CHALLENGES OF THE ENERGY TRANSITION IN MAINTAINING THE ENERGY SYSTEM SECURITY AND CONTINUITY

PROVOCĂRILE TRANZIȚIEI ENERGETICE ÎN MENȚINEREA SIGURANȚEI ȘI CONTINUITĂȚII SISTEMULUI ENERGETIC

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Abstract: *Accelerating the transition to a competitive economy with low carbon emissions represents both an urgent need and an enormous opportunity for the Republic of Moldova. This is the primary challenge of our times. Failure could endanger our prosperity and well-being. The success will provide unprecedented economic opportunities and new paths to prosperity, well-being and growth. More important is that the transition to a low-carbon, energy-efficient and climate resilient economy requires a more decentralized and open system, which involves the whole resilient society.*

Keywords: energy transition, clean energy, energy efficiency, energy revolution.

Rezumat: *Accelerarea tranziției către o economie competitivă cu emisii scăzute de dioxid de carbon reprezintă atât o necesitate urgentă, cât și o șansă enormă pentru Republica Moldova. Aceasta este primordiala provocare a timpurilor noastre. Eșecul ne-ar putea pune în pericol prosperitatea și bunăstarea. Succesul va oferi oportunități economice fără precedent și noi căi spre prosperitate, bunăstare și creștere. Mai important este faptul că tranziția către o economie cu emisii scăzute de dioxid de carbon, eficientă din punct de vedere energetic și rezistentă la schimbările climatice, necesită un sistem mai descentralizat și mai deschis, care să implice întreaga societate rezilientă.*

Cuvinte cheie: tranziție energetică, energie curată, eficiență energetică, revoluție energetică.

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1. Introduction

Energy transition plays a vital role in the top of the global needs. Against the backdrop of constant changes and global warming problems, the energy transition is desired toward the development of the renewable energy market and energy efficiency. The present approach to the secure transformation process, but insufficiently rapid, tends to reduce greenhouse gas emissions. [1].

Europe's transition to a future society with low carbon dioxide becomes the new reality on the ground [2].The change of the geopolitical environment refers to an energy union in order to protect the long-term economic interests and a balance both in Europe and throughout the world.

The energy transition must be socially equitable, lead to innovation and be based on a future-oriented infrastructure, while strengthening the security of supply. The European Union's investment instruments and its foreign and development policy support Europe's energy transition [3].

2. Primordial steps of the transition to clean, renewable sources

Following a comprehensive analysis in the evaluation of advanced technologies that are running very fast, our country can no longer afford to attend passively to this phenomenon and must go to direct actions.

Thus, it requires a three step approach of transition from a classic energy system based on fossil fuels to one oriented towards clean sources, renewable [4]:

1. Energy efficiency

The increase of the energy efficiency is the result of the implementation a series of measures that allow to optimize the relation between the amount of energy used (what goes in) and the products and services obtained (what goes out), under the same quality of service. The efficiency objective can be achieved through measures and investments in technology, management, education and usage habits [4]. For example, any improvement activity maintains the building in a better shape, extending its lifespan and increasing its value. The investments also contribute to the saving of primary energy resources, as well as to the reduction of environmental pollution through the gas emissions inherent in the energy production process.

2. Structural changes

- Changing the mode of energy production in big power plants - the move towards a decentralized energy system, using local renewable resources, such as wind, sun or geothermal energy.

3. Energy efficient transports

- Building efficient public transport systems.
- Using efficient cars and trucks, etc.

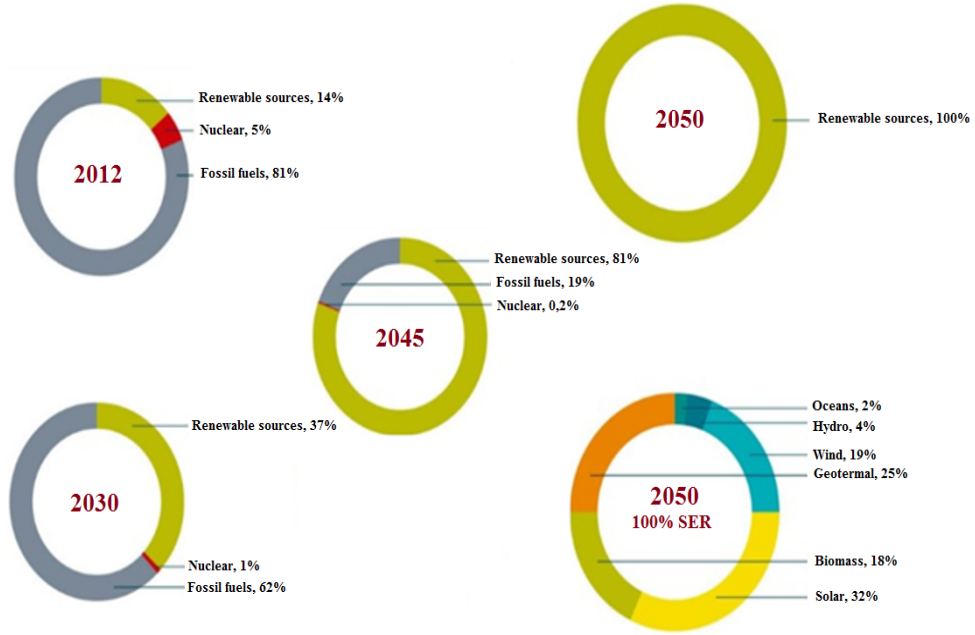

Figure 1. The scenario of the Energy Revolution [15]

3. Energy transition - a lasting political will

The Energy Union and the "Clean Energy for All Europeans" package are currently a clear impulse for accelerating the construction of energy networks in order to strengthen the security of energy supply and facilitate the transition to clean energy [5].

The scenario of the Energy Revolution 2015 [4] shows that humanity can make the transition toward 100% renewable energy by 2050.

The transition - modifies the production of electricity and determines a lower energy requirement, locally, cleanly and efficiently [7].

A complete decarbonisation of the electricity sector by 2050 is feasible and efficient in terms of cost than the current system of electricity. Energy transition is no longer a matter of technological feasibility and economic profitability, but a matter of political will, reflected in a fall in prices on solar panels and batteries - therefore - cheaper energy.

Switching to renewable energy sources also has an impact on the labor market. Currently, around 19 million people from all over the world work in the electricity sector, of which only half activate in the coal industry. Workplaces in the coal industry are being lost, but according to the calculations there will be twice as many jobs in the field of renewable energy sources.

Prospects for energy transition: it needs investments for low carbon. Energy of the transition refers to the case of increasing the implementation of energy from renewable sources and energy efficiency, which determines the emission reductions needed to maintain the global temperature rising to no more than two degrees Celsius, avoiding the worst effects of climate change [8].

The transition [9] toward a low-carbon economy has important consequences for the sustainable use of resources than fossil fuels, based on the emblematic resource efficiency initiative under the Europe 2020 strategy. The reduction of GHG emissions from the energy sector coincides with the considerable reduction of other atmospheric pollutants, with related health benefits. The reduction of GHG emissions from the energy sector coincides with the considerable reduction of other atmospheric pollutants, with related health benefits.

4. EU energy and climate targets and goals

EU targets and objectives [10] on reducing greenhouse gas emissions, renewable energy and energy efficiency are reflected as follows:

By 2020 [11]:

- 20% reduction of greenhouse gas emissions (compared to 1990 levels);
- increasing to 20% the share of renewable energy in final energy demand;
- an indicative target to improve energy efficiency by 20% compared to forecasts on future energy needs;

By 2030 [12]:

- reducing greenhouse gas emissions to at least 40% (compared to 1990 levels);

• increasing to at least 27% the share of energy from renewable sources in the final energy requirement (mandatory target at EU level);

• an indicative target for improving energy efficiency by at least 27% compared to forecasts regarding future energy needs; this quota should be revised in 2020 taking into account a target of 30% EU [13].

By 2050 [14]:

EU intends to reduce emissions of greenhouse gases by 80-95% compared to 1990 levels.

The current trends, projections and targets considered are shown in Figure 2, along with the emission reductions required to meet these targets. Analyzing the figure, the targets and objectives by 2030 and 2050 are prominent in terms of reducing greenhouse gas emissions effect that can not be achieved unless additional and significant efforts. By achieving the targets set by 2030, annual emissions reduction efforts will be increased by 50% over the next ten years.

The most important change will be required for the period after 2030, when the rate's reduction of emissions should exceed historical levels three to four times to achieve the desired objective set by 2050.

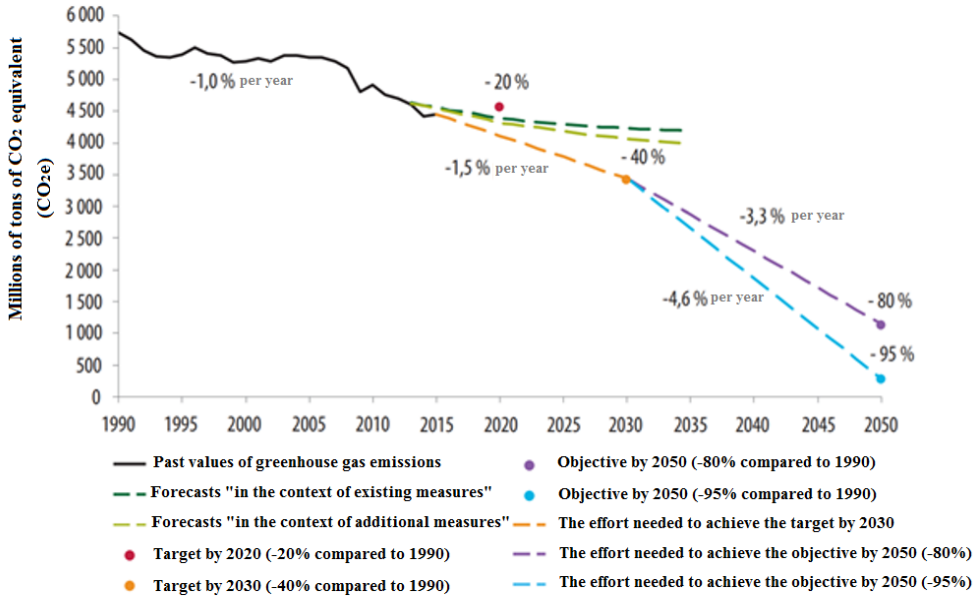

Figure 2. Greenhouse gas emissions in the EU: trends, projections, targets and reduction objectives [16]

5. Policies based on comprehensible governance

Worldwide, the renewable energy industry [36] has seen rapid growth and cost reductions in recent years, for example in wind and solar energy. Thus, as regard to the micro, national and EU levels, the reports of the highest audit institutions in the EU on energy from renewable sources identified the following issues [37]:

- obstacles to investments;
- poor cost-effeciency report;
- monitoring and evaluation issues.

In 2015, EU Member States (Figure 3) have released approximately 4.6 gigatons of CO_2 equivalent (CO_2 *presents - a unit used to compare the global warming potential of different greenhouse gas emissions using global warming potential reference* CO_2) [16].

In order to monitor progress on reducing greenhouse gas emissions in the EU, the European Commission and the Member States report annually the level of anthropogenic greenhouse gas emissions, organizing and establishing an internal emissions reporting system [6]. Consequently, the action is directed by the EU on greenhouse gases, as a result of compiling the respective inventories of the Member States. Inventory quality of Member States is checked annually, respectively international experts from countries outside the EU must review the inventories of greenhouse gas emissions from EU at least once every five years.

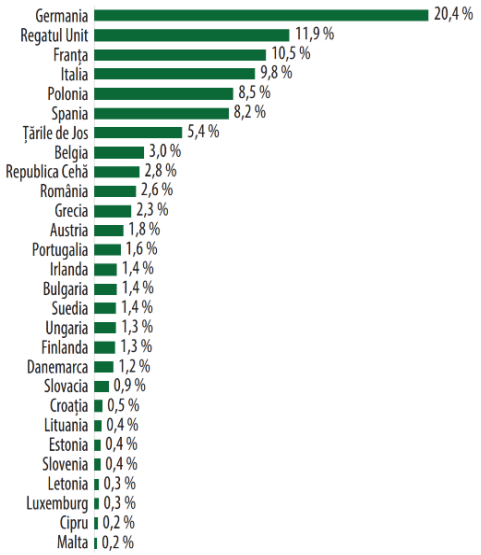

Figure 3. GHG emissions (2015) in EU Member States [17]

The road toward renewable energy sources requires comprehensive governance. Policy development and implementation should be based on the best available data, modeling and analysis.

This thing represents a challenge when are being approached topics such as energy and climate change, because of their complexity, the relatively new character of some data and the pace of change that are taking place both as a result of the energy transition, as the consequences of climate change.

In the context of impact assessments [41], the Commission relies heavily on data and modeling to compare different policy options.

All these models, considered useful, have certain limitations, of which their users must be aware [42], [43]. Depending on the model used, these limitations include:

- the sensitivity of the results to individual assumptions, for example the discount rates used to calculate the yield on investments;
- a limited level of particularization, for example in relation to the effects on individual households;
- difficulty to take into consideration future technological revolutions and social change and the effects of climate change.

6. Transition to low carbon energy production

The transition to a low-carbon energy supply sector requires significant additional changes in energy production [18]. In the current policy framework, a change in the energy mix of the future is expected (Figure 4), marked by a strong decline of all fossil fuels (coal, oil and natural gas) in the EU's domestic production and switch to energy from renewable sources. Therefore, additional capacities are required for energy production from renewable sources.

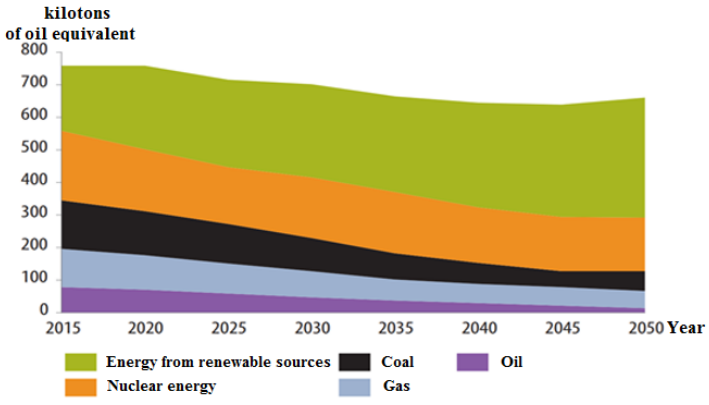

Figure 4. Forecasts on energy production in the EU by fuel type [19]

The development of renewable energy sources must take place mainly in the electricity sector, as the potential for increased use of these sources in the production of thermal energy is currently lower [20]. In-depth transformation of the energy system brings a number of challenges. First of all, the growth and integration of certain non-controllable forms of energy from renewable sources, mainly wind and solar energy, into the electricity system, where demand and supply must be constantly balanced and where storage solutions are currently limited, raises series of technical challenges.

Because the EU wants to establish conditions for supply safe and affordable for all citizens and businesses in the EU and to make the EU the world leader in renewable energy, there will be further changes that will evolve consequence on the Republic of Moldova.

First of all, this means that an increasing amount of energy will have to be the subject of cross-border transactions [38], which implies an efficient cooperation between all operators in the market. Because the share of energy produced from renewable sources will increase [39], the networks must facilitate cross-border cooperation to reflect the increasing variability of production.

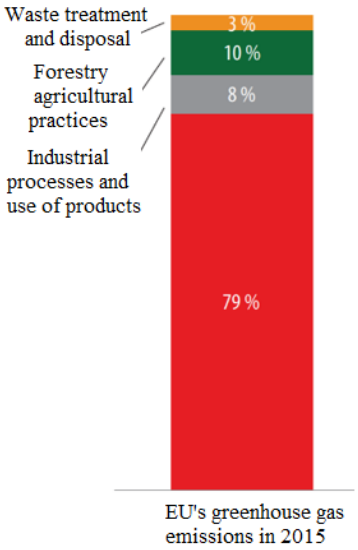

Figure 5. EU greenhouse gas emissions in 2015, according to source [21]

New technologies such as smart grids, smart meters, smart homes, energy own production equipment and storage give citizens the opportunity to get involved in the energy transition, using these new technologies to reduce bills and actively participate in the market [40].

The production and use of energy causes 79% of emissions of greenhouse gases in the EU (Figure 5). In recent decades, the EU has made progress in order to increase sustainability, accessibility in terms of price and security of energy sector. But EU transition of energy sector by sources of low carbon energy still has a long way to go and still faces many challenges.

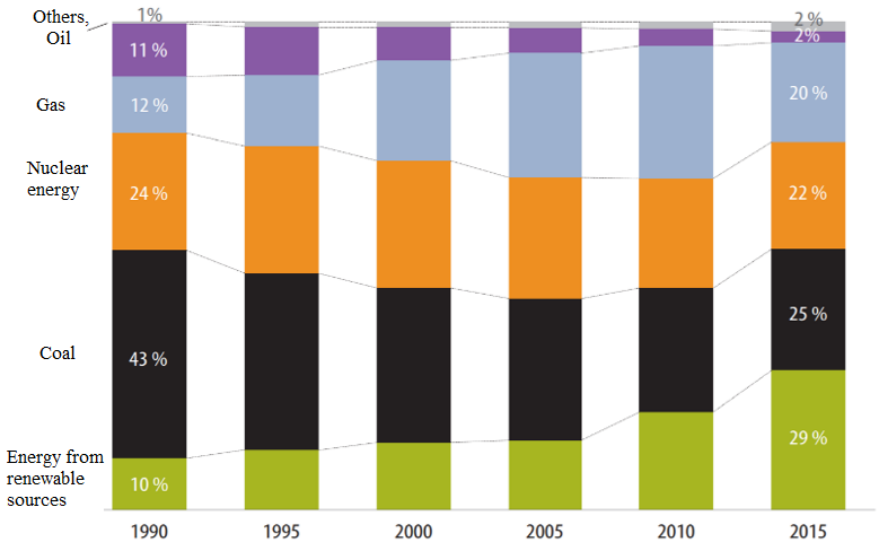

Figure 6. Evolution of the energy mix used in EU-28 for the production of electricity and heat, between 1990 and 2015 [22]

It is expected in the EU a significant decline in the production of fossil fuel energy, along with a continuous increase in the production of energy from renewable sources (Figure 6). The latter contributes to mitigate climate change and reduce dependence on energy imports, improve security of energy supply in the EU. At the same time, the integration of energy production from renewable sources into the energy system presents a number of challenges.

7. Primordial challenges masked in the energy transition

In continuation, profound changes are needed in the electricity system, in order to meet the challenges such as:

- the variability of the energy production from intermittent renewable sources,

- energy storage,
- decentralized energy production and
- more dynamic demand management.

Energy infrastructure, both in the Member States and in the Republic of Moldova, is not yet fully designed for integrated markets. The development of internal markets [23] for electricity and natural gas is the fundamental element of ensuring energy supply [24] in a cost-effective way, as they open up possibilities for greater diversification of supply [25] , by creating flexible trade exchanges within and between Member States [26], [27]. EU legislation concerning the interruption of electricity and natural gas supply [28], [29] is being updated. Circulated proposals include the transition from national to regional approach and cross-border in situations of power supply outage [30].

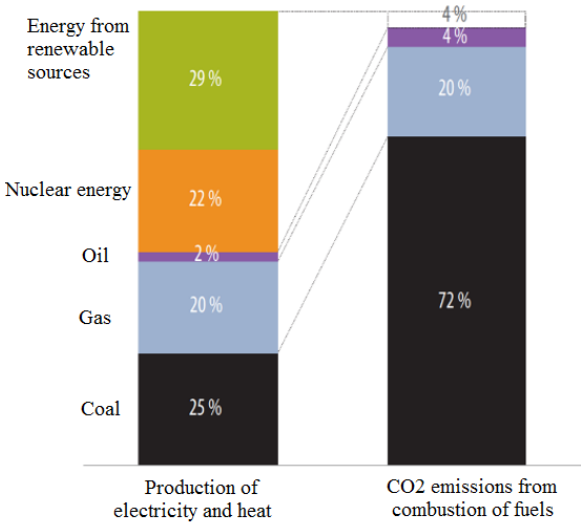

Figure 7. Electricity and heat generated and CO_2 emissions
from different energy sources in 22 EU Member States in 2015 [33]

Similarly, the transport sector must undergo a series of changes in energy use, switching toward modes of transport with low carbon emissions and using biofuels and alternative fuels, such as electricity [31]. Energy efficiency measures will further transform the energy system.

The volume of greenhouse gas emissions varies greatly depending on the energy source used (Figure 7). Thus, the transition of the energy supply

sector toward a decarbonisation of production is vital for reducing emissions.

From Figure 7 it is observed that the use of coal leads to a higher emission of CO_2 volume per unit of energy produced than any other fossil fuel. In 2015, only one quarter of the EU electricity and heat was produced from coal, but related CO_2 emissions represent 72% of total CO_2 emissions from electricity and heat production in the EU [34].

In addition to the effects that can have in terms of limiting climate change, energy transition can also benefit in other areas, such as improving air quality and reducing dependence on imports, while also taking into account economic growth. produced by the creation of "green" jobs.

8. Conclusions

Within an analysis with the presentation of documented evidence it was concluded that in general, must be a transition toward renewable energy and the sustainable development. The main problem is that, although we are talking about a technological and organizational transition, there is a wide social transition that affects everyone, and if social effects of the transition are not treated in a proper way, it will lead toward failure.

Following a simple analysis, we can see that if we give up mining and coal energy, new industries will create new jobs, often more numerous than the old ones. However, it will be needed for dozens, hundreds, even thousands of people to be re-qualified, which is a complicated problem.[2]

Consequently, it requires continuous dialogue and social action and politics to decide the fate of those affected by this transition. It is more a social transformation than a technological one.

Promoting technologies for obtaining energy from renewable sources constitutes a central element of the EU's global leadership regarding the transition toward clean technology [35].

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[2] *Note from editors: The case study analyses the Republic of Moldova energy system.*

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