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# The Green Economy for a Sustainable Future: Experience from the Visegrad Group Countries

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## Abstract

The objective of this paper is to identify the significance of the green economy for a sustainable future and compare the situation and developments in achieving the European Green Deal (EGD) in the Visegrad Group (V4) countries. To achieve this objective, the paper focuses on the challenges, risks and opportunities of implementing green economy policies. Comprehensive data analysis is conducted, and a European Green Deal Index (EGDI) for the V4 countries is developed. The Eurostat database is used to monitor 18 key indicators in the V4 countries from 2015 to the latest year available. The results show that Slovakia is the best-performing V4 country with the highest EGDI score, while Poland shows the most significant improvement, mainly in the category *Enabling a green and just transition*. Between 2015 and 2023, Slovakia and Czechia experienced negative trends in the percentage of the population unable to keep their home adequately warm for financial reasons. The paper highlights the social dimension of the EGD and the green economy as well as the importance of a just transition concept across the whole European Union since increased household spending on the green transition could affect public support.

Keywords: European Green Deal, European Green Deal Index, green economy, just transition, Visegrad Group

JEL: O13, Q54, Q58

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## Introduction

The European Commission presented the European Green Deal (EGD) on 11 December 2019 as one of its six political priorities for the period 2019–2024. The EGD should help make Europe the first climate-neutral continent by 2050 while strengthening the economy and improving people's health and quality of life. However, there is also criticism of the EGD. In the transition to a green economy, the biggest uncertainty is associated with the social dimension, in the sense that individual steps within the implemented policies are aimed at ensuring a just transition for all individuals and all regions. The green economy is the key to achieving the set goals because this concept is based on respecting the limits of our planet and on the importance of using natural resources wisely and justly. The social pillar has the same importance as the environmental and economic pillars within the green economy.

The objective of this paper is to identify the significance of the green economy for a sustainable future and compare the situation and developments in achieving EGD goals in the Visegrad Group (V4) countries – Czechia, Hungary, Poland and Slovakia.

The paper is organised as follows. Section 2 provides the theoretical background and focuses on previous research in the area of green economy. It offers an overview of selected policies to support the development of the green economy and highlights the challenges for V4 countries in the green transition. Section 3 summarises the data and methodology utilised and presents the European Green Deal Index (EGDI) developed for this research. The empirical findings, which include a comparison of the V4 countries, are presented in Section 4, followed by a discussion and conclusions in Sections 5 and 6, respectively.

## Theoretical background

There is general agreement that certain policy interventions are needed to address the challenges of unsustainable development and the loss of well-being over time (Figure 1). However, there is no agreement regarding the appropriate level or extent to which it is desirable to implement interventions. As Huberman (2010) notes, policy recommendations are primarily formulated at the macroeconomic level and reflect the need for global solutions. This is because macroeconomic analyses are useful for outlining major trends and identifying key sectors that are associated with contemporary global challenges. Lawn (2008) offers his own perspective on the issue, stating that environmental crises cannot be effectively faced at the global level. Meanwhile, Barbier (2012) emphasises the need for a mix of short-term and long-term policies. When compiling an appropriate mix of policies and tools for their implementation, it is also necessary to consider whether the context is that of a rich or poor country. Additionally, it is essential to recognise that compromises will be necessary in the implementation of various policies, even when they have a common goal, i.e., supporting the development of the green economy (Table 1).

The choice of an appropriate policy to develop a green economy depends on how the concept is defined and interpreted. Newton and Cantarello (2014) state that many policymakers perceive no conflict between the way the economy or society functions and a healthy environment.

And therefore, they argue, there is no need for fundamental social and economic changes. Cato (2011) states that if fundamental social and economic changes are not implemented, it is ecological modernisation, that is, the development of the green economy, that preserves economic structures such as corporations and markets. Products are produced more efficiently and their production consumes less energy and materials.

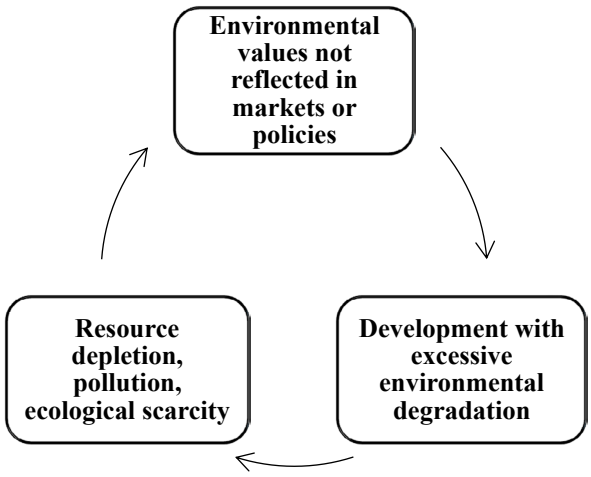


Figure 1. The vicious cycle of unsustainable development
Source: Barbier and Markandya 2013.

For supporters of ecological modernisation, the solution to the environmental crisis is ecological efficiency. However, Cato (2009) contends that if we want to move towards a truly green economy, we need to fundamentally change the system that created the environmental and social problems. Fiorino (2018) notes that the concept of ecological modernisation has both supporters and critics. Much of the criticism parallels the problems connected with the green economy today, particularly the ongoing dominance of rich countries and corporations, which are seen as key contributors to ecological degradation. However, the validity of the criticism depends on the specific version of ecological modernisation in question – whether it emphasises ecological efficiency and innovation or a more systemic approach based on institutional changes. However, Jänicke (2008) concludes that, despite the impressive potential of ecological modernisation, this concept is not sufficient to ensure long-term environmental stability. Solving many problems requires certain social and lifestyle changes, and even a significant increase in ecological efficiency will not be enough to counter exponential growth. Nonetheless, proponents of ecological modernisation highlight its significant contribution in that most environmental research is based on the assumption that the way industry and states operate is the cause of ecological damage (Murphy 2000).

The transition to the green economy can be initiated and driven by several factors. The International Labour Organization (ILO 2011) notes that within the market mechanism, there are incentives to trigger such a transition. However, for structural change, an exogenous shock is necessary, which could come mainly from one of four areas: energy prices, new technology, changes in preferences and demand, or the role of policies. The transition will vary significantly between countries due to differences in natural and human capital and the relative level of development of each country.

The United Nations Environment Programme (UNEP 2011) states that countries will face a number of challenges and opportunities as part of the transition to the green economy. Some have achieved a high level of human development, but often at the cost of excessive depletion of natural resources, environmental degradation and high greenhouse gas emissions. The challenge for these countries will be to reduce their ecological footprint per capita without compromising quality of life. Practical examples include improving green spaces in cities and investing in low-carbon public transportation.

Conversely, less developed countries, which typically have a relatively low ecological footprint per capita, will need to improve the level of service provision and the standard of living. The biggest challenge for these countries is that increasing overall well-being should not be associated with an extreme increase in their ecological footprint. Patrick ten Brink et al. (2012) emphasise that the transition to the green economy will require the adoption of a wide range of political and financial instruments aimed at promoting sustainable production and consumption. The greening of economic sectors will have to be supported by tools and approaches designed to achieve social goals.

The main elements of a green policy agenda are principles, policy instruments and indicators. Principles express the basic ideas and criteria for evaluating policy instruments and their application. Policy instruments are mechanisms designed to change behaviour to achieve set goals. They should reflect the principles and link them to desired outcomes. Indicators are used to measure the extent to which the agenda is being fulfilled and, therefore, whether it is successful or not.

The basis of the green political agenda is the principles on which it is based. In public policy, these principles guide the decision-making process and the use of policy tools. These principles emphasise that policy instruments, or their combinations, should be a) effective in achieving their intended goals; b) fair, ensuring they do not disadvantage or favour certain groups; c) cost-effective in achieving desired outcomes; and d) feasible in terms of gaining the necessary political support.

Within this framework, individual strategies should be designed to reduce environmental and human health risks, promote local control and be implemented only if the expected benefits outweigh the costs (Fiorino 2018). However, the transition to the green economy has perceived contradictions in certain cases and raises concerns within society. For example, the OECD (2011) highlights a widespread perception that some people will be worse off because of green policies. Even if this is not the case, it is necessary to deal with this perception so that key policies in the transition are not called into question. All stakeholders likely to be affected by the transition must be part of the policymaking process from the beginning. The policy-making process must be transparent and clearly explain the rationale for the reforms. Any negative effects on poorer households must be compensated by well-targeted measures that consider the tax and transfer system. When there are negative impacts on the competitiveness of companies, compensation schemes may be justified, although they are costly.

Therefore, it is important to coordinate adopted policies with all stakeholders. For example, while phasing out fossil fuel subsidies will have positive effects on the environment and the economy,

negative consequences are also likely in some countries or within certain population groups. A key problem is the time mismatch between negative and positive effects: increases in fuel prices will be significant and immediately obvious to some people, while environmental positives will be more diffused and will be visible over a longer time horizon. It is for this reason that, within the transition to the green economy, it is necessary to introduce compensatory measures aimed at the most vulnerable segments of the population.

According to the World Bank (2012), strategies must be adapted to maximise local and immediate benefits on the one hand while ensuring that the process of greening economies is not hindered. Effective green policies require governments to better manage market and governance failures. Optimal solutions will vary across countries, as there are differences in institutional capacity, transparency and accountability. It is important to recognise that even if a certain strategy is extremely successful in one country, it may fail completely in another country. Therefore, strategies must be adapted to the conditions of the given country.

Strategies for greening economies should aim to minimise transition costs while offsetting them as much as possible with visible and immediate benefits. It is, therefore, essential to design policies to maximise short-term local benefits such as increased efficiency, productivity, safety and resilience, job creation and poverty alleviation. However, governments cannot make all the necessary changes at once. They have limited resources and limited implementation capacity to address complex issues. Their political capital to push for change and defend their policies against interest groups and political opposition is also limited. Therefore, governments must focus on sectors and interventions that are most urgent and can help reduce inertia and prevent irreversible harm within their economies.

Table 1. Overview of selected policies to support the development of the green economy

| Political difficulty of implementation | Local and immediate benefits versus global and long-term benefits | | |
|---|---|---|---|
| | Fewer trade-offs | Some trade-offs | More trade-offs |
| Easy | a) Energy conservation<br>b) Landuse planning | a) Improved drinking water and sanitation<br>b) Development of fuelefficient vehicles | a) Carbon sequestration projects |
| Moderate | Public transport | a) Lowcost clean energy supply<br>b) Removal of fossil fuel subsidies<br>c) Subsidies for clean energy R&D | a) Ocean conservation and fisheries management<br>b) International payment and ecosystem services<br>c) Largescale water management projects |
| Hard | Pollution regulation and pricing | a) Natural resource management and pricing<br>b) Sustainable intensification of agriculture<br>c) Water pricing<br>d) Removal of water subsidies<br>e) Carbon pricing | a) Global carbon tax<br>b) Highcost clean energy supply<br>c) Removal of agricultural subsidies |

Source: Barbier 2012.

Table 1 presents examples of principles for creating strategies for greening economies and also offers local and immediate benefits. While low-carbon energy from renewable sources is highly desirable, it is easier to build renewable energy plants later than to try to reverse the poor land-use planning that led to sprawling cities. Good spatial planning and public urban transport can provide short-term benefits, such as reducing congestion and exposure to natural disasters, as well as prioritising denser and more energy-efficient development. For lower-income countries, three policy categories are particularly relevant:

1. Those that have zero economic costs due to development synergies. Examples include the development of hydropower or expanding family planning policies to manage population pressures and improve education and health outcomes.

2. Policies with some economic costs that have a direct impact on welfare. They are focused on local environmental problems such as natural hazards and air pollution.

3. Externally financed policies, including carbon trading.

The approach of the national government is key to development. Borel-Saladin and Turok (2013) argue that adopting a comprehensive range of available tools for greening economies can lead to either a partial or a transformational change in the economy. The green economy is a complex set of solutions that must be appropriately combined to enable countries and regions to move towards a sustainable future. In this process, the government's attitude is a crucial determinant of whether a country achieves partial or transformational change. In some cases, achieving partial change is closely linked to a lack of commitment to green solutions and may be more about creating the impression that the country is greener than it really is. Conversely, adopting a bold vision of the green economy involves implementing the full range of available tools to transform the current economic system into one that is inherently environmentally friendly and sustainable. Ultimately, it is political will that is the key to achieving the transformational change necessary to green the economy and make substantial progress towards long-term sustainability.

While numerous studies (Tomaszewski 2020; Riepl and Zavarská 2023; Streimikis et al. 2024; Takyi et al. 2024) acknowledge that significant progress has been made toward a greener economy, the V4 countries still lag behind their EU counterparts in several key aspects of the green transition. Achieving green targets poses a significant challenge for the V4 countries due to their fossil fuel-dependent industries and heavy reliance on coal mining in certain regions. Consequently, progress toward the green transition in the region has been uneven.

Riepl and Zavarská (2023) identified five key challenges that the V4 face: a low starting point, less societal awareness and political prioritisation of the climate crisis, the role of the automobile industry, the fear of social fallout in mining regions, and reducing their dependence on Russian fossil fuel imports. The lower starting point means that V4 countries face difficulties in reducing emissions while still striving to catch up economically, as their development trajectory may sometimes seem at odds with climate objectives. Furthermore, the automotive sector's crucial role in the economy and employment of all V4 countries makes the EU's decision to end the sale of new combustion engine vehicles by 2035 a particularly challenging issue.

Takyi et al. (2024) examined the relationship between green innovation, the circular economy, renewable energy, economic growth, and urbanisation in relation to carbon emissions in the V4 countries. They found that these countries have been actively exploring the potential of the green and circular economy to address both environmental and economic challenges. Their findings indicate that the V4 can mitigate environmental externalities and reduce carbon emissions by implementing green innovation practices and circular economy strategies.

## Data and methodology

A comprehensive data analysis was conducted, and a European Green Deal Index (EGDI) for the V4 countries was developed. The Eurostat database offers 27 key indicators that are important to achieve the EGD objectives. Nine indicators were excluded for two reasons: some indicators are not available for all V4 countries, and others are collected only every 3 years and, therefore, are not up-to-date. As a result, 18 key indicators were used in this research to monitor progress in the V4 countries from 2015 to the latest year available (2022 or 2023).

The year 2015 is used as a baseline due to data availability for each V4 country. For two indicators – generation of waste and environmental tax revenues – 2016 and 2018 were chosen as the baseline years, respectively, as data for 2015 were not available for all countries. These years are the closest to the general baseline year. Selected indicators are important to achieve the EGD objectives. The indicators are divided into three main components:

1. *Reducing our climate impact* (7 indicators)
2. *Protecting our planet and health* (3 indicators)
3. *Enabling a green and just transi*tion (8 indicators).

Table 2 presents all indicators and units of measurement for the EGDI.

Table 2. European Green Deal Index

| Main components | Indicator | Unit of measure | Baseline year | Latest data available |
|---|---|---|---|---|
| Reducing our climate impact | Net greenhouse gas emissions | Tonnes per capita | 2015 | 2022 |
| Reducing our climate impact | Renewable energy | % of gross final energy consumption | 2015 | 2023 |
| Reducing our climate impact | Primary energy consumption | Tonnes of oil equivalent per capita | 2015 | 2023 |
| Reducing our climate impact | Household energy consumption | GJ per capita | 2015 | 2022 |
| Reducing our climate impact | Zero-emission vehicles | % of new vehicles registered in the year | 2015 | 2023 |
| Reducing our climate impact | Passenger transport – rail | % in inland passenger-km | 2015 | 2022 |
| Reducing our climate impact | Freight transport – rail | % in inland freight tonnes-km | 2015 | 2022 |

| Main components | Indicator | Unit of measure | Baseline year | Latest data available |
|---|---|---|---|---|
| Protecting our planet and health | Organic farming area | % of utilised agricultural area | 2015 | 2022 |
| Protecting our planet and health | Premature deaths due to exposure to fine particulate matter (PM2.5) | Rate | 2015 | 2022 |
| Protecting our planet and health | Waste generation | Kilograms per capita | 2016 | 2022 |
| Enabling a green and just transition | Raw material consumption | Tonnes per capita | 2015 | 2023 |
| Enabling a green and just transition | Circular material use rate | % of material input for domestic use | 2015 | 2023 |
| Enabling a green and just transition | Gross domestic expenditure on R&D | % of GDP | 2015 | 2023 |
| Enabling a green and just transition | Population unable to keep their home adequately warm | % of population | 2015 | 2023 |
| Enabling a green and just transition | Greenhouse gas emissions intensity of employment | t GHG / employed | 2015 | 2023 |
| Enabling a green and just transition | High-speed internet coverage | % of households | 2015 | 2023 |
| Enabling a green and just transition | Environmental tax revenues | % of total tax revenue | 2015 | 2023 |
| Enabling a green and just transition | Environmental protection expenditure | % of GDP | 2018 | 2022 |

Source: own elaboration based on Eurostat database.

Each indicator was ranked on a scale from 1 to 4 based on the relative performance of each country. For each indicator and year, the country with the best outcome received a score of 4, while the country with the poorest outcome received a score of 1. For example, if net greenhouse gas emissions in 2015 were the highest in Czechia and lowest in Hungary, Czechia would receive 1 point and Hungary 4 points.

# Findings

As Figure 2 shows, the V4 countries have experienced varying developments between the baseline year and the latest data available in each main component of the EGDI.

## Reducing our climate impact

This category includes seven indicators: Net greenhouse gas emissions, Renewable energy, Primary energy consumption, Household energy consumption, Zero-emission vehicles, Passenger transport – rail, and Freight transport – rail. Major improvements can be seen in Poland (from 14 to 16 points) and Slovakia (from 19 to 21 points). Poland's progress is primarily driven by advancements in 2 indicators: Zero-emission vehicles (from 0.03% in 2015 to 3.6% in 2023)

and Passenger transport – rail (from 6.7% in 2015 to 8.3% in 2022). In contrast, Hungary experienced a decline, specifically in the area of Passenger transport – rail, dropping from the leading position in 2015 (9.7%) to the lowest in 2022 (8.2%). According to the latest data available, Slovakia leads in this category, with a slight improvement over the years, especially in reducing Net greenhouse gas emissions (from 6.6 tonnes per capita in 2015 to 5.5 tonnes per capita in 2022).

## Protecting our planet and health

This category consists of 3 indicators: *Organic farming area*, *Premature deaths due to exposure to fine particulate matter (PM2.5)*, and *Generation of waste*. The current leaders are Czechia and Slovakia, each with 10 points. In Czechia, there are no changes from the baseline year, while Slovakia shows a slight improvement (from 9 to 10 points). Poland recorded the highest decrease due to declines in the share of *Organic farming area* (from 4.3% in 2015 to 3.91% in 2022) and the rate of *Premature deaths due to exposure to fine particulate matter (PM2.5)* (from 117 in 2015 to 94 in 2022).

## Enabling a green and just transition

This category includes eight indicators: *Raw material* consumption, *Circular material use rate*, *Gross domestic expenditure on R&D*, *Population unable to keep home adequately warm*, *Greenhouse gas emissions intensity of employment*, *High-speed internet coverage*, *Environmental tax revenues*, and *Environmental protection expenditure*. The current leader is Poland, which has improved significantly since the baseline year, particularly in increasing *Gross domestic expenditure on R&D* (from 1% in 2015 to 1.56% in 2023), expanding *High-speed internet coverage* (from 9% in 2015 to 81.1% in 2023), and reducing the percentage of *Population unable to keep home adequately warm* (from 7.5% in 2015 to 4.7% in 2023). By contrast, Slovakia, surprisingly, has substantially increased the percentage of *Population unable to keep home adequately warm* (from 5.8% in 2015 to 8.1% in 2023), which has contributed the most to its weaker performance in this component.

As Table 3 shows, Slovakia is currently the best-performing V4 country, achieving a score of 49. Hungary ranks second with a score of 47, followed by Czechia (43) and Poland (41). The data analysis shows the most significant changes occurred in Poland, particularly in the categories *Reducing our climate impact* and *Enabling a green and just transition*. Poland demonstrated notable progress in several areas. First, the percentage of newly registered zero-emission passenger vehicles significantly increased from 0.03% in 2015 to 3.6% in 2023. Zero-emission vehicles do not produce any direct exhaust emissions and include both hydrogen fuel cell vehicles and battery electric vehicles. Second, the share of passenger transport by rail experienced a substantial rise, from 6.7% in 2015 to 8.3% in 2022. Third, gross domestic expenditure on R&D grew from 1% of GDP to 1.56% of GDP between 2015 and 2023. Fourth, *High-speed internet coverage* expanded significantly, from 9% in 2015 to 81.1% in 2023, indicating a major increase in households with access to very high-capacity fibre optic networks. Finally, there was a significant decrease in *Population unable to keep their home adequately warm* due to financial reasons, which fell from 7.5% in 2015 to 4.7% in 2023.

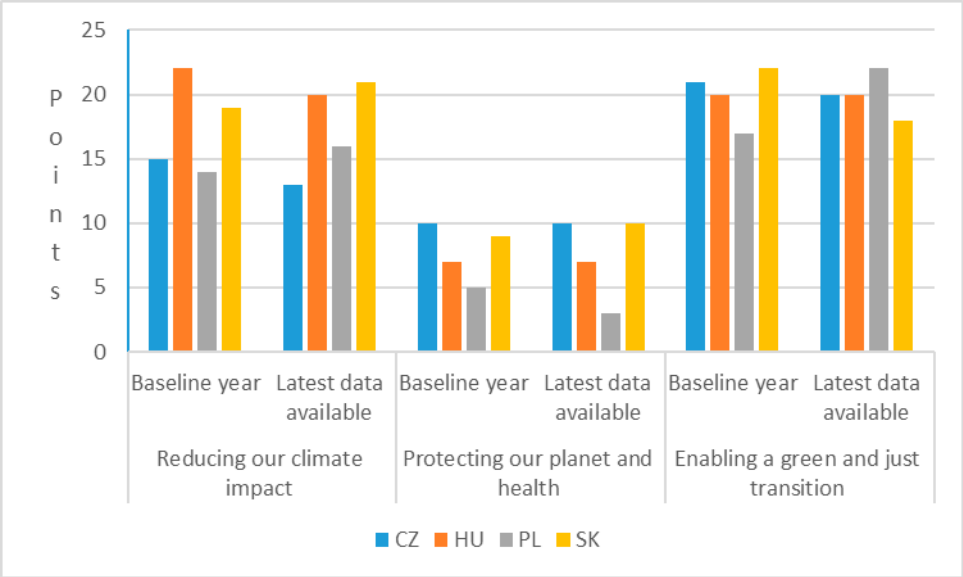


Figure 2. Main components of the European Green Deal Index in the V4 countries

Source: own elaboration based on Eurostat data.

Despite these improvements, it was not enough to surpass Slovakia, Hungary, and Czechia. Slovakia leads in only six out of the 18 monitored indicators (*Net greenhouse gas emissions, Household energy consumption, Passenger transport – Rail, Freight transport – Rail, Generation of waste,* and *Raw material consumption*), although it ranks second in another four categories, which is the reason for its final EGDI score.

Table 3. European Green Deal Index and its components in the V4 countries

| | Reducing our climate impact | | Protecting our planet and health | | Enabling a green and just transition | | EGDI | |
|---|---|---|---|---|---|---|---|---|
| | Baseline year | Latest data available | Baseline year | Latest data available | Baseline year | Latest data available | Baseline year | Latest data available |
| CZ | 15 | 13 | 10 | 10 | 21 | 20 | **46** | **43** |
| HU | 22 | 20 | 7 | 7 | 20 | 20 | **49** | **47** |
| PL | 14 | 16 | 5 | 3 | 17 | 22 | **36** | **41** |
| SK | 19 | 21 | 9 | 10 | 22 | 18 | **50** | **49** |

Source: own elaboration based on Eurostat data.

## Discussion

The EGD is designed to inspire and guide fundamental changes in the way the green transition is understood and implemented. Green measures and initiatives used to be the responsibility of specialised institutions focused on biodiversity conservation and climate change mitigation. However, as highlighted in the report *Implementing the European Green Deal: Handbook for Local and Regional Governments* (European Union 2022), the EGD seeks to empower actors at all levels and across all sectors to help protect and preserve ecosystems, health, food and water security, human security and human development. Gradual changes are no longer enough; transformational changes are required.

The empirical results of this research suggest that no single country can lead across all EGDI indicators (Table 2, Table 3, and Figure 1). Thus, countries must choose and set their priorities for the future due to budget restraints. The findings also show that the indicator *Population unable to keep home adequately warm*, which is perceived more sensitively within the population, is deteriorating in some V4 countries like Czechia, where it increased from 5.0% in 2015 to 6.1% in 2023, and Slovakia, which saw a rise from 5.8% in 2015 to 8.1% in 2023. By contrast, the indicator *Environmental tax revenues*, which measures the share of environmental taxes in total revenues from taxes and social contributions, improved in all V4 countries between 2015 and 2023.

There is broad consensus that the most sustainable path to long-term prosperity and growth throughout the European Union (EU) is a transition to environmentally and climate-friendly technologies and methods of production and consumption. The EGD, which is conceived as a growth strategy, offers a stable framework for transitioning to the green economy at the local and regional levels (European Union 2022). However, there are also criticisms of the EGD and the just transition. The biggest questions arise in the social area, and our findings show that *Household energy consumption* improved only in Hungary (from 18.6 to 18.2 GJ per capita) between 2015 and 2022. All the other V4 countries experienced an increase: Slovakia from 10.5 to 14.5 GJ per capita, Czechia from 18.1 to 19.7 GJ per capita, and Poland from 13.8 to 14.8 GJ per capita. The more energy that households use, the more they have to pay. Additionally, the findings contradict Riepl and Zavarská (2023), who concluded that retrofitting schemes are working well in the V4 in terms of reducing household energy consumption. Thus, this offers a possibility for future research.

Akgüç, Arabadjieva, and Galgóczi (2022) emphasise that the social dimension of the EGD remains underdeveloped. The challenges associated with greening are mainly related to job losses, retraining and increasing the qualifications of the workforce, protecting citizens' social rights, citizen participation and the distributional effects of the green transition. Actions to mitigate climate change without further measures might deepen social inequalities, as initiatives designed to ensure a just transition remain fragmented.

The just transition must be considered an integral part of the EGD and not just a set of additional measures to solve problems that have arisen. The European Environmental Bureau (EEB 2022) report praises the EGD for its vision, strategies, long-term commitments and the important legislative reforms it has brought. However, it lags behind, particularly in the pace of making real changes and introducing financial and restrictive measures. This slow progress reflects ongoing resistance from industry, political groups and other stakeholders seeing to maintain the status quo and avoid implementing new measures.

A fundamental task for the coming decades is the decarbonisation of economies and the transition to a low-carbon and green economy. However, this transition can only succeed if it is fair and that no one is left behind. According to Galgóczi (2018), the term just transition appeared in the early 1990s as a response to trades unions' demand to harmonise labour, social and environmental priorities. In 2010, it began to appear in international agreements, and since then, it has become a well-established policy tool at the global level. The 2015 Paris Agreement (UNFCCC 2015) requires that the just transition of the workforce and the creation of decent work and quality jobs be taken into account in line with development priorities defined at the national level.

A just transition should involve more than just welfare adjustments; it requires proactive societal support and clearly defined decarbonisation goals. Unlike other shifts that affect people's working and living conditions, such as digitisation and globalisation, this transition demands targeted and holistic approaches when creating and implementing policies. It should not be merely a supplement to climate policy; it must be an integral part of the political framework of sustainable development. Functionally, there are two main dimensions.

1. Outcome-oriented: A new working and social environment that eradicates poverty and ensures decent work for all in an inclusive society.

2. Process-oriented: It focuses on how we get to the desired results and should be based on a controlled transition with meaningful social dialogue at all levels. It will ensure that the distribution of the burden is fair and that no one is left behind (Galgóczi 2018).

The shift to a low-carbon and green economy requires prioritising indicators related to decarbonisation, such as net greenhouse gas (GHG) emissions, renewable energy, and GHG emissions intensity of employment. However, it is equally essential to consider various other indicators which are important for a just transition, like the population being unable to keep their home adequately warm for financial reasons and the generation of waste.

Our findings show that between 2015 and 2022, there were reductions in net GHG emissions in Czechia (from 11.7 to 11.4 tonnes per capita), Hungary (from 5.8 to 5.6 tonnes per capita), and Slovakia (from 6.6 to 5.5 tonnes per capita). However, despite a massive EU campaign supported by large-scale financial instruments, Poland experienced a surprising increase (from 9.2 to 9.4 tonnes per capita).

The EU's energy and climate policy presents a major challenge, both at the EU level and for individual Member States. For Poland, this problem is particularly challenging due to its current energy production model, which relies heavily on fossil fuels, mainly lignite and hard coal (Tomaszewski 2020; Riepl and Zavarská 2023; Takyi et al. 2024).

All V4 countries increased the share of renewable energy in gross final energy consumption between 2015 and 2023: Czechia from 15.7 to 18.6, Hungary from 14.5 to 17.1, Poland from 11.9 to 16.6, and Slovakia from 12.9 to 17.0. While Poland showed a significant improvement, some authors consider it to be the least prepared of the V4 for the green transition in the energy sector (Tomaszewski 2020; Riepl and Zavarská 2023; Streimikis et al. 2024).

Poland is the worst-performing V4 country on the indicator that tracks GHG emissions per employed person, providing insight into the potential social impact of the green transition (Riepl and Zavarská 2023). Nonetheless, all V4 countries, including Poland, made progress. Between 2015 and 2023, Hungary experienced the most significant decrease (from 12.2 to 9.7 tonnes), followed by Slovakia (from 14.9 to 12.4), Czechia (from 20.4 to 16.2), and Poland (from 21.3 to 18.7 tonnes).

A successful green and just transition must focus not only on decarbonisation indicators like net GHG emissions, renewable energy, and GHG emissions intensity of employment but also on waste generation and the population unable to keep home adequately warm for financial

reasons. Another indicator in which Poland lags the other V4 countries is waste generation, which measures all waste generated in a country in kilograms per capita. The V4 countries typically produce significantly less municipal waste per capita compared to the EU average, which can be attributed to their lower levels of economic development, which result in reduced purchasing power (Riepl and Zavarská 2023).

Between 2016 and 2022, Poland reduced its waste generation from 4793 to 4739 kilograms per capita. In contrast, Czechia (from 2402 to 3672 kg), Hungary (from 1624 to 2838 kg), and Slovakia (from 1953 to 2462 kg) increased their waste generation. Takyi et al. (2024) and Streimikis et al. (2024) conclude that the V4 countries mitigate their environmental externalities and carbon emissions by adopting circular economy strategies and implementing green innovation practices.

Riepl and Zavarská (2023) argue that managing the green transition requires particularly strong and well-implemented social policies. However, the experience from the V4 countries is mixed. Two countries faced negative trends in energy poverty. In Slovakia, the percentage of the population unable to keep their home adequately warm increased from 5.8% in 2015 to 8.1% in 2023, while in Czechia, it rose from 5% to 6.1% over the same period. This trend presents an opportunity for future research, as the transition to a green economy requires support from all stakeholders, especially lower-income households.

In 2015, the International Labour Organisation adopted the *Guidelines for a just transition towards environmentally sustainable economies and societies for all* (ILO 2015). They provide a policy framework and an operational tool to address environmental change in a way that promotes social justice and the creation of decent jobs (ILO 2022). The guidelines identify two core principles for addressing the challenges of a just transition.

First, greening economies within the framework of sustainable development and poverty eradication requires a combination of macroeconomic, industrial, sectoral and labour market policies. This integrated approach will create an enabling environment for the development of sustainable businesses and the creation of decent job opportunities by mobilising and directing public and private investment towards sustainable environmental activities. The goal should be to create decent jobs, improve skills and increase productivity throughout the supply chain. Second, sustainable development must be addressed in all policy areas. Effective integration of economic, environmental and social dimensions requires cooperation and coordination at regional, national and global levels. Institutional conditions must also be created for meaningful social dialogue at all levels.

Galgóczi (2018) states that the just transition should not be considered an abstract concept because it appears in many policies; these policies must be adapted to national, regional and sectoral circumstances. The concept is present in programs supporting the transition between jobs due to company closures, in green public procurement (in decent work clauses), and in international framework agreements. Climate change increases the likelihood of natural disasters, which can affect the economy, cause financial losses, and affect GDP, employment, the sectoral distribution of jobs and labour productivity.

The ILO (2022) states that green macroeconomic growth policies should help reduce negative economic effects and ensure a just and equitable transition to a green economy for everyone. The global policy framework must be adapted to the circumstances of individual countries to address the effects of climate change on labour markets and business environments. Just transition policies could foster job creation, business resilience, social inclusion and inclusive growth. As part of the just transition, it will be important to support vocational training and retraining programs, implement investment in long-term climate projects, support green business, green innovations and green jobs, improve social protection networks, health and safety conditions at work and facilitate the reallocation of workers to green activities.

As the just transition is part of the EGD, the Just Transition Mechanism (JTM) was created alongside the EGD (European Commission 2019), as only a just and inclusive transition can be successful. The JTM aims to support and protect regions that will be most affected by the shift away from fossil fuels, often those where jobs are tied to heavy industry, which is dependent on fossil fuels. The JTM supports low-carbon activities and the retraining of workers. It also provides easy access to loans and financial support for these activities (Fetting 2020), as well as financial support and technical assistance to those most affected by the transition to the green economy.

## Conclusion

The big challenge of the 21st century is to find a solution to achieve global development that considers economic, social and environmental aspects. Currently, there are significant differences between the state of the environment and the EU's short- and long-term objectives. When planning for the future, it is crucial to adopt new approaches and move beyond traditional methods. For that reason, the Eurostat database offers 27 key indicators that are relevant to the objectives of the EGD, making it possible to compare and highlight both positive and negative developments across countries. In this research, due to data availability, 18 key indicators were used to monitor progress in the V4 countries.

When adopting new measures, emphasis must be placed not only on the quantitative outcomes but also on qualitative aspects, with more emphasis now being placed on the social dimension of the green transition. Nevertheless, between 2015 and 2023, Slovakia and Czechia experienced negative trends, with an increase in the percentage of the population unable to keep their home adequately warm for financial reasons. Rising household costs associated with the green transition could affect public support for it.

The concept of the just transition is widely supported with increasing efforts to address the needs of those most affected by the transition to a green economy. Successful management of a sustainable transition requires careful consideration of both potential risks and opportunities, with policies playing a vital role in achieving a just transition. Our findings show that Poland experienced a major improvement in the category *Enabling a green and just transition* between 2015 and 2023 in comparison to the other V4 countries. Nevertheless, it is necessary to realise that financial resources are limited, and countries must prioritise their actions in the coming years.

Support will be needed for companies and workers in declining industries, whether through retraining, subsidies or technical assistance and investment for negatively affected regions. Early identification of emerging risks and opportunities related to technological and social development is a key task for the V4 countries and all EU Member States in the decades ahead.

This study has several limitations that must be acknowledged. It focuses on the V4 countries and could be extended to cover all EU27 countries and/or groups of countries. Combining data from multiple sources would strengthen the analysis. In 2019, the European Commission launched the EGD as one of its six key political priorities for the 2019–2024 period. Therefore, future research could focus on evaluating the entire 2019–2024 time frame to provide a more comprehensive assessment of progress.

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## Zielona gospodarka dla zrównoważonej przyszłości: doświadczenia krajów Grupy Wyszehradzkiej

Celem artykułu jest zidentyfikowanie znaczenia zielonej gospodarki dla zrównoważonej przyszłości oraz porównanie sytuacji i postępów w realizacji założeń Europejskiego Zielonego Ładu (EGD) w krajach Grupy Wyszehradzkiej (V4). Aby osiągnąć ten cel, w artykule skoncentrowano się na wyzwaniach, zagrożeniach i szansach związanych z wdrażaniem zielonej gospodarki. Dokonano kompleksowej analizy danych oraz opracowano Indeks Europejskiego Zielonego Ładu (EGDI) dla krajów V4. Wykorzystano dane z bazy danych Eurostatu do monitorowania 18 kluczowych wskaźników w krajach V4 od roku 2015 do ostatniego roku, dla którego dostępne były dane. Wyniki pokazują, że Słowacja jest najlepiej radzącym sobie krajem V4, z najwyższym wynikiem EGDI, podczas gdy Polska wykazuje największą poprawę, głównie w kategorii *Umożliwienie zielonej i sprawiedliwej transformacji*. W latach 2015–2023 na Słowacji i w Czechach odnotowano negatywne tendencje w zakresie odsetka ludności, która nie jest w stanie odpowiednio ogrzać swoich domów z powodów finansowych. W dokumencie podkreślono społeczny wymiar Europejskiego Zielonego Ładu i zielonej gospodarki, a także znaczenie koncepcji sprawiedliwej transformacji w całej Unii Europejskiej, ponieważ zwiększone wydatki gospodarstw domowych na transformację ekologiczną mogą wpłynąć na wsparcie publiczne.

Słowa kluczowe: Europejski Zielony Ład, Indeks Europejskiego Zielonego Ładu, zielona gospodarka, sprawiedliwa transformacja, Grupa Wyszehradzka