



# Report on the 10-Day Renewable Energy Systems Training for Female Engineers and Technicians



**March, 20-31, 2023 Training**

**Mzuzu University**

**TCRET**

**CESET Project**





April, 2023

This report reflects the renewable energy training for women engineers and technicians which was implemented by the Test and Training Center for Renewable Energy Technologies, (TCRET), with funding from the Community Energy Systems and Sustainable Energy Transitions (CESET) Project. The information contained in this report is entirely consistent with the training sessions held at Mzuzu University.

**Checked by:** Dr Chrispin Gogoda  
*Co-Investigator*

**Compiled by:** Mr. Christopher M Hara  
*Research Assistant*



## ACRONYMS

BWB	Blantyre Water Board
CESET	Community Energy Systems and Sustainable Energy Transitions
EGENCO	Electricity Generation Company (Malawi) Limited
KIA	Kamuzu International Airport
MERA	Malawi Energy Regulatory Authority
NRWB	Northern Region Water Board
ODL	Open Distance Learning
PV	Photovoltaics
PVHO	Plant and Vehicle Hire Organisation
RES	Renewable Energy Systems
TCRET	Testing and Training Center for Renewable Energy Technologies



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## 1.0 Background

Malawi is one of the countries with low rates of access to clean energy at about 14% and 2% grid electricity access and access to clean cooking, respectively (ESMAP, 2021). Women are one of the most affected entities say from drudgery in accessing fuel wood and exposure to harmful emissions (Ipsita , Pamela , & Karin , 2018). However, their participation in providing solutions to the challenges in increasing access to clean energy remains low as demonstrated by low numbers of female participants in most of the courses the Test and Training Centre for Renewable Energy Technologies (TCRET) has offered over time. To address this gap, with funding from Community Energy and Sustainable Energy Transitions (CESET) Project at Sheffield University, UK, Mzuzu University held a 10-day training in renewable energy with focus on Solar photovoltaic (PV), for female engineers and technicians from different organisations.

The program targeted engineers, and technicians working for renewable energy (RET) businesses, as well as consultancies, local authorities, and other organizations active in the energy sector. Mzuzu University hosted the course from 20 to 31, March 2023. Twenty people were invited, and 19 of them were able to complete the session. The major goal of the course was to give the attendees the knowledge and abilities needed to plan, build, install, and maintain renewable energy systems. Participants were trained by lecturers and lab technicians from the Department of Energy Systems and TCRET, respectively. The CESET project, which is expected to run up to September 2024, is aimed at exploring how community energy systems might support a just energy transition.



*Fig. 1: Participants listening to the course introduction*

The program covered a variety of modules, such as an introduction to energy options, wind power, solar photovoltaics (including design and installation), hydropower, etc. To ensure a full and effective



participation of the female learners, the training employed an interactive methodology which involved different activities. Participant activities included peer discussions, question-and-answer sessions, sharing of experiences, demonstrations, and hands-on practical exercises in order to achieve active participation. Group assignments, a power point presentation, and energy equipment were just a few of the educational tools used to support these participatory sessions.

## 2.0 Training Objectives

The 10-day training included the following objectives.

- 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.

## 3.0 Trainers Profile

Lecturers, a lab technician, and one associate lecturer made up the TCRET team that participated in the training. A brief summary of each trainer and the modules they taught are included in Table 1.

Table 1: Trainer's Profile

No	Name	Designation	Session Modules
1	Dr Chrispin Gogoda	<ul style="list-style-type: none"><li>• Lecturer</li><li>• TCRET Coordinator</li><li>• Co-Investigator for CESET Project</li></ul>	<ul style="list-style-type: none"><li>• Photovoltaic Systems Components – Inverters, Batteries, charge Controllers, PV Modules,</li></ul>
2	Mr Timeyo Maroyi	<ul style="list-style-type: none"><li>• Head of Energy Systems Department</li><li>• Lecturer</li></ul>	<ul style="list-style-type: none"><li>• Working Safety- Mechanical Safety</li><li>• Renewable Energy Standard Regulations</li><li>• PV Module Mounting Structures</li><li>• RE and Electricity Policies, Regulations, Standards and Code of Practice</li></ul>
3	Mr Vincent Mwale (PhD Student)	<ul style="list-style-type: none"><li>• Lecturer in the Dept. of Energy systems</li></ul>	<ul style="list-style-type: none"><li>• Wind Power</li><li>• Solar PV /Wind Hybrid Systems Sizing Procedures</li></ul>
4	Mr Thapasila Gondwe (PhD Student)	<ul style="list-style-type: none"><li>• Lecturer at the Dept. of Energy systems</li></ul>	<ul style="list-style-type: none"><li>• Introduction to Solar PV Water Pumping Systems</li><li>• Systems Commissioning</li><li>• Practical-Water Pumping</li></ul>



5	Mr Gomani	<ul style="list-style-type: none"><li>• Senior Lab Technician in the Dept. of Energy Systems</li></ul>	<ul style="list-style-type: none"><li>• Planning for Solar PV System Installation – Site inspection, BoQs &amp; Costing</li><li>• Solar Electrical Wiring and Installation Tests and Testing Procedures</li><li>• Solar Refrigeration Systems</li></ul>
6	Miss Lumbani Nyoni	<ul style="list-style-type: none"><li>• Ass Lecturer in the Dept. of Energy systems</li></ul>	<ul style="list-style-type: none"><li>• Solar Photovoltaic Systems (Size and Design)</li></ul>
7	Christopher Hara	<ul style="list-style-type: none"><li>• Research Assistant for CESET Project</li></ul>	<ul style="list-style-type: none"><li>• Introducing CESET Project</li></ul>

## 4.0 PROCEEDINGS

### 4.1 THEORY SESSIONS

#### 4.1.1 Session: Introduction to Energy and Training Objectives

The participants in this session were first given an explanation of the training objectives before a quick poll was taken to gauge their expectations for the entire course. The definition and types of energy were then discussed, as well as how energy may be obtained from various resources. Then, many types of renewable energy sources and their associated technologies, including solar PV, wind turbines, hydropower, and geothermal, were introduced to the trainees. The audience examined case studies or examples connected to these technologies in Malawi by citing actual examples, such as the JCM solar power plant in Salima and Kapichira and Nkula hydropower stations on the Shire River.

#### 4.1.2 Session: Introducing the CESET Project

Mr. Christopher Hara, the Research Assistant for the CESET project, conducted this session. He gave a brief overview of the CESET project, outlining its main goal, its partners, and its geographic reach. He went on to stress the reasons behind the project's decision to conduct the training only for female technicians and engineers. After that, participants were directed to the project website for more details.

#### 4.1.3 Session: Solar Photovoltaic Systems

During this session, Dr. Chrispin introduced basic PV physics and demonstrated various components of a solar PV system mainly the PV cell/module, inverter, charge controller, and battery for energy storage. to help students better understand the components of a solar PV systems. The session involved showcasing actual inverters, charge controllers and batteries for demonstration purposes to help reinforce their understanding. Students were guided through the recommended specifications and ideal conditions of each and every component.



*Fig. 2: Participants during one of the sessions*

#### 4.1.4 Session: Solar PV System Design

The solar PV session sought to give the attendees the knowledge and skills necessary to design, size, and install solar household systems, solar water pumps, and solar refrigerators. The participants in this workshop, which was presided over by Miss Lumbani Nyoni, learned about solar household systems. Participants in the Sizing course learned how to calculate their daily energy needs and then pinpoint the precise system components they needed. Students were also given an introduction to the different solar products on the market today and their suggested specifications. Trainees were given a group project on estimating the energy demand for the department of Energy's systems, followed by questions and answers, in order to expedite this work.

#### 4.1.5 Session: Wind Power and System components

In this session, Mr. Vincent Mwale reintroduced wind energy and the different technologies used to harness it. This included a variety of simulations on the operation of a wind turbine, from aerodynamics through to energy production. Clear wind turbine visuals and movies were used for better comprehension and delivery of the content.



#### **4.1.6 Session: Working Safety- Mechanical Safety**

The goal of this training event was to teach the participants the value of putting safety first whenever working with energy systems. The participants were introduced to various safety guidelines and precautions that should be taken when working in different environments. The dangers of working with energy system technology were emphasized to the trainees in order to encourage them to adhere to these safety precautions. Mr. Timeo Maroyi, a safety expert in the field of energy systems, was in charge of this session.

#### **4.1.7 Session: Overview of Renewable Energy Projects in Malawi**

To improve participants' comprehension of the energy sector, a briefing on the nation's energy profile was given to them. Next was a presentation of several noteworthy off-grid and grid-tied renewable energy projects in Malawi. Through the use of power point presentations and images, many community energy projects that have been implemented throughout Malawi and their implementing institutions/organizations were discussed. With reference to local instances, the significance of diversifying electricity generation was discussed, along with the relative merits of clean energy sources and nonrenewable energy options.

#### **4.1.8 Session: Renewable Energy Standard Regulations and Policies**

The participants were introduced to a variety of energy standard requirements, using Malawi Bureau of Standards (MBS) and international standards where necessary, for each component of the energy system, including batteries, solar modules, and electrical cables, to name a few, along with several regulatory bodies, to ensure that every installation must adhere to standard regulations. The Malawi Government's policies governing the renewable energy sector were also discussed such as the framework for mini grids, National Energy Policy (2018), Malawi Renewable Energy Strategy and the Malawi Rural Electrification Act. This was done in order to arm the trainees with the policies they would need to know when working on diverse energy systems in Malawi.

### **4.2 PRACTICAL SESSIONS**

The participants in this session were introduced to the practical installation of Solar PV systems. The following practical sessions were conducted over the course of the last three days.

#### **4.2.1 Site Visit: Mzuzu Central Hospital**

A site visit to Mzuzu Central Hospital was made to introduce the participants to existing solar PV projects from within Mzuzu City as shown Fig. 3. The system at this site was not functional, a situation that helped the participants to appreciate some of the factors that affect system sustainability.



*Fig. 3: Site visit at Mzuzu Central Hospital Solar PV installation*

#### 4.2.2 Site Visit: Northern Region water Board Solar Water Pumping System



*Fig. 4: Participants appreciating the solar PV water pumping system at NRW*

After learning about solar water pumping systems in class, participants were taken to the Northern Region Water Board, a Statutory Corporation in charge of providing water to the entire northern region of Malawi. The system, which was up and running, was installed due to severe electricity blackouts which was affecting water supply in Mzuzu City. The participants appreciated the solar PV water pumping system at a larger scale used for water supply.

#### 4.2.3 Session: Installation of Solar Fridge

Participants in this activity, as shown in Fig. 5, received instruction on how to connect a solar vaccine fridge, which is now widely utilized in Malawian health facilities without grid power. At the conclusion of the lessons, participants were able to install/assemble the solar fridges, starting with setting up the PV array structure to connecting the solar fridge and measuring the amount of power and temperature achieved by the fridge. Every learner was given a different role at each level of the practical session in order to promote active engagement.



*Fig. 5: Practical session on installation of solar PV fridge*



#### 4.2.4 Session: Installation of Solar Back Up System



*Fig. 6: Practical installation of solar power backup system at the Department of Energy Systems.*

Regarding this session, participants were given the task of installing a PV array on a structure with the assistance of the lab technician and a welder. Shown in Fig. 6 are the participants fixing the solar PV modules on a mounting structure while in Fig. 7 the participants are raising the pole mounted solar PV panel. The participants installed all of the electrical connections under the supervision of Mr. Gondwe. The participants subsequently successfully installed a 2kW back up system for the Energy System Department offices.



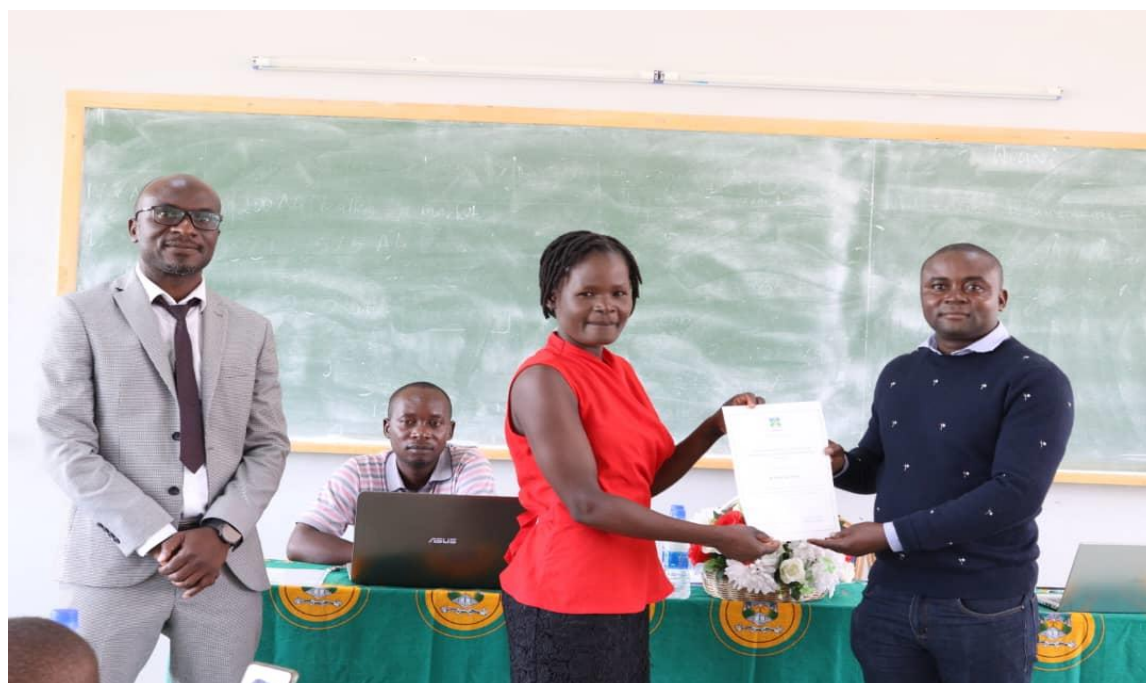
*Fig. 7: Practical installation of the pole mounted solar PV system*



## 5.0 Award of Training Certificates and Closing

Dr. Chrispin Gogoda, the TCRET coordinator, on closing gave the attendees a vote of gratitude for their active and enthusiastic involvement throughout the course. The training moderator, Miss Lumbani nyoni, requested one of the participants to address the audience on behalf of the entire group of trainees. Miss Elizabeth, speaking on behalf of the participants, acknowledged the training's many advantages for them, both theoretically and practically, and that they would be leaving as well-trained energy engineers prepared to support Malawi's energy transitions by promoting various clean energy options.

Dr Naphtale Mumba, who presided over the Certificate award ceremony on behalf of the Dean of Faculty as shown in Fig. 8, congratulated the participants on finishing the 10-day training program with the intention that the participants would favorably impact the energy sector with the knowledge and skills they have learned from the training. Additionally, He presided over the awarding of certificates. Participants may apply for a renewable energy installation licence at Malawi Energy Regulatory Authority (MERA) with these credentials.



*Fig. 8: On far Left and far right, Dr Chrispin Gogoda and Dr Mumba, respectively, presenting a certificate of completion to one of the participants*

## 6.0 End of Training Evaluation

The participants were then given assessment questionnaires to complete regarding the training programs, materials, and approach at the conclusion of the session on day 10.

The general feedback was that the training was worthwhile and that the strategy, course content, and resources employed were all well designed.

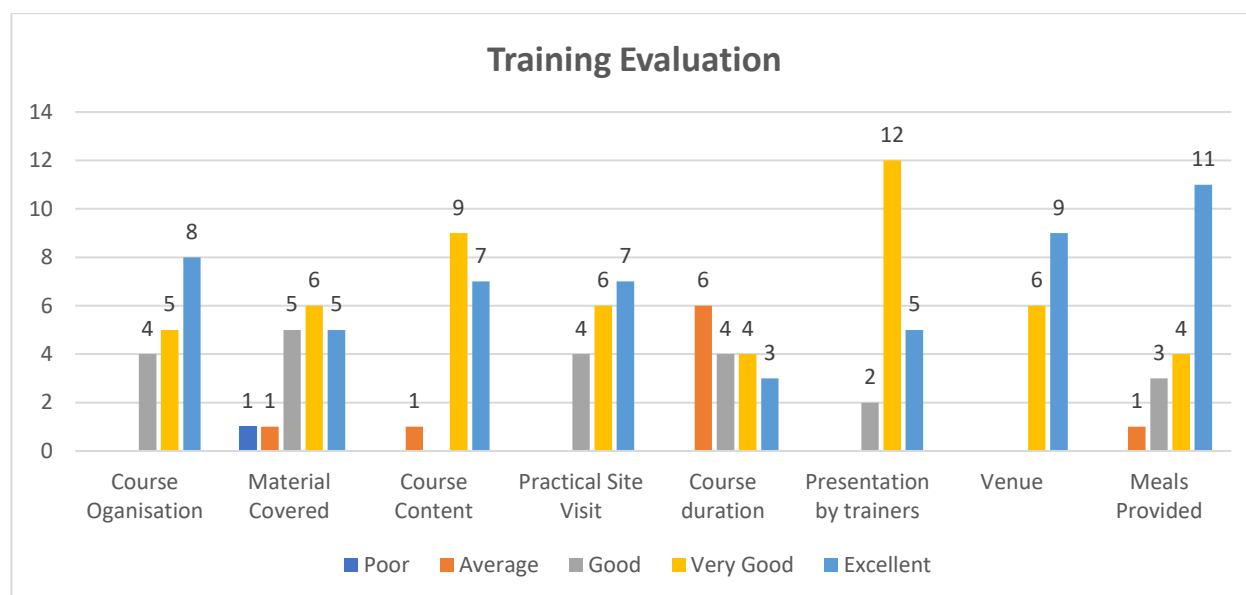


Fig. 9: Evaluation of training by participants

The majority of participants also expressed satisfaction with the practical sessions, but a few participants had some concerns about the length of the practical lessons. They suggested giving the practical sessions additional time and starting them during the first week of training.

## 7.0 Lessons and Recommendations

- The training approach used was very effective and enhanced both the theoretical and practical aspects of the course delivery. The participants' sharing of their personal experiences with various energy systems, along with the utilization of demonstrations and slides, contributed to a deeper understanding of the training sessions. The recommendations for the future trainings are listed below. More time should be allotted for practical sessions.
- To Conduct a follow-up survey asking participants how the training has affected or modified their work.
- Provision of adequate PPEs to the trainers during the practical sessions
- Consider inclusion of online session prior to the face-to-face session to enhance level of understanding of the subject matter.





## 8.0 References

ESMAP. (2021). *Tracking SDG7*. Retrieved from Tracking SDG7:  
<https://trackingsdg7.esmap.org/country/malawi>

Ipsita , D., Pamela , J., & Karin , Y. (2018). Biomass Cooking Fuels and Health Outcomes for Women in Malawi. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5357447/>

## 9.0 Annex





## List of Participants

No	Name	Institution/organization	Phone Numbers	Email Address
1	Elizabeth Nyanja	EGPAF	0993818750	<a href="mailto:Lizzienyanja2@gmail.com">Lizzienyanja2@gmail.com</a>
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19	Lonely Chavula	Linthipe one Engineering	0884857704	<a href="mailto:lonniechavula@gmail.com">lonniechavula@gmail.com</a>



## MZUZU UNIVERSITY

### FACULTY OF SCIENCE, TECHNOLOGY AND INNOVATION

#### TEST & TRAINING CENTRE FOR RENEWABLE ENERGY TECHNOLOGIES (TCRET)

**Short Course on Planning, Design, Installation and Management of Renewable Energy Systems 20<sup>th</sup> March– 31<sup>st</sup> March 2023**

**Venue: Room C- Centre for Open and Distant Learning Luwunga Campus**

#### Course Timetable

DATE TIME	Monday 20 <sup>th</sup> March 2023	Tuesday 21 <sup>st</sup> March 2023	Wednesday 22 <sup>nd</sup> March 2023	Thursday 23 <sup>rd</sup> March 2023	Friday 24 <sup>th</sup> March 2023
08:30–10:00	Registration  Participants' Expectations & OPENING CEREMONY  By The Vice-Chancellor of Mzuzu University	Photovoltaic Systems  Components - Inverters  - Dr. Chrispin Gogoda-	Solar PV System Planning, Design and Sizing Procedures  -Mr KT /Dr Chrispin Gogoda/Miss Lumbani Nyoni -	Planning for Solar PV System Installation - Site inspection, BoQs & Costing  -Sam D Gomani-	Overview of Large-scale Grid Solar PV Power Plants  - Mr. Vincent Mwale -
10:00 - 10:15	<b>B</b>	<b>R</b>	<b>E</b>	<b>A</b>	<b>K</b>



<b>10:15 - 12:00</b>	Overview of Renewable Energy Projects in Malawi  - Mr Vincent Mwale	Photovoltaic System Components -Batteries-  -Dr. Chrispin Gogoda-	Introduction to Solar PV Water Pumping Systems  - Mr. KT Gondwe -	Solar Electrical Wiring and Installation Tests and Testing Procedures  -Mr. SD Gomani-	Introduction to Hydropower  - Dr Chrispin Gogoda -
<b>12:00 - 13:30</b>	<b>L</b>	<b>U</b>	<b>N</b>	<b>C</b>	<b>H</b>
<b>13:30 - 14:30</b>	Introduction to Photovoltaic Systems  - Dr. Chrispin Gogoda-	PV Module Mounting Structures  - Mr. Timeyo Maroyi -	Sizing Solar PV Water Pumping Systems and System Structure  - Mr. KT Gondwe /Mr Vincent Mwale-	Troubleshooting and Maintenance of PV Systems  -Mr. SD Gomani-	Introduction to Wind Energy  - Mr. Vincent Mwale -
<b>14:30 -16:00</b>	Photovoltaic Systems Components - PV Modules  - Dr. Chrispin Gogoda-	Solar PV System Planning, Design and Sizing Procedures  - Mr KT/Dr Chrispin Gogoda/Miss Lumbani Nyoni -	Solar Refrigeration Systems  -Mr. SD Gomani-	RE and Electricity Policies, Regulations, Standards and Code of Practice  - Mr. Timeyo Maroyi	Solar PV /Wind Hybrid Systems Sizing Procedures  - Mr. Vincent Mwale -
	<b>End of Day 1</b>	<b>End of Day 2</b>	<b>End of Day 3</b>	<b>End of Day 4</b>	<b>End of Day 5</b>

<b>DATE</b>	<b>Monday</b>	<b>Tuesday</b>	<b>Wednesday</b>	<b>Thursday</b>	<b>Friday</b>
<b>TIME</b>	<b>27<sup>th</sup> March 2023</b>	<b>28<sup>th</sup> March 2023</b>	<b>29<sup>th</sup> March 2023</b>	<b>30<sup>th</sup> Mar 2023</b>	<b>31<sup>st</sup> Mar 2023</b>





08:30 - 10:00	Safety- Electrical  -Mr. KT Gondwe	Practical Solar Home System  -Mr. KT Gondwe/SD Gomani/Chrispin Gogoda/Vincent Mwale/Lumbani Nyoni/Timeyo Maroyi	Practical- Water Pumping  -Mr. KT Gondwe/SD Gomani/Chrispin Gogoda/Vincent Mwale/Lumbani Nyoni/Timeyo Maroyi	Field Visit-TBC	Closing Ceremony  &  End of Course
10:00 - 10:15	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	
10:15 - 12:00	Safety- Mechanical  -Mr. Timeyo Maroyi	Practical- Solar Home System Installation  -Mr. KT Gondwe/SD Gomani/Chrispin Gogoda/Vincent Mwale/Lumbani Nyoni/Timeyo Maroyi	Practical- Water Pumping  -Mr. KT Gondwe/SD Gomani/Chrispin Gogoda/Vincent Mwale/Lumbani Nyoni/Timeyo Maroyi	Field Visit-TBC	
12:00 - 14:00	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>	
14:00 - 16:00	Systems Commissioning  -Mr. KT Gondwe/Dr Chrispin Gogoda	Practical-Water Pumping  -Mr. KT Gondwe/SD Gomani/Chrispin Gogoda/Vincent Mwale/Lumbani Nyoni/Timeyo Maroyi	Practicals- Wind  -Mr. KT Gondwe/SD Gomani/Chrispin Gogoda/Vincent Mwale/Lumbani Nyoni/Timeyo Maroyi	Field Visit-TBC	
16:00	<b>End of Day 6</b>	<b>End of Day 7</b>	<b>End of Day 8</b>	<b>End of Day 9</b>	<b>End of Day 10</b>



## Resource & support Persons

1. Dr Chrispin Gogoda – Coordinator
2. Miss Lumbani Nyoni- Lead Facilitator
3. Mr. KT Gondwe
4. Mr. V Mwale
5. Mr. T Maroyi and
6. Mr. SD Gomani
7. Mrs K Khoza
8. Mr Christopher Hara