IRENA
International Renewable Energy Agency

RENEWABLE ENERGY

A GENDER PERSPECTIVE

SECOND EDITION

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ABOUT IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as the principal platform for international co-operation, a centre of excellence, and a repository of knowledge on policy, technology, resources and financing related to renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

www.irena.org

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Abbreviations

CSO	civil society organisation
DEI	diversity, equity and inclusion
IRENA	International Renewable Energy Agency
NDC	Nationally Determined Contribution
NGO	non-governmental organisation
PV	photovoltaic
SDG	Sustainable Development Goal
STEM	science, technology, engineering, mathematics
TVET	Technical and Vocational Education and Training

Francesco La Camera | *Director-General, IRENA*

Foreword

As nations strive to shift away from fossil fuels and towards renewable energy sources, the conversation has largely focused on technology, finance, profit and infrastructure. However, the energy transition is not just about megawatts, capacity and generation – it is also about people, the planet and the world we are building for future generations.

Behind every solar panel installed, every wind turbine constructed and every clean cooking stove delivered is a story – and too often, that story is missing the voices of women. Women are the backbone of communities, and are often the first to feel economic shocks and the weight of energy poverty. Yet they remain under-represented in design, deployment and decision-making processes related to renewable energy systems.

In many parts of the world, where communities lack equal access to electricity and modern fuels, women struggle with additional burdens, having to spend time collecting wood or putting their health at risk by using polluting cooking systems. They are also often deprived of the training and financial resources that would empower them to be full participants in the energy economy and workforce. Even in the more developed markets, women occupy only a fraction of technical, management and policy roles in the renewables sector.

This report is both a reflection and a call to action. Through original survey data and qualitative insights, it reveals the gender disparities woven through the renewable energy sector, from the barriers that women face in accessing basic energy services, to the glass ceilings they encounter in renewable energy careers. But beyond the gaps, we highlight the extraordinary potential women embody and the role they can play as agents of change in the transition.

Gender-equitable energy policies should be neither a side issue nor an afterthought. They are essential to achieving energy access, climate resilience and economic justice. By mainstreaming inclusion in all programmes, policies and stages in energy planning, deployment and investment, we can unlock innovation, expand market opportunities and build energy systems that serve entire populations more effectively.

Although better information and awareness alone does not guarantee action, the road to a just, inclusive and sustainable energy future begins with better data, and with the political will to ensure that nobody – be they woman, man or child – is left in the dark.

About the *A Gender Perspective* series

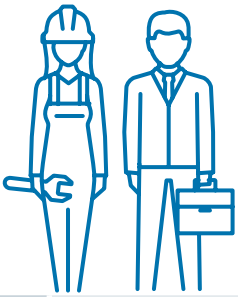
IRENA has examined the question of gender equity throughout the renewable energy sector in an array of publications that address the socio-economics of the energy transition. The Agency has also issued dedicated reports to mainstream the gender dimension, recognising that the topic merits undivided attention, and that the issue requires tailored action.

The first stand-alone gender brief, published in 2017, was prepared in collaboration with Bloomberg New Energy Finance (BNEF) and the Clean Energy Business Council (CEBC), and presented results from a survey conducted exclusively in the Middle East and North Africa region.

In 2019, the first global report dedicated to gender in renewable energy, Renewable Energy: A Gender Perspective, was released. The report examined gender equity across different technologies. Building on a groundbreaking survey of employees, companies, and institutions, the study quantified the share of women in the workforce and highlighted significant opportunities for greater gender balance in the global energy transformation.

Early in 2020, a new publication was focused on the wind energy sector. It was followed by a report on the solar photovoltaics (PV) industry, and shortly afterward by a study on decentralised solar PV for a selected group of countries in 2024.

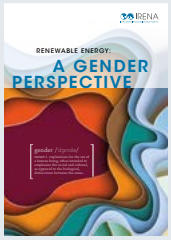
This new edition updates the global figures for the entire sector and offers recommendations to advance gender equality throughout the energy transition.



Gender assessments

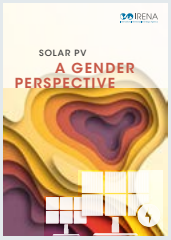
2017

2019



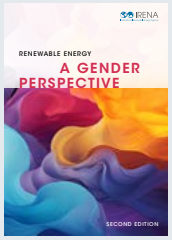
2020

2022



2024

2025



RENEWABLE ENERGY
A GENDER PERSPECTIVE
Second Edition

Executive summary

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The global transition to renewable energy is the key to reduce greenhouse gas emissions and mitigate climate change. Provided the right policies are put in place, it is also a promising way to improve livelihoods, create millions of decent jobs, and open new economic opportunities, while increasing energy security. The International Renewable Energy Agency (IRENA) estimates that the renewable energy workforce (16.2 million strong in 2023) can expand to 30 million jobs by 2030 and nearly 40 million by 2050, under a pathway aligned with the Paris Agreement's target to keep global temperature rise within 1.5 degrees Celsius. Beyond renewable power generation, relevant industries such as energy efficiency and energy flexibility could generate tens of millions of additional jobs. This unprecedented expansion requires holistic policy frameworks to reshape and improve labour markets worldwide.

Yet, the question of who truly benefits from this transformation still remains. Despite progress, women and other typically marginalised groups continue to be under-represented in renewable energy employment. Gender-wise, the sector performs better than fossil fuel industries, but it still mirrors many of the inequalities that pervade the global economy. This Second Edition of the report, *Renewable energy: A Gender Perspective*, provides an updated picture of women's roles in renewable energy, the barriers they face and the measures needed to enable their full participation. Building on IRENA's 2019 flagship study, to assess the share of women in the overall renewable energy sector, this report draws on a global survey of individuals and organisations, offering insights into both quantitative patterns and lived experiences.

The findings underscore that gender equity is a matter not only of justice but also of effectiveness: the energy transition cannot achieve its goals if half of humanity is excluded from shaping it.

Millions of people work in renewable energy, a rapidly expanding sector creating new jobs worldwide.

Women's role in renewable energy

IRENA's analysis shows that women hold 32% of full-time jobs in the renewable energy sector. This is higher than in oil and gas (23%) or nuclear energy (25%), demonstrating that renewables are comparatively more inclusive. However, this share still falls far short of women's global workforce average of 43.4%, meaning that nearly one in nine potential female workers is absent in the renewable energy sector compared to the economy at large (Figure S1).

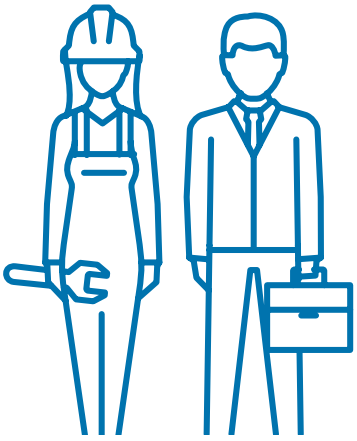
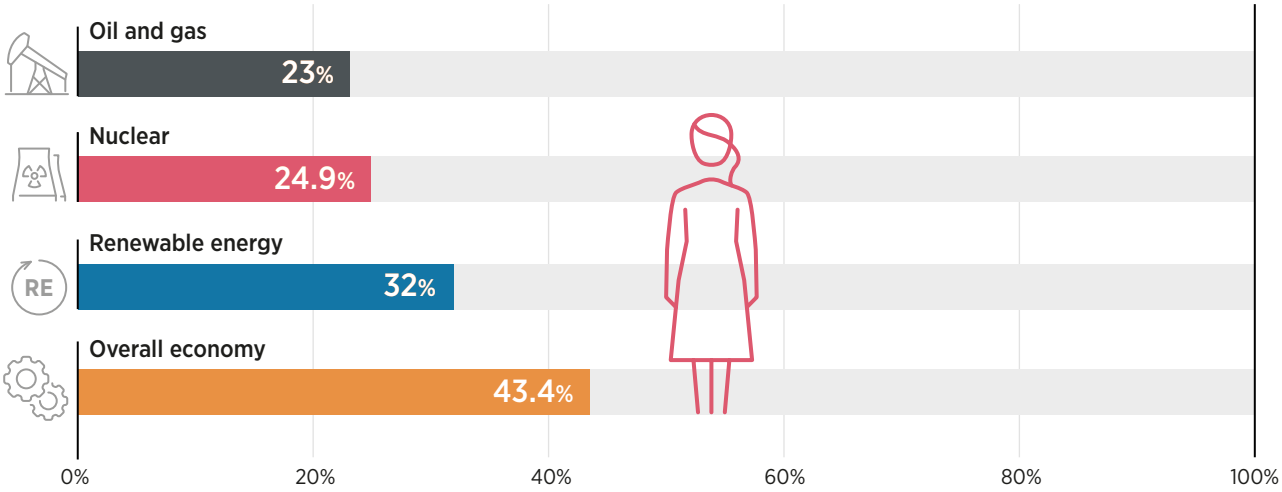


Figure S1 Female share of employment across the energy sector and overall economy



Based on: IRENA Global Survey; Hughes-Plummer *et al.*, 2023; NEA, 2023; LinkedIn, 2025.

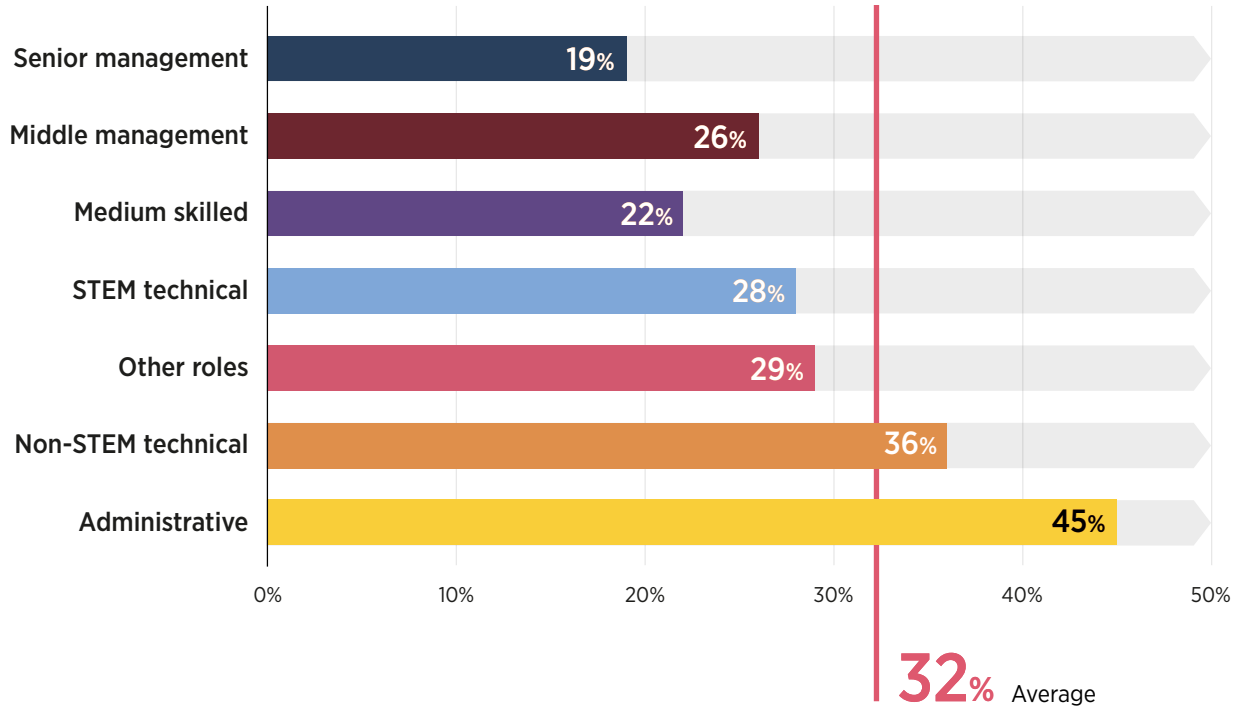
Averaging 32%, the share of women in the renewables workforce is higher than in traditional energy sectors.

Importantly, the definition of the sector boundaries also influences perceptions. When narrowly defined as direct employment in manufacturing, operations and installation, women's participation in renewable energy drops to 25%. When broadened to include project development, services, research, and education, the share rises to 32%. In energy access contexts, particularly off-grid projects led by non-governmental and community organisations, women's participation approaches 35%. While these broader definitions highlight important contributions, they risk overstating women's involvement in the economic core of the industry.

However, this report confirms our previous analysis – mirroring the situation in the overall economy – that women's representation in renewable energy is uneven across job categories. Jobs held by women are highly concentrated in administrative roles, which account for 45% of female employment in the sector, and in non-STEM[1] technical positions such as legal roles, where they make up 36% (Figure S2). By contrast, women comprise only 28% of STEM-related roles (including engineers, data scientists, and technical specialists, for example) and just 22% of medium-skilled jobs such as solar installation and construction. At the highest levels of decision making, women are even scarcer: 26% of middle managers are female, as are only 19% of senior managers or board members. This imbalance illustrates the persistence of a "glass ceiling" that limits women's influence on strategic and technical aspects of the energy transition.

1 STEM = science, technology, engineering and mathematics.

Figure S2 Female share of full-time employment in renewable energy, by role



As is true with the type of skills required for the role, the type of work performed seems to influence the proportion of female employment (Figure S3).

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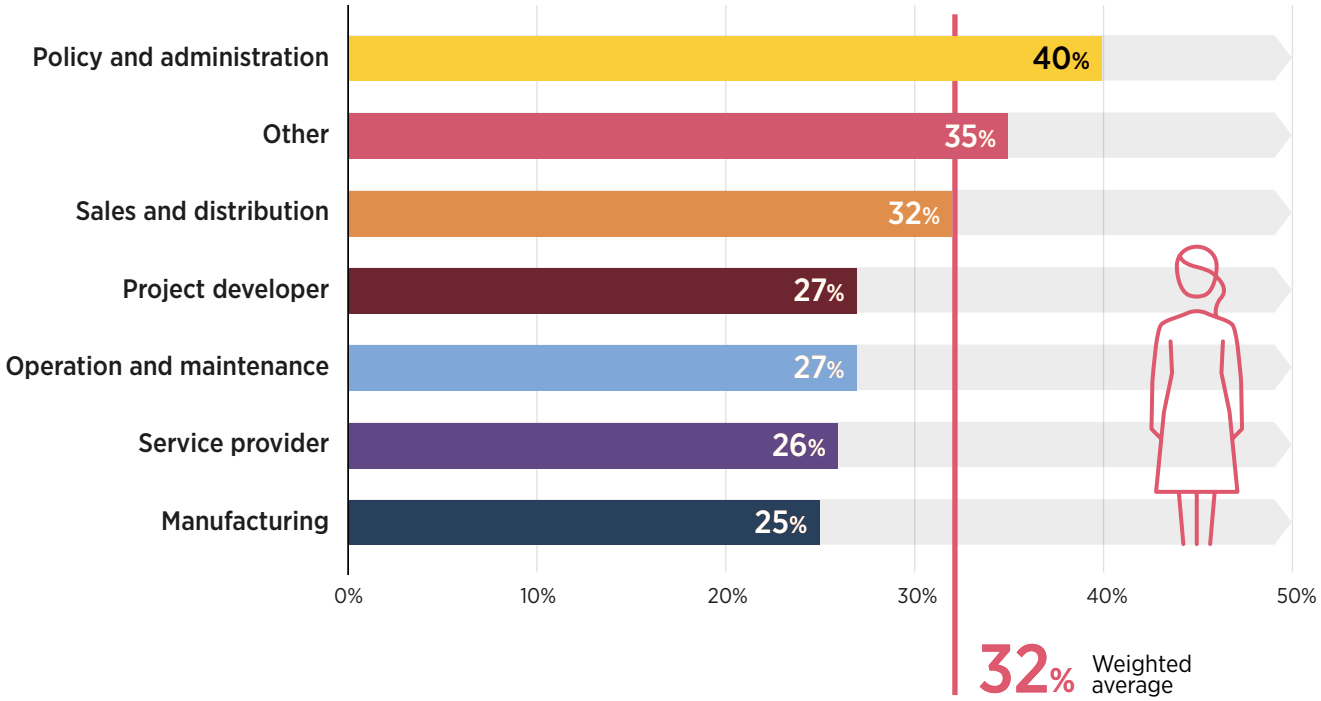
Women remain concentrated in administrative roles, while their presence in STEM and leadership positions lags far behind.

Figure S3 Female share of full-time employment in renewable energy, by activity



Organisation type is another determinant of gender balance. Private enterprises, which dominate the narrower definition of renewable energy employment, report the lowest female share at 25%. By contrast, non-governmental and civil society organisations report nearly 48% female participation, while government and non-commercial organisations average 37% (Figure S4).

The **share of women in renewable energy depends on the type of employer**: it is lowest in private sector companies and highest in NGOs.


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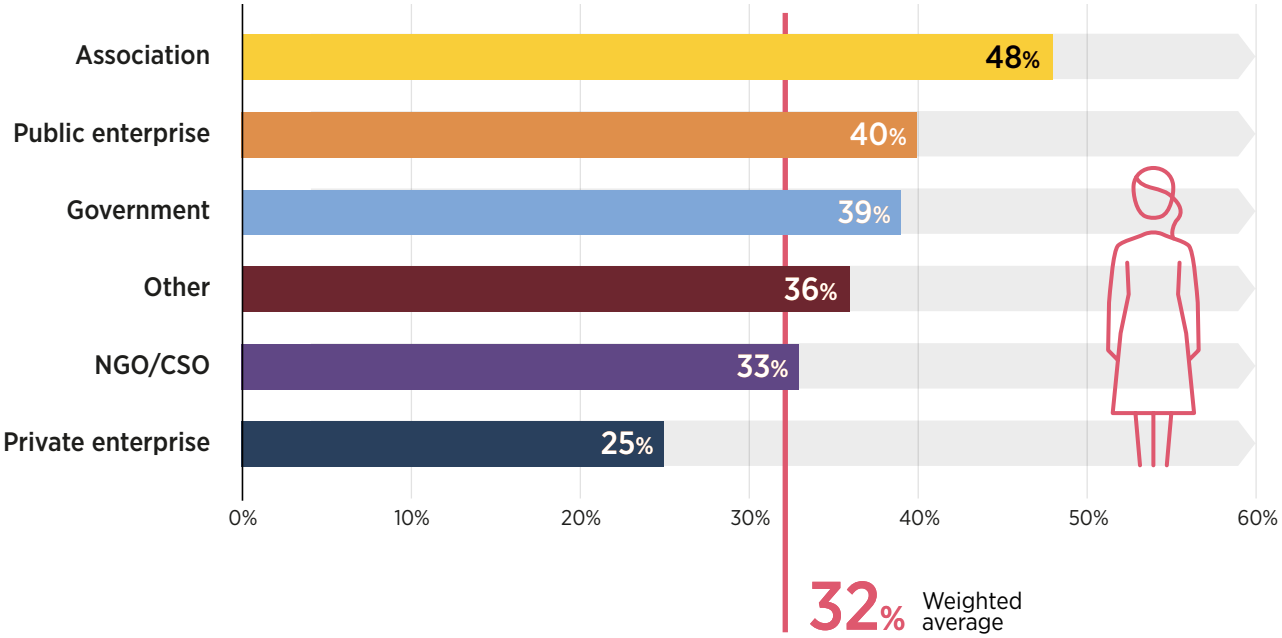
Figure S4 Female share of full-time employment in renewable energy, by type of organisation



Notes: CSO = civil society organisation; NGO = non-governmental organisation.

Regional differences are relatively modest. Africa and the Asia-Pacific region report slightly higher female participation at 33%, while Europe and North America record the lowest at 27%. These variations are not statistically significant, pointing to a global pattern of under-representation rather than region-specific disparities. Whether in advanced or emerging economies, women's access to the renewable energy workforce is consistently constrained.

The analysis also shows that smaller organisations tend to have more gender-balanced workforces, while larger firms report declining female shares as size increases. This suggests that workplace culture and institutional design matter as much as the sector itself. Furthermore, the analysis shows that part-time work provides both opportunities and risks. While this may enable flexibility for workers balancing care responsibilities, part-time positions are often associated with lower pay, fewer benefits and limited career progression. Unless carefully designed, part-time employment can entrench rather than reduce inequalities.

Women's under-representation in the renewable energy sector is not confined to a single country or region, but **reflects a global pattern that cuts across geographies.**

Barriers to women's entry, retention and advancement

The under-representation of women in renewable energy is not due to a lack of interest or ability but is the result of systemic barriers at multiple levels. The survey highlights three categories of obstacles: workplace barriers, societal constraints and academic barriers.

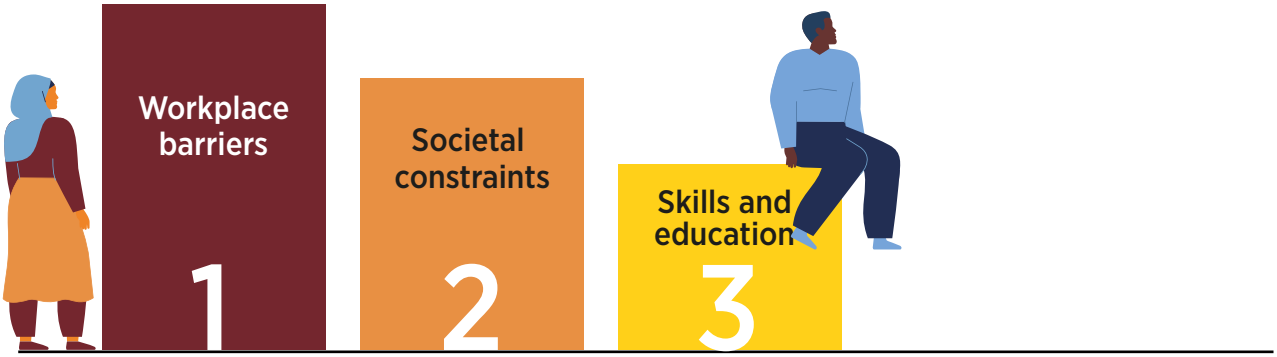
Workplace barriers were rated the most significant by survey respondents, with the perception of a "glass ceiling" highlighted as the most acute for women seeking leadership positions. Additional barriers included gender bias in recruitment, the absence of gender and diversity targets, inflexible work arrangements, mobility requirements, inadequate facilities and a lack of family-friendly policies.

Systemic barriers, not lack of talent or interest, **keep women out of the renewable energy workforce.**

Nearly 45% of female respondents reported experiencing gender-based discrimination in the workplace. Examples ranged from being overlooked for technical tasks and promotions, to inappropriate comments and harassment. These barriers varied by region and level of experience, with respondents in Latin America and more experienced professionals reporting higher discrimination levels. Yet, the survey also showed that only a minority of those cases were reported, and even fewer resulted in organisational action, with many respondents reporting a lack of confidence in reporting mechanisms and hinting at fearing inaction or retaliation.

National-level laws[2] were not seen as crucial for retention but were considered a barrier to entry, particularly in countries with restrictive labour laws and limitations on women's rights. Larger organisations tended to rate barriers lower, perhaps due to more standardised practices and resources to enforce gender-equality measures. Education also played a key role: women with lower qualifications reported facing more challenges, suggesting that expanding access to training and higher education could help improve opportunities. Overall, the survey shows that barriers to women's participation grow over time (in other words, becoming more pronounced with greater years of experience, accumulating as women progress in their careers), requiring targeted policies and organisational change to ensure equal opportunities across all career stages.

2 National-level laws or policies refer to government legislation that affects women's workforce participation, either by enforcing restrictions on job access, working hours, industry participation, mobility (e.g. travel without a male guardian), access to resources such as land, capital, or technology, and education and training, or by removing such restrictions to promote equal opportunities.



Societal constraints form a deeper, structural layer of barriers, ranked second by the respondents. Cultural expectations around caregiving, entrenched stereotypes about women's capabilities, and a lack of visible role models shape career choices and self-perception. Many women internalise self-doubts about their suitability for technical or leadership roles. In some regions, discriminatory laws further restrict women's participation, such as prohibitions on working night shifts, requirements for male guardians' approval to travel, and unequal rights to own property and access finance. These constraints underscore how renewable energy cannot be isolated from broader gender dynamics in society.

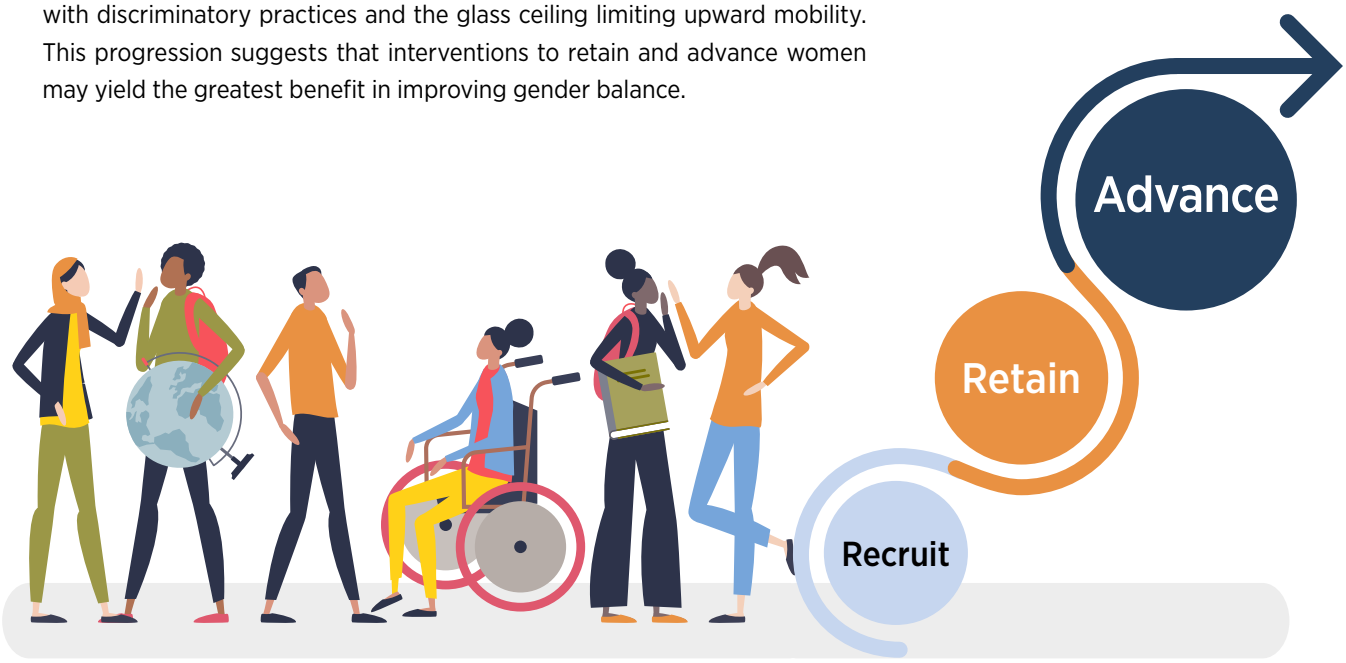
Demographic differences also emerged: respondents from Europe and North America, as well as those in larger organisations, tended to downplay the importance of societal barriers compared to those in Africa and Asia-Pacific. Unlike workplace barriers, societal constraints did not show clear patterns related to experience or educational background, implying that broader cultural and legal reforms, alongside education at the population level, are necessary to address these systemic issues and foster greater inclusion in the sector.

Women face workplace, societal, and educational barriers at every stage, growing steeper over time.

Academic barriers begin early in life and are continually reinforced. The survey emphasises that while girls' education is crucial for development, global disparities persist, particularly in secondary education, vocational training, and STEM pathways, all of which are essential for renewable energy careers given the diverse requirements of the workforce. Women often face a "leaky pipeline", where they leave STEM-related fields at various stages, despite achieving high rates of post-graduate education in many regions. The survey respondents highlighted a missing link between education and employment due to the lack of structures to support women's career growth. These include mentorship and networking opportunities as well as leadership training, which was rated as the most significant obstacle to progress in the career ladder into senior roles, where advancement programmes are scarce and often inaccessible.

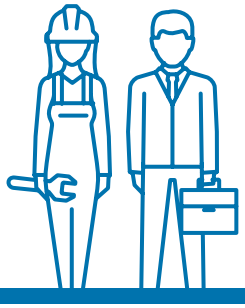
Regional and demographic patterns were consistent with earlier findings: participants from Europe, North America and larger organisations gave lower scores overall. Respondents with higher qualifications also reported fewer barriers, pointing to the protective effect of education. Addressing these challenges requires improving girls' access to education, promoting STEM engagement, expanding technical and leadership programmes, and fostering mentorship and networking systems. The persistence of interconnected issues, such as the gender pay gap, further illustrates how workplace, societal, and academic barriers reinforce one another, trapping women in lower-paying positions and perpetuating inequality.

Results also show consistently that barriers accumulate and worsen over time. At the **entry stage**, women face bias in recruitment and cultural stereotypes. During **retention**, challenges intensify, particularly for women balancing professional roles with caregiving. At the **advancement** stage, barriers peak, with discriminatory practices and the glass ceiling limiting upward mobility. This progression suggests that interventions to retain and advance women may yield the greatest benefit in improving gender balance.



In addition, there are barriers that arise as consequences of the previously mentioned categories. These barriers are deeply interconnected and persist despite efforts to isolate and address their underlying causes. A notable example is the **gender pay gap**[3] that comes from several factors including gendered workplace dynamics due to the absence of robust equal pay measures, and a reliance on individual negotiation to determine pay scales. Broader societal constraints also play a role in shaping the pay gap, with implicit biases that unfairly disadvantage certain groups. Finally, academic barriers contribute as well: while it is reasonable for roles with lower levels of responsibility to command lower pay, individuals with limited access to education will typically find themselves trapped in lower-paying positions, perpetuating cycles of inequality.

The survey shows that pay inequality remains a stubborn reality, with 68% of individuals surveyed believing that men are paid more than women for similar roles, although only 32% of organisations admitted to such disparities. The gap was most often attributed to differences in negotiating power, the absence of standardised pay scales and biased promotion practices. While some differences can be explained by variations in job type or seniority, a significant portion reflects unjustified inequities. Without standardised compensation systems and transparency, these gaps are likely to persist, perpetuating structural disadvantages for women.



68% of individuals surveyed believe that **men are paid more than women** for similar roles.

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3 The pay gap reflects overall differences in earnings across groups. Some pay differences are legitimate (due to experience, role or performance), but others stem from bias and create unfair gaps.

Women in the energy access context

Energy access, while it should be a basic right, is still far from being a reality. Without urgent action, hundreds of millions of people, disproportionately women, will remain without modern energy services even by 2030, when commitments under the Sustainable Development Goals (SDGs) promised substantial progress. Addressing both energy poverty and gender inequality together is essential for achieving SDG 5 (gender equality) and SDG 7 (universal energy access).

In this energy access context (which is characterised by efforts to expand access to modern energy services), women's roles are both vital and under-recognised. Survey data suggest that women make up 35% of employees in organisations focused on energy access, mainly non-governmental organisations (NGOs), civil society organisations (CSOs) and government agencies. Yet this institutional perspective does not fully reflect reality: women are central to energy use and management in households and communities. They bear the brunt of energy poverty, spending hours collecting fuelwood or cooking with polluting fuels, with significant consequences for their health, education and livelihoods.

Women make up 35% of employees in organisations focused on energy access, mainly non-governmental organisations and government agencies.

At the same time, women are agents of change in decentralised renewable energy systems. Programmes that engage women as sales agents, maintenance workers and micro-grid managers consistently report higher adoption rates, better system sustainability and broader social benefits. However, too often inclusion is token-centric, with women being present but not heard or empowered. "Transformative participation", recognises women as decision makers and co-creators rather than as passive beneficiaries. IRENA's pilot projects in indigenous communities illustrate how participatory approaches can integrate women's perspectives and generate lasting socio-economic benefits.

Measures to "engender" the energy transition

Diversity, equity and inclusion (DEI) strategies are proven drivers of stronger business performance, yet recent political pushback has undermined DEI initiatives globally, threatening women's rights in many countries. In the renewable energy sector, advancing gender equality requires robust data, targeted interventions and collaboration across multiple levels of society.

Governments bear primary responsibility for creating enabling conditions for gender equity in the renewable energy sector, and in the broader society. This includes enacting and enforcing laws on non-discrimination, equal pay, and access to land, finance, and education, while protecting women against violence. Governments must also raise awareness, promote advocacy and advance equity to protect the most disadvantaged.

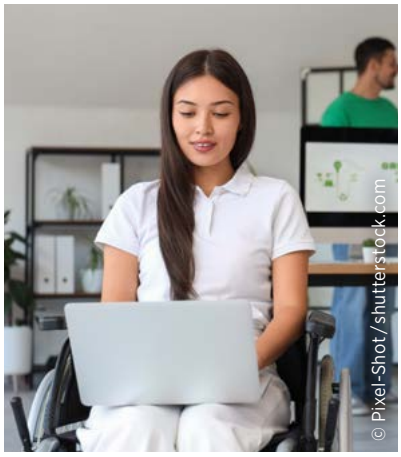
Gender mainstreaming is essential: gender-sensitive data collection in the energy sector ensures accountability and tailored policy action; gender energy audits can highlight gaps and enable targeted solutions; and gender budgeting would integrate equality objectives into national finance systems, ensuring that climate and energy spending benefits all groups equitably. Gender mainstreaming in broader climate policy can also be key, by embedding gender considerations into Nationally Determined Contributions (NDCs) beyond a simple mention. Although NDCs now reference gender, many remain weak on concrete actions.

Employers should do their part to improve workplace practices. Employers play a critical role in addressing persistent challenges in recruiting and retaining women (issues reported by 42% of surveyed organisations). Key measures can include:

- Work–life balance policies (flexitime, remote work, job sharing, childcare support).
- Family support (extended maternity/paternity leave, childcare facilities).
- Professional development (mentorship, training funds, sponsorship programmes).
- Safe, respectful workplaces (zero-tolerance harassment policies, sensitivity training).
- Fairness and inclusion (transparent recruitment, pay equity, gender diversity targets, inclusive language).

Results show that women participating in the survey rated the gender equity efforts of their employers at 69/100, appreciating the company efforts, but hinting that more can be done. Employees indicated in the survey that they strongly prefer measures supporting work–life balance, fairness and inclusion, and career development. However, many policies remain unevenly applied, especially for part-time workers, where availability is far lower.

Governments, employers and other actors, and even society at large, all play a role in dismantling gender inequity.



Other actors, beyond governments and employers, can be key to supporting gender equality in renewables:

- Inter-governmental organisations such as IRENA, UN Women, and the International Labour Organization (ILO) establish norms, support gender mainstreaming in energy policies and provide technical/funding support.
- Civil society is key to amplify women's voices, build capacity and hold institutions accountable. This includes women's networks that provide mentorship, visibility and leadership opportunities across technologies and regions. Examples include the Global Women's Network for the Energy Transition (GWNET), Women in Geothermal (WING), Women in Green Hydrogen (WiGH), and regional and national groups such as REDMEREE in Latin America and WiSER in the United Arab Emirates. IRENA's new HERHub platform aims to connect these networks to amplify impact.
- Trade unions are key to negotiating inclusive policies, to ensure women's representation in leadership and to advocate for systemic reforms.
- Educational institutions can dismantle stereotypes, promote STEM careers, and provide scholarships and mentorship, ensuring that women transition smoothly into the workforce.

Last, but not least, **society at large** is also critical to break down systemic barriers, deeply ingrained gender norms, and unequal domestic responsibilities that limit women's participation in renewables and in other sectors. Achieving equality requires cultural transformation. Campaigns must promote shared care work, celebrate women leaders and challenge harmful stereotypes. Women's solidarity coupled with men's active allyship is critical. Individuals need to challenge their own bias and support equitable systems, making gender justice a collective responsibility.

Female solidarity, combined with **male support**, is critical to overcoming gender inequity.

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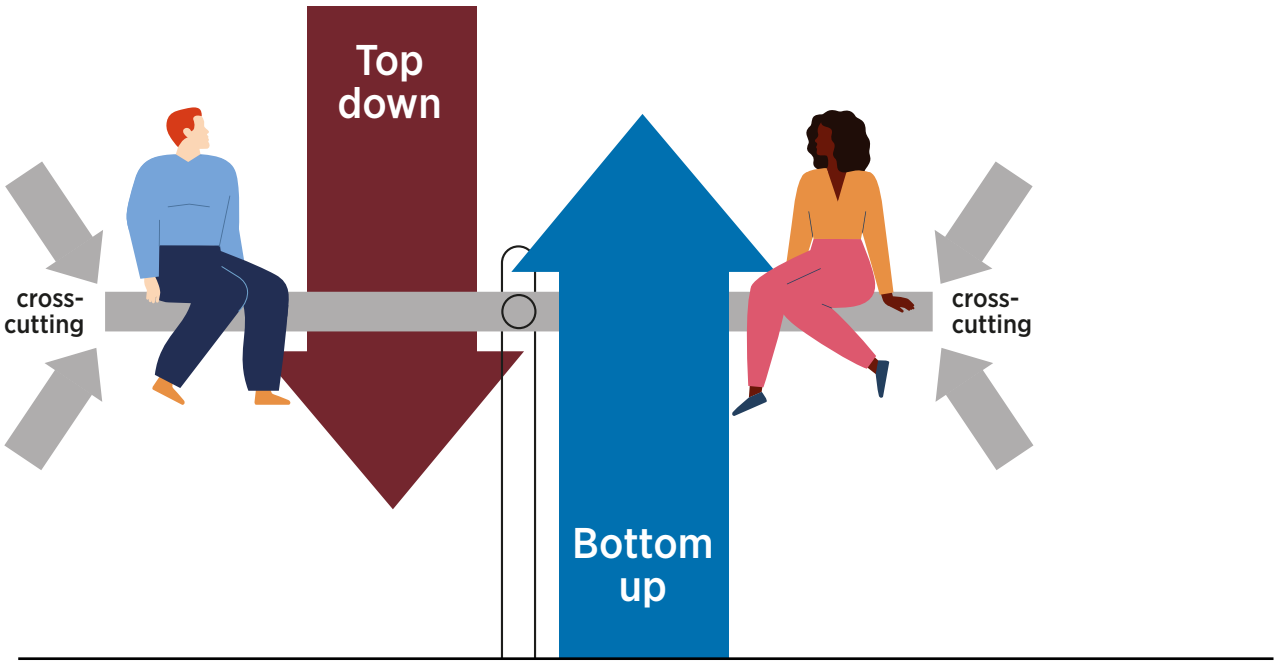


The way forward

The renewable energy transition represents a great opportunity to build not only a cleaner energy system but also a fairer society. But this will not happen automatically. Gender equity must be deliberately and systematically pursued through **top-down** action (political leadership, regulatory reform and gender-sensitive energy policies), **bottom-up** strategies (through community empowerment, inclusive programming and participatory project design) and **cross-cutting** initiatives (by mainstreaming gender across every stage of energy planning, financing and implementation).

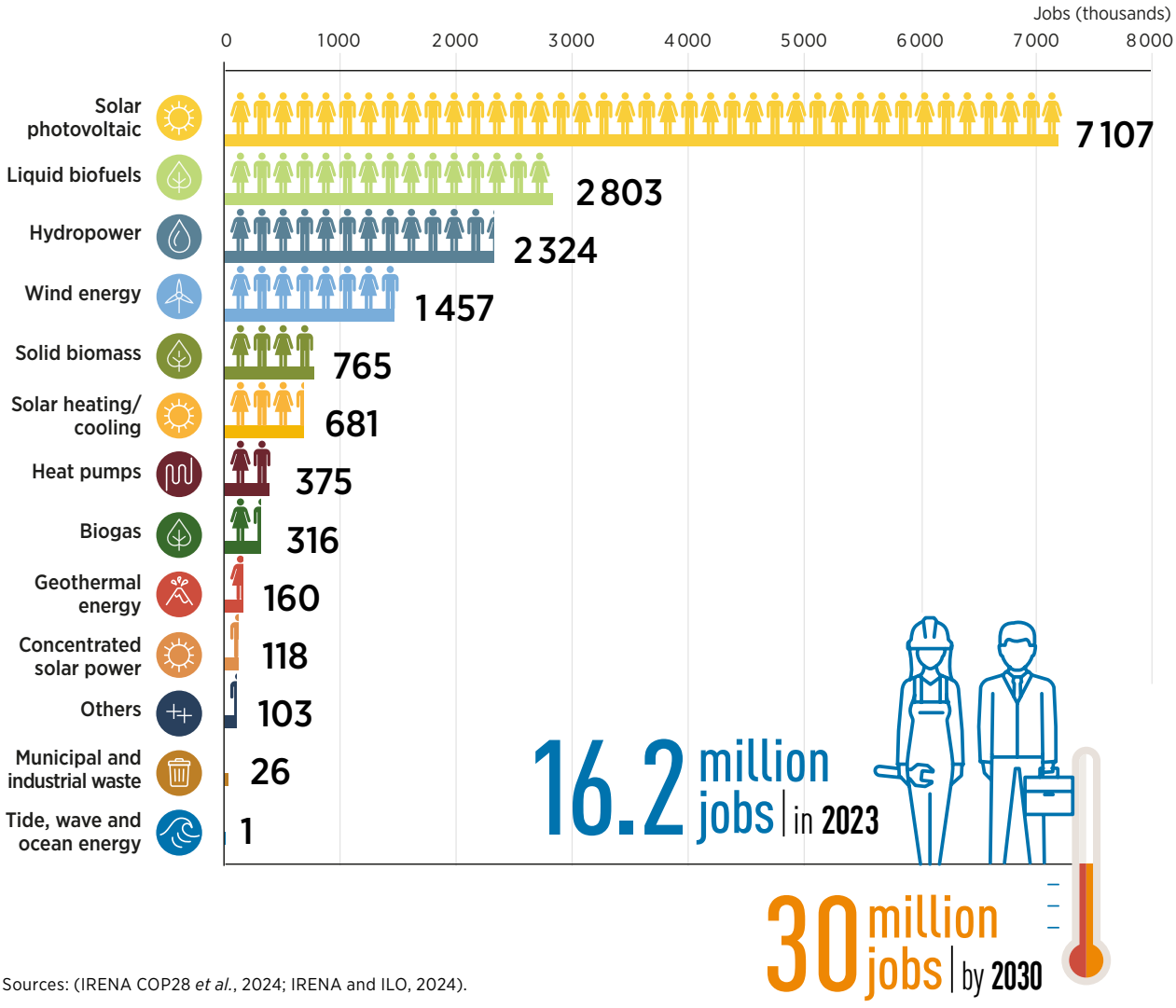
While this is a matter of fairness, it also makes economic sense, and in sum, the energy transition cannot succeed if women remain marginalised. The clean energy economy must be built not just on renewable technologies, but also on inclusive institutions. Ensuring women's equal participation will not only accelerate the transition but also make it more resilient, equitable and enduring. The future of renewable energy must be shaped by all and deliver for all: the greatest measure of success does not lie in the megawatts installed, but in the lives that renewable energy empowers and transforms.

Introduction

Renewable energy and related industries have been one of the world's most dynamic job creation engines in the last decade and are expected to grow even faster in the coming years. Driven by climate targets, steadily declining technology costs, rising investment, and growing concerns about energy sovereignty, the sector is expanding much faster than the labour markets that feed it.

According to estimates from the International Renewable Energy Agency (IRENA), the global renewable energy workforce climbed to 16.2 million people in 2023, up 18% from the previous year (IRENA and ILO, 2024). Under a pathway compatible with the Paris Agreement goal to keep global temperature rise within 1.5 degrees Celsius (°C), the Agency estimates that employment could reach around 30 million jobs by 2030 – more than double today's level (Figure 1) – and around 40 million by 2050 (IRENA, 2024a).

Figure 1 Jobs in 2023 and expected in 2030 in a pathway consistent with the Paris Agreement



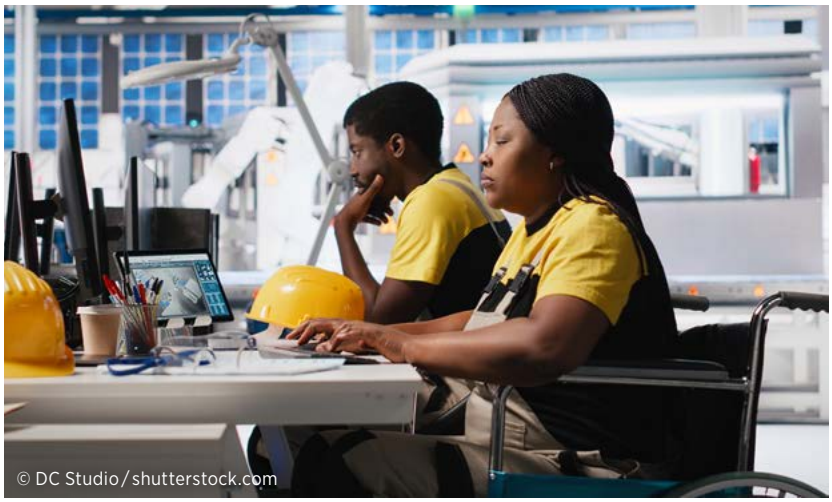
Sources: (IRENA COP28 *et al.*, 2024; IRENA and ILO, 2024).

These opportunities extend across the entire renewable value chain, but also across other industries related to the energy transition. IRENA estimates that sectors such as energy efficiency could reach 50 million jobs by 2030, and jobs in flexibility almost 27 million by the same year, encompassing both large utility-scale projects and decentralised solutions such as mini-grids, rooftop photovoltaics (PV) and clean cooking technologies (IRENA, 2024a).

The demand for employees is growing across the renewable energy value chain, from upstream planning and material procurement to component manufacturing, project development, construction, installation, grid integration, operations and maintenance, and end-of-life recycling. Renewable energy offers many entry points for workers of many educational backgrounds, from high-skilled roles (engineers, data scientists, finance and policy specialists), to medium-skilled trades (electricians, welders, tower climbers, solar installers), to more administrative roles. IRENA has analysed and mapped these requirements for selected technologies (Figure 2).

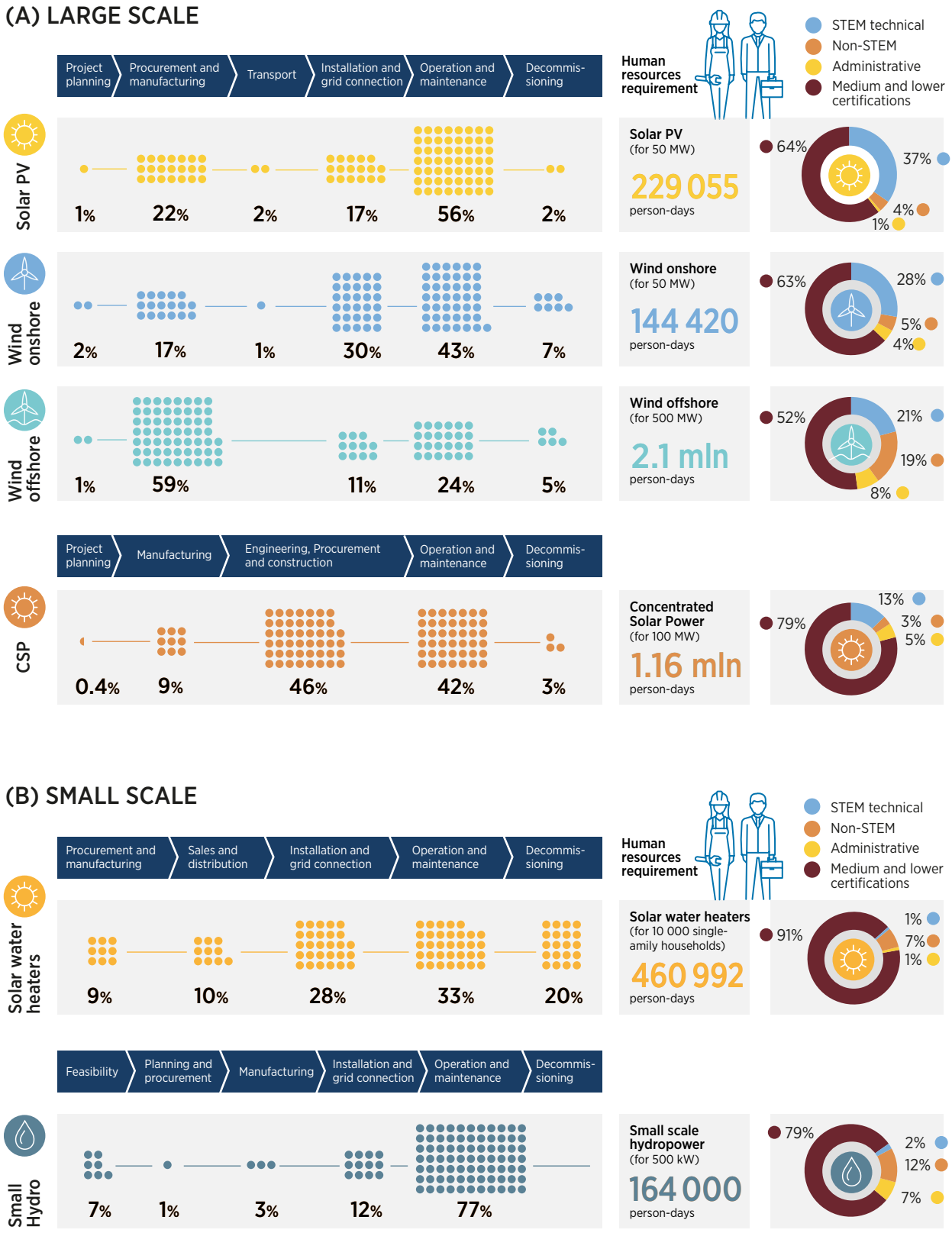
With the rapid expansion of renewable energy and the transition away from fossil fuels, skill demand is outpacing supply (LinkedIn, 2024). IRENA's work has been highlighting for over a decade that educational misalignments and persistent labour and skills shortages are increasing and are likely to become more widespread unless pro-active measures are taken.

There is already evidence showing that organisations trying to hire skilled workers struggle to find qualified applicants for nearly every occupation, with installation and repair technicians topping the list. For example, the Engineering Construction Industry Training Board's (ECITB) workforce census report revealed that in 2024, 81% of renewable energy employers in the engineering construction industry (ECI) were experiencing challenges hiring workers, compared to 71% in the wider ECI in the United Kingdom (Fantini and de Leon, 2024). This is even more acute when trying to recruit women, as this study highlights in the following sections.



As renewable energy rapidly expands, the **shortage of skilled workers** threatens to slow the clean energy transition.

Figure 2 Human resource requirements along the renewable energy value chain and occupational patterns for workers in (a) large-scale and (b) decentralised selected technologies



Source: (IRENA, 2017, 2018, 2021, 2023, 2025).

Notes: CSP = concentrated solar power; kW = kilowatt; mln = million; MW = megawatt; STEM = science, technology, engineering and mathematics.

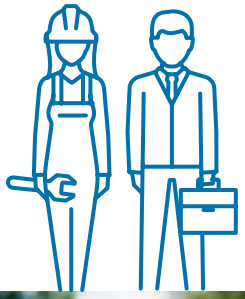
Addressing the skills shortage gap requires a deep understanding of labour market dynamics, long-term commitments and a strong talent development strategy that anticipates workforce challenges. These strategies need to be holistic and multi-level, ranging from modernising university programmes that integrate renewable energy considerations and ensuring vocational and technical education aligned with industry certification standards, to creating dual training and apprenticeship models that blend classroom learning with hands-on experience and provide continuous professional upskilling and reskilling, especially for workers transitioning from fossil fuel sectors (IRENA and ILO, 2024). Additionally, social dialogue and workers' and citizen engagement is crucial to bring employees and communities together, particularly since evidence shows that, in some cases, workers themselves display little enthusiasm for roles labelled as "green jobs" (IDRIC, 2025).

Social dialogue is crucial to bring employees and communities together.

In least-developed markets, additional considerations need to be taken into account, such as recognising informal jobs, ensuring proper access to training programmes, and enabling on-the-job learning pathways, which are often the entry point for young individuals. But all these strategies will fail if the talent pool is restricted to men. Efforts need to be put in place to ensure that under-represented individuals (which includes women, youth, Indigenous people, persons with disabilities and other marginalised communities) are also part of the skilling efforts so they have a chance to be the workforce of the future. By broadening and diversifying the talent pipeline today, governments, industry, and education providers can ensure that renewable energy not only powers the planet but also is the engine of equitable and lasting prosperity for millions of people worldwide.

This report aims to serve as a base to support inclusivity efforts for women in the renewable energy sector through the following arc:

Section 1 provides a clear picture of the role of women in renewable energy. **Section 2** examines the barriers that women face in the sector. **Section 3** presents the recommendations and measures that remove these barriers and enable women's full participation in the workforce. **Section 4** shows a path towards a more inclusive renewable energy workforce – one that helps remove systemic barriers and prevent attitudes that perpetuate gender inequalities, not only in the renewable energy sector but in society at large.



RENEWABLE ENERGY
A GENDER PERSPECTIVE
Second Edition

Women's role in renewable energy

1

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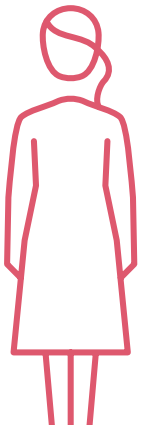
01

As countries ramp up investments in clean technologies, and as associated jobs continue to grow, there is a unique opportunity to redesign energy systems to be more diverse, inclusive and fair. However, this requires intentional strategies based on high-quality data that ground the complex dynamics and that identify emerging and persistent structural barriers in sectors undergoing rapid transformation, such as energy. Data collection may not by itself trigger action but serves as the foundation for evidence-based policy making and is needed for tracking progress and assessing the true impact of these policies. Consistent and comprehensive data are not just useful, they are indispensable.

Historically, data collection in the energy sector has focused primarily on capacity and generation metrics, overlooking emerging challenges and their social impacts. IRENA has taken a leading role in moving beyond measuring gigawatts by also examining employment figures and the participation of under-represented groups, namely women, in the energy workforce. Without robust gender-disaggregated data, efforts to build inclusive energy systems risk failing or being misguided from the get-go.

This section aims to address the persistent gap in gender-disaggregated data by presenting findings from a global survey designed to examine women's participation in the renewable energy sector. The survey, an update to IRENA's groundbreaking 2019 study, collects both quantitative and qualitative data from individuals and organisations worldwide (Box 1). It provides a deeper, updated view of gender[4] dynamics in the sector, offering insights into employment patterns, role distribution and organisational characteristics based on the responses collected after conducting a statistical analysis. This evidence forms the basis for targeted recommendations that support greater gender equity in the clean energy workforce.

The transition is a unique opportunity to redesign energy systems to be more diverse, inclusive and fair.



4 *For the purposes of this report and analysis, gender refers to women and men. "Other" was offered as an additional response option; however, only three respondents selected this category, which did not warrant disaggregating their responses separately. Therefore, for the analysis, "other" was integrated into the "female" responses, as those who identify as "other" will most likely face similar if not greater obstacles than women.*

Box 1 IRENA Global Gender Survey

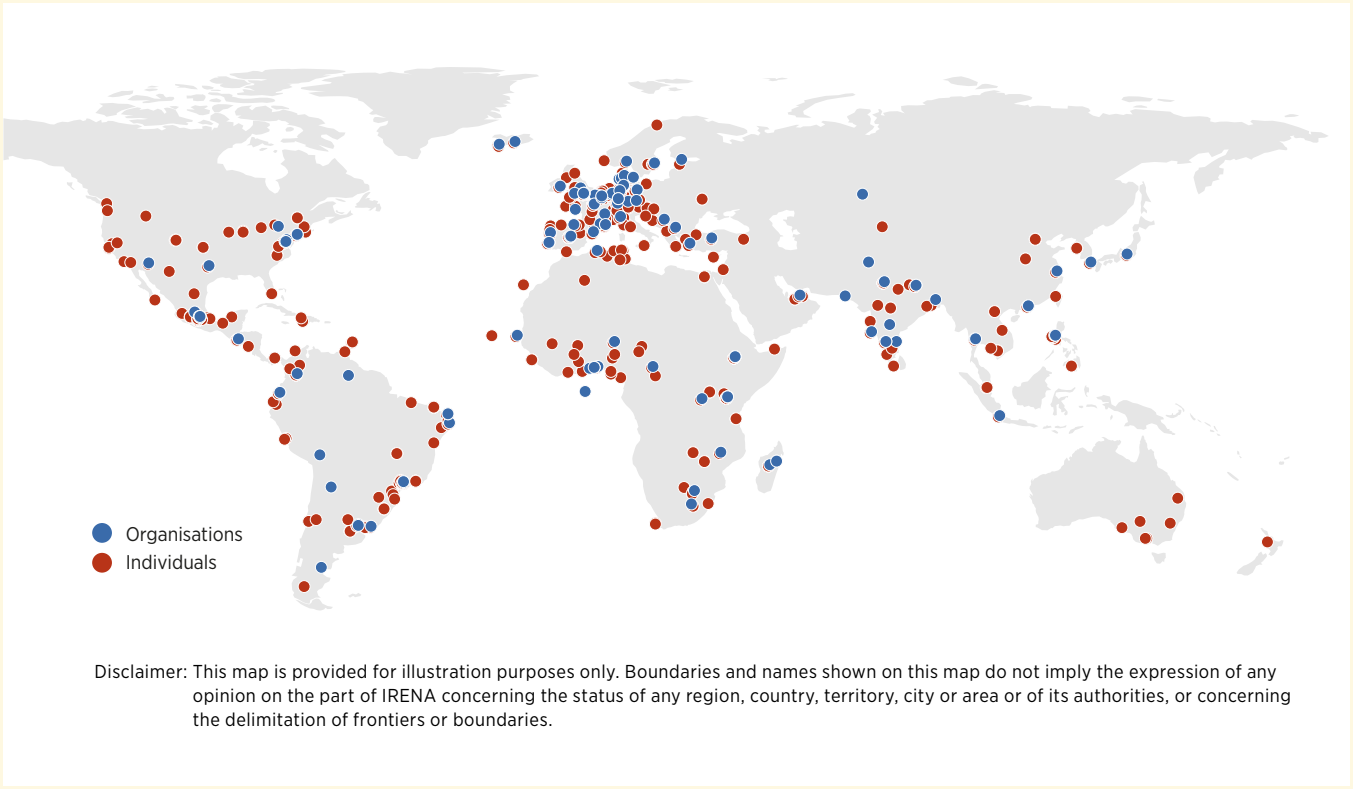
The data come from a global online survey conducted to gather quantitative and qualitative information about women's participation in the renewable energy sector, the challenges faced by females working or wanting to work in the sector and suggestions to improve gender diversity.

Respondents could complete the survey by replying either as individuals or as representatives of their employers (organisations). For representatives of organisations, the survey asked for more quantitative information about the gender distribution in the organisation's workforce and the policies and measures used to support greater gender diversity. For individuals, information was collected about their perceptions of the main barriers and challenges to attracting and retaining women in the workforce, as well as suggestions for potential solutions to some of these problems.

Organisations and individuals from 119 countries and areas participated in the survey, and responses covered most of the world (Figure 3).

For more details on the representation, demographics and limitation of the survey, see the Annex.[5]

Figure 3 Location of survey respondents



Disclaimer: This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

5 Please note that previous publications and other data sources referenced in this report were based on different survey questions and/or methodologies. Therefore, strictly speaking the figures presented here are not directly comparable. Nevertheless, different sources and data points are presented together for illustrative purposes. See the Annex for more information on the methodology of the presented survey.

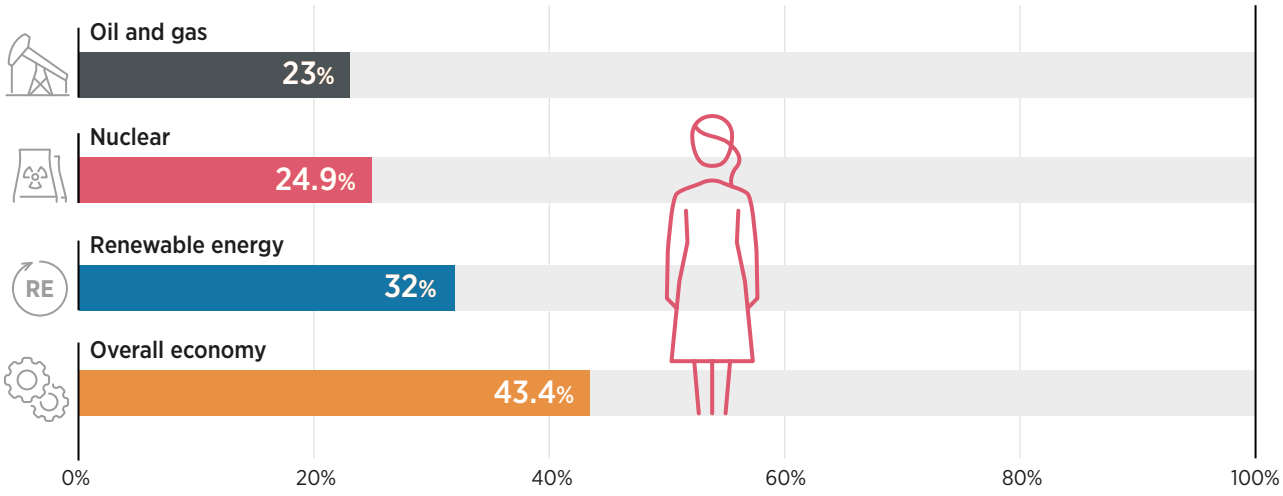
1.1 Women's share in the renewable energy workforce, globally and by region

IRENA's 2019 flagship analysis of workforce diversity, focused specifically on gender, found that while the renewable energy sector performs better than the broader energy industry, women remain under-represented – with their contributions under-recognised – and far from achieving equal participation (IRENA, 2019). Despite IRENA's advocacy efforts since the first analysis, the new study shows that women continue to be under-represented in the renewable energy workforce. The new global survey results show that women still remain at the mark of 32% of full-time positions in the renewable energy sector.[6]

Renewable energy holds significant promise, and women are better represented in its workforce compared to the traditional oil and gas sector – where female participation was estimated at 23% as of 2023 (Hughes-Plummer *et al.*, 2023) – or the nuclear sector, where it stood at 24.9% (NEA, 2023). However, female participation in renewables is still far from the global average for women in the overall economy, estimated at 43.4% in 2024 (LinkedIn, 2025) (Figure 4).

Women's share of full-time positions in the renewable energy sector remains at **32%.**

Figure 4 Female share of employment across the energy sector and overall economy



Based on: IRENA Global Survey; Hughes-Plummer *et al.*, 2023; NEA, 2023; LinkedIn, 2025.
Note: Other sources (LinkedIn) estimate the oil and gas share at 24.8%.

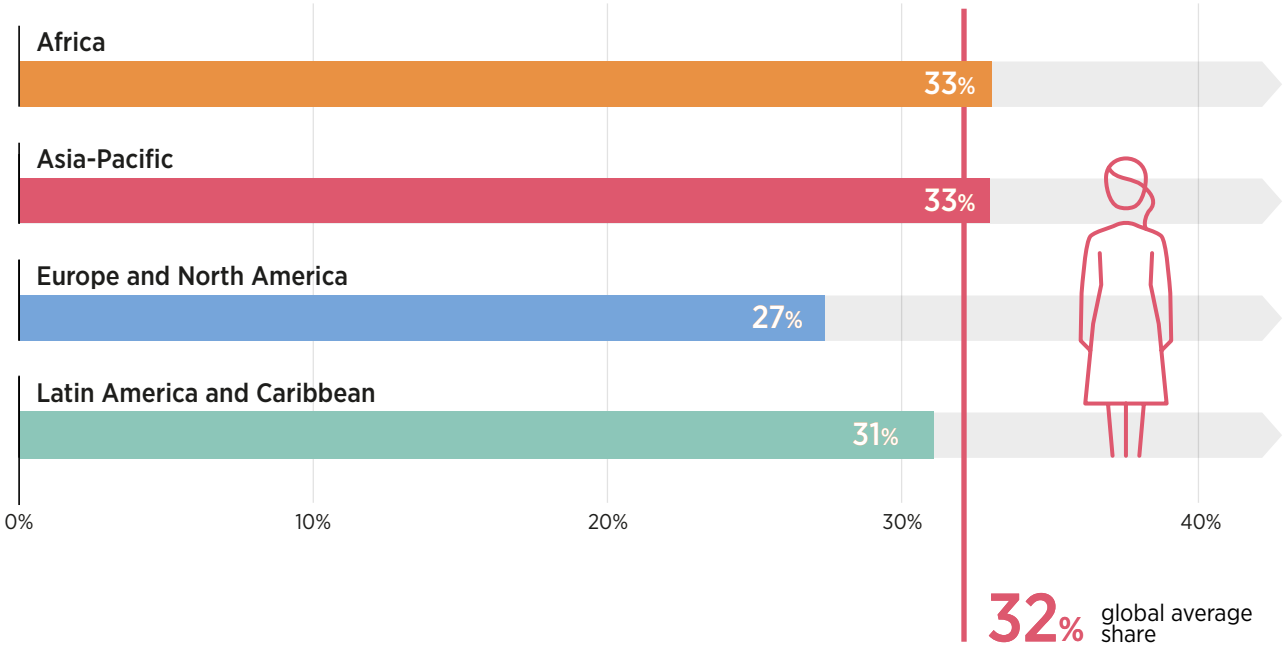
6 *For the estimation, the question on the share of full-time female employment in organisations was asked by bands of 10% each (i.e. 0-10%; 11-20%; 21-30%, etc.). Based on the mid-points of those bands, the global average weighted was calculated. The average is weighted to remove over and/or under-representation compared to the workforce distribution as IRENA's Renewable Energy and Jobs – Annual Review estimates.*

Notably, this 32% average masks considerable variations across technologies, roles, regions and types of organisations. For example, organisations working across various or all renewable energy technologies reported the highest average female share of employment (38%), while those focused solely on a single technology reported much lower shares. This could be partly because the large-scale manufacturing operations of these specific technologies tend to be male dominated.

Yet, analysis reveals that the specific technology focus of an organisation does not greatly influence gender outcomes once other factors (such as organisation size and activity type) are controlled for. This highlights a broader point: barriers to gender equity in renewable energy are less about the technical field itself and more about organisational cultures, recruitment practices and systemic gender norms embedded across the value chain (see section 2).

Across the world's regions,[7] the share of women in renewable energy employment remains clustered around the 32% global average. Africa and Asia-Pacific reported female participation levels that are slightly above average (33%), while Europe and North America recorded the lowest levels (27%) (Figure 5). However, these regional differences are not statistically significant, suggesting that gender disparities in the renewable energy workforce are a global issue rather than a regional anomaly.

Figure 5 Female share of full-time employment in renewable energy, by region



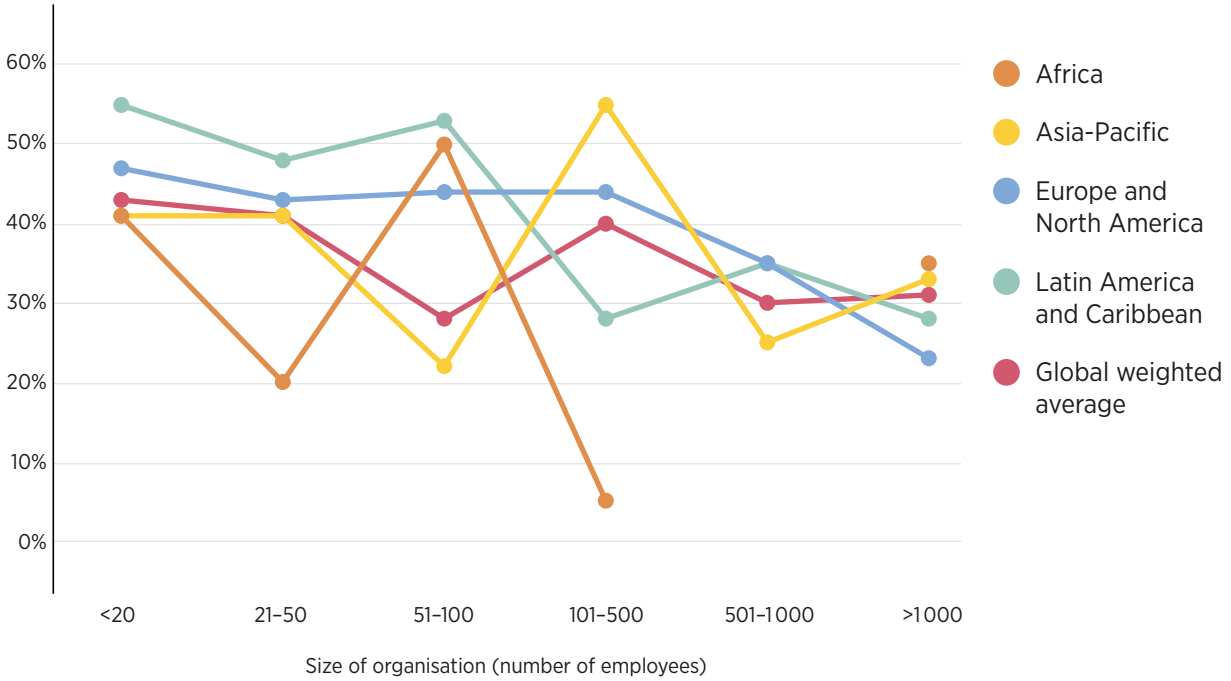
7 The analysis considered the following regions: Africa, Asia-Pacific, Europe and North America, and Latin America and the Caribbean. This last region includes Mexico.

In some cases, the lower figures reported in specific regions (notably Europe and North America) can be attributed to survey responses from large manufacturing firms, which traditionally have lower shares of female employment.

Further analysis reveals significant differences in women's participation levels, depending on the size of the organisations they work for, across regions. Employment levels vary considerably within each size category, although this variability narrows in the larger size categories (Figure 6). At both the global and regional levels, the trend suggests that the share of female employment declines slightly as organisation size increases.[8] This is likely because most respondents in the larger size categories work for a single type of organisation, primarily private enterprises in the manufacturing sector.

The trend suggests that the share of female employment declines slightly as organisation size increases.

Figure 6 Female share of full-time employment in renewable energy, by region and size of organisation



8 *This is confirmed by the statistical analysis, which indicates that organisation size does have a significant impact on the share (with a significance level of < 1%, or p < 1%). The follow-up analysis shows that the results in the two extreme size categories (< 20 and > 1,000 employees) are most different from the results in the other size categories. The level of female employment in the very smallest and largest organisations is significantly different, when compared to each other (p < 1%). The significance of the differences between these two size categories and the others is somewhat lower (p = 5-10% in most cases).*

As the true distribution of employment in organisations of different sizes is not known, it is likely that large organisations are over-represented in the sample and small ones are under-represented. Thus, given that the female share of employment tends to decline as the organisation size increases, the global weighted average share of female employment reported here (32%) may be a slight under-estimate of the true share. This interpretation is further supported by the fact that most of the large organisations responding to the survey were manufacturing enterprises (another possibly over-represented characteristic where the female employment share tends to be slightly lower than elsewhere). This interpretation (of a slight under-estimation in the calculated results) may also apply to the female employment shares reported for each region.

1.2 Women's share in the renewable energy workforce, by role

Senior leadership and decision-making positions remain male dominated.

When analysing diversity and inclusion, it is tempting to stop at positive headline findings – in this case, the global share of women in the renewable energy workforce. At first glance, this average appears somewhat positive, suggesting that a higher level of equality has been achieved compared to other energy industries. However, important disparities lie beneath the surface. A closer look often reveals a less positive reality, such as presented in the previous analysis, where women are unevenly represented across the occupational hierarchy and are mostly concentrated in administrative, support, or non-technical roles, whereas senior leadership and decision-making positions remain male dominated.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Complete data sets are key to illustrating the full picture, showing the distribution across different roles and activities, wage bands, career progression opportunities and decision-making capacities. Without this depth, organisations risk painting a misleading picture of inclusion and overlooking structural barriers that prevent equitable participation, especially in the most influential positions. Granular data enable us to identify where inequalities persist, to set more meaningful goals and to design targeted interventions. Therefore, in addition to asking about the overall level of female employment, the survey also asked about the proportion of jobs held by females in the different occupations and skills profiles that the sector offers, such as middle management positions; senior management or Board of Directors; STEM[9]-technical roles (requiring a degree in STEM subjects); non-STEM technical roles (requiring a degree in another subject); administration; medium-skilled roles (requiring certification); and other roles (Box 2).

9 Science, technology, engineering and mathematics.

Box 2 Roles across the sector

For the purposes of this report, the term role refers to the different job categories/positions within the renewable energy sector, categorised both by the educational backgrounds or professional profiles of employees and by their levels of responsibility within organisations. These categories reflect the diverse skill sets and hierarchical structures that characterise the sector, grouped as the following:

STEM technical roles: specialised technical positions requiring a degree in science, technology, engineering or mathematics (STEM) disciplines; examples include renewable energy engineers, grid integration specialists, materials scientists, environmental scientists and data analysts.

Non-STEM technical roles: specialist roles that require higher education in non-STEM fields, such as lawyers, policy advisors, environmental economists, sustainability consultants and regulatory compliance officers.

Administrative roles: administrative assistants, office co-ordinators, clerks and other support staff.

Medium-skilled roles: the bulk of roles in the sector, typically requiring technical certifications, vocational training or apprenticeships; examples include installers, machine operators, electricians and construction workers.

Other roles: includes ancillary roles such as cleaners and security guards, for example.

For leadership positions, the survey distinguished between:

Middle management positions: roles such as unit directors, department heads, project managers, and team leads, among others.

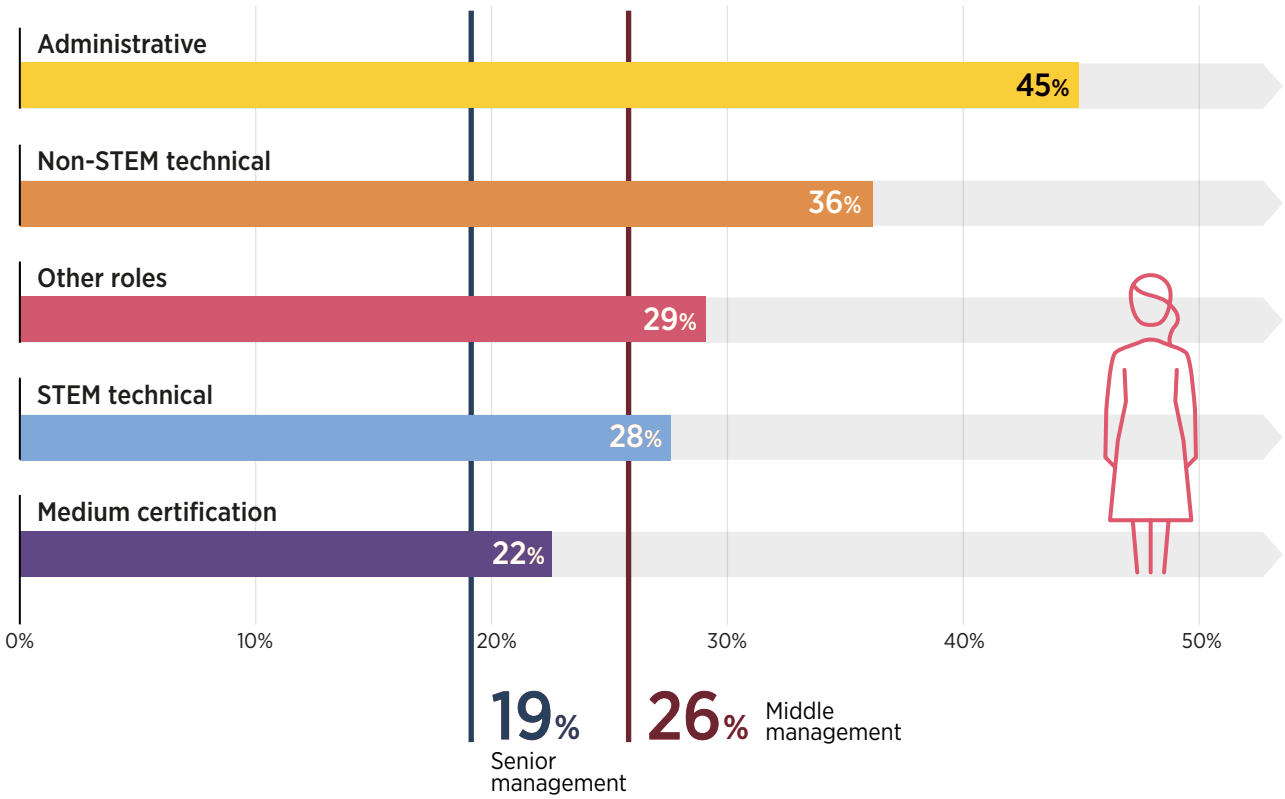
Senior management or Board of Directors: executive-level leadership and governing bodies of organisations, such as chief executive officers (CEOs), chief operating officers (COOs), presidents, director generals and members of the Board of Directors.

Notably, these categories are not mutually exclusive in the dynamic renewable energy sector and often overlap. Individuals with STEM academic backgrounds may hold medium-skilled positions, and other workers have executive roles. Similarly, some positions may not formally require a specific educational background yet may nonetheless be held by individuals with advanced degrees or specialised training. These overlaps and trajectories highlight the sector's flexibility and the opportunities for professional development inherent in the evolving field of renewable energy.

Women are better represented in **support functions** than in technical and decision-making roles.

Figure 7 shows the average share of female employment in each of the different positions or roles included in the survey.[10] The highest share of female employment is in administrative roles, with 45% of those positions held by females in organisations that employ people in those roles. The next highest share is for employment in non STEM technical roles (36%). The female share of employment in "other" roles is 29%, followed by STEM technical roles (28%). The lowest shares of female employment are for medium-skilled roles (22%). This uneven distribution indicates that women are disproportionately represented in support functions and are under-represented in technical and decision-making roles, a clear sign of gender stratification in the workforce.

Figure 7 Female share of full-time employment in renewable energy, by role

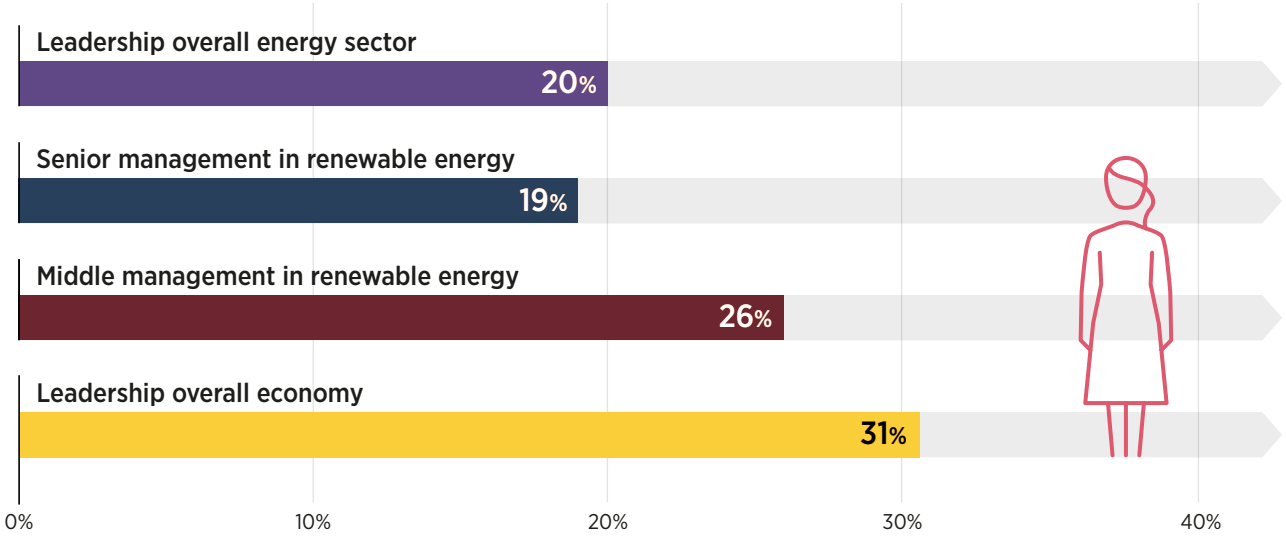


10 Results are weighted by location, and the size of the organisation is included in the calculation of these shares. The proportion of senior management positions held by females is calculated as a location-weighted average of responses from each organisation, without also including organisation size in that calculation (i.e. each response from an organisation is treated equally in the calculation of the average, except for the weighting by location). This is because the number of these senior management positions typically does not vary in proportion to the size of the organisation and is likely to be similar across a wide range of organisation sizes.

Compared to 2018, the share of women in STEM and administrative roles has remained largely unchanged, while non-STEM technical roles have increased by one percentage point. However, this should not be interpreted as an actual improvement, since the two surveys are not directly comparable: the more recent survey introduced a disaggregation into medium-skilled and other roles. Instead, these results should be seen as an improvement in the level of detail captured by the newer survey, providing a clearer indication of the differences in female employment shares across different roles.[11]

The widest gap is in senior leadership, where women account for only 19% of positions. They fare slightly better at 26% of middle management positions. Similarly, data from LinkedIn suggest that only 20% of leadership positions in the broader energy sector are held by women. The energy sector disparity is even more striking when compared to the overall economy, where women account for 35.4% of managers (ILO, 2025) and hold an estimated 30.6% of leadership roles as of 2024 (LinkedIn, 2025), or below 30% according to ILO data (ILO, 2025) (Figure 8).

Figure 8 Female share of full-time employment in leadership positions



11 Results are weighted by location, and the size of the organisation is included in the calculation of these shares. The proportion of senior management positions held by females is calculated as a location-weighted average of responses from each organisation, without also including organisation size in that calculation (i.e. each response from an organisation is treated equally in the calculation of the average, except for the weighting by location). This is because the number of these senior management positions typically does not vary in proportion to the size of the organisation and is likely to be similar across a wide range of organisation sizes.

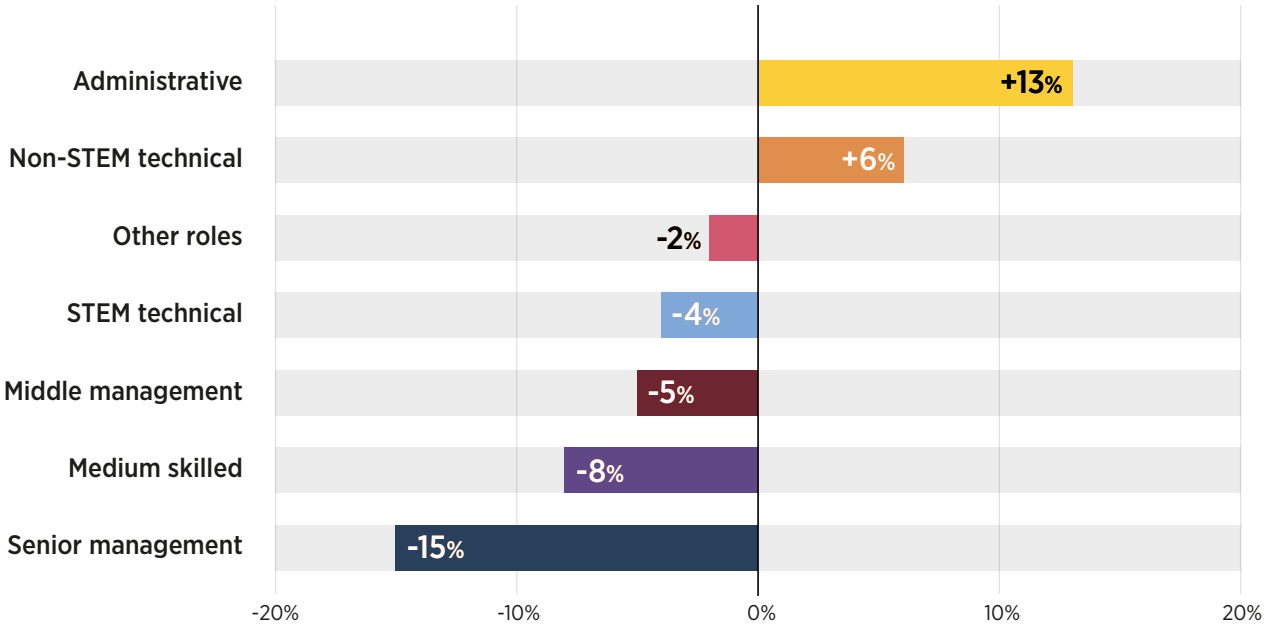
The analysis suggests that more women in higher positions result in more women overall in the workforce.

As seen in Figure 9, the female employment share in administration is 13 percentage points higher than the average for all employees economy-wide. The share of females in non-STEM technical jobs is 6 percentage points higher. For all the other types of roles, the share of females employed is below average, with the largest difference in the female share of employment in senior management (minus 15 percentage points).[12]

The statistical analysis also shows the correlation between the share of women in each role and the overall share of female employment, finding a positive correlation in all cases, indicating that organisations with higher overall female employment also tend to have higher female representation in specific roles. The strongest correlation (0.64) was observed for women in middle management, suggesting a relatively strong association in this role, which could imply that more women in higher positions result in more women overall in the workforce. In contrast, the weakest correlation (0.03) was found for women in "other" roles, indicating little to no relationship in that category.

Targeted policies remain essential to enable women's entry in STEM and in Technical and Vocational Education and Training (TVET) programmes oriented to the renewable energy sector, as well as their advancement into higher decision-making and leadership roles.

Figure 9 Female share of renewable energy employment in different roles compared to the share in economy-wide employment



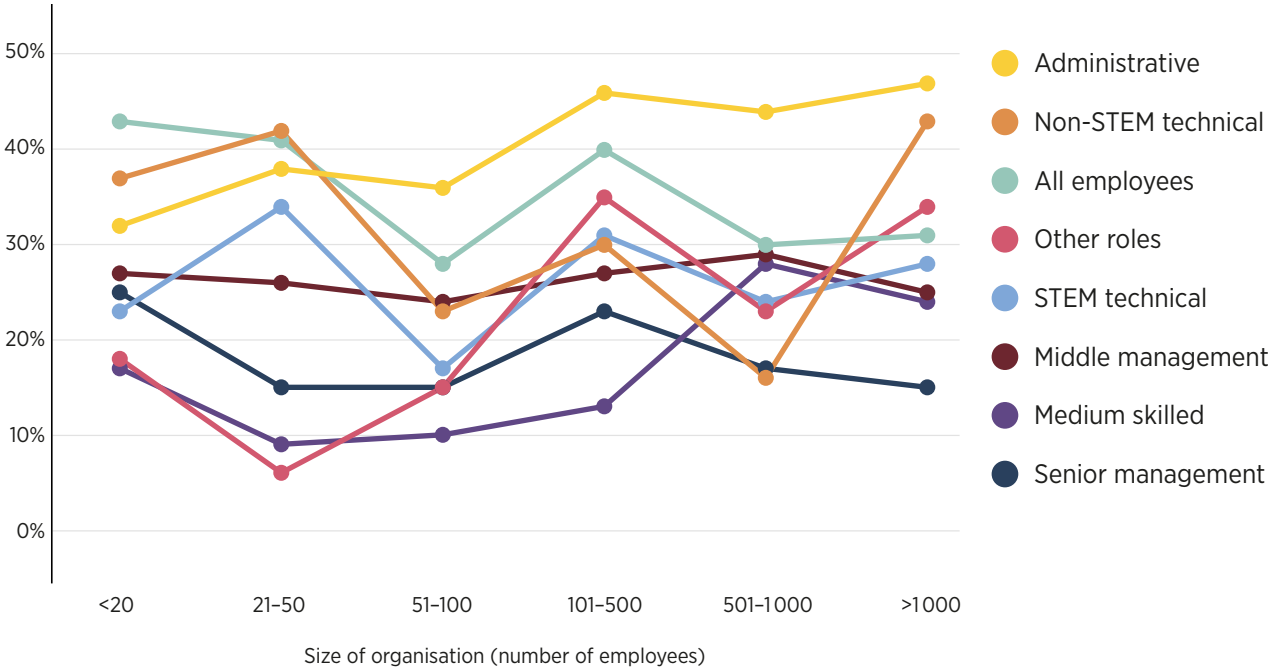
12 All of these differences were highly significant (p < 1% in all cases).

As in the regional averages, the representation of females in the different roles exhibits significant differences with changing organisation size. Women are better represented in administrative, non-STEM technical and other roles than the overall share of female employment in the largest-size organisations, which has a big impact on the average share of employment calculated for all three of these roles. In the case of administration, the share of female employment is generally higher than average across most of the size classes, but this is not the case for female employment in non-STEM technical and other roles (Figure 10).

Notably, in smaller organisations the share of women in senior management roles is reported to be much higher than in larger firms. This is possibly due to more flexible structures or different recruitment pathways.

Figure 10 also shows the impact of non-response bias in the answers to the questions about employment shares in different roles. Far fewer respondents were able to answer these questions either because they did not know how many females were employed in these roles, or the roles did not exist in their organisation. This partly explains why the average shares of employment in each role are almost always below the line for the overall share of female employment (all employees). This is particularly noticeable for the smallest size class, where it might be expected that some roles do not exist or employees cover several roles at the same time.

Figure 10 Female share of full-time employment in renewable energy, by size of organisation and role



Note: The inclusion of organisation size in these calculations implicitly assumes that the distribution of employment in these roles within the renewable energy workforce matches the distribution of organisation size. (For example, the calculation assumes that if two-thirds of total renewable energy employment occurs in organisations with over 1 000 employees, then two-thirds of employment in administration also occurs in those same organisations.) This means that the results for each role have to be interpreted with some care.

1.3 Women's share in the renewable energy workforce, by organisation type, activity and functional typology

To contribute to a better understanding of the participation of women in the renewable energy workforce, we next assess their presence across different segments of the sector. This analysis includes the type of organisation they work for, the main area of activity within the renewable energy value chain, and the functional typology that captures whether the work is commercially oriented or non-commercial (Box 3). This approach allows for a more meaningful assessment of gender patterns across the diverse organisational and functional contexts found in the sector.

Box 3 Organisation type, activity and functional typology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The survey specified both the type of organisation that women work for and the main activity that the organisation is engaged in.

The **type of organisation** refers to the institutional or legal nature of the employer. Respondents could select from: private enterprise; public enterprise; government or government-funded agency; non-governmental organisation (NGO)/civil society organisation (CSO); association; individual employers (such as freelancers, contractors or consultants); or another category specified by the respondent. This classification helps capture differences between public, private, and non-profit actors, as well as informal or individual employment arrangements.

The **activity** refers to the main area of work carried out by the organisation within the renewable energy value chain or related services. Respondents were asked to identify the primary activity from a list that includes: project planning and development; manufacturing of technologies; installation; maintenance; operation of technologies; sales; service provision (such as finance or insurance); policy and administration; research and development; and education and training. This information provides insight into how employment conditions and opportunities vary across different segments of the sector.[13]

For the purpose of this analysis, the impacts of organisation type and activity area on gender outcomes are examined separately. However, with six distinct organisation types and seven activity areas, it is impractical to analyse all combinations in detail, given the qualitative nature of the categories and the small sample sizes within each. To explore whether the interaction of these two factors influences gender outcomes, we developed a combined **"functional typology"** of organisational context and functional role.

13 The question about activities did not clarify whether this should refer to the organisation employing individuals, so the responses from organisations could reflect what the respondent does personally rather than their employer's main focus.

This typology groups respondents based on whether their organisation is commercially oriented or not, and on the broad nature of their activities (*e.g.* engineering; policy, administration or sales; research, training and education; or other technical work).

The combined typology of organisational context and functional role is defined as follows:

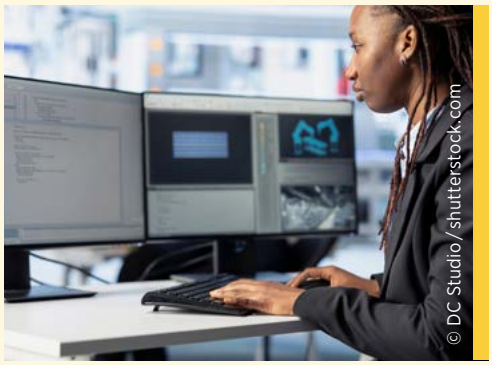
Commercially oriented work (respondents working for public or private enterprises and self-employed) includes:

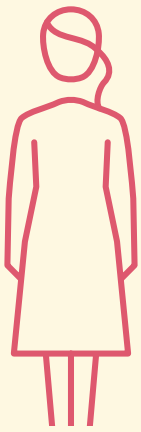
- Manufacturing (respondents working in manufacturing of renewable energy equipment)
- Operations (respondents working in installation, maintenance and operation of technology)
- Development (respondents working in project planning and development)
- Service provider (respondents working as a service provider – *e.g.* in finance or insurance)
- All others (respondents working in sales, distribution, policy, administration or other activities)

Non-commercial work (respondents from all other types of organisations) includes:

- Industry-focused (respondents working in manufacturing, operations, development, services, sales)
- Policy and administration (respondents working in policy and administration)
- Other (respondents working in other activities – *e.g.* research, training and education)

For more on the distribution of responses on both type of organisation and activity, see the Annex.



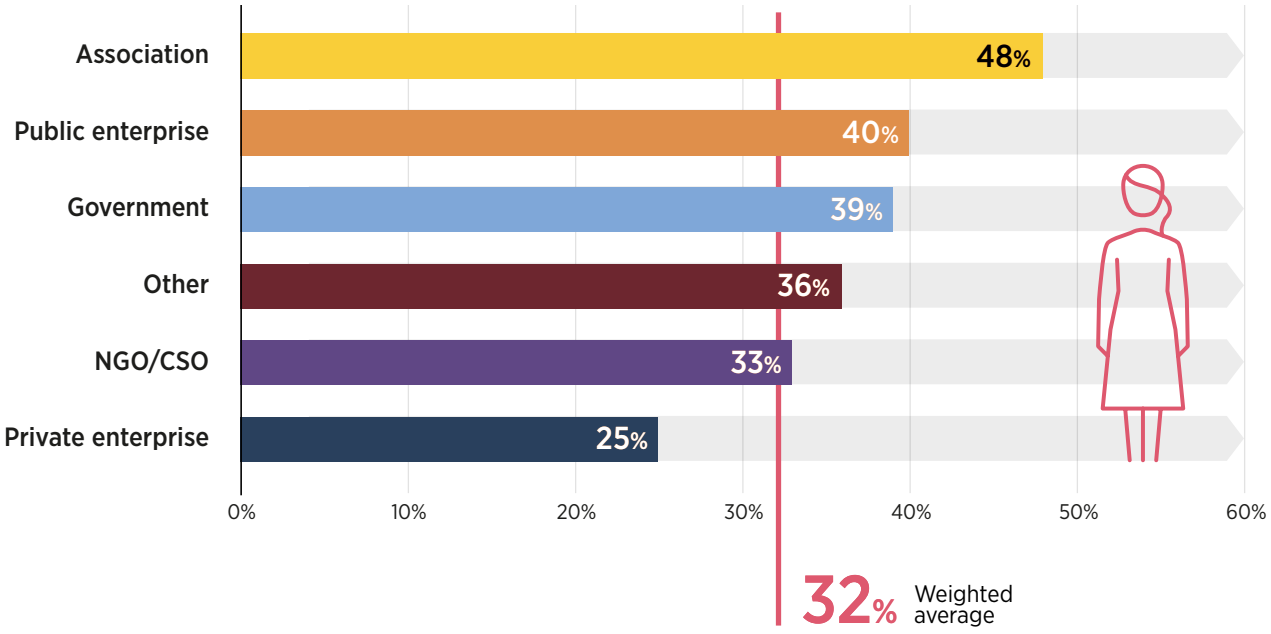


The share of female employment varies across organisation types, from 48% in associations to much lower 25% in private enterprises.

The statistical analysis confirms that the type of organisation and the activity that the organisation focuses on has a significant bearing on the level of female employment.[14] Figures 11 and 12 show how the share of female employment varies by type of organisation and the main activity of the organisation. The share of female employment varies considerably across organisation types, ranging from 48% in associations to just 25% in private enterprises, the latter being the only category below the global weighted average of 32% (Figure 11). This lower share among private enterprises drives this average, as jobs in the private sector account for the largest share of total employment, and thus carry more weight in the overall figure.

Overall, the activity performed appears to have a significant influence on the proportion of female employment.[15] The share of female employment varies substantially across different activities, with women making up around 40% of those employed in policy and administration, but only around 25% in manufacturing (Figure 12). The proportion of women working in sales and distribution is notably higher than in most other activities, but none of the pairwise differences between specific activities are statistically significant at the 5% level. This is likely due to the relatively large number of activity categories recorded in the survey and to the small sample sizes within some of these categories.

Figure 11 Female share of full-time employment in renewable energy, by type of organisation



14 Statistical difference found at p-value of 2%, indicating that there is only a 2% chance that the observed association between organisation type, activity and female employment has occurred by random chance.

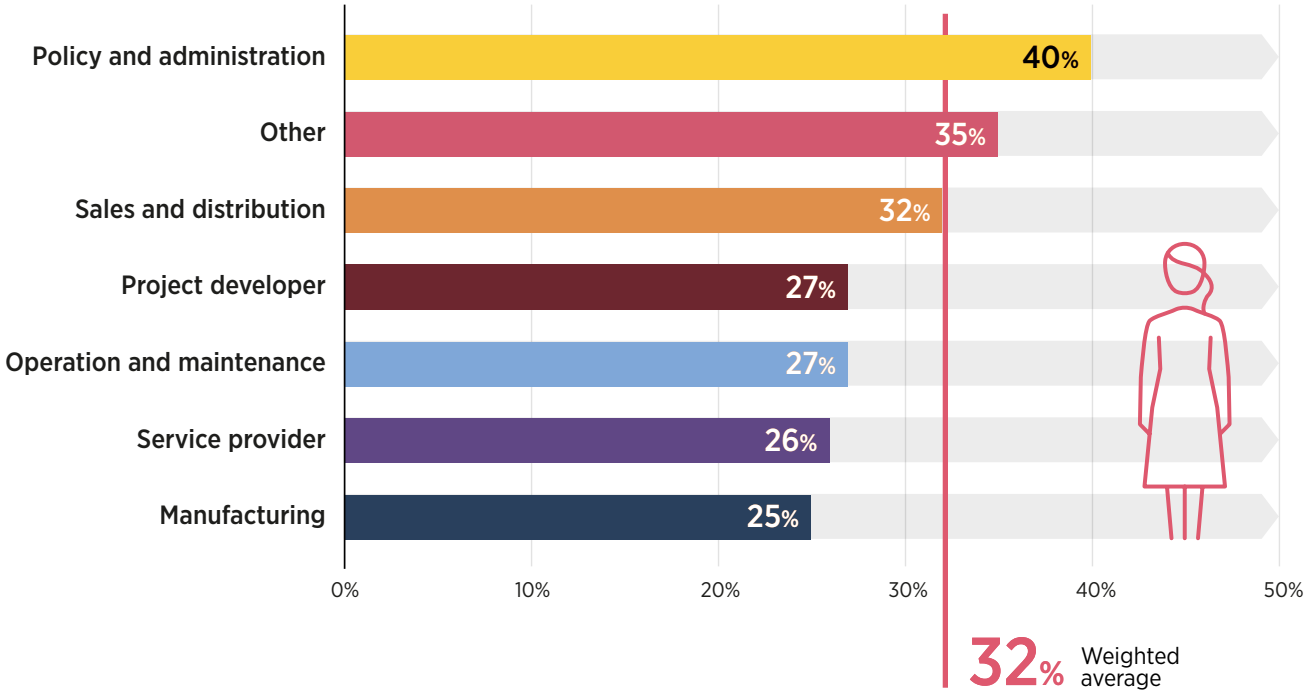
15 The overall effect of activity performed on the share of female employment is statistically significant (p < 1%).

Similarly, the type of work performed seems to influence the proportion of female employment,[16] although none of the individual differences among categories are statistically significant when compared pairwise.

As explained in Box 3, to analyse if the participation of women is influenced by the interaction of the type of organisation and the activity of such organisations, a combined "functional typology" of organisational context and functional role was developed. This groups respondents based on whether their organisation is commercially oriented or not. The commercial group is more closely aligned with what is typically called the renewable energy "industry", and it has an average female employment share of 28% (lower than the overall average at 32%). In contrast, the non-commercial group (which includes other organisations involved in renewables) has a higher average share of women at 37%. This difference, of nearly 10 percentage points, is substantial and statistically significant (p = 0.02) (Figure 13).

In summary, the preceding analysis has shown that several characteristics of organisations (size, activities and type of organisation) influence the shares of female employment reported by organisations. These findings are similar to the previous (2018) survey, although the characteristics analysed here have a significant impact on the results, whereas most of those reported in 2018 did not. This is likely due to the reporting of female employment shares in smaller bands (10%) rather than the four bands (of 25%) used in 2018.[17]

Figure 12 Female share of full-time employment in renewable energy, by activity



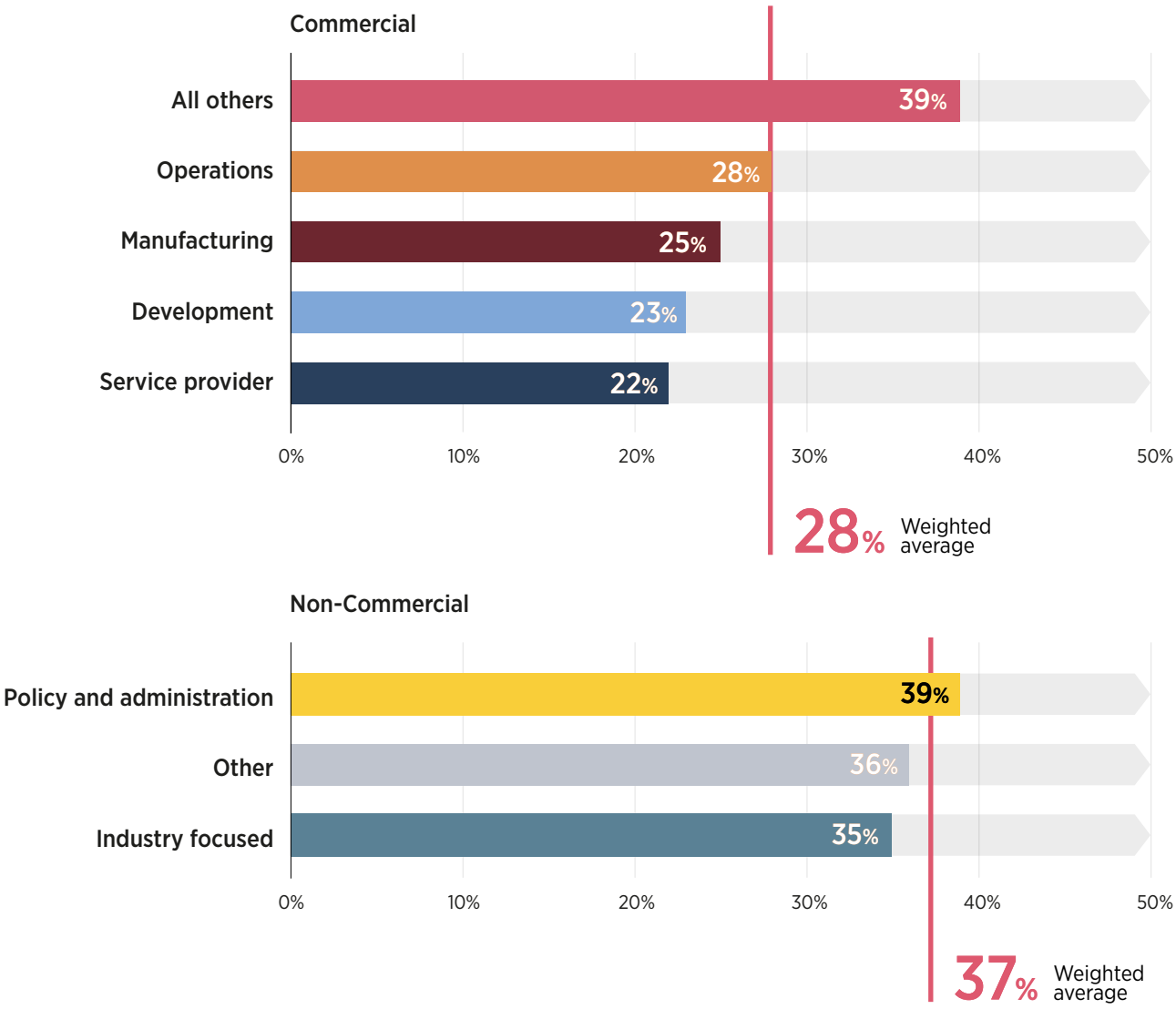
16 The overall effect of the type of work performed on the share of female employment is statistically significant (p = 4%).

17 The characteristics analysed in the current report show a significant impact on the results, whereas most of those reported in 2018 did not. This is likely due to the reporting of female employment shares in smaller bands (10%) rather than the four bands (of 25%) used in 2018. With 10% bands, it is possible to treat the results as a continuous variable and to use ANOVA as a test for significance, whereas in the previous survey, with only four bands for female employment shares, it was necessary to treat the results as a categorical variable and to use chi-squared tests for significance.

The size, activities and type of organisation influences the shares of female employment.

Non-commercial activities, including those in NGOs/CSOs and government bodies, tend to employ more women overall, especially in medium-skilled and support roles. Private enterprises, particularly large ones engaged in manufacturing, reported the lowest levels of female participation. This variation suggests that these types of organisations may be implementing successful tools and practices, unlike other sorts of organisations, that not only increase diversity within the field but also foster pathways for women into technical and leadership roles across different types of organisations.

Figure 13 Female share of full-time employment in renewable energy, by functional type of work (commercial versus non-commercial)



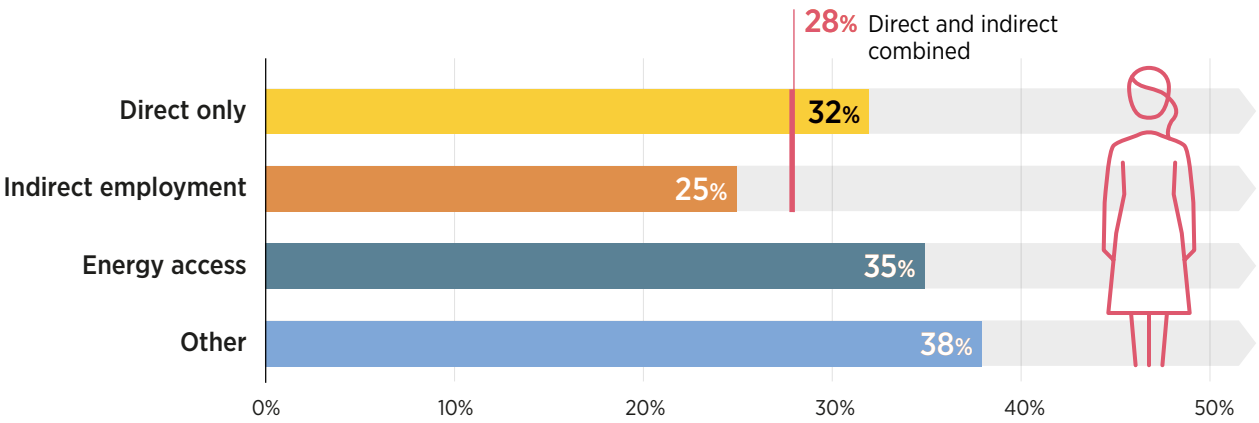
1.4 Women's share in the renewable energy workforce, depending on the definition

An overall limitation of gender-disaggregated employment data is the lack of a single definition of the "renewable energy sector". Respondents to this in other surveys may have different interpretations of what the sector entails. This makes comparisons over time, with other data sources, or with previous data analysis from IRENA, challenging.

The current analysis identifies a major difference in the female employment shares depending on how the sector is defined, especially between those working in what are defined as "commercial organisations" and other type of entities. But even setting the boundaries for this distinction can present an issue, as the definition adopted may not fully match what other sector statistics consider the renewable energy sector to be from the standpoint of economic analysis. Commercial organisations include project developers and service providers that would normally be grouped in other categories of economic activity. Most direct employment in the renewable energy sector is likely to be in what is classified in the survey as manufacturing and as operations and maintenance (including installation). Others working in commercial organisations would normally be considered as indirectly employed in renewables.

Taking into account that female employment shares generally increase under a broader definition of the sector, Figure 14 shows varying results under different definitions of the economic activities included as part of the renewable energy sector. Under the narrowest definition (encompassing only manufacturing, operations and maintenance), the female share of direct employment is 25%. The female share of indirect employment in project development, services and other commercial activities is 32%, and for direct and indirect employment combined it is 28%. The latter figure applies to 60% of all employment by organisations included in the survey.

Figure 14 Female share under different definitions of the renewable energy sector



A distinction between employment in on-grid and off-grid renewables is not possible for all of the organisations responding to the survey (and the previous survey in 2018 found that many organisations are likely to say that they work in both areas[18]). However, the vast majority of those employed directly and indirectly are likely working mostly in on-grid renewables. For those working specifically in off-grid renewables (or energy access), the one category that most closely resembles this sort of work is the non-commercial organisations working on industry-focused activities. These are mostly NGOs/CSOs and government agencies working on project development, services, operations and maintenance. These organisations account for just under 5% of all employment captured in the survey, and among them the female share of employment is 35%. This figure is close to the 39% reported for those working solely on energy access, in previous IRENA analysis (IRENA, 2019, 2024b).

Other organisations with an interest in renewables – such as financial institutions, research and training centres, consultancies, and international or community organisations that support the sector but are not generally considered part of it in economic terms – have a female employment share of 38%. These organisations account for around one-third of all employment covered in the survey, and their inclusion has a major impact on the overall share of female employment calculated above (32%).

United Nations statistics show that women account for 10–30% of total employment in the energy and water supply sector in countries where data are available, with an average of 23% for Europe and North America and around 15% for the rest of the world (UN Women and UNIDO, 2023). The survey results presented here show that the female share of employment is similar or slightly higher for those working directly in renewables (organisations in charge of manufacturing components, operations and maintenance) but is much higher if other organisations (related but less directly involved in the deployment of renewables) are included in the results.

Among NGOs/CSOs and government agencies working on project development, services, operations and maintenance, **the female share of employment is 35%.**

18 The 2018 survey asked about whether respondents worked on renewable energy in the context of energy access or not (or in both contexts) and found that the female employment share was much higher for those working on energy access.

1.5 Part-time employment in the renewable energy sector

In 2023, ILO data revealed that globally, 708 million working-age women were not participating in the labour market, with 45% citing care responsibilities as the main reason. In contrast, only 5% of men outside the workforce reported care duties as their reason; the most common explanation among men was being in education, ill or disabled (ILO, 2024). No comparable statistics are available for the renewable energy sector. Measures to support women with these responsibilities are needed across all sectors. One option could be part-time employment, as it can provide an opportunity to enable women's participation in the workforce. However, this can also reinforce traditional expectations that women should bear the primary responsibility for childcare and elder care, resulting in long-term consequences for their careers and financial security (EIGE, 2023) (see section 3).

Recognising this dual role, the survey included several questions on the availability and conditions of part-time work. Results show that overall, 56% of organisations reported offering part-time positions. Availability was notably higher in Europe and North America, where 72% of organisations offered part-time work. Sector differences were also evident: 84% of organisations in sales and distribution and 83% of service providers offered part-time opportunities, compared with just 15% of manufacturers.

After statistical adjustments, the global weighted average share of women in part-time employment was estimated at 39%. Although data limitations and variability introduce some uncertainty, the results suggest that women's share of part-time employment in the renewable energy sector is likely similar to, or slightly higher than, their share of full-time employment.

Among organisations offering part-time work, 52% said that wage rates for part-time and full-time employees were the same, while 38% reported lower rates for part-time staff, 2% reported higher rates, and 7% were unsure. Regarding employee benefits, 42% stated that benefits were the same for part-time and full-time employees, 46% said they differed, and 11% did not know.

Women occupy

39%

of part-time positions

1.6 Women's role in the renewable energy access context

As highlighted in section 1.4, survey data indicated that women account for around 35% of the workforce in organisations engaged in energy access. However, this figure largely reflects employment in NGOs, CSOs and government agencies working on project development, services and advocacy. This institutional perspective captures an important dimension of the energy access workforce, but it does not fully reflect the lived realities in communities where energy poverty is most acute. In those contexts, women's contributions as primary household energy managers, small-scale entrepreneurs and community actors often remain invisible in formal employment data. The limitations of the survey therefore suggest the need to complement workforce statistics with a broader view of women's roles in energy access. This report seeks to highlight these realities, which are essential to understanding both the challenges and the opportunities at the intersection of gender and sustainable energy.

Gender inequality is a key driver of poverty, and more so in areas with limited access to electricity. Access to reliable electricity offers immense benefits to everyone, but especially women, improving their health, reducing drudgery, enabling education and income-generating activities, and enhancing participation in community life. Closing the energy and gender gaps is not just a moral imperative but a prerequisite for sustainable development, as progress on universal energy access (SDG 7) and gender equality (SDG 5) is deeply interconnected (World Bank *et al.*, 2025).

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Despite the urgency, progress on both goals remains too slow and uneven to meet the 2030 targets. Access to electricity has improved globally in the last year, reaching around 92% of the population, but nearly 670 million people, mostly in rural sub-Saharan Africa, still live without it. Even more concerning, around 2.1 billion people continue to rely on polluting fuels such as wood and charcoal for cooking, a burden that disproportionately affects and burdens women's health, time and livelihoods (IEA *et al.*, 2025).

Despite their central role in household energy use, cooking, water collection, and small-scale productive activities, women are disproportionately vulnerable to energy poverty. Furthermore, their potential as consumers, entrepreneurs, skilled workers and decision makers remains largely untapped (World Bank *et al.*, 2025). Decentralised renewable energy solutions are essential for expanding electricity access in off-grid communities. The role of women in this context remains both critical and under-represented, both in practice and in data collection efforts such as this survey.

Because this survey was conducted online, the results likely under-represent the voices and perspectives of women in areas where access to energy is limited, even for those working thanks to, or with, distributed renewable energy technologies. Barriers such as low digital literacy and the gender digital divide (Tyers-Chowdhury and Binder, 2021) make women in these contexts less likely to participate in online data collection. Consequently, the findings presented here should be read with this limitation in mind but call for further research and deliberate inclusion strategies to capture and amplify women's experiences and contributions to energy access.

Women are disproportionately affected by energy poverty not just as consumers, but also as potential entrepreneurs, skilled workers and decision makers.


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Box 4 Beyond participation: Increasing the agency of rural and indigenous women towards socio-economic transformation

Women in Indigenous communities bring unique knowledge, cultural perspectives and stewardship practices that can strengthen the social and environmental outcomes of decentralised renewable energy projects. However, on occasion, projects integrate an inclusion lens as a **"token participation"** – where women are present but not heard; where they are invited but not empowered; and where "gender mainstreaming" is reduced to a checkbox and women's participation becomes symbolic, failing to address the deeper structural challenges they face (Saeed, 2025). Instead, the approach should focus on **"transformative participation"** – engaging indigenous women in ways that are meaningful, recognising their lived experiences, listening to their priorities and creating space for them to shape the very processes, policies and projects that affect their lives.

To ground this approach, and thanks to the generous contribution of Denmark, IRENA has launched a pilot project in an Indigenous community in Mindanao, the Philippines, introducing small-scale hydropower through a *participatory action research (PAR)* approach. The goal is to co-create strategies that optimise the socio-economic benefits of community-scale hydropower while addressing broader energy access and gender equity challenges. This approach ensures that tools and insights are developed with, not just for, indigenous women who are already organised and engaged in hydropower initiatives.

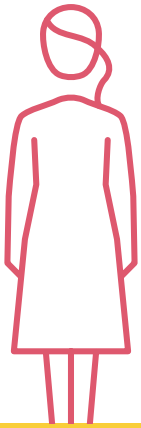
Because gender and social equitability depend on place-based, cultural norms, and with the multi-regional peer-to-peer learning approach, the idea would be to scale up later on to apply the participatory action research to Indigenous contexts with other norms, such as in Latin America.

Embedding gender and indigenous perspectives into every stage of energy planning – from design to implementation – makes it possible to unlock deeper, more lasting socio-economic benefits. These community-scale systems will not simply be functional, but also **transformational** in terms of socio-economic and environmental outcomes.

Women are key agents of change in the deployment and adoption of distributed renewable energy technologies. Evidence from programmes that actively engage women as sales agents, maintenance workers and micro-grid managers shows higher uptake, improved sustainability of systems and stronger social impact (IRENA, 2024b). Programmes, initiatives and research should place greater emphasis on engaging women, especially in remote and marginalised communities, not only as beneficiaries, but as leaders and active stakeholders in the energy transition (Box 4).

Without a sharp acceleration in investments and gender-responsive policies, hundreds of millions of people will remain without modern energy by 2030, and women and girls will continue to bear the brunt of its absence, trapped by the dual weight of energy poverty and gender inequality.

In summary, as seen across this chapter, women's participation in the renewable energy workforce varies greatly, shaped by local labour markets, educational systems, cultural norms and policy frameworks. Better data collection and regular monitoring are essential to track progress and to evaluate the effectiveness of the measures in place. Understanding these differences is critical. This report highlights that a one-size-fits-all approach will not work. Effective strategies must be tailored to specific social, cultural, and economic contexts, and as such, understanding the challenges that women face is a must. Addressing these differences is also key to guide international co-operation, allowing countries to learn from one another and to scale what works.



Evidence shows that women are key agents of change in the deployment and adoption of distributed renewable energy technologies.

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RENEWABLE ENERGY
A GENDER PERSPECTIVE
Second Edition

Barriers that limit women's entry, advancement and retention in the workforce

2

Persistent gender inequality in renewable energy is emblematic of a much broader reality. All too often, women are denied their fundamental rights, confronted by discrimination and inequality, and denied opportunities to learn, earn, lead and in some instances, even exist. Beyond structural violence, they frequently face physical violence and abuse, at home, at work and in their communities. Women form the majority of people living in poverty and generally have fewer resources, less power and less influence than men, conditioned and exacerbated by other variables such as class, ethnicity, age, looks, etc. Structural inequalities, discriminatory laws and entrenched social norms present significant barriers, with some estimates suggesting that, at the current pace, full gender parity in areas such as legal rights and political representation could take more than a century[19] to achieve (UN Women and UNDESA, 2024).

Recognising the unique barriers that women encounter is essential for unlocking women's full potential in driving the energy transition.

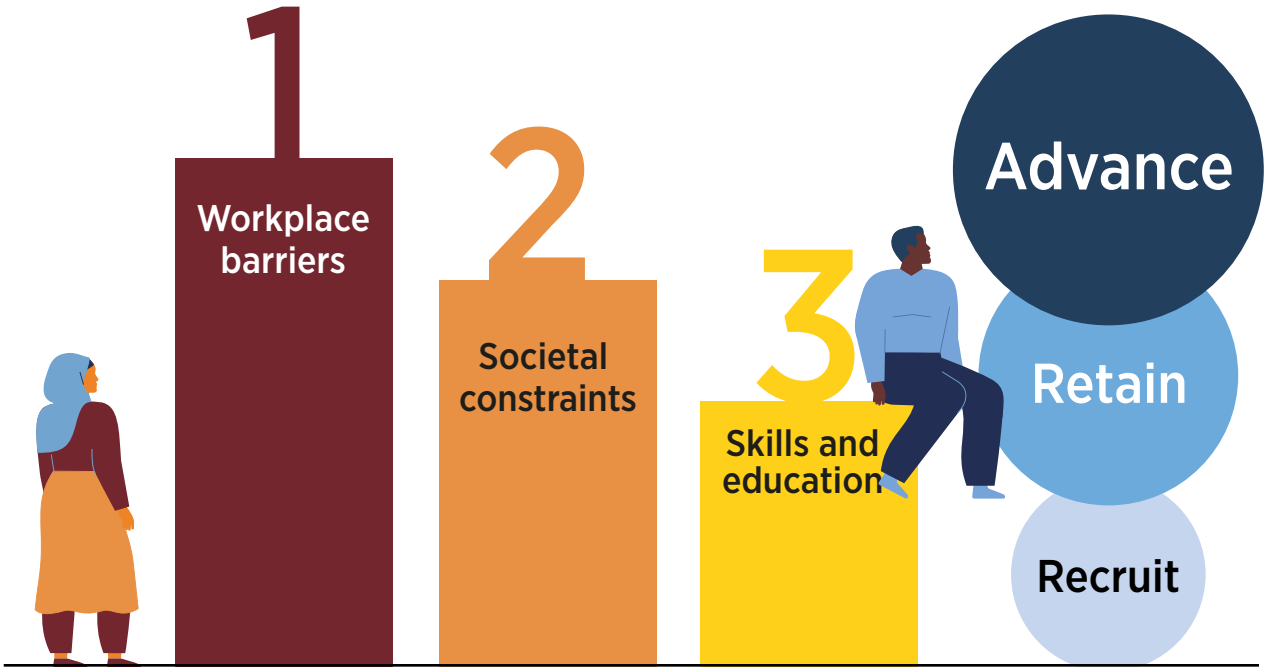
While the challenges that women face in the renewable energy sector may seem more specific or narrower than the broader inequalities they experience in society, it is crucial to understand and identify what these challenges are and where they come from. Only by recognising the unique barriers that women encounter in the sector is it possible to design effective solutions and to unlock women's full potential in driving the energy transition. For that reason, the IRENA survey included a set of questions for individual respondents who perceive or experience such barriers (female respondents were asked if they had encountered or experienced any of the barriers, while male respondents were asked about their perceptions of these barriers).

The survey results show that only 41% of male respondents perceived that women working or seeking work in the renewable energy sector face gender-related barriers. The responses of female survey participants reflect a very different reality, with 60% indicating that they had encountered or directly experienced such barriers. While closely interconnected, three main categories of challenges were identified: **societal constraints** (cultural and social norms along with discriminatory laws and policies); **skills, educational and professional development-related barriers**; and **workplace barriers** (biased hiring practices and/or restrictions in the working environment that disproportionately affect women).

19 The 2025 Global Gender Gap Index report projects full parity still 123 years away at the current pace (World Economic Forum, 2025), while the report Progress on the Sustainable Development Goals: The Gender Snapshot 2024 indicates that, based on current progress, it will take 134 years to achieve full gender parity (UN Women and UNDESA, 2024).

In addition, recognising that certain challenges tend to be more pronounced at specific stages, respondents were asked to reflect on these barriers at three key stages of professional development: **recruitment** or **entry** into the workforce (some issues may arise more prominently in the early stages of a career), **retention** (particular challenges during childbearing years) and **advancement** (barriers when seeking progression into leadership roles).

Overall, the ranking of the three factors was significant.[20] Workplace barriers were indicated as the most important challenge for women working or seeking employment in the sector, whereas skills, educational and professional development-related barriers were ranked as the least important challenge. The scores also reveal that barriers intensify along the career path – being lower at entry, higher for retention and highest for advancement.



20 Workplace barriers were ranked as the most important factor by 53% of respondents, and skills, educational and professional development-related barriers were ranked last (third) by 53% of respondents. Societal constraints were ranked second by 41% of respondents, but around 30% of respondents ranked them as most important, and a similar amount ranked them as least important.

There were, however, some significant differences across respondents. Interestingly, male respondents ranked societal constraints as slightly more important than workplace barriers, suggesting that they have different perceptions of the barriers to female employment in the sector.

While the overall rankings were the same in all regions, respondents from Africa placed more importance on workplace barriers (ranking this much more highly than the other two factors). They also ranked skills, educational and professional development-related barriers as relatively more important compared to the ranking given by respondents from other regions (with an average ranking almost equal to that of societal constraints).[21]

As in previous IRENA analyses, the survey showed that the relevance of barriers to retention of women in the workforce were scored much more highly than for the other two career stages. This confirms that a focus on investing in the retention of female employees could be the most effective strategy for improving the gender balance in the sector workforce. Regarding the reasons why respondents reported leaving their jobs, almost half of the respondents (46%) indicated that they left to progress to a more senior or leadership position. However, this was followed closely by 39% of respondents who indicated that they left their position due to the lack of support from a previous manager or the broader company. Leaving to achieve better flexibility in workplace arrangements was mentioned by 28% of respondents.[22]

Taking a deeper look at what sort of barriers each of these categories entail, a series of survey questions aimed to obtain more detail by asking respondents to evaluate the importance of each using a sliding scale from 0 to 100.[23]

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Investing in the retention of female employees is a key strategy for improving the gender balance in the sector.

21 The significance of these results was tested using a Friedman test on the overall ranking, as well as Kruskal-Wallis tests on the rankings given by different groups of respondents. The Friedman test indicated that the average rank given to each of the three factors was significantly different to that given to the other two factors. The Kruskal-Wallis tests examined whether the ranks given by different groups of respondents (e.g. from different regions) were significantly different from each other. The Kruskal-Wallis test is similar to ANOVA but is applied where the response data (i.e. answers to the question) are ordinal values (ranks) rather than continuous variables.

22 Respondents were allowed to provide several reasons, therefore the results present the relative frequency of the reasons given for respondents leaving their previous job, so the percentages for each of the answers sum to more than 100%.

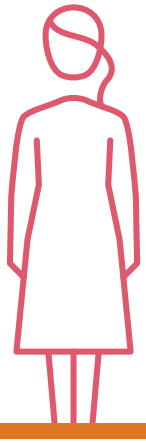
23 The sliding scale used in the online questionnaire was initially set to a score of 50 (the mid-point of the scale), but the results presented below have been converted to deviations from that mid-point to show more clearly which of the barriers are more or less important. Where a respondent did not move the sliding scale for a barrier, this was recorded as a non-response, and it is not included in the calculation of the average level of importance for each barrier.

2.1 Gendered workplace barriers

While societal norms and unequal access to skills and education undoubtedly shape women's participation in the renewable energy workforce, the role of gendered workplace barriers was highlighted as the most widespread that women face. These barriers directly impact women's ability to enter, remain and progress in their careers. Addressing workplace barriers is also one of the areas where employers and policy makers have the most immediate influence, making these barriers the easiest to target through tailored efforts to foster gender equity and unlock the full potential of the renewable energy transition.

Workplace barriers take many forms, ranging from **structural** issues in workplace culture and practices that lack supporting policies (such as the absence of family-friendly policies or gender targets), to actively **discriminatory practices** and environments (which include bias in recruitment, harassment and exclusion from informal networks). They also include **practical and logistical** constraints (*i.e.* inadequate facilities, rigid mobility and relocation requirements, and inflexible work arrangements) which tend to disadvantage women disproportionately (Box 5).

Biased hiring practices and hostile workplace environments have been widely referenced as a challenge in the energy sector (Qian, 2024; Thomson, 2022). The World Bank found that insufficient childcare and rigid mobility expectations in particular constrained women's retention and advancement (Devercelli and Beaton-Day, 2020). These barriers are not unique to renewable energy, but they are especially pronounced in a sector that has historically been male dominated, technically oriented and field-based (Roseberry and Williamson, 2024).



Gendered workplace barriers are the most widespread that women face.

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Box 5 List of gendered workplace barriers

The barriers in this category are broad, often overlapping with those in the other two main categories (societal and academic barriers), and are not exhaustive. The list of options presented to respondents included the following:

Gender bias in recruitment – discrimination in recruitment through gender-associated terms, biased interview questions and non-diverse hiring panels.

Lack of family-friendly policies – absence of family-friendly corporate policies, including inadequate parental leave, breastfeeding facilities and affordable childcare.

Discouraging workplace practices – discriminatory working environments, exclusion and harassment.

Mobility requirements – mandated job relocations, rotations and inadequate gender-informed transport infrastructure.[24]

Unsuitable infrastructure – insufficient facilities, such as lack of separate toilets and changing facilities.

Lack of workplace flexibility – limited availability of flexible working hours, job sharing and remote work options.

Absence of gender and diversity targets – lack of set goals for gender and diversity representation in the workplace.

Lack of supportive national policies – insufficient national policies mandating equal treatment, flexibility measures and discrimination bans.

Glass ceilings and sticky floors (only applicable for advancement) – unacknowledged barriers to advancement, especially affecting women and minority members.


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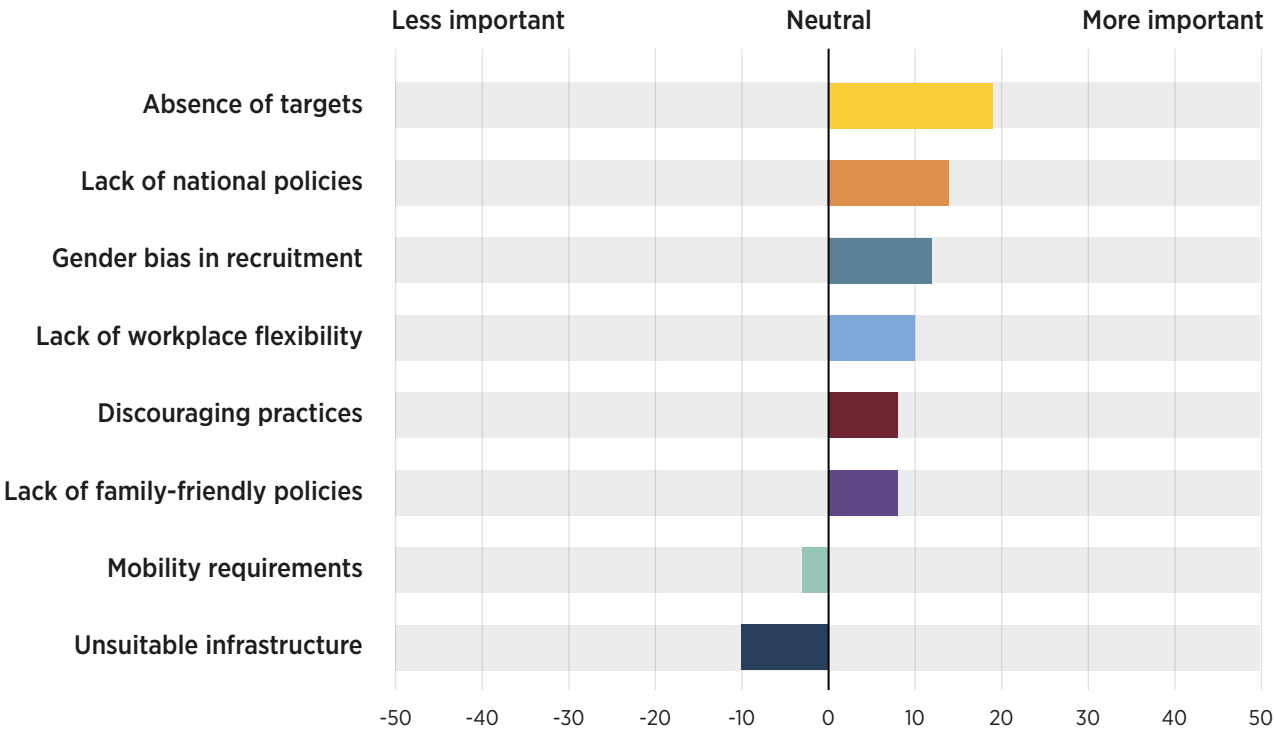
24 Transport infrastructure and services often overlook the travel patterns and mobility needs of women. Women typically walk longer distances than men and rely more on public transport for shorter trips with multiple stops, often to combine work, caregiving and household tasks. Infrastructure planning frequently neglects the fact that women are more likely to travel with children or elderly relatives, requiring accessible and accommodating facilities. In addition, transport services often fail to adequately address women's safety concerns, particularly when travelling at night.

Understanding how barriers manifest at different stages of a woman's career is crucial for **designing effective interventions.**

Understanding how these barriers manifest themselves at different stages of a woman's career – whether at entry, during retention or in progression to senior roles – is crucial for designing effective, targeted interventions. The survey therefore explored respondents' views on the importance of a range of workplace barriers,[25] recognising that these challenges are inter-related but may weigh differently at different points in a career.

The results of this analysis are presented in Figures 15 to 17 and discussed below.

Figure 15 Workplace barriers to females entering the renewable energy workforce



25 This was done for all of the barriers previously mentioned. As in IRENA's previous gender studies, the confidence limits on the scores given to each barrier were fairly wide, so the scores were mostly not significantly different from each other, except for the barriers with the highest and lowest scores.

Figure 16 Workplace barriers to female retention in the renewable energy workforce

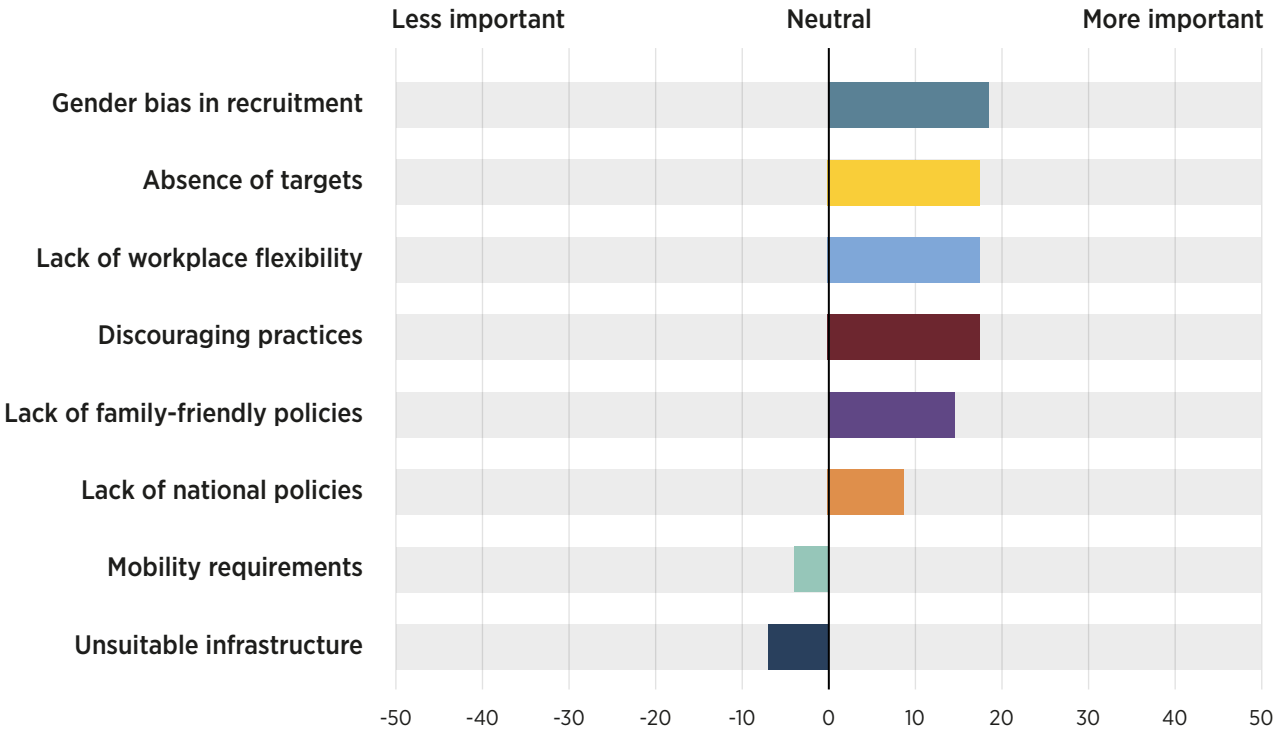
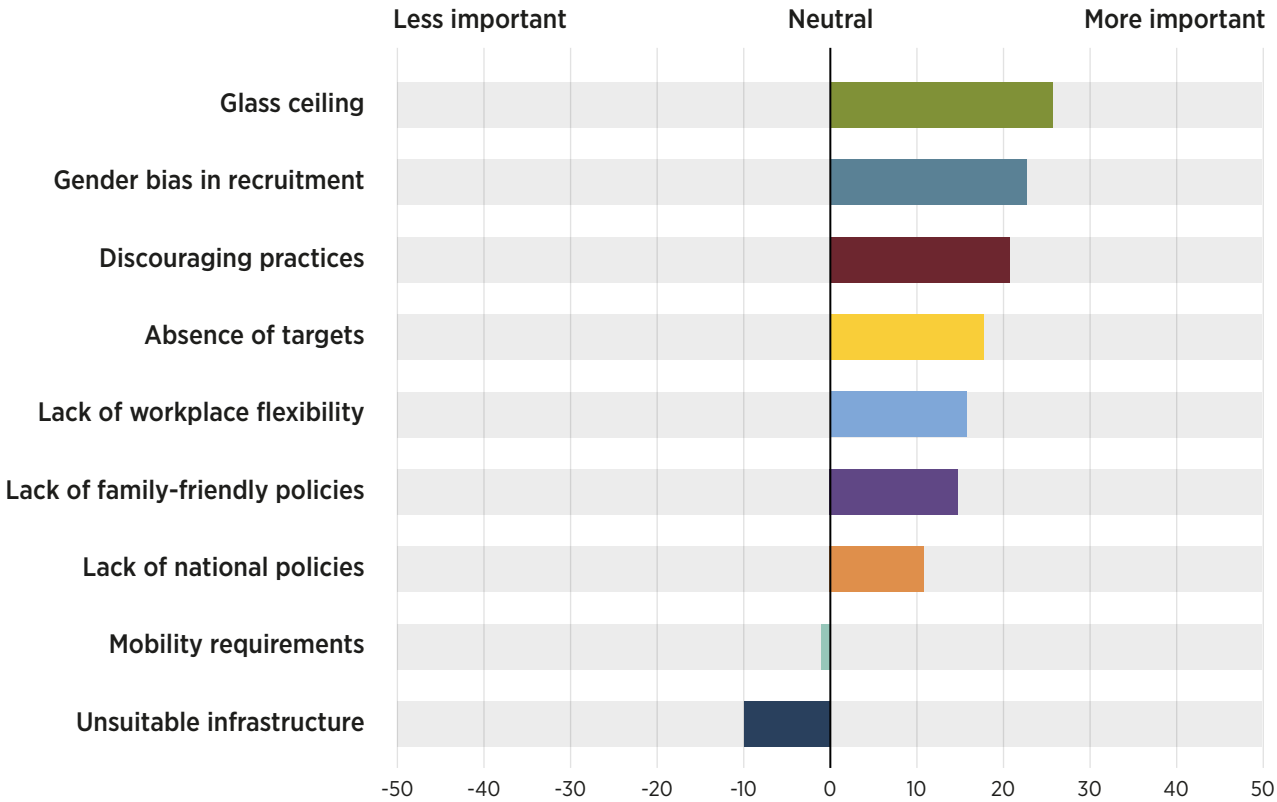


Figure 17 Workplace barriers to female advancement in the renewable energy workforce



Note: Glass ceiling only shows advancement punctuation, as it is, by definition, only an obstacle that keeps women from advancing in their careers.

Two barriers that often scored highly were **gender bias in recruitment** and the **absence of gender and diversity targets**. These are two barriers that employers may not have difficulty addressing, thus providing them an opportunity to facilitate more female employment in the sector. Another issue to address would be the perception of a **glass ceiling** (another type of gender bias), which was scored as the most important barrier for the advancement of women in the sector.

Discouraging working practices were also considered important. A deeper look into this issue was conducted in the survey (Box 6).

Box 6 Gender discrimination in the renewable energy workplace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To assess the prevalence of gender discrimination in the renewable energy sector, women respondents[26] were asked if they had ever been the target of gender-based discrimination at their current or previous workplaces. Those who answered yes were further asked if they had reported the incident, and whether the organisation took any action to address the issue and to protect them or other women. Overall, 45% of the respondents reported that they had been the target of gender-based discrimination at their current or previous workplace. Among them, 24% reported it to their employer, and in only one-third of those reported cases did the organisation take action.

Gender discrimination varied greatly by region, with respondents from **Latin America and the Caribbean** reporting higher levels of experience of gender discrimination (55%), whereas the results for the other regions were similar to or below the global average. Significant differences also appeared for individuals from **different levels of experience**. Those with more experience reported higher levels of gender discrimination, which could mean that discrimination increases with years of experience, or that those who have been working longer are also more likely to experience gender discrimination simply because they have been working for longer.

The survey also invited respondents to provide more details about their experience of gender discrimination, and 117 respondents provided such information. Although it is difficult to summarise the wide range of comments and statements provided by respondents, some broad generalisations are as follows:

- **A woman's role in the workplace:** Almost one-third of respondents who provided more details mentioned that they were either not listened to or were considered not suitable for certain types of work because of their gender. The biases mentioned by respondents varied from the relatively mild (being expected to take notes or to serve tea at meetings) to more serious accusations of male colleagues taking credit for the respondents' work or ideas.

- **Inappropriate comments and behaviour:** Almost one-third of respondents (32 respondents), mentioned that they had received inappropriate comments or been subjected to inappropriate behaviour. This ranged from casual comments about their appearance or being hired to fill a quota, to more serious problems such as sexual harassment and bullying.
- **Inequality in pay or promotion:** Around 10% of respondents gave examples of male colleagues being paid more or being promoted, while having similar or lower levels of qualifications and/or experience compared to the respondent. This was often believed to be simply because these colleagues were men.
- **Family constraints:** A similar share (10%) of respondents mentioned specific instances where they were not hired or promoted, or were fired, because of pregnancy or a concern that the individual would leave or have to take time off if they wished to start a family.

Another issue that was mentioned frequently in the comments was a belief that reporting discrimination was ineffective or could even make matters worse for the individual.

The results presented above, while qualitative, suggest that almost **half of the women working in the renewable energy sector face some type of gender discrimination**. They also show a lack of faith in current measures to address such problems. These results show that, as is true in other sectors,[27] there is much work to be done to address these issues through efficient policies and measures (see section 3).

26 Those who identified as "other" also were asked this set of questions.

27 Further analysis would be required to examine how these results compare with studies of gender discrimination more broadly in the workplace in different countries, but a cursory examination of the results of other recent studies suggests that these figures are no better or worse than reported elsewhere.

National policies were not considered particularly important for female retention and advancement but were identified as the second most important barrier to securing a job in the sector. While this question was framed largely in terms of discrimination and equality, this result could also be interpreted as a need for more active policies to encourage women to train and apply for jobs in the sector. While this may not have been identified as a major concern, likely due to the contexts where the survey respondents live and work, some economies do still enforce labour laws that restrict the types of jobs that women can hold and prohibit them from working at night, particularly in industrial settings. In some countries, women's freedom to travel, work or obtain passports independently remains limited, often requiring permission from a male relative. Additionally, in certain countries, women face restrictions on inheriting property, registering businesses, signing contracts or opening bank accounts on the same terms as men (World Bank, 2024).

Mobility requirements and unsuitable infrastructure were consistently evaluated as least important by respondents and were given scores significantly lower than the importance of the other barriers.

In some countries, **restrictive labour laws limit the types of jobs that women can hold**, while they also face limits on freedom to travel, inheriting property, and registering or running a business.

Comparing the results for entry, retention, and advancement in the sector, the scores given to each of the barriers generally increased, suggesting that they increase over time and become more important later on in women's careers. This could also indicate that younger generations face fewer challenges than those who have been working longer, as gender equality, despite the recent risks of reversals, has generally slowly improved within a period of less than two decades (UN Women, 2025; World Economic Forum, 2025).

Within the demographic of the respondents, some differences can also be highlighted. Notably, male respondents rated the importance of nearly all barriers across the three stages of career development higher than female respondents did. While surprising, this may indicate that the males who took the time to reply to the survey are "allies" in the sense of being aware of, and concerned about, gender inequality.

Respondents from **Europe and North America** gave much lower-than-average scores to the importance of most of the barriers across all three stages of career development, while those from **Africa** and the **Asia-Pacific** region tended to give much higher scores to many of the barriers. Individuals working in **large organisations**[28] also gave much lower scores to the importance of most of the barriers across all three stages of career development.[29] This suggests that, despite not inherently guaranteeing better gender equality, large organisations often have standardised practices that remove bias, as well as more resources and opportunities to implement and enforce policies that promote it (Huttunen and Kosonen, 2021; OECD, 2021).

Individuals with **fewer years of work experience** tended to identify barriers to entry at a lower level than average respondents did. Given that those are the only barriers they have experienced to date, these respondents only stood out in how they rated these early-stage barriers, and they did not rate later career stages. This concurs with the earlier observation that barriers tend to grow over time, with more experienced women reporting encountering barriers more often.

On the other hand, respondents with lower **educational levels** and fewer qualifications (basic or high-school education and diploma) gave higher scores and in some cases much higher scores to the importance of almost all of the barriers across all three stages of career development. Meanwhile, respondents with doctorates mostly gave much lower-than-average scores for barriers at all stages, indicating that education matters and that those with lower certifications may face more challenges than those with higher education. The impact of educational background on the importance of barriers is worth noting, as this suggests that actions to improve access to qualifications and training to work in the sector could be a useful way to facilitate more employment of women in the sector, even when the academic barriers were not highlighted as the highest (see section 2.3).

Although not inherently guaranteeing better gender equality, the **standardised practices of large organisations remove some bias.**

28 Employing 1 000 or more people.

29 The results were cross-checked to see if the results for organisation size were due to most large organisations in the sample being located in Europe and North America, and this was not the case.

Patriarchal societal norms are the second-most important reason for women's difficulties in entering, remaining and thriving in the energy workforce.


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2.2 Societal constraints

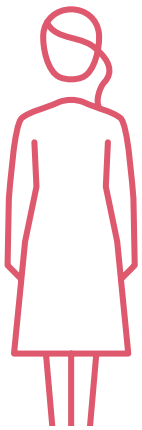
The survey responses indicate that, beyond workplace-specific barriers, entrenched power structures rooted in patriarchal societal norms (Box 7) are ranked second, and are responsible for women's difficulties in entering, remaining and thriving in the energy workforce (Schaefer-Kehnert *et al.*, 2025).

These deep-rooted social norms result in **cultural expectations** and shape the **stereotypes behind gender roles**, worsening the structural inequities that influence women's choices long before they even reach the workplace. For many women, stereotypical gender roles and cultural pressures around marriage, motherhood and caregiving create an expectation where paid work, and more so in technical and field-based jobs, is seen as secondary or even inappropriate.

These constraints not only reflect external **discrimination and bias** but are also internalised by women, eroding their self-perception and confidence, fostering self-doubt and impostor syndrome,[30] and limiting their aspirations and perceived capabilities. Furthermore, the absence of visible **role models** across some activities or positions (namely in leadership) can discourage young women from envisioning careers in renewable energy, perpetuating a cycle of under-representation.

Legal restrictive frameworks also impose direct, tangible unfairness on women's opportunities and promotions. In some contexts, laws continue to limit women's participation in certain industries, restrict their work hours, and require male guardians' permission for travel or employment. Such restrictions are in some instances compounded by unequal access to resources (*i.e.* land or capital), limiting even more women's ability to pursue entrepreneurial opportunities or to build careers in technical fields. These structural inequities are often beyond the immediate control of employers but form the backbone against which all workplace and policy efforts operate.

In societies where **discrimination, gender-based violence, and harassment** remain prevalent, women also face significant psychological and physical barriers to participating fully and safely in the workforce.



30 A term that describes a psychological pattern where individuals, commonly women, doubt their accomplishments and have a persistent and intense fear of being exposed as a fraud, despite evidence of their competence and success.

Box 7 List of societal constraints

The barriers in this category are broad, often overlapping with those in the other two main categories (gendered workplace and academic barriers), and are not exhaustive. The list of options presented to respondents included the following:

Cultural expectations – societal pressures related to marriage, motherhood and caregiving roles.

Stereotyped gender roles – societal expectations and stereotypes limiting women's career choices and opportunities.

Discrimination and bias – lack of opportunities, promotions and unequal pay due to discrimination and bias.

Self-perception and confidence – self-doubt, lack of confidence and internalised societal messages affecting women's perceived capabilities.

Lack of role models – absence of inspirational figures impacting women's professional aspirations.

Gender-based violence – harassment, psychological abuse, microaggressions and intimidation.

Legal restrictions on gender – laws limiting women's work hours, job access and participation in specific industries.

Legal restrictions on mobility – country policies restricting women's travel alone or without a male guardian's permission.

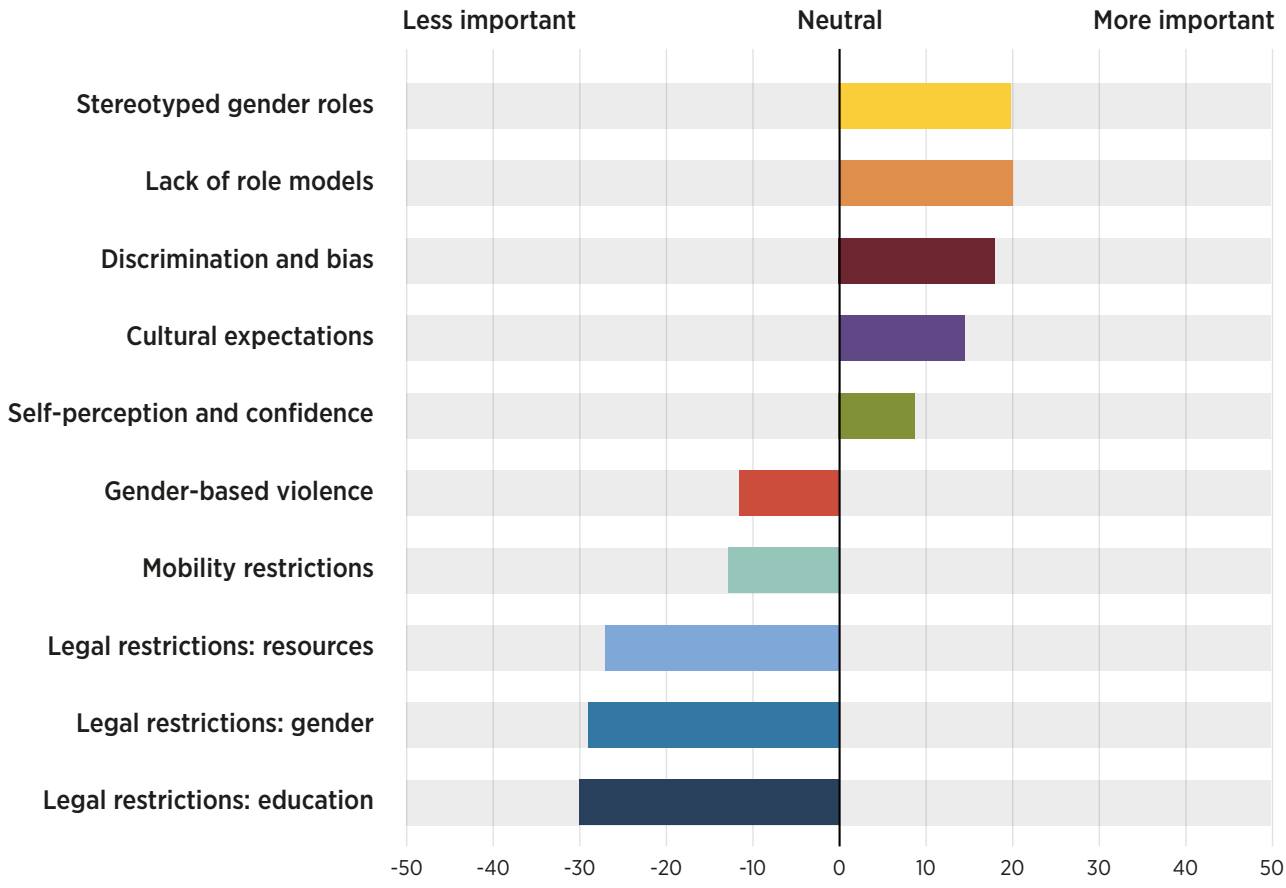
Legal restrictions on resources – limited access to land, capital, financial resources and technology due to discriminatory laws.

Legal restrictions on education access – legal barriers hindering women's access to education.

Co-ordinated action by governments, communities and civil society is needed to erase societal constraints on women.

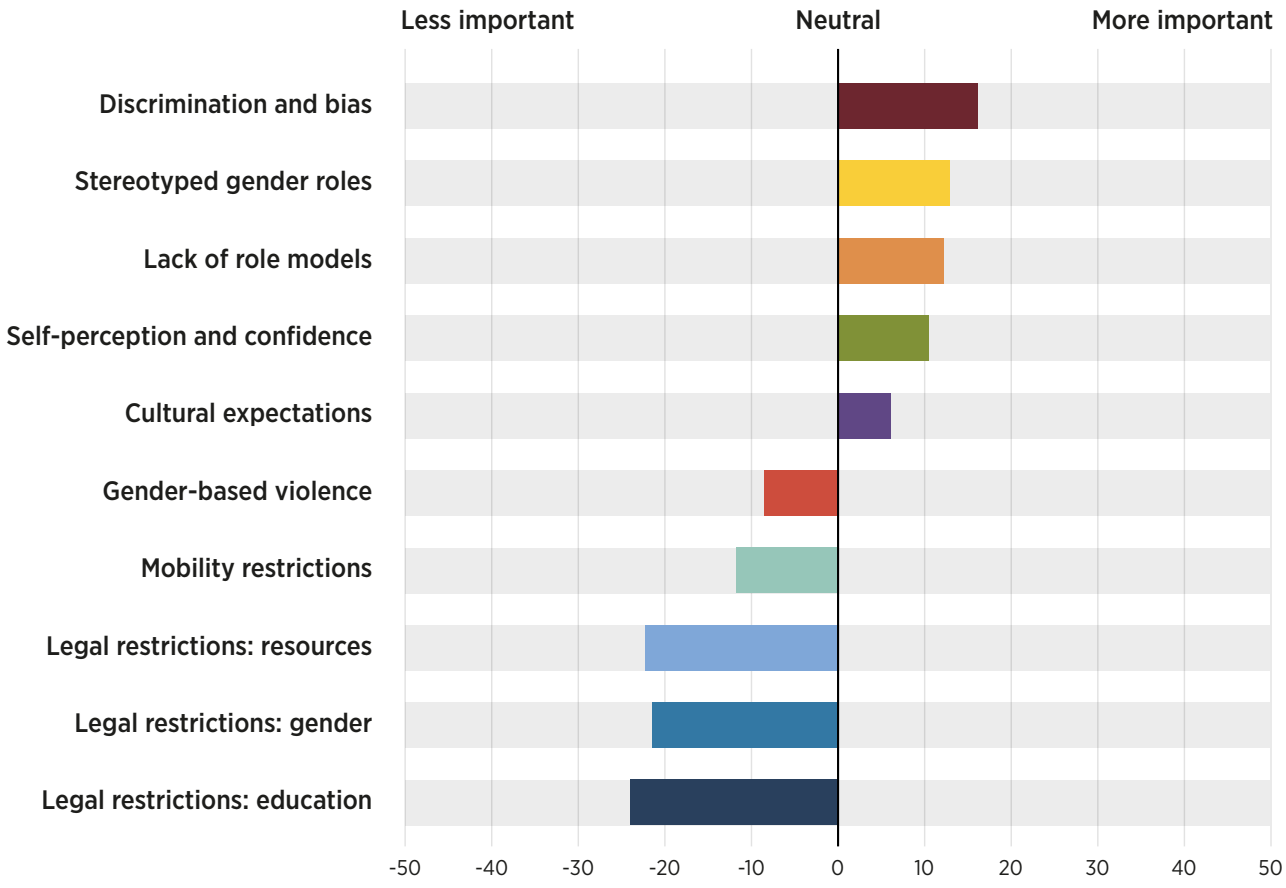
Addressing these societal constraints requires co-ordinated action by governments, communities and civil society to erase (once and for all) the discriminatory laws, challenge harmful norms and create enabling environments that support women's full participation in the overall economy. To understand these limitations specifically for the renewable energy sector (as done in the previous section), the survey explored the extent to which respondents perceived these societal factors as barriers, acknowledging their significant and often under-appreciated role in shaping career trajectories.

Figure 18 Societal constraints to females entering the renewable energy workforce

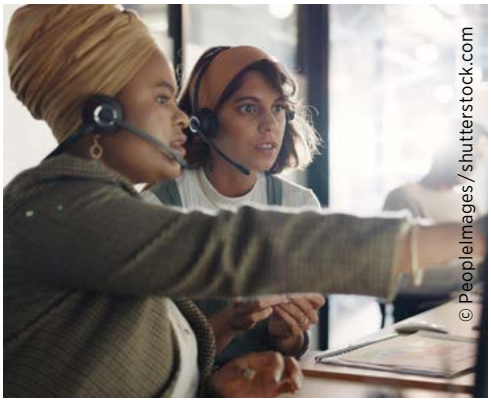


In this case, the scores that respondents gave for each barrier were mostly very different from one another (see Figures 18 to 20). This reflects both the greater agreement among respondents about the level of importance of each barrier (leading to smaller confidence intervals on the score for each constraint) and the larger differences between the levels of importance (scores) of each constraint.[31]

Figure 19 Societal constraints to female retention in the renewable energy workforce

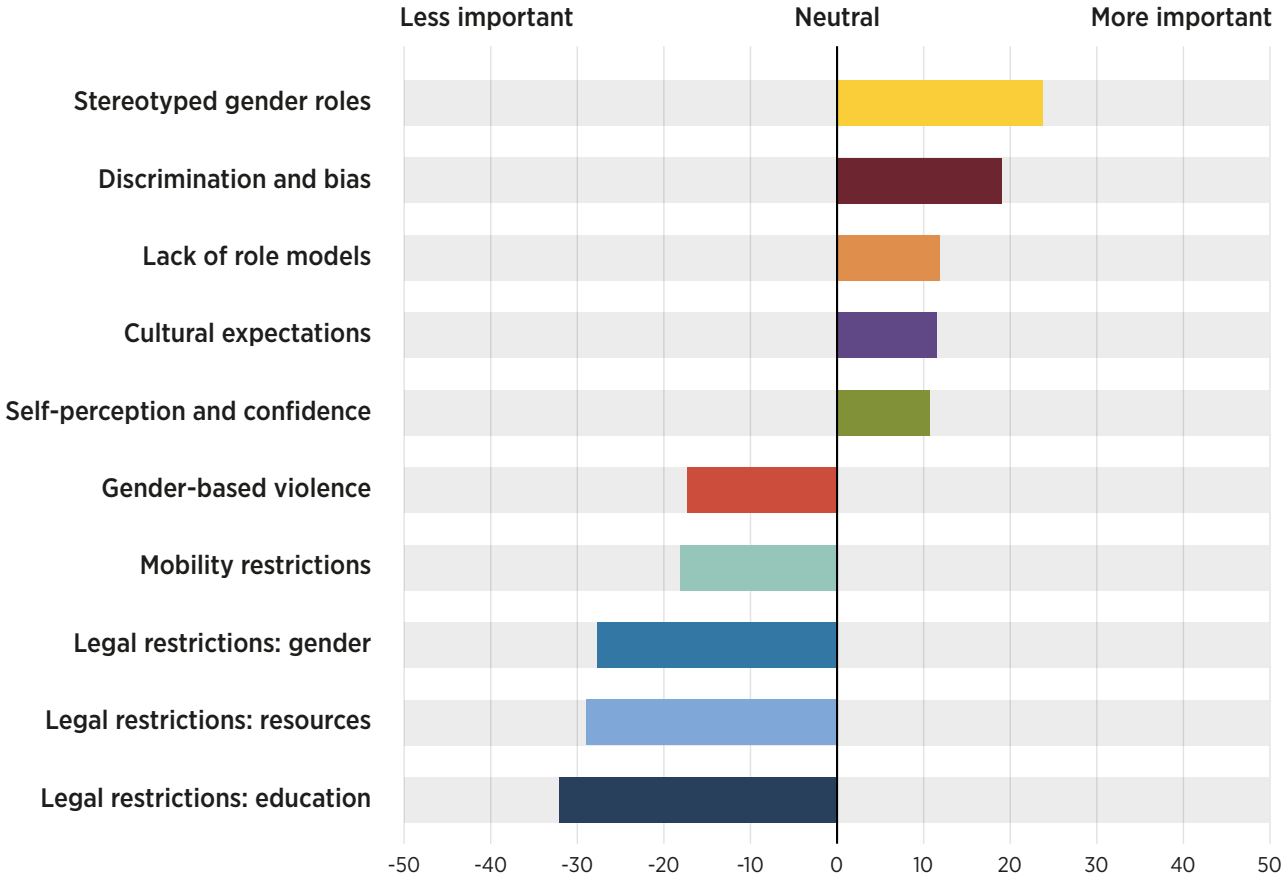


31 The two exceptions to this were as follows: The scores given to the three legal restrictions were significantly different from the scores given to the other constraints but were not significantly different from each other; and, the scores given to self-perception and confidence were not significantly different from the scores for cultural expectations.



The results show that while **cultural expectations** were only viewed as moderately important, the **stereotyping of gender roles** is far more of a challenge. Thus, the idea of women working is not as much of a barrier as is the type of work they may be interested in pursuing. In other words, women's access to the overall economy is widely accepted, but some sectors, including renewable energy, are still lagging. The closeness of the scores for cultural expectations and **self-perception and confidence** also suggests that the two may be possibly linked. The **lack of role models** was also viewed as important, particularly with respect to entering the workforce, suggesting that this could be something to address to overcome some of these constraints.

Figure 20 Societal constraints to female advancement in the renewable energy workforce



The scores for **discrimination and bias** were relatively high across all three of the main stages of career development and were consistent with those reported for workplace practices. While the question about workplace practices was related specifically to practices (such as in hiring), the framing of the question in this case was more general, to include other aspects. Respondents agreed that this broader perception around discrimination and bias is a problem for women in the workforce.

Whether in working hours and sectors, financial or educational, **legal restrictions** were consistently evaluated as least important by respondents and were given scores significantly lower than most of the other barriers. One exception highlights an issue important for very location-specific audiences: **mobility restrictions**. As this was only for a small part of regional respondents, the impact globally is relatively less important across the whole sample. However, even in the regions where they were given higher-than-average scores, these scores were still almost always much lower than the scores given to other constraints in those same regions, indicating that they are relatively less important in almost all cases.

Other noticeable differences in the results between different demographics include that respondents from **Europe and North America** again gave much lower-than-average scores to the importance of most of the barriers across all three stages of career development. Additionally, individuals working in **large organisations**[32] (typically located in these two regions) also gave much lower scores to the importance of many of the barriers across all three stages of career development.

Again, **males** mostly gave higher scores to the importance of almost all of the barriers across all three stages of career development. The one exception was discrimination and bias, where males viewed this constraint as much less important than females and other respondents (probably reflecting the fact that as allies, they do not hold this sort of bias).

In this set of barriers, there was no systematic pattern in the variation of answers given by individuals with different **levels of work experience or types of educational backgrounds (STEM versus non-STEM)**. However, those with a higher level of education (doctorates) mostly gave much lower-than-average scores for barriers at all stages.

The idea of women working is less of a barrier than acceptance of the type of work they may be interested in pursuing - indicating that stereotyping of gender roles remains strong.

32 The two largest size bands, employing more than 500 people.

The differences between regions, organisation size and gender were similar to those reported for workplace barriers, suggesting that many of the workplace barriers probably reflect the broader environment of social constraints in countries. The lack of any systematic pattern in the differences with respect to experience and education suggests that improving experience and education may address some of the workplace barriers that women face but may have less of an impact on broader societal constraints.

While this may be true for individuals in renewable energy, it is possible that as societies as a whole attain higher levels of education, attitudes towards diversity and inclusion also evolve, reducing the societal constraints that women face. Evidence shows[33] that rising educational attainment in a population is strongly associated with more egalitarian views of gender roles, suggesting that investment in education can contribute not only to individual empowerment but also to a broader cultural change (OECD, 2017).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2.3 Academic barriers

There is clear evidence that girls' education is crucial for development. But globally, gender disparities in **access to education** persist, with just 49% of countries having reached gender equality in primary education, only 42% of countries in lower secondary education and barely 24% in upper secondary education (UNICEF, n.d.).

In the majority of developing countries, women are much less likely than men to enroll in **Technical and Vocational Education and Training (TVET)**, profiles that are vital in the renewable energy sector (Santos and Rubiano-Matulevich, 2019). In STEM fields, women and men still have different chances of starting a career. On one hand, women are earning 54% of postgraduate degrees in member countries of the Organisation for Economic Co-operation and Development (OECD), with even higher rates – nearly 70% – reported in several Global South countries, including Algeria, Indonesia, the Kyrgyz Republic, Malaysia, Qatar, Thailand, Tunisia and Uruguay (World Bank, n.d.). However, a degree in STEM does not guarantee employment, and one of the weakest joints in the STEM pipeline is the connection between education and employment (Almukhambetova, 2024). This phenomenon, known as the "leaky pipeline", reflects the steady loss of women from STEM and related careers at various stages, depriving the sector of diversity, talent and innovation (Qadi, 2025).

33 "Higher levels of education tend to correlate strongly with more gender-egalitarian attitudes, both at the individual and societal level. In particular, better-educated men are more likely to support gender equality" (OECD, 2017).

In addition, the absence of **supportive professional development structures** limits women's career growth. Women often report a lack of mentorship and sponsorship, which are critical for navigating career pathways, gaining confidence and accessing senior-level opportunities. Limited networking opportunities likewise restrict women's visibility and ability to build professional relationships, which are key to advancing in a competitive and male-dominated sector. These gaps are particularly evident when women seek to transition into leadership roles, where tailored leadership training and development programmes are often scarce or inaccessible.

The survey respondents judged under-representation of women in STEM occupations least relevant. But to address the problem, it is important to understand what experiences women have compared to men, which factors determine whether women continue into STEM-related employment or leave the profession soon after graduation, and what unique challenges they face when employed in STEM jobs. For that, the survey assessed the degree to which these academic and skills constraints were seen as obstacles (Box 8), recognising their foundational importance for achieving gender equity in the workforce.

Lack of mentorship, sponsorship and networking opportunities limit women's career pathways and access to senior-level opportunities.

Box 8 List of academic barriers

The barriers in this category are broad, often overlapping with those in the other two main categories (gendered workplace and societal barriers), and are not exhaustive. The list of choices presented to respondents included the following:

Lack of access to education – limited availability of educational resources hindering skill development.

Lack of STEM background – insufficient exposure or background in science, technology, engineering and mathematics fields.

Lack of non-STEM background – inadequate knowledge or training in non-STEM disciplines.

Limited training opportunities – scarce availability of skill-specific training programmes.

Absence of mentorship – lack of guidance and mentorship for professional development.

Limited networking opportunities – insufficient platforms for building professional networks.

Absence of leadership training (for advancement) – inadequate opportunities for training in leadership skills.

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Figures 21 to 23 show the results of the analysis of barriers related to skills, education, and professional development, which statistically were all significantly different from each other.

Results show that **mentoring, networking and training** are consistently evaluated as more important than the other challenges listed. The scores for mentoring and networking are not very different (insignificantly different in the first two stages of career development), with limited access to training opportunities being slightly less important. In addition, for career advancement, lack of access to leadership training is evaluated as the most important barrier.

Insufficient exposure or background in STEM subjects is generally rated as quite important, but general access to education and lack of a background in non-STEM subjects are rated as much less important. Thus, respondents perceive that education in STEM subjects is more important than other types of education for working in the renewable energy sector. Comparing the scores for these barriers overall, the results show that, while formal education is still important, respondents believe that deficiencies in other aspects are more important barriers for their career development in the sector.

Within the sample of respondents, the differences in results were similar to those noted previously, with **male** respondents again giving higher-than-average scores than women to the importance of many of the barriers for retention and advancement.

Figure 21 Skill and educational barriers to females entering the renewable energy workforce

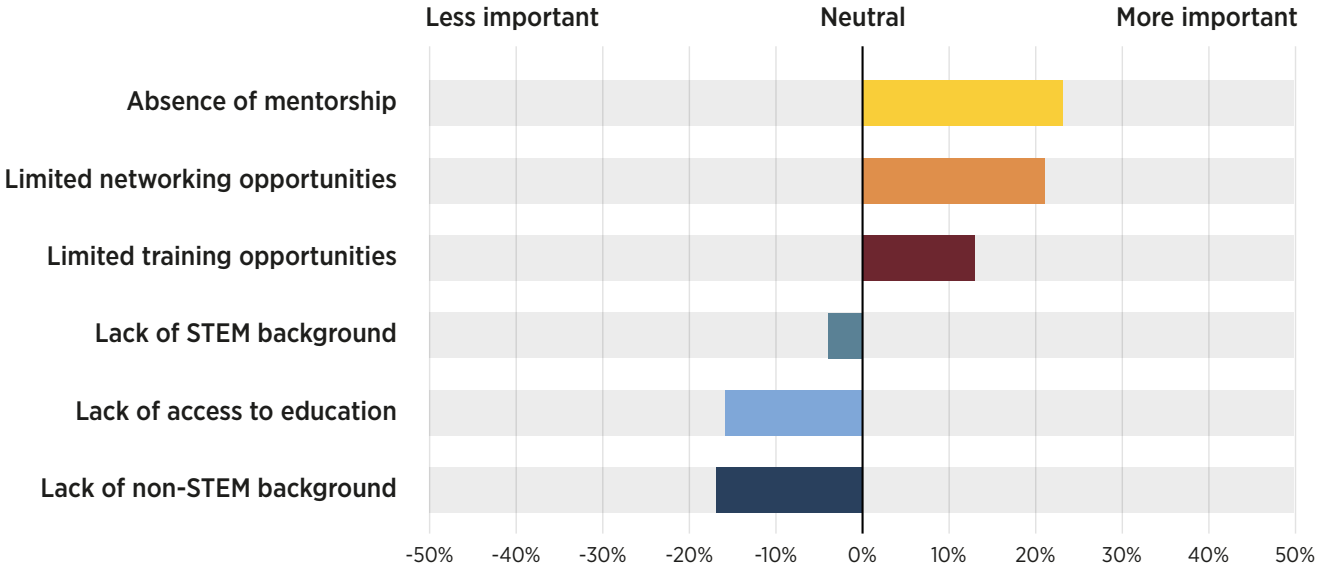


Figure 22 Skill and educational barriers to female retention in the renewable energy workforce

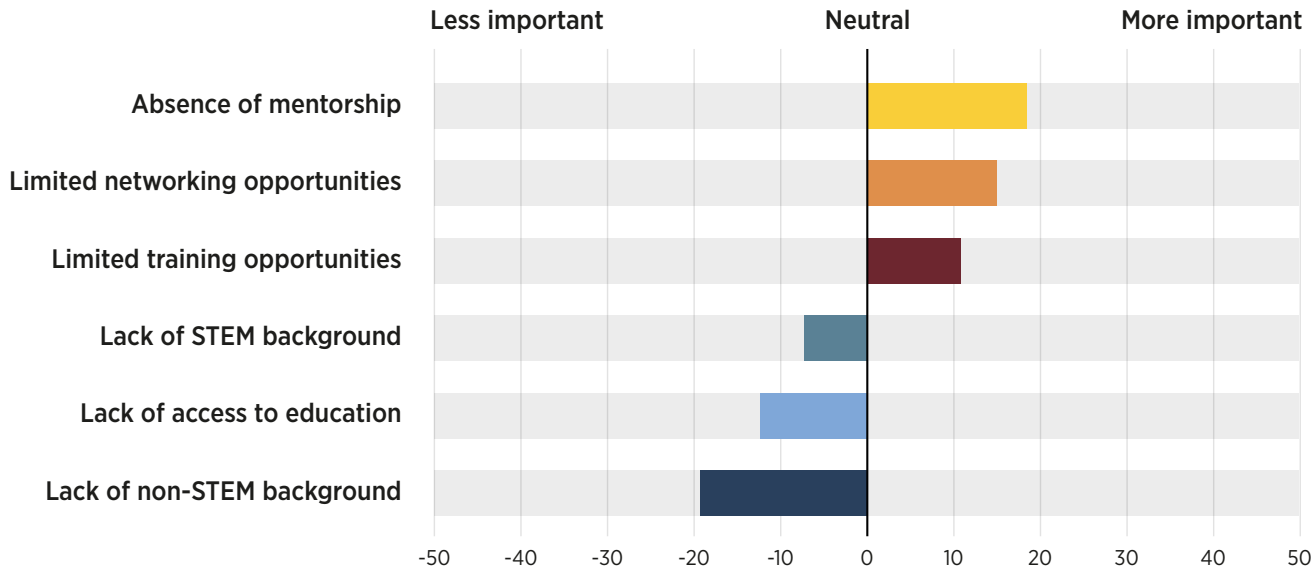
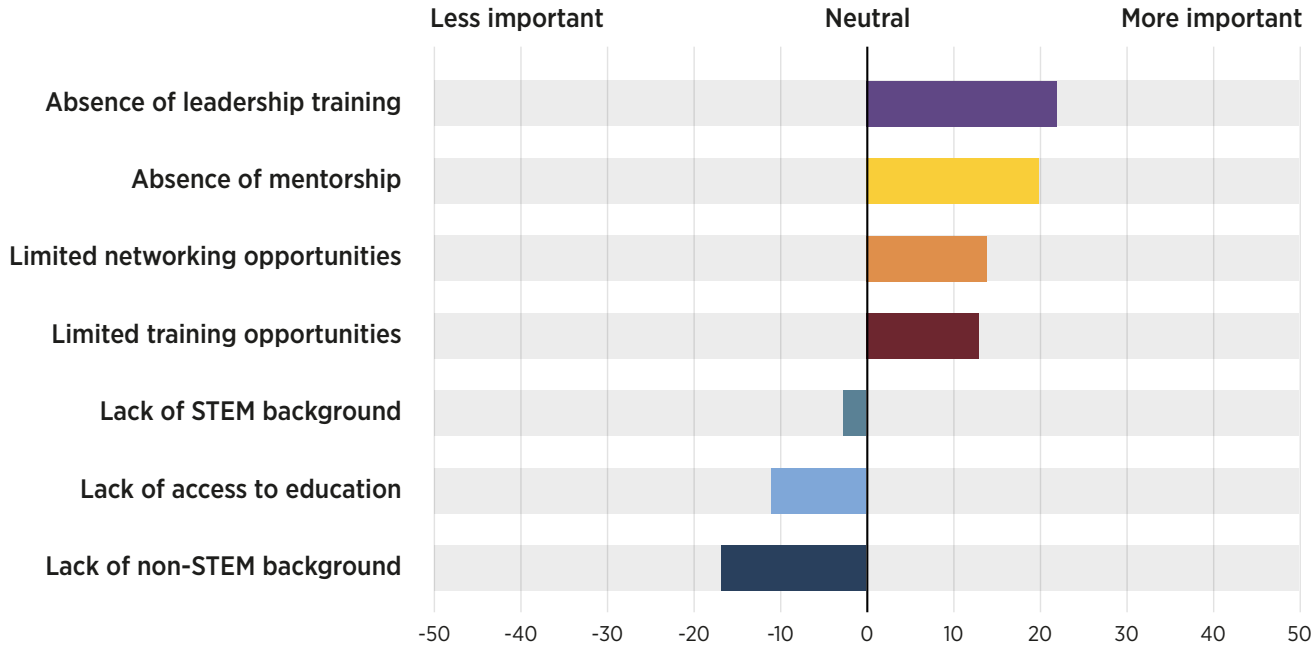


Figure 23 Skill and educational barriers to female advancement in the renewable energy workforce



Note: Absence of leadership was only offered for the advancement question.

Likewise, the lowest scores were given by respondents from **Europe and North America** and those individuals working in **large organisations**[34] across all three stages of career development. As might be expected, respondents with **higher-level qualifications** (master and doctorate degrees) gave much lower scores for many of the barriers across all three stages of career development.

Addressing academic and skills-related barriers therefore requires a multi-faceted approach: improving access to quality education for girls, promoting STEM and non-STEM learning pathways, expanding technical and leadership training programmes, and – most importantly for the respondents – fostering mentoring and networking opportunities to support women's ongoing professional growth.

In addition, barriers arise as consequences of the previously mentioned categories. These barriers are deeply interconnected and persist despite efforts to isolate and address their underlying causes.

A notable example is the gender pay gap, which arises from several factors including **gendered workplace dynamics** due to the absence of robust equal pay measures, and a reliance on individual negotiation to determine pay scales. **Broader societal constraints** also play a role in shaping the pay gap, with implicit biases that unfairly disadvantage certain groups. Finally, **academic barriers** contribute as well: while it is reasonable for roles with lower levels of responsibility to command lower pay, individuals with limited access to education will typically find themselves trapped in lower-paying positions, perpetuating cycles of inequality. To ensure nuanced understanding, the survey and consequent analysis examined the gender pay gap by addressing the issue with a set of questions.

Barriers related to skills, education, and professional development are deeply interconnected and persist.

34 Employing more than 500 people.

Gender Pay Gap

As defined in previous IRENA reports, **pay gap** refers to the overall differences in pay between classes of people within a grouping, such as a country, sector or organisation. **Pay equity** means providing equal compensation for employees who are similar in terms of job duties and responsibilities, and in important characteristics such as experience, tenure, location and job performance. **Pay equality** describes a broader concept than pay equity and refers not just to equal pay for people in similar situations, but also to the equality of opportunity, motivating factors and acceptance that lead to the proportional holding of positions across the pay spectrum.

This distinction implies that some portion of the pay gap is justified due to legitimate differences in roles, experience, or performance, while another portion reflects bias and results in an unjustified and unfair pay gap. In this sub-section, we present findings from a set of questions designed to explore respondents' perceptions of the reasons behind the observed wage differences, to serve as the baseline to propose potential measures to eliminate unjustified pay disparities between genders while minimising justified pay differences, ensuring fairness across individuals regardless of their gender.

Overall, 31% of respondents said that both genders are paid equally, **68% said that men are paid more** and 1% said that women are paid more. This result, however, reflects individuals' perceptions. More telling is that with respect to the organisation responses, these figures were reversed, with 65% of the participating organisations saying that both genders are paid equally, but **32% still saying that men are paid more**. As in previous surveys, men reported much higher levels of perception of pay equality than others, both in the overall economy and in their own organisations (Table 2).

While a portion of the **pay gap may be due to legitimate differences** in roles, experience, or performance, **another portion reflects bias**.

Table 1 Perceptions of pay equality overall and in the individual respondent's own organisation

Region	Who is paid more (overall)?			Who is paid more in your organisation?		
	Men	Neither	Women	Men	Neither	Women
Africa	37%	62%	1%	22%	76%	2%
Asia-Pacific	61%	38%	1%	24%	74%	2%
Europe and North America	79%	20%	1%	35%	63%	2%
Latin America and Caribbean	75%	23%	1%	41%	56%	2%
Global average	68%	31%	1%	32%	65%	2%
Responses by gender						
Female/other	79%	21%	1%	40%	59%	2%
Male	34%	63%	3%	12%	85%	3%
Responses by organisation						
Government	52%	46%	1%	18%	82%	0%
Other	56%	40%	4%	15%	81%	4%
Public enterprise	61%	38%	1%	26%	73%	2%
Self-employed	64%	33%	3%	28%	69%	3%
NGO/CSO/ Assoc.	72%	27%	1%	30%	66%	4%
Private enterprise	74%	25%	1%	43%	56%	2%

There were significant differences (p <= 1%) in the responses to the question of pay equality among respondents from different regions, between males and others, and from respondents working for different types of organisations. Differences in responses were not significant with respect to other variables (years of experience, organisation size, educational background).

By region, respondents from **Africa** stated a much higher level of belief in pay equality, as did those from the **Asia-Pacific region** (with respect to their own employers). Respondents from **Europe and North America** believed that pay inequality was much less common overall but reported results similar to the global average for their own employers.

With respect to type of organisation, respondents working in government, public enterprises and other types of organisations reported higher-than-average perceptions of pay equality, while those working in private enterprises reported much lower perceptions of pay equality.

In all cases, respondents reported much higher levels of pay equality in their own organisations compared to their perceptions of pay equality in the overall economy. Thus, it appears that respondents generally believe that **pay equality is more likely to occur in the renewable energy sector** than in the wider economy.

To explore why gender-driven pay gaps may occur, respondents reporting that pay was not equal were also asked why that may be the case – whether for **"justified"** reasons such as differences in type of job (activities) or differences in years of experience (seniority); or for **"unjustified"** reasons including differences in negotiating position, lack of common pay-scale or company policy, or other reasons.

Figure 24 presents the relative frequency of the different possible reasons that respondents gave for a gender pay gap.

Higher-than-average perceptions of pay equality are reported among government and public enterprise workers than by private enterprise employees.

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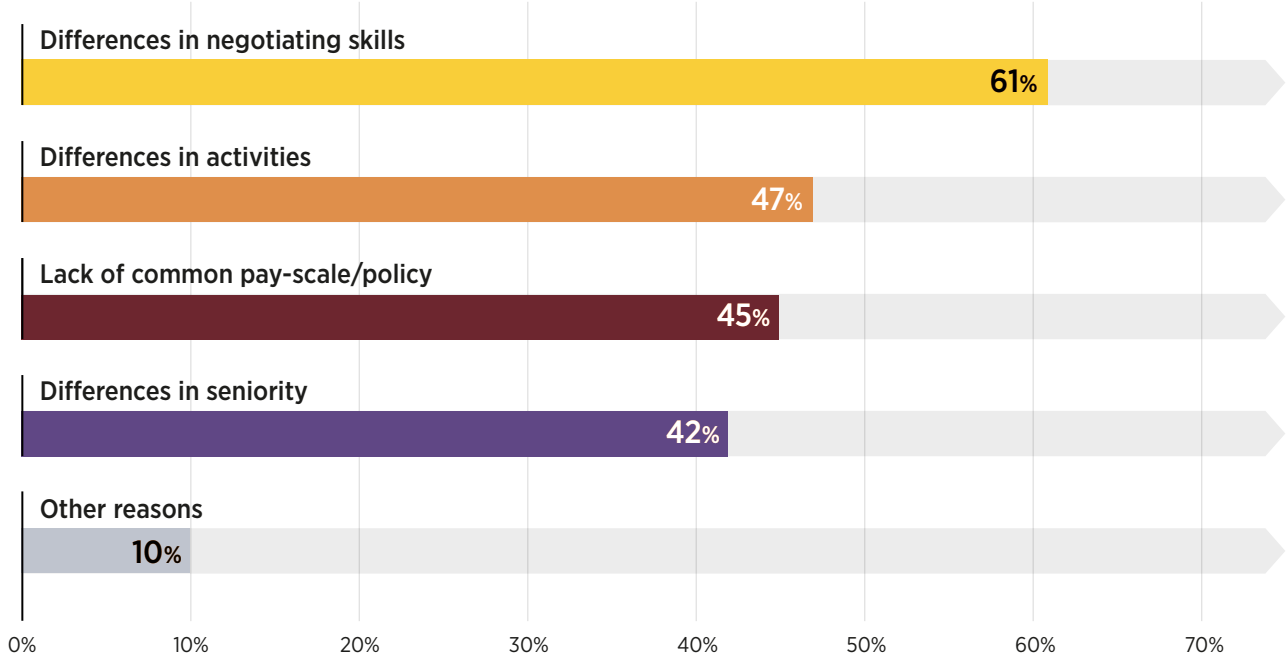
Figure 24 Reasons given for gender pay gaps



Note: Respondents could reply with as many of the above reasons as they thought applied, so the percentages for each of the answers sum to more than 100%.

The practices used to determine compensation vary greatly among different companies and organisations.

Differences in negotiating skills was most frequently mentioned as an explanation for pay differences, with 61% of respondents stating that this was a reason. Differences in activities was the next most frequent answer (47% of respondents), followed by the lack of a common pay-scale or policy (45%) and differences in seniority (42%). This means that having a compensation policy and common pay-scales can solve the unfairness derived from women valuing the work less.

Overall, nearly two-thirds (64%) of respondents said that salary scales for roles and levels are defined in the organisations where they work, while the other one-third said that wages and salaries were negotiated. However, the practices used to determine compensation varied greatly among respondents. Respondents from Europe and North America reported a lower use of salary scales (58%), while respondents from other regions all reported higher-than-average use. The use of salary scales also tended to increase with organisation size and the education level of respondents (individuals from larger organisations and/or with higher educational qualifications reported a greater use of salary scales than others). Those working for government, public enterprises or other organisations also reported a higher use of salary scales than individuals working for other types of organisations.

One purpose of this question was to see if the use of salary scales had a positive impact on pay equality, and this was found to be the case. More than three-quarters (77%) of individuals working in organisations using salary scales reported that men and women were paid the same in their organisation, compared to 44% of those working in organisations where wages and salaries are negotiated. Along with the finding that differences in negotiating skills is an important reason for pay disparities, this suggests that **the use of salary scales is an effective way to address pay inequalities** that may exist in the sector.

Figure 25 Structural and individual factors influencing wage disparities between genders

The informality of employment in areas that **lack access to electricity**, particularly in the **Global South**, disproportionately affects women.

2.4 Barriers for women in the energy access context

As previously discussed, the distributed nature of off-grid renewable energy solutions offers tremendous opportunities for women's engagement along multiple segments of the value chain. Many of the skills needed to take advantage of these opportunities can be developed locally, and women are ideally placed to lead and support the delivery of off-grid renewable energy solutions. However, in the energy access context, women face significant barriers to fully participating in and benefiting from these opportunities.

Although the online nature of the survey that forms the backbone of this report limits the ability to fully capture these barriers, literature and previous IRENA work suggest that the barriers in the renewable energy sector mirror those observed across the broader energy and employment sectors. Cultural and social norms, the lack of gender-sensitive programmes and policies, and limited access to skills and training opportunities remain among the most frequently cited obstacles (IRENA, 2024b)

In addition to these widely acknowledged barriers, the informality of employment in areas that lack access to electricity, particularly in the Global South, poses a particular challenge, disproportionately affecting women. Data show that women are over-represented in the informal and vulnerable economy: nearly 55% of women's employment globally is informal, and the figure increases for low-income countries (ILO, 2023).

Decentralised renewable energy solutions can help mitigate these challenges by creating direct formal jobs that women can benefit from (as sales agents, technicians and micro-entrepreneurs). Also, the expansion of access can enable productive uses and resilient livelihoods. However, these are still often informal and lack security, social protection and opportunities for advancement (IRENA, 2024b). To fully harness the potential of renewable

energy in transforming women's economic prospects, efforts must focus not only on expanding access but also on improving job quality and security in the sector.

Furthermore, the intersecting impacts of climate change exacerbate the barriers faced by women in these communities. Women and girls are often the most affected by the adverse consequences of climate-related shocks and stresses, given their traditional roles in water collection, food production and household energy management. Heat stress, in particular, represents a growing yet under-recognised challenge. Women's disproportionate presence in informal and outdoor work, combined with socio-cultural constraints and lower access to health care, increases their vulnerability to heat-related illnesses and productivity losses. In Asia and the Pacific, women face an estimated annual productivity loss equivalent to USD 41 billion due to heat stress, a figure that is projected to grow with rising global temperatures (ADB, 2024).

These hidden tolls of climate change on women and girls further underscore the urgency of accelerating renewable energy deployment, which can help reduce their exposure to climate risks by improving access to clean cooking, cooling, water pumping and other resilience-enhancing services.

Targeted policy measures – such as supporting the formalisation of jobs (beyond renewable energy), integrating gender-responsive approaches into climate adaptation and energy access programmes, and providing women with training and resources tailored to their needs – are critical, but so are measures to distribute better the traditional chores and burdens among both genders. Such interventions can ensure that the transition to renewable energy not only expands access but also enhances women's resilience and agency in the face of climate change, and improves their role in society as well.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RENEWABLE ENERGY
A GENDER PERSPECTIVE
Second Edition

Measures and solutions to support women working in renewables

3

03

Studies consistently show that companies that are committed to diversity and inclusion greatly outperform those that are not (McKinsey & Company, 2023), and how increasing the share of women in leadership roles correlates with higher profitability (Noland *et al.*, 2016). Yet, these are challenging times for workplace diversity. Diversity, equity and inclusion (DEI) efforts are increasingly being attacked and criticised for political gain amid divisive debates. In response to pressure campaigns, many initiatives are being scaled back or even abandoned. During 2024, these developments weakened and threatened women's rights in a quarter of all countries (UN Women, 2025).

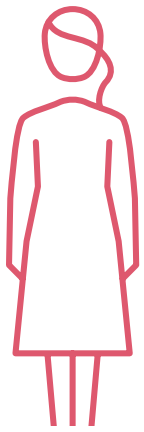
The availability of robust data can help debunk false information and biases. Gender-disaggregated data on renewable energy, as in any other sector, lay the foundation for more effective, evidence-based policy making. By understanding where unfairness exists and which factors contribute to it, stakeholders are better equipped to implement measures that are both relevant and impactful.

Having now established a clearer picture of women's participation and the gender-driven challenges and gaps within the renewable energy sector, a logical next step is to consider actions that can remove barriers and improve women's representation and perception of the sector. Policy makers, industry leaders, educational institutions and other stakeholders need to design targeted interventions that address the specific barriers that women face.

Informed by the survey data evidence, this section suggests a range of measures and policies to foster an inclusive environment where women can access opportunities, develop skills and advance their careers in renewables. They could thus become key agents to not only drive change towards gender equity, but also accelerate the inclusive energy transition towards a renewables-centric energy system.

Building a truly inclusive and equitable workplace requires a multi-level approach. Governmental institutions must remove restrictive laws and pursue policies that promote gender equality. Organisations, regardless of existing national policies, must adopt a comprehensive set of measures that address the diverse needs and the particular challenges faced by women throughout their careers. Other stakeholders such as financial institutions, education, and training centres can integrate gender considerations within their mandates. Inter-governmental organisations and NGOs/CSOs can contribute by advocating for international norms, facilitating knowledge sharing and monitoring progress towards global commitments. Such a combination of approaches can remove social, structural and cultural barriers and create an environment where all women are able to thrive in the workplace.

Gender-disaggregated data on renewable energy lay the foundation for more effective, evidence-based policy making.



3.1 Governments

The responsibility of governments is to ensure that all members of society are able to live, work and thrive under conditions of fairness, security and opportunity. This includes creating enabling environments where the principles of equality and equity are actively promoted and protected, A central dimension of this responsibility is advancing gender equality and equity, both within and beyond the renewable energy sector. This includes laws that protect women from misogynist violence, protect their rights, and ensure non-discrimination laws, equal pay legislation, and equal access to land, finance and education – all of which are often barriers to women's participation in the overall workforce. As important as it is to pursue such measures as worthy ends in and of themselves, it is clear that they are also of tremendous benefit to the energy transition, elevating the voices, insights and capabilities of women.

Institutions are critical. There are numerous examples of countries that have established institutions such as ministries for gender equality, with mandates to formulate and carry out or support gender-sensitive monitoring and evaluation, gender-responsive reporting, staff training on gender issues, technical training opportunities for women, performance indicators on gender mainstreaming for staff, and gender-sensitive communication strategies.

In the energy sector, as in other sectors, governments should carry out **gender-sensitive data collection** and transparency mechanisms to track progress to hold both public and private actors accountable. While IRENA's survey provides a solid baseline, context matters, and therefore country-level and sub-sector-level gender-disaggregated data are essential to support efforts to increase women's participation in the energy sector.

In addition, ministries, including those related to energy affairs, should integrate a gender mainstreaming strategy across all areas of their work, to identify strengths, weaknesses, constraints and opportunities for aligning with political commitments to gender mainstreaming. **Gender energy audits**, such as the ones carried out by ENERGIA,[35] identify and address inequalities such as gender blindness and lack of consultation with women, leading to increased awareness, design of targeted interventions, and ways to measure success. By actively involving a country's ministry of energy from the start of the audit in several countries – such as Botswana, Kenya, and Senegal, among others – ENERGIA builds a sense of ownership by the ministry, and, in turn, increases the likelihood of policy implementation (ENERGIA, n.d.).

35 ENERGIA, an international network on gender and sustainable development, developed an energy audit methodology in response to the growing concerned about the slow progress with mainstreaming gender in countries' energy policies.

Another example of effective mainstreaming lies in **gender budgeting**, a public finance approach that integrates gender equality objectives into budgeting processes, ensuring that resource allocation and public spending benefit women, men and gender-diverse groups equitably. Rather than creating separate budgets, they systematically integrate monitoring to measure the impact on different groups, identifying and addressing gender gaps, and tracking progress. Applying gender budgeting to the energy transition, especially to renewable energy, can amplify benefits and make climate action more inclusive.

Gender mainstreaming needs to also integrate gender considerations into all climate and energy policies, such as **Nationally Determined Contributions (NDCs)** currently being revised. Countries are increasingly integrating gender considerations into their NDCs under the Paris Agreement (GGGI, 2024). As of 2024, 82% of NDCs include gender references, with nearly half committing to gender-responsive implementation; while this reflects continued progress, the quality and depth of integration remain uneven, and many Parties still fall short of clearly linking gender considerations to concrete climate actions (GGGI, 2024; UNFCCC, 2024). More ambition and proper monitoring and accountability are required to truly advance and achieve meaningful mainstreaming.

Last, but not least, governments have a key role in **awareness raising and advocacy**. Governmental institutions have the responsibility to ensure that women and men alike are protected with full human rights and have access to opportunities and comprehensive social protection. A holistic approach extends from the workplace to the wider policy and cultural environment, recognising and addressing individual differences to elevate those most disadvantaged. Ultimately, the goal is not only to achieve equality but also to advance equity, ensuring justice for women, but also for all who are in a situation of disadvantage.

Gender mainstreaming strategies include gender energy audits, gender budgeting, and efforts to integrate gender considerations into all climate and energy policies.

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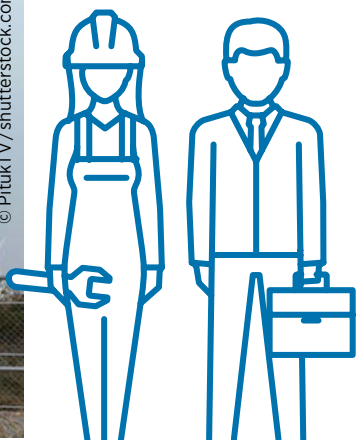

3.2 Employers

Organisations hold the key to increasing women's participation in the workforce. However, as highlighted in the introduction of this analysis, many organisations are facing challenges in recruiting and retaining employees (LinkedIn, 2024). These challenges appear to be even more pronounced when increasing the representation of women. As much as 42% of the organisations participating in IRENA's survey reported difficulties in recruiting and retaining female employees. This issue was consistent across different locations and organisational types. Notably, 90% of project developers indicated that they faced such challenges, with the most common reason being a lack of female applicants.

To address this, organisations can implement targeted actions that make these roles more attractive to women. Key areas for action include **arrangements that enable work–life balance** in various forms; specific measures to support women and men with **family responsibilities**; initiatives to **promote professional growth** and advancement for women; policies that guarantee and foster a **safe and respectful workplace**; and processes and practices that strengthen **fairness, diversity and inclusion at all levels** (Box 9).

Box 9 Policies and measures

Arrangements that **enable work–life balance** for both women and men and their caring and personal responsibilities:

- Flexitime – allowing employees to adjust their start and end times to accommodate personal responsibilities.
- Remote working arrangements – enabling employees to work from home or other locations, full-time or on certain days.
- Job-sharing and part-time options – offering alternatives to full-time work that still allow for career progression.

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Policies that **support family responsibilities**: flexible arrangements also contribute to the support of family care and dependents, but some particular policies are required for those in childbearing years:

- Extended maternity and paternity leave – providing leave beyond the minimum legal requirements to support parents equally.
- Workplace on-site childcare or childcare vouchers – making childcare accessible and affordable to ease the return to work.

Initiatives that **promote professional growth and advancement**:

- Training opportunities and education funding – supporting upskilling and continuous development for all employees.
- Mentorship, sponsorship and networking programmes – creating avenues for women to build connections and advance their careers.

Guidelines that **foster a safe and respectful workplace**:

- Awareness and sensitivity training – educating employees on unconscious bias, inclusivity and respectful behaviour.
- Zero-tolerance policies on gender-based violence and harassment – establishing clear reporting mechanisms, addressing microaggressions and enforcing appropriate disciplinary measures.

Measures that **strengthen fairness, diversity and inclusion practices**:

- Gender diversity targets – setting and monitoring goals to improve representation at all levels.
- Inclusive language policy – using gender-neutral language in job ads, descriptions and official communications.
- Fair and transparent recruitment practices – implementing blind resume screening, diverse interview panels and unconscious bias training for hiring managers.
- Pay equity transparency – including salary ranges in job postings and regularly reviewing pay practices to close gaps.
- Objective and transparent promotions – basing advancement decisions on clear, measurable criteria and minimising bias in evaluations.

The options and examples outlined above are neither exclusive to the renewable energy sector nor limited to it. Promoting is a universal imperative that applies across all industries and workplaces. These organisational policies cannot be expected to, on their own, fix an ongoing issue. They must accompany and complement broader efforts and actions at the national and societal levels.

To assess which measures are already in place and accessible to employees in the sector, IRENA's survey collected responses from individuals at their preference, but also asked about the availability of such measures across organisations (for part-time and full-time employees).

When asked to rate their employers' efforts toward gender equity, women gave an average score of 69/100, while men rated these efforts higher at 77/100. Overall, around three-quarters of respondents rated their employers' efforts at 61/100 or above, indicating that most employers are perceived as making a noticeable effort in promoting gender equity.

An analysis of individuals' preference for ways to foster a gender-inclusive and supportive work environment, the analysis showed that the top three solutions (improved work arrangements that enable work–life balance; policies that strengthen fairness, diversity and inclusion practices; and measures that promote professional growth and advancement) were all rated as equally important and clearly preferred over the others. Although no single solution stood out far above the rest, these three consistently ranked higher than solutions to support family responsibilities to foster a safe and respectful workplace.

The lower priority given to safety and respect initiatives may reflect respondents' confidence in their employers' existing efforts in this area, as seen in the generally positive ratings mentioned above. Importantly, these preferences were consistent across different groups (regions, genders, organisation types and sizes), suggesting that the pattern reflects the renewable energy workforce as a whole.

Work–life balance; fairness, diversity and inclusion practices; and promotion of professional growth and advancement are preferred solutions.

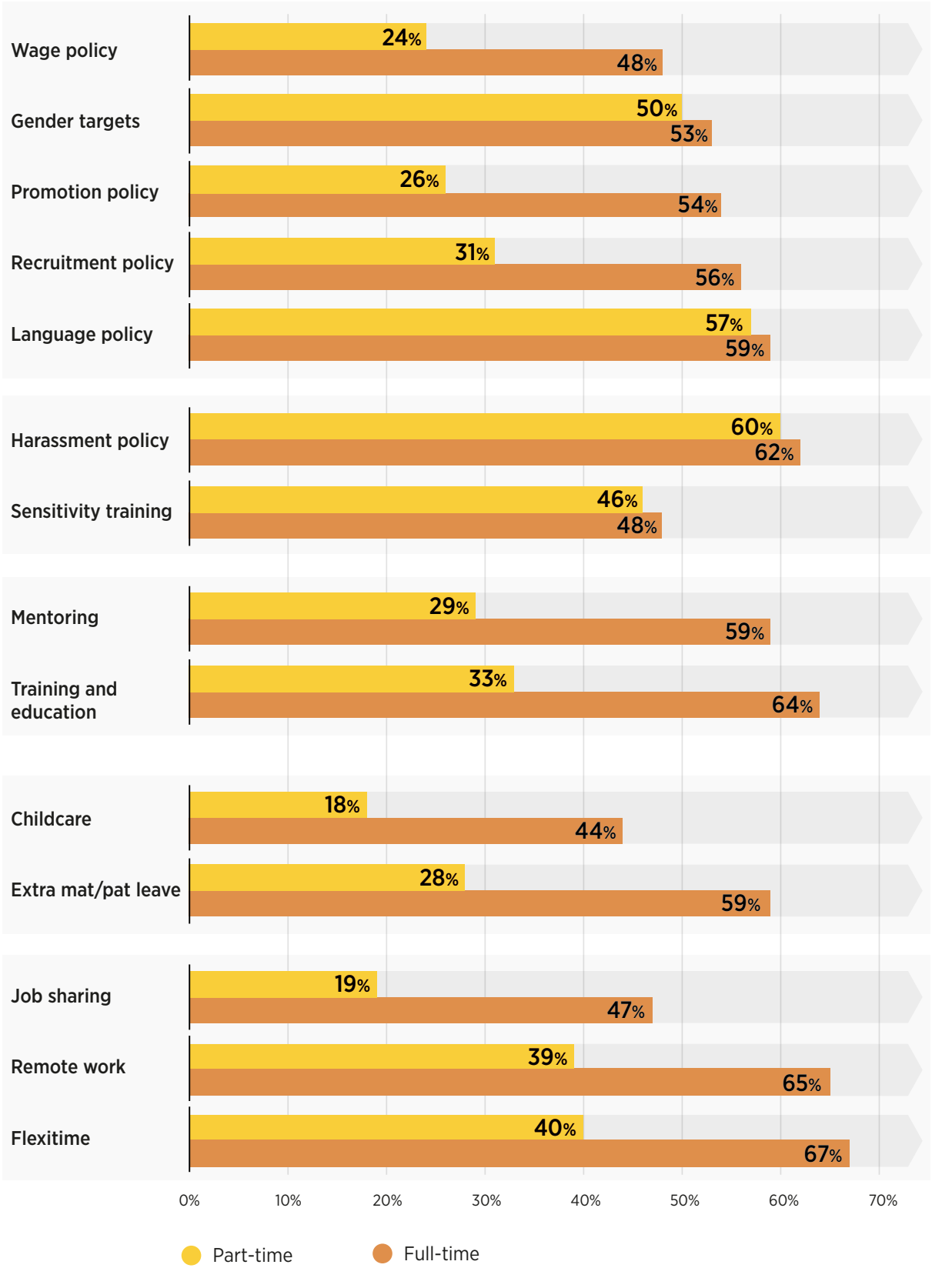
Figure 26 Employee-preferred workplace policies

Knowing the importance of these measures, the survey gathered information about the availability of these policies and measures for both full-time and part-time employees (Figure 27). The shares presented here include organisation size in the calculation, so they represent the share of the workforce where these are available.[36]

Around 45-65% of the full-time employees have each policy or measure available, whereas for part-time employees, availability was generally much lower, at 20-40%. The most commonly available measures for full-time employees were those in flexible arrangements, such as flexitime and remote working, which are available to around two-thirds of employees. This is slightly higher than the previous IRENA results, where flexible working arrangements were only available to just over half of employees. The COVID-19 pandemic may have been the trigger for those policies to be more available (Zucconi *et al.*, 2024), as IRENA's first study was conducted before the pandemic.

36 Although the unadjusted results for organisations also looked quite similar.

Figure 27 Shares of full-time versus part-time employees who have listed policies available



Regarding parental leave, respondents were asked if any additional maternity or paternity leave may be available, and this is the case for 59% of full-time employees. Mentoring is also available for 59%, and funds for education or training are widely available for full-time employees. A variety of policies are available to facilitate and support female employment, with the most common being policies for zero tolerance of gender-based violence and harassment (available to 62% of the full-time workforce), while policies to ensure fairness and transparency in wages were reported with the lowest availability (48%). Sensitivity training, job sharing and childcare support were the least available measures, available to less than 50% of full-time employees.

3.3 Other

Beyond governments and policy makers, a diverse set of actors play their own role in advancing gender equality in the renewable energy sector through unique capacities and by reaching different audiences. From setting international norms and providing technical assistance, to offering mentorship, advocacy, and education, their combined efforts help address structural barriers, create opportunities for women's leadership, and foster more inclusive workplaces and career pathways across the renewable energy value chain. These other actors include international organisations, NGOs, industry networks, trade unions and educational institutions.

Inter-governmental organisations such as IRENA, UN Women and the ILO play a key role in promoting international norms, providing technical guidance and co-ordinating cross-country learning. They can support governments in mainstreaming gender in their NDCs and renewable energy plans, as well as provide funding and technical assistance for women-led projects. Inter-governmental organisations can also convene multi-stakeholder platforms where lessons learnt from pilot projects in one region can be adapted elsewhere. By producing and disseminating evidence and data, they empower national and local actors to design more effective gender-responsive policies.

NGOs and grassroots civil society organisations are often closest to the affected communities and can amplify the voices of women, particularly those from marginalised groups. They play a critical role in awareness-raising, capacity building and advocacy for policy changes. They also hold governments and corporations accountable to their gender commitments through campaigns and public reporting.

Industry women networks, whether international, regional, or national, or technology-focused (Box 10) can help level the playing field by providing professional support, mentorship and visibility for women in the renewable energy sector.

Box 10 Relevant examples of women's networks in renewable energy and clean technologies

A wide range of women's networks around the world are actively advancing gender equity in the renewable energy and clean technology sectors.

At the international level, organisations such as the **Global Women's Network for the Energy Transition (GWNET)** and **WiRE (Women in Renewable Energy)** provide mentorship, knowledge sharing, and advocacy to support women's participation and leadership. The **Women in Wind Global Leadership Program**, a collaboration between GWNET and the **Global Wind Energy Council**, is specifically designed to promote female leadership in the wind energy sector.

Technology-specific global networks also exist. In the geothermal sector, **Women in Geothermal (WING)** works to promote the education, professional development and advancement of women in the global geothermal community. In the emerging green hydrogen sector, the **Women in Green Hydrogen (WiGH)** network connects women worldwide to foster diversity, build expertise and encourage collaboration.

Regionally focused, in North America, **WRISE (Women of Renewable Industries and Sustainable Energy)** offers education, professional development and policy engagement opportunities for women across clean energy fields. In the United Arab Emirates, WiSER (Women in Sustainability, Environment and Renewable Energy) promotes female leadership in sustainability, while in Australia, the **Clean Energy Council's Women in Renewables programme** supports career progression and leadership development for women in the industry.

Latin America has witnessed strong regional momentum through networks such as **REDMEREE (Red de Mujeres en Energía Renovable y Eficiencia Energética)**, which spans the region to promote gender equality in renewable energy and energy efficiency. National-level initiatives in the region include **Mujeres en Energía Renovable México (MERM)**, the Argentine **Asociación de Mujeres en Energías Sostenibles (AMES)**, and Women in Energy platforms in Colombia, Chile, Brazil, and Mexico, all of which focus on capacity building, visibility and peer support tailored to local contexts.

Technology-specific and country-based networks also play a key role: for instance, Brazil's **MESol (Brazilian Network of Women in Solar Energy)** promotes gender inclusion in the solar sector, while **AEMENER (Asociación Española de Mujeres de la Energía)** in Spain supports women across the broader energy industry.

Other regional efforts include **Women in African Power (WiAP)**, launched by the US Agency for International Development under Power Africa; the network is dedicated to advancing the role and representation of women within the energy sector across Africa. **Power Africa's Women in Energy programme** strengthens women's participation in the energy sector across Sub-Saharan Africa, and national Women in Energy networks exist in **Ghana, India, Pakistan, South Africa** and many other countries. The International Finance Corporation's **Women in Renewable Energy in Africa Network (W-REA)**, the first professional network for women working in sub-Saharan Africa's renewable energy sector, aims to enhance women's participation in leadership and employment in the sector through networking, mentoring, advocacy and leadership trainings.

Cross-cutting initiatives such as **Women+ in Climate Tech** provide global platforms for collaboration, community building, and inclusive innovation across the wider climate technology landscape.

The networks listed above are only a few among many, and more continue to emerge around the world. All the networks and associations represent critical platforms for mentorship, professional development, advocacy and knowledge exchange. Joint efforts and mutual support are essential to avoid duplicating efforts. Together, these networks are breaking down barriers, amplifying women's voices and helping build more inclusive leadership across the world and the entire renewable energy value chain. IRENA's new initiative, HERHub, will serve not only as a platform to give visibility to women and networks, but also to amplify and streamline efforts.

Trade unions can also play a pivotal role in advancing gender equality. By negotiating for inclusive workplace policies with robust anti-harassment focus, they can help create safer and more supportive environments for women. Beyond policy, unions can work to ensure that women are meaningfully represented in leadership and decision-making structures, amplifying their voices in shaping workplace priorities. Through advocacy, training, and solidarity campaigns, trade unions can challenge systemic barriers and promote a culture of fairness and respect across all sectors.

Schools, vocational training centres and universities are crucial for dismantling the gender stereotypes that often steer girls and women away from STEM fields and technical careers, which are dominant in the renewable energy sector. Educational institutions should promote gender-inclusive curricula, mentorship programmes and scholarships for women in engineering, environmental science and energy management. Partnerships between industry and academia can help ensure that women graduates transition smoothly into employment in the renewable energy sector.

Advancing gender equality in renewable energy requires action from diverse actors, each bringing unique strengths and audiences.

3.4 Society at large

Finally, achieving gender equality in the renewable energy sector cannot be separated from broader societal transformation. Deeply ingrained gender norms, cultural expectations and the disproportionate burden of unpaid care work greatly influence women's ability to access and thrive in the renewable energy workforce, as in other sectors. These systemic barriers limit not only women's entry into technical and leadership roles, but also their long-term career progression and economic empowerment. Addressing this requires looking beyond the boundaries of the energy sector and engaging in holistic efforts that promote gender equity at every level of society.

Campaigns aimed at encouraging the equitable sharing of domestic responsibilities, challenging and preventing gender-based violence, and celebrating women leaders and change makers across all fields are essential. These initiatives help reshape social perceptions and foster an environment in which women can participate fully and safely in public and professional life. Individual efforts are also key. Women need to foster the cultivation of sorority (strong bonds of solidarity among women) as well as to celebrate mutual support, amplify women's voices and strengthen collective action against systemic inequality.

But the responsibility for driving this change should not fall on women alone. Men must actively participate as allies in the pursuit of gender equality. Their engagement is not merely supportive, it is essential. When men challenge discriminatory behaviours, advocate for inclusive policies, and model equitable partnerships both at work and at home, they contribute to dismantling the structural barriers that hold women back (Palarmar and Bax, 2023). Just as it is vital for women to have a seat at every decision-making table, it is equally important for men to be present and engaged in the conversations and actions that promote gender justice.

True equality can only be realised when all members of society, regardless of gender, collaborate to build systems that are inclusive, just and reflective of our collective potential. In renewable energy and beyond, this means fostering a culture where both women and men are empowered to lead, innovate and drive the sustainable changes our world urgently needs.

03

Notes: IGO = intergovernmental organisation; NGO = non-government organisation.

RENEWABLE ENERGY
A GENDER PERSPECTIVE
Second Edition

The Way Forward: Empowering progress

4

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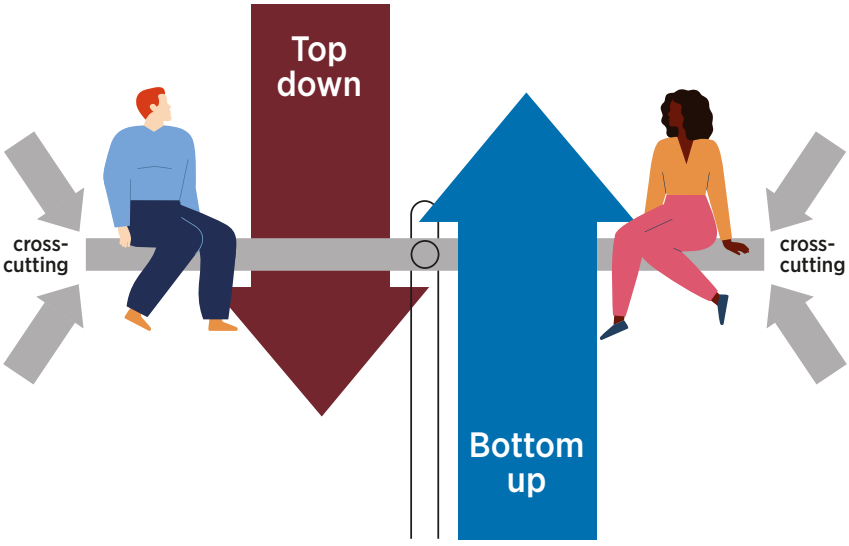
04

The renewable energy transition holds transformative potential, not only for decarbonising economies, but for rebuilding energy systems in ways that reflect and promote the diversity, aspirations and rights of all people. As this report has shown, achieving this transformation requires confronting the persistent gender gaps across the renewable energy value chain, as well as society as a whole – gaps that limit individual opportunity and hinder collective progress.

Women comprise just **32%** of the full-time renewable energy workforce, with even lower representation in technical (28%) and senior leadership (19%) roles. These numbers are not simply reflective of market inefficiencies, they are symptomatic of deeper structural inequities that pervade organisations, policies and societal expectations. At the same time, women in off-grid and energy access contexts, especially in rural and Indigenous communities, continue to face a double burden, excluded both as energy users and as active participants in solution design and delivery. Despite evidence that inclusive engagement leads to better outcomes, these voices are often left unheard or reduced to symbolic roles.

Addressing these disparities demands that gender mainstreaming goes beyond a checkbox exercise. It requires a fundamentally transformative agenda: one that is **top-down**, through political leadership and regulatory reform; **bottom-up**, through community empowerment and inclusive programming; and **cross-cutting**, embedded across all stages of energy policy, planning, finance and implementation. This vision must be grounded in data, dialogue and accountability.

Transformative energy agendas must be top-down, bottom-up, and cross-cutting, **embedding gender equity at every stage.**



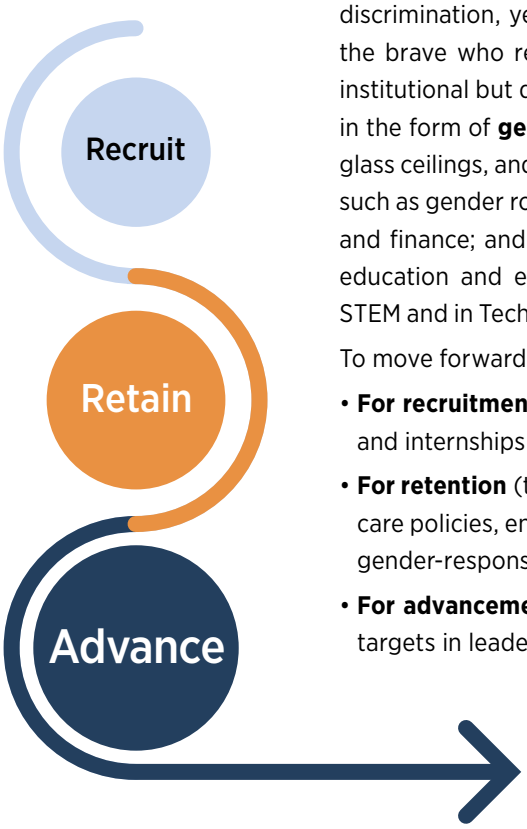
4.1 The imperative of gender data

Throughout this report, one truth emerges clearly: we cannot change what we do not measure. Despite global recognition of the gender-energy nexus, SDG 7 remains one of the few goals without a dedicated gender indicator. This invisibility obstructs meaningful policy design, hides inequalities and weakens accountability. IRENA data show that women are better represented in administrative roles (45%) but are painfully under-represented in STEM (28%) and medium-skilled trades (22%). The gender pay gap and lack of career progression are persistent factors in workforce attrition. Access to part-time work, often necessary for care responsibilities, remains uneven and is frequently penalised in pay and benefits.

The institutionalisation of gender-disaggregated energy data is crucial, and as a stepping stone to proper national planning, budgeting and progress reporting. There is a need to develop and harmonise gender indicators, reflecting national realities while ensuring global comparability.

4.2 Dismantling barriers across the life cycle

Women face barriers at every stage of their career journey, from entering the workforce, to retaining jobs, to advancing into leadership. Alarmingly, nearly half of women respondents reported experiencing gender-based discrimination, yet only a quarter of those reported it, and only a third of the brave who reported it saw action taken. These barriers are not only institutional but deeply societal and interlinked with each other. They come in the form of **gendered workplace barriers**, including biased recruitment, glass ceilings, and lack of parental leave and flexibility; **societal constraints**, such as gender roles, legal restrictions, and unequal access to mobility, land and finance; and academic barriers, including the leaky pipeline between education and employment, and the under-representation of women in STEM and in Technical and Vocational Education and Training (TVET) fields.



To move forward, targeted interventions must address all three stages:

- **For recruitment and entry**, improve access to STEM/TVET, scholarships and internships for women and girls.
- **For retention** (the most severe-rated among the barriers), institutionalise care policies, ensure safe and inclusive workplaces, and train managers on gender-responsive leadership.
- **For advancement**, implement mentorship programmes, enforce gender targets in leadership, and track promotion and pay data by gender.

4.3 Recognising women's role in energy access and just transitions

The transition to clean energy is not only about expanding grids, but also about transforming lives. Yet the potential of women in the energy access space remains underutilised. As shown in the report, programmes that engage women as sales agents, microgrid operators and clean cooking entrepreneurs yield higher adoption rates and better community outcomes. However, digital divides, limited training access and cultural constraints continue to hold them back.

Approaches must shift from token participation to transformative engagement, especially in rural and Indigenous contexts. Energy access programming must move beyond "delivery" to "co-creation", where women are not just beneficiaries but designers, decision makers and owners of solutions.

A gender-just energy transition also aligns with broader economic and climate goals, including workforce development, care economy expansion and SDG-aligned inclusive growth (that helps achieve several interconnected goals). Governments and development partners should embed gender dimensions into NDCs, climate finance frameworks, and national energy plans, as well as into green industrial strategies.

True gender equity means moving beyond tokenism to **participation for transformation.**

4.4 A roadmap towards equity, inclusion and justice

As the renewable energy workforce is expected to double in size by 2030, the sector faces a crucial choice: grow with equity or grow with exclusion. The renewable energy future must be built on:

Diversity

Ensuring varied backgrounds and perspectives in all parts of the value chain.

Equity

Addressing unequal access to roles, resources and leadership.

Inclusion

Embedding cultural change that values voice, agency, and belonging.

Justice

Realising equal rights and equitable outcomes for those historically marginalised.

04

This approach must be embedded across governance, finance, workforce planning, procurement and monitoring. No single actor can do this alone. Governments, private companies, trade unions, civil society, educational institutions and international partners must collaborate to re-align the energy transition with principles of justice.

In sum, this report is also a call to collective action beyond gender equality. A truly inclusive energy transition is not an abstract ideal or an unattainable dream – it is a measurable, achievable goal. It demands bold vision, strategic design, continuous action and support. By grounding efforts in data, informed by lived experiences, supported by inclusive leadership, and monitored through accountability frameworks, we can close the gender gap in renewable energy. We can build energy systems that are not only sustainable, but also equitable and just, with the inclusion of broader vulnerable groups such as peoples with disabilities, ethnic minorities (including Indigenous peoples), LGBTIQ and other individuals facing systemic barriers.

The future of renewable energy must be shaped by all and deliver for all: the greatest measure of success does not lie in the megawatts installed, but in the lives that renewable energy empowers and transforms.

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The **future of renewable energy** must be shaped by all and deliver for all.

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Annex:
IRENA's Global Gender Survey – methodology, respondent profile and representativeness

A1 Questionnaire

Echoing previous surveys but improving and expanding its methodologies, IRENA created a new survey to assess the role of women in the renewable energy sector and the challenges they face. The global survey was directed at organisations and individuals working across all renewable energy technologies and related industries. The study outlines quantitative insights derived from the organisations' responses, as well as qualitative insights on the barriers to entry, retention and advancement based on individual responses.

The survey was available online from 8 March 2024 (coinciding with International Women's Day) through to the end of year. It was widely publicised through IRENA distribution channels and further disseminated in newsletters, mailing lists, etc. of various partner organisations.

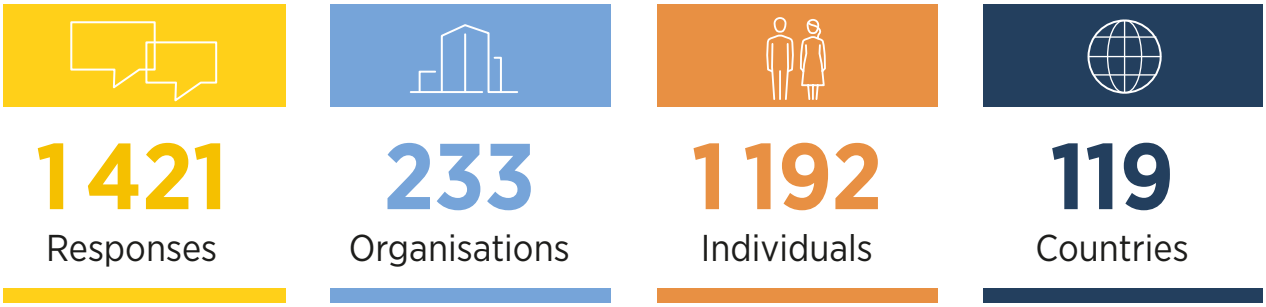
Respondents could complete the survey by replying either as individuals or as representatives of their employers (*i.e.* on behalf of organisations).

- For **individuals**, information was collected about their perceptions of the main barriers and challenges to attracting and retaining women in the workforce, as well as suggestions for potential solutions to some of these problems.
- For representatives of **organisations**, the survey asked for more quantitative information about the gender[1] distribution in the organisation's workforce and the policies and measures used to support greater gender diversity. Answering these questions accurately requires some knowledge of the relevant staff statistics, so respondents were encouraged to consult with their human resources department to complete this part of the questionnaire.

1 For the purpose of this report, gender refers to women and men. "Other" was offered as an additional choice for respondents. However, only three individuals identified themselves as such, not a sufficiently significant number to warrant aggregating their answers into a separate category.

A2 Survey respondent profile (organisations and Individuals)

Organisations and individuals from 119 countries and areas participated in the survey, and responses covered most of the world.



The following distribution includes data both from organisational responses and from individuals reporting on their respective employers.

A2.1 Organisation characteristics (from organisations and individuals reporting on their organisations)

By location

A relatively large number of responses were received from people and organisations located in Europe and North America. For organisations, the responses from other regions were evenly distributed, whereas for individuals, 25% of responses were from Latin America and the Caribbean and the remainder were split roughly equally between Africa and the Asia-Pacific region (Figure A1).

By type of organisation

Figure A2 presents the distribution of survey respondents by the type of organisation they represent. For both organisations and individuals, private enterprises dominated the respondent pool, accounting for 48% and 50%, respectively. Government-affiliated respondents made up 11% of organisations and 12% of individual responses, while public enterprises accounted for 6% of organisations and 11% of individual responses. Notably, self-employed individuals made up 6% of individual responses but only 2% of organisational representations, highlighting their distinct role in the survey.

Non-governmental and civil society organisations (NGOs/CSOs) contributed significantly to organisational responses (16%) and made up 10% of individual responses. Associations were more frequently reported by organisations (11%) than individuals (4%). Meanwhile, respondents categorised as "Other" made up 7% of organisational and 8% of individual responses. These were primarily affiliated with research, education and training institutions.

Figure A1 Distribution of respondents by location

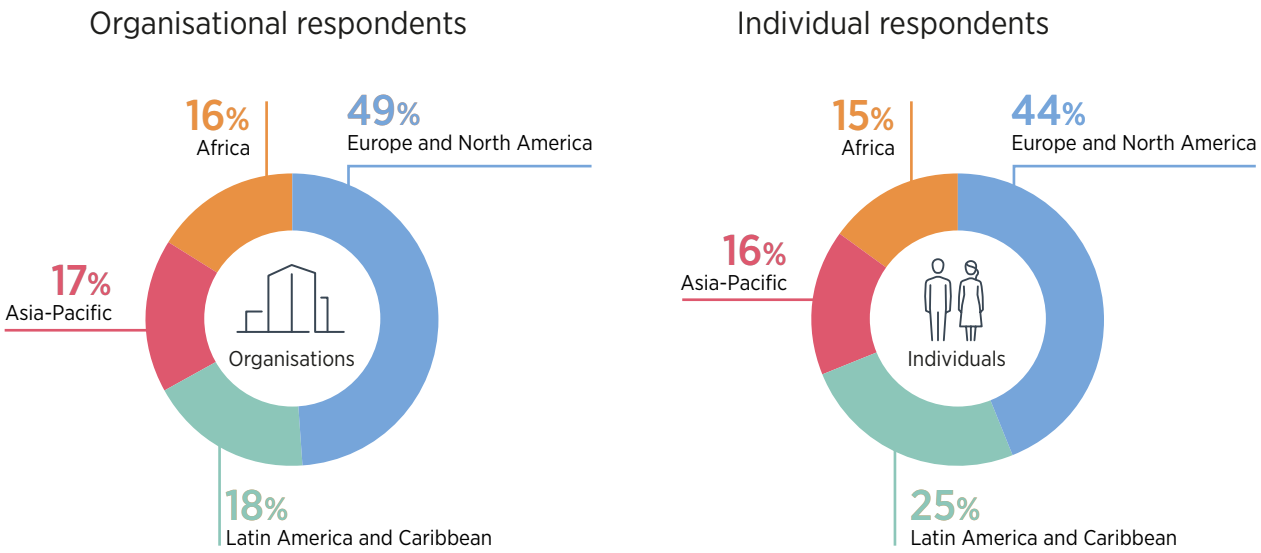
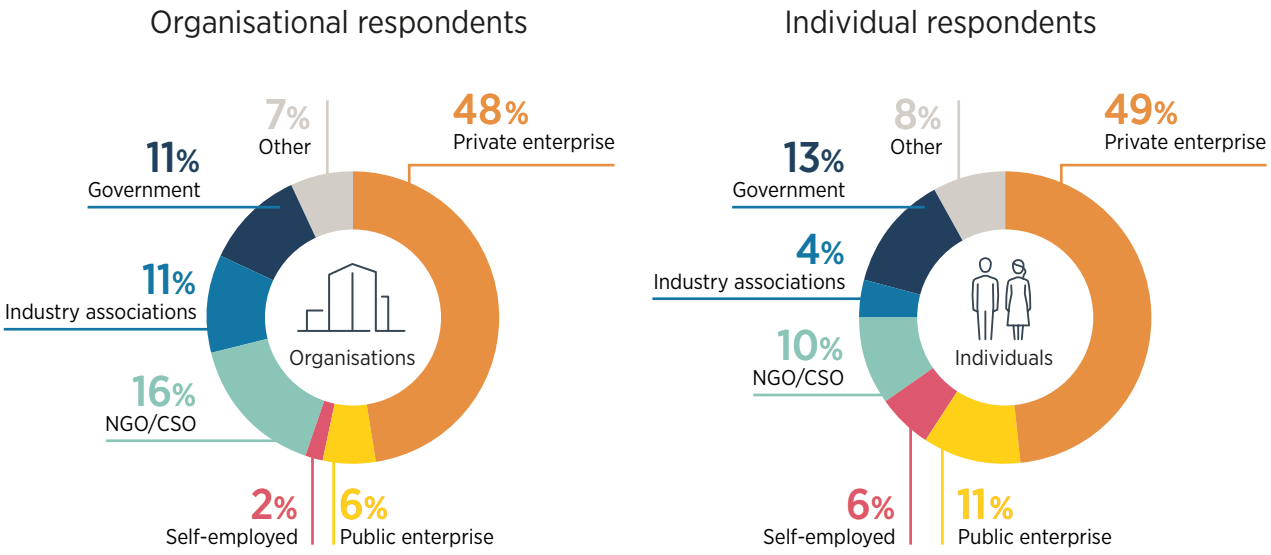


Figure A2 Distribution of respondents by type of organisation



Notes: CSO = civil society organisation; NGO = non-governmental organisation.

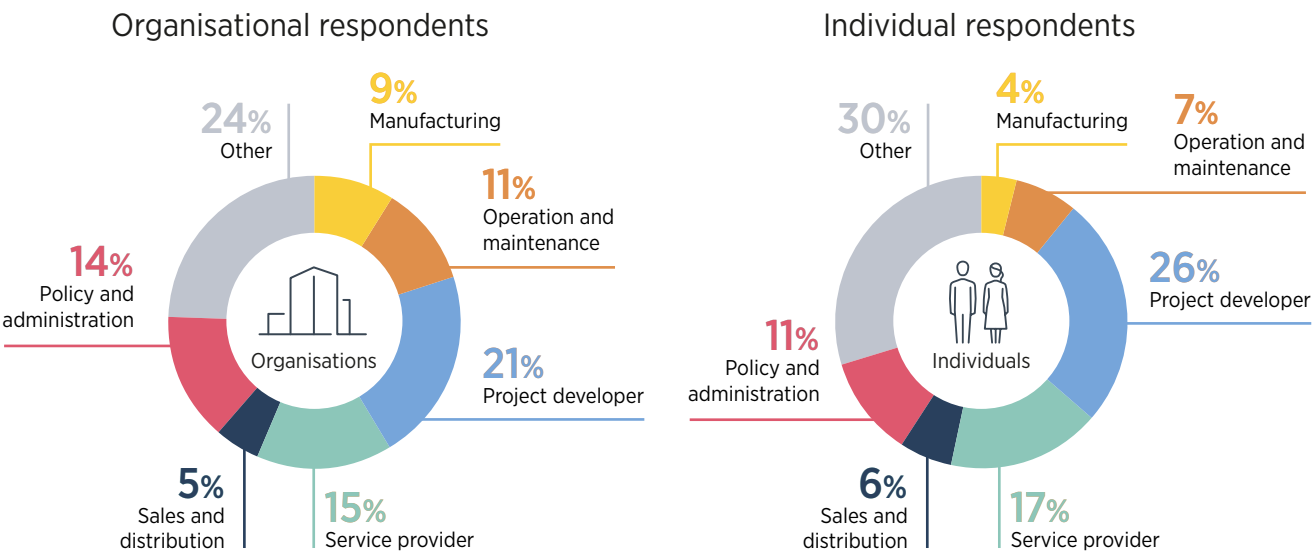
By main activity of the organisations

Figure A3 presents the main activities of both organisational and individual respondents.[2] While there are similarities in activity types across the two groups, some notable differences emerge in their distribution. A significant portion of responses – 24% from organisations and 30% from individuals – fell under the "Other" category, for a wide range of additional roles not captured by the listed categories (this group included many people working on research, education or training for enterprises, NGO/CSOs and government organisations).

Project development was the most commonly reported activity for both groups, accounting for 21% of organisational and 26% of individual responses. Service providers (working on activities such as finance and insurance) followed, reported by 15% of organisations and 17% of individuals. Policy and administration also featured prominently, particularly among organisations (14%), while slightly lower among individuals (11%).

Activities related to operations and maintenance accounted for 11% of organisations and 7% of individual respondents. Manufacturing and sales/distribution were less commonly reported activities across both groups. Only 9% of organisations and 4% of individuals indicated a focus on manufacturing, while sales and distribution comprised 5% and 6% respectively.

Figure A3 Distribution of respondents by main activity



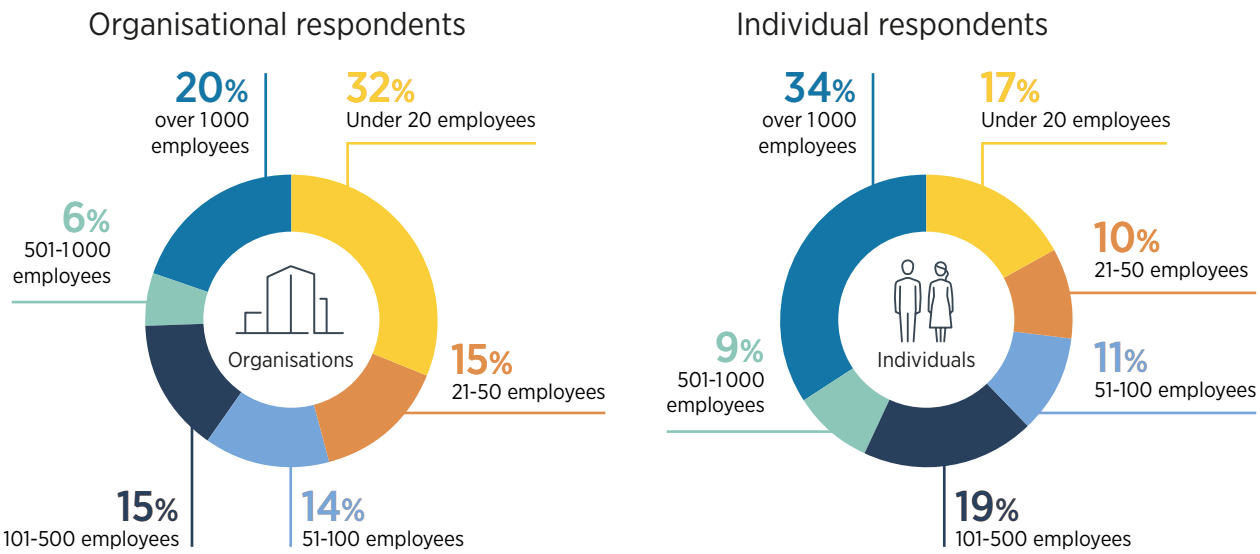
2 Note that the question about activities did not clarify whether this should refer to the organisation employing individuals, so the responses from organisations could reflect what the respondent does personally rather than their employer's main focus.

By size of the organisations

Figure A4 shows the distribution of responses across different sizes of organisation, measured in terms of the number of people employed by the organisation (either the organisation replying to the survey or the organisation employing each individual respondent).

Almost one-third of the organisations participating in the survey employed fewer than 20 people. Another 20% were at the opposite end of the scale, employing more than 1000 people. The reminder of the sample was split almost equally between the small to medium-sized categories, along with a small number of respondents from organisations employing 501 to 1000 people.[3] For individuals, over one-third of responses came from people working in organisations employing more than 1000 people. The next two largest groups came from organisations employing 101 to 500 people (19%) and fewer than 20 people (17%). The other three size categories each accounted for around 10% of responses.

Figure A4 Distribution of respondents by size of organisation (number of employees)



3 Based on the mid-points of the size categories and a figure of 1000 employees for the last category, the total number of employees in organisations replying to the survey would be equivalent to at least 65 000.

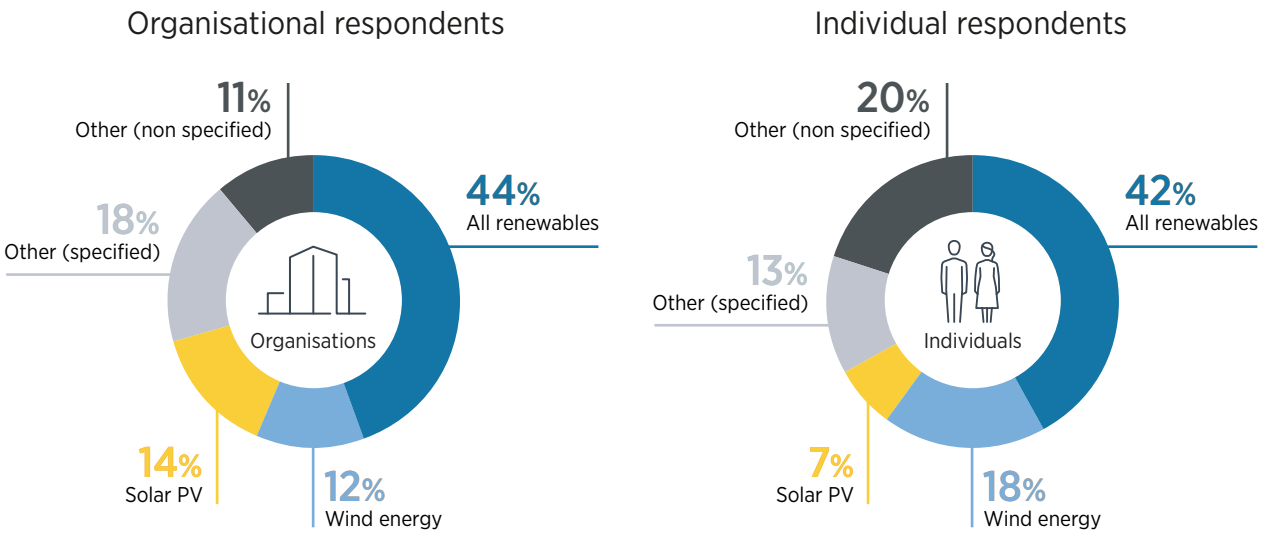
By sector (technology) focus

The survey gathered responses from a broad range of organisations across the renewable energy sector, as it offered response options including all renewables and related sectors, solar PV, concentrated solar power (CSP), wind, hydropower, geothermal power, bioenergy (covering biomass, biogas and liquid biofuels), ocean energy, green hydrogen, renewable heating and cooling (such as solar water heaters, geothermal heat, and district heating and cooling networks), clean cooking and other. This marked an expansion from previous surveys, which were less disaggregated and focused only on core renewable energy technologies, offering a more limited set of options: solar (PV, CSP and thermal), bioenergy, wind (onshore and offshore), hydropower, geothermal, ocean energy and other.

Figure A5 shows the distribution of respondents working on each of the main renewable energy technologies. In contrast to the previous survey in 2018, respondents were asked to state the technology that best describes their main area of work (one answer) rather than list all of the technologies they may work on. Thus, a large proportion of respondents replied that they worked on all renewables and other related sectors (44% of responses from organisations and 42% of responses from individuals).

The two individual technologies most often listed as a single focus of a respondent's work were solar PV and wind energy, together accounting for around one-quarter of responses from both organisations and individuals. None of the other specified technologies accounted for more than 5% of all responses, and together they accounted for 18% of responses from organisations and 13% of individual responses.

Figure A5 Distribution of respondents by area of work (renewable energy technology)

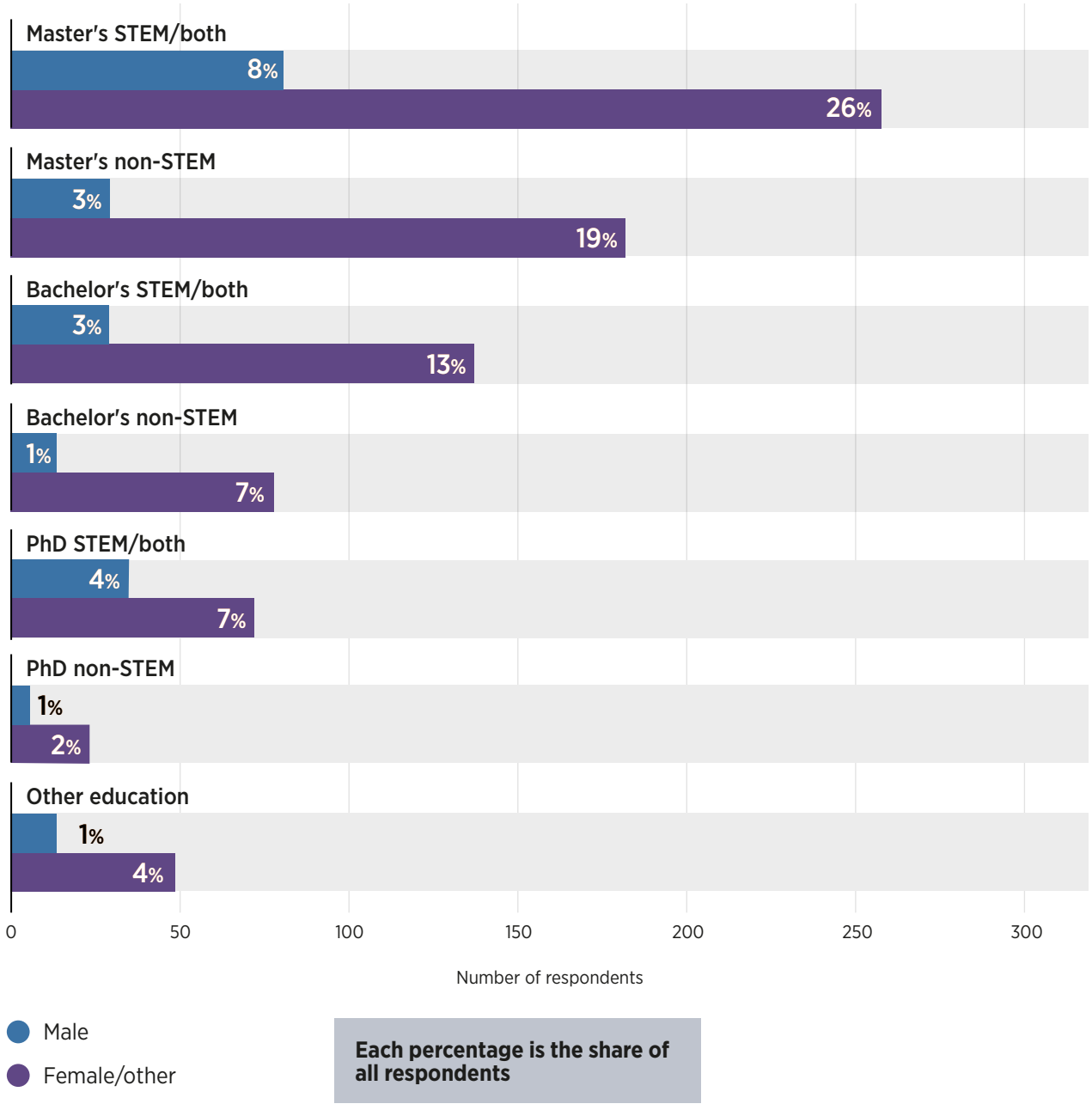


Note: Other specified technologies listed in the questionnaire included concentrated solar power (CSP); hydropower; geothermal power; bioenergy (biomass, biogas, liquid biofuel); ocean energy; green hydrogen; renewable heating/cooling (including solar water heaters, geothermal heat, district heating and cooling networks) and clean cooking; PV = photovoltaics.

A2.2 Demographics of individual respondents

As individual respondents to the survey were providing answers in a personal capacity, they were also asked some questions about their gender and academic background. The number and distribution of the responses to these questions is shown in Figure A6, which divides the responses by gender and then by the highest level of education obtained. The education level is also divided into those with their highest degree in a science, technology, engineering or mathematics (STEM) subject and those with a degree in other subjects.

Figure A6 Gender and highest level of education of individual respondents



Around 20% of individual respondents to the survey were male, and almost all of the others were female;[4] non-male respondents greatly outnumbered male respondents across all education levels. In terms of educational status, 95% of respondents had a university degree. Most of the other respondents had a high-school education (18 respondents) or vocational qualification (21 respondents).

Over half of respondents (56%) had a master's degree, 25% had a bachelor's degree and 14% had a doctorate. Taking only the highest level of qualification into account, 61% of respondents had a degree in a STEM subject, compared to 34% with degrees in other subjects,[5] and respondents with a degree in a STEM subject outnumbered those with degrees in other subjects at all levels. The distribution of educational status (level and subject) was similar for both male and female respondents.

A3 Limitations to the representativeness of the sample and how they were addressed

An online survey such as that described here is a form of convenience sampling, and, as such, the results may not produce very reliable estimates for a larger population. In particular, two types of bias may be present in this sample. The first is due to the use of the internet as the surveying mechanism, which is likely to exclude part of the population of interest for a variety of reasons (*e.g.* internet availability, language issues, etc.). The second is the uncontrolled, self-selected participation in the survey, which is likely to bias the results in favour of people with an interest in the topic. These issues should be considered when interpreting the results of the survey. Despite these limitations, the background information collected in the survey (*e.g.* location, organisation size, area or work, etc.) can be used in two ways to improve the interpretation of results:

A3.1 Weighting to improve representativeness

If the distribution of a characteristic in the population of all organisations or individuals working in renewable energy is known, then responses can be weighted to correct for any differences in the distribution of that characteristic between the population and the sample.

4 A few respondents stated their gender as "other" or did not answer the question about gender, and these have been grouped together with female respondents.

5 Taking all qualifications into account, 64% of respondents had a degree in a STEM subject, including those who also had a higher degree in a non-STEM subject.

For renewable energy employment, IRENA's estimates of global employment in the sector are divided into two dimensions – location and technology – and information about both of these characteristics was collected in the survey. Location (region) can be used to create weighted global averages that adjust the results to account for the difference between the location of respondents in the survey and the regional distribution of employment as reported in global estimates.

The distribution of the other three characteristics recorded in the survey (type and size of organisation and main activity) may also differ from the distribution of those characteristics in the population as a whole, but information about their global distribution does not exist. Thus, it is not possible to use weights to adjust for any sampling bias in these characteristics. However, it is possible to use this information to help interpret the results.

A3.2 Interpretation by respondent sub-groups

The background information collected about respondents can be used to examine whether any of these characteristics affect the results for different groups within the sample. For this type of analysis, the number of respondents with each characteristic is important (as significant differences are more likely to be revealed with larger sample sizes), and it is less important that the distribution of responses for each characteristic matches that of the global population. Thus, any findings related to how these characteristics affect results are less likely to be adversely affected by any possible sampling bias.

If some of these characteristics do affect results, it may also be possible to suggest where hidden biases in the sample may lead to uncertainties in interpretation of the results at the global level. This is similarly the case for the analysis of individual responses, where the gender and educational background of respondents to the survey may be distributed very differently to the background of all employees in the sector.

Considering the above, a brief description of how representative the survey sample may be with respect to each of the main characteristics recorded in the survey is given below.

A4 Representativeness by key characteristics

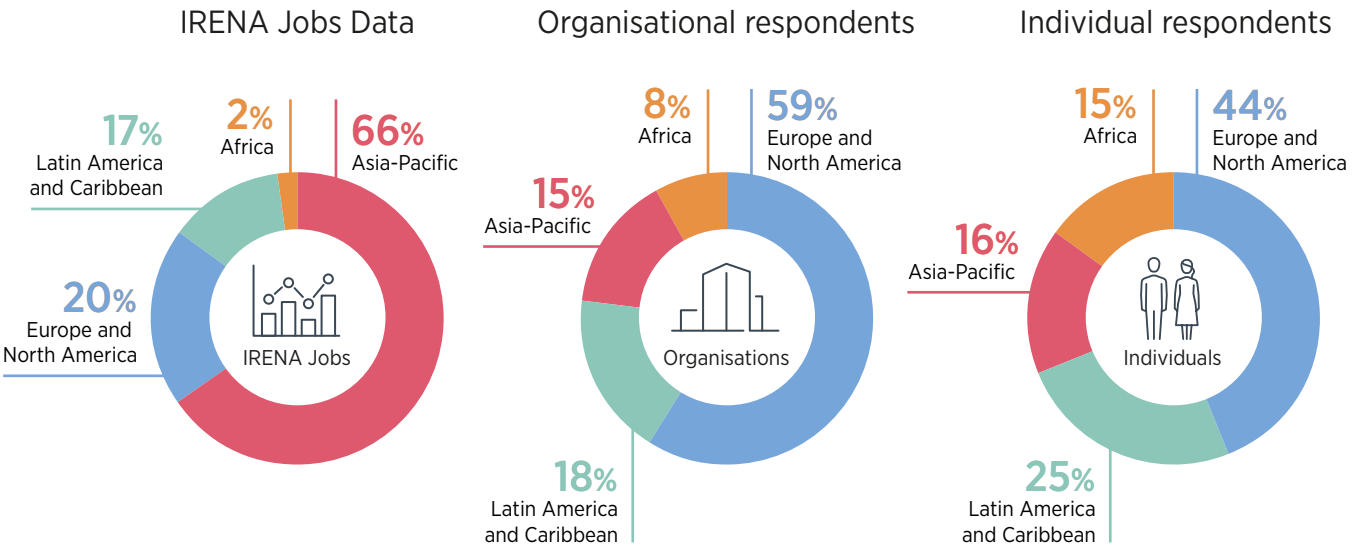
A4.1 Location and organisation size of survey respondents

As noted previously, a large share of responses to the survey were located in Europe and North America, while responses from the other three regions were fairly evenly distributed. This distribution of responses is different from the global distribution of employment in renewables.

Figure A7 compares the distribution of employment across the four regions estimated in the latest IRENA jobs report with the responses to the survey.

As the figure shows, the share of responses from the Asia-Pacific region is much lower than the share of global employment in that region. Responses from Europe and North America and from Africa are over-represented in the survey sample, particularly in the case of individual responses from Africa. Responses from Latin America and the Caribbean are also over-represented somewhat.

Figure A7 Location of employees included in the survey compared to the estimated global distribution



Note: For organisations, the distribution shown here is different from that shown in Figure A1, because it reflects the number of employees reported by each organisation responding to the survey. The distribution of individual responses is the same as that shown in Figure A1.

To account for these differences, results from the survey presented at the global level have been weighted to make them more representative of the global distribution of employment across the regions. These global weighted averages were calculated using the weights shown in Table A1.

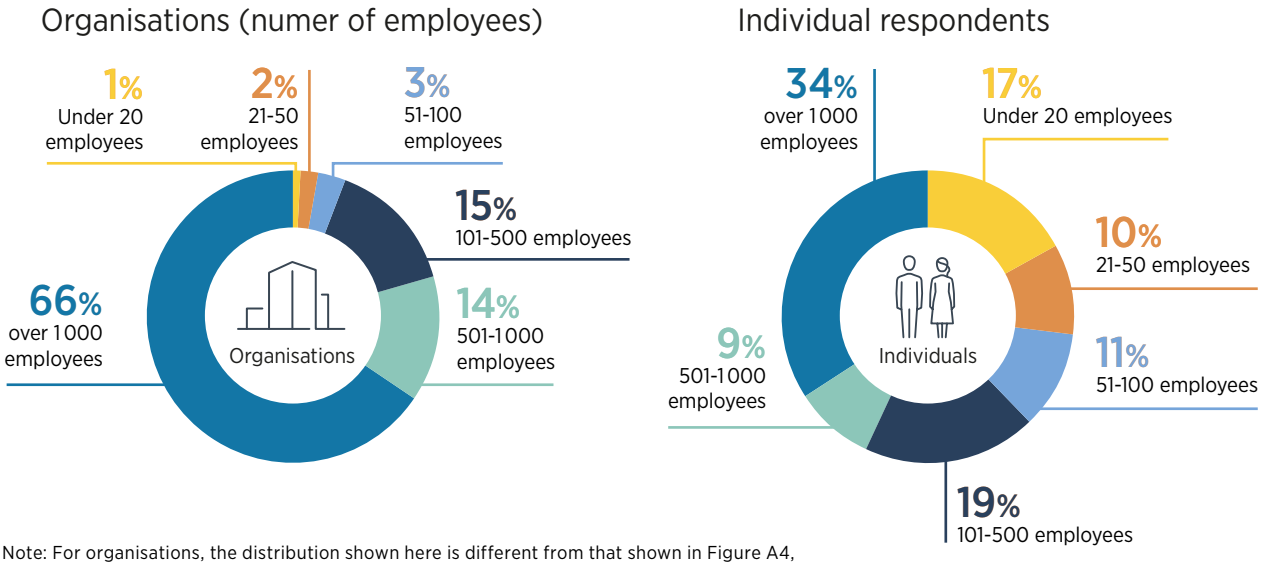
Table A1 Weights used to calculate global weighted averages

Region	Source of responses	
	Organisations	Individuals
Africa	0.24	0.13
Asia-Pacific	4.33	4.23
Europe and North America	0.33	0.44
Latin America and Caribbean	0.72	0.51

Given the magnitude of these weights, the global weighted averages presented should be considered as fairly uncertain in cases where location is indicated to have a significant influence on the variable of interest.

With respect to the size of organisation, the global distribution of employment in renewables across different sizes of organisation is not known. Figure A8 shows the distribution of responses by organisation size, taking into account that the calculation of results for organisations implicitly weights those results by distribution of organisation size within the sample (Box A1).

Figure A8 Distribution of employment reported in the survey, by size of organisation



Note: For organisations, the distribution shown here is different from that shown in Figure A4, because it reflects the number of employees reported by each organisation responding to the survey; however, the chart for individuals matches that shown in Figure A4.

Box A1 Calculation of results for responses from organisations

Respondents replying on behalf of organisations were asked questions about employment in their organisation. Thus, their responses represented the situation for a number of employees, which has to be considered in the analysis. For example, if one organisation with 20 employees reported female employment of 50% (10 employees) and a second with 100 employees reported female employment of 10% (10 employees), the average level of female employment in those two organisations together would be 17% (20 female employees out of a total of 120). This is different than the simple average of 30% that would be calculated if both responses were treated equally (*i.e.* 50% plus 10% then divided by two).

This calculation methodology means that responses from larger organisations have a greater impact on results than the responses from smaller organisations and that the results from organisations are weighted to reflect the distribution of employment in different size categories within the sample. This is not the same as weighting the results to reflect the distribution of employment across size classes in the sector as a whole (which is unknown), so the results may still suffer from some sampling bias due to mis-representation of the true size class distribution within the sample.

The calculation as described above has been used for all responses from organisations related to the workforce (*e.g.* female share of employment, benefits available), but the results to questions about challenges and policies have been analysed without taking into account organisation size (*i.e.* percentages refer to the percentage of organisations providing each answer to a question and not the percentage of those employed).

Although the global distribution of employment by organisation size is not known, it might be expected that relatively large shares of employment occur in the larger size classes simply because they are larger. This is certainly the case in many developed economies, as for example reported by the US Bureau of Labor Statistics,[6] although the distribution across size classes may be different in other countries. For the smaller size classes, the shares of employment in each can be fairly evenly distributed; however, it is also possible to have large numbers of people employed in very small organisations, especially in less-developed countries that have more informal economies and lower levels of industrialisation.

Considering the above, it seems likely that employees in the largest size class in the survey sample are over-represented in the responses from organisations (after accounting for the calculation methodology explained in Box A1), and the three smallest size classes are under-represented. However, for the responses from individuals, the distribution across size classes may be close to what might be expected.

6 For instance, according to the US Census Bureau's Statistics of US Businesses, in the United States, enterprises with fewer than 100 employees accounted for 34.6% of private sector employment in 2017, down from 35.8% in 2012 (Georgi et al., 2021).

A4.2 Type and activities performed by organisation of survey respondents

Without a clear definition of the types of organisation and activities that should be considered as part of the renewables "sector", it is not possible to consider how closely the shares of different types of organisation in the sample match that in the population. It can be noted that the sample collected in this survey includes responses from government, NGOs/CSOs and others that would not normally be considered as part of the sector in an economic sense (*i.e.* within an industrial or economic classification of activities such as the ISIC).[7]

For the responses from both individuals and organisations, around one-third of the employees represented in the sample worked for government, NGOs/CSOs and others. Thus, the sample is not representative of the "renewable energy industry" but should be considered more as a sample of a broader group of organisations with an interest in renewable energy.

The distribution of activities or type of work recorded in the survey is also different from what might be expected in the population, even after excluding those not working in the industry. For example, Figure 2 showed how the typical labour requirements for solar and wind energy projects might be distributed. Very broadly, project development accounts for 1-2% of labour requirements, procurement and manufacturing accounts for around 20% of employment (more in the case of offshore wind), and other activities account for the remaining share of employment (around 80%, or 40% for offshore wind).

Comparing the above shares to the shares of responses for the same activities in the survey, people engaged in project development activities are over-represented, and those involved in installation, operations and maintenance are under-represented, both by considerable amounts. For responses from individuals, those engaged in manufacturing are slightly under-represented (10% of the number of responses for all three activities combined), but manufacturing is over-represented in the sample from organisations (67% of employees working on the three activities combined). The latter is due to the presence of quite a few large manufacturing enterprises included in the responses from organisations.

7 The International Standard Industrial Classification of All Economic Activities.

A4.3 Gender and educational background of individual respondents

With respect to gender, around 10% of individual respondents were male, which is likely to be under-representative of their presence in the population of all those working in the sector. However, this is not a major problem, as it is the difference in responses from males and others that is likely to be more interesting than the "average response" from all those working in the sector.

In terms of educational qualifications, the sample is very strongly biased towards people with a university education. As stated in the Introduction section, the skill levels required to implement four types of renewable energy projects mostly require qualifications below a university education. This contrasts sharply with the responses collected in this survey, where 95% of respondents had a university education.

The number of responses from those without a university education was fairly small (50 in total), which could make it difficult to identify any significant differences between these respondents and others.

However, if the experiences and perceptions of those without a university education differ greatly from those with a university education, then this should be considered in the analysis.

To summarise, the main points to consider with respect to representativeness are as follows:

- **Location and organisation size:** The location of respondents is not representative of the population, but this is addressed by the weighting of responses. For responses from organisations, large organisations are probably over-represented in the sample, whereas small ones are under-represented. For individual responses, the distribution across size classes in the sample may be closer to reality.
- **Type of organisations and activities:** The sample as a whole represents a population that is broader that what would normally be considered as the renewable energy "industry", as noted in any discussion of the results. Analysis of the results at a more detailed level by splitting respondents into those working in industry and others can address this issue. However, even a sub-sample of those respondents working in the industry may not be a very accurate representation of that population.
- **Educational background:** The sample of individual responses is biased towards those with a university education, suggesting that those without a university education should be considered separately where significant differences arise and the sample size permits.

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