



The Role of Renewable Energy Investment on Achieving Economic Growth at the Gulf Cooperation Council Countries

Mohammad Sulieman Mohammad Jaradat*

Department of Banking and Financial Studies, College of Business, Ajloun National University, Ajloun, Jordan.

*Email: mhmmmd71@yahoo.com

Received: 09 September 2021

Accepted: 13 December 2021

DOI: <https://doi.org/10.32479/ijeep.12498>

ABSTRACT

Study aims to investigate the renewable energy investment effect on achieving the economic growth (EG) at countries of Gulf Cooperation Council (GCC) for the period of 2010-2019. The percentage of renewable energy investment of total investments is an explanatory variable, and EG is a dependent variable. This research focuses on analyzing literature review to demonstrate how investment in renewable energy impacts the achievement of EG, and it also tries to explain this effect in the GCC countries for this period by utilizing Regression Analysis in E-Views. The research reaches significant and positive effect of renewable energy investment on EG at UAE, KSA, and Qatar but showed insignificant effect of renewable energy investment on EG in Bahrain, Kuwait, and Oman for the period (2010-2019).

Keywords: Investment, Renewable Energy, Economic Growth

JEL Classifications: O40, E01, D25

1. INTRODUCTION

Economic growth (EG) is used to describe an upsurge in goods and services' volume produces by economy. EG leads to increased wages and higher living standards for people; it leads to a rise in society's consumption of goods and services. EG also refers to an increase in an economy's potential output. In essence, sting of scarcity is reduced by EG (Wolla, 2013). EG may be created through factors, such as increased capital, increased labor, and efficient use of capital or labor. The growth that comes from increases in capital and labor represents growth that results from increases in inputs. Sustainable growth, in the long run comes from the efficient use of existing resources, raising economic output per unit input; thereby raising productivity (Wolla, 2013).

Energy is an essential grounds for EG due to the fact that a lot of manufacturing and consumption events use energy as a main input, where EG requires several essential inputs that include energy. From a physical standpoint, energy utilization enhances

economic output and industrialized development (Asghar, 2008). In short, Energy consumption is important for human well-being and economic activities for the expansion and development of a country. Supplied energy is a precondition for mitigating poverty and the accomplishment of sustainable development's goals (Sadekin et. al., 2021).

In particular, renewable energy has spread in the last two years, because its technologies have become less expensive and more efficient than before. At the beginning of the millennium, the cost of producing one watt of energy through photovoltaic cells (PV) was about 5 US dollars, while today it is less than one dollar only and it is expected to reach about a quarter of a dollar by 2020. The major types of renewable energy's bases are Solar, Geothermal, Biomass, Winds, and Hydropower (Wang and Wang, 2020).

The adoption of policies that support the renewable energy sector was not limited to oil-importing countries. Rather, the circle of countries that support renewable energy has extended to include

oil-producing countries including the United Arab Emirates. In March 2013, the UAE became one of the key renewable energy's producers through concentrated solar power (CSP) technology (Abdmouleh et al., 2015).

The GCC countries own massive locations of solar radiation that isn't available in a lot of world countries, where its geographic areas and secure conditions allow it to continuously play a role as the world leading energy producers (Reiche, 2010). In this context, the research concentrates on estimating impact of renewable energy investment on EG in GCC countries (UAE, KSA, Bahrain, Kuwait, Qatar, and Oman).

The research problem embedded in estimating renewable energy effect on EG at GCC countries and identifying whether this effect is significant or not, and also examining the causes of this effect at each country. The importance of research problem comes from the renewable energy role on enhancing economic productivity, protecting the environment from pollution, and achieving sustainable economic growth. The main objective of research is to estimate the effect of renewable energy investment rate on EG at GCC countries during (2010-2019). The importance of research lies in renewable energy role on enhancing EG, due to the fact that numerous production and consumption activities use energy as key ingredients, which enhances economic productivity and EG.

2. LITERATURE REVIEW

Due to the importance of renewable energy role on boosting EG, this part concentrates on analyzing studies that examine renewable energy impact on EG as follows:

Karimi et al. (2021) study analyzes renewable energy effect on EG at Iran for the period (1975-2017) by using the ARDL method, where the study found a positive impact of renewable energy on Iran's EG.

Khobai (2021) study aims to test the effect of renewable energy consumption on EG in South Africa by relying on quarterly data during (1990-2018) and implementing a Vector Errors Correction Model, where the study found that renewable energy consumption will ultimately leads to EG.

Li et al. (2021) paper concentrates on testing the impact of renewable energy sources on EG growth at SAARC countries during (1995-2018) using Fixed Effect Test and Panel Vector Errors Correction Model. The study found a positive effect of renewable energy sources on EG at these countries.

Moustapha et al., (2021) study analyzed impact of renewable energy consumption on EG at (15) West African countries for the period (2000-2018), where the study depends on economic ARDL and VECM methods. Study indicated a positive and significant effect of Renewable Energy Consumption of EG and unidirectional causalities from Renewable Energy Consumption Resources on EG.

Parika and Singh, (2020) paper aims to analyze relationship between human capital and EG of India for the period (1980-2017)

using Johanson Cointegration and Fully Modified Ordinary Least Squares techniques. Study found human capital to be a key element of EG in India.

Khan et al., (2019) paper studies renewable energy impact on EG at the Southeast Asian Nations Association of participating countries by relying on secondary data of (100) observations and depending on Structural Equation Modeling. Study concludes that utilization of renewable energy in supporting activities will enhance environmental and economic performance by reducing emissions and boosting EG.

Ntanos et al., (2018) study aims to analyze effect of Renewable Energy Consumption on EG of (25) European countries for the period (2007-2016) using the ARDL method. Study reaches a positive correlation between Consumption of Renewable Energy Resources and EG of these countries.

Soava et al., (2018) paper aims to analyze the correlation between EG and Consumption of Renewable Energy of (28) EU during (1995-2015) by using lots of Panel Data Methods. Results indicated a positive impact of Renewable Energy Consumption on EG at these countries.

Neitzel, (2017) study employed fully-modified Least Squares Regression Approach to estimate correlation between EG and Renewable Energy at a Panel of (22) OECD countries during (1995-2012). Study indicated an existing Unidirectional Causality from Renewable Energy on EG.

The study of Shukla, (2017) examined Human Capital effect on EG in India; for the period (1995-2014) using Multiple Linear Regression Models. The study reaches a strong positive impact of Human Capital on EG in India.

Neuhaus, (2016) paper analyzed the effect of Renewable Energy Consumption on EG in a panel of sub-Saharan Africa countries during (1990-2011) using Panel Cointegration and Fully-Modified OLS Methods. Study reaches Unidirectional Causalities from Renewable Energy Consumption on EG; on the long run.

Wang and Liu, (2016) study tested human capital's educational effect on EG in a data panel of (55) countries for the period (1960-2009) by depending on Panel Data Analysis. The study found positive and significant effect of human capital education on EG at those countries. Previous studies have employed various techniques at different time periods to demonstrate positive effect of Renewable Energy Consumption on EG at various countries.

3. RESEARCH METHODOLOGY

The research aims to analyze effect of Renewable Energy Investment on EG at the GCC countries for the period (2010-2019) by depending on simple regression analysis to reach results and recommendations.

The basic hypothesis of research indicated a positive and significant effect of Renewable Energy Investment on EG at GCC

countries; for the period (2010-2019) by depending on a simple regression method.

The study used data obtained from reports and bulletins related to study topic issued by the World Bank and annual bulletins and reports from official authorities in the GCC countries for the period of 2010-2019.

4. RESULTS AND DISCUSSION

Due to the positive effect of Renewable Energy Investment on EG in previous studies, this part concentrates on analyzing relationships between Renewable Energy Investment and EG at GCC countries (UAE, KSA, Bahrain, Kuwait, Qatar, Oman) for the period (2010-2019), as follows in Table 1:

Table 1 and Chart 1 show that GDP growth rate (EG rate) for UAE during the period (2010-2019) ranged between two limits, a lowest amounted to about (1.19%) in 2018 and a highest of about (6.93%) in 2011, with an annual average value during the study period of about (3.58%).

The Renewable Energy Investment rate; as a percentage of total investments at UAE during the period (2010-2019) ranged between two limits, the lowest amounted to about (13.48%) in 2019 and the maximum amounted to about (17.26%) in 2013, with an annual average value during the study period of about (15.41%). Researchers indicated a positive relationship between GDP (EG rates) and rates of Renewable Energy Investment at UAE during (2010-2019).

Table 1: EG and Rates of Renewable Energy Investment at UAE

Years	EG	Renewable energy investment rates
2010	1.60	14.67
2011	6.93	15.67
2012	4.48	16.37
2013	5.05	17.26
2014	4.28	15.67
2015	5.11	16.49
2016	3.06	15.93
2017	2.37	14.56
2018	1.19	13.99
2019	1.68	13.48

Source: By researcher depending on World Bank data, annual bulletins, and reports from GCC countries authorities

Table 2: KSA

Years	EG	Renewable energy investment rates
2010	5.04	10.54
2011	10.00	12.79
2012	5.41	12.25
2013	2.70	11.44
2014	3.65	10.24
2015	4.11	6.03
2016	1.67	4.97
2017	-0.74	5.98
2018	2.43	7.42
2019	0.33	6.20

Source: By researcher

Table 2 and Chart 2 indicate that GDP (EG rates) for KSA during the period (2010-2019) ranged between two limits, a lowest which amounted to about (-0.74%) in 2017 and a largest of about (10.00%) in 2011, with an annual average value during the study period of about (3.46%).

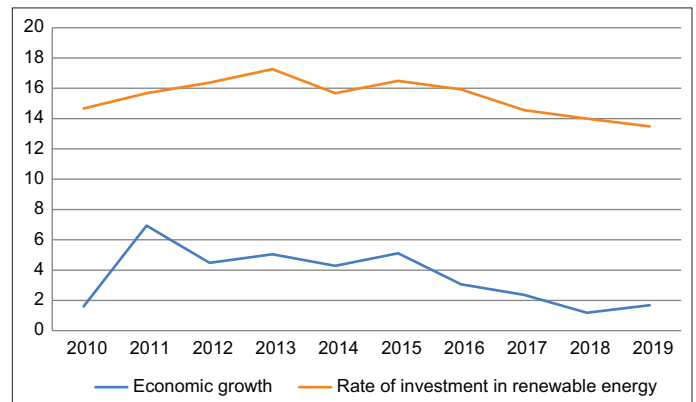
The Renewable Energy Investment rate as a ratio of total investments at KSA; during the period (2010-2019) ranged between two limits, the lowest, amounted to about (4.97%) in 2016 and maximum amounted to about (12.79%) in 2011, with an annual average value during the study period of about (8.79%).

Chart 2 indicated a positive effect of Renewable Energy Investment rates on GDP (EG rates) at KSA; during the period (2010-2019).

Table 3 and Chart 3 indicated that GDP (EG rates) at Bahrain during the period (2010-2019) ranged between two limits, the lowest which amounted to about (1.78%) in 2018 and a highest of about (5.42%) in 2013, with an annual average value during the study period of about (3.38%).

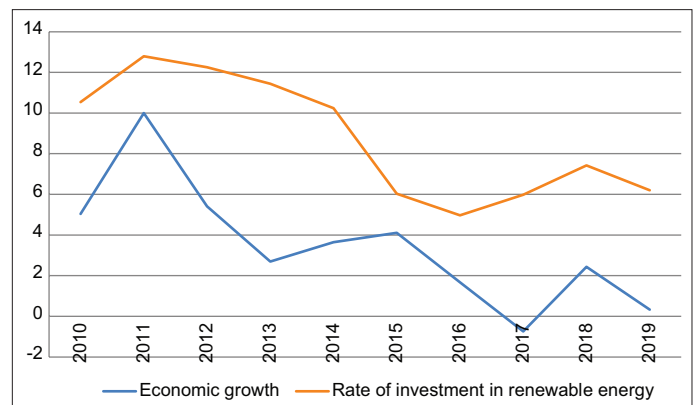
The Renewable Energy Investment rates as a percentage of total investments at Bahrain during the period (2010-2019) ranged between two limits, a lowest amounted to about (3.19%) in 2016

Chart 1: EG and rates of renewable energy investment in UAE



Source: By researcher depending on World Bank data, annual bulletins, and reports from GCC countries authorities

Chart 2: KSA



Source: By researcher

and the maximum amounted to about (9.31%) in 2013, with an annual average value during the study period of about (6.07%).

Researchers indicated a positive effect of Renewable Energy Investment rates on GDP (EG rates) at Bahrain; in some years during the period (2010-2019).

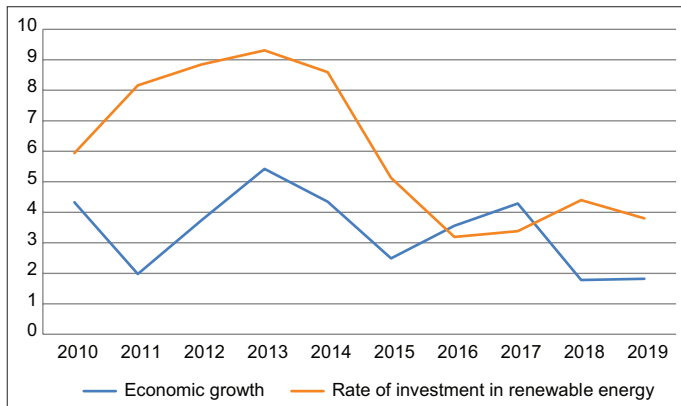
Table 4 and Chart 4 show that GDP (EG rates) at Kuwait during the period (2010-2019) ranged between two limits, the lowest which amounted to about (-4.71%) in 2017 and a maximum of about (9.63%) in 2011, with an annual average value; during the study period of about (1.60%).

Table 3: Bahrain

Years	EG	Renewable energy investment rates
2010	4.33	5.94
2011	1.98	8.16
2012	3.73	8.84
2013	5.42	9.31
2014	4.35	8.59
2015	2.49	5.13
2016	3.56	3.19
2017	4.29	3.38
2018	1.78	4.40
2019	1.82	3.80

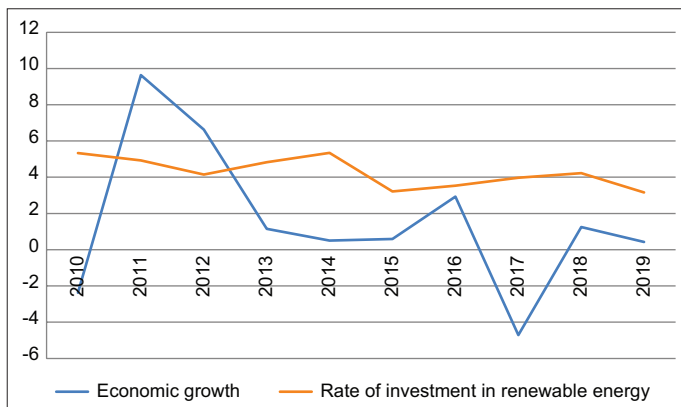
Source: By researcher

Chart 3: Bahrain



Source: By researcher

Chart 4: Kuwait



Source: By researcher

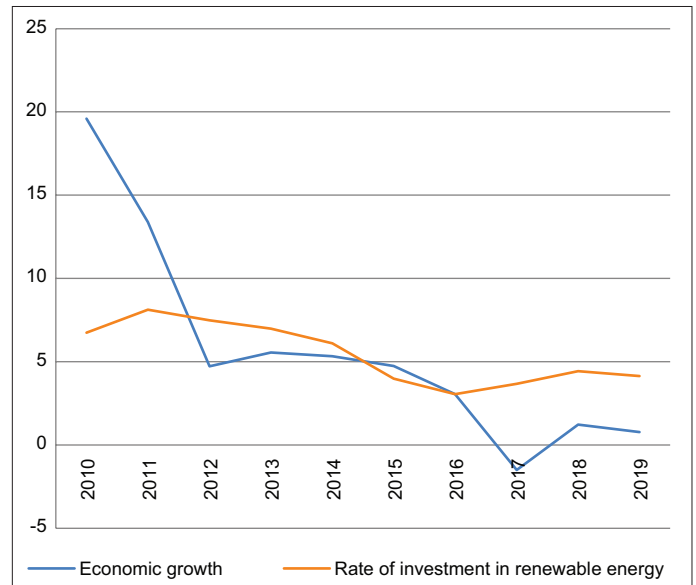
The Renewable Energy Investment rate; as a percentage of total investments at Kuwait during (2010-2019) ranged between two

Table 4: Kuwait

Years	EG	Renewable energy investment rates
2010	-2.37	5.33
2011	9.63	4.93
2012	6.63	4.15
2013	1.15	4.83
2014	0.50	5.34
2015	0.59	3.22
2016	2.93	3.53
2017	-4.71	3.97
2018	1.25	4.22
2019	0.43	3.16

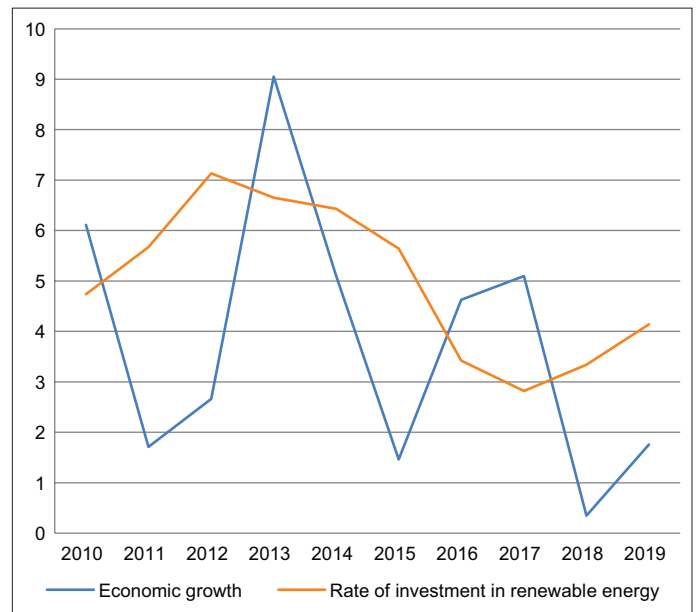
Source: By researcher

Chart 5: Qatar



Source: By researcher

Chart 6: Oman



Source: From researcher

limits, the lowest amounted to about (3.16%) in 2019 and the maximum amounted to about (5.34%) in 2014, with an annual average value during the study period of about (4.27%). These didn't show a significant effect of renewable energy investment rates on GDP (EG rates) at Kuwait; in most years during the period (2010-2019).

Table 5 and Chart 5 show that GDP (EG rates) of Qatar during the period (2010-2019) ranged between two limits, the lowest which amounted to about (-1.5%) in 2017 and a maximum of about (19.59%) in 2010, with an annual average value during the study period of about (5.69%).

The Renewable Energy Investment rates; as a percentage of total investments at Qatar during the period (2010-2019) ranged between two limits, the lowest amounted to about (3.06%) in 2016 and a maximum amounted to about (8.13%) in 2011, with an annual average value during the study period of about (5.47%). Researchers indicated nonexistence of unique impact of Renewable Energy Investment rate on GDP (EG rates) at Qatar; during the period (2010-2019).

Table 5: Qatar

Years	EG	Renewable energy investment rates
2010	19.59	6.74
2011	13.38	8.13
2012	4.73	7.48
2013	5.56	6.98
2014	5.33	6.10
2015	4.75	3.99
2016	3.06	3.06
2017	-1.50	3.68
2018	1.23	4.44
2019	0.77	4.14

Source: By researcher

Table 6: Oman

Years	EG	Renewable energy investment rates
2010	6.11	4.74
2011	1.71	5.67
2012	2.66	7.13
2013	9.05	6.65
2014	5.10	6.43
2015	1.46	5.64
2016	4.63	3.42
2017	5.10	2.82
2018	0.35	3.34
2019	1.76	4.14

Source: By researcher

Table 7: Results of the impact of renewable energy investment rates on EG at GCC countries; during (2010-2019) using simple regression analysis

Countries	X-Coefficient	Intercept	R-squared	Adjusted R-Squared	Standard errors	F- statistics
UAE	1.205	-14.987	0.59	0.53	1.29	11.33
KSA	0.765	-3.259	0.56	0.51	2.11	10.33
Bahrain	0.208	2.114	0.16	0.05	1.25	1.48
Kuwait	0.390	-0.063	0.01	-0.12	4.33	0.05
Qatar	0.189	4.398	0.43	0.36	5.03	6.12
Oman	0.152	4.390	0.05	-0.07	2.77	0.39

Source: By researcher depending on E-Views' results

Table 6 and Chart 6 showed that GDP (EG rates) of Oman during the period (2010-2019) ranged between two limits, the lowest which amounted to about (0.35%) in 2018 and a maximum of about (9.05%) in 2013, with an annual average value during the study period of about (3.79%).

The Renewable Energy Investment rate; as a percentage of total investments at Oman during the period (2010-2019) ranged between two limits, the lowest amounted to about (2.82%) in 2017 and a maximum amounted to about (7.13%) in 2012, with an annual average value during the study period of about (5%). Researchers indicated nonexistence of unique impact of Renewable Energy Investment rate on GDP (EG rates) at Oman; during the period (2010-2019).

4.1. Renewable Energy Investment Impact on EG at GCC Countries; During (2010-2019)

In order to identify Renewable Energy Investment Impact on EG rates at GCC countries during the period (2010-2019), researchers calculated the Simple Regression Equation by measuring the relationship between Renewable Energy Investment rates; as a percentage of total investments (X) which represents independent variable and EG rate(Y) as the dependent variable, results as follows:

The above Table 7 shows that in UAE, KSA, and Qatar the effect of renewable energy investment on EG is significant and positive for (2010-2019), which may be as a result of these countries depending so much on renewable energy and their efforts to enhance economic growth. For example, in March 2013 UAE became one of the most important producers of Renewable Energy through CSP Technology.

Table also showed an insignificant effect of renewable energy investment on EG at Bahrain, Kuwait, and Oman for the period (2010-2019), which reveals that other factors affect EG other than investment in renewable energy.

In comparison with other studies, this study provides a much more significant contribution to literature, due to its estimation of the effect of Renewable Energy Investment rate on EG at all GCC countries; for the most recent period of (2010-2019).

5. CONCLUSION

Renewable Energy plays a crucial role in improving Economic Production and EG, where this study aims to estimate the impact

level of Renewable Energy Investment rate on EG at GCC; during (2010-2019) using Simple Regression Analysis.

Study results showed significant and positive effects of Renewable Energy Investment on EG in UAE, KSA, and Qatar. This result may be due to the dependence of these countries on Renewable Energy and their efforts toward enhancing EG, while in Bahrain, Kuwait, and Oman the effect of Renewable Energy Investment on EG is insignificant. This reflects that there are other factors that affect EG; apart from Renewable Energy Investment.

This paper recommends giving more attention to the enhancement of Renewable Energy Investment, especially in Bahrain, Kuwait, and Oman in order to increase Sustainable EG.

REFERENCES

- Abdmouleh, Z., Alamdari, R.A., Gastli, A. (2015), Recommendations on renewable energy policies for the GCC countries. *Renewable and Sustainable Energy Reviews*, 50, 1181-1191.
- Annual Bulletins and Reports from GCC Countries Authorities. (2009 - 2020), Central Banks in GCC Countries and Several Ministries. United States: Annual Bulletins and Reports from GCC Countries Authorities.
- Asghar, Z. (2008), Energy-GDP relationship: A causal analysis for the five countries of South Asia. *Applied Econometrics and International Development*, 8(1), 167-80.
- Karimi, M.S., Ahmad, S., Karamelikli, H., Dinç, D.T., Khan, Y.A., Sabzehei, M.T., Abbas, S.Z. (2021), Dynamic linkages between renewable energy, carbon emissions and economic growth through nonlinear ARDL approach: Evidence from Iran. *PLoS One*, 16(7), e0253464.
- Khan, S.A.R., Zhang, Y., Kumar, A., Zavadskas, E., Streimikiene, D. (2019), Measuring the impact of renewable energy, public health expenditure, logistics, and environmental performance on sustainable economic growth. *Sustainable Development*, 28(4), 833-843.
- Khobai, H. (2021), Renewable energy consumption, poverty alleviation and economic growth nexus in South Africa: ARDL bounds test approach. *International Journal of Energy Economics and Policy*, 11(5), 450-459.
- Li, Q., Cherian, J., Shabbir, M.S., Sial, M.S., Li, J., Mester, I., Badulescu, A. (2021), Exploring the relationship between renewable energy sources and economic growth. The case of SAARC countries. *Energies*, 14(3), 520.
- Moustapha, M., Yu, Q., Danqauh, B. (2021), Analyzing the linkage between renewable energy consumption and economic growth in West Africa. *International Energy Journal*, 21(2), 225-234.
- Neitzel, D. (2017), *Examining Renewable Energy and Economic Growth: Evidence from 22 OECD Countries*. Florida: Rollins College.
- Neuhaus, L. (2016), *Examining the Renewable Energy Consumption-economic Growth Nexus in Sub-Saharan African Countries*. Iowa: University of Northern Iowa, Honors Program Theses. p241.
- Ntanos, S., Skordoulis, M., Kyriakopoulos, G., Arabatzis, G., Chalikias, M., Galatsidas, S., Katsarou, A. (2018), Renewable energy and economic growth: Evidence from European countries. *Sustainability*, 10(8), 2626.
- Parika, A., Singh, B. (2020), *How Does Human Capital Affect Economic Growth in India? An Empirical Analysis*. Varanasi: Banaras Hindu University.
- Reiche, D. (2010), Renewable energy policies in the Gulf countries: A case study of the carbon-neutral “Masdar City” in Abu Dhabi. *Energy Policy*, 38(1), 378-382.
- Sadekin, M.N., Alam, M.M., Moudud-Ul-Huq, S., Hassan, M.G., Islam, T. (2021), Do energy consumption and environmental degradation CO. *International Journal of Energy Economics and Policy*, 11(5), 289-297.
- Shukla, S. (2017), Human capital and economic growth in India. *International Journal of Current Research*, 9(11), 61628-61631.
- Soava, G., Mehedintu, A., Sterpu, M., Raduteanu, M. (2018), Impact of renewable energy consumption on economic growth: Evidence from European Union countries. *Technological and Economic Development of Economy*, 24(3), 914-932.
- Wang, Q., Wang, L. (2020), Renewable energy consumption and economic growth in OECD countries: A nonlinear panel data analysis. *Energy*, 207, 118200.
- Wang, Y., Liu, S. (2016), Education, human capital and economic growth: Empirical research on 55 countries and regions (1960-2009). *Theoretical Economic Letters*, 6, 347-355.
- Wolla, S. (2013), *What Are the “Ingredients” for Economic Growth?* United States: Economic Research, Page One Economics.
- World Bank Data. (2009 - 2020), Available from: <https://www.data.worldbank.org>