



Female Technicians & Engineers Training Report-2nd Cohort -6th May to 30th May, 2024

CESET Project
Mzuzu University
Department of Energy Systems
TCRET

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It is my strong view that women have the capability to serve in leadership positions within the energy industry- Eluby



CESET
Community Energy and the Sustainable Energy Transition
in Ethiopia, Malawi and Mozambique



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1.0 Introduction



Women engineers or technicians in sub-Saharan Africa account for at least 20% while men represent the remainder. While in Malawi, women's participation in the energy sector is quite low despite women appearing to be the most significant energy users. Currently, only 5% of engineers or technicians in Malawi are women. Furthermore, based on recent trainings conducted by the Test and Training Center for Renewable Energy Technologies (TCRET) under Mzuzu University, women's participation was far lower compared to men. Only 2% of total participants were women while 98% consisted of men. This imbalance in participation in the engineering sector has been attributed to a perception that anything technical is "men's work." In an effort to eradicate this type of stereotype among women and men in Malawi, the Community Energy and Sustainable Energy Transitions (CESET) project has a component focused on social inclusion that promotes women participation on energy issues affecting their livelihoods. One of the interventions to address challenges related to including women is training women on renewable energy technologies.

In an effort to promote women's participation in the renewable energy sector in Malawi, the Community Energy and Sustainable Energy Transitions project (CESET) in collaboration with Mzuzu University conducted a 4-week training on planning, design, installation, maintenance, and management of renewable energy systems. A total of 27 female participants were selected and all attended the 4-week training session which consisted of 2 weeks online and the remaining 2 weeks in-person. The selected participants represented various fields including engineering, construction, health, social science and journalism. The training covered a variety of energy options including wind, solar, and various cooking technologies with a strong focus on solar PV installation systems. The main objectives of the training were to enable participants effectively plan, design, install, troubleshoot and maintain Renewable Energy Systems. To enable participants to supervise installations and maintenance of Renewable Energy Systems (RES). To enable participants to comply with relevant regulations and standards for the design, installation, and maintenance of RES. To enable participants to comply with safety and occupational health regulations when installing and maintaining RES.



Why Focus on Females Only?



Powering Economic Growth through Just-Inclusion



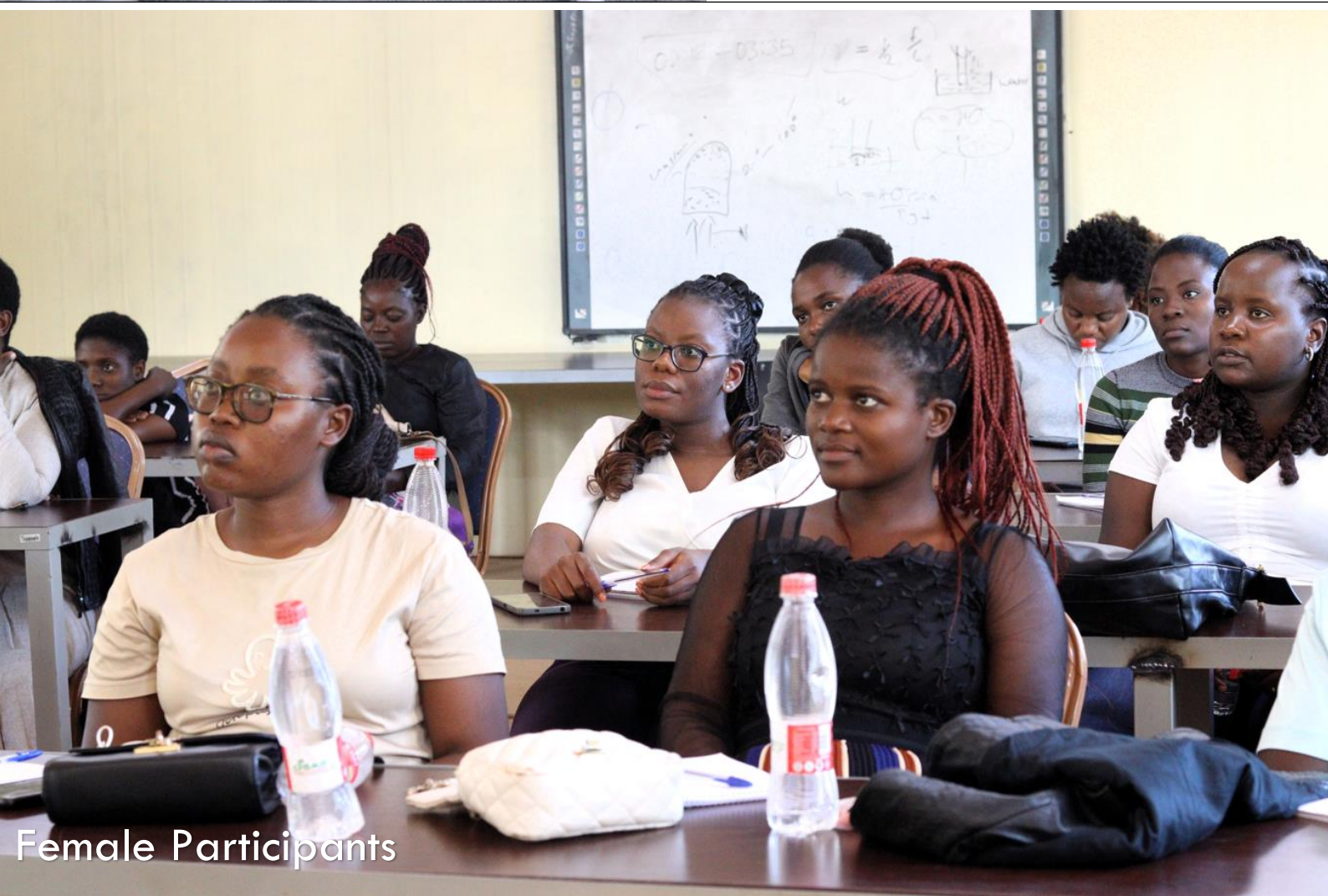
Paving the Way for a Brighter Future



Bridging the skills gap between women and men in the energy sector



Promoting Inclusive Decision Making in the Energy sector



Female Participants

2.0 Shortlisting

A flyer calling for interested applicants was designed and circulated across Malawi through different platforms including LinkedIn, Facebook pages and WhatsApp professional groups. For applications submission, a Google form was developed to provide a streamlined means of applying.

2.1 Shortlisting Team & Process

The Shortlisting Team consisted of the following Personnel all from Mzuzu University under the department of energy systems

No	Name	Profile
1	Dr Chrispin Gogoda	TCRET Coordinator & CESET Co-Investigator
2	Mr KT Gondwe	Energy Systems Lecturer
3	Christopher Hara	Project Research Assistant for CESET Project

2.2 Shortlisting Process

We received a total of 135 applications submitted through the Google Forms intake process. However, given the available project funding, we had capacity for only 25 primary selectees and 5 applicants on reserve. The selection process applied the following criteria:

The following criteria will be considered during the application review process:

- The applicant's qualifications and their relevance to the energy sector.
- The applicant's statement of motivation and how it demonstrates their fit for the role.
- The applicant's current field of work and experience.
- The volume of applications from candidates with similar professional backgrounds.

Thirty-two applicants were deemed ineligible for the training program due to failure to meet qualification standards. Specifically:

- Applicants possessing an academic background in energy systems were disqualified.
- Those with academic backgrounds irrelevant to the subject matter were also disqualified.
- Some applicants disqualified were male.
- The motivation statements of certain applicants were found to lack sufficient conviction.

The applicants were categorized based on the qualifications specified in their applications. The following table illustrates the distribution of applicant qualifications.

3.0 Shortlisted

Academic Qualifications	No of Applicants	Selected	Reserve
BSc Irrigation Engineering	36	7	
Dip Irrigation Engineering	3	2	
BSc Biomedical Engineering	4	1	1
Masters in Civil Engineering	1	1	
Masters of Arts (Economics)	1		
BSc Transformative Community Development	1		
BSc Communication and Journalism	3	1	
BSc Food Security and Nutrition	1		
BSc Civil Engineering	3	2	
BSc Industrial Engineering	1		
Master Water Resource Management	1	1	
Masters in Renew Engineering	1		
BSc Renewable Energy Technologies	5		
BSc Fisheries and Aquatic Science	1		
BSc Water Resource Management	6	2	
BSc Technical Education	1	1	
BSc Information and Communication Technology	1		
Bsc Computer Science	3		
BSc Agri Eng	9	2	2
BSc Electrical and Electronics	2	2	
Cert Electrical Installation	16	4	2
BSc Social Work & Gender	2	1	
Cert Solar Installation	2		
MSCE & Other Certificates	38		
Totals	136	27	5

4.0 Sessions

4.1 THEORY SESSIONS

The Malawi Energy Regulatory Authority recommended that the training course be conducted over a period of no less than four weeks to effectively deliver all relevant course materials. As a result, the training was administered across a four-week period with two weeks spent online utilizing the university's information and communications technology infrastructure an e-learning platform.

4.1.1 The E-Learning Platform

During the initial two-week period, participants underwent four introductory courses aimed at providing an electrical and chemical foundation for the primary subjects covered during the subsequent training phase. These foundational courses included: fundamentals of electricity, an introduction to biogas production and storage, and photovoltaic solar energy. Instruction consisted of course materials presented via slides and supplemental references. Furthermore, assessments followed at the conclusion of each course module, wherein participants were expected to complete and submit assigned work. To facilitate an interactive experience, quizzes and open discussion forums related to the course topics were made available to participants within the learning management platform to encourage further engagement with the material.

4.1.2 Face to face Session-Theory

Through the one-week theory training session, participants were trained on various renewable energy options as outlined in Table 2 above. A deeper understanding of these renewable energy technologies was emphasized during the training. The sessions demonstrated how renewable energy is harnessed through different technological means and how they are all ultimately powered by the sun.



Figure 1: Participants during the Theory Sessions

The facilitators provided an overview of various renewable energy technologies available on the commercial market to familiarize the participants. Specifically, the training introduced different types of solar photovoltaic modules, charge controllers, battery storage solutions, solar water pumps, and briquette production machines. Hands-on demonstrations and presentations provided insights into the technical specifications and applications of this equipment.

Additionally, the participants received guidance on potential quality issues to consider when procuring such technologies. They were advised to carefully vet suppliers and products to avoid

inferior or substandard options that may undermine performance, safety, and return on investment. As renewable solutions continue gaining traction, it is important consumers and procurement professionals can discern legitimate equipment from opportunistic offerings that fail to meet industry standards.

No	Course	Instructor	Delivery Mode
1	Introduction to Renewable Energy	Dr Chrispin Gogoda	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A
2	Introduction to Bio Energy	Mrs Lavinia Chikomo	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A
3	Bio Energy and Biogas	Mrs. Lavinia Chikomo	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A
4	Solar Thermal Technologies	Mr. Timeo Maroyi	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A
5	Photovoltaic Mounting Structures	Mr. Timeo Maroyi	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A
6	Introduction to PV Systems	Dr Chrispin Gogoda	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A
7	PV Components-PV, Charge Controller, Battery	Dr Chrispin Gogoda	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A • Show casing of Batteries, Inverters, Different types of Solar PV and Charge controllers
8	Sizing Stand-Alone Solar PV systems	Ms Lumbani Nyoni	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A • Group Assignments
9	Introduction to Wind Power	Mr. Timeyo Maroyi	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A
10	Solar Water Pumping and Sizing	Mr. TK Gondwe	<ul style="list-style-type: none"> • Presentation • Interactions through Q&A • Show casing Different types of solar water Pumps
11	Working Safety, Mechanical Safety	Mr. Timeo Maroyi	<ul style="list-style-type: none"> • Power Point Presentations • Interactions through Q&A
12	Working Safety, Electrical Safety	Mr. TK Gondwe	<ul style="list-style-type: none"> • Power Point Presentations • Interactions through Q&A
13	Solar Refrigeration Systems	Mr. Dalitso Gomani	<ul style="list-style-type: none"> • Power Point Presentations and videos • Interactions through Q&A • Show cased different Solar Pico home systems and solar Fridges
14	Practical sessions on Wiring and installation of Solar Home System	Christopher Hara Mr. Dalitso Gomani Mr. TK Gondwe	<ul style="list-style-type: none"> • House single phase wiring • Solar Home system installation • Solar water pumping

To ensure interactive participation, group and individual assignments were given to each participant. Significant attention was given to solar PV applications and clean cooking technologies. The solar PV applications focused on included solar home systems, solar refrigeration, solar water pumping and solar thermal. The importance of safety when working with these technologies was stressed through courses on electrical and mechanical work safety.

TCRET also engaged various stakeholders from the private sector within Malawi in the energy industry. These included representatives from the Malawi Energy Regulatory Authority (MERA), Malawi Bureau of Standards (MBS) and Renewable Energy Industries Association of Malawi (REIAMA). The primary aim of these organizations was to provide sessions on the various standards required in the renewable energy sector for procurement and installation of renewable energy systems. Furthermore, they aimed to provide mentorship to the participants to actively participate in the energy sector by registering with REIAMA.

4.2 PRACTICAL SESSIONS

4.2.1 House Wiring and Installation of SHS

To bridge the gap between theory and application of renewable energy technologies, female participants received hands-on technical training. This practical work focused on equipping participants with skills in installation and troubleshooting of renewable energy systems, with a particular emphasis on solar photovoltaic (PV) technology. The practical sessions consisted of training participants in electrical wiring techniques as demonstrated in the pictures below. The wiring exercises included making all necessary connections for a single-phase residential home system. Participants also practiced sizing and installing solar home systems, which involved connecting solar panels, inverters, charge controllers, and batteries.



Figure 2: Participants during Practical

During these sessions, participants were divided into two groups and assigned to complete a house installation of a solar home system, starting with the wiring and followed by mounting the solar components. Voltage drops and other performance metrics were then measured to further enhance participants' understanding of how solar home systems function in practice.



Figure 3: Participants during Practical sessions

This followed by a campus tour which involved appreciating different solar PV installations done on campus by the last female participants who attended the CESET training and other practitioners.

4.2.2 Water Pumping

During this practical training session, the various types of solar water pumps available on the commercial market were presented to the female participants, including alternating current (AC) pumps and direct current (DC) pumps. Several troubleshooting exercises were conducted prior to the installation demonstrations. This was followed by a hands-on installation session of a solar water pump powered by direct current (DC), specifically a submersible pump. The female participants successfully installed the water pump on the campus grounds, as depicted in the figure 4 below. Following the installation, the training included measuring the voltage drop across and flow rate of the newly installed solar pump. This practical session provided valuable experience for the participants to learn about selecting, installing and testing different models of solar water pumps.



Figure 4: Participants Installing a solar water pump on campus

5.0 Site Visits

The purpose of the visit to Choma Health Center was to expose participants to larger-scale solar photovoltaic (PV) applications that could supply electricity to significant loads. At the Center, a 15 kilowatt-peak (kWp) solar PV system was installed to meet the majority of the facility's energy needs. As depicted in the attached image, the system provides power to support the Center's core medical operations with the exception of the pharmacy, which continues to rely on the local electric grid. Through observing this installation firsthand, participants gained valuable insights into the technical, operational, and economic considerations of implementing solar PV systems at the scale of an entire health clinic. The Center has successfully utilized solar to reduce its dependence on conventional fuels for energy, saving costs while also advancing more sustainable and resilient sources of power for essential community services.



Figure 5: Site Visit at Choma health facility Solar PV Plant

6.0 Closing Ceremony

All participants that were called to attend the training managed to show up for the duration of the training. The closing ceremony was honored by the presence of the Dean of the Faculty of Science and Innovation, Associate Professor Khumbo Kumwenda and Mr. Allister Kondowe, Deputy Head of the Chemistry Department. The Dean of the Faculty acknowledged that there is low participation of females in engineering and science fields. And He further encouraged the participants to make use of the skills attained from the 4 weeks training. These fields are more dominated by men rather than women, which is a concern for advancing development in Malawi's energy sector. And it was for the very cause why the CESET project had to come up with this initiative to promote gender and social inclusion in the energy sector.



Figure 6: Ass Prof Dr Khumbo Kumwenda Addressing the participants and presenting certificates

The TCRET coordinator Dr Chrispin Gogoda applauded the participants for their active participation invested during the two weeks training. He further recommended the participants to find ways on how they can invest in the energy sector based on the skills they attained from the training in order to contribute to the economic development of the country and the sustainable development goal 7.

Certificates of attendance for the one-month period were awarded to each participant upon completion and submission of their required exercises and assignments. These certificates serve as a basic requirement for obtaining an installation permit from the Malawi Energy Regulatory Authority.

7.0 Recommendations and Evaluation

At the conclusion of the training program, a post-evaluation questionnaire was administered among the participants. The purpose of this questionnaire was to assess whether the training's objectives had been achieved and to determine the level of satisfaction among those in attendance. The results of the questionnaire provide valuable insight into areas where the training could potentially be improved, as well as recommendations for enhancing future training programs we deliver. The data indicates that a vast majority of participants reported being satisfied with the overall training experience, with positive feedback received from approximately 90% of total attendees. Additionally, at minimum 60% of participants stated that they felt they had gained knowledge comparable to an expert in the subject matter covered during the training sessions. The information collected from this post-training evaluation will be analyzed thoroughly to identify any deficiencies and help strengthen subsequent training initiatives we carry out.

Recommendations

- There is a need to expand the program to better accommodate female participants from non-engineering or technical fields.
- Additional funding to allow for the procurement of more materials and equipment needed to enhance the practical training sessions.
- Further consideration should also be given to hosting a future training in Lilongwe

Appendices

NO	NAME OF PARTICIPANT
1	LINLY MERCY MASONA
2	ELUBY AZARIAH KAWELAMA
3	BRENDA HELLENA MATEWERE
4	CHIKONDI ALICE MATITHA
5	EMILY KAMBALAME
6	PHOEBE ALFAZEMA
7	YAMIKANI MTOSO NKHONO
8	CHIFUNIRO KADAM'MANJA
9	JANE CHAPONDA
10	CHINSINSI CHIKABVUMBWA
11	ESTHER KELLY MWAFULIRWA
12	THANDIWE CHINULA
13	JOYCE D. PHIRI
14	ALINAFE CHINGENI
15	JESSIE KADZAMIRA
16	ANASTASIA KAFUMU BANDA
17	BRENDA TWALINDE MUYAYA
18	CATHERINE BOTOMANI
19	EPIPHANIA MAGASO
20	MEMORY MOYO
21	ETINA KAMANGA

22	RUTH SHELLAH
23	PAMELA CHIRWA
24	PRUDENCIA BRIDGET KHUNDI
25	MERCY CHISIZA
26	OLIVE KAMTANGWALA
27	COLNESS N. DINGA

