



THE 17TH EDITION OF THE INTERNATIONAL CONFERENCE
EUROPEAN INTEGRATION
REALITIES AND PERSPECTIVES

Green Economy - the Engine of Economic Growth and Development in Romania in the Context of Climate Change

Florentina Chițu¹, Andra-Nicoleta Mecu², Anca-Gabriela Turtureanu³, Carmen-Mihaela Crețu⁴, Georgiana-Ionela Marin⁵

Abstract: In recent years, the issue of climate change management has been intensely debated as a subject of national interest, as extreme weather events have had negative effects on Romania through significant economic losses in most industrial sectors. In the context of a negative scenario of increasing global warming, the economic situation of the country, under the impact of climate change, would deteriorate significantly. However, as a responsible member of the European Union and the global community, Romania contributes to harnessing the opportunities for gains from active climate change management by increasing the expansion and efficient use of resources that will improve competitiveness, by green technologies and practices that will reduce local pollution, and by resilient approaches to climate change that will protect against weather-related risks. Resilient and adaptive measures by the state to manage the impacts of climate change can generate inclusive, green and long-term growth in the state's economy, resulting in improved human well-being and social equality.

Keywords: Green economy; Climate change; Green Growth; Sustainable Development

JEL Classification: Q01 - Sustainable Development; Q56 - Environment and Development; Environment and Trade; Sustainability; Environmental Accounts and Accounting; Environmental Equity; Population Growth; R11 - Regional Economic Activity: Growth; Development; Environmental Issues; and Changes;

1. Introduction

Challenges in the energy sector are often debated by authorities at global, regional and national level. Romania, as a member state of the European Union, is taking up the best practices in the field of energy and energy security, while adhering to the Green Energy for All Europeans legislative package, as well as to the provisions of the European Green Pact, which builds another energy system based on innovation, development, digitalisation and security. For a successful approach to the transition to green energy, Romania needs efficiency as a fundamental principle in linking investments, technologies, policies with the climate and geopolitical specifications of the state. Investments in improving energy efficiency, including energy production, transport, distribution and end-use, will bring major

¹ PhD in progress, The Economics and International Business Doctoral School, Bucharest University of Economic Studies, Bucharest, Romania, Address: Piața Romană 6, Bucharest 010374, Romania, Corresponding author: florentina.chitu@stud.ase.ro.

² PhD in progress, The Economics and International Business Doctoral School, Bucharest University of Economic Studies, Bucharest, Romania, Address: Piața Romană 6, Bucharest 010374, Romania, E-mail: andra.mecu@stud.ase.ro

³ Professor, PhD, Faculty of Economic Sciences, Danubius University of Galati, Romania, Address: 3 Galati Blvd, 800654 Galati, Romania, E-mail: ancaturtureanu@univ-danubius.ro.

⁴ Associate Professor, PhD, Faculty of Economic Sciences, Danubius University of Galati, Romania, Address: 3 Galati Blvd, 800654 Galati, Romania, E-mail: carmencretu@univ-danubius.ro.

⁵ Master Student, Faculty of Theoretical and Applied Economics, The Bucharest University of Economic Studies, Romania, Romania, Address: Piața Romană 6, Bucharest 010374, Romania, E-mail: maringeorgiana17@stud.ase.ro.

environmental benefits, reduce a large part of greenhouse gas emissions, improve energy security, contribute to reducing energy poverty and increase the competitiveness of economic activity in all sectors of the Romanian economy.

The use of renewable energy sources in Romania is expected to increase, given the country's commitment to phase out coal and lignite-based electricity generation. The plan foresees the phasing out of coal and lignite power generation by 2032; this is essential for the decarbonisation of the energy sector and supports the transition to green sources for energy production (European Commission, 2022).

The review of the scientific approaches of researchers on the transition from energy to renewable energy sources revealed that recently strategies, policies and regulations are being addressed for each country to increase the share of renewable energy in gross final energy consumption.

The literature is approached in this paper from two perspectives. On the one hand, the approach of the literature which reflects the pillars of the energy development process in Romania, and on the other hand, the approach of the literature which addresses the provisions, clear directions and defines the benchmarks that Romania should consider for the implementation of the European Green Pact directives and which require the transformation of the energy sector into another system model, based on clean, innovative technologies, which can face competition in an integrated electricity market.

The policy at European level on the production of energy from renewable sources and the promotion of the use of this form of energy is laid down in EU Directive 28/2009. The European Commission has published a proposal for a revised directive on renewable energy with the aim of making the EU a world leader in the renewable energy market by 2030. This directive aims to set national renewable energy targets for each member country, based on the specific renewable energy potential of each country.

During 2016, the EC presented two packages of proposals to reform European energy policies, anticipated in 2015 through the Energy Union Framework Strategy. These packages are defining for the European energy sector, and implicitly for the Romanian one, in the period 2020-2030, being aimed at accelerating the energy transition in the EU. In July 2016, a first package of proposals was published, regarding: the reduction of non-ETS emissions in each Member State for the period 2021-2030 (Romania has been allocated a 2% reduction quota), the accounting of GHG emissions from land use, land-use change and forestry, as well as a communication on a European strategy for decarbonisation of the transport sector (Pakulska, 2021).

At the end of 2019, the EC presented a new proposal for tackling climate and environmental challenges in the form of a growth strategy, with the objective of transforming the EU into a fair and prosperous society with a modern, competitive and resource-efficient economy with zero net greenhouse gas emissions in 2050 and with economic growth decoupled from resource use.

Subsequently, at the end of 2021, the European Commission sends Romania a late warning on the transposition of the EU Energy Efficiency Directive 2012/2002 into national legislation. This means that Romania will assume the EU energy efficiency target for 2020 of at least 32.5%.

2. Share of Renewable Energy in Gross Final Energy Consumption

Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources provides in Article 3 (Overall binding Union target for 2030) that Member States shall collectively ensure that the share of energy from renewable sources in the Union's gross final consumption of energy in 2030 is at least 40%.

The European Commission announced at the end of 2019, through the Green Deal, under which the EU aims to become a world leader in combating the effects of climate change and to be the first continent with net zero greenhouse gas emissions in 2050. Basically, it aims for a sustainable and durable transformation of the economy, by removing fossil fuels, promoting clean, renewable energy and developing a circular economy (European Commission, 2020).

At national level, Romania has already taken important steps in this direction by developing the National Integrated Energy and Climate Change Plan 2021-2030 (PNIESC), which will form the basis of the national strategy in this area. The plan is currently being updated following recommendations from the European Commission and Romania will increase its ambition for the share of renewable energy in gross final consumption to 30.7% by 2030 (National Integrated Energy and Climate Change Plan, 2020).

Romania has rich and varied renewable energy resources: biomass, hydropower, geothermal potential, wind and photovoltaic. These are distributed throughout the country and will be exploited on a larger scale as the performance-price ratio of the technologies improves with the maturity of new generations of equipment and related installations.

The use of renewable energy has many potential benefits, including a reduction in greenhouse gas emissions, diversification of energy supply and reduced dependence on fossil fuel markets (in particular, the oil and gas market), especially at this time in terms of the Ukraine-Russia border conflict. The development of renewable energy sources may also have the potential to boost employment in the EU by creating jobs in the new 'green' technology sector (Ministry of Economy, Energy and Business, 2020).

In order to analyse Romania's integration into EU standards for achieving energy targets, we will see the share of renewable energy use in gross final energy consumption from 2010 to 2019, according to data published by the Romanian National Institute of Statistics.

The indicator analysed measures the share of renewable energy consumption in gross final energy consumption, according to the Renewable Energy Directive. Final gross energy consumption is the energy used by final consumers (final energy consumption), plus grid losses and self-consumption of power plants.

This indicator is part of the set of indicators:

(a) EU Sustainable Development Goals (SDGs) indicator is set if used to monitor progress towards SDG 7 on clean and affordable energy, SDG 12 on ensuring sustainable consumption and production patterns and SDG 13 on climate action. SDG 7 calls for ensuring universal access to modern energy services, improving energy efficiency and increasing the share of renewable energy. To accelerate the transition to an affordable, reliable and sustainable energy system, countries must facilitate access to clean energy research, promote investment in energy infrastructure and clean energy technology. SDG 12 calls for sustainable consumption and production that uses resources efficiently, reduces food and other waste globally, safely disposes of toxic waste and pollutants. SDG 13 aims to implement the commitment to the UN Framework Convention on Climate Change and to put the Green Climate Fund into operation.

b) EU 2020 Strategy indicators, where used to monitor progress towards the EU climate and energy policy objective „Increase the share of renewable energy in gross final energy consumption to 20%”. In addition, the indicator is part of the impact indicators for the Strategic Plan 2016-2020 which refers to the Commission's 10 priorities and is included in the set for the EU Framework Strategy for a Resilient Energy Union.

It can be considered identical to the global SDG indicator 7.2.1 “Share of renewable energy in total final energy consumption”. The Europe 2020 strategy has set a target to increase the share of renewable energy in gross final energy consumption to 20% by 2020. By 2030, the share should further increase to at least 27%, in line with the 2030 climate and energy policy framework The Energy Union Strategy highlights renewable energy as part of the efforts needed to decarbonise the energy system. The EU Cohesion Policy (2014-2020) invests €29 billion in sustainable energy, including energy efficiency, renewable energy, smart energy infrastructure and low carbon research and innovation.

Table 1. Share of Renewable Energy in Gross Final Energy Consumption in Romania 2010-2019

Year	Share of renewable energy in gross final energy consumption in Romania 2010-2019 (Percentages)
2010	22,8 %
2011	21,2 %
2012	22,8 %
2013	23,9 %
2014	24,8 %
2015	24,8 %
2016	25 %
2017	24,5 %
2018	23,9 %
2019	24,3 %

Source: National Institute of Statistics, <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>

In the period 2010-2019, with the exception of the years 2011, 2017, 2018, there is a continuous increasing trend of the share of renewable energy in the gross final energy consumption, which demonstrates the promotion of renewable energy sources, encouraging the production of energy from less exploited renewable resources.

In terms of energy consumption, in 2019, just over 24% of energy consumption came from renewable energy sources, placing our country in 10th place in the EU and above the EU average level. La nivelul anului 2030, România își propune atingerea unei ponderi de energie din surse regenerabile în consumul final brut de energie electrică (SRE – E) de 49,4%, de la 41% în 2020. (MMediu, 2020).

Also for the same period of time, 2010-2019, we will analyse the CO₂ emissions intensity in Romania, as well as the greenhouse gas emissions by economic activities, in order to intensify Romania’s efforts to achieve the transition to a green, low-carbon, climate resilient economy and to integrate climate change adaptation measures in vulnerable economic, social and environmental sectors, in line with EU policies.

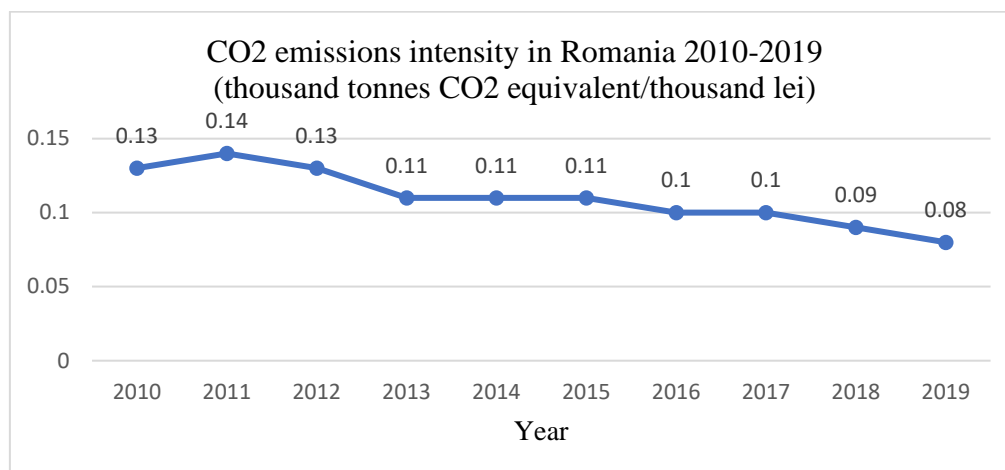


Figure 1. CO2 Emissions Intensity in Romania 2010-2019

(Own production following data collection from National Institute of Statistics)

Source: National Institute of Statistics, <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>

Greenhouse gas emissions intensity shows how much gas was emitted to produce one unit of GDP (constant 2010 prices), with a decreasing trend, this shows a positive aspect in terms of the environmental impact of economic activity.

The development of the energy sector is part of Romania's development process. The vision of Romania's Energy Strategy is one of growth of the energy sector in conditions of sustainability, economic growth and accessibility, in the context of the implementation of the new legislative package. (Oncioiu et al., 2017). Clean energy for all Europeans 2030, with the setting of targets for the reduction of greenhouse gas emissions, renewable energy sources and energy efficiency and with the perspective of Romania's implementation of the European Green Pact 2050.

The EU aims to reduce GHG emissions by 80-95% below 1990 levels by 2050, with targets of 40% for 2030 and 60% for 2040. With the European Green Deal, it is proposed to revise this target, i.e. a 50% reduction to 55% in 2030 and to reach "net zero" emissions in 2050 (MMediu, 2020).

Using the aggregate form of greenhouse gas emissions, the evolution of the global warming potential of greenhouse gases in industry and households is tracked, in 2016 in industry 85.4% of greenhouse gas emissions were distributed and in households 14.6% (INS, 2018).

Table 2. Greenhouse Gas Emissions in Romania by Activity Sectors in 2010 and 2019

Year CAEN Rev.2 (activities of the national economy - sections) (Thousand tonnes CO2 equivalent)	2010	2019
A Agriculture, forestry and fisheries	104861,38	96839,22
B Mining and quarrying	18715,88	20838,49
C Manufacturing	7696,06	5723,34
D Electricity, gas, electricity, gas, hot water and air conditioning supply	26658,1	24797,98
E Water supply; sewerage, waste management, remediation activities	31409,96	22394,69
F Construction	6676,28	6944,55
G Wholesale and retail trade; repair of motor vehicles and motorcycles	3316,75	3644,49
H Transport and storage	1410,2	1673,24
I Hotels and restaurants	5494,47	6753,07

J Information and communication	169,05	197,31
K Financial intermediation and insurance	291,36	354,53
L Real estate	223,36	240,16
M Professional, scientific and technical activities	473,12	506,31
N Administrative and support service activities	526,45	630,98
O Public administration and defence; public social insurance	358,78	412,34
P Education	434,85	480,08
Q Health and social assistance	253,99	293,2
R Performing, cultural and recreational activities	343,35	424,86
S Other service activities	112,43	162,6

Source: National Institute of Statistics, <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>

We observe that in a rather long period of time, about 10 years, there are no big changes in the sectors of activities of the national economy, by sectors, in terms of greenhouse gas emissions, which leads the state to implement as effectively as possible the directives of the European Union and stimulate a green economy, sustainable at the level of each activity.

The estimate of the total amount of GHG fluxes to the atmosphere should be provided as an aggregate emission in tonnes of CO₂ equivalent. The largest share of GHG emissions belongs to the activities of production and supply of electricity and heat, gas, hot water and air conditioning (CAEN D), both in 2010 and 2015-2019, followed by activities in agriculture, forestry and fishing (CAEN A). For Romania, the European Commission has set a reduction target of 2% in 2030 compared to 2005 levels (Regulation (EU) 2018/842) while the average for the EU28 is a 30% reduction (European Parliament, 2021).

Conclusions

Climate change is driven by anthropogenic activities that produce greenhouse gas (GHG) emissions, which are most often expressed as CO₂ emissions. The effects of climate change are felt differently at local, regional or even continental level.

The European Union, following the global trend, is moving towards a sustainable energy system, promoting high consumption of energy from renewable sources and energy efficiency in all sectors. Policy instruments have a key role to play in achieving the targets set (energy efficiency, increased renewable energy production, biomass use, etc.) and implementing this energy system.

Following the European trend, at national level, the legislative framework has started to adapt to the new energy production and promotion systems, thus Romania is involved in the European process of integration of energy markets.

The potential of renewable energy on the local market can become the engine for decarbonisation of the Romanian energy sector.

Romania is committed to achieving a 30.7% share of renewable energy in the total energy mix by 2030, according to the National Integrated Energy and Climate Change Plan 2021-2030.

Author Contributions

All authors have an equal contribution to the publication. All authors have read and agreed to the published version of the manuscript.

References

- *** (2018). *Regulation (EU) 2018/842*. <https://op.europa.eu/en/publication-detail/-/publication/33b50796-7380-11e8-9483-01aa75ed71a1/language-ro>.
- *** (2020). *National Integrated Energy and Climate Change Plan 2021-2030*. https://energy.ec.europa.eu/system/files/2020-04/ro_final_necp_main_ro_0.pdf.
- European Commission (2020). *Report towards a climate neutral Europe by 2050*. <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2020:0777:FIN:RO:PDF>.
- European Commission (2022). *Romania Country Report 2022*. https://ec.europa.eu/info/sites/default/files/2022-european-semester-country-report-romania_ro.pdf.
- European Parliament (2021). *Greenhouse gas emissions by country and sector (infographic)*. <https://www.europarl.europa.eu/news/ro/headlines/society/20180301STO98928/emisii-de-gaze-cu-efect-de-sera-pe-tari-si-sectoare-infografic>
- Gunay, S.; Kurtishi-Kastrati, S. & Krsteska, K. (2022). Regional green economy and community impact on global sustainability. *Journal of Enterprising Communities: People and Places in the Global Economy*. Vol. ahead-of-print Nr. ahead-of-print. <https://doi.org/10.1108/JEC-03-2022-0040>.
- International Trade Administration (2021). *Romania - Country Commercial Guide*. <https://www.trade.gov/country-commercial-guides/romania-energy>.
- Marinescu, N. (2020). Changes in Renewable Energy Policy and Their Implications: The Case of Romanian Producers. *Energies*. MDPI.
- Ministry of Economy, Energy and Business Environment (2020). *Romania's Energy Strategy 2020-2030, with a 2050 perspective*. http://www.mmediu.ro/app/webroot/uploads/files/Strategia%20Energetica%20a%20Romaniei_aug%202020.pdf.
- National Energy Regulatory Authority (2020). *Report on the overcompensation analysis of the green certificate promotion scheme for electricity from renewable energy sources for 2020*. file:///C:/Users/User/Downloads/Raport_supracompensare_2020.pdf.
- National Statistical Institute, (2018). *Environmental economic accounts*. https://insse.ro/cms/sites/default/files/field/publicatii/conturi_economice_de_mediu_3.pdf.
- Oncioiu, I.; Petrescu, AG.; Grecu, E. & Petrescu M. (2017). Optimizing the Renewable Energy Potential: Myth or Future Trend in Romania. *Energies*. 10(6), p. 759. <https://doi.org/10.3390/en10060759>.
- Pakulska, T. (2021). Green Energy in Central and Eastern European (CEE) Countries: New Challenges on the Path to Sustainable Development. *Energies* 14, no. 4, p. 884. <https://doi.org/10.3390/en14040884>.
- Surajit, B.; Gunjan, Y.; Pavitra, D. & Krishan K. K. (2021), Key resources for industry 4.0 adoption and its effect on sustainable production and circular economy: An empirical study. *Journal of Cleaner Production*. Volume 281, 125233. <https://doi.org/10.1016/j.jclepro.2020.125233>.