

## SHAPING A SUSTAINABLE FUTURE IN THE ENERGY SECTOR

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### Abstract

The growing consumption of energy is felt worldwide, and because of this issue the application of measures are required in this area. These measures are stipulated in the framework of policies and strategies in the energy field, whose objectives can be more easily achieved if the principles of sustainable development are taken into account.

Confusion is created between these principles and the dimensions of sustainable development; this paper wants to emphasize the difference between the two notions, with examples edifying in this respect.

Once the policies and strategies are formulated, things can move in any direction, and to demonstrate this, we considered it appropriate to present scenarios on energy policies and to try to identify where Romania stands right now, according to the axis that separates the two scenarios: a government commitment and degree of cooperation and integration.

Starting from the idea that “the main tool in the fight against climate change (...) is the energy policy” (A. Leca, V. Musatescu, 2010), the paper presents the premises of formulating viable policies and strategies, making some observations on Romania’s Energy Strategy 2007-2020.

**Key words:** energy, GHG emissions, sustainable development, climate changes

### INTRODUCTION

As the world increasingly feels the consequences of the growing of the energy consumption, the application of measures in this field is required, in order to minimize the adverse effects and lead to the increased quality of life through sustainable development. These measures are stipulated in the policies and strategies in the energy sector.

Once the policies and strategies are formulated, good or bad things can evolve, depending on their credibility, according to government involvement and the degree of cooperation and integration of the state.

XXI th century world faces a growing demand for energy and also with a decrease

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in the reserves of conventional resources, oil, natural gas, coal. If in the year 1950, world energy consumption was somewhere around 2 billion tonnes of oil equivalent, in 2010 it climbed to about 11 billion tonnes of oil equivalent (H. Wagner, 2010). About 20% of world population consumes 60% of the total energy produced and the remaining 80%, representatives of the less developed or developing countries, are consuming 40% of the total energy produced (J. Mohammad et al, 2010). This energy production (K. Kachkynbaeva) is materialized in: heat, electricity, and mechanical energy.

Associated with the energy consumption are: the growing high levels of water and air pollution, global warming, greenhouse gas emissions, all with negative effects on the quality of life and the environment.

“Energy is an indispensable input for economic activity. Economic growth will not be possible if a stable energy reserves will not be provided; it must come at a reasonable price and in a sustainable manner”<sup>2</sup>. This last point is actually one of the most important, given the vast spread of the concept of sustainable development, first formulated in 1987 by the World Commission on Environment and Development, in the raport named Our Common Future: “Sustainable development is one that satisfies needs of the present without compromising the ability of the future generations to meet their own needs.”

To ensure a sustainable development, the first solution is to use renewable energy sources, thereby reducing dependence on fossil fuels and, covering a big part of the energy demand and decreasing the pollution.

### **The dimensions and principles of sustainable development in the energy sector**

When talking about sustainable development dimensions, it refers in fact to the scope of sustainable development, namely the elements, called dimensions, to whom the sustainable development is aimed. A confusion is often being made between the size and the principles, the latter derives largely from the definition of sustainable development.

One approach that comes to support the idea above is to define the following dimensions of sustainable development in energy (according to International Atomic Energy Agency, United Nations Department of Economic and Social Affairs, International Energy Agency, Eurostat and European Environment Agency) :

**Social dimension.** The existence of energy impacts on education, poverty, people health. For the most part, sustainable development aimes the social dimension through the following fundamental aspects: the distribution of energy resources to be a fair one, and pricing schemes to be formulated so as to provide access to resources. “Energy should be available to all at a fair price” (Jonathan M. Harris, 2000). Also, the fact that the energy is used from various sources, should not be life threatening, but rather improving to our living.

1. **Economic dimension.** All activities that take place in the sectors of an economy are energy consuming, their deployment depends on enough and

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2 Asian Economic Integration and Energy Cooperation, <http://www.rieti.go.jp/users/tanabe-yasuo/pdf/20050800.pdf>

safe quantity. Therefore the economic dimension circumscribes on the energy security aspects, but primarily on the production structure and methods of use.

2. **Ambiental (environmental) dimension.** Obviously, in order to talk about sustainable development, we must consider the impact that production and the use of energy from various sources have on the environment, especially on water, air, soil, and biodiversity.

3. **Institutional dimension.** Institutional dimension includes elements of the energy system infrastructure in a country, and policies and strategies that aim to apply a sustainable energy future.

In the view of the World Energy Council, the dimensions of sustainable energy<sup>3</sup> are:

**Energy security.** This concept refers to the management of primary energy supply with internal and external sources, to the reliability of energy infrastructure, and to the capacity of the suppliers to meet both current demand, and future demand.

**Social equity.** Aims to see what percentage of the population has access to energy.

**Environmental impact mitigation.** This dimension is what brings in the notion of energy efficiency and renewable energy.

We can say that this approach is incomplete because the dimensions should include several aspects on which to act to achieve sustainable development.

R.J. Fuller, a researcher at a university in Australia, makes a description of the following four principles that underpin sustainable development in general, to customize the energy sector:

- **Futurity.** This principle focuses on carrying for the future generations and to substantiate an energy demand based on the need and not the false impression that we need to consume to more.
- **Environment.** This principle supports the care for the environment, on which no human activity consequences should fall. Most often, the nature supports these consequences, whether we talk about waste generation, land usage, water use, pollution, etc.
- **Equity.** The principle is very reasonable, but in the author's opinion, its the hardest to meet. We can see this, trying to answer the following question: to what extent people that are living in developed countries are willing to consume less energy, in the favour of the poor, in the underdeveloped areas, which can receive only the light of day to ensure daily living.
- **Participation.** Last but not least, the principle of participation, follows the idea that each of us must take part in the decision process, to understand all the implications and potential risks.

The order in which they are mentioned is not related to the importance of taking every single principle, nor the importance of compliance with them. Really important is the bond that forms between them and the fact that only taken together they provide guidance to sustainable development.

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3 Pursuing sustainability: 2010 Assessment of country energy and climate policies, World Energy Council

**Possible evolution scenarios in the energy sector**

An approach worthy of consideration, is the one of the World Energy Council, the study *Deciding the Future: Energy Policy scenarios to 2050*, which, in the idea of promoting sustainable energy, used to achieve the following graph, whose axes are the elements: government commitment, which may have a low or high expression, respectively, the degree of cooperation and integration, which also can be low or high.

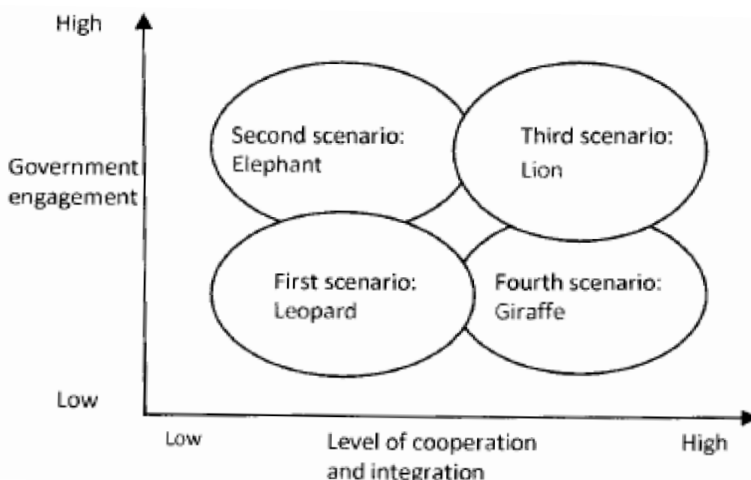
To better understand why these two components have been proposed, it seems appropriate to analyze their definition. Thus, the government commitment refers to how it is involved in the power system operation, the intervention ways in the energy market through various actions and regulations.

The degree of cooperation and integration in energy development, aims at forming joint ventures in order to solve common problems. The most common are the regional and international cooperation and integration. As we can see, these two notions are taken together, as they influence each other, although they can be defined separately (according to Asian Development Bank), for example:

- Regional integration refers to the process by which the economies of a region develop more connections between the elements which worked separately before in that area.
- Regional cooperation refers to the policies and initiatives of the cooperative countries, which could be included in intergovernmental treaties.

According to the two coordinates, four possible scenarios for energy policies are revealed, which can fit within the current energy policies, and to which they may tend, depending on the decisions that are taken. Thus, it outlines the following situations or so-called scenarios, named suggestively after animals, according to their characteristics (see Figure 1):

**Figure 1. Graphical representation of the four scenarios that concern energy policies**



Source: After the model of the scenarios presented in “Deciding the Future: Energy policy scenarios to 2050”, WEC 2007

1. The first scenario is governed by the **LEOPARD**

To designate the low degree in terms of cooperation and integration as well as government commitment, we used the comparison with the leopard, a solitary animal, which acts only when opportunities arise, defend their territory from intruders and not divide the spoil with anyone.

All this transposed in to the economy, means difficulty in transferring technology and know-how, deepening poverty level, and if we consider a low degree of cooperation and integration; if this is supplemented with a low government involvement, then the result is weak capacity to react to external events such as the influence of economic crisis, energy crisis etc.

2. The second scenario is the subject of an **ELEPHANT** behavior.

The elephant, although it is a social animal, once they build a family, they prefer not to relate too much with other families.

High government involvement translates into energy security. Cooperation and integration at low levels, results in pursuing their own interests, their needs, without taking into account the various programs and projects developed by the regional or international organizations.

3. The third scenario refers to the characteristics of the **LION**.

The lion is a social animal and has nothing against the share of their food with others, is a good game art professor, teaching youngsters how to carefully plan a future attack.

In this case we can speak of a high-level cooperation, the pursuit of common interests, important at a global level, technological barriers removal by providing financial assistance in this regard, the development of programs whose objectives will be consistent with the principles of sustainable development.

4. The fourth scenario is based on studying the behavior of **GIRAFFES**.

A very adaptable animal, the giraffe is doing well on its own, but also in alliances, it does not depend on anyone to survive and it defends itself in dangerous situations. The similarity made wants to emphasize the idea of government intervention, usually low, the short-term effects without proactive strategies that would save an economy in crisis. Salvation comes from the private economic agents that promote new technologies and open borders pertaining to transfer of know-how and for understanding with the powers in the field.

Therefore, the careful study of the four scenarios described briefly in this paper provides a starting point for establishing and targeting strategies and policies in the energy sector, depending on the framing in one of them. It should be noted that the analysis was done not by country, but by regions: North America, South America and Caribbean region, Europe, Africa and Asia. You can also see that there were considered only extreme possibilities. Most times, there are situations in which, the countries that try switching to a level of cooperation and higher integration, and the government is making efforts to involve and engage more in the field etc.

### Romania seen from the perspective of sustainable energy

In Romania's Energy Strategy for the period 2007-2020, the principles mentioned in this paper, can be found translated into strategic objectives, covering: *energy security, sustainable development and competitiveness factors*, considered primarily by the European Union by the common energy policy.

“The overall objective of the strategy of the energy sector is meeting the energy needs both now and in the medium and long term, at a suitable price, appropriate to a modern economy and a civilized life standard, in terms of quality food safety, complying with the principles of sustainable development. “(the Romanian Energy Strategy 2007-2020).

Each EU country has, primarily a different degree of development, therefore, to claim the same objectives can cause imbalances in other areas, which ultimately will not target the concept of sustainability. Some targets are challenging even for developed countries of the European Union, not only for the developing countries like Romania.

The European Union started the program 20/20/20, which aims that by 2020<sup>4</sup>:

- to record a reduction in greenhouse gas emissions by 20% in comparison to the year 2005;
- to increase the share of renewable energy in total primary energy production, by 20%;
- to increase the energy efficiency, by 20%;
- to change the share of biofuels, to increase the content of transport fuels by 10% in 2020;

Towards these targets, Romania follows: the use of renewable energy at a level of 24% from the total use by the year 2020, the reduction of the greenhouse gas emissions by 21% and the percentage of biofuel to be at least 10 % in terms of using the new generation of biofuels (as PNAER).

The World Energy Council calculates the Energy Sustainability Index, taking into account two aspects: Energy Performance (75%) and Contextual Performance (25%). Energy performance includes in equal proportions of 25%, three elements: Energy Security, Social Equity, Environmental Impact Mitigation. The second aspect, the one related to the Contextual Performance is also measured by three items: Political Strength. Societal strength, Economic strength. All these elements are measured through indicators, giving scores from 1 to 10, obviously a larger score means a better situation in that category.

The table below shows the results for the year 2010 for Romania and the countries that occupy the higher and low places. We can easily see where are the lower scores, but on overall we have a touch of 5.13, which ranks us on the 40<sup>th</sup> place out of 91 analyzed countries.

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<sup>4</sup> According to Romania's Energy Strategy for 2007-2010

Table 1. Rankings based on the Energy Sustainability Index in 2010

Place	Country	ENERGY SUSTAINABILITY INDEX 2010						TOTAL
		Energy security	Social equity	Environmental impact mitigation	Political strenght	Societal strenght	Economic strenght	
1	Switzerland	9.88	6.66	10.00	10.00	9.77	8.88	9.02
2	Sweden	9.00	6.22	9.88	9.66	9.88	7.22	8.51
...	...	...	...	...	...	...	...	...
39	Cameroon	8.88	1.22	8.44	1.22	0.33	5.00	5.18
<b>40</b>	<b>Romania</b>	<b>6.44</b>	<b>6.77</b>	<b>3.77</b>	<b>4.77</b>	<b>5.11</b>	<b>0.77</b>	<b>5.13</b>
41	Filipines	4.00	5.55	6.88	2.77	2.44	5.22	4.98
...	...	...	...	...	...	...	...	...
90	Ethiopia	0.22	1.77	5.44	0.77	1.22	0.44	2.06
91	Mongolia	0.77	1.11	1.11	2.88	1.66	3.55	1.42

Source: Table based on data available at [www.worldenergy.org/documents/index\\_2010.xls](http://www.worldenergy.org/documents/index_2010.xls)

The lowest scores are found to Economic Strength indicator, calculated on Macroeconomic stability, Cost of living expenditure, Availability to the private sector, and the Environmental Impact Mitigation calculated from the Energy Intensity, Emissions intensity, effects on air and water and Efficiency of Electricity Production. Also, political strength does not have a passing grade because our country does not sit well at the following chapters: Political Stability, Regulatory Quality and Effectiveness of Government, the indicators on which the note was obtained.

It is known that Romania is a net importer of energy, although we have an energy potential resulted in a wide range of resources: natural gas, oil, coal, uranium, and renewable resources.

If we consider the presented analysis, we can make the following observations:

- The results depend on the availability and degree of the data accuracy;
- Is hard to give shares to such indicators, given to the fact that the states considered differ according to the degree of development, size, resources, priorities, concerns, etc.;
- We can make an integration of the policy and energy strategy of Romania in one of the four cases, respectively these four scenarios of evolution presented above.

As we all know, there was no need to confirm our notes, that in Romania, the Government does not have a high involvement degree when it comes to development and especially in the energy sector. The government is unaware of the current issues, and the political instability disturbs the legislative, so most often cases it diminishes the effects of targeted measures in the strategy.

Therefore, on the graph whose axes have been given by the government's commitment and degree of cooperation and integration, we can not choose anything but a low level of government involvement. Regarding the second axis and considering the definitions of cooperation and integration and that we have already adopted the energy strategy, and the national policy in energy from renewable sources from the requirements of Directive 2009/28/EC, we can appreciate, but with great indulgence as we head to a high degree of cooperation and integration and that we can find a place in

the fourth situation, symbolically called Giraffe.

What this positioning of our country actually means? It means that we can expect the following developments:

- Cooperation between states and cooperation between private sector businesses, with potential positive influence on the economic growth;
- A decrease in energy intensity, which refers to „The amount of energy used in producing a given level of output or activity. It is measured by the quantity of energy required to perform a particular activity (service), expressed as energy per unit of output or activity measure of service” (according to the U.S. Department of Energy). This decrease is attributable to new technologies used, whose effects will begin to materialize;
- The increasing oil prices will lead to a lower demand for this resource;
- A tension caused by a larger demand for energy from renewable sources will be felt;
- Because of the poor government involvement, there will be increases in emissions of greenhouse gases;
- Total primary energy required will increase as a result of the free cooperation and the use of new technologies.

### **Romanian energy sector**

In Romania, the energy is produced primarily in plants based on coal, natural gas and oil, plus the energy from hydroelectric plants and a few years now, specifically since 1996, nuclear power. There are three major energy consumers (INS, 2008), in order of use: industry, households and transport.

The entire energy sector is regulated by National Agency for Energy Regulation (ANRE), which “has the mission to create and apply the system for the functioning of energy sector regulation and market power, heat and gas in terms of efficiency, competition, transparency and consumer protection, and the one necessary to assure the implementation of the regulatory system and promoting energy efficiency to end users use of renewable energy”.

Although considered to be an authority of national interest, ANRE is suffering because of the political influence since Romania’s Prime Minister appoints the President of the agency. The European Commission has threatened to apply sanctions precisely because of this, and the lack of specialized training people in leadership positions.

The national companies acting in energy are: Nuclearelectrica, for generating nuclear power; Hidroelectrica, for hydropower production, thermoelectric power generation and electricity; Transelectrica energy transport in the national grid; Electrica for distribution and supply; Romgaz, the gas largest national producer; Transgaz, the national company for gas distribution.

### **Renewable energy in Romania**

The specific types of energy resources in our country, and also the potential of renewable energy are presented in the National Action Plan for Renewable Energy



Sources Sector. But using these sources is restricted, so the potential is lower than the one presented in Table 2, because of the appearance of technological barriers, economic efficiency implications, but also on the environment.

**Table 2. Annual energy potential of renewable energy in Romania**

No.	Renewable energy source	Annual potential (thousand toe)
1.	Solar thermal energy	1 433
2.	Photovoltaic Solar Energy	103,2
3.	Wind energy	1 978
4.	Hydropower	3 440
5.	Geothermal energy	167
6.	Biomass	7 597

Source: National Action Plan for Renewable Energy Sources Sector

Romania produces and consumes energy from renewable sources (the sources mentioned above), according to Eurostat, as follows:

**Table 3. Production and consumption of energy from renewable sources during 2002-2008**

	2002	2003	2004	2005	2006	2007	2008
Primary production of renewable energy (thousand toe)	3748	4061	4594	4984	4831	4717	5418
Gross domestic energy consumption from renewable sources (thousand toe)	3749	4002	4567	4940	4781	4753	5483

Source: Eurostat

If we study briefly the data presented in Table 3, we see that in some years, the consumption of renewable energy exceeds the production. This is possible because Eurostat calculates this consumption, accounting the primary production with the production recovered, with total imports and variations in stocks, minus total exports and bunkers.

### **Investments in the energy sector, especially in renewable energy**

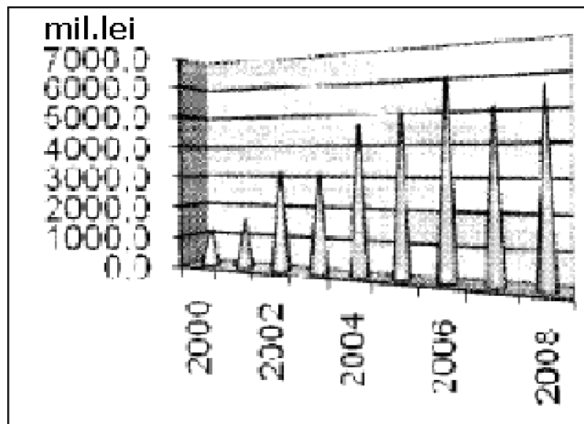
“Promoting investment projects in the renewable energy sector (wind, solar, biomass, geothermal, including municipal waste) and harmonizing the legal framework” (PNAER) is one of the directions for achieving the strategic objective in the energy sector, namely to ensure the energy security of the country.

Usually, such investments are characterized by: substantial financial costs,

the return on investment takes place over several years, there are risk elements and uncertainty about future flows of income and expenditure (Popescu, 2011).

In Romania’s Energy Strategy for 2007-2020, an estimated of 1.8 billion is needed for investment in new electricity generation in the period 2007-2015, “so gross electricity consumption of renewable energy to be 33% in 2010 and 35% in 2015 from the gross national electricity “. In 2008, according to Eurostat, it was 20.4%, the values for 2009 are not specified, it remains to be seen whether Romania has managed to reach the target in 2010.

**Figure 2. Investments in electricity, thermal energy, gas and water**



Source: National Institute of Statistics

During the 2000-2008 period, the evolution of the investment in energy, including gas and water, was the one in figure 2, with the maximum value in 2006.

To achieve their PNAER goals, Romania would require investments worth 2.7 billion euros by 2015<sup>5</sup>. From what sources can these investments come? Romanian State and the European Union provide to investors, the following<sup>6</sup>:

- ERDF (European Regional Development Fund)
- EAFRD (European Agricultural Fund for Rural Development)
- Governmental Funds – Environmental Fund

### **Barriers to development investment projects in renewable energy**

There are many barriers that are most often challenges to development investment projects in the energy sector, especially in development projects that focus on renewable energy. Therefore, we developed a grouping in a few categories that will be presented below.

5 <http://www.windalliancegroup.com/proyectos/eng/romania.pdf>

6 <http://www.ziuaenergiei.ro/2009/pdf/GIR.pdf>

*Administrative barriers*

A study made on 27 European Union countries (including Romania), reveals that, there were a number of administrative barriers, meaning all types of difficulties encountered by stakeholders in the process of investment, difficulties that are related to working with people and public institutions. These barriers will be presented in an order made that shows that were they were mentioned most often. Among the administrative barriers are the following elements:

- Spatial planning failure

For most technologies used for obtaining energy from renewable sources are required considerable stretching sites, eg for wind turbines. Thus, in many places viable for exploitation of renewable sources a suitable location for the placement of plants cannot be determined.

- Nimby attitude

Nimby stands for “not in my back yard”. Nimby attitude effect in this context can be translated as a reluctance to the project of general interest as social opposition, as a protest, usually against the rise of buildings near the house.

- Difficult procedures

They are actually referring to the long time needed to obtain the permits needed to develop, and to implement the investment projects in renewable energy.

- Too many authorities involved

Closely related to the one mentioned above, this barrier refers to the excessive number of authorities involved in the licensing procedures.

- Local administration

The reasons for which the local government actions are seen as barriers may be: considering that such a project will have negative effects on tourism, local people disagree, the influence of power groups in the energy sector and more.

- Lack of experience

In most cases, those involved in the licensing procedures, do not have the necessary expertise on RES, delaying or refusing to grant permits.

- Heterogeneous application of the law

It was observed that often the same legal provisions are applied differently depending on the region, territorial administrative unit, etc. This is possible because the laws suffer of political influences and are made so as to leave room for interpretation.

- Unclear administrative framework

This includes corruption, conflicting legal provisions, lack of transparency.

- Governmental attitude

Governmental attitude refers to how the government is involved in the power system operation, the methods for intervention in the energy sector, through various actions and regulations.

*Technological and technical barriers*

This category of barriers relates to the degree of novelty of the technologies that are used depending on the type of renewable energy. Also, new technologies compete

with old technologies (UCS), shaping the first two barriers. Their presentation order is random.

- Lack economies of scale in the technology production in order to obtain the renewable energy

Economies of scale can lead to lower unit price of products, in the wind energy technology, solar or biomass. But as long as the demand for these technologies is low, then the production will be low, therefore the costs will remain high.

- Infrastructures

The investments in renewable energy require also the investment in infrastructure construction, which at least in the early years reflects the high costs of electricity supply from renewable sources exploited. Also, negative implications arise when the access to a power transmission line is difficult. Meanwhile, environmental aspects are taken into consideration, respectively the negative influence that the future technology may have on the environment.

Some authors (Beck & Martinot, 2004), include two barriers in the category of the market barriers, but they were included here, because they clearly refer to the technique and technology. Maybe a better manage would have been in a distinct category, which will relate to social barriers, because it targets the workforce that will operate with different technologies.

- Lack of technical skills

Technical skills are concerning primarily on those who work directly with the technology of producing energy from renewable sources; they will arrange the installation, operation, maintenance. These authorities targets the people who develop the project, the engineers, managers, architects and so on, because their absence will aggravate the decisions on technological characteristics correlated with the existing resources, needed for maintenance, identifying operating cost, etc.

- Lack of information on the new technologies

The technologies used in renewable energy are relatively new, there is a small number of people who knows information about them so they can understand how they function.

## CONCLUSIONS

Renewable energy sources have a great potential in our country, and this is a motive on which investment projects can be developed to ensure a green energy production, necessary for a sustainable future.

Through this work, we tried to outline barriers that tend to limit the development of renewable energy, without claiming that we have given all. These are just some of the most common challenges when it comes to investment in RES projects. Grouping them into four groups, is an approach chosen by the authors, in the literature there are many approaches.

The barriers can be eliminated by various measures in the energy sector policies and more. Identifying and removing them is important, because many of renewable energy are obtained with low cost at a small scale.

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