Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Mapping Gender (In)Justice in the European Green Transition: A Comparative Analysis of Eco-Social Indicators

Greta Kraujalytė
Vilnius University
Jekaterina Navickė
jekaterina.navicke@fsf.vu.lt
Vilnius University

Research Article

Keywords: eco-social policy, gender justice, Green Deal, green transition, intersectionality

Posted Date: June 30th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10035979/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Mapping Gender (In)Justice in the European Green Transition: A Comparative Analysis of Eco-Social Indicators

Abstract
The green transition is frequently evaluated through narrow technocratic or economic lenses, overlooking the gendered distribution of power and resources. The study aims to map the gendered domains of the European green transition, revealing how gender-blind policy design may reproduce existing social inequalities. Integrating eco-feminist and intersectional perspectives, the research identifies critical intersections between environmental and social goals, and investigates the selected domains of the green transition: mobility, housing and green labor market. Utilizing secondary data from Eurostat and the European Institute for Gender Equality, we select and evaluate eleven gender-sensitive indicators across the EU-27. Descriptive analysis is used to map gender gaps and hierarchical cluster analysis is applied to classify national performance profiles. The findings reveal systemic gender inequality across the EU. While men dominate the green labor market, women remain more dependent on public transport and bear a disproportionate housing-related burden. Furthermore, the results demonstrate that the achievement of gender justice is deeply contingent upon prevailing welfare state models. The analysis identifies four profiles: *North-Western* group demonstrating horizontal professional segregation despite egalitarian pragmatism; *Continental* group reflecting a conservative compromise with moderate gender gaps across all analyzed domains; *Central-Eastern* group marked by high horizontal labor segregation and significant internal variation in both sustainable mobility and housing; *South-Eastern* group exhibiting the highest gender pay gaps and a significant risk of transport poverty for women. We argue that achieving just sustainability requires shifting towards policies that explicitly address structural gender imbalances, both though policy design and indicators used for evaluation.

Keywords: eco-social policy, gender justice, Green Deal, green transition, intersectionality.

Acknowledgements and Declarations
No funding was received to assist with the preparation of this manuscript. The authors have no competing interests to declare that are relevant to the content of this article.

Introduction

The green transition, aimed at creating a sustainable, low-carbon economy, is an inevitable process facing Europe and the rest of the world (Porto et al., 2022; Soto & Martinez-Cobas, 2024). While it is a response to climate change and an attempt to modernize the economy, this process also requires significant changes in social structures and the redistribution of resources (Streimikiene et al., 2021). A narrow approach that evaluates this transition solely from a technological or economic perspective overlooks social aspects and may not only fail to reduce inequality but even further increase it and create new forms of social exclusion (Cavicchia et al., 2023). For this reason, an eco-social approach is necessary, which combines economic sustainability, environmental goals, and the principles of social justice (Mandelli, 2022).

One of the aspects which is often overlooked when evaluating the green transition is gender. The prevailing gender blindness in environmental decision-making process and policy results is harmful to those with fewer opportunities (Magnusdottir & Kronsell, 2024). For example, gender-neutral terminology in European Union (hereafter, EU) policy documents overshadow real structural inequalities (Akgüç & Arabadjieva, 2024). The situation is further complicated by the fact that sectors where strategic decisions are made are dominated by men, leading to women's interests often being ignored (Alonso-Epelde et al., 2024). It is also essential to consider that women do not form a homogeneous group. Hence, to understand diverse experiences of vulnerability, an intersectional approach must be integrally applied, as gender interacts with age, social class, disability and other aspects (EIGE, 2023; Drucza et al., 2023).

A major obstacle to effective policymaking is the lack of reliable data. There is a lack of statistics disaggregated by gender and other social variables, without which it is impossible to assess the impact of policies and create targeted measures (Sauer & Stieß, 2021). Although the intersections of vulnerability and gender are visible in some spheres of the green transition, we lack systematic data collection for a full picture at the EU level (Carroll, Singh & Mangina, 2024).

Furthermore, the integration of the gender dimension is essential not only for achieving eco-social justice, but also for ensuring the effectiveness of the policy itself (Alonso-Epelde et al., 2024). Only a gender-sensitive and intersectional approach can ensure that the green transition is both environmentally sustainable, socially just and inclusive.

The study aims to map the gendered domains of the European green transition through a comparative analysis of eco-social indicators, revealing how gender-blind policy design may reproduce existing social inequalities.

The first theoretical section of the article highlights and critically analyzes the primary gender-sensitive domains of the green transition and identifies the key aspects for each of those. In the second section we discuss methods used for empirical analysis, as well as identify eco-social indicators for the selected gender-sensitive domains of the green transition. The third empirical section includes a descriptive analysis of selected eco-social indicators to map gender gaps. The fourth section includes results of the hierarchical cluster analysis, which groups countries and helps classify national performance profiles. This allows for a comprehensive assessment of whether the European Green Deal is truly gender-just or, conversely, risks reproducing existing inequalities.

The novelty of this work is manifested in three ways. First, the study consistently integrates a gender-sensitive and intersectional perspective, which has been largely absent from eco-social policy studies to date, as most analyses rely on gender-blind indicators and therefore fail to reveal existing social inequalities (Nenning et al., 2023). Second, the study constructs a gender-sensitive eco-social policy evaluation model, which helps assess whether gender-related inequality not only exists, but is also reproduced through eco-social policy measures (Toro et al., 2023). Third, a large-scale comparison of the EU-27 member states is conducted, based on gender-sensitive eco-social policy indicators. Such data analysis has been lacking until now, as there are very few environmental indicators systematically disaggregated by gender and other social variables (Sauer & Stieß, 2021). Although some research examines the social dimension and gender inequality issues at the intersection with the EU's environmental goals, it often does so unsystematically (Toro et al., 2023). Most of these studies focus on general environmental outcomes, such as greenhouse gas reduction (Bukowski & Kreissl, 2022). This study aims to fill these identified gaps.

1. European Green Transition and Gender Justice: Towards an Eco-Social Analysis

The current period in the EU and the world is marked by the inevitable and urgent necessity to transition towards a sustainable, low-carbon economy (Porto et al., 2022). This transformation, referred to as the Green Deal, is not only a response to the deepening climate crisis but also an ambitious project aiming to modernize the economy, increase its competitiveness and ensure long-term well-being (Magnusdottir & Kronsell, 2024). However, this transition, while just in its environmental goals, is an extremely complex social and political process (Bohnenberger, 2023). It inevitably affects fundamental social structures, redistributes resources, and creates new opportunities and risks (Akgüç & Arabadjieva, 2024).

Ignoring gender inequality may undermine the effectiveness of the Green Deal because women's empowerment is linked to better environmental outcomes (Drucza et al., 2023). Gender equality and intersectionality are not merely add-on topics but are fundamental conditions for economic efficiency and political stability. Understanding how inequality is reproduced allows for the development of solutions that ensure a truly just and sustainable future for everyone regardless of gender, age, disability or social status.

The European Green Deal encompasses eight main policy domains: increasing climate ambition, clean energy, a circular economy for industry, energy-efficient construction and renovations, the zero-pollution ambition, ecosystem protection, a sustainable food system and the transition to sustainable mobility

(EC, 2019). In this study, the analysis of eco-social policy focuses on the areas where environmental and economic transformation goals directly intersect with dimensions of social welfare, inequality and daily life. This means that domains such as ecosystem protection, biodiversity or a sustainable food system, while important from an environmental perspective, are not included in the analysis because their direct social impact within the gender dimension is less pronounced or requires different research methods. Furthermore, macro-level policy domains (e.g., general climate ambitions, industrial circular economy) that operate through indirect and (or) long-term chains were avoided. Priority was given to domains where the policy's impact on individual well-being and daily life is direct: sustainable mobility, sustainable housing and energy transition.

Additionally, green labor market has been included, although it is not highlighted as a separate Green Deal pillar. The inclusion of this domain is justified by the fact that green transition alters the structure of the labor market, affecting primary income distribution, employment and professional demand. These changes have a distinct gender dimension, as they can differently affect the opportunities for women and men to secure employment, earn income and participate in new sectors. Moreover, without access to high-quality paid green jobs, the sustainable transition risks becoming a project of new privileges and segregation rather than inclusive well-being (EIGE, 2023).

Based on the arguments presented above, four gender-sensitive domains of the green transition are identified: sustainable mobility, sustainable housing, energy transition and green labor market. These constitute the core of eco-social policy, where economic vulnerability, individual well-being, and structures of inequality intersect. Each of these domains is further analyzed separately to reveal specific mechanisms of gender (in)sensitivity.

1.1. Sustainable Mobility – From the "Male" Standard Toward Gender-Just Mobility

Sustainable mobility is a central axis of the European Green Deal, aiming to transform movement and reduce fossil fuel dependence (Gervasi et al., 2022). However, transport systems were historically built according to the "male" mobility standard, tailored to linear trips (de Madariaga & Zucchini, 2019; Christensen & Hvidt Breengaard, 2025). In contrast, women's mobility is characterized by "mobility of care" and complex "trip-chaining" to balance household and care tasks (Scheiner & Holz-Rau, 2017). Consequently, while men are more likely to use private cars for longer distances (OECD, 2020), women make up the majority of public transport users, pedestrians and cyclists (Gervasi et al., 2022; Sagaris & Tiznado-Aitken, 2023). This choice is driven by structural factors rather than preference, including lower income, limited car access and fewer driving licenses (Kawgan-Kagan, 2020; Gervasi et al., 2022).

Women's reliance on public transport is further complicated by the presence of children and significant safety concerns. Women report negative experiences, such as harassment and theft, much more frequently than men, making fear for personal safety a powerful factor restricting their mobility (Punzo et al., 2022; Sagaris & Tiznado-Aitken, 2023). They often face a "triple burden": gender-based violence, road hazards and burglary – which forces women to avoid certain routes or limit movement to their immediate neighborhood. This fundamental restriction of freedom is frequently ignored in policy planning, where current measures often act regressively and deepen transport poverty (Streimikiene, 2021; Smidfelt Rosqvist, 2024; Sagaris & Tiznado-Aitken, 2023).

Gender-blind policies, such as subsidies for electric vehicles, primarily benefit middle- and high-income men who already own cars, while offering no benefit to women who rely on public transport (Alonso-Epelde et al., 2024; Christensen & Hvidt Breengaard, 2025). Furthermore, urban infrastructure planned around the car ignores the needs of pedestrians, cyclists, and seniors (Tammaru et al., 2023). Without adequate pedestrian planning and rural accessibility, women face a heightened risk of transport poverty – a situation where systemic deficiencies prevent access to essential services (Mejía Dorantes & Murauskaite-Bull, 2023). Ultimately, a gender-blind approach fails to encourage a green transition and instead punishes those who already use sustainable modes of transport (Sagaris & Tiznado-Aitken, 2023).

1.2. Sustainable Housing – Between Green Transition and the Risk of Social Exclusion

As one of the largest energy consumers in the EU, the building sector's transformation is vital for Green Deal success (Fragkos et al., 2023). While mass renovation promises lower bills, better health and increased comfort (Volodzkiene, 2024; Martini, 2023; Bardazzi & Pazienza, 2023), this policy can deepen inequality for women. Many EU countries face a housing affordability crisis exacerbated by high energy prices (IEECP, 2022; EAPN, 2024). Women, especially single mothers and the elderly, are disproportionately affected by energy poverty as they often live in low-quality, inefficient housing (Munoz Boudet et al., 2018). Because women in the EU perform the majority of unpaid care work and spend more physical time at home, they are more exposed to health threats from cold, dampness and indoor air pollution (Vásquez-Vera, Fernández & Borrell, 2022; EIGE, 2023; Kwauk & Casey, 2022; Pérez-Cirera et al., 2017).

Sustainable housing measures can catalyze social exclusion through green gentrification. While renovation increases property value for owners, it often results in higher costs for tenants (Cavicchia et al., 2023; EIGE, 2023). Low-income households, which are frequently headed by women, face the risk of "renoviction" when they can no longer afford rent in upgraded buildings (IEECP, 2022). These dynamic risks create a two-tier society consisting of green buildings for the wealthy and energy deprivation for the remaining poor.

Structural issues like the split incentive problem further hinder a just transition. Split incentive problem occurs when owners lack motivation to invest in expensive renovations if they can easily pass high energy costs onto tenants – a situation, which leaves women particularly vulnerable in the rental market (IEECP, 2022; Cavicchia et al., 2023; Dobbins & Fahl, 2023). Even for female homeowners, the initial investments or loans required can be financially unbearable despite long-term returns (Munoz Boudet et al., 2018). Rising construction prices and mandatory financial contributions remain major barriers for low-income individuals, a group where women are statistically more numerous (Akgüç & Arabadjieva, 2024; EIGE, 2023).

1.3. Energy Transition – Challenges to Justice in a Gender-Blind Green Deal

Energy transition involves transitioning from fossil fuel-based energy to renewable sources and increased efficiency, serving as a cornerstone of the EU climate response (Streimikiene et al., 2021). However, behind this technological progress lies a web of social consequences where gender acts as an ignored factor of exclusion (Stephens, 2024). The central social impact of the energy transition is energy poverty – a multidimensional phenomenon encompassing inadequate access to heating, cooling and essential household energy (Soto, 2024; Volodzkiene, 2024; Streimikiene et al., 2021). Access to energy is determined not only by physical availability, but also by affordable electricity and gas prices for household use. High prices are, in turn, reflected in the utility bills. Low energy accessibility and affordability increases energy poverty risk, which in turn directly undermines health and social inclusion, disproportionately affecting elderly women and single mothers due to systemic income and pension gaps (Polimeni et al., 2022; Toro, 2023; Shrestha, 2025; EIGE, 2024).

The impact transcends financial boundaries to directly affect women's health and daily lives. Women are physiologically more sensitive to temperature fluctuations and suffer disproportionately from heatwaves, which are increasing in frequency due to climate change (EIGE, 2023; van Daalen et al., 2024). Data from France and across Europe confirm higher female mortality rates during extreme heat events, while energy poverty and poor housing increase risks of respiratory and mental diseases (Fouillet, 2006; Nawaz, 2021; Aarstad, 2024). Studies in Barcelona further confirm that women affected by energy poverty experience significantly poorer health outcomes (Carrere et al., 2021).

Moreover, certain energy-saving measures can increase the domestic workload. Transitioning to complex heating systems or monitoring energy consumption requires additional time and effort that traditionally falls on women (Shrestha et al., 2025). Large-scale renewable energy projects also risk replicating discriminatory labor patterns where women are offered low-paid or temporary jobs while men secure better-paid and more stable positions (Aiken & Leigh, 2015).

1.4. Green Labor Market – Between New Opportunities and Long-Standing Segregation

The green transition promises a boom in jobs aimed at climate mitigation and biodiversity restoration (Drucza et al. 2023; Moso-Diez et al., 2025). However critical analysis reveals that instead of promoting equality, green labor market reinforces historical professional segregation inherited from technical masculinities (Moso-Diez et al., 2025). Globally men occupy more than two-thirds of green jobs while women constitute only one-third of the workforce (IMF, 2024). This persistent gap indicates that new economic opportunities are not distributed evenly across the population.

This imbalance starts in the education system where cultural norms and stereotypes continue to regard technical fields as male domains (Moso-Diez et al., 2025). Globally women constitute only 36% of science, technology, engineering, and mathematics (hereafter, STEM) students while in the EU only 27% of engineering students were women in 2020 (Drucza et al., 2023; EIGE 2023). Data from Spain where only 1.8% of women in green programs chose energy and water fields illustrate the scale of this structural problem which limits female empowerment and voice in the green transition (Drucza et al., 2023; Moso-Diez et al., 2025).

New green jobs are predominantly created in energy, construction and manufacturing sectors where masculinized cultures often remain unwelcoming to women (Moso-Diez et al., 2025; Vásquez et al., 2022). While work in these sectors is stereotyped as physically demanding and unsuitable for women the intense physical workload in feminized professions like nursing is undervalued (Drucza et al., 2023; EIGE, 2023). Consequently, women are underrepresented in both technical positions and leadership roles within environmentally sensitive sectors which leaves policy measures to be developed according to male standards (Strumskyte et al., 2022; Baldez 2006; Drucza et al., 2023).

One of the most critical aspects is the overly narrow definition of green jobs. Usually, it is limited to technical, male-dominated sectors (Moso-Diez et al., 2025). However, it is argued that sectors where women are already better represented, such as care, education, healthcare, and small-scale agriculture, are essentially green by nature (Aiken, 2015; Greens, 2021). These are low-carbon and socially sustainable jobs that foster the ability to care for the well-being of others and the health of the environment, thereby contributing to climate change mitigation and resilience building (Aiken, 2015; MacGregor, 2017).

The capitalist and patriarchal system devalues this work, even though it is vital for the functioning of society (Aiken, 2015, Magnusdottir & Kronsell, 2024). To achieve a just green transition, it is necessary not only to strive to include women in male-dominated green sectors but also to recognize, value and invest in already existing female-dominated green sectors (Drucza et al., 2023; Moso-Diez, 2025). With investment and decent wages in these sectors, it will be easier to attract men, thereby reducing labor market segregation (Yavorsky & Dill, 2020).

2. Data and Methods

The goal of the following empirical evaluation is conducting a comparative analysis of eco-social indicators across the gender-sensitive domains of the European green transition that were identified in the previous section of this article.

A quantitative assessment is performed based on the analysis of secondary data collected from the Eurostat and European Institute for Gender Equality (hereafter, EIGE) databases. The selection of indicators was guided by two principles: (i) the indicators must correspond to the selected policy domains: sustainable mobility, sustainable housing, energy transition and green labor market; (ii) only indicators disaggregated by gender are selected. Subsequently, the suitability of the selected indicators was evaluated based on the following criteria: (a) the frequency of data collection and (b) the availability of data disaggregated by other intersectional parameters such as age, income, household type, disability status, urbanization level, etc. The full classification and characteristics of all the reviewed indicators are provided in Annex 1. The latest

statistics available for all indicators at the time of writing were used. As a result, the following 11 out of 15 indicators[1] were selected for the analysis:

1. *Sustainable Mobility*: Selected indicators include frequency of (*M1*) private car use and (*M2*) public transport use among men and women. These two indicators allow for the identification of the prevalence of "male" (car-oriented) and "female" (public transport-oriented) mobility patterns and their uneven distribution across the EU-27.
2. *Sustainable Housing*: Selected indictors include (*H1*) housing cost overburden (the share of income spent on housing), (*H2*) living in energy-efficient (renovated) dwellings and (*H3*) prevalence of poor housing quality (dampness, mold, rotting structures) among men and women. These indicators help assess how the green transition in the housing sector interacts with gender-based economic inequality and health risks in the home environment.
3. *Energy Transition:* No indicators were selected for the energy transition domain since there were no indicators disaggregated by gender at the individual level that met the above-mentioned selection criteria. Therefore, this domain was excluded from the quantitative analysis. Nevertheless, as the energy transition is closely linked to energy poverty and, consequently, to sustainable housing, the lack of gender-sensitive indicators in this domain, although regrettable, does not constitute a major limitation of the performed empirical evaluation.
4. *Green Labor Market*: Selected indicators include employment rate (*L1, L2*) and number of graduates (*L3, L4*) in technical and care sectors, and unadjusted gender pay gaps (*L5, L6*) within these sectors. These indicators allow for the identification of horizontal segregation (the distribution of men and women across sectors) and an evaluation of the education system's influence and potential vertical segregation during the green transition. As previously mentioned, indicators reflecting gender gaps in the care sector reveal the feminization of the "soft" green economy and the prevailing patterns of vertical and horizontal segregation within it.

To sum up, the empirical assessment consists of 11 indicators across three gender-sensitive domains of the European green transition: sustainable mobility, sustainable housing and green labor market (including both technical and care sectors). The analysis of these indicators was performed using the IBM SPSS Statistics 31.0 software. The following methods were applied:

- *Calculation of the Gender Gap (hereafter, GG).* The GG is calculated as follows for each indicator, except for the gender pay gap (which is already pre-calculated): $GG = S_m - S_w$, where S_m and S_w denote the percentage shares of men and women, respectively. Depending on the nature of the indicator, gaps in both benefits (*M1-M2, H2, L1-L6*) and burdens (*H1, H3*) are evaluated. Furthermore, to ensure interpretive consistency, all GG indicators were harmonized so that positive values in all cases indicate male dominance in the respective domain, while negative values indicate female dominance.
- *Hierarchical Cluster Analysis.* Ward's method (hierarchical clustering with the minimum variance criterion) was applied using the squared Euclidean distance measure to group EU-27 countries according to their gender gap profiles in selected gender-sensitive domains of the green transition. This method was chosen because it produces compact, clearly distinct clusters, works well with small sample sizes, and tolerates heterogeneous variables. Furthermore, all variables were standardized (z-score transformation) to avoid the influence of scale differences.

In interpreting the results of the cluster analysis, the study seeks to empirically test whether gender gaps in the domains of the European green transition resemble welfare state typologies. Research indicates that eco-social policy measures are designed to simultaneously reduce multiple interconnected ecological and social

[1] All indicators are numbered and labelled as following: M – sustainable mobility, H – sustainable housing, L – green labour market. For example, M1 – the first indicator of the sustainable mobility domain.

risks and to operate in a complementary manner (Koch & Fritz, 2014; Gough, 2017; *[anonymized for peer-review]*, 2021). Furthermore, studies show that such form of gender injustice as feminization of poverty is less prevalent in countries characterized by the social-democratic welfare model (e.g., Sweden and Denmark), and most prevalent in Southern European countries (e.g., Greece), as well as in some post-communist countries (e.g., the Czech Republic) and countries with a conservative welfare model (e.g., Germany) (Perzyńska & Guzowska, 2024). Therefore, when assessing gender justice in the context of the green transition, welfare state typologies can help reveal certain patterns in the clustering and differentiation of countries. In assessing the potential impact of the European green transition, it is essential to empirically verify whether it further entrenches existing gender inequalities or fosters new, more gender just practices.

3. Gender Gaps in the Green Transition: Systemic Inequality with National Variations

The first descriptive stage of the analysis reveals systemic gender inequalities across all investigated domains, although their magnitude varies among EU countries. The results confirm the male dominance in technical sectors of the green labor market and the concentration of women in care work described in the literature review, while simultaneously revealing unexpected nuances.

3.1. Sustainable Mobility

Sustainable mobility represents the totality of daily commuting habits, focusing on the transition from private motorized transport to public or active mobility. The data for car use (see Chart 1.M1) show stable male dominance with an EU-27 average GG of +4.1 percentage points (hereafter, p.p.). Men choose the private car as their primary transport mode in 23 out of 27 member states, with the highest gaps found in Slovakia (+9.9 p.p.) and Czechia (+9.8 p.p.). This data supports the "male mobility" model where individualized motorized transport is prioritized as a sign of mobility privilege (Scheiner & Holz-Rau 2017). Even in car-reliant households, gendered roles persist as research indicates that women are more likely to be passengers while men remain the primary drivers (EIGE, 2023). Outliers such as Ireland (-5.7 p.p.) and Luxembourg (-3.0 p.p.) where women dominate car use may reflect specific national urbanization patterns or a lack of accessible public alternatives that forces car dependency across genders.

Conversely, public transport use (see Chart 1.M2) reflects the "mobility of care" and reveals a reverse gendered pattern where women lead by an EU average of -3.1 p.p. This female dominance is recorded in 22 countries and is most extreme in Estonia and Lithuania (-13.7 p.p.). Such significant gaps confirm that women's mobility is often characterized by complex trip-chaining and reliance on systems that are frequently ill-suited for non-linear care tasks (de Madariaga & Zucchini, 2019). While ecological sensitivity is a factor, this high dependency often indicates a lack of freedom of choice and a higher risk of transport poverty driven by lower income and limited car access (Kawgan-Kagan, 2020; Punzo et al., 2022). In contrast, only five countries, including Luxembourg (+5.1 p.p.) and Denmark (+3.1 p.p.), show male dominance in public transport use, suggesting that gender-neutral or subsidized systems can successfully shift male behavior toward sustainable modes.

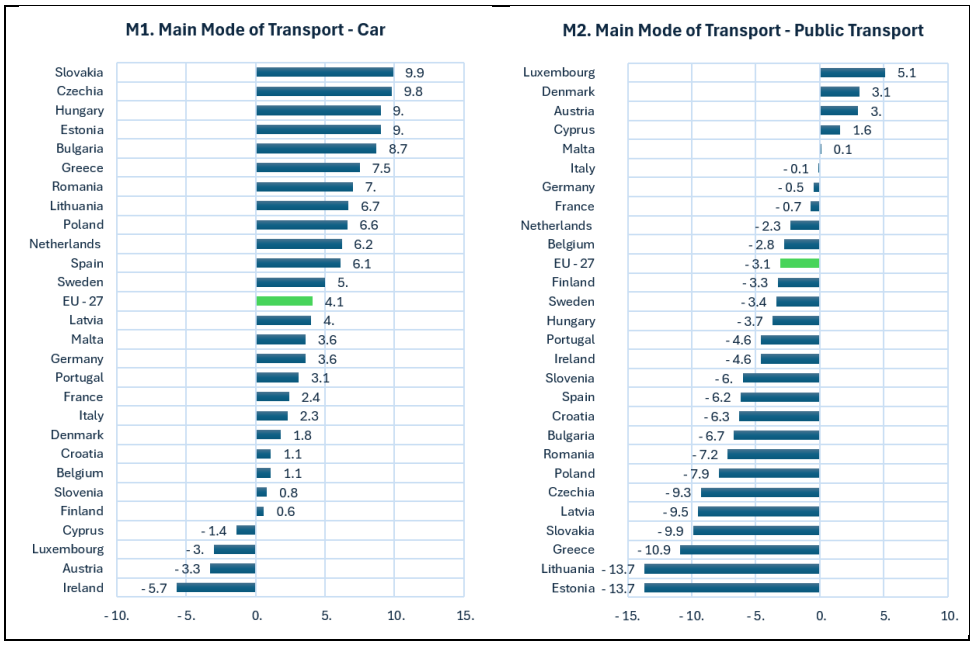

Chart 1. Gender Gaps in Sustainable Mobility (p.p.)

Source: compiled by the authors using EIGE data (2022)

Ultimately, these mobility gaps demonstrate that current transport infrastructure, optimized for peak-time commutes, continues to ignore the specific needs of those performing care work (OECD 2020; Gervasi et al. 2022). By focusing policy and subsidies on individual electric vehicles rather than expanding accessible public networks, the Green Deal risks reinforcing a regressive mobility standard that rewards car ownership while penalizing the sustainable modes women already rely upon (Sagaris & Tiznado-Aitken 2023). Conceptualizing these gaps as a failure of gender-blind planning highlights how the transition can deepen social exclusion if it fails to address the structural differences between male privilege in individualized mobility and female dependency on public systems.

3.2. Sustainable Housing

Sustainable housing domain provides a fragmented picture of vulnerability because various indicators do not strongly correlate, suggesting that housing encompasses several distinct planes of inequality. Across 23 EU member states women face a higher housing cost overburden (see Chart 2.H1) with an average gap of -0.8 p.p. indicating that energy poverty materializes primarily through economic strain on female-headed or female-occupied households. Greece shows the highest economic vulnerability for women (-3.8 p.p.) while Lithuania and Malta show reverse trends where men are more likely to bear high costs. These disparities suggest that women spend larger shares of their income on essential utilities to maintain a basic standard of living which might be consequence of systemic gender pay and pension gaps (IEECP, 2022; EAPN, 2024; EIGE, 2024).

Access to renovated or energy efficient housing (see Chart 2.H2) reveals a mixed picture with an average EU gap of +0.6 p.p. in favor of men. While 19 countries show a positive GG indicating men live more frequently in renovated dwellings national differences remain minimal. Sweden (-1.3 p.p.) and Portugal (+2.0 p.p.) represent the opposite ends of this spectrum. While these gaps appear small, they must be interpreted with caution as individual-level data often mask intra-household power dynamics regarding control over renovation decisions or asset ownership (Munoz Boudet et al., 2018). The slight male lead in renovated housing suggests that the benefits of green investments may be trickling down more slowly to women who are more likely to be in the rental market or living in older less efficient structures.

The quality of the housing environment (see Chart 2.H3) specifically regarding issues such as dampness, mold and rotting structures shows narrow gender gaps with an average EU lead for women of -0.4 p.p. Despite the small scale, women are more likely to live in poor quality housing in 16 out of 27 states. This vulnerability is most visible in Malta where the gap reaches -1.7 p.p. for women while Lithuania shows a significant lead for men at 1.3 p.p. Such findings support theoretical assumptions about the gendered burden of energy poverty which affects women unequally, as poor indoor air quality and thermal discomfort directly threaten the physical and mental health of women who spend more time in the domestic sphere performing unpaid care work (Vásquez-Vera et al., 2022; EIGE, 2023).

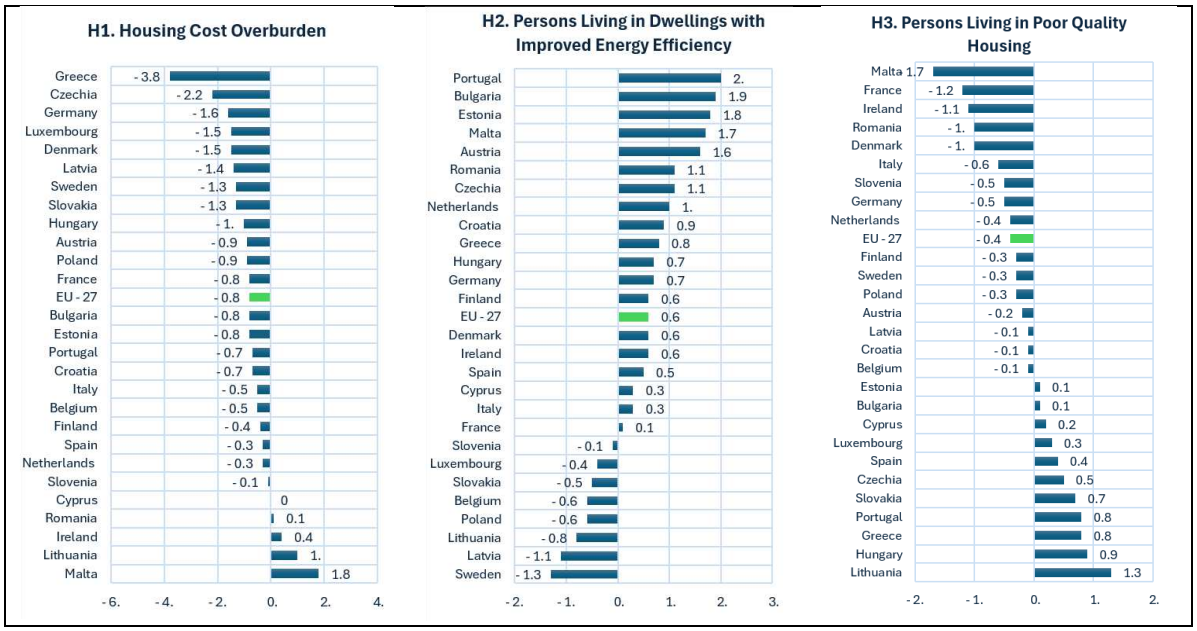

Chart 2. Gender Gaps in Sustainable Housing (p.p.)

Source: compiled by the authors using Eurostat data (H1: ilc_lvho07a, 2024; H2: ilc_lvhe08, 2023; H3: ilc_mdho01, 2023)

Ultimately these indicators reveal that housing vulnerability for women is not always visible as a sharp structural divide but rather as a weakly expressed and fragmented reality. However, the fact that women in 17 countries face poorer housing conditions confirms that they bear a disproportionate burden of the green gentrification risks. Without targeted social protection the push for energy efficiency could further marginalize women by increasing rent and utility costs without necessarily improving their immediate quality of life (Cavicchia et al., 2023).

3.3. Green Labor Market: Technical and Care Work Intersections

As discussed above, green labor market is conceptualized broadly to include both technical sectors (energy, construction and manufacturing) and care sectors (education, healthcare and social work). While technical sectors are traditionally prioritized in Green Deal frameworks, care sectors are identified in eco-feminist literature as essential to a sustainable economy due to their low carbon footprint and high social value (Stephens, 2024; Kwauk, 2022; Echavarren, 2023). Comparing these two poles reveals a deeply segregated labor market that replicates historical gender hierarchies.

Employment rates reveal a mirror-image of horizontal segregation. In technical green sectors (see Chart 3.L1), men dominate across all 27 EU countries with an average GG of +21.4 p.p. ranging from +9.5 p.p. in Luxembourg to +27.7 p.p. in Slovakia. Conversely, employment in care sectors (see Chart 3.L2) exhibit stable feminization with a negative average GG of -22.2 p.p. where the gap reaches its peak in

Finland at -30.5 p.p. This confirms that technical masculinities remain the foundation of the green industrial transition (Moso-Diez, 2025).

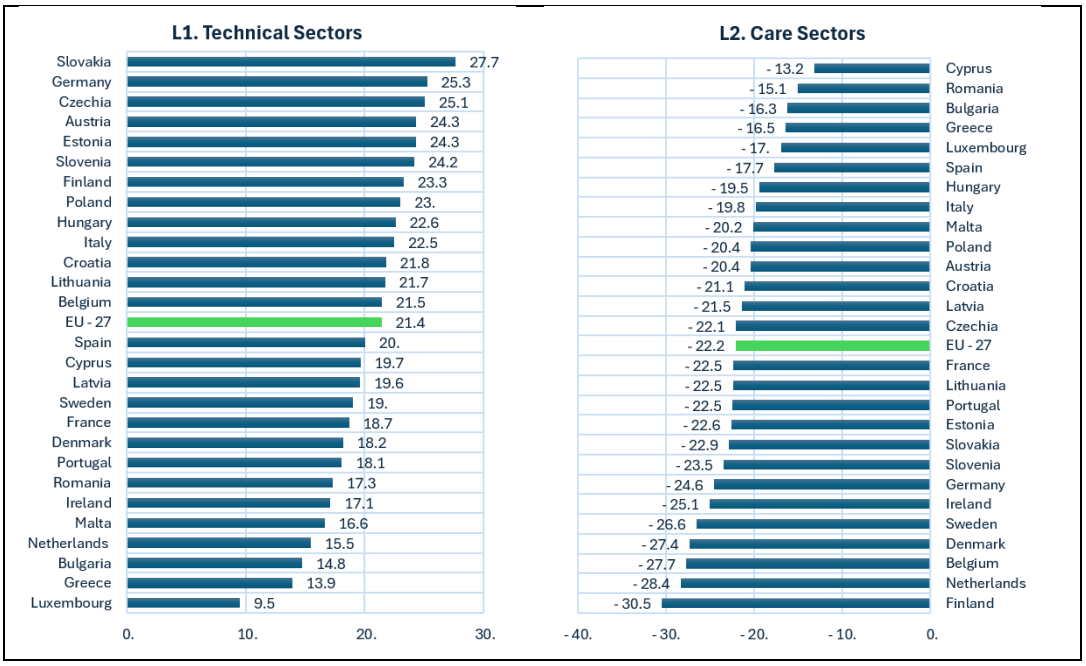

Chart 3. Gender Gaps in the Green Labor Market: Employment Rates (p.p.)
Source: compiled by the authors using Eurostat data (lfsa_egan2, 2024)

This segregation is programmed within the educational pipeline. The graduate GG in technical fields (see Chart 4.L3) (+26.3 p.p.) is even higher than the employment gap, particularly in Hungary (+37.2 p.p.) and Slovakia (+36.8 p.p.), signaling that STEM fields remain exclusionary (Moso-Diez et al., 2025). Care graduates (see Chart 4.L4) show a similarly gendered trend with an average GG of -21.2 p.p. reflecting deeply rooted cultural norms that influence study choices. However, the data suggests a "glass ceiling" effect in some nations; in Malta, the graduate gap is the lowest in the EU (+11.9 p.p.) yet the employment gap is significantly higher (+16.6 p.p.), indicating that women often fail to transition from qualification to technical employment (Baldez 2006).

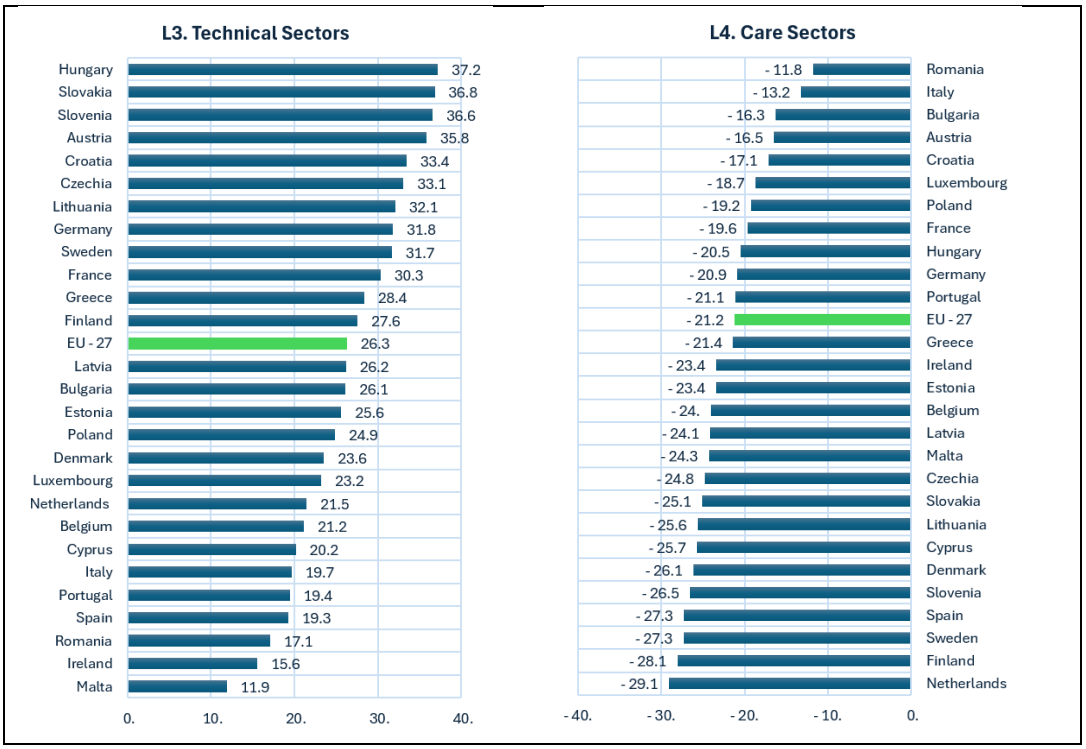

Chart 4. Gender Gaps in the Green Labor Market: Graduates (p.p.)

Source: compiled by the authors using Eurostat data (educ_uoe_grad02, 2023)

The gender pay gap analysis reveals the most significant paradox of the green labor market. In technical sectors (see Chart 5.L5), the unadjusted wage gap appears minimal at +0.9 p.p. but this figure is deceptive. In nine countries, including Cyprus and France, women earn more than men. This paradox likely stems from the fact that women in male dominated technical sectors often occupy administrative or managerial office roles which carry higher pay than lower skilled physical labor performed by men within the same broad sector (EIGE, 2017).

In contrast, the gender pay gap in the care sector (see Chart 5.L6) exhibits a massive and systematic undervaluation. Despite being dominated numerically by women, care sectors show a positive wage gap in favor of men in 26 out of 27 countries, with an EU-27 average of +13.0 p.p. This confirms that care work is systematically devalued and that investments in these sectors remain insufficient (Yavorsky & Dill, 2020). Even in "feminized" fields, men often occupy better paid leadership positions while women are concentrated in direct care roles, replicating vertical segregation hierarchies (Porto et al., 2022).

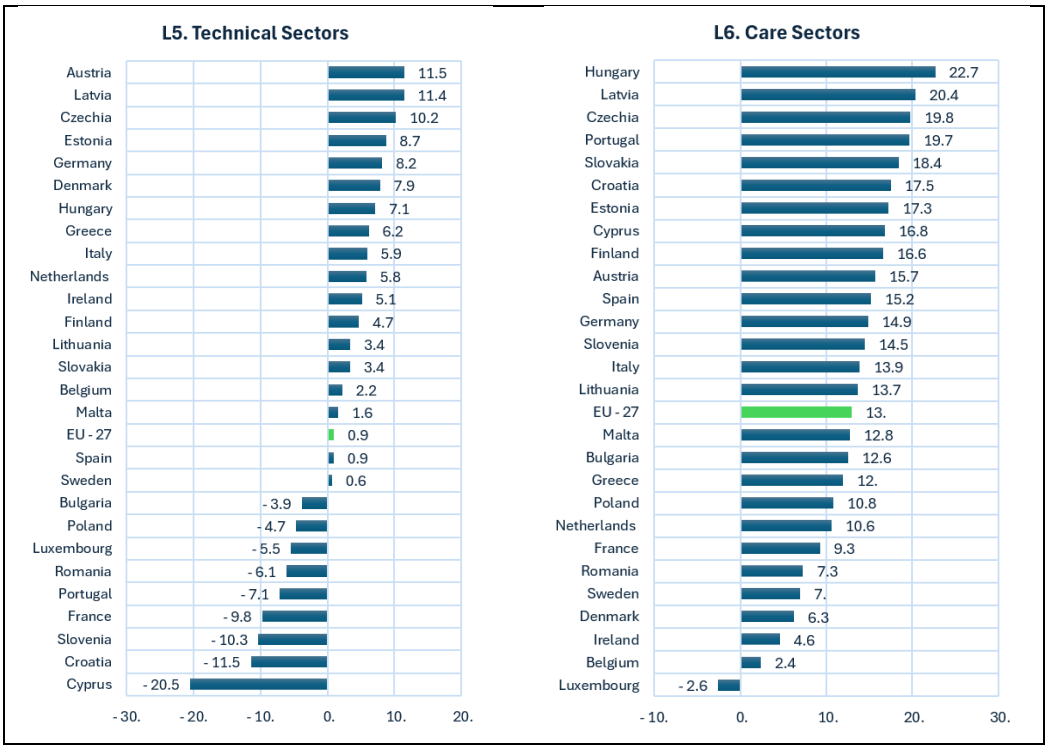

Chart 5. Gender Gaps in the Green Labor Market: Unadjusted Gender Pay Gap (p.p.)
Source: compiled by the authors using Eurostat data (earn_gr_gpgr2, 2023)

This descriptive analysis deconstructs the myth of a gender-neutral green transition. Green labor market remains a fortress of technical masculinity where male dominance is solidified through the education system. Meanwhile, the care economy functions as a heavily feminized but economically devalued pole. By ignoring care work in official green policies, the transition risks becoming a project of new male privileges while penalizing the very sectors that contribute most to social sustainability and resilience. Achieving a gender-just green transition requires shifting from a narrow technical focus to a holistic model that values and invests in the care economy to reduce both horizontal and vertical segregation.

4. Cluster Analysis: Welfare State Reflections and Gender Gap Profiles

The second stage of the analysis – hierarchical cluster analysis using Ward's method – aimed to empirically identify groups of EU countries based on their gender gap profiles in selected domains of the green transition, and to test whether these groups align with welfare state typologies. Based on the dendrogram (see Annex 2) and the dynamics of the agglomeration coefficients, a four-cluster solution was chosen to ensure sufficient internal homogeneity and interpretive clarity. The clusters partially confirm the logic of welfare regimes, while simultaneously revealing new grouping patterns specific to eco-social policy. Detailed information regarding the distribution of individual indicators within the clusters is provided in Table 1.

Table 1. Comparison of Gender Gaps Across Regional Clusters

Domain and Indicator GG	Central-Eastern (Cluster 1)	North-Western (Cluster 2)	Continental (Cluster 3)	South-Eastern (Cluster 4)
Sustainable Mobility				
M1. Main Mode of Transport: Car	1.9 (3.01)	1.8 (3.89)	4.0 (4.60)	8.1 (2.30)
M2. Main Mode of Transport: Public Transportation	-2.6 (4.06)	-1.9 (2.63)	-4.1 (5.54)	-10.0 (3.68)
Sustainable Housing				
H1. Housing Cost Overburden	-0.8 (0.46)	-0.3 (1.11)	-1.0 (1.35)	-1.0 (1.07)
H2. Living in Improved Energy Effieciency Housing	0.4 (0.72)	0.4 (1.00)	0.9 (0.86)	0.2 (1.17)
H3. Living in Poor Quality Housing	-0.5 (0.36)	-0.7 (0.58)	0.2 (0.61)	0.6 (0.52)
Green Labour Market				
L1. Employment: technical sectors	22.8 (2.17)	18.7 (2.77)	16.2 (3.73)	23.5 (2.81)
L2. Employment: care sectors	-21.8 (1.79)	-26.5 (3.27)	-16.9 (2.87)	-21.8 (1.26)
L3. Graduates: technical sectors	30.4 (6.12)	21.8 (6.72)	22.0 (4.09)	31.8 (5.01)
L4. Graduates: care sectors	-19.0 (4.16)	-26.1 (2.20)	-20.3 (5.35)	-23.9 (1.86)
L5. Wage: technical sectors	-1.5 (9.77)	4.0 (2.59)	-5.1 (8.25)	7.4 (3.42)
L6. Wage: care sectors	13.8 (2.85)	8.6 (4.96)	11.6 (7.36)	18.7 (3.07)

Source: compiled by the authors. Note: Values are presented as: Mean (Standard Deviation).
Positive values indicate male dominance while negative values – female dominance.

4.1. Central-Eastern European Cluster

The Central-Eastern European cluster brings together six post-communist states whose eco-social profiles are defined by a shared post-socialist welfare heritage. This group includes Czechia, Estonia, Latvia, Lithuania, Slovakia and Hungary. In these nations the green transition currently reproduces traditional gender segregation where a heavy industrial orientation favors men while insufficient investment in care infrastructure limits women's ability to transition into new economic sectors.

Mobility patterns in this cluster reveal that women are significantly more dependent on public transport than men with an average GG of -2.6 p.p. (SD = 4.06). In Estonia and Lithuania this gap reaches a staggering -13.7 p.p. compared to the EU average of -3.1 p.p. This reliance is linked to historically developed, but aging transport systems that have been slow to adapt to shifting demographic needs. Women who bear responsibility for a larger share of care work face acute difficulties in balancing complex trip chains with rigid public transport schedules (de Madariaga & Zucchini, 2019).

The housing sector exhibits significant internal variation among these member states. While men generally experience a lower housing cost burden with an average GG of -0.8 p.p. (SD = 0.46) and are slightly more likely to live in energy efficient housing (+0.4 p.p.), specific countries like Czechia show a much higher burden for women (-2.2 p.p.), whereas Lithuania shows an opposite trend at 1.0 p.p. Housing quality mirrors this divergence as women in Hungary and Czechia are more likely to live in poor condition buildings whereas the situation is reversed in Lithuania at 1.3 p.p.

Labor market analysis identifies some of the largest gender gaps in the EU within this cluster. Technical green sectors are characterized by high male dominance in both employment (+22.8 p.p., SD = 2.17) and education where the graduate GG reaches +30.4 p.p. with Hungary and Slovakia holding leading positions. This technical orientation favors men while care sectors remain highly feminized in both employment (-21.8 p.p.) and studies (-19.0 p.p.). Despite women dominating the care workforce the wage gap remains positive in favor of men at +13.8 p.p. (SD = 2.85) confirming the systemic devaluation of care labor even in sectors where women are the majority (Aiken 2015; Stephens 2024).

4.2. North-Western European Cluster

The North-Western European cluster combines social-democratic Nordic countries (Denmark, Finland and Sweden) with Western European states (Belgium and the Netherlands) along with structural outliers Ireland[2]

[2] Ireland is a non-typical country in the EU due to its economic profile and other characteristics, hence often left out of the cluster analysis entirely. We keep it in the analysis and in the cluster, albite it connects to other countries in the group at the largest distance.

and Malta[3]. The defining axis of this group is a profile of egalitarian pragmatism where systematic investments in public services and transport reduce immediate gender gaps despite persistent structural segregation. Labor market dynamics in this cluster reveal a significant paradox: while technical green sectors exhibit the smallest GGs in the EU (+18.7 p.p., SD = 2.77), care sectors remain the most heavily feminized with an average employment gap of -26.5 p.p. (SD = 3.27) that reaches -30.5 p.p. in Finland. This indicates that while developed networks of public care services reduce the immediate burden on women, they also reinforce horizontal segregation by creating feminized job markets (Mandelli, 2022; Koch, 2014; EIGE, 2024).

The educational and wage profiles in the labor market further emphasize these contradictions. The graduate gap in technical fields (+21.8 p.p., SD = 6.72) is lower than the EU average yet remains high in countries like Sweden (+31.7 p.p.), showing that STEM segregation is deeply rooted even in egalitarian societies (Moso-Diez et al., 2025). However, wage inequality in these sectors is moderate and in some cases approaches equality, reflecting the influence of strong collective bargaining and robust social protections (Bohnenberger, 2023). In care sectors, this cluster boasts the smallest wage gap in the EU (+8.6 p.p., SD = 4.96) compared to the average of +13.0 p.p. nevertheless, care work remains systematically undervalued even in universal welfare states, as numerical dominance does not translate into economic power for women.

Mobility and housing indicators in this cluster present the most balanced situation in the EU. This group stands out for having the smallest GGs in mobility with an average car use gap of only +1.8 p.p. (SD = 3.89) indicating that men and women choose cars and public transport nearly equally. The case of Denmark illustrates how ex-ante gender assessments in transport planning can successfully narrow gaps by accounting for diverse mobility patterns (Christensen & Hvidt Breengaard, 2025). Similarly, the housing sector shows the lowest economic burden for women (-0.3 p.p., SD = 1.11) with only fragmented differences in the distribution of renovated or poor-quality housing. Ultimately, this cluster demonstrates the potential of the social-democratic model to reduce the feminization of poverty and balance mobility through infrastructure investment, even as it struggles to resolve deeper structural segregation in the workforce.

4.3. Continental European Cluster

The Continental European cluster combines traditional conservative welfare states (Germany, Austria and France) with Central European post-communist states (Poland, Croatia and Slovenia) and Italy (Esping-Andersen, 1990; Koch, 2014). This group represents a "conservative compromise" where formally recognized gender equality policies coexist with deeply rooted patriarchal structures. Occupying a middle position across most domains, this cluster is neither extremely discriminatory nor actively transformative, reflecting a commitment to the status quo within existing welfare systems.

In the field of transport, the data reflects higher male motorization with an average GG of +4.0 p.p. (SD = 4.6) and female dependence on public transport with an average GG of -4.1 p.p. (SD = 5.5). The most significant gaps in public transport use are visible in Poland and Croatia. Housing indicators reveal a specific paradox for this cluster: women face the highest housing cost burden with an average GG of -1.0 p.p. (SD = 1.35) despite being relatively more likely to live in renovated dwellings (average GG +0.9 p.p.; SD = 0.9). This suggests that while women may inhabit upgraded housing, they pay a disproportionately larger share of their income for it. However, the high sample variance requires caution in generalizing these findings as the SD exceeds the mean.

The labor market demonstrates moderate but stable male dominance in technical green sectors with an average employment GG of +16.2 p.p. (SD = 3.73). High graduate gaps in technical fields, particularly in Austria and Slovenia, directly correspond to the conservative male breadwinner model where technical fields are historically linked to male identity (EWL, 2025). Meanwhile, employment and graduate gaps in the care

[3] Malta is a non-typical country in the EU due to its size and other characteristics, hence often left out of the cluster analysis entirely. We keep it in the analysis and in the cluster, albite it connects to other countries in the group at the largest distance.

sector remain closer to the EU average at -19.9 p.p. (SD = 2.9) and -20.3 p.p. (SD = 5.35) respectively, confirming the persistent horizontal segregation characteristic of these regimes.

The fundamental flaw of this conservative model emerges in the care sector wage gap, which is nearly the highest among all clusters at an average of +11.6 p.p. (SD = 7.36). In Croatia, this wage gap for care work reaches +17.5 p.p. in favor of men. These findings empirically confirm that care remains privatized within the family as a female responsibility while public investment remains insufficient to close economic disparities (EIGE, 2024; Magnusdottir & Kronsell, 2024; Yavorsky, 2020). Ultimately, the privatization of care and the persistence of breadwinner norms slow the transformational potential of the green transition within this cluster.

4.4. South-Eastern European Cluster

The South-Eastern European cluster is the most heterogeneous group, uniting Mediterranean and Balkan countries with Luxembourg[4] as a structural outlier. This group follows a fragmented policy trajectory rather than a clear welfare logic, resulting in the highest eco-social risk profile in the EU. Gender gaps here are closely tied to regional economic disparities and the lingering effects of financial crises, forming a peripheral model where the green transition risks deepen existing social imbalances without targeted intervention.

Mobility patterns in this cluster reveal the highest level of male motorization in the EU with an average GG of +8.1 p.p. (SD = 2.3) and the strongest female dependency on public transport at -10.0 p.p. (SD = 3.68). Greece represents an extreme case of female public transport dependency linked to high poverty levels while Luxembourg remains an exception where men use public transit more frequently (+5.1 p.p.) due to its specific urban structure and free service model. Housing indicators mirror this vulnerability, showing a high economic burden for women (-1.0 p.p.), while men are more likely to inhabit poor-quality dwellings with an average GG of 0.6 p.p., although the latter remains conditional due to high variance.

Labor market dynamics reveal the most severe disparities among all analyzed clusters. Technical green sectors show a systemic consolidation of male dominance with a +23.5 p.p. (SD = 2.8) employment lead and a +31.8 p.p. (SD = 5.0) graduate gap. While technical sectors are male-dominated, care sectors remain heavily feminized in both employment (-21.8 p.p.) and education (-23.9 p.p.). This cluster is characterized by a double injustice for women as they are concentrated in undervalued care sectors while men within those same sectors occupy the best paid leadership roles, leading to the highest sample-wide wage gap in favor of men at +18.7 p.p. (Porto et al., 2022).

Ultimately, the lack of integrated social protection and gender equality policies in this cluster threatens to accelerate the feminization of poverty. The massive gaps in mobility and the green economy demonstrate that the current transition trajectory lacks the necessary investment in accessibility and labor market desegregation. Without these corrective measures, the green transition in the South-Eastern periphery risks marginalizing vulnerable groups and further entrenching systemic gender-based social exclusion.

Conclusions

The European green transition is an inherently social process that acts as a mirror to societal power asymmetries. Without gender justice, the Green Deal risks triggering new forms of inequalities and conflict (Drucza et al., 2023). Therefore, gender-sensitive and intersectional policy design is a strategic necessity for ensuring the transition is resilient and fair. This study identifies four critical domains for evaluation: sustainable mobility, sustainable housing, energy transition and green labor market. A fundamental obstacle to this assessment is the systemic lack of gender-disaggregated statistics, particularly within energy transition, which limited the scope of quantitative analysis.

[4] Luxemburg is a non-typical country in the EU due to its size and other characteristics, hence often left out of the cluster analysis entirely. We keep it in the analysis and in the cluster, albite it connects to other countries in the group at the largest distance.

Quantitative findings confirm that gender gaps in mobility, housing and labor market are echoes of historically entrenched inequality. In sustainable mobility, women remain more dependent on public transport while men predominantly choose private cars as their primary mode of transport. The housing domain reveals fragmented vulnerability where women face higher cost burdens and energy poverty risks that are often hidden by household-level data. The most significant disparities occur in the green labor market, characterized by male dominance and horizontal segregation programmed within the education system. Furthermore, despite the heavy feminization of the care economy, men continue to receive higher wages within the sector, reflecting persistent vertical segregation.

Cluster analysis reveals that gender justice is heavily contingent upon welfare state models and the technocratic nature of the transition. The *North-Western* cluster shows egalitarian pragmatism (i.e. the smallest gaps in mobility and employment), but also horizontal professional segregation (i.e. persistent horizontal segregation in STEM fields of education). The *Continental* cluster exhibits a conservative compromise, i.e. moderate gaps, where developed welfare systems coexist with patriarchal family structures. The *Central-Eastern* cluster is marked by high horizontal labor segregation and significant internal variation in both domains of sustainable mobility and housing. Finally, the *South-Eastern* cluster presents the largest unadjusted gender pay gaps in the EU and a significant risk of transport poverty for women. Ultimately, achieving a gender-just green transition requires a shift toward policies and evaluation of indicators that explicitly address these structured gender imbalances across the EU.

References

Aarstad, J. (2024). Were the 2022 Summer Heatwaves a Strong Cause of Europe's Excess Deaths? Climate, 12(69). https://doi.org/10.3390/cli12050069

Aiken, S. R., Leigh, C. H. (2015). Dams and indigenous peoples in Malaysia: development, displacement and resettlement. Geografiska Annaler: Series B, Human Geography, 97(1), 69–93. https://doi.org/10.1111/geob.12066

Akgüç, M., Arabadjieva, K. (2024). Is the European Green Deal really leaving no-one behind? Exploring the intersection of gender with age, disability and migrant status. ETUI Policy Brief. https://doi.org/10.2139/ssrn.4839031

Alexander, N.-R., Cazzaniga, M., Fabrizio, S., Jaumotte, F., Li, L., Mondragon, J., Priano, S. & Tavares, M. M. (2024). Green Jobs and the Future of Work for Women and Men. International Monetary Fund. https://doi.org/10.5089/9798400286049.006 (ISBN: 979-8-40028-604-9).

Alonso-Epelde, E., García-Muros, X. & González-Eguino, M. (2024). Climate action from a gender perspective: A systematic review of the impact of climate policies on inequality. Energy Research & Social Science, 112, 103511. https://doi.org/10.1016/j.erss.2024.103511

Bardazzi, R., Pazienza, M. G. (2023). Vulnerable Households in the Energy Transition. In R. Bardazzi & M. G. Pazienza (Eds.), Vulnerable Households in the Energy Transition (pp. 1-10). Springer. https://doi.org/10.1007/978-3-031-35684-1_1

Bohnenberger, K. (2023). Peaks and gaps in eco-social policy and sustainable welfare: A systematic literature map of the research landscape. European Journal of Social Security, 25(4), 328–346. https://doi.org/10.1177/13882627231214546.

Bukowski, M. & Kreissl, K. (2022). Social and Climate (In-)Equality Perspectives within the SDGs: Introducing the Inequality and Poverty Assessment Model for a Sustainable Transformation of Housing. Sustainability, 14(23), 15869. https://doi.org/10.3390/su142315869

Carrere, J., Peralta, A., Oliveras, L., López, M. J., Marí-Dell'Olmo, M., Benach, J. and Novoa, A. M. (2021). Energy poverty, its intensity and health in vulnerable populations in a Southern European city. Gaceta Sanitaria, 35(5), 438–444. https://doi.org/10.1016/j.gaceta.2020.07.007

Carroll, P., Singh, B. & Mangina, E. (2024). Uncovering gender dimensions in energy policy using Natural Language Processing. Renewable and Sustainable Energy Reviews, 193, 114281. https://doi.org/10.1016/j.rser.2024.114281

Cavicchia, R., Friesenecker, M., Munson, L., Peverini, M., Susani, A. & Waneska De Jesus, K. (2023). Greener housing, but affordable? A study of synergies and conflicts between environmental policy instruments and access to housing. Sciences Po Urban School. https://www.sciencespo.fr/ecole-urbaine/sites/sciencespo.fr.ecole-urbaine/files/Rapport%20greenhousing.pdf

Christensen, H. R. & Hvidt Breengaard, M. (2025). Green Transport Technology and Diversity. A Guide for Danish Municipalities. Co-ordination for Gender Studies, University of Copenhagen. https://www.sociology.ku.dk/research/research-projects/green-transport/

de Madariaga, I. S., & Zucchini, E. (2019). Measuring Mobilities of Care, a Challenge for Transport Agendas. In C. Lindkvist Scholten & T. Joelsson (Ed.), Integrating Gender into Transport Planning (pp. 145–173). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-05042-9_7

Dobbins, A., & Fahl, U. (2023). Effects of Carbon Tax Redistribution Schemes on Energy Welfare of Households in Germany. In R. Bardazzi & M. G. Pazienza (Eds.), Vulnerable Households in the Energy Transition (pp. 139-172). Springer. https://doi.org/10.1007/978-3-031-35684-1_7

Drucza, K., Kaddour, A., Ganguly, S. & Sarea, A. M. (Ed.). (2023). Centering Gender in the Era of Digital and Green Transition: Intersectional Perspectives. Palgrave Macmillan. https://doi.org/10.1007/978-3-031-38211-6

Echavarren, J. M. (2023). The Gender Gap in Environmental Concern: Support for an Ecofeminist Perspective and the Role of Gender Egalitarian Attitudes. Sex Roles, 89, 610–623. https://doi.org/10.1007/s11199-023-01397-3.

OECD (2020). EPOC Survey on integrating gender in environmental policies: Reporting on key findings. Organisation for Economic Co-operation and Development. https://doi.org/trūksta.

EAPN (2024). EU 2024 Poverty Watch: Towards a systemic approach to social protection. European Anti-Poverty Network. https://www.eapn.eu/wp-content/uploads/2025/04/eapn-EU-2024-PovertyWatchReport-6131.pdf

EC (2019). A European Green Deal. European Commission. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

EIGE (2017). Economic Benefits of Gender Equality in the European Union: Report on the empirical application of the model. European Gender Equality Institute. https://doi.org/10.2839/970626

EIGE (2023). Gender Equality Index 2023: Towards a green transition in transport and energy. Publications Office of the European Union. European Gender Equality Institute. https://doi.org/10.2839/64810.

Esping-Andersen, G. (1990). The Three Worlds of Welfare Capitalism. Polity Press.

EWL (2025). For an Ambitious EU Gender Equality Policy: EWL's Recommendations to The European Commission on the EU Gender Equality Strategy Post-2025 (2026-2030). European Women's

Lobby. https://womenlobby.org/wp-content/uploads/2025/07/EWL-contribution-Gender-Equality-Strategy-consultation-FINAL.pdf

Fouillet, A., Rey, G., Laurent, F., Pavillon, G., Bellec, S., Guihenneuc-Jouyaux, C., Clavel, J., Jougla, E. & Hémon, D. (2006). Excess mortality related to the August 2003 heat wave in France. International Archives of Occupational and Environmental Health, 80(1), 16–24. https://doi.org/10.1007/s00420-006-0089-4

Fragkos, P., Kanellou, E., Konstantopoulos, G., Nikas, A., Fragkiadakis, K., Filipidou, F., Fotiou, T., & Doukas, H. (2023). Energy Poverty and Just Transformation in Greece. In R. Bardazzi & M. G. Pazienza (Eds.), Vulnerable Households in the Energy Transition (pp. 235-268). Springer. https://doi.org/10.1007/978-3-031-35684-1_10

Gervasi, O., Murgante, B., Misra, S., Rocha, A. M. A. C. & Garau, C. (Ed.). (2022). Computational Science and Its Applications – ICCSA 2022 Workshops: Malaga, Spain, July 4–7, 2022 Proceedings, Part VI. Springer Nature. https://doi.org/10.1007/978-3-031-10592-0

Gough, I. (2017). Heat, greed and human need: Climate change, capitalism and sustainable wellbeing. Edward Elgar Publishing.

Greens, T. (2021). Green Jobs: Successes and Opportunities for Europe. Retrieved from https://www.greens-efa.eu/legacy/fileadmin/dam/Documents/Publications/GND/Green_jobs_EN_01.pdf

IEECP (2022). A socially-just EU renovation wave: Recommendations for EU policymakers based on findings in 10 member states. Institute for European Energy and Climate Policy. https://europeanclimate.org/wp-content/uploads/2022/05/ieecp-socially-just-homes-summary-report-may-2022.pdf

Kawgan-Kagan, I. (2020). Gender Inequality of Innovative and Sustainable Mobility Solutions: Development of measures to bridge the gender mobility gap to overcome socially constructed gender-typical obstacles by means of free-floating e-carsharing in urban areas [Daktaro disertacija, Technische Universität Berlin].

Koch, M., Fritz, M. (2014). Building the eco-social state: do welfare regimes matter? Journal of Social Policy, 43(4), 679–703. https://doi.org/10.1017/S004727941400035X.

Kwauk, C. T. & Casey, O. M. (2022). A green skills framework for climate action, gender empowerment, & climate justice. Development Policy Review, 40(S2), e12624. https://doi.org/10.1111/dpr.12624

MacGregor, S. (Ed.). (2017). Routledge Handbook of Gender and Environment. Routledge. (ISBN 9780367352899).

Magnusdottir, G. L., & Kronsell, A. (2024). Climate institutions matter: The challenges of making gender-sensitive and inclusive climate policies. Cooperation and Conflict, 59(3), 361–378. https://doi.org/10.1177/00183672412300 11.

Mandelli, M. (2022). Understanding eco-social policies: a proposed definition and typology. Transfer, 28(3), 333–348. https://doi.org/10.1177/10242589221125083.

Martini, C. (2023). Assessing Ecobonus as Energy Poverty Mitigation Policy: Is Energy Efficiency for All? In R. Bardazzi & M. G. Pazienza (Eds.), Vulnerable Households in the Energy Transition (pp. 207-234). Springer. https://doi.org/10.1007/978-3-031-35684-1_9

Mejía Dorantes, L. & Murauskaite-Bull, I. (2023). Revisiting transport poverty in Europe through a systematic review. Transportation Research Procedia, 72, 3861–3868. https://doi.org/10.1016/j.trpro.2023.11.497

Moso-Diez, M., Mondaca-Soto, A., Gamboa, J. P. & García-Blázquez, I. (2025). A quantitative analysis of the underrepresentation of women on green occupational programmes groups within VET in Spain: A new leaking pipeline phenomenon. International Journal of Training and Development, 29(2). https://doi.org/10.1111/ijtd.12350

Nawaz, S. (2021). Energy poverty, climate shocks, & health deprivations. Energy Economics, 100(105338). https://doi.org/10.1016/j.eneco.2021.105338

Nenning, L., Bridgen, P., Zimmermann, K., Büchs, M. & Mesiaislehto, M. (2023). Climate Crisis and Social Protection - From Worker Protection to Post-growth Transformation? Social Policy & Society, 22(4), 695–714. https://doi.org/10.1017/S1474746423000246

Munoz Boudet, A. M., Buitrago, P., Leroy De La Briere, B., Newhouse, D. L., Rubiano Matulevich, E. C., Scott, K. & Suarez Becerra, P. (2018). Gender differences in poverty and household composition through the life-cycle: a global perspective. Policy Research Working Paper No. WPS 8360. World Bank Group. https://doi.org/10.1596/1813-9450-8360

Pérez-Cirera, V., López-Corona, O., Teruel, G., Carrera, F., Reyes, M., & García, A. (2017). Incorporating the environmental dimension into multidimensional poverty measurement: An initial proposition. Institute for Equitable Development. https://doi.org/10.48550/arXiv.1701.04530

Perzyńska, J., & Guzowska, M. K. (2024). The Feminisation of Poverty in European Union Countries-Myth or Reality? Sustainability, 16(17), Article 7594. https://doi.org/10.3390/su16177594

Polimeni, J. M., Simionescu, M. & Iorgulescu, R. I. (2022). Energy Poverty and Personal Health in the EU. International Journal of Environmental Research and Public Health, 19(18), 11459. https://doi.org/10.3390/ijerph191811459

Porto, N., de la Vega, P., & Cerimelo, M. (2022). Going Green: Estimating the Potential of Green Jobs in Argentina. Universidad Nacional de La Plata. https://doi.org/10.1186/s12651-023-00359-2

Punzo, G., Panarello, D. & Castellano, R. (2022). Sustainable urban mobility: evidence from three developed European countries. Quality & Quantity, 56, 3135–3157. https://doi.org/10.1007/s11135-021-01253-0

Sagaris, L. & Tiznado-Aitken, I. (2023). New horizons for sustainable transport planning: An analysis of seven years of gender-related research in Chile. Journal of Transport & Health, 28, 101544. https://doi.org/10.1016/j.jth.2022.101544

Sauer, A. & Stieß, I. (2021). Accounting for gender in climate policy advice: adapting a gender impact assessment tool to issues of climate change. Impact Assessment and Project Appraisal, 39(3), 262–273. https://doi.org/10.1080/14615517.2021.1904710

Scheiner, J. & Holz-Rau, C. (2017). Women's complex daily lives: a gendered look at trip chaining and activity pattern entropy in Germany. Transportation, 44(1), 117–138. https://doi.org/10.1007/s11116-015-9627-9

Shrestha, R. P., Mainali, B., Mokhtara, C. & Lohani, S. P. (2025). Bearing the Burden: Understanding the Multifaceted Impact of Energy Poverty on Women. Sustainability, 17(5), Article 2143. https://doi.org/10.3390/su17052143

Smidfelt Rosqvist, L., Winslott Hiselius, L. & Kronsell, A. (2024). The potential in moving mobility planning towards a feminine mobility concept. Transportation Research Interdisciplinary Perspectives, 26, 101168. https://doi.org/10.1016/j.trip.2024.101168

Soto, G. H. & Martinez-Cobas, X. (2024). Green energy policies and energy poverty in Europe: Assessing low carbon dependency and energy productivity. Energy Economics, 136, Article 107677. https://doi.org/10.1016/j.eneco.2024.107677

Stephens, J. C. (2024). The dangers of masculine technological optimism: Why feminist, antiracist values are essential for social justice, economic justice, & climate justice. Environmental Values, 33(1), 58–70. https://doi.org/10.1177/09632719231208752.

Streimikiene, D., Kyriakopoulos, G. L., Lekavicius, V. & Siksnelyte Butkiene, I. (2021). Energy Poverty and Low Carbon Just Energy Transition: Comparative Study in Lithuania and Greece. Social Indicators Research, 158, 319–371. https://doi.org/10.1007/s11205-021-02685-9

Strumskyte, S., Ramos Magaña, S., & Bendig, H. (2022). Women's leadership in environmental action. OECD Environment Working Papers, No. 193. https://doi.org/10.1787/f0038d22-en.

Tammaru, T., Sevtsuk, A. & Witlox, F. (2023). Towards an equity-centred model of sustainable mobility: Integrating inequality and segregation challenges in the green mobility transition. Journal of Transport Geography, 112, 103686. https://doi.org/10.1016/j.jtrangeo.2023.103686

Toro, F., Fernández-Vázquez, E., & Serrano, M. (2023). The Gender–energy–poverty Nexus Under Review: A Longitudinal Study for Spain. In R. Bardazzi & M. G. Pazienza (Eds.), Vulnerable Households in the Energy Transition (pp. 117-138). Springer. https://doi.org/10.1007/978-3-031-35684-1_6

Vásquez, P., Gómez, E., Gallego, V. & Potes, A. (2022). Integrating Gender Equity in Vocational Studies to Transform Agricultural Activities Towards Green and Inclusive Businesses. European Journal of Sustainable Development, 11(4), 141–157. https://doi.org/10.14207/ejsd.2022.v11n4p141

Vásquez-Vera, C., Fernández, A. & Borrell, C. (2022). Gender-based inequalities in the effects of housing on health: A critical review. SSM - Population Health, 17, 101068. https://doi.org/10.1016/j.ssmph.2022.101068

Volodzkiene, L. & Streimikiene, D. (2024). Towards Energy Equity: Understanding and Addressing Multifaceted Energy Inequality. Energies, 17(17), 4500. https://doi.org/10.3390/en17174500

Yavorsky, J. E. & Dill, J. (2020). Unemployment and men's entrance into female-dominated jobs. Social Science Research, 85, 102373. https://doi.org/10.1016/j.ssresearch.2019.102373

Annexes:

Annex 1: Eco-Social Indicators in the Four Gender-Sensitive Domains of the European Green Transition

Domain	Indicator Name (Source, code)	Period, latest	Disaggregation	Label	Usage
Energy Transition	Electricity and gas prices for household consumers (Eurostat, nrg_pc_204)	Annual, 2025	Macro level only		Excluded: lacks gender data
	Arrears on utility bills (Eurostat, ilc_mdes07)	Annual, 2024	Household type and poverty status		Excluded: lacks individual gender data
Sustainable Mobility	Consumption expenditure on transport (Eurostat, hbs_str_t211)	Every 5y, 2020	Age, income, activity, urbanisation employment and household type		Excluded: lacks individual gender data
	Most used means of transportation: Car (EIGE)	2022	Gender	**M1**	**Included** in GG analysis
	Most used means of transportation: Public transport (EIGE)	2022	Gender	**M2**	**Included** in GG analysis
Sustainable Housing	Inability to keep home adequately warm (Eurostat, ilc_mdes01)	Annual, 2024	Household type and age		Excluded: lacks individual gender data
	Housing cost overburden rate (Eurostat, ilc_lvho07a)	Annual, 2024	Gender, age, urbanisation, poverty status, citizenship, birth place	**H1**	**Included** in GG analysis Individual level indicators calculated based on the proportion of the population living in certain types of households or dwellings rather than individual housing characteristics. Indicators are not assigned solely to the head of the household but include all individuals living in the respective dwelling. This means that if an excessive housing cost burden etc. is recorded in the household, these characteristics are statistically assigned to all individuals living in that dwelling regardless of their gender, economic status or decision making power regarding the housing. In accordance with the research aim, the choice was made to analyze gender gaps at the individual level without distinguishing them by household composition or marital status.
	Population in dwellings with improved energy efficiency (Eurostat, ilc_lvhe08)	2023	Gender, age, poverty & social exclusion status, disability, urbanisation and household type	**H2**	
	Population in dwellings with leaking roof, damp or rot (Eurostat,	Annual, 2023	Gender, age, income and household type	**H3**	
Green Labour Market	**Employment in Technical and Care sectors (Eurostat, lfsa_egan2)**	Annual, 2024	Gender, age and NACE activity	**L1 (Tech) L2 (Care)**	**Included** in GG analysis **Technical Green Sectors** (NACE Rev. 2): [C] Manufacturing; [D] Electricity, gas, steam and air conditioning supply; [F] Construction. **Care Sectors** (NACE Rev. 2): [P] Education; [Q] Human health and social work activities.
	Unadjusted gender pay gap in Technical and Care sectors (Eurostat, earn_gr_gpgr2)	Annual, 2023	Gender and NACE activity	**L5 (Tech) L6 (Care)**	
	Graduates in Technical and Care fields of study (Eurostat, educ_uoe_grad02)	Annual, 2023	Gender and ISCED-F program orientation	**L3 (Tech) L4 (Care)**	**Included** in GG analysis **Technical Fields of Study** (ISCED-F 2013): [F05] Natural sciences, mathematics and statistics; [F07] Engineering, manufacturing and construction. **Care Fields of Study** (ISCED-F 2013): [F01] Education; [F09] Health and welfare. Includes tertiary and upper secondary vocational graduates.

Source: compiled by the authors based on Eurostat and EIGE databases [accessed in November 2025].
Note: highlighted and labeled indicators were selected for the analysis.

Annex 2. Cluster Analysis of the Gender Gaps in the Selected Domains of the Green Transition: Dendrogram

