DOI: 10.47743/eufire-2024-1-6

THE IMPACT OF EUROPEAN REGULATIONS ON ENVIRONMENTAL PERFORMANCE OF EU COUNTRIES: A COMPARATIVE ANALYSIS

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Abstract
Since the adoption of the European Green Deal in 2020, the European Union constantly tried to improve its environmental protection policy, aiming to develop a climate-neutral economy that will help Europe to become the world's first 'climate-neutral' continent, with net zero GHG emissions by 2050. Indeed, according to 2022 estimates, the EU has successfully reduced its GHG net emissions by 31% since 1990, meeting its 2020 targets without sacrificing its prosperity. The use of renewable energy and the increase of energy efficiency proved to be of paramount importance for cutting down pollution.
Even though, so far, progress has been made by Member States, the achievement of climate neutrality by 2050 imposes a faster pace on them. Still, their policies, strategies, programs and measures need to be well-synchronized in content and timing to curb climate change and protect prosperity. To measure the results and to anticipate future efforts require adequate tools. One of these is the environmental performance index (EPI), a complex global environmental indicator based on 40 performance indicators grouped into 11 issue categories, which are tracking progress on three broad policy objectives: environmental health, ecosystem vitality, and climate change.
The objective of the paper is to analyze the environmental performance of the European Union (EU) countries, measured according to the environmental performance index (EPI), in order to highlight the impact of the European regulations and how these contributed to better environmental performance, taking into consideration the fact that demanding environmental policy is associated with greater competitiveness and more eco-innovation, according to the European Environment Agency (EEA).
Keywords: *environmental protection; environmental performance index; European Green Deal; EU regulations.*
JEL Classification: F64, Q01, Q58.

1. INTRODUCTION

In September 2015, all United Nations Member States adopted the 17 Sustainable Development Goals (SDGs) (United Nations, 2024), which provide a blueprint for peace and prosperity addressing global challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice (Hope Sr, 2020). Curbing climate change through the transition towards a climate neutral economy remains also a primary goal for the European Union (EU). During the last ten years significant progress has been made by the EU to reach a sustainable, environmental friendlier economy.

Thus, in December 2019, the EU Member States adopted the European Green Deal (EGD), which is the EU's growth strategy, and it aims to transform the Union into a climate-neutral society (Eurostat, 2023a). From the 17 SDGs goals, 12 are the European Commission priorities included in the EGD, respectively: SDG 2 – Zero Hunger; SDG 3 – Good Health and Well-Being; SDG 6 – Clean Water and Sanitation; SDG 7 – Affordable and Clean Energy; SDG 8 – Decent Work and Economic Growth; SDG 9 – Industry, Innovation and Infrastructure; SDG 10 – Reduced Inequalities; SDG 11 – Sustainable Cities and Communities; SDG 12 – Responsible Consumption and Production; SDG 13 – Climate Action; SDG 14 – Life Below Water; SDG; 15 – Life on Land (Eurostat, 2023, p. 21).

The Environmental – "E" component of sustainable development addresses issues related to climate change, resource use, waste management, and environmental conservation (Senadheera *et al.,* 2021). The "E" component directly aligns with SDGs such as: SDG 6 - Clean Water and Sanitation, SDG7 - Affordable and Clean Energy, SDG 13 - Climate Action, SDG 14 - Life Below Water and SDG 15 - Life on Land.

Since the adoption of the EGD, the EU constantly tried to improve its environmental protection policy, aiming to develop a climate-neutral economy that will help Europe to become the world's first 'climate-neutral' continent, with net zero GHG emissions by 2050. Indeed, according to 2022 estimates, the EU has successfully reduced its GHG net emissions by 31% since 1990, meeting its 2020 targets without sacrificing its prosperity. The use of renewable energy and the increase of energy efficiency proved to be of paramount importance for cutting down pollution.

The EU legal necessary framework regarding climate change adaptation and mitigation was set up under 2023 "Fit for 55 package", with the purpose of reducing domestic net GHG emissions with 55% by 2030 from 1990 levels. Despite its efforts so far, the EU goal for 2030 seems too ambitious. The European Environmental Agency (EEA) in its five years overview report, which quantifies the state of the environment, draws attention on the unprecedented environmental challenges EU faces in terms of scale and urgency. The increased impact of climate change, biodiversity loss and the depletion of natural resources

generated by overconsumption are the main concerns at this time. The agency warns that if not properly addressed at a faster pace during the next years, these persistent problems will prevent the EU from meeting its 2030 target. Europe needs to rethink "not just technologies and production processes but also consumption patterns and ways of living" (European Environment Agency, 2019, p. 331). The changes need to be systemic to not only take the pressure off the environment and slow down climate change but also protecting biodiversity and ecosystems and human health as well.

The EU 8th Environmental Action Programme (EAP) that builds on the EGD, includes these goals as long-term thematic priority objectives for 2050 of living well on the planet, which remains the main long-term one. Since 2023, the EEA monitors 28 EAP headline indicators and corresponding monitoring targets, showing that the EU has registered some progress but, it also shows a moderate and high degree of uncertainty in respect to meeting these targets.

In this context, according to the 2023 EEA first monitoring report (European Environment Agency, 2023a) it is highly unlikely for the EU to meet five of the targets by 2030 when it comes to climate change mitigation, namely GHG emissions from land use, land change and forestry; environmental and climate pressure related to EU production and consumption, namely energy consumption, circular material use rate, area under organic farming; living well, within planetary boundaries, namely consumption footprint. Fifteen out of the 28 monitored targets are unlikely but uncertain, 3 out of 28 are likely to be met but uncertain and 5 out of 28 are very likely to be met by 2030.

The EEA report shows that there is an obvious gap between the current projection levels and the target. This is the result of the slow and uneven pace at which EU Member States are implementing current policies and acting for reducing emissions. Member States are still in the process of updating their National Energy and Climate Plans but, at the same time, their policies and measures should extend to all socio-economic sectors if they want to meet the 2030 target. It is necessary to improve Environmental Performance Index (EPI) through regulations based on the Green Deal and improved, transformative legislation based on the pillars of "Fit for 55 package".

The objective of this paper is to emphasize the way EU Member States are trying and succeeding to improve their environmental performance.

The paper is organized as follows: the Introduction is Section 1. Section reviews the literature regarding the European Green Deal and the environmental performance to highlight the importance of the topic and the contribution of EU EDG to improve its environmental performance. Section 3 presents the methodological approach. Section 4 discusses the research results and Section 5 concludes the paper.

2. LITERATURE REVIEW ON EUROPEAN GREEN DEAL AND ENVIRONMENTAL PERFORMANCE

The European Green Deal (EGD) is a much-discussed topic in specialized literature, through the lens of its coherence and its effects in terms of direct actions and synchronization of Member States to achieve a decarbonized economy, largely based on sustainable development and climate change policy objectives.

In his paper, Montini (2021) criticized the EGD's lack of coherence because according to him, the policy package contains a variety of parallel and concurrent goals that will be hard to achieve in a fixed time frame without integrating them all within a single and comprehensive policy and legal framework concerning environmental protection. For this reason, he argues that to be successful, the transition to a green economy needs to be based on the principle of environmental integration enshrined in Article 11 TFEU: "Environmental protection requirements must be integrated into the definition and implementation of the Union policies and activities, in particular with a view to promoting sustainable development". This principle seems to be forgotten by the EU decision makers. His opinion is supported by other studies. For example, Jans (2021) argues that from a legal point of view, if used, the principle could help to overcome the constraints placed upon EU institutions by the principle of conferral to promote environmental protection objectives when decisions are taken in the framework of policies such as common commercial market, transport, energy, agriculture, trade etc. Also, the principle gives the possibility to interpret EU law outside the specific environmental field and thus, to successfully promote the environmental protection objectives.

Pisari-Ferry *et al.* (2023) analyzed the efficiency of the EGD and concluded that its implementation will face major political and social difficulties. The EU green transition will be slowed down for two reasons. The first one is the lack of coordination because key policies, especially energy ones, do not exist at EU level, but are mostly national. In this respect, the EGD does not improve the EU's energy and climate governance framework. The second reason for potential failure is the need to make profound changes to lifestyles that will have distributional consequences, affecting households unequally, and thus, leading to a political backlash, which is already happening in the EU.

The Green Deal also aims at promoting sustainable finance and sourcing. Green Deal Investment Plan (EGDIP), also known as the Sustainable Europe Investment Plan, from January 2020, is set to facilitate the implementation of Green Deal policies by supporting sustainable investments through the EU budget, creating a supportive investment framework for green investments in the public and private sector and bringing administrative support for sustainable projects. The European Commission decided that 500 billion euros will come

directly from the EU budget, while most of the remaining funds will be mobilized through the investment programme InvestEU (Feting, 2020).

In this respect, some studies show that there are hurdles in achieving these financial goals that are directly linked to the environmental efficiency of EU Member States. For example, Křemečková and Šreflová (2024) considered to be such challenges the paucity of reliable and consistent data regarding environmental and social performance, the lack of standardization in the sustainable finance, the lack of awareness among investors and corporations regarding the significance of sustainable finance and the absence of comprehensive regulatory frameworks that can favor the proliferation of unsustainable practices.

Another issue brought up by specialists is the access to funding sources in order to achieve carbon neutrality envisioned in the Green Deal. According to Negreiros and Falconer (2021), to boost the EU environmental performance, it is essential for cities in the EU to have direct access to funds for low-carbon infrastructure investments. It is known that financing available for EGB implementation comes from EU funds and institutions. So, key improvements would be to simplify and expand the access modalities for EU funds and to make more direct access funding channels available to EU cities.

Environmental performance is the subject of a significant number of studies. However, only some of them focus on interactions between indicators or the influence of one indicator over others. An example of such study is the one conducted by Puertas *et al.* (2022), focusing solely on measuring the eco-efficiency, meaning the use of fewer natural resources to satisfy human needs, with a focus on production and death due to pollution. The analysis is extended to 20 EU Member States, over four years, between 2014–2018. Based on Data Envelopment Analysis (DEA) and the Malmquist Index (MI), the study reveals that almost all of them had a good environmental performance unconditioned by their wealth or their economic growth. However, out of the twenty EU members, the Eastern European ones show the most room for improvement.

An example of a more extensive study is the one conducted by Matsumoto *et al.* in 2020 that evaluates the environmental performance of all EU Member States using the data envelopment analysis (DEA) approach and the global Malmquist-Luenberger index, but also considering different types of undesirable outputs such as carbon dioxide and particulate matter emissions, and waste and using panel data on EU countries during the period 2000-2017. The results of this research revealed that the trends in the environmental performance of the entire EU and its individual Member States were similar. Environmental performance, especially the one of eastern EU countries, was negatively affected by the financial crisis of 2007-2008, but Member States overall efficiency was significantly influenced by economic and environmental variables. However, EU

countries experienced an improvement in their environmental efficiency during the studied period.

Similar studies are analyzing a multitude of environmental performance indicators, over extensive periods of time. Thus, Stoian *et al.* (2022) demonstrate that EU environmental performance is influenced by a myriad of factors, their impact being analyzed using data collected between 2010 and 2020, once in 2 years and by using a panel data model. The results show that a positive relationships exists between EPI scores at EU level and organic farming, circular material use rate, Eco innovation index, energy productivity, ratio of female-to-male labor force participation rate, forest area, Human Development Index, Internet users, livestock production index, new business density, patent applications-residents, tertiary school enrollment, the share of renewable energy consumption in gross final energy consumption, and the proportion of seats held by women in national parliaments. At the same time, results show that higher inequality between individuals, natural resources rents, trade volume index, and environmental taxes in total tax revenues constrain the EU's environmental performance.

Resuming, studies show that the European Green Deal has opened a path towards a decarbonized economy and EU Member States made good progress towards its goals. However, the environmental performance is linked to a multitude of social and economic sensitive factors that need to be carefully considered to reach sustainability.

3. METHODOLOGY AND DATA

For achieving our purpose, we have included all the 27 EU countries, namely: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

The data for SDGs was collected from Eurostat (Eurostat, 2023a; Eurostat, 2024) for a period of five years (2016–2021 or 2017–2022, according to data availability), while the data for Environmental Performance Index (EPI) and projected emission in 2050 were collected from the web page dedicated to Environmental Performance Index (Block *et al.*, 2024).

The 2024 Environmental Performance Index (EPI) is a comprehensive environment index that provides a summary of relevant data revealing the state of sustainability around the world, including EU Member States, which is our sample of countries to be analyzed. The EPI is evaluating and ranking 180 countries based on climate change performance, environmental health, and ecosystem vitality. The 58 performance indicators across 11 issue categories are used to provide a national scale indicator of how close countries are to meet the environmental policy objectives. Thus, the EPI ranks countries by score,

highlighting the leaders and laggards in environmental performance and providing practical recommendations for those that want to move towards a more sustainable future.

Table 1. Descriptive statistics – EPI

No.	Rank	Country	2014 EPI	2024 EPI	EPI (10 years change)
1.	1	Estonia	58.0	75.3	17.3
2.	2	Luxembourg	70.9	75.0	4.1
3.	3	Germany	70.2	74.6	4.4
4.	4	Finland	65.4	73.7	8.3
5.	6	Sweden	68.9	70.5	1.6
6.	8	Austria	69.3	69.0	-0.3
7.	10	Denmark	66.1	67.9	1.8
8.	11	Greece	59.2	67.4	8.2
9.	12	Netherlands	62.4	67.2	4.8
10.	13	France	65.5	67.1	1.6
11.	14	Belgium	61.5	66.7	5.2
12.	15	Malta	59.0	66.6	7.6
13.	16	Ireland	63.6	65.7	2.1
14.	17	Czech Republic	64.9	65.6	0.7
15.	18	Slovakia	66.3	65.0	-1.3
16.	19	Poland	61.9	64.4	2.5
17.	21	Spain	62.8	64.2	1.4
18.	22	Lithuania	58.4	63.9	5.5
19.	24	Croatia	59.9	62.6	2.7
20.	25	Slovenia	63.7	62.5	-1.2
21.	26	Portugal	59.8	62.2	2.4
22.	29	Italy	56.6	60.5	3.9
23.	30	Hungary	62.5	60.1	-2.4
24.	31	Latvia	57.7	59.9	2.2
25.	35	Romania	59.8	57.2	-2.6
26.	37	Bulgaria	58.0	56.3	-1.7
27.	43	Cyprus	53.4	54.0	0.6

Source: author calculation, based on Environmental Performance Index, https://epi.yale.edu/measure/2024/EPI

The descriptive statistics for EPI and the change registered in its value in the last ten years for EU Member States are presented in Table 1. The index

score countries on a 0-100 scale, from worst to best performance. In Table 1, countries are ranked according to 2024 values for EPI, from highest to lowest.

Table 2. Descriptive statistics – projected emissions in 2050

No.	Rank	Country	Score	10 years
1.	1	Estonia	100	75.0
2.	1	Finland	100	70.9
3.	1	Greece	100	82.1
4.	12	Malta	57.7	13.6
5.	22	Luxembourg	47.5	9.1
6.	31	Denmark	40.5	-59.5
7.	45	Latvia	33.7	0.5
8.	46	Slovenia	33.6	-1.7
9.	48	Cyprus	33.4	-2.8
10.	61	Croatia	28.9	0.2
11.	62	Lithuania	28.8	0.3
12.	73	Sweden	25.7	-3.7
13.	77	Portugal	24.7	0.4
14.	80	Slovakia	23.6	-8.0
15.	95	Bulgaria	21.4	-3.8
16.	99	Austria	20.6	-3.8
17.	102	Ireland	20.5	-9.6
18.	108	Belgium	19.8	-4.8
19.	111	Hungary	19.4	-80.6
20.	115	Czech Republic	18.6	-2.7
21.	115	Netherlands	18.6	3.2
22.	121	Romania	17.1	-12.9
23.	130	Germany	14.9	11.5
24.	141	France	12.8	0.6
25.	142	Spain	12.5	-2.1
26.	150	Italy	9.2	1.2
27.	154	Poland	7.7	-0.9

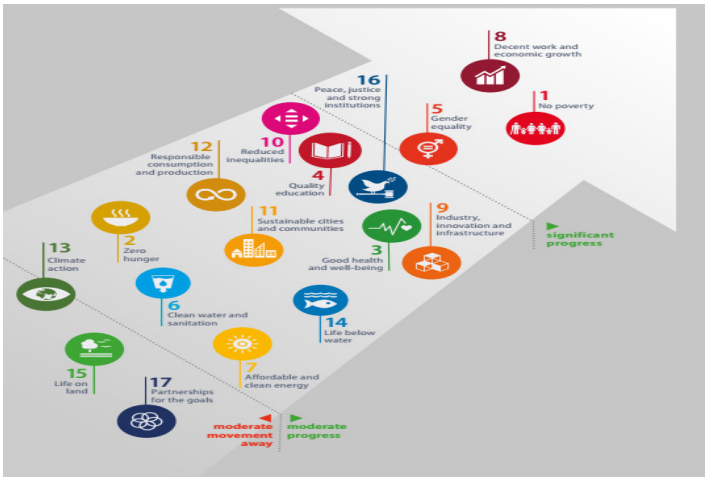
Source: author calculation, based on Environmental Performance Index, https://epi.yale.edu/measure/2024/GHN

The descriptive statistics for projected emissions in 2050 and the ten years change are presented in Table 2. This indicator captures whether countries are on track to reach zero emissions of four greenhouse gases by 2050. In Table 2,

countries are ranked according to projected 2050 emissions and a score equal to or below zero receive the maximum score.

4. RESULTS AND DISCUSSION

The European Union (EU) has fully committed itself to delivering on the 2030 Agenda, and the SDGs form an intrinsic part of the European Commission's work programme. The EU member states are implementing the SDGs regarding the environment, considering the EDG requirements. In this context, in 2023, the European Commission published voluntarily its first review on the implementation of the 2030 Agenda at the United Nations' (UN) High-level Political Forum held in July 2023.



Source: Eurostat (2023)

Figure 1. Overview of EU progress towards the SDGs *

Regarding the "E" goals – SDG6, SDG7 and SDG14 – from Figure 1, we can see that the progress was less significant. Trends in the areas of clean water and sanitation (SDG6), affordable and clean energy (SDG7) and life below water (SDG14) were moderately favorable at EU27 level. Regarding climate action (SDG13) and life on land (SDG15) is expected more progress, because the 2023 Report (Eurostat, 2023a) showed moderate movement away from the targets. In the case of SDG13, according to provisional estimates for 2021, the EU has reduced its net greenhouse gas emissions by about 30% since 1990 (Eurostat, 2023b). Considering the last report on progress towards SDGs (Eurostat, 2024), the EU's per capita emissions were one of the lowest among other high-income economies, but higher than the world average. In this context, considering the EU ambitious and unparalleled climate targets for 2030, and

compared with past trends, reducing greenhouse gas emissions will require more effort. Additional measures have been implemented through the "Fit for 55 package". In the case of SDG15, concerning life on land, even were reported the increase of terrestrial protected since 2013, additional efforts are still needed to reverse the degradation of ecosystems.

Although data in the figure mainly refer to 2016–2021 or 2017–2022, there is no doubt that SDG implementation comes with its own set of challenges and issues that need to be addressed in policy and institutional research over the years to come (Nilsson and Persson, 2017). On the other hand, the EPI represents an important policy tool to meet the targets of the SDGs, showing to the countries how close they are to established environmental policy targets. EPI scores are positively correlated with a country's wealth, although after a point, scores show that wealth yields are diminishing and register an increase. However, at each level of economic development, there are some countries that outperform their peers, while others stay behind.

On one hand, wealth allows countries to invest in the infrastructure needed to provide clean drinking water, safely manage waste, and rapidly expand renewable energy. On the other hand, wealth also leads to greater consumption of resources and its associated environmental impacts, such as higher rates of waste generation, GHG emissions and ecosystem degradation.

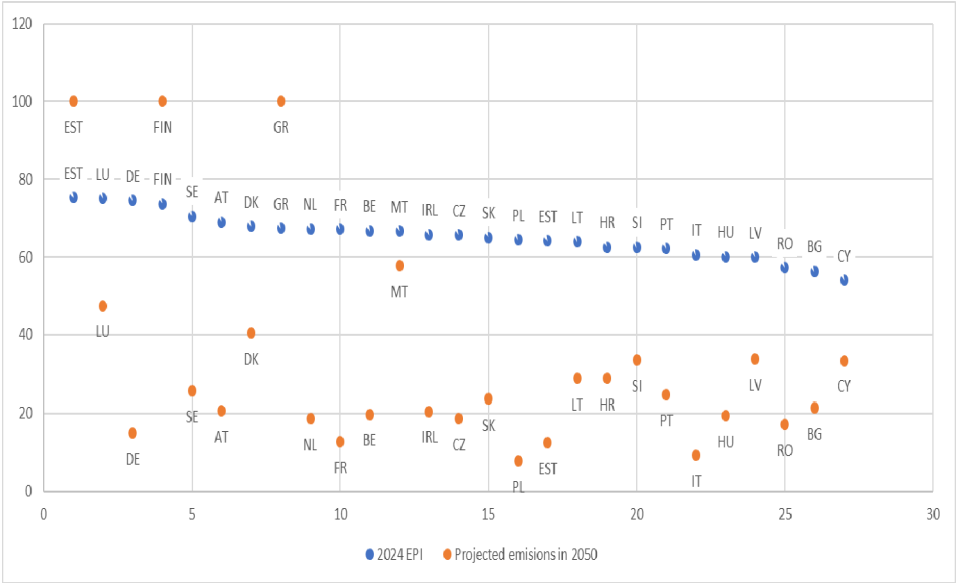
As we can see from Table 1, the change registered in the last ten years regarding EPI score show the progress toward mitigating climate change, improving environmental health, and protecting ecosystem vitality for most EU countries, with the exception of six countries, most of them being countries that became EU members in 2004 and 2007. Estonia, Luxembourg and Germany are the most successful at addressing a wide variety of global environmental challenges, while Romania, Bulgaria and Cyprus are at the bottom of the ranking. Even most of the EU countries improved their EPI in accordance with the record deployment of renewable energy, which is associated with a higher environmental performance, the 2024 EPI analysis of emission trends over the last decade shows that only five countries (three EU member states) — *Estonia*, *Finland, Greece*, Timor-Leste, and the United Kingdom — cut their GHG emissions at the rate needed to reach zero emissions by 2050 (Block et al, 2024, p. IX). Even so, it is not certain that the mentioned countries can maintain the pace of reduction that they achieved in recent years to fulfill the 2050 target.

The environmental performance of EU countries is a good one. The 2024 EPI overall ranking shows that they occupy the top 20 positions (Block *et al.*, 2024). These top ranked Member States have indeed comprehensive environmental policies, relying on strong regulations and financial investments. However, even these countries also have important gaps to fill since none of them scores above 80 in the overall 2024 EPI, showing that the success of reaching sustainability is still far ahead. For example, based on the 2024 EPI's

pilot indicators of protected area stringency and greenhouse emission reductions relative to allocated shares of the remaining carbon budget, many of the top ranked European countries registered a modest environmental performance. Even though these pilot indicators receive a low weight in the EPI, they indicate the need for significant improvement.

Despite this shortcoming, Estonia is the first Eastern European country that reached the top position of the 2024 EPI overall ranking, and it has also earned the top score on the Climate Change policy objective. Also, Estonia has managed to reduce by 40 percent its greenhouse gas (GHG) emissions during the last ten years (Block, 2024, p. 11). Regarding the projected emission levels in 2050 (Table 2), we notice that at this pace, Estonia could reach zero emissions by 2050 (Table 2) without exceeding its allocated share of the remaining carbon budget (Block, 2024, p. 37).

Figure 2 presents the EPI 2024 score for EU member states and the projected emissions in 2050. We can see that in the case of EPI all EU countries are registering appropriate values between 54 and 75.3, in the case of emissions is not occurring the same. There are clear differences, and we can observe three groups: the first one includes Estonia, Finland and Greece, the second group includes Malta, Luxembourg and Denmark and the third group which consists in the remain countries.



Source: elaborated by the authors

Figure 2. EPI score and projected emissions in 2050

5. CONCLUSIONS

This paper investigated the environmental performance of the EU Member States, based on the environmental performance index (EPI), with the objective to highlight the impact of the European regulations, especially of the EGD, and how these contributed to better environmental performance, including to the progress in accomplishing the SDGs targets.

We consider that this comparative perspective can offer a better understanding of the environmental progress determinants, and it can help refining policy choices for EU Member States on their way towards sustainability. To achieve climate neutrality by 2050 by reducing GHG emissions at the pace needed will require significant and ongoing investments in renewable energy, transforming food systems, electrifying buildings and transportation, and redesigning cities.

Moreover, to accomplish the objectives of the EGD and to respond to the 8th Environment Action Programme which aims to accelerate the green transition, the EU must also increase environment- and climate-related expenditure (European Environment Agency, 2023b) as additional funds will be made available through the EU's 2021-2027 budget and the 2021-2026 EU Recovery and Resilience Facility (RRF).

Further research can analyze the contribution of increased environmental expenditure to improve EPI scores.

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