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UNLOCKING GREEN POTENTIAL: HOW THE EGSS SECTOR CAN REDUCE NEET RATES IN THE EU

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Abstract

This article establishes the significant relationship between the growth of the Environmental Goods and Services Sector (EGSS) and the reduction of NEET (Not in Education, Employment, or Training) rates across 33 European countries from 2013 to 2022. Through robust data analysis, the findings reveal an inverse correlation between EGSS expansion and NEET rates, underscoring the sector's potential to drive youth engagement in the green economy. The results suggest that targeted educational and training programs aligned with green sector demands could play a critical role in fostering socio-economic stability and reducing youth disengagement.

Keywords: NEET, EGSS, youth activation, green skills, STEM education

JEL: Q56, J21, J24, O44

Introduction

According to data from the European Environment Agency, as of 2021, the environmental goods and services sector employed 5.2 million people in full-time positions across the EU, representing 2.5% of total employment in the region. The environmental goods and services sector, also referred to as the "green economy", encompasses the production of goods and the provision of services aimed at environmental protection and resource management (European Environment Agency, 2024). This sector is crucial for economic development and the integration of human capital. Employment opportunities in the EGSS arise in various industries, including renewable energy production, manufacturing of equipment essential for generating renewable energy (such as wind turbines and photovoltaic systems), production of energy-efficient equipment, as well as research and development (R&D) activities, among others (European Environment Agency, 2024).

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The intersection of green economic growth and labor market activation, particularly regarding the reduction of NEET (Not in Education, Employment, or Training) levels, has emerged as a critical area of research in recent years. Targeted investments in the green economy not only foster economic growth in countries with strong environmental traditions but also provide a new avenue for engaging NEET individuals. Evidence indicates that the Environmental Goods and Services Sector (EGSS) can significantly contribute to the integration of NEET individuals into the labor market. This research empirically demonstrates this relationship.

Recent studies have increasingly focused on the role of green economies in job creation and the accessibility of new job opportunities for young people. According to the United Nations Environment Program (UNEP), the transition to a green economy is projected to create millions of jobs worldwide in sectors such as renewable energy, waste management, and sustainable agriculture. Furthermore, a report by the International Labour Organization (ILO) predicts that the green economy could generate 24 million new jobs globally by 2030, with substantial opportunities for young people. This aligns with structural transformation theory, which posits that shifts toward environmentally sustainable industries can lead to new employment opportunities, contingent on adaptable labor markets. "*The transition to a Green Economy is transforming the labor market – as the climate crisis approaches its critical point, the demand for 'green skills' is increasing"*. This was the overarching theme of one of the most recent United Nations Climate Change Conferences (COP 28), held in 2023. The conference marked a decisive shift, effectively closing the debate on the necessity of the green transition and placing a strong emphasis on the development of green skills, particularly among young people, including NEETs (Not in Education, Employment, or Training).

Several studies support the notion that the green economy can be a driver of youth employment; however, the realization of these opportunities depends on a workforce equipped with the necessary skills to fill roles in emerging green sectors. This skills gap is especially relevant for the NEET population, many of whom lack the educational and vocational training required for such positions.

The NEET group – *young people aged 15-29 who are not engaged in employment, education, or training* – represents one of the most challenging demographics to reintegrate into the labor market. Barriers to youth employment continue to grow, ranging from educational attainment and lack of work experience to social exclusion, particularly among marginalized groups. While the Environmental Goods and Services Sector (EGSS) has the potential to absorb NEETs, the immediate impact of its growth on NEET levels is constrained by the existing skills gap. Green jobs, often referred to as "new professions", require emerging skills, particularly in STEM fields. According to CEDEFOP's

report "*Skills in Transition – The Road to 2035*", achieving the objectives of the European green deal will drive demand across various sectors, commonly referred to as green sectors. This increased demand will, in turn, necessitate the expansion of "green skills" within the workforce. Green skills are often perceived as technical, scientific, technological, or engineering-based – what are known as STEM competencies. One key factor in integrating NEETs into the EGSS labor market is the development of STEM skills. Many EU countries have recognized this need, leading to improvements in NEET levels in some nations, suggesting that these states are investing significantly in developing the fundamental skills required to integrate unemployed youth into the labor market

Through various "Green Programs and Projects" the EU has emerged as a pioneer in this area, implementing numerous green innovations that have contributed to reducing NEET rates across Europe. These initiatives not only support sustainable development but also create employment and training opportunities for young people. One of the key programs in this transition is the European Social Fund Plus (ESF+), which supports EU member states in their shift towards a green and digital economy by providing funding for youth training and reskilling. By promoting equal opportunities, inclusion, diversity, and fairness, the ESF+ contributes to reducing NEET levels in Europe. Other successful initiatives include "*Focus on Green Jobs*", "*Support for Entrepreneurship in the Green Economy*", and "*Training and Reskilling in Green Technologies*", all of which have significantly improved NEET integration in countries that have successfully implemented them. Nearly all EU member country have benefited from these green programs, with Finland and Spain being standout examples in the integration and development of green skills among young people. In more economically developed EU nations, successful cases of NEET integration through EGSS can also be observed. One such initiative is in Germany, where the government provides numerous programs for solar panel installation, incorporating young people into the labor market through short-term training and skill development. In addition to job creation, these programs foster innovation in more efficient solar technology production. As a result, according to studies by the *German Institute for Economic Analysis*, the number of job offers related to the energy transition increased to 372,500 last year, up from approximately 173,000 in 2019. The same study notes that job postings in the solar energy sector rose to 102,000 in 2024, compared to 41,500 in 2019, while job advertisements in the wind energy sector grew by 70% to nearly 53,000 over the same period. The only threat to the continued positive development of the EGSS sector is the quantity and quality of the workforce, with the key undoubtedly lying in the hands of NEETs. Another positive example is Denmark, where programs focus on training young people in sustainable construction and energy efficiency. These programs

offer both theoretical knowledge and practical experience through internships and projects. Participants in sustainable construction initiatives contribute to the development of environmentally efficient housing, thereby reducing the country‘s carbon footprint. Hand in hand, green technologies and young people are finding their place in the evolving job market. This dual impact not only reduces NEET rates but also accelerates the ecological transition of the economy, aligning with the needs for sustainable growth and social inclusion. The link between EGSS growth and NEET reduction is thus validated, further reinforcing the importance of investing in green skills development.

Despite everything, Eurofound studies (2021, 2022) indicate that NEET levels are particularly high in countries grappling with economic instability, such as Greece, Spain, and Italy, as well as in certain regions of Bulgaria, where NEET rates exceed those of other EU countries. As evidenced by this study, these countries exhibit significant variability in NEET rates and are the focus of policy interventions aimed at promoting youth employment through targeted training and educational initiatives.

Examining the Environmental Goods and Services (EGSS) sector provides a unique opportunity to explore the relationship between sectoral growth and NEET activation outcomes. Empirical research discussed in this article supports the hypothesis that countries with developed EGSS sectors tend to experience lower NEET rates over time. For example, a study by Fankhauser et al. (2019) found that countries with strong environmental sectors, such as Germany and Sweden, have been more successful in reducing youth unemployment through the creation of green jobs. This issue extends beyond NEETs to include young people actively seeking work. The analysis also reinforces the thesis that countries with stable NEET levels consistently exhibit stable growth in their EGSS. Notable examples of this trend are Sweden and Finland.

Methodology

The methodology involves a multi-step approach to handling data and applying appropriate statistical methods to examine the relationship between NEET rates and the environmental sector (EGSS) across 33 European countries over the period from 2013 to 2022 from Eurostat.

The methods used in this article are:

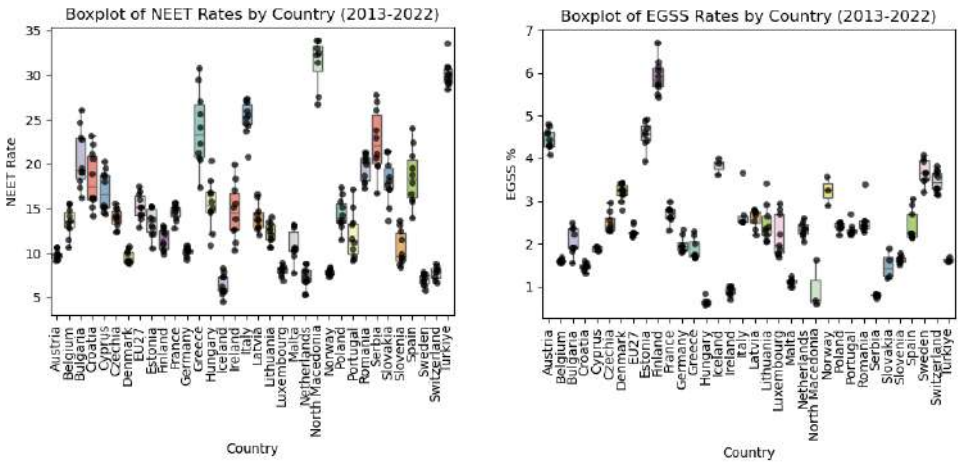
Exploratory data analysis (EDA) methods, including descriptive statistics visualizations, to understand the distribution of NEET rates and EGSS indicators over time and across countries. Boxplots were used to reveal the variability in NEET rates and EGSS indicators, highlighting the interquartile range, median, and outliers for each country. This provided initial insights into which countries exhibited higher or lower variability and allowed for the identification of patterns

or anomalies in the data. Heatmaps with hierarchical clustering were then utilized to explore the relationships between countries and across the years. These heatmaps revealed patterns of similarity and dissimilarity in NEET rates and EGSS indicators, with hierarchical clustering used to group countries that exhibited similar trends over time. This approach provided a visual representation of how NEET rates and EGSS activities evolved across different regions, suggesting potential clusters of countries with shared economic or social characteristics.

To analyze the relationship between NEET rates and the environmental sector polynomial regression and mixed-effects model (Mixed Linear Model or MixedLM) ware employed. This choice was driven by the repeated measures structure of the data, where each country had observations across multiple years, resulting in correlated data points. The mixed-effects model was particularly suitable because it accounts for both fixed effects (capturing overall trends over time) and random effects (addressing variability between countries). Also to address the issue of missing data, a combination of forward fill (ffill) and backward fill (bfill) methods was applied, ensuring that only countries with no more than 50% missing values were included in the analysis.

Empirical analysis

The two boxplots in figure 1 illustrate the distributions of NEET (Not in Education, Employment, or Training) rates and EGSS (Environmental Goods and Services Sector) percentage values across various countries over the period 2013 – 2022. Each boxplot represents the interquartile range (IQR) of the respective rates for each country, with the line inside the box indicating the median. The whiskers extend to values within 1.5 times the IQR, while outliers are shown as individual points.



Source: World Bank

Figure 1: Boxplots of NEET and EGGS by EU country for 2013 – 2022 year

Greece exhibits the highest variability in NEET rates, with a wide interquartile range and several outliers, indicating significant fluctuations over the years. Similarly, Serbia, Bulgaria, Spain and Ireland show substantial variability, suggesting ongoing challenges in stabilizing youth engagement. Conversely, countries like Sweden, Switzerland, and Germany display narrower interquartile ranges, reflecting relatively stable NEET rates throughout the period.

In terms of the EGSS percentages, the variability is generally lower than in NEET rates, implying more stable economic activities related to the environmental sector. However, some countries, such as Finland, Bulgaria, and Luxemburg, show wider interquartile ranges, indicating changes or growth phases in their environmental sectors. Finland, Austria, and Estonia report higher median EGSS values, reflecting a more substantial contribution of the environmental sector to their economies.

Countries like Spain and Bulgaria experience high variability in both NEET and EGSS indicators, pointing to broader economic instability that affects both youth engagement and environmental sector development. Meanwhile, Sweden, Switzerland, and Germany show low variability in both indicators, suggesting stable conditions across these domains. Greece, Serbia and Ireland, however, display divergent patterns, with noticeable differences in variability between NEET and EGSS rates, highlighting distinct dynamics in the labor market and environmental sectors.

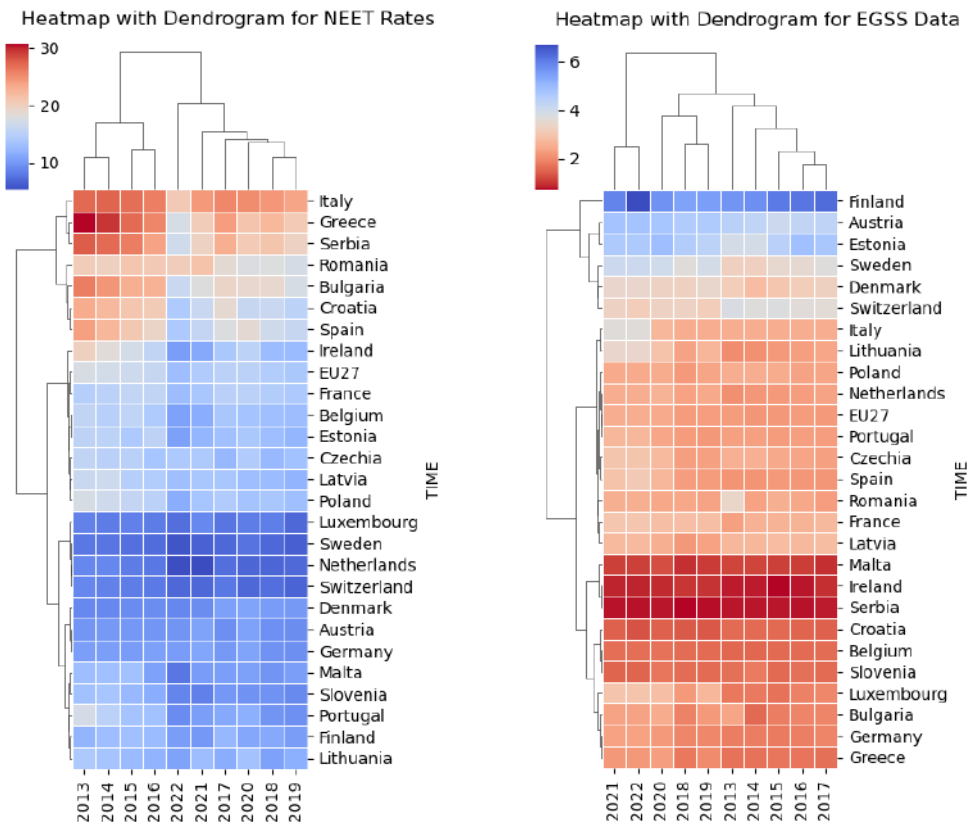
The findings indicate that countries exhibiting significant variability in NEET rates could benefit from targeted youth engagement policies, whereas those

with fluctuations in EGSS percentages might need to prioritize fostering stable growth in the environmental sector to support sustainable development. These relationships warrant a deeper investigation, which will be explored further in the following sections of this article.

The heatmaps with dendrograms for NEET rates and EGSS data, presented in figure 2, offer a detailed perspective on the variability and clustering patterns observed in the boxplots, reinforcing the earlier findings. In the NEET rates heatmap, countries such as Italy, Greece, and Serbia consistently display higher rates, as indicated by the red shading, especially in the earlier years (2013 – 2016). This aligns with the boxplot's identification of these countries as having higher median NEET rates and more variability, thus corroborating the challenges in youth integration during that period. Conversely, countries such as Sweden, Switzerland, and Netherlands consistently exhibit lower NEET rates across all years, evident from the blue shading, which again matches the stable patterns noted in the boxplot analysis.

For the EGSS data, the heatmap shows that countries like Finland, Austria, and Estonia have higher EGSS values in more recent years (2021 – 2022), reflected by the blue shading. This trend suggests that these countries have strengthened their environmental sectors over time. Meanwhile, countries such as Serbia, Ireland, and Malta exhibit lower EGSS values, especially in earlier years, indicating a more modest contribution from the environmental sector to economic activities.

The dendrograms further enhance the analysis by identifying clusters of countries and time periods with similar patterns. In the NEET rates dendrogram, Italy, Greece, and Serbia form a distinct cluster, indicating a shared trend of higher NEET rates, particularly in earlier years. In contrast, countries with stable and lower NEET rates, such as Sweden and the Netherlands, cluster together, showing consistent trends over time.



Source: World Bank

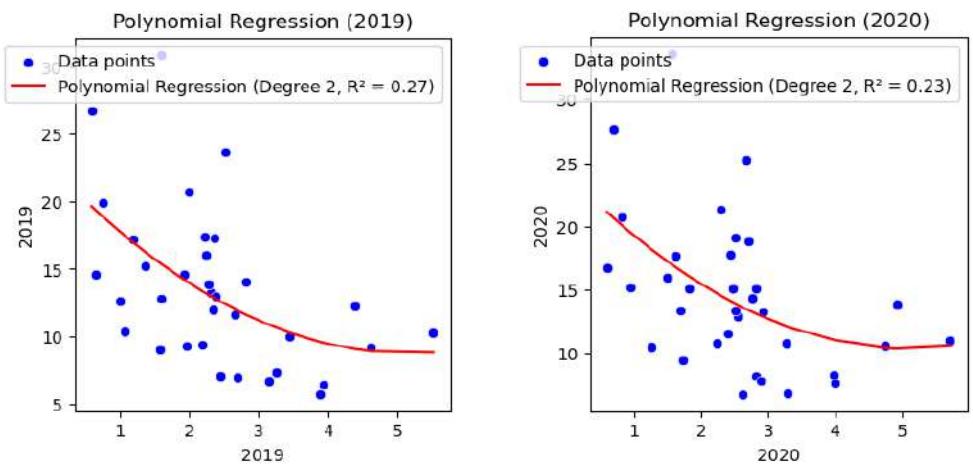
Figure 2: Heatmaps for NEET and EGGS Data for EU countries in period 2013 – 2022 year

The dendrograms further enhance the analysis by identifying clusters of countries and time periods with similar patterns. In the NEET rates dendrogram, Italy, Greece, and Serbia form a distinct cluster, indicating a shared trend of higher NEET rates, particularly in earlier years. In contrast, countries with stable and lower NEET rates, such as Sweden and the Netherlands, cluster together, showing consistent trends over time.

Similarly, the EGSS dendrogram reveals that countries like Finland and Sweden, which have higher and increasing EGSS values, cluster together. The clustering of years also suggests temporal connections, with more recent years (2021 – 2022) often grouped together, indicating a shift in EGSS activities that likely reflects growing emphasis on environmental policies.

Overall, the heatmaps and dendrograms not only reinforce the findings from the boxplots but also highlight meaningful clusters, pinpointing connections between countries and years in a correlated perspective.

Based on this overview, the next step in our analysis is to proceed with regression modeling to better understand the relationship between NEET rates and EGSS data across countries. We will start by performing polynomial regression for the years 2019 and 2020, which are the only years in our dataset without any missing values (figure 3). This initial analysis will allow us to observe the potential nonlinear relationships between the variables in these two years.



Source: Own calculations

Figure 3: Polynomial regression of NEET and EGGS in 2019 and 2020 year

The polynomial regression analysis for 2019 and 2020 reveals a nonlinear relationship between the indicators, with the trend lines indicating a downward curve. In both years, the second-degree polynomial regression captures a moderate level of variability, with R^2 values of 0.27 for 2019 and 0.23 for 2020, suggesting that approximately 23-27% of the variance in the NEET rates can be explained by the polynomial model.

The downward trend in both years indicates that as the environmental sector indicators increase, the NEET rates tend to decrease, reflecting a potential inverse relationship between the two variables. However, the relatively low R^2 values imply that other factors not included in the model may play a significant role in explaining the variability in NEET rates. The consistency of the relationship across both years suggests a stable, albeit modest, association, warranting further exploration using more advanced regression techniques and comprehensive data covering all available years.

Following the polynomial regression, we will conduct a more in-depth regression and correlation analysis over the entire period from 2013 to 2022, covering all countries. This comprehensive approach will include examining various regression models to account for the repeated measures structure of the data (such as mixed-effects models), as well as calculating correlation coefficients that take into consideration the longitudinal nature of the dataset.

Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	neet
No. Observations:	270	Method:	REML
No. Groups:	27	Scale:	1.7873
Min. group size:	10	Log-Likelihood:	-527.0418
Max. group size:	10	Converged:	Yes
Mean group size:	10.0		

	Coef.	Std.Err.	z	P>|z|	[0.025	0.975]
Intercept	14.547	1.396	10.423	0.000	11.811	17.282
C(Year)[T.2014]	-0.385	0.365	-1.055	0.291	-1.100	0.330
C(Year)[T.2015]	-1.020	0.364	-2.802	0.005	-1.733	-0.307
C(Year)[T.2016]	-1.680	0.364	-4.617	0.000	-2.394	-0.967
C(Year)[T.2017]	-2.642	0.364	-7.256	0.000	-3.355	-1.928
C(Year)[T.2018]	-3.357	0.364	-9.224	0.000	-4.070	-2.643
C(Year)[T.2019]	-3.918	0.365	-10.748	0.000	-4.632	-3.203
C(Year)[T.2020]	-2.951	0.373	-7.906	0.000	-3.683	-2.220
C(Year)[T.2021]	-3.727	0.382	-9.767	0.000	-4.475	-2.979
C(Year)[T.2022]	-5.031	0.384	-13.092	0.000	-5.784	-4.278
env	0.782	0.361	2.168	0.030	0.075	1.490
Group Var	29.618	6.748				

Source: Own calculations

Figure 4: Mixed model results

The Mixed Linear Model (MixedLM) results provide insights into the relationship between NEET rates and the environmental sector (EGSS) across 27 countries from 2013 to 2022. The model has converged, indicating stability in the estimates, and includes a total of 270 observations grouped by country, with a scale value of 1.7873. In the model, “Year” is treated as a fixed effect, capturing the overall trend in NEET rates across time, while “country” is treated as a random effect. This means the model accounts for country-specific variability, allowing each country to have its own baseline NEET rate and trend over time.

The random effect captures unobserved heterogeneity among countries, such as cultural, economic, or policy differences that affect NEET rates in ways not explicitly included in the model.

By incorporating both fixed effects (time-related changes) and random effects (country-specific deviations), the mixed model appropriately handles the hierarchical structure of the data. This hierarchical structure reflects that observations are not independent, with repeated measures nested within countries.

The coefficient for the environmental sector (env) is 0.782 ($p = 0.030$), indicating a statistically significant positive association with NEET rates. Temporal effects show a significant downward trend in NEET rates over the years, with negative coefficients for most years relative to the baseline year (2013). For instance, the coefficient for 2019 is -3.918 ($p < 0.001$), indicating that NEET rates were, on average, 3.918 percentage points lower than in 2013. The largest decrease is observed in 2022, with a coefficient of -5.031 ($p < 0.001$), suggesting a continued decline in NEET rates over the decade.

The variance component for the grouping variable (countries) is 29.618, indicating variability in NEET rates between countries, which suggests that while the environmental sector plays a significant role in reducing NEET rates, country-specific factors also contribute to variations in youth disengagement. The model thus underscores the importance of tailored policies that consider both sectoral growth and country-specific socio-economic dynamics to effectively address NEET rates across Europe.

Conclusion

In the short term, the positive coefficient for the environmental sector (EGSS) shows that growth in this sector initially corresponds to higher NEET rates. This occurs because the sector requires specialized skills, certifications, and training, which are not immediately accessible to the current NEET population. The immediate job opportunities in the green sector are often not available to young people who lack the necessary skills or qualifications, delaying the sector's direct impact on reducing NEET rates.

However, the negative coefficients for the year variables indicate that NEET rates have been decreasing over time. This long-term trend shows that the growth of the environmental sector leads to a reduction in NEET rates as policies and programs equip young people with the necessary skills. Over the years, as the sector continues to mature, more of the NEET population is absorbed into green jobs. Thus, the sustained development of the EGSS sector reduces NEET rates, as training programs, educational alignment, and accessible job opportunities gradually transform youth employment outcomes.

When interpreting the results of the econometric model, the negative impact of the independent variable "env" on the dependent variable "neet" over the long term should not be viewed as a direct causal relationship but rather as a reflection of structural changes in the economy, including the development of green industries and accompanying social policies. Additionally, the coefficient values for individual years indicate not only the impact of environmental factors on NEET levels but also the presence of a time trend, suggesting the influence of other macroeconomic and demographic factors. This highlights the need for further research to control for these effects, including analysis using alternative models.

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