TASHKENT STATE UNIVERSITY OF ECONOMICS

International journal of topics

INNOVATION SCIENCE AND TECHNOLOGY

Scopus || Electronic journal specializing in Scopus

ISSUE 11

Acceptance of papers **November, 2025**

Acceptance of papers

Published monthly

Topics

economics, technology, social sciences

ISSN 3060-5229

Electronic publication, Issue 11. 249 pages.
Approved for publication on November, 2025.

THE SCIENTIFIC-POPULAR ELECTRONIC JOURNAL **"INNOVATION SCIENCE AND TECHNOLOGY"** HAS BEEN REGISTERED UNDER THE NUMBER **C-5669633** BY THE AGENCY FOR INFORMATION AND MASS COMMUNICATIONS (AOKA) OF THE REPUBLIC OF UZBEKISTAN, EFFECTIVE FROM OCTOBER 9, 2024.

CONTACTS

Phone: **+998 50 737 87 88**

Website: https://ist-journal.uz

Email: innovationist2025@gmail.com

The scientific electronic journal “Innovation Science and Technology” has been included in the list of scientific publications recommended for the publication of main scientific results of dissertations for the award of PhD and DSc degrees in economics and technical sciences, in accordance with the Resolution No. 370 of the Presidium of the Higher Attestation Commission of the Republic of Uzbekistan, dated May 8, 2025.

Editorial board:

CONTENTS

CONTENTS

ANALYZING N-SHAPED ENERGY VERSUS ENVIRONMENT MODEL: EVIDENCE FROM UZBEKISTAN

Xalimjonov Nurbek Ulug‘bek o‘g‘li
PhD student, Department of Econometrics, TSUE
ORCID: 0009-0005-0180-9447
Emai: nurbekkhalimjonov070797@gmail.com

Toxirov Shodiyor Zafar o‘g‘li
Assistant teacher in Department of Econometrics, TSUE
Email: shodiyordemo@gmail.com

Jumamuratov Sultanbek Ilyasovich
Master’s student in TSUE, Econometrics
Email: sultan.jmrtv@gmail.com

Abstract: The Kuznets Curve (EKC) has been widely studied in the literature, but energy evaluation studies are lacking. Taking the Energy-EKC test is essential for those who rely heavily on non-renewable energy sources. In this article, the relationship between Uzbekistan’s energy use and GDP are evaluated with the help of cubic equation. The time frame covers from 1990 to 2020. The energy-environment Kuznets curve (energy-EKC) has been supported in Uzbekistan for long term. At constant GDP per capita of $9783, the N-curve model started to curve, beginning to result in increased energy consumption and subsequent environmental impacts and the second inflection point occurs in $16731. This rise in GDP per capita will cause a reduction in energy use and this is good for the nature. Similar patterns in energy consumption are observed in the short term. Thus, the energy-environment Kuznets curve (EKC) is also confirmed to be valid for short term.

Key words: Energy Use, The Kuznets curve, GDP, Uzbekistan.

Annotatsiya: Kuznets egri chizig‘i (EKC) iqtisodiy va ekologik adabiyotlarda keng o‘rganilgan bo‘lsa-da, energiya iste’moli bo‘yicha tadqiqotlar yetarli emas. Energiya-EKCni baholash, ayniqsa qayta tiklanmaydigan energiya manbalariga tayanadigan davlatlar uchun muhimdir. Ushbu maqolada O‘zbekistonning energiya iste’moli va YAIM o‘rtasidagi bog‘liqlik 1990–2020-yillar davri uchun kubik model yordamida baholangan. Natijalar shuni ko‘rsatadiki, O‘zbekistonda energiya-atmosfera Kuznets egri chizig‘i uzoq muddatda mavjud. Aholi jon boshiga YAIM 9 783 AQSH dollari bo‘lganida N-shaklli egri yuqoriga osha boshlaydi va energiya iste’moli hamda ekologik bosim ortadi. 16 731 AQSH dollari darajasidagi ikkinchi o‘zgarish nuqtasi energiya iste’molining pasayishini ko‘rsatib, iqtisodiy o‘sishning ma’lum chegaradan keyin tabiat uchun foydali bo‘lishini anglatadi. Qisqa muddatli tahlillar ham Energiya-EKCning qisqa muddat uchun amal qilishini tasdiqlaydi.

Kalit so‘zlar: energiya iste’moli, Kuznets egri chizig‘i, YAIM, O‘zbekiston.

Аннотация: Кривая Кузнеца (EKC) широко изучается в экономической и экологической литературе, однако исследований, посвящённых именно энергопотреблению, всё ещё недостаточно. Оценка модели Energy-EKC особенно важна для стран, которые в значительной степени зависят от невозобновляемых источников энергии. В данной статье анализируется взаимосвязь между потреблением энергии и ВВП Узбекистана с использованием кубической модели за период 1990–2020 гг. Результаты показывают, что энергетико-экологическая кривая Кузнеца подтверждается для Узбекистана в долгосрочной перспективе. При уровне ВВП на душу населения 9 783 долл. США N-образная кривая начинает расти вверх, что приводит к увеличению энергопотребления и экологических нагрузок, тогда как вторая точка перегиба при уровне 16 731 долл. США указывает на последующее снижение потребления энергии. Это свидетельствует о том, что дальнейший экономический рост способствует улучшению экологической устойчивости. Аналогичные краткосрочные тенденции также подтверждают применимость Energy-EKC в краткосрочном периоде.

Ключевые слова: энергопотребление, кривая Кузнеца, ВВП, Узбекистан.

INTRODUCTION

The pattern of energy consumption in Uzbekistan is mostly influenced by the country's heavy reliance on fossil fuels, and the country's economic development has a substantial effect on this pattern. Due to the fact that both production and consuming activities need energy, an increase in economic development may lead to an increase in the demand for energy within the economy. In contrast, the increase in energy consumption may result in a transition away from non-renewable sources and toward environmentally friendly alternatives. Additionally, the manufacturing process has the ability to alter from a system that is polluting to a one that is more ecologically friendly.The international community has come to acknowledge that climate change is one of the most significant challenges that mankind is now confronting. The "greening" of the economy is considered by many to be one of the most significant actions that can be taken to both the prevention of climate change and the adaptation to its effects. Regarding this matter, our nation has initiated the beginning stages of actual effort. The adoption of a number of normative legal papers that are associated with the sector was particularly noteworthy. The idea of environmental protection of the Republic of Uzbekistan until the year 2030, the concept of environmental protection of the Republic of Uzbekistan during the period 2019-2030, and the laws for "On the use of renewable energy sources" and "On hydrometeorological activity" There are many different strategies, one of which is the transition to a "green" economy.

The decision that was made by the President on December 2, 2022, which was titled "On measures to increase the effectiveness of reforms aimed at the transition of the Republic of Uzbekistan to a "green" economy until 2030," was a natural continuation of these processes, the goals that were set in the development plan of New Uzbekistan. It is essential to make certain that the implementation is carried out in a timely manner, to enhance the efficiency of the steps that are taken to guarantee "green" and inclusive economic development within the framework of the plan for transitioning to a "green" economy, to leverage renewable energy sources, and to save resources across the board in the economy. When we state that it is a historical record, we are not exaggerating the situation.The decision that was made to adopt the program of transitioning to a "green" economy and guaranteeing "green" development in the Republic of Uzbekistan until the year 2030 envisions the accomplishment of a number of significant strategic objectives. In particular, the duty for lowering greenhouse gas emissions per unit of gross domestic product by 35 percent from the level in 2010 has been allocated, and this is done while maintaining a commitment to the responsibilities that are outlined in the Paris Agreement. Figures 1 and 2 show the level of energy use and the rate of GDP growth (Figure 1).

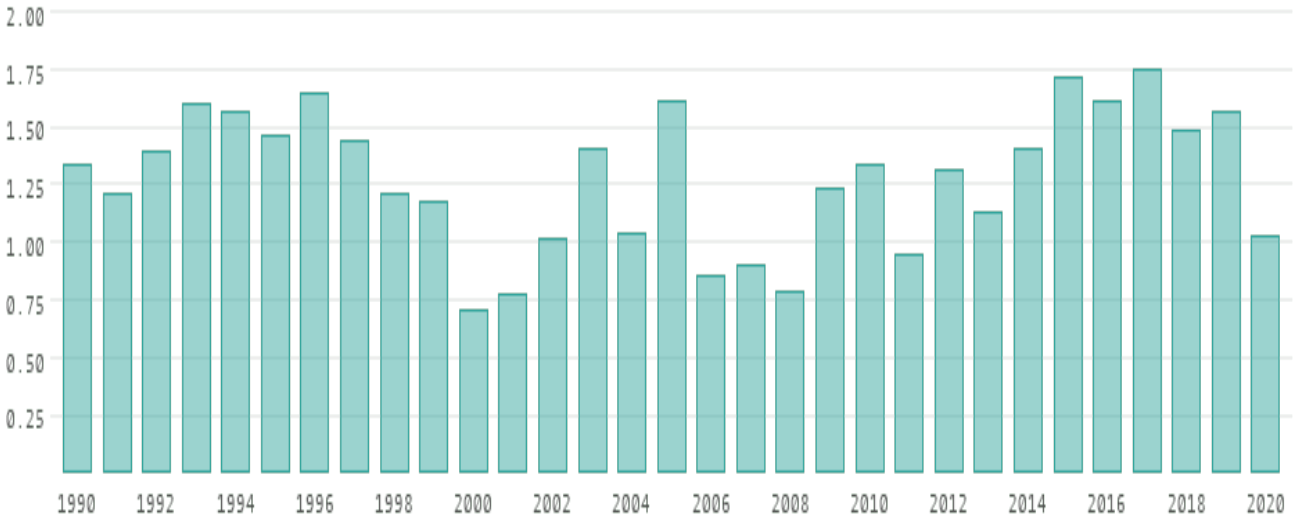

Figure 1. Energy consumption growth rate in Uzbekistan[1]

It is essential to take the required steps to enhance the ecological and hygienic conditions of communities, and one of those steps is to increase the level of solid household waste processing from 65 percent. In addition, the concept of transitioning to a "green" economy and ensuring energy efficiency in industrial sectors, as well as the action plan for transitioning to a "green" economy and ensuring "green" growth in the Republic of Uzbekistan until 2030, as well as the target parameters for saving fuel and energy resources in economic sectors in 2022-2026, have all been approved as a result of this decision. At the same time, the text outlines the state authorities that are responsible for the implementation and growth of the "green" economy, as well

1 Source: from World Bank resources

as the responsibilities that are assigned to the official ministries and agencies in this respect. At this point, it is necessary to bring out that a number of constructive actions are now being carried out in the direction of the significant objectives that were outlined before. In particular, during the nine months of 2022 alone, a total of 150 pieces of dust and gas cleaning equipment that have an efficiency of at least 95 percent will be upgraded in 28 significant businesses that produce metallurgy, oil, energy, and building materials that have a high and medium degree of hazard. The emission of waste gasses into the environment was stopped, resulting in the prevention of 2.2 thousand tons altogether.

In the last five years, the quantity of emissions that have been released into the atmosphere has fallen by eleven percent as a direct consequence of the implementation of such measures. In order to significantly reduce the amount of pollution that is released into the atmosphere, it is essential to raise the number of cars that are friendly to the environment and to bring the quality of gasoline up to international standards. Our nation is now engaged in a variety of activities that are related to this matter.

As Uzbekistan's population and level of urbanization continue to grow, new opportunities are emerging to expand the sustainable use of natural resources and introduce more efficient consumption and production patterns. In this context, gradual decarbonization of industrial, agricultural, and transport sectors is becoming an important strategic direction, enabling the country to adapt to global climate trends.

Ongoing reforms aimed at improving energy efficiency are expected to support stable economic growth by modernizing existing systems and introducing innovative, resource-saving technologies. The transition toward efficient energy use will also help reduce the economic losses previously associated with high energy intensity.

Sustainable water management is becoming increasingly relevant, and the wider introduction of water-saving technologies, modern irrigation systems, and integrated resource-management approaches is expected to strengthen long-term resilience. Parallel measures in land restoration, soil improvement, and erosion control will contribute to higher agricultural productivity and more stable rural livelihoods.

Efforts to enhance climate resilience—especially among communities in arid regions—continue to expand through social support programs, capacity-building initiatives, and environmental education. These measures aim to strengthen society's overall ability to adapt to climate-related challenges.

Large-scale environmental initiatives in the Aral Sea region and across the country demonstrate a long-term commitment to sustainable development. As economic growth accelerates, Uzbekistan is steadily advancing toward a balanced model that integrates environmental protection, efficient resource use, and the well-being of future generations (Figure 2).

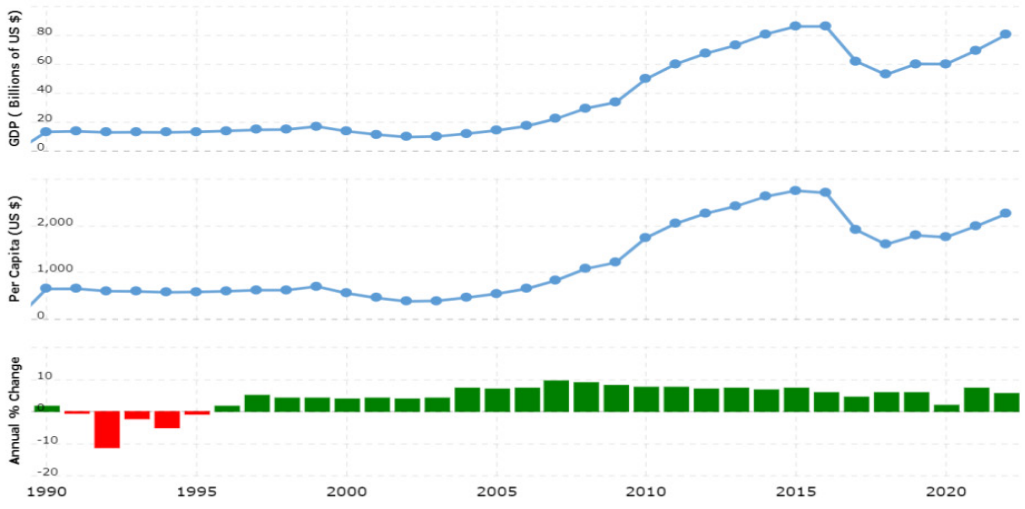

Figure 2. Economic growth rate in Uzbekistan[2]

The "Uzbekistan - 2030" plan is supposed to be a reflection of the most important directions that our country's economy should be heading in. As a consequence of this, the outcomes of the work that was done in the previous year are readily apparent in the primary macroeconomic indicators.In example, early projections indicate that the country's gross domestic product in 2023 would equal to 1 quadrillion 66.6 trillion soums at current prices. This is a 6% increase in comparison to the previous year's figure. Other services are included in the gross domestic product (GDP), which is comprised of agriculture, forestry, and fisheries at a rate of four, industry at six, construction at six, trade, lodging, and food services at ten, transportation, storage, information

2 Source: from World Bank resources

and communication services at twelve, and other services. There was a growth rate of 4.5 percent seen in the branches.

The study has not yet provided a conclusive answer about the connection between energy and income. Studies that have already been conducted have revealed evidence that both supports and contradicts the existence of the energy-environmental Kuznets curve, often known as the energy-EKC. On top of that, the economy of Uzbekistan does not have any energy-EKC infrastructure. Consequently, prior to the development of an ideal strategy for energy consumption, it is very necessary to do extensive study on this connection. The variation in the functional structure of each research, which is based on diverse data sets from the literature from across the globe, may be ascribed to the variety of correlations that have been collected. By doing so, we were able to get an understanding of the kind of communication that is prevalent in Uzbekistan. As a result, the purpose of this research is to analyze the impacts of nonlinear cumulative circumstances on energy consumption in order to identify the economy that is the most efficient. An examination of time series data spanning the years 1990 to 2020 is what we employ to accomplish this objective.

REVIEW OF LITERATURE ON THE SUBJECT

The energy and environment literature focuses mostly on other sources when it comes to examining concerns that are associated with energy use and growth. Scholars Krueger (1991) and Grossman (1991) were the ones who first introduced the EKC test, and it has been extensively researched in the medical literature for the purpose of analyzing correlations. The investigation of the energy-environment Kuznets curve (EKC) is presently restricted due to the limited availability of data, which precludes the examination of energy variables and economic development. [1]

It was Suri and Chapman (1998) who were the pioneers in the field of energy-EKC concept research. Their reasoning is based on the fact that the manufacturing sector has a substantial influence on the relationship between energy and economic development in every country. They made the observation that expansion of exports results in an increase in the rate of energy consumption. This is because the expansion of exports results in an increase in demand for any commodity. On the other hand, imported goods minimize the amount of energy that is required. If they are not imported, then they must be created locally, which might result in an increase in the amount of energy that is used during the production process. Researching the cubic relationship, on the other hand, offers a more precise illustration of the connection between energy and expansion.[2]

Within the body of research, EKC conducts an exhaustive investigation of the connection between emissions and expanding populations. Separate panels are used to summarize the majority of the investigations. Alam and colleagues (2016) conducted an investigation on the environmental Kuznets curve (EKC) between the years 1970 and 2012 in four major economies that were characterized by high levels of pollution. They discovered that both energy consumption and income were favorably impacted by the EKC. Both India and Brazil have seen a rise in their populations, which has led to an increase in their emissions. The Environmental Kuznets Curve, also known as the EKC, has been discovered in China, Brazil, and Indonesia. However, India was not the location where it was found. It may be concluded that the growth of three of the four economies that were investigated did not result in any environmental issues. A consistent and favorable association has been found between the expansion of the economy and the emission of greenhouse gases in India.[3]

In order to conduct an analysis of the rates of renewable energy consumption (REC) in all of the locations that were researched, Al-Mulali and et al. (2016) evaluated the Ecological Kuznets Curve (EKC) for seven regional evaluations that were conducted between the years 1980 and 2010. Validation of the Environmental Kuznets Curve (EKC) has been achieved in locations that have a higher share of usage of renewable energy sources.[4]

A sample of nineteen African countries was used to investigate the Ecological Kuznets Curve (EKC) between the years 1971 and 2012. Shahbaz and colleagues (2016) conducted this study. In nine of the nations that were investigated, globalization was responsible for a drop in emissions, whereas in five of the countries, it was responsible for a rise in emissions. In the six nations that were investigated, the Ecological Kuznets Curve (EKC) was seen, however the U-curve was detected in just two of the countries to be analyzed. In addition, the concentration of energy led to an increase in emissions in fifteen of the nations that were investigated.[5]

In 1901, Le and Ozturk (2020) examined the Environmental Kuznets curve for 47 emerging nations. their findings were published in 2020. As a result of the red coloration of the correlation in the panel, they used correlation estimators. According to the findings, the process of globalization and the use of energy both contributed to the rise in the amount of emissions that were released into the atmosphere. In addition, the growth of the financial industry has also been a contributor to the rise in the amount of carbon dioxide emissions. Furthermore, they discovered interactions between all of the factors that were found to be explored and emissions.[6]

In the research that he conducted in 2017, Keho investigated the Ecological Kuznets Curve (EKC) by analyzing it across a number of distinct groupings of fifty-nine economies from a variety of countries. Quantile regression was the way that they went about doing their analysis. Three out of the five panel groups that were assessed were found to have verified the validity of the EKC [7].

A study was conducted by Solarin and colleagues (2017) to investigate the Ecological Kuznets Curve (EKC) for China and India from 1965 to 2013. In addition, rising real incomes have contributed to an increase in emissions in both China and India. Hydropower, on the other hand, has been a significant contributor to the reduction of emissions. In India and China, the Environmental Kuznets Curve (EKC) has been seen, and feedback effects have also been proven for a wide variety of various It is [8].

Since the 1920s, Saqib (2018) has been doing research on the interplay that exists between energy, economic development, and emissions in the nations that are located in the Gulf region. As well as a link between growth and emissions, there was also a correlation between behaviors and attitudes. It was also observed that there was a one-way link between the causal influence of energy on emissions and the emissions themselves [9].

In order to evaluate the connection between emissions and economic development in Egypt, El-Aasar and Hanafy (2018) carried out an EKC analysis that was particular to the nation. Egypt did not have an EKC at the time. It has been shown that the Renewable Energy Certificate (REC) program has been effective in lowering emissions, whereas trade has not had any impact on emissions.[10]

A study on the Environmental Kuznets Curve (EKC) in Kenya was carried out by Sarkodie and Ozturk (2020). The researchers analyzed data spanning from 1971 to 2013 to determine the link between emissions and income using the Environmental Kuznets Curve (EKC). The use of energy has been a contributor to the rise in emissions in Kenya. Moreover, the demand for energy has grown as a result of domestic consumption. Greater urbanization has resulted in a rise in the amount of energy that is required. It is worth noting, however, that the significance of energy has not had any substantial influence on the availability of renewable energy sources in Kenya.[11]

After doing a literature analysis, it was discovered that there are several research that investigate the environmental Kuznets curve (EKC) via. When it comes to research for Uzbekistan, however, there is not a sufficient amount of Environmental-energy Kuznets Curve (EKC) studies. As a result, we have improved the information that was already available about the energy-ecological curve (EKC) for Uzbekistan.

RESEARCH METHODOLOGY

Earlier research has investigated the link between economic development and absolute energy use, as represented by the energy–environmental Kuznets curve (EKC) (Suri and Chapman, 1998).[12]

In order to get the same result, we adhered to the same pattern in the cubic connection between energy and growth:

$$EC_t = f(Y_t, Y_t^2, Y_t^3) \quad (1)$$

Logarithms of per capita gross domestic product and energy consumption are denoted by the letters Y_t and E_t, respectively. The Statistical Agency of Uzbekistan [15] and the World Bank [16] were respectively the sources of the data that were obtained. We used the Augmented Dickey and Fuller (ADF) test (1981) in order to guarantee that the series does not have any unit roots. This was accomplished by using equations that had three distinct [13]:

$$\Delta w_t = a_1 w_{t-1} + \sum_{i=0}^{q} a_{2i} w_{t-i} + u_{1t} \quad (2)$$

$$\Delta w_t = a_0 + a_1 w_{t-1} + \sum_{i=0}^{q} a_{2i} w_{t-i} + u_{2t} \quad (3)$$

$$\Delta w_t = a_0 + a_1 w_{t-1} + \sum_{i=0}^{q} a_{2i} w_{t-i} + a_3 T + u_{3t} \quad (4)$$

In the level and difference series, equations (2) through (4) are examined for issues involving unity. The Autoregressive Distributive Lag (ARDL) model, which was created by Pesaran et al. (2001) [14], is the next example that we will employ:

$$\Delta EC_t = b_0 + b_1 EC_{t-1} + b_2 Y_{t-1} + b_3 Y_{t-1}^2 + b_4 Y_{t-1}^3 + \sum_{i=1}^{k1} b_{5i} \Delta EC_{t-i} + \sum_{i=0}^{k2} b_{6i} \Delta Y_{t-i} + \sum_{i=0}^{k3} b_{7i} \Delta Y_{t-i}^2 + \sum_{i=0}^{k4} b_{8i} \Delta Y_{t-i}^3 + e_{1t} \quad (5)$$

$$\Delta EC_t = b_{10} ECT_{t-1} + \sum_{i=1}^{k1} b_{5i} \Delta EC_{t-i} + \sum_{i=0}^{k2} b_{6i} \Delta Y_{t-i} + \sum_{i=0}^{k3} b_{7i} \Delta Y_{t-i}^2 + \sum_{i=0}^{k4} b_{8i} \Delta Y_{t-i}^3 + e_{1t} \quad (6)$$

ANALYSIS AND RESULTS

The stationarity of all series is confirmed using the ADF test. The results are shown in Table 1. EC_t, Y_t, Y_{t2} and Y_{t3} are not stationary when measured at the same level. Nevertheless, DEC_t, DY_t, DY_{t2} and DY_{t3} show stationarity after the initial difference at the 1% level. Therefore, the energy-EKC model has first-order integration and can be analyzed using cointegration (Table 1).

Table 1. Augmented Dickey–Fuller test

Variable	Intercept	Intercept and trend	None
EC_1	−0.5874(0.7956)	−2.9894(0.1002)	2.0047(0.8796)
Y_1	−2.1784(0.1546)	−2.4412(0.4129)	−0.2936(0.4457)
Yt_2	−2.3478(0.2119)	−2.2697(0.1974)	−0.2947(0.4129)
Yt_3	−2.3594(0.2457)	−2.0236(0.4519)	0.3145(0.4309)
ΔEC_1	−9.0197(0.0000)	−8.4513(0.0000)	−8.0789(0.0000)
ΔY_1	−4.9471(0.0001)	−5.4593(0.0009)	−5.4473(0.0000)
ΔYt_2	−5.1473(0.0001)	−5.0874(0.0010)	−5.3314(0.0000)
ΔYt_3	−5.4687(0.0001)	−4.6544(0.0073)	−5.1973(0.0000)

Table 2 shows the result of the bound test. The F-value from the Wald test is significantly below the lower critical value at the 10% significance level. Therefore, the model failed to show cointegration (Table 2).

Table 2. Bound testing.

Variable	Statistic	P-value
F-value based on bound test	1.5123	-
Serial correlation	0.6179	0.4965
Heteroskedasticity test	0.59740	0.34790
Normality test	0.7124	0.3748
Ramsey Reset test	1.8974	0.1974
Critical bounds	Lower	Upper

Table 3 shows the expanded and reduced results of the N-curve energy-EKC. To analyze the data, it is necessary to establish cointegration, which is not confirmed by the bound test. Nevertheless, the negative and significant ECT_{t-1} value confirms this. Therefore, we analyze the findings shown in Table 3. The values of Y, Y_2 and Y_3 are shown as 6874.7419, -856.2987 and 19.2794. Therefore, the existence of an N-shaped energy-environmental Kuznets curve (EKC) in Uzbekistan is supported. The initial turning point of Energy-EKC is determined as a constant USD 9783 using mathematical calculations and python packages. Therefore, the increase of GDP per capita by USD 9783 directly affects the degradation of the environment associated with the increase in energy consumption in Uzbekistan.

Despite this, Uzbekistan is successfully achieving a GDP per capita of 9783, while energy consumption is decreasing. Such positive economic growth is beneficial in mitigating environmental damage. Similarly, we consider the second inflection point of the energy-environment Kuznets curve (EKC) to be equal to 16731. Ecoonomic expansion again leads to an increase in energy consumption and environmental degradation due to the increase in fossil fuel consumption (Table 3).

Table 3. Long term and short term results

Variable	Parameter	Standard error	t-value	P-value
Y_1	6874.7419	3712.4954	1.9874	0.0567
Yt^1	-856.2987	397.4921	-1.887	0.0645
Yt_3^2	19.2794	10.4596	1.9654	0.0745
Intercept	-20749.497	11248.451	-1.874	0.0687
ΔY	549.4931	275.4326	2.1548	0.0496
ΔYt_2	-65.4978	19.4697	-1.887	0.0445
ΔYt_3	2.0489	0.7491	1.8496	0.0368
ECT_{t-1}	-0.0679	0.03722	-2.1569	0.0413

The coefficient of the ECT_{t-1} parameter is -0.0679 and its convergence is confirmed. The values of DY_t, DY_{t2}, and DY_{t3} are 549.4931, -65.4978, and 2.0489, respectively. Thus, the existence of N-curve energy-EKC is also confirmed. Hence, in the near term, a lower level of development leads to a higher amount of energy. Later, the reduced energy is employed in a more advanced stage of production. In addition, the third phase of development is expected to further increase energy demand in the near future. Therefore, we confirmed the existence of a short-term N-curve.

CONCLUSIONS AND SUGGESTIONS

Uzbekistan's pattern of energy consumption is primarily impacted by the country's high dependence on fossil fuels, and the country's economic growth has a significant impact on this pattern. Both of these factors are interrelated. It is possible that a rise in economic development will result in an increase in the total demand for energy within the economy. This is because activities that include production as well as activities that involve consumption need energy. On the other hand, the rise in energy consumption may lead to a shift away from sources that do not replenish themselves and toward alternatives that are more favorable to the environment. To add insult to injury, the manufacturing process has the potential to transform from a polluting system into a system that is friendlier to the environment.There is a growing consensus among members of the world community that climate change is one of the most critical concerns that humanity is now facing.

The use of fossil fuels has the potential to have a detrimental effect on the environment. When it comes to the environment, the implications of economic development are likely to pose higher threats to nations that depend significantly on fossil fuels. As a result, it is essential to create a direct connection between the patterns of energy and the formation of development. With the use of a cubic relationship, this research investigates the connection between energy and economic development in Uzbekistan. The cointegration test is used for the whole of the study, which spans the years 1990 through 2020. Using unit root analysis, one may determine whether or not the initial difference is stationary.Our investigation into cointegration and short-term association was carried out with the help of the calculated parameters of t-1.

The long-term forecast parameters are defined as positive, negative, and negative, respectively, for the linear, quadratic, and cubic terms of economic growth. For the cubic term, the parameters are specified as negative. As a result, the presence of a Kuznets curve (EKC) that covers the long-term relationship between energy and the environment in Uzbekistan is established. The first inflection point of the N-curve was characterized as a constant GDP per capita of $9783, while the subsequent inflection point was determined to be $16731. A rise in the gross domestic product (GDP) per capita from 9,783 to 16,731 results in a reduction in the use of energy and a favorable environment. In addition, a similar trend of energy consumption is seen in the short run in conjunction with the growth of the economy. Therefore, the energy-environmental Kuznets curve (EKC) is supported in the short time that we are discussing.

The analysis of the research led to the formulation of the following ideas and recommendations:

1. Currently, the primary goals of legislative regulations on environmental relations are to stabilize and significantly enhance the environmental situation by aligning industrial practices with environmental standards. It is particularly crucial to include resource-conserving and low-waste technology into manufacturing.

2. To mitigate the impacts of climate change, it is imperative to adopt measures such as developing eco-friendly technologies and integrating them into agriculture, enhancing the effectiveness of irrigation systems, addressing desertification and drought, as well as combating soil salinization and land erosion.

3. It is imperative to establish collaborative initiatives within the country to enhance the social collaboration between government and non-governmental organizations in executing environmental projects with the goal of fostering a sense of environmental responsibility and conservation among citizens, particularly the youth. By actively engaging environmental public groups that possess the capability to establish partnerships with government agencies, the public, and philanthropists, it is feasible to guarantee the realization of inventive strategies for addressing environmental protection concerns.

List of used literature:

1. Farhani, S., Chaibi, A., Rault, C. (2014), CO_2 emissions, output, energy consumption and trade in Tunisia. Economic Modelling, 38, 426-434. Grossman, G.M., Krueger, A.B. (1991), Enrironmental Impacts of the North American Free Trade Agreement. NBER, Working Paper 3914. United States: NBER.
2. Suri, V., Chapman, D. (1998), Economic growth, trade and energy: Implications for the environmental Kuznets Curve. Ecological Economics, 25(2), 195-208.
3. Alam, M.M., Murad, M.W., Noman, A.H.M., Ozturk, I. (2016), Relationships among carbon emissions, economic growth, energy consumption and population growth: Testing enrirommental Kuznets Curve hypothesis for Brazil, China, India and Indonesia. Ecological Indicators, 70,466-479.
4. Al-Mulali, U., Ozturk, I, Solarin, S.A. (2016), Investigating the enrironmental Kuznets curve hypothesis in seven regions: The role of renewable energy. Ecological Indicators, 67, 267-282.
5. Shahbaz, M., Solarin, S.A, Ozturk, I. (2016), Enrironmental Kuznets curve hypothesis and the role of globalization in selected African countries. Ecological Indicators, 67, 623-636.
6. Le, H.P., Ozturk, I. (2020), The impacts of globalization, financial development, government expenditures, institutional quality on CO_2 emissions in the presence of environmental Kuznets curve. Enrironmental Science and Pollution Research, 27, 22680-22697.
7. Keho, Y. (2017), Rerisiting the income, energy consumption and carbon emissions nexus: New evidence from quantile regression for different country groups. International Joumal of Energy Economics and Policy, 7(3), 356-363.
8. Solarin, S.A., Al-Mulali, U., Ozturk, I. (2017), Validating the enrirommental Kuznets curve hypothesis in India and China: The role of hydroelectricity consumption. Renewable and Sustainable Energy Retriews, 80, 1578-1587.
9. Saqib, N. (2018), Greenhouse gas emissions, energy consumption and economic growth: Empirical evidence from gulf cooperation council countries. International Journal of Energy Economics and Policy, 8(6),392-400
10. El-Aasar, K.M., Hanafy, S.A. (2018), Investigating the enviromental Kuznets curve hypothesis in Egypt: The role of renewable energy and trade in mitigating GHGs. Intemational Journal of Energy Economics and Policy, 8(3), 177-184.
11. Sarkodie, S.A., Ozturk, I. (2020), Investigating the environmental Kuznets curve hypothesis in Kenya: A multivariate analysis. Renewable and Sustainable Energy Reriews, 117, 109481.
12. Suri, V., Chapman, D. (1998), Economic growth, trade and energy: Implications for the environmental Kuznets Curve. Ecological Economics, 25(2), 195-208.
13. Dickey, D.A., Fuller, W.A. (1981), Likelihood ratio statistics for autoregressive time series with unit root. Econometrica, 49, 1057 1072.
14. Pesaran, M.H., Shin, Y., Smith, R.J. (2001), Structural analysis of vector error correction models with exogenous I (1) variables. Journal of Econometrics, 97(2), 293-343.
15. http://stat.uz/en/
16. World Bank. (2021), World Development Indicators. World Bank.

Proofreader: Zokir ALIBEKOV

Layout and Designer: Oloviddin Sobir ugli

2025. № 11

To publish articles in this journal, you may submit articles, advertisements, stories, and other creative materials through the following links. Materials and advertisements are published on a paid basis.

You may subscribe to the journal at any time using the following details. Once subscribed, please send a screenshot or photo of your payment confirmation to our Telegram page @iqtisodiyot_77. Based on this, we will send the latest issue of the journal to your address each month.

“The journal “INNOVATION SCIENCE AND TECHNOLOGY” has been registered by the Agency for Information and Mass Communications under the Administration of the President of the Republic of Uzbekistan from 09.10.2024 under the registration number №390637. License number: C-5669633. PNFL: 30407832680027

Our address: Tashkent city, Yunusobod district, 19th block, House 17.

TASHKENT STATE UNIVERSITY OF ECONOMICS

Google Scholar | OPEN ACCESS | ULRICHSWEB GLOBAL SERIALS DIRECTORY

Academic Resource Index ResearchBib | ISSN INTERNATIONAL STANDARD SERIAL NUMBER INTERNATIONAL CENTRE | CYBERLENINKA

OpenAIRE | ROAD | НАУЧНАЯ ЭЛЕКТРОННАЯ БИБЛИОТЕКА LIBRARY.RU

BASE | INDEX COPERNICUS INTERNATIONAL | Crossref

doi Digital Object Identifier | CiteFactor Academic Scientific Journals | zenodo

Acceptance of articles

Published every monthly

Directions

Social, economic, political, technological, scientific

Scopus || Scientific electronic journal specializing in Scopus

CERTIFICATE NUMBER: №390637

ORDER NUMBER ACCORDING TO THE LICENSE REGISTER: C-5669633

CONTACT:

Contact us
+998 50 737 87 88

Telegram channel
t.me/scopus_IST2100

Journal official website
https://ist-journal.uz/index.php/IST