

EVI-SICEE-RESEARCH BRIEF-13

MOVING WOMEN AND YOUTH BEYOND LAST-MILE DISTRIBUTION INTO HIGHER- VALUE ACTIVITIES IN CLEAN ENERGY VALUE CHAINS: INSIGHTS FROM MALAWI

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BOX 1: KEY MESSAGES

- Despite rapid expansion of solar and clean cooking markets, most economic benefits remain concentrated in low-value activities such as sales and distribution rather than high-value industrial or technical functions.
- Nearly all entrepreneurs (98% women and 94% men) are engaged in selling, while participation in manufacturing, engineering, and fabrication remains extremely limited, reinforcing income inequality.
- Most technologies are imported, and local enterprises mainly function as distributors, limiting domestic value addition, industrial growth, and long-term economic transformation.
- Participation is expanding, but entrepreneurs remain locked into low-margin roles with limited pathways for upgrading into manufacturing, design, or technology innovation.
- Gender norms, customer bias, and limited access to technical training continue to restrict women's participation in engineering, installation, manufacturing, and leadership roles.
- High-potential growth areas include installation, maintenance, energy auditing, pay-as-you-go (PAYG) financial systems, productive-use energy technologies, and digital energy services, which can provide realistic pathways for inclusion.

OVERVIEW

Malawi's clean energy sector is growing rapidly as investment in off-grid solar, clean cooking and decentralised renewable energy systems becomes established, creating important opportunities for jobs, entrepreneurship and energy access (IRENA et al, 2021). According to World Bank (2023), solar distribution, clean cooking enterprises, briquette production and last-mile energy delivery models see increased participation of young people and women. Despite cooperatives' involvement in various activities, this study finds their engagement is still focused on downstream commercial activities, particularly on sales and distribution. According to the survey findings, 98% of women with clean energy businesses and 94% of men with clean energy enterprises say selling is their main business role. Limited involvement in higher value function such as manufacturing, fabrication, installation, maintenance, technology development is extremely low at only sixteen percent manufacturing and eight percent fabrication among respondents.

In line with global evidence, women and youth are often concentrated in the lower and more vulnerable-valued segments of renewable energy value chains while functions related to technical, industry, and innovation orientation continuously remain dominated by men as well as those companies with greater access to capital, technology, and specialized skills (IRENA, 2024). The results highlight that the act of participating, is not sufficient to create structural transformation or to lead to growing incomes or economic upgrading.

The study also reveals that Malawi's clean energy economy still heavily relies on imported technologies, particularly in the solar sector where most businesses operate as distributors and retailers and not producers, assemblers or innovators. The same patterns have also been noted in Sub-Saharan Africa, which has largely import-dependent supply chains and limited domestic manufacturing capacity for renewable energy markets (GOGLA, 2023).

BOX 2: METHODOLOGY AND APPROACH

This brief is part of an International Development Research Council (IDRC) funded project entitled "Evidence for Informing Scaling and Impact in Youth and Women-led Clean Energy Enterprises (EVI-SICEE) in Africa", which is implemented by a consortium led by African Centre for Technology Studies (ACTS). In 2025, ACTS alongside Mzuzu University undertook a study to assess the state of women and youth entrepreneurship in Malawi's clean energy sector. The study adopted both quantitative and qualitative methods with an initial scoping study that informed the subsequent development of data collection tools. Utilizing these tools, a broad survey was carried out covering 905 clean energy entrepreneurs across Malawi. Four main cities which are representative of the regional hubs were selected namely Lilongwe in the Central region, Mzuzu in the North; and Zomba and Blantyre cities in the South. A total of 79% of the respondents were men and 21% were women. Half of the respondents consisted of male youth, followed by men who are adults (29%), female youth (14%), and adults who are women (6.5%). Interestingly, most respondents were the sole owners of clean energy enterprises as co-partners were only 3%, while 24% were employees and agents at 8%. The assessment also included key informant interviews to enrich the qualitative aspect of the study. A workshop for stakeholders validated the findings. This research brief therefore combines findings from the various data sources from Malawi.

PARTICIPATION PATTERNS IN MALAWI'S CLEAN ENERGY VALUE CHAINS AND STRUCTURAL CONSTRAINTS

The global clean energy transition is recognized increasingly as a powerful source of employment, entrepreneurship, innovation and structural economic change. According to the International Renewable Energy Agency (IRENA), in 2022 there were 13.7 million people employed in renewable energy globally. A rapidly increasing share of new jobs are in decentralized energy systems such as solar PV and clean cooking (IRENA, 2023). Multiple studies indicate that low-value, informal and downstream segments of the energy value chain such as sales, marketing and distribution are dominated by women and youth, while roles in manufacturing, engineering or technology development have been far less accessible (IRENA, 2024; World Bank, 2023). Women in decentralized solar markets typically dominate informal retail and community-based distribution roles, but rarely own high-value enterprises or venture into spaces of technology innovation (GOGLA, 2023; UN Women and UNIDO, 2024).

Across Sub-Saharan Africa, off-grid solar and clean cooking markets are growing quickly, driven by donor-funded programs and private sector-led PAYG models. Nevertheless, these markets have supply chains that are dependent on imports and most of the technologies are made outside the continent and only distributed locally by last-mile entrepreneurs. In this way, value-chains become persistently imbalanced in the sense that local actors capture very little of total economic value.

In Malawi, where electricity access is still among the lowest in the world, off-grid renewable energy solutions are becoming increasingly critical to energy access expansion (World Bank 2023; IRENA et al 2021). Women and youth have emerged as prominent players in this transition, buoyed by solar distribution, clean cooking, briquetting and community energy sales initiatives. Many enterprises are joining in, including EcoGen, Sollys Energy, Green Impact Technologies, Solar Ku Midzi, Village Solar, Mudzi Cooking Project, and women-led cookstove and briquette projects. The findings are in line with wider African evidence that indicates that women often participate in clean energy markets as social entrepreneur and/or community-based distributors. Such participation entails lower capital needs, but also lower profit ceilings (IRENA, 2024).

Despite this increasing participation, evidence shows that engagement remains mostly only with downstream, low-value activities that limit long-term earning potential, scalability and innovation. Empowering women and youth beyond the last-mile distribution into higher-value segments like manufacturing, system design, installation engineering, maintenance services, financing, and research and development is important. The Vision 2063, National Energy Policy (2018) and National Youth Policy of Malawi advocate for inclusive industrialisation and economic transformation. A number of studies show that local manufacturing and assembly of renewable energy technologies have higher employment multipliers and higher domestic value retention compared to retail distribution models (AfDB, 2022; IRENA, 2023; World Bank, 2022). However, Malawi depends on imported technologies that may restrict the transformational benefits of clean energy transition.

EVIDENCE OF WOMEN AND YOUTH CONCENTRATION IN LOW-VALUE SEGMENTS

The results of the survey have shown that women and youth are concentrated in the downstream and lower value segments of Malawi's clean energy economy. Figure 1 shows that for 98% of women and 94% of men running clean energy businesses, selling (sales) of clean energy enterprises is their primary function (figure 1). This shows that more than nine in ten entrepreneurs tend to be in sales, compared with their engagement in the technology or innovation space (e.g. manufacturing or fabricating).

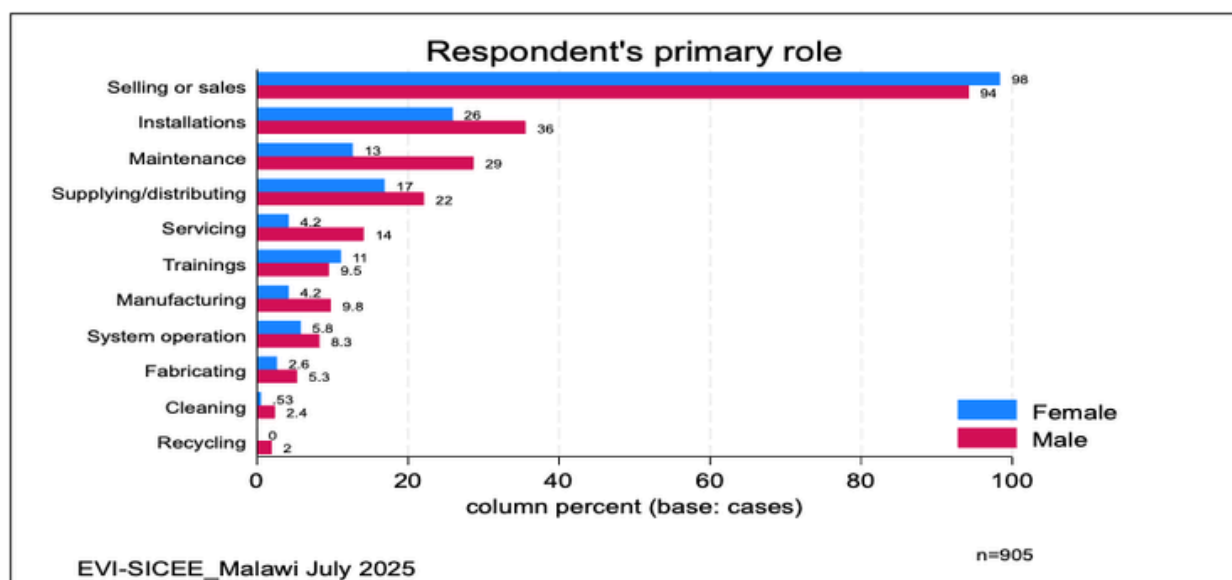


Figure 1. Primary role of clean energy entrepreneurs in Malawi

From a sectoral perspective, our research shows that women and youth in Malawi's clean energy sector are not only underrepresented but are also structurally concentrated in the least profitable segments of the clean energy value chains.

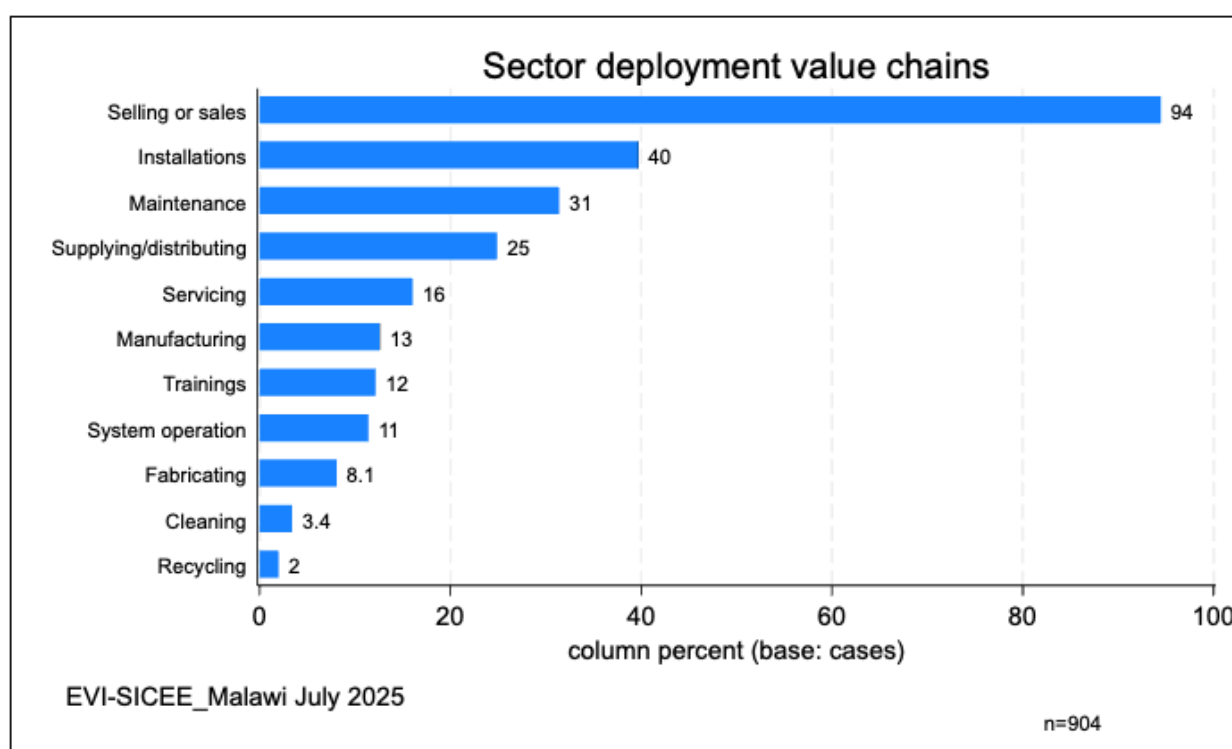


Figure 2. The value chain for sector deployment

Further synthesis of data shows that only 13 % of the entrepreneurs are engaged in manufacturing activities and 8 % in fabrication and confirms that there is a serious underdevelopment of participation in upstream value chain activities (Figure 2).

Arguably, the distribution and sales functions may be vital for increasing energy access, but they lead to much lower value capture than manufacturing, assembly of systems, engineering services, product development and technology innovation. According to global renewable energy value chain studies, the upstream functions like component manufacture, research and development, software integration, and advanced technical services consistently yields the best economic returns (IRENA & ILO, 2024).

Debatably, evidence from this study supports the wider notion that Africa's renewable energy markets remain reliant on imported technology. For instance, GOGLA reports highlight that solar products in Sub-Saharan Africa's off-grid markets are typically imported. Thus, the local players engage more in distribution, installation and after-sales services than manufacturing (GOGLA, 2023, 2024). This means that women and youth end up embroiled in what can be described as a 'last-mile distribution trap', where participation is broadening but value capture remains limited. This restricts domestic value addition and inhibits prospects for industrial upgrading.

Qualitative evidence from this study highlights this constraint:

"Sometimes we find it difficult to work with materials like sheet metal to make stoves" (Producer 4).

"We have our own plant in Cape Town, South Africa, where we produce solar panels" (Producer 2).

"Most of these products we do not have a local manufacturer; many are imported" (Institution 4).

This has key policy implications. According to IRENA and ILO (2024), renewable energy employment has become more closely linked to industrial policy and localization strategies within countries. This implies that those countries that are able to develop local manufacturing capabilities will capture substantially more jobs and economic value than those relying on or dominated by the import of equipment.

The findings from Malawi align with challenges facing African industries. For instance, limited manufacturing ecosystems, lack of industrial infrastructure, weak supplier networks and insufficient technology transfer mechanisms are hindering renewable energy industrialisation, according to the African Development Bank (AfDB, 2022). This implies that an absence of targeted industrial policy, local content requirements, manufacturing incentives, and investment in production ecosystems is unlikely to enhance significant wealth creation, enterprise scaling and structural transformation.

SOLAR ENERGY AS THE MAIN ENTRY POINT BUT NOT A PATHWAY TO UPGRADING

About a third of entrepreneurs (33%) were into solar only businesses, followed by clean cooking (28%) and both solar and clean cooking (17%). Moreover, 13% sold solar along with non-clean energy products, 3% sold clean cooking along with non-clean energy products, and 6% sold solar, clean cooking, and non-clean energy products. The distribution indicates that solar technologies are the most common access point to clean energy entrepreneurship in Malawi, reflecting their comparably lower capital requirements and ease of scaling (Figure 3).

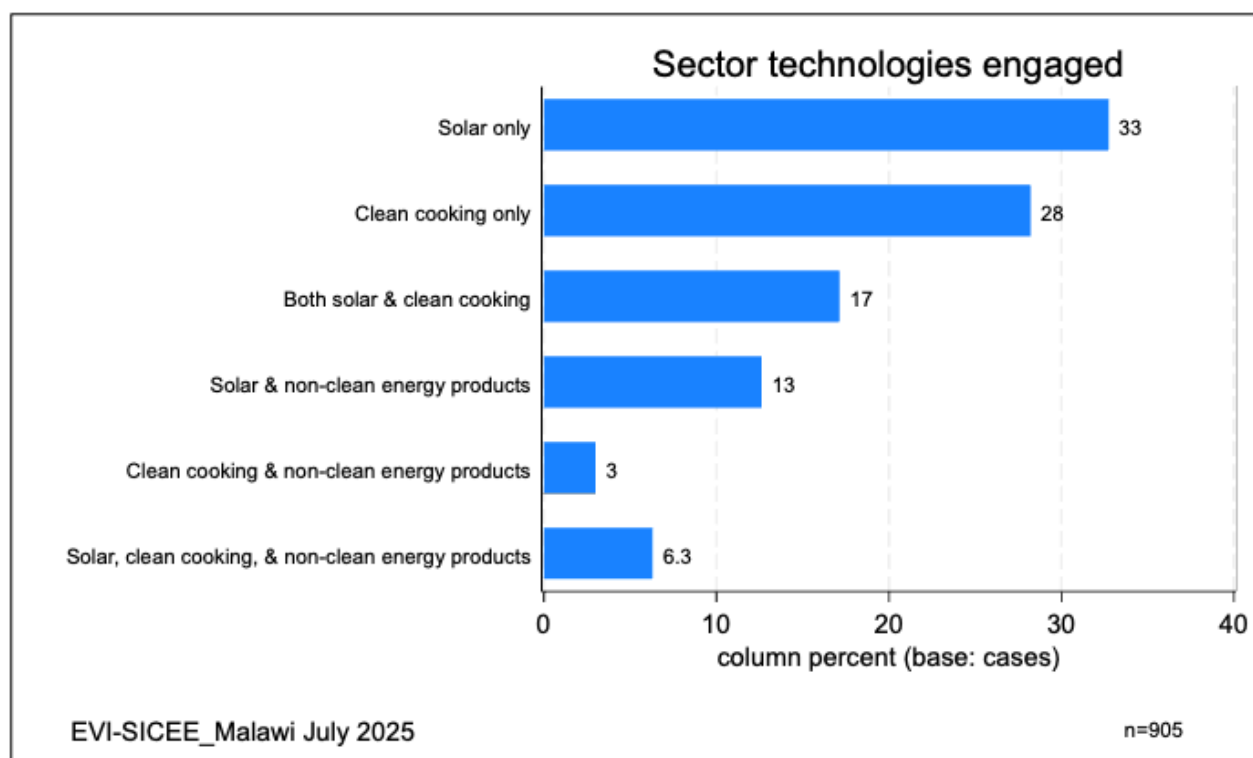


Figure 3. Solar technologies engaged by the respondents

GOGLA predicts that close to nine million off-grid solar kits were sold globally in 2023, with Sub-Saharan Africa being one of the biggest markets for on and off grid solar technologies (GOGLA, 2024). The sector is attracting increasing numbers of entrepreneurs as demand rises and technology costs fall along with the spread of PAYG financing models.

Most activities that take place in the solar domain are in retail and distribution. From Figure 4, the solar entrepreneurs who sold solar panels are 90 percent, the solar entrepreneurs who sold solar appliances are 80 percent, those who sold pico-solar products are 66 percent 48 percent sold solar home systems. Only a small proportion of the industry, less than 1%, specialized in solar installation services. Furthermore, virtually none participated in manufacturing or technology development.

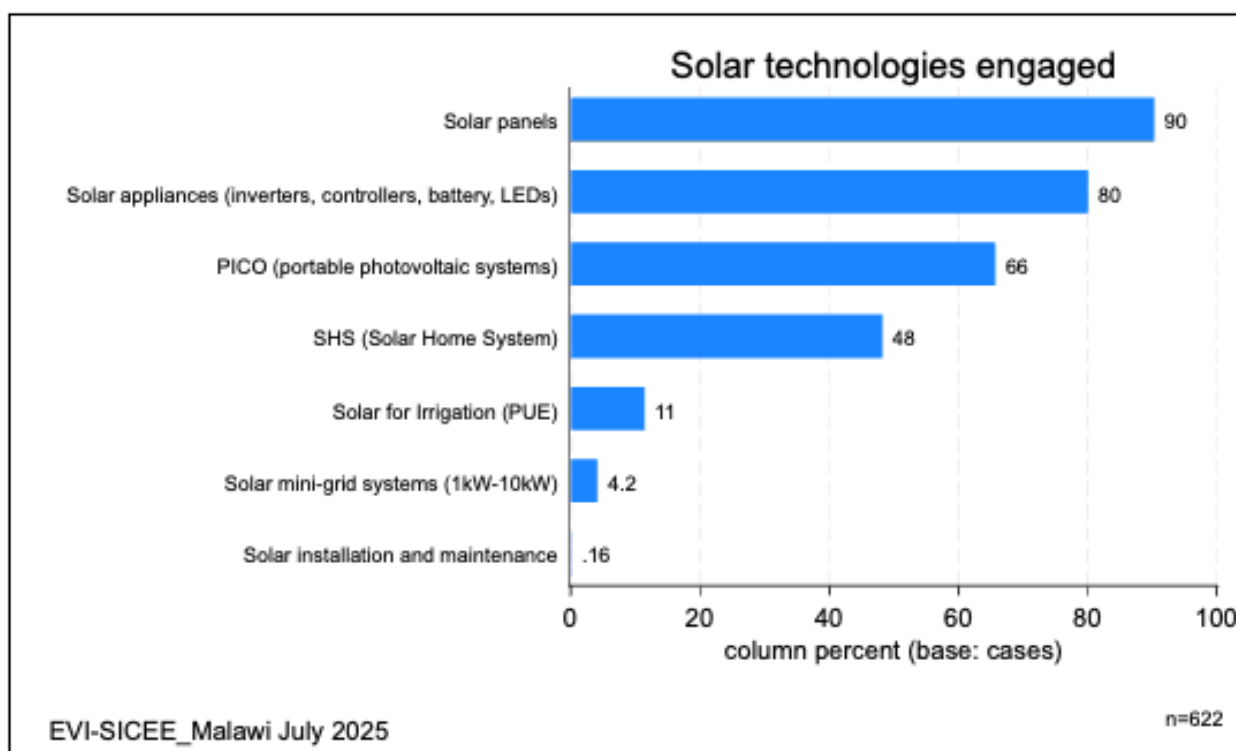


Figure 4. Solar technologies engaged

This pattern confirms the observations of IRENA (2024b), which show that decentralized solar markets often create an abundance of jobs and that, importantly, most jobs are in sales, marketing, customer acquisition and distribution. As per the agency, jobs within manufacturing, engineering, software development and product development continue to be concentrated in a handful of nations with industrial prowess. As access to solar energy has become an important entry point for women and youth entrepreneurship, it has not yet been evolved into a pathway for technological upgrading, industrial participation and innovation-led growth.

IN TERMS OF TECHNICAL ROLES, YOUTH PARTICIPATION IS LOW

Young people are recognized as important actors for a successful green transition worldwide. This can be attributed to their adaptability, digital skills, and innovative power. According to the International Labour Organization (2022), youth experience difficulties while entering technical green occupations due to skills mismatch, poor linkages between training institutions and industry, and insufficient work-based learning opportunities. The ILO Green Jobs for Youth Initiative indicates that developing countries require a greater technical competence to deploy renewable energy than is available. This results in growing demand for labour but a mismatch in preparedness (ILO, 2022).

Evaluation of Africa's green economy has similar findings that shortage of electrical engineering, solar installation, system maintenance and management of renewable energy projects are some of the key constraints hampering the scaling-up of green employment opportunities in Africa.

This study reinforces the fact that youth economic participation rates in green transition can no longer be a good indicator of impact. Transitioning the youth from informal sales and commissions to technical occupations with higher productivity, earnings and longer-term career development implies meaningful inclusion.

PERSISTENT GENDER SEGMENTATION ACROSS THE VALUE CHAIN

In Malawi's clean energy landscape, gender segmentation persists, as the survey findings show. Women are primarily concentrated in the spheres of marketing, awareness creation, and customer engagement activities whereas men dominate the technical, engineering and production functions (Figure 1). The observed gender segmentation is strongly reinforced by recent global evidence. IRENA (2024b) outlook report notes that while more women have been joining the entrepreneurial and sales functions, they still remain underrepresented in the decentralized renewable energy sector for technical and leadership roles.

IRENA recognizes that women's participation in technical occupations is limited due to employer bias, customer bias, mobility restrictions, unequal access to technical training, safety concerns and social norms. Women technicians often report the requirement to prove their competence more than men. Customers also often make the assumption that men have the technical capability. The experiences of respondents in Malawi closely resemble these findings.

The continuation of occupational segregation thus does not reflect just individual choice, but rather the systemic constraints in the labour markets, training system and social norms. When women are segregated into less-desired professions, their access to better-paid technical jobs is limited. This also limits their future technical assets, intellectual property and business capital.

The qualitative assessment of the study found that women face continuous challenges of being taken seriously as technical practitioners:

"Many clients prefer the assistance of a male installer for the installation work, in spite of the fact that I am the business owner and am currently doing the technical work" (Installer 1).

"People expect us to bring in men for the technical work, even when women have the skills" (Producer 2).

Such experiences corroborate global evidence that gender bias in technical areas limits women's access to higher value energy jobs and diminishes enterprises' growth potential (World Bank, 2023; IRENA, 2024b).

While many women and youth believe that clean energy should not be dominated by men, survey perceptions in Figure 5 highlight a sizeable gender perception gap, whereby men are more likely than women and non-male respondents to under-recognize structural inequalities.

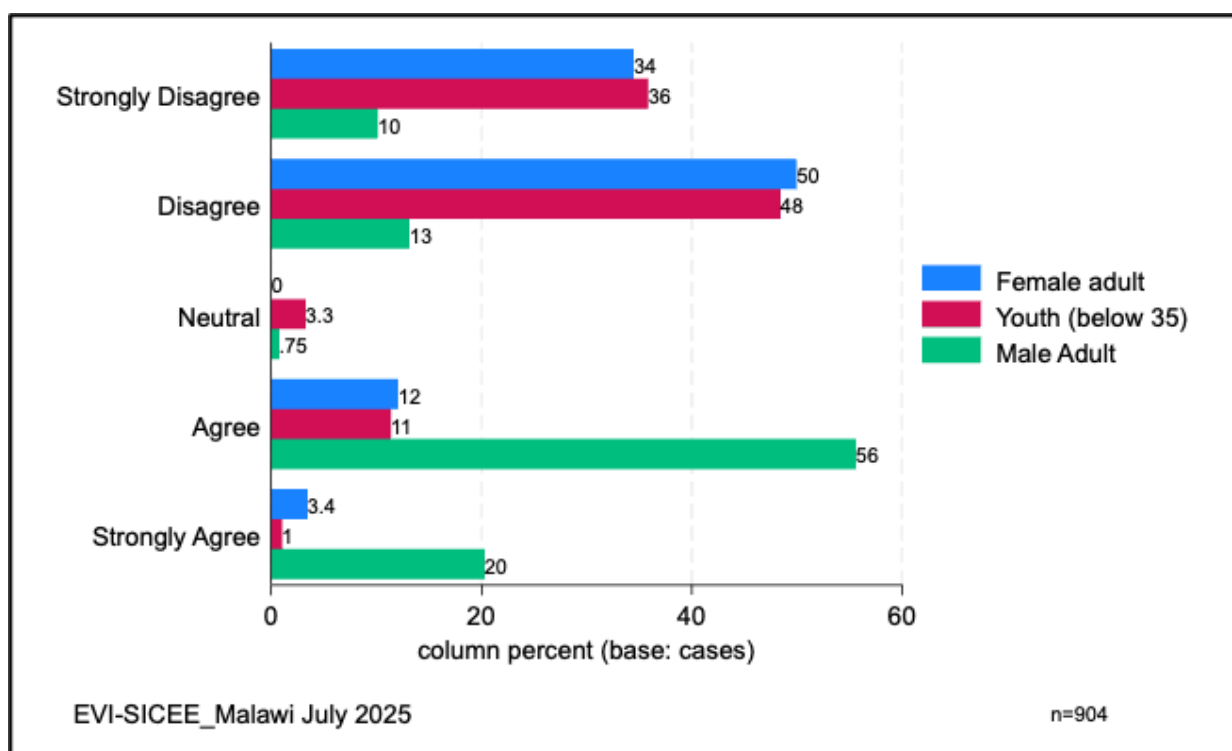


Figure 5. Respondent's view on male domination in clean energy sector.

UN Women and UNIDO (2024) describe this effect as “the invisibility of gender bias in technical energy systems”, whereby through occupational segregation inequality becomes normalized. The persistence of these norms limits women's progression into key areas including:

- Engineering roles
- Manufacturing and fabrication
- System design
- Enterprise ownership and leadership

PRODUCTS DIVERSIFICATION AND BUSINESS MODEL INNOVATIONS AS UPGRADING PATHWAYS

Most respondents opined that diversification of products is a key reason for enterprise growth. Specifically, 55% youth, 53% female adults and 51% male adults agreed with the statement with an additional 40–44% strongly agreeing (Figure 6).

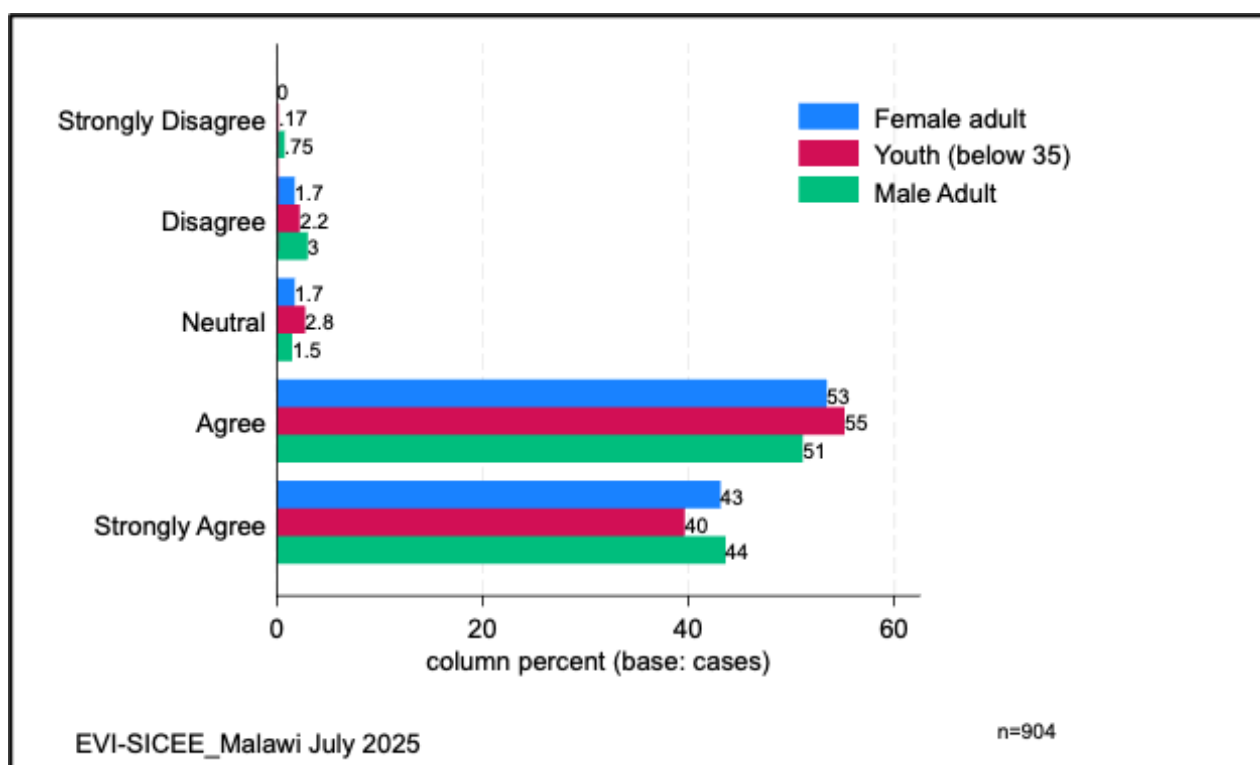


Figure 6. Respondent's perception on product diversification as a driver of enterprise growth

The findings are well supported by literature. As GOGLA's market reports reveal, businesses diversifying on productive-use appliances, solar water pumps, refrigeration, efficient appliances, after sales service and financial solutions tend to note a stronger growth in revenue and improved resilience than those simply selling solar products (GOGLA, 2024). Recent investment patterns show greater interest in productive-use renewable energy technologies due to their income-enhancing benefits for households and businesses. IRENA and ILO (2024) further emphasize that value creation in renewable energy is as much about manufacturing and increasingly about service intensive activities like installation, maintenance, digital energy management, energy audit, leasing and financing, software, customer support systems.

The survey in particular pointed towards solid opportunities for shifting women and youth from core sales and distribution functions. Making technical service markets stronger, and giving energy services for productive use, digital energy platforms, PAYG management systems and energy advisory services may provide immediate and scalable, pathways for women and youth into more valuable segments of the clean economy. In the same way, respondents noted the importance of new selling models. The analysis of the data revealed that various strategies (including PAYG systems, agent networks, bundled products, after-sales services, and digital marketing) was the most critical drivers of enterprise and customer growth (Figure 7).

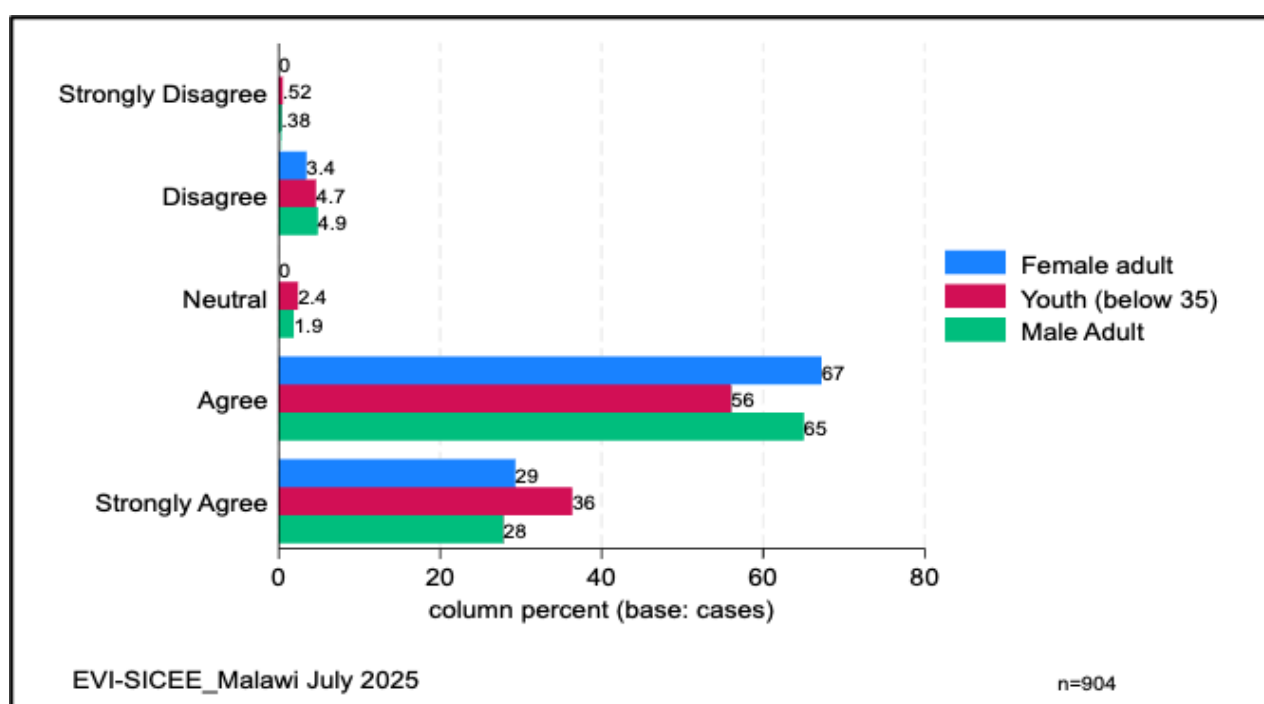


Figure 7. Respondent's perception on effective selling models as a driver of clean energy business expansion and customer growth

Service-based upgrading, particularly in the provision and installation of equipment, maintenance, and energy advisory services, provides immediate opportunities for women and youth inclusion, even when manufacturing capacity is limited (IRENA et al, 2021).

CONCLUSION AND RECOMMENDATIONS

The results reveal that clean energy sector in Malawi is characterized by a structural 'last-mile participation trap' where inclusion in clean energy markets does not guarantee value capture. Overcoming this challenge will require a shift from a narrow focus on enhanced distribution for energy access to a broader value-chain transformation agenda. The latter calls for intentional support for local manufacturing, technical capacity development, innovation, entrepreneurship, and gender- and youth-responsive industrial policies that position women and youth as producers, innovators, and leaders in the clean energy economy. In light of the findings, the following recommendations are suggested.

- Create a dedicated strategy that fosters local assembly, fabrication, component manufacturing and technology customization of solar and clean cooking technologies with gender and youth specific targets.
- Clean energy firms, industry associations, and development initiatives should build structured career progressions that intentionally move women and youth from sales and distribution functions into the technical, managerial, engineering, and executive leadership roles through mentoring, on-the-job training, and leadership development.
- The government and other partners should support programs to help women and youth start productive-use enterprises that use clean energy technologies. Productive-use enterprises can include solar irrigation, refrigeration, agro-processing, water pumping, electric cooking businesses, or digital services.

- Clean energy interventions going forward must do more than view women and youth as just consumers, retailers or last-mile distributors. Instead, they should be seen as manufacturers, innovators, financiers, engineers, technology developers, and businesspeople able to capture more of the economic value of Malawi's clean energy transition.
- Programs offering support to enterprises ought to motivate businesses that are run by women and youths to go beyond the basic sales of solar products and diversify into higher-margin services including system design, maintenance contracts, energy audits, appliance financing, productive-use solutions, consulting in clean energy, and after-sales technical support.
- Women- and youth-led enterprises should be assisted through trade promotion agencies and investment authorities and development partners to access regional and international markets through export readiness programmes, standards certification, trade fairs, and participation in continental clean energy value chains.
- The government and development partners should help position women and youth in emerging sectors, which is also a pathway to diversification of sectors. This includes electric cooking, e-mobility, battery assembly, energy storage systems, productive-use appliances, climate-smart agriculture technologies, and circular economy innovations.
- Support businesses to venture into installation, maintenance, energy audit, productive-use energy services, appliance leasing, PAYG management and digital energy services, and after-sales support through focused business development services and technical assistance.

SELECTED FURTHER READING

African Development Bank (AfDB). (2022). African Economic Outlook 2022: Supporting climate resilience and a just energy transition in Africa. Retrieved at: https://www.afdb.org/sites/default/files/documents/publications/african_economic_outlook_2022_web.pdf

GOGLA. (2023). Global Off-Grid Solar Market Report: January–June 2023. Retrieved at: <https://gogla.org/reports/semi-annual-solar-market-report/global-off-grid-solar-market-data-jan-june-2023/>

GOGLA. (2024). Global Off-Grid Solar Market Report 2024. Retrieved at: <https://newsroom.gogla.org/237233-almost-9m-solar-kits-sold-in-2023-according-to-the-new-global-off-grid-solar-market-report/>

ILO. (2022). Green Jobs for Youth Pact. International Labour Organization. Retrieved at: <https://www.ilo.org/resource/news/ilo-launches-initiatives-green-jobs-youth-and-just-transition-financing>

International Renewable Energy Agency (IRENA), KfW Development Bank, & Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). (2021). The renewable energy transition in Africa. International Renewable Energy Agency. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/Renewable_Energy_Transition_Africa_2021.pdf

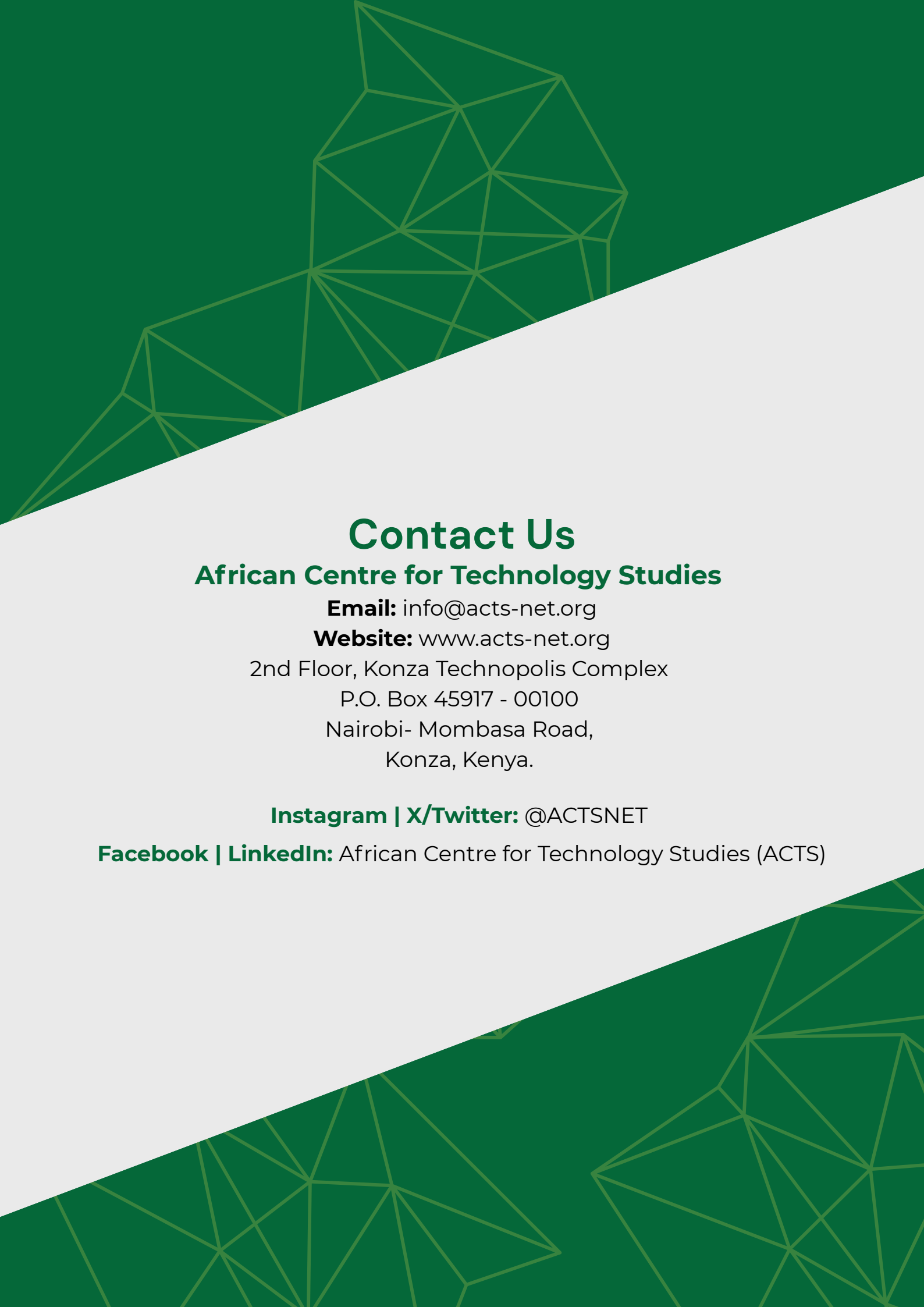
IRENA & ILO. (2024). Renewable Energy and Jobs: Annual Review 2024. International Renewable Energy Agency and International Labour Organization. Retrieved at: <https://www.irena.org/Publications/2024/Oct/Renewable-energy-and-jobs-Annual-review-2024>

IRENA. (2024a). Renewable Energy and Jobs: Annual Review 2024. International Renewable Energy Agency. Retrieved at: <https://www.irena.org/Publications/2024/Oct/Renewable-energy-and-jobs-Annual-review-2024>

IRENA. (2024b). Decentralised Solar PV: A Gender Perspective. International Renewable Energy Agency. Retrieved at: <https://www.irena.org/Publications/2024/Oct/Decentralised-Solar-PV-Gender-Perspective-2024>

UN Women & United Nations Industrial Development Organization. (2023). Gender equality in the sustainable energy transition. <https://www.unwomen.org/en/digital-library/publications/2023/05/gender-equality-in-the-sustainable-energy-transition>

World Bank. (2022). Off-Grid Solar Market Trends Report. World Bank Group. Retrieved at: <https://documents.worldbank.org/en/publication/documentsreports/documentdetail/099090225151516968>



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