



Briefing Paper

Advancing women's economic opportunities in the solar energy sector

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Advancing
Learning and
Innovation on
Gender Norms

Key messages

Jobs in the renewable energy sector are booming, with solar photovoltaics (PV) leading this expansion. Yet women are underrepresented throughout the PV sector, particularly in higher paid and technical roles – even as labour shortages slow the renewables rollout. Closing the gender gap is good for women, climate goals and economic growth.

Barriers to women's equitable participation in the sector include: limited access to relevant training and skills development opportunities; male-dominated environments with risks of sexual harassment and violence; few women role models and mentoring opportunities; and pervasive gender norms that influence the types of sectors and roles deemed socially acceptable for women – and often create additional care and mobility constraints.

Emerging solutions to address gender-based barriers in the solar PV sector include:

- Boosting access to formal and informal skills development through holistic interventions that complement technical training such as business and leadership skills, access to finance, and support for women to transition to employment and entrepreneurship opportunities in the sector.
- Creating more gender-inclusive workplace environments through women's mentorship and leadership programmes – with robust action against discrimination and violence – to enhance the recruitment, retention and progression of women to leadership positions.
- Overcoming wider gender-based barriers through more flexible learning and employment opportunities, and supportive infrastructure that includes quality care services and safe transport options.

Closing outstanding knowledge and action gaps will require sustained political will, more gender-disaggregated and intersectional data, and coordinated action across key stakeholders in the sector.

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Abbreviations and acronyms

IFC International Finance Corporation

ILO International Labour Organization

IRENA International Renewable Energy Agency

MENA Middle East and North Africa

NGO non-governmental organisation

PV photovoltaics

STEM science, technology, engineering and mathematics

TVET technical and vocational education and training

1 Introduction

Transitions to renewable energy are a key element of energy security and are vital for low-carbon development. They also have important implications for people's livelihoods and well-being. In 2024, at least 16.6 million people were directly or indirectly employed in the renewable energy sector – the highest level recorded to date (IRENA and ILO, 2026). The transition to renewable energy is expected to lead to the net creation of jobs, largely because renewable energy value chains are more labour intensive than those for fossil fuels (Wei et al., 2010).

Yet women are likely to remain underrepresented in the renewable energy sector (ILO, 2023). Job creation and reallocation will be concentrated in male-dominated positions like installers, technicians, plant managers, engineers and system designers (ILO, 2019). This risks excluding women from the employment-generating potential of a low-carbon, renewable energy future.

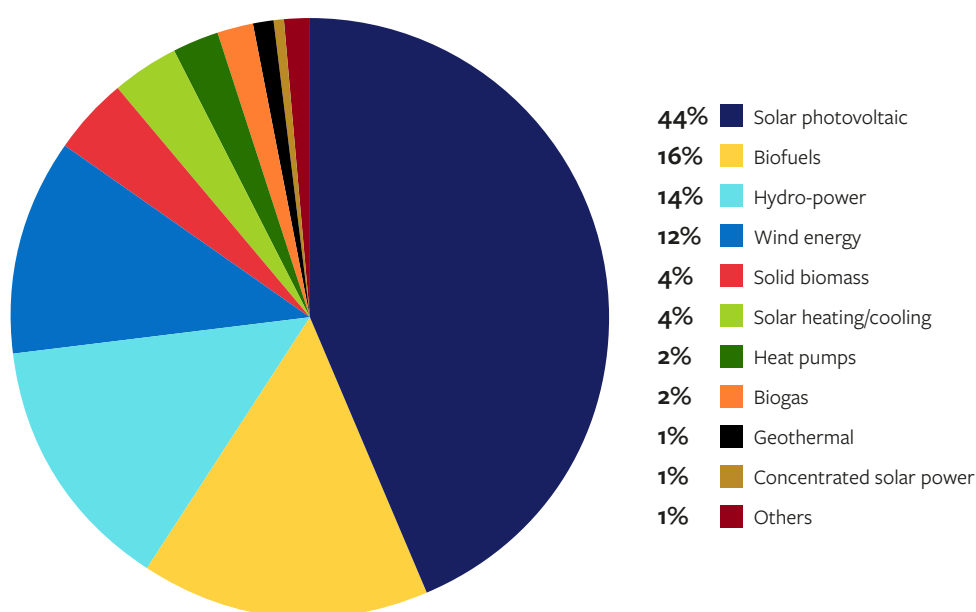
Boosting women's participation in the sector could help reduce gender gaps in labour-market outcomes and enhance women's economic empowerment, while also helping meet severe labour shortages in the renewable energy sector (McKinsey, 2022). This is made more pressing, given the increased cost competitiveness of renewable energy vis-à-vis fossil fuels in recent years. Renewables are now the cheapest source of new electricity in most markets, with the cost of solar photovoltaics (PV), for example, falling by 89% since 2010 (IRENA, 2026). Meanwhile, the recent escalation of conflict in the Middle East has triggered large-scale volatility and exposed deep vulnerabilities in global fossil fuel markets, intensifying interest in renewable energy expansion from both an economic and a security perspective (Mehlum and Rabley, 2026; Hanson and Isaacs, 2026).

This brief is one of a series of outputs from ODI Global's research and policy engagement programme on Boosting Women's Equitable Participation in Renewable Energy. It complements forthcoming primary research commissioned by ODI Global in India, Indonesia and Morocco to generate evidence on solutions that enhance women's equitable participation in the solar PV sector. The brief synthesises key insights on barriers and solutions to women's underrepresentation in solar PV, highlighting some evidence gaps that will be examined in the primary research. It is based on a desk review of academic literature, grey literature and policy documents, prioritising sources relevant to the sector and those with strong evidence of effectiveness. Therefore, the review is illustrative rather than exhaustive.

2 The extent and scale of women's participation in the solar PV sector

Solar PV accounts for the largest proportion of renewable energy employment globally, accounting for over 7.2 million of the 16.6 million total jobs in the renewable energy sector in 2024 (see Figure 1) (IRENA and ILO, 2026).

Figure 1 Renewable energy employment by technology, 2024



Gender-disaggregated data on employment in renewable energy are rarely captured in national economic statistics, however (IRENA, 2025). Meanwhile, estimates tend to differ greatly depending on whether or not they include informal employment, which is particularly common in many low- and lower middle-income countries (Baruah, 2017). The International Renewable Energy Agency (IRENA) periodically conducts a global, multi-stakeholder survey to capture insights from those working in the renewable energy sector, including private companies, government agencies, non-governmental organisations (NGOs) and industry associations (see Box 1).

Box 1 Women's participation in the renewable energy sector

32% Women accounted for 32% of full-time employees in the renewable energy sector globally in 2024, unchanged from 2018.

23% In the oil and gas sector, women accounted for only around 23% of full-time employees in the sector in 2023.

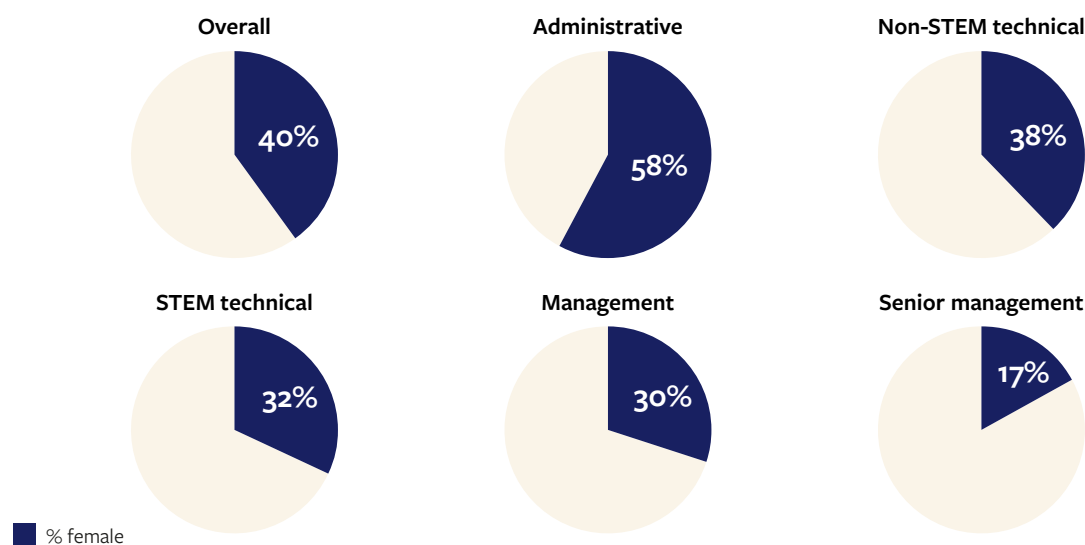
22% But women's share of employment in renewables fell to just 22% in 2024 for medium-skilled technical jobs like solar installation and construction.

40% Women's representation is relatively higher in solar PV than in other renewable technologies, at 40% of full-time positions in 2021.

Sources: BCG and WPC (2023); ILO (2019, 2023); IRENA (2019, 2022, 2025)

The IRENA surveys show that roles within the solar PV sector are stratified by gender (see Figure 2). Overall, women are more likely to be employed in lower-paid, non-technical and administrative positions than in technical, managerial or policy-making roles. The evidence shows, therefore, that women's relatively higher representation in solar PV compared to other renewable technologies largely reflects their over-representation in administrative-type jobs across all functions (IRENA, 2022).

Figure 2 Women's share of employment by role in the solar PV sector, 2021



Note: Science, technology, engineering and mathematics (STEM) technical roles include engineers, data scientists and other technical specialists.

Source: IRENA (2022)

2.1 Centralised and decentralised solar: different contexts, different dynamics

Solar PV can be centralised or decentralised. Centralised solar typically consists of large utility-scale projects, often located in remote or isolated areas, that connect users to a grid system. Decentralised solar is deployed at the local level at or near the point of energy consumption, usually through standalone systems like mini-grids and solar home systems. These decentralised solutions increase the possibility of reaching rural populations and are critical to expanding electricity to the 655 million people concentrated in rural areas who still lack access (Pearl-Martinez, 2020; IEA et al., 2026). Over 60% of the underserved population worldwide is expected to gain access to electricity through off-grid and decentralised energy technologies (IRENA, 2025).

Global data on the proportion of total solar PV energy generated from centralised and decentralised sources is not available. However, the Global Off-Grid Solar Association (GOGLA) reported sales of 10.2 million decentralised solar energy kits by its affiliates in 2025, a 10% increase from 2024 (GOGLA, 2026). And energy think-tank Ember estimates that three-quarters of Africa's solar PV growth between 2023 and 2025 came from decentralised sources (although data is largely missing from official statistics) (Jones and Nana, 2026).

The key distinctions between centralised and decentralised solar PV have implications for women's participation in the sector. Centralised solar PV projects are relatively more capital-intensive, with jobs tending to be more engineering-, construction- and technical-oriented – often requiring significant travel and time away from home. This disadvantages women who have mobility constraints and care responsibilities. Because decentralised solar initiatives are deployed at the local level, they potentially offer more community-based employment opportunities for women – including in rural areas – across different stages of the value chain, from sales and installation, to customer service, maintenance and repairs (Baruah, 2017; IRENA, 2024).

In 2023, more than 300,000 people were estimated to be directly employed in the decentralised solar PV sector across Ethiopia, India, Kenya, Nigeria and Uganda alone (IRENA, 2024). Women's share of employment varied across these countries, with highs in Kenya (41%), Ethiopia (37%) and Nigeria (37%). Across all five countries, the gender pay gap increased with the skill level of jobs (Power for All, 2022).

Women have made gains in decentralised solar through employment as researchers, retailers, installers and maintenance workers; and also as (micro)entrepreneurs starting and growing their businesses (Nelson and Kuriakose, 2017). However, women are significantly underrepresented in the installation of solar PV, with only an estimated 12% share of employment in this field (IRENA, 2022; Jenns, 2025). In many rural areas, women's common role as primary energy managers within their households – together with their strong

relationships within their communities, where prevailing gender norms allow this – can make them effective last-mile distributors of solar PV and other clean energy products (UN Women and UNIDO, 2023; IRENA, 2024).

Table 1 Employment opportunities in centralised vs decentralised solar

Dimension	Decentralised solar	Centralised solar
Scale	Small; community-level	Large; utility-level
Location	Community-level, including rural, remote and hard-to-electrify areas	Often remote or isolated areas; centralised grid infrastructure
Primary job types	Sales, distribution, installation, maintenance and repair, customer service, entrepreneurship	Engineering, project management, construction, grid operations, manufacturing
Skills required	Technical (installation, maintenance), business, sales, community engagement	Higher-level engineering and STEM; construction and project management
Training pathways	Technical and vocational education and training (TVET), informal training, NGO-led programmes, on-the-job learning	Formal university education and TVET, professional engineering qualifications
Women's participation	Potentially more opportunities for women, including in non-technical positions and in entrepreneurship	Potentially more male dominated, especially in technical and senior roles
Mobility requirements	Local; women can work within their communities	Often requires significant travel and time away from home
Capital requirements	Lower; accessible to micro- and small enterprises and entrepreneurs	Higher; requires significant investment and institutional financing
Key benefits for women	Enables employment within communities; better suited to women's mobility and care constraints	Higher-skilled, higher-paid roles; but more barriers to entry for women

Sources: Baruah (2017); IRENA (2019, 2022, 2024, 2025); Jenns (2025)

Summary

- Both centralised and decentralised solar PV can provide economic opportunities for women.
- Many jobs in centralised solar are higher-skilled and higher-paid, but they come with significant barriers to entry for women.
- Decentralised solar holds more potential for women's employment at scale at the local level. This is due to lower barriers to entry in terms of level of education and mobility expectations given employment is often closer to home – but it remains unclear if these are decent jobs.

3 Barriers for women in the solar PV sector

Women face numerous barriers to enter, remain and progress in the solar PV sector. Obstacles vary depending on the scale of the technology within centralised and decentralised solar, as well as the position in the value chain. This brief focuses on **installation, operations and maintenance** as the relevant medium- and high-skilled technical roles within the sector. Operations and maintenance jobs are also recognised as the most important for local training and job-creation opportunities in decentralised solar PV (IRENA, 2024).

Overall, many of the barriers faced by women across the solar PV sector reflect those faced by women more generally in the labour market, particularly in similarly male-dominated sectors (Baruah, 2017; Kazimierczuk et al., 2024; IRENA, 2025).

This section focuses on three barriers:

1. Gaining the necessary **skills and training** to embark on a career in the solar PV energy sector.
2. The **workplace environment** that contributes to women dropping out of or not progressing in the solar PV workforce.
3. **Broader gender-based barriers** that affect both training and the workplace.

Underlying many of these barriers are gender norms – collectively shared beliefs that define socially acceptable behaviour, roles and entitlements for people according to their gender (Marcus and Somji, 2024). Perception of these barriers also varies according to gender: 60% of women working in the renewable energy sector worldwide think women face gender-based barriers in the sector, compared with only 41% of men who share this view (IRENA, 2025).

3.1 Skills and training

Technical STEM skills are particularly relevant for medium and highly skilled job profiles in the renewable energy sector, including solar PV (ILO, 2023). Engineering, manufacturing and construction are among the most relevant STEM subjects at tertiary level and within TVET courses for medium-to-high-skilled employment in the solar PV sector. Yet gender gaps persist across educational institutions (see Box 2).

Box 2 Gender gaps in STEM education and training

35%

On average, women accounted for 35% of STEM students in higher education globally in 2018–2023, with little change since 2010.

28%

Women represented 28% of engineering, manufacturing and construction graduates globally in 2016–2018.

43%

Women constituted 43% of upper secondary TVET enrolments globally in 2023, with gaps more pronounced in STEM fields.

??%

Global data is scarce on women's participation in informal short courses, apprenticeships and internships in STEM fields.

Sources: UNESCO (2024, 2026); UNESCO-UNEVOC (n.d.)

Five key factors contribute to gender differences in solar energy-related skills training and education.

1. **Financing:** Financial barriers represent a significant obstacle to women's participation in STEM and technical training, particularly in low- and middle-income countries. This can lead women, in particular, to focus on lower-paying specialisations with fewer barriers to entry (World Bank et al., 2023). Research on electrical engineering training in Zimbabwe found that some female students from economically deprived backgrounds needed to find financial support to sustain their studies, including, in some instances, high-risk coping strategies such as engaging in transactional sex (Malomalo et al., 2025). Financial barriers are likely to be significantly greater for high-skill training opportunities like university engineering courses, and relatively lower for vocational training, especially short courses.
2. **Suitability:** Some people – women and men alike – perceive STEM-related fields, including in the energy sector, as not being 'suitable' or 'appropriate' for women. This can lead to self-exclusion from skills and training pathways for particular jobs (Baruah, 2017; GWNET, 2019; IRENA, 2022; ILO, 2023). Such views reflect pervasive ideas about the types of jobs women are 'naturally' suited to, such as people-centred, caring roles in sectors like health and education (Marcus and Somji, 2024). These views may also reflect perceptions that the energy sector is likely to be a challenging environment for women to work in, for example, due to long hours on worksites without adequate toilets, or the requirement to carry heavy equipment (e.g. solar panels). The perception that technical jobs in the energy sector require more hands-on, manual work that demands greater physical strength may hold true to some extent, although increased automation and mechanisation make this less relevant than in the past (IRENA, 2019, 2025; Dhaleine and Fauvet, 2025).

3. **Competence:** Women may be perceived, and perceive themselves, as less competent in technical roles in STEM sectors and therefore self-select out of training and skills development opportunities in such fields. This is likely perpetuated by the male-dominated nature of the sector. This perception starts early: the 2022 Programme for International Student Assessment (PISA), a global study of 690,000 15-year-olds from 81 countries, found that girls consistently exhibit higher levels of anxiety than boys with respect to mathematics, for example (UNESCO, 2024). However, the relationship between perceived competence and STEM participation can be complex and requires nuanced understanding by regional context (see Box 3 for examples).
4. **Policy context:** While there are many well-documented policy efforts to enhance women's access to solar energy as consumers, there are noticeably fewer efforts focusing on women's economic participation in the sector and the corresponding implications for skills development and training. International Labour Organization (ILO) research across 27 country studies found that gender equality was not being mainstreamed in key policy documents on skills development for the green transition (ILO, 2018). Analysis from Kenya found a lack of skills development training programmes specifically targeted at women, along with a general mismatch between the education syllabus and the skills demanded by industry (Kingiri et al., 2025). And while Kenya established its Gender Policy in Energy in 2019, this policy does not mention the training and skills requirements nor the gender-based barriers to be addressed for women to successfully enter and progress in the solar energy workforce (GWNET, 2019; Republic of Kenya, 2019).
5. **Wider barriers to training and skills development:** On the whole, women are less likely than men to enrol in training programmes, more likely to drop out if they do enrol, and less likely to find a job after training (Beegle and Rubiano-Matulevich, 2020). Several interlinked factors contribute this, including family responsibilities; restrictions on mobility; lack of information or outreach; risk of harassment and violence; and unsuitable training facilities, including poor hygiene and sanitary conditions, limited transportation options, inconvenient scheduling of courses, and lack of childcare facilities. Without due consideration of these factors, women's active and sustained participation in skills development and training will remain limited (Beegle and Rubiano-Matulevich, 2020; Ubfal, 2023).

Box 3 Women's STEM participation in the Middle East and North Africa

Women often achieve high rates of STEM enrolment in the Middle East and North Africa (MENA) region. For example, in Egypt, women outnumber men in physics enrolment by 27%, and Saudi Arabia has among the highest percentages of women science graduates globally.

Yet only 19% of women in MENA aged above 15 years participate in the labour force, and women are significantly underrepresented in senior STEM positions even in fields where they outnumber men in education. This disparity between rising educational attainment in STEM and stagnant female labour-force participation points to broader sociocultural constraints – particularly expectations that women should prioritise family roles – which educational achievement alone cannot overcome (El-Deghaidy et al., 2025).

3.2 Workplace environment

Recruitment into the renewable energy workforce including solar PV has remained male dominated, with little shift in the proportion of women over time (IRENA, 2019, 2020, 2022). This may lead women with relevant technical skills to choose not to work in the sector or to consider leaving soon after they have joined – resulting in these women working in unrelated fields and potentially underutilising their skills (Kazimierczuk et al., 2024).

Gendered workplace barriers were identified as the most significant and widespread obstacles by respondents of the 2024 Global Renewable Energy Survey (IRENA, 2025). Three key factors in the workplace contribute to women dropping out of technical fields in the sector.

1. **Prevailing masculine culture:** Research with women and men working in the renewable energy sector has found that the overwhelmingly masculine culture often creates a hostile environment for women and this is a key barrier to greater female participation (GWNET, 2019). Examples include the language and imagery used in job advertisements (see Figure 3), recruitment practices, anxiety about the timing of a pregnancy and the inflexible nature of work in the sector (GWNET, 2019; Tikly et al., 2020; Fiset and Oldford, 2021).

Figure 3 Example Zimbabwean job advert circulated via social media



Source: Malomalo et al. (2025)

2. **Lack of women mentors, role models and leadership:** The importance of role models and mentors for career development is well documented. Seeing women from similar backgrounds in positions of leadership can reduce gender stereotypes and enhance career aspirations (Carranza et al., 2023), while more experienced colleagues can help early-career women

navigate the sector and access professional networks (IRENA, 2019). But because women remain significantly underrepresented in senior positions – making up just 17% of senior management across the solar PV sector (IRENA, 2022) – few women are available to serve as mentors and role models in the first place. This creates a self-reinforcing cycle: the shortage of senior women makes it harder for early-career women to remain and progress in the sector, which in turn limits the pipeline of future leaders and mentors (GWNET, 2019; UN Women and AfDB, 2021). This is a significant barrier across both centralised and decentralised renewable sectors. In many cases, women need to be willing to break gender norms to take on such jobs (IRENA, 2024).

3. **Sexist workplace culture:** Women working in the solar PV sector are more likely to be exposed to discrimination, sexist comments, sexual harassment and violence from men than in other sectors, given the highly unequal sex ratios and also the seniority and power differentials between women and men in the workforce. In turn, these challenges can lead to high absenteeism and staff turnover (Beegle and Rubiano-Matulevich, 2020). For example, a survey conducted among over 130 women working in the solar PV sector in Brazil found that half had experienced some form of gender discrimination at work, while 62% reported hearing sexist comments in the work environment (GWNET, 2019). Young women electrical engineers in Zimbabwe reported instances of sexual harassment at work, including men body-shaming them, ridiculing them for their choice of attire and making explicit comments towards them referring directly to sexual intercourse (Malomalo et al., 2025).

3.3 Broader gender-based barriers

Broader gender-based barriers can also impact women's ability to enter, remain and progress in the solar PV sector. In the 2018 IRENA survey of people working in renewable energy sectors, respondents ranked issues related to gender norms such as 'perception of gender roles' and 'cultural and social norms' as the highest barriers (IRENA, 2019). Similarly, a smaller qualitative study of women and men working in the sector found that gender norms had an effect early on in life, influencing beliefs around girls' capabilities in STEM fields, and that these views contributed to restrictive gender roles (GWNET, 2019).

Two key barriers are underpinned by gender norms.

1. **Care:** The unequal distribution of unpaid care work is a significant barrier to labour-market access for women in most contexts (Charmes, 2019; Gammarano, 2020). Difficulties balancing care responsibilities with work in the renewable energy sector – through a lack of childcare services and flexible working arrangements – lead many women to drop out of the renewable workforce altogether, particularly around their childbearing years (IRENA, 2019). Focus group discussions with women working in decentralised solar PV in Ethiopia found that women's fathers and husbands tended to disapprove of their occupations, due to cultural expectations about women's childcare responsibilities and men's preferences for women to take on roles that they could fulfil from home (IRENA, 2024).

2. **Mobility:** Women tend to face greater mobility constraints due to a combination of safety concerns, care responsibilities and, in some contexts, norms around respectability and honour (Marcus and Somji, 2024). Jobs in the solar PV sector can require significant travel and time away from home (see Box 4), therefore women's limited mobility serves as a major barrier to entry and advancement across the sector, both in centralised and decentralised solar PV (Baruah, 2017; IRENA, 2019, 2022).

Box 4 Mobility constraints for women in India's solar PV sector

India has one of the highest participation rates of women in STEM subjects, but also one of the lowest participation rates of women in the workforce (GWNET, 2019). Research on solar PV and women's empowerment in Chhattisgarh and Bihar found that qualified female solar engineers and technicians existed, but they generally avoided taking field-based roles in both grid and off-grid companies, citing difficulties travelling to remote locations plus unfavourable working conditions like a lack of health clinics and other facilities in rural areas (University of Oslo et al., 2019).

Care and mobility constraints are likely to be greater for women working in installation, operations and maintenance roles in centralised solar PV projects, which are large-scale and tend to be located in remote or isolated areas (Baruah, 2017; IRENA, 2019). Although decentralised initiatives may also require women to navigate care and mobility constraints, these barriers are often weaker due to less extensive travel requirements and the tendency to work within one's own local community. As such, decentralised solar PV holds promise for enabling women to work around some of these norms and find employment in the solar energy sector.

Summary

- Women face multiple barriers to accessing the technical training required for skilled jobs in the solar PV sector, including gendered perceptions of their suitability and competence, financing, and an uncondusive policy context in many countries.
- In the workplace, a prevailing masculine culture, the risk of sexual harassment and violence, and a lack of women role models, mentors and leaders can contribute to women leaving the sector.
- Gender norms play a critical role throughout, influencing the types of sectors and roles that are deemed socially acceptable for women as well as contributing additional gender-based barriers – with norms around care and mobility common barriers to women's greater participation in the sector.

4 Enhancing women's equitable participation in the solar PV sector

This section outlines three approaches to address participation and equity gaps in the solar PV sector:

1. **Boosting access to training and skills development.**
2. **Transforming recruitment, retention and workplace environments.**
3. **Overcoming wider gender-based barriers around care and mobility.**

Examples stem from the solar PV or renewable energy sector; however, some are from other sectors where parallels can be drawn. Table 2 summarises approaches to enhance women's participation in solar PV.

4.1 Boosting access to training and skills development

Formal education systems: Education systems can structure students' decisions about STEM. The gender gap in STEM manifests early and widens as students progress through their academic lives (González-Gallego et al., 2025). The design of secondary education systems is instrumental in determining whether students pursue STEM at higher education level (Sevilla et al., 2023), with early subject selection shown to increase gender gaps in educational outcomes across countries (Lorenz and Schneebaum, 2024). Education systems that delay track selection by keeping STEM subjects compulsory for longer may help prevent girls from being steered away from STEM before they have the opportunity to build interest and confidence.

Informal training: Many initiatives that work to strengthen women's access to employment and entrepreneurship opportunities in solar PV, particularly in rural areas, are carried out through informal training. Programmes are usually delivered by for-profit or non-profit organisations outside of formal educational structures like schools, universities or TVET institutions. These initiatives tend to have lower barriers to entry than formal institutions, can be combined relatively easily with other responsibilities, and often link directly to employment and entrepreneurship opportunities. While several well-known programmes exist in this space (see Box 5), results tend to focus on the number of women trained and number of people with increased access to electricity, rather than collating detailed impact data on women's economic empowerment measures. This is a key knowledge gap for future research.

Financing: Scholarships and financial aid are often identified as critical interventions to address financial barriers to participating in training and skills development (Dhaleine and Fauvet, 2025; Malomalo et al., 2025). For example, a study in Italy found that targeted scholarships for female

STEM students led to over 200 additional female engineering graduates over 2022–2024, a 17.5% increase relative to the counterfactual scenario without the scholarship (Çiftaslan, 2026). Similar scholarship approaches have been adopted in Chile and the Philippines to increase women's participation in STEM-related TVET, though rigorous impact evaluations of these specific interventions remain limited (Tikly et al., 2020).

Box 5 Example informal training programmes for women in solar PV

Solar Sister provides training and entrepreneurship opportunities for women across sub-Saharan Africa. The social enterprise recruits, trains and supports women entrepreneurs to sell portable solar lights, solar home systems and other solar-powered products – focusing on rural, last-mile communities that lack access to the grid. Trainees receive a comprehensive package of technical and business training over 12 months, combined with ongoing mentoring. The women entrepreneurs then earn income by selling the products directly to people in their community, who in turn benefit from the multi-dimensional benefits of clean energy (Kazimierczuk et al., 2024; Solar Sister, n.d.). Since 2010, Solar Sister has trained more than 12,500 women entrepreneurs, while also facilitating access to clean energy products for almost 6 million people across sub-Saharan Africa (Hivos, 2024; Solar Sister, n.d.).

Barefoot College trains rural women in solar technology installation and maintenance, promoting clean energy for remote, off-grid communities and generating employment opportunities for women. After identifying viable communities from requests made by local leaders or NGOs, the non-profit recruits and trains women for up to six months on assembling, installing and maintaining solar systems, plus other skills (IRENA, 2022). These women can then develop a livelihood by maintaining solar systems, as 'Master Trainers' training other women and by selling solar products to their community. Since its inception, Barefoot College has trained over 3,500 women from 93 countries, facilitating access to solar systems for almost 2.5 million people (Barefoot College, n.d.).

Role models: A scoping review of 57 studies of gender-stereotypical beliefs on STEM engagement and interest found that women and girls generally benefit from exposure to relatable female STEM role models (De Gioannis et al., 2023). Similarly, a UK-based study found that girls identified exposure to relatable female STEM role models and real-world STEM career pathways as influential in their decision to take STEM subjects in their senior secondary school years (age 16–18) (UK Department for Education and Behavioural Insights Team, 2020). When well-designed, behavioural interventions around role models can help reframe norms and perceptions about the fields women are suited to as well as the perceived competence of women in STEM.

A multifaceted approach: ENERGIA undertook a multi-year project to support more than 4,000 women from mostly rural and low-income communities across 7 countries to establish and run clean energy businesses. A key finding from the project was that the provision of bundled services – combining things like vocational training, finance, business skills, technology, mentorship and leadership – led to greater growth and sustainability of their businesses, and to women’s empowerment through increased control over resources and self-confidence (Dutta, 2018). Research from grid and off-grid systems in India, Kenya and Nepal points to the ‘instrumental’ nature of many capacity-building programmes – where a one-off training is conducted with the expectation that this will enable women to participate in the sector. However, capacity-building is a necessary but often insufficient condition: there is a need to go beyond education to address the financial and social conditions that lead to women’s exclusion from economic opportunities in solar energy (University of Oslo et al., 2019).

Transition from training to workplace: A recurring challenge for STEM and solar energy trainees, especially women, is bridging the gap between completing training and securing employment (Malomalo et al., 2025). Common examples include employers asking for previous work experience and a skills mismatch between what is taught in formal education and what is required by the industry (INCLUDE, 2024; Kingiri et al., 2025). Targeted schemes can potentially increase women’s participation in STEM employment (see Box 6); but no publicly available data exists on the impact of these initiatives, such as whether they have reached their targets or how they have translated into jobs for women after tertiary education.

Box 6 Example initiatives to help women transition from training to the workplace

Ghana’s Millennium Development Authority internship and mentoring programme targets 200 female students per year who are pursuing STEM programmes in tertiary institutions to help them gain skills relevant for jobs in the power sector (Tikly et al., 2020).

Natfort Energy Zimbabwe, a last-mile clean energy distributor, recognised that relying on existing recruitment channels would limit staff diversity and its long-term growth, given that only 28% of STEM graduates in Zimbabwe are women. In response, the company established partnerships with two universities to attract women STEM graduates into internships and technical roles, introduced structured mentoring and performance support, and set a formal target of 100% women interns in technical roles for 2026 (Value for Women, 2026).

4.2 Transforming recruitment, retention and workplace environments

Gender-responsive recruitment: In Kenya, the Solar Mamas project in Homa Bay County and the Ikisaya Energy Centre in Kitui County both adopted a gender-responsive approach to recruitment with the explicit goal of enhancing women's employment opportunities. In Homa Bay, the project recruited only middle-aged and older women to train for six months as solar engineers, while at Ikisaya, efforts were made to hire suitably qualified female candidates for vacant positions, as well as gradually taking on more women for roles at management and board level (University of Oslo et al., 2019). The Homa Bay project also contributed to a shift in gender norms, transforming men's attitudes about what women can do and achieve – including women's capacity to fulfil electricity-related roles (University of Oslo et al., 2019; UN Women, 2025).

Inclusive workplace culture: Companies with more inclusive workplace cultures and stronger leadership commitments to diversity tend to report stronger retention and advancement outcomes for women employees, and they can reduce the feelings of exclusion experienced by women in some STEM workplaces (Hall et al., 2023; Remerscheid and Kotecha, 2024). The International Finance Corporation's (IFC) Energy2Equal initiative supported renewable energy companies in implementing workplace inclusion measures including leadership commitments to gender equality, anti-harassment policies, gender-sensitive recruitment and promotion practices, diversity and inclusion training, and mentorship opportunities. Participating firms reported improvements in women's recruitment, retention and advancement, alongside broader benefits such as improved workplace satisfaction and organisational performance (IFC, 2022).

Mentorship, networking and leadership: Mentorship programmes provide career guidance, access to professional networks and peer support. IRENA's global survey found that mentorship opportunities, networking opportunities and fair treatment in the workplace were consistently ranked among the most important measures supporting women's retention and career progression in the renewable energy sector (IRENA, 2025). Power Africa delivered a leadership programme to enhance young African women's leadership and technical skills in the energy sector, plus an apprenticeship scheme to help young women gain professional experience and networks. Close to 100 women from East and West Africa were selected for the leadership programme (UN Women and AfDB, 2021). Similarly, IFC's Energy2Equal initiative supported peer-learning and mentorship opportunities across participating firms, with companies reporting that these interventions strengthened women's leadership pathways and professional development (IFC, 2022).

Robust action against discrimination and violence: Organisational responses to discrimination and harassment are critical for improving retention in male-dominated sectors, particularly where unequal power dynamics and underrepresentation can increase women's exposure to hostile work environments (Hersch, 2024; Noviski, 2021). Across 19 participating companies in IFC's

Powered by Women initiative in Nepal's hydropower sector, the formalisation of gender-based violence and harassment policies and grievance redress mechanisms contributed to a 7% increase in women recruited in non-traditional roles and an 88% reduction in absenteeism (IFC, 2023).

Across the board, large-scale centralised solar energy companies may be better placed than smaller decentralised solar PV organisations to transform workplace environments. These larger companies are more likely to be able to institutionalise policies that promote an inclusive culture and address discrimination and violence, for example, through corporate frameworks and standards.

4.3 Overcoming wider gender-based barriers

Broad gender-based barriers often require interventions at the policy level. This includes flexible learning and employment opportunities, care infrastructure, and programmes aimed at reducing mobility and access constraints. Given that many of these barriers are rooted in restrictive gender norms and unequal distributions of unpaid care work, broader structural approaches may be necessary to improve women's long-term participation and advancement within the solar energy sector (ILO, 2024; IRENA, 2025).

Flexible learning and employment opportunities: The Philippines offers online STEM-related TVET programmes that aim to increase accessibility for women who are balancing their learning alongside household and caregiving responsibilities (Tikly et al., 2020). To enable flexible working patterns, IFC's Powered by Women initiative in Nepal worked with hydropower companies to demonstrate the well-evidenced benefits of family friendly policies. Sixteen companies instituted flexible working arrangements and three companies provided on-site childcare – all companies reported higher attendance, lower unplanned absenteeism and reduced productivity losses as a result (IFC, 2023).

Care infrastructure: IFC's Powered by Women initiative in Nepal also helped three hydropower companies to provide on-site childcare, with similar positive findings for their business outcomes (IFC, 2023). Though not from the renewable energy sector, another initiative in Uganda showed that providing quality childcare services to women entrepreneurs increased their business revenues by 47% on average, along with self-reported happiness (10%) and life satisfaction (8%) – with these effects strongest among single mothers (Bjorvatn et al., 2025). Bogotá's network of Care Blocks (*Manzanas del Cuidado*) offers daycare for children and other dependents alongside education and skills training, entrepreneurship support and wellness services, enabling women to access learning and employment opportunities while their care responsibilities are covered. By 2023, 20 Care Blocks and 2 mobile Care Buses were operating across the city, with 28,812 women having graduated from training programmes and 27,579 having received assistance with employment services (PAHO, 2023; CHANGE, n.d.).

Mobility and access interventions: Women's participation in solar energy and other technical sectors can be constrained by mobility limitations linked to safety concerns, care responsibilities and restrictive gender norms. Solutions have increasingly focused on improving women's safety and accessibility within transport and mobility systems. For example, the Quito Metro Line Project in Ecuador implemented various measures to prevent and respond to sexual harassment on public transport, including survivor-centred reporting systems, communication mechanisms to report harassment, gender sensitisation training for metro staff and public awareness campaigns. The project also introduced a quota requiring at least 20% of metro staff to be women. By 2023, women accounted for 40% of the workforce, including 50% of management positions and 35% of technical roles (Dominguez Gonzalez et al., 2023).

Table 2 Key approaches to enhance women's equitable participation in solar PV

Boosting access to training and skills development	
Formal education systems	Delay track selection or subject specialisation to keep STEM subjects compulsory for longer
Informal training	Tailor informal training opportunities with lower barriers to entry
Financing	Consider targeted scholarships and financial aid for women and other underrepresented groups
Role models	Enhance exposure to relatable female STEM role models and mentors
Multifaceted approach	Go beyond technical solar PV training to include access to finance and business and leadership skills
Transition from training to workplace	Provide targeted work experience, internship and mentoring schemes to help women bridge the gap
Transforming recruitment, retention and workplace environments	
Gender-responsive recruitment	Change recruitment practices to intentionally hire more women, including in leadership positions
Inclusive workplace culture	Uphold and promote greater gender equality through policies, standards and culture
Mentorship, networking and leadership	Connect early-career women with senior women in the sector for career guidance, professional networks and peer support
Robust action against discrimination and violence	Formalise and uphold anti-discrimination and anti-violence systems and policies
Overcoming wider gender-based barriers	
Flexible learning and employment opportunities	Offer online learning opportunities and flexible working patterns
Care infrastructure	Provide quality care services including childcare, elder care and care for people with disabilities
Mobility and access interventions	Improve women's safety and security within transport and mobility systems

Summary

- Technical training alone is unlikely to overcome gender-based barriers without complementary interventions to address financial barriers, practical considerations around suitable training facilities, and support to transition from training to the workplace.
- A more inclusive work environment can help enhance women's participation in the solar PV workforce, including through gender-sensitive recruitment, women's mentorship and leadership programmes, and robust action against discrimination and violence.
- Broader, structural approaches are necessary to shift or work around gender norms that limit women's participation in the sector. These include flexible learning and employment opportunities, enhanced care infrastructure, and improved safety and accessibility within transport systems.

5 Conclusion

Economic opportunities are rapidly being created in the renewable energy sector. Solar PV is leading this expansion with 7.2 million jobs already created globally, amounting to almost half of all jobs in renewables. Yet existing patterns of employment in the sector reflect gender-based barriers, which means women will not benefit equally from the employment or entrepreneurship opportunities of our low-carbon future. Women are still concentrated in lower-paid administrative positions in the solar PV sector and they are significantly underrepresented in technical and leadership roles. Without proactive policies and initiatives to redress these gender imbalances, the large gender gaps in the solar PV workforce will be reproduced or even exacerbated.

Gendered barriers to women's equitable participation in the solar PV sector are well-researched. They can affect women through different stages of their lives: from childhood aspirations and adolescent decisions about STEM subjects and future career ambitions, to gaining the necessary skills and training to launch their career in solar PV, to a workplace environment that can support or hinder their progress in the sector. Gender norms influence the types of subjects, sectors, roles and careers that are seen as socially acceptable for women, and contribute to other gender-based barriers through care and mobility constraints.

Emerging solutions to address these gender-based barriers in the solar PV sector include boosting access to training and skills development through holistic interventions that target multiple constraints; transforming workplace environments to enhance the recruitment, retention and progression of women to leadership positions; and overcoming wider gender-based barriers through supportive infrastructure that expands quality care services and improves transport, safety and mobility.

But several important knowledge and action gaps remain. First, global data is scarce on women's participation in solar PV – particularly on decentralised solar and on informal training, apprenticeships and internships. Second, greater commitment is needed to generate intersectional data to go beyond broad-brush statements about 'women' as a homogenous group. Third, deeper analysis is necessary on the potential of decentralised solar to generate decent employment opportunities at scale for women and to work around the normative barriers that limit women's participation in centralised solar in some contexts. Fourth, greater emphasis should be placed on policy efforts, commitments and action to enhance women's participation as producers of solar energy, not just as consumers. Lastly, and most importantly, more rigorous impact evaluation data is required to test specific emerging solutions that address gender-based barriers in the solar PV sector – moving beyond simple participation and access metrics to assess the impact of these interventions on women's economic empowerment.

This brief is a starting point for further research, policy engagement and action from ODI Global on this topic. Translating the series of outputs into concrete improvements in women's participation in the solar PV sector will require sustained political will, better gender-disaggregated data, and coordinated action across governments, international institutions, civil society and the private sector. The initial set of tools, evidence, policy frameworks and financing mechanisms to advance this work exists, and the analysis here contributes to the growing body of knowledge needed to support that effort.

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