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Transforming Energy Access

UNLOCKING AFRICA'S GREEN TRANSITION

Opportunities Towards a Green and Inclusive Workforce

June 2026

Shell Foundation | Shortlist

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ABBREVIATIONS

AfCFTA	African Continental Free Trade Area
AfDB	African Development Bank
BESS	Battery energy storage system
BMS	Battery management system
CETA	Construction Education and Training Authority
CSO	Civil society organisation
DFI	Development finance institution
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EPR	Extended producer responsibility
GBV	Gender-based violence
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HSE	Health, safety and environment
ICE	Internal combustion engine
IFC	International Finance Corporation
IRP	Integrated Resource Plan
JET-IP	Just Energy Transition Investment Plan
JPU	Jobs-per-unit
KNQA	Kenya National Qualification Authority
KEREA	Kenya Renewable Energy Association
KIHBS	Kenya Integrated Household Budget Survey
KIIs	Key informant interviews
KNQA	Kenya National Qualifications Authority
MRV	Measuring, reporting and verification
MSMEs	Micro, small and medium enterprises
NBS	Nature-based solutions
NDCs	Nationally Determined Contributions
NGO	Non-governmental organisation
NITA	National Industrial Training Authority
PAYGO	Pay as you go
PUE	Productive use of energy
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RPL	Recognition of prior learning
SETA	Sector Education and Training Authority
SHS	Solar home systems
T&D	Transmission and distribution
TVET	Technical and vocational education and training
TVETA	Technical and Vocational Education Training Authority
VC	Value chain
VSLA	Village savings and loan association

EXECUTIVE SUMMARY

The state of Africa's green transition

Africa is at a structural inflection point

Africa's economies are growing. Sub-Saharan Africa expanded at:

3.7% by 2024

with growth projected to consolidate at:

4% by 2025[1]

Yet this growth is not translating into employment at the pace the continent's demographics demand

Each year, more than:

10M **young Africans** enter the labour market...

...but only around:

3M **formal jobs** are created annually.[2]

15M new jobs must be created each year in Sub-Saharan Africa alone just to absorb new labour market entrants.[3]

The labour market challenge is compounded by structural inequalities

Women

Women in Africa, where they do work, are concentrated in lower-value, informal and care-adjacent roles, with limited pathways into technical employment, enterprise ownership or managerial positions.

Youth

Young people are concentrated in entry-level informal work: around 90% of young employed Africans work in informal jobs[4] with no social protection, no recognised credential and no progression pathway.

Low-income workers

Low-income workers, particularly those outside urban centres, face barriers of geography, digital exclusion and capital access that place large segments of the workforce outside the productive economy's reach.

1 International Monetary Fund, 2024.
2 Ibid.
3 Ibid.
4 Ibid.

Against this backdrop, Africa bears a disproportionate burden of climate change impact. The continent faces the most acute climate exposure of any region — rising temperatures, drought, reduced river flows, and flooding — at the same moment its fiscal space is most constrained.[5] This is despite contributing only 3–4% of global carbon emissions.[6] Mounting debt levels, with a median debt-to-GDP ratio of 65.5% across African countries, leave governments with limited room to absorb climate shocks or redirect public expenditure towards long-term resilience.[7]

Climate finance is flowing, but not at the required scale or in the right forms. Africa received only 3.3% of global climate finance flows in 2021–22, and current flows meet only 23% of the estimated annual investment needed to implement nationally determined contributions (NDCs) and meet 2030 climate goals.[8] Most of what does flow arrives as debt instruments rather than grants, adding to the fiscal burden of countries that are already stretched.[9] Climate finance must at minimum quadruple annually until 2030 to close this gap. In addition, almost none of it is directed towards workforce development, skills systems or social protection infrastructure.

The policy architecture for Africa's green transition is nevertheless advancing. NDCs have been submitted across the continent, national energy transition plans are operational, and Mission 300[10] has mobilised $50 billion to connect 300 million people to electricity by 2030. The transition is underway, but the issue to make sure it addresses, rather than entrenches, the structural inequalities described above.

This report, commissioned by FSD Africa, Shell Foundation and Shortlist, and produced by Genesis Analytics, extends the evidence base of the Forecasting Green Jobs in Africa study, published in 2024.
It does this in four ways:

- Modelling indirect employment alongside direct job counts
- Introducing clean cooking as a value chain
- Projecting employment to 2050 under technology and climate risk scenarios;
- Disaggregating employment by formality, gender, enterprise size and income level

ACROSS
Kenya, Nigeria and South Africa

These extensions shift the analysis from estimating the scale of the opportunity understanding who can access it, and how.

5 United Nations University – Institute for Natural Resources in Africa, 2024.
6 Our World in Data, 2020.
7 Clean Air Task Force, 2025.
8 Climate Policy Initiative, 2024.
9 Ibid.
10 World Bank Group, 2025.

What this study argues

Africa's green transition is projected to generate between 3.8 and 7.9 million jobs[11] by 2030, rising to between 65.9 and 84.5 million by 2050. The distance between the upper and lower bounds is a measure of what deliberate policy action could achieve. Realising this hinges on four defining features of Africa's transition:

1 THE TRANSITION IS A SERVICE-LED AND DECENTRALISED STORY, AND THIS DETERMINES WHO CAN PARTICIPATE

The narrative around green jobs tends to centre on roles in construction and manufacturing – but indirect jobs generated through installation, distribution, operations and last-mile service ecosystems are projected to account for 56% of all green employment by 2030, rising to 62% by 2050. Clean cooking is projected to be the largest green value chain on the continent by 2030 — ahead of utility-scale solar — generating between 1.4 and 2.5 million jobs through micro-distributors, maintenance technicians and community agents. Waste recycling, solar home systems (SHS), and electric two- and three-wheelers follow a similar pattern: high employment intensity, low entry barriers and delivery architectures that reach workers in informal, peri-urban and rural contexts.

This finding has implications for investment and policy design. An investor or government that prioritises utility-scale solar over clean cooking and SHS will generate not only fewer jobs by 2030, but a different employment trajectory through to 2050. The employment dividend of Africa's green transition will be realised through service chains, not construction sites. Workforce strategies built around manufacturing-heavy assumptions imported from other regions will miss the workers who stand to benefit most.

2 WORKFORCE CAPABILITY IS JUST AS CONSTRAINING AS CAPITAL AVAILABILITY, BUT IT RECEIVES LESS ATTENTION

In all three focus countries, there are opportunities to align training with the value chains that will scale fastest. While entry-level installation skills are broadly available, there are gaps for the roles that deployment increasingly requires: IoT-enabled remote operations, battery management system governance, carbon measurement, reporting and verification, and digital customer management. There are no national training programmes for any of these areas in the three countries studied. Africa's renewable energy workforce is approximately 324,000 — 2% of the global total — despite the continent holding 60% of the world's best solar resources.[12] This disparity points to a constraint that capital alone cannot resolve.

Where trained workers are absent, deployment stalls, projects import expertise, and the local employment and capability-building opportunity is lost. Only 6.5% of African youth have completed a TVET (technical and vocational education and training) programme,[13] and the training programmes that do exist are largely calibrated to legacy technologies.

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[11] Total green jobs including direct and indirect, only covering the 13 value chains within scope of this study. Direct jobs are those in the core activity of the value chain. Indirect green jobs refer to employment in the immediate backward (downstream) and forward (upstream) linkages that support the same value chains. Indirect employment in this study does not include indirect jobs outside the value chains, nor does it include induced, economy-wide employment effects.

[12] International Renewable Energy Agency, 2024.

[13] This report.

3 INCLUSIVITY WILL BE DETERMINED BY SYSTEMIC REFORMS, NOT BY PARTICIPATION TARGETS ALONE

86% of projected 2030 green jobs will be informal, and the value chains generating the largest employment volumes — clean cooking, waste recycling, solar home systems and e-mobility — are also the most accessible to women, youth and low-income workers. This is not coincidental: the same distributed, service-intensive delivery architectures that drive employment volume are the ones with the lowest entry barriers. Women are projected to account for 31% of 2030 lower-bound green jobs, rising to 44% under the 2050 high employment scenario, with clean cooking and SHS approaching gender parity by 2050.

But these projections will not happen automatically, and participation does not equal meaningful inclusion. Across all three countries, women remain concentrated in lower-value, informal roles, while men dominate technical, field-based, and formally contracted positions where earnings are higher and career progression is stronger. The delivery models that make green value chains accessible to women also tend to channel them into the segments with the weakest job quality. Policies designed for formal wage workers, meanwhile, are expected to reach at most 14% of 2030 green workers — meaning that most of the green workforce will remain outside the reach of standard labour protections unless deliberate corrective measures are taken.

4 AFRICA DOES NOT HAVE A SINGLE GREEN TRANSITION AND STRATEGY MUST BE TAILORED ACCORDINGLY

The three focus countries were selected because their differences illuminate the range of transition architectures across the continent. The findings confirm that a single continental template would be inadequate.

Nigeria

Nigeria's projected 2030 green workforce is 87% informal and dominated by nano-enterprises, with growth occurring through millions of independent operators rather than corporate payrolls. The policy priority is improving job quality and extending social protection within informal systems, not mandating formalisation.

South Africa

South Africa's transition is 70% formal, shaped by regulated procurement frameworks and the most capitalised just transition plan on the continent. It has different challenges: strengthening the skills pipeline, addressing the occupational segregation that is keeping women's participation stagnant at around 25%, and ensuring that the shift from construction-phase to operations and maintenance roles translates into improved incomes.

Kenya[14]

Kenya occupies a middle ground — a renewable electricity system already operational, an emerging e-mobility sector anchored by the continent's most mature mobile money infrastructure, and a devolved governance structure that requires green skills to be integrated at county level if employment benefits are to reach workers where deployment is occurring.

[14] Kenya inclusion metrics were not available throughout this study hence the country analysis is limited. The Kenya Integrated Household Budget Survey (KIHBS) microdata was inaccessible.

These distinctions matter beyond the three countries. East and Southern Africa's deeper enabling conditions — policy, digital infrastructure and investment pipelines — explain its projected 58% share of 2050 high-scenario green employment, despite housing only 40% of sub-Saharan Africa's population. West and Central Africa's opportunity is different: large unmet demand in clean cooking and waste, delivered through informal channels, with enabling conditions still forming.

A continental approach that embraces these differences, through differentiated financing instruments, context-specific training pathways and inclusion strategies calibrated to each country, is most likely to unlock Africa's green employment potential.

Recommendations for action

Capital deployment alone will not be enough. This study indicates a set of structural conditions that will determine whether the employment opportunity is realised broadly or captured narrowly. Ten priority actions are recommended – these are organised by urgency and feasibility, and are outlined in more detail in Section 7:

1. **Direct public and development finance** towards service-led value chains.
2. **Embed workforce development and inclusion criteria** into green infrastructure financing.
3. **Link green finance** to employment quality and inclusion.
4. **Close the labour market data gap.**
5. **Invest in market-making infrastructure** for underserved segments.
6. **Formalise on-the-job training and apprenticeships** to recognise informal workers' skills and experience.
7. **Reform TVET delivery** through modular, short-cycle programmes that integrate digital and green competencies.
8. **Extend social protection and minimum earnings floors** to informal and nano-enterprise workers through mobile-based platforms.
9. **Establish dedicated national green jobs policy frameworks** and embed employment outcomes into sector-specific strategies.
10. **Remove regulatory bottlenecks.**

SECTION 1

INTRODUCTION

FSD Africa, Shell Foundation and Shortlist commissioned Genesis Analytics to extend the evidence base of the Forecasting Green Jobs in Africa[15] study published in 2024.

The 2024 study was the first pan-African demand-side forecast of direct green employment across 12 priority value chains, projecting 1.5 to 3.3 million new direct jobs by 2030. The current report expands its scope in four ways:

Indirect employment is modelled alongside direct job counts, capturing supply chain and livelihood effects.

Clean cooking is introduced as a disaggregated value chain.

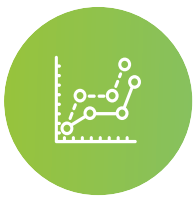
Long-term projections to 2050 are introduced under technology and climate risk uncertainties.

Employment is disaggregated by formality, gender, enterprise size and income level, across Kenya, Nigeria and South Africa and at continental scale.

A central theme of this report is ensuring that the opportunities created by Africa's green transition reach all Africans — in particular women, informal workers and those in low-income employment. It moves the analysis from estimating the scale of the opportunity to understanding who can access it and what needs to change for more of them to do so.

Scope, focus countries and the questions this study answers

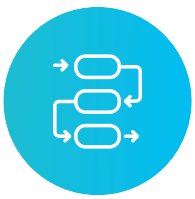
This study is structured around four thematic areas:



Forecasting green employment volumes and role profiles.

Assessing workforce supply and skills gaps.

Identifying opportunities and barriers for women, informal and low-income workers.



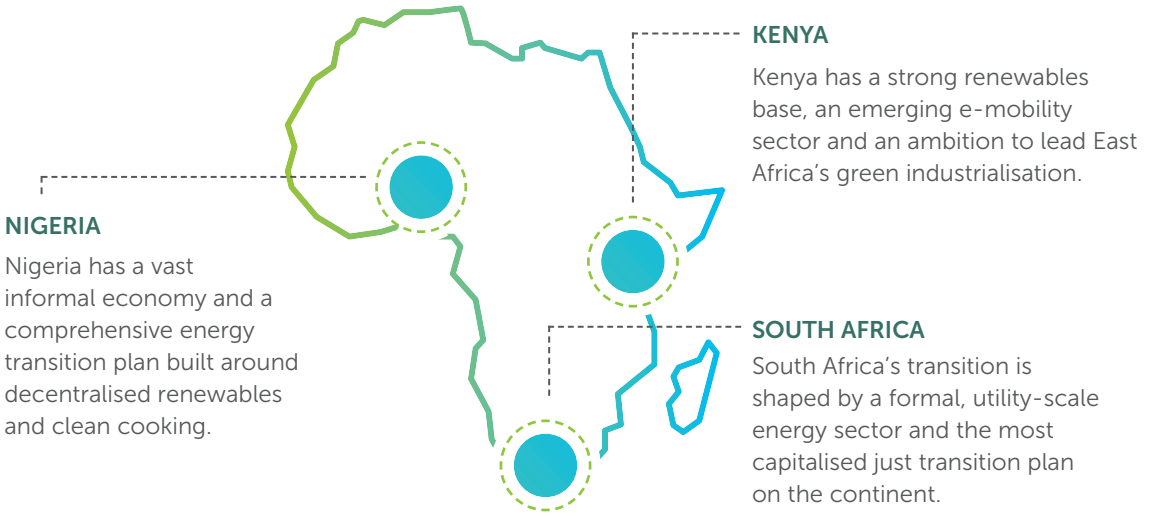
Translating findings into actionable strategies for policymakers, investors and training institutions.

[15] FSD Africa and Shortlist, 2024.

Key questions include how many workers will be needed across priority value chains by 2030 and 2050, where the most acute mismatches between training systems and industry demand lie, and what financing and policy interventions are needed to ensure Africa has a skilled workforce for the green economy. The full research framework is set out in Annex 2.

Kenya, Nigeria and South Africa were selected as the three focus countries for this study. They are three of Africa's largest and most economically significant economies, and serve as regional anchors for East, West and Central, and Southern Africa. Collectively, they account for 27.6% of the continent's economic output and green transition investment.[16, 17, 18, 19] They also represent different green transition pathways, which makes them representative of contexts across the continent:

Green transition pathways in the focus countries



All three countries were covered in the previous studies on which this work builds.

Thirteen value chains were chosen, across energy and power, mobility and transport, agriculture and nature, and waste remediation[20] and recycling. These reflect the green transition priorities in each country's national planning documents, and capture the full employment architecture of a diversified transition. Annex 2 outlines the rationale behind each.

The analytical time horizon runs to both 2030 and 2050. The near-term horizon is anchored to the 2030 NDC (Nationally Determined Contribution) window: the period for achieving climate targets set under the Paris Agreement. The longer horizon captures the shifts in technology, climate risk and employment composition that will determine the scale and inclusivity of Africa's green workforce.

16 World Economic Outlook, 2024.
17 UNCTAD, 2024.
18 Worldometer, 2025.
19 The combined nominal GDP of South Africa ($479.96 billion) Nigeria ($377.37 billion) and Kenya ($147.26 billion) totals $1.004 trillion, representing 27.6% of Africa's $3.64 trillion total economic output for 2026.
20 Renamed from earlier report version (Manufacturing & Materials).

How this study will help

The findings of this study are intended to move the conversation on Africa's green workforce from diagnosis to action. It is grounded in a conviction that green jobs are not just an outcome of Africa's green transition, but one of the conditions that make it possible.

This study provides:

For governments and policymakers: job demand forecasts and occupational profiles that can serve as the demand-side foundation for TVET (technical and vocational education and training) reform, national green skills registries and NDC implementation planning.

For DFIs and investors: the first Africa-specific employment data broken down by formality, gender, enterprise size, and income level at the value-chain scale. This enables the creation of local content and inclusion targets based on the actual structure of African labour markets, rather than relying on inaccurate proxies from other regions.

For training providers and TVET institutions: identification of the mismatches between curriculum and industry demand, and where short-course, modular pathways are likely to be more effective than traditional diploma programmes.

For private sector actors including businesses, employers and industry associations: the first Africa-specific, value-chain-level baseline for understanding the employment and enterprise structure of green markets, which can inform hiring strategies, ESG reporting and general workforce decisions.

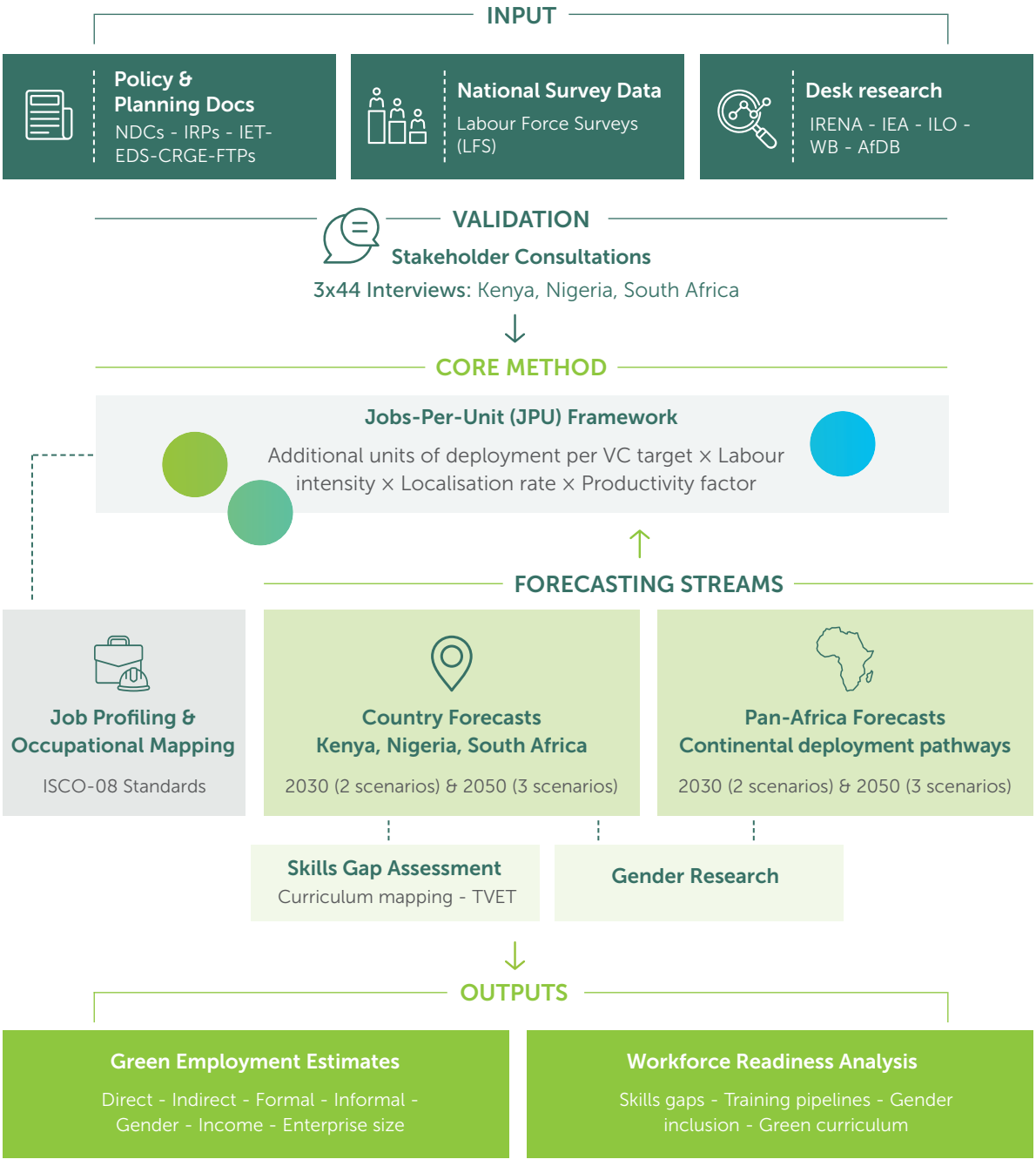
The study also examines the structural determinants of women's access to green employment, suggesting that deliberate design choices are required to shift women's share of the green workforce.

SECTION 2

METHODOLOGY

This study uses mixed methods of data collection and analysis. Secondary research and stakeholder consultations inform economy-wide analyses with granular, value chain-specific insights, for target countries and at a continental level. The full description of the research methodology can be found in Annex 1.

Figure 1 Overview of methodology



Definition of green jobs

A green job, for the purposes of this study, is any job generated within green growth sectors (and value chains thereof) that contributes to the production, deployment, operation, maintenance, financing or enabling of environmentally sustainable goods or services. Green jobs in this study are not defined solely by environmental contribution, but also by their potential to constitute decent work. This includes employment that provides fair income opportunities and a pathway to stability or enterprise growth. Given the structure of African labour markets, this encompasses both formal employment (registered firms with contracts and protections) and informal work or self-employment, including nano- and micro-enterprise[21] activity.

The research applies a three-stage value chain lens:

Upstream

Input supply, raw materials, component manufacturing, equipment production and preparatory services.

Midstream

Core production, installation, processing, construction or direct service delivery activities.

Downstream

Distribution, last-mile deployment, maintenance, repair, aggregation and end-user services.

Employment is distinguished by economic positioning: direct green jobs are those in the core activity of the value chain, whereas indirect green jobs refer to employment in the immediate backward (downstream) and forward (upstream) linkages that support the same value chains. Indirect employment in this study does not include indirect jobs outside the value chains or economy-wide employment effects resulting from input–output linkages or macroeconomic spillovers.

Sectoral scope

The study covers 13 value chains across four green growth sectors:

Energy and power

Wind, solar, geothermal, hydroelectric power, battery storage, power transmission and distribution (T&D), and clean cooking.

Mobility and transport

Electric two- and three-wheelers, and charging infrastructure.

Agriculture and nature

Climate smart agri-tech, aquaculture and poultry, and ecosystem conservation and nature-based solutions (NBS).

Waste remediation and recycling

Waste remediation, recycling, upcycling and waste sorting.

[21] Nano-enterprises are considered as one-worker operations, while micro-enterprises hold 2–4 workers.

Stakeholder interviews

Forty-four key informant interviews (KIIs) with stakeholder groups were conducted in each target country, to complement the desk research and primary data analysis. These groups included employers, private industry associations, policymakers and government ministries, NGOs and CSOs (civil society organisations), TVET and education providers, development partners, financial institutions, and green jobs experts.

Forecasting the number of green jobs to 2030

Green job volumes for 2030 are forecast using a demand-driven jobs-per-unit (JPU) methodology that links employment to physical deployment targets such as installed renewable energy capacity, solar home systems (SHS) deployed, kilometres of transmission infrastructure, numbers ofelectric two- and three-wheelers and charging points, hectares under climate-smart agriculture and tonnes of waste processed. For each value chain, 2023 baseline activity levels are established from national data, and 2030 targets are drawn from official planning documents including NDCs, Integrated Resource Plans, and Long-Term Low Emissions Development Strategies, with feasibility validated through in-country stakeholder consultations. The full list of data and documents used is provided in Annex 4. All results are presented under two scenarios: a conservative scenario reflecting trend-based growth and partial policy realisation, and a favourable scenario aligned with full achievement of stated national targets.

Forecasting the trend of green jobs to 2050

The 2050 approach assumes full realisation of long-term targets drawn from national planning documents and introduces scenario variation through two adjustment factors: a technology factor capturing labour productivity shifts from automation, digitalisation and process optimisation,[22] and a physical climate risk factor capturing employment losses from infrastructure damage, extreme weather events, heat stress, water scarcity and ecosystem degradation.

Results are presented under three scenarios: favourable, moderate and conservative. These represent structured combinations of lower to higher technology-driven job displacement and climate-related disruption, under otherwise comparable deployment pathways.

Pan-African forecasting

The Pan-African forecasting exercise applies the same JPU framework to convert continental-scale physical transition pathways into value-chain-specific labour requirements, while capturing regional and demographic differences. It was developed independently of the country forecasts and does not aggregate or extrapolate from them, to avoid double counting.

Job profiling, granular analysis and skills assessment

Green job profiles are identified by first mapping value chain activities against country-specific policy frameworks. Expected job roles are then identified using sector studies, occupational databases and green skills assessments from comparable countries, classified by value chain stage and economic positioning. Required competencies are assessed at task level and mapped against observable training supply in each country. To enable disaggregated analysis, green jobs are identified and classified using national labour force survey data and an occupation-based

[22] This does not measure changes in productivity from shifts in education or skill levels since these are variables of interest of the study and measured separately.

approach aligned to ISCO-08. Country-specific coding systems are harmonised into this common framework and ISCO-08 unit groups are then matched to a predefined value chain mapping that specifies which occupations qualify as green at each stage of the value chain. A tiered validation procedure using industry and activity descriptors is applied to confirm alignment to green economic activity and reduce false positives.

Key considerations and limitations

1	**All employment figures represent gross headcount demand** at a point in time — 2030 or 2050 — rather than cumulative job additions or net employment effects. They also do not capture the greening of existing roles where workers transition into equivalent green activities without changing occupation. The figures are therefore conservative with respect to the full scale of workforce transformation underway.
2	**Job losses in fossil fuel or conventional sectors** are not modelled, and net employment effects, while expected to be positive, are outside the scope of this analysis.
3	**Indirect job figures** are conservative relative to economy-wide indirect effects: the model measures indirect employment within each value chain rather than through input–output multipliers capturing spillover employment across the broader economy. The tiered ISCO-08 validation procedure and primary stakeholder interviews were applied to reduce the risk of misclassification compounding through the model.
4	**Nano- and micro-enterprise livelihoods** are included as a sub-category within indirect employment. This is because their activities sit upstream and/or downstream of the core installation and operations roles that define direct employment, and their structural characteristics place them outside the direct employment categories applied in this model. This classification is consistent with labour force survey architecture, which records own-account workers separately from employees.
5	**On data quality,** national labour force surveys, while the best available source for informal employment estimates, may undercount workers in unregistered enterprises, particularly in agriculture and waste management.
6	**Job quality dimensions are not modelled directly.** The income band disaggregation provides a partial signal, but a dedicated job quality analysis remains an important area for follow-on research.
7	**Value chains are modelled** as maintaining a fixed structure up to 2050.
8	**Productive use of energy (PUE)** is treated as an indirect employment multiplier within each relevant value chain rather than as a separate category, and its full contribution is therefore distributed across sectors. A clean cooking connection that enables food processing or catering is counted in the energy and power sector, while a solar irrigation connection that enables agro-processing is captured in agriculture and nature.

SECTION 3

PAN-AFRICA INSIGHTS

Africa's green economy is projected to reach up to 7.9 million jobs by 2030 and up to 84.5 million jobs by 2050. But this opportunity is different from utility-scale infrastructure model common in high-income markets: Africa's transition will be decentralised and service-led, delivered through informal networks and independent operators.

This chapter sets out what that means for the scale and composition of green jobs to 2050, the value chains and sub-regions where opportunity exists, and the policy, regulatory and financial levers that will determine the outcome.

Key takeaways: Pan-Africa

Africa's green economy will generate millions of jobs. Projections stand at 3.8–7.9 million jobs by 2030, and 65.9–84.5 million by 2050.

Growth will be service-led, not infrastructure-led. Around 56% of green jobs in 2030, rising to 62% by 2050, will be indirect service roles, rather than manufacturing or installation.

Four value chains will provide the most employment. Clean cooking, SHS, waste recycling and electric two- and three-wheelers will account for most green employment to 2050.

The transition offers entry points for women, youth and low-income workers. Distribution, servicing and operations roles offer accessible entry, but rising skills demand will require investment in progression pathways.

Africa has two distinct regional pathways. East and Southern Africa is led by mature renewables and distributed energy markets, and West and Central Africa by clean cooking, waste recovery and mobility.

Policy and finance execution will determine how many jobs are created. The 4.1 million employment gap between 2030 scenarios depends on three factors: clean cooking investment, e-mobility regulatory enforcement and circular economy regulation. The 18.6 million gap for 2050 turns on technology productivity and climate risk.

Figure 2 Pan-Africa headline numbers

Gross Green jobs

2030 UPPER BOUND → 2050 HIGH SCENARIO

7.9M → 84.5M

Direct and indirect jobs modelled across 13 value chains.

55-57%

Of projected 2030 jobs expected to be indirect (distribution, operations, maintenance, services) rising to ~62% by 2050

Projected sub-regional distribution

2050

49M

in East and Southern Africa

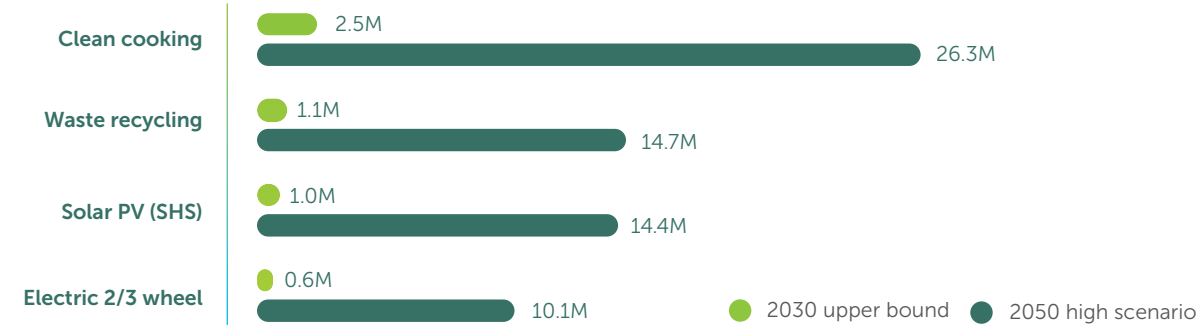
58%

of total green jobs across Africa potentially to be concentrated here

Top value chains by projected employment

Expected 2030 sectoral split:

- **65%** Energy and Power
- **16%** Waste Recycling
- **11%** Agriculture and Nature
- **8%** Mobility & Transport



Inclusion metrics in green employment

Expected informality rate

86% 2030 lower | **51%** 2050 high

By 2050, a positive structural shift expected as EPR, e-mobility and SHS market mature

Accessible to women

31% ~1.2M jobs | **44%** ~36.8M jobs

Clean cooking and solar SHS modelled with highest female participation, expected to near gender parity by 2050.

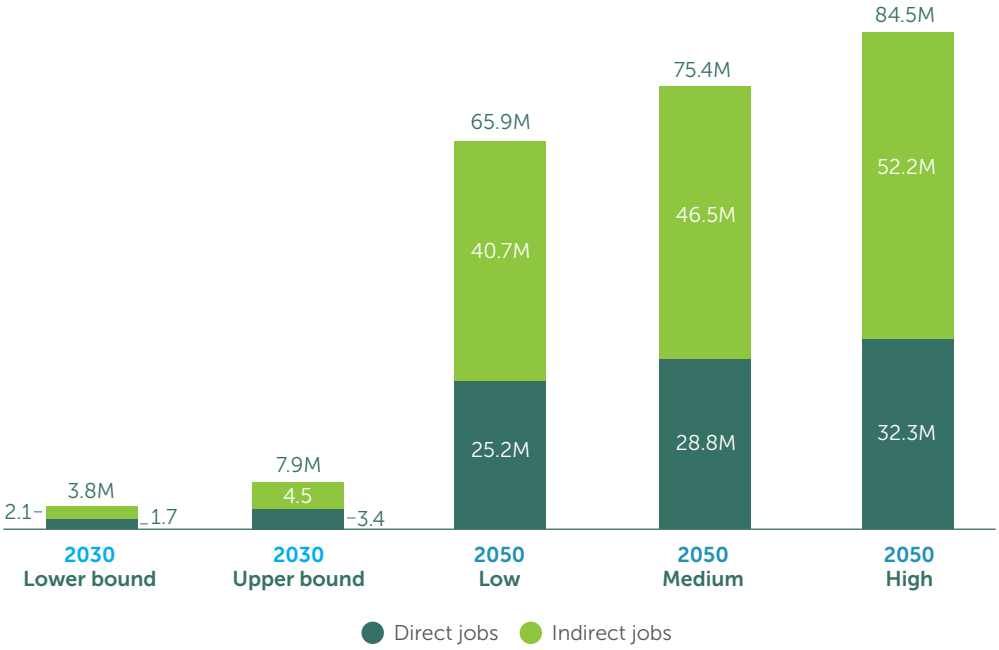
Accessible to low-income workers

57% 2030 upper | **52%** 2050 high

Highest projected 2030: waster recycling (~72%), clean cooking (~68%), solar SHS (~64%)

All figures are approximate

Figure 3 Gross green jobs by scenario: direct and indirect



The 2030 projections: what will drive the outcome

The lower and upper projections for 2030 differ by 4.1 million jobs. The outcome will depend on three main factors, all of which require immediate action if they are to have meaningful influence by 2030.

Investment in clean cooking

Closing the clean cooking financing gap is the most effective lever for 2030, and the largest value chain in this study for all time horizons. The IEA estimates that achieving universal clean cooking access across Africa by 2040 requires $37 billion in cumulative investment, equivalent to around $2 billion per year.[23] Direct investment in Africa's clean cooking sector reached $675 million in 2023 – this was a 10% year-on-year increase, but still less than 35% of the annual requirement.[24] The 2024 IEA Summit on Clean Cooking in Africa mobilised $2.2 billion in commitments, of which $470 million had been disbursed by early 2025.[25]

E-mobility regulations

Thirteen African countries have published national e-mobility strategies, but the gap between formulation and implementation is wide. The upper bound assumes at least 15 countries have operational, enforced frameworks by 2030. Kenya had only 350 registered EVs as of 2023 despite active policy frameworks. Ethiopia's 2024 ICE (internal combustion engine) import ban, the first of its kind globally, and Rwanda's 2025 ban on ICE motorcycles in Kigali represent the front edge of enforcement-led adoption.[26] Nigeria's 10-year tax relief for EV manufacturers and Ghana's import incentives signal intent.

Circular economy regulatory enforcement

The upper bound assumes progressive enforcement of these frameworks, while the lower bound reflects the current implementation gaps. South Africa's Extended Producer Responsibility (EPR) regime, in place since

23 IEA, 2025.
24 Ibid.
25 Ibid.
26 Africa E-Mobility Alliance, 2025.

2020–21, Kenya's Sustainable Waste Management Act (2022) and EPR Regulations (2024), and Nigeria's 2025 single-use plastic ban create the legal demand that converts informal waste activity into structured employment.[27] The African Union's Continental Circular Economy Action Plan, adopted July 2025, is a sign of political momentum.[28]

The 2050 projections: what will drive the outcome

The 18.6 million gap between the 2050 high and low employment scenarios is influenced by two factors: technology productivity and climate risk.

Typically, where technology matures faster, direct employment per unit of output falls. But Africa's distributed service models are expected to retain higher employment intensity than high-income markets because manual installation, last-mile logistics and agent-based customer service cannot be easily automated. Where climate risk is higher, realised employment is lower than the headline target because reduced generation capacity and agricultural stress reduce operational demand for workers.[29]

The value chain least sensitive to either factor is clean cooking, which is why it retains the highest absolute employment figure through to 2050. The value chains most sensitive to the downside scenario are hydropower and solar irrigation, where climate risk is the main variable.

Technology

For clean cooking, technology-based productivity improvements are expected to come mainly from more durable cookstove designs and digital platform improvements that make pay-as-you-go (PAYGO) agent management more efficient. These will reduce the number of service visits per household connection by around 20–25% by 2050. The employment implication is modest, because distribution and last-mile logistics are hard to automate.
For SHS, the main technology shift is from high-touch PAYGO sales models to platform-managed IoT monitoring and remote diagnostics. As mobile money infrastructure deepens, particularly in East Africa, the labour requirement per connection in customer management falls. However, the installation, maintenance and productive-use-enabling roles associated with SHS connections are not automated: a solar panel in a rural compound still needs a technician.

For waste recycling, balers, shredders and optical sorting equipment will increase throughput per worker, but the collection, segregation and transport stages will remain manual across most of the urban waste economy. The main variable is regulatory enforcement: EPR frameworks that create a legal demand floor for formal recycling services are the primary determinant of employment quality and scale.

For e-mobility, improvements will include more sophisticated battery management, swapping station automation and platform-based fleet management. All of these will reduce per-vehicle labour requirements in operations. Assembly, maintenance and repair are highly localised and resistant to automation. The employment intensity of e-mobility at the scale Africa requires is structurally higher than in high-income markets, because the decentralised assembly model, which builds and services vehicles at regional hubs rather than centralised factories, is more labour intensive.

Climate risk

Africa faces the highest climate risk relative to adaptive capacity, with projected increases in drought frequency, reduced river flow in Southern and East Africa, and increased flood intensity across West Africa.[30]

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27 NEMA Kenya, 2024.
28 African Union, 2025.
29 It is acknowledged that this may be offset through an expected increase in employment from resilient agriculture/infrastructure, which was not modelled as part of the research scope for this study.

For clean cooking and waste recycling, climate risk is low. Clean cooking is not water or weather dependent and distribution networks are resilient to most climate hazards. Waste collection and sorting are also insulated from climate disruption.

For SHS, climate risk is low to moderate. Extreme heat and dust can affect panel performance, and flooding can disrupt distribution, but neither result in the severe employment cuts seen in hydrology-dependent value chains. For e-mobility, climate risk is moderate, because flooding disrupts urban mobility corridors and charging infrastructure.

For hydropower, reduced precipitation lowers generation capacity and means fewer workers are needed to run facilities.

For solar irrigation, the dynamic runs the other way: moderate drought increases demand. Across sub-Saharan Africa, where agriculture is mostly rainfed, climate stress is the primary driver of solar pump adoption. Research has found that drought exposure directly stimulated solar pump demand in northern Ghana, and that erratic rainfall has accelerated adoption in Zimbabwe.[31, 32] But there is a ceiling: in areas where drought depletes groundwater below the depth a pump can reach, adoption stalls. This is why the model assigns hydropower and solar irrigation the highest climate risk factors of any value chain.

Financing facilities that prioritize climate-resilient infrastructure and nature-based solutions alongside renewable energy deployment are likely to deepen employment in the very geographies where climate risk is highest.[33] Watershed rehabilitation workers, flood-barrier construction crews, drought-resilient irrigation engineers and rangeland restoration technicians are among the occupation types that adaptation investment in water-stressed areas of East and Southern Africa and flood-prone zones of West Africa is expected to generate.

Closing the gaps: what must happen to reach the upper bounds in Africa's forecasted green employment

2030
Towards 7.9 million jobs

Enforce policies and targets. Only 45% of African NDCs include clean cooking targets.[34] The 4.1 million gap is largely determined by whether clean cooking, e-mobility and EPR frameworks move from legislation to active market signals.

Direct climate finance to the high-potential value chains. Mitigation capital needs to reach clean cooking distribution, SHS networks and e-mobility assembly rather than utility-scale infrastructure. Adaptation finance is equally critical for water-stressed areas.

Adapt localisation requirements to build supply chain depth. This is especially important for solar, battery and e-mobility, and African Continental Free Trade Area (AfCFTA) green goods provisions and domestic content requirements in procurement will be instruments of change.

30 Intergovernmental Panel on Climate Change, 2022.
31 Insights derived from AICCRA, 2025.
32 IWMI 2024.
33 Insights derived from Systemiq & WRI, 2025.
34 UNDP, 2025.

Ensure infrastructure keeps pace with deployment. Distributed renewable energy and e-mobility employment will scale only where electricity systems can support increased demand and new connections.

Deliver green skills for the high-potential value chains. Clean cooking, SHS, waste recycling and electric two- and three-wheelers will generate most 2030 jobs. But 86% of them will be informal, and only 6.5% of African youth have completed a TVET programme. RPL (recognition of prior learning) and employer-linked credentialing are the instruments to change this.[35]

Extend labour protections to platform and agent-based workers. Agent-contracted workers in clean cooking, SHS and e-mobility currently have no earnings floor or social protection; without policy action, green job growth will not translate into decent work.

2050
Towards 84.5 million jobs

Sustain service-phase business models for clean cooking and SHS. Clean cooking employment is projected to grow more than tenfold between 2030 and 2050, driven by service-phase deepening. The nano and micro-enterprise models that deliver it is the defining long-run question.

Establish domestic manufacturing for solar, battery and e-mobility. Solar PV assembly alone could generate 140,000 jobs annually to 2050 if industrial hubs develop at scale. Realising this requires AfCFTA-aligned industrial policy and investment now.[36]

Build carbon market and MRV infrastructure to access private climate finance. Clean cooking, ecosystem conservation and waste recycling depend on results-based finance for commercial viability at scale. Without better measuring, reporting and verification (MRV) systems, these value chains cannot attract the private capital they need.

Invest in climate resilience to protect water-dependent value chains. Hydropower, solar irrigation and cold storage carry the highest physical climate risk in this model. Investing in resilience could reduce projected employment losses by up to 25% under the low scenario.

Enable small and informal enterprises to deliver green livelihoods at scale. Building access to finance, stable demand and fair earning opportunities is essential to allow green growth to translate into sustainable livelihoods, given the large share of indirect jobs in the 2050 projections.

Build skills for the value chains 2050 will need. Beyond 2030, key value chains will evolve towards more system- and service-driven models, alongside growing demand in battery systems, grid operations and circular economy management. This will require building capabilities in system operations, maintenance, data monitoring and environmental compliance. Strengthening training systems will be critical.

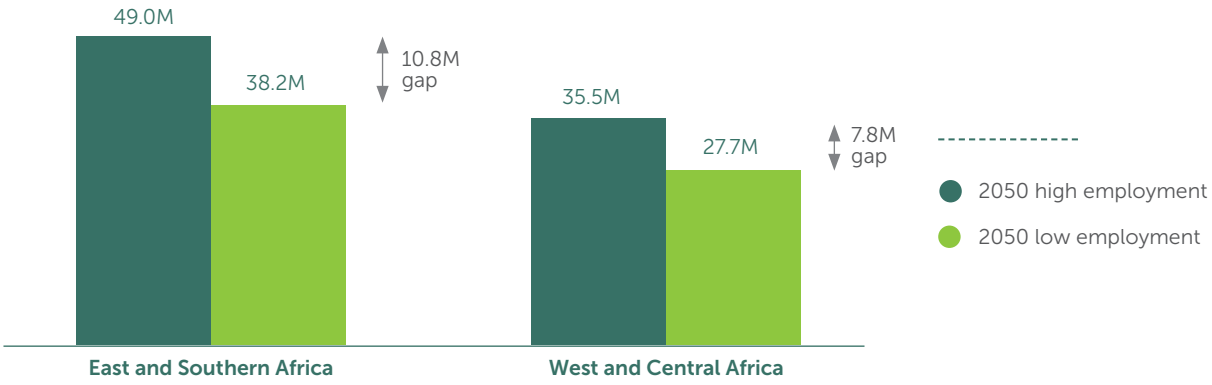
Shift climate finance from asset deployment to long-term capital for service-based value chains. As markets mature, financing must evolve from capital for infrastructure to models that support ongoing operations, asset replacement and revenue stability.

35 Based on data available for 43 countries in Africa as in ILO, Employment and Social Trends, 2026.
36 UNCTAD, 2025.

Regional variations

Africa's green employment opportunity is likely to follow two distinct regional pathways: one for East and Southern Africa, and another for West and Central Africa. These will be shaped by each region's policy frameworks, market structures and enabling conditions.

Figure 4 Green jobs by African region: 2050 high vs low employment scenario (millions)



East and Southern Africa

This region is projected to generate 58% of the 2050 high-scenario green employment, despite being home to only 40% of sub-Saharan Africa's population (a figure which is likely to remain stable to 2050). This disproportionate share reflects over a decade of investment in procurement, digital finance and market development.[37]

These will be the main drivers of green employment growth:

Policy execution: Countries such as Kenya, Rwanda and South Africa are moving from commitment to implementation. They have clearer sector strategies and are beginning to plan their workforces. This higher level of policy execution will help to align investment, skills systems and labour demand, enabling earlier and more sustained job creation.

Digital delivery: East Africa's SHS ecosystem is the most mature on the continent – Kenya, Ethiopia and Tanzania lead in per capita SHS connections, underpinned by deep mobile money infrastructure and established PAYGO distribution networks. These systems are expected to continue expanding across sectors, sustaining service-led employment.

E-mobility ecosystems: The region leads the way in electric mobility adoption and ecosystem development. Around 80% of sub-Saharan Africa's EV fleet is concentrated in Ethiopia, Kenya, Rwanda, Uganda and Tanzania. This brings first-mover employment benefits in assembly and maintenance, and as these ecosystems mature, they will provide recurring employment in servicing and operations.

Investment pipelines: A stronger track record in project delivery and capital absorption will continue to attract climate and private finance. This will allow the region to scale infrastructure and distributed systems more rapidly, supporting long-term employment growth.

37 UNFPA ESARO, 2024.

West and Central Africa

This region has a 42% share of the projected high-scenario employment for 2050. It is a significant but differently structured opportunity: unmet demand in clean cooking and waste, delivered through informal channels, with enabling conditions still forming.

Unmet demand: This region has some of the world's largest access gaps in clean cooking, energy and urban services. Addressing these should drive high employment intensity, particularly in distribution and service roles.

Informality: With some of the highest informality rates globally, economic activity largely happens through micro-enterprises and agent networks. This creates a large, ready labour base, enabling rapid job absorption as green solutions scale.

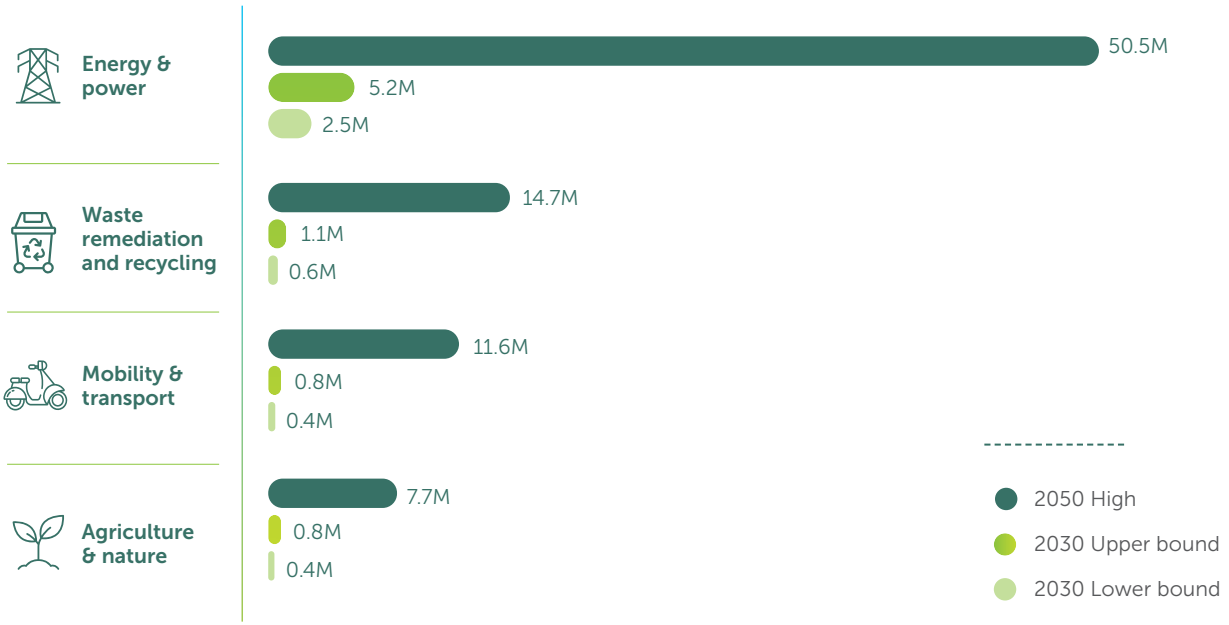
Early-stage policy systems: While NDCs and green strategies are in place, many countries are yet to implement. As policy frameworks move from intent to execution, they will unlock investment and accelerate employment growth.

Commercial ecosystems: Private sector activity in areas such as e-mobility and waste is developing ahead of regulatory maturity. As financing models and digital payment systems expand, these early ecosystems are expected to convert latent demand into employment at scale.

Distribution by sectors and value chains

Africa's green jobs opportunity will be driven by a few sectors where demand is large and can expand as markets mature. Energy and power will account for most jobs across both time horizons, while waste recycling and mobility emerge as important drivers too by 2050.

Figure 5 Green jobs by sector across all scenarios (million)



What will drive employment in each sector?

Energy and power

Clean cooking, SHS and utility-scale solar will drive most green employment demand, but through different channels. Clean cooking and SHS together will account for around 70% of 2030 lower-bound green employment for the sector. Utility-scale solar will depend on procurement, grid readiness, and project development and execution.

Africa's clean cooking transition is concentrated in a small number of populous countries, where access gaps are large and policy momentum is growing stronger. That will drive demand: clean cooking is projected to generate 1.4–2.5 million jobs by 2030, with continued growth through 2050. Demand to 2030 will be driven by deficits in countries like Nigeria, Ethiopia, the Democratic Republic of Congo (DRC), Tanzania and Uganda; by national strategies such as Kenya's Clean Cooking Strategy and Nigeria's clean cooking policy architecture; and by a continent-wide investment push accelerated by the 2024 Summit on Clean Cooking in Africa. By 2050, demand is expected to depend less on first-time access and more on denser fuel distribution, appliance replacement, urban retail markets and carbon-finance-supported scale-up.

SHS demand is expected to grow where standalone solar is part of national electrification plans. SHS is projected to generate 0.4–1 million jobs by 2030, with continued expansion beyond that. To 2030, demand will be driven by least-cost electrification planning in countries where grid extension remains slow or uneconomic; by PAYGO-enabled affordability; and by subsidy and results-based finance facilities.[39] Through to 2050, demand will broaden from basic household access to appliance upgrades, productive-use energy and replacement cycles, making employment growth increasingly dependent on a maturing rural energy market rather than new connections.

Demand through utility-scale solar PV will increase as countries seek to meet their growing electricity needs. This value chain is projected to generate up to 0.9 million jobs by 2030, with longer-term growth depending on how deployment integrates with wider power systems. The main drivers of demand to 2030, will be rising electricity demand, persistent supply shortfalls and the alignment of national energy plans and NDCs with utility-scale solar targets. The continued decline in solar PV costs should continue to make utility-scale solar one of the most competitive sources of new power generation in Africa, increasing demand for engineering, construction and installation roles. To 2050, demand will depend on how far solar becomes embedded in regional power systems, and in industrial use – including cross-border trade under the AfCFTA and mining and manufacturing.

Waste remediation and recycling

Waste recycling will provide most of the employment demand in this sector. It will generate 0.6–1.1 million jobs by 2030 and up to 14.7 million by 2050, making it one of the largest employment sources in the study.

Waste recycling demand is expected to grow because Africa's urban transition is generating rising material flows that cities can no longer manage through informal disposal alone. By 2030, demand will be driven by urban growth in cities such as Lagos, Kinshasa and Nairobi, and by the spread of EPR and circular economy frameworks such as South Africa's EPR regime, Kenya's waste legislation and the African Union's Continental Circular Economy Action Plan.[40] South Africa's EPR regime has already created over 24,000 formal jobs since 2022 and supported 47,000 waste pickers.

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38 IEA, 2025.
39 Power for All, 2022.
40 South Africa DFFE / Xinhua, 2025.

By 2050, demand is expected to deepen as waste systems move beyond basic collection towards higher-value plastics recovery, organics processing, e-waste and secondary materials markets, especially where informal pickers are integrated.

Mobility and transport

Electric mobility is projected to generate 0.3–0.6 million jobs by 2030 and up to 10.1 million jobs by 2050.[41] This growth will happen because fleet electrification is becoming commercially viable for urban transport operators before full market formalisation is in place. Near-term demand will be driven by the central role of motorcycles in passenger and delivery transport, by fuel and operating cost pressures, and by policy signals such as Ethiopia's import restrictions and Rwanda's EV strategy.[42] In the longer term, demand will shift towards fleet renewal, battery management and local assembly and repair ecosystems, making employment growth more dependent on operating and maintaining a larger electrified stock.

Agriculture and nature

Several value chains will contribute to growth in this sector. Cold storage, which can reduce farm losses and is becoming necessary to serve fast-growing African cities, will generate 0.2–0.5 million jobs by 2030 and up to 4.8 million by 2050. Near-term demand is driven by high loss rates in countries such as Nigeria, Kenya and Tanzania, rising urban demand for perishables, and new cold chain solutions that make aggregation and distribution more viable. By 2050, demand is expected to deepen as AfCFTA-supported trade, food processing and logistics systems mature, making cold chain services part of the core market infrastructure rather than a niche intervention.

Solar irrigation demand will rise where farmers need to lower pumping costs and manage increasingly erratic rainfall. Short-term demand is driven by the economics of replacing diesel pumping, by irrigation needs in drought-prone and water-stressed corridors, and by the falling cost of solar-powered irrigation systems. By 2050, the driver becomes more climate-related, as water stress and rainfall volatility make irrigation less of an optional productivity tool and more of a production requirement in parts of the Sahel and East Africa.

Demand in regenerative and resilience-oriented agriculture will increase where climate stress and input cost pressures make adaptation commercially rational for farmers and governments. Practices that improve soil health, reduce fertiliser dependence and stabilise yields will provide near-term opportunity – early uptake often begins through farm economics rather than climate mandates. By 2050, demand will be driven by adaptation finance,[43] restoration programmes and resilience spending, expanding labour demand in agroforestry, land rehabilitation, watershed protection and other land-based systems.

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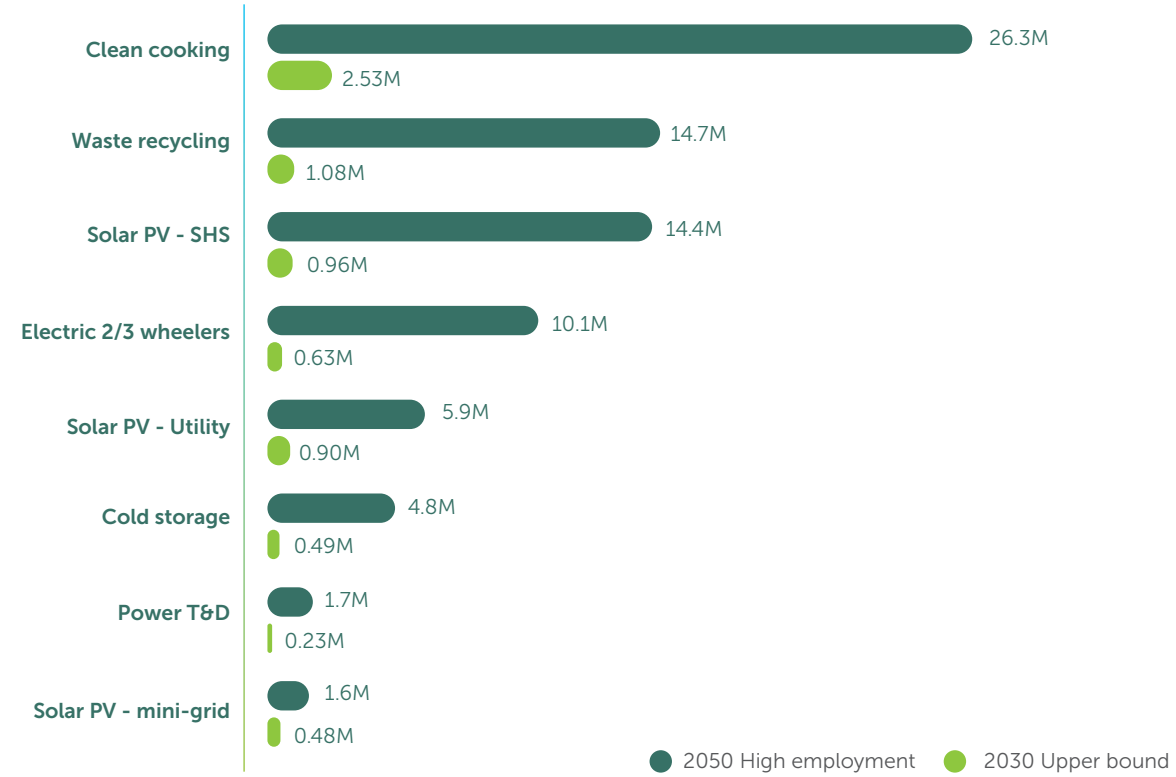
41 A share of e-mobility employment is also expected to come from the greening of an existing informal transport workforce, including boda boda and okada riders, rather than entirely new job creation. While this study captures gross employment linked to electric vehicle value chains, it does not fully reflect the scale of workforce transition within existing roles, and therefore likely underestimates the total impact as additional jobs emerge in areas such as battery swapping and servicing. Accordingly, the overall green employment potential for e-mobility in Africa is expected to grow further.

42 Africa E-Mobility Alliance, 2025.

43 Adaptation finance has lagged relative to its employment and developmental potential and cost effectiveness of job creation in these value chains. Source: Systemiq & WRI, 2025.

Where growth will be concentrated

Figure 6 Top value chains: 2030 upper bound vs 2050 high employment (million)



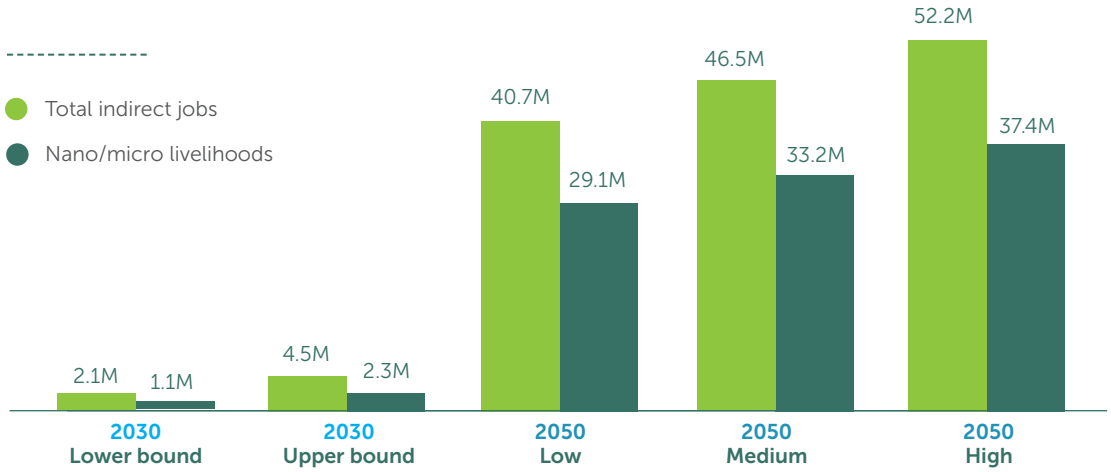
In both 2030 and 2050, green employment will be distributed unevenly across value chains, as shown in Figure 6. Clean cooking and SHS are expected to dominate in both periods, but the expansion is most dramatic for clean cooking, which is expected to grow more than tenfold. By contrast, utility-scale solar will see a more modest expansion, reflecting the temporary construction-phase character of its employment. An investor or government prioritising clean cooking and SHS over utility solar will generate not only more jobs in 2030 but a fundamentally different employment trajectory through to 2050, compounding value chain effects that no single-horizon analysis can capture.

Inclusion: informality, women, youth, and low-income workers

Informality and the micro-enterprise economy

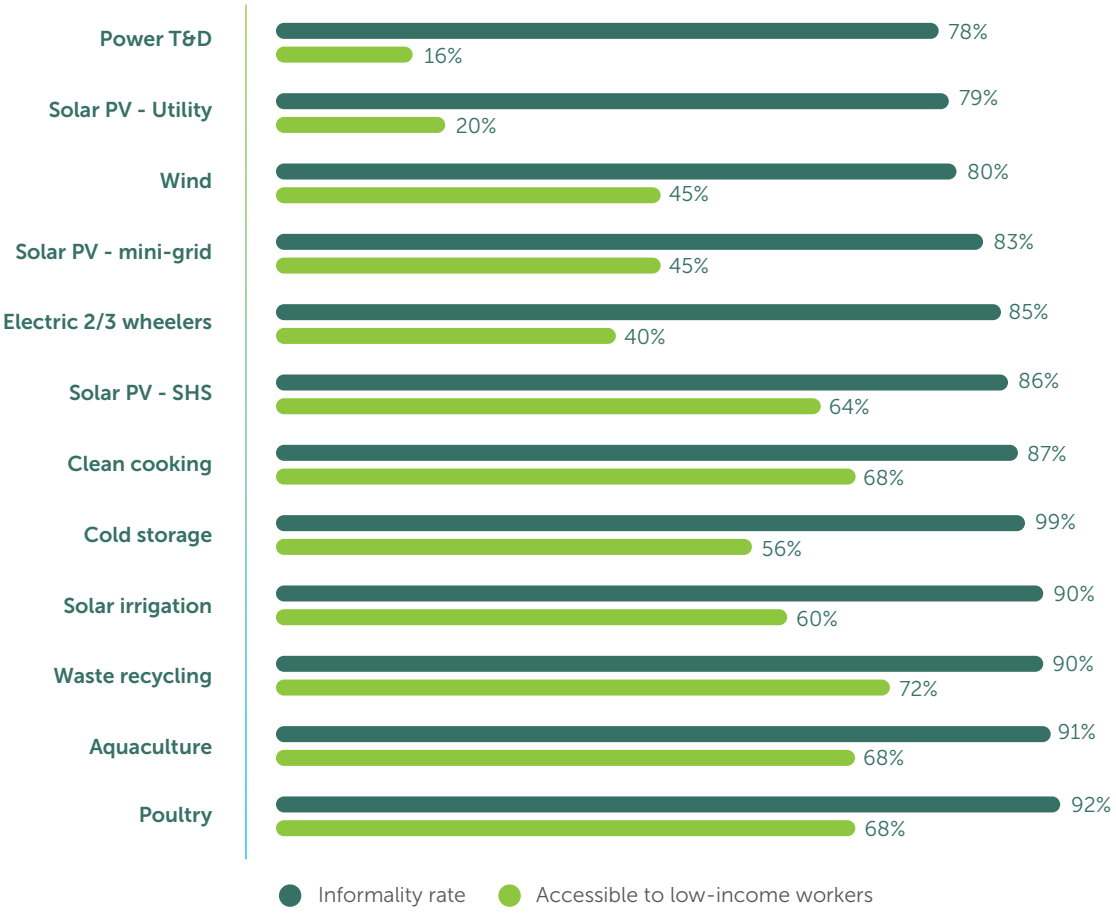
In 2030, around 86% of lower-bound green jobs will be informal, but by 2050, this is expected to fall to around 51% across all three scenarios. By this stage, around 71% of all indirect employment will be through nano- or micro-enterprise, equivalent to 29 to 37 million people operating as micro-distributors, informal agents, community technicians and household-level service providers. The percentage is consistent across all three 2050 scenarios, confirming that the dominance of nano- and micro-enterprise is a structural feature of Africa's distributed service economy.

Figure 7 Indirect jobs and nano- and micro-enterprise livelihoods by scenario (million)



The value chains with the highest informality rates are also expected to be those most accessible to low-income workers in 2030, as shown in Figure 8 below. The positive correlation between informality and accessibility reflects the delivery architecture of distributed value chains, which by design reach lower-income, more dispersed workers. Waste recycling, which projects a 90% informality rate, is the value chain most accessible to low-income workers. Utility-scale solar, the most formally structured value chain, has only 20% low-income accessibility.

Figure 8 Informality rate by value chain compared against accessibility for low-income workers, 2030 lower bound



The value chains generating the largest employment volumes are therefore accessible to workers without formal qualifications, permanent employers or significant capital. Job profiling across Kenya, Nigeria and South Africa identified roles that illustrate this opportunity: PAYGO solar agents and SHS after-sales advisors in off-grid solar; clean cooking micro-distributors and stove maintenance technicians in clean cooking; waste reclaimers, sorters and informal recycling cooperative operators in waste management; agroforestry field technicians and solar irrigation maintenance workers in climate-smart agriculture; and battery swapping station operators and e-mobility maintenance micro-enterprises in e-mobility.

Youth: the quality gap in an access economy

While Africa's youth are participating in the green economy, they are largely confined to its most precarious roles. Ninety per cent of young, employed Africans work in informal jobs (Mastercard Foundation, 2026) and 57% of them fall within the low-income band, mirroring the conditions of Africa's labour market as a whole: no social protection, no recognised credentials and no progression pathway.

The green value chains with the highest employment volumes are accessible to youth, with practical training achievable in weeks. Kenya's e-mobility sector employs more than 11,000 people directly, with youth participation disproportionately high in informal maintenance and distribution.[44] In Ghana, focus groups identified clean energy entrepreneurship and waste management as primary career aspirations for young people.[45] But policy will be important: APRI's youth and green technology policy analysis found that Nigeria and Kenya's frameworks contain no mechanism for linking existing informal youth operators, including boda boda riders, e-waste sorters and clean cooking agents, into formal career pathways.[46]

Inclusion: women

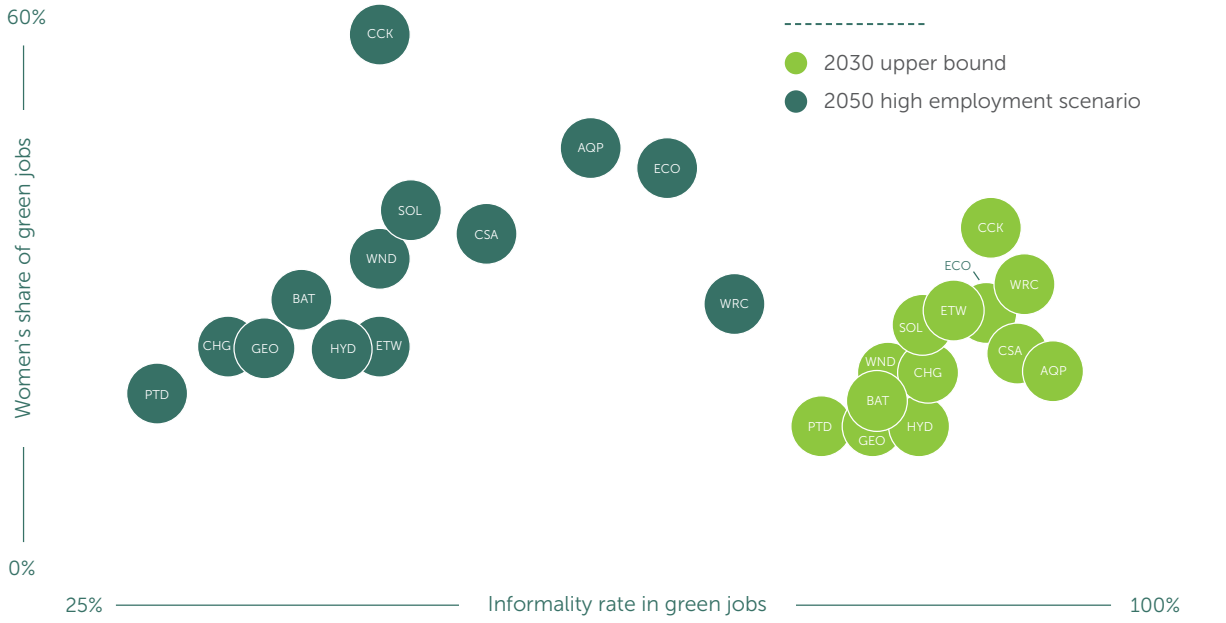
While aggregate projections suggest a significant expansion in women's participation, these figures mask a deeply fragmented reality. Women's experiences are not all the same; instead, they are shaped by a complex interplay of geography, income and social identity.

Informality and women's participation

Female participation is expected to be highest in the most informal value chains. These value chains have the weakest job quality indicators, showing the lowest earnings potential and most limited pathways for progression. As shown in Figure 9, clean cooking, waste recycling, ecosystem conservation and electric two- and three-wheelers are expected to account for the highest female participation to 2030. By 2050, clean cooking provides the most significant share, with women's participation rising as PAYGO models formalise parts of the workforce.

[44] Africa Policy Research Institute, 2024.
[45] Green Africa Youth Organization, 2026.
[46] Africa Policy Research Institute, 2024.

Figure 9 Informality vs women's share across value chains: 2030 upper bound and 2050 high employment scenario



Energy & power	**CCK** Clean cooking | **SOL** Solar PV | **WND** Wind | **GEO** Geothermal | **HYD** Hydropower | **BAT** Battery storage | **PTD** Power T&D
Mobility & transport	**ETW** E-2/3 wheelers | **CHG** Charging infrastructure
Agriculture & nature	**CSA** Climate-smart agri-tech | **AQP** Aquaculture & Poultry | **ECO** Ecosystem conservation & NBS
Waste remediation and recycling	**WRC** Waste recycling

This is important, as it indicates that female participation does not signal inclusion. Women are concentrated in lower-value, informal roles while men dominate technical, field-based, and formal positions where earnings and career progression are higher.[47] For example, while women account for 33% of the renewable energy workforce, participation remains below 15–20% in engineering, installation and operations.[48] Women are also overrepresented in informal trade, services, and care-related work.[49] Evidence also suggests that while training and placement programmes can improve women's earnings, they do little to address the workplace barriers that limit retention in higher-value roles.

In fact, the same delivery models that make it easier for women to enter tend to channel them into these informal commission-based roles. Last-mile delivery depends on low-cost models that make use of women's existing networks and community roles. A female PAYGO solar agent may be counted in participation figures, but often works without a formal contract, social protection or access to training.

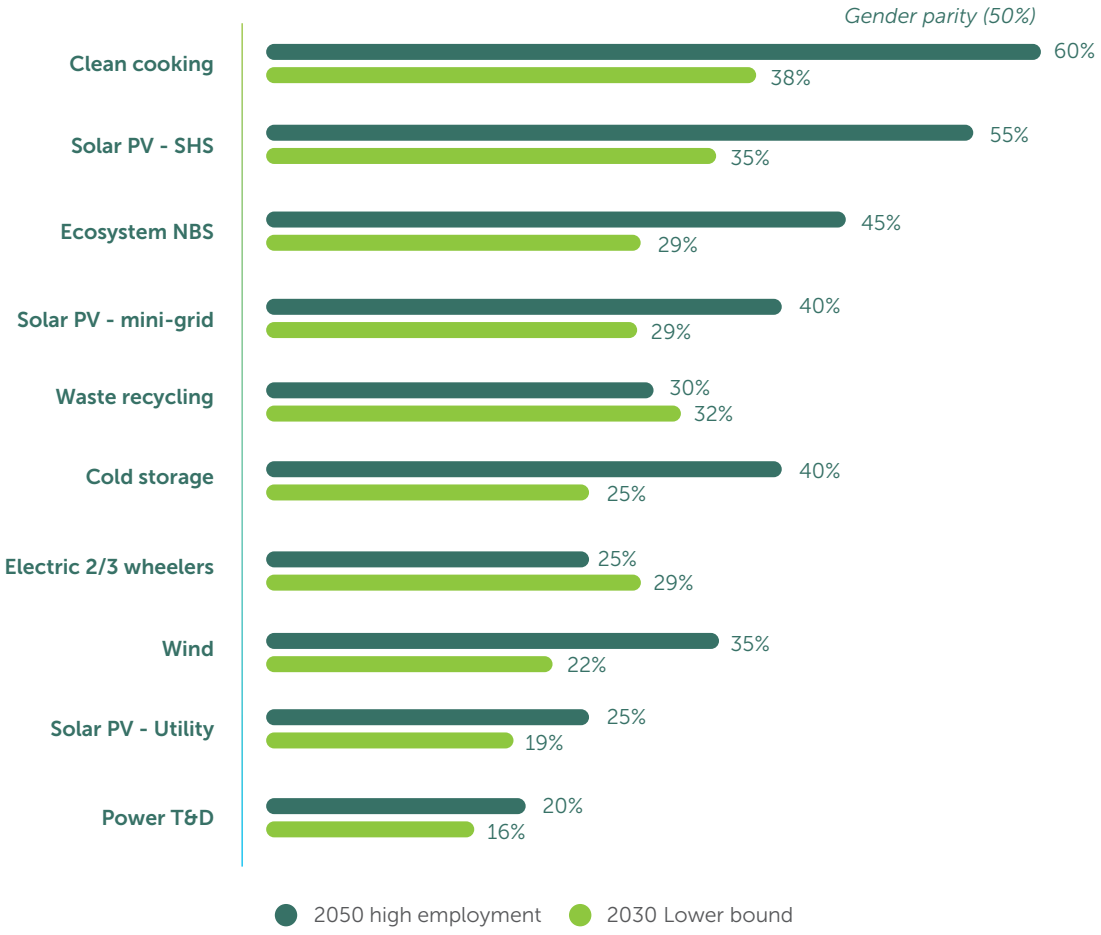
47 Africa Policy Research Institute, 2024.
48 Ibid.
49 IRENA, 2025

For inclusion efforts to be meaningful, both access and outcomes need to be tracked. A better measure than participation is where women are positioned within the value chain – whether they remain concentrated in entry-level roles or are able to move into contracted positions. These findings reinforce the need to prioritise value chains like clean cooking, solar PV and ecosystem conservation for formalisation pathways.

Value chain composition as the primary gender lever

Women are expected to hold about 31% of green jobs by 2030 (lower bound), or 1.2 million roles. By 2050 (high employment scenario), that could grow to 44%, or nearly 37 million jobs.

Figure 10 Women's participation by value chain: 2030 lower bound and 2050 high employment scenario (%)



Women's participation is more likely to expand if deployment scales and enabling conditions hold over the long term, as indicated by Figure 10. By 2050, clean cooking and SHS are projected to cross the 50% gender parity threshold. These are projected demand-side outcomes derived from the fundamental structure of these markets: the majority of clean cooking and SHS customers are women, and effective distribution in these markets is achieved by agents who reflect and are trusted by the customer base.

For DFIs, achieving measurable gender impact requires a shift from broad portfolio mandates towards the selection of high-participation value chains. Evidence from programmes such as IFC's Energy2Equal and IRENA's gender-responsive procurement guidance shows that DFIs achieve stronger results when they combine targeted investment with deliberate conditions. First, they set value chain-specific gender targets, recognising that participation levels differ across sectors. Second, they provide enterprise support tailored to women-led businesses (such as working capital, agent network financing and PAYGO inventory facilities) to address persistent

barriers to finance. Third, they embed retention and progression measures into investee practices, including safe transport for field roles, RPL for informal technicians, and clear anti-harassment protocols. Without these, investments risk increasing women's participation only in low-value, informal roles.

Barriers to women's participation

Three structural challenges shape the gap between women's participation in green value chains and their access to higher-value roles:

Safety and mobility issues limit women's access to technical and field-based jobs. Female solar installers and e-mobility technicians are often unable to take on remote or overnight assignments, because of a lack of safe transport, appropriate accommodation and adequate facilities. These problems confine women to roles closer to home, regardless of their skills.

Unpaid care responsibilities limit women's availability for the long hours and site-based work typical of higher-tier green jobs. Measures like flexible scheduling, childcare support and work closer to residential areas could help to change this.

Gaps in certification and field placement mean that many women who enter technical training do not transition into qualified roles. Female enrolment in engineering and technical fields across sub-Saharan Africa remains low, and those who do enrol often face challenges completing practical requirements due to limited access to safe placements, mentorship and supportive assessment environments. This creates a pool of trained but uncertified women who are unable to access higher-quality jobs.

Intersectionality, aspiration and the technical pipeline gap

Women's experiences are shaped by several intersecting factors. These things, combined with social gatekeeping, create a 'leaky pipeline' that can prevent women from moving beyond entry-level roles in the green economy.

The myth of homogeneity: Women's experiences are not homogeneous. They are shaped by the intersection of geography, income, and education.[50, 51] Rural women might be constrained by mobility and infrastructure deficits, while low-income and informal workers lack the digital access and financial collateral to transition from manual labour to technical ownership.

The aspiration and awareness barrier: Aspiration is undermined by social gatekeeping and a lack of visible role models. In technical training environments, female students face stigmatisation (being labelled as 'tomboys' or presumed technically incompetent), which erodes the confidence necessary for career progression.[52] Key informants report that without visible female leadership and structured mentorship, the green transition remains a "male-dominated" professional network that discourages young women from pursuing STEM pathways in high school.

The weak pipeline of skilled women workers: Women represent just 15% of certified solar PV trainees, with total female enrolment in technical programmes rarely exceeding 20%.[53] Even when enrolled, women struggle to complete certifications due to the 'verification gap' and a lack of safe field placements, including a deficit in secure accommodation and transport to remote infrastructure sites.

The need for systemic reform: Constraints in employment (institutional bias, safety risks) and entrepreneurship (financial exclusion, regulatory gaps) are self-perpetuating. Realising the inclusive promise of the green economy requires moving beyond 'gender-blind' training towards integrated, system-level reforms that combine technical mastery with safety-linked transport, worksite childcare and alternative credit-scoring models. Without these structural anchors, inclusive green growth will remain aspirational rather than transformative.

Interconnected barriers across two pathways

Although barriers to women's participation vary by sector, they operate through two interlinked pathways: the employment pathway and the enterprise pathway. These intersect and reinforce one another.[54]

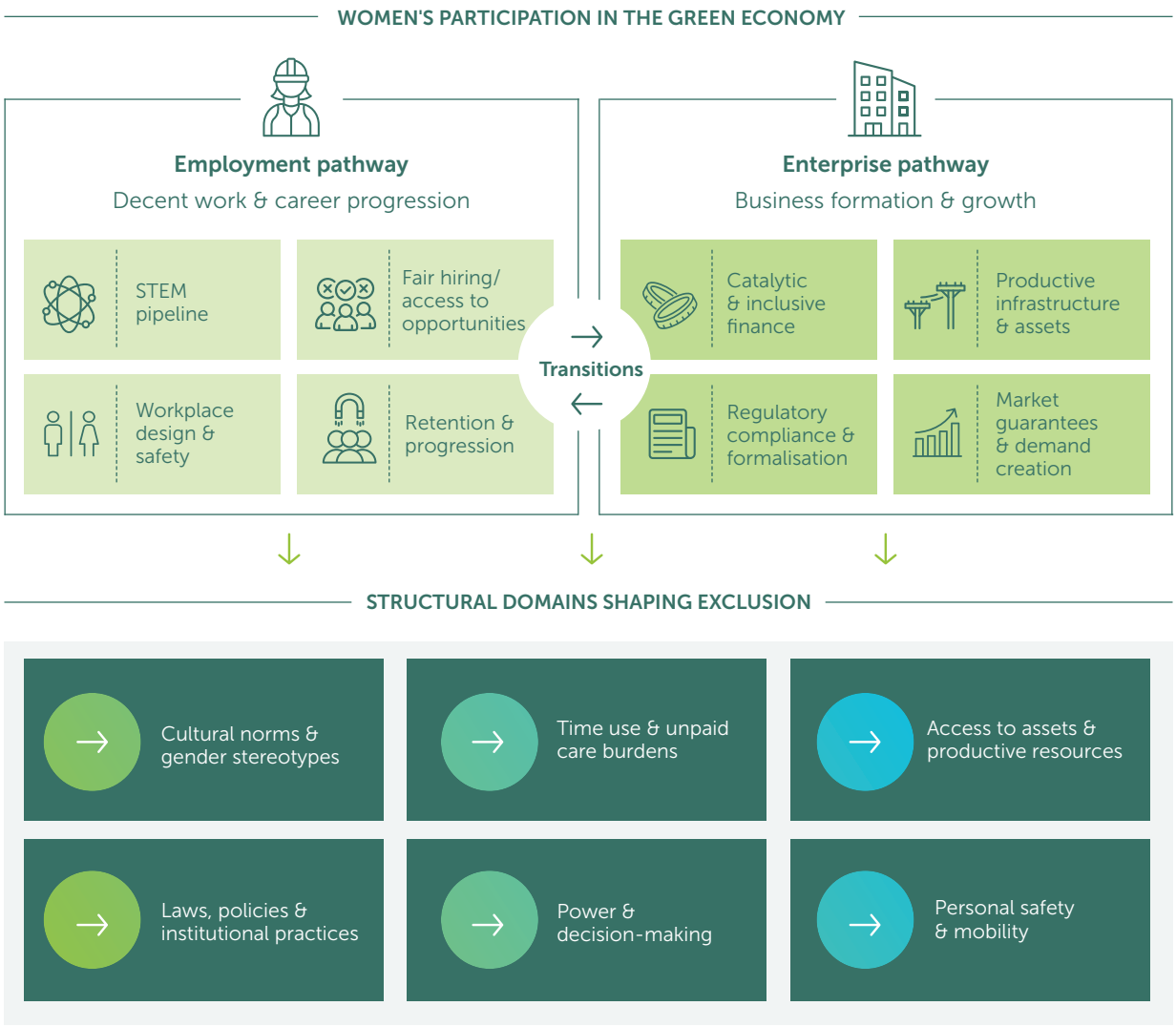
The employment pathway concerns women's progression towards decent work.[55] Entry is shaped by biased recruitment, limited access to technical training, unsafe workplaces and rigid schedules that conflict with caregiving. Advancement is also constrained by exclusion from informal networks and narrow promotion pipelines. Key informants repeatedly identified the absence of gender-sensitive facilities at worksites, such as separate washrooms and safe changing areas, as a barrier to retention. The box above demonstrates how modest

50 University of Chicago Law Forum, 1989.
51 Cornwall & Rivas, 2015.
52 Zollmann & Remerscheid, 2023.
53 Ibid.
54 Ibid.
55 International Labor Organisation, 2019.

operational standards could improve this, and embedding them into financing instruments, SME support schemes and procurement frameworks would shift these measures from voluntary practice to institutional requirement. The enterprise pathway is dominated by micro and small women-led businesses. Here, the primary constraints are financial exclusion, limited business development support and regulatory systems that restrict market access and formalisation.[56]

Systemic barriers converge across these two pathways, creating a cycle of exclusion that keeps women on the periphery of the green transition (see Figure 11 below). In the employment pathway, institutional biases and unsafe workplace designs create a 'leaky pipeline' that filters women out before they reach technical or leadership roles. The enterprise pathway remains largely informal, as asset norms and a lack of 'bundled' support trap women-led businesses in low-growth, survivalist activities.

Figure 11 Framework for understanding women's participation[57]



[56] UN Women, 2021.
[57] Open Capital, 2025.

As the graphic shows, women's exclusion stems from six systemic domains of gender inequality.[58] Structural inequality is driven by gender-neutral policies that fail to account for women's lived realities and a financial landscape that frequently excludes them. These may affect the employment or enterprise pathways in distinct ways, as shown in Table 1 below.

Table 1 The six systemic domains of gender inequality

Domain	Manifestation in green value chains
Cultural norms & gender stereotypes Deep-seated gender stereotypes that shape labour segmentation and women's perceived suitability for technical work.	**Employment:** Women are channelled into customer-facing roles while men dominate high-income technical, logistics and after-sales segments. **Enterprise:** Women are often confined to marketing and micro-trading; men dominate formal distribution and franchising networks where capital and scale are concentrated.
Time use & unpaid care burdens Unpaid domestic and caregiving work that imposes time poverty and limits participation in training and fieldwork.	**Employment:** Rigid schedules and site-based roles conflict with caregiving duties, leading women to decline or exit higher-tier roles. **Enterprise:** Micro-entrepreneurs must operate between domestic tasks, restricting production hours and the ability to attend supplier meetings or demonstrations.
Access to assets & productive resources Weaker asset ownership and financial exclusion that restrict both professional mobility and business growth.	**Employment:** Women frequently lack the 'tools of the trade', such as driver's licences, smartphones for monitoring platforms, or motorcycles for field service. **Enterprise:** Gendered land and property norms result in a lack of traditional collateral, blocking women from securing the seed capital or inventory finance needed to scale.
Laws, policies & institutional practices Gender-neutral frameworks that fail to correct market biases or provide protections like maternity leave.	**Employment:** Reliance on informal, male-dominated recruitment networks and a lack of maternity protection or flexible work arrangements. **Enterprise:** Complex licensing and gender-blind procurement exclude small, women-led firms; municipal waste contracts rarely reach informal women's cooperatives.
Power & decision-making Male dominance in leadership and policy spaces that restricts women's influence on sector priorities.	**Employment:** Extreme underrepresentation in senior management and investment boards limits influence over product design and HR reform. **Enterprise:** Men typically control procurement and pricing negotiations in agro-processing cooperatives, leaving women with little advocacy power.
Personal safety & mobility Physical insecurity and risks of gender-based violence (GBV) that undermine productivity and retention.	**Employment:** Harassment risks during travel to remote sites or overnight assignments, combined with a lack of gender-sensitive worksite facilities. **Enterprise:** Women conducting door-to-door sales or collecting waste in public spaces face intimidation and verbal abuse.

[58] USAID, 2017.

For investors and donors, the implication is clear: where you invest matters as much as how much you invest. Addressing any single domain in isolation produces limited and temporary gains. Effective gender equality and social inclusion programming in green value chains requires coordinated interventions across at minimum three areas: capital access (to address financial exclusion), workplace standards (to address safety and cultural norms) and skills/certification pathways calibrated to the occupational structure of the specific value chain.

The access–employment paradox in clean cooking

Clean cooking shows us that a large female customer base does not automatically translate into equitable employment. While the sector will approach 60% female participation by 2050, women's current roles are concentrated in informal, downstream activities, which are often uncounted in formal employment data.[59] By contrast, higher-value roles in LPG distribution, bulk logistics and sales management are male-dominated.

This reflects how the sector is structured: commercial and logistics systems built around existing recruitment networks and operating models that favour men. The result is a gap between women's central role in driving demand and their presence in formal employment.

Investing in high-growth value chains alone will not shift employment outcomes. Without deliberate design, capital will scale markets while reinforcing existing patterns of occupational segregation. Converting participation into quality employment requires targeted interventions: expanding women's access to distribution roles, providing working capital for women-led enterprises, and formalising agent-based work through clear employment standards. Gender covenants that specify these conditions are essential to ensure that growth translates into higher-value roles for women.

[59] IEA, 2025.

Economic transition and workforce strategy

The transition to 2050 will be defined by a narrowing gap in informality as markets mature, though the workforce will initially continue to scale through informal systems.

The green economy in Africa is built on millions of independent operators: nano- and micro-enterprises projected to employ 29–37 million people by 2050. This informality is a structural feature of how green services are delivered at scale. Value chains like poultry (92%), aquaculture (91%) and waste recycling (90%) show the highest informality because their labour flows through street-level distributors and smallholder farmers. However, as markets like e-mobility and SHS mature, the informality range across green value chains will narrow from 85–92% in 2030 to 55–75% by 2050.

The formalisation shift will be driven by value chain maturation rather than regulatory pressure. As sectors scale, they shift from artisanal delivery towards consolidated service networks that require certified technicians and documented contracts to access institutional finance and procurement. This progress is uneven; while grid-integrated sectors like utility solar and power T&D accelerate towards formality, clean cooking and aquaculture are expected to retain high informality even at 2050 scale due to their dispersed nature. While this structural correlation between distributed delivery and inclusion offers significant entry opportunities, women's participation currently remains uneven and segmented.

The prevalence of informality suggests the workforce strategy must shift from standard training programmes to policy instruments tailored to informal contexts. For young people, interventions should not necessarily focus on increasing entry but on building the progression architecture. The analysis and consultations with stakeholders highlighted three specific instruments:

Mobile-based social protection

linked to mobile money platforms, where Africa leads globally in adoption.

Portable credential systems

that recognise informal skills acquisition through RPL pathways and help convert informal entry into career development.

Supply chain integration mechanisms

that give micro-distributors access to working capital and trade finance.

By understanding which sectors will formalise and when, policy can be sequenced: RPL and mobile social protection are the priority instruments for the informal majority today, while formal apprenticeship systems and occupational standards become essential as markets reach maturity.

SECTION 4

COUNTRY DEEP-DIVE: SOUTH AFRICA

South Africa's green economy is expected to generate 0.7–1.3 million jobs by 2030, increasing to 4.3 by 2050 (medium scenario). While these figures represent a significant structural shift, the realisation of this potential depends on addressing misalignments in income distribution, skills development and sectoral concentration.

Key takeaways: South Africa

Despite a high level of formality, most green workers earn below $5,000 per year. This is because entry-level, labour-intensive roles dominate construction and waste collection.

A weakening education pipeline threatens the engineering talent base. Declining pass rates in maths restrict the candidate pool for the projected technical roles, which means a risk of reliance on imported talent.

Projected green jobs for 2030 are concentrated in two sectors. Energy and power and waste recycling account for almost all projected jobs for that year. Agriculture and nature is the main diversification opportunity – it could grow by up to 32x by 2050.

Female participation will stagnate at around 25% through to 2050. This is due to segregation in male-dominated trades, and workplace barriers like inadequate facilities and transport risks.

The workforce will shift from temporary to permanent roles. By 2050, construction-phase jobs will give way to operations and maintenance work in battery storage, smart grids and specialised recycling, meaning a more stable foundation for skills investment and household incomes.

Figure 12 South Africa headline numbers

Gross Green jobs

2030 UPPER BOUND → 2050 MEDIUM

1.3M → 4.3M

Direct and indirect jobs modelled across 13 value chains.

55-57%

Of projected 2030 jobs expected to be indirect

Leading sectors

Energy and power + manufacturing and materials

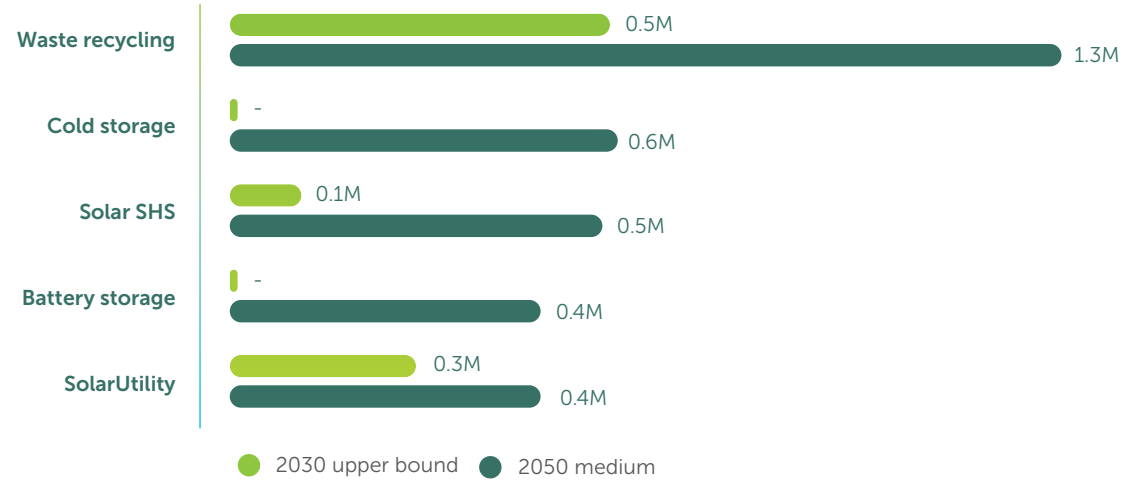
97%

7% → 16%

Agriculture emerges as third leading sector by 2050, driven by 550k cold storage jobs

Top value chains by projected employment

Expected 2030 sectoral split:

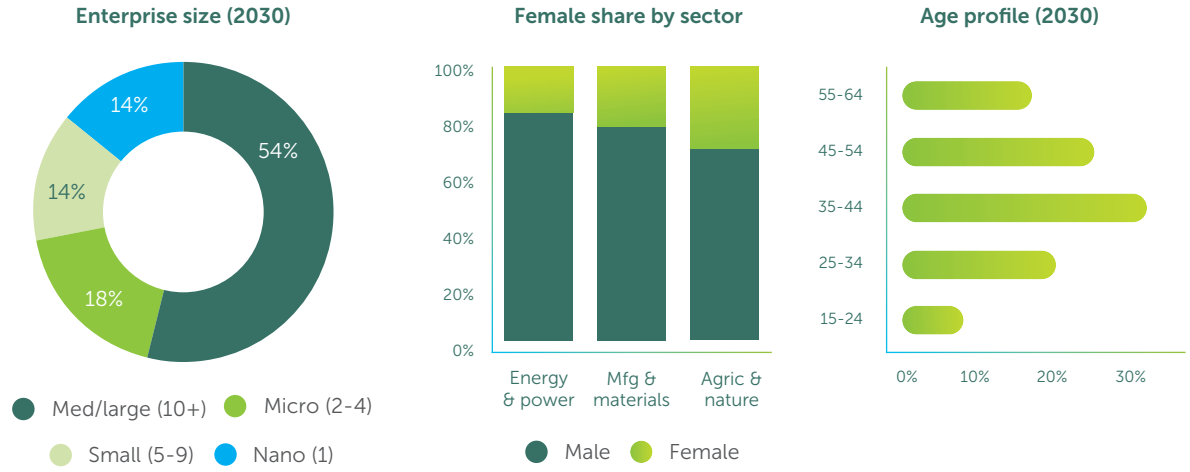


Inclusion metrics in green employment

Formal employment rate		Accessible to women		Below $5,500/yr	
70%	70%	24%	24%	93%	88%
2030 lower	2050 medium	2030	2050	2030	2050

All figures are approximate

Figure 13 South Africa key insights



Job creation by sector

While energy and power will be the dominant sector, it is noted that concentration in a single sector creates vulnerability. Deliberate investment in agriculture-linked and circular economy value chains is needed to broaden the employment base. By 2050, agriculture and nature is projected to emerge as a meaningful third sector, creating one of the continent's most balanced green employment profiles.

Energy and power

This sector will account for 60–70% of South Africa's green employment by 2030, led by utility-scale solar, power T&D and clean cooking. Construction under the country's 2019 Integrated Resource Plan (IRP) and 2023 Just Energy Transition Investment Plan (JET-IP) creates significant near-term employment, but these roles are cyclical and project-bound — grid modernisation and distributed services provide the more durable long-term base. Power T&D generates permanent technical roles (transmission technicians, control operators, substation specialists), while distributed systems such as SHS and battery storage are projected to overtake utility-scale solar as the dominant employment source by 2050.

Waste recycling

Employment growth in this sector is anchored in regulatory design. South Africa's EPR regulations of 2020–21 transformed waste management from a largely informal activity into a regulated industry, creating formal employment in collection, sorting, processing and compliance. Unlike energy, where technology reduces labour per unit of output, waste recycling will stay manual, and each additional tonne processed generates proportional labour demand. The sector spans the full formality spectrum, from informal waste pickers to formal SMEs and corporate compliance roles. This makes it an important channel for inclusive employment and one that rewards deliberate intervention across the entire value chain.

Agriculture and nature

Growth is driven primarily by cold chain infrastructure in this sector. Most projected jobs are concentrated in cold storage systems, reflecting a shift from traditional farming towards technology-enabled supply chain roles. This also makes agriculture the most climate-sensitive sector in the green economy: rising heat stress and post-harvest losses increase demand for cold storage, but exposure to drought, water scarcity and ecosystem degradation

could reduce total employment in a conservative scenario. Realising the projected growth depends as much on the effectiveness of adaptation investment as on the energy transition itself.

An overview of green jobs numbers at sector level is presented in the table in Annex 8.2

Inclusion and workforce structure

Formality

Approximately 70% of green workers in South Africa are in formal employment. This is driven by regulated procurement frameworks in energy and EPR compliance systems in waste. Informality concentrates in waste collection, agricultural labour, and last-mile distribution — where dispersed work, irregular hours, and micro-enterprise models make formalisation difficult — and this split is projected to remain stable through 2050 without deliberate intervention. Increasing the formal share requires segment-specific policy: social protection for informal workers, portable credentials, and formalised agent networks, rather than broad mandates that do not account for the operational realities of micro-enterprise work.

An overview of these numbers is presented in the table in Annex 8.3

Income

Most green workers earn below the annualised minimum wage threshold of $3,155 per year, and two-thirds earn less than $2,750 per year (classified in this report as the 'very low' income band). Over 93% earn less than $5,000 per year. Technical roles in the energy sector command higher incomes, while waste recovery and agricultural roles cluster at the bottom. Nearly all workers (99.2%) in the agriculture and nature sector fall within the 'very low' band.

The income distribution reflects the construction-phase character of 2030 employment: utility-scale solar, grid upgrades and waste facility build-out create high volumes of entry-level, semi-skilled roles paid at or near minimum wage, pulling the overall distribution downward even as technical roles in energy pay above minimum wage. Sector composition compounds this — waste recycling accounts for a large near-term share, with most jobs in manual collection, sorting and aggregation. The income profile improves modestly over time as operations replace construction, with battery technicians, grid engineers and recycling plant operators representing the middle-income growth.

This evidence indicates that green jobs are not inherently 'good jobs'. Creating more roles does not automatically deliver better-paid or higher quality work, and without deliberate wage and quality interventions, the 2050 workforce will inherit the same inclusion profile at 3–4x the scale.

Gender

Women represent only 25.5% of green employment. Their participation is concentrated in agriculture-linked value chains – 29% female participation in agriculture and nature is the highest representation in any sector. This is driven by women's existing concentration in smallholder and informal agricultural work, alongside nature-based and land restoration programmes that increasingly engage women in rural livelihoods.

Other sectors with higher female participation rates are energy and power (24%) and waste remediation and recycling (24.2%). Clean cooking shows only 4–5% female participation, because the modelled value chain centres on LPG distribution, which is male-dominated.

The barriers driving this pattern are occupational segregation in high-employment sectors, a thin female pipeline into technical training, and workplace conditions that suppress retention. They operate through the employment and enterprise pathways set out in Section 3. What distinguishes South Africa is the formality of its transition architecture: with approximately 70% of green employment formal and anchored in regulated procurement, the levers for change are institutional rather than informal. Unlike Nigeria's challenge of reaching workers outside formal systems, South Africa's challenge is reforming the conditions within them — procurement standards, training pipelines and worksite design — so that they stop filtering women out. The country-specific interventions with the strongest evidence base in this context are set out below.

Gender-responsive workplace adaptations

In South Africa, retention of women in technical green sectors is shaped more by workplace design than by skill or capability. This means there are several practical, cost-effective interventions that could significantly improve retention.

Improve basic infrastructure for women.

Providing separate washrooms and changing facilities at remote or field-based worksites addresses a persistent deterrent to participation.

Introduce clear contractual protections.

Written maternity and leave provisions embedded in employment contracts, alongside structured grievance and reporting mechanisms, ensure that women are informed of their rights and have credible channels for redress.

Provide flexible working arrangements.

Adjusted duties for expectant workers, flexible reporting hours, structured mentorship and counselling, and safety-linked transport support for late or remote shifts reduce attrition linked to caregiving burdens and mobility risks.

When embedded into green jobs programming, SME support schemes and blended finance conditionalities, these operational standards have the potential to shift gender-responsive retention from voluntary practice to institutional expectation.

Enterprise size

Medium-sized and large firms dominate South Africa's green economy. This is likely associated with the capital-intensive nature of the country's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and JET-IP-related market development. Utility-scale projects need large balance sheets and technical certifications, which concentrates employment in larger firms. This supports formal employment and career progression but narrows the base of job creation. To expand inclusion, diversification will need to happen through subcontracting and micro-enterprise support in segments like waste collection and SHS distribution.

By 2050, the modest rise in nano- and micro-enterprises may suggest some expansion of decentralised service roles such as solar SHS, cold storage and community-level maintenance, consistent with a gradual shift from build-out to operations.

An overview of employment by enterprise size is presented in the table in Annex 8.6

Age

The 2030 projections show green employment concentrated in older age cohorts. This reflects the JET-IP's reliance on established professionals with specialised industrial experience. Youth participation is 7.1%, which represents an emerging pipeline, with programmes such as the Presidential Youth Employment Intervention and the Green Skills Programme beginning to channel younger workers into green occupations. By 2050, the relatively stable projected age distribution suggests a maturing employment base characterised by high-retention industrial roles and continuous upskilling, rather than rapid workforce turnover.

Skills for the green transition

In South Africa, there are several systemic issues that constrain the development of green skills. But opportunities exist to prioritise green skills development in important value chains such as solar PV, wind energy and waste recycling, where most green jobs will be created.

Structural conditions

System-level conditions will be critical in determining whether green skills are developed at scale. These factors are particularly important given South Africa's infrastructure-led transition, where skills shortages can harm project delivery and system performance.

Declining STEM foundations limit the pool of graduates available for advanced roles. This is a decade-long structural deficit. Beyond numeracy, graduates from conventional engineering programmes lack the multidisciplinary competencies that advanced grid, carbon and circular economy roles require, specifically the integration of resource economics, environmental law and systems engineering.

Irregular procurement signals suppress training investment. Without some certainty of employment, manufacturers cannot offer sustained career pathways, TVET institutions cannot align curricula and workers cannot commit to long-cycle qualifications. The result is underinvestment in advanced skills pipelines where it is most needed. More predictable procurement commitments, combined with mandatory skills development spend as a scored criterion in bid evaluation, are the financing levers most likely to generate sustained investment.

Lack of data infrastructure. South Africa has no national green jobs registry, no consolidated enrolment data across green-relevant qualifications, and no occupational forecasting process linking training investment to deployment targets. This means training institutions, development finance institutions and the government lack the demand signals they need to do proper planning for skills development.

Private sector firms are the main providers of green training. The public vocational system lags behind in designing programmes for occupation-specific green skills. The most practical near-term lever to expand the credentialled green workforce is extending RPL to green occupations, using employer records as documented evidence of competence within existing national qualification frameworks.

Job profiles and skills demand by value chain

Green skills demand in South Africa is expected to be anchored in solar PV, wind energy and waste recycling. These are the value chains projected to generate the highest volume of green employment by 2030, while also driving a shift towards more specialised roles by 2050. Within each value chain, the nature of work will evolve from deployment and basic operations towards system performance, resource efficiency and environmental compliance.

Solar PV

Green job profiles expected

- Installation and commissioning roles (e.g. solar PV installers, commissioning technicians).
- Operations and maintenance roles (e.g. solar technicians, service and repair workers).
- System monitoring roles (e.g. solar performance monitoring technicians, control room operators).
- Performance optimisation roles (e.g. energy yield analysts, asset performance managers).
- Commercial and customer interface roles (e.g. rooftop solar advisors, energy service coordinators).
- End-of-life roles (e.g. panel refurbishment and recycling technicians).

Green skills expected

- Installing, testing and maintaining solar PV systems safely and efficiently.
- Monitoring system output and identifying performance losses.
- Diagnosing faults and carrying out preventive maintenance.
- Optimising energy generation and improving system efficiency.
- Managing panel reuse, repair and recycling at end of life.

Mismatches between industry demand and training supply

- Training programmes are largely focused on installation, with limited emphasis on system monitoring and optimisation.
- Weak integration of digital tools used for performance tracking and diagnostics.
- Limited availability of training for lifecycle management, including repair, reuse and recycling of solar panels.
- Customer-facing and advisory roles in distributed solar are not well supported by formal training.

Wind energy (utility-scale wind systems)

Green job profiles expected

- Turbine installation and commissioning roles.
- Wind turbine technicians responsible for operations and maintenance.
- Blade inspection and repair specialists.
- Control room and remote monitoring operators.
- Safety and environmental compliance officers for wind sites.
- Component refurbishment and recycling roles (e.g. blade recycling technicians).

Green skills expected

- Operating and maintaining wind turbines to ensure reliability and safety.
- Conducting inspections, repairs and component replacements (including blades and gearboxes).
- Monitoring turbine performance using digital systems.
- Applying health, safety and environmental standards in wind operations.
- Managing end-of-life processes for turbine components.

Wind energy (utility-scale wind systems) Continued

Mismatches between industry demand and training supply

- Limited domestic training capacity for specialised turbine maintenance and repair roles.
- Skills for blade inspection, repair and recycling are not widely available.
- Insufficient training in remote monitoring and diagnostics systems.
- Reliance on OEM-led training for advanced wind technologies.

The pattern documented in the three priority value chains is consistent across the remaining value chains. In almost every case, entry-level technical skills are broadly available; the gap concentrates in advanced, cross-disciplinary and emerging roles that the formal TVET system has not yet designed programmes for. Annex 11 expands further on skills analysis.

Battery storage and power T&D are expected to help shape green skills demand towards 2050, as renewable energy deployment increases and grid systems become more complex. Employment is expected to grow in roles such as grid operators, substation technicians, control room engineers and smart grid specialists. These roles require skills in real-time system monitoring, fault detection and response, digital grid management and optimisation of power flows. While South Africa has a relatively strong base in conventional grid operations, training provision in emerging areas such as smart grids, automation and digital system management remains limited, creating a potential bottleneck for scaling renewable energy systems.

Green skills delivery: lessons from practice

In South Africa, there are four models of public-private collaboration for developing inclusive green skills that could be replicated and could inform the design principles for future investment.

Industry association-led certification in the solar sector: SAPVIA (South African Photovoltaic Industry Association) has established a national certification framework operating alongside the Sector Education and Training Authorities (SETA) system. This demonstrates how sector associations can shape qualification standards ahead of regulatory requirements and generate industry-recognised credentials before formal mandates exist.

Occupational standard-setting for wind technicians: SAWEA (South African Wind Energy Association) has developed a competency framework for wind technicians that individual firms use to structure internal training pipelines, creating occupational standards more current than the formal TVET curriculum and providing a template for accelerated Quality Council Trades and Occupations (QCTO) qualification development.

Fossil fuel worker retraining through a just transition model: A partnership between the government, a state utility and philanthropic funders has established a retraining centre linked to a coal power station decommissioning site. Displaced fossil fuel workers are trained in solar mounting and battery maintenance roles, with training tied to local employer demand. Training towards a defined occupational role with a guaranteed employment pipeline is the most effective design template identified across all stakeholder consultations.

Public research and academic co-creation: A national research entity and a major university have established co-created research proposals and live industry feedback loops for students, grounding academic green energy programmes in actual policy and industry needs. This approach addresses the transition literacy gap documented across consultations and produces graduates with the multidisciplinary competencies required by advanced green infrastructure roles.

Skills pathways

Women

The workplace and retention barriers for women set out in Section 3, such as travel safety, worksite infrastructure and the unequal care burden, also limit their access to skills training. In South Africa, this is particularly the case for site-based programmes in the Northern Cape, Eastern Cape wind corridors, and Mpumalanga coal transition zones.

Women also face two further barriers to skills progression in South Africa:

STEM pipeline deficits

Declining mathematics pass rates in basic education disproportionately exclude women from technical roles. Without upstream STEM investment, gender representation in higher-skill green occupations cannot improve materially.

Gap in STEM bursaries ring-fenced for women

Private sector bursaries ring-fenced for women in STEM pathways, identified consistently across stakeholder consultations as a critical financing gap, are the upstream intervention required to build the long-term pipeline for higher-skill roles.

Informal and micro-enterprise workers

Informal workers across waste recycling, clean cooking and small-scale solar accumulate practical competence through on-the-job experience, but do not get the opportunity to convert those skills into recognised qualifications. This blocks access to formal employment, constrains income growth and prevents workers from upskilling.

Three instruments exist within South Africa's qualifications system that can address these challenges without new legislation.

1

The SAQA RPL framework provides the legal mechanism for assessing and credentialing competences acquired through informal and firm-based learning. Adapting it to green sector occupations, using employer records such as installation logs, commissioning certificates and safety compliance histories as documented evidence, would extend recognised qualifications to workers who already possess the relevant competence.

2

The Construction Education and Training Authority (CETA) RPL model is applicable to solar installation, battery storage maintenance and EPR compliance roles. It offers a tested operational template for credentialing informal workers in green trades without requiring new legislative instruments and can be adapted by the relevant SETAs with industry association support.

3

The Grootbos Foundation's Green Futures programme trains approximately 20,000 workers annually, targeting 60% women, 20% youth and 5% people with disabilities, with 90% of trainees being placed into roles in the local biodiversity and restoration economy (the fynbos sector). The programme's success is built around identifying specific employer demand within a defined value chain. Extending this approach to EPR-driven waste formalisation would address growing demand for certified MRF operators and EPR compliance coordinators.

SECTION 5

COUNTRY DEEP-DIVE: NIGERIA

While Nigeria's transition is projected to scale from 1.2 million jobs in 2030 to 10.5 million by 2050, the workforce is characterised by informality and a prevalence of nano-enterprises. Growth is driven by decentralised energy solutions rather than utility-scale infrastructure. Realising this potential requires a strategy that improves job quality within existing informal systems, closes the acute gender gap and bridges a widening technical skills deficit.

Key takeaways: Nigeria

Around 87% of Nigeria's green workforce is informal, and 73% operates through nano-enterprises. Improving the quality of these jobs matters more than increasing the level of formality.

Employment is concentrated in one sector. Energy and power accounts for 91% of projected 2030 jobs, leaving the green economy vulnerable. Expanding mobility and transport, and agriculture and nature, will be vital.

A shortage of skilled workers is keeping wages high. Around 60% of green workers earn above the annualised minimum wage, because technicians and engineers are in short supply. Wage floor protections may be needed as training is expanded.

The green workforce will still be over 90% male in 2050. This is because of the dominance of the energy sector, which is currently over 93% male. Closing the gap will require workplace adaptations and deliberate expansion of sectors where women are better represented, like climate-smart agriculture.

The skills system is mismatched to market demand. Nigeria has no national green skills registry, and TVET produces generalists rather than specialists. Bootcamps and firm-based internships could be viable solutions.

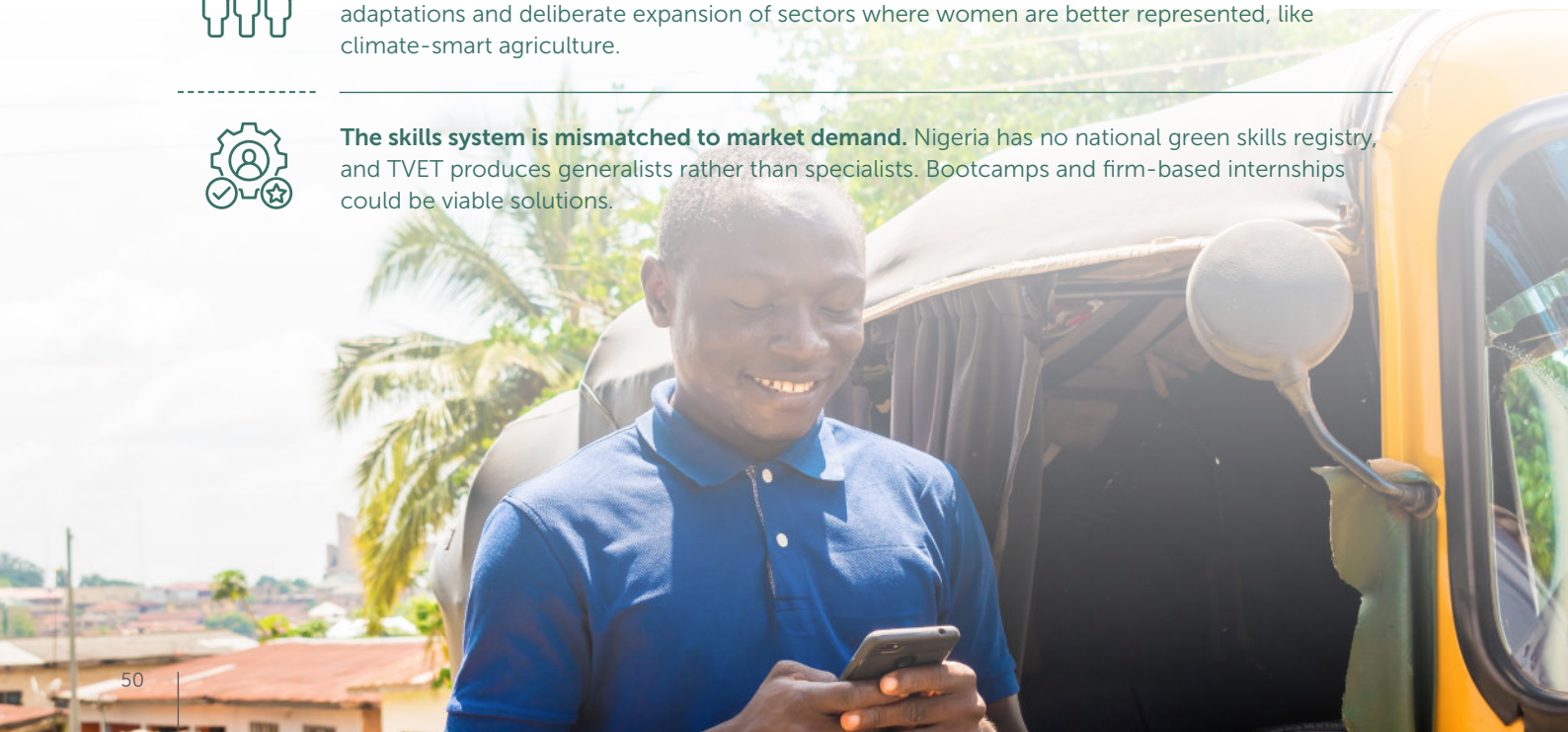


Figure 14 Nigeria headline numbers

Gross Green jobs

2030 UPPER BOUND → 2050 MEDIUM

2.4M → 10.5M

4.4 x growth trajectory. Direct and indirect jobs.

55-57%

Of projected 2030 jobs expected to be indirect; rising to ~62% by 2050

Leading sectors

Energy and power

91%

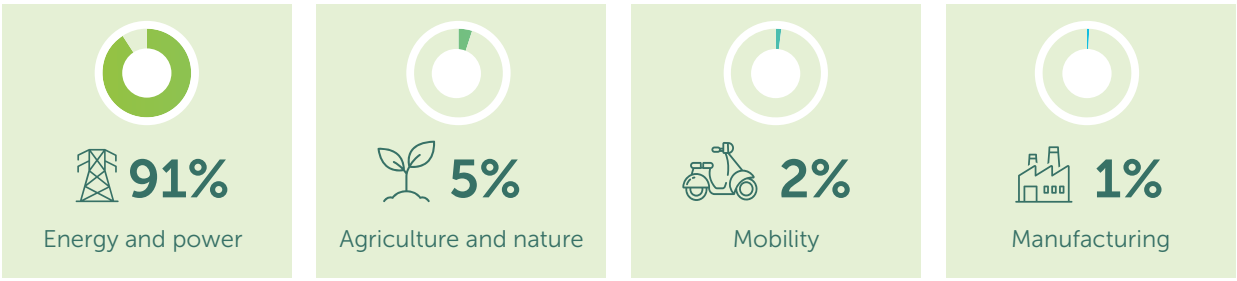
of 2030 green jobs concentrated in a single sector

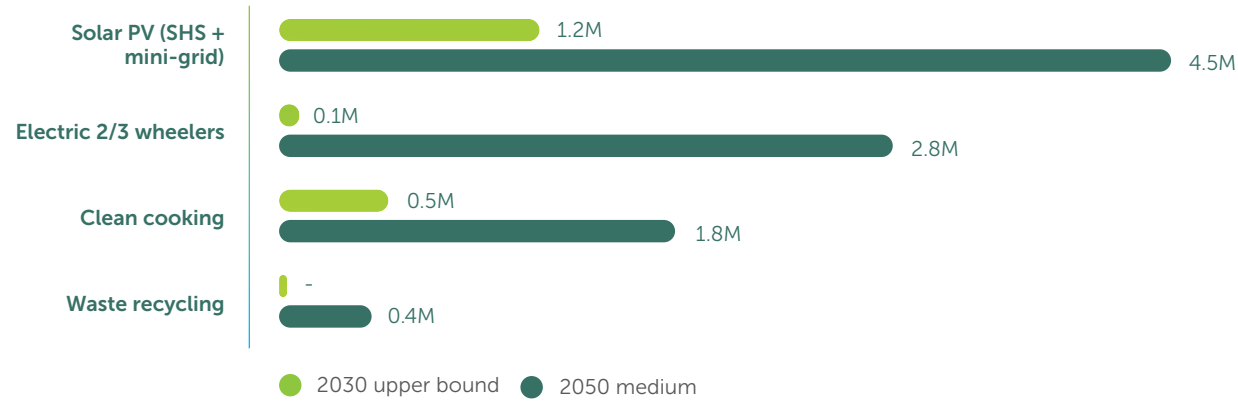
2% → 27%

Mobility emerges as second leading sector by 2050, driven by electric okada/keke fleet.

Top value chains by projected employment

Expected 2030 sectoral split:





Inclusion metrics in green employment

Formal employment rate		Accessible to women		Earning >$475/yr	
87%	88%	8.5%	7.5%	60%	60%
2030 lower	2050 medium	2030	2050	2030	2050

All figures are approximate

Figure 15 Nigeria key insights

Job creation by sector

The energy and power sector will drive most green jobs through to 2030, thanks to off-grid and distributed renewable deployment under Nigeria's Energy Transition Plan. Over the longer term, the electrification of two- and three-wheeler fleets could see mobility and transport grow its share of employment, representing a shift in where green jobs are concentrated.

Three variables will determine the extent to which these trends take place:

Technology choices

The decision between manual, decentralised systems and automated, utility-scale solutions will determine how many workers are required per unit of energy or service delivered, with more labour-intensive pathways generating more employment.

Policy implementation

The pace and quality of delivery of the Energy Transition Plan, mini-grid reform and e-mobility regulation will determine how much of the projected potential is realised.

Climate risk

Flooding, heat stress and land degradation introduce variability across sectors by affecting productivity, infrastructure viability and operational continuity. Their effects are difficult to predict but could lead to fewer jobs in a conservative scenario.

Energy and power

Energy's dominance of green employment stems from three characteristics of Nigeria's transition. First, the country has a large electricity access gap. This means millions of households still require connection through SHS and mini-grids, and because these systems are installed and maintained one household at a time, labour demand scales with the number of connections required rather than with installed capacity.

Second, decentralised delivery is more labour-intensive than utility-scale delivery. Off-grid systems require installation, financing setup, customer training and ongoing servicing at the household level, so employment scales with customer numbers rather than megawatts.

Third, indirect employment multipliers in value chains such as SHS and clean cooking generate significant downstream employment in distribution, sales, financing and maintenance. This amplifies total employment beyond direct installation figures and means energy is the dominant sector by a wide margin across most projected scenarios.

Agriculture and nature

Agricultural employment growth is contingent on how electrification is designed, not just how much is deployed. Where energy access extends to cold storage, irrigation and agro-processing, employment effects across processing, maintenance and distribution will be substantially larger than through household connections alone. The binding variable is therefore policy design. The Nigeria Electrification Project (which focuses on micro, small and medium enterprises and productive users) and the National Agricultural Technology and Innovation Policy (which focuses on technology-enabled modernisation of the agri-food system) are the instruments most aligned with the higher employment scenario. Whether these are implemented at sufficient scale and coordination is likely to be the main determinant of agricultural employment outcomes for 2050.

Mobility and transport

Mobility employment is anchored in the electrification of Nigeria's large okada and keke transport system – the primary vehicle for green job creation in the sector. Electrification will reshape the service economy around it, introducing new roles in battery swapping, charging infrastructure and electric vehicle maintenance while displacing traditional fuel distribution and mechanical services. Given the scale of the existing fleet, even gradual electrification could generate substantial employment. In the near term, however, growth is constrained by infrastructure sequencing: grid and charging limitations mean mobility's share of green employment will remain small until upstream energy investments mature and enable broader electric vehicle deployment (consistent with the sequencing embedded in the Energy Transition Plan). The sector's long-term employment potential is therefore tied to the pace of upstream energy infrastructure development.

Inclusion and workforce structure

Formality

Nigeria's inclusion profile is defined by extreme informality – around 87% of the country's green workforce is informal. This reflects the artisanal nature of decentralised solar installation and maintenance. It also mirrors Nigeria's broader labour market structure: SHS, mini-grids and clean cooking are delivered through agents, micro-franchises and self-employed workers at the household level, producing a workforce dominated by nano- and micro-enterprises by design.

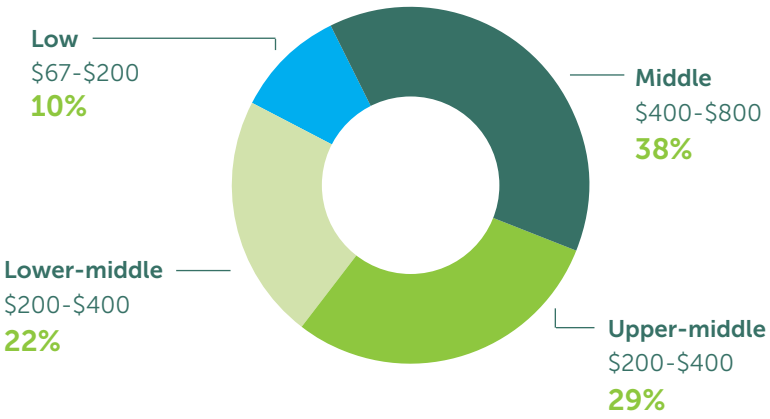
Formality is lowest in energy and power (12.3% formal) where nano-enterprise SHS installers dominate, and highest in agriculture and nature (17.2% formal). Effective policy responses must work within informal systems: the most viable interventions extend social protection to informal workers, introduce portable credentials that recognise skills acquired outside formal training, and establish quality standards. Mandating formalisation is unlikely to be effective at the scale and speed the sector requires.

Income

Nigeria's income distribution is shaped by high demand for specialised roles, like engineers, project managers and certified technicians. These are required by off-grid energy deployment, which is an early-stage sector where demand for specialised labour has outpaced training supply. Off-grid solar, mini-grid operations and battery storage commissioning need certified engineers and diagnostics technicians whose skills are scarce domestically, and Nigeria's annualised minimum wage falls within the middle-income bracket, suggesting a large portion of the

green workforce could earn at or above this level. This is a phase effect: as the training pipeline scales, the scarcity premium is likely to compress. Policymakers should anticipate this compression and design complementary measures — minimum wage enforcement, social protection floors and career progression pathways — to prevent earnings from declining as the workforce scales.

Figure 16 Annual income band distribution in Nigeria



Nigeria's income distribution is shaped by high demand for specialised roles, like engineers, project managers and certified technicians. These are required by off-grid energy deployment, which is an early-stage sector where demand for specialised labour has outpaced training supply. Off-grid solar, mini-grid operations and battery storage commissioning need certified engineers and diagnostics technicians whose skills are scarce domestically, and Nigeria's annualised minimum wage falls within the middle-income bracket, suggesting a large portion of the green workforce could earn at or above this level. This is a phase effect: as the training pipeline scales, the scarcity premium is likely to compress. Policymakers should anticipate this compression and design complementary measures — minimum wage enforcement, social protection floors and career progression pathways — to prevent earnings from declining as the workforce scales.

Gender

Nigeria's green workforce is projected to be more than 91% male in 2030, and this will remain unchanged to 2050. This is driven by the 'infrastructure-first' phase of Nigeria's Energy Transition Plan, which will mean jobs in the energy and power sector – a male-dominated area – will make up the bulk of green employment.

The barriers driving this pattern operate through the six systemic domains described in Section 3, but with a dynamic specific to Nigeria's transition: because a single sector dominates near-term employment while employing very few women, sectoral composition is the primary gender lever here, not workplace conditions. To close the gap, two complementary strategies are required: increasing women's participation within the energy sector through recruitment, training and workplace adaptation, and expanding the share of employment in agriculture and other sectors where women are better represented.

Policies linking electrification to agricultural productive use are the most direct instrument for carrying out both of these strategies at once. In Nigeria's context, three sector-specific entry points stand out: dedicated land allocations for women's cooperatives in agriculture, where land ownership is the binding collateral constraint; investment in women-led cooperatives in waste management, where women already dominate informal collection; and standardised certification for roadside e-mobility mechanics, which is critical to distributing electrification benefits beyond corporate service centres.

Scaling women-led green enterprises

When finance, infrastructure, regulation and market access are addressed separately, women-led enterprises stay stuck in the low-value segments of green value chains. This was highlighted by key informant interviews. To scale women-led businesses, those four elements must be tackled in coordination.

Catalytic finance unlocks entry. Alternative credit-scoring systems, VSLAs (village savings and loans associations) and demand-aggregation mechanisms expand access where collateral-based lending excludes women. Philanthropic 'risk capital' is particularly strategic at this stage, absorbing early-stage risk and piloting productive-use financing models that commercial lenders are unwilling to support in nascent markets.

Productive infrastructure converts capital into value creation. Shared production hubs equipped with industrial-grade machinery enable women to shift into higher-value processing and technical services without prohibitive upfront investment. When paired with locally delivered training and multi-year funding cycles, these investments translate technical skills into viable enterprises rather than short-term income activities.

Market guarantees reduce uncertainty and enable expansion. Phased compliance windows prevent upfront exclusion, while EPR frameworks and procurement quotas create predictable demand. Guaranteed market access improves investment viability and reduces the risk profile for small and early-stage firms.

Relational support stabilises growth. Solidarity cohorts, entrepreneur-led mentorship and on-the-job training models reduce isolation and confidence barriers. When combined with market-led growth strategies that prioritise revenue generation over grant dependence, these practices support movement from subsistence activity to scalable participation in the green economy.

Enterprise size

Nano- and micro-enterprises comprise 73% and 21% of the workforce respectively. This pattern of is projected to remain unchanged through to 2050, and it reflects the last-mile delivery architecture of Nigeria's green economy: off-grid solar, clean cooking and e-mobility scale through millions of independent operators. While this decentralised model lowers barriers to entry and creates accessible livelihoods, nano-operators often lack access to social protection, structured training, quality certification and collective bargaining power. These conditions will need to be improved from within the decentralised system, through portable digital credentials, mobile-based social protection registration, quality standards within agent networks, and fair compensation frameworks.

Age

The 2030 projections show green employment concentrated in the 25-44 age cohort, which accounts for 48.2% of all green workers. This reflects the physical and technical demands of Nigeria's dominant value chains, solar installation, clean cooking, and battery storage, where midstream roles in deployment, maintenance, and operations favour workers with 5-15 years of labour market experience. Youth participation at 16.5% represents a meaningful entry pipeline, driven largely by informal apprenticeship networks and the labour-intensive nature of off-grid solar distribution across Nigeria's expanding rural and peri-urban markets. The 35-44 age group represents 25.3% of green employment, confirming that experienced workers in their peak productive years anchor the current green workforce. By 2050, the projected age structure is expected to shift modestly toward younger cohorts as TVET systems, the National Renewable Energy and Energy Efficiency Policy training targets, and expanding value chains

in electric mobility and battery storage create more structured entry points for youth, though the dominance of experienced workers in technical and supervisory roles will likely persist.

Skills for the green transition

In Nigeria, the main skills constraints appear in the value chains that will generate the largest share of green employment: distributed solar PV, clean cooking and e-mobility.

Scale of training is the main issue. The most relevant national green skills programme only produces hundreds of graduates per year, and the TVET system creates hardware-centric generalists for a labour market that increasingly requires newer technological skills.

Structural conditions

Nigeria's green skills gaps reflect structural conditions that cut across the green economy. There are four main issues that any sector-specific intervention will need to address.

Training is not aligned with the green labour market. Public TVET institutions teach wiring and installation while the market requires AI-based fault detection, IoT monitoring and battery management system (BMS) firmware governance. The informal apprenticeship system produces capable workers but without standardisation or certification, leaving high-value technical roles to be filled by expatriate experts.

Firms and non-formal providers are the de facto training system. Most of Nigeria's green workforce is trained outside the formal system, by firms, civil society organisations and informal networks. Education stakeholders believe a 'triple helix approach' is necessary to tackle this: the government provides policy context, industry provides applied training, and institutions provide theory. Structured programmes that tie training to employment pathways, such as the Rural Electrification Agency NextGen initiative, offer early evidence of what this could look like.

Lack of data infrastructure. Nigeria has no mechanism for tracking green skills demand against the trained workforce pipeline. No national registry exists and enrolment data for green-relevant qualifications is not consolidated. This means training institutions cannot plan for demand and the government is unable to sequence skills investment ahead of deployment.

Geography compounds the deficit. Northern Nigeria has the greatest energy access deficit and the largest potential for distributed renewable energy employment, yet also the lowest digital literacy in the country. Current institution-based provision does not reach this population at a meaningful scale. Emerging evidence suggests that flexible, community-level delivery models are likely to be more effective than fixed institution-based provision.

Job profiles and skills demand by value chain

Nigeria's highest-volume green employment growth is projected to come from distributed solar PV, clean cooking and e-mobility, which together will account for the majority of new green jobs through to 2050. Across these value chains, skills provision will be concentrated in installation and basic technical roles, while employment growth will accelerate in higher-value functions like operations, digital monitoring, BMS governance, carbon MRV and smart grid management.

Annex 11 expands further on skills analysis

Solar PV (utility-scale and distributed solar systems)

Green job profiles expected

- Assembly and manufacturing roles (e.g. solar panel assembly technicians, quality control inspectors).
- Installation and commissioning roles (e.g. PV installers, system designers).
- Operations and maintenance roles (e.g. maintenance technicians, asset managers).
- Digital and remote operations roles (e.g. IoT remote operations technicians, AI fault detection specialists).
- Commercial and distribution roles (e.g. PAYGO solar agents, last-mile distribution technicians).
- End-of-life roles (e.g. solar e-waste and battery recyclers).

Green skills expected

- Installing, testing, and commissioning solar PV systems from household to mini-grid scale.
- Designing and sizing solar systems for varying applications.
- Monitoring system performance via IoT platforms and remotely identifying faults.
- Applying AI-based diagnostics for fault detection and predictive maintenance.
- Managing PAYGO customer platforms, including onboarding and default management.
- Processing solar e-waste and retired batteries in compliance with environmental standards.

Mismatches between industry demand and training supply

- Existing installation skills require upgrading for IoT and AI-based systems.
- Digital monitoring and remote operations skills are absent from mainstream TVET curricula.
- Solar e-waste and battery recycling skills do not exist in-country.
- Training coverage in Northern Nigeria remains thin despite high potential.
- Customer-facing PAYGO management and financial literacy roles are not supported by formal TVET programmes.

E-mobility

Green job profiles expected

- Assembly roles (e.g. EV final assemblers, battery pack assemblers).
- Charging and infrastructure roles (e.g. charging/swap station technicians, EV infrastructure planners).
- Commercial roles (e.g. sales and rider finance officers).
- Maintenance and diagnostics roles (e.g. EV mechanics for diagnostics and motor repair).
- Lifecycle management roles (e.g. battery recycling and disposal personnel).
- Displaced worker transition roles (e.g. retrained petrol mechanics).

Green skills expected

- Assembling and testing electric two- and three-wheelers.
- Installing, commissioning and maintaining battery swapping and EV charging infrastructure.
- Diagnosing and repairing EV motor controllers, battery management systems and drivetrains.
- Applying high-voltage safety protocols.
- Managing battery end-of-life logistics, collection and processing.
- Providing rider finance and PAYGO fleet management services.

E-mobility Continued

Mismatches between industry demand and training supply

- No national EV technician standard exists, excluding informal mechanics.
- Battery assembly skills exist but require upgrading regarding BMS firmware and thermal runaway.
- Battery recycling and disposal skills do not exist in-country.
- EV charging infrastructure planning has no country evidence and current training is nascent.
- There is a substantial displacement risk for petrol-dependent mechanics with no managed transition pathway.
- Sales and rider finance skills are adequate in supply, the only role assessed as sufficient.

Clean cooking

Green job profiles expected

- Fabrication and upstream roles (e.g. improved cookstove fabrication technicians, welders).
- Distribution and logistics roles (e.g. last-mile distribution agents, LPG tanker drivers).
- Commercial and finance roles (e.g. consumer finance officers for PAYGO systems).
- Consumer engagement roles (e.g. consumer awareness and extension agents).
- Carbon and climate finance roles (e.g. MRV technicians, climate finance documentation specialists).
- Repair and maintenance roles (e.g. appliance maintenance technicians).

Green skills expected

- Fabricating and quality-checking improved cookstoves to defined standards.
- Distributing clean cooking products via last-mile retail networks.
- Managing PAYGO consumer finance relationships.
- Documenting fuel savings and carbon emissions for MRV and results-based finance.
- Conducting consumer awareness and behaviour change activities.
- Maintaining and repairing clean cooking appliances and LPG equipment.

Mismatches between industry demand and training supply

- Carbon MRV and climate finance documentation skills are completely absent from mainstream TVET programmes.
- Consumer awareness and extension agents lack country evidence in the training system.
- Improved cookstove fabrication skills exist but need upgrading to meet international or carbon verifier standards.
- Results-based financing disadvantages programmes serving women and low-income workers, making grants more appropriate.
- LPG distribution training is limited to basic logistics, missing PAYGO and carbon reporting elements.
- Productive-use roles, such as women as cookstove artisans, are underrepresented in programme design.

Green skills delivery: lessons from practice

Nigeria's most effective green skills outcomes have emerged from models that train for a defined role with a guaranteed income or employment pipeline. Four documented approaches share this design logic and inform what scaled provision could look like.

Demand-linked training pipelines. Training programmes tied directly to employment pathways consistently produce better outcomes in workforce quality and deployment capacity than standalone supply-side programmes. The Rural Electrification Agency's NextGen Renewable Energy Service Company model, combining structured bootcamp training with nine-month paid internships, is a model of success which could be expanded.

Coordinated industry and government investment. Where industry investment and government programme support are aligned around clear employment targets, workforce scale-up is achievable in short timeframes. The Climate Action for Women in Nigeria Mobility and Youth in Power Foundation partnership, targeting 14,000 electric vehicle technician trainees by the end of 2026, is an example in the e-mobility sector.

Development finance structured to build skills in climate-critical value chains. Development partners have a role in funding training in value chains that are both climate critical and labour intensive, but where market incentives alone are insufficient to drive investment. The Federal Ministry of Environment and World Bank IDEAS Project, delivering six-month intensive training in solar irrigation and climate-smart agriculture, offers a replicable model.

A 'triple helix' curriculum model. Where government provides policy direction, industry defines practical requirements and academic institutions deliver theoretical grounding, the curriculum stays closer to market demand without requiring frequent reform. The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) regional certification framework, aligned with international accreditation standards, shows how this approach can operate at scale.

Skills pathways

Women

The workplace, mobility and financing barriers facing women that are set out in Section 3 also affect women's access to training in Nigeria's green economy. This is especially true in the energy and power sector, which will generate the largest share of green jobs and yet exhibits low female participation.

Women also face two further barriers to skills progression in Nigeria:

Training programmes lack childcare provisions

Training programmes structured without childcare provisions, especially those with fixed schedules, long durations or site-based delivery, effectively exclude a substantial share of the potential female green workforce.

Technical networks are dominated by men:

Women in clean cooking, SHS distribution and e-mobility sales operate at the margins of technical networks. This limits their access to informal knowledge transfer, peer learning and mentorship, which are the primary routes to upskilling for informal workers in Nigeria.

Informal and micro-enterprise workers

The nano- and micro-enterprise workforce, comprising solar agents, clean cooking distributors, informal e-mobility mechanics and waste collectors, is likely to acquire competence through informal apprenticeship and firm-based learning, rather than through the formal TVET system.

Nigeria's institutional architecture has instruments to support credentialing without requiring formal TVET enrolment.

1

ECREEE Regional Certification in Sustainable Energy Skills. This framework allows industry associations and employer groups to certify workers against defined occupational standards without TVET enrolment. It is grounded in an internationally recognised accreditation standard and does not require re-entry into the formal qualifications system. It is the most directly applicable instrument for credentialing Nigeria's PAYGO solar agents, SHS installers and clean cooking distributors.

2

The National Business and Technical Examinations Board and National Board for Technical Education provide the domestic authority for RPL pathways in green occupations. Firm operational records, including PAYGO agent performance data, installation logs and carbon reporting histories, constitute verifiable evidence of prior competence that RPL frameworks can formally recognise. Adapting these frameworks to green sector occupations is a near-term lever that does not require new legislation.

3

Portable digital credentials linked to firm-based learning records. Given that 73% of Nigeria's projected green workforce will operate in nano-enterprises, portable digital credentials tied to firm platforms, PAYGO networks and agent management systems offer a scalable route to recognition that works within the informal structure. Stakeholder consultations identified this as a higher-impact instrument than traditional RPL for workers who do not have fixed employer relationships.

SECTION 6

COUNTRY DEEP-DIVE: KENYA

Kenya's green transition is distinguished by its sectoral diversity and a relatively mature digital infrastructure, positioning the country for a more balanced employment landscape than its regional peers. While the transition is projected to scale from 364,000 jobs in 2030 to 2.6 million by 2050, the main challenge lies in coordinating workforce development across a decentralised governance system. Success depends on moving beyond foundational technical skills towards advanced digital integration and domestic verification capabilities.

Key takeaways: Kenya

Kenya's 2030 green jobs are spread across sectors, but utility solar will dominate by 2050. In 2030, jobs will be split across SHS (18%), clean cooking (19%), distributed renewable energy (17%) and utility solar (16%). But utility solar is projected to grow 30x between 2030 and 2050.

The county-based system hampers workforce planning. Employment is growing at county level but training systems are still centralised or fragmented. Green skills need to be implemented into County Integrated Development Plans.

The market is shifting from foundational to advanced technical skills. Manual installation skills are common, but demand is moving to solar analytics, remote monitoring and EV bus assembly. Currently, specialists are often imported.

Kenya has carbon market potential, but this is undermined by a lack of verification capability. Without local experts to verify carbon credits, Kenya relies on expensive international consultants, meaning the financial benefit goes elsewhere.

Unpaid placements and lack of childcare are excluding youth and women. Unpaid industrial work placements ('attachments') and the absence of childcare at TVET institutions harm inclusion. Paid attachments and on-site childcare have been shown to improve retention, particularly for women in technical trades.

Figure 17 Kenya headline numbers

Gross Green jobs

2030 UPPER BOUND → 2050 MEDIUM

364K → 2.6M

7.1x growth trajectory. Most sectorally balanced at 2030 horizon.

55-57%

of projected 2030 jobs expected to be indirect

Leading sectors

Energy and power

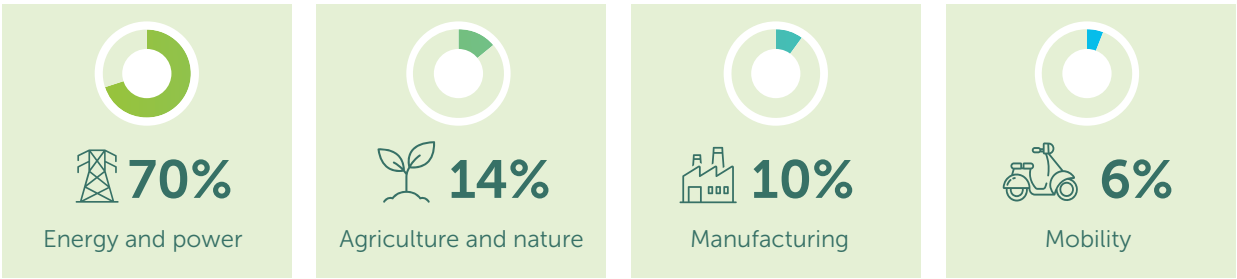
70%

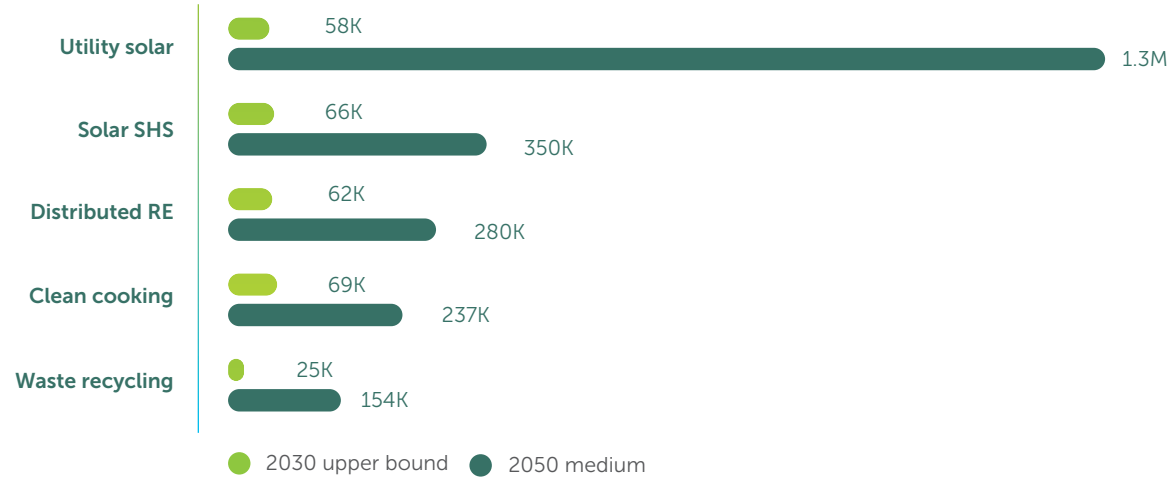
Distributed across 4 sub-sectors: SHS (18%), clean cooking (19%), distributed RE (17%), utility solar (16%)

Utility solar grows ~30x from ~58K to ~1.3M jobs by 2050,

Top value chains by projected employment

Expected 2030 sectoral split:





Inclusion metrics in green employment

Data note: Kenya inclusion metrics are not available. The Kenya Integrated Household Budget Survey (KIHBS) microdata was inaccessible at the time of this analysis. Estimates of formality status, gender composition, income distribution and enterprise size that are presented for South Africa and Nigeria could not be produced at equivalent precision for Kenya. Inclusion comparisons across the three countries should be interpreted with this data asymmetry in mind.

All figures are approximate

Skills for the green transition

Kenya has a diversified green economy, and the country has built basic skills across most green value chains through its TVET system. But the transition will increase demand for roles that go beyond manual installation and conventional maintenance, which have traditionally been taught, towards newer technical capabilities.

Supply shortfalls against projected demand are therefore evident across most roles, and there are opportunities to prioritise green skills development in the value chains where most green jobs will be created – particularly geothermal, e-mobility and clean cooking.

Structural conditions

Kenya's skills gaps are shaped by structural conditions that are distinct from both South Africa and Nigeria, though they share some features with both. Four conditions are particularly consequential.

The curriculum is misaligned with market demand. Kenya's TVET institutions have built foundational competencies, but the market has moved faster than curriculum reform. Public TVETs teach manual installation and basic fabrication while employers require AI-driven solar analytics, IoT remote monitoring, battery energy storage system (BESS) operations, and carbon MRV documentation. Only a small fraction of TVET trainers have adequate green skills exposure, meaning curriculum reform, even when initiated, cannot be implemented without trainer upskilling.

Private firms are the primary green training infrastructure. Private sector firms across e-mobility, clean cooking and geothermal are the primary providers of occupation-specific green training. Employer-anchored institutions, such as the KenGen Geothermal Training Centre, show that firm-based training can serve skills markets beyond a single company's workforce. Formalising this learning requires Kenya's qualification authorities to extend RPL pathways to green occupations, using verifiable firm records as evidence of competence.

Devolved governance and a lack of data. Kenya's governance structure means skills demand is partly shaped at county level, yet green skills have not been integrated into county planning frameworks. This creates a coordination gap between national TVET reform agendas and local deployment realities, particularly for climate-smart agriculture, ecosystem conservation and distributed energy, where employment is county-level but demand signals do not reach national training institutions. Kenya also lacks consolidated data on enrolment and graduation rates for green-relevant qualifications. This limits visibility of the supply–demand gap and likely understates informal green employment in agriculture and waste recovery.

Job profiles and skills demand by value chain

Green skills demand in Kenya is expected to be anchored in geothermal, e-mobility and clean cooking. These are the value chains projected to generate the highest volume of green employment by 2030, while also driving a shift towards more specialised roles by 2050. Within each value chain, the nature of work is expected to evolve from manual installation and basic operations towards digital integration, data-driven system management and specialised technical services that enable climate finance access and dispersed deployment at scale.

Geothermal

Green job profiles expected

- Upstream exploration and resource assessment roles (e.g. geothermal resource engineers, well logging and testing technicians, drilling rig operators).
- Construction and infrastructure roles (e.g. civil and construction technicians, health, safety and environment (HSE) officers).
- Operations roles (e.g. geothermal plant operators, geothermal reservoir technicians).
- Maintenance and diagnostics roles (e.g. geothermal maintenance technicians, condition monitoring engineers).
- Environmental and social management roles (e.g. environmental compliance officers for geothermal sites).

Green skills expected

- Characterising and monitoring subsurface geothermal resources.
- Operating and maintaining geothermal plant equipment, including turbines and heat exchangers.
- Applying HSE standards specific to geothermal operations.
- Conducting condition monitoring and predictive maintenance of geothermal plant systems.
- Managing well integrity and reservoir pressure over the operational life of a geothermal field.

Mismatches between industry demand and training supply

- Reservoir engineering and drilling-rig operator skills do not exist in-country; these roles depend on imported expertise.
- Geothermal maintenance technician competences have no country evidence, leaving operations reliant on original equipment manufacturer (OEM) contractors.
- The KenGen Geothermal Training Centre functions as an employer-anchored institution, limiting system-wide replication.
- No formal qualification pathway exists for geothermal site HSE officers.
- Training provision does not extend to smaller-scale or distributed geothermal uses.

E-mobility

Green job profiles expected

- Assembly and manufacturing roles (e.g. electric motorcycle assembly technicians, battery assembly and pack technicians, EV wiring and control systems operators).
- Quality assurance roles (e.g. electric two- and three-wheeler QA and safety inspectors).
- Installation and charging infrastructure roles (e.g. charging station technicians, EV charger manufacturing technicians).
- Maintenance and diagnostics roles (e.g. EV maintenance and diagnostics technicians).
- Commercial and platform roles (e.g. e-mobility platform agents, customer service agents).
- Lifecycle management roles (e.g. recyclable material processors for battery casings and electronic waste).

E-mobility Continued

Green skills expected

- Assembling and testing electric motorcycles and light electric vehicles.
- Installing and integrating battery packs, BMS units and motor controllers.
- Diagnosing and repairing EV electrical and drivetrain faults.
- Installing and maintaining EV charging infrastructure, including grid connection.
- Applying high-voltage safety protocols during assembly, servicing and repair.
- Processing battery and electronic waste in line with environmental standards.

Mismatches between industry demand and training supply

- EV component fabrication has no country evidence; highly specialised welding labour is currently imported.
- Component supply chain coordination has no country evidence.
- EV maintenance and diagnostics skills exist but need upgrading, with no standardised national qualification.
- Advanced battery diagnostics, motor controller tuning and BMS firmware skills are absent from mainstream TVET curricula.
- Training provision is dominated by firm-based programmes with narrow, fleet-specific scope.
- No training pathway exists for battery end-of-life processing.

Solar PV (utility-scale and distributed solar systems)

Green job profiles expected

- Assembly and upstream roles (e.g. solar PV assembly technicians, solar inverter assembly technicians, QC and testing engineers).
- Installation and commissioning roles (e.g. solar PV installers, electrical integration engineers).
- Project management and supervision roles (e.g. solar project site supervisors).
- Operations and maintenance roles (e.g. solar maintenance and operations technicians).
- Commercial and customer interface roles (e.g. solar system sales and after-sales service advisors).
- Micro-enterprise and distributed service roles (e.g. local owners of micro, small and medium enterprises (MSMEs) and operators for solar service and maintenance).

Green skills expected

- Installing, testing and commissioning solar PV systems for residential, commercial and utility-scale applications.
- Integrating solar systems with distribution networks and managing grid-tie connections.
- Monitoring system output, diagnosing performance losses and carrying out preventive maintenance.
- Applying AI-driven analytics and IoT remote monitoring tools for performance optimisation.
- Managing productive use of energy applications including solar irrigation, agro-processing and cold chain.
- Operating and servicing solar systems as micro-enterprises across dispersed rural locations.

Solar PV (utility-scale and distributed solar systems) Continued

Mismatches between industry demand and training supply

- AI-driven solar analytics and IoT remote monitoring are absent from mainstream TVET curricula.
- Training provision is concentrated at the installation end; system monitoring, optimisation and diagnostics are underserved.
- Productive use of energy roles carry no credential or progression pathway.
- Only an estimated 3 to 4% of TVET trainers have adequate green skills exposure, constraining curriculum reform.
- Customer-facing and advisory roles in distributed solar are not supported by formal training.

The structural pattern across Kenya's remaining value chains mirrors that of the priority chains. Foundational skills are broadly available but insufficient in volume, and the roles driving higher-value employment in operations, digital management and climate finance are either absent from training provision or produced in volumes far below deployment requirements.

Annex 11 expands further on skills analysis

Green skills delivery: lessons from practice

Kenya's most effective green skills outcomes share the design principle that holds across all three focus countries: training for a defined occupational role with a guaranteed employment or income pipeline consistently outperforms generic green credentials. Four documented models illustrate this.

Paid apprenticeships. Linking classroom instruction to paid industry apprenticeships produces stronger retention and skills quality outcomes than unpaid models. Industry stakeholders confirm that paid apprenticeships are the most effective retention intervention available in Kenya's green skills system, and the GIZ-supported dual training model across energy and manufacturing value chains offers a replicable template for TVET reform.

Employer-anchored training as a scalable model. Where employers anchor training institutions collectively, training capacity can serve a skills market beyond any single company's needs. The KenGen Geothermal Training Centre demonstrates this at regional scale and the model is directly applicable to the solar, BESS and e-mobility sectors as they grow.

Green skills delivery: lessons from practice (continued)

Firm-based training operating within national qualification frameworks. Kenya's comparative advantage is firm-based training that is formally recognised within a national qualification structure. Private bus and motorcycle operators have established technician training programmes linked to fleet maintenance needs and recognised within national frameworks, a position neither Nigeria nor South Africa has fully achieved. Extending this approach to other value chains would be practical route to scaling green technician supply without building parallel qualification infrastructure.

Embedding sustainability into existing curricula. Integrating green skills modules into existing curricula would scale green skills provision without requiring new qualifications or institutions. This approach is the most cost-efficient route to broadening the green skills base at system level and is replicable by qualification bodies across the region.

Skills pathways

Women

The six systemic barriers described in Section 3 are present in Kenya's green economy, but there are three structural conditions specific to Kenya that are the main determinants of women's participation and retention.

Childcare is the main participation barrier

Childcare is the most frequently cited structural barrier for women entering green technical trades in Kenya. Some measurable improvement has been made: industry stakeholders and local governments have funded childcare centres at TVET institutions, and this has raised female participation and programme completion rates. However, this type of structural intervention has yet to be scaled into standard TVET programme design.

Unpaid industrial apprenticeships disproportionately disadvantage women

Women often cannot absorb the cost of full-time unpaid work, which affects their participation in industrial apprenticeships. This reduces the pipeline of women completing technical green qualifications in the value chains where gender representation is already lowest, such as e-mobility, solar and BESS.

County-level planning challenges affect rural women workers

Devolved planning shapes demand for skills at the local level where most women's green employment is generated. The absence of green skills from county planning frameworks means that women in rural counties face training supply that does not reflect local deployment realities.

The most effective design responses for improving female participation in Kenya's green economy combine paid attachment structures with locally delivered training that does not require extended periods away from home. Training for productive-use roles in solar agro-processing, irrigation and cold chain, which more closely reflect women's existing agricultural livelihoods, represents a higher-penetration pathway to female green employment than formal technical training in construction-phase energy roles.

Informal and micro-enterprise workers

Three instruments available within Kenya's current institutional architecture could extend recognised credentials to informal and micro-enterprise workers without requiring new legislation.

1

RPL pathways. The National Industrial Training Authority (NITA) and the Kenya National Qualifications Authority (KNQA) provide the domestic authority for RPL in green occupations. Firm operational records, including installation logs, commissioning certificates and PAYGO agent performance data, constitute verifiable evidence of prior competence within these frameworks. Adapting RPL to green sector occupations is a near-term lever that uses existing institutional architecture and does not require new legislation.

2

Greening curriculum. Systematically embedding sustainability modules into existing curricula would help to scale green skills across Kenya's TVET system without requiring high investment costs. Extending coverage of BESS operations, EV diagnostics, carbon MRV and farm data analytics would close the second-tier competency gaps identified across the value chain mapping without requiring new institutions.

3

Productive use of energy as the primary informal employment multiplier. Solar agro-processing, solar irrigation and cold chain storage are the largest informal employment multipliers in Kenya's green economy, yet training for these micro-entrepreneurs carries no credential or progression pathway. Developing occupational micro-credentials for productive-use roles, tied to NITA's existing qualification levels, would extend formal recognition to the employment tier generating the most green livelihoods for rural Kenya.

SECTION 7

RECOMMENDATIONS FOR ACTION

The shift to clean cooking, distributed solar, e-mobility and circular economy systems represents one of the continent's most significant opportunities: to expand formal employment at scale, to close gender gaps in labour market participation and to provide security, progression and fair wages to the informal workforce. But Africa's green transition will not deliver on its employment potential without action.

The recommendations below suggest simultaneous action at regional, national and sectoral levels. Governments must provide the policy and data foundations that make green employment legible and plannable. Development finance institutions must reorient capital towards employment-intensive sectors and condition disbursement on quality outcomes. Training institutions must close the gap between skills supply and market demand. And the private sector must treat workforce development as an operational commitment rather than a compliance function.

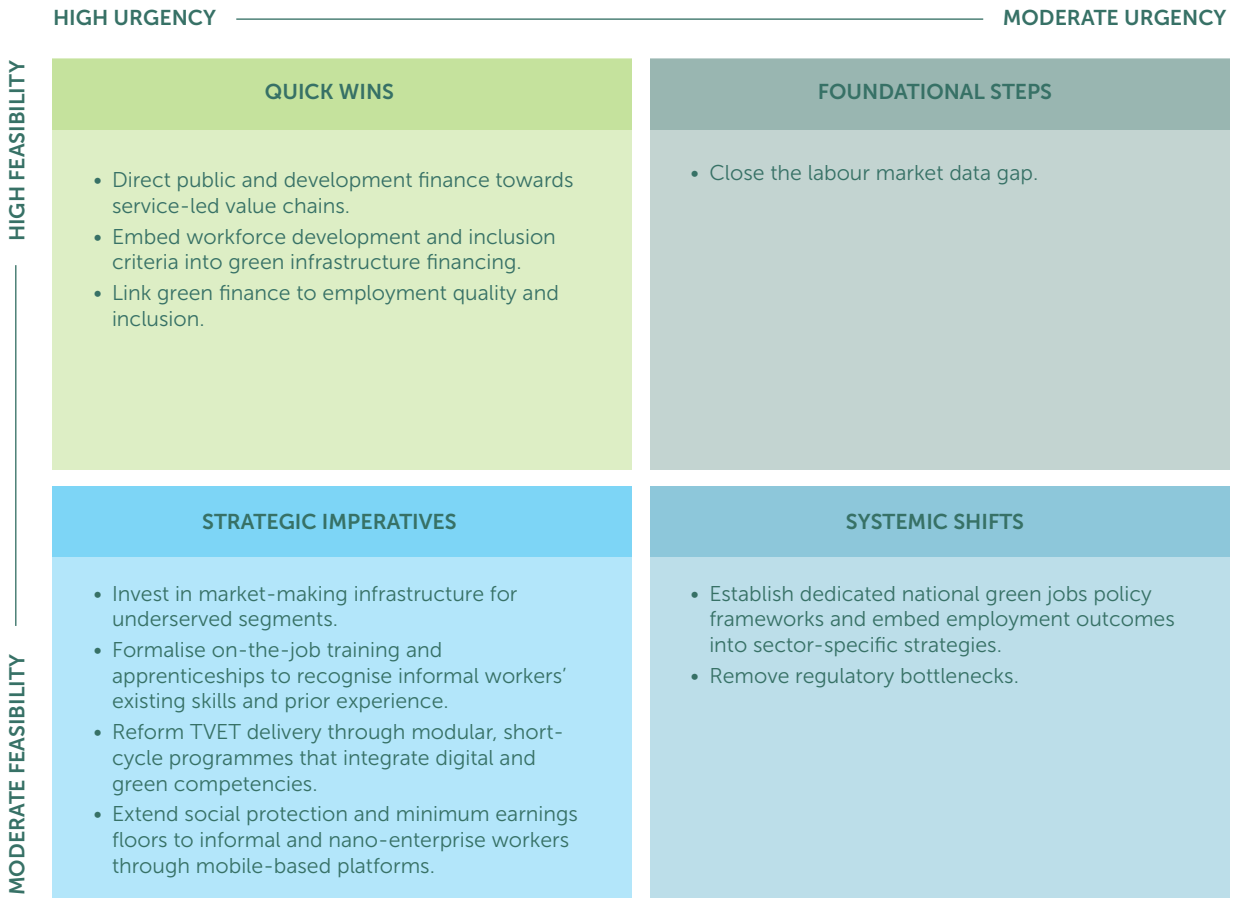
Where these efforts converge, the green transition becomes a credible mechanism for formalisation, gender equity and inclusive growth. Where they do not, the opportunity risks being captured by foreign supply chains and concentrated in a narrow tier of established firms.

Ten actions for the green transition

This study recommends ten actions for unlocking Africa's green employment potential. These actions have been prioritised in terms of urgency and feasibility and organised into a prioritisation matrix, shown below.

The matrix sequences the ten actions across four quadrants: quick wins that can be activated immediately through existing climate finance and private sector adjustments, foundational steps that establish data and policy infrastructure, strategic imperatives that require deeper institutional reform, and systemic shifts that need structural change and stakeholder alignment. Together, these constitute a set of 'no-regret' actions that will be vital under both the 2030 lower-bound deployment and the 2050 high-employment scenarios.

Figure 18 Action prioritisation matrix



Quick wins: high urgency, high feasibility

1. Direct public and development finance towards service-led value chains

The employment return on green investment will be determined by where capital is allocated. An overemphasis on utility-scale renewable energy infrastructure, which generates most of its employment in the construction phase and captures a lower share of women and informal workers, risks concentrating green finance in the value chains with the lowest long-run employment potential. Service-chain value chains, including clean cooking distribution, SHS maintenance networks, e-mobility services and waste recycling, as well as the indirect jobs generated across supply chains, distribution networks and after-sales services, generate more employment per dollar invested and reach a wider range of workers. DFIs should use value-chain-specific gender covenants and track women in technical, management and enterprise roles.

Relevant for:
DFIs, funders, finance ministries, planning authorities.

Potential timeline:
Short term.

Geographic application:
Pan-Africa.

2. Embed workforce development and inclusion criteria into green infrastructure financing

The separation between capital investment in infrastructure and investment in the workforce produces coordination failures. When deployment outpaces workforce availability, projects import expertise, depress local wage formation and miss a major capacity-building opportunity. Earmarking a defined share of deployment financing for workforce training ensures skills supply aligns with deployment. Gender inclusion criteria, such as minimum women's participation ratios in construction and operations phases, gender-responsive worksite infrastructure and safe transport provisions, should also be part of deal terms. Other metrics could include women-led distributors, women-owned subcontractors, retention of women in technical roles and progression into higher-skill roles.

Relevant for:
DFIs, investors, funders.

Geographic application:
Pan-Africa.

Potential timeline:
Short term.

3. Link green finance to employment quality and inclusion

'Jobs created', the standard metric used in development finance, is inadequate for capturing the quality of employment. This obscures whether the green transition is producing decent work or merely relabelling precarious employment under a green label. Financing instruments should therefore be conditioned on indicators that capture wage levels relative to statutory thresholds, social protection coverage, contract duration, and the proportion of workers drawn from historically excluded groups — including women and workers on formal contracts. Replicable models for empowerment-oriented financing already exist and should be scaled.

Relevant for:
DFIs, investors.

Geographic application:
Pan-Africa.

Potential timeline:
Short term.

Foundational steps: moderate urgency, high feasibility

4. Close the labour market data gap

Governments currently cannot sequence training investments ahead of green deployment because they lack occupation-level employment data. Green employment will not materialise simply as a by-product of climate policy. To close this gap governments must integrate green occupation modules into existing labour force surveys, disaggregated by gender, employment type and value chain. They must also link survey data to national qualifications registries and social protection enrolment records to track the formalisation of informal green workers over time. These systems should be designed for continental interoperability from inception, using African Union statistical harmonisation mechanisms to enable shared data infrastructure.

Responsibility also lies with the private sector. Industry associations need to publish annual sector workforce plans anchored to three-year deployment projections, disaggregated by occupation, geography and gender, including shares of women in technical, distribution and management roles. This would provide the accountability baseline for gender covenants and inclusion targets across the full investment and training ecosystem. Occupation-level employment projections from the private sector would represent an important demand signal without which TVET institutions cannot justify curriculum investment, DFIs cannot underwrite workforce readiness conditions, and governments cannot sequence public skills expenditure.

Relevant for:
Governments, supported by National Statistics Offices and the African Union; private sector; industry associations.

Geographic application:
Pan-Africa.

Potential timeline:
Short and medium term.

Strategic imperatives: high urgency, moderate feasibility

5. Invest in market-making infrastructure for underserved segments

Green value chains in Africa will not scale unless the nano- and micro-enterprise tier is strengthened. Private sector actors have a direct commercial interest in the depth and quality of the markets they serve, so co-investment in market-making infrastructure for underserved groups is both a development priority and a business case. There are several areas where companies and sector associations could invest alongside public and development finance partners. These include business development services and digital financial literacy support tailored to women-owned clean cooking and SHS enterprises; simplified formalisation pathways for informal e-mobility mechanics and waste recyclers that do not require exit from the informal delivery model; and youth-targeted apprenticeship programmes with guaranteed income during the training period. These investments build the supply chain depth and service quality that commercial operators require and generate the documented enterprise performance track records that financial institutions need to extend credit to the nano-enterprise tier.

Relevant for:
DFIs, investors.

Geographic application:
Pan-Africa.

Potential timeline:
Short to medium term.

6. Formalise on-the-job training and apprenticeships to recognise informal workers' existing skills and prior experience

The majority of Africa's green workforce acquires competencies through on-the-job learning and informal apprenticeships. Co-credentialling frameworks that allow firms' internal documented training programmes to contribute towards recognised national occupational certificates could be developed by training institutions and qualifications authorities working jointly with industry associations. Expanding RPL enables uncertified workers to convert demonstrated competence into portable credentials, improving their mobility, access to better-paying roles and integration into formal financial services. Portable digital credentials, verified and stored on platforms accessible via basic mobile devices, would allow workers to improve their bargaining position and would tackle the information asymmetry that depresses wages for experienced but uncertified workers. DFIs could provide co-financing and institutional recognition to industry associations willing to lead this process.

Relevant for:
Training and qualifications authorities, industry associations, and DFIs.

Potential timeline:
Medium term.

Geographic application:

Pan-Africa, leveraging existing frameworks such as SAQA in South Africa, NBTE/NABTEB in Nigeria, and Technical and Vocational Education and Training Authority, Kenya National Qualifications Authority (KNQA), and Kenya Renewable Energy Association in Kenya.

7. Reform TVET delivery through modular, short-cycle programmes that integrate digital and green competencies.

Africa's TVET systems produce qualifications calibrated to legacy technologies, but the market is shifting towards digital integration. This must be addressed. Furthermore, because fixed-site institutions struggle to reach underserved communities and workers cannot afford long classroom absences, training must become modular and competency-based, delivered through mobile training units and directly on employer premises. Embedding green skills modules into existing programmes would be more resource efficient than launching standalone green credentials. This mirrors the approach taken in Germany's dual system during the Energiewende, where renewable energy modules were added to existing electrical and mechanical qualifications. Women-only cohorts with employer-guaranteed placement commitments and training schedules, and locations adapted to reduce barriers related to childcare and mobility, could improve female participation rates.

Relevant for:
TVETs, governments (for financing).

Potential timeline:
Medium term.

Geographic application:

Pan-Africa, specifically addressing geographic disparities such as the training access gap in Northern Nigeria and remote agricultural counties in Kenya.

8. Extend social protection and minimum earnings floors to informal and nano-enterprise workers through mobile-based platforms.

Most green jobs projected for 2030 are informal. Clean cooking distributors, waste collectors and SHS agents are building the green economy's operational infrastructure with limited occupational health and safety coverage or with no minimum earnings standard. Social protection instruments, including health insurance, accident coverage and contributory pension schemes, could be extended to self-employed green workers as a condition of market authorisation for the platforms and companies that engage them. Using existing digital payment platforms and mobile money architectures – where Africa leads globally – to facilitate mobile-based social protection registration could turn a commercial payment channel into a scalable safety net.

Relevant for:
Governments, supported by digital payment platforms.

Potential timeline:
Medium term.

Geographic application:

Pan-Africa, but most urgent for Nigeria where 87% of the green workforce is informal, and Kenya where mobile money infrastructure is highly mature.

Systemic shifts: moderate urgency, moderate feasibility

9. Establish dedicated national green jobs policy frameworks and embed employment outcomes into sector-specific strategies

Governments across Africa need to develop standalone national green jobs strategies, as Kenya and Ghana have begun to do, that define employment targets by sector and value chain, assign institutional ownership to labour and energy ministries jointly, and establish coordination mechanisms between climate, finance and employment portfolios. Just transition frameworks, energy plans, NDC implementation plans and national industrial strategies all need to include occupation-level workforce targets linked to deployment milestones, with gender-disaggregated participation requirements and explicit provisions for informal and nano-enterprise workers. Countries at earlier stages of policy development could leverage the African Union's continental frameworks, including Agenda 2063 and the AfCFTA, to anchor green jobs policy within broader regional integration strategies and secure peer accountability.

Relevant for:
Governments.

Geographic application:
Pan-Africa.

Potential timeline:
Medium term.

10. Remove regulatory bottlenecks

Administrative friction in mini-grid licensing, solar hardware importation and fuel pricing currently penalises clean alternatives and suppresses employment-generating investment. Labour economics research on infrastructure-led job creation shows that employment multipliers per megawatt installed are highest when projects proceed in predictable sequences, because this allows local labour markets and supply chains to develop absorptive capacity. When South Africa's REIPPPP bid windows stall or grid connections bottleneck, the workforce assembled for one project disperses before the next materialises, destroying the knowledge and organisational capital that had begun to accumulate.

Relevant for:
Governments.

Potential timeline:
Short to medium term.

Geographic application:
Pan-Africa. Removing licensing and pricing bottlenecks is especially relevant in Nigeria and Kenya, while enforcing inclusive procurement bid thresholds is the primary lever for South Africa's REIPPPP.

Supporting actions

To complement the recommended priorities, the following are extra actions that provide the institutional and operational foundations for Africa's green transition. These measures address the enabling environment: the regulatory frameworks, private sector norms and inclusive practices that allow green value chains to scale.

PAN-AFRICA

Enforce inclusive local procurement standards and extend supply chain inclusion beyond first-tier subcontracting. Corporate commitments to local content must move beyond retrospective compliance checks and the first tier of the supply chain, where they are most visible to procurement auditors. Unless domestic content provisions are embedded at the procurement design stage, Africa's green transition could end up generating employment primarily in foreign supply chains. Minimum thresholds for local hiring, women's participation and MSME subcontracting must carry enforceable weight at the bid evaluation stage to incentivise inclusive supply chains. Extending these commitments into second- and third-tier subcontracting, where most small and informal enterprises operate, would lead to greater inclusion. This would require structured supplier development programmes, simplified procurement processes accessible to smaller firms, and mentoring arrangements that build the technical and administrative capacity of emerging enterprises.

Transition the private sector from commission-only sales models to structured training and professional development programmes. The rapid expansion of PAYGO solar and clean cooking relies on agent-based distribution networks designed to keep fixed costs low. However, commission-only incentive structures generate short-term distribution reach at the cost of retention, product integrity and workforce quality. Transitioning to structured capability programmes – combining technical product training, financial literacy and diagnostics, paired with training stipends – is an operational investment. Minimum earnings floors and occupational safety standards for all contracted workers need to be formalised as company policy. Structured career progression tracks are particularly effective at retaining women, who exit informal green roles at disproportionately higher rates when no progression pathway exists. Where sector associations are active, minimum training and worker standards could be agreed collectively and published. It is also recommended that private firms track gender-disaggregated data on recruitment, retention, progression and supplier participation.

NIGERIA

Develop certification frameworks for green energy installers and clean cooking distributors. Nigeria lacks standardised occupational certification for the two fastest-growing green employment categories: off-grid solar installation and clean cooking distribution. Without certification, quality is uneven, consumer trust is fragile and workers cannot signal their competencies to new employers or across state boundaries. Establishing nationally recognised certification for these occupations would raise service quality, improve worker mobility and provide the government with a documented workforce it can plan around.

KENYA

Release restricted KIHBS microdata to enable granular, county-level workforce planning. The KIHBS microdata would substantially improve the quality of green employment intelligence available to policymakers and researchers.

Develop a national EV technician standard and close the carbon finance verification gap. Two sector-specific regulatory gaps must be addressed in the near term. The first is the absence of a national occupational standard for electric vehicle maintenance and diagnostics. Kenya's e-mobility sector is growing rapidly, particularly in two- and three-wheeler segments, and the installed vehicle base will soon generate maintenance demand that the current workshop ecosystem cannot absorb. Establishing a nationally recognised EV technician standard now, before the skills shortage materialises at scale, positions the workforce system to lead demand rather than respond to it. The second is the verification gap in carbon finance. Kenya's forests, rangelands and coastal ecosystems have substantial carbon sequestration potential, but realising the employment benefits of carbon credit markets requires a domestic workforce capable of measurement, reporting and verification to international standards. Investing in MRV capacity development, including training for field-level data collection, remote sensing interpretation and registry-compliant documentation, would unlock carbon finance flows that in turn generate sustained employment in conservation and ecosystem restoration.

SOUTH AFRICA

Coordinate the coal transition through geographically embedded reskilling. The political economy of energy transitions shows that communities dependent on a single declining industry face a compound disadvantage: the erosion of the local tax base weakens public institutions precisely when those institutions are most needed to coordinate economic diversification. Effective reskilling programmes succeed when they are located in affected communities, designed around the actual occupational profiles of displaced workers, and connected to concrete employment pipelines in renewable energy, grid infrastructure or environmental remediation. This requires tighter institutional coordination between the Department of Mineral Resources and Energy, the Department of Higher Education and Training, the Department of Science and Innovation, and Mpumalanga's provincial government.

SECTION 8

FUTURE RESEARCH AVENUES

This brief section outlines some future research avenues relevant to this study.

- **Net employment and just transition modelling:** Estimating job losses in fossil fuel, conventional transport and carbon-intensive agriculture alongside green job creation, to produce net employment balances by country and sector. South Africa's coal transition is the most immediate case requiring this analysis.
- **Adaptation-focused employment:** A dedicated quantitative exercise modelling employment in adaptation-aligned sectors, including coastal systems management, disaster risk reduction, water and sanitation, and climate-resilient agriculture. The JSNE (Jobs and Skills for the New Economy) framework[61] provides a starting methodology that could be applied at country level.
- **Greening of existing roles:** Quantifying the scale of workforce transition where existing workers move into green equivalents of their current occupation, including motorcycle taxi operators, mechanics and agricultural workers. This requires a different methodological approach from the deployment-driven JPU model used here.
- **Job quality and worker welfare:** Analysis of wages, income stability, worker protections and social protection access across green value chains. The income band disaggregation in this study provides a starting point but does not substitute for dedicated job quality measurement.
- **Skills pipeline quantification:** Mapping training provider capacity, enrolment volumes and qualification output against the occupational demand projections in this study, to produce country-level skills gap estimates that are actionable for TVET reform and financing decisions. This would also include identification of the highest-priority qualifications for each green value chain.
- **Skills pathways for informal and self-employed workers:** Developing entry-point frameworks by skill level within green value chains, with specific attention to RPL pathways and progression from informal to more stable employment structures.
- **Productive use of energy employment:** Quantifying jobs generated downstream of clean energy access, including agro-processing, cold chain operations and digital services, which are currently captured only partially through indirect multipliers.
- **Rural versus urban green workforce dynamics:** Disaggregating employment projections and inclusion analysis by geography to understand how green job quality, accessibility and gender composition differ between rural and urban contexts.
- **Firm-based and informal training systems:** Mapping employer-led, apprenticeship-based and platform-mediated training that currently fills the gap left by formal TVET, and assessing how these can be recognised and brought into national qualification frameworks.
- **Formalisation pathways for nano- and micro-enterprises:** Analysing the conditions under which informal green enterprises can access working capital, achieve certification and transition to more stable employment structures.

[61] Systemiq & WRI, 2025.

- **Pan-African interoperability of green credentials:** Assessing the feasibility of mutual recognition frameworks for green occupational qualifications under AfCFTA provisions, to support workforce mobility and raise qualification standards across borders.
- **Longitudinal tracking and baseline updating:** Establishing a recurring data collection framework to track actual green employment against projections over time, enabling model recalibration and policy accountability as deployment targets evolve.[62]
- **Cost-effectiveness of workplace safety protocols:** Research must prioritise the impact of physical insecurity and GBV as a barrier to women in field-based green roles. In South Africa and Nigeria, the risk of harassment during night shifts or on unsafe transit routes to remote construction and energy sites is a primary deterrent. Future studies should evaluate the cost-effectiveness of 'intentional design' interventions, such as providing safe transport, secure site facilities and 'solidarity cohorts', in which women are paired in groups during field placements to mitigate harassment.
- **Dismantling the 'leaky pipeline' and 'sticky floors':** The research identifies a 'leaky pipeline', where women exit technical fields shortly after graduation due to exclusionary work cultures or better opportunities in non-technical sectors. Women also face 'sticky floors' caused by time poverty and a disproportionate burden of unpaid domestic care. Priority should be given to longitudinal studies that track career progression and evaluate the impact of flexible work arrangements and on-site childcare on female retention.
- **Sectoral segmentation and value chain upgrading:** Research must identify pathways for moving women into higher-productivity midstream and upstream roles, including local manufacturing, system design and logistics management. This includes evaluating the efficacy of phased formalisation windows that allow women-led micro-enterprises to meet technical standards and certifications incrementally rather than facing prohibitive upfront compliance costs.

[61] Green employment projections are expressed in absolute terms rather than as shares of total sectoral employment or labour force participation, as doing so would require country-specific forecasts of total sectoral employment through to 2030 and 2050 – a modelling exercise that falls outside the scope of this study. Contextualising green job figures against projected labour force growth is identified as a valuable extension of this work and is noted as a priority for follow-on research.

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