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# ECONOMIC GROWTH, FINAL ENERGY CONSUMPTION AND EMISSION TRENDS IN THE EUROPEAN UNION MEMBER STATES IN RELATION TO THE GREEN DEAL OBJECTIVES

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**ABSTRACT**

One of the pressing questions of our time is how to sustain economic growth while reducing final energy consumption and $CO_2$ emissions. This issue is surrounded by much debate, and the literature presents conflicting research findings. The objective of this analysis is to examine the extent to which the European Union Member States (27) can meet policy objectives related to energy decarbonisation, energy efficiency, and the reduction of greenhouse gas emissions, as well as their adaptability to the unprecedented global challenges currently underway. Additionally, we aim to explore whether economic growth is decoupling from environmental degradation. Our analysis will investigate whether Member States can be classified into "core" and "periphery", along an east-west divide, based on the results of the indicators. We use K-means cluster analysis, and comparative analysis. Two groups of countries demonstrate complete decoupling, where minimal economic growth and reduced $CO_2$ emissions were achieved alongside decreasing energy consumption. The performance of the Member States is heterogeneous, with the "Lagging" group falling significantly behind in meeting climate policy goals. Thus, full adaptation of policy objectives in these areas remains a work in progress.

*JEL codes:* F02, F68, L50, O52, P51

*Keywords:* European Union, cluster analysis, Green Deal, energy efficiency, ecnomic growth, emissions

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## 1 INTRODUCTION

The European Union's Green Deal initiative represents a comprehensive strategy aimed at promoting sustainable development and addressing the climate crisis in an era of increasingly pressing environmental challenges. Global temperature rise, extreme weather events, the energy crisis, and the depletion of natural resources all highlight the urgency of aligning economic growth with sustainability and societal well-being. The primary objective of the Green Deal is to make Europe climate-neutral by 2050, while simultaneously reducing energy dependence, fostering the dissemination of clean technologies, and ensuring a just transition from a fossil fuel-based economy to a circular, green economy. This analysis links policy objectives related to sustainability with appropriate indicators and classifies the 27 EU Member States into clusters. This will give us a snapshot of the current performance of Member States and allow us to identify potential solutions.

The study aims to assess the extent of differentiation among Member States based on indicator results. Additionally, we shall also analyse whether EU countries can sustain the dynamic economic growth observed in previous years without causing environmental degradation. The analysis also investigates whether integration disparities exist in the adaptation of Green Deal objectives between core and peripheral countries (Pelle, 2017; Pelle, 2018). Furthermore, the study also assesses the extent to which EU Member States comply with sustainability requirements. After reviewing the relevant literature, the analysis employs the K-means cluster analysis method, complemented by regression analysis.

## 2. THE INTERRELATION BETWEEN ENERGY SECURITY AND SUSTAINABILITY

An increasing body of research argues that decarbonisation requires a broad mix of mutually reinforcing policy measures. Energy policy, which is closely linked to climate protection, is a key factor in achieving sustainable development goals. The Green Deal strategy and the Agenda 2030 framework integrate these elements. We present some of the results that have examined the presence of sustainability in different countries. García-Álvarez et al. (2016) presented the energy sustainability index for 15 EU Member States, incorporating environmental factors related to climate change, such as $CO_2$ emissions intensity[2].

2 Sustainability means that economic growth can be achieved without environmental damage (Srivastava et al., 2022).

Chudy-Laskowska et al. (2022) examined the energy mix management strategies of individual EU Member States, comparing the levels of fossil fuel usage and renewable energy sources (RES). Su et al. (2020) analysed the sustainability of the energy sector in 21 EU Member States and China, revealing that China lags behind EU countries in terms of energy sector sustainability. Sobczyk (2021) examined whether alternative energy sources, particularly biomass, align with sustainable development policies. Findings indicate that, although Poland's renewable energy usage remains below the EU average, significant progress was made between 2010 and 2018.

Sustainability is inherently linked to energy security, which, in turn, influences economic growth. Ensuring both sustainability and secure energy supplies supports long-term energy independence, resource efficiency, and climate change mitigation. Reducing reliance on fossil fuels not only minimises $CO_2$ emissions but also enhances geopolitical stability by mitigating vulnerabilities associated with imported energy sources. Policies promoting energy transition – such as a shift towards renewables and energy efficiency measures – create a system that ensures a continuous energy supply while using natural resources in a sustainable manner. The objectives of the Green Deal address these dual challenges, fostering both economic growth and environmental protection while reducing risks associated with energy supply and the long-term effects of climate change. One of the long-term ambitions of the Green Deal is to integrate climate and sustainability policies into all economic sectors (Skjærseth, 2021).

A key element of the European Commission's 2007 energy policy objectives was securing energy supply (Tóth–Kulin, 2019). To achieve energy security, Member States must reduce energy dependence and diversify their energy mix (Hafner–Tagliapietra, 2020). The European Commission set a target to reduce greenhouse gas emissions by 55% by 2030 compared to 1990 levels (EC, 2020). Another goal set by EC (2020) is to increase energy efficiency and produce affordable, low-carbon energy. Improving energy efficiency is an essential condition for achieving this goal.

EU energy policy is based on collaboration between the European Commission, the European Council, and the European Parliament, with the overarching aim of ensuring competitive, sustainable, and secure energy supplies for European citizens and businesses (EC, 2024). The EU's energy dependence threatens energy security, as geopolitical conflicts can lead to price volatility and supply disruptions (Van de Ven – Fouquet, 2017)[3].

3 The theoretical framework of energy policy encompasses the fundamental principles and approaches guiding decision-making in the energy sector, from energy source production and distribution to consumption and regulation of the energy sector (EC, 2024).

The negative outcomes of policies regulating energy consumption led the European Union to develop a comprehensive energy strategy for energy security. As a result, the European Commission created the Green Paper in 2000 (EC, 2000). In 2006, new guidelines for the Green Paper were formulated to enhance energy security, aiming to reduce dependence on energy imports (EC, 2006). To further strengthen energy security, the European Council called for the implementation of the Energy Union by 2018. The goal of establishing the Energy Union is to enhance energy security, sustainability, and competitiveness. Energy security can be achieved by creating a fully integrated European energy market, thereby eliminating dependence on energy imports. Moreover, improving energy efficiency – in other words, accomplishing the same tasks with less energy[4] – helps mitigate energy demand, decarbonise the economy, and enhance competitiveness.

In addition to energy security concerns, global warming and extreme weather conditions emerged as key issues in the early 2000s. Consequently, the 2007 Green Paper outlined new energy policy goals, committing the EU to reducing $CO_2$ emissions. As of 2021, fossil fuel-related $CO_2$ emissions accounted for 80%[5] of the EU's total greenhouse gas emissions. This fact is the primary reason that significant changes are needed in energy policy regulation. The strategic objectives of energy policy today are no longer solely about energy security but also about reducing environmental degradation. On the one hand, efforts must be made to reduce emissions, which requires using less fossil energy and more clean, renewable energy in terms of volume. On the other hand, the EU's increasing exposure to energy imports, which can cause volatility in the market prices of oil and gas, must be limited (Skjærseth, 2021). According to a communication issued by the European Commission, the transition to green energy could potentially make the EU energy market more competitive, stimulate innovation, create new technology, and generate new jobs. The primary strategic goal is that Member States must increase the production and consumption of locally sourced, low-emission energy. The major challenge is achieving this transition in a manner that maximises Europe's competitiveness while minimising potential costs (EC, 2007; Pelle–Tabajdi, 2021).

The Green Deal is a policy package issued by the European Commission on 11 December 2019[6], committed to environmental measures. Its primary aim is to preserve the natural capital of the European Union and protect people's health. A key priority of the Green Deal is to create a resource-efficient, competitive

4 https://www.eesi.org/topics/energy-efficiency/description (downloaded: 28.10.2024).

5 https://www.iea.org/regions/europe (downloaded: 19.06.2024).

6 https://www.consilium.europa.eu/hu/policies/green-deal/ (downloaded: 31.10.2023).

economy that ensures zero greenhouse gas emissions by 2050 (Hafner – Tagliapietra, 2020). The aim is that Member States should achieve economic growth without using additional resources. To reduce environmental degradation, the European Commission established the Paris Agreement, a multilateral[7] agreement that came into effect on 4 November 2016[8]. The Member States of the European Union are uniformly committed to reducing greenhouse gas emissions and keeping the temperature rise below 2°C, for which they have formulated specific targets. To achieve the targets, the European Commission adopted the European Climate Law in 2021, giving the European Union and its Member States a legal obligation to reduce emissions (EC, 2021). In a press release on 17 October 2023[9], the European Union announced that the European Council had approved the EU's updated NDC (Nationally Determined Contribution) submission, stating that it will reduce net greenhouse gas emissions by at least 55% by 2030. Member states are committed to the target, which is legally binding.[10] To achieve the environmental goals, the long-term strategy of the European Union includes increasing the use of renewable energy sources, improving energy efficiency, and promoting greener agriculture and transportation.[11] To enhance energy security, the European Commission submitted the REPowerEU plan on 18 May 2022, triggered by the Russian-Ukrainian war. The plan aims to reduce the EU's dependence on excessive imports of Russian natural gas, coal, and oil as soon as possible. As a result, prioritising EU energy autonomy and the transition to clean energy has become a priority. The plan's key objectives include energy savings, which involve reducing energy consumption[12], diversifying energy supplies, and accelerating the introduction of renewable energy sources.[13]

The European Union has committed to reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990 levels (EC, 2011)[14]. As stated in the European Un-

7 https://unfccc.int/process-and-meetings/the-paris-agreement (downloaded: 28.10 2024).

8 https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en (downloaded: 28.10.2024).

9 https://ec.europa.eu/commission/presscorner/detail/en/mex_23_5067 (downloaded: 03.07.2024).

10 https://www.consilium.europa.eu/hu/press/press-releases/2023/10/16/paris-agreement-council-submits-updated-ndc-on-behalf-of-eu-and-member-states/ (downloaded: 28.10.2024).

11 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en (downloaded: 31.10.2023).

12 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R1854&from=SK (downloaded: 03.03.2024).

13 https://www.consilium.europa.eu/hu/policies/eu-recovery-plan/repowereu/ (downloaded: 31.10.2023).

14 https://energy.ec.europa.eu/system/files/2014-10/roadmap2050_ia_20120430_en_0.pdf (downloaded: 28.10.2024).

ion's Energy Roadmap 2050 (ER2050), the goals of the decarbonisation processes are not only to transition from fossil fuels to renewable energy sources but also to reduce final energy consumption (Nieto et al., 2020).

Strategies aimed at achieving climate targets are generally based on the concept of "decoupling" which aims to promote economic growth while reducing the use of natural resources and greenhouse gas (GHG) emissions. If a country can achieve GDP growth per capita while simultaneously achieving absolute reductions in greenhouse gases and resource use, it is referred to as an "absolute decoupling" process, as opposed to a "relative decoupling" process, where the growth in resource use or emissions is smaller than GDP growth (Haberl et al., 2020). Numerous studies examine the "decoupling" process in the Member States of the European Union. In some countries, such as Luxembourg and the Netherlands, initial "decoupling" processes can be observed based on data from 1950-2012 (Rodríguez, D. et al., 2018). With the reduction in energy intensity, greenhouse gas emissions decrease. Reducing energy intensity and increasing the share of renewable energy sources are fundamental to reducing $CO_2$ emissions (Drastichová, 2017; Moutinho et al., 2018).

## 3 GROWTH MODELS

It is important to mention growth models because the strategic objectives of the Green Deal undergo continuous analysis, with models being used to forecast the impacts of policies and performance outcomes. This study compares MEDEAS forecasts with the obtained results in the discussion section, from which conclusions can be drawn. For the Member States of the European Union, analysing changes in final energy consumption and identifying causal relationships are of key importance for advancing sustainable development and energy efficiency. Ecological economics encompasses the concept and processes of the ongoing energy transition (Nieto et al., 2020). The evaluation of the Energy Roadmap 2050 (ER2050) objectives is conducted using a new modelling method, MEDEAS, which is based on Post-Keynesian Economics and Ecological Economics. It focuses on demand-driven economic growth and absolute biophysical constraints (i.e., energy availability limits). MEDEAS is a new Integrated Assessment Model that builds upon a methodology combining systems dynamics and input-output analysis. Integrated assessment models are complex analytical frameworks that examine the interconnections between the environment, economy, and society (de Blas et al., 2019; Nieto et al., 2020). The decarbonisation imperative driven by climate change encourages researchers to examine how changes in final energy consumption impact economic growth. There are numerous debates surrounding the Green Deal's strategic objective that economic growth should be achieved through a reduction in final energy consumption[15] (Conrad-Cassar, 2014; Ekins et al., 2016). If this decoupling process were realised, it would allow for the achievement of the sustainability targets outlined in the Green Deal (Gazheli et al., 2016).

## 4 SUSTAINABILITY-RELATED INDICATORS

In the following section, the variables applied in this research are summarised based on a review of the relevant literature. One of the key objectives of the Green Deal is for countries to achieve economic growth while minimising environmental degradation. To accomplish this, it is essential to ensure a high share of clean energy (energy mix), promote energy-efficient production (energy efficiency), and reduce greenhouse gas emissions (environmental degradation).[16] The literature review presented in *Table 1* has been conducted based on these considerations.

**Table 1**
**Indicators assigned to policy objectives**

| Aspects examined | Authors, year | Objective | Indicator |
|---|---|---|---|
| energy mix<br>environmental degradation | Evans et al., 2009 | Renewable energy sources were ranked according to efficiency | $CO_2$ emissions per capita<br>share of renewable energy sources |
| | Kozma, 2023 | Options for measuring sustainable development | $CO_2$ emissions per capita |
| economic growth<br>energy efficiency<br>sustainability | Cevik, (2024) | Exploring the link between climate change and energy security | $CO_2$ emissions per capita<br>energy intensity<br>GDP per capita<br>share of renewable energy sources |
| energy efficiency<br>sustainability | Blas, (2019) | The MEDEAS framework introduces a new method for estimating energy demand | final energy consumption per capita<br>energy intensity<br>renewable energy sources |

15 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/story-von-der-leyen-commission/european-green-deal_en (downloaded: 03.06.2024).

16 https://www3.weforum.org/docs/WEF_Fostering_Effective_Energy_Transition_2023.pdf (downloaded: 19.02.2024).

| Aspects examined | Authors, year | Objective | Indicator |
|---|---|---|---|
| economic growth | Veugelers et al. (2015) | Examining the effectiveness of the Horizon 2020 strategy. | GDP per capita |
| destruction of the environment<br>economic growth | Altıntaş – Kassouri, (2020) | Link between environmental sustainability and economic growth. | renewable energy sources<br>fossil energy<br>$CO_2$ emissions per capita<br>GDP per capita |

*Source*: own editing

In *Table 1*, we have compiled the publications of authors who have studied sustainability, economic growth, energy security, and energy efficiency. We compared the indicators they used with variables that align with the objectives of our study. Based on this analysis, we determined the indicators to be included in the measurement.

We have collected the data for the indicators listed in *Table 2* for all 27 EU Member States. To examine the energy mix, we used the share of clean and renewable energy sources, calculated based on 2022 data. Clean energy includes both nuclear energy and renewable energy sources. If the share of renewable energy sources in a country significantly differs from the average, while the share of clean energy does not, this may indicate that the country uses a higher proportion of wind or solar energy, for example, and a lower proportion of nuclear energy.

To assess energy efficiency, we analyse per capita final energy consumption and the development of energy intensity over the past 10 years. Per capita final energy consumption refers to the amount of energy used by industry, transportation, households, services, and agriculture, adjusted for the population. Its unit of measurement is million tonnes of oil equivalent (TOE), calculated using the 2005 value as the base year with an index of 100 and expressed as TOE per capita. As another energy efficiency indicator, we examine energy intensity, which expresses the ratio of gross energy consumption to GDP. This indicator shows the amount of energy required to produce one unit of economic value. A decrease in energy intensity signals sustainable development (de Blas, 2019). The data covers the years 2011–2022 and was exported from the Eurostat database. A general assessment of a country's energy efficiency can be made using the total energy supply per unit of economic output. This not only reflects energy efficiency but also the economic structure: service-oriented economies typically have lower energy intensity than heavy industry-based economies[17].

17 https://www.iea.org/countries/austria/efficiency-demand (downloaded: 15.09.2024).

GDP, as a measure of economic activity, is widely used to assess material living standards, although it does not reflect the full spectrum of economic well-being. For example, it does not include unpaid household labour, nor does it consider the environmental impacts of economic activity, such as environmental degradation. Therefore, for our analysis, we chose to use the per capita real GDP indicator. Per capita real GDP is determined as the ratio of real GDP for a given year to the average population, based on rounded data[18].

A key element of sustainable development is that economic growth should occur without an increase in environmental degradation. We investigate whether the economic growth of EU Member States is accompanied by a disproportionate increase in $CO_2$ emissions, or whether, in parallel, a decrease in environmental damage can also be observed. The precondition for reducing $CO_2$ emissions is improving energy efficiency and increasing the share of renewable energy sources. The net greenhouse gas emissions per capita is a key indicator of environmental degradation, which integrates the global warming potential of individual greenhouse gases in $CO_2$ equivalent. [19]

18 https://ec.europa.eu/eurostat/cache/metadata/en/sdg_08_10_esmsip2.htm (downloaded: 15.09.2024).

19 https://ec.europa.eu/eurostat/cache/metadata/en/sdg_13_10_esmsip2.htm (downloaded: 15.09.2024).

**Table 2**
**Indicators used for analysis**

| Policy objective | Aspects examined | Indicators used |
|---|---|---|
| Sustainability | energy mix (cleaner energy transition) | renewables, clean energy share in 2022 (%)[20] |
| | energy efficiency | final energy consumption per capita[21] (TOE/capita) (2011-2022) |
| | destruction of the environment | energy intensity[22] (MJ/thousand 2015 USD) (2022-2022) |
| | | net greenhouse gas emissions per capita (tonnes per capita, $CO_2$ equivalent)[23] (2012-2022) |
| Economic growth | Economic growth | real GDP per capita[24] (euro (2010)/person) (2011-2022) |

*Source*: own editing

## 5 STATISTICAL ANALYSIS OF THE SUSTAINABILITY OF EU MEMBER STATES

The diversity of EU Member States has been examined by several authors. Pérez (2019) suggests the formation of two clusters based on the priority of the energy transition: one driven by business interests and the other consisting of peripheral countries. Another body of literature categorizes countries according to their progress toward sustainable development goals into "low performers", "fast-growing" and "top performers" (Kozma, 2023). Meanwhile, Dinya (2023) classifies countries based on competitiveness and diverse autonomy. The analysis of integration processes following the 2007 enlargement of the European Union categorises EU Member States into core countries (Northern and Western European

20 https://www.iea.org/countries/austria/energy-mix (downloaded: 15.09.2024).

21 https://ec.europa.eu/eurostat/databrowser/view/sdg_07_11/default/table (downloaded: 5.09.2024).

22 https://www.iea.org/countries/austria/efficiency-demand (downloaded: 15.09.2024).

23 https://ec.europa.eu/eurostat/databrowser/view/sdg_13_10/default/table?lang=en (downloaded: 15.09.2024).

24 https://ec.europa.eu/eurostat/databrowser/view/sdg_08_10/default/table (downloaded: 15.09.2024).

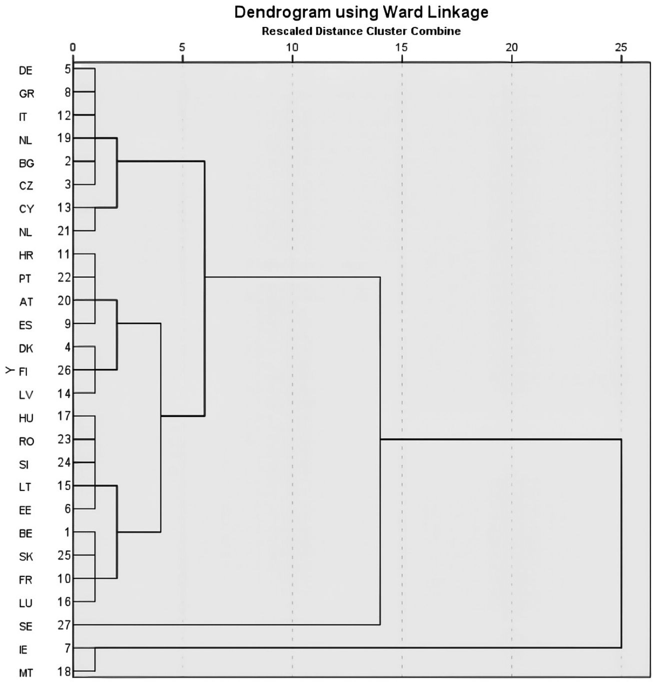
members) and peripheral countries (newly acceded Southern and Eastern European members) (Pelle, 2013). Farkas (2016) identified six distinct country groups based on different models of capitalism. Similarly, Pelle, London, and Kuruczleki (2019) applied a clustering approach to integration and also distinguished six country groups. In both clustering methods, ambiguous results were observed. In our analysis, we based our methodology on Beáta Farkas's clustering method, but we examined different data and timeframes.

The aim of the cluster analysis is to determine whether a western-eastern block or a core-periphery group of countries, as well as ambivalence among countries, can be observed in achieving the strategic objectives of the Green Deal as outlined above. We are investigating how the implementation of policy objectives, including energy efficiency, energy transition, and sustainability, has been realised in the Member States over the past nearly 10 years. One of the strategic objectives of the Green Deal is to sustain economic growth without increasing the ecological footprint. The aim is to ensure that greenhouse gas emissions do not increase, final energy consumption decreases, and energy intensity declines, meaning less energy is used to produce the same amount of products.

The objective of the clustering process is to create compact groups of similar observations that are as distinct as possible from other groups. Firstly, we built a hierarchical cluster in SPSS, and initially standardised the indicators, performed according to the Ward method. The main characteristic of this method is that it does not require specifying the number of existing groups in the sample for classification. During hierarchical agglomerative procedures, n individuals are merged into a single group in (n–1) steps. The merging process is represented in a dendrogram.

The data for the variables listed in *Table 2* was exported from the Eurostat database, and a hierarchical cluster analysis was performed in SPSS, as shown in *Figure 1.* The analysis results are presented in a two-dimensional chart: on the vertical axis, we can see the merged elements, while on the horizontal axis, the distance values at which the mergers occurred. Based on the dendrogram, we can identify six clusters. The Ward method is based on minimising internal variance, meaning it always merges individuals that least increase the system's internal variance and heterogeneity.

**Figure 1**
**Hierarchical cluster**




*Source*: own editing in SPSS

It is important to note that regardless of the distance measure and clustering method chosen, we do not receive a definitive answer to the question of how many groups the examined data set can be classified into. This procedure for structure exploration is only suitable for exploratory purposes, therefore we apply the K-means clustering method in the following.

As the next step, we applied K-means cluster analysis to the EU-27 with the aim of grouping the EU Member States into clusters with similar characteristics (Pelle et al., 2021; Schmitt-Starke, 2011). For economic indicators, we use the squared Euclidean distance, calculated between *i* and *k* individuals as follows, where *j* index denotes the individuals or variables:

$$d_{ik}^2 = \sum_j \left(x_{ij} - x_{kj}\right)^2 \tag{1}$$

Proportional division among clusters is not a requirement, but significant disproportions carry important information. The general aim is to achieve a classification that minimises the differences within each cluster. In K-means cluster analysis, the centroid is the average of the nearest points. The greater the homogeneity of a group, the smaller the distance of the average points from the centroid. Single-element clusters suggest the presence of outliers with significantly different characteristics from others.

## 6 CLUSTER ANALYSIS RESULTS

To achieve the most accurate results, we examined various cluster formation possibilities. Based on the table in the appendix, it can be observed that with a cluster count below 5, there is high variance within the clusters, and the homogeneity of the country groups is low. By increasing the cluster count to 6, the homogeneity of the country groups improved, resulting in more accurate measurements. Creating 2 or 3 clusters leads to high variance within the clusters, while 4 clusters result in three outliers, and 5 clusters also result in three outliers. With 6 clusters, the within-cluster variance is lower, forming more homogeneous groups, but three outliers are still observed. We included the outliers in the analysis as we are conducting an exploratory analysis for all 27 Member States.

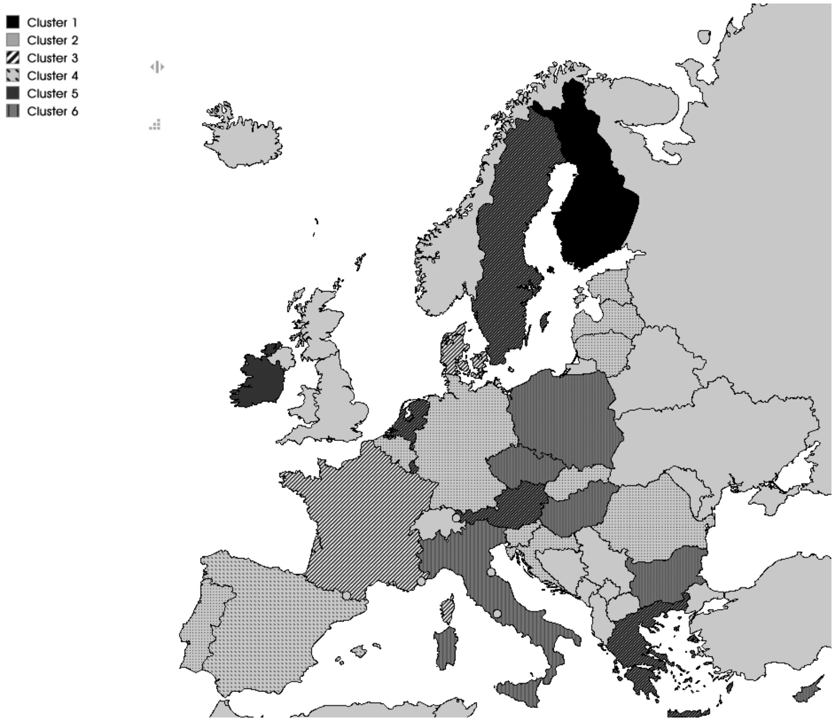
*Table 2* contains the final results and characteristics of the cluster analysis, the positive and negative averages, and the variances of the clusters. Standardised variables were used in the analysis.

**Table 3**
**Result of the K-means cluster analysis**

| Cluster | Countries of the cluster | Standard deviation | Changes in final energy consumption per capita 2011-2022 | Changes in energy intensity 2011-2022 | Changes in real GDP per capita 2011-2022 | Share of renewable energy sources 2022 | Share of clean energy sources 2022 | Changes in greenhouse gas emissions per capita 2013-2022 |
|---|---|---|---|---|---|---|---|---|
| | | | Average | | | | | |
| Cluster 1 | Finland | 0.00 | −0.17249 | 0.97511 | −0.91268 | 0.49190 | 1.29392 | −4.00661 |
| Cluster 2 | Malta | 0.00 | 3.95991 | −2.40904 | 0.94550 | −1.22838 | −1.99685 | 0.55556 |
| Cluster 3 | Denmark<br>Greece<br>France<br>Luxembourg<br>Netherlands<br>Austria<br>Sweden | 0.2878 | −0.75764 | −0.03542 | −0.75515 | 0.74110 | 0.63459 | −0.25661 |
| Cluster 4 | Germany<br>Estonia<br>Spain<br>Croatia<br>Latvia<br>Lithuania<br>Portugal<br>Romania<br>Slovakia<br>Slovenia | 0.4115 | −0.07618 | 0.17646 | 0.09081 | 0.17233 | 0.22346 | 0.07013 |
| Cluster 5 | Ireland | 0.00 | 0.51208 | −2.99342 | 3.44175 | −0.21976 | −0.96098 | 0.11924 |
| Cluster 6 | Bulgaria<br>Czechia<br>Italy<br>Cyprus<br>Hungary<br>Poland | 0.2731 | 0.30699 | 0.45571 | 0.13543 | −1.02117 | −0.87271 | 0.72611 |

*Source*: Own editing run in SPSS based on Eurostat 2011-2022 data

**Figure 2**
**Clusters of EU-27 Member States**




*Source*: own editing using www.mapchart.net

Clusters were defined on the basis of averages. The arithmetic mean of the countries' averages for each indicator is 0, against which the deviation is examined. A negative deviation indicates below-average performance, while a positive deviation indicates above-average performance. Clusters 1, 3, and 5 each consist of only one country: Finland, Malta, and Ireland, respectively, indicating that certain indicator values are exceptionally high. These countries were not removed from the dataset, as the aim is to examine data for every Member State.

Cluster 1 includes Finland, where the share of clean energy is significantly higher than the average, the final energy consumption per capita has decreased compared to the average, while energy intensity is higher than the average decrease, and, parallel to this, greenhouse gas emissions have significantly decreased. It can be concluded that the real GDP per capita increased less than the average.

Cluster 2 includes Malta, which also has exceptional values and is the complete opposite of Finland. The share of clean energy and energy efficiency is significantly below average, while greenhouse gas emissions and GDP growth per capita are significantly above average.

Cluster 3 includes Denmark, Greece, France, Luxembourg, the Netherlands, Austria, and Sweden. The parameters of this country group are similar to Finland's results, with the difference that the decrease in greenhouse gas emissions is smaller compared to the average. In this country group, energy efficiency increased significantly compared to the average, and the share of clean energy is also exceptionally high compared to the average, but economic growth is lower than the average. Greece's energy intensity is higher than the group's average, but taking advantage of its geographical conditions, it has a significant amount of renewable and clean energy sources, thus reducing greenhouse gas emissions more than the average.

Cluster 4 includes Belgium, Germany, Estonia, Spain, Croatia, Latvia, Lithuania, Portugal, Romania, Slovakia, and Slovenia. In these countries, the share of clean energy is higher than the average, the final energy consumption per capita slightly decreased, energy intensity is above average, greenhouse gas emissions increased, and economic growth is lower.

Cluster 5 also includes a single country, Ireland, which is an outlier with exceptionally high values. The share of renewable energy sources in 2022 was below average, final energy consumption per capita increased, but energy intensity is significantly below average, meaning the same amount of products is produced with less energy investment. Much less energy is required to produce one unit of GDP compared to the average. The real GDP growth per capita is exceptionally high compared to the average, while greenhouse gas emissions deviate only slightly in a positive direction.

Cluster 6 includes Bulgaria, the Czech Republic, Italy, Cyprus, Hungary, and Poland. In this country group, countries have, on average, a lower share of renewable energy sources, energy consumption per capita and energy intensity are above average, and greenhouse gas emissions are significantly higher than the average and those of other clusters. These countries achieved higher than average GDP growth per capita. Comparing the country groups, it can be concluded that only the countries in cluster 3 were able to improve energy efficiency by reducing energy intensity compared to the average decrease, meaning they actually used less energy to produce the same amount of products, while also reducing greenhouse gas emissions. The share of renewable energy sources is above average. It can also be concluded for this country group that real GDP growth per capita is below average. Energy intensity decreased in all countries over the 10-year interval, due to higher-quality energy and more modern technology.

Comparing the characteristics of the clusters and grouping countries with similar characteristics into the corresponding clusters, we can distinguish the following country groups: “Leading” countries including Finland, Denmark, Greece, France, Luxembourg, the Netherlands, Austria, and Sweden (clusters 1 and 3). “Catching-up” countries including Belgium, Germany, Estonia, Spain, Croatia, Latvia, Lithuania, Portugal, Romania, Slovakia, and Slovenia. “Lagging” countries including Malta, Bulgaria, the Czech Republic, Italy, Cyprus, Hungary, and Poland. Ireland was labelled as “Dynamic”, as it achieved exceptionally high economic growth with minimal increases in energy consumption and greenhouse gas emissions. In the formation of clusters, we considered the standard deviation values for comparing the homogeneity of the groups, which show how far certain countries are from the cluster centroids. The closer they are to the centroid, the greater the homogeneity of the groups according to the indicators, meaning the countries are closer to each other.

We also performed the cluster analysis by removing the outliers, and the results can be viewed in *table of the appendix*. Cluster 1 countries: Denmark, Estonia, Latvia, Lithuania, Luxembourg, Slovenia, and Sweden represent countries that operate more sustainable economies through their energy efficiency strategies, relying heavily on renewable energy sources. Cluster 2 countries: Bulgaria, Cyprus, Hungary, Poland, and Romania refer to countries achieving rapid economic growth at a significant environmental cost and do not prioritise renewable or clean energy sources. Cluster 3 countries: Belgium, the Czech Republic, Germany, Greece, Spain, France, Croatia, Italy, the Netherlands, Austria, Portugal, and Slovakia represent countries with slower economic growth, which are not energy-efficient, but their environmental burden is not extreme either. It reflects a transitional state where clean energy sources are needed. The result essentially remained unchanged, but the country groups are more clearly distinguished from each other, and instead of 6 clusters, we can distinguish 3 clusters, as described above.

**Table 4**
**European Union Member States by clusters**

| Number of clusters | Cluster name | Countries | Changes in final energy consumption | Changes in energy intensity | Changes in real GDP per capita | Share of renewable energy sources 2022 | Share of clean energy sources 2022 | Changes in greenhouse gas emissions per capita |
|---|---|---|---|---|---|---|---|---|
| 1 | Leading | Finland | decreased compared to average | above average | increased at a smaller rate compared to average | higher than average | significantly higher than average | significantly decreased compared to average |
| 3 | Catching up | Denmark Greece France Luxembourg Netherlands Austria Sweden | decreased compared to average | below average | increased at a significantly smaller rate compared to average | significantly higher than average | significantly higher than average | decreased slightly compared to average |
| 4 | | Belgium Germany Estonia Spain Croatia Latvia Lithuania Portugal Romania Slovakia Slovenia | around average change | above average | increased slightly compared to average | higher than average | higher than average | increased slightly compared to average |
| 5 | Dynamic | Ireland | increased compared to average | below average | increased very significantly compared to average | lower than average | significantly lower than average | increased compared to average |
| 6 | Lagging | Bulgaria Czechia Italy Cyprus Hungary Poland | increased compared to average | above average | increased slightly compared to average | significantly lower than average | significantly lower than average | increased compared to average |
| 2 | | Malta | increased sharply compared to average | below average | increased more than average | significantly lower than average | significantly lower than average | increased significantly compared to average |

*Source*: own editing

The number of clusters ranges from 1 to 6. The diversity of the energy mix is indicated by whether the share of renewable energy sources is above or below the average. If it is above average, the diversity is high, and if below, it is low. Clean energy also includes the proportion of nuclear energy. If the average final energy consumption is above 0, it has increased; if it is close to 0, it is average; and if it is below 0, it has decreased in a given country. Energy efficiency cannot be assessed based on a single indicator, which is why the change in energy intensity was also observed. If both indicators show a decrease together, it can be concluded that there has been a genuine improvement in energy efficiency. Economic growth is considered increasing if there is an above-average change in per capita GDP, while if the value is close to the average, it is considered less increasing. All Member States achieved growth in per capita real GDP between 2011 and 2022; however, clusters 1 and 3 experienced lower growth. The level of per capita $CO_2$ emissions is above average in some Member States and below average in others, which we labelled as increasing or decreasing accordingly.

**Table 5**
**Cluster characteristics**

| Country | Cluster | ratio of renewable and clean energy | final energy consumption per 1 person | energy intensity | economic growth | emission |
|---|---|---|---|---|---|---|
| Finland | "Leading" | high | decreasing | above average | less increasing | decreasing |
| Denmark<br>Greece<br>France<br>Luxembourg<br>Netherlands<br>Austria<br>Sweden | "Leading" | high | decreasing | below average | less increasing | decreasing |
| Belgium<br>Germany<br>Estonia<br>Spain<br>Croatia<br>Latvia<br>Lithuania<br>Portugal<br>Romania<br>Slovakia<br>Slovenia | "Catching up" | high | decreasing | above average | increasing | increasing |
| Ireland | "Dynamic" | low | increasing | outstandingly below average | increasing | increasing |
| Bulgaria<br>Czechia<br>Italy<br>Cyprus<br>Hungary<br>Poland | "Lagging" | low | increasing | above average | increasing | increasing |
| Malta | "Lagging" | low | increasing | outstandingly below average | increasing | increasing |

*Source*: own editing

*Table 4* shows that the parameters of clusters 1 and 3 are similar, with the only difference being that Finland performs exceptionally well on all four indicators. Both clusters show lower economic growth compared to the average over nearly 10 years. These countries have succeeded in increasing energy efficiency, and simultaneously, the reduction in greenhouse gas emissions is also above average. Malta is more appropriately classified into cluster 6 according to the four criteria; however, Malta's per capita energy consumption and $CO_2$ emissions have shown outstanding increases compared to other countries, which is why it behaves as an outlier. Countries in clusters 2 and 6 exhibit low shares of clean energy, decreasing energy efficiency compared to the average, and increasing greenhouse gas emissions. Both clusters also show higher than average economic growth. In the case of clusters 4 and 5, there is a difference in the share of clean energy: Ireland has a lower share of clean energy compared to the average, while cluster 4 shows higher levels. Energy efficiency has increased compared to the average, as has emissions. Ireland achieved an exceptional above-average per capita GDP growth, which makes it an outlier.

## 7 DISCUSSION

European Union Member States show highly heterogeneous results concerning the achievement of targets. Hannesson (2020) argues that there is a positive but disproportionate relationship between GDP growth and energy consumption.

The Green Deal's strategic goal of achieving economic growth through a reduction in final energy consumption can be interpreted as follows based on the data. All countries have managed to achieve economic growth over the past decade, but to varying extents. The per capita final energy consumption evolved as follows between 2011 and 2022: Finland achieved a value of –0.17249, the "Leading" group (Denmark, Greece, France, Luxembourg, the Netherlands, Austria, Sweden) –0.75764, and the "Catching-up" group (Belgium, Germany, Estonia, Spain, Croatia, Latvia, Lithuania, Portugal, Romania, Slovakia, Slovenia) 0.07618, indicating that they were able to reduce their energy consumption. In the case of Malta, the result was 3.95991, and for the "Lagging" group (Bulgaria, Czech Republic, Italy, Cyprus, Hungary, Poland) it was 0.30699, indicating an increase in final energy consumption. These countries showed higher than average economic growth, namely the "Lagging" countries achieved the value of 0.13543 and Malta 0.94550. Ireland achieved an exceptionally high economic growth rate (3.44175), with higher-than-average energy consumption (0.51208) but a significantly decreasing energy intensity (–2.99342).

It can be concluded that Finland, the "Leading" countries, and the "Catching-up" countries have thus far been able to meet the Green Deal's energy policy objectives, while other countries have struggled. Moreover, the findings of Hannesson (2020) are confirmed, indicating a positive but disproportionate relationship between GDP growth and final energy consumption, and decoupling is evident.

Blas et al. (2019) found that as energy intensity decreases, so does final energy consumption. With technological development and the production of higher quality energy, energy intensity has decreased in all countries, but to varying extents.

In the "Leading" group (Denmark, Greece, France, Luxembourg, the Netherlands, Austria, Sweden), energy intensity decreased more significantly than the average (–0.03542), and final energy consumption also decreased (–0.75764). Energy intensity decreased significantly in Malta (–2.40904) and Ireland (–2.90342), while final energy consumption per capita increased in Malta (3.95991) and Ireland (0.51208). While energy intensity decreased in all countries, the extent of the decrease varies. However, it cannot be unequivocally stated that a reduction in energy intensity leads to a decrease in final energy consumption, as in the "Lagging" countries, energy consumption actually increased.

Cevik (2024) shows that improving energy efficiency can significantly contribute to meeting climate commitments across Europe, thereby reducing per capita $CO_2$ emissions.

Energy efficiency cannot be measured solely by energy intensity; it is advisable to assess it alongside final energy consumption. Cevik's statement is supported by the data, with Finland reducing its per capita final energy consumption (–0.17249), and at the same time, significantly reducing its per capita $CO_2$ emissions (–4.00661). The "Leading" countries also reduced their per capita final energy consumption (–0.75764), with a corresponding reduction in per capita $CO_2$ emissions (–0.25661).

Referring to Haberl et al. (2020), when we can increase per capita GDP while simultaneously reducing per capita final energy consumption and $CO_2$ emissions, we are talking about the "absolute decoupling" process.

Based on the results, Finland and the countries in the "Leading" group (Finland, Denmark, Greece, France, Luxembourg, the Netherlands, Austria, Sweden) can achieve absolute decoupling, since per capita final energy consumption is –0.17249 for Finland and –0.75764 for the "Leading" group, while per capita $CO_2$ emissions are –4.00661 for Finland and –0.25661 for the "Leading" group, indicating a decrease. For the other groups of countries, $CO_2$ emissions increased with GDP per capita growth.

"Relative decoupling" means that the increase in per capita final energy consumption or $CO_2$ emissions is lower than the economic growth rate. This phenomenon is observed in the "Catching-up" country group, where the per capita GDP growth rate is higher than average (0.09081), compared to per capita final energy consumption (0.07618) and per capita $CO_2$ emissions (0.07013). Here, both energy consumption and $CO_2$ emissions increased at a lower rate. This is also observed in Ireland, where per capita GDP growth is significantly higher than average (3.44175), compared to per capita final energy consumption (0.51208) and $CO_2$ emissions (0.11924), which increased at a lower rate.

In the "Lagging" country group, no decoupling is observed. The per capita GDP growth rate is higher than average (0.13543) but compared to per capita final energy consumption (0.30699) and per capita $CO_2$ emissions (0.72611), both indicators show larger increases compared to GDP growth.

Based on the MEDEAS measurement results of Nieto et al. (2020), with a reduction in final energy consumption, GDP growth may stagnate, and an increase in renewable energy installations will not resolve climate issues. The data shows that Finland (–0.91268) and the "Leading" country group (Denmark, Greece, France, Luxembourg, the Netherlands, Austria, Sweden) have lower than average per capita real GDP growth (–0.75515), and in parallel, policy objectives have been most effectively met in these countries.

In the country groups with higher-than–average economic growth, climate goals are less clearly achieved. In countries with an above-average share of clean energy (excluding nuclear energy), such as Finland (1.29392) and the "Leading" country group (0.63459), the change in per capita $CO_2$ emissions shows a significant decrease in Finland (–4.00661) and a decrease in the "Leading" countries (–0.25661). In the "Catching-up" group, the share of clean energy is above average (0.22346), and in parallel, the change in per capita $CO_2$ emissions is slightly higher than average (0.07013). In Ireland (–0.96098), Malta (–1.99685), and the "Lagging" country group (–0.87271), the share of clean energy in 2022 is below average, and in parallel, the change in per capita $CO_2$ emissions is above average in Ireland (0.11924), the "Lagging" group (0.72611), and Malta (0.55556), showing an increase.

From these data, we can conclude that MEDEAS measurements seem to confirm that the more clean energy (wind, solar, water) a country uses, the better it is able to achieve climate targets. The findings of Nieto et al. (2020) are only partially confirmed, showing that while the reduction in final energy consumption leads indeed to slower economic growth, however, the increased share of clean energy could be a solution for achieving climate goals.

Lange et al. (2020) concluded that transitioning from fossil fuels to higher quality energy sources reduces final energy consumption. The share of renewable energy includes both clean and nuclear energy, which are considered higher quality energy sources.

The share of renewable energy sources is above average in Finland (0.49190), the "Leading" country group (0.74110), and the "Catching-up" group (0.17233). In these groups, per capita final energy consumption decreased, as it was below average: Finland at −0.17249, the "Leading" countries at −0.75764, and the "Catching-up" countries at −0.07618. It can be seen that in the latter case consumption has fallen minimally. For the other groups of countries, the share of renewable energy is below average, −1.22838 for Malta, −0.21976 for Ireland and −1.02117 for the "Lagging" group. In parallel, per capita final energy consumption increased significantly in Malta (3.95991), in Ireland (0.51208), and in the "Lagging" group (0.30699), showing an increase.

The findings of Lange et al. have been confirmed, as countries that favour higher quality energy have lower final energy consumption.

**Table 5**
**Comparison of the authors' and our results**

| Author | Assertion | Result |
|---|---|---|
| Hannesson (2020) | There is a positive but disproportionate relationship between GDP growth and energy consumption. | Finland, the "Leading" countries, and the "Catching-up" countries have thus far been able to meet the Green Deal's energy policy objectives, while other countries have struggled. |
| Blas et al. (2019) | As energy intensity decreases, final energy consumption also decreases. | It cannot be unequivocally stated that a reduction in energy intensity leads to a decrease in final energy consumption, as in the "Lagging" countries, energy consumption actually increased. |
| Cevik (2024) | Improving energy efficiency can significantly contribute to meeting climate commitments across Europe. | The data support Cevik's claim. |
| Haberl et al. (2020) | "Absolute decoupling" appears | For the "Lagging" country group, no decoupling is observed, whereas for the "Leading" and "Catching-up" country groups it is observed. |
| Nieto et al. (2020) | As final energy consumption falls, GDP growth may stall. | The reduction in final energy consumption indeed leads to slower economic growth. |
| Lange et al. (2020) | Switching to a higher quality energy source reduces final energy consumption. | Countries that favour higher quality energy have lower final energy consumption. |

*Source*: own editing

## 8 CONCLUSION

The aim of the analysis was to determine the extent to which the Member States are differentiated. Through cluster analysis, we identified four groups: "Leading" (Finland, Denmark, Greece, France, Luxembourg, the Netherlands, Austria, and Sweden), "Catching-up" (Belgium, Germany, Estonia, Spain, Croatia, Latvia, Lithuania, Portugal, Romania, Slovakia, and Slovenia), "Lagging" (Bulgaria, the Czech Republic, Italy, Cyprus, Hungary, Poland, and Malta), and Ireland, which forms a separate group due to its exceptionally high GDP growth per capita. It can be observed that the heterogeneity of the countries spans a wide range.

The cluster analysis does not clearly reveal a distinction between the core and peripheral countries.

The analysis indicates that those countries achieved higher economic growth where per capita energy consumption increased or decreased slightly, the share of clean energy was lower, and $CO_2$ emissions increased. These countries are the "Lagging" group, and also Ireland and Malta. Countries with lower per capita final energy consumption and higher clean energy shares did not experience the same level of economic growth as the others but have a lower carbon footprint. These countries are Finland, as well as the "Leading" and "Catching-up" countries. They use a higher proportion of clean energy, have managed to reduce $CO_2$ emissions, and experience the "decoupling" process. These countries benefit from a higher share of higher quality energy, meaning renewable energy, and are able to reduce final energy consumption per capita and $CO_2$ emissions.

The results show that countries with a higher share of renewable and clean energy have been better able to meet policy measures, including climate targets, but have not been able to achieve above-average economic growth. The results suggest that the "Lagging" group should increase the share of clean energy, thus reducing fossil energy use, lowering energy intensity and final energy consumption, which would allow them to reduce $CO_2$ emissions.

## APPENDIX:

### Classification of EU Member States into clusters 2-5

| | | | | Average | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Number of clusters | Cluster | Member States | Standard deviation | Changes in final energy consumption | Changes in energy intensity | Changes in real GDP per capita | Share of renewable energy sources 2022 | Share of clean energy sources 2022 | Changes in greenhouse gas emissions per capita |
| 2 | 1 | Belgium<br>Denmark<br>Germany<br>Estonia<br>Greece<br>Spain<br>France<br>Croatia<br>Italy<br>Latvia<br>Luxembourg<br>Netherlands<br>Austria<br>Portugal<br>Slovenia<br>Slovakia<br>Finland<br>Sweden | 0.708031 | −0.4576 | 0.26113 | −0.4591 | 0.3382 | 0.35674 | −0.31703 |
| | 2 | Bulgaria<br>Czechia<br>Ireland<br>Cyprus<br>Lithuania<br>Hungary<br>Malta<br>Poland<br>Romania | 0.968817 | 0.9152 | −0.5226 | 0.91834 | −0.67639 | −0.71348 | 0.63405 |
| 3 | 1 | Ireland<br>Lithuania<br>Malta | 0.506184 | 0.51208 | −2.9934 | 3.44175 | −0.2976 | −0.96098 | 0.11924 |
| | 2 | Denmark<br>Luxembourg<br>Austria<br>Finland<br>Sweden | 0.354254 | −0.1724 | 0.97511 | −0.9126 | 0.4919 | 1.29392 | −4.00661 |
| | 3 | Belgium<br>Bulgaria<br>Czechia<br>Germany<br>Estonia<br>Greece<br>Spain<br>France<br>Croatia<br>Italy<br>Cyprus<br>Latvia<br>Hungary<br>Netherlands<br>Poland<br>Portugal<br>Romania<br>Slovenia<br>Slovakia | 0.558317 | −0.0172 | 0.51697 | −0.2967 | −1.12825 | −1.89402 | 1.41262 |

| | | | | Average | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Number of clusters** | **Cluster** | **Member States** | **Standard deviation** | **Changes in final energy con-sumption** | **Changes in energy intensity** | **Changes in real GDP per capita** | **Share of renewable energy sources 2022** | **Share of clean energy sources 2022** | **Changes in green-house gas emissions per capita** |
| **4** | 1 | Finland | 0 | −0.1724 | 0.97511 | −0.9126 | 0.4919 | 1.29392 | −4.00661 |
| | 2 | Malta | 0 | 3.95991 | −2.4090 | 0.9455 | −1.22838 | −1.99685 | 0.55556 |
| | 3 | Ireland | 0 | 0.51208 | −2.9934 | 3.44175 | −0.21976 | −0.96098 | 0.11924 |
| | 4 | Belgium<br>Bulgaria<br>Czechia<br>Denmark<br>Germany<br>Estonia<br>Greece<br>Spain<br>France<br>Croatia<br>Italy<br>Cyprus<br>Latvia<br>Lithuania<br>Luxembourg<br>Hungary<br>Netherlands<br>Austria<br>Poland<br>Portugal<br>Romania<br>Slovenia<br>Slovakia<br>Sweden | 0.5854 | −0.3496 | 0.5526 | −0.0690 | −0.87556 | 0.98938 | 0.65945 |
| **5** | 1 | Finland | 0 | −0.1724 | 0.97511 | −0.9126 | 0.4919 | 1.29392 | −4.00661 |
| | 2 | Ireland | 0 | 0.51208 | −2.9934 | 3.44175 | −0.21976 | −0.96098 | 0.11924 |
| | 3 | Bulgaria<br>Czechia<br>Greece<br>Italy<br>Cyprus<br>Hungary<br>Netherlands<br>Poland | 0.2106 | −0.0172 | 0.51697 | −0.2967 | −1.12825 | −1.89402 | 1.41262 |
| | 4 | Belgium<br>Denmark<br>Germany<br>Estonia<br>Spain<br>France<br>Croatia<br>Latvia<br>Lithuania<br>Luxembourg<br>Austria<br>Portugal<br>Romania<br>Slovenia<br>Slovakia<br>Sweden | 0.434372 | −0.1989 | 0.06697 | −0.5809 | 1.08324 | 1.69467 | −0.18723 |
| | 5 | Malta | 0 | 3.95991 | −2.4090 | 0.9455 | −1.22838 | −1.99685 | 0.55556 |

| | | | | Average | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Number of clusters** | **Cluster** | **Member States** | **Standard deviation** | **Changes in final energy con-sumption** | **Changes in energy intensity** | **Changes in real GDP per capita** | **Share of renewable energy sources 2022** | **Share of clean energy sources 2022** | **Changes in green-house gas emissions per capita** |
| **CLUSTER ANALYSIS WITHOUT OUTLIERS** | | | | | | | | | |
| **3** | 1 | Denmark<br>Estonia<br>Latvia<br>Lithuania<br>Luxembourg<br>Slovenia<br>Sweden | 0.5061 | −0.4210 | −1.02118 | 0.26104 | 0.89292 | 0.68804 | −0.45745 |
| | 2 | Bulgaria<br>Cyprus<br>Hungary<br>Poland<br>Romania | 0.3544 | 0.34737 | −0.04128 | 1.0359 | −0.84095 | −0.86323 | 1.43617 |
| | 3 | Belgium<br>Czechia<br>Germany<br>Greece<br>Spain<br>France<br>Croatia<br>Italy<br>Netherlands<br>Austria<br>Portugal<br>Slovakia | 0.5503 | 0.10088 | 0.61289 | −0.58390 | −0.17047 | −0.04168 | −0.33156 |

*Source*: own editing in SPSS

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