	0.84184	23.18194
Sri Lanka	2011	504.2083	3,027.113	1.464116	27.49229
Sri Lanka	2012	524.3084	3,286.139	1.375173	25.74604
Sri Lanka	2013	525.7226	3,371.317	1.255214	24.6289
Sri Lanka	2014	531.2696	3,506.871	1.126054	25.12544
Nepal	1990	35.46779	789.2173	0.163746	16.09438
Nepal	1991	37.51613	785.9925	0.056611	17.33753

1	2	3	4	5	6
Nepal	1992	37.32217	831.0631		20.84771
Nepal	1993	38.77729	861.1939		23.59479
Nepal	1994	41.59652	915.4099		25.21604
Nepal	1995	44.21308	983.2625		29.74526
Nepal	1996	46.56816	1,029.178	0.423749	29.22888
Nepal	1997	46.89635	1,065.057	0.468752	32.01777
Nepal	1998	49.61432	1,100.162	0.247612	28.3548
Nepal	1999	55.43638	1,155.21	0.086419	26.28349
Nepal	2000	59.30691	1,201.106	–0.00882	27.85529
Nepal	2001	64.97866	1,263.968	0.347092	27.89996
Nepal	2002	67.97919	1,360.792	–0.09837	23.11536
Nepal	2003	70.90003	1,425.055	0.233444	22.12394
Nepal	2004	74.75469	1,469.373	–0.00574	23.07364
Nepal	2005	77.37823	1,534.821	0.030156	22.03147
Nepal	2006	84.23084	1,601.916	–0.07351	22.38099
Nepal	2007	88.1943	1,848.566	0.055606	22.28964
Nepal	2008	84.07659	1,898.053	0.007932	23.0181
Nepal	2009	97.45297	1,986.136	0.297715	23.53972
Nepal	2010	102.5048	2,178.921	0.548295	22.99245
Nepal	2011	114.6113	2,310.004	0.497115	20.91413
Nepal	2012	118.0112	2,387.006	0.488006	21.8291
Nepal	2013	131.4261	2,399.919	0.385265	24.073
Nepal	2014	139.1437	2,500.26	0.151994	26.1276

World Development Indicators 2017.

References

Ababneh, K.I. 2020. Effects of met expectations, trust, job satisfaction, and commitment on faculty turnover intentions in the United Arab Emirates (UAE). *International Journal of Human Resource Management* 31(2), pp. 303–334, DOI: 10.1080/09585192.2016.1255904.

Ahamed, M.A. 2014. Nuclear power as a tool for sustainable development in energy sector in Bangladesh. [In:] *1st International Conference on Electrical Engineering and Information and Communication Technology*, ICEEICT 2014.

Alam et al. 2015 – Alam, A., Malik, I.A., Abdullah, A.B., Hassan, A., Faridullah, Awan, U., ... and Naseem, I. 2015. Does financial development contribute to SAARC'S energy demand? From energy crisis to energy reforms. *Renewable and Sustainable Energy Reviews* 41, pp. 818–829, DOI: 10.1016/j.rser.2014.08.071.

Alberini et al. 2011 – Alberini, A., Gans, W. and Velez-Lopez, D. 2011. Residential consumption of gas and electricity in the US: The role of prices and income. *Energy Economics* 33(5), pp. 870–881.

Ara et al. 2015 – Ara, J., Ahasan, A., Ahmad, S. and Kamruzzaman, M. 2015. Poverty, Protection and Exclusion in Rural Bangladesh.

Attinay, G. and Karagol, E. 2005. Electricity consumption and Economic Growth: Evidence from Turky. *Energy Economics* 27, pp. 849–856.

Bäker, A. and Goodall, A.H. 2020. Feline followers and "umbrella carriers": Department Chairs' influence on faculty job satisfaction and quit intentions. *Research Policy* 49(4), DOI: 10.1016/j.respol.2020.103955.

Bekhet, H.A. and Othman, N. 2011. Assessing the Elasticities of Electricity Consumption for rural and urban areas in Malaysia: A Non-linear approach. *International Journal of Economics and Finance* 3(1), pp. 208–217.

Bento, J.P.C. and Moutinho, V. 2016. CO_2 emissions, non-renewable and renewable electricity production, economic growth, and international trade in Italy. *Renewable and Sustainable Energy Reviews* 55, pp. 142–155.

Bhatti et al. 2019 – Bhatti, M.A., Alshagawi, M., Zakariya, A. and Juhari, A.S. 2019. Do multicultural faculty members perform well in higher educational institutions? Examining the roles of psychological diversity climate, HRM practices and personality traits (Big Five). *European Journal of Training and Development* 43(1–2), pp. 166–187, DOI: 10.1108/EJTD-08-2018-0081.

Bozkaya et al. 2022 – Bozkaya, Ş., Onifade, S.T., Duran, M.S. and Kaya, M.G. 2022. Does environmentally friendly energy consumption spur economic progress: empirical evidence from the Nordic countries? *Environmental Science and Pollution Research* 29(54), pp. 82600–82610, DOI: 10.1007/s11356-022-23452-4.

BPDB 2020. Annual Report 2019–2020. Retrieved from Dhaka, Bangladesh. [Online] http://bd.bpdb.gov.bd/bpdb/resourcefile/annualreports/annualreport_1605772936_AnnualReport2019-20.pdf [Accessed: 2023-01-06].

Chandran et al. 2010 – Chandran, V., Sharma, S. and Madhavan, K. 2010. Electricity consumption–growth nexus: the case of Malaysia. *Energy Policy* 38(1), pp. 606–612.

Cheng-Lang et al. 2010 – Cheng-Lang, Y., Lin, H.-P. and Chang, C.-H. 2010. Linear and nonlinear causality between sectoral electricity consumption and economic growth: Evidence from Taiwan. *Energy Policy* 38(11), pp. 6570–6573.

Garg et al. 2015 – Garg, A., Naswa, P. and Shukla, P.R. 2015. Energy infrastructure in India: Profile and risks under climate change. *Energy Policy* 81, pp. 226–238, DOI: 10.1016/j.enpol.2014.12.007.

Ghosh, S. 2002. Electricity consumption and economic growth in India. *Energy Policy* 30(2), pp. 125––129.

Ibrahiem, D.M. 2015. Renewable electricity consumption, foreign direct investment and economic growth in Egypt: An ARDL approach. *Procedia Economics and Finance* 30, pp. 313–323.

Jha, S. 2021. Understanding mindfulness outcomes: a moderated mediation analysis of high-performance work systems. *Humanities and Social Sciences Communications* 8(1), DOI: 10.1057/s41599-021-00708-x.

Jumbe, C.B. 2004. Cointegration and causality between electricity consumption and GDP: empirical evidence from Malawi. *Energy Economics* 26(1), pp. 61–68.

Kalyoncu et al. 2013 – Kalyoncu, H., Gürsoy, F. and Göcen, H. 2013. Causality relationship between GDP and energy consumption in Georgia, Azerbaijan and Armenia. *International Journal of Energy Economics and Policy* 3(1), pp. 111–117.

Katircioğlu et al. 2016 – Katircioğlu, S., Fethi, S., Kalmaz, D.B. and Çağlar, D. 2016. Interactions between energy consumption, international trade, and real income in Canada: an empirical investigation from a new version of the Solow growth model. *International journal of green energy* 13(10), pp. 1059–1074.

Kennedy, P. 2008. *A guide to econometrics*: John Wiley & Sons.

Khan et al. 2014 – Khan, M.A., Khan, M.Z., Zaman, K., Irfan, D. and Khatab, H. 2014. RETRACTED: Questing the three key growth determinants: Energy consumption, foreign direct investment and financial development in South Asia.

Mozahid et al. 2022 – Mozahid, N., Akter, S. and Hafiz Iqbal, M. 2022. Causality analysis of CO_2 emissions, foreign direct investment, gross domestic product, and energy consumption: empirical evidence from South Asian Association for Regional Cooperation (SAARC) countries. *Environmental Science and Pollution Research* 29, pp. 65684–65698, DOI: 10.1007/s11356-022-20362-3.

Mozumder, P. and Marathe, A. 2007. Causality relationship between electricity consumption and GDP in Bangladesh. *Energy Policy* 35(1), pp. 395–402, DOI: 10.1016/j.enpol.2005.11.033.

Mudakkar et al. 2013 – Mudakkar, S.R., Zaman, K., Shakir, H., Arif, M., Naseem, I. and Naz, L. 2013. Determinants of energy consumption function in SAARC countries: Balancing the odds. *Renewable and Sustainable Energy Reviews* 28, pp. 566–574, DOI: 10.1016/j.rser.2013.08.006.

Pesaran et al. 2001 – Pesaran, M.H., Shin, Y. and Smith, R.J. 2001. Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics* 16(3), 289–326, DOI: 10.1002/jae.616.

Rabab Mudakkar et al. 2013 – Rabab Mudakkar, S., Zaman, K., Shakir, H., Arif, M., Naseem, I. and Naz, L. 2013. Determinants of energy consumption function in SAARC countries: Balancing the odds. *Renewable and Sustainable Energy Reviews* 28, pp. 566–574, DOI: 10.1016/j.rser.2013.08.006.

Rafindadi, A.A. and Ozturk, I. 2016. Effects of financial development, economic growth and trade on electricity consumption: Evidence from post-Fukushima Japan. *Renewable and sustainable energy reviews* 54, pp. 1073–1084, DOI: 10.1016/j.rser.2015.10.023.

Sacko, I. 2004. Analysis of the links between economic growth and energy consumption in Mali (*Analyse des liens entre croissance économique et consommation d'énergie au Mali*). CERFOD-FSJE, Université du Mali (*in French*).

Saidi et al. 2017 – Saidi, K., Rahman, M.M. and Amamri, M. 2017. The causal nexus between economic growth and energy consumption: New evidence from global panel of 53 countries. *Sustainable cities and society* 33, pp. 45–56, DOI: 10.1016/j.scs.2017.05.013.

Shahbaz et al. 2017 – Shahbaz, M., Sarwar, S., Chen, W. and Malik, M.N. 2017. Dynamics of electricity consumption, oil price and economic growth: Global perspective. *Energy Policy* 108, pp. 256–270, DOI: 10.1016/j.enpol.2017.06.006.

Siddika, R. and Ahmad, S. 2022. Trade Liberalization and Economic Growth: A Cross-Country Study using Updated Sachs-Warner Index. *Asian Journal of Economic Modelling* 10(3), pp. 216–225, DOI: 10.55493/5009.v10i3.4581.

WDI 2016. *World development indicator*. World Bank.

Wolde-Rufael, Y. 2006. Electricity consumption and economic growth: a time series experience for 17 African countries. Energy Policy 34(10), pp. 1106–1114, DOI: 10.1016/j.enpol.2004.10.008.

Yildirim Durmuş et al. 2019 – Yildirim Durmuş, Ç., Yildirim, S. and Demirtas, I. 2019. Investigating energy consumption and economic growth for BRICS-T countries. *World Journal of Science, Technology and Sustainable Development* 16(4), pp. 184–195, DOI: 10.1108/WJSTSD-12-2018-0063.

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Rozwój gospodarczy i związek zużycia energii w krajach rozwijających się: dowody z pięciu krajów Azji Południowej

Streszczenie

W niniejszym artykule zbadano związek między zużyciem energii a rozwojem gospodarczym w pięciu krajach Azji Południowej na podstawie danych panelowych na poziomie krajowym w latach 1990–2014. Chociaż wiele badań dotyczyło już związku między zużyciem energii a wzrostem gospodarczym, wyniki są mieszane. Według wielu badaczy kraje Azji Południowej zwiększyły zużycie energii od lat 90. W związku z tym zużycie energii, jako zmienna dla określonego okresu, jest rozpatrywane dla krajów Bangladeszu, Indii, Nepalu, Pakistanu i Sri Lanki. Ponadto bezpośrednie inwestycje zagraniczne (BIZ) i handel międzynarodowy (IT) są również uważane za powiązane zmienne w tym badaniu. Aby zapewnić wiarygodne oszacowanie, kompensując efekty stałe kraju, stosuje się połączone techniki najmniejszych kwadratów, efekty losowe i efekty stałe. Model z efektem stałym jest najbardziej efektywnym modelem, który ujawnia związek między zużyciem energii elektrycznej a czynnikami wzrostu, zgodnie z testem specyfikacji i testem Hausmana. Stwierdzono statystycznie istotną korelację między handlem międzynarodowym, BIZ, wzrostem gospodarczym i zużyciem energii. Największy wpływ na rosnące zapotrzebowanie na energię mają BIZ, a następnie światowy handel i PKB per capita (produkt krajowy brutto). Dokładniej, wyniki badania pokazują, że zwiększone zużycie energii powoduje więcej inwestycji, co skutkuje zwiększonym wzrostem gospodarczym w krajach Azji Południowej. Wyniki badania pokazują ponadto, że BIZ znacząco wpłynęły na zużycie energii i obszar zapotrzebowania SAARC na energię, powodując wejście nowych technologii i wzrost zarówno wzrostu gospodarczego, jak i zużycia energii. Przyszłe polityki mogą koncentrować się na inwestycjach w sektorze energetycznym w celu wspierania rozwoju gospodarczego.

Słowa kluczowe: zużycie energii elektrycznej, energia, PKB per capita, BIZ, handel międzynarodowy, dane panelowe, region SAARC