IDRC · CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

African Centre for Technology Studies
ACTS
Knowledge for Better Livelihoods

EVI-SICEE RESEARCH BRIEF No. 03

Employment Opportunities And Gaps For Women And Youth In Clean Energy Value Chains – Insights From Kenya

August 2025

Ann Kingiri, Wycliffe Amakobe and Mourine Cheruiyot

Design and layout by Peter Ongalo

Key Messages

- The predominant clean energy value chains in the informal sector provide multiple job opportunities for young people and women in Kenya.
- Women remain underrepresented in distributed renewable energy (DRE) workforce and in technical, skilled, and leadership roles, despite their growing participation in informal and entry-level jobs.
- Gender disparities in Science, Technology Engineering and Mathematics (STEM) education and vocational training limit women's ability to access better-paying technical jobs in clean energy value chains.
- Structural and socio-cultural barriers, such as unpaid care work, mobility restrictions, and social bias, continue to exclude women from clean energy careers.
- Policy interventions backed by contextualized evidence disaggregated by gender, age, and disability are needed for critical and deliberate inclusion measures like flexible working hours, childcare, or safety considerations for women in technical roles.
- Optimizing business support through business incubation hubs and related platforms can increase the quality and quantity of clean energy jobs in informal microenterprises, especially for women and young people.

Overview

Kenya's transition to clean energy is generating significant employment opportunities across various value chains, including bioethanol, biogas, solar, electric cooking, e-mobility, and energy efficiency. These sectors offer job creation across production, installation, maintenance, distribution, and after-sales services. For instance, expanding local bioethanol production could create up to 370,000 jobs, primarily for smallholder farmers, while productive use of energy (PUE) activities such as solar-powered irrigation and agro-processing supported an estimated 65,000 jobs in just one year (Lee et al., 2021; Ministry of Energy and Petroleum, 2024). Moreover, distributed renewable energy systems like solar home systems (SHS) and mini-grids continue to generate formal and informal jobs, particularly in rural and peri-urban areas. However, women and youth remain underrepresented in skilled and leadership roles across the clean energy sector. Despite comprising 23% of the DRE workforce, women are largely concentrated in informal, part-time, and lower-paying roles, with limited access to training, credit, and enterprise leadership opportunities (Power for All, 2022). Structural barriers such as unpaid care work, gender stereotypes, limited access to vocational education, and exclusion from policy design persistently hinder equitable participation. To realize inclusive clean energy growth, Kenya must invest in gender-responsive policies, skills development, targeted financing, and localized manufacturing, ensuring the clean energy transition drives both environmental sustainability and social equity.

Approach And Methodology

This article is part of a project **evidence for informing scaling and impact in youth and women-led clean energy enterprises (EVI-SICEE)** in Africa funded by IDRC and implemented by a consortium led by African Centre for Technology Studies (ACTS). In 2024, ACTS and partners conducted an assessment to evaluate the status of women and youth entrepreneurship in Kenya's clean energy sector. The study employed both quantitative and qualitative methods, beginning with an in-depth scoping study that guided the development of data collection tools. These tools were subsequently used to conduct a comprehensive survey involving 1,093 clean energy entrepreneurs from 32 counties across Kenya. Of the respondents, 65% were youth, while 44% were women. Notably, 57% of the participants reported being employees in different capacities within the multiple clean energy value chains. For the women and youth entrepreneurs, majority were involved in non-technical roles such as sales, supply, and distribution, while their participation in technical activities, including manufacturing and fabrication, remained limited. To enrich the data, the assessment also incorporated key informant interviews and focused group discussions. The findings were validated during a stakeholder workshop held in February 2025. This research brief integrates insights from the different data sets and evidence generated in Kenya.

Emerging Job Opportunities Across The Clean Energy Value Chain

Evidence from scoping study

A review of literature provides an impressive picture around the opportunities presented by the clean energy sector. We highlight selected cases in this section.

Bioethanol value chain: Over 1.25 million households currently use bioethanol for cooking, supporting formal, better-paying jobs primarily in sugarcane farming. Over 1,000 additional jobs exist in bioethanol production, transport, retail, and stove distribution (Lee et al., 2021). With local production currently meeting just 1.2 million litres of the 40 million litre demand, there is significant potential to generate up to 370,000 new jobs, mainly for smallholder farmers, through enhanced domestic production (Ministry of Energy and Petroleum, 2024).

Biomass improved cookstove (ICS) value chain: Offers diverse employment opportunities across manufacturing, distribution, sales, after-sales services, and support functions such as R&D and microfinance, with strong potential to engage women, youth, and informal artisans through decentralized production models. However, the sector remains highly informal, with limited policy support for reskilling displaced charcoal workers and a lack of reliable data to quantify job creation despite its growing role in Kenya's clean energy landscape (Lee et al., 2021). Figure 1 illustrates value chain opportunities for internationally manufactured stoves.

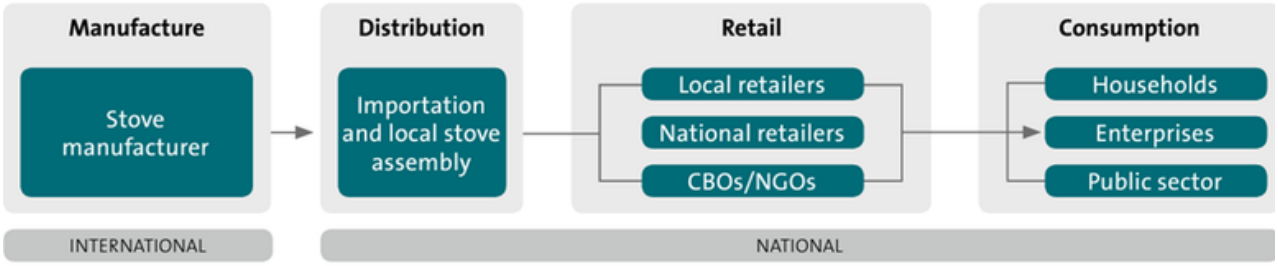

Figure 1: Biomass improved cookstoves value chain-internationally manufactured stoves model. (European Union Energy Initiative Partnership Dialogue Facility & Practical Action, 2015)

Solar PV value chain: Solar home systems (SHS) generated over 14,500 direct formal jobs in 2021, compared to 3,160 in commercial and industrial (C&I) standalone systems and only 91 in mini grids (Power for All, 2022). The SHS companies selling 100,000 units annually could create 800 sales roles and 200–300 technician positions (EEP Africa, 2019). Clean cooking fuels, including LPG, biogas, and bioethanol, created an estimated 15,000 to 35,000 direct informal jobs in 2019 (Lee et al., 2021; IRENA, 2020). In this value chain, most employment opportunities are found in physically demanding roles such as loaders at depots and filling plants, which require minimal training. The value chain is increasingly automated, especially in activities like cylinder manufacturing, revalidation, and filling, further reducing the potential for widespread employment growth.

Biogas value chain: Supported approximately 800 jobs in 2019 across manufacturing (450 jobs), installation (220), after-sales services (320), and stove-related employment (Lee et al., 2021). Informal opportunities, particularly in installation and construction, also play a vital role, adding an estimated 770 jobs.

Electric cooking value chain: Employment estimates include 10 formal jobs in wholesale and 980 combined jobs in retail, 210 formal and 770 informal, per 1,000 electric pressure cookers (EPCs) sold (Lee et al., 2021). Figure 2 illustrates this dynamic value chain.

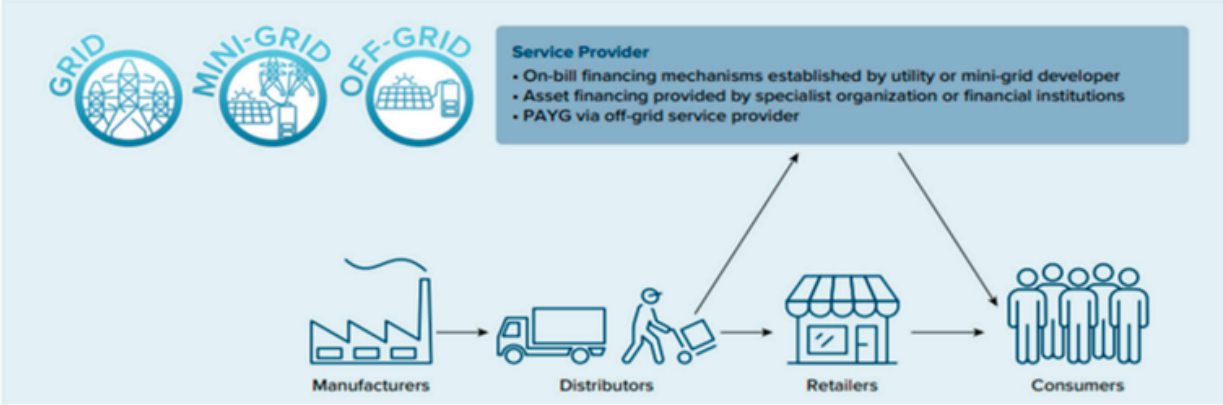

Figure 2: Electric cooking value chain. Source: (Leary et al., 2021)

Mini-grid development value chains: A study of 33 Kenyan mini-grids revealed they supported 4,407 jobs, with over 85% (3,755) of those during the design and construction phases (Oyuma et al., 2023). As these systems expand, ongoing employment will be driven by operations, maintenance, and customer services.

Productive use of energy (PUE): Activities such as solar-powered irrigation, food processing, cold storage, and poultry lighting are supporting indirect employment by expanding business productivity. In 2017–2018 alone, PUE contributed approximately 65,000 jobs in Kenya (Lee et al., 2021). Solar-powered appliances for agro-processing, refrigeration, and weaving further demonstrate PUE's cross-sectoral potential (SNV Kenya, 2022).

E**nergy efficiency value chain:** Retrofitting can boost job intensity from 17 to 20 jobs per USD 1 million invested, demonstrating a strong multiplier effect (American Council for an Energy Efficient Economy, 2021).

E-mobility value chain: Although local EV manufacturing is yet to take off in Kenya, employment prospects are high in the service and maintenance segments. European estimates suggest maintenance could account for 39% of all e-mobility jobs, followed by battery manufacturing (17%) and installation (11%) (AIE, 2020). Figure 3 provides an overview of the potential job opportunities within the value chain.

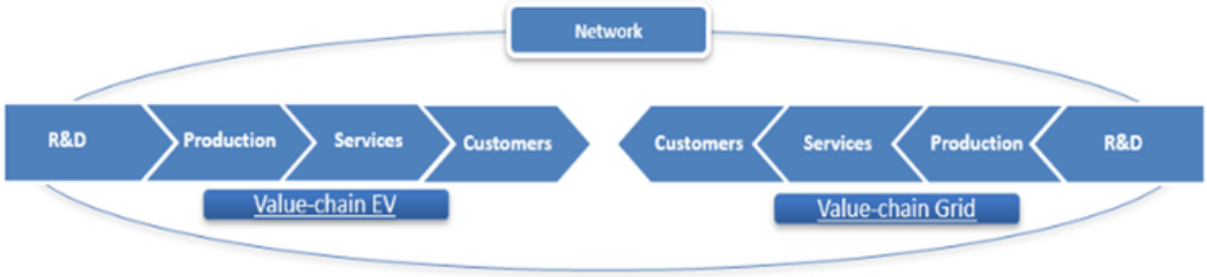

Figure 3: The three value chains of e-mobility. (van der Steen et al., 2015)

LPG: Most employment opportunities are found in physically demanding roles such as loaders at depots and filling plants, which require minimal training. The value chain is increasingly automated, especially in activities like cylinder manufacturing, revalidation, and filling, further reducing the potential for widespread employment growth. Additionally, LPG stove sales and distribution generate limited new jobs, as most retailers operate LPG sales alongside other business ventures. Since LPG stoves are imported and manufactured to high durability standards, they require minimal maintenance, further constraining opportunities for after-sales services or repairs. Centralized bulk importation and packaging of LPG also reduces the need for decentralized labour inputs, thereby minimizing localized employment impacts within the sector.

Evidence from survey data

The survey conducted under this research sheds further light around the opportunities presented by clean energy sector for women and young people. The empirical data further exposes the roles played by these gender groups in the clean energy entrepreneurship ecosystem.

Sector based deployment value chain

Figure 4 below illustrates that sales and installation are the most dominant activities across solar, clean cooking, and combined technology enterprises, while manufacturing remains limited, except in clean cooking, underscoring the need to strengthen local production to deepen value chain engagement and job creation. Sales dominate employment activities across the clean energy sector, with over 80% of enterprises in solar and combined technologies, and 70% in clean cooking engaging in sales, underscoring it as a major job driver in Kenya's clean energy ecosystem. Installation work is the second most common engagement, particularly in solar enterprises (40%), indicating that technical installation roles are a critical avenue for employment growth, especially for youth and entry-level technicians. Supply and distribution roles are prominent in solar (38%) and clean cooking (29%) enterprises, further demonstrating the potential of downstream segments of the value chain to absorb both formal and informal labour.

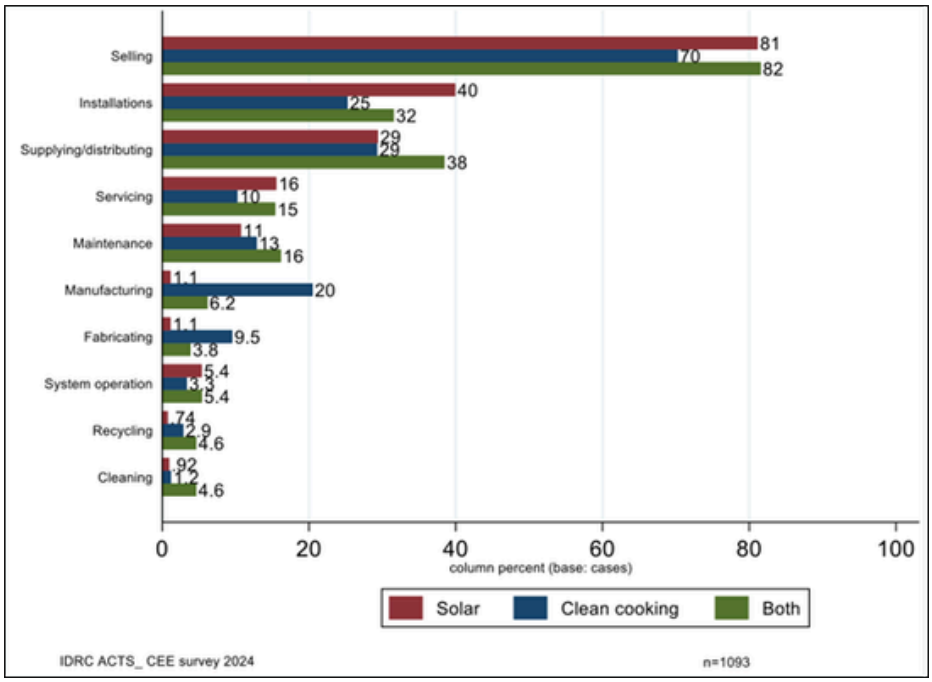

Figure 4: Deployment value chain by sectors

Gendered patterns in women and youth roles in clean energy value chains

An analysis from all the data sources presents a better understanding on the roles, which is important for targeted policy and practice support.

Figure 5 below reveals gendered patterns in clean energy enterprise operations, while both male- and female-owned businesses are heavily engaged in sales, men dominate technical roles like installation and maintenance, whereas women show higher participation in distribution, manufacturing, and fabrication, highlighting their emerging role in production-related activities within the sector.

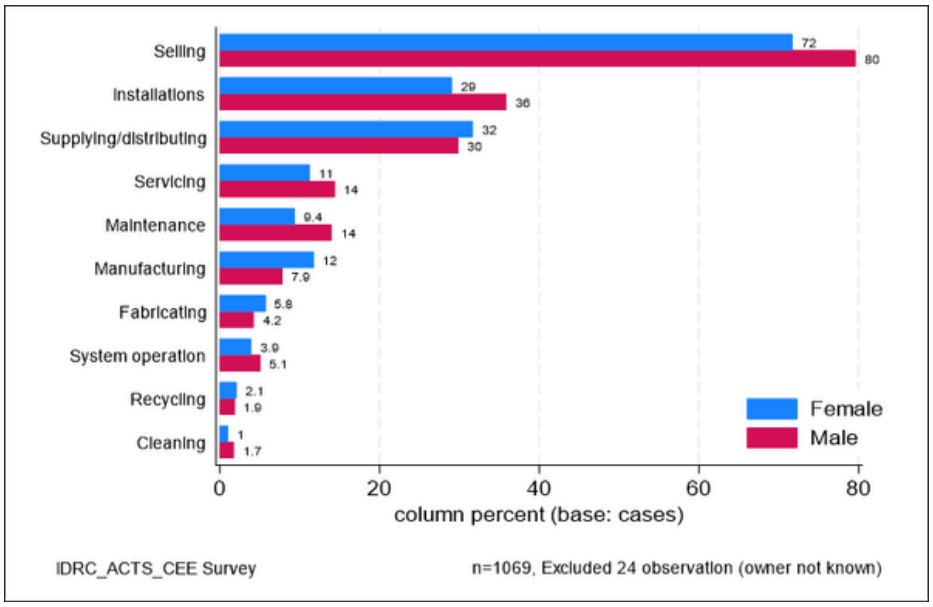

Figure 5: Deployment value chain by gender

Women in clean energy enterprises are primarily concentrated in sales and supply roles across solar and clean cooking sectors, with minimal representation in technical areas such as servicing and fabrication, underscoring the need for targeted training and mentorship to increase their participation in skilled roles and promote gender equity in the sector.

In figure 6 below, disaggregated assessment by gender established that overall, youth are most active in sales and installations, male adults lead in technical roles, and female adults excel in sales but are underrepresented in other sectors. These highlights distinct patterns of specialization among the groups. Youth are primarily active in sales and installations, suggesting that interventions targeting these entry points can be highly effective in scaling youth engagement in the sector. Female adults are concentrated in sales roles but remain underrepresented in more technical, high-value roles, reinforcing the need for gender-targeted technical training and policy incentives to diversify their participation across the value chain. Male adults dominate technical roles, reflecting prevailing gender biases in skill-based and higher-paying occupations, and highlighting the need for deliberate inclusion strategies and mentorship programs for women and youth in technical domains.

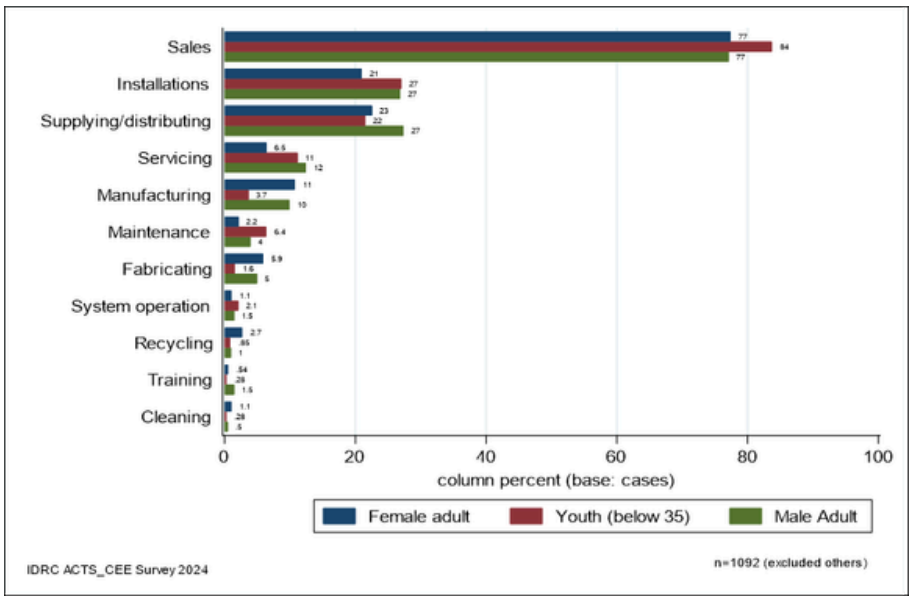

Figure 6: Roles of the respondents in CEE

Evidenced Based Lessons For Policy And Practice

Based on evidence from the EVI-SICEE project and informed by the Kenyan context, we draw a number of learning lessons that could stimulate a productive conversation for policy and practice among the clean energy ecosystem stakeholders.

Gender disparities in access to jobs, skills, and leadership roles

Our study has shown that, majority of women in the clean energy value chains are essentially participating as micro entrepreneurs (as opposed to small and medium entrepreneurs) and the informality of this context cannot be ignored. In the bioethanol value chain, many informal jobs are occupied by women running kiosks that sell bioethanol fuel alongside other household goods (Lee et al., 2021).

This informality nature of work perpetuates inclusivity where work is typically insecure, underpaid, and lacks essential protections such as health insurance, pensions, or structured career growth. Further, women involvement is in these jobs is informal and entry-level low skilled roles, including sales, distribution, stove retail, and technical services. The imbalance is more pronounced in technical roles such as system installation, maintenance, and engineering, where access to vocational training and upskilling opportunities for women is limited. As a result, gender disparities in employment outcomes continue to undermine inclusive growth within the clean energy sector. These disparities are well reported in literature across scales as shown below.

- Women are disproportionately concentrated in part-time, informal, and lower-paid roles such as retail and direct sales, which contributes to a persistent gender wage gap (Baruah, 2017b; Power for All, 2022).
    - In solar home systems (SHS) and pico-solar value chains, women are highly visible in sales and distribution roles, leveraging their community networks and entrepreneurial acumen (Shirley et al., 2020).
    - In the distributed renewable energy (DRE) sector, women are often found in unskilled or soft-skill positions, while technical, managerial, and higher-paying roles are largely occupied by men.

  - In Kenya's DRE workforce, women account for just 23% of employees and only 25% of managerial positions (Shirley et al., 2020).
  - Women's participation in managerial roles within clean cooking enterprises remains low, less than 30% (Lee et al., 2021).
  - In the mini-grid sub-sector, only 12% of skilled positions are held by women, reflecting a broader trend of gender-biased job creation that favours men (Oyuma et al., 2023).
  - In sectors where women are visibly active, such as solar sales and administrative roles, access to enterprise ownership, strategic leadership, and product development remains minimal (Lee et al., 2021; Power for All, 2022).
- Barriers to education and training further reinforce gender disparities. Although female enrolment in primary and secondary education in Kenya has improved, participation in science, technology, engineering, and mathematics (STEM), particularly in energy-related fields, remains low. Arguably, this is attributed to cultural stereotypes, lack of mentorship, and limited visibility of female role models in STEM professions (Fajardo, 2020).

Structural and socio-cultural barriers limiting women and youth participation in clean energy value chains

Despite increased attention to inclusivity, women and youth continue to face deeply rooted structural and socio-cultural barriers that hinder their full participation in clean energy employment. These factors are well articulated in literature, irrespective of value chain.

- Women are burdened with a disproportionate share of unpaid domestic responsibilities; spending up to 14 hours a day on household and caregiving tasks, which limits their availability for income-generating opportunities (Baruah, 2017b). Clean energy businesses often lack supportive workplace policies, such as flexible hours or childcare services, reinforcing women's exclusion from formal employment (Shankar, 2020).
- Social and cultural norms further restrict women's access to technical and entrepreneurial roles. In many communities, roles like solar PV installation are considered male-dominated, and women are often required to seek permission from spouses to travel for training or employment (Kariuki & Balla, 2012; Pearl-Martinez, 2020). Additionally, societal biases may question women's morality when they travel for work, unlike their male peers, discouraging them from fully participating in field-based energy enterprises (Govindan & Murali, 2021).
- Physical labour requirements in sectors such as clean cooking, biogas installation, and solar construction also deter female participation (Lee et al., 2021). In rural areas, women's time is further constrained by tasks such as collecting firewood, which limits their capacity to engage in entrepreneurship or wage labour in the energy sector.
- Youth face a different set of structural constraints. While the clean energy sector demands new competencies, particularly in technical, financial, and business operations, many young people lack workplace readiness, soft skills such as communication, and practical experience due to gaps in formal education systems (Power for All, 2022). Further, financial barriers, such as limited access to capital and credit, hinder youth from starting businesses in high-potential areas like biogas or solar distribution (Lee et al., 2021).
- In the emerging e-mobility sector, product design often overlooks the specific mobility needs of women, such as the ability to transport goods or travel with children. Additionally, women's limited access to financing constrains their ability to purchase or lease electric vehicles, including e-bikes (Hassan et al., 2023).

- The systemic exclusion from business networks, discrimination in hiring practices, and lack of institutional support tailored to the unique needs of women and youth (GEM, 2017; Women's World Banking, 2020).
    - In mini-grid construction, employment is predominantly given to unskilled male laborers, many of whom are brought in from outside communities, thereby marginalizing local women and youth (Oyuma et al., 2023).
    - Youth also face regulatory bottlenecks and limited access to information, which hinders their ability to navigate clean energy entrepreneurship (ILO, 2018).
    -

Inadequate policy and institutional support for inclusive job creation

Despite notable progress, many clean energy policies in Kenya remain gender-neutral in design and implementation, often neglecting crucial considerations such as childcare, flexible work arrangements, and safety in male-dominated technical fields (Lee et al., 2021). Implementation is further hindered by the lack of disaggregated data on gender, age, and job quality, limiting the ability to assess and tailor interventions for marginalized groups (Lee et al., 2021).

While national and continental frameworks emphasize youth employment through vocational training and microcredit, their impact on job quality, inclusivity, and gender equity remains weak due to poor policy-outcome linkages and the absence of a comprehensive just transition policy (Mwaura & Glover, 2021; ILO, 2024). The low levels of involvement of women and youth in technical aspects of deployment value chain like manufacturing and fabrication signal a missed opportunity for deeper industrialization and domestic job creation. This supports a case for incentivizing local production through policy, infrastructure, and enterprise support.

Affirmative action, such as quotas, tax breaks, concessional financing, and targeted training, is essential to bridge persistent women and youth employment gaps. Bundling clean energy technology interventions with entrepreneurship training, digital literacy, and market linkages can significantly accelerate women's and youth participation (Clancy & Dutta, 2005b). Access to affordable credit remains a major bottleneck, particularly for female and youth-led enterprises. Tailored financial products, including micro-grants and low-interest loans, are necessary to address structural disadvantages and facilitate participation in high-potential sub-sectors like clean cooking, solar home systems, and mini-grids.

Likewise, inclusive product and service design, such as e-mobility solutions that meet women's transport needs, can help remove gender-specific barriers (Hassan et al., 2023). Policy reforms must also target systemic issues in education and workforce readiness. Integrating gender-sensitive curricula into technical and vocational education and enhancing mentorship for women in STEM fields. This is crucial to boost representation in technical and leadership roles. Moreover, investments in youth-focused training programs on sales, system maintenance, and after-sales support, especially in rural areas, will help align labour supply with sectoral demand (Power for All, 2022).

Conclusion and Recommendations

Kenya's transition to clean energy presents a powerful opportunity to drive inclusive and sustainable job creation, especially for women and youth. This however, requires intentional policy actions that address existing structural, educational, financial, and cultural barriers. The following recommendations offer practical pathways for consideration.

- Enhance local capabilities for expanded and upgraded roles for women and youth in the clean energy deployment value chain.
- Evidence based alignment of skills Development with clean energy sector market needs. A mismatch between current training programs and industry needs limits youth employability and sector growth.
- Strengthen and harmonise policies to embrace both social and technical Standards. For instance, Inclusive employment requires supportive energy policies that also remove gender and care-related barriers in the workplace.
- Promotion of inclusive leadership and Business Models since women are underrepresented in leadership and high-value segments of the clean energy sector. For instance, expand support to women-led cooperatives and offer leadership training, financing, and access to decision-making roles across clean energy value chains.
- Promote an integrated business incubation support for upgrading and scaling of micro-enterprises that dominate clean energy value chains and requisite growth. This may entail supporting women and youth in formalizing clean energy businesses by offering training, registration incentives, and micro-financing options.
- Embed gender and youth metrics in policy and reporting across clean energy programs to track inclusion and job quality outcomes This is important because effective policymaking requires disaggregated data on employment outcomes.
- Foster digital integration and innovation. For instance, digital tools are reshaping the energy entrepreneurship landscape and require corresponding and inclusive workforce capabilities.
- Design Inclusive Fiscal and Private Sector Incentives. The private sector buy-in is key to scaling inclusive employment practices.
- Institutionalize and align Policy Reforms for Inclusion. A just energy transition and equitable job creation demands institutional accountability and policy alignment at macro, meso and micro levels.

Selected Further Reading

- American Council for an energy efficient economy. (2021). How does energy efficiency create jobs? 639–639. Retrieved at: https://doi.org/10.1007/978-3-319-95867-5_300102
- Baruah, B. (2017b). Renewable inequity? Women's employment in clean energy in industrialized, emerging and developing economies. Natural Resources Forum, 41(1), 18–29. https://doi.org/10.1111/1477-8947.12105
- Clancy, J., & Dutta, S. (2005a). Gender mainstreaming in the context of energy. Role of energy in women' s enterprises: Gender issues in the context of PURE. May, 9–11.
- EEP Africa. (2019). Profiles of change: youth opportunities in the clean energy sector. Retrieved at: https://eepafrica.org/wp-content/uploads/2019/12/Youth-opportunities-brief_Digital.pdf

- Fajardo, A. P. (2020). Can gender approaches to promote clean energy entrepreneurship improve energy access and women empowerment in Sub-Saharan Africa. University of Sussex.
- GEM. (2017). Women's entrepreneurship 2016/2017 report, London: Global Entrepreneurship Consortium
- Govindan, M., & Murali, R. (2021). Energising change. Dilemmas of Energy Transitions in the Global South, 111–133. https://doi.org/10.4324/9780367486457-7
- Hassan, F., Martin, R., & Naidu, V. (2023). Women's economic empowerment and electric vehicles in Kenya Confidential. Work and Opportunities for Women Helpdesk, May.
- International Labour Organization (ILO). (2018). Youth and the Future of Work: Youth Entrepreneurship. Geneva: ILO.
- International Labour Organization. (2024). Digital labour platforms in Kenya: Exploring women's opportunities and challenges across various sectors. International Labour Organization.
- International Renewable Energy Agency. (2020). Renewable Energy and Jobs – Annual Review 2021. Retrieved at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Oct/IRENA_RE_Jobs_2021.pdf
- Kariuki, P., & Balla, P. (2012). GVEP's experience with working with women entrepreneurs in East Africa.
- Lee, C. J., Shirley, R., Otieno, M., & Nyambura, H. (2021). Powering jobs: the employment footprint of clean cooking solutions in Kenya. Energy, Sustainability and Society, 11(1), 1–22. Retrieved at: https://doi.org/10.1186/s13705-021-00299-0
- Ministry of Energy and Petroleum. (2024). Kenya national cooking transition strategy 2024-2028. MoEP. Nairobi
- Mwaura, G., & Glover, D. (2021). Evidence synthesis paper series green jobs for young people in Africa: Work in progress
- Oyuma, C., Game, A., & Lieuw-Kie-Song, M. (2023). Employment impact assessment of the Green Mini- Grid (GMG) Facility, Kenya.
- Pearl-Martinez, R. (2020). Global trends impacting gender equality in energy access. IDS Bulletin, 51(1), 7–26. https://doi.org/10.19088/1968-2020.103
- Power for All. (2022). Power jobs census 2022 – the energy access workforce.
- Shankar, A., Elam, A. B., & Glinski, A. (2020). Strengthening the women's entrepreneurship ecosystem within the energy sector. IDS Bulletin, 51(1). Retrieved from https://bulletin.ids.ac.uk/index.php/idsbo/article/view/3073/3060
- Shankar, A., Elam, A. B., & Glinski, A. (2020). Strengthening the women's entrepreneurship ecosystem within the energy sector. IDS Bulletin, 51(1). Retrieved from https://bulletin.ids.ac.uk/index.php/idsbo/article/view/3073/3060
- Shirley, R., Lee, C. J., Njoroge, H. N., Odera, S., Mwanzia, P. K., Malo, I., & Dipo-Salami, Y. (2020). Powering Jobs: The employment footprint of decentralized renewable energy technologies in Sub Saharan Africa. Journal of Sustainability Research, 2(1). Retrieved at: https://doi.org/10.20900/jsr20200001
- SNV Kenya. (2022). The market for productive uses of solar energy in Kenya: a status report energizing change.
- Women's World Banking. (2020). Empowering MSMEs: Creating a Better Banking Experience for Women-Led Micro, Small, and Medium Enterprises in Kenya. November, 1–25.

Contact Us

African Centre for Technology Studies
2nd Floor, Konza Technopolis Complex
P.O. Box 45917 - 00100
Nairobi- Mombasa Road,
Konza, Kenya.