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COMPARISON OF RENEWABLE ENERGY GENERATION OF TURKEY AND DEVELOPED COUNTRIES ACCORDING TO THE HUMAN DEVELOPMENT INDEX

Mehmet ÖZDEMİR[1], Özlem YURTSEVER[2], Ayhan ONAT[1]

ABSTRACT

The existence of resources to meet the energy needs for the economic development of a country and their diversity come into prominence. It is known that renewable energy sources make a considerable contribution to economic development and a clean environment. Providing electricity from renewable energy sources is an important energy policy in terms of reducing Turkey's external dependence on energy and the negative effects of fossil fuels on the environment. It is necessary not only to produce energy-but also to use the energy produced efficiently. In order to make a comparison of a country with other countries in terms of energy efficiency, the energy intensity of the countries should be examined. The lower the energy intensity, the greater the gain of energy for economic development.

In this study, a comparison was made between Turkey and the 49 most developed countries from Turkey, according to the Human Development Index (HDI), in electricity production from renewable energy sources and renewable energy intensity. Pearson and Spearman correlation analysis was performed employing the SPSS program for this comparison. As a result of the study, although Turkey produces electricity from renewable energy sources like the countries that are more developed than itself, it can not use electricity as efficiently as 92.86% of these countries.

Keywords: *Renewable Energy Resources, Energy Efficiency, Energy Intensity.*

INTRODUCTION

As a result of the technological developments of the countries as well as the population growth and rapid developments in the socio-cultural field, electricity consumption is increasing day by day. Concordantly, meeting current electricity demands is decreasing due to the significant decrease in fossil fuels. In addition to reducing the resources required to meet the electrical energy needs, the amount of cost per unit increases at the same rate. Due to the rapidly changing living conditions, the need for electricity is emerging as a global problem. In order to cope with the global energy problem, countries need to be independent in energy and be able to meet their needs. By doing this, energy security should not be ignored. Countries develop national and international policies with the intent to solve their current energy problems. The most important step of these policies is the energy obtained from renewable energy sources.

Consumption of fossil fuels to obtain energy accompanies many irreversible negativities in the future. The greenhouse gas effect caused by fossil fuels significantly increases environmental pollution. The environmental pollution caused by fossil fuels is the most significant factor that increases global warming [22].

It is necessary to know the extent to which the countries present the policies are successful. The determination of this is determined by energy efficiency. The energy efficiency of the countries is calculated and evaluated with the energy intensity. In other words, the indicator used to make energy efficiency comparisons of countries is energy density [8]. Studies in this area are given below.

In the study was made about electricity consumption in residences in Taiwan by Lin KL. and his friends, the result found that the electricity consumption is reduced in the ratio of 39.78% in well-insulated dwellings, and the energy density (efficiency) is affected in the ratio proportion of 45% by contributing to Taiwan's economy [18].

As a result of the application and performance analysis of renewable energy sources were performed by Che X. and his friends in areas with less social density, the conclusion was deduced that the amount of electricity to be obtained with solar energy investments to be made in 30 different regions in China would increase in the ratio of 70% and thus, that 85% of the energy needs of heat pumps and electric heaters can be met. In addition, it is foreseen that

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the economic performance of the country will increase in the ratio of 30-60% according to the current conditions. It is possible to increase the competitiveness of China with other countries by improving the energy density with the incentives to be made [5].

In the study of Body T. on CO_2 emissions, renewable energy consumption, population density, and economic growth in G7 countries, it has been determined that there is a bidirectional relationship between CO_2 emissions and gross national product and that a decrease in CO_2 emissions will cause an increase in the amount of GNP by using the Granger causality model. In addition, it is concluded that it is possible to reduce CO_2 emissions with renewable energy sources. Although the transition process of renewable energy is costly, the gross national product is increased by enhancing economic development at the side of energy sources that have a positive effect on the environment in the long term [10]. The higher the economic development of a country, the more positive energy density is affected by it.

In their study, made on energy density by Nammalam LNR. and friends, it is found that the energy produced from renewable energy sources has a serious effect on energy intensity. According to the results of the correlation analysis, the correlation coefficient between renewable energy sources and energy density was determined as -0.7880. In other words, electricity obtained from renewable energy sources provides economic growth, contributes to the country's development. As a result, it was determined that the energy intensity was significantly reduced [21]. Energy is the most important parameter affecting developed or developing economies in terms of both consumption and production. Because societies are so dependent on energy, the living conditions of societies and the purchasing power of their incomes are seriously affected in case of any interruption in the generation or consumption of energy [7]. Renewable energy sources have become more efficient, and energy costs of it are lower thanks to technological developments; electricity generation with renewable energy sources has come to the point of competing with fossil fuels.

40% of the investment made in renewable energy sources belongs to the high-income countries with 15% of the world's population. It was revealed the results of ensuring the transition to low-carbon energy technologies and reducing residential energy bills with the investment required for renewable heating networks was constituted in urban areas of Sweden in the 1970s and 1980s. The incentives, realized by the Indian government, paved the way for low-cost energy investments. Solar parks are established to meet 50-60% of the energy need due to these incentives. The government of Fiji derates for public transportation and large-scale agricultural companies to increase energy efficiency and use renewable energy sources. It has invested F$25 million for a tax break.

Considering the data in Table 1, while the electricity production from renewable energy sources in the world increased by an average of 9.50% between the years 1960-2000, it increased by 11.98% between the years 2000-2020. In other words, the amount of electricity produced from renewable energy sources in the last 21 years has been more than the amount of electricity in the past 40 years. Electricity production amounts obtained from renewable energy sources belonging to other countries are included in World Bank Open Data, International Energy Agency, Energypedia International Renewable Energy Agency databases [31, 32, 33, 34].

The amount of electricity Turkey-obtained from renewable energy sources between 1960 and 2020 is given in Figure 1. The reason for the heavy increase in the energy obtained from renewable energy sources of Turkey is shown as serious investments-made by entrepreneurs, with licenses are granted thanks to the incentive and support packages are applied by the Ministry of Energy and Natural Resources for solar power plants, wind power plants, biomass energy projects, geothermal energy projects. In addition, the value of the Gross National Product of Turkey (GNP) is increasing, and the external dependence on energy is decreasing with the energy obtained from renewable energy sources step by step. The amount of electricity obtained from renewable energy sources worldwide between 1960 and 2020 is given in Figure 2. In addition to percentage share of Turkey in the amount of electricity produced from renewable energy sources in the world between 1960 and 2020, is shown in Figure 3. [37].

Turkey has serious potential in terms of using renewable energy sources, which are defined as clean energy sources, in order to ensure energy security and maintain a clean environment policy. However, the amount of electricity Turkey's renewable energy sources does not significantly contribute to the total amount of electricity produced from renewable energy sources of other countries in the world [23]. Considering the data in Figure 3, the percentage share of Turkey in the produced amount of electricity from renewable energy sources in world between 1985-2005, has

decreased. In other words, while the amount of electricity obtained from renewable energy sources in the world from 1985-2000 was increasing, it was decreasing in Turkey [31,32].

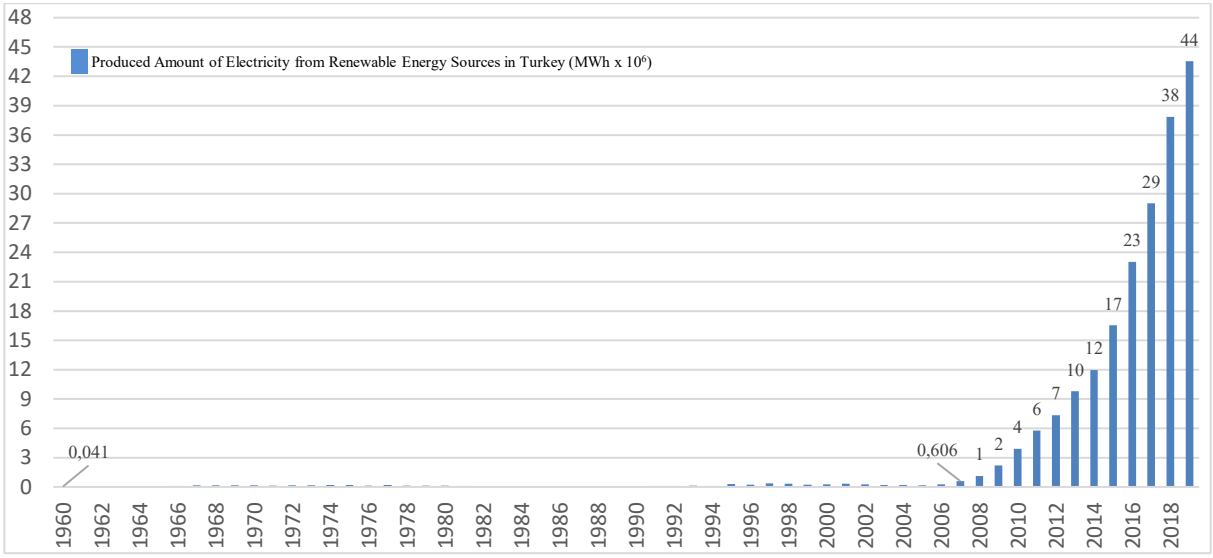

Figure 1. The amount of electricity produced from renewable energy sources between 1960 and 2020 in Turkey [31,32].

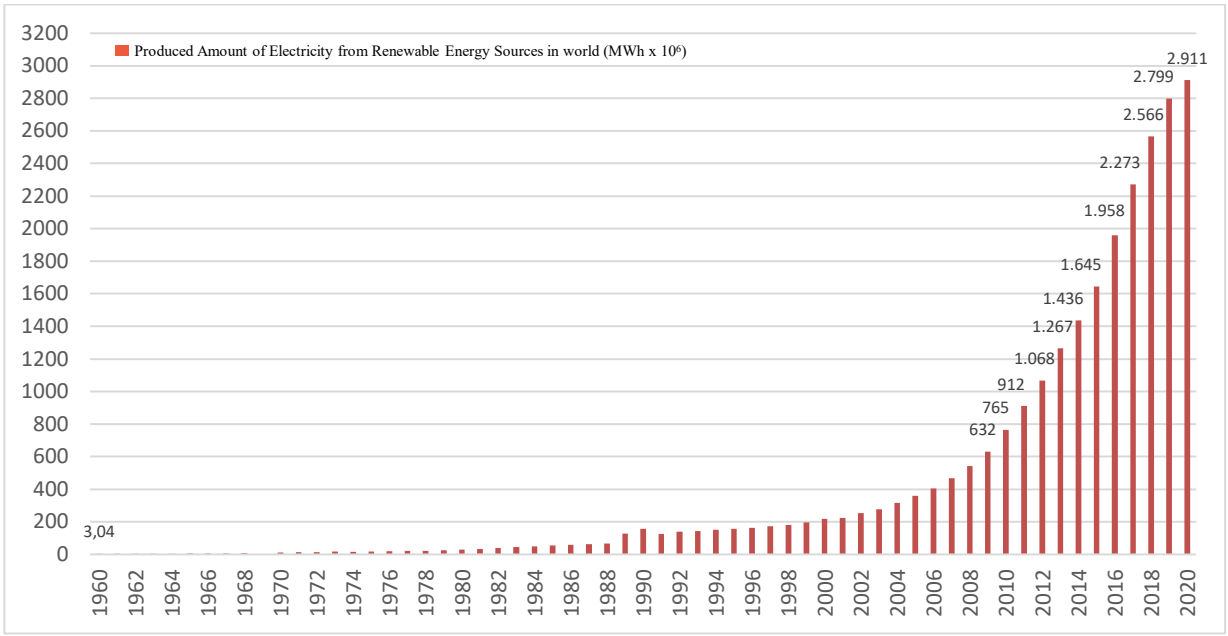

Figure 2. The amount of electricity produced from renewable energy sources between 1960 and 2020 in world [31,32].

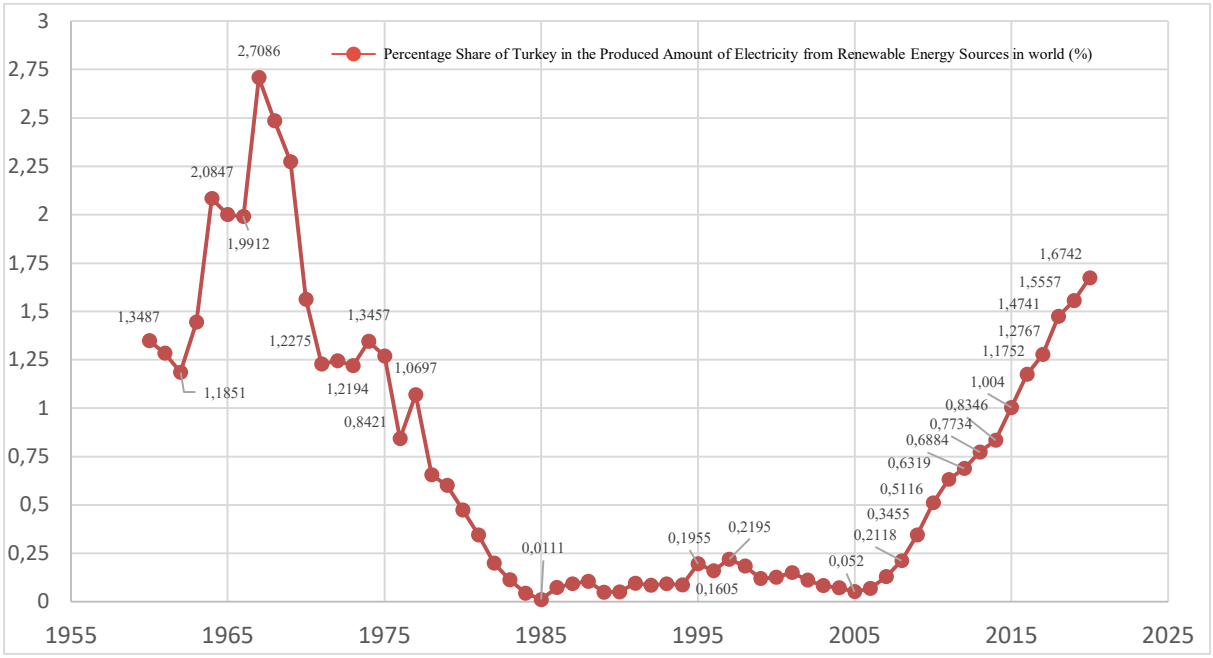

Figure 3. Percentage Share of Turkey in the Produced Amount of Electricity from Renewable Energy Sources in world between 1960 and 2020 [31,32].

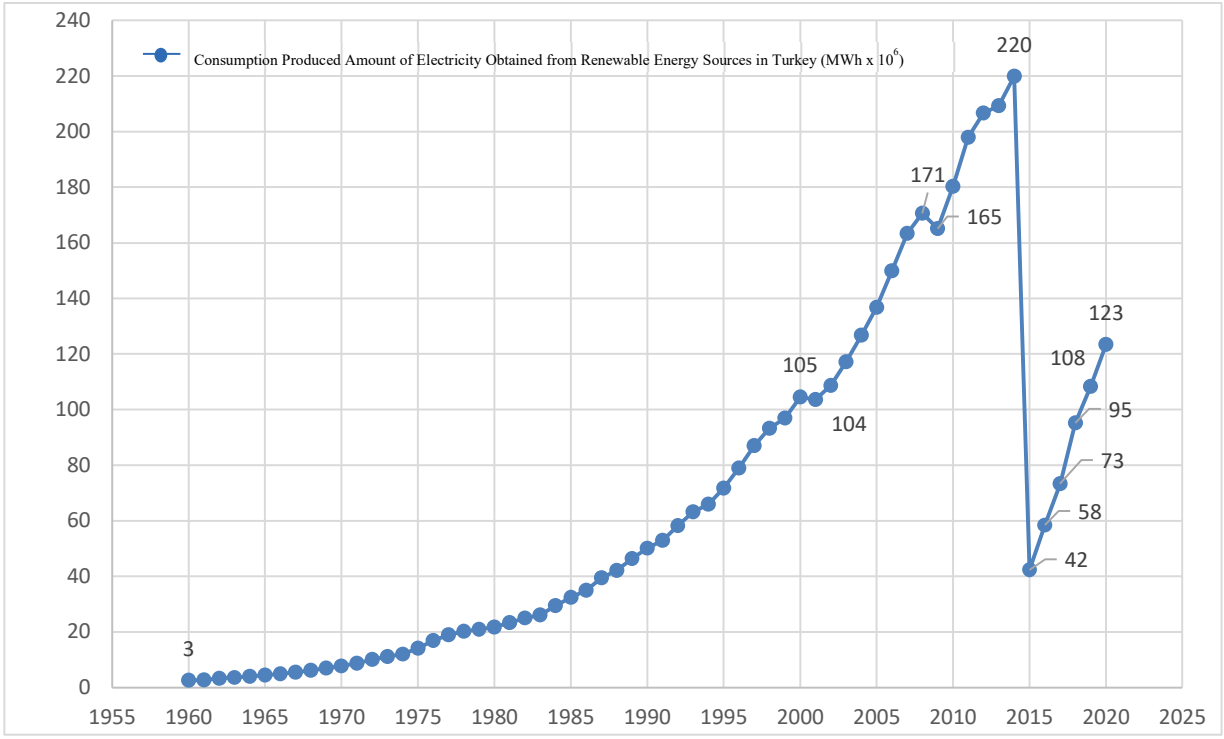

Figure 4. The consumption of electricity of Turkey, obtained from renewable energy sources between 1960 and 2020 [31,32, 33, 34, 36].

Turkey's share of renewable energy sources on energy varied between 2% and 6% before 2010. However, it was realized as 10% in 2017, 12.7% in 2018, and 14.7% in 2019. Although the rate of increase in the amount of electricity Turkey obtains from renewable energy sources was realized as 74% between 1960 and 2006 (47 years), this rate has been 99% in the last 14 years [35]. In other words, Turkey has gained a rapid acceleration in generating electricity from renewable energy sources in recent years.

In Figure 4, it is shown the consumption amount of electricity obtained from renewable energy sources by Turkey, which is required to calculate the renewable energy intensity of Turkey. In addition, the data of other countries to compare between them are included in the databases of World Bank Open Data, International Energy Agency, Energypedia International Renewable Energy Agency [31, 32, 33, 34].

Energy is the most important formation necessary for living things in the universe to continue their lives. Energy intensity is obtained by dividing the consumption amount of electricity obtained from energy sources by the gross national product. The energy intensity parameter is used to make comparisons between countries on energy efficiency [9]. The energy density is calculated by Equation 1.

$$RI = {}^{E_c}/_{GDP} \quad (1)$$

It means that RI is energy density, E_c is the consumption of electricity consumed from the energy source(s), and GDP stands for Gross Domestic Product [4].

The effect of energy consumption on economic development is explained by the concept of energy intensity [12]. Ensuring that countries with high energy intensity produce the energy are included in the Gross Domestic Product indicates that they have a high incidence of costs. This means that a country cannot use energy more efficiently than other countries. Ensuring that countries with low energy intensity produce the energy are included in the Gross Domestic Product indicates that they have a low incidence of costing. This means that a country can use energy more efficiently than other countries [4].

In order to reduce energy intensity, it is necessary to reduce the waste in energy consumption or increase the Gross Domestic Product of the country. In addition, energy density decreases because of the fact that economic development is increasing by using energy to obtain high-tech products. As the energy intensity of the country is lower, so the energy used in the country is higher [26].

Gross Domestic Product (GDP) is defined as the sum of the monetary values of the ultimate products and services produced by the operators and entrepreneurs within the country's borders in a specified period of a country whose economic development process will be examined [19]. However, if the monetary values of the ultimate products and services, produced in a country within a one-year period are calculated based on the market prices of one year, it is called real gross domestic product. In other words, the real gross domestic product represents the changes in the amount of ultimate products and services produced in borders of a country within a one-year period [11].

Economic development is expressed as the increase in the gross domestic product within a period. The gross domestic product per capita is found by dividing the total gross domestic product to the population to country. If the gross domestic product per capita is high, it means that the economic development of that country is not always high [19].

Gross Domestic Product is calculated by summing the values obtained from agriculture, industry, construction, commerce, transportation, communication, financial institutions, residences, services (Public and Private), and import tax parameters [3].

According to the Human Development Index (HDI), the top ten countries with the highest Gross Domestic Product as of 2020 among the 52 more developed countries than Turkey, were United States 20.936.600.000.000 $ Japan 5.390.716.000.000 $; Germany 3.806.060.140.124,52 $, England 2.707.743.777.173,91 $, New Zealand $2.707.743.777.173,91; France 2.603.004.395.901,95 $; Italy 1.886.445.268.340,71 $, Canada 1.643.407.977.068,93 $, South Korea 1.630.525.005.469,11 $, Russia 1.483.497.784,867,60 $ The Gross Domestic Product of Turkey has been taken place as 720.101.212.394,11 $ in 2020 [30]. The Gross Domestic Products of Turkey between 1990 and 2020 are shown in Figure 5. Figure 6 shows that having a high income does not mean that economic development will be high.

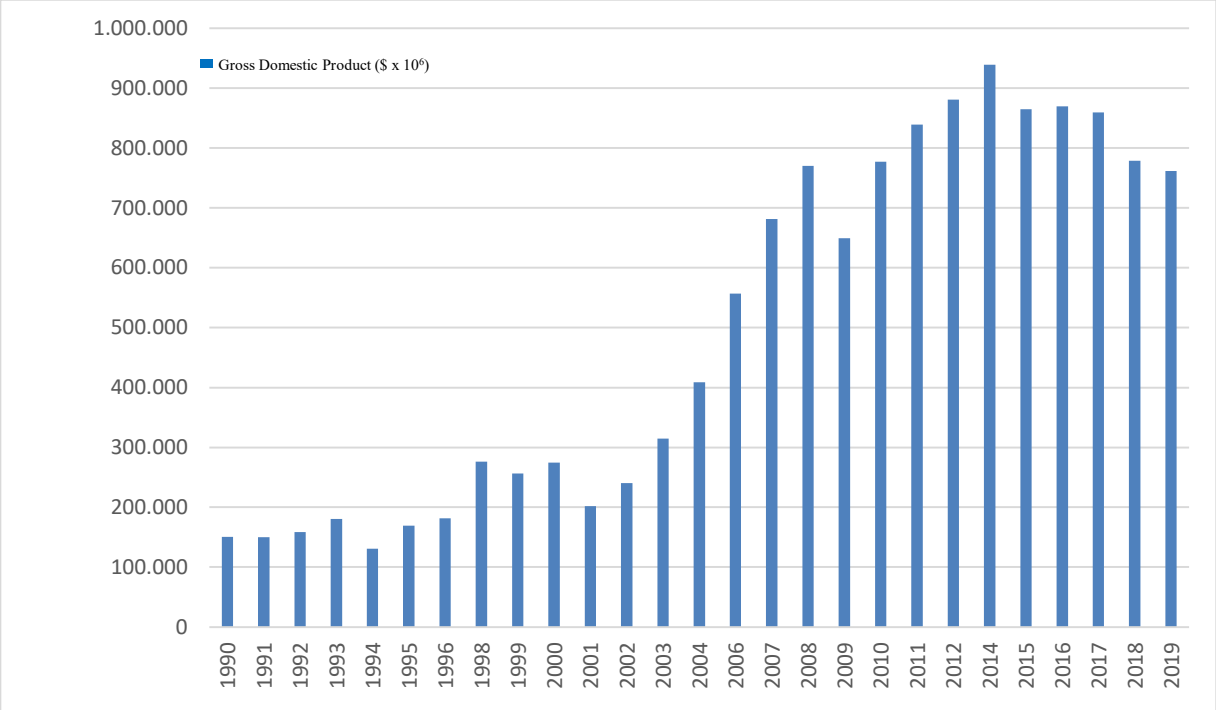

Figure 5. The Gross National Product of Turkey between 1990 and 2020 [31,35].

The wealth of a state consists of its people. The main purpose of development is to provide an appropriate environment on behalf of people to live a long, healthy, and quality life [29].

It is impossible to say that the increase of the economic growth rate enhances the quality of life, level of welfare, and purchasing power of the people of every country at the same rate. Especially in countries where economic development mostly depends on natural resources such as oil, mining, forest, agriculture, it is seen that economic growth is not possessed of a regular and continuousness system, breaks become fact in economic parameters, and improvement does not become a reality in people's welfare levels.

Different indicators, taking cognizance of different socio-cultural characteristics, have been set into motion by considering that the increase in the Gross Domestic Product is insufficient for the development of the countries [24]. The most important of these indicators is the Human Development Index, determining the level of development of countries and enabling comparison with other countries.

The report of the United Nations Development Program (UNDP) published in 2019 explained that the increase in per capita income has not been sufficient to compare development levels between countries. Nevertheless, it was stated that social factors such as education and health should also be considered [29]. In addition, countries showing more development than Turkey according to the Human Development Index are shown in Figure 6.

It is accepted that the Human Development Index is a process of increasing the importance of humanitarian values. Naturally, this acceptance is a complex phenomenon that emerges with different aspects in terms of demographic, cultural, political-legal, and socio-economic. Based on this phenomenon, the effects on the economic and national development of a country are estimated [6].

The Human Development Index (HDI) measures the level of welfare society by gathering success criteria in three characteristics. These are health, education, and income [14]. Sub-criteria are classified as socio-economic continuousness, ecological continuousness, women's empowerment, the gender gap in the course of life, and human development quality [30]. One of the three indicators used to calculate the Human Development Index is the quality of life (health), the second is the literacy and primary, secondary, and higher school status (education), and the third is the life standard (purchasing power).

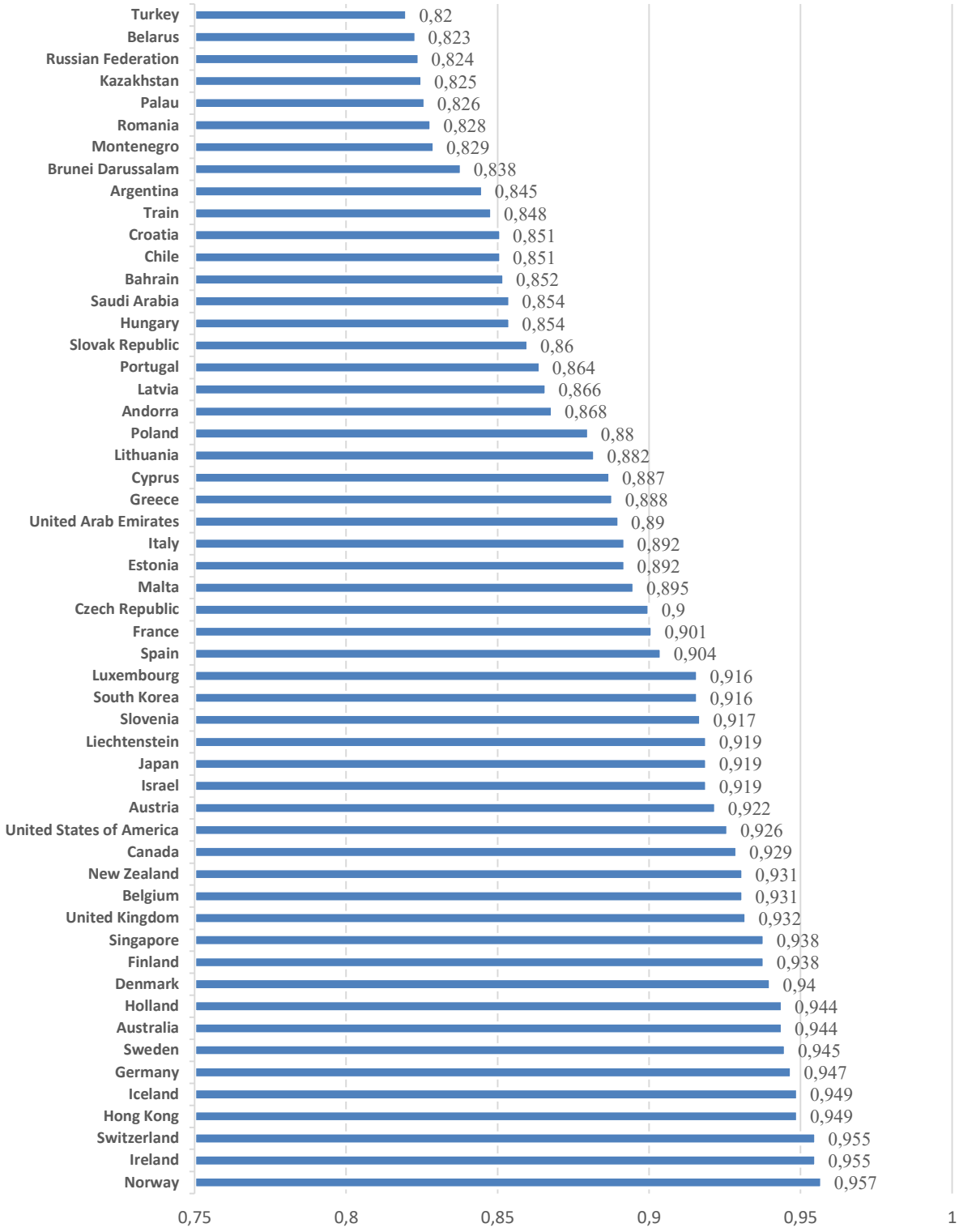

Figure 6. Countries showing more development than Turkey according to the Human Development Index [30].

THEORY

The Human Development Index (HDI) is the result acquired by calculating the arithmetic average of the values obtained from these three indicators. This result is between 0 and 1. If HDI is 1, the highest valued Human Development Index is attained, and if HDI is 1, the lowest valued Human Development Index is obtained [6]. The Human Development Index is calculated with Equation 2.

$$HDI=\frac{I_H+I_E+I_M}{3} \tag{2}$$

It means that HDI is the Human Development Index, IH health indicator (Lifetime Index), IE education indicator (education index) IM purchasing area (GDP index). Equation 3 is used to obtain the index values of the indicators [6].

$$I_{index}=\frac{I_{actual\ value}-I_{minimum\ value}}{I_{maximum\ value}-I_{minimum\ value}} \tag{3}$$

It means that I_{index} is the value of each indicator, I_{actual} value is the current indicator value of each country, $I_{Minimum}$ value is the lowest index value of the indicator, and $I_{maximum}$ value is the highest index value of the indicator. The highest and lowest index values are shown in Table 1 for each indicator [6].

Table 1. Accepted the maximum and minimum values for calculating the index values of the indicators [6].

Extent	Indicator	Min.	Max.
Health	Lifetime at birth (years)	20	83,2
Education	Expected education year	0	20,6
	Average number of years	0	13,2
Life Standard	GDP per capita ($)	163	108211

The following specified values are used for the HDI value obtained as a result of the calculations for the Human Development Index. The size used in getting the HDI value and the minimum and maximum values are given in Table 1 [6].

0,00 < HDI < 0,55 weak Human Development Index,
0,55 < HDI < 0,70 middle Human Development Index,
0,70 < HDI < 0,80 high Human Development Index,
0,80 < HDI < 1,00 very high Human Development Index.

Correlation analysis is one of the most effective statistical methods used to determine the relationships between two independent variable groups. It describes the degree of interaction between the two independent variables groups that are investigated [25]. The correlation coefficient is the quantitative expression of the results of all calculations. Correlation analysis allows determining complex and random relationships between data sets [17].

The ultimate result of each correlation coefficient is represented with the “r” symbol. Spearman and Pearson Correlation Coefficients are the two most commonly used analytical formulas, depending on the research's data types [25]. After the correlation analysis, the interpretation of the results is provided with the correlation coefficient. The correlation coefficient is expressed with “r”. It also takes a value between -1 and +1 [1].

- If the value of r is 0, there is no relationship between the two variables.
- If the value of r is -1, there is a negative relationship between the two variables.
- If the value of r is +1, there is a positive relationship between the two variables [1].

In Table 2 and Table 3, it is shown how the relationship levels between two variables are expressed, according to the intermediate values of the correlation coefficient.

Table 2. Positive relationship levels between variables according to correlation coefficient value ranges [20].

Correlation Coefficient Value Range	Relationship Level
0,90 - 1,00	Very high positive relationship
0,70 - 0,90	High positive relationship
0,50 - 0,70	Medium positive relationship
0,30 - 0,50	Weak positive relationship
0,00 - 0,30	Insignificant level positive relationship

Table 3. Negative relationship levels between variables according to correlation coefficient value ranges [20].

Correlation Coefficient Value Range	Relationship Level
0,90 - 1,00	Very high negative relationship
0,70 - 0,90	High negative relationship
0,50 - 0,70	Medium negative relationship
0,30 - 0,50	Weak negative relationship
0,00 - 0,30	Insignificant level negative relationship

The Pearson Correlation Analysis, most commonly used to measure correlation, calculates the similarity between the sampled group and the other reference group. [16]. Karl Pearson introduced the Pearson correlation coefficient to measure the relationship between two variable groups. To use this method, the number of sampling must be greater than 30 (n>30), or the received data must conform to the normal distribution. It is sufficient that one of these two conditions is attained [27]. Pearson correlation coefficient (r) is calculated with Equation 4 for x and y variables.

$$r=\frac{N\sum xy-\sum x\sum y}{\sqrt{|N\sum x^2-(\sum x)^2||N\sum y^2-(\sum y)^2|}} \tag{4}$$

It means that N is the number of data of two variables, $\sum xy$ is the sum of the multiplications of the data of two variables, $\sum x$ is the sum of the data of the x variable, $\sum y$ is the sum of the data of the y variable, $\sum x^2$ is the sum of the square of the data of the x variable, $\sum y^2$ is the square of the data of the y variable, $(\sum x)^2$ is the square of the sum of the data of the x variable and $(\sum y)^2$ is the square of the sum of the data of the y variable [28]. Spearman Correlation analysis is used in statistical analysis applications when the data of two variables have a quantitative or seriation (ordinal) scale. In addition, if the data numbers are less than 30 (N<30) and the data do not conform to the normal distribution, Spearman Correlation analysis is used [2]. While obtaining meaningfulness results with Spearman Correlation analysis, variances are neglected. In other words, while performing the analysis, the variances are not taken into account, and the differences between the variances are also ignored. Spearman's Correlation evaluates linear or nonlinear monotonic correlation relationships of data, whereas Pearson's Correlation evaluates linear correlation relationships. Spearman correlation coefficient is calculated by Equation 5 [15].

$$r_s=\rho=\frac{\frac{1}{n}\sum_{i=1}^{n}\left(R(x_i)-\overline{R(x_i)}\right).\left(R(y_i)-\overline{R(y_i)}\right)}{\sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(R(x_i)-\overline{R(x_i)}\right)^2.\frac{1}{n}\sum_{i=1}^{n}\left(R(y_i)-\overline{R(y_i)}\right)^2}} \tag{5}$$

It means that n is the number of data of the two variables, $R(x_i)$ is the ordinal numbers of x sorted variable data, $R(y_i)$ is the ordinal numbers of y sorted variable data, $\overline{R(x_i)}$ is the average of ordinal numbers of x sorted variable data and $\overline{R(y_i)}$ is the average of ordinal numbers of the y sorted variable data [15].

RESULTS AND DISCUSSION

According to the Pearson Correlation results in Table 4, a very high level of relationship was found between Turkey and fourteen countries on electricity generation from renewable energy sources. A high level of relationship was found between Turkey and thirteen countries. In other words, the very high correlation rate was 51.85%, and the high relationship rate was 48.15%. The number of observations must be less than 30, and the data must not conform with normal distribution to perform a Spearman correlation analysis.

Table 4. The results Pearson Correlation of the comparison of electricity production from renewable energy sources of Turkey and twenty seven countries by means of SPSS.

Turkey									
Countries	**r_p**	**Sig. (2-tailed)**	**N**	**Pearson Correlation Relationship Level**	**Countries**	**r_p**	**Sig. (2-tailed)**	**N**	**Pearson Correlation Relationship Level**
Australia	0,968	0,00	61	Very high positive relationship	**Japan**	0,979	0,0000	48	Very high positive relationship
New Zealand	0,796	0,0000	61	High positive relationship	**Holland**	0,899	0,0000	46	High positive relationship
United States of America	0,921	0,0000	61	Very high positive relationship	**Switzerland**	0,957	0,0000	43	Very high positive relationship
Italy	0,875	0,0000	61	High positive relationship	**Denmark**	0,816	0,0000	43	High positive relationship
Poland	0,9	0,0000	61	High positive relationship	**Canada**	0,921	0,0000	43	Very high positive relationship
Portugal	0,824	0,0000	61	High positive relationship	**Luxembourg**	0,956	0,0000	43	Very high positive relationship
France	0,961	0,0000	55	Very high positive relationship	**United Kingdom**	0,97	0,0000	37	Very high positive relationship
Iceland	0,755	0,0000	52	High positive relationship	**Hungary**	0,828	0,0000	37	High positive relationship
Germany	0,909	0,0000	51	Very high positive relationship	**Norway**	0,93	0,0000	35	Very high positive relationship
Sweden	0,882	0,0000	51	High positive relationship	**Singapore**	0,857	0,0000	35	High positive relationship
Spain	0,782	0,0000	51	High positive relationship	**Greece**	0,929	0,0000	34	Very high positive relationship
Argentina	0,836	0,0000	51	High positive relationship	**Finland**	0,891	0,0000	31	High positive relationship
Chile	0,97	0,0000	50	Very high positive relationship	**South Korea**	0,994	0,0000	31	Very high positive relationship

Belgium	0,934	0,0000	48	Very high positive relationship					

According to Table 5, although the probability values of Turkey-Ireland, Turkey-Russia, Turkey-Czech Republic, Turkey-Estonia, Turkey-Latvia, Turkey-Slovenia, Turkey-Israel, Turkey-Lithuania, Turkey-Slovak Republic, and Turkey-Romania data are less than 0.05 ($p<0.05$), according to the results of skewness and kurtosis in Table 6, since the values of "Skewness Statistic " and "Kurtosis Statistic " are not between -1.0 and 1.0, electricity generation data, obtained from renewable energy sources in Turkey and twenty two countries, do not conform with normal distribution. Therefore, the necessary conditions for performing Spearman correlation analysis are provided [13].

Table 5. The results of Normal Distribution Analysis of electricity generation data obtained from renewable energy sources in Turkey and twenty two countries by mean of SPSS.

		Kolmogorov Smirnov		**Shapiro Wilk**				**Kolmogorov Smirnov**		**Shapiro Wilk**	
	df	**statistic**	**sig.**	**statistic**	**sig.**		**df**	**statistic**	**sig.**	**statistic**	**sig.**
Turkey	29	0,196	0,006	0,836	0,000	**Turkey**	17	0,202	0,083	0,823	0,004
Ireland	29	0,292	0,000	0,653	0,000	**Croatia**	17	0,207	0,050	0,834	0,060
Turkey	29	0,292	0,000	0,953	0,000	**Turkey**	17	0,202	0,063	0,823	0,004
Russia	29	0,194	0,007	0,872	0,002	**Belarus**	17	0,241	0,010	0,811	0,003
Turkey	28	0,284	0,000	0,663	0,000	**Turkey**	13	0,193	0,199	0,884	0,082
Czech Republic	28	0,251	0,000	0,757	0,000	**Bahrain**	13	0,351	0,000	0,691	0,000
Turkey	26	0,266	0,000	0,686	0,000	**Turkey**	11	0,18	0,200	0,9	0,187
Estonia	26	0,289	0,000	0,802	0,000	**Malta**	11	0,172	0,200	0,876	0,092
Turkey	25	0,259	0,000	0,699	0,000	**Turkey**	11	0,18	0,200	0,9	0,187
Latvia	25	0,314	0,000	0,748	0,000	**Andorra**	11	0,25	0,053	0,818	0,016
Turkey	22	0,24	0,000	0,741	0,000	**Turkey**	11	0,18	0,200	0,9	0,187
Slovenia	22	0,218	0,008	0,847	0,003	**Kazakhstan**	11	0,241	0,073	0,749	0,002
Turkey	20	0,225	0,090	0,741	0,000	**Turkey**	10	0,169	0,200	0,909	0,277
Israel	20	0,261	0,001	0,697	0,000	**Train**	10	0,267	0,042	0,766	0,006
Turkey	20	0,225	0,009	0,772	0,000	**Turkey**	10	0,169	0,200	0,909	0,277
Lithuania	20	0,195	0,044	0,852	0,006	**Brunei Darussalam**	10	0,524	0,000	0,366	0,000
Turkey	20	0,225	0,009	0,772	0,000	**Turkey**	9	0,162	0,200	0,924	0,423
Slovak Republic	20	0,193	0,049	0,877	0,015	**Saudi Arabia**	9	0,275	0,048	0,797	0,019
Turkey	19	0,216	0,020	0,789	0,000	**Turkey**	8	0,149	0,200	0,936	0,568

Romania	19	0,264	0,044	0,752	0,006	**United Arab Emirates**	8	0,296	0,037	0,735	0,006
Turkey	17	0,202	0,063	0,823	0,004	**Turkey**	4	0,172	-	0,936	0,568
South Cyprus	17	0,195	0,085	0,852	0,012	**Montenegro**	4	0,255	-	0,735	0,006

Table 6. The results of SPSS skewness and kurtosis of electricity generation data obtained from renewable energy sources in Turkey and twenty two countries.

		Skewness		**Kurtosis**				**Skewness**		**Kurtosis**	
	df	**statistic**	**sig.**	**statistic**	**sig.**		**df**	**statistic**	**sig.**	**statistic**	**sig.**
Turkey	29	1,064	0,434	0,084	0,845	**Turkey**	17	1,086	0,550	-0,121	1,063
Ireland	29	1,843	0,434	2,353	0,845	**Croatia**	17	0,826	0,550	-0,808	1,063
Turkey	29	1,843	0,434	2,353	0,845	**Turkey**	17	1,086	0,550	-0,121	1,063
Russia	29	-0,057	0,434	-0,186	0,845	**Belarus**	17	1,362	0,550	0,860	1,063
Turkey	28	1,791	0,441	2,143	0,858	**Turkey**	17	0,769	0,616	-0,826	1,191
Czech Republic	28	0,601	0,441	-1,560	0,858	**Bahrain**	17	-1,990	0,616	-2,310	1,191
Turkey	26	1,682	0,456	1,723	0,887	**Turkey**	11	0,604	0,616	-1,157	1,279
Estonia	26	0,620	0,456	-1,239	0,887	**Malta**	11	0,003	0,616	-1,843	1,279
Turkey	25	1,624	0,464	1,512	0,902	**Turkey**	11	0,604	0,616	-1,157	1,279
Latvia	25	0,828	0,464	-1,175	0,902	**Andorra**	11	0,324	0,616	-1,948	1,279
Turkey	22	1,440	0,491	0,883	0,953	**Turkey**	11	0,604	0,616	-1,157	1,279
Slovenia	22	1,177	0,491	-1,805	0,953	**Kazakhstan**	11	1,929	0,616	4,154	1,279
Turkey	20	1,306	0,512	0,473	0,992	**Turkey**	10	0,501	0,687	-1,052	1,334
Israel	20	2,233	0,512	5,676	0,992	**Train**	10	-1,323	0,687	-0,543	1,334
Turkey	20	1,306	0,512	0,473	0,992	**Turkey**	10	0,501	0,687	-1,323	1,334
Lithuania	20	0,599	0,512	-1,219	0,992	**Brunei Darussalam**	10	-3,162	0,687	10,000	1,334
Turkey	20	1,306	0,512	0,473	0,992	**Turkey**	9	0,374	0,717	-1,471	1,400
Slovak Republic	20	0,273	0,512	-1,607	0,992	**Saudi Arabia**	9	-0,688	0,717	-1,645	1,400
Turkey	19	1,235	0,524	0,27	1,014	**Turkey**	8	0,232	0,752	-1,585	1,481
Romania	19	0,391	1,014	-1,882	1,014	**United Arab Emirates**	8	1,354	0,752	0,144	1,481
Turkey	17	1,086	0,550	0,043	1,063	**Turkey**	4	0,232	1,014	-0,354	2,619
South Cyprus	17	-0,121	0,550	-1,811	1,063	**Montenegro**	4	1,354	1,014	-3,013	2,619

According to the spearman correlation relationship results in Table 7, a very high-level of relationship was found between Turkey and twelve countries in terms of electricity production from renewable energy sources. In addition, it was found that a high-level relationship between Turkey and nine countries, and an insignificant level relationship between Turkey and Brunei Darussalam were determined. In other words, the very high correlation rate was 54.55%, the high relationship rate was 40.91%, and the insignificant relationship rate was 4.54%.

Table 7. The result of spearman correlation of electricity production comparison of Turkey with twenty two countries obtained from renewable energy sources by mean of SPSS.

Turkey									
Countries	**r_s**	**Sig. (2-tailed)**	**N**	**Spearman Correlation Relationship Level**	**Countries**	**r_s**	**Sig. (2-tailed)**	**N**	**Spearman Correlation Relationship Level**
Croatia	0,832	0,0000	29	High positive relationship	**South Cyprus**	0,995	0,0000	17	Very high positive relationship
Ireland	0,887	0,0000	29	High positive relationship	**Belarus**	0,971	0,0000	17	Very high positive relationship
Russian	0,811	0,0000	29	High positive relationship	**United Arab**	0,976	0,0000	8	Very high positive relationship
Czech Republic	0,881	0,0000	28	High positive relationship	**Bahrain**	0,827	0,0000	13	High positive relationship
Estonia	0,846	0,0000	26	High positive relationship	**Malta**	0,991	0,0000	11	Very high positive relationship
Slovenia	0,884	0,0000	22	High positive relationship	**Andorra**	0,995	0,0000	11	Very high positive relationship
Israel	0,934	0,0000	20	Very high positive relationship	**Kazakhstan**	0,989	0,0000	11	Very high positive relationship
Lithuania	0,955	0,0000	20	Very high positive relationship	**Train**	0,767	0,0100	10	High positive relationship
Slovak republic	0,989	0,0000	20	Very high positive relationship	**Brunei Darussalam**	0,058	0,8730	10	Insignificant level positive relationship
Latvia	0,872	0,0000	25	High positive relationship	**Saudi Arabia**	0,979	0,0000	9	Very high positive relationship

Romania	0,927	0,0000	19	Very high positive relationship	**Montenegro**	1,000	0,0000	4	Very high positive relationship

There was a high level of relationship between Turkey and three countries, a medium relationship with ten countries, a weak relationship with eighteen countries, and an insignificant relationship with eleven countries on renewable energy intensity according to the Pearson Correlation results in Table 8. In other words, the high correlation rate was 7.14%, the medium relationship rate was 23.80%, the weak relationship rate was 42.86%, and the insignificant relationship rate was 26.20%.

Table 8. The result of spearman correlation of comparison of renewable energy intensity of Turkey with forty two countries by mean of SPSS.

Turkey									
Countries	**r_p**	**Sig. (2-tailed)**	**N**	**Pearson Correlation Relationship Level**	**Countries**	**r_p**	**Sig. (2-tailed)**	**N**	**Pearson Correlation Relationship Level**
Norway	0,216	0,24300	31	Weak positive relationship	**Luxembourg**	0,323	0,07600	31	Weak positive relationship
Ireland	-0,016	0,93300	31	Insignificant level negative relationship	**Spain**	0,364	0,04400	31	Weak positive relationship
Switzerland	0,084	0,65400	31	Insignificant level positive relationship	**France**	0,495	0,00500	31	Weak positive relationship
Iceland	-0,322	0,07800	31	Insignificant level negative relationship	**Czech Republic**	0,599	0,00000	31	Medium positive relationship
Germany	-0,432	0,01500	31	Insignificant level negative relationship	**Estonia**	0,529	0,00200	31	Medium positive relationship
Sweden	0,743	0,00000	31	High positive relationship	**Italy**	0,409	0,02200	31	Weak positive relationship
Australia	0,843	0,00000	31	High positive relationship	**South Cyprus**	0,403	0,01570	31	Weak positive relationship
Holland	0,003	0,98800	31	Insignificant level positive relationship	**Greece**	0,338	0,06300	31	Weak positive relationship
Denmark	0,32	0,07900	31	Weak positive relationship	**Lithuania**	-0,053	0,77758	31	Insignificant level negative relationship
Finland	0,405	0,02400	31	Weak positive relationship	**Poland**	0,615	0,00023	31	Medium positive relationship

Singapore	-0,03	0,87200	31	Insignificant level negative relationship	**Portugal**	0,35	0,05300	31	Weak positive relationship
United Kingdom	0,281	0,12600	31	Weak positive relationship	**Slovak republic**	0,618	0,00000	31	Medium positive relationship
Belgium	0,324	0,07600	31	Weak positive relationship	**Hungary**	0,567	0,00100	31	Medium positive relationship
New Zealand	0,436	0,01400	31	Weak positive relationship	**Saudi Arabia**	0,698	0,00001	31	Medium positive relationship
Canada	0,424	0,01800	31	Weak positive relationship	**Chile**	0,725	0,00000	31	High positive relationship
United States of America	0,593	0,00000	31	Medium positive relationship	**Argentina**	0,419	0,01888	31	Weak positive relationship
Austria	0,38	0,04200	31	Weak positive relationship	**Croatia**	0,519	0,00300	31	Medium positive relationship
Israel	0,408	0,02300	31	Weak positive relationship	**Romania**	0,426	0,01700	31	Weak positive relationship
Japan	0,571	0,00100	31	Medium positive relationship	**Kazakhstan**	0,552	0,00130	31	Medium positive relationship
Slovenia	0,153	0,41200	31	Insignificant level positive relationship	**Russian Federation**	0,179	0,33422	31	Insignificant level positive relationship
South Korea	0,042	0,82100	31	Insignificant level positive relationship	**Belarus**	-0,080	0,66835	31	Insignificant level negative relationship

Table 9. The result of normal distribution analysis of electricity generation data, obtained from renewable energy sources of Turkey, Malta and Montenegro by mean of SPSS.

		Kolmogorov Smirnov		**Shapiro Wilk**	
	df	**statistic**	**sig.**	**statistic**	**sig.**
Turkey	19	0,215	0,021	0,776	0,001
Malta	19	0,411	0,000	0,634	0,000
Turkey	16	0,282	0,001	0,731	0,000
Montenegro	16	0,191	0,123	0,902	0,087

Table 10. The result of skewness and kurtosis of electricity generation data obtained from renewable energy sources of Turkey, Malta and Montenegro by mean of SPSS

		Skewness		Kurtosis	
	df	statistic	Std. Error	statistic	Std. Error
Turkey	19	1,571	0,524	1,701	1,014
Malta	19	0,877	0,524	-1,357	1,014
Turkey	16	1,537	0,564	1,221	1,091
Montenegro	16	0,147	0,564	-1,578	1,091

It is shown that the data of Turkey-Malta and Turkey-Montenegro do not conform with normal distribution when probability, skewness, kurtosis values are examined according to the results in Table 9 and Table 10. Therefore, performing Spearman Correlation analysis for the date of Turkey-Malta and Turkey-Montenegro is appropriate.

According to the Pearson Correlation results in Table 11, a weak relationship between Turkey and the two countries on renewable energy intensity was found. In other words, the weak correlation rate was 100%.

Tablo 11. Spearman Correlation results of comparison of renewable energy intensity of Turkey with two countries

Turkey				
Countries	**r_s**	**Sig. (2-tailed)**	**N**	**Spearman Correlation Relationship Level**
Malta	0,281	0,244	19	Weak positive relationship
Montenegro	0,461	0,054	18	Weak positive relationship

CONCLUSION

Relationship levels between Turkey and forty nine countries that are more development level than Turkey were determined with spearman and Pearson correlation analysis by using the SPSS program on electricity generation from renewable energy sources. In the direction of the results in Table 4 and Table 7, on electricity generation, produced with RES technology, meanwhile, Turkey has a very high relationship with twenty six countries and a high-level relationship with twenty two countries, it has an insignificant relationship with only one country. According to the Human Development Index, Turkey can produce electricity from renewable energy sources at the same quality and at the same rate of increase as forty eight of the forty nine countries with more development levels than itself. In other words, since Turkey has a very high and high level of relationship with 97.96% of these forty nine countries, it invests renewable energy resources and provides the necessary incentives like these countries.

According to the Human Development Index, on the intensity of energy obtained from renewable energy sources, relationship levels between Turkey and forty four countries with more development levels than Turkey were determined with Spearman and Pearson correlation analysis using the SPSS program. In line with the results in Table 8 and Table 11, Turkey has an insignificant relationship with eleven countries, a weak relationship with eighteen countries, a moderate relationship with ten countries, and a high relationship with only three countries regarding the intensity of energy produced by RES technology. According to the Human Development Index, Turkey has not the same renewable energy intensity as 92.86% of the forty four countries that have more development levels than itself. In other words, Turkey does not use the energy obtained from renewable energy sources effectively and beneficially as forty one of these forty four countries. It does not transferred the marginal utility from energy to economic development.

As a result, according to the Human Development Index, Turkey produces electricity from renewable energy sources, like countries with a better level of development than itself. However, it can not be used effectively and efficiently like these countries.

NOMENCLATURE

%	Percentage
G7	Developed 7 Countries
CO2	Carbon Monoxide
F$	Fiji Dollar
IEA	International Energy Agency
HDI	Human Development Index
$	American Dollar
KWh	Kilowatthour
GSYİH	Gross Domestic Product
UNDP	United Nations Development Program
SPSS	Statistical Package for the Social Sciences
TÜİK	Turkish Statistical Institute
RES	Renewable Energy Resources
p	Probability Value
Min.	Minimum
Max.	Maximum
r_s	Spearman Correlation Relationship Coefficient
r_p	Pearson Correlation Relationship Coefficient

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