



.....



Women, STEM and Just Green Future

Introduction

As the world grapples with a climate crisis, there is a global shift toward sustainability that is driving up the demand for "green jobs" across various industries. These "green jobs" focus on the development and implementation of technologies needed to tackle climate change and rely on expertise in science, technology, engineering and mathematics (STEM). While such a shift has been predicted to significantly reduce "brown" or "polluting" jobs, it is also estimated to drive the creation of millions of jobs. According to the International Labour Organization (ILO), the transition to a circular economy could create a net total of up to 24 million jobs by 2030, offsetting job losses in the high-emission sectors. For example, solar power is expected to become a leading source of energy in Europe by 2030 and the renewable energy sector is projected to support up to 4 million jobs by 2050.¹ Additionally, the EU's aim to improve building efficiency is expected to create 160,000 jobs in the energy and heating sector by 2030.²

However, as the demand for STEM and green jobs continues to grow, the supply of the workforce cannot keep up and there is currently a 29% higher hiring rate than the workforce.³ Currently, women make up 22% of the STEM workforce in G20 countries.⁴ Interestingly, despite this burgeoning demand, the following UNDP-OECD study highlights women are being employed into less than one third of positions. Additionally, those women currently working in "brown" or "polluting" jobs have less opportunities than men to reskill and transition. As such, the demand is difficult to meet, as nearly half of the possible talent is ignored. Ensuring women have equal access to education and jobs in STEM fields is essential not only for addressing labour shortages for green jobs but also for accelerating the green transition through better innovation, increasing productivity, and accelerating green economic growth. Additionally, companies with a workforce of more than 30 percent women are more likely to financially outperform those with 30 percent or fewer women.⁵

If no action is taken, the green transition will deepen gender inequality in the labour market, worsening wage gaps and career opportunities for women—while also limiting innovation and economic growth by excluding a large share of potential talent from STEM and green sectors.

^{1.} World Economic Forum. "The Future of Work in the Green Economy." World Economic Forum, 22 June 2023,

www.weforum.org/stories/2023/06/the-future-of-work-in-the-green-economy. Accessed 26 Feb. 2025.

^{2.} World Economic Forum. "The Future of Work in the Green Economy." World Economic Forum, 22 June 2023,

www.weforum.org/stories/2023/06/the-future-of-work-in-the-green-economy. Accessed 26 Feb. 2025.

^{3.} LinkedIn Economic Graph and World Economic Forum. The Green Gender Gap: Exploring Gender Disparities in the Green Economy. LinkedIn, 2023.

^{4.} Changing the Equation: Securing STEM Futures for Women. UNESCO, 2024, unesdoc.unesco.org/ark:/48223/pf0000391384.

^{5.} Hunt, Vivian, et al. "Diversity Matters Even More: The Case for Holistic Impact." McKinsey & Company, 24 June 2020,

www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-matters-even-more-the-case-for-holistic-impact. Accessed 26 Feb. 2025.

UNDP and OECD are working on a joint regional study to examine the green labour market, pathways to STEM occupations and gender in the Europe and Central Asia region⁶ answering key questions:

- 1. How accessible are green jobs for women, when measured in terms of employment shares?
- 2. To what extent do women's existing skills align with the evolving demands of the green economy?
- 3. How is the green transition expected to impact women and men workers?
- 4. How can policymakers and the private sector support a more gender-responsive and just green transition?

In the ECA region, the transition to a green economy presents distinct challenges and opportunities, particularly for women. While gender disparities in STEM are a shared issue across the globe, the pace and priorities of the transition vary. Some economies are more reliant on fossil fuels than others, while others face institutional and educational barriers to integrating women into STEM and green jobs. To tackle these challenges effectively, policies must be tailored to each country's context and ensure equal opportunities for both women and men.

STEM Pipeline Framework

To examine the intersections of the green transition, equality between women and men, and the differentiated labour market experiences of women and men, this report analyses these dynamics through the lens of the STEM pipeline. The traditional STEM Pipeline Framework⁷ is a conceptual model that tracks how individuals progress from early education to STEM careers and leadership, identifying where and why some exit the pipeline. This report updates the framework to reflect the evolving nature of today's labour market, recognizing that STEM careers are no longer accessed solely through formal education. Instead, workers increasingly enter through multiple pathways, including reskilling and upskilling, and at different time points and career transitions throughout their working lives.⁸

As the green transition is driving up the demand for STEM skills, not just for new labour market entrants but also for mid-career workers transitioning from declining industries, the STEM pipeline needs to be open at multiple entry points However, women tend to face additional barriers at all stages of the STEM pipeline, from early years through career progression. Social norms and a lack of role models discourage early interest, while structural barriers such as workplace discrimination, limited mentorship, and work-life balance constraints contribute to high attrition rates. The "leaky pipeline" effect is particularly pronounced at leadership levels, where women remain underrepresented.

- 7. Berryman, S. E. (1983). Who Will Do Science? Trends and Their Causes in Minority and Female Representation Among Holders of Advanced Degrees in Science and Mathematics. New York: Rockefeller Foundation.
- 8. (OECD, 2023)

^{6.} Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kosovo*, Kyrgyzstan, Montenegro, Moldova, North Macedonia, Serbia, Tajikistan, Türkiye, Turkmenistan, Ukraine, Uzbekistan

By analysing these "leakage points"—whether in school, workforce entry, career retention, or advancement to leadership roles—this report highlights how barriers differ depending on the stage and context, helping to shape interventions and policies that target specific barriers or lifecycle approaches that provide adaptive support to women and girls to tackle the range of obstacles they encounter in the pipeline.



Scope of the Study

This report presents key findings from Georgia, Montenegro, Serbia, and Türkiye as part of a broader regional study. It is one in a series of reports that will ultimately also cover findings from Albania, Azerbaijan, Moldova, North Macedonia, Ukraine and Uzbekistan. For Türkiye, this report draws on the microdata from Labour Force Surveys (LFS); qualitative research (e.g. interviews, focus groups and surveys) is currently ongoing and will be integrated in subsequent phases of the study.



Qualitative Quantitative How accessible are green jobs for What are key barriers and solutions for women in the labour market? women's inclusion in green jobs? Montenegro Serbia: 6 Georgia: 16 Türkiye Interviews Focus Group Discussions Serbia: 6 Serbia Database green Collabs Georgia: 5 tasks with Georgia **Online Survey** Serbia: 330 NSOs Georgia: 132 **Labor Force** O*NET Survey Voices from communities present their perspectives and recommend pathways Pathways for women in STEM and green careers **Descriptive Statistics** Transitions for green jobs Policymakers, international organizations, **Opportunities** Evaluation of gender Evaluation of skill and and educators contextualize opportunities to complement the data disaggregated data by wage distance with a region, sector, and focus on gender sector, Diverse stakeholders highlight systemic occupation region, and occupation **Key Barriers** patterns faced by women in STEM education and jobs *Non-representative sample. These findings should be interpreted as indicative, offering preliminary signals about public attitude and perception

*Nationally representative LFS

Study Progress Report

This study uses a mixed-methods approach that combines a literature review, national labour force surveys microdata, and stakeholder insights, ensuring a research approach that is both data-driven and grounded in real-world experiences.





Data on Women's Access to Green Jobs in ECA

Any analysis about green jobs faces the challenge of a lack of a universally accepted definition of what constitutes a green job. The degree to which labour markets are transitioning to green jobs depends on the definitions used. Women's representation in green employment is influenced by whether these definitions include sectors with high levels of gender segregation. Among several robust methods for identifying green jobs, a well-established task-based approach in labour economics computes a *greenness indicator* and measures the share of green-specific tasks within each occupation. The following findings provide preliminary insights into women's participation in green jobs in Georgia, Montenegro, Serbia and Türkiye - defined, based on the greenness indicator, as occupations directly engaged in deploying green technologies and reducing greenhouse gas emissions.⁹



Green employment as share of total employment by gender

Country	Men	Women	🔵 Men 🛛 🔵 Women
Georgia	3.05%	1.43%	
Montenegro	3.38%	2.07%	
Serbia	3.05%	1.96%	
Türkiye	2.90%	1.37%	

Source: own elaborations of national Labour Force Survey data, social security data for Türkiye, and O*NET data, 2022, based on OECD (2023)

9. New and emerging occupations in the green economy, that is entirely novel; occupations which develop and foster the uptake of green innovations green-enhanced occupations, that is occupations that have undergone a significant change in task content due to the greening of the economy, with tasks aimed at developing solutions for decarbonisation; existing occupations that are expected to be in high demand due to the greening of the economy, but do not undergo significant changes in their task content.

Based on this definition, our estimates indicate that green occupations emerging within the labour market comprise less than 3% of total employment and is largely in line with the OECD average equal to 2.91% of total employment (OECD, 2023)¹⁰. Montenegro reports the highest share of workers in green jobs (2.78%), followed by Serbia (2.56%), Türkiye (2.40%), and Georgia (2.34%).

Despite being in the early stages of development, a significant gender gap is already evident in green job opportunities across all four countries. On average, for every three green jobs, approximately two are held by men and one by a woman. Women's participation is particularly low in Türkiye (1.37%) and Georgia (1.43%), suggesting greater gender-based barriers to accessing green job opportunities. In contrast, Montenegro and Serbia show slightly higher women's participation, with around 2% of all employed women working in green occupations.

Which types of green jobs are most accessible to women?

Important cross-country gender differences emerge when looking at the top three green occupations, at the ISCO-08 three-digit level - that is, based on the International Standard Classification of Occupations, a system developed by the International Labour Organization to categorize jobs according to the tasks and duties involved - as women and men tend to take on somewhat different types of green jobs.¹¹

In Georgia, the top three green jobs consist of a mix of high- and medium-skilled occupations. For women, these include managerial roles in retail and wholesale trade as well as in manufacturing, mining, construction, and distribution, alongside medium-skilled occupations such as manufacturing labourers. For men, the top green jobs include highly skilled managerial positions in manufacturing, mining, construction, and distribution, and distribution, as well as medium-skilled occupations such as building frame workers and electrical installers.

In Montenegro, the top three green occupations employing women are all highly skilled professions: architects, planners, surveyors, and designers; engineering professionals; and life science professionals. In contrast, for men, the demand in the green economy is driven by a mix of mid-skilled occupations, such as electrical installers and building frame workers, alongside highly skilled engineering professionals.

In Serbia, medium-skilled green occupations almost entirely drive men's employment in the green economy, particularly in roles such as electrical installers, building frame workers, and manufacturing labourers. Women are also mostly employed as manufacturing labourers, but there is significant demand for highly skilled green jobs, such as architects, planners, surveyors, designers, and engineering professionals.

Based on analyses at ISCO-08 3 digits level for Georgia, Montenegro and Serbia, we observe that, similarly to the IMF (2024) findings for Colombia, women's participation in

green jobs tends to be more skewed toward occupations requiring higher levels of education, whereas men's participation in green jobs is more evenly distributed between middle- and highly- skilled occupations.

Lastly, as Türkiye's LFS microdata is available to researchers only at the ISCO-08 2 digits level, it is only possible to broadly identify that the main green occupations fall under the occupational groups of science and engineering professionals, production and specialized services managers and electrical and electronics trades workers.

Table 1: Top	three areen	occupations	at ISCO-08	3-digits leve	el, by gender

F	Women	Men
Montenegro	 Architects, planners, surveyors and designers Engineering professionals (excluding electrotechnology) Life science professionals 	 Electrical equipment installers and repairers Engineering professionals (excluding electrotechnology) Building frame and related trades workers
Serbia	 Manufacturing labourers Architects, planners, surveyors and designers Engineering professionals (excluding electrotechnology) 	 Electrical equipment installers and repairers Building frame and related trades workers Manufacturing labourers
Georgia	 Retail and wholesale trade managers Manufacturing labourers Manufacturing, mining, construction and distribution managers 	 Building frame and related trades workers Manufacturing, mining, construction and distribution managers Electrical equipment installers and repairers
Türkiye (ISCO-08 2-digits)	 Science and engineering professionals Production and specialized services managers Electrical and electronics trades workers 	 Electrical and electronics trades workers Science and engineering professionals Production and specialized services managers

Source: own elaborations of national Labour Force Survey data, social security data for Türkiye, and O*NET data, 2022, based on OECD (2023)

Which sector drives the demand for women workers?

Among the three broad sectors – agriculture, manufacturing and services – it is the services sector that produces most green jobs and serves as the primary "green" employer of both women and men across all four countries. This does not come as a surprise as the services sector constitutes the largest component of economic activity, accounting for more than half of the analysed countries' GDP,¹² and its role in driving the green transition has been widely acknowledged.¹³ The manufacturing sector is the second-largest driver greening the labour markets whereas the share of green jobs in agriculture remains marginal.¹⁴

Across all sectors, women are underrepresented in green jobs, with the widest gender gap in the services sector. This highlights the persistent barriers women face in accessing green employment, even in the sector that offers the highest number of opportunities, underscoring the need for targeted policies to close the gender gap in the green economy.

^{12.} According to the World Bank data, the services sector accounted for 59.6% of GDP in Georgia, 62.5% in Montenegro, 52% in Serbia and 51.7% in Türkiye in 2022. 13. (OECD, 2011)

^{14. &}quot;Framework and Tools for Assessing and Understanding the Green Economy at the Local Level." OECD, May 2011, https://www.oecd.org/content/dam/oecd/en/publications/reports/2011/05/framework-and-tools-for-assessing-and-understanding-thegreen-economy-at-the-local-level_g17a1fad/5kgc8n8n66wf-en.pdf.



Figure 1 – Share of employment in green occupations by gender and sector

Source: own elaborations of national Labour Force Survey data, social security data for Türkiye, and O*NET data, 2022, based on OECD (2023)

Do women face regional disparities in access to green jobs?

Overall, an analysis of 30 regions (11 regions in Georgia, 3 regions in Montenegro, 4 regions in Serbia and 12 regions in Türkiye) assessed the distribution of women and men in green jobs.

Green jobs appear heavily concentrated in regions with capital cities and/or central economic hubs —notably in Georgia's capital Tbilisi, in Montenegro's Central region which includes the capital city Podgorica, in Serbia's capital Belgrade, as well as in Türkiye's industrial hubs such as Istanbul, the Ege and Doğu Marmara regions.

Beyond capital regions and economic centres, green job opportunities drop sharply particularly in rural and remote areas. In Türkiye's Kuzeydoğu Anadolu region, for instance, green jobs are almost non-existent.

Women are underrepresented in green jobs across all 30 regions studied. Moreover, women's green employment appears to be more concentrated in capital city regions and economic hubs, but men's green jobs are more evenly spread across regions, including in rural areas. In other words, women have far fewer green job prospects outside major urban centres.

Do women have the same chances as men to enter green jobs?

Policies for a net-zero economy will drive both technological and organizational change. From a labour market perspective, this shift will boost demand for workers in green sectors while reducing jobs in carbon-intensive industries. The key challenge is to assess these labour market impacts and implement timely policies to mitigate any negative effects.

When it comes to reallocation of workers, literature shows that the costs largely depend on the degree of skill similarity or mismatch between origin and destination occupations (e.g., Kambourov and Manovskii, 2009; Gathmann and Schönberg, 2010; Guvenen et al., 2020). This implies that transition costs rise when the skills profile of expanding occupations – in this case green jobs – does not align with the skills profile of declining occupations – i.e. brown jobs. However, the rising demand for green occupations will need to match not only the workers' ability to carry out green tasks required for green jobs, but also to match with the worker's willingness to search for and accept job offers in green occupations. In other words, green jobs should be quality jobs offering also competitive wages, especially when compared to relatively good employment conditions of brown jobs.

Some initial insights into women's prospects for transitioning into green jobs can be drawn using two indicators adapted from OECD (2023):

- "*not possible transition*" indicator that measures the share of workers, by gender, at risk of facing a significant difficulty to transition to a green job due to a large skills gap between the brown and green occupations.
- "*not acceptable transition*" indicator that measures the share of workers, by gender, at risk of facing a significant difficulty to transition to a green job due to substantial skills mismatch and a risk of a wage decline of more than 10%, making the shift to green occupation economically not viable.

By comparing skills and wages, these indicators highlight the challenges of transitioning from brown jobs - defined as occupations with a sevenfold higher likelihood of being tied to polluting industries - to green jobs.¹⁵

^{15.} Brown jobs were defined following Vona et al. (2018). Note that the definition considers pollution intensive industries as 4-digit NAICS industries that are in the 95th percentile of the pollution intensity (measured in terms of emissions per worker) for at least three pollutants (CO2, CO, VOC, NOx, SO2, PM10, PM2.5 and Lead).

Table 2 - Estimated share of workers at risk of significant difficulty to transition to a green occupation, by gender, 2022.

	"Not possible transition" based on skills distance		"Not acceptable transition" based on skills & salary distance		
Country	Women	Men	Women	Men	
Georgia	58.3%	29.1%	61.6%	33.4%	
Montenegro	44.9%	26.7%	47.9%	30.6%	
Serbia	42.1%	26.4%	49.2%	33.5%	
Türkiye	46.4%	36.0%	51.5%	42.4%	

Source: own elaborations of national Labour Force Survey data, social security data for Türkiye, and O*NET data, 2022, based on OECD (2023)

Overall Green Transition Challenges by Gender



The analyses show that not only men currently dominate green jobs, but also for women employed in brown jobs, the prospects of transitioning to green jobs are filled with obstacles. As the transition to a net-zero economy reshapes labour markets, women employed in polluting industries face a risk up to two times higher of being left behind than their male counterparts across all four countries studied.

As shown in Table 2, if we look only at the skills gap between brown and green occupations, the share of women at risk of struggling to make the transition to a green job range from 42.1% in Serbia to 58.3% in Georgia. The transition is further deepened when wages are factored in. Once the potential wage decline from switching to a green job is factored, the share of women facing significant barriers rises to 47.9% in Montenegro, 49.2% in Serbia, 51.5% in Türkiye and 61.6% in Georgia.

The transition to a green economy is far from uniform, bringing distinct opportunities and challenges to each country. Georgia and Türkiye show relatively higher shares of both women and men facing difficulties to transition to green jobs, indicating larger skills gaps between current brown-sector jobs and emerging green-sector jobs. In comparison, Montenegro and Serbia register relatively lower shares, suggesting a somewhat better alignment of skills between brown and green jobs or potentially lower wage penalties associated with job-to-job transitions in these two countries.

Women's prospects to transition into green jobs depend not just on their skills, but also on the sector they work in and the region they live in.

Why do sectors matter for women's path to green jobs?

At the sectoral level (Figure 2), estimates for the four countries show that nearly half of the women employed in brown occupations in the manufacturing sector face significant barriers to the transition to green jobs. In the services sector, the risk is slightly lower but still substantial, with around 40% of women struggling to transition. These results highlight the need to tailor policies, such as those on upskilling and reskilling of workers, that consider both gender differences and the sectoral distribution of women workers to ensure a smooth just transition. In other terms, that implies considering that today women are predominately employed in brown occupations such as the food processing and related trades workers, garment and related trades workers, and textile, fur and leather products machine operators; whereas men are mostly employed in brown occupations like mining and construction labourers, painters, building structure cleaners and related trades workers.¹⁶



Figure 2 - Estimated share of workers at risk of having a greater difficulty to transition to a green occupation, by gender and sector, 2022.

Regions where women live matter for their path to green jobs

Finally, any analysis on the greening of the economy should not overlook that a country's economic growth and prosperity are deeply connected to its regional development. For effective green and just transition policies, it translates into the need to better understand and address regional inequalities in the process of the net-zero transition and ensuring that the regions where polluting industries are located can generate enough quality green jobs and ensure a gender equal access to these employment opportunities.

For just transition policies to succeed, it is crucial to acknowledge and address interconnected gender and regional inequalities that come with the transition to a green economy. Among others, this implies ensuring that regions with high employment shares in polluting "brown" industries are not left behind but have an enabling environment to produce quality green jobs that are accessible to all, including women.

According to the latest estimates, however, women are at higher risk of not being able to access the green employment opportunities in all 30 analysed regions. Figure 3 shows that women face higher risk of having difficulties to transition to green occupations than men due to large skills and wage gaps between current brown and green occupations. Moreover, as pointed out in the previous paragraphs, women's green job opportunities are concentrated mainly in central economic hubs, which leaves women in rural and brown industrial areas to face the toughest barriers to entry. This is quite evident in rural areas such as Türkiye's Kuzeydoğu Anadolu or Georgia's Samtskhe-Javakheti regions where green jobs are scarce and the path to transition seems even more daunting. In these areas, the lack of new green opportunities means that women, already facing significant transition challenges, are at an even greater disadvantage.

The greening of the labour markets in the four countries in this study is happening unevenly across gender and regions. In this context it will be crucial to tailor green and just transition policies, and direct investments, to mitigate barriers to green job access, particularly by addressing the gender and economic disparities between urban economic centres and rural or remote areas, where green jobs opportunities remain scarce.





data for Türkiye, and O*NET data, 2022, based on OECD (2023)

To conclude, initial analyses suggest that women are significantly underrepresented in green jobs across all analysed countries, with men holding most of these positions. Sectoral and regional disparities further limit women's access, as they are concentrated in highly skilled roles like architects and engineers, while men have more diverse entry points into both middle- and high-skilled green jobs. Additionally, women's green employment is largely confined to capital cities and economic hubs, whereas men's opportunities are more evenly distributed, including in rural and industrial areas. However, gender inequalities in green employment are not merely a labour market issue but reflect deeper systemic barriers in education and skills development. Gender disparities start early, making it essential to examine how these barriers are created from the outset and address them at all levels of education through career preparation. The following analysis examines how gender gaps in STEM education and jobs—an essential part of the green transition—develop and persist from early education to the workplace.

Data on Women's Access to Green Jobs in ECA

Early STEM Exposure and Aspirations (Youth and Adolescence)

The rationale behind career choice, progression, and opportunities, that women are currently facing in green jobs, STEM jobs, and the wider just transition appear early. These differences are shaped by entrenched social norms, systemic gaps in education, limited mentorship and role models. Research shows that while girls perform as well as boys in math and science during primary school, these factors mean they receive less encouragement at home and in school to pursue technical fields. Parents lack of awareness about growing opportunities in green jobs further reinforces these barriers. As one CSO focus group participant stated:

"If parents do not have information about STEM and green jobs, these children will be left behind."

66

CSO focus group discussant in Georgia

As well as parents, teachers reinforce different expectations for girls and boys, steering girls toward subjects perceived as "suitable" for them, such as humanities or caregiving professions, while boys are more likely to be encouraged in science, technology, and engineering.¹⁷

Beyond the classroom and home life, societal expectations, media, and social norms can further shape girls' perceptions of what jobs are "for them."¹⁸ Additionally, toys, extracurricular activities, and early social interactions play a role in skill development—with boys more likely to receive STEM-related toys like building blocks and coding kits, while girls are often encouraged toward play that reinforces caregiving and communication skills. These subtle but persistent messages reinforce status quo bias—a cognitive tendency to prefer familiar choices over uncertain ones. For example, the lack of visible women in STEM reinforces the availability heuristics, making STEM fields seem inaccessible as they are men-dominated,¹⁹ and leading girls to opt for traditionally female-dominated fields rather than exploring less familiar STEM pathways.²⁰

Across written surveys, focus group discussions (FGDs), and key informant interviews (KIIs) in Georgia, Montenegro and Serbia, respondents cited stereotypes and social norms as

- 17. UNESCO. Cracking the Code: Girls' and Women's Education in STEM. UNESCO, 2017.
- 18. Tversky, Amos, and Daniel Kahneman. "Availability: A Heuristic for Judging Frequency and Probability." Cognitive Psychology, vol. 5, no. 2, 1973, pp. 207-232.
- 19. Ibid.
- 20. "Girls' and Women's Education in STEM." UNESCO, https://www.unesco.org/en/gender-equality/education/stem.

the most significant obstacles to women's participation in STEM and green jobs. In Montenegro parents often steer girls towards traditionally "female" fields, such as humanities and social sciences, while STEM fields are seen as unsuitable for women. These perceptions begin very early in education, where girls are not sufficiently encouraged to explore their interests in science, technology, engineering, and mathematics.

However, opportunities for the few girls who do decide to continue their STEM and green education are further limited, particularly the quality of education. Stakeholders in Georgia, Montenegro and Serbia reported that early education must focus more on the knowledge, skills and attitudes of the future jobs driving the green transition. A business sector focus group discussant in Serbia underscored this concern:



Current education systems are not adequately preparing students for the demands of the green economy and modern labour market. There is a considerable decline in the quality and relevance of education, particularly in primary and preschool institutions. There is a need for reforms to include practical skills development and interdisciplinary cooperation in academic programs.

Business focus group discussant in Serbia

The urgency for education reform is evident. In Serbia, 53% of survey respondents agreed that the education system does not meet the demands of the green transition, citing poor STEM education, unprepared teachers, and a lack of practical lessons as key barriers. In Georgia, 54.5% of respondents said STEM education was insufficient and did not prepare people for STEM and green jobs. In Montenegro, 51.1% of participants noted that education was somewhat ineffective and needed improvement.

Primary and secondary education need enhancements to integrate modern teaching methods and technologies. Promoting curiosity and interactive teaching methods can improve student retention and interest in STEM fields.

Serbia government interview

Current education does not prepare [us] for the green economy. [We] learn about environmental issues in theory, [but] there are not enough practical opportunities to apply this knowledge, such as hands-on projects or internships in green industries."

Student interviews in Montenegro

Early exposure to gender-responsive STEM education can form a strong foundation for future learning, but primary and secondary education are struggling to provide effective STEM teaching.

Further to this issue, challenges persist beyond primary and secondary school. At the tertiary level, when students make career-defining choices, systemic barriers and gender stereotypes continue to limit women's access to technical pathways, particularly in fields critical for the green transition.

Do women in early adulthood have access to the skills needed for the green transition?



Existing literature shows that while girls perform the same or better than boys in math and science in primary and secondary education, their further access to STEM skills in early adulthood marks a critical juncture where inequalities between women and men widen.²¹

Gendered Enrolment Trends in Tertiary Level

Data from Georgia and Serbia illustrate the persistent disparities between women and men across STEM and non-STEM fields at the tertiary level. Data from Montenegro was not available.

Et al.	Georgia (2019)		Serbia (2023)	
Field	Female %	Male %	Female %	Male %
Arts and Humanities	79.6%	20.4%	68%	32%
Business, Administration and Law	58.5%	41.5%	65%	35%
Education	95.8%	4.2%	80%	20%
Engineering, Manufacturing and Construction	15.7%	84.3%	42.3%	57.7%
Health and Welfare	71%	29%	75%	25%
Information and Communications Technologies	20.6%	79.4%	30.9%	69.1%
Natural Sciences, Maths and Statistics	68.1%	31.9%	67%	33%
Services	44.9%	55.1%	58%	42%
Social Services, Journalism	64.6%	35.4%	68%	32%

These figures reveal a long-standing divide in STEM fields between men and women, with engineering, ICT, and manufacturing showing the highest levels of men dominance. Conversely, women are overrepresented in education, health sciences, and social sciences—fields that tend to have lower wages and fewer opportunities for high-growth careers in the green economy.

Those who do pursue STEM degrees find themselves in classrooms full of mostly men. They may feel isolated, constantly needing to prove competence in an environment where implicit biases and stereotypes still exist.²² Research on stereotype threat —

^{21.} Munoz Boudet, Ana Maria; Rodriguez Chamussy, Lourdes; Oral Savonitto, Isil; Chiarella, Christina. Women and STEM in Europe and Central Asia (English). Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/306791618914384894 22. Hill, Catherine, Christianne Corbett, and Andresse St. Rose. Why So Few? Women in Science, Technology, Engineering, and Mathematics. American Association of University Women (AAUW), 2010.

the psychological phenomenon where individuals disengage when they fear confirming negative stereotypes about their social group—suggests that the underrepresentation of women in STEM can reinforce self-doubt, negatively impacting academic performance and retention.²³

The lack of visible role models and mentors further limits opportunities for women to access academic and professional networks that are critical for success. Institutions that fail to address these gaps can risk perpetuating a cycle in which women's underrepresentation discourages future generations from entering STEM fields. A woman university student in Georgia participating in our study shared her experience:



"When we want to study IT, we face the answer that being a hacker is a male job by our teachers."

Similarly, a STEM professional in Georgia emphasized how cultural norms continue to shape career pathways:

Men in Georgia often have better access to STEM and green jobs due to a combination of historical approaches and social norms. Traditional gender roles and stereotypes discourage women from pursuing these fields from a young age, leading to fewer women in STEM and green career pipelines.

Financial barriers can be an additional hurdle. Many STEM degrees require costly materials, lab work, and extended study periods, making it difficult for women from low-income backgrounds to complete their studies.²⁴ Without targeted scholarships or financial aid programs, the cost of STEM education becomes a limiting factor, particularly for young women whose families may not prioritize their education.

Without targeted and adaptive interventions that evolve based on where women and girls are in the STEM and green job pipeline, these challenges will continue to reinforce existing inequalities, limiting both economic growth and the shift toward a more sustainable future. Bridging the gap between skills and employment requires a closer examination of sectorspecific skills gaps and how they align with the green job opportunities available in the country and which are expected to grow in demand.

Workforce transition into STEM and green jobs: Where are the women?

As highlighted in Section 3, green jobs represent a relatively small fraction of overall employment. However, they are steadily expanding as occupations in the four countries analysed, with green task content increase, driven by advancements in green innovations and solutions for decarbonization.

^{23.} Spencer, Steven J., Claude M. Steele, and Diane M. Quinn. "Stereotype Threat and Women's Math Performance." Journal of Experimental Social Psychology, vol. 35, no. 1, 1999, pp. 4–28.

^{24.} UNESCO. Deepening the Debate on Those Still Left Behind: Who Are the Unreached? Global Education Monitoring Report, United Nations Educational, Scientific and Cultural Organization, 2022

This growth is likely influenced by international pressures, particularly commitments under the Paris Agreement and their status as EU accession candidates. Georgia, Montenegro and Serbia, specifically, are aligning their labour markets with EU sustainability directives, such as the European Green Deal, which requires stronger climate policies and investments in green sectors. Additionally, increasing investor and trade requirements such as the EU's Carbon Border Adjustment Mechanism (CBAM)—are pushing businesses to adapt to low-carbon standards, further driving demand for green skills.

When it comes to specific sectors, based on the classification used by the OECD above, services and manufacturing emerge as key sectors in the green transition. When we examined perceptions through expert interviews, focus groups and surveys, we uncovered more granular insights. Across all stakeholder groups in Georgia, Montenegro and Serbia, **the most frequently identified emerging green sectors include renewable energy, energy efficiency in buildings, sustainable agriculture, environmental protection, green tourism, and waste management** (see Figure 4). However, there were certain stakeholder groups that emphasized sectors that support or enable the green transition more than others. Businesses in Georgia, for example, highlighted more policy and regulatory administration, and CSOs in Georgia identified consulting services as a top sector. The remaining stakeholders reported the technical sectors which implement solutions for the green transition.

Policymakers and CSOs reported the key green jobs in demand as waste management experts, energy efficiency specialists, and environmental protection professionals. These roles could reflect current policy priorities and sustainability initiatives driving the green transition in Georgia and Serbia. Recycling and waste management offer an example of how the green transition is expected to transform occupations across all education levels: ranging from refuse workers with elementary education to waste treatment plant operators, environmental inspectors, and circular economy specialists with advanced technical and engineering expertise. These findings should be interpreted alongside the stylised fact that gender equality in the labour market evolves alongside education levels. Therefore, it is crucial to address differences between men and women at all levels of education to ensure that women are equally represented and prepared for these growing green job opportunities. Without targeted and adaptive interventions that evolve based on where women and girls are in the STEM and green job pipeline, these challenges will continue to reinforce existing inequalities, limiting both economic growth and the shift toward a more sustainable future. Bridging the gap between skills and employment requires a closer examination of sector-specific skills gaps and how they align with the green job opportunities available in the country and which are expected to grow in demand.



Figure 4 - Top Three Green Growth Sectors Identified by Stakeholders*

*Stakeholders include businesses, CSOs, educators, and governments. Limitations occurred in collecting surveys from Business, Government and Educators in Montenegro; this limitation was compensated for through extra interviews and focus groups.

Which skills are in demand for the green transition?

The econometric modelling using O*NET dataset identified two core sets of green skills that are more strongly associated with green jobs than non-green jobs: STEM skills, which are essential for the design and production of the technology for decarbonisation, and managerial and monitoring skills, which are crucial for the implementation, monitoring, and ensuring the regulatory compliance of greening activities (Table 3).



Renewable Energy Technicians

Table 3 - Green General Skills Identified from O*NET

Engineering & Technical	 Engineering and Technology Design Building and Construction Mechanical Drafting, Laying Put, and Specifying Technical Devices, Parts, and Equipment Estimating the Quantifiable Characteristics of Products, Events, or Information
Operations Management	 Systems Analysis Evaluation Updating and Using Relevant Knowledge Provide Consultation and Advice to Others
Monitoring	Law and GovernmentEvaluating Information to Determine Compliance
Science	PhysicsBiology
	Source: OECD (2023) based on Vonna (2018).

During the qualitative data collection, stakeholders provided expanded insights into both technical and transferable skills necessary for green jobs. Their responses highlight sector-specific workforce needs and reveal important gaps in skills development, particularly in leadership and upskilling.



surveys in Montenegro, so compensated with extra interviews and focus groups

Figure 7 - Transferable (Soft) skills in demand by stakeholder type**



Despite the demand for technical expertise and adaptability, leadership experience (18.2%) and upskilling (9.1%) were among the least frequently mentioned skills across stakeholders in Georgia. This suggests a systemic gap in leadership development and career progression opportunities within STEM and green sectors.

Skills gaps and labour shortages

Labour force survey data analysis suggests that women are currently underrepresented in green jobs and that many women employed in brown occupations face greater difficulties in transitioning to green jobs due to skills mismatches. As shown in Table 2, the skills gap between brown and green occupations poses a significant challenge, potentially hindering the transition to a green job for 42.1% of women in Serbia, 44.9% in Montenegro and 58.3% in Georgia who are currently employed in brown jobs.

Perceived Skills Gaps and Labour Shortages

Most experts and focus group discussants from Georgia, Montenegro and Serbia believe that the education systems in their respective countries does not equip the labour force with the technical or soft skills required to perform green jobs. Across the countries, stakeholders report that students should be provided more practical lessons in school. This has implications on the supply of qualified workers. In Georgia, the larger businesses reported they were motivated to develop their own training academies to upskill their existing workers to address the labour shortages, but small-to-medium-sized companies have less capacity and resources to do this. The ICT company discussants in Georgia stated they were outsourcing their jobs due to the lack of adequate labour supply: We have a critical situation in STEM, energy, technical positions and ICT. The businesses are trying to solve the supply gap by head hunting labour in foreign countries, but it is costly.

The STEM hiring gap: are women given a fair shot?

Despite the challenge of labour shortages many interviewees report a lack of information about job opportunities in emerging green sectors, especially new roles created by the digital and green transitions. Additionally, hiring is not purely meritocratic—behavioural factors such as affinity bias and implicit social norms create hidden barriers for women who want to work in green jobs. Employers often rely on existing networks for recruitment, reinforcing male dominance when hiring in these fields based on assumptions about technical competency, leadership potential, or long-term career commitment.²⁵

Job seekers surveyed in Georgia, Montenegro and Serbia were asked to indicate main challenges for men and women to break into early-career green jobs:

- Difficulty Finding Entry Level Positions
- Limited Job Openings in Desired Locations
- Lack of relevant work experience or qualifications



Figure 9 - Challenges to Accessing Entry-Level Green Jobs

In both Georgia and Serbia, job seekers reported there is a lack of entry-level job openings. These insights are also supported by labour force survey data in Georgia which indicate that manageriallevel occupations in trade, manufacturing, mining, construction and distribution are driving the demand for green employment for both women and men.

One reason for the shortage of entry-level green jobs could be the relative newness of the sectors. Many green sectors-such as renewable energy and circular practices-require highly economy specialized expertise, which businesses may prioritize over developing junior talent pipelines. Because businesses are still developing their green strategies, they rely on experienced professionals to meet immediate technical and regulatory

25. European Commission. She Figures 2021: Gender in Research and Innovation. Publications Office of the European Union, 2021.

demands. The OECD Employment Outlook (2023) finds that companies transitioning to green production models tend to outsource high-skill jobs or hire experienced specialists rather than develop in-house training pipelines for early-career professionals.²⁶ This can force them to hire from elsewhere (usually abroad) which means local talent may not have the opportunity to upskill into mid-level careers.

The current supply in the labour force for green jobs is not fully meeting needs. [There are] challenges in finding candidates with the right skills for technical roles, particularly those related to sustainability and new green technologies."



Business Interview in Montenegro

Similarly, in absence of local green employment opportunities, early-career talent may move abroad to find jobs that match their skills, exacerbating the brain drain of the countries analysed, or they can find employment in occupations that do not match with their skills and for which they are often overeducated, or drop out of the labour market altogether.

This hiring preference disproportionately disadvantages women, who are already underrepresented in STEM fields. According to the 2020 ILO Green Jobs Report,²⁷ women seeking to transition into green sectors face hiring biases that favour men candidates with prior experience, reinforcing occupational segregation.²⁸ Without clear entry points into green jobs, the transition from education to employment remains challenging, particularly for women, who already face structural barriers in these fields. For women transitioning from declining industries, this creates a double disadvantage—not only do they face the broader challenges of entering green jobs, but they also contend with career disruptions (care work) that reduce their employability in new sectors. Without clear upskilling pathways and structured career progression models, many can be left behind in the green transition.

Cultural norms and gender stereotypes often stop women from studying STEM subjects, which limits their chances of getting jobs. Women also face difficulties balancing work and family, which makes it harder for them to move into leadership roles. For women running green small businesses (MSMSEs), there are challenges like getting funding, training, and networking opportunities. They also have less access to mentors and support for business growth, which makes it harder for them to succeed."

Business Interview in Montenegro



 ^{26.} Organisation for Economic Co-operation and Development. OECD Employment Outlook 2023: Artificial Intelligence and the Labour Market. OECD Publishing, 2023.
 27.

As in previous stages, in Georgia and Montenegro, most stakeholders surveyed reported that social norms was the biggest barrier for women when accessing STEM-based green jobs. The lack of female role models in STEM fields further contributes to these prejudices, creating a vicious cycle of low representation of women in these sectors.

In Serbia, stakeholders agreed that women's entry to green jobs is restricted by deepseated social norms (28%) as well as limited support to work-life balancing, particularly when it comes to (child) care responsibilities (38%). Women in Serbia continue to bear disproportionate responsibility for unpaid household and caregiving duties, limiting their ability to pursue STEM skilling opportunities, engage in continuous upskilling, or transition into new careers. According to respondents, the absence of affordable childcare and family-friendly workplace policies further restricts participation in industries that demand full-time or irregular work schedules, such as engineering, energy, and environmental management. Survey respondents in Serbia also recognized a need for stronger systemic support and resources for enhancing women's skills and knowledge in STEM and green jobs, as well as need for more efficient policies supporting women in STEM and green sectors (31%).

The Perception Gap: Are Employers Aware of These Barriers?

Interestingly, despite these structural challenges and data to show the gaps in employment between men and women, 43% of businesses surveyed in Georgia and 36% of businesses in Serbia reported that there were no barriers for women in STEM and green job access or advancement within their companies.²⁹ This suggests a disconnect between employer perceptions and labour market realities. While employers recognize skills shortages as a major challenge, many may not acknowledge how inequalities between men and women contribute to the shortages – both in terms of access to skills and recruitment.

The OECD modelling on skills distance to green jobs provides critical insights into which skills need to be prioritized and in which sectors.

Are women getting leadership roles?

Women in STEM and green jobs face significant barriers to retention and advancement, with many leaving the workforce or stagnating in mid-level positions before reaching senior roles. Particularly, there are less women when it comes to the leadership end of the pipeline. Globally, women only hold 26% of CEO positions in tech firms³⁰ and make up only one-tenth of STEM leaders, compared to one-fourth of non-STEM leaders.³¹As women progress beyond the director level in STEM, for example to VP or C-suite roles), the drop-off in STEM becomes more pronounced. Within OECD countries, women constitute only 10.6% of the STEM workforce and only 18.3% of senior leadership roles.³²

https://www.grantthornton.global/en/insights/women-in-business/women-in-tech-a-pathway-to-gender-balance-in-top-tech-roles/. 31. Global Gender Gap Report 2024. World Economic Forum, 2024, https://www3.weforum.org/docs/WEF_GGGR_2024.pdf.

^{29.} Relevant data from Montenegro not available at the time of analysis.

^{30. &}quot;Women in Tech: A Pathway to Gender Balance in Top Tech Roles." Grant Thornton, 2023,

^{32.} Gender Balance in the Nuclear Sector. OECD Nuclear Energy Agency, 2023, <u>https://www.oecd-nea.org/jcms/pl_78831/gender-balance-in-the-nuclear-sector?details=true</u>.

In a focus group discussion with STEM professionals in Georgia – again - traditional views and social norms were the overarching obstacles women face to advance to leadership positions. Participants noted a significant gap in leadership roles when comparing men to women, particularly in large companies. While greater diversity was observed at the middle-management level, women remained underrepresented in CEO and executive positions within major firms. In contrast, small and medium-sized enterprises (SMEs) were perceived to have a higher proportion of women in leadership roles. This could be due to the different promotion pathways between larger companies and SMEs. Large companies may create greater competition for advancement, reinforcing gender biases in promotion decisions. SMEs often have flatter hierarchies, potentially making leadership roles more accessible due to less rigid promotion structures. Larger companies also tend to have more entrenched traditional leadership models, where men-dominated executive networks influence hiring and promotions. SMEs, especially those founded or co-managed by women, may be more open to gender-diverse leadership.

In Serbia, surveyed business representatives identified several limiting aspects of workplace policies and organizational cultures preventing women's advancement in STEM and green jobs. They cited insufficient flexible working arrangements, limited career development opportunities, and structural barriers to promotion as contributing factors, as well as lack of diversity and inclusion initiatives within the company/institute. The underrepresentation of women in STEM leadership was attributed to traditional family roles, which disproportionately burden women and constrain their career progression. Additionally, discriminatory practices and implicit biases within professional environments were reported as persistent challenges. Notably, women managers in local governments often did not perceive gender perspectives as relevant within technical fields, potentially limiting efforts to integrate gender-sensitive policies in STEM and green sectors.

In Montenegro, the representation of women in STEM fields remains low. Leadership positions are still seen as reserved for men, and politics plays a key role in this. Business leaders again believe that cultural norms and gender stereotypes often stop women from studying STEM subjects, which limits their chances of being employed in a green job. Limited access to mentors and support for business growth also makes it harder to succeed.

A primary driver of this dropout is the unequal distribution of unpaid care work, which disproportionately falls on women and limits their ability to remain in or advance within demanding STEM fields. Even when women remain in the labour market, they are more likely to take on part-time roles, lower-paying positions, or transition to less technical career paths to balance work and family responsibilities. This trend contributes to the persistent gender leadership gap in STEM and green sectors, where few women hold decision-making roles despite their increasing presence in STEM education and entry-level jobs. If women disproportionately exit STEM and green sectors, the country will face ongoing skills drain.

Policy Recommendations

This report offers a gender-responsive lens for navigating the green and just transition one that recognizes systemic barriers, sector-specific dynamics, and cultural contexts across the Europe and Central Asia region. While the following recommendations are rooted in the insights gathered from Georgia, Serbia, and Montenegro, we invite policymakers, educators, and employers across the region to adapt them to their own contexts.

A green and just transition requires more than simply preparing the labour force for new technologies. It requires transforming the social, institutional, and economic ecosystems that have historically excluded women from full participation in STEM and green sectors. In all four countries, there is a foundation for greening the economy through existing policies and institutional frameworks. However, implementation is hampered by lack of coordination, capacity and resources according to stakeholder interviews, focus group discussions and surveys. Our report highlights four interconnected areas of action—building the pipeline, bridging education and employment, advancing women's careers, and strengthening cross-border collaboration.

Building the Pipeline: Early Exposure

Shared Priorities

Across all three countries, stakeholders stressed the need to integrate green economy principles and gender equality into early and formal education systems.

- **Reform** school and university curricula to reflect sustainability, emerging green technologies, and interdisciplinary STEM learning; mainstream courses that integrate gender and civic education to build inclusive, sustainable values early on.
- **Invest** in continuous professional development for educators to improve instruction in STEM and stay up to date with new technologies and build awareness of gender biases

Recommendations in Context

- Serbia emphasized subjects like green chemistry.
- Montenegro focused more on making the **business case** for inclusion and improving data to track readiness and progress.
- Georgia stakeholders highlighted the importance of local partnerships with CSOs to reach vulnerable and rural women to **transform social norms**.

Bridging Education & Employment: Transition to Workforce

Shared Priorities

There is consensus on the critical role of industry–education and private-public partnerships to ensure that education systems are aligned with green labour market needs.

- **Expand** hands-on, practical learning opportunities for women and girls in both urban areas and in the regions, in green sectors in demand.
- **Develop** accessible training programs for digital literacy, e-commerce, and emerging technologies as part of reskilling, upskilling and lifelong learning opportunities for women.
- **Encourage** collaboration between employers and education providers to create job pathways for women.

Recommendations in Context

- Serbia called for leveraging **public-private partnerships** in renewable energy and environmental sciences.
- Montenegro focused on increasing awareness of existing cross-border initiatives, suggesting that **visibility and accessibility** remain key barriers.
- Georgia stakeholders emphasized the need for **data systems** to track women's transitions from education into the green workforce.

Retaining and Advancing Women in STEM Careers

Shared Priorities

All three countries recognize that workplace reform is essential to retain women in STEM fields and support their advancement:

- Promote flexible work arrangements and normalize for both men and women.
- Formalize care work, provide paid leave, and ensure access to affordable childcare.
- Enact and enforce wage transparency laws and anti-discrimination policies.
- Promote role models, mentorship programs, and leadership pathways for women.

Recommendations in Context

- Serbia proposed introducing **financial incentives** for gender-inclusive hiring and leadership development, as well as targeted support for women-led green startups.
- Montenegro stakeholders emphasized **role modelling and shadowing programs** to change social norms and inspire younger generations.
- Georgia respondents underscored the importance of **intersectionality**, urging policies that consider rurality, disability, and ethnicity alongside gender.

Strengthening Regional and Cross-Border Collaboration

Shared Priorities

There is regional agreement on the value of cross-border cooperation to foster inclusive green labour markets.

- **Strengthen** mentorship networks and women-in-STEM alliances across borders targeting emerging green sectors.
- **Expand** scholarships, study visits, and regional skills-building platforms targeting green sectors.
- **Secure** sustained funding for women's participation in STEM, particularly from donors and governments.

Recommendations in Context

- Montenegro and Georgia both reported that cross-border initiatives are growing but remain underfunded and underutilized. Stakeholders called for **stronger government support and visibility.**
- Serbia provided concrete examples of successful regional platforms (e.g., WISE, SRNA) and suggested expanding these to support **cross-border mentorship and startup** ecosystems.
- Montenegro stakeholders proposed developing a tool to demonstrate the economic benefits of women's inclusion in STEM for the green economy, making the business case more compelling for **regional cooperation**.