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Assessing Indicators of Clean Energy Performance for Sustainable Energy Transitions

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ABSTRACT:

The use of renewable resources, as well as new technologies, can be solutions to mitigate the effects of climate change. Applying solutions to mitigate the manifestations of climate change leads to changes in the energy field. From this point of view, it is considered that energy production, but also energy consumption, are of great importance. Starting from these considerations, the analysis is made for the Member States of the European Union, for the period 2015-2024. Primary and final energy consumption were taken into account. In the desire to reduce the use of fossil fuels, renewable sources can constitute an alternative. Their use can be a basis for the transition to clean energy. We can consider that the green technologies are a consequence of the process of producing electricity using renewable resources. Depending on the type of plant, the article presents the comparative situation for gross production of electricity and net production of electricity. The importance of renewable sources is also reflected through a comparative analysis for the share of renewable energy in gross final energy consumption for transport.

Key words

gross and net production of electricity, primary and final energy consumption, European Union

INTRODUCTION

The main consequence of measures to reduce greenhouse gas emissions is the production of electricity through the use of renewable resources. The positive trend manifested in the recent period refers to an increasingly increased use of renewable sources. The most important increases have been hydroelectric energy, solar energy and wind energy. Depending on the climatic conditions, as well as the location, there is an increased interest in tidal energy and geothermal energy. Replacing fossil fuels with renewable sources contributes to reducing greenhouse gas emissions and protecting the environment.

It is noted that new energy generation technologies are increasingly sought after. Thus, investments leading to the development of these technologies based on renewable sources are increasing.

Even though the production of electricity from renewable sources has increased, it is necessary to transport it to those regions with high demand. This way, the stability of the electricity grid can be ensured. At the same time, balancing production can be achieved with the help of storage facilities. In these cases, the dynamics of the quantities of electricity generated by wind energy and solar energy come into play.

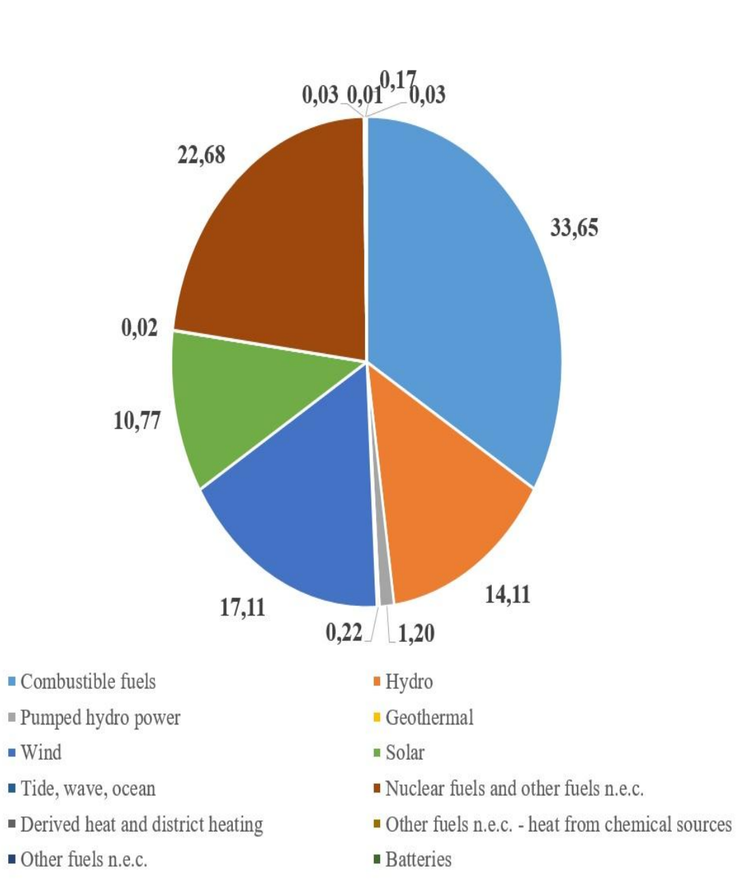
The support and involvement of local communities for urban energy projects is becoming increasingly important. Depending on local characteristics related to possible water shortages or high temperatures, there is an increased interest in alternative energy sources.

Both human survival, social development and economic activities require the use of natural resources. However, an increase in the degree to which natural resources are used leads to negative environmental and social impacts, respectively. However, technological progress and the use of improved technologies lead to a more rational and complete use of natural resources.

RESULTS

For the period 2015-2024, within the Member States of the European Union, an analysis was carried out of both primary energy consumption and final energy consumption. Also, depending on the type of plant, the article presents the comparative situation for gross production of electricity and net production of electricity. The importance of renewable sources is also reflected through a comparative analysis for the share of renewable energy in gross final energy consumption for transport.

Distribution of gross electricity production by type of plant, 2024



DISCUSSION

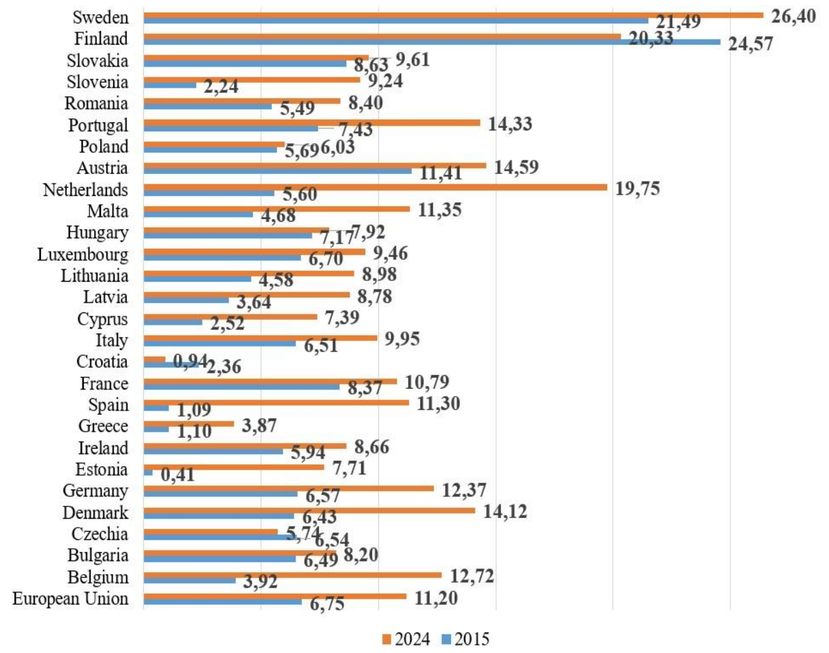
Comparative situation of gross and net production of electricity, for the period 2015-2024 (GWh)

Countries	Total gross electricity production		Total net electricity production	
	2015	2024	2015	2024
European Union	2907139	2828342	2760991	2717966
Belgium	69705	77157	67376	74328
Bulgaria	49227	38535	44726	35711
Czechia	83892	73900	76916	68139
Denmark	28941	35318	27921	34468
Germany	648309	514009	610292	490978
Estonia	10149	6368	9062	5339
Ireland	28498	31493	27621	30721
Greece	51874	57924	47806	57573
Spain	280911	287915	269751	279398
France	579918	570713	555161	547780
Croatia	11403	15360	10983	14839
Italy	282993	271007	272428	263274
Cyprus	4535	5763	4314	5508
Latvia	5533	6322	5093	6044
Lithuania	4933	8092	4676	7789
Luxembourg	2766	2742	2738	2712
Hungary	30360	37987	28150	36098
Malta	1305	2186	1241	2139
Netherlands	110213	123844	105752	120228
Austria	65299	82407	61928	80567
Poland	164944	172384	150695	162019
Portugal	52420	51089	50940	50577
Romania	66296	53376	61277	49168
Slovenia	15100	16993	14187	16113
Slovakia	26903	29938	24758	27277
Finland	68599	83153	66155	79902
Sweden	162112	172367	159045	169281

At the European Union level, in 2024, total gross electricity production was 2828342 GWh. Compared to 2015, this value was 78797 GWh lower. Total gross electricity production values of over 100000 GWh were recorded in: France (570713 GWh), Germany (514009 GWh), Spain (287915 GWh), Italy (271007 GWh), Sweden (172367 GWh), Poland (172384 GWh), Netherlands (123844 GWh).

Total net electricity production, for the year 2024, at the European Union level, was 2717966 GWh. Compared to 2015, this value was 43025 GWh lower. Total net electricity production values of over 100000 GWh were recorded in: France (547780 GWh), Germany (490978 GWh), Spain (279398 GWh), Italy (263274 GWh), Sweden (169281 GWh), Poland (162019 GWh), Netherlands (120228 GWh).

Comparative situation of share of renewable energy in gross final energy consumption for transport (%), 2015-2024.



At the European Union level, in 2024, participation in vocational education and training programs was 13.5%. For a number of 12 states, they had values over 15%.

CONCLUSIONS

In 2024, total gross electricity production was lower than the value recorded in 2015. For this time interval, 4 countries had decreases in values of over 10000 GWh (Germany, Romania, Italy, Bulgaria). At the same time, increases in values of over 10000 GWh were recorded in: Austria, Finland, Netherlands, Sweden. Compared to 2015, in 2024 the values decreased for both primary energy consumption and final energy consumption. In 2024, values of over 50 Mtoe were recorded in: Germany, France, Spain, Poland, Netherlands. Regarding the share of renewable energy in gross final energy consumption for transport, at the European Union level, it is noted that in 2024, compared to 2015, the shares increased by 4.45% (from 6.75% to 11.20%). The values decreased for 3 countries: Finland, Croatia, Czechia. For the other countries, the values increased. In 2024, values over 10% were recorded in: Sweden, Finland, Netherlands, Austria, Portugal, Denmark, Belgium, Germany, Malta, Spain, France.