

Is There Relationship between Renewable Electrical Consumption and Economic Growth in Romania?

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Abstract

This study probes the causal link between renewable electrical consumption (REC) and economic growth (EG) in Romanian. In recent years, the development of renewable energy in Romania has achieved basic results, but it also faces many problems, such as funding, technical policies and so on. This paper reviews the development motivation, characteristics and main problems of renewable energy in Romania. And put forward strategies such as increasing investment in research and development, adapting to local conditions and sustainable development.

Keywords: Renewable electrical consumption; Economic growth.

JEL Classification: G10, G38, Q20.

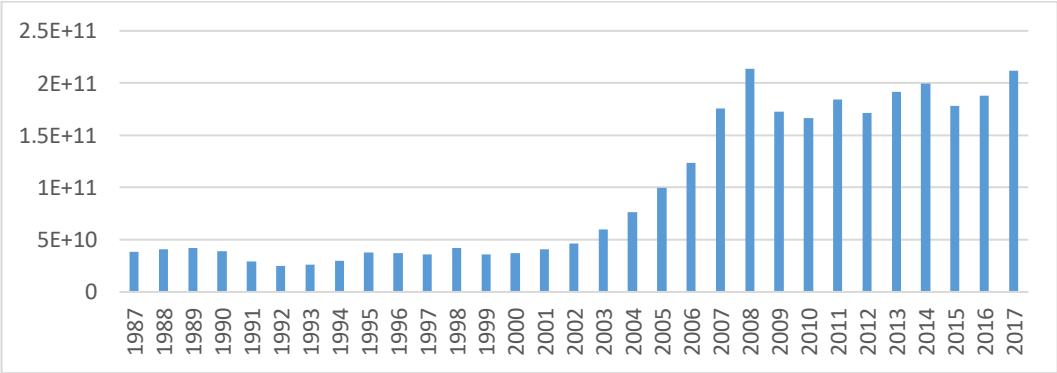
1. Romanian renewable energy development motivation

The target of this paper is to discuss the relationship between renewable electricity consumption (REC) and economic growth in Romania. The consumption structure knows, in the last years, a new trend in the global energy consumption structure, and a high attention was paid to renewable energy that faced a rapid development. The global renewable energy will cover 60% of total power generation in 2040 according with the International Energy Outlook 2016 published by the International Energy Agency (IEA). Taking the European Union as an example, the total energy consumption slowly declined from 1990 to 2015, with an average annual growth rate of - 0.1%. Even so, the consumption of the renewable energy grows from 4.37% to 12.91% from the total energy used, that means approximately three times. The production of the renewable energy also grow about 2.5 times as share in total production (from 12.63% to 29.86%).

Renewable energy consumption has increased rapidly. First, because the bottleneck of crude oil supply has become prominent, and the situation of local oil-producing countries has been unstable. The adjustment of oil output has led to violent fluctuations in international oil prices, and energy security has been challenged; Second, issues such as climate change, health and safety, and economic losses caused by the usage of fossil energy consumption have attracted global attention. At the 2015 Paris Climate Conference, China clearly stated that CO₂ emissions peaked and non-fossil energy consumption accounted for 20% of the total around 2030. In 2017, the European Parliament setup a new target of EU countries related to the share of the renewable energy in total energy consumption to reach 35% in 2030 instead of 20% as it was previously. It can be seen that the EU strategy on energy is focused on the renewable sources in terms of production and consumption.

As we can see in Figure 1, in 2015, Romania's total GDP was 177.95 billion US dollars, and GDP growth rate was 3.7%. From 2005 to 2015, the average annual growth rate of GDP is 3%, and the per capita GDP is 8 972.9 US dollars, which is a middle-income income country. In 2015, the proportion of agriculture, industry and services in GDP was 4.8%, 26.4% and 68.8% respectively. The key industries are petrochemical, machinery, automobile, food processing and so on. In the first quarter of 2016, Romania's GDP growth rate was 4.3%, ranking first in the EU and the economic situation was good.

Figure1. Romanian GDP during 1987-2017



Sources: Data are from World Bank Units: Dollar

There are many definitions of energy on a global scale. In a broad sense, energy refers to the material resources that nature can provide for energy conversion and the material basis for human activities. The actual development of society is more and more dependent by the high-quality energy and, at the same time, the long term provisions drives to the need of using advanced technologies

and sources. In world where energy issues are becoming more urgent, the iterative advances in energy technology and the coordinated development of energy and the environment have become rigorous issues concerning the common destiny of mankind. The main ways of energy classification are as follows: basic forms, renewability, environmental pollution, etc. As we can see from Table 1,

Table 1. Energy classification

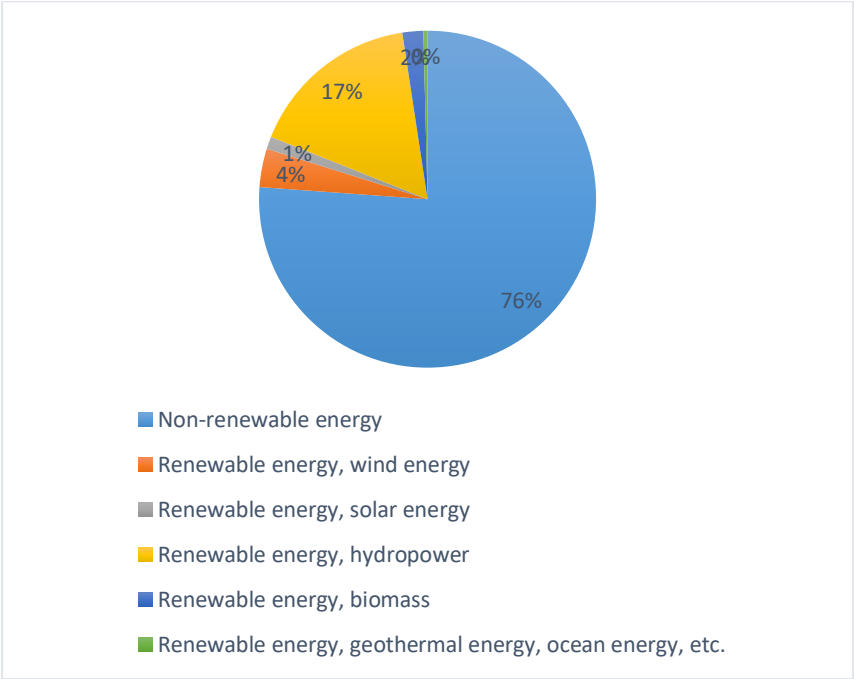
Renewability	Renewable Energy	Hydro, wind, solar energy etc.
	Non-renewable energy	Coal, oil, natural gas
Basic form	One-time energy	Coal, oil, natural gas, biomass, water energy
	Secondary energy	Gas, coke, gasoline, kerosene, electricity
Whether it pollutes the environment	Non-clean energy	Coal and oil
	Clean energy	Wind, hydro, nuclear, solar, natural gas
Type of use	Conventional energy	Coal, oil, natural gas
	New energy	Solar energy, hydro energy, nuclear energy, geothermal energy, biomass energy

Source: International Energy Agency

According to the definition of the International Energy Agency, renewable energy means a source of energy derived from the continual replenishment of natural processes. It generally refers to an inexhaustible variety of energy sources, which are environmentally sound or minimally harmful and widely distributed and suitable for development. Renewable energy comes from natural processes, such as sunlight and wind, and is inexhaustible. The main types include hydropower, solar energy, and wind energy. As the energy shortage has intensified, the share of renewable energy in many fields such as electricity, heating, refrigeration, and transportation has increased significantly in recent years. According to the "Renewable Energy Status Report", renewable energy is gradually occupying a mainstream energy position with certain competitive advantages in many countries around the world. As of the end of 2014, the proportion of renewable energy consumption in total energy consumption has reached 19.2%. As we can see from Figure 2, in terms of power generation, by the end of 2015, the proportion of renewable energy power generation to global power generation

reached 23.7%, of which hydropower generation accounted for 16.6%, and wind power generation accounted for 3.7%. It can be seen that renewable energy is playing an increasingly important role in power field.

Figure 2. Renewable energy generation accounts for the proportion of global energy generation



Source: REN21, 2016 Global Renewable Energy Status Report

2. The relationship between energy consumption and economic growth

Economists are often attracted to analyze the link between the economic grows and the energy consumption, but more than this they are considering now new parameters between sustainable development and renewable energy. The study found that there are regional differences and non-linear relationships between energy consumption and economic growth. At present, most studies on the impact of renewable energy consumption on economic growth are based on linear and grouped research methods. There is no consistent conclusion from the perspective of different impact mechanisms. Most scholars use renewable energy as a factor of production to study the production function, and find that renewable energy can replace part of non-renewable energy, which is conducive to energy diversification and mitigation of climate problems, together with non-renewable energy consumption and other factors of production to promote economic growth. Inglesi-Lotz (2016) takes OECD countries as the research object, finds that

the increase of renewable energy consumption is conducive to the growth of economic aggregate and per capita GDP, and believes that energy transformation strategy can not only improve the environment of a country but also improve the economic level. Based on Co-integration and Granger causality test, Wang (2008) finds that there is a co-integration relationship between China's renewable energy consumption and economic growth, and renewable energy consumption is the one-way Granger cause of GDP growth. Some scholars believe that compared with the traditional energy, the development of renewable energy does not have the advantages of technology and cost. At this stage, the expansion of renewable energy consumption is mainly driven by government policies, with a certain economic cost. Ocal and Aslan (2013) used the autoregressive distribution lag model to find that for every 1% increase in renewable energy consumption, GDP decreases by 0.3%. There are specialist that are considering that renewable energy consumption has no significant impact on economic growth. Payne (2009), based on the Toda-Yamamoto test, finds that there is no Granger causality between renewable energy consumption and non-renewable energy consumption in the United States and real GDP. Menegaki (2011) studied 27 European countries and found that there was no Granger causality between renewable energy consumption and real GDP. The inexistence of a strong causality between GDP and renewable energy consumption was considered the main reason of a unstructured development of new sources.

In recent years, studies shows that there are regional differences in the impact of renewable energy consumption on economic growth (or employment). Al-mulali et al., (2013) found that the higher the income level, the more sustainable and significant the positive impact of renewable energy consumption on economic growth. Others found heterogeneity in the impact of renewable energy consumption on employment in different regions. (Apergis and Salim, 2015; Markandya et al., 2016).

3. Development status of renewable energy in Romania

In 2009, Romania produced 12MW energy from renewable sources, but starting with 2010 its production capacity grew at an accelerated pace to 2880MW by the end of 2013, while an approximately equal capacity is still under construction. Such a development took place on a spectacular increase in the attractiveness to investors of the Romanian renewable sector (4 billion euro in 2012), which placed our country No. 13 on a list of 40 nations ranked by their attractiveness for investment in renewables, mainly due to big wind projects. Romania's natural potential is favored by its geographic location and weather

conditions. Hence, Romania has: a) large surfaces of land for building wind and solar (PV) power plants with comparatively lower cost, especially for land purchase; b) the largest theoretical wind potential in SE Europe and the second largest on the entire continent (14 000 MW) (Ministerul Industriei, 2007); c) a considerable, completely unexploited, potential to develop offshore wind farms, in the Black Sea waters; d) a relatively important solar energy potential, as Romania enjoys 210 sunny days per year (300 sunny days/year in Spain, Italy, Greece) (GISCO, 2012); e) available biomass resources-the RES with the highest potential in Romania. Romania has developed RES projects only in the recent few years, especially wind farms, but this delay has “the advantage of the latecomer” as the newest and best performing technologies were installed and a high technology industry was set up. For 2050, Romania is estimated to theoretically have the potential to cover from renewable sources 73% of its total energy demand (European Renewable Electricity Data).

4. Major issues facing renewable energy development

At this stage, although the development and utilization of renewable resources in Romania has achieved initial results, there is still a big gap compared with developed countries. Most of Romania's relevant development strategies copy the strategies of developed countries in Europe, and they are not closely integrated with the current status and regional characteristics of renewable energy development in the region. With the further optimization and upgrading of related industries in Romania, current resource support and relatively extensive development strategies will be difficult to meet the demand. At the same time, the disorderly development of renewable energy, the untimely revision of laws and regulations, and the imperfect public participation mechanism will also reduce the development and utilization efficiency of regional renewable energy. For long-term sustainable development, the following major problems exist in the development of renewable energy in Romania: First, the investment and financing system for renewable energy projects is not perfect. In general, investment choices focus on industrialization of renewable energy technologies rather than technological innovation. Second, insufficient investment in technology research and development, and weak renewable energy innovation and development capabilities in the region. At present, Romania still lacks a strong platform to support relevant technology research. In this country, a leap-forward development mechanism and a clear long-term sustainable renewable energy development investment plan are needed to ensure local R&D funding support. Last, lack of coordination and consistency of policies. Due to the differences in the development goals of various renewable energy sources in Romania, it is difficult

to ensure the consistency of the policy framework. Therefore, it is necessary to formulate a long-term effective policy system to support the sustainable development of regional renewable energy.

5. Renewable energy development strategy

In order to achieve the sustainable development of renewable energy in Romania, it is necessary to combine policy support with independent development, transition from short-term benefits to long-term benefits, reduce external dependence, and explore mechanisms and approaches with more regional characteristics and practical significance. First, establish a development cooperation mechanism to form a related development pattern: As far as the reality is concerned, the development potential of renewable energy in Romania is huge, but the economic development rate is relatively backward. Therefore, it is necessary to establish a cooperative mechanism for renewable energy development, and promote the development and utilization of renewable energy resources by local, industrial, and research institutions through the established economic relations and organizational system. Therefore, it is necessary to establish a cooperative mechanism for renewable energy development, and promote the development and utilization of renewable energy resources by local, industrial, and research institutions through the established economic relations and organizational system.

Increase R&D investment and promote technological innovation: Pay attention to the development of energy science and technology in Romania, and effectively narrow the gap between industrial technology and developed areas. Strengthen the research work of renewable energy, and actively promote the research on the theory and methods of energy basic science and development and utilization technology in light of the resource endowments in various regions. Formulate preferential policies, strengthen the introduction of relevant talents, and directly subsidize the R&D activities of the regional private sector in the renewable energy industry. Focusing on the frontier technology fields and industrial development trends, Romanian government should guide the leap-forward development of renewable energy industries and technologies, and in-depth research and development of core technologies for the large-scale development and utilization of major renewable energy sources such as wind energy, solar energy and biomass energy.

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