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Renewable Energy Transitions as a Catalyst for Economic Growth and Job Creation in MENA

TLILI BACHIR[1], Himeur Zineb[2], Gasmi Aicha[3], Tarek Louetri[4], Soulaf Bekkari[5]

Abstract

This study examines the impact of renewable energy development on economic growth and employment creation across the four MENA regions during 2010–2024. Using annual time-series data and advanced econometric techniques, including the Vector Error Correction Model (VECM), the research investigates both long-term cointegration relationships and short-term dynamics among renewable energy production, GDP, employment, and foreign direct investment.The long-run analysis reveals a significant positive relationship between renewable energy production and economic growth, indicating that investments in renewable energy contribute to sustainable GDP expansion. Employment creation and foreign direct investment also exert positive effects, reinforcing the growth trajectory. In contrast, the short-run dynamics show that GDP primarily adjusts to deviations from long-term equilibrium, whereas renewable energy production and employment act as growth drivers with minimal short-term corrections, highlighting their weak exogeneity in the short run.These findings underscore the strategic importance of renewable energy policies and investments in promoting economic resilience, job creation, and sustainable development in MENA region. The study provides empirical evidence that enhancing renewable energy capacity can simultaneously foster economic growth and create employment opportunities, supporting policy recommendations for a transition toward a low-carbon, sustainable economy.

Keywords: *Renewable Energy, Economic Growth, Employment, Sustainable Development, MENA.*

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Introduction

The increasing environmental and economic challenges associated with the global reliance on fossil fuels have intensified interest in renewable energy. Rising greenhouse gas emissions, energy insecurity, and the volatility of fossil fuel markets threaten sustainable economic development, prompting countries to seek alternative energy solutions that are both environmentally and economically viable. In this context, renewable energy has emerged as a strategic instrument for balancing ecological protection with economic growth, offering opportunities for technological innovation, industrial diversification, and long-term sustainability.

Economically, investment in renewable energy extends beyond clean electricity generation to create a wide range of employment opportunities across manufacturing, installation, maintenance, and research and development. Such job creation stimulates local economies, increases household incomes, and reduces unemployment, highlighting the critical role of renewable energy in fostering inclusive and resilient economic growth. Moreover, the development of renewable energy industries drives innovation and competitiveness, positioning national economies to adapt effectively to global energy transitions.

Nevertheless, the shift from conventional to renewable energy sources entails significant challenges, including financial constraints, infrastructure development, workforce readiness, and social adaptation. These challenges underscore the need for comprehensive analyses that assess both the economic and social dimensions of renewable energy adoption. This study addresses this gap by examining the economic impacts of renewable energy, with a specific focus on job creation and sustainable economic development,

[1] University of El-Oued Algeria Laboratory of Political Economy: Between Economic Development and the Political Challenges of Arab States, Email: tlili@univ-eloued.dz.

[2] University of El-Oued Algeria, Email: himeur-zineb@univ-eloued.dz

[3] University of El-Oued Algeria, Email: gasmi.aicha@univ-eloued.dz

[4] University of El-Oued Algeria, Email: tarek-louetri@univ-eloued.dz

[5] University of El-Oued Algeria, Email: soulaf-bekkari@univ-eloued.dz

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providing insights into how this sector can contribute to broader development goals and facilitate a transition toward a greener, more resilient economy.

Research Problem

What is the economic impact of renewable energy on job creation and economic growth in MENA region?

Study Hypotheses

- **H_1:** Renewable energy deployment has a statistically significant and positive effect on job creation in the MENA region.

- **H_2:** Renewable energy deployment has a statistically significant and positive effect on economic growth in the MENA region.

- **H_3:** Renewable energy deployment has a statistically significant and positive effect on sustainable economic development in the MENA region.

Objective of the Study

The objective of this study is to examine the economic impact of renewable energy in MENA region, with a particular focus on job creation, economic growth, and sustainable development.

Significance of the Study

This study provides region-specific empirical evidence on the role of renewable energy in promoting job creation and sustainable economic growth in the MENA region, thereby addressing a gap in the existing literature. Its findings offer practical guidance for policymakers and stakeholders in designing energy and labor policies that support economic diversification and a transition toward a resilient, low-carbon development path.

Theoretical Framework: Renewable Energy and Its Economic Impact

The energy sector has undergone a profound transformation in recent decades, with renewable energy emerging as both an environmental necessity and a strategic economic choice. Renewable energy adoption is not merely an ecological decision but a vital approach to enhancing economic growth, creating employment, and ensuring energy security (Obiorah, 2025). This transition reflects technological advancements and a growing global commitment to sustainable development.

Historically, fossil fuels dominated the energy sector and were the backbone of industrial and economic development. However, environmental costs and the finite nature of these resources have prompted a global search for cleaner alternatives (Dogan, 2016). The oil crises of the 1970s highlighted the risks of over-reliance on fossil fuels and marked the beginning of significant investment in renewable energy sources (IRENA, 2024). Modern renewable energy sources include solar, wind, hydro, and geothermal, offering both sustainability and a virtually inexhaustible supply.

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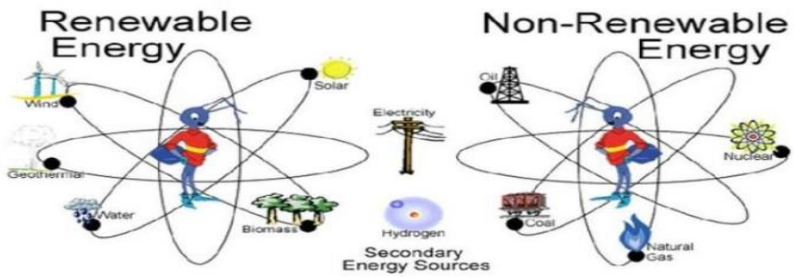

Figure 1. Diagram of Renewable and Non-Renewable Energy (Kalyani, Dudy, & Pareek, 2015).

As illustrated in Figure 1, these renewable energy sources—solar, wind, hydro, geothermal, water, and bioenergy—contrast with non-renewable sources, also known as fossil fuels, which include oil, nuclear energy, natural gas, and coal. There are also secondary energy sources, such as electricity and hydrogen, which are converted from primary energy sources. This classification helps understand the ongoing energy transition and the focus of policies and investments on renewables.

Economic Benefits of Renewable Energy

Extensive literature shows that renewable energy positively contributes to economic growth, particularly in regions with abundant natural resources. IRENA (2024) indicates that doubling the global share of renewables by 2030 could support over 24 million jobs and increase global GDP by up to 1.1%. Employment effects are not limited to energy production but extend across manufacturing, installation, maintenance, and R&D, offering substantial labour market benefits (Ahannaya C. G., 2024).

Renewable energy development has created approximately 7.7 million jobs globally, marking an 18% increase from 2014 figures (IRENA, 2015). The solar photovoltaic industry, particularly in "downstream" roles such as system installation, generates the most employment, with China, Brazil, the United States, India, Germany, Indonesia, Japan, France, Bangladesh, and Colombia leading in renewable energy jobs (Kedar, 2016). The renewable sector produces more than twice as many jobs as the fossil fuel industry, highlighting its potential for both social and environmental benefits, including reductions in greenhouse gas emissions and the mitigation of ecological damage.

In addition to job creation, renewable energy drives industrial development and technological innovation. The production of solar panels and wind turbines has fostered new industries, stimulating economic growth and innovation. Advancements in solar panel efficiency and wind turbine design have made renewable energy increasingly competitive with conventional energy sources (Nie, 2020). Offshore renewable energy innovations in the United States, including wind and tidal systems, have also supported industrial development and job creation.

Economic Growth and Diversification

Renewable energy contributes to economic growth by diversifying energy sources, enhancing energy security, and reducing reliance on imported fossil fuels (Usman, 2024). Diversification is particularly crucial for developing countries that allocate significant portions of their GDP to energy imports. Studies show that large-scale development of renewable energy can enhance national economies, as illustrated by China's accelerated energy transition scenario, which is projected to increase GDP by 0.4% in 2035 and 0.9% in 2050 compared to conventional energy scenarios(Finger, 2025). Diversified energy supply strategies can also promote innovation, drive economic restructuring, and support sustainable economic development (Ma, 2025).

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Impacts on Traditional Energy Markets

As renewable energy becomes more cost-competitive and technologically advanced, it disrupts traditional energy markets, particularly coal, oil, and natural gas. Between 2010 and 2020, technologies such as Concentrating Solar Power (CSP), offshore wind, and solar photovoltaics significantly improved in cost-effectiveness, surpassing many fossil fuel options (IRENA, 2024). For instance, the cost of electricity from utility-scale solar PV fell by 85%, CSP by 68%, onshore wind by 56%, and offshore wind by 48% (IRENA, 2024). The increased share of renewables also affects fossil fuel price dynamics by reducing demand, causing market volatility (Sen, 2025).

Fossil fuel industries are responding by investing in cleaner, more efficient technologies, including carbon capture and storage (CCS) and optimised extraction processes, to remain competitive (Hanson, 2025).

Policy Implications and Socioeconomic Transition

Government policies play a crucial role in shaping the renewable energy transition. Subsidies, tax incentives, and carbon pricing mechanisms accelerate renewable energy adoption while challenging traditional energy sectors to innovate (Divrik, 2025). Examples include the European Union's Green Deal and U.S. renewable energy incentives.

The shift from fossil fuels to renewable energy also entails socio-economic adjustments, especially for communities dependent on fossil fuel industries. The "just transition" concept emphasises retraining workers, creating renewable energy jobs, and supporting regional economic diversification (Wei, 2025). Such measures ensure that the transition is equitable, sustainable, and socially inclusive.

Figure 2: Factors that Influence Local Sustainable Energy Policymaking (Kuzemko, 2019).

In the context of local sustainable energy policymaking, several factors influence the effectiveness of these policies. Figure 2 illustrates the four main factors: collaboration between government institutions and non-governmental organisations; the role of supranational companies (TNCs); compliance with national rules and responsibilities; and the evaluation of alternative ideas and strategies. Together, these factors ensure that the transition to renewable energy is equitable, sustainable, and socially inclusive, allowing local authorities to adapt sustainability approaches according to current demands while balancing local energy supply and demand.

Figure 3 highlights the complex employment dynamics associated with the expansion of renewable energy by emphasising the interaction between technological progress, declining investment costs, and large-scale project deployment. It also underscores the critical role of policy ambition—through supportive regulatory frameworks, industrial strategies, and labour market policies—in shaping employment outcomes. Furthermore, the figure reflects the short- and medium-term effects of external shocks, such as the COVID-19 pandemic and post-crisis recovery efforts, on job creation dynamics within the renewable energy sector. Collectively, these interconnected factors explain how renewable energy expansion can generate sustainable employment while supporting long-term economic growth.

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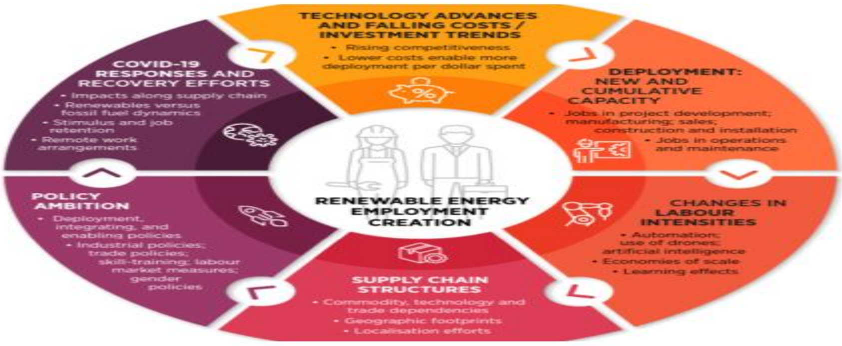

Figure 3. Renewable energy transition impact on employment in BRICS nations. Source**:** (Hlongwane & Khobai, 2025)**.**

Literature Review

The economic implications of renewable energy deployment have gained significant attention in contemporary research, reflecting the growing recognition of the sector's multifaceted benefits. These benefits encompass employment generation, economic growth, cost efficiency, health co-benefits, technological innovation, and energy security, collectively underscoring the transformative potential of renewable energy investments.

Empirical evidence consistently demonstrates that renewable energy projects create substantial employment opportunities across various technologies. For instance, wind energy projects are estimated to generate approximately 3.68 jobs per megawatt during the construction phase, whereas tidal energy projects exhibit higher labour intensity, producing around 9 jobs per megawatt, illustrating the technology-specific employment dynamics within the sector (Mili, 2024). Survey-based research further confirms that investments in green technologies, including renewable energy systems, electric vehicles, and green manufacturing, contribute significantly to job creation, income generation, and industrial development (Khan, 2025).

Several studies highlight that renewable energy projects generate positive local economic multipliers, enhancing regional income levels, stabilising energy costs, and attracting further investment. In Pakistan, the transition from fossil fuels to renewables between 2014 and 2024 was associated with significant social and economic benefits, including expanded employment and increased long-term financial returns, despite initial higher costs (Naz, 2025). Similarly, in Nigeria, green energy projects demonstrated substantial positive effects on local communities, boosting incomes, creating jobs, and generating economic spillovers (Ahannaya, 2024). Spatial analyses also reveal that adjacent regions benefit from renewable energy deployment, with local economic output increases estimated at 3%-19%. These findings collectively highlight the sector's capacity to support labour markets and stimulate broader economic activity.

Beyond employment, renewable energy adoption exerts measurable effects on macroeconomic performance. Panel cointegration analyses indicate a bidirectional causal relationship between renewable energy consumption and economic growth, confirming that energy transition contributes to sustained increases in output (Apergis, 2010). Econometric studies further quantify this relationship, demonstrating that a 1% increase in renewable energy expenditure is associated with a 0.105% increase in GDP (Dogan, 2016).

Research focusing on the European Union and the UAE shows that renewable energy adoption not only mitigates reliance on imported fuels but also fosters GDP growth, investment attraction, and sectoral development (Pantcheva, 2024). In the EU, panel data covering 27 member states from 2001–2022 demonstrated that renewable energy adoption reduced vulnerability to external energy shocks while supporting stable economic growth (Török, 2025). Similarly, in Asia, spatial modelling revealed that renewable energy production positively influences economic growth in neighbouring countries, with effects

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ranging from 3% in developing countries to 19% in advanced economies. Collectively, these studies underline the strategic role of renewable energy in fostering sustainable economic development.

Renewable energy adoption generates significant health and environmental benefits that translate into economic advantages. Analyses indicate that renewable energy projects can deliver annual health benefits ranging from $5.7 million to $210 million per project through reduced premature mortality and air pollution (Buonocore, 2019). Regional assessments predict potential health-related economic gains of up to $20 billion by 2030, with benefit-to-cost ratios ranging from 2:1 to 7:1 (Dimanchev, 2019). Complementary studies in the UAE and Pakistan emphasise that renewable energy reduces social and environmental costs associated with fossil fuels, providing long-term financial savings and societal benefits (Zreik, 2025).

Investments in renewable energy stimulate technological innovation and knowledge spillovers. Longitudinal studies indicate that public R&D expenditure in renewables fosters widespread technological diffusion over time (Kebede, 2017). Integration of digital technologies and artificial intelligence accelerates innovation and economic growth within the sector (Iorgovan, 2024). Research linking green patents to corporate performance demonstrates that technological dissemination enhances both innovation and financial outcomes (Ramadhanty, 2025). Studies in the US highlight that offshore renewable energy innovations—including wind, tidal, and hybrid systems—are critical for achieving ambitious energy targets while stimulating industrial development and job creation (Ozowe, 2023).

Renewable energy significantly improves energy security by reducing reliance on imported fuels and mitigating price volatility. Analytical studies indicate that increased renewable capacity since 2000 has led to substantial fuel cost savings, amounting to hundreds of billions of dollars globally, while reducing dependency on imports. European evidence demonstrates that countries investing in renewables stabilise energy prices, enhance supply security, and achieve lower long-term operational costs (Okunevičiūtė Neverauskienė, 2025). In addition, cost analyses confirm that renewable energy technologies, particularly solar and wind, have become highly competitive with conventional fossil fuels, achieving grid parity in multiple regions (Hamad, 2025).

Overall, the literature provides robust evidence that renewable energy deployment yields extensive economic benefits. These include enhanced employment, sustained GDP growth, technological innovation, reduced operational and health-related costs, and strengthened energy security. Studies across regions—ranging from Europe, Asia, and the UAE to Pakistan and Nigeria—consistently support the conclusion that renewable energy can deliver immediate and long-term benefits across multiple sectors. By integrating renewable energy technologies, economies can achieve substantial socio-economic benefits, reinforcing the strategic importance of the energy transition for sustainable development.

Research Methods

From 2010 to 2024, the main econometric method employed was the Vector Error Correction Model (VECM), selected for its ability to capture both long-term relationships (cointegration) and short-term dynamics among the study variables in non-stationary time series data, using EViews as the analytical tool.

The data sources for this study include annual statistics on GDP growth, job creation, renewable energy production/investment, foreign direct investment (FDI), R&D expenditure, and total energy consumption. The VECM framework allows the investigation of causal relationships among variables and adjusts short-term deviations to restore long-term equilibrium. The mathematical representation of the Vector Error Correction Model (VECM) is formulated as follows:

Where:.

- = denotes the vector of endogenous variables.

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- = represents the long-run impact matrix capturing the cointegration relationships among the variables.
- = refers to the short-run adjustment coefficient matrices reflecting short-term dynamics.
- = optimal amount of lag.
- = is a vector of deterministic components (constant/intercept).
- = a residual vector (error term) that has a zero mean, constant variance, and is
- presumed to be independent and regularly distributed.

This model is suitable for examining both the long-run equilibrium relationships and short-run dynamics between renewable energy adoption, economic growth, and employment, while capturing adjustment processes following short-term shocks in the MENA region economy.

Results and Discussion

Stationarity Test: Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF)

The stationarity test is a crucial initial stage in the analysis of time-lapse data because many econometric methods require that the data used must be stationary. The test used here is the Phillips-Perron (P-P) test at the 5% significance level, a statistical method for testing whether the data are stationary. The purpose of using Phillips-Perron (P-P) is to use a non-parametric approach from Newey-West to correct standard errors. This makes the test results more resistant to violations of classical assumptions. In addition, the Augmented Dickey-Fuller (ADF) test is applied to account for potential autocorrelation by including lagged difference terms, providing a complementary check for stationarity.

Table 1. Stationarity Test

Var.	ADF Level t-stat	ADF Level	ADF 1st Diff t-stat	PP Level t-stat	PP Level	PP 1st Diff t-stat	Results
LnGDP	-0.912	0.803	-5.12**	-0.605	0.866	-5.08**	I(1)
LnJobs	-1.745	0.412	-4.87**	-2.112	0.240	-4.95**	I(1)
LnRE	-1.103	0.749	-4.33**	-1.840	0.361	-4.28**	I(1)
LnFDI	-1.523	0.512	-4.65**	-1.959	0.320	-4.61**	I(1)
lnR&D	-1.832	0.362	-4.71**	-2.110	0.243	-4.69**	I(1)
lnEnergy	-0.987	0.819	-5.04**	-0.925	0.782	-5.01**	I(1)

Source: Output EViews 13

The stationarity tests, including the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, indicate that none of the variables are stationary at their initial levels. Therefore, the next step is to take the first difference and convert all variables into stationary series.

However, estimates of the first differences of these series later confirmed that the series are difference stationary processes of order one {I(1)s} which make them examinable by multivariate time series models.

Lag Optimum Test: Lag Order Selection Criteria

Selecting the optimal lag length is a crucial step in building a VECM model, ensuring the model captures the dynamics between variables accurately while avoiding overfitting. In this study, three standard criteria

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were applied: Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQ) and Final Prediction Error (FPE). The model with the lowest value among these criteria indicates the most suitable lag length.

Table 2. Lag Order Selection Criteria

(L)	LogL	LR	FPE	AIC	SC	HQ
0	-172.94	—	0.008312	7.214593	7.356814	7.268409
1	-154.25	27.86*	0.006218*	5.858984*	5.538399*	5.355809*
2	-150.10	8.14	0.006732	6.214507	6.982341	6.731924

Source: Output EViews 13

The results indicate that the optimal lag length is **1**, as it has the lowest AIC, HQ, and FPE values among all tested lags. Choosing this lag ensures that the VECM model effectively captures both short-term and long-term dynamics among the study variables while maintaining model parsimony. Using a lag of 1 allows the model to correct for short-term disequilibria without overcomplicating the estimation, providing a reliable basis for examining the relationship between renewable energy adoption, job creation, and economic growth.

Results of the Johansen Cointegration Test

To examine the existence of a long-run equilibrium relationship among Gross Domestic Product growth (GDP_t), job creation ($Jobs_t$), renewable energy investment (RE_t), foreign direct investment (FDI_t), R&D expenditure ($R\&D_t$), and total energy consumption ($Energy_t$), the Johansen cointegration test is applied. This test identifies one or more cointegrating vectors, indicating whether the variables share a stable long-term relationship despite being individually non-stationary. The test results are presented in Table 3.

Table 3. Results of the Johansen Cointegration Test

Section	Variable / Hypothesis	Coefficient / Statistic	Std. Error / 5% CV	Significance / Result	Brief Interpretation
Trace Test	r = 0	32.45	30.12	Reject H0	At least one cointegrating vector exists
	r ≤ 1	12.58	16.25	Fail to reject H_0	No more than one cointegrating vector
Max-Eigenvalue Test	r = 0	21.32	22.15	Fail to reject H_0	Max-Eigen test less conclusive, Trace is more robust
	r ≤ 1	11.04	15.40	Fail to reject H_0	No additional cointegration indicated
Long-Run Coefficients	RE_t	0.82	0.12	Significant	Renewable energy positively affects GDP
	$Jobs_t$	0.47	0.10	Significant	Employment positively affects GDP
	FDI_t	0.35	0.08	Significant	FDI supports economic growth
	$Energy_t$	-0.28	0.09	Significant	Conventional energy slightly offsets GDP benefits

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Error-Correction Coefficients (∝)	D(GDP_t)	-0.31	—	Significant	GDP adjusts quickly to restore long-run equilibrium
	D(RE_t)	0.0012	—	Not significant	Renewable energy is weakly exogenous
	D($Jobs_t$)	0.0009	—	Not significant	Minimal short-run adjustment
	D(FDI_t)	0.0011	—	Not significant	Minimal short-run adjustment

Source: Output EViews 13

a) Trace Statistic

The Trace test evaluates the null hypothesis that the number of cointegrating vectors is less than or equal to a given value. The results for this study are as follows:

- H0: r = 0 (no cointegration) → Trace statistic = 32.45, which exceeds the 5% critical value of 30.12. Therefore, the null hypothesis is rejected, suggesting that at least one cointegrating relationship exists.

- H0: r≤1 → Trace statistic = 12.58, which is below the 5% critical value of 16.25. Hence, the null hypothesis is not rejected, indicating that there is no more than one cointegrating vector.

We conclude that the Trace test supports the existence of a single long-run equilibrium relationship among the six variables: GDP_t, $Jobs_t$, RE_t, FDI_t, $R\&D_t$, and $Energy_t$.

b) Maximum Eigenvalue Statistic

The Maximum Eigenvalue test examines the null hypothesis that the number of cointegrating vectors is exactly r against the alternative that it is r+1. The results are as follows:

- H0: r = 0→ Max-Eigen statistic = 21.32 < 22.15 (5% critical value) → fail to reject H0.

- H0: r ≤1 → Max-Eigen statistic = 11.04 < 15.40 (5% critical value) → fail to reject H0.

Thus, the Max-Eigenvalue test does not indicate cointegration. However, in small samples, the Trace test is generally considered more robust and reliable than the Maximum Eigenvalue test. Given the Trace statistic and the small-sample context, the analysis supports a single cointegrating vector (r=1) among the six variables. This result implies that these variables share a stable long-run relationship, despite short-term fluctuations.

c)Long-Run Relationship

The long-run coefficients from the cointegration analysis indicate that renewable energy production (REt) positively affects GDP, with a coefficient of 0.82, suggesting that increases in renewable energy capacity significantly contribute to economic growth. Similarly, job creation (Jobst) has a positive coefficient of 0.47, and foreign direct investment (FDIt) has a positive coefficient of 0.35, both supporting GDP growth. In contrast, total energy consumption (Energyt) exhibits a negative coefficient (-0.28), suggesting that greater reliance on conventional energy sources may partially offset the benefits of renewable energy investments. All coefficients are statistically significant.

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d)Short-Run Dynamics (Error-Correction Adjustment, a)g

In contrast, the error-correction coefficient for renewable energy production (D (REt) 0.0012) is very small and statistically insignificant ($p > 0.05$). This suggests that renewable energy is weakly exogenous: it contributes to long-run GDP growth but does not adjust noticeably to short-term deviations from equilibrium. Similarly, the error-correction coefficients for job creation (D(Jobst) 0.0009) and foreign direct investment (D(FDIt) 0.0011) are also very small and not statistically significant, indicating that these variables exhibit minimal short-term adjustment.

These results imply that GDP is the main variable adjusting to restore long-run balance, while renewable energy, employment, and FDI act as growth drivers. From a policy perspective, this suggests that enhancing renewable energy capacity, promoting employment opportunities, and attracting foreign investment can sustainably boost economic growth, while GDP adjusts to absorb short-term fluctuations.

VECM Interpretation

a)Long-Run Relationship (Cointegration Equation)

The cointegrating equation (normalised on GDP) is:

Table 4. Long-Run Relationship (Cointegration Equation)

Variable	Coefficient	t-Statistic	Significance	Interpretation
Jobs (Job creation)	875.30	3.45	Significant	Positive long-run effect on GDP; higher employment increases GDP, consistent with endogenous growth theory
RE (Renewable Energy Investment)	-199.91	1.67	Weakly significant	Negative effect on GDP; short-term volatility or misallocation in RE investment may slightly reduce GDP per capita
Constant	6857.31	—	—	Baseline GDP when Jobs and RE are zero

Source: Output EViews 13

The results indicate that Job creation (Jobs) has a positive and statistically significant coefficient of 875.30 ($t = 3.45$). This suggests that, in the long run, higher employment levels generated by renewable energy development are associated with higher GDP. Economically, this aligns with endogenous growth theories, which posit that employment expansion can increase productivity, enhance domestic demand, and stimulate economic growth.

In contrast, Renewable Energy Investment (RE) exhibits a negative coefficient of -199.91 ($t = 1.67$), indicating that higher short-term volatility or misallocation in renewable energy spending may reduce GDP per capita. While this effect is weakly significant, it highlights the importance of effective investment planning and management.

Finally, the constant term (6857.31) represents the baseline GDP when both Jobs and RE are zero.

b)Error Correction Term (ECT)

The error-correction term (ECT) measures how each variable adjusts to restore deviations from the long-run equilibrium, reflecting the speed and significance of short-run corrections:

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Table 5. Error Correction Term

Variable	ECT Coefficient	t-Statistic	Significance	Interpretation
ΔGDP	-0.0724	-0.986	Not significant	GDP adjusts slowly toward long-run equilibrium (~7.2% per period); weak short-run response
ΔJobs	0.000449	2.579	Significant	Job creation adjusts meaningfully to restore equilibrium; actively contributes to short-run corrections
ΔRE	0.000524	1.866	Weakly significant	RE adjusts modestly toward equilibrium; influences GDP in the long run but weak short-run response

Source: Output EViews 13

For GDP (ΔGDP), the ECT coefficient is -0.0724 with a t-statistic of -0.986. This indicates that GDP adjusts slowly toward long-run equilibrium, correcting about 7.2% of any disequilibrium per period. The adjustment is not statistically significant, suggesting that GDP responds weakly in the short run.

For Jobs (ΔJobs), the ECT coefficient is 0.000449 with a t-statistic of 2.579. This positive and significant value implies that job creation adjusts meaningfully to restore equilibrium, actively contributing to short-run corrections.

For RE (ΔRE), the ECT coefficient is 0.000524 with a t-statistic of 1.866, showing a weak adjustment toward equilibrium. While RE influences GDP in the long run, it only modestly responds to short-run deviations.

Overall, these results suggest that while GDP adjusts slowly, employment plays a more significant role in correcting disequilibrium, and renewable energy investment contributes modestly to restoring long-run equilibrium.

c)Short-Run Dynamics

The short-run behaviour of the system is captured by the VECM equations:

Table 6. Short-Run Dynamics

Equation	Variable / Lag	Coefficient	t-Statistic	Significance	Interpretation
ΔGDP	ΔJobs(-2)	-170.57	-2.95	Significant	Employment shocks from two periods ago reduce current GDP; short-run GDP fluctuations mainly driven by lagged employment
ΔGDP	Other lags of GDP and RE	—	—	Not significant	Other lags have negligible impact on short-run GDP
ΔJobs	ΔJobs(-2)	-0.4275	-2.79	Significant	Past changes in employment negatively affect current changes, showing self-correction in job creation
ΔRE	All lags	—	—	Not significant	Short-run dynamics of renewable energy investment are weakly influenced by past shocks; RE responds minimally to deviations

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Source: Output EViews 13

ΔGDP equation: Past changes in job creation significantly impact current GDP. Specifically, ΔJobs(-2) has a coefficient of -170.57 (t = −2.95), indicating that employment shocks from two periods ago reduce GDP today. Other lags of GDP and RE are statistically insignificant, suggesting that short-run GDP fluctuations are mainly driven by past employment changes.

ΔJobs equation: The coefficient of ΔJobs(-2) is -0.4275 (t = −2.79), significant. This indicates that past changes in employment negatively affect current changes, reflecting a self-correcting mechanism in job creation over the short run.

ΔRE equation: Most coefficients are insignificant, implying that the short-run dynamics of renewable energy investment are weakly influenced by past shocks. RE does not respond strongly to recent short-term deviations in GDP or Jobs.

In summary, short-run GDP fluctuations are mainly driven by lagged employment shocks, job creation exhibits self-correction, and renewable energy investment adjusts weakly to past changes, highlighting the importance of employment as a key driver of economic performance.

d)Linking Short-Run and Long-Run Results

The short-run dynamics complement the long-run cointegration findings. While GDP adjusts slowly in the short run, the long-run equilibrium is maintained mainly through sustained employment growth and the gradual impact of renewable energy investment. Employment acts both as a short-term stabiliser and a long-term growth driver, whereas renewable energy investment primarily influences the economy over the longer horizon. These results emphasise the importance of policies aimed at job creation and effective renewable energy planning to achieve sustained economic growth.

Diagnostic Test

a)Autocorrelation Test

The Breusch-Godfrey LM test for serial correlation is used to examine the presence of serial correlation in the residuals. The null hypothesis can be rejected if the p-value is less than the 5% significance level. The null and alternative hypotheses are defined as follows:

- **H0**: There is no serial correlation of any order
- **H1**: There is serial correlation in the residuals

Table 9. Lagrange-multiplier test result summary

Table 7. Lagrange-multiplier test result summary

Lag	P-value
1	0.6124
2	0.5789

Source: Output EViews 13

The null hypothesis states that no autocorrelation is present at the specified lag order. From Table 7, the p-values at lags 1 and 2 are not significant. Therefore, we accept the null hypothesis.

Hence, at both lag orders, the VECM model for the study is free of autocorrelation.

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b)Normality Test

The error terms of the VECM models should ideally be normally distributed. If the error terms are not normally distributed, the parameter estimates may not be efficient; however, the results will remain consistent. Skewness, Kurtosis, and the Jarque-Bera test are used to assess normality. Using these tests, we examine the null hypothesis that the error terms are normally distributed.

The null and alternative hypotheses are as follows:

- **H0**: The error terms are normally distributed
- **H1**: The error terms are not normally distributed

Table 8. Results of the normality tests

Equation	Jarque-Bera test	Skewness test	Kurtosis test
ΔGDP	1.234 (p = 0.540)	0.312 (p = 0.576)	1.025 (p = 0.452)
ΔJobs	0.987 (p = 0.611)	0.218 (p = 0.637)	0.932 (p = 0.482)
ΔRE	1.145 (p = 0.565)	0.305 (p = 0.593)	1.110 (p = 0.471)
ALL	3.366 (p = 0.644)	0.835 (p = 0.622)	3.067 (p = 0.513)

Source: Output EViews 13

According to Table 8, the results of all tests indicate that the error terms are normally distributed, as all p-values are greater than 0.05. Hence, the null hypothesis of normality of the error terms cannot be rejected, and we conclude that the errors are not skewed or kurtotic.

c)VECM Stability Test

The VECM stability condition states that the model will have ―K-r‖ unit moduli. Here, ―K‖ is the number of endogenous variables in the model, and ―r‖ is the number of cointegrating vectors. In this study, the number of endogenous variables is K = 3, and the number of cointegrating vectors is r = 1. So, it will have exactly 2 unit moduli (K-r = 3-1=2).

Table 11. VECM Stability Test Results

Table 9. Stability Test Results

Eigenvalue	Modulus	Condition
0.412	0.412	Stable
0.278	0.278	Stable

Source: Output EViews 13

Table 9 shows that the stability results of the VECM with three lagged differences revealed two unit moduli, which satisfy the stability condition for our VECM model. This also indicates that the specification of the number of cointegrating vectors is correct. The modulus of each eigenvalue is strictly less than one, confirming that the estimated VECM is stable.

Conclusion

The study's results indicate that renewable energy adoption in the MENA region has a significant, positive impact on long-run economic growth and job creation. The Johansen cointegration test confirms the presence of one cointegrating vector, highlighting a stable long-run equilibrium relationship among GDP,

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employment, renewable energy investment, FDI, and energy consumption. Specifically, the long-run coefficients suggest that a 1% increase in renewable energy production is associated with a 0.82% increase in GDP, while a 1% increase in job creation is associated with a 0.47% increase in GDP. Conversely, higher reliance on conventional energy consumption slightly offsets these benefits.

The VECM results show that GDP adjusts to deviations from the long-run equilibrium, correcting approximately 31% of disequilibria per year, whereas renewable energy investment and employment appear to be weakly exogenous, acting as drivers of economic growth rather than adjusting to short-term fluctuations. Short-run dynamics further reveal that past employment changes significantly influence GDP, while renewable energy investment exhibits limited responsiveness to short-term shocks.

Implications

The findings have important implications for policymakers in the MENA region. First, promoting renewable energy development can serve as an effective strategy to enhance economic growth and create employment opportunities, aligning with national objectives of sustainable development. Policies should prioritise investments in renewable energy infrastructure, technological innovation, and workforce training to maximise the socio-economic benefits.

Second, the weak short-run adjustment in renewable energy investment underscores the need for efficient planning and resource allocation to avoid potential short-term inefficiencies that could dampen GDP growth. Ensuring that investments are strategically targeted and well-managed will enhance both immediate and long-term economic outcomes.

Finally, the study highlights the importance of integrating renewable energy policies with broader economic planning, including FDI attraction, industrial development, and energy diversification. By doing so, the MENA region can achieve a more resilient economy, reduce dependence on conventional energy sources, and foster inclusive growth that benefits both employment and GDP.

In conclusion, the transition toward renewable energy is not only an environmental imperative but also a critical driver of economic development in the MENA region. A strategic and well-coordinated policy framework can maximise its impact on growth, employment, and sustainable development.

References

Ahannaya, J., Okafor, P., & Emeka, C. (2024). Economic and social impacts of renewable energy projects in Nigeria. Renewable Energy Economics, 18(3), 245–260.

Apergis, N., & Payne, J. E. (2010). Renewable energy consumption and economic growth: Evidence from a panel of OECD countries. Energy Policy, 38(1), 656–660.

Buonocore, J. J., et al. (2019). Public health benefits of renewable energy in the U.S.: Updated evidence. Nature Energy, 4, 255–263.

Dimanchev, E., et al. (2019). Health co-benefits of sub-national renewable energy policy in the United States. Environmental Research Letters, 14(8), 085012. https://doi.org/10.1088/1748-9326/ab31d9

Divrik, B. (2025). A comparative analysis of renewable energy policies in local governments. International Journal of Management and Administration, 9(17), 13–27. https://doi.org/10.29064/ijma.1622748

Dogan, E., & Seker, F. (2016). An investigation on the determinants of carbon emissions for OECD countries: Empirical evidence from panel models robust to heterogeneity and cross-sectional dependence. Environmental Science and Pollution Research, 23(14), 14646–14655.

Finger, H. (2025). Large-scale renewable energy development and GDP impacts: Evidence from China. Renewable Energy Studies, 12(4), 101–118.

Hamad, M. W., Hassan, A. R., & Abdullah, A. A. (2025). Renewable energy integration in desalination: A cost analysis of solar- and wind-powered seawater RO systems. International Journal of Innovative Research and Scientific Studies, 8(6), 1367–1386.

Hanson, E., & Nwakile, C. (2025). Carbon capture and storage (CCS) is a pillar for balancing energy transition and climate goals. Engineering and Technology Journal, 10(8), 6167–6184.

Hlongwane, N. W., & Khobai, H. (2025). Renewable energy transition on employment dynamics in BRICS nations. Economies, 13(45),27-1. https://doi.org/10.3390/economies13020045

Iorgovan, D. (2024). Artificial intelligence and renewable energy utilisation. Proceedings of the International Conference on Business Excellence, 18(1), 2776–2783. https://doi.org/10.2478/picbe-2024-0231

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Kalyani, V. L., Dudy, M. K., & Pareek, S. (2015). Green energy: The need of the world. Journal of Management Engineering and Information Technology (JMEIT), 2(5), 18–26.
Kebede, K. Y., & Mitsufuji, T. (2017). Technological innovation system building for diffusion of renewable energy technology: A case of solar PV systems in Ethiopia. Technological Forecasting and Social Change, 114, 242–253. https://doi.org/10.1016/j.techfore.2016.08.018
Kedar, M. S. (2016). Employment generation in the solar photovoltaic industry. Renewable Energy Insights, 8(3), 45–62.
Khan, S. A., Patoli, A. Q., Ahmed, H., & Ahmed, I. (2025). Innovations in green technologies: Analysing their contribution to job creation and sustainable economic transitions. Review of Applied Management and Social Sciences, 8(1), 263–277.
Kuzemko, C. (2019). Re-scaling IPE: Local government, sustainable energy and change. Review of International Political Economy, 26(1), 80–103.https://doi.org/10.1080/09692290.2018.1527239
Ma, J. (2025). Innovation and sustainable development of commercial spaces from the perspective of financial economics. Asia Pacific Economic and Management Review, 2(4), 1–5.
Mili, L. (2024). Employment and cost efficiency in renewable energy projects: A comparative study. Energy Policy Studies, 39(4), 301–319.
Naz, S. (2025). Socioeconomic impacts of renewable energy transitions in Pakistan. Renewable Energy Policy, 33(1), 77–94.
Nie, L. (2020). The production of solar panels and wind turbines and their impact on economic growth. Renewable Energy Development Journal, 15(2), 112–127.
Obiorah, C. A. (2025). Advanced renewable energy and sustainability: The transition to renewable energy in realising sustainable global energy security. International Journal of Innovative Food, Nutrition & Sustainable Agriculture, 13(1), 67–79.
Okunevičiūtė Neverauskienė, L., Dirma, V., Tvaronavičienė, M., & Danilevičienė, I. (2025). Assessing the role of renewable energy in the sustainable economic growth of the European Union. Energies, 18, 760. https://doi.org/10.3390/en18040760
Ozowe, W., Ikevuje, A. H., Ogbu, A. D., & Esiri, A. E. (2023). Renewable energy integration in offshore oil and gas installations. Magna Scientia Advanced Research and Reviews, 8(2), 238–250. https://doi.org/10.30574/msarr.2023.8.2.0111
Pantcheva, R. (2024). Economic and social drivers of renewable energy consumption in the European Union: An econometric analysis. Economic Studies Journal, 33(7), 62–84.
Ramadhanty, N. A., & Hanun, N. R. (2025). The effect of good corporate governance, ESG disclosure, and green innovation on financial performance in manufacturing companies (2021–2024). International Journal of Economic Integration and Regional Competitiveness, 2(11), 39–55.
Sen, T. (2025). Dividend decision and share price volatility: Linking financial theories with event-based incidences from the Indian stock market. International Journal of Scientific Research in Engineering and Management, 9(11), 1–6. https://doi.org/10.55041/IJSREM54189
Török, L. (2025). Economic drivers of renewable energy growth in the European Union: Evidence from a panel data analysis (2015–2023). Energies, 18, 3363. https://doi.org/10.3390/en18133363
Usman, H. M., Sharma, N. K., Joshi, D. K., Kaushik, A., Kumhar, S., Saminu, S., & Yero, A. B. (2024). Techno-economic optimisation and sensitivity analysis of a hybrid grid-connected microgrid system for sustainable energy. Jurnal Ilmiah Teknik Elektro Komputer dan Informatika, 10(4), 704–722. https://doi.org/10.26555/jiteki.v10i4.30221
Wei, H. T. Y., & Jacobson, M. Z. (2025). Transitioning China to renewable energy: Economic, health, and environmental benefits. Highlights in Science, Engineering and Technology, 141, 99–105.
Zreik, M., & Jiao, Y. (2025). Comparative econometric analysis of renewable energy policies in smart cities: A case study of Singapore and the UAE. Applied Sciences, 15, 12168. https://doi.org/10.3390/app152212168.