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Climate Action and Affordable, Clean Energy – a Review on European Sustainable Development Goals Indicators

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Abstract

The post-pandemic period experienced by all European countries has reshaped the way we relate to energy production and use, both in terms of increasing prices, responsible consumption through improved energy efficiency, and the generation of energy from renewable sources as a contribution to significantly reducing greenhouse gas emissions (GHG) and combating climate change. The article analyses European statistics on climate action and clean, affordable energy. The debate on the achievements of the EU-27 Member States and the EU, but the achievement of Romania and the Eastern European Countries, is analysed from the perspective of reducing GHG, financing climate change and energy poverty. Conclusions and endnotes converge on the need for an integrated approach for the future development: accelerating investments in renewable energy production, increasing energy efficiency through the development of local energy and climate action plans, focusing on sustainable economic growth and adequate support for vulnerable groups.

Keywords: Climate change, clean energy, affordable energy, SDGs, GHG emissions

INTRODUCTION

Climate change is one of the greatest challenges of this century, but it is also a real challenge to reverse the unsustainable ways developed and practiced in the last century. The European Green Deal therefore aims to provide the strategic framework necessary for a profound societal transformation by setting targets to reduce emissions by at least 55% by 2030 compared to 1990 levels, but above all to make Europe climate neutral by 2050, "*a fair and prosperous society, with a modern, resource efficient and competitive economy*". The "*2030 Agenda for Sustainable Development*" created a

common vision of development in 2015 that represents a turning point for all social, economic and environmental aspects worldwide. The 17 Sustainable Development Goals (SDGs) and the associated indicators and targets anchor national strategies in a new reality and constraints related to the implementation of ambitious plans and measures, but also to the monitoring of reported data, the use of which indicates the current state of progress and underpins a wide range of solutions to support the achievement of the goals. To raise ambition on climate change, the European Commission has also proposed a package of new and revised EU climate and energy legislation – the "*Fit for 55*" package. In addition, the Commission launched the Climate Pact to support action by people across Europe and the European Climate Law. It focuses on connecting interested people, communities, and businesses to share and build knowledge, development, implementation and scaling up new and innovative solutions.

The monitoring of SDG7 - Affordable and clean energy and SDG 13 - Climate action will contribute to "ensuring universal access to modern energy services, improving energy efficiency and increasing the share of renewable energy" and to achieving a "*climate-neutral world by mid-century, with a target of limiting global warming to 1°C by 2030*" and accelerating the transition to an affordable, reliable and sustainable energy system" and to achieving "*a climate-neutral world by mid-century to limit global warming to well below 2°C, with a goal of 1.5°C, compared to pre-industrial levels*". It also aims to strengthen the resilience and adaptive capacity of countries to climate-related natural hazards and the resulting disasters, with a particular focus on support for least developed countries, as supported by the analysis of statistical data (European Union, 2022)

LITERATURE REVIEW

Climate change - Approaches and implications at the European level

The "climate change" concept has been approached in a variety of ways over the years. Climate change skepticism refers to an attitude that questions or doubts the scientific consensus on the causes and impacts of climate change, while the incremental approach involves taking incremental steps to reduce greenhouse gas emissions and address climate change (Bere-Semeredi & Mocan, 2019). The scientific approach involves relying on scientific evidence and research to inform policy decisions and actions to address climate change, while the catastrophic approach recognizes the potential for severe, irreversible impacts if action is not taken quickly and decisively, as seen in Table 1. The scientific approach is also used to identify potential strategies to reduce greenhouse gas emissions and mitigate the impacts of climate change, and to develop climate projections and models to predict future climate scenarios. In Table 2, the main indicators related to SDG7 and SDG13 will be analyzed, highlighting aspects related to the situation in Romania, in a report with the situation of other European Member States.

Table 1: Approaches to climate change (synthesis from the literature)

Approach	Definition and implication	References
Climate change mitigation	This approach aims to prevent or slow the rate of global warming by reducing greenhouse gas emissions. Mitigation strategies can include the transition to renewable energy sources, the improvement of energy efficiency and the implementation of policies to incentivize emission reductions.	(Reckien et al., 2018; Aguiar, 2018)
Adapting to Climate	This approach involves preparing for and adapting to the impacts of climate change that are already taking place, such as rising sea levels, an	

Change	increase in the frequency of extreme weather events, and changes in precipitation patterns. Adaptation strategies can include infrastructure improvements, water management strategies and land-use planning.	
Carbon capture and sequestration	Capturing carbon dioxide from the atmosphere and storing it in long-term reservoirs, such as underground geological formations. A variety of methods, including afforestation, reforestation and direct air capture, can be used to sequester carbon.	(Boot-Handford, 2014; Stangeland, 2007; Mac Dowell et al., 2017)
Climate finance	This approach involves the mobilization of financial resources to support climate change mitigation and adaptation efforts, particularly in developing countries that may not have the resources to implement these strategies on their own. Climate finance can include funding for renewable energy projects, climate-resilient infrastructure, and disaster prevention and response.	(Hidalgo-Oñate et al., 2023 ; Mihaylova & Blumer, 2022 ; Tan et al., 2020)
Ecological restoration and conservation	This approach involves the restoration and conservation of ecosystems that can act as natural carbon sinks and support biological diversity. Reforestation, wetland restoration and sustainable agricultural practices can all be part of ecological restoration and conservation.	Donadieu, 2002; Grimm et al., 2008)
Public awareness and education	This approach involves improving the understanding of the public about the causes and impacts of climate change, as well as about the potential solutions. Communication campaigns, public events and school curricula can be used to raise public awareness and education.	(Lee et al., 2015 ; Semenza et al., 2008)
International cooperation and diplomacy	This approach involves cooperation on climate change at the global level through mechanisms such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. Sharing knowledge, technology and resources to support mitigation and adaptation efforts can be facilitated through international cooperation and diplomacy.	(Kinley, 2017; Oberthür & Groen, 2018)
Carbon pricing	This approach involves putting a price on carbon emissions to reflect their negative impact on the environment and to incentivize reducing emissions. Carbon pricing can be a carbon tax or a trading scheme.	(Klenert et al., 2018)

Table 1: The considered indicators for the SDG7 and SDG13

SDG indicator	Definition and description
SDG7 - Affordable and clean energy	
Final energy consumption in households per capita	Excluding energy used for transport, this indicator measures how much electricity and heat each citizen consumes at home.
Population unable to keep home adequately warm	Measures the proportion of the population who are not able to keep their dwelling adequately warm. Data are collected to monitor the development of poverty and social inclusion in the EU and is survey-based (indicator values are self-reported).
SDG13 – Climate action	
Net GHG emissions	Measures total national emissions (the "Kyoto basket" of all seven GHGs), the indicator presented reflects net emissions including land use, land use change and forestry (LULUCF) The data for the GHG emission inventories are reported annually by the EU Member States (MS) to the UNFCCC.
Population covered by the Covenant of Mayors for Climate and Energy signatories	Measures the ratio between the population of the cities that have signed the Covenant in a country and the total population of that country, as a percentage of the EU population covered by the new Covenant of Mayors of EU MS.
Contribution to the international USD 100bn commitment on climate-related expending	Measures the total amount spent from the annual budgets of EU member states, the European Commission (EC) and the European Investment Bank (BEI) to contribute to the international climate finance commitment of USD 100 billion under the UNFCCC for mitigation and adaptation, as well as for appropriate technology and capacity building support.
Net greenhouse gas emissions of the LULUCF sector	Measures net carbon removals from LULUCF sector. It takes into account both emissions and removals from the sector, expressed as CO_2 equivalents, using the global warming potential (GWP) of the GHGs.

The six indicators, described in Table 2, will be analyzed in the next section of this article with the aim of demonstrating the statement of on the different disparities between the developments and policies of the Western European countries and those of the Eastern ones (Brożyna et al., 2023).

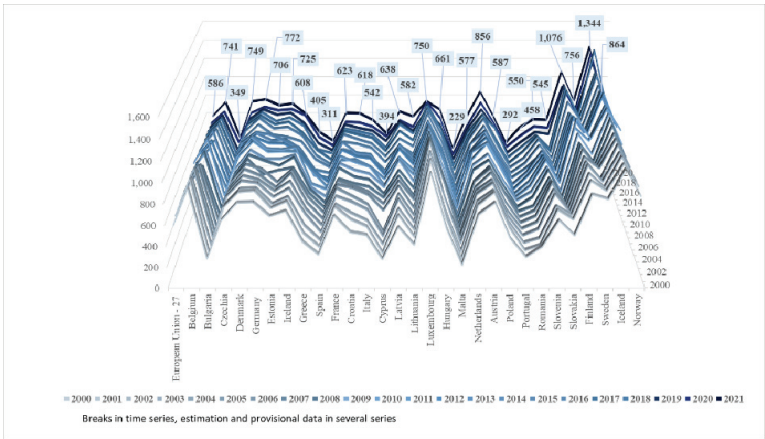
MATERIALS AND METHOD

The review study is based on the available Eurostat statistics for the category "Environment". The focus of the study is on the SGDs methodology and the related United Nations SDGs, from which the only ones that have been selected are for "Affordable and clean energy" and "Climate action" in Europe (statistics from The European Green Deal database, https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF). In the following, the main indicators related to SDG 7 and SDG 13 will be analyzed, highlighting aspects related to the situation in Romania, in a report with the situation of other European Member States.

RESEARCH RESULTS AND DEBATES

Households account for a quarter of final energy consumption, which depends crucially on the outside temperature, the energy performance of the building, the efficiency of the appliances used and the behavior of the users, and is used for heating, cooling, cooking, lighting and the use of electronic equipment. In 2021, there is an increase in the energy consumption of households - to 586 kilograms of oil equivalent (KGOE) per inhabitant in the EU, which is about 5.59% more than in 2020. Romania, with an increase of 10% in 2020, also shows an increase in consumption to 458 KGOE per inhabitant. The long-term data analyzed show that since 2001 (Picture 1) there has been a 39% increase in consumption in Romania, but this aspect must be seen from the perspective of the improvement of housing and its equipment. In Europe, since 2005, energy consumption per inhabitant in the EU has decreased by about 9%, with a slight downward trend in total household energy consumption, which corresponds to an increase in population. Romania's energy consumption is more than 31% higher than that of Bulgaria, but below the European average (-28%) and lower than that of Slovakia (-19%), Slovenia (-20%), Hungary (-44%) and the Czech Republic (-63%).

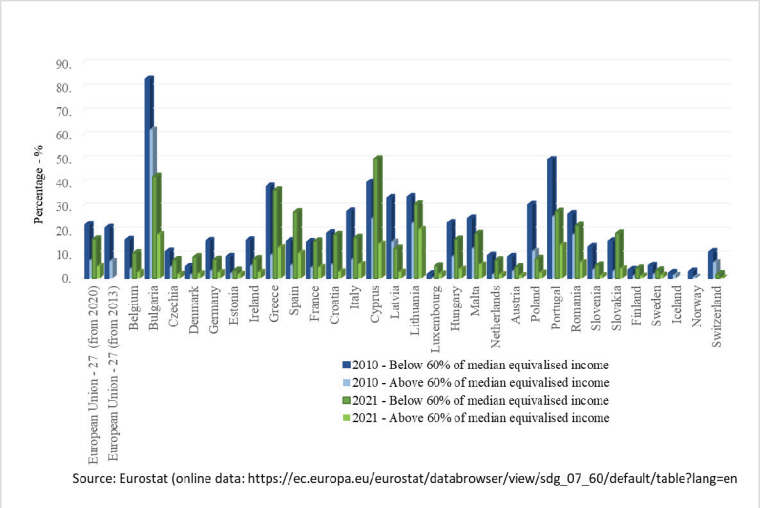
Picture 1: Final energy consumption in households per capita in the period 2000 – 2021 (kg oil equivalent)



The EU has made progress in improving access to affordable energy over the last decade, with the share of people unable to afford adequate heating falling steadily to 6.9% in 2019. In 2020, the share increases to 8.2%. This is most likely due to the COVID-19 pandemic. Lithuania, Bulgaria, Cyprus,

Portugal, Greece and Spain, countries heavily affected during the pandemic, had the highest shares in 2020. Romania exceeds the shares of some countries in Central and Eastern Europe (Slovakia and Hungary) with shares of 6.7% and 22% (above and below 60% median equivalized income), Picture 2.

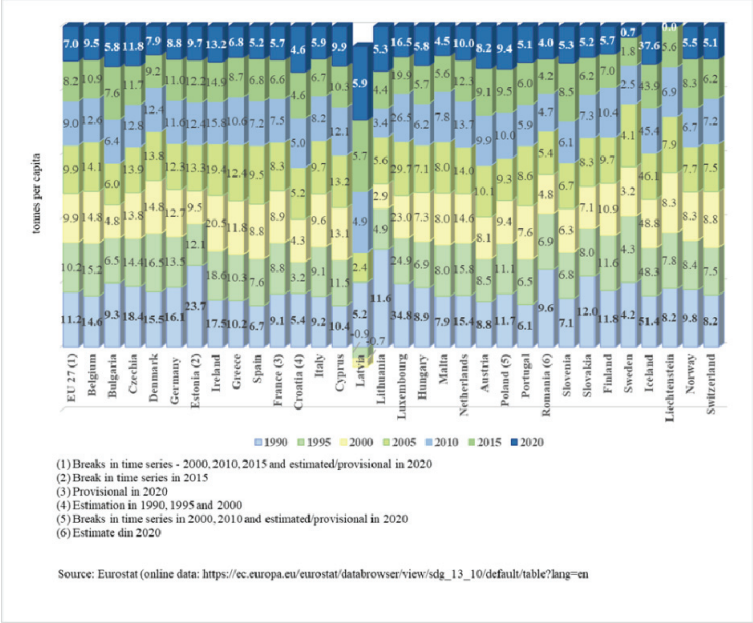
Picture 2: Population unable to keep home adequately warm by poverty status - 2010 and 2021



Source: Eurostat (online data: https://ec.europa.eu/eurostat/databrowser/view/sdg_07_60/default/table?lang=en

As seen in Picture 3, in the EU, the net GHG emissions per capita ranged from 0.7 t CO2 in 2020 (Sweden) to 16.5 t CO2 in 2020 (Luxembourg). Compared to 2015 and 2020 (Figure 3), net GHG emissions per capita decreased in all but four Member States. The largest increase was in Lithuania: Net emissions per capita increased by 0.9%. Net emissions increased slightly in Latvia, the Czech Republic and Hungary. Luxembourg, Slovenia, the Netherlands, Estonia and Germany reported reductions of between 3.4 and 2.2% due to reduced emissions and increased net removals from the LULUCF sector. Romania's emissions of 4t. CO_2 per capita has been declining in recent years and are among the lowest in the EU in 2020.

Picture 3: Net GHG emissions - evolution: 1990, 1995, 2000, 2005, 2010, 2015 and 2020 (tones per capita)

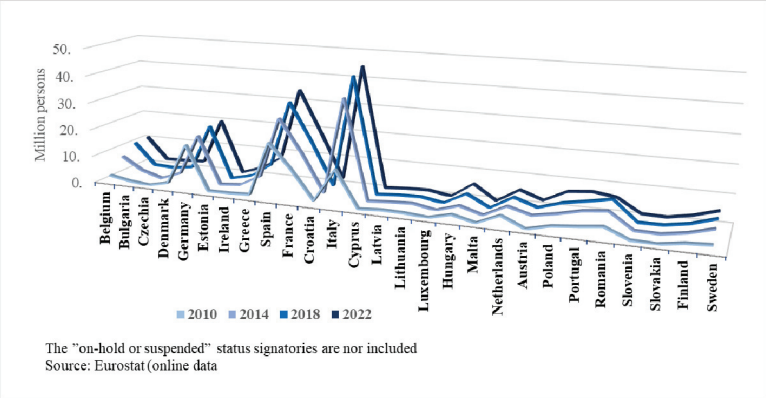


Source: Eurostat (online data: https://ec.europa.eu/eurostat/databrowser/view/sdg_13_10/default/table?lang=en

The European Covenant of Mayors for Climate and Energy remains a successful initiative bringing together civil society actors and the different levels of government (Picture 4). The continued growth

shows that the movement is continuing to make a positive impact by developing plans to mitigate and adapt to climate change. At EU27 level, all countries recorded an increase in the number of citizens living in cities and towns that are signatories to the Covenant of Mayors in Europe. Only Romania recorded a decrease of 1.84 million inhabitants. This can only be explained by the fact that some of the signatories are in "hold/suspended" status because of their failure to complete the Sustainable Energy and Climate Action Plans (SECAPs).

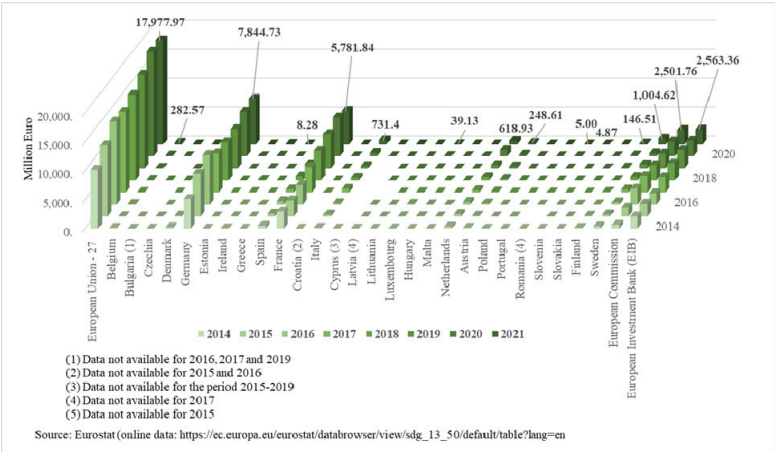
Picture 4: Population covered by the Covenant of Mayors for Climate & Energy signatories: 2010, 2014, 2018 and 2022 (million persons)



The "on-hold or suspended" status signatories are nor included
Source: Eurostat (online data

The commitment of the world's developed countries to mobilize USD 100 billion per year by 2025 through a collective effort translates into a contribution from the EU and Member States of USD 23.0 billion in 2021, slightly reduced compared to 2020 but increasing by more than 80% compared to 2014. Germany, followed by France, the EIB and the EC are the main contributors. The largest contributors to climate finance in developing countries remain the EU, Member States and the EIB (Picture 5).

Picture 5: Contribution to the international 100bn USD commitment on climate related expending, in the period 2014-2021 (Million Euro)



(1) Data not available for 2016, 2017 and 2019
(2) Data not available for 2015 and 2016
(3) Data not available for the period 2015-2019
(4) Data not available for 2017
(5) Data not available for 2015
Source: Eurostat (online data: https://ec.europa.eu/eurostat/databrowser/view/sdg_13_50/default/table?lang=en

The trend in net removals in the LULUCF sector decreased by 17.4% between 1990 and 2020 (Picture 6). The largest decrease in the last five years was 16.8%. By reducing total GHG emissions, they contributed more than 7% of the emissions in 2020, a much higher share than in previous years. The net emissions avoided in 2020 will amount to more than 229 Mt CO_2eq. Romania contributes with 32.9 Mt CO_2 eq. to the net carbon removal target through land and forestry use, which is slightly lower than in 2015. It is the third largest contributor in EU after Sweden and Spain.

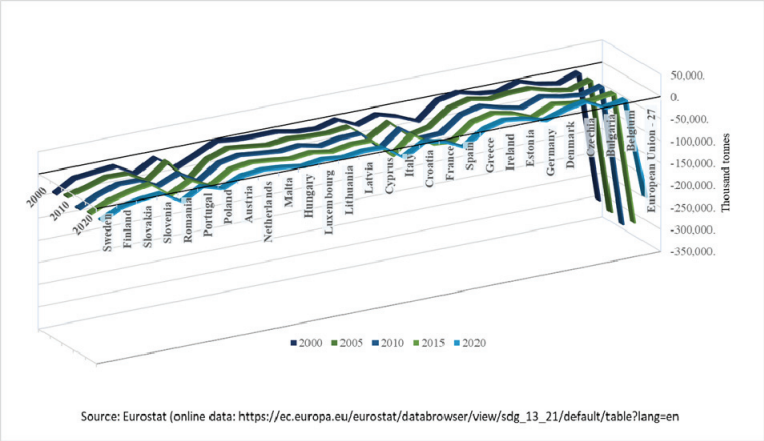


Fig. 6: Net GHG emissions of the LULUCF – 2000,2005, 2010, 2015 and 2020 (thousand tones)

CONCLUSIONS

The monitoring of statistical data for SDG7 and SDG13 indicators in the EU context shows a difference between the achievements of Western and former communist countries. According to the Integrated National Plan for Energy and Climate Change in Romania, GHG emissions will have to be reduced by at least 50% by 2030 compared to 1990 levels, mainly through a significant reduction of polluting industrial activities, an increase in EE and compliance with stricter environmental standards. At the population level, it will still be necessary to implement measures to improve the energy performance of buildings and to produce energy from renewable sources to reduce per capita consumption and to increase energy consumption from RES accordingly. Local authorities in Romania, signatories of the Covenant of Mayors for Climate & Energy, will have to make the necessary efforts to develop the SEAPs to identify climate risks and implement measures and actions to mitigate and adapt to climate change. The gap recorded in recent years can be closed in the coming years by strengthening the administrative capacity to develop such strategies, in an integrated manner with the other local planning documents, through participative governance, using European best practices, exchange of experiences and international cooperation. Tackle energy poverty through concerted actions with a view to minimizing the phenomenon by 2030, through inter-institutional cooperation, joint efforts of organizations and groups most at risk of energy poverty. Energy poverty as a social phenomenon remains a sensitive issue. Early identification of vulnerable consumers and specific support to them through urgent measures and changes in consumption behavior must be a priority, especially at local level. To reverse the declining trend in the LULUCF sector and achieve the 310 Mt of CO_2 equivalent removals by 2030, further promotion of sustainable management practices in all EU countries is needed.

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