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The Effect of Energy Consumption on Economic Growth in Industrialized G8 Countries (1990-2011)

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Abstract
Consumption of energy, due to its unique characteristics can transform a society and job framework. This question about Germany, Italy, Britain, Japan, France, America, Russia, Canada is also true. In this study, using panel data, Influence factors of energy consumption and economic growth have been reviewed in industrialized countries of G8 in the period 1990 to 2011 and has been tested the long-term concurrent relationships between variables based on the model of error correction method and is calculated for each variable. The results indicate that the labor force is in the first or second generation and increasing it will increase production. In other words, G8 states of the workforce are still not saturated and labor is considered as one of the most important growth factors. Physical capital is a basic requirement for the development of G8 countries and the need to increase investments and an increase in physical capital for economic growth is felt. Many factors affect the energy is positive and significant. For example, the consumption of gas has the most significant effect on economic growth indicating that gas energy technologies have higher productivity and economic growth further increases. After gas, energy technology of the different ways of producing electricity has a significant positive effect on the way G8 countries. Water as an energy technology has some negative effect on production. Effects of nuclear energy technology are also positive and significant, but small.

Keywords: energy factors, economic growth, industrial G8 countries

1 - Introduction

With the advent of technology and expansion of energy consumption at the community level, and micro-economic variables have been changed. One of the Macroeconomic variables is economic growth. Manufacturing, energy, due to its unique characteristics, can transform a community job framework that this question about Germany, Italy, Britain, Japan, France, America, Russia, Canada is also true. Since the G8 economic growth in industrialized countries is an important issue to investigate the effect of technological change on this energy consumption. In this study, the impact of energy consumption on economic growth has been study in industrial manufacturing of G8 by using a macroeconomic model. Energy debate as one of the major factors in the continuing growth of industrialized countries that important economic and

social development of other countries. The issue of Iran, because of the central role of energy products, especially high share of the proceeds of crude oil income and the subsidies paid to the consumption of energy carriers increased importance within the whole. With advances in econometric techniques and different tests focused on determining the effects of these two variables. G8 energy industry is a driver of economic growth drawers or economic growth has led to an increase in energy, manufacturing, especially in developed countries due to competing demands for scarce resources, diagnosis is essential for energy management.
In this study, short-term relationship between energy consumption and economic growth in industrialized countries G8 technological using a long-term relationship between the variables and the application of concurrent error correction model, adjust quickly to deviations from long-term equilibrium is calculated for each variable.

2 - Theoretical and research background

2-1 - The relationship between economic growth and energy consumption, Capital and labor, both specialist and non-specialist that are the most important factors affecting economic growth, in which the functions are considered. The new growth theory is the energy factor model, but its importance in various models, not identical.

Stern (1993), quoted Aires and Nair (1984), states that the biophysical model of growth, energy is the most important factor. Labor and capital, the factors that are directly linked to the use of energy. Also, Stern (1993) as quoted by neoclassical economists

Like Brent (1978) and Denison (1979, 1985) argues that the energy of the impact on labor and capital, the indirectly affect economic growth, but does not directly affect economic growth.
Today, the new growth theories, in addition to capital and labor inputs, as one of the leading energy inputs are considered in the discussion of macroeconomic in production and function of the inputs of labor, capital and energy is considered. It is assumed that the utilization of these inputs and production levels, there is a direct relationship. On the other hand, energy consumption is the inverse function of its price

Energy change, no matter is energy, and therefore GDP (Maleki, 1378: 12).

If it is assumed that the determination of the total supply in macroeconomics, labor,

Variables and other factors are constant, In this case, the rise in energy prices and thereby reducing the demand for it causes reduced labor productivity , then the demand curve for labor is shifted to the left resulting in reduced employment levels.

Loss of employment, reduction of the national product and price increases, in this case, the total supply curve is shifted to the left.

Also, the energy price shock in general level of prices by increasing the cost of production increases, In this case the components of aggregate demand is reduced and macroeconomic aggregate demand curve shifted to the left and reduces real national product (Ahmadian, 1378: 14).

2-2 – The effect of Technology of energy consumption and economic growth in industrialized countries

Degree in economics, an issue that is too important and has been far too much attention and energy technology and its impact on economic growth, the G8 industrial countries. The issue is the question of which variable takes precedence over the other. The G8 industrial manufacturing, energy consumption, economic growth is unity or economic growth has led to

an increase in energy, manufacturing, especially in developed countries due to competing demands for scarce resources, diagnosis is essential for energy management.

With the advent of technology and expansion of energy consumption at the community in level, micro-and macroeconomic variables are subject to change. Macroeconomic variables of economic growth like manufacturing, energy, due to its unique characteristics, can work within the system and transform a society.

This question about Germany, Italy, Britain, Japan, France, America, Russia, and Canada is also true. Since the issue of economic growth in industrialized countries G8 is a major issue, on examining the impact of technological change on this energy consumption is an important point.

2.3 - Energy consumption and energy intensity per ¬

Relative abundance of energy resources has resulted in the per capita consumption and energy intensity (Amount of energy used to produce a certain quantity of goods and services) compared to countries with similar structures and less energy is higher.

In other words, the somewhat high per capita consumption of energy commodities and energy intensity are justified in Iran. However, due to the abundance and richness of Iranian energy resources, It can be an advantage in energy-intensive industries and economic activities and may partly explain the logic high energy intensity, but the data Indicates that the country's energy intensity is higher than in most OPEC countries.

Although approximately high energy intensity in Iran is because of inefficiencies in the Iranian society, however, the energy sector in recent decades could explain part of this phenomenon. Although in recent years the share of natural gas (lower emissions) of the country's total energy consumption has increased, but it should be noted that generally a high level of energy intensity can have negative effects on the environment that can adopt favorable policies toward the energy demand and supply, out of vehicles, engines and old equipment and replace it with a new car, especially in the energy sector;

The domestic and commercial, transport, industry and power generation, while increasing energy efficiency, reduce energy intensity (energy balance, 1381).

Using various indicators of energy intensity, Energy can be more carefully examined.

Table (3), the country's total energy intensity and energy intensity of agriculture and transport sectors Based on information contained in the internal energy balance of the show.

It should be noted that energy intensity in other sectors, In order to calculate the energy consumption of the different subdivisions what is the value of that part is used in the calculation, is not provided.

Although a review of the country's total energy intensity in the period 85-1376 shows the index average growth rate of 2/0 per year has increased, but of growth in 1384 to 4 percent in 1385 to about 5/2 percent, much longer than the average period is discussed. Growth of energy intensity in the period 85-1376 in agriculture and transport, 72/1- and 14/0-, respectively, and in 1385 the 4/5 and 8/6- respectively. Thus, the energy intensity of the sector declined in the period 85-1376 and therefore have a negative impact on the overall energy intensity, thus the total energy intensity of positive growth during this period, especially in the years 84 and 85, could be due to increased energy consumption in other sectors such as domestic sectors. Also, the quantities of energy intensity in this sector, It is clear that creating value added in the transport sector requires a great deal of energy consumption.

2.1 - Background Investigations

Prjys and Paynh (2011), based on panel cointegration techniques and VECM panel To examine the relationship between renewable energy consumption and economic growth (2006-1980) For the six Central American countries began. Also, the causality between variables in renewable energy consumption and economic growth in these countries set
And these results were The long-run equilibrium relationship between the variables of renewable energy,
Economic growth, capital and labor have been established And a two-way causal relationship between energy consumption and economic growth there. Prjys and Paynh (2010) using panel cointegration tests And using data from 13 countries in Central Asia for the period (2007-1992) To examine the causal relationship between renewable energy consumption and economic growth have
And showed that long-run equilibrium relationship between GDP, renewable energy, Gross domestic fixed capital formation and labor there. Also, the results indicate that both short-term error correction model Bidirectional causality between renewable energy consumption and economic growth in the long run there. Ready and colleagues (1388), in a study using Recurrent Pattern Distributed Lag (ARDL) Error correction model (ECM), the long-term and short-term relationship between the consumption of energy And final consumption of energy carriers include petroleum products, electricity, gas Economic growth and employment in various sectors of the economy during the 82-1350 Examined. The results showed that a causal relationship between short-term and long-term one-sided final consumption of energy final energy consumption and economic growth exists. A causal relationship between short-term economic growth as a way of final consumption of natural gas is available. In addition, a one-way causal relationship between consumption of final energy Growth in the manufacturing sector value added in this sector and a causal relationship between short-term and long way from final consumption of electricity in agriculture to increase added value there. 3 - Research model and variables Given that most of the energy consumption in these countries, electricity consumption is More technology is different according to the data available in the field of power generation is considered Of course, other fossil energy and nuclear power, oil and gas has been studied in model The variables in the research model are as follows:
Fossil energy, nuclear energy, electricity production from fossil sources, electricity generation from hydro sources, Electricity production from natural gas, electricity production from nuclear sources, power generation, oil, Electricity production from oil, gas and fossil resources and physical capital and labor Statistics are calculated using the World Bank And for the period 1990 to 2011 has been studied.

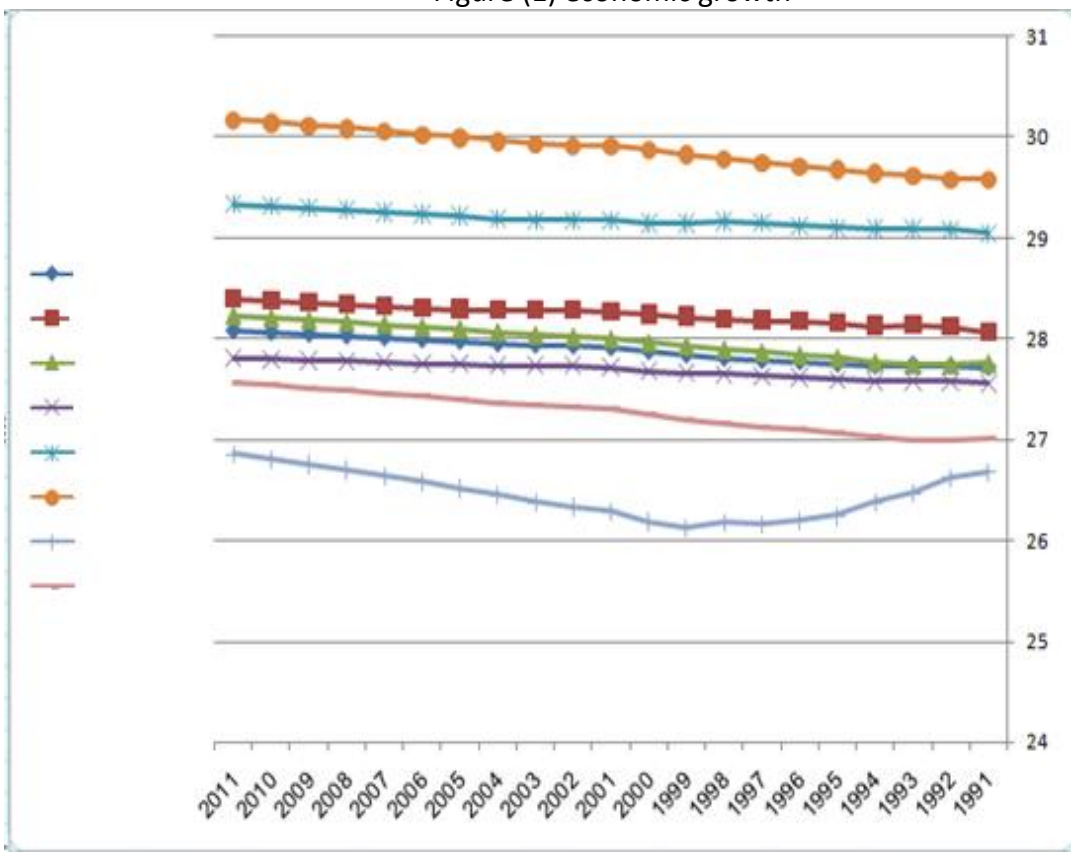
$$LY = \alpha_{.} + \alpha_{1} LX_{1} + \alpha_{2} LX_{2} + \alpha_{3} LX_{3} + \alpha_{4} LX_{4} + \alpha_{5} LX_{5} + \alpha_{6} LX_{6} + \alpha_{7} LX_{7} + \alpha_{8} LX_{8} + \alpha_{9} LX_{9} + \alpha_{10} LX_{10} + \alpha_{11} LX_{11} + \alpha_{12} LX_{12} + \varepsilon$$

Variables used in this study are as follows:
The dependent variable is economic growth and Independent variables: labor, physical capital, a variety of energy technologies (Consumption of fossil energy, nuclear energy, electricity production from fossil sources, electricity generation from hydro sources, electricity production from natural gas, electricity production from nuclear sources, power generation, oil, power generation, oil, Gas and fossil resources. In this study, using a macroeconomic model to study

the impact of energy consumption on economic growth of technological G8 industrialized countries is Using panel data to estimate the model And examine variables on economic growth has been studied And tests associated with it have been studied.

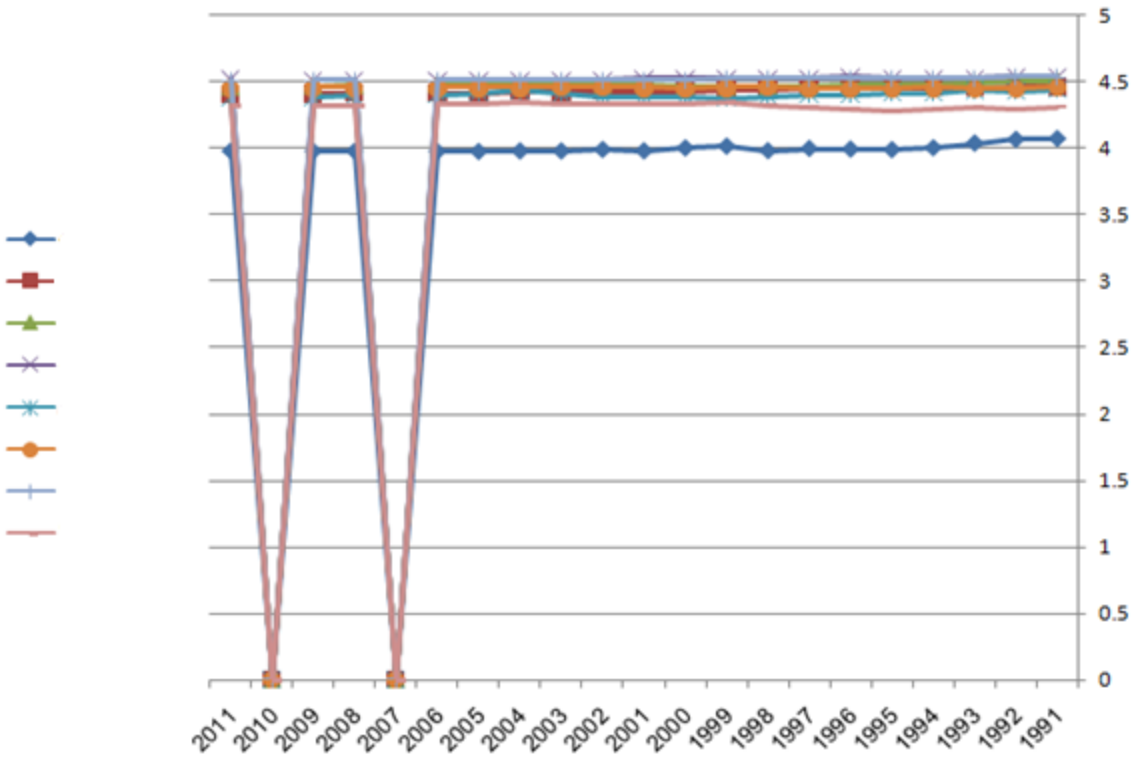
4 - Evaluation of process variables

Figure (1) economic growth



Source: Institute for International Energy Studies, 1391.

Graph (2) the fossil energy technologies



The fossil energy technologies in all surveyed countries except Canada have a constant trend.

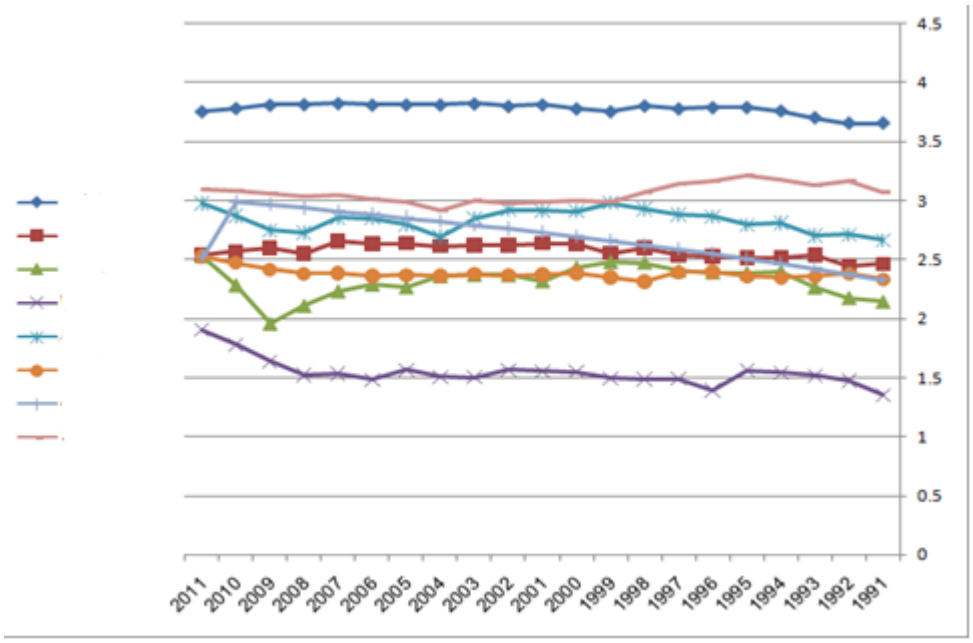


Figure (3) trend atomic energy and its alternatives

Suggests that the nuclear energy and its alternatives

France has the highest level of technology has been the Energy and Italy the lowest level of technology in the extraction and consumption of energy is located.

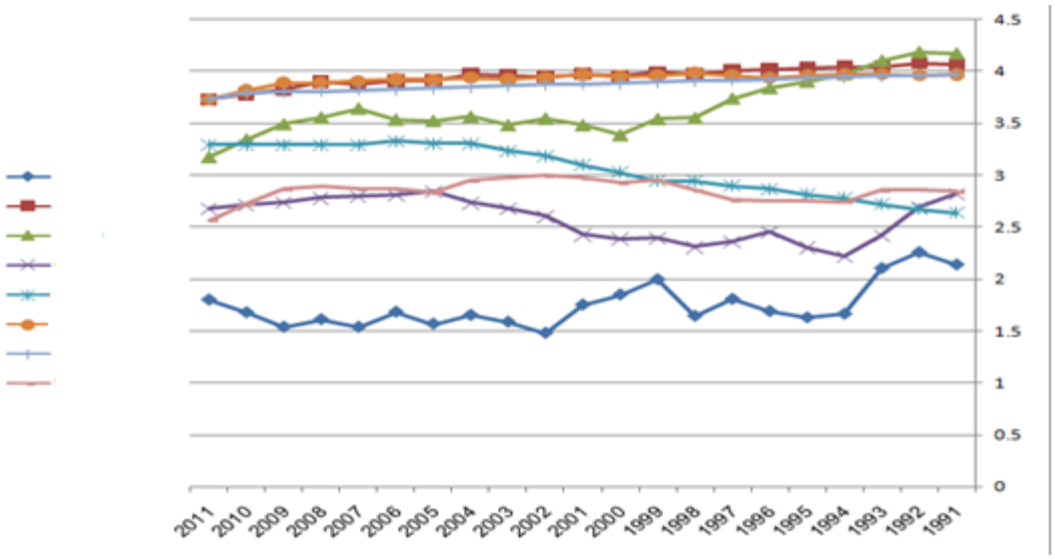


Figure (4) The process of producing electricity from fossil sources The process of generating electricity from fossil sources, America and Germany have shown that the highest level of technology that the electricity production and has consumption of such appointment and power consumption of fossil resources in France, the technology is at the lowest level.

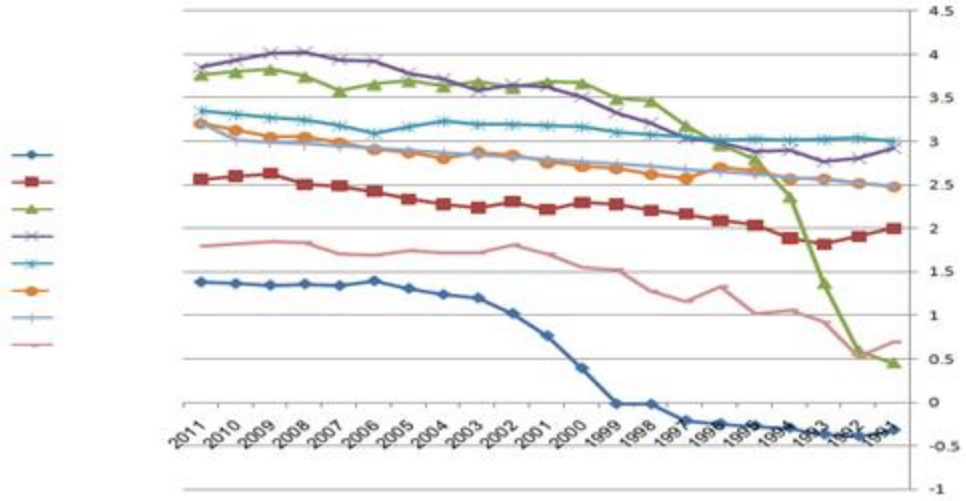


Figure (5) Electricity production from natural gas sources Electricity production from natural gas sources has shown the Italy where this technology has been used in electricity production from other countries.

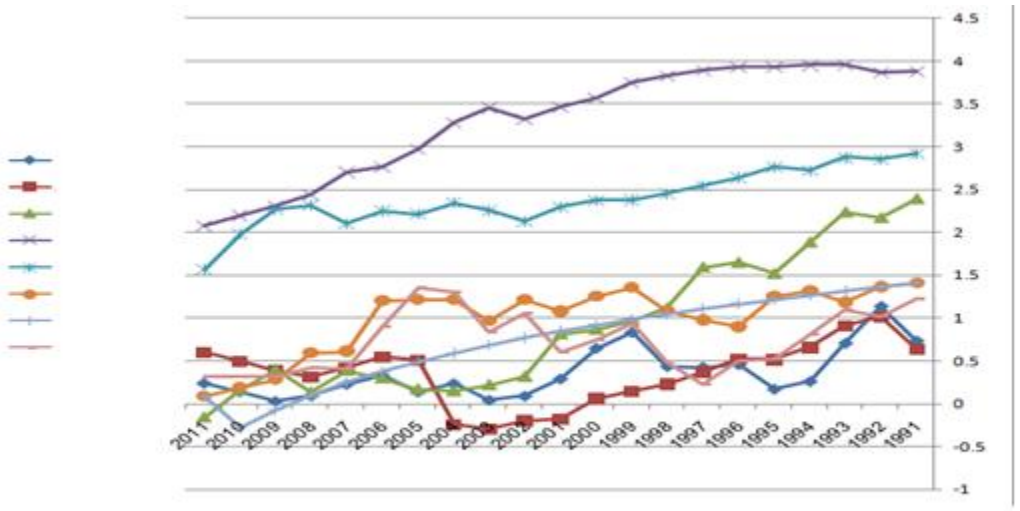


Figure (6) Electricity production from oil sources Electricity production from oil sources has shown that the technology of electricity production from oil sources but the overall trend suggests a decline in recent years has eight member countries of G. Showing that replace other power generation technologies in the country.

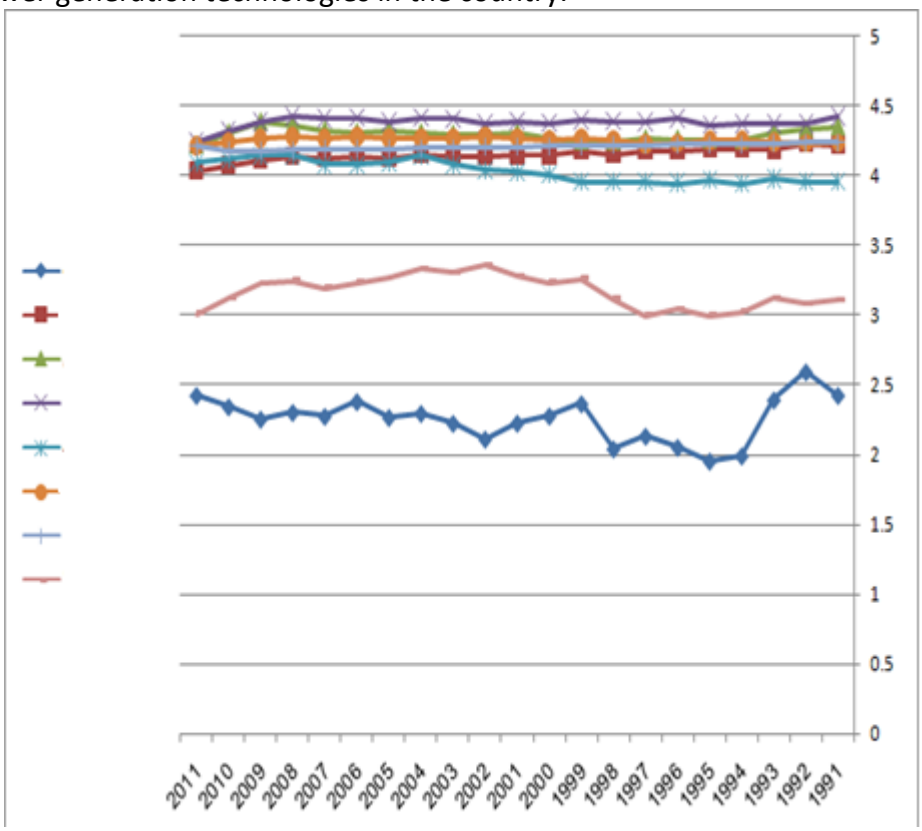


Figure (7) Electricity production from oil, gas and fossil resources electricity production from oil, gas and fossil resources from all eight member states J is nearly constant.

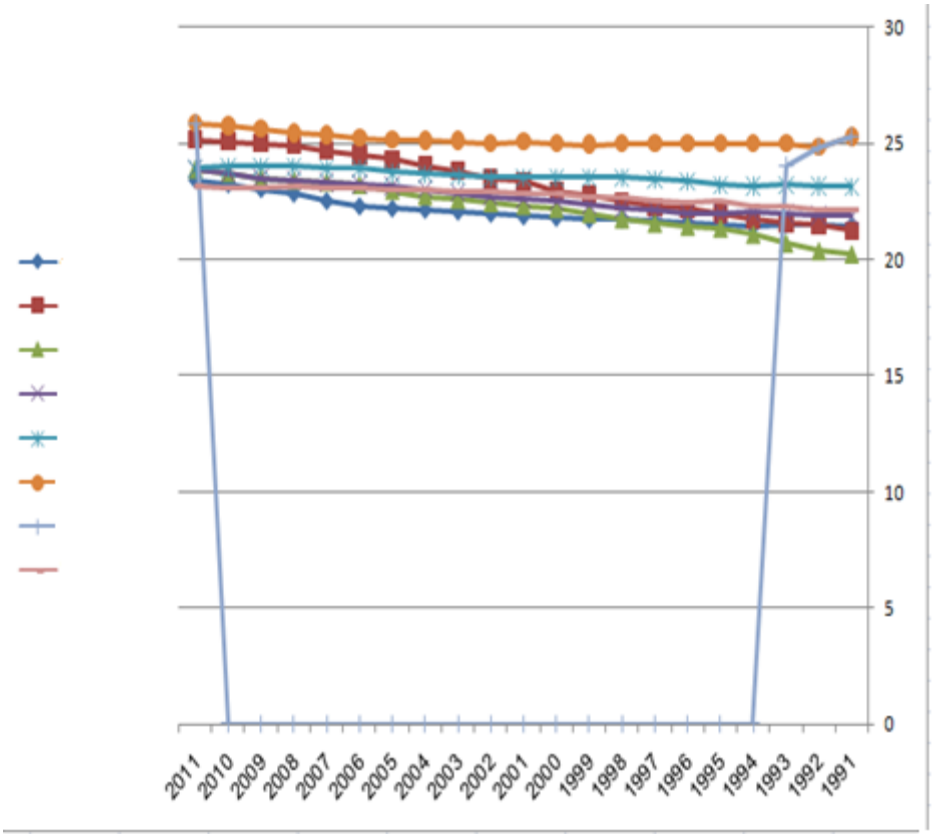


Figure (8) The production of electricity from renewable sources, excluding hydroelectric resources Electricity production from renewable sources, excluding hydroelectric sources suggest these countries embrace that this type of technology to generate electricity and the has been use of this technology in America that the highest consumption of this type of technology and the power of technology and given the importance of the environment and the issue of development and access to technological and minimize the cost of production in this sector in the consumption that this type of technology has been generating electricity at the forefront of the countries studied.

5 - Estimation Model To evaluate the test variables stationary of Levin, Lin and Joe (LLC), we test, IS Pesaran (ISP) , Brtvng test, Fisher's exact test - ADF is being used.the results shows the stationary of all variables in the model. In these tests the hypothesis H0, H1 hypothesis based on non stationary and stationary variables and as has been seen in Table 4-1, all the variables are stationary in levels.

After reviewing stationary variables the model has been estimate by using panel data G8 member countries.

These models have been tested by using eviews software. Selection, based on panel data estimation method or combination of methods, data, Lymr the F-statistic is used. F-statistic 52.80 Lymr number shown is zero probability of approval is a panel data approach that therefore, according to this test statistic and panel data approach is acceptable.

Table 1 Results of static variables

Result	Probability	t Statistics Levin, Lin & Chu	Variable
I(0)– Mana	0.0298	-1.88346	Fossil Energy
I(0) – Mana	0.0236	-1.98394	Economic Growth
I(0) – Mana	0.0024	-2.81553	Atomic Energy
I(0) – Mana	0.0025	-2.80445	Electricity productionfrom nuclear sources
I(0) – Mana	0.0121	-2.25469	Electricity generation from hydro sources
I(0) – Mana	0.0001	-8.06236	Electricity production from natural gas sources
I(0) – Mana	0.0568	-1.58241	Electricity production from nuclear sources
I(0) – Mana	0.0072	-2.44637	Electricity production from oil sources
I(0) – Mana	0.0001	-11.4867	Nuclear Energy
I(0) – Mana	0.0244	-1.97088	Electricity production from oil
I(0) – Mana	0.0001	-3.76385	Gas and fossil resources
I(0) –	0.0303	-1.87640	Physical capital

Mana			
I(0)– Mana	0.0001	-3.65008	Work force

Table 2 Estimates of the research model using panel data

Probability	t-statistic	Coefficient	
0.0001	4.518561	10.17898	Intercept
0.0001	13.83643	0.600646	Capital
0.0584	2.298028	0.389726	Work force
0.2315	-1.206677	-0.064394	Electrical Technology
0.0277	2.245956	0.513040	Fossil Energy
0.0001	6.559913	0.437233	Gas and fossil resources
0.0001	7.917655	0.781872	Electricity production from fossil sources
0.0001	7.871946	0.748663	Electricity generation from hydro sources
0.0001	6.742478	0.506128	Electricity production from natural gas sources
0.0001	6.750207	0.581210	Electricity production from nuclear sources
0.0001	7.274678	0.382946	Electricity production from oil sources
0.0001	7.274737	0.621517	Electricity production from oil
0.0114	2.595219	0.071375	Nuclear Energy
		0.899637	The coefficient of determination
1.987679	Camera	10589.26	Statistics F-

	Watson		
0.0001			Probability

For deciding on the method to fixed effects or random effects, the Hausman test is applied. This test actually tests for individual effects and the explanatory variables are uncorrelated According to the generalized least squares estimation, under the hypothesis H0, consistent under hypothesis H1, is inconsistent. In other words, using the random effects where are used the generalized least squares estimators. Hypothesis H0, has shown consistency coefficients, while the hypothesis H1, based on the rule of consistency.

If you do not Reject H0 hypothesis of Hausman test, the method used to estimate is a random effect. (Baltajy, 2005) 110.32 Hausman test number and the probability is zero that showed a fixed effects method.

Given that most of the energy consumption in these countries, electricity consumption is more technology is different according to the data available in the field of power generation is considered . Of course, other fossil energy and nuclear power, oil and gas the model was designed to examine the variables in the research model are as follows:

The ECM coefficient has been examined.

According to the error correction coefficient can be expressed in the ECM model, that adjustment speed towards equilibrium and long-term fit (adjusted coefficient above 0.5 is high).

In fact, the ratio is shown as a shock to the variables to be entered and the equation of state has run out, Each year, 67 percent error correction and correction is deviation from a long-term relationship.

The results of the estimation of the ECM method is shown below that in other words, it is a shock to the variables and the equation of state will run out, every year, 67 percent error correction that the deviation from a long-term relationship is modified with appropriate government policies to dampen the country's economic approaches Increased production and economic growth in the long-term trend is increasing.

Table 3 Estimates of ECM

Probability	t-statistic	Coefficient	
0.0001	8.476089	10.34916	Intercept
0.1259	-2.275286	-0.092715	Capital
0.0001	4.336059	0.495543	Work force
0.0001	13.57759	0.501600	Electrical Technology
0.0001	28.35770	0.627161	Fossil Energy
0.0013	3.351732	0.585415	Atomic Energy

0.0001	14.36941	13.93896	Electricity production from fossil sources
0.0001	14.27697	13.89599	Electricity generation from hydro sources
0.0001	10.05711	22.94402	Electricity production from natural gas sources
0.0001	10.06327	22.95256	Electricity production from nuclear sources
0.0001	12.46690	38.75162	Electricity production from oil sources
0.0001	12.47195	38.75803	Electricity production from oil
0.0001	7.977246	0.103410	Gas and fossil resources
0.0001	-14.03818	-0.672286	ECM
		0.899931	The coefficient of determination
		0.899912	Adjusted coefficient of etermination
1.813456	CameraWatson	52235.36	F-statistic
		0.0001	Probability

6 - Conclusions and Recommendations

Given that most of the energy consumption in these countries is higher power consumption of different technologies, according to the data available in the field of power generation is considered . Of course, other fossil energy and nuclear power, oil and gas has been studied in model The variables in the research model are as follows: Fossil energy, nuclear energy, electricity production from fossil sources, electricity generation from hydro sources, Electricity production from natural gas, electricity production from nuclear sources, power generation, oil, power generation, oil, Gas and fossil resources and physical capital and labor that statistics are calculated using the World Bank and for the period 1990 to 2010 has been studied. In the first or second stages of labor and increasing production has increased. In other words, the countries of the workforce is still not saturated and labor is regarded as one of the most important growth factors. Physical capital is a basic requirement for growth in G8 countries .

Non-significant negative effect on water technology on economic growth, effects of energy technologies in many cases is positive and significant. For example, the consumption of gas has the most significant effect on economic growth, which has been shown that the gas energy technologies by higher productivity and have increased economic growth. After the gas , technology, the energy consumption of electrical paths through different countries has produced a significant and positive effect. Water as an energy technology has some negative effect on production. Use of nuclear power as an energy technology is positive and significant.
According to the study, the following suggestions are offered:
Especially in developed countries due to competing demands for scarce resources, energy management is essential for diagnosis. Manufacturing, energy, due to its unique characteristics, Job framework of a society to change it in Germany, Italy, Britain, Japan, France, America, Russia, and Canada is also true. due to the greater influence than technology, nuclear power and fossil energy should be planned towards creating jobs in this country has led to this. With respect to the environment and reduce air pollution from the use of new energy technologies in these countries is proposed and considering that most of these countries import food and energy, fossil fuels are due to fluctuating prices and the effects of the economic substance for which there are is recommended switching to alternative energy due to their high impact on economic growth in these countries.
Bringing in the developed countries the new energy and energy efficiency and reduce fossil and the level of imports from developing countries including Iran has caused in the long run due to lower oil revenues and reducing the demand for raw materials, oil and gas , i fail to economic reform and areas for further development and petrochemical industries and increase the value added in the country, and with their long-term prospects increasing employment and skilled labor force in the country and the potential for development and growth potential in the country to provide raw materials.

Resources:

1. Abrishami, H. & Mostafaei, A. (1380). Investigates the relationship between economic growth and consumption of major oil products in Iran. **Journal of Knowledge and development**, No. 14, pp. 45-11.
2. Abdoli Ch. Varahrami, V., (1388), The effect of technological progress on energy efficiency in industry and agriculture using Cobb-Douglas function, **energy economics studies**, No. 23, Winter 1388
3. Ahmadian, M. (1378). Theoretical and Applied Economics oil. First published in Tehran, Faculty of Tarbiat Modarres, Department of Economics. three. Energy for the Future - published translated into Farsi - the World Energy Council - Tehran 1375.
4. Armen S. Aziz, Z. R. (1384), examine the Granger causality relationship between energy consumption and economic growth in the years 81-1346, **Iranian Economic Research Journal**, 7 (24), 143-117.
5. Armen, A. and Zare, R. (1384) .. Granger investigate the relationship between energyconsumption and economic growth in Iran during 81-1346. **Quarterly newsletter of Economic Research**, No. 24, pp. 143-117.

6. Fierce, GH. - Haqqani, M., Evaluation of the causal relationship between carbon emissions and emphasized the role of energy in national income, **Economic Researc**h, Tehran University, No. 87, Summer 1388
7. Ready H., Judge M. Abbasi F. (1388), examining the relationship between energy consumption and economic growth and employment in various sectors of the economy, **Economic Research Journal**, 44 (86), 38-1. 7.
8.Ready, H. - Judge M. F. Abbasi, Z., (1388), to investigate the relationship between energy consumption and economic growth and employment in various sectors of the economy, Economic Research, Tehran University, No. 86, Spring 1388 .
9. Recovery, D., Mohammad, P. and Soda G., (1388), examining the relationship between energy consumption and GDP in developing and developed countries, **Energy Economics Studies**, No. 23, pp. 22-1.
9. Energy balance of the country in 75 years (1376) - Tehran - Department of Energy Department of Energy.
10. Hatamzadeh, o. and Reza M. (1378). Check Oil prices rise on inflation and government budget, the Office of Financial Research and the Politics of Economic Affairs, Ministry of Economy and Finance.
11. Hoseini S. and Emadoleslami M. H., KASHMARI A. (1386), examining the causal relation of energy consumption, employment and GDP in the years 80-1350, **Research in Economic Sciences (Humanities and Social Sciences)**, 7 (24), 58-31.
12. Just, Yadu'llah, Farmer, Gahani. and Tyatrj, A. (1385), in explaining the relationship between inflation and economic growth, **economic inquiries**, No. 5, pp. 88-60.
13. Port, A. and Faith Hassan Gh. (1382), analyzing the determinants of economic growth in Iran (with an overview of endogenous growth models), **Journal of Business Research**, No. 26, pp. 33-1.
14. Romer, D. (1383). **Advanced Macroeconomics**. Translations of Mehdi Taghavi doctor. Printing. Tehran: Publication of Islamic Azad University, Science and Research.
15. Site industrialized countries G8.
16. Patience, AR - Ahmadloo, M.,(1390) The relationship between energy consumption and economic growth in sub-sections 1386-1346 VECM approach, **energy economics studies**, No. 30, Fall 1390
17. Industrial drawers recent IMF accounts.
18. Tayebi, K. and Imad M. and Sheikh Bahai A.. (1385). The impact of human capital on economic growth and foreign trade among OIC member countries. **Economic Research**, 85: 256-237.
19. Tayebi, K. and Imad M. and Sheikh Bahai A. (1387). The impact of human capital on productivity of exports and industrial production and economic growth in member countries of OIC. **Some economies (former Economic Review**), 5 (2): 106-85.
20. KARBASI AR, covered Tehrani SH (1385), e-commerce applications to optimize energy consumption and reduce environmental pollution, **Journal of Environmental Science and Technology**, (28) 8, 188-106.
21. Institute of Business Studies (1376). Analysis of energy consumption in Iran, **Journal of Business Reviews**. No. 119.