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WOMEN IN INDIA'S GREEN SKILLS TRANSITION

A REPORT FOR GENDER INCLUSIVE GREEN SKILLING POLICY

IMPRINT

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National Skill Development Corporation (NSDC) is a not-for-profit company set up in 2008 under Section 25 of the Companies Act 1956 (corresponding to Section 8 of The Companies Act, 2013). NSDC works under the aegis of the Ministry of Skill Development & Entrepreneurship (MSDE), Government of India. NSDC acts as a knowledge partner to the Skill India Mission to build efficient vocational training initiatives, empowering India's youth. It serves as the knowledge hub to create impact, supporting India's journey towards becoming a skill capital of the world. It drives collaboration among national policy actors, private sector, state and district-level players through MoUs, capacity building, and digital integration, resulting in decentralized, context-sensitive delivery of skill initiatives.

The Indo-German Green Skills Programme (IGGSP) is implemented the by GIZ GmbH, under commission of the Federal Ministry for Economic Cooperation and Development (BMZ), Germany. IGGSP works in close cooperation with the Ministry of Skill Development and Entrepreneurship (MSDE), Government of India. The project tackles gender disparities in TVET for green occupations by promoting gender-equitable training, improving systemic conditions, and aligning curricula with international standards. It adapts learning materials, enhances career guidance, and adjusts practical training phases to better support girls and women. At the structural level, it works to remove barriers such as limited workplace safety, transport challenges, and childcare needs, while enabling international peer learning through benchmarking. IGGSP also advances the standardization of curricula to German and global norms, helping Indian institutions deliver consistent, internationally recognized qualifications.

ABSTRACT

India's green transition is expected to generate substantial employment across renewable energy and electric mobility value chains. The solar sector alone is projected to create approximately 3.26 million jobs by 2050, while the electric vehicle (EV) transition could generate nearly 10 million direct and 50 million indirect jobs by 2030 (Skill Council for Green Jobs, 2023; IRENA–ILO, 2024). Despite this employment potential, women remain significantly underrepresented in green skills training and technical occupations. Available evidence indicates that women's participation in formal technical and vocational education and training (TVET) remains limited, particularly in technical and STEM-oriented trades relevant to solar and electric mobility sectors, reflecting persistent structural barriers in access, retention, and progression.

This report examines the gendered nature of India's emerging green skills ecosystem with a focus on the solar and EV value chains. It draws on extensive secondary research, state-level evidence from Maharashtra, Karnataka, Telangana, West Bengal and Kerala, and international benchmarks from the Philippines, Vietnam and South Africa. Using the Rights, Representation, and Resources (3R) framework, the report analyses structural barriers across policy design, institutional systems, and labour-market outcomes. The analysis identifies three persistent gaps: limited integration of gender objectives and accountability mechanisms in green and skilling policies; continuedunderrepresentation of women in technical training, employment and leadership roles; and inadequate access to enabling resources such as gender-responsive training infrastructure, industry linkages, and gender-disaggregated data systems. The analysis is situated within the expanding architecture o**f Indian–German cooperation on education,** skilling, and workforce mobility. Following the German Chancellor's visit to India in November 2025, both governments reaffirmed education, vocational training, and skilled mobility as core pillars of the Strategic Partnership (PIB, 2025). Initiatives such as inviting German universities to establish campuses in India under the National Education Policy and expanding German language education across schools, universities, and vocational institutions are integrating this cooperation into formal systems. This policy context creates a timely opportunity to embed gender-responsive approaches within green skilling and mobility pathways as they scale.

Building on **national evidence, international experience and stakeholder consultations,** the paper proposes policy and programme recommendations to embed gender inclusion within green skilling systems. These include integrating gender targets into green and skilling policies, strengthening institutional and employer readiness, expanding women's access to technical training and employment, and aligning green workforce development with international labour standards. Strengthening women's participation in green skills is positioned as both a gender equity priority and a strategic workforce imperative for inclusive growth and effective India–Germany cooperation in the green economy.

Key findings of this report can be summarised as follows:

- Women represent **only 11–15%** of India's solar and EV workforce (IEA, 2019)
- Less than **15% female** enrolment in technical green TVET pathways (SCGJ, 2023)
- Gender objectives largely **absent** from national and state green policies
- 5-state analysis shows persistently **male-dominated** green value chains
- International evidence confirms **gender inclusion** improves with policy mandates

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BACKGROUND

Growing Need for Green Skilling

Environmental degradation, biodiversity loss, desertification, rising sea levels and shifting climate patterns are disrupting livelihoods and economic structures worldwide. Global responses to address climate change are reshaping growth models across countries and sectors. The transition is fundamentally a **labour-market transition** altering the nature of jobs and the skills they require.

The combination of knowledge, technical abilities, and behavioural attributes that allow a person to carry out occupational tasks to required standards and contribute productively to the economy and society is referred to as skills (ILO and OECD). This is an essential prerequisite for the transition to environmentally sustainable and socially inclusive economies. While there is no single, universally accepted definition of skills for green jobs, international organisations broadly converge on their scope and significance. The International Labor Organization (ILO) defines skills for green jobs as follows:

"Skills that are necessary to successfully perform tasks for green jobs and to make any job greener."

ILO, 2025

The European Training Foundation (ETF, 2022) defines green skills "as skills that are both (i) technical knowledge and skills that enable professionals to effectively use green technologies and processes (i.e. resource efficient technologies or processes that reduce waste and minimise the environmental impact of human action); and (ii) transversal skills, as well as knowledge, values and attitudes that help them take pro-environmental decisions in their work and lives."

Similarly, the United Nations Industrial Development Organisation (UNIDO, 2022) defines it as "knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society. The transition to a low-carbon, resource-efficient economy requires systemic changes that will result not only in new products and services but also in changes in production processes and business models." These definitions underscore the common conclusion that the greening of the economy will inevitably change the skills required and the tasks involved in many of the existing occupations.

For India, green transition presents a dual economic opportunity. First, it aligns domestic employment creation with national climate commitments, including the goal of achieving net-zero emissions by 2070. Second, it positions India to contribute skilled human resources to a growing global demand for green talent, as countries accelerate their own energy and industrial transitions. This opportunity is reinforced by India's demographic profile where the working-age population is projected to peak at nearly 69% of the total population by 2030. Whether this demographic advantage translates into productive employment will depend critically on how skills are developed and deployed.

The **demand for green skills** is expanding across sectors, including those traditionally considered carbon intensive. According to the World Economic Forum (2025), environmental stewardship is currently a "less essential skill in many occupations but is expected to see a sharp increase in relevance over the coming years." However, the ecosystem required to train, certify and absorb workers with these skills particularly at scale remains nascent in India.

India is the world's fourth-largest producer of **renewable energy** and has committed to sourcing 50% of its cumulative electricity

capacity from renewables by 2030. Within this, solar energy has emerged as the dominant driver of employment. Estimates suggest that solar energy could generate approximately 3.26 million jobs by 2050, while wind energy could support around 0.18 million jobs by 2030. Emerging segments such as bioenergy and green hydrogen are projected to create 0.27 million and 0.6 million jobs respectively by 2030.

Parallel transitions are underway in traditional industries. The **electric vehicle (EV)** transition alone is expected to generate nearly 10 million direct and 50 million indirect jobs by 2030. Crucially, this transition will also require the reskilling and redeployment of an estimated 35 million workers currently employed in internal combustion engine value chains. Similarly, sustainability transitions in textiles and construction are expected to affect millions of workers by 2030, underscoring the scale of workforce transformation involved.

Women at the Margins of the Green Transition

Women in India continue to face structural disadvantages in accessing stable, skilled, and future-oriented employment. India's female labour force participation rate (FLFPR) rose to 41.7% in 2023–24, recovering from a historic low of 23.3% in 2017–18. However, this remains substantially below the male participation rate of approximately 77% and below the global average of around 51%. Much of this growth reflects distress-driven or low-quality employment rather than increased access to secure, skilled jobs (IWWAGE, 2024).

Within the formal skilling ecosystem, women's **participation in technical and STEM-related trades** remains extremely limited (NSDC, 2020), accounting for only 30% of enrolments in engineering and allied disciplines. Similar patterns are observed in vocational education and training. Only about 4.5% of India's working-age population is enrolled in formal skilling programmes, and women constitute roughly 20–25% of enrolments in Industrial Training Institutes (ITIs). The overall tertiary gross enrolment ratio for women stands at approximately 28%, with post-secondary dropouts linked to mobility constraints, care responsibilities, and persistent social norms. Thus, reinforcing occupational segregation and constraining entry into emerging green sectors. At the macro level, India's ranking on global gender indices underscores the persistence of these disparities. The country ranks 131 out of 148 on the Global Gender Gap Index (2025) and 108 out of 193 on the UNDP Gender Inequality Index (2022), pointing to continued deficits in labour-market outcomes, education, and decision-making power.

Globally, women account for approximately 32% of the global **renewable energy workforce and** about 40% of employment in solar PV; however, their participation is heavily concentrated in administrative and support roles, with limited representation in technical and leadership positions (IRENA & ILO, 2024). In India, women constituted only about 11% of the rooftop solar workforce in 2019 and between 11–15% of employment in the EV sector in recent years. Barriers related to mobility, workplace safety, social norms, and weak recruitment practices continue to constrain women's entry and retention in these sectors (OMI Foundation, 2024).

These numbers point to persistent and wide **gender disparities** in the labour market. Women remain systematically underrepresented in skilled employment, concentrated in lower-paid and informal work and frequently excluded from decision-making and emerging sectors. At the same time, expanding women's participation in green sectors represents a

high-return opportunity with limited trade-offs. Greater access to decent work for women can generate positive spillovers for households and communities, strengthen adaptive capacity to climate risks, and contribute to emissions reduction. The green transition offers a rare window to disrupt entrenched labour-market inequalities.

As the green economy becomes a major driver of future job creation, the absence of targeted interventions risks widening these gaps, with new forms of exclusion layered onto existing labour-market inequalities.

As green jobs are still emerging and institutional arrangements are still being shaped, early investments in gender-responsive skilling systems can yield long-term distributional gains. For firms and economies, it can ease skill shortages, improve productivity and competitiveness, and support more resilient growth, while advancing equity in access to emerging employment opportunities.

Figure 1: Sustainable Development Goals (SDGs) tackled by gender-responsive green skilling systems

About this report

This report was jointly developed by the National Skill Development Corporation (NSDC) and GIZ under the Indo-German Green Skills Programme (IGGSP). IGGSP is a bilateral cooperation between the Governments of India and Germany to support the development of green skills in India. Particularly, it promotes skills development on solar energy and EV across four Indian states - Karnataka, Maharashtra, Telangana, and West Bengal.

The analysis is framed within the evolving architecture of **India-German cooperation** on education, skilling and workforce mobility, as these systems are being actively expanded through bilateral policy commitments. During the German Chancellor's visit to India in November 2025, both governments reaffirmed education, vocational training and skilled mobility as central pillars of the Strategic Partnership (Press Information Bureau [PIB], 2025).

The invitation to German universities to establish campuses in India under the National Education Policy, together with expanded German language education across schools, universities, and vocational institutions, integrates this cooperation into formal systems. This policy context creates a timely opportunity to embed gender-responsive approaches within green skilling and mobility pathways as they scale.

The **objective of this report** is to provide a shared and evidence-based understanding of green jobs in India, with a specific focus on the solar energy and EV sectors and women's participation within them. The report subsequently will be the foundational part to further generate evidence through primary research, implementation learning and the development of practical and policy-relevant recommendations under IGGSP.

The report contributes to the implementation of the 2030 Agenda for Sustainable Development by addressing the interlinkages between gender equality, clean energy transitions, decent work, reduced inequalities, and climate action. By examining women's access to green skills and employment, it highlights pathways through which inclusive green transitions can support long-term, sustainable development outcomes.

The report was developed using the following approach:

Extensive **secondary research** was undertaken to gain a preliminary understanding of the national and international policy frameworks, labour-market evidence, and emerging debates on green skilling. Semi-structured interviews with 42 experts and targeted field visits were conducted to examine good national and international practices. The Indian analysis examines trends and gaps in five states - Maharashtra, Karnataka, Telangana, West Bengal, and Kerala - selected for their diversity in policy, training ecosystems and IGGSP implementation purview. The international benchmarking highlights lessons from the Philippines, South Africa and Vietnam, identifying transferable practices that could be adapted for India.

Findings were further validated through a **national stakeholder consultation workshop** held in April 2025 in New Delhi, which brought together 48 participants (27 of which female) from key institutions, including the Ministry of Skill Development and Entrepreneurship (MSDE), NSDC, NITI Aayog, UN Women, the Ministry of Women and Child Development (MWCD), as well as representatives from the Green Sector Skill Council and the Automotive Skills Development Council (ASDC). The consultation aimed at sharing key findings from the national and international benchmarking studies, and at identifying concrete policy and programmatic recommendations for advancing gender inclusion in India's solar and electric mobility sectors.

Using the **Rights, Representation, and Resources (3R)** framework, this document examines the barriers women face in accessing training, employment, and progression within the solar and EV value chains. The 3R framework, originating in Sweden's Feminist Foreign Policy, has become a key tool for addressing structural gender inequalities in labour markets. It focuses on Rights (legal protection and freedom from discrimination), Representation (participation in decision-making and leadership), and Resources (access to education, finance, assets, and productive inputs). This framework is frequently used by UN Women, ILO, and the World Bank to design inclusive labour, social protection, and development policies.

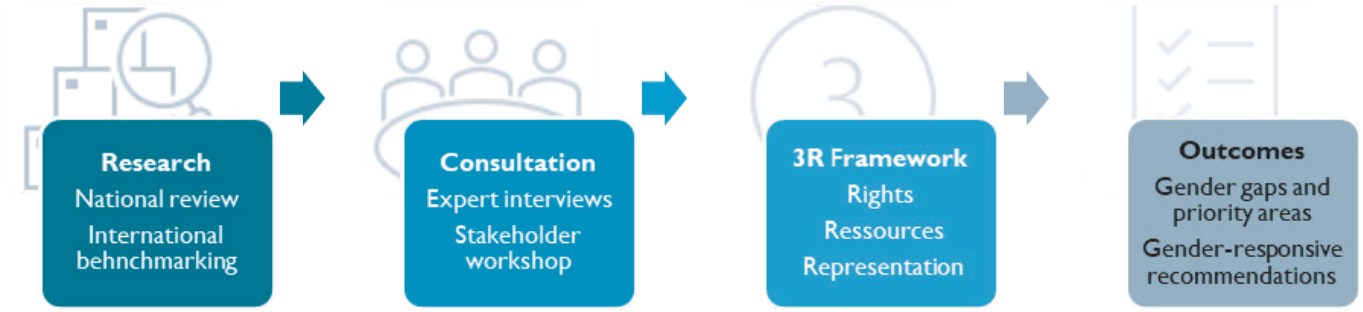


Figure 2: Methodological approach for developing this report

GENDER INCLUSION IN INDIA'S SOLAR AND EV SECTORS

This section presents national-level evidence on gender inclusion in India's solar and electric mobility sectors, drawing on state-level analysis from Maharashtra, Karnataka, Telangana, West Bengal, and Kerala. Rather than documenting widespread examples of gender-responsive policies, the evidence reveals **systemic gaps in policy design, institutional readiness, and implementation** that continue to limit women's participation in green skills and employment. The state cases illustrate how rapid growth in solar and EV industries has largely proceeded without explicit gender inclusion strategies, resulting in persistently male-dominated workforces despite differing economic and social contexts.

Barriers to Women's Participation

The **barriers that women face** can be understood through the Rights, Representation, and Resources (3R) framework, which captures gaps in policy, participation, and institutional support.

Rights – Policy and Accountability

Despite ambitious energy and mobility policies, **gender remains absent** as a formal objective. At the national level, the National Electric Mobility Mission and most of the state renewable energy policies does not explicitly address women's inclusion. Maharashtra's Skill Gap Analysis (2023) provides no gender breakdowns, effectively making women invisible in official planning. Similarly, Karnataka and Telangana, despite being leading states in the EV sector, lacks gender integrated objectives into their strategies. The absence of explicit gender targets, dedicated budgets, and accountability mechanisms means that inclusion is often left to ad hoc efforts rather than systemic planning.

Representation – Participation in Training and Jobs

The underrepresentation of women begins in the classroom and continues into the labour market. Very **few female students enrol in technical trades** such as solar PV installation, automotive electrics, or EV servicing. Social norms reinforce this imbalance: technical roles are still widely considered "male" work, and women who attempt to enter these trades face discouragement from families and communities. The consequence is stark: in Maharashtra's solar and EV workforce, more than 90% of jobs are held by men, and similar patterns prevail in other industrializing states. Even Kerala, which has higher female participation in vocational training overall, sees limited entry into technical green trades.

"The enrolment rate of women in ITIs has shown some improvement in recent years but remains significantly low at just 13.3%."
National ITI Upgradation Program, 2025

Resources – Infrastructure, Support and Data

Where women do attempt to enrol, **institutional environments** often fail them. TVET centres lack gender-sensitive facilities such as safe transport, childcare, and sanitation facilities. The scarcity of female trainers and mentors' limits role models for women aspiring to join technical professions. Finally, gender-disaggregated data collection remains weak. Most state skill reports do not track women's enrolments or job outcomes in solar or EV courses.

State-Level Evidence

Maharashtra is among India's most industrialised states, with substantial activity in solar deployment and a growing EV

manufacturing and servicing ecosystem. Despite this scale, women remain largely excluded from these sectors: the solar and EV workforce is overwhelmingly male, with **women estimated to hold less than 10% of industry roles.** The state's Skill Gap Analysis (2023) does not apply a gender lens, providing no systematic data on women's enrolment, completion, or placement in green skills programmes. As a result, women's participation is neither visible nor prioritised in workforce planning. Evidence from training institutions further indicates that even when women complete technical courses related to solar or EVs, their transition into employment is weak, as employers remain hesitant to recruit female technicians. Maharashtra thus exemplifies how rapid industrial growth in green sectors, in the absence of gender-responsive policy and industry engagement, continues to reproduce exclusionary labour-market outcomes.

Mahindra Pink Collars – Women in EV Service

The Pink Collars initiative, launched by Mahindra & Mahindra in Maharashtra, is one of the first industry-led programmes in India to train and employ women as EV service technicians. Through Pink Collars, Mahindra recruits women into its authorised service centres, providing targeted technical training, workplace sensitisation for male colleagues, and assured placement opportunities. The programme directly addresses barriers to women's entry into green technical trades: lack of role models, limited employer acceptance, and weak connections between training and jobs. The initiative highlights how private sector leadership can complement public skilling initiatives and reshape perceptions of women's capabilities in the automotive and green economy.

OLA Electric All-women future electric scooter factory in in Tamil Nadu's Krishnagiri © Ola Electric

Karnataka

Karnataka, home to Bengaluru's vibrant technology ecosystem, has positioned itself as a national leader in electric mobility and clean energy, attracting both global manufacturers and start-ups. Through the Clean Mobility Policy 2025–30, which targets ₹50,000 crore in investment and the creation of approximately one lakh jobs, alongside the Renewable Energy Policy 2022–27, which aims to add 20 GW of solar and wind capacity, the state has articulated an ambitious industrial vision (Invest Karnataka Forum, 2025). However, this leadership has not translated into gender inclusion. Neither the EV policy nor the renewable energy framework explicitly addresses women's participation in training, employment, or entrepreneurship. While some training providers have piloted measures such as flexible schedules to accommodate women learners, these efforts remain isolated and small in scale. In the absence of systemic policy integration and clear implementation mechanisms, women are unlikely to benefit from Karnataka's otherwise rapid growth in green jobs.

Telangana

Telangana has intensified its clean energy

and electric mobility push, positioning Hyderabad as an emerging hub through **large-scale renewable and EV investment**s. At the Rising Telangana Summit, the state has signed renewable energy MoUs exceeding ₹1.23 lakh crore and approved Power Purchase Agreements (PPAs) for 3,000 MW of solar and 2,000 MW of pumped storage capacity. The government has also announced a forthcoming green energy policy aimed at accelerating clean power deployment, improving grid stability, and enabling industrial self-sufficiency through renewable energy generation. These measures signal a strong investment-led approach to scaling renewable energy and electric mobility infrastructure in the state. However, this expansion has not been accompanied by explicit **gender inclusion strategies.** Across the electric mobility, renewable energy, and skilling policy frameworks reviewed under this study, women's participation in training, employment, and entrepreneurship remains largely unaddressed. Policy emphasis continues to rest on infrastructure creation, manufacturing growth, and energy security, with limited guidance on integrating women into emerging green value chains. In the absence of gender-responsive objectives and implementation mechanisms, Telangana's green transition risks replicating existing workforce inequalities, constraining women's access to the expanding solar and EV employment landscape.

West Bengal

In West Bengal, gender inclusion in solar and EV sectors is constrained primarily by policy gaps and weak data systems rather than lack of industrial potential. Despite expanding renewable energy deployment and a broad skills development infrastructure, gender considerations remain largely absent **from state skill planning and sectoral strategies.** Planning exercises rely on outdated or aggregate labour market data, while gender-disaggregated information on enrolment, completion, and placement in green skills programs is largely unavailable. Without reliable gender-specific data, the state cannot effectively diagnose women's exclusion or design targeted interventions for solar and EV value chains. Although West Bengal has built successful industry-training partnerships in sectors like hospitality and services, these models have not been adapted to renewable energy or electric mobility. Women's interest and capability in technical fields is evident - as demonstrated by the solar-powered village model created by trainees at the Women's ITI in Gariahat - yet their participation in green technical training remains low and invisible in policy discussions. West Bengal thus illustrates how institutional inertia and weak evidence systems can impede gender inclusion in emerging green sectors, even without overt social resistance.

Solar-powered village model created by Solar Technician trainees of Women's ITI, Gariahat © EMC

Kerala

Kerala presents a comparatively more enabling context for women's participation in skills development, with women accounting for approximately **61% of vocational training enrolments,** significantly higher than in other

states examined. This favourable baseline is reinforced by Kudumbashree, the state's flagship women's empowerment programme, which has supported women's self-help groups to establish micro-enterprises in areas such as solar installation and maintenance. These initiatives demonstrate how community mobilisation and collective enterprise models can help women overcome barriers related to social norms, mobility, and access to markets.

However, despite these strengths, gender inclusion in solar and EV sectors is **not systematically embedded** in Kerala's formal energy or skilling policies. Progress to date has been driven primarily by community-based programmes rather than by explicit policy mandates, targets, or implementation frameworks within the state's renewable energy or skills strategies. This decoupling limits the scalability and sustainability of existing initiatives. Kerala thus illustrates that even in relatively progressive contexts, the absence of formal policy integration can constrain the expansion of women's participation in technical green sectors.

Kudumbashree – Community-Led Women's Solar Enterprises

Kudumbashree, Kerala's flagship poverty reduction and women's empowerment programme, has long mobilised self-help groups (SHGs) as engines of social and economic change. Building on its strong grassroots networks, the programme has supported women's SHGs to diversify into renewable energy by establishing micro-enterprises for solar installation, repair, and maintenance. This model leverages the collective strength and credibility of women's groups, enabling them to overcome socio-cultural barriers that often prevent individual women from entering technical trades.

© Kudumbashree Mission

By working together, women gain peer support, negotiate more effectively with clients and suppliers, and build visibility in a sector traditionally seen as male-dominated. Importantly, Kudumbashree has also provided access to training, finance, and government linkages, ensuring that these enterprises are not one-off experiments but integrated into broader livelihood strategies.

In comparison, the five states illustrate different dimensions of the challenge. Maharashtra and Karnataka show how industrial growth in EV and solar has not translated into gender-inclusive participation. Telangana and West Bengal highlight socio-cultural and institutional barriers that keep women out from entering in the green skilling pipelines. Kerala, while more advanced in community-led models, still lacks systemic integration of gender inclusion into state policy for the specified sectors. Taken together, the evidence reveals a triple gap: gender inclusiveness is largely absent from formal policy frameworks, institutional environments are not conducive for women, and cultural norms continue to limit their choices in these sectors.

Across all five states examined, solar and EV policies and skill planning instruments largely remain gender-neutral in design, with limited recognition of women as a target group for green skills development. State EV and renewable energy strategies focus on investment attraction and workforce demand but rarely include gender objectives, targets, or monitoring mechanisms. As a result, women's participation in technical training and employment is not systematically tracked or prioritised, even in states with strong industrial growth in green sectors.

Beyond policy design, institutional and industry readiness emerges as a shared constraint. Across states, training institutions and employers report challenges related to gender-sensitive infrastructure, workplace norms, and recruitment practices. Limited availability of female trainers, concerns around safety and mobility, and persistent perceptions of technical work as "male" occupations continue to shape women's participation. Where inclusion has occurred, it is typically driven by isolated pilots or community-led initiatives rather than systemic industry engagement.

Key findings

- Gender inclusion is weakly articulated in India's solar and EV policies, with few explicit targets, budgets, or accountability mechanisms at national or state levels.
- Women's participation in green skills pipelines remains limited: women account for only 13.3% of long-term TVET enrolments, with particularly low representation in technical and STEM-related trades linked to solar and EV sectors.
- In industrializing states such as Maharashtra and Karnataka, rapid growth in solar and EV industries has not translated into inclusive employment outcomes, resulting in persistently male-dominated workforces.
- Institutional and socio-cultural barriers continue to constrain women's enrolment, retention, and transition into green jobs.
- Where progress exists, it is largely driven by isolated industry initiatives or community-led models, such as Mahindra's Pink Collars programme and Kerala's Kudumbashree, rather than systemic policy integration.

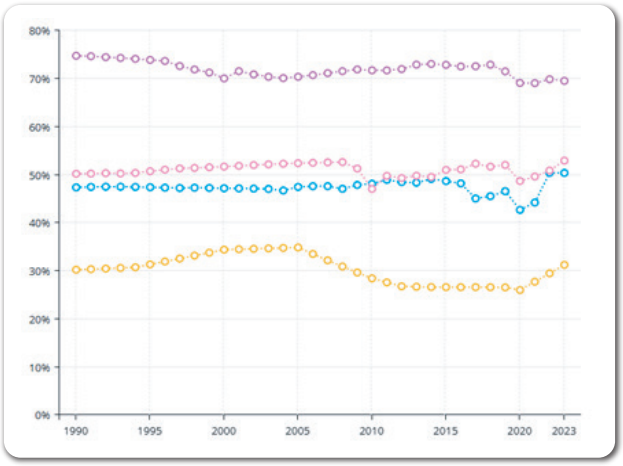
GENDER INCLUSION IN SOLAR & EV: OTHER COUNTRIES

International Benchmarking

To place India's experience in perspective, this report draws on international evidence from the **Philippines, Vietnam, and South Africa.** These three countries were selected because they combine dynamic growth in renewable energy and e-mobility with proactive, efforts to advance women's participation in technical and green jobs.

Labour market and TVET participation indicate significant differences to the Indian context. In 2023, female labour force participation was at 69.5% in Vietnam, 52.9% in South Africa, and 50.4% in the Philippines. In India, 79.6% of women were in vulnerable employment – i.e. own-account workers or contributing family workers, compared to 10.6% in South Africa (ILO, 2023). Women are well represented in vocational training across all three benchmarking countries, but challenges in gender equality also persist: STEM-related programmes in general are still largely male-dominated.

The international benchmarks are not presented as models to be replicated wholesale, but as illustrative policy pathways for embedding gender inclusion in green sectors. The three countries demonstrate different combinations of legal mandates, public programmes, regulatory tools, and industry engagement that have expanded women's participation in technical and green jobs. Examining these experiences helps identify policy instruments and institutional approaches that could inform India's efforts to strengthen women's inclusion in solar and e-mobility value chains.



Female labour participation rates in Vietnam, India Philippines, & South Africa 1990-2023. Source: ILO (2023)

Philippines

The Philippines has established one of the most comprehensive and enforceable policy frameworks for gender equality in Asia, providing a strong enabling environment for women's participation in emerging green sectors. The Magna Carta of Women (2009) creates a binding obligation for all public institutions to mainstream gender into policies, programmes, and budgets, operationalized through mandatory Gender and Development (GAD) planning and budgeting and overseen by the Philippine Commission on Women. This legal mandate ensures that gender inclusion is not discretionary, but a core requirement across sectors, including in skills development. Within the energy sector, the Philippine Energy Plan explicitly recognizes women as key stakeholders in sustainable energy development, linking gender inclusion to energy access, workforce development, and local economic participation. In parallel, the Electric Vehicle Industry Development Act (EVIDA, 2022) establishes the regulatory framework for EV manufacturing, charging infrastructure, and workforce development. While EVIDA does not set explicit gender quotas, it creates new demand for technical skills in automotive electrification, battery systems, and charging services - areas where existing gender mandates can be applied through implementing agencies.

Generally, more female graduates with qualifications in male-dominated fields found a job compared to women with qualifications with high female shares.
TESDA Evaluation Report, 2019

In skills development, the Technical Education and Skills Development Authority (TESDA) plays a central role in translating national gender policy into operational measures. Women account for a substantial share of overall TVET enrolments in the Philippines, though participation declines in STEM and non-traditional trades. To address this gap, TESDA institutionalised gender mainstreaming through its GAD framework, which includes designated gender focal points across training institutions, mandatory gender sensitivity training, integration of gender considerations into curricula, and systematic monitoring of outcomes. Public funding for training programmes is required to comply with GAD guidelines, ensuring that gender inclusion is embedded in programme design rather than treated as an add-on. Importantly, TESDA's monitoring and evaluation systems routinely generate gender-disaggregated data on enrolment, completion, and employment outcomes, enabling evidence-based adjustments to trainings.

Philippines: Gender-Responsive TVET systems

TESDA has become a regional leader in gender-responsive TVET. Building on the Philippines' Magna Carta of Women, TESDA applies gender budgeting, audits, and indicators to all its programmes. One of the most impactful interventions has been the introduction of scholarships targeted at women in non-traditional trades. These scholarships not only reserve slots for female trainees but also provide stipends to cover indirect costs such as transport or childcare, which often discourage women from enrolling in technical courses.

Alongside these incentives, TESDA established the TESDA Women's Center (TWC) as a dedicated institution for training women in technical fields. TWC offers courses ranging from traditional trades like food processing to male-dominated sectors such as automotive repair, construction, and renewable energy technologies. The Center integrates support services, including counselling, mentoring, and in some cases childcare, creating a safer and more enabling environment for women learners.

Vietnam

Vietnam combines a strong gender equality framework with rapid growth in renewable energy and electric mobility, creating favourable conditions for women's participation in green sectors. The country has one of the highest female labour force participation rates globally and ranks among Asian countries with the highest representation of women in senior management positions. These outcomes are underpinned by a robust legal and policy architecture.

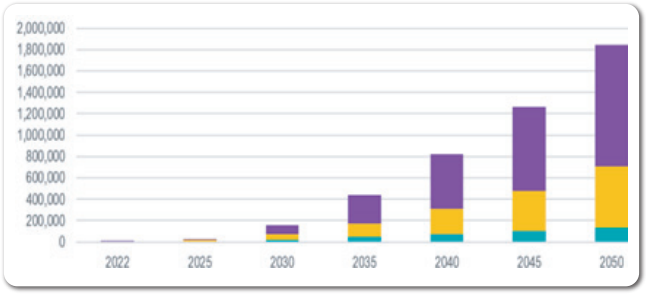
The Law on Gender Equality (2006) establishes equal rights for women and men across education, employment, and economic participation, while the National Strategy on Gender Equality (2021–2030) sets time-bound targets to increase women's participation in wage employment and leadership. These include raising the share of women in paid employment to 60% and increasing the proportion of female business owners and managers to 30% by 2030. In the labour market, the Employment Law (2013) reinforces these commitments by prohibiting gender-based discrimination and mandating equal pay for work of equal value. Complementing these regulatory measures, the government has introduced incentives for enterprises employing women in technical and non-traditional occupations, including preferential access to finance, tax incentives, and targeted support for women-led businesses. These measures aim to shift employer behaviour in sectors traditionally dominated by men, including manufacturing, energy, and transport.

VinFast, Vietnam's leading EV manufacturer, is a female-led enterprise with more than 50% women in management positions.
VinFast, 2022

Gender considerations are further institutionalised through Gender Responsive Budgeting (GRB), mandated under the Law on State Budget (2015). GRB requires gender objectives to be integrated into national and local budget planning, including in infrastructure-intensive sectors such as energy and transport. This provides an important fiscal mechanism to translate gender equality commitments into funded programmes and projects, rather than stand-alone initiatives.

Vietnam's green growth strategy reinforces these institutional foundations. Power Development Plan VIII places renewable energy - particularly solar and wind - at the centre of the country's energy transition,

while the National Electric Vehicle Development Strategy supports the expansion of domestic EV manufacturing and associated supply chains. According to the International Labour Organization (2024), Vietnam's rapidly expanding green economy is expected to generate substantial employment opportunities, with an estimated 1.8 million additional jobs across the EV value chain by 2050.



Estimated jobs created in Vietnam's e-mobility transition © International Bank for Reconstruction and Development

Vietnam: Women in Energy Vietnam (WEVN)

WEVN is the country's first forum connecting female representatives of different businesses, organizations, academic institutions, media, and experts to enhance their position and role in the energy sector. It builds the knowledge and skills of its members, promotes visibility and exchange at national and international levels, and advocates for women's participation in decision-making. Supported by GIZ, WEVN has recently launched Women-led Balcony Solar Businesses Incubation Programme. - training and mentoring women entrepreneurs to start micro-enterprises installing balcony solar systems, combining technical learning with business development skills. By providing solar kits, mentorship, and exposure to investor networks, the initiative helps women overcome entry barriers and demonstrates the viability of small-scale solar as a livelihood model.

Women in Energy Vietnam Members © WEVN

South Africa

South Africa has embarked on one of the most ambitious energy transitions on the continent. The Integrated Resource Plan (IRP 2019) sets long-term targets for expanding renewable energy capacity, with solar and wind expected to play central roles in diversifying the country's coal-dominated energy mix. This strategy has been reinforced by the Just Energy Transition Partnership (JET-P), launched in 2021, which mobilises financing to accelerate coal phase-down while promoting social and gender equity in the transition. Parallel reforms in mobility are anchored in the South African Automotive Masterplan 2035, which positions the country as a hub for electric vehicle production. Gender equality is a cross-cutting policy priority, reflected in the Employment Equity Act (1998) and the Broad-Based Black Economic Empowerment (B-BBEE) Act (2003), which set obligations for women's participation in employment, management, and enterprise development. Women account for nearly 47% of the national labour force, yet they remain concentrated in lower-paid work and are less represented in technical jobs and the energy sector. To tackle this issue, the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) gender aspects directly into tender contracts. Bidders are evaluated not only on price and technical quality but also on their commitments to local development, job creation, and social inclusion. Developers

report on the percentage of project ownership, management, and employment held by women over the life of the project. Targets typically include a minimum share of women in construction and operations jobs, a percentage of enterprise funds allocated to women-owned businesses, and women's participation in project shareholding.

Women in Engineering (WomEng)

WomEng is an organisation set out to tackle the underrepresentation of women in engineering and technical professions. At the school level, it runs outreach programmes to inspire girls to consider careers in engineering. At the university level, WomEng provides mentoring, leadership camps, and technical innovation challenges to help women persist in engineering studies. For young professionals, the organisation offers career guidance, networking opportunities, and direct linkages with employers. A distinctive feature of WomEng is its Southern Africa Fellowship, a multi-month professional development programme designed for early- to mid-career women engineers. The Fellowship combines technical exposure, leadership training, mentoring, and industry engagement, with a growing focus on renewable energy and sustainability-related fields. Fellows are supported to build expertise relevant to energy transition sectors, including clean energy systems, infrastructure development, and climate-resilient technologies. WomEng's impact is reinforced through its strong partnership model with industry and government. WomEng ensures that participants are connected to internships, scholarships, and employment opportunities, while employers gain access to a pipeline of skilled female talent. This alignment creates incentives for firms to adopt more inclusive recruitment, retention, and progression practices in technical roles. WomEng's ecosystem is reinforced by WomHub, a dedicated innovation hub and incubator that supports women entrepreneurs in engineering and technology. WomHub provides co-working spaces, business incubation, and access to investor networks, enabling women not only to enter technical professions but also to establish and grow their own enterprises.

Key Findings

- **Legal mandates create momentum:** The Philippines' Magna Carta of Women and Vietnam's Law on Gender Equality embed gender into sectoral policies, a gap in India's green transition.
- **Gender-responsive TVET works:** TESDA's scholarships, gender framework and data systems show how targeted incentives and accountability bring more women into technical training.
- **Networks strengthen pathways:** Platforms such as WEVN and WomEng support women STEM, provide role models, and influence policy.
- **Policy levers shape industry behaviour:** South Africa's REIPPPP shows regulation can compel inclusion, while Vietnam's EV sector illustrates how green growth can expand roles for women.

CONCLUSIONS

This report finds that India's green transition in the solar energy and electric mobility sectors is advancing rapidly, but without systematically including women in its emerging skills and employment

opportunities. Gender remains weakly integrated into policy frameworks, women's participation in technical training and green jobs is limited, and institutional systems are not yet equipped to support their sustained entry and progression in these sectors. As a result, women remain concentrated in low-skilled, informal, and traditional roles, while technical, higher-value green jobs continue to be dominated by men.

At the same time, national and international evidence shows that more inclusive outcomes are achievable when gender is embedded deliberately into policy design, skilling systems, industry practices, and regulatory frameworks. Inclusion does not occur automatically through sectoral growth - it requires intentional, coordinated action. This creates an urgent call to move from gender-neutral green growth to gender-responsive green transformation. The following recommendations are designed for immediate implementation through policy instruments, pilot programmes, and institutional reforms.

RECOMMENDATIONS

Rights – Embedding Gender in Policy and Regulation

Action	Recommendation	Good Practice Example
Set Gender Targets in Policies	Introduce explicit gender objectives in the **National Electric Mobility Mission, FAME-II** scheme, and state renewable energy policies. Targets should include women's enrolment in green TVET programmes, share of jobs in solar/EV sectors, and percentage of women-owned enterprises in supply chains. Monitor annually through MSDE and MNRE.	Magna Carta of Women (Philippines) mandates gender integration in all sectoral policies and budgets
Procurement with Gender Conditions	Embed **gender inclusion clauses in public tenders** for solar parks, EV charging infrastructure, and fleet electrification. Bidders must commit to women's employment, management, and supply-chain participation. Include compliance audits and reporting. Complement with gender-responsive- budgeting measures, mandating earmarked finds for women's training.	REIPPPP (South Africa) embeds gender and social inclusion directly into renewable energy tenders
Gender Inclusivity Toolkits for Industry and Training	Develop and disseminate training / **workplace gender inclusivity** toolkits for training institutions, renewable energy and EV firms. Conduct HR manager trainings through state institutes, pilot the toolkits in selected companies, and submit to Directorate General of Training (DGT) for institutional adoption.	Department of Energy Gender Toolkit (Philippines) guides institutionalization of gender equality through workplace audits, GAD plans and budgets.

Representation – Expanding Women's Participation in Training and Jobs

Action	Recommendation	Good Practice Example
Gender Responsive Curriculum & SOPs	Roll out Standard Operating and Procedures **(SOPs) for mainstreaming gender** in curriculum design. Integrate modules on gender equality, safety, and workplace inclusion into all green trades and technical courses.	TESDA (Philippines) applied gender audits and integrated equality content into its TVET curricula.
Career Counselling in Schools and ITIs	Introduce **career counselling modules** focused on green and non-traditional jobs in schools and ITIs. Implement through NCVET and state departments with industry sessions to expose students early to solar and EV careers.	WomEng (South Africa) inspires girls through mentorship, innovation camps, and leadership programmes
On-the-Job Training (OJT)	Expand access to solar and EV jobs through **short-duration OJT training programmes** in partnership with industry, also targeting women from rural and peri-urban areas. Training should be delivered via mobile skill units, community centres, or local ITIs, with stipends, safety provisions, and clear pathways to employment or enterprise.	Mahindra Pink Collars (India) demonstrates employer-led OTJ training; Kudumbashree (Kerala, India) rural community-based mobilization

Resources – Building an Enabling Environment for Women

Action	Recommendation	Good Practice Example
Upgrade TVET Infrastructure	Require all ITIs and skill centres offering solar/EV courses to provide safe transport, childcare facilities, sanitation, and at least one female instructor per technical trade.	Women's ITI, Gariahat (India) upgraded to train women in solar technology
Support Women Entrepreneurs	Create **green enterprise incubators** and dedicated credit lines (e.g., via SIDBI, Mudra, MNRE) for women-led MSMEs in solar and EV value chains. Provide mentorship, equipment grants, and investor linkages.	Kudumbashree (Kerala) for women-led enterprises; Balcony Solar Incubation for women (Vietnam)
Highlight Success Stories	Establish a **national communications campaign** featuring women role models in green jobs. Use digital media, community radio, and local champions to build awareness and social acceptance.	WEVN (Vietnam) showcase female ntrepreneurs as ambassadors.

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