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THE RURAL SUSTAINABLE DEVELOPMENT THROUGH RENEWABLE ENERGY. THE CASE OF ROMANIA

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Abstract. The study aims to analyze the importance of renewable energy and to assess the progress made by Romania comparing to European Union and to targets set by Community institutions. We consider that both economic issues such as job creation or reduction of import dependency, but also ecological issues including reducing greenhouse gas emissions are important in discussions about renewable energy in rural areas in Romania. By using linear regression it has been identified a strong correlation in Romania, for period 2004–2014, between share of renewable resources in gross final energy consumption and import dependency. Taking into account that energetic independence is a problem of great importance for each country, the paper aims to identify unused renewable energy potential in rural areas and also opportunities for developing renewable energy sector based on the resources that can be exploited with high efficiency, action that will generate economic and social positive effects. Our results reveal that Romania has a high development potential of rural areas using renewable energy because Romania has a high volume of renewable resources (sun, wind, water). Under these circumstances it is necessary to adopt the policies in order to support projects referring to these types of energy.

Keywords: green economy, rural economy, rural development, renewable energy, sustainable development, Romania.

JEL Classification: Q01, Q1, Q2.

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Introduction

Lately, it has been paid a great attention to the environment protection and to the possibility that the orientation towards these issues would lead to job creation. The organizations and governments try to find effective solutions to solve both the problems of climate change, pollution, waste and communion with the environment, but also issues such as economic crises, high unemployment, low employment rates for youth or women, fewer job opportunities for rural population. The best solutions will be those, which would generate low economic and social opportunity costs for individuals and societies as a whole.

The economic development has been associated over time with the increase in energy consumption and greenhouse gas emissions. Orientation towards renewable energy can decouple this correlation, thus contributing to sustainable development (IPCC 2011). Also, the energy security is very important to ensure a green growth for a green economy. The increase of renewable energy contribute to the reduction of energy import dependency and to the faster transition to a green economy, in accordance with the provisions of the Europe 2020 Strategy (Streimikiene *et al.* 2016). Therefore, the current challenge for world and european economies is to increase the share of renewable energy considering the context of negative effects of irrational actions on the environment and natural resources and of climate change, that put pressure on the economy. Because of that, the environmental considerations must be integrated at an early stage of policy making to get results (Roggeri *et al.* 2011).

Renewable energy, as diversification of energy sources, reduces dependency on fossil fuels (which have the risk of generating shock waves especially the imported ones) and consequently it contributes to increase energy security. The development of this field creates opportunities for new industries, both in the exploration productive area and in new technology production area, affecting job creation and economic growth. This sector will have to exploit the unused or low efficiency used resources, i.e. the underused labour force or agricultural land, inappropriately exploited biomass, wind power or solar energy that can be captured on large areas and can provide energy for households with limited access to forms of energy with higher costs. The energy efficiency is one of the most important issue of the European climate policy and of the economic growth. Balitskiy *et al.* (2016) show the relationship between energy efficiency, consumption of the natural gas and economic development in the European Union. They conclude that in the EU there is a positive relationship between economic development and the consumption of the natural gas, and a negative one between the consumption of the natural gas and economic development. As a result it is important for economic and environmental policies to take into account all the implications on the short and long time (Balitskiy *et al.* 2016).

Two-thirds of the world's poor population live in rural areas (ILO 2012), therefore the need to reduce poverty refers mainly to the rural poverty. Important aspects of rural areas are the improvement of road transport infrastructure to facilitate the access to rural areas, the access to electricity and water for domestic use and internet and health care services. There are many other problems facing rural areas, that aggravate poverty, which include the lack of employment that provides decent income. The solutions aim at increasing employment by improving skills, adapting them to the current labour market needs and to the requirements of sustainable development of the global economy. Providing opportunities for starting

own business is another effective solution that targets rural poverty. The passive methods of providing aid for different low-income families cannot generate effects and do not provide a long-term reduction of the phenomenon.

The need to find new ways to reduce poverty in rural areas coexists with concerns about the environment and resource scarcity, food security and economic crises (ILO 2011). The specialized studies in renewable energy show increasing concerns in this area capturing the main approaches in sustainable and renewable energy systems problems (Mardani *et al.* 2015).

1. The purpose of the study and the methodology

Greening the rural economy is an important and necessary step to reduce rural poverty and improve well-being of the population. Environmental challenges facing rural areas refer to negative impact of climate change, resource scarcity and degradation of natural resources. These have to be addressed into rural development strategies in order to promote environmental sustainability (ILO 2015).

Rural areas have unused economic potential through their human capital and natural resources. However, on the one hand, renewable natural resources are limited, therefore effective ways to use alternative renewable resources has to be identified. Degradation, waste of resources, pollution are types of negative externalities, which affect the future generations, but they are still not internalized and not evaluated by investors. Even if activities produce negative externalities, they are considered rational choice in terms of profits. However, The United Nations stress on the importance of transforming our world in accordance with Sustainable Development Goals and create a plan of action for people, planet and prosperity for the next 15 years (2015–2030). Ending poverty, protecting planet from degradation, recording economic, social and technological progress in harmony with nature, fostering peaceful are objectives that could be achieved only by partnership based on solidarity with the poorest and most vulnerables (United Nations 2015).

Providing the necessary resources for the future can be achieved through different ways of intervention, either in the markets (resources markets, labour market, etc.) or in economic policies (protection of resources by control and regulations, encouraging green technologies etc.). Nowadays, the need for sustainable development is a constraint to growth. The economic system works in a closed ecological system, the two of them must evolve together and support each other. Incomplete information or differences in knowledge can make difficult to evaluate the performance of alternatives when choosing between green and classical investments (Liou *et al.* 2016).

On the other hand, the labour force is poorly qualified, aged and not adapted to the need of sustainable development of rural areas. Therefore, there's the need to find solutions to transform the labour force as to co-exist in harmony with nature and to increase the efficiency of association between the rational use of resources (i.e. the use of renewable resources) and employment opportunities for the rural population with emphasis on providing equal opportunities for youth and women. The rural population ensure their decent living conditions, mostly from agriculture, forestry, fishing, mining, tourism.

Creating and using the renewable energy, creating green jobs to reduce climatic or environmental dependency to ensure effective adaptation to the changing conditions and to reduce the irrational use of natural resources and greenhouse gas emissions leads not only to the improvment of well-being through decent income for the rural population, but also to the improvment of the quality of environment and reduction of waste and pollution. Acclaimed as generally positive, the net effect on employment depends on the loss of jobs in other sectors and the opportunity cost of replicating renewable energy. Some specialists show that all non-fuel technologies, including renewable energies generate more jobs per unit of energy produced than coal or natural gas (Wei *et al.* 2010). In addition, renewable energy jobs represent local opportunities that reduce the need for labour migration to urban areas (IRENA 2011).

Sustainable development must be supported through sustainable agriculture, conservation of natural resources, adapting modern technologies to rural traditional knowledge but also through the education of rural labour force, especially youth and women (organic agriculture, entrepreneurship, financing). The education system must adapt to skills demands of the labour market so as to meet the requirements of a green society. Education has an important role in facilitating the achievement of sustainable development through understanding the value of sustainability goals (Biswas 2012; Holban-Oncioiu *et al.* 2010). Under these circumstances, education have to be supported not only by schools and universities, but also by NGOs and governmental actors who have more experience in implementing projects and policies and in successful linking with other economic and social actors (Kolleck 2016).

Starting from these aspects, the research method used has both a qualitative and a quantitative value. The study starts from a quantitative analysis of collected data from international official institutions (Eurostat, IEA, EEA, IRENA, NIS) that are useful for identifying trends in renewable energy at European Union level. Quantitative data reflects the current state of renewable energy were analyzed in correlation with qualitative data on development potential of renewable sources in order to characterize the level of development of renewable energy sector in Romania and to identify ways of action. The hypothesis that increasing use of renewable sources leads to lower import dependency in Romania was performed using simple linear regression. Also, using linear regression model we have shown that renewable energy sector and economic growth sustain each other in rural areas and between them there is a bidirectional relation between them. By analyzing and correlating the available data we have identified the potential changes arises by use of renewable energy in rural areas and their contribution to rural sustainable development in Romania.

2. Literature review and background

2.1. The importance of renewable energy for sustainable development in rural areas

The potential of developing or producing renewable energy in rural areas lies in the availability and abundance of needed resources in these areas (e.g. sun, wind, water, biomass). One of the tools for sustainable development and for developing the rural areas is eco-innovation. This is very important at the enterprise, society and state levels and should be

applied throughout the product or service life-cycle in order to ensure the economic and environmental benefits. The main objective of eco-innovation is to reduce the impact on the environment and to create new market opportunities, to improve environmental performance (Urbaniec 2015).

The development of businesses based on renewable resources in rural areas can be advantageous for low-income population with unused high level of education or for underused agricultural land that can be suited for systems of capturing different types of energy. Such new green investments can generate jobs in construction, operation, supervision, distribution of renewable energy which can provide increased opportunities for using human capital and higher incomes for the rural population. Agriculture will not loose its importance in the new rural development, but its role will change (Van der Ploeg *et al.* 2000). The gains of new jobs in renewable resources could compensate and overcome the loss of jobs in agriculture for use's changed lands (ILO 2012).

The renewable energy is a source of new jobs and economic growth, but also a way to amplify the challenges of environmental and energy security in all regions of the world. To provide an opportunity for rural areas agriculture needs a long-term strategy, a framework of complex and flexible regulations. In return, it will generate firstly a place new income for local authorities in rural areas as an opportunity for further investment, jobs and entrepreneurial opportunities. Secondly, it will generate an increased innovation and adaptation capacity of technologies and existing products. Third, it will generate more dynamic local communities as a result of accumulation of new technologies and skills, learning capacity growth, innovation and adaptation of the workforce to labour market needs (OECD 2012).

Green economy creates opportunities on the labour market, making a successful transition to quality and sustainable jobs associated with these specific skills (Ragwitz *et al.* 2009). But this transition requires educating the leadership and labour force to actively realize green economies and jobs in the renewable energy sector (Karakul 2016). This approach is supported by the new EU vision of the new circular economy package within which the renewable materials will continue to play an important role in the production processes, attention being moved to social and environmental issues. From this point of view, the multiple possibilities of use of biological resources (biomass in particular) create the competition and put pressure on land use (COMM 2015a). The development of a green economy at EU level must also take into account the convergence between EU member states. The difference in economic development between the EU member states cause them to form clusters that do not always converge with each other. Strielkowski and Höschle (2015) show that there is not much evidence about the existence of economic convergence within the European Union, which affects the transition to the green economy.

The increased capital stock in rural areas creates a capital intensive agriculture and, as a consequence, labour relocate from agriculture to other sectors of the economy (Nishida 2016). The challenge of creating jobs in rural areas must be seen in correlation with equal opportunities and gender equality. An industrial strategy is required to encourage investment in renewable energy in order to increase labour supply for rural areas or former industrial areas. Public policies should provide young people who enter the labour market and those in different stages of their careers the ability to adapt to the new technologies, new regula-

tions, to pass to renewable energy sources (Strietska-Ilina *et al.* 2011). As labour force is the decisive factor, it should capture all efforts to gain access to vocational training, throughout the active life (EP 2014). This transition will generate a loss of jobs in traditional sectors and therefore requires social support to those affected, especially through retraining programs. It is estimated that the impact will be positive on workers with high skills level in a first phase (COMM 2012b). However, there will be a spectacular growth in employment in the production sector of technologies associated with green economy (low, medium skills), but these will only be available for the short period because, jobs related to green economy in the long term are highly skilled (CESE-ESC 2012).

The transition to the green economy in rural areas requires encouraging investments in this area, permanent and fluent communication between the public and private sectors in order to achieve objectives (Pasakarnis *et al.* 2013) and support investors to adapt their strategies to the new challenges (Schouten *et al.* 2012). Unlike the IT skills which have become a necessity for jobs in the previous period, green skills do not have the same motivation for investors to be developed. The increase of IT skills was undertaken by the private sector in order to increase competitive advantages, creating the advantage of cost reductions in the design, production or distribution phases. Instead, business need to be convinced of the benefits of investment in green technologies to achieve them. They have high initial costs and large payback periods, which reduces interest in these investments, especially in the current economic conditions that induce more prudent investment behavior (CEDEFOP 2012). For example, Castro-Santos L., Martins E. and Soares C. G. (2016) show that the most important cost in terms of a farm that uses renewable energy sources is the exploitation cost, followed by the manufacturing and the installation cost.

2.2. Concerns on renewable energy at European Union level

Energy from renewable sources refers to energy from non-fossil sources (wind, solar, geothermal, hydropower, biomass and sewage treatment plant gas) as an alternative to traditional energy sources (COMM 2009). The use of this type of energy contributes to the diversification of energy supply, reducing greenhouse gas emissions and reducing energy dependency. Fossil fuel, oil and gas markets are very volatile with the risk to significantly disrupt markets with high import dependency in case of shocks. The Kyoto Protocol negotiated in 1997 represents the recognition of the importance of avoiding and preventing climate change at global level. It sets limits for emissions of greenhouse gas emissions for the industrialized countries. The European Union is one of the parties that have accepted quantitative emissions limits. It has transposed into its legislation targets on these objectives and has developed recommendations on effective strategies to achieve the objectives in the Member States.

The European Union sets courses of action regarding the energy sector in the Treaty on the Functioning of the European Union (art. 194, consolidated version), recognizing the importance of a functioning energy market, interconnection of energy networks and energy supply security, but also of, promoting of savings, energy efficiency and development of new and renewable forms of energy (O.J.326/2012, EUR-Lex 2012). Starting from 1997, the EU set indicative targets for Member States and targets at Union level regarding renewable energy (COMM 2001).

In 1999, in the Commission Communication on climate change (COMM 1999) the EU shows that current trends in terms of emissions, unchecked, would not lead to fulfillment of Kyoto Protocol commitment, therefore sustainable policy response is needed. The lack of progress in meeting the goals by 2010, determines the EU to establish as mandatory by 2020 a target of 20% of EU energy consumption to come from renewable sources (COMM 2006). The new Directive from 2009 (COMM 2009) set, beyond the general target, also mandatory national targets for all Member States. The directive defined the mechanisms that states can use to accomplish the national target (according to Art. 3 of the directive): supporting or cooperation schemes between Member States or between Member States and third countries to achieve the objectives (joint partners, statistical transfer). Also, Member States should adopt National Action Plans for renewable energy by the middle of 2010, according to a model developed by the European Commission, which includes the minimal requirements for harmonization of National Action Plans. National plans include forecasts of final energy consumption for 2020, sectoral targets, share of energy from renewable sources by categories of uses and measures proposed to achieve objectives.

In 2012, the European Commission has identified areas where action should be taken to continue increasing the share of renewable energy in total energy consumption by 2030 (COMM 2012a), especially by reducing the cost of currently used technologies, so that they become more competitive and to encourage investments in the field. The increasing of renewable energy sectors and energetic efficiency could generate 5 million jobs by 2020, it could increase the EU's competitiveness as the importance of this sector increase at global level (COMM 2012b).

Following the consultation launched by the Green Paper "A 2030 framework for climate and energy policies") in 2013 (COMM/0169 2013) and the Commission Communication "A policy framework for climate and energy in the period from 2020 to 2030" in 2014 (COMM/015 2014), growth target is set at 27% of renewable energy in the EU in 2030, leaving to the Member States establishing national targets. Even in the absence of a direct intervention at Union level, it is estimated that at the moment there is a convergence in terms of ways of action and purpose of implementing renewable energy policies (Kitzing *et al.* 2012). Bigerna *et al.* (2016) show that new renewable energy sources proposed by the objectives of the European Commission, implies producing costs that depend on the comparative advantages generated by localization, and on economic policies in each country. An important aspect in sustaining the production of renewable energy is the 2014 revision of the legislation on state aid in the field of energy and environmental protection, so they do not contravene the principles of the internal market and serve to fulfill Union objectives (COMM/200/01 2014).

European Union owns 5.8% of production of total world energy in 2013. Only 13.4% of this come from renewable sources in the EU and 13.5% worldwide. At the same time, EU holds 12% of world gross inland consumption and 12.4% of gross final energy consumption (COMM 2015b). Renewable energy share in gross inland consumption is increasing at EU level for all renewable sources of energy, while gross inland consumption is on a downward trend since 2006.

The European Commission organized, from 18 November 2015 till 10 February 2016 a public consultation process on preparing the new Directive on renewable energy for the

period after 2020 (European Commission 2016a). After that process, the majority of the respondents (73%) considered the current directive as have being successful "in helping to achieve the EU energy and climate objectives", but more than 90% of them emphasized that "the renewable energy potential at local level is still underexploited" (European Commission 2016a).

The new framework is more ambitious than the previous one, as it sets out the European Union renewable energy target of at least 27% of final energy consumption in the EU by 2030, and this has to be made "in a cost-effective manner across the three sectors of electricity (RES-E), heating and cooling (RES-H&C) and transport (RES-T)" (European Commission 2016b, 2016c).

3. Discussion and perspective

3.1. The state of rural development in Romania

The characteristics of the rural area in Romania affirm the necessity but also the possibility of moving from traditional to sustainable in terms of energy production, employment, gross value added, etc. The territorial units associated to rural area represent 95% of the total land area in Romania and 81% in the EU. The largest part is for agricultural land use in Romania 60.44% (43.97% in EU) and 29.22% represent forest area (37.83% EU). This provides significant resources for rural economic development, but Romanian rural area, could not benefit from them because it was in a constant transformation after 1989, period marked by successive reversing of rural-urban migration processes (reflected in the fluctuating shares of rural population in total population according NIS (NIS 2016). The reverse migration was not the result of increasing opportunities in the villages. The rural area was a safety net for a large part of the population that was affected by the processes of economic restructuring in the first period of transition, maintaining the same character in the next periods marked by economic crisis and job losses.

The agricultural sector is still a sensitive issue, because over time it has not been outlined and implemented an effective policy in this area. Thus, the frequent changes have often generated instability and lack of credibility. The effects of agricultural policies applied often in contradictory ways, lacking continuity after 1989, have generated an agriculture which is fluid, unstructured, non-performing, noncompetitive and mostly of subsistence. Although EU membership has brought a series of financial resources and opportunities for agricultural activities, this area still requires continuous efforts to increase the productivity.

Since 1989 collective farms began to crumble, in attempting a faster transition to a market economy as the ones in the West, employment opportunities in the secondary or tertiary sectors in the rural area were low (Iorio, Corsale 2010; Hubbard *et al.* 2014). Otiman considers the transition from large agricultural units, that characterized the socialism, to small agricultural units, was accompanied by some problems:

– Leaving uncultivated arable land, abandonment of natural grasslands, of plantations of trees and vines, using only 8–10% of the country's irrigation potential. Unutilized agricultural land, registered at the General Agricultural Census in 2010, including the units that did not meet the conditions to be considered farms was 896 thousand

hectares, compared to the rest of the agricultural surface of 953 thousand hectares (NIS 2010);
- Depopulation of rural areas and the increase of share of unskilled labour force, the aging of rural population. For example in 2011, the number of farmers – heads of farms aged 60 and over, represented more than half of the number of farmers registered with APIA-Agency for Payments and Intervention in Agriculture (51.88%) and worked approximately 2.62 million hectares;
- The decrease in the level of processing of agricultural raw materials and the disappearance of rural social economy, which led to a decline in the living standards of many inhabitants in rural areas;
- Romanian bank loans granted to agricultural holdings are lower compared to credits granted to European farms. This slows the renewal process of technologies and equipment and also the development of infrastructure;
- A serious dependence of the Romanian farmers on the annual meteorological conditions;
- Lack of properly trained staff to support an efficient agricultural system (agricultural schools that have survived over time are insufficient compared to the need of skilled workers). The General Agriculture Census 2010 data showed a worsening situation and enhance the gap with the European average (29.4%). Thus, only 2.5% of the farmers were characterized by complete basic education in agriculture, while the majority had only practical agricultural experience (NIS 2010);
- The low level of productivity. Even in the years that are favorable for the crop, the productivity level is below 50% of the EU27 average, which shows the economic untapped potential of the Romanian agriculture system and rural areas (Otiman 2012).

Currently, the rural population represents 45% of the total population in Romania, only two countries, Slovakia (46%) and Slovenia (50%) exceed this level in the EU – which gives the Romanian economy, from this point of view, a more pronounced rural character than in other EU countries. A quarter of the total employed population in Romania works in agriculture, a subsistence agriculture, that do not provide decent incomes and which creates an increased dependence on climatic conditions and increases the risk of poverty or social exclusion. In 2013, according to NIS (NIS 2016), 67.17% of the employed population in Romania are employees, but in rural areas, only 38.64% of the employed population has this status.

As a results of collectivization and of the long process that aimed land restitution, among others, the agricultural structure based on farms is highly polarized (Salasan, Fritzsch 2009) and fragmented – more than 70% of the rural inhabitants are farming on less than 2 hectares and only 2% of exploitations exceed 10 hectares (Alexandri, Luca 2012). The average size of an agricultural holding in Romania is 3.6 hectares, that means four times lower than the EU average, which stands at 16.1 hectares. At EU-28 level, almost half of the land used in agriculture can be found in four Member States of the European Union, namely: France (15.9%), Spain (13.4%), the UK (9.8%) and Germany (9.6%) (Eurostat 2014).

The low level of mechanization, the crumbled land caused by the change of ownership regime after 1989, the existence of small farms with low productivity which mostly produce

for the own consumption are reflected in the low contribution of agriculture to GDP, which although higher than the EU average indicates, in correlation with the level of employment, a much lower productivity than the national average productivity. This means wasting some important resources, primarily human recourses but also natural recourses (non-mechanized cropland that could be partly put aside and used with higher efficiency in other areas, such as renewable energy).

The development level of Romanian rural area can be analyzed also by limited access of rural population to non-solid fuel: 56%, the lowest in the EU, given that the majority of EU states records of 99–100% (except Estonia, Latvia, Croatia with levels between 70–80%). This creates a certain dependence on solid fuel, renewable or non-renewable, which may mean a forced increase in energy consumption from renewable sources, biomass, for rural population.

The vulnerable groups, which have found in rural areas the solution for solving subsistence problems, are those that cannot adjust or adapt hard to new requirements imposed by the market economy. These categories are generally old people or people with low level of education and reduced availability of retraining. Education level is lower for the rural population compared to urban areas. The differences are significant in Romania both compared to the total population and compared to the rural population in the EU. Thus 43% of the rural population has primary education in Romania, compared to only 30% in rural areas in the EU or to 29% if we refer to the total population in Romania.

Romania's rural area is still dominated by agriculture, a low productivity sector which offers no incentives or financial resources necessary to the labour force to qualify or re-qualify and which do not stimulate entrepreneurial activities. The major challenge is to produce food for the population using reduced labour force, natural resources and reducing waste, to transform agriculture from an intensive resource consumer sector in a sector that release resources for alternative uses. Development opportunities for rural areas aimed not only agriculture or organic farming but also the development of renewable energy that found in rural areas contributing factors: unused land, underemployed labour force, low income, poverty, which requires intervention by authorities.

Thus, the issue of rural development is complex because the rural areas have a high development potential that results from their diversity and specificity. Even more, Romanian rural areas have a high development potential derived from the size and extent of these areas. Stan, Vintila and Tenea show that Romania's development potential based on renewable sources is high, wind energy is being one of the forms of renewable energy that can be the engine of development of rural communities in Romania (Stan *et al.* 2016). So, the Romanian rural area has significant potential, but in order to be correctly exploited, coherent policies, concrete measures and people well trained are required.

3.2. Renewable energy in Romania and European Union

Romania's accession to the EU has brought increasing concerns for agriculture development projects and for the transition to renewable energy use. Progress of Romania in the development of renewable energy have been made after Romania became EU member country

(2007). This happened because, on the one hand Romania was needed to adapt to demand from the EU and, on the other hand, Romania has received European funds to develop this domain. For this purpose, in 2007 it was adopted Romanian Energy Strategy, which analyzed Romania's potential for renewable energy.

For rural development, has been elaborated a Romanian strategic document – National Strategic Rural Framework (2014–2030), which was shaped around the functions of the countryside and its economy, based on the new common agricultural policy reform and European agricultural budget of over 7 billion euros. The document is structured on three pillars: agriculture, food and environment and represents a horizontal strategy for shaping other national strategies and programs that impact the rural development. It is estimated that Romania has a significant alimentary potential, hence to the year 2030 for supporting 38.5 million people, which shows a great potential for export and consumption of non-food agricultural raw materials of about 49–50 bn. Euro (National Strategic Rural Framework 2014–2030).

In terms of cost competitiveness with conventional energy, in Romania, renewable energy can be a low cost alternative (cost-competitive) under favorable conditions of location and resources (water, wind, geothermal). Even if the production of renewable energy has decreasing costs, they are still high. There should be the support of public policy, if we consider the negative effects of using fossil fuels, not included in the cost. The European Union recognizes the importance of using renewable energy sources by setting a target of 20% share of energy from renewable sources in total final energy consumption by the end of 2020 with a minimum of 10% share in the transport sector through the Renewable Energy Directive (COMM 2009). This objective is also part of The 2020 climate and energy package set in 2007 by EU leaders and is also one of Europe 2020 Strategy headline targets for smart, sustainable and inclusive growth (COMM 2010). Each state has its own national action plan and target that varies within a range of 1% in Luxemburg, to 42% in Sweden depending on the starting point of each country (Figure 1). The target set for Romania was 24%, 4 percentage points above the EU target, because at the moment of discussions Romania's level was near the overall target of 20%. The establishment of mandatory national targets is important for increasing security investments and encouraging technological innovation. The overall target is calculated based on share of renewable energy in electricity generation, in heating and cooling production and in transport. Even if for transport Romania, as the EU, is far below the target, the share of renewables in electricity and heat production determine in 2014 a share of overall renewable energy in gross final energy consumption in Romania above the target set by Europe 2020 Strategy. Achieving objectives regarding renewable energy is estimated to generate consequences in economic, social, institutional and environment fields (Zografakis *et al.* 2010).

Both in Romania and at the EU level as average, the share of different energy sources in final energy consumption has changed in the last 25 years (Figure 2), in both cases; the share of renewable energy has been significantly increasing. At EU level it was a significant decrease in the share of solid fuels in final consumption, from 12% in 1990 to 4% in 2014, and an increase in the share of gas and renewables. In Romania, during the same period, the share of gas significantly decreased in final energy consumption, as result of price liberalization, and the share of oil and renewable energy in final consumption increased.

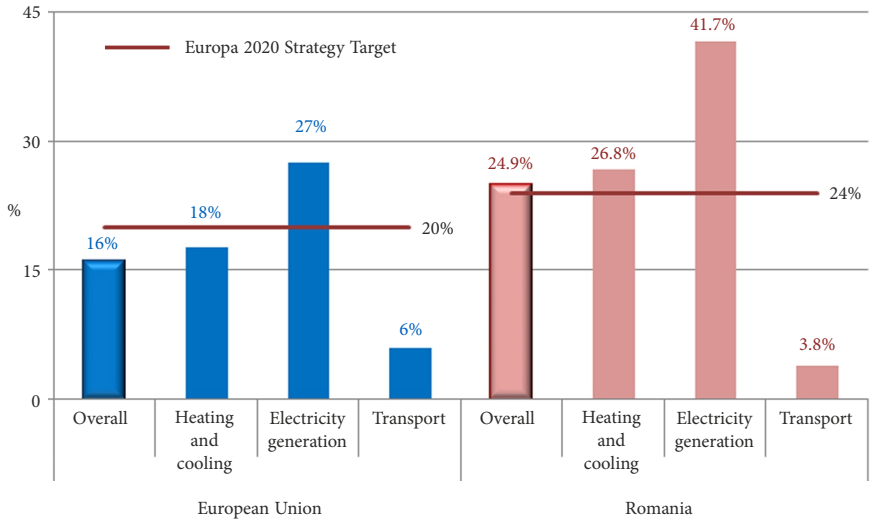

Figure 1. Renewables in gross final energy, Romania and European Union, effective 2014 vs Europe 2020 Strategy target (COMM 2009; Eurostat 2016)

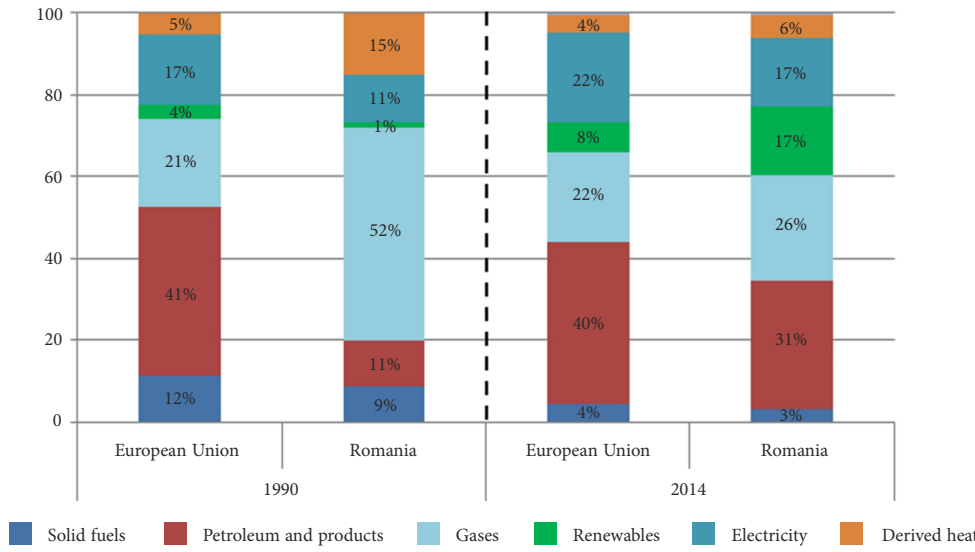

Figure 2. Final Energy Consumption by fuel type, Romania, 1990–2014 (European Commission (d), DG ENER, Energy Statistics, 2016)

The increase of production and use of renewable energy after 2005 has led to decrease of CO2 emissions in 2013 by 5% in Romania, and by 7% across the entire European Union, according to estimates EEA (EEA 2016). The effect of using renewable energies in 2005–2013, in terms of reducing CO2 emissions equates to a reduction equivalent to 3.5 times more than the annual emissions recorded by Romania.

It is estimated that renewable energy can generates effects on job creation, both directly and indirectly and can have spillover effects that induce new jobs in the economy, especially in the implementation phase.

Those jobs indirectly generated that are related to provide various industrial inputs, are the consulting firms or research organizations etc. Those induced by renewable energy are generated throughout the economy due to increased welfare of individuals (IRENA 2011). The most easily understood and measured are the green jobs, directly generated by the renewable energy sector. Most of them are related to the production, deployment, storage and transportation of technologies. Also directly, the renewable energy creates more jobs in the installation processes, explain/operation and maintenance of these technologies. The existence of this second category of direct jobs is an advantage for countries with low potential of modern technology production. This is a direct effect of globalization, because once produced, technology can be accessible to everyone, uncertainties being related only to the time of dissemination and costs. Regarding to the cost of the new technologies, there is a decreasing trend, stressed by the great potential of new technological innovations in the field. The advantage is even greater for countries that aim as through renewable energy to increase the development potential of rural areas, exploiting the potential workforce in these areas.

The barriers to adoption of the associated technologies to renewable energy are related to limited access to financing, lack of access to grids, large periods of time necessary for various approvals (Nasirov *et al.* 2015).

Renewable energy will create new jobs in the future. Currently, in Romania it is estimated that there are approximately 19,000 jobs in the renewable energy, mostly being associated to biomass sector, due to the low level of mechanization in this sector, on the one hand, and as a result of low investments (high initial costs in the other sectors which generate renewable energy) on the other hand.

The need for regulation of the renewable energy field is due to the fact that since 2004 the European Union has been dependent on energy sources located abroad, with high and volatile prices, even if objectives established at the EU level are estimated to generate a cost of 0.4–0.6% of GDP in 2020 (Capros *et al.* 2011).

Energy supply security, understood as ensuring the continuity of energy supply is an important concern in European Union, given that high import dependency on fossil fuel increases the vulnerability to shocks that affect prices or supply resources possibilities. Energy import dependency is increasing in the European Union for all types of energy (53.5% overall in 2014, Figure 3) and is situated at a very high level for oil (87.4% in 2014), which accounts for 34% in total gross inland consumption.

In Romania, the import dependency is low if compared to EU: 17% in 2014, the third lowest level in the EU after Estonia (11.9%) and Denmark (12.3%). For Romania, import dependency is very high for hard coal (anthracite, coking coal, other bituminous coal, bituminous coal and under), being at the maximum and stable level of 100% after 2002, due to closing mining exploitations. This high import dependency for this fuel is also explained by the fact that the share in national energy production decreased from 6.83% in 1990 to 0.17% in 2014 and the decline was much slower in gross inland consumption during the same period: from 21.92% to 17.79%. Therefore, consumer demand is covered by imports.

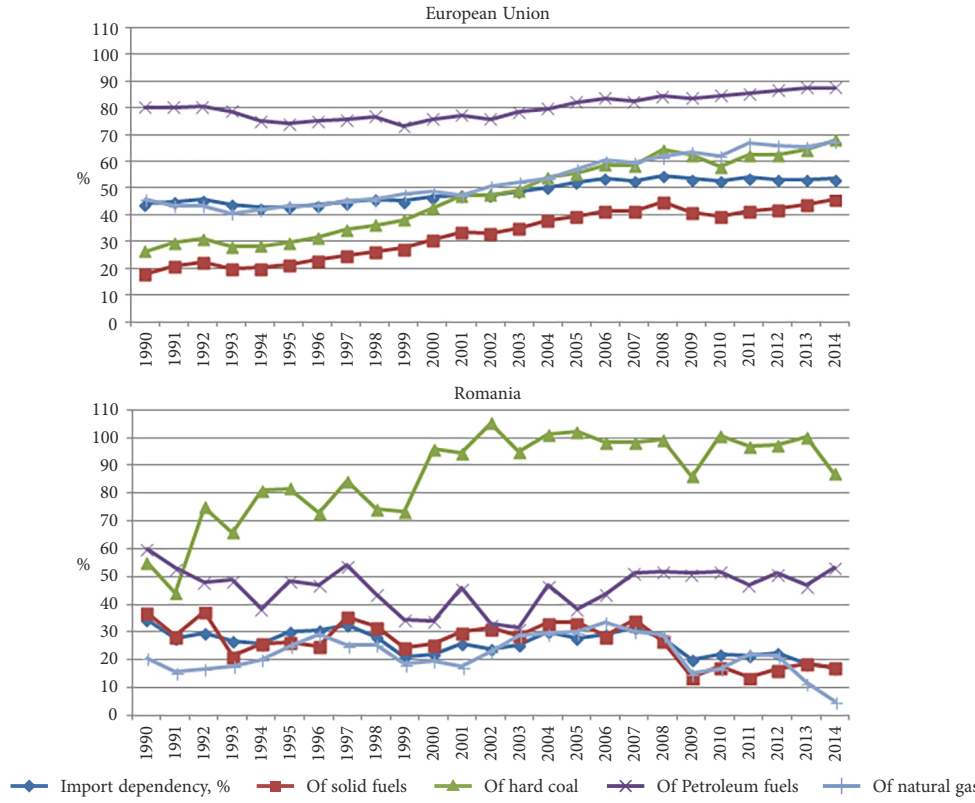

Figure 3. Import dependency: European Union (EU) and Romania (European Commission 2016d)

Reduced dependency can be achieved by increasing energy efficiency, diversification of supply countries and transport routes or through renewable energy or domestic sources of fossil fuels. Renewable energy is a viable alternative for conventional energy. The production capacity is not directly related to the degree of endowment with conventional sources of fuel. It is estimated that it will generates positive effects not only in terms of energy security, but also in terms of climate change and economic development in general (OECD 2012). The analyze on the link between import dependency and use of renewable energy in Romania using linear regression revealed a strong negative correlation between the two variables between 2004–2014 in Romania, having a significant coefficient of determination (0.86) that indicates that the increasing use of renewables can be a significant factor (Figure 4).

For the sustainable development of rural areas, to enhance people's lives but also for security of energy supply and reduce import dependency, Romania must exploit the potential that holds in the fields of renewable energy and develop the production of these types of energy, considering the resources of each area, the technical characteristics of production in each case, consumption patterns and also the usage of land areas. We must not forget that sustainable development of rural areas means sustainable development for Romania, which involves the transition to a green, friendly environment.

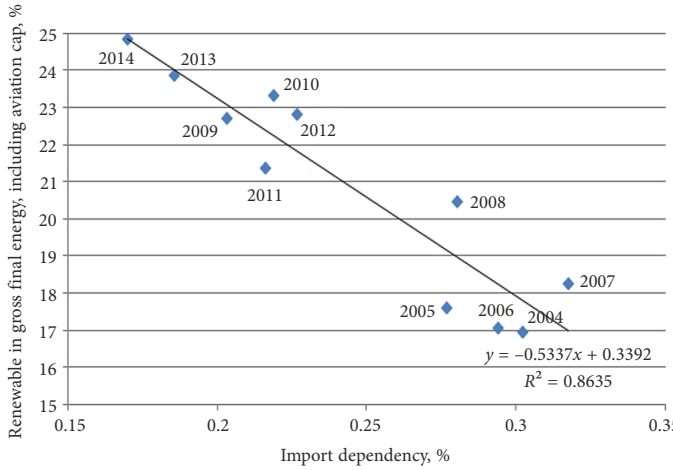

Figure 4. Import dependency and renewable in gross final consumption (%), Romania, 2014 (European Commission 2016d)

3.3. Linking sustainable development to rural renewable energy potential in Romania

Romania's Energy Strategy (2016–2030) promotes the production of energy from renewable sources, so that a high share of energy to be covered from these sources, i.e. 38% of energy should be produced from renewable sources, up to 2020.

The National Action Plan on Renewable Energy pays a special attention to rural energy potential, because of the great diversity of renewable resources that could be used for providing energy both for rural and urban areas (PNAER 2010).

62% of renewable energy is represented in Romania by biomass (Figure 5). Urban areas in Romania, with few exceptions (for example the use of thermal waters), are using heating systems based on natural gas or solid fuels. Their transition to renewable energy sources involves large investments for the entire area. The attention is paid in the current period to increase energy efficiency of buildings, without bringing many discussions on renewable

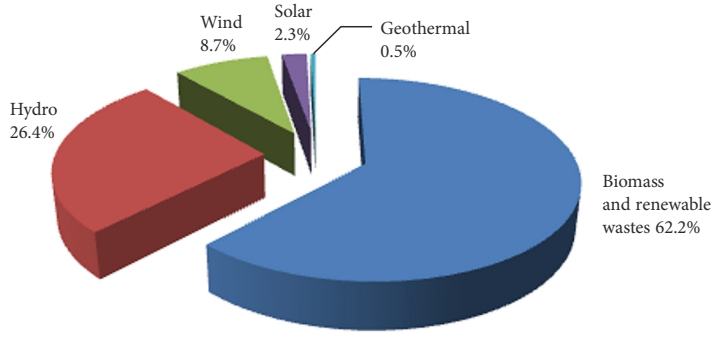

Figure 5. Share of renewable energy by type in gross inland consumption, Romania 2014 (COMM 2010)

energy. In rural areas, however, investment choices are made by households individually, which ensures higher chances of achievement. Thus, the possibility of using renewable energy in rural areas is higher for the moment. Resource constraints will determine the future move emphasis from increasing energy efficiency to use renewable energy sources in rural areas: the solar energy that can provide hot water also in urban centralized systems for a large part of the year, the burning waste, the use of biomass or the thermal water. Solar power still occupies a very small share in the total renewable energy in Romania, 2% compared to 6% the EU average. This is due to higher costs of photovoltaic (PV) solar panels compared to the cost of biomass in the installation phase, although the operating cost is very low. Romanian government has tried in the previous period to support the installation of solar PV through projects like "Green House" which provided grants for such investments. Although it hasn't been successful in the previous period because of delayed allocation of subsidies, the project was reopened in 2016 to support the installation of solar PV and heat pumps both in individuals and legal entities.

If we analyze the relation between energy consumption from renewable sources (RW) and GDP per capita in predominantly rural areas (GDP), in Romania, we'll notice that between the GDP and the consumption from renewables there is a strong positive interdependence.

Using linear regression model we have define the GDP per capita (GDP in Euro) as independent, explanatory variable, while the energy consumption from renewable sources (RW in MToe) was considered a dependent, resultant variable. The parameters were determined using a dataset of indicators for the period 2000–2013, available from official European Commission database, Eurostat and using Eviews 7 with the least squares method, the regression equation being displayed on the next chart (Figure 6).

The linear regression of final energy consumption from renewables and GDP per capita in predominantly rural areas shows that the indicators are strongly correlated, both R square (0.8191) and adjusted R square (0.8040) being strong. The coefficient of independent variable is 0.0002 showing that at each increase of 1 euro of GDP per capita, the consumption from renewables increase by 0.0003 MToe.

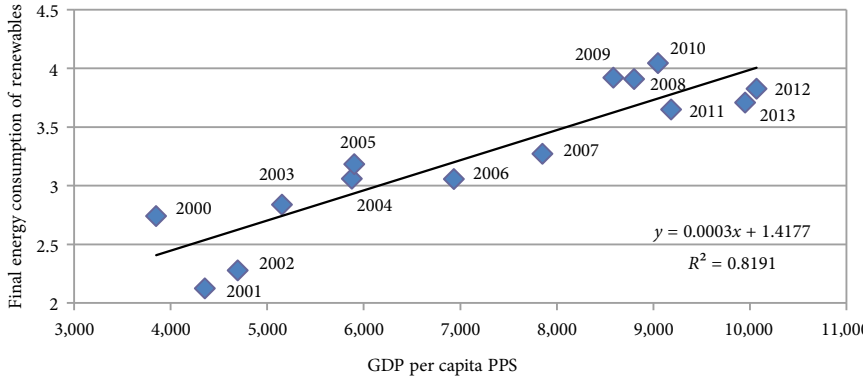

Figure 6. Energy consumption from renewable sources and GDP, Euro PPS, in predominantly rural area, Romania 2000–2013 (European Commission 2016d; Eurostat 2016)

Renewable energy sector and economic growth sustain each other in rural areas. The strong relation can be considered as normal one because the economic growth in rural area is based on agriculture, a sector with very low labour productivity, old technologies, low skilled labour force. A strong economic growth in rural areas can be explain by other development than classical agriculture, such as industry, ecological agriculture, changing land use from agriculture to renewable energy production, increasing the education of labour force in order to find employment opportunities in other sector than agriculture, with high income. High attractiveness of renewable energy sector both for labour force and for investors with long term view is related to increased value added of this sector and high energy consumption from renewable sources. As a result, we also consider that the relation between renewable energy and economic growth in rural area is bidirectional.

The potential of renewable energy in Romania is high, offering for areas both environmental and socio-economic benefits (Stan *et al.* 2016; Del Rio, Burguillo 2016). Used capacity is much lower due to the availability and cost of the technologies and to the economic efficiency of their use. Renewable energy represents 6.12 Mtoe in 2014 in Romania and the potential of renewables is 14.72 Mtoe. This indicates a renewables exploitation at a rate of 41.57% of potential (Figure 7). Exploited at maximum economic capacity, renewable energy would cover 45.57% of gross inland consumption and 67.83% of final energy consumption in Romania 2014 (Figure 7).

In Romania, wind energy accounts for 13% in renewable energy and is exploited at a rate of 27% of total economic capacity. Wind conditions in Romania are close to the EU average, but still far from the level recorded by countries such as Germany or Spain, countries with more favorable conditions in terms of wind speed. Investments in wind power were built in 2010–2013, when Romania was among the first emerging markets in Europe, considering the installed capacity of wind power. In 2012, wind power covered 5% of the total renewable energy consumption, given that in 2009, it represented only 0.9%. In 2013 Romania was ranked 10th in the world in wind energy potential (Romanian Business Digest 2014).

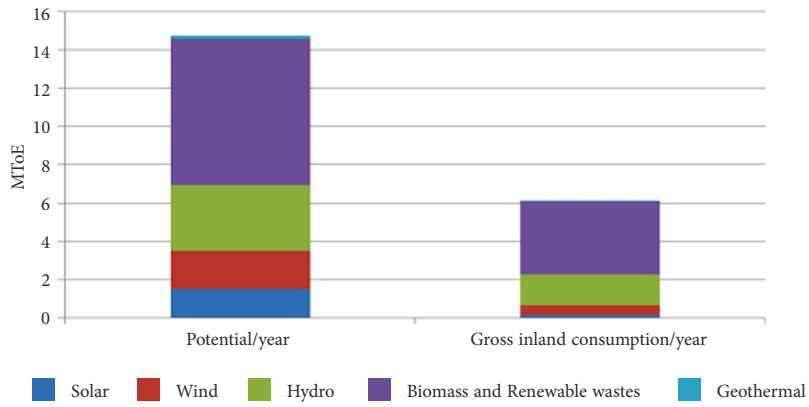

Figure 7. Renewable energy by type of resources: energy economic potential and gross inland consumption, Romania 2014 (European Commission 2016d; PNAER 2010)

Areas suitable for development of this type of energy are Dobrogea, Moldova and the Black Sea coast, which is characterized by a high speed of the wind, but also by a low population density. Wind energy development in recent years continued but not with the same intensity, mainly due to the subsidize reduction for these investments, but also due to the problems faced by investors, such as unstable energy transport infrastructure.

Any investment in wind power should consider the following: access roads to wind turbine areas, the technological platform required to install and maintain the turbines, the necessary elements for linking to the national energy system. Wind turbines use its own energy, renewable, starting from a wind speed of only 3.5 m/s (Stan *et al.* 2016).

Investing in wind energy in rural areas is profitable as long as it is located in areas suited to this type of energy. It supports rural development through environmental protection, job creation (for installation but also for maintenance of wind turbines phases) and contribution to the electricity national production, which allows Romania to reduce import dependency of primary energy resources, mainly fossil fuels and to increase productivity and competitiveness in the field, so to reduce disparities with developed countries in the EU. The advantage of this source of renewable energy is that the land on which the turbines are located can still be used for certain agricultural activities. It is also a completely clean investment that does not involve high costs. The disadvantages of locating wind turbines in rural areas are: noise generated by turbines, unsightly changing of landscape, possible destruction of an investment when storms.

Stan *et al.* (2016) stress the importance of renewable energy, especially wind energy in Romanian rural areas, because they consider that renewable energy is essential for Romania and can be an engine for development of rural areas.

Solar energy recorded, at global level in 2015, the largest increase in investment compared to investment in other renewable energy sources (12% increase compared to 2014). Moreover, investments in renewable energy, in 2015, were higher in developing countries than in developed ones. The largest investments of this type, in 2015, were made in China ($ 102.9 BN), USA ($ 44.1 BN) and Europe ($ 48.8 BN) (UNEP 2016).

Used both for electricity generation and for heat production, it is estimated that solar energy has a potential of about 14 times greater for heat production compared with electricity generation in Romania, estimates that include individual usage of this type of energy (especially for domestic hot water in heat). Romania's potential for solar energy is high, especially in lowland areas, The Romanian Plain, the Danube Delta and Dobrogea, with an average sunshine of 2,300 hours per year (Ecoven 2016). Romania is located in the European B sunshine area, which means great potential for solar energy (Green Revolution 2016). Although it owns only 10% of the potential of renewable energy in Romania, this type of energy is the least exploited, only 9% of potential, as investments in this sector are low, especially after 2013, when the state was less involved in supporting the domain.

Investments in solar energy in rural areas would bring many advantages, mainly related to ensuring energy at a lower costs, but also some disadvantages arising from agricultural land use change. An issue that could be raised is the recycling of the equipment used in this sector. The lifespan of this equipment is about 20 years, which makes us think about the need to develop recycling programs.

Biomass owns 52% of the total renewable energy potential in our country. 38.75% of the biomass potential in Romania is represented by the agricultural biomass, followed by the forest biomass with 9.5% and other types of biomass with accounts below 5% in total: wood waste, biogas and municipal waste. With a share of 90.8% in total biomass potential, vegetal biomass is the main fuel used in rural areas for water and housing. The problem facing rural areas in Romania in terms of developing this potential is the lack of systems to collect agricultural waste and the lack of a specific market (Ministry of Economy 2010). In January 2016, the production of electricity based on biomass represent 0.58% of total energy production. It experienced a slight increase compared to January 2012, when it was 0.29% (Transelectrica 2016). The advantages of using biomass for rural development consists, in addition to converting this waste into energy, in creating jobs for collecting, transporting and storing biomass. It also improve the quality of soil, water and maintain the human and animal health. As a result of the large share of population employed in agriculture, biomass could represent the best cost-effective solution for Romania, as the farmers could add or adapt biomass energy generation to their agricultural production. Biomass generates emissions much lower than fossil fuels and reduces waste and carbon dioxide released into the atmosphere (Gavrilescu 2008). Geographically, The South Plain and Subcarpathian Mountains hold 45.68% of the biomass potential in the whole country.

Hydro energy, including small hydropower, has great potential in Romania, ranking 2 in terms of the potential of renewable energy. However, the lack of investments to achieve artificial accumulations to compensate for low water flows in certain periods and areas make this energy unusable. The degree of exploitation of the hydro energy potential is 47% in 2014. However, Romania has experience in hydro energy generation as a result of water resources at its disposal, 18.63% of electricity production using this source. Hydro energy production has a lower environmental impact, providing other benefits, apart from producing electricity at low cost, such as flood protection, irrigation, tourism development. At present, Romania's potential for hydro energy is not entirely used and requires investment to modernize and upgrade new hydropower production centers.

Geothermal energy potential is low in Romania, 1% of the total renewable energy potential, only 17% of potential being exploited, mostly for heating greenhouses and agriculture.

The common uses of renewable are electricity and heat production. The largest share of renewables used in electricity production is represented in 2014 by hydro sources and wind, 70% and 22% respectively. For heat production (sold) biomass is the most important source, accounting for 93% of total renewables, followed by geothermal 7%.

In order to increase the renewable energy potential in Romania, can be used, as described in National Renewable Energy Action Plan (PNAER 2010), two types of support schemes. The first scheme applies only to investment stage, both for private operators and for local government. An example of support schemes granted to individuals in Romania is Green House Program, which awarded a grant for the installation of heating systems using renewable energy, including replacing or supplementing traditional heating systems (solar, turbine wind, heat pumps etc.). Although the program is in progress for 2016, it wasn't a success one over time as a result of excessive bureaucracy and syncope in its unfolding.

The second scheme is applied to the entire period of operation of an investment project (mandatory quota system combined with the trading of green certificates). They provide grants from structural funds and from the Environment Fund. In this respect, for promoting the production of renewable energy, Romania established in 2008 (Law 220/2008) a very advantageous scheme through green certificates linked to the mandatory annual quota of suppliers of electricity. In a study conducted by an NGO which analyzed 40 countries around the world, Romania ranked 13 in 2011 in terms of attractiveness of renewable energy sector (it ranks 24th in terms of solar energy and even 10th in terms of wind power) (Ernst & Young 2012).

At European Union level there was the belief that renewables have grown at a pace faster than foreseen due to modern technologies and economies of scale (COMM 2012a) which resulted in Member States repeated changes in schemes of support for renewables. This trend was also followed in Romania, where Emergency Ordinance 88/2011 reduces the number of green certificates granted for renewable energy sources in order to avoid situations of overcompensation. As a result, in terms of Renewable energy country attractiveness index (RECAI – a composite index on the attractiveness of renewable energy investment and deployment opportunities), Romania ranks 33rd in 2015 in a list of 40 countries in the world. This index takes into account indicators on three issues: the macroeconomic situation (stability, ease of doing business), energy market drivers (privatization of renewables, bankability of renewables) and technology (wind, solar and other technologies) (Ernst & Young 2015). The mandatory quotas are maintained at a lower level than initially planned. The direct consequence is the decreased incentive for investment in this field. 2016 is the third consecutive year in which it was decided to maintain the quota at a low level of 12.15% although the level mentioned by the law 220/2008 was 17%. The measures are justified by the fact that it has registered a rapid development of renewable energy sector compared to NREAP and, accordingly, it is necessary to be avoided increasing the share of green certificates in consumer bills.

However, relying on their excellent potential in rural areas, renewable energy deployment can put rural areas back to work, bringing, as a significant change, the transition from agriculture as a central point of rural areas development to other economic sectors with development potential. Although the effect on economic growth is still not significant, growth potential of renewable energy in rural areas is high, as this sector is integrated in the rural area traditional branches: tourism, agriculture, fishing, forestry, manufacturing etc., and along with understanding, awareness of the importance of the environment in the development equation (UNEP 2016). The subsidies granted by local or national authorities in order to achieve the ambitious targets set out at community or global level and nationally accepted are an incentive for acceptance of the change of land use, for equipping individuals with new skills, for accepting investment risk for those who have certain financial resources. Preparing the individuals with new skills, according with the requirements of the green economy is very important to obtain the long term performances (Dimian *et al.* 2013). This is an important point for large-scale renewable energy production in rural areas, facilitating the necessary transition, from small private individual investment to large private business investment and assuming the investment risk.

Conclusions

The concerns for the renewable energy use have been amplified in recent years, worldwide. The development of any economy requires, in addition to boosting growth, and implement policies to support the efficient use of resources and environmental protection. The European Union policies give a great importance to the green economy transition, which involves a higher care for the environment, both urban and rural.

Romania's rural development policy focuses on improving the quality of life in rural areas and on the development of these areas. Romania is among the first EU countries in terms of the share of land area in total area and the rural population in the total population. According to a region classification of European Commission, Romania is integrated in the predominantly rural region (Burja, C., Burja, V. 2014). Agriculture is one of the major branches, although it has not developed greatly in recent years. As a result, the contribution of agriculture to GDP is still low comparing to the size of population employed in agriculture. Therefore, use of renewable energy in agriculture and rural areas is important for Romania because, on the one hand, it has potential, and, on the other hand, it would lead to the development of rural areas.

The underdeveloped rural economy generates negative effects in the long term, such as creating a vicious circle of poverty and social exclusion, migration of youth to urban areas or abroad with effects on age balance, degradation of natural resources.

Through public policies, rural development can be sustained as a central pillar of sustainable development only with private initiative, its role is particularly important in both the phase of identifying weaknesses, but also in the investment risk-taking phase.

It is therefore necessary the awareness of decision makers and their active involvement in order to support rural economic development as a central cornerstone of national economic development, through appropriate policies and regulations. Ensuring of a stable, coherent and favorable investment environment attracts the investors and reduces the uncertainty of the business environment, by better exploiting available inputs, especially labour force, which is underused in agriculture, offering, through new jobs created, real chance to increase the living standard and get out of poverty. This requires an efficient communication of business environment with local, regional or national authorities and involves the recognition of the needs and achievements of rural areas and the opportunity of business environment to influence the decision making process.

Until now, the increasing of the share of renewable energy in final energy consumption, in Romania, has reduced CO_2 emissions and helped to reduce the import dependency. How rural areas haven't experienced a significant development in terms of agriculture, expansion of renewable energy exploitation is a solution for rural development both from the point of view of energy production, employment, energy security and of developing of a green economic environment. Indeed, in the first stage of implementation, the renewable energy is more expensive, but it becomes competitive under favorable conditions of location. In Romania there are favorable conditions for five renewable energy sources: wind, solar, hydro, thermal and biomass. The national legislative framework was improved through the development of a package of financial support schemes and market operation mechanism of green certificates, which has boosted the development in the field.

Some renewable energy sources require large spaces (especially solar panels), others can be made without disturbing crops (wind turbines). How Romanian rural areas have land that can accommodate to the development of renewable energy sources and because Romania has a high volume of renewable resources (sun, wind, water), there are justify the investment in these energy sources in rural areas.

Romania is at the beginning of the transition to a sustainable economy, having a high development potential of rural areas using renewable energy. Thus, it is necessary to identify the most suitable types of renewable energy, for different areas and to adopt the policies in order to support projects referring to these types of energy. This will generate investment efficiency and attractiveness for new potential entrepreneurs. In addition, improving grids is necessary: creating infrastructure for the transportation of renewable energy from small investors.

Solutions that should be targeted by economic policies in Romania are efficient supportive of the entrepreneurship in renewable energy through schemes that are viable and stable over time. Many changes in law or repeated waivers discourage investors especially in an area where initial investments and the recovery periods are so large. The important role of entrepreneurship as creating new sustainable businesses and jobs has been identified in many studies, which show that the key factors influencing the successfulness of a green company are: customer value-added, collaboration in R&D and supply chain, knowledge of markets, products and processes (Jernstrom *et al.* 2017).

The role of agriculture in the Romanian economy must be reconsidered in a system of circular economy such as suggested by the European Union. The opportunity cost of jobs in agriculture is small due to low efficiency, which encourages rethinking land use in terms of increased efficiency and positive impact on the environment. Such a reorientation of the economy would create favorable conditions for migrants in Romanian agriculture with low incomes, but requires a long-term strategy to integrate aspects of individuals, economy and environment.

It is also necessary to anticipate the new skill needs for labour force and to create skills in renewable energy in order to reduce skills shortages but also to improve communication and to inform the population for a better understanding and awareness of the importance of renewable energy sector and of jobs in this area. Some studies show that "the employment can promote the development of renewable energy" by adapting to the demands of the green economy (Xu, Dongkun 2017).

Managing the transition to a sustainable economy based on use of renewable energy, at national level and in rural areas, should continue given the availability of resources in Romania. However, to get results, these efforts have to be shared by both public sector and private sector.

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