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ENERGY IMPORTS AND GROWTH PERSPECTIVE: THE CASE OF TURKEY

ABSTRACT

In recent years, the main macroeconomic problem of Turkey is current deficits. In order to realize sustainable growth, the balance of payment should be kept under control. This control system is directly depends on minimization of current deficits. One of the main reasons of Turkey's current account deficits is energy imports. By applying the Johansen co-integrated analysis, this paper aims to identify the relationship between energy consumption and economic growth by using the data set between the years 1984–2012 with reference to VAR (Vector Auto Regression). Furthermore, unit root test was applied to the data which is the traditional unit root tests ADF (Augmented Dickey Fuller), PP (Phillip–Perron) and KPSS (Kwiatkowski–Phillips–Schmidt–Shin) and taking into account the structural break test was performed Zivot–Andrews. In addition to examining the long-term relationship between the two variables, taking into account the structural break in the cointegration test Engle–Granger and taking into account the structural break Hatemi-J cointegration test were applied. According to the results of the analysis, we reached that there is a relationship between energy consumption and economic growth.

Keywords: Co-integration, Current account deficits, Energy Consumption, Economic Growth, Ziwot, Hatemi-J

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INTRODUCTION

For the economies which started to go through a metamorphosis after the industrial revolution advanced technology, and for the advanced technology the energy that is needed became prominent. The notion of growth and development, the improvement of the economies, fast urbanization and advanced technology has enhanced the dependency for energy use. If the obligatory position of natural resources for countries is considered energy demand for Turkey, which has limited energy sources and is covering great distances in development, is in a way a essential necessity. Since the available natural resources are scarce Turkey meets a great deal of its energy needs through imported inputs (Bayrak & Esen, 2014:140). Constantly growing energy demand has made the countries which are limited in resources dependent on outside sources for energy.Those countries that aim for sustainability in growth and development had to face serious current deficit because of energy importation. Industrial revolution which started with coal-dependent energy use has become varied with petrol and natural gas. According to IEA's data, a great part of the energy needed on Earth is met through fossil resources (coal, petrol, natural gas) (IEA, 2013).

Developing countries has turned towards alternative energy resources after 1990's in the matter of the use of fossil fuel because of the high current deficit level caused by the importaion of fossil fuels and the criticism coming from civil society organizations. Developing countries, which includes Turkey, are known to be foreign-dependent in energy use. As a matter of fact, Turkey has gotten the first rank among these countries by meeting 75% of its energy consumption from foreign resources (Tübitak Energy Annotation). Turkey's being one of the first-20 countries of the world in energy consumption shows the size of its foreign-source dependency. In spite of being rich in renewable energy resources, Turkey, not being able to benefit enough from sun, wind, bioenergetics and geothermic faces great current deficit.

Current deficit, meaning spending more than the present income, causes domestic savings to decrease in relation to the country's income transfer and its income decrease. Scarcity of savings which is an obstacle for the actualisation of investments produces the failure to increase the produc-

tion more. Alond with this the saving deficiencies that are compensated with loan will bring about interest payments, which would lead to much bigger problems if the taken resources aren't used in more fruitful and profitable production activities. The importance of the mentioned knock-on effect and the current deficit notion is great concerning the growth which is the main purpose of the economy. In their study, Kostakoğlu and Dibo (2011) talks about the existence of a reverse relationship between current accounts deficit and growth. Yet it can be said that in the case of deficiency's stemming from input importation, increased production has a positive effect on national dividend (Kostakoğlu & Dibo, 2011). Curent deficit that effects macro indicators negatively is known as energy gap in Turkey. This situation makes it obligatory that new investments be made concerning renewable energy resources. Turkey's geopolitical position, being between Europe which has high levels of energy needs and Asia which has the most dense energy sources, creates an advantage. The advantage that this position brings shows itself as an active role in multi-national associations in areas such as reaching energy sources for lower costs, resource transfer and processing (Demir, 2013:3).

In this study, the relation between energy resources and growth for Turkey, which meets most of its energy need through importation and thus has high current deficit, wil be mentioned and the importance of renewable energy resources will be emphasized. In addition, the notions of energy, renewable energy resources and growth will be mentioned and their relations will be taked about in this study.

THE NOTION OF ENERGY AND ENERGY GROWTH RELATIONSHIP IN TURKEY

Energy resources are named in two ways that are primary and secondary energy. Primary energy resources are all of the sources of nuclear energy, solar power, wind power and fossil fuels such as coal, petrol, natural gas. And secondary energy resources are sources that are obtained by putting resources that are in primary energy form through certain processes and turning them into another form of energy such as electricity. In addition

to this, primary energy resources can be gathered in two branches which are renewable energy sources and nonrenewable energy sources. While petrol, coal, natural gas and nuclear energy are the main nonrenewable energy resources, wind energy, solar energy, biomass energy, hydrogen energy, geothermic energy and hydro-electric energy are considered as renewable energy resources. Nonrenewable energy is defined as energy that cannot be used again once it is consumed and limited in quality. And renewable energy source is known to be able to renew itself in a faster way than the consumption pace of the energy source, however fast it is used. When energy potentials are looked into as two sections, being fossil fuels and renewable energy resources, it is seen that Turkey isn't a rich country in terms of fossil resource types other than lignite. Along with this, it is known that lignite isn't a fruitful source due to its low calorific power. In terms of renewable resources Turkey is rich in hydraulic, wind, solar, geotheermic and biomass energy potential yet it cannot use theses resources enough.

Turkey imports 75% of its total energy comsumption from abroad and it obtains only 15% of the total consumed energy from renewable resources (ETKB, TÜBİTAK Energy Annotation).

ENERGY PRODUCTION, ENERGY CONSUMPTION AND GROWTH RELATION IN TURKEY

Energy consumption is constantly in tendency to increase in parallel with the desire of economic growth, increment in social welfare level, technological advancement and population growth. This increasing energy consumption is in active position despite important regional changes (Akova, 2008; Bahar, 2005, p. 38; Yüksel & Kaygusuz, 2011).

After 1980, which falls into the period in which industry market livened up and machinary use became widespread, energy need in Turkey naturally increased quite a bit. Considering that the country development is directly connected to increment in production, it should be seen natural that there has been an increasing trend of energy consumption for years. When the energy consumption of the 80's is examined in terms of existing energy

resources, that there weren't many other alternatives for fossil fuels, of course, resulted in energy consumption's being built highly on fossil fuels.

Energy consumption that increased as a consequence of the effect of the rapidly growing population and the growth in industry market made Turkey, which is not rich in fossil fuels, foreign-dependent. When we examine the production factors in terms of production level that is necessary for economic growth, the basic inputs we will see are recess, capital goods and energy. When looked into Turkey's energy production profile, it is seen that imported ones are mostly encountered in the recruitment of these inputs. It is known that domestic energy production in Turkey is vey weak in meeting energy importation. As can be seen on Table 1, from 2013 on Turkey can produce only the 35% of its total energy consumption.

Table 1. Coverage Ratio of Energy Consumption

Year	Domestict Energy Production	Total Energy Consumption	Coverage Ratio
2004	24,332	69,004	35.26
2005	24,549	71,510	34.33
2006	26,580	77,440	34.32
2007	27,454	82,748	33.18
2008	29,209	79,624	36.68
2009	30,328	80,574	37.64
2010	32,493	83,372	38.97
2011	32,229	83,110	38.78
2012	33,485	86,224	38.83
2013	31,944	90,002	35.49

Source: ETKB, www.enerji.gov.tr.

According to the Energy and Natural Resources Ministry's energy statistics report of 2013, 45%of Turkey's electricity production of 2013 is obtained from natural gas. Respectively 25% of hydroelectric, 12% of lignite and 12% of imported coal follows this. And in the light of the same data it is observed that 70% of the electricity production is obtained from fossil resources.

The most used renewable energy resource in energy production in Turkey are hydro-electric power plants. The share of these power plants in the total electricity production is 25%. Renewable energy resources that are more environment-friendly compared to hydro-electric power plants are not as much benefitted in Turkey as in countries that are geographically similar in terms of solar and wind energy. Renewable energy's share in the total energy consumption in Mediterranean countries such as Italy and Spain is respectively 13% and 18% while it is 2.2% in Turkey (BP, 2014).

A negative situation that is similar to that of renewable energy use can be seen in current account balance. Considering that current deficit and growth are inversely proportional, it should sure be important that current deficit is one of the most important problems of Turkey's economy. Turkey's current deficit of 2014 was 45.8 billion dollars (TCMB, 2014).

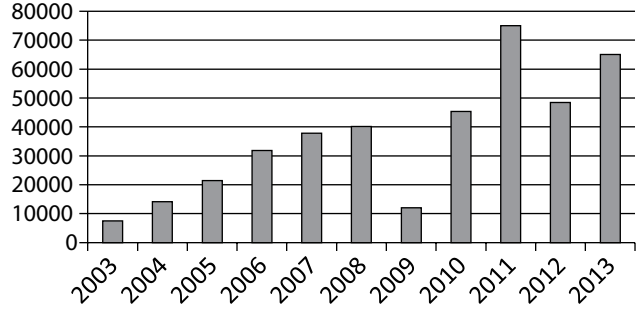

Figure 1. Turkey's current account balance by years (Billion Dollar)

Source: TCMB.

As seen in Figure 1, there has been a constant increase in the current deficit since 2003. In developing Turkey, this being an expected situation, the main reason of the sudden fall in the year 2009 is for sure the global crisis of 2008. As known the economies of the world has been shaken deeply by the 2008 global crisis that originated in USA. Considering USA's place in world economies, this economy's going into stillness is sure to affect world economies. That is, all the world economies including Turkey entered into a serious state of stillness as a result of the aforesaid crisis.

Total demand has fallen in international markets and demand for energy products and advanced technology products has fallen. And this is the main reason why curretn deficit fell in 2009.

Table 2. Energy Importation and Total importation of Turkey

Year	Current Account Balance	Total Import	Balanced of Foreign Trade	Energy Importation	Energy Import/ Total İmport
2000	-9,920	54 502	-26 727	9,540	17.5
2001	3,760	41 399	-10 064	8,339	20.14
2002	-626,000	51 553	-15 494	9,203	17.85
2003	-7,554	69 339	-22 086	11,575	16.69
2004	-14,198	97 539	-34 372	14,407	14.77
2005	-21,449	116 774	-43 297	21,255	18.2
2006	-31,837	139 576	-54 041	28,859	20.68
2007	-37,779	170 062	-62 790	33,883	19.92
2008	-40,192	201 963	-69 936	48,281	23.91
2009	-12,010	140 928	-38 785	29,905	21.22
2010	-45,313	185 544	- 71 661	38,497	20.75
2011	-75,050	240 841	-105 934	54,117	22.47
2012	-48,494	236 545	- 84 083	60,114	25.41
2013	-65,034	251 661	- 99 858	55,915	22.22

Source: TÜİK, TCMB, ETKB.

All the numbers of current account balance, total importation, balance of foreign trade and energy importation can be found in Table 2. Based on this data, the energy importation's share in total importation was calculated and added to the table. For years current balance has had a deficit in Turkey except for 1998 and 2001. The numbers of balance of foreign trade, total importation and energy importation has implicitly been on the trend of ascent. Without doubt, this outcome is an expected one for a developing country. In Turkey between the years of 2004–2014 energy importation took place as much as the 85% of the approximate current deficit amount. In the last 10 years approximate energy importaion's share

in the total importation is 21%. When the same evaluation is made for the previous decade, approximate energy importation's share in the total importation is 14%. As seen in Table 2, Turkey's dependency on foreign sources for energy is increasing year by year. If we look at the relation between energy and growth in the perspective of Figure 3 and Figure 4, the increment in both periods can be seen. A similar rise and fall can be seen in the same years.

In Figure 2, energy consumption and GDP's (Gross Domestic Product) year-by-year change percentage is shown in graphics. As can be seen in the figure, successive breakages exists in both components. In the time period except between 2003 and 2007, there is an equalisation in the course of energy consumption and GSYİH. In the last 15 years 1999 Russian Crisis and the big earthquake that folowed it, the big crisis that began in banking sector and grew in 2001 and the mortgage crisis of 2008 shows markedness.

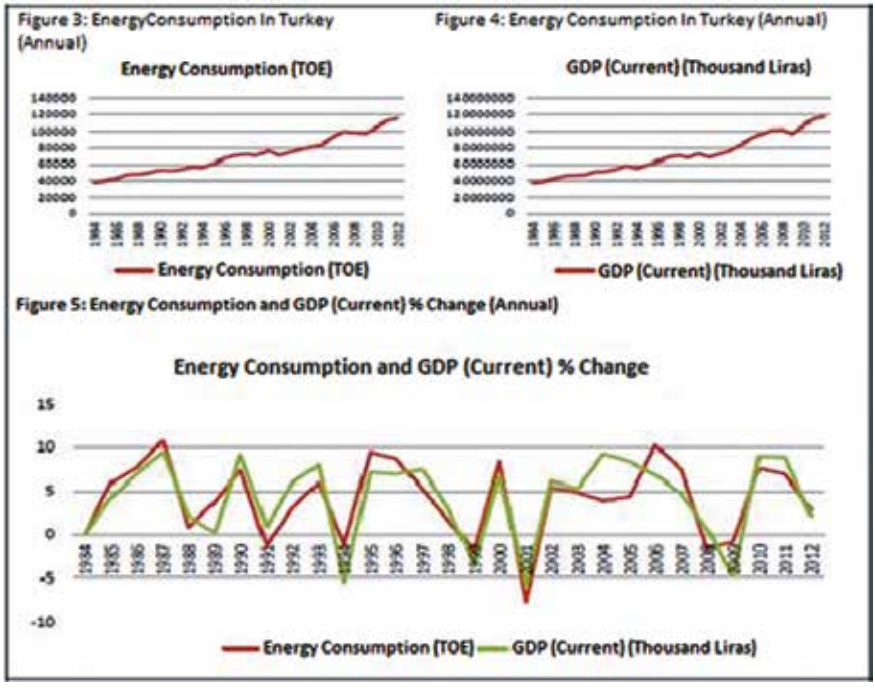

Figure 2. Energy Consumption and GDP (Current) % Change (Annual)
Source: ETKB, www.enerji.gov.tr.

LITERATURE VIEW

There are various studies in Turkey and in the world aiming towards the relationship among energy, current deficit and economic growth. These studies emphasize the importance of the causation relationships among the aforesaid variables in terms of policies that will be applied.

Together with the relation between energy and growth's being the subject of many studies, it was examined for the USA economy for the first time by Kraft and Kraft (1978). Data that belonged to the years 1947–1974 was worked with and the conclusion that there occurs a causation from growth to energy consumption was reached.

Murry and Nan (1996) applied thte standard causation test to their 15-country study, which includes Turkey and 14 other countries, with the help of data from the years 1970–1990. In the conclusion of the analysis came out results that are indigenuos to countries and the causation relation for Turkey came out as 'from electricity production to income'.

Hondroyiannis vd. (2002), by using the data of the years between 1960–1996 for Greece, examined the relation between energy consumption and economic growth by using the vector error recovery model. In the empirical study, it was observed that in the long run the variables of energy consumption and growth were cointegrated and energy consumption was active in the determination of economic growth.

Paul and Bhattacharya (2004) analysed the causal relationship between energy consumption and economic growth for India. Engle–Granger, by applying the causation test, showed that the variables are in mutual interaction with the help of data from the 1959–1996 period.

Lise and Montfort (2007) tested the relation between energy consumption, which was expected to show a high increment, and GDP. In the study in which the data from 1970–2003 was used, the results of cointegration and vector error recovery model showed that variables act together in the long run and causation occurs from GDP towards energy consumption.

In their study Kar and Kınık (2008) examined the relation between total electricity consumption and economic growth for the period of 1975–2005 using the cointegration approach and vector error recovery method and as

a result detected that variables are cointegrated and between this variable pair exists a long term relationship.

Erdal vd. (2008) analised in their study the causation relationship between energy consumption and real GNP (Gross National Product) fot the 1970–2006 period for Turkey. Johansen cointegration and Pairwise Granger causation test results have showed that there is a connection between the handled variables.

Telatar and Terzi (2009) made Granger Causation and VAM (Vector Autoregressive Model) analysis in this study that investigated the relation between growth rate and current deficit in Turkey. Used data belongs to the 3-month periods of years 1991 and 2005. The conclusion that there is a one-way and statistically significant causation from growth rate towards current account balance was reached.

Mucuk and Uysal (2009) analysed the relationship bewteen the economic growth and energy consumption in Turkey with the data from 1960–2006 using unit root, cointegration and Granger causation analysis. They showed that in the long run energy consumption and growth move together and that the relationship between variables occur from energy consumption towards economic growth using Granger causation test and that energy consumption affects growth in a negative way.

Tsani (2010) in his study made an evaluation on industry market and energy consumption using the data of the 1960–2006 period in his analysis made with Granger causation and VAM analysis. In the study it was observed that causation occurs from energy consumption towards GDP.

In the study, Yanar and Kerimoğlu (2011) analysed the relationship among current deficit, economic growth and energy consumption for the years 1975–2009. In consequence of Johansen cointegration, action-reaction and variance distintegration, it was seen that an increment taking place in energy consumption highly affects the GDP.

Demir (2013) made Johansen cointegration and VAM analysis among current deficit, industry production index and energy importation using data from 1987 to 2012. In te study, the conclusions that Turkey's energy demand occurs depending on production increments and that production increment causes current deficit by increasing energy demand.

THE RELATIONSHIP BETWEEN ECONOMIC GROWTH AND ENERGY IMPORTS: THE CASE OF TURKEY

In this part of study, unit root test was applied to the data which is the traditional unit root tests ADF (Augmented Dickey Fuller), PP (Phillip–Perron) and KPSS (Kwiatkowski–Phillips–Schmidt–Shin) and taking into account the structural break test was performed Zivot–Andrews. In addition to examining the long-term relationship between the two variables, taking into account the structural break in the cointegration test Engle–Granger and taking into account the structural break Hatemi-J cointegration test were applied.

DATA AND METHODOLOGY

In this study, which examined the relationship between economic growth and energy imports after the neo-liberal policies implemented in Turkey, we worked with energy imports and GDP data (Gross domestic product) for the 1984–2012 period. Also all series were taken in logarithm.

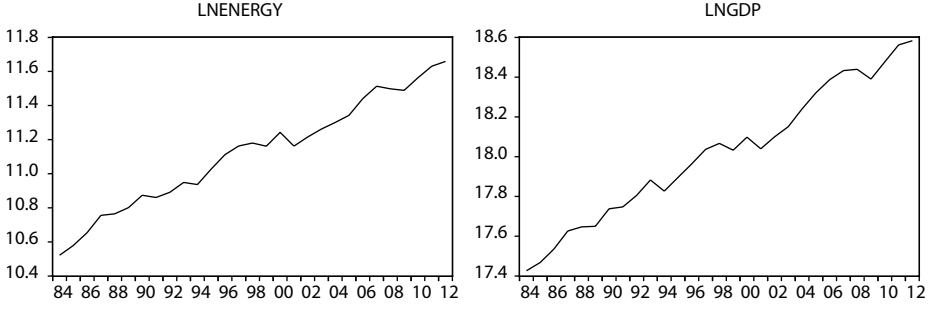

Figure 3. Graph of Series

THE RESULTS OF THE UNIT ROOT TESTS

If we mention about statistically significant the relation between the two time series, we have to assign whether the relation is superious or not. If two series are stationary at same level, the relation between them is not

a superious relation. These series are named as cointegrated series. Time series stationarity is a statistical characteristic of series' mean, variance and covariance over time. If they are constant over time, then the series are said to be a stationary process, otherwise, the series is described as being a nonstationary process. Different unit root tests are used in the literatüre. In this study, series of stationary was analyzed using Dickey–Fuller (1979), Phillips–Perron (1988), Kwiatkowski–Phillips–Schmidt–Shin (KPSS), Zivot–Andrews (1992) tests.

Table 3. ADF, PP and KPSS Unit Roots Test

Table 3.a. The results of Lnenergy

	Test Statistics		
	ADF	PP	KPSS
Level	-0.90	-0.95	0.69
First Differences	-5.80	-6.01	0.10
	Test Statistics		
%1	-3.68	-3.68	0.73
%5	-2.97	-2.97	0.46
%10	-2.62	-2.62	0.34

Table 3.b. The results of Lngdp

	Test Statistics		
	ADF	PP	KPSS
Level	-0.58	-0.61	0.69
First Differences	-5.82	-5.96	0.17
	Test Statistics		
%1	-3.68	-3.68	0.73
%5	-2.97	-2.97	0.46
%10	-2.62	-2.62	0.34

Lag value was determined according to SIC (Schwarz Info Criterion) criteria. As it is seen from table 2, all of the variables in the model is not stationary on level but taking first differences they are becoming stationary.

One of the most widely used unit root test in presence of a structural break is the Zivot and Andrews test. Zivot and Andrews (1992) developed a test that includes the time of the break internally. Zivot and Andrews (1992) test which takes the possible structural break into consideration allows, only a single structural break in the trend function. Zivot and Andrews (1992) performed the unit root test on three different models. Model A, of these models, allows a change in the level (intercept) of the series; Model B allows a change in the slope of the series; Model C allows change in both the level and the slope of the series. The hypothesis for Zivot and Andrews (1992) test can be expressed as below;

H_0: There is unit root in the series
H_1: The series is stationary with a structural break in the trend

Table 4. Zivot–Andrews Unit Root Test Results

Lnenergy	Model A	Model C
Test Statistics	-4.82	-4.74
Lag Length	4	0
Break Date	2001	2001
Critical Values (%1–5–10)	-5.34 , -4.93, -4.58	-5.57, -5.08, -4.82

Lngdp	Model A	Model C
Test Statistics	-4.03	-3.94
Lag Length	0	0
Break Date	1999	1999
Critical Values (%1–5–10)	-5.34 , -4.93, -4.58	-5.34 , -4.93, -4.58

Cause of the absolute value of the Zivot–Andrews unit root test statistic is smaller than the critical value we accepted the null hypothesis, so series are not stable under the structural breaks. In summary, unit roots that contained by series are not false, series are not stationary.

COINTEGRATION ANALYSES

Engle–Granger Cointegration Test. This test can be done using one of the following regressions:

$$Y_t = \alpha_0 + \alpha_1 X_t + u_{1t}$$
$$X_t = b_0 + b_1 Y_t + u_{2t}$$

Using the regression et residual is obtained. So,

$$e_t = \delta e_{t-1} + v_t$$

regression is obtained. Applying the ADF unit root test to the et residual series is whether series is stationary. If the series contains unit root, it is not stationary and decided that they are not cointegrated variables Yt and Xt. Conversely, if the series do not contain unit root, they are cointegrated. In case of two series are cointegrated, the series must be a causal relationship between at least one direction (Tarı, 2010). If they are not integrated series of the same degree, Engle–Granger approach is not used.

Table 5. Engle–Granger Cointegration Test

Test Statistics	Critical Values (%1–5–10)
-1.86	-4.41 -3.61 -3.23

According to the results in the above table, there is no cointegration relationship between the variables in all the significance level so they do not move together in long-term.

Hatemi-J Cointegration Test. In order to test for cointegration characteristics between variables under the consideration of a structural break presence, the Gregory and Hansen (1996) test was employed for a case where one structural shift was detected. This test allows for the break in the three alternative models, such as a break in the level (model C), in the level with trend (model C/T), and in the level and slope coefficients

(model C/S). For a case where the Bai and Perron (1998) test detected two breaks, the Hatemi-J (2008) test was employed. The Hatemi-J (2008) test is an extended procedure of the Gregory and Hansen (1998) method to allow for two structural shifts in three different models: model C, model C/T and model C/S.

Table 6. Hatemi-J Cointegration Results

	Test Statistics	Critical Values (%1–5–10)	Break Date
Model C (Level Shift)	-4.87	-6.50 -6.01 -5.65	1989 1998
Model C/T (Level Shift with Trend	-5.32	-6.50 -6.01 -5.65	1990 1998
Model C/S (Regime Shift)	-8.99	-6.50 -6.01 -5.65	2002 2002

Cointegration test statistics based on Hatemi-J results, except model C/S, are smaller than the ciritical value. Accordingly, there is a long-term relationship between variables only at model C.

CONCLUSION

Energy demand in Turkey, while the industrial revolution until today, has been continuously increasing. Turkey is not rich in fossil fuels and resolve its energy needs by importing large amounts of energy. Therefore, due to the increasing energy demand in recent years has increased the current account deficit.

Considering the overall progress of Turkey's economy, growth is ensured through imports. Therefore, according to the analysis, the variable energy imports and GDP is expected to move together in the long term. Results of the tests were observed long-term relationship between variables.

Most of the energy used in Turkey is oil and its derivatives. In order to increase Turkey's growth rate, energy consumption, and therefore needs to increase its energy imports. For this reason, in the long run, it is necessary to give priority to increasing domestic production and use of natural resources.

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