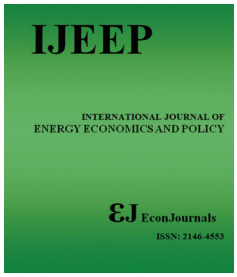
Al-Tamimi, Khaled Abdalla Moh'd; Jaradat, Mohammad Sulieman; YachouAityassine, Fatima Lahcen et al.

Article

Impact of renewable energy on the economy of Saudi Arabia

Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

Reference: Al-Tamimi, Khaled Abdalla Moh'd/Jaradat, Mohammad Sulieman et. al. (2023). Impact of renewable energy on the economy of Saudi Arabia. In: International Journal of Energy Economics and Policy 13 (3), S. 20 - 27. https://www.econjournals.com/index.php/ijeep/article/download/14099/7277/33431. doi:10.32479/ijeep.14099.



International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2023, 13(3), 20-27.

Impact of Renewable Energy on the Economy of Saudi Arabia

Khaled Abdalla Moh'd AL-Tamimi[1]*, Mohammad Sulieman Jaradat[2], Fatima Lahcen Yachou Aityassine[1], Mustafa M. Soumadi[1]

[1]Department of Financial and Administrative Sciences, Irbid University College, Al-Balqa' Applied University, Jordan, [2]Department of Banking and Financial Sciences, Ajloun National University, Jordan, *Email: khaled_tamimi@yahoo.com

Received: 03 January 2023 **Accepted:** 02 April 2023 **DOI:** https://doi.org/10.32479/ijeep.14099

ABSTRACT

The objective of the study was to identify the impact of renewable energy on Saudi economy during 2000-2021. Analytical techniques were used to conduct this study. An analysis of the study used a set of variables, in which Renewable energy perceives as independent variable and the dependent variables are GDP per capita, net foreign direct investment, unemployment, fixed capital formation, and net foreign trade. The data of the study were analyzed using the E-views program. According to Results of the study, renewable energy has an impact on certain economic variables and does not have an impact on others. A partial validity is found for the study's central hypothesis. According to our findings, renewable energy's impact contributes significantly on net foreign direct investment and unemployment. However, there is no statistically significant of renewable energy on to GDP per capita, net foreign trade, or fixed capital formation. The current study recommends continuous implementation of Kingdom of Saudi Arabia Vision plan 2030, where through it the National Renewable Energy Program will contribute effectively to the support of Kingdom's economy and development of its human resources to expand investment in new sectors as well as attracting investments from international and local companies.

Keywords: Renewable Energy, Saudi Economy, Per Capita, Net Foreign Direct Investment, Unemployment, Fixed Capital Formation
JEL Classifications: Q2, Q3, Q4

1. INTRODUCTION

Over the past few years, Renewable energy investment has become an increasingly important part of sustainable economic, social, and environmental development strategies. In addition, energy consumption is closely tied to economic growth. Industrialization shifted production methods dramatically from humans to machines, and coal was increasingly used for steam generation during the industrial revolution. According to several studies, the demand for additional energy resources has been strongly correlated with economic expansion worldwide. In the future, it stands to reason that the world's population and economy will continue to expand, thus increasing the energy demand. Additionally, Saudi Arabia has the highest energy consumption among Middle Eastern countries. Saudi Arabia's domestic oil consumption increased from 4.1 million barrels per day in 2018 to over 4.3 million barrels per day by the end of 2019 (Zafar et al., 2019).

The Saudi Arabian economy is heavily dependent on oil as one of the world's top producers and exporters of petroleum products. Renewable energy investments are now in demand. The Saudi government seeks several reasons to diversify the economy away from oil dependency. Because Saudi Arabia consumes a great deal of its oil production domestically, it may be unable to export it. The fact that Saudi Arabia is a member of the Organization of Petroleum Exporting Countries explains its limited production. It is not sustainable long-term to rely solely on the export and production of a single commodity (such as oil or refined goods). An epidemic or crisis could also cause oil prices to drop. Oil market volatility is evident in the COVID-19 problem. Over 60%

of Saudi Arabia's government revenues come from oil, according to newly released figures from the General Authority of Statistics. Saudi Vision 2030 aims to expand the kingdom's economic base (Kahia et al., 2021).

Numerous renewable energy initiatives are being implemented in the region, all contributing to the expansion of regional industries. Additionally, Saudi Arabia could contribute more to the fight against climate change if carbon emissions were reduced in the local economy. It can save the Saudi government money to keep its people healthy since it spends so much on healthcare. Saudi Arabia's economy can be transformed into one that is dynamic, sustainable, and stable by investing in renewable energy (Negewo, 2012).

By the end of 2018, Saudi Arabia consumed about three million barrels of oil for domestic energy purposes; half of this amount was used for desalination. The demand for water and energy is also expected to increase dramatically in Saudi Arabia due to its rapid population growth (about 3.2% yearly from 2012 to 2017) and economic growth. Approximately eight million barrels of oil will be consumed daily in the Kingdom by 2050. Oil export prospects are discouraged because of the current energy consumption of the country, which puts a strain on government finances. Meanwhile, renewable energy investments will generate more work for Saudi businesses, including construction, manufacturing, services, and utilities, increasing Saudi employment. (Apergis and Payne, 2010).

In recent years, investing in and developing renewable energy sources has been a priority of Saudi Arabia. KSA launched the National Renewable Energy Program, 2017 in an active aspiration to naturalize renewable energy market in the Kingdom while achieving highest international standards, where this sustainable program aims to activate local sources of renewable and sustainable energy production. It is planned to produce a total of (9.5) GW of renewable energy by 2023 with a future target of total renewable energy production that estimated at approximately (200) GW; according to KSA Kingdom Vision 2030. All this will lead to an increase in the GDP of energy field, which reflect the balance of payments through diversification of income sources, creation of human resources jobs, and the help of supported services in this aspect (www.energy.gov.sa). Although Saudi Arabia has great potential for renewable energy, few academic studies examine and analyze the benefits and risks of investing in this sector. Despite the availability of multiple renewable energy investment scenarios and options in Saudi Arabia, deciding on the ideal investment scenario can be challenging. Since the COVID-19 outbreak will cause economic volatility and uncertainty before, during, and after the period for investing in renewable energy, there is no apparent optimal initiative or alternative for doing so (Abid et al., 2017).

On the other hand, the specialist in energy affairs and oil marketing and former Director of Energy Studies at OPEC; Dr. Faisal Mirzah showed that partnership with Softbank is moving at an accelerated pace to achieve KSA Vision 2030 by diversifying sources of income and investing in solar energy away from oil addiction, stressing that partnership we rely on a lot will support local content as well as supporting national competencies. Dr. Mirzah indicated that signing the memorandum of understanding with Softbank to establish largest solar energy project in the world with a production capacity of up to (200) GW is a main result of the Custodian of Two Holy Mosques King Salman bin Abdulaziz Al Saud initiative for renewable energy; launched last year with the focus on Saudi citizen by providing and localizing jobs in the renewable energy industry and supporting national research centers through the implementation of these principles on solar energy plan agreement with Softbank; signed by His Highness the Crown Prince represented in benefiting from the electrical energy production and making Kingdom one of the largest manufacturers and exporters of solar panels in the world (Saudi Press Agency, 2018).

In this study, the primary objective is to measure and analyze the impact of renewable energy on the Saudi Arabian economy between the years 2000 and 2021. Our focus here is to investigate the effects of renewable energy on the economy. We consider renewable energy as an independent variable. The dependent variables will be Gross Domestic Product per capita, net foreign direct investment, unemployment rate, fixed capital formation, and net foreign trade. To determine relationships between variables we used E-Views to determine the relationship between variables using various standardized tests such as the extended Dickey-Fuller test, causality test, and cointegration test, as well as other standardized tests. In other words, the problem with this study is rooted in the fact that there are hardly any studies, research, or references that deal with the positives or negatives of renewable energy on the economy that may be useful for this study.

2. LITERATURE REVIEW

This literature review focuses mainly on analyzing all studies that deal with the impacts of renewable energy on Saudi Arabia's economy as a result of the importance of renewable energy on the Saudi economy.

The study of Bosah et al. (2020) addressed asymmetric relationship between electricity consumption, economic growth, and carbon dioxide emission in (15) countries during (1971-2014) using NARDL model to verify the asymmetric integration between variables. Results confirmed non-linear integration between variables in Cameroon, Republic of Congo, Zambia, Canada, and UK as well as an asymmetric relationship between electricity consumption, economic growth, and carbon emissions in Canada and Cameroon. In AlKhars et al. (2020) the Authors present a review of the current research that has been conducted on the topic of the energy consumption of nations in the Gulf Cooperation Council (Saudi Arabia, United Arab Emirates, Bahrain, Qatar, Oman, Kuwait) and their GDP development was undertaken as part of this study. Between 2006 and 2019, 59 publications were found in 18 different journals and 18 other books. Those papers that examined the energy-growth relationship at the national level were divided into two groups: those that examined the connection at the regional or global level and those that examined it at the national level. This study shows that 18% of the data fit the growth hypothesis, 26% the conservation hypothesis, 43% the feedback hypothesis, and 13% the neutral hypothesis, based on this research. It was also noted that 23 percent of the data fit the conservation hypothesis, but 23 percent fit the feedback

hypothesis. Considering the study results of the authors, we may conclude that GCC countries have prioritized energy supply to facilitate industrialization and socioeconomic growth to facilitate rapid growth in automation and socioeconomic development. GCC countries must rapidly adopt renewable energy technology to achieve sustainable development and growth of their economies.

The study of Awodumi and Adewuyi, (2020) focused on the role of non-renewable energy on economic growth and carbon emissions at the highest oil-producing economies in Africa during (1980-2015). The paper adopted nonlinear distributed autoregressive deceleration (NARDL) model, and reveals evidence on asymmetric effect of oil and natural gas individual consumption on economic growth and carbon emissions in all selected countries; except Algeria. Therefore, it is imperative for policy makers at the oil-producing economies in Africa to explore ways for investing in carbon-reducing technologies and enhancing them in the production processes; in their quest for economic growth, if they must continue to consume their rich resources of natural gas and oil. Munir and Riaz (2020) conducted a study that aimed to examine the asymmetric impact of energy consumption; such as oil, gas, coal, and electricity on environmental degradation in Australia, China, and USA for the period (1975-2018) by collecting data and using NARDL model to examine the long and short-term relationship between variables. Results showed that increased consumption of oil and coal in Australia, consumption of oil, gas, and electricity in China, and the consumption of oil, gas, and coal in USA leads to an increase in carbon dioxide emissions in the long-term. Study recommended that research and development centers should control pollution through new technologies for reducing emissions and using renewable energy resources as an energy source.

A study by Amran et al. (2020) analyzes RnSE technology potential, growth, resources, sustainability performance, and prospects in Saudi Arabia based on Saudi Vision 2030. Research has been conducted on various RnSE resources, including solar, wind, geothermal, hydropower, and biomass. RnSE has been provided by solar power for more than 50 years, which has undergone numerous technological advancements. Furthermore, introducing RnSE from clean and maintainable resources reduces Saudi Arabia's dependence on oil and gas. Electrical demand is also expected to increase, and power shortages are expected. A study suggests that underutilized RnSE technologies in KSA could be crucial to the country's future and development. It is also necessary to explore offshore-wind energy, biomass energy, and thermal energy as possibilities. RnSE technology is being analyzed in this review to provide a comprehensive understanding of how it might be applied in the KSA to contribute to long-term prosperity and energy security. Several suggestions can be made to enhance the effectiveness of RnSE tools. Al-Douri et al. (2019) a reliable renewable energy source is essential for the KSA's long-term prosperity, according to Al-Douri et al. (2019). To ensure the foundation of the outstanding benefits of the RnSE sources, KACARE conducted a comprehensive evaluation. The KACARE wishes to preserve several aspects of the hydrocarbon industry, including the economics of hydrocarbons, the water and electricity demand arrangements, technology choices, the needs of infrastructure, and the possibility of expanding human capacity and value chains. However, due to this consideration, the determination has been made to produce hydrocarbons as a residual primary source of electricity by 2032. Wind energy accounts for 9 GW, solar power accounts for 41 GW (25 GW concentrated solar power and 16 GW solar PV cells), nuclear energy accounts for 17.6 GW, Geothermal accounts for 1 GW and renewable energy accounts for 3 GW, bringing the total of hydrocarbons to 60 GW. Consequently, geothermal, nuclear, and WtE can meet wintertime base load needs. Hydrocarbons provide residual energy for base load and PV technologies, with concentrated solar energy able to cover the difference in demand variances between them. Photovoltaic power alone can meet daytime energy needs, whereas PV technology alone cannot meet peak demand variances. KACARE conducts its business fairly and transparently to ensure competitive pricing and keep investors satisfied with its methods.

Adebumiti and Masih (2018) study aimed to examine nonlinear and asymmetric relationship between energy consumption and economic growth in Nigeria during (1980-2014) by implementing NARDL method to examine the asymmetric integration between variables and using causality testing to examine the causal relationships between variables. Results indicated co-integration between variables in the presence of asymmetry while causal results showed that negative shocks of energy consumption have an impact on the economic growth. (Mosly and Makki, 2018) examine renewable energy adoption and interest in western Saudi Arabia in this study. Different sociodemographic groups and their level of background knowledge about six types of renewable technologies are investigated in this study to understand better their willingness to adopt renewable technologies. To obtain cross-sectional data, 416 people were surveyed according to a well-designed questionnaire in a quantitative research project. Statistical inference and descriptive analysis were conducted on the data. A ranking was based on the study's findings based on participants' prior knowledge and opinions of six renewable energy sources. Educating people about renewable energy sources is critical to raising awareness of them. In addition, the findings were used to rank the five attitudes toward embracing renewable resources. The economic component was the most influential in determining the adoption propensity. Furthermore, based on the study's findings, it was discovered that age significantly impacted people's willingness to adopt these technologies. We hope this report will serve as a valuable resource for energy policymakers, government agencies, and investors as they develop more effective strategies to raise public awareness of renewable energy sources and promote their use in their daily lives. Therefore, this will significantly contribute to the Kingdom's goal of increasing energy efficiency and production capacity in line with its Vision 2030.

According to Sung and Park (2018), the Authors provide an overview of the factors influencing the transition from fossil fuels to renewable energy; this study aims to provide an overview of the factors influencing the growth. An unbalanced panel data set for 25 OECD member nations from 1990 to 2014 was generated using a conceptual framework based on a literature study and text-mining analysis. A panel vector autoregressive (VAR) model with a bias-corrected least squares dummy variable (LSDVC) estimate for the first difference was used to examine the dynamic

relationship between policymakers, markets, citizens, conventional energy (such as nuclear, coal, oil, and natural gas) and renewable energy. Our further investigation of causal relationships between variables is based on Wald tests using LSDVC estimations to test for causality. Traditional energy sectors negatively impact renewable energy, while governments and markets actively promote it. However, as the renewable-energy sector emerges, the public has little influence. It is shown in this study that the government and the people can indirectly affect the transformation of the economy through their interactions with the market. Our results further reinforce the dynamic-path dependence of all of our estimates. The study concludes with a discussion of its implications. A stable economy is driven mainly by renewable and sustainable energy (RNE) resources in wealthy nations like the Kingdom of Saudi Arabia. RnSE has demonstrated success and reliability in several technological contexts as a substitute for conventional hydrocarbons. Due to Saudi Arabia's rapid population growth and dynamic economy, the Kingdom of Saudi Arabia (KSA) consumes a significant amount of electricity. As a result, the KSA has installed massive RnSE systems throughout the country using its considerable financial resources.

According to (Tiba and Omri, 2017). IRENA (International Renewable Energy Agency) reports that KSA could reduce its use of fossil fuels in the water and energy sectors by 25% by 2030. KSA has the world's largest solar facility covering its parking lot, which Saudi Aramco Oil Company owns. Since this incident, the KSA has invested in RnSe, changed its power structure at home, and projected a global energy leadership image to diversify its economy and spur development. Maintaining a pristine environment is one of the environmental benefits of the increased availability of RnSE resources. As a result of these factors, job openings increase, the trade deficit shrinks, and greenhouse gas emissions can be mitigated. For example, global market rates in 2008 averaged 50.4 SAR/kWh for an equivalent GCC utility, whereas Saudi government subsidies resulted in roughly 0.15 SAR/kWh overall cost for the KSA. But solar power costs have decreased from US $101/kWh to around the US. Tlili (2015) stated that the world is progressing and moving away from NRnSE resources like relic fuel towards RnSE resources for energy. SV2030, developed by the KSA, has protected RnSE infrastructure. By investing in RnSE in Saudi Arabia and the Gulf Cooperation Council states, it is expected that about $87 billion in reserves will be developed, and about one gigaton of carbon emissions will be reduced. KACARE is gradually adopting nuclear and RnSE energy as part of its overall energy strategy to secure 50% of total electricity consumption by 2032. Jobs, infrastructure, and educational opportunities are affected by the expansion of the RnSE industry in KSA. In the KSA alone, there could be 80,000 new jobs created by 2030 as the RnSE sector triples its funding for careers.

3. RESEARCH METHODOLOGY

This study aims to measure and analyze renewable energy's impact on Saudi Arabia's economy during the period (2000-2021). Renewable energy is used as an independent variable and, on the other hand, the dependent variables (GDP, per capita, net foreign direct investment, unemployment, fixed capital formation, and net foreign trade). These variables were calculated using a set of standard tests such as the extended Dickey-Fuller test, causality test and co-integration test.

3.1. Main Hypotheses

The statistically significant impact of renewable energy on the economy of Saudi Arabia.

1. First_sub hypothesis

The statistically significant positive impact of the level of (Renewable energy) on the (GDP per capita) in Saudi Arabia.

2. Second_sub hypothesis

The statistically significant positive impact of the (Renewable energy) level on (net foreign direct investment) in Saudi Arabia.

3. Third_sub hypothesis

The statistically significant positive impact of the (Renewable energy) level on (unemployment) in Saudi Arabia.

4. Fourth_sub hypothesis

The statistically significant positive impact of the (Renewable energy) level on the (Fixed capital formation) in Saudi Arabia.

5. Fifth_sub hypothesis

The statistically significant positive impact of the level of (Renewable energy) on the (net foreign trade) in Saudi Arabia.

Researchers noted from data in the above Table 1 that Kingdom of Saudi Arabia in 2017 began to actively pay attention to the use of renewable energy sources, which means that KSA already has raw materials, sunlight, earth and willpower, which are ingredients that qualify it to be a producer of renewable energy in the future.

4. RESULTS AND DISCUSSION

4.1. First: The Evolution of the Study Variables During the Period)2000-2021)

From the study of the data presented in Table 2.

Renewable energy (% of total final energy consumption) during the period (2000-2021) ranged between 0.01% and 0.03%, which meant 0.0136%.

The GDP per capita (Constant 2010 US$) during the period (2000-2021) ranged between 9.98 thousand dollars and 15.51 thousand dollars and mean of 18.2091 thousand dollars.

The net foreign direct investment (Constant 2010 US$) during the period (2000-2021) ranged between -35.96 Billion dollars and 15.01 billion dollars with and mean of -6.4523 Billion dollars

The unemployment during the period (2000-2021) ranged between 4.57% and 7.45%, with and mean of 5.7323%.

The fixed capital formation (Constant 2010 US$) during the period (2000-2021) ranged between 50.95 billion dollars and 223.58 billion dollars, with and mean of 148.1927 billion dollars.

Table 1: Renewable energy, GDP per capita, net foreign direct investment, unemployment, fixed capital formation, and net foreign trade, during the period (2000-2021)

Net foreign trade	Fixed capital formation	Unemployment	Net foreign direct investment	GDP per capita	Renewable energy	Years
100.84	54.38	4.57	1.88	16.97	0.01	2000
99.43	50.95	4.62	−0.02	16.35	0.01	2001
82.8	62.46	5.27	0.61	15.51	0.01	2002
104.86	62.36	5.56	0.59	16.86	0.01	2003
107.67	73.86	5.82	0.33	17.81	0.01	2004
96.38	85.52	6.05	−12.45	18.24	0.01	2005
62.84	107.92	6.25	−18.33	18.02	0.01	2006
29.27	129.99	5.73	−24.45	17.64	0.01	2007
7.78	162.24	5.08	−35.96	18.04	0.01	2008
−1.79	156.25	5.38	−34.28	17.02	0.01	2009
−6	175.08	5.55	−25.33	17.31	0.01	2010
2.75	191.21	5.77	−12.88	18.58	0.01	2011
−6.13	197.05	5.52	−7.78	19.15	0.01	2012
−14.01	199.23	5.57	−3.92	19.26	0.01	2013
−33.67	211.98	5.72	−2.62	19.56	0.01	2014
−29.3	223.58	5.59	−2.75	19.98	0.01	2015
33.21	196.93	5.65	1.48	19.91	0.01	2016
25.27	189.9	5.89	5.86	19.31	0.02	2017
36.3	172.4	6.04	15.01	19.33	0.02	2018
4.13	204.94	5.67	8.98	18.96	0.03	2019
25.42	176.58	7.45	−0.49	18.09	0.03	2020
23.48	175.43	7.36	4.57	18.7	0.03	2021

Source: World Bank - Saudi Arabia data (2000-2021)

https://data.albankaldawli.org/country/saudi-arabia?view=chart

Table 2: Variable descriptions statistics

Variables	Mean	SD	Min	Max
Renewable energy	0.0136	0.0073	0.01	0.03
GDP per capita	18.2091	1.1979	9.98	15.51
Net foreign direct investment	−6.4523	13.6398	−35.96	15.01
Unemployment	5.7323	0.6764	4.57	7.45
Fixed capital formation	148.1927	58.3214	50.95	223.58
Net foreign trade	34.1605	46.0478	−33.67	107.67

Source: E-views 12 program calculations

The net foreign trade (Constant 2010 US$) during the period (2000-2021) ranged between −33.67 Billion dollars and 107.67 billion dollars with and mean of 34.1605 billion dollars.

4.2. Second: Standard Relationships Between the Independent Variable (Renewable Energy) and the Dependent Variables (GDP Per Capita, Net Foreign Direct Investment, Unemployment, Fixed Capital Formation and Net Foreign Trade)

A set of standard tests, such as the extended Dickey-Fuller test, causality test and co-integration test to test the relationship between variables, were used to evaluate the impact of the independent variable (renewable energy) and the dependent variable (GDP per capita, net foreign direct investment, unemployment, fixed capital formation, net foreign trade).

1. Standard relationships between Renewable energy and GDP per capita

- Unit root test

This shows the Renewable energy (X) stability at its no level, and stability occurred when the two difference was taken, which shows that the chain is integrated at two degrees. It shows the instability of the GDP per capita (Y1) at its no level, and stability occurred when the first difference was taken, which shows that the series is integrated of the first degree. Because the two series are complementary at two different degrees, the Ardle co-integration is used.

- Causality test

There are no two-way or one-way causal relationships between the variables at the significance level of 0.05.

- Bounds test

It turns out that there is no co-integration between the variables at the significance level of 0.05.

2. Standard relationships between Renewable energy and net foreign direct investment

- Unit root test

When the two differences are taken, the Renewable energy (X) chain is integrated at two degrees, indicating stability at its no level, and stability. Y2 represents the net foreign direct investment (Y2) at its no level, and it became stable when the first difference was taken, which illustrates the series is integrated for the first degree. Due to the complementary nature of the two series at two different degrees, we use Ardle cointegration.

- Causality test

There are no two-way or one-way causal relationships between the variables at the significance level of 0.05.

- Bounds test

It turns out that there is no co-integration between the variables at the significance level of 0.05.

3. Standard relationships between Renewable energy and unemployment

- Unit root test

A no level of Renewable energy (X) demonstrates its stability. When the two differences were taken, stability was found, indicating the chain is integrated by two degrees. The series appears to be integrated at the first degree when the first difference is taken, which shows the instabilities of unemployment (Y3) at its no level. Due to the complementarity of the series at two different degrees, the Ardle cointegration is used.

- Causality test

It is clear that there are one-way causal relationships between the variables at the significance level of 0.01 and Show that Renewable energy Causality unemployment.

- Bounds test

It turns out that there is no co-integration between the variables at the significance level of 0.05.

1. Standard relationships between Renewable energy and Fixed capital formation

- Unit root test

Renewable energy (X) exhibited stability at its no level, and stability became apparent when two differences were taken, indicating a two-degree integration. In this case, the Fixed capital formation (Y4) shows instability at the zero level, while it becomes stable at the first difference, indicating that the series is integrated. Using the Ardle cointegration, we can combine the two series at two different degrees of complementarity

- Causality test

There are no two-way or one-way causal relationships between the variables at the significance level of 0.05.

- Bounds test

It turns out that there is a co-integration between the variables at the significance level of 0.05.

2. Standard relationships between Renewable energy and net foreign trade

- Unit root test

Renewable energy (X) is stable at its no level. The chain is stable when the two differences are taken, indicating two degrees of integration. As the series is integrated to the first degree, it is unstable at its lowest and stable at its highest level. This analysis is conducted using the Ardle co-integration since the two series are complementary at two degrees.

- Causality test

It is clear that there are one-way causal relationships between the variables at the significance level of 0.01 and shows that net foreign trade Causality Renewable energy

- Bounds test

It turns out that there is no co-integration between the variables at the significance level of 0.05.

4.3. Third: The Impact of the Independent Variable (Renewable Energy) on the Dependent Variables (GDP Per Capita, Net Foreign Direct Investment, Unemployment, Fixed Capital Formation and Net Foreign Trade)

To identify the impact of the independent variable (Renewable energy) on the dependent variables (GDP per capita, net foreign direct investment, unemployment, fixed capital formation and net foreign trade) during the period study and to test the study's hypotheses, a simple regression equation was calculated between the independent variable (Renewable energy) and the dependent variables (GDP per capita, net foreign direct investment, unemployment, Fixed capital formation and net foreign trade) during the period study.

1. Impact of renewable energy on GDP per capita

It became clear in Table 3 the no significance of the model, where F was not statistically significant at 0.05 and no statistically significant impact of Renewable energy on GDP per capita at the level of 0.05, meaning that the study's first sub-hypothesis was rejected.

2. Impact of renewable energy on net foreign direct investment

Table 4 shows the significance of the model became apparent, where F was statistically significant at 0.05 and the presence of a statistically significant impact on Renewable energy on net foreign direct investment at the level of 0.05. It was found that the independent variable (Renewable energy) explains 22.4% of the changes that occur in the dependent variable (net foreign direct investment) while it returns. The rest of the changes were for other variables that were not included in the model. It was clear that there was a positive impact of the level of (Renewable energy) on the level of (net foreign direct investment). It was clear that there was a positive relationship between the level of (Renewable energy) and the level of (net foreign direct investment), where the value of the correlation coefficient reached 0.474. It was found that when (Renewable energy) increased by 1%, the level of (net foreign direct investment) increased by 889.090%. And this explains that the study's second sub-hypothesis was accepted.

3. Impact of renewable energy on unemployment

Table 5 shows the significance of the model was evident, with F statistically significant at 0.01 and Renewable energy having a statistically significant impact on unemployment. According to the independent variable (Renewable energy), the changes in unemployment are explained by 46.4%. Several other variables were changed that were not included in the model. As a result of

Table 3: Impact of renewable energy on GDP per capita

b	t	F	r	R2	P-value
40.279	1.127	1.270	0.244	0.060	0.273

Source: E-views 12 program calculations

Table 4: Impact of renewable energy on net foreign direct investment

b	t	F	r	R2	P-value
889.090	2.406*	5.787*	0.474	0.224	0.026

Source: E-views 12 program calculations

Table 5: Impact of renewable energy on unemployment

b	t	F	r	R2	P-value
63.416	4.163*	17.331**	0.681	0.464	0.000

Source: E-views 12 program calculations

Table 6: Impact of renewable energy on fixed capital formation

b	t	F	r	R2	P-value
2620.689	1.545	2.387	0.327	0.107	0.138

Source: E-views 12 program calculations

Table 7: Impact of renewable energy on net foreign trade

b	t	F	r	R2	P-value
−952.615	0.680	0.364	0.150	0.023	0.504

Source: E-views 12 program calculations

the level of (renewable energy), the level of (unemployment) has been increased. The correlation coefficient reached 0.681 when the level of renewable energy was compared with the level of unemployment. There was a 63.416% increase in unemployment when the level of renewable energy increased by 1%. So the third sub-hypothesis of the study is accepted.

4. Impact of renewable energy on fixed capital formation

It became clear in Table 6 the no significance of the model, where F was no statistically significant at 0.05 and no statistically significant impact of Renewable energy on Fixed capital formation at the level of 0.05, meaning that the study's fourth sub-hypothesis was rejected.

5. Impact of renewable energy on net foreign trade

It became clear in Table 7 the not significance of the model, where F was not statistically significant at 0.05 and no statistically significant impact of Renewable energy on net foreign trade at the level of 0.05, meaning that the study's fifth sub-hypothesis was rejected.

5. CONCLUSION

The study found that renewable energy had no statistically significant impact on GDP per capita at 0.05. The study's sub-hypothesis for the first sub-hypothesis was rejected. Net foreign direct investment was significantly affected by renewable energy at 0.05. When the level of renewable energy increased by 1%, net foreign direct investment increased by 889.090%. As a result, the second sub-hypothesis of the study is accepted. This study found that renewable energy had a statistically significant impact on unemployment at the level of 0.01 and that when renewable energy increased by 1%, unemployment increased by 63.416%. So the third sub-hypothesis is accepted. At 0.05, renewable energy did not significantly impact the fixed capital formation, and the fourth sub-hypothesis was rejected. At 0.05, renewable energy does not significantly impact net foreign trade, and the fifth sub-hypothesis is rejected.

The study's central hypothesis is partially valid as it is demonstrated that renewable energy has a statistically significant effect on net foreign direct investment and unemployment. However, renewable energy does not have a statistically significant impact on GDP per capita, fixed capital formation, or net foreign trade. In this study, the authors recommend studying how new energy impacts all economic variables that affect Saudi Arabia's economy at full scale. Identifying factors influencing the use of new energy in the Saudi economy and how it can be maximized essential and implementing of KSA Vision plan 2030, where through it the National Renewable Energy Program will contribute effectively to the support of Kingdom's economy and development of its human resources to expand investment in new sectors as well as attracting investments from international and local companies. As there is a highly need to assess the factors that contribute significantly to GDP per capita. In addition to encouraging researchers to conduct research and studies related to renewable energy and to understand its effects on various economic, environmental, and social variables in Saudi society.

REFERENCES

Abid, M.R., Lghoul, R., Benhaddou, D. (2017), ICT for renewable energy integration into smart buildings: IoT and big data approach. In: 2017 IEEE AFRICON. New Jersey: IEEE. p856-861.

Adebumiti, Q., Masih, M. (2018), Economic Growth, Energy Consumption and Government Expenditure: Evidence from a Nonlinear ARDL Analysis. Munich Personal RePEc Archive (MPRA), Paper No. 87527.

Al-Douri, Y., Waheeb, S.A., Voon, C.H. (2019), Review of the renewable energy outlook in Saudi Arabia. Journal of Renewable and Sustainable Energy, 11(1), 015906.

AlKhars, M., Miah, F., Qudrat-Ullah, H., Kayal, A. (2020), A systematic review of the relationship between energy consumption and economic growth in GCC countries. Sustainability, 12(9), 3845.

Amran, Y.A., Amran, Y.M., Alyousef, R., Alabduljabbar, H. (2020), Renewable and sustainable energy production in Saudi Arabia according to Saudi Vision 2030; Current status and future prospects. Journal of Cleaner Production, 247, 119602.

Apergis, N., Payne, J.E. (2010), Renewable energy consumption and growth in Eurasia. Energy Economics, 32(6), 1392-1397.

Awodumi, O.B., Adewuyi, A.O. (2020), The role of non-renewable energy consumption in economic growth and carbon emission: Evidence from oil producing economies in Africa. Energy Strategy Reviews, 27, 100434.

Bosah, P.C., Li, S., Ampofo, G.K.M., Asante, D.A., Wang, Z. (2018), The nexus between electricity consumption, economic growth, and CO2 Emission: An asymmetric analysis using nonlinear ARDL and nonparametric causality approach. Energies, 13(5), 1-24.

Kahia, M., Omri, A., Jarraya, B. (2021), Green energy, economic growth and environmental quality nexus in Saudi Arabia. Sustainability, 13(3), 1264.

King Abdullah City for Atomic and Renewable Energy. Available from: https://www.energy.gov.sa

Makki, A.A., Mosly, I. (2020), Factors affecting public willingness to adopt renewable energy technologies: An exploratory analysis. Sustainability, 12(3), 845. Available from: https://www.mdpi.com/2071-1050/12/3/845

Mosly, I., Makki, A.A. (2018), Current status and willingness to adopt renewable energy technologies in Saudi Arabia. Sustainability, 10(11), 4269.

Munir, K., Riaz, N. (2020), Asymmetric impact of energy consumption on environmental degradation: Evidence from Australia, China, and

USA. Environmental Science and Pollution Research, 27, 11749.
Negewo, B.D. (2012), Renewable Energy Desalination: An Emerging Solution to close the Water Gap in the Middle East and North Africa. United States: World Bank Publications. Available from: https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/443161468275091537/renewable-energy-desalination-an-emerging-solution-to-close-the-water-gap-in-the-middle-east-and-north-africa
Saudi Press Agency. (2018), The solar energy agreement comes in accordance with the Kingdom's Vision 2030 with a Diversity of Sources of Income. Saudi Arabia: Saudi Press Agency. Available from: https://www.spa.gov.sa/1746833?lang=ar&newsid=1746833
Sung, B., Park, S.D. (2018), Who drives the transition to a renewable-energy economy? Multi-actor perspective on social innovation. Sustainability, 10(2), 448.
Tiba, S., Omri, A. (2017), Literature survey on the relationships between energy, environment and economic growth. Renewable and Sustainable Energy Reviews, 69, 1129-1146.
Tlili, I. (2015), Renewable energy in Saudi Arabia: Current status and future potentials. Environment, Development and Sustainability, 17(4), 859-886.
World Bank-Saudi Arabia data (2000-2021). Available from: https://data.albankaldawli.org/country/saudi-arabia?view=chart
Zafar, M.W., Saud, S., Hou, F. (2019), The impact of globalization and financial development on environmental quality: Evidence from selected countries in the Organization for Economic Co-operation and Development (OECD). Environmental Science and Pollution Research, 26(13), 13246-13262.