



REPUBLIC OF MALAWI

**TRACKING PROGRESS MADE IN IMPLEMENTING AND ACHIEVING
MALAWI'S NATIONALLY DETERMINED CONTRIBUTIONS UNDER
ARTICLE 4 OF THE PARIS AGREEMENT**

SUBMITTED TO

**ENVIRONMENTAL AFFAIRS DEPARTMENT OF THE REPUBLIC OF
MALAWI**

AS

AS A CHAPTER IN

**THE INITIAL BIENNIAL TRANSPARENCY REPORT (BTR) FOR THE
REPUBLIC OF MALAWI TO CONFERENCE OF THE PARTIES
SERVING AS THE MEETING OF THE PARTIES TO
THE PARIS AGREEMENT**

By

Suzgo Kaunda Ph.D et al

**NDC Tracking Expert and Chapter Team Leader
Malawi University of Business and Applied Sciences
P/Bag 303, Blantyre 3**

skaunda@mubas.ac.mw

Acknowledgements

Information and data to write this Chapter came from several organizations and experts. Such organizations include Malawi Energy Regulatory Authority, Energy Generation Company, Electricity Supply Corporation of Malawi, Environmental Affairs Department, Ministry of Energy, Ministry of Agriculture, and Department of Forestry, Non-Governmental Organizations, and City Councils (Blantyre, Zomba, Lilongwe and Mzuzu). These are well acknowledged. Mr. Thokozani Malunga of Ministry of Energy and Dr. Khumbo Kalulu of Malawi University of Business and Applied Sciences were valuable experts, deserving special recognition. The Initiative for Climate Action Transparency Project, contributed information that helped in tracking the NDCs. Lastly but not least, Roberta Chikoko, the NDC Country Coordinator for Malawi, and officials at Environmental Affairs Department, helped a lot in providing necessary documents and logistics in data collection. This is well acknowledged.

Table of Contents

Acknowledgements.....	i
Table of Contents.....	ii
List of Tables.....	v
List of Figures.....	vi
Abbreviations and Acronyms.....	vii
Chapter Summary.....	ix
CHAPTER THREE.....	1
3.1 National Circumstances and Institutional Arrangements.....	1
3.1.1 National Circumstances.....	1
3.1.1.1 Government structure.....	1
3.1.1.2 Population profile.....	2
3.1.1.3 Geographical profile.....	3
3.1.1.4 Economic profile.....	3
3.1.1.5 Climate profile.....	5
3.1.1.6 Sector details.....	6
3.1.2 Institutional Arrangements.....	8
3.2 Description of Malawi’s nationally determined contribution under Article 4 of Paris Agreement, including updates.....	14
3.3 Information necessary to track progress made in implementing Malawi’s Nationally Determined Contribution under Article 4 of the Agreement.....	21
3.3.1 Indicators for Tracking Progress.....	21
3.3.2 Methodologies and Accounting Approaches.....	24
3.3.3 Contribution from Land Use, Land-Use Change and Forestry.....	24
3.3.4 Cooperative Approaches that Involve the Use of Internationally Transferred Mitigation Outcomes.....	25
3.3.4.1 Malawi’s Engagement in cooperative approaches in the reporting period 2021-22	25
3.3.4.2 Authorised Mitigation Activities.....	28
3.3.4.3 Projects that are not yet authorized.....	29
3.3.4.4 Article 6.2 initial report (AIR) for Malawi.....	30
3.3.4.5 Governance of ITMOs in Malawi.....	30
3.3.5 The Structured Summary.....	31
3.3.6 Mitigation Co-benefits of Adaptation actions and economic diversification plans.....	31

3.4 Mitigation policies and measures, actions and plans, including those with mitigation co-benefits resulting from adaptation actions and economic diversification plans, related to implementing and achieving a nationally determined contribution under Article 4 of the Paris Agreement.....	33
3.4.1 Grid-connected hydropower generation	34
3.4.1.1 Extension of Wovwe Small Hydropower Plant	36
3.4.1.2 Mpatamanga Hydropower Project	37
3.4.1.3 Kholombidzo Hydropower Project.....	39
3.4.1.4 Fufu Hydro Power Project	39
3.4.1.5 Songwe Hydropower Project	40
3.4.1.6 Chasombo and Chizuma Hydropower Project.....	41
3.4.1.7 Estimation of emission reduction/avoided from Grid-connected hydropower projects	41
3.4.2 Off-grid small scale solar PV systems	46
3.4.2.1 Numbers of Solar Home System Installed in Malawi	47
3.4.2.1.1 Estimation of emission avoided/reduced from use of Solar Home Systems	48
3.4.2.2 Solar PV Mini-grids in Malawi.....	51
3.4.2.2.1 Mthembanji solar PV mini-grid.....	52
3.4.2.2.2 Sitolo Solar PV mini-grid	52
3.4.2.2.3 Mwalija solar PV mini-grid	52
3.4.2.2.4 Oleole solar mini-grid.....	53
3.4.2.2.5 Nyamvuwu solar mini-grid.....	53
3.4.2.2.6 Chimombo Solar PV mini-grid.....	53
3.4.2.2.7 Rural Off-Grid Energy Kiosks.....	53
3.4.2.3 Estimation of emission reduction from solar off-grid power systems.....	54
3.4.3 Grid connected large scale solar PV	55
3.4.3.1 Status of grid-connected large-scale solar PV in Malawi.....	55
3.4.3.2 Estimation of emission reduction from grid-connected solar PV	56
3.4.4 Improved Biomass Cookstoves (Charcoal and Firewood)	57
3.4.4.1 Status of Clean Cooking in Malawi and Projects	57
3.4.4.2 Estimation of emission reduction from implementation of efficient biomass cookstoves	58
3.4.4.3 Estimation of Emission from cookstoves considering ITMOs transferred.....	60
3.4.5 Analysis of emission reduction from all implemented NDC measures.....	61
3.5 Summary of greenhouse gas emissions and removals.....	61
3.6 Projections of greenhouse gas emissions and removals	61

3.7 Other information.....	62
References.....	63

List of Tables

Table 3-1: Institutional Arrangements to track progress made in implementing Malawi’s NDC under article 4 of Paris Agreement	9
Table 3-2: Institutions for domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to implementation and achievement of NDCs	11
Table 3-3: Policies related to domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to implementation and achievement of NDCs	12
Table 3-4: Description of Malawi's Mitigation NDC measures	15
Table 3-5: NDC emission reduction scenarios and relative reductions against business as usual scenario excluding emissions from FOLU	19
Table 3-6: Projection of absolute emission reductions in relation to emission pathways (business as usual and under implementation of NDC measures	22
Table 3-7: Comparison between GHG emissions for reference years (during NDC.2 estimation) and current GHG Inventory for reporting years of 2021 and 2022	23
Table 3-8: Projects intending to become authorized under Article 6	27
Table 3-9: Projects authorized under Article 6	27
Table 3-10: ITMOs authorised under Article 6 (refer to Table 2 for project title) in reporting period	27
Table 3-11: Corresponding Adjustments (averaging method) in t CO2e for CTF Table 4	27
Table 3-12: Issued carbon credits to Hestian Innovation Limited as of May 2025	28
Table 3-13: Expected GHG mitigation from the cooperative approach	30
Table 3-14: Mitigation co-benefits from adaptation actions	32
Table 3-15: Activities for Grid-connected hydropower NDC for period (2017-2024)	35
Table 3-17: Electric energy generated from grid connected hydropower planned projects	43
Table 3-18: GHG reductions from the NDC measure on grid-connected hydropower projects ..	45
Table 3-19: Grid-connected hydropower projects, likely year of commissioning and correspond GHG reduced	45
Table 3-20: Number of installed solar home systems and energy generated from installed solar home systems	49
Table 3-21: CO ₂ emission reduction from solar home systems	51
Table 3-22: Power and energy from installed solar off-grid power systems	54
Table 3-23: Estimated energy production and avoided GHG emissions by solar-off-grid power systems	55
Table 3-24: GHG avoided from grid-connected solar PV installed systems	56
Table 3-25: Number of wood fuel cookstoves and their emission reductions	60
Table 3-26: Net GHG emission reductions and their projection from improved cookstoves considering ITMOs transferred	60
Table 3-27: Summary of emission reductions in NDC-2 from measures in solar PV and improved cookstoves	61

List of Figures

Figure 1: Institutional arrangements for tracking Malawi’s NDC implementation.....	8
Figure 2: Share of number of sectoral mitigation measures over all mitigation measures.....	18
Figure 3: Summary of GHG emissions under business as usual and mitigation scenarios, with sectoral reductions with respect to implementation of NDC measures for base year (2017) and target year (2040) for each sector	20
Figure 4: Projection of Indicator (Total GHG reduction) on grid-connected hydropower from 2027 to 2040	46
Figure 5: Installed power from solar home systems	50
Figure 6: A picture showing an example of solar PV energy kiosk that will be used for small scale irrigation and water supply, battery charging, lighting: constructed by RENAMA in Thyolo District.....	53
Figure 7: Projections of greenhouse gas emissions and removals.....	62

Abbreviations and Acronyms

2006 IPCC Guidelines	2006 IPCC Guidelines for National Greenhouse Gas Inventories
AfDB	African Development Bank
AFOLU	Agriculture Forestry and Other Land Use
ASCENT	Accelerating Sustainable and Clean Energy Access Transformation (in Malawi)
ATM	Agricultural Tourism and Mining (Strategy)
BAU	Business as Usual (scenario)
BOOT	Build-Own-Operate-Transfer
BTR	Biennial Transparency Report
CARD	Churches Action in Relief and Development
CBIT	Capacity Building Initiative for Transparency (a project)
CDM	Clean Development Mechanism
CEPA	Centre for Environmental Policy and Advocacy
CH ₄	Methane
CISONECC	Civil Society Network on Climate Change. (CISONECC is an umbrella body of Civil Society Organizations working in Climate Change and Disaster Risk Management in Malawi).
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CTF	common tabular format (for Tables)
DRM	Disaster Risk Management
EAD	Environmental Affairs Department
EASE	Social Enterprise and Decentralization (project)
ECGES	Enabler Coordination Group on Environmental Sustainability
EnDev	Energizing Development (a programme for providing energy access worldwide)
ESCOM	Electricity Supply Corporation of Malawi
ESIA	Environmental and Social Impact Assessment
FOLU	Forestry and Other Land Use
GDP	Gross Domestic Products
GEF	Global Environmental Facility
Gg	Gigagrammes
GHGs	Greenhouse gases
GoM	Government of Malawi
HVAC	Heating Ventilation and Air Conditioning
IFC	International Finance Corporation
IPCC	Intergovernmental Panel o Climate Change
IPPs	Independent Power Producers
IPPU	Industrial Processes and Product Use
ITMOs	Internationally transferred mitigation outcomes
LPG	Liquefied petroleum gas
LULUCF	Land Use, Land Use Change and Forestry
MAIN	Mitigation Activity Idea Note
MAMICO	Malawi Mining Company

MCHF	Modern Cooking for Healthy Forest (Programme)
MEAP	Malawi Energy Acceleration Project
MEPA	Malawi Environmental Protection Agency
MERA	Malawi Energy Regulatory Authority
MHPL	Mpatamanga Hydropower Limited
MIP	The Malawi 2063 First 10-Year Implementation Plan (MIP-1)
MITC	Malawi Investment and Trade Centre
MITC	Malawi Investment and Trade Centre
MPGs	Modalities, Procedures and Guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, set out in the annex to Decision 18/CMA.1
MRA	Malawi Revenue Authority
MTF	multi-tier framework
MW	Megawatt
MWh	Megawatt-hour
N ₂ O	Nitrous Oxide
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organisation
NOCMA	National Oil Company of Malawi
NPC	National Planning Commission
NSCCC	National Steering Committee on Climate Change
OPC	Office of President
PDNA	Post-Disaster Needs Assessment
PPP	Public Private Partnership
Pv	Photovoltaic
REIAMA	Renewable Energy Industries Association of Malawi
RENAMA	Renewable Energy Malawi (a company)
SHSs	Solar Home Systems
SPV	Special Purpose Vehicle
TCCC	Technical Committee of Climate Change
tCO ₂ e	tonnes of carbon dioxide equivalent
TJ	Terajoule
TNC	Third National Communication
TV	Television
UNFCCC	United Nations Framework Convention on Climate Change

Chapter Summary

Malawi submitted its revised NDC under Article 4 of the Paris Agreement in 2021, pledging to reduce 17.7 million tCO₂e by 2040 relative to a *business as usual (BAU) emission* scenario that would emit 34.61 million tCO₂e by that year. This is an ambitious emission reduction, which targets a 51% emission reduction relative to BAU by 2040. Revised NDC measures are categorized into unconditional and conditional measures, basing on their planned sources of financing. Unconditional measures are those that are to be implemented using domestic financial resources. Emissions from implementation of unconditional measures describe emissions path under “*with measures*” scenario. Unconditional measures are planned to contribute 2.1 million tCO₂e emission reduction over the period, representing a reduction of 6% relative to BAU. On the other hand, conditional measures are planned to contribute 15.6 million tCO₂e (45% relative to BAU). Emissions resulting from implementation of conditional measures describe emissions under “*with additional measures*” scenario. Conditional measures are planned to contribute 15.6 million tCO₂e (representing 45% relative to BAU emissions). Modelling emission projections upto to 2040 under these three scenarios are presented in Figure 3-E1.

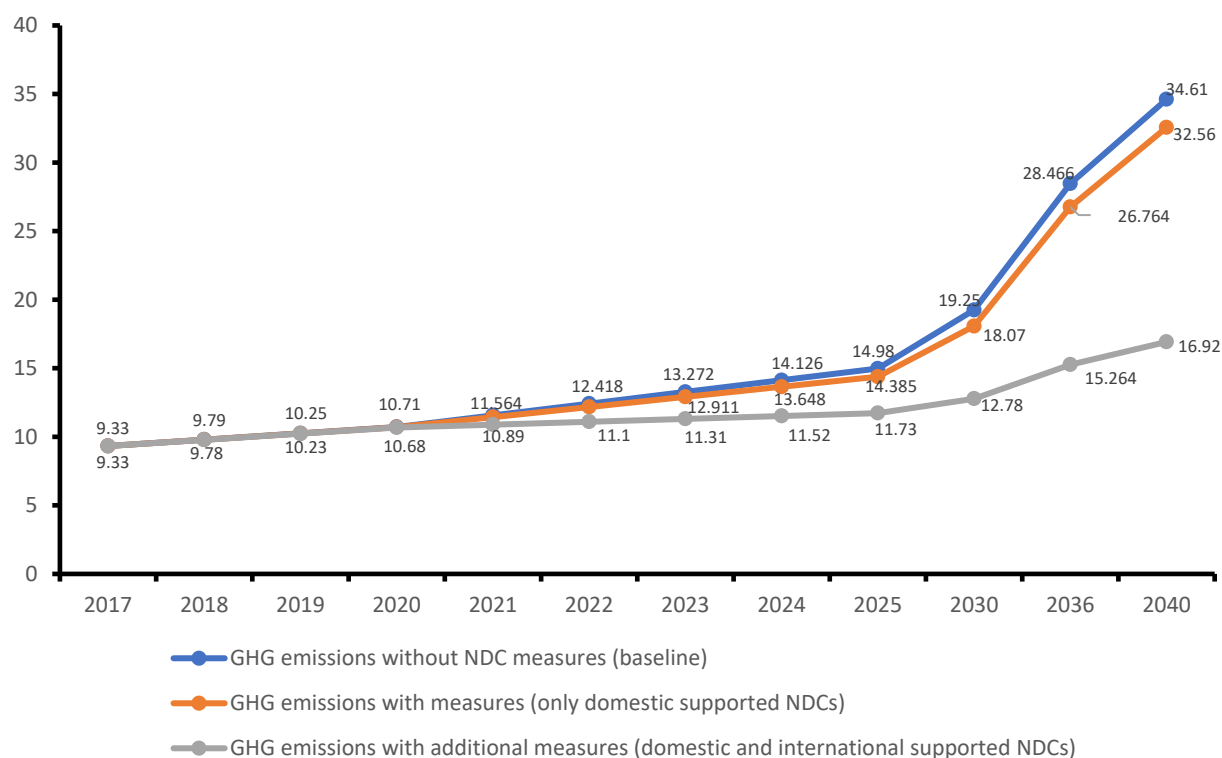


Figure 3-E1: GHG emission projection under different NDC scenarios

The indicator, absolute GHG emission relative to baseline emission as described in NDC, has been used to track progress of NDC implementation. This is the indicator that Malawi, as Party, selected to track its implementation and achievement of its NDC by 2040. With respect to reporting requirement for the BTR, actual GHG emissions for 2021 and 2022, are compared with emissions described by the mitigation scenario in the NDC. It is the expectation that actual emissions are to be constantly below the mitigation emission scenario (hence BAU scenario) to achieve the

projected emission reduction of 17.7 million tCO₂e by 2040. From the GHG Inventory conducted for this BTR, emissions (excluding FOLU) in 2021 and 2022 (refer to Table 3-E1) are very much higher than for the mitigation scenario described the revised NDC.

Table 3-E1: Comparison between GHG emissions for reference years (during NDC.2 estimation) and current GHG Inventory for reporting years of 2021 and 2022

Inventory Year	Energy (Gg CO ₂ e)	Industrial Processes and Product Use (Gg CO ₂ e)	Agriculture (Gg CO ₂ e)	Waste (Gg CO ₂ e)	Total (Gg CO ₂ e)	Total emission in the Current Inventory (million tCO ₂ e) $E_{Inventory,y}$ (million tCO ₂ e)	Total Emission Under Mitigation scenario where all NDC-2 measures implemented (million tCO ₂ e) $E_{MIT,NDC.2,y}$ (million tCO ₂ e)	Relative difference between emissions when all NDC-2 measures are implemented and actual emissions (%)
2017	1,366.32	89.38697	4,056.55	14,631.92	20,144.18	20.144	9.33	-116%
2018	1,629.07	107.5394	4,489.38	15,635.91	21,861.90	21.862	9.78	-124%
2019	1,693.66	146.0092	4,258.79	16,125.19	22,223.65	22.224	10.23	-117%
2020	1,859.69	179.4682	4,638.31	16,622.88	23,300.36	23.300	10.68	-118%
2021	1,697.86	194.8529	5,113.06	17,124.02	24,129.79	24.130	10.89	-122%
2022	1,810.16	188.3158	5,714.96	17,547.87	25,261.30	25.261	11.1	-128%

Since actual emissions emission levels are much higher than planned emissions described by NDC mitigation scenario, Malawi is not making progress in reducing emission relative to its business as usual emission, with high level of unlikely to meet the target of reducing 17.7 million tCO₂e by 2040. Therefore, basing on actual emissions provided by the GHG inventory, Malawi's progress in NDC implementation is not satisfactory. However, it was noted that emissions from the waste sector (refer to Table E1) in the current GHG inventory are extremely high relative to other sectors and to prior GHG inventories. It is recommended to check the methodology and data sources on estimation of emissions from the waste sector in the revision of NDC and in the subsequent GHG inventory compilations.

In its revised NDC Malawi, submitted a total of 34 mitigation measures, and a number of adaptation measures. This Chapter tracks progress made in implementing the revised NDC. Tracking progress of implementation is in terms of evaluating the indicator, which in the case of Malawi, is the absolute economy-wide GHG reduction relative to BAU. Thus, tracking of progress considered only GHG reductions from mitigation NDC measures. In order to understand the opportunities and challenges related to NDC implementation, national circumstances and institutional arrangements for the country have been provided. Challenging economic conditions facing the country have limited its capacity to implement most of the planned NDC measures, while the need for adapting to impacts of climate change increases as frequency and magnitude of climate related impacts continue to rise. The country's power sector, planned to have considerable amount of coal-fired power plants is still dominated by hydropower generated from a climate sensitive resource, long the Shire River. Population continues to rise, putting pressure on natural resources and the need to have efficient biomass cookstoves.

Energy Sector makes a significant share of contributions in the revised NDC, designed to mitigate emissions that would come from planned coal-fired power plants at Kam'mwamba (350 MW) in

Neno District and in Salima District (120 MW), as well as the diesel electric generators powered by EGENCO to generate electricity. A prioritized list of NDC measures were identified for tracking, using the following criteria, with equal weighting: availability of data (whether the measure is implemented or not), the measure addresses a key category in emission inventory, and potential for GHG emission reduction. Four NDCs measures were identified and tracked, as follows: Grid-connect hydropower generation; Off-grid small scale solar PV systems; Grid-connected large-scale solar PV; and Improved Biomass Cookstove (Charcoal and Firewood). The Table 3-E1 provides summary of status and its projected GHG-based outcomes for the prioritized measures.

Table 3-E2: Summary of NDC measures tracked in terms of status and GHG-based mitigation outcomes

NDC measure	Status of Implementation During the NDC-2 implementation period (2021 to 2024)	GHG-based mitigation outcomes from the measure
Grid-connect hydropower generation	<p>Grid based hydropower generation as an NDC has a target of having 410 MW of additional electricity to the grid by 2030. By 2024, the following were achieved</p> <ol style="list-style-type: none"> 1. Reviewing and updating the hydropower component of Malawi's IRP (2015 - 2035) was being done, but not yet completed. 2. Technical and financial feasibility studies conducted for the following for priority grid-connected hydropower projects: Wovwe Extension, Mpatamanga, Kholombidzo, Lower Fufu, Songwe, and Chasombo and Chizuma. Financial proposals are produced, including technical designs of the power plants. 3. Financing secured for the 360 MW Mpatamanga Hydropower Project (from World Bank) and major construction works to commence by end of 2025. Preliminary construction works have already started. <p>Implementation of this NDC is satisfactory and will likely surplus its target of 410 MW by 2030.</p>	<p>Electricity from grid connected hydropower is estimated to replace emissions from planned coal power plants at Kam'mwamba, Neno (350 MW) and at Pamodzi, Salima (120 MW).</p> <p>Total estimated hydropower energy from the 7 priority projects is 4,370,337.80 MWh. Estimated cumulative GHG reduction potentials for all priority grid connected hydropower projects are: 0.73 million tCO₂e by 2030, 1.28 million tCO₂e by 2035, and 2.25 million tCO₂e by 2040</p>
Off-grid small scale solar PV systems	<p>The target is to achieve at least 50,000 of additional small scale off-grid PV systems/solar lanterns by 2025 through Malawi. This target has been achieved, beyond the target, through project supported SHS installations. For example, during the period, The Malawi Electricity Access Project (MEAP), which was approved in 2009, in 2024, it registered 38,000 SHS through Ngwengwengwe Fund installed Tier 1 SHS. Tier 1 category of SHS are those that comprise of a solar lantern at least 1,000 lumen-hours (lm-hr) per day and sufficient energy to keep a well-used mobile phone operational. With support from World Bank, Malawi Government implements Accelerating Sustainable and Clean Energy Access Transformation in Malawi (ASCENT-Malawi) Project from 2025 to 2030, which aims to provide solar home systems (SHS) to over 800,000 households, contributing towards a 70% electricity access level by 2030. Further, The USAID funded Solar Home System Kickstarter Programme in Malawi installed over 108,000 SHS in Malawi from 2019 to 2022, through market activities of 4 companies it contracted to implement the project, namely SolarWorks, Vitalite, Yellow, and Zuwa Energy.</p>	<p>The SHS/solar lanterns displace kerosene lamps. The quantified GHG emission reductions from the reported SHS installations are as follows</p> <p>2021 = 29,380 tCO₂e 2022 = 39,757 tCO₂e</p> <p>Projected GHG emission reductions are estimated as follows</p> <p>2030 = 301,985 tCO₂e 2036 = 404,902 tCO₂e 2040 = 491,902 tCO₂e</p>

	<p>During this implementation period, Malawi about 6 solar PV mini-grids have been installed in Malawi. However, some of the mini-grids in Chikwawa District were damaged by flooding.</p> <p>Implementation of this NDC measure is progressing satisfactorily.</p>	
Grid-connected large-scale solar PV	<p>With enabling the environment for private sector participation in the power market, for example through favorable energy sector-wide policy of 2018, putting in place regulatory system, power purchase agreements, the first implementation period of NDC (2021 – 2025), saw a number of negotiated large-scale solar projected installed and commissioned, presented as follows.</p> <ul style="list-style-type: none"> i). Installation of the 60 MW Salima Solar PV power station by JCM Solar company of Germany and commissioned. This plant was commissioned in 2021; ii). Installation of 20 MW solar PV power systems installed by JCM company at Golomoti in Ntcheu District, commissioned in 2022; iii). Serengeti Energy installed 21 MW Solar PV, and commissioned in 2023 in Nkhotakota; iv). Votalia Company installed 40 MW of solar PV in Dwangwa in 2023. <p>Addition of solar PV electricity has enabled Malawi to decommission diesel power electric generators of 78MW installed capacity, contributing to avoiding related carbon emissions from the electricity generation industry. The Ministry of Energy reported that installation of battery-based energy storage system in Lilongwe would be commissioned in mid-2025. This battery storage power system will enable Ministry of Energy to integrate more solar PV based electricity to the grid.</p> <p>At a time of reporting this BTR, Press Corporation Malawi Limited was negotiating with Ministry of Energy to install 50 MW solar PV electricity in Lilongwe. Also, Atlas Energy company was negotiating to install 20 MW to be installed in Balaka. These two projects would put 70MW of electricity into the grid by 2027.</p> <p>A summation of installed and commissioned grid connected large scale solar PV give an installed capacity of 141 MW (by 2024). Together with planned installed of 70MW, there would be at least 210 MW of grid-connected large-scale PV by 2027. Therefore, grid-connected large-scale solar PV as an NDC measure, is progressing well and would surpass the target of 200MW before its NDC target year of 2030.</p>	<p>Grid connected solar PV power stations has displaced diesel-powered electric generators for generating electricity. The GHG emission reduction are estimated as follows</p> <p>2021 = 92,012 tCO₂e 2022 = 122,683 tCO₂e 2023 = 216,229 tCO₂e</p>
Improved Biomass Cookstove (Charcoal and Firewood)	<p>During this NDC-2 implementation period, Malawi has registered several players in promoting improved biomass cookstoves, through coordinated clean cooking programmes, such as the Ministry of Energy, non-Governmental organizations (local and international), some of whom are involved in carbon trading. However, numbers on actual biomass cookstoves are difficult to get, because of limitations in data collection on stoves. There are conflicting numbers of stoves that are reported, possibly because there is lack of tracking and recording of information related to implementation of wood fuel cookstoves. The most reliable information is those from the Ministry of Energy, reporting that up</p>	<p>The estimated GHG emission reduction through use of improved cookstoves replacing 3-stone open fire stoves as provided as follows:</p> <p>2021 = 1.28 million tCO₂e 2022 = 1.75 million tCO₂e 2023 = 2.19 million tCO₂e 2024 = 2.56 million tCO₂e</p>

	<p>to 2 million improved cookstoves were distributed in Malawi by October 2020 through a presidential decree in 2013 to intervene to control deforestation through popularizing use of efficient biomass cookstove. However, data from Malawi Energy Compact document on available improved biomass cookstoves in 2020 show that less than 2 million biomass cookstoves reported to have been achieved. Since the Malawi Energy Compact was validated through a rigorous process, this BTR uses the data from this source, which has also estimated cookstove numbers from 2025 upto 2030.</p>	<p>2028 = 2.86 million tCO₂e 2030 = 3.59 million tCO₂e</p>
--	--	--

During the NDC-2 reporting period (2021 to 2024), Malawi has traded in internationally transferred mitigation outcomes, with first transferred emissions deducted from GHG reductions in the improved cookstove NDC. Authorised ITMOs, issued to Hestian Innovation Limited as in May 2025, are presented in Table 3-E3.

Table 3-E3: Issued carbon credits to Hestian Innovation Limited as of May 2025.

Year	tCO ₂ e issued under GS11677
2021	989,219
2022	563,536
2023	207,295
2024	18,425
Total	1,778,475

Malawi has developed tools to help in tracking NDC implementation: Malawi NDC score-card; NDC implantation plan, and resource mobilization strategy. However, the following are the challenges that limits implementation of NDC measures: financing challenges; limited collaboration among NDC stakeholders, and limited awareness on NDC measures especially at local level.

CHAPTER THREE

TRACKING PROGRESS MADE IN IMPLEMENTING AND ACHIEVING MALAWI'S NATIONALLY DETERMINED CONTRIBUTIONS UNDER ARTICLE 4 OF THE PARIS AGREEMENT

3.1 National Circumstances and Institutional Arrangements

3.1.1 National Circumstances

In line with paragraph 59 of the MPGs, “*Each Party shall describe its national circumstances relevant to progress made in implementing and achieving its NDC under Article 4 of the Paris Agreement, including: Government structure; Population profile; Geographical profile; Economic profile; Climate profile; and Sector details*”, the following national circumstances for Malawi are presented.

3.1.1.1 Government structure

The Malawi Government is a democratic republic with a multi-party system, featuring a presidential head of state and a unicameral legislature. Governing the country is based on the Malawi constitution. Before, Malawi was a British Protectorate and it got independence from Britain in 1964. From 1971 to 1994, the country was governed based on one-party state principle. Multiparty democracy was introduced in 1994. The country has Central Government and Local Government system. The Central Government is made up into three branches that have separate powers: executive, legislative, and judicial. The Executive Branch comprises of The President, who is both head of state and head of Government, and is elected by popular vote. The President appoints a Cabinet, which advises and supports the President. The Office of the President and Cabinet (OPC) provides support and oversight leadership in the public service, according to the Malawi Government.

The Legislative Branch of Malawi Government is the National Assembly, a unicameral legislature. The National Assembly is responsible for making laws, providing an oversight role on the Executive Branch of the Government, and representing the people of Malawi. It is the supreme legislative body and holds the ultimate power over other political bodies in the country. The National Assembly used to consist of 193 Members of Parliament (MPs), but from 2025 elections, the number of MPs will be 229 following re-demarcation and the subsequent increase in number of constituencies by the Malawi Electoral Commission. Members of Parliament are directly elected by the people in single-member constituencies using the first-past-the-post system. The Legislative Branch is led by the Speaker of Parliament, who is elected by the MPs. Members of Parliament serve five-year terms, unlimited.

Judicial Branch (or Judiciary), as another arm of the Government is made up of lower courts (subordinate courts), a High Court, and a Supreme Court of Appeal. The judicial system is based on the English model. The Judiciary is headed by The Chief Justice, who is also the head of the supreme court. It is independent of the Executive and Legislative branches. The Judiciary's main functions include interpreting and applying the law, resolving disputes, and reviewing government actions for conformity with the Constitution. The Judiciary aims to provide access to justice for all

citizens and offers various services to facilitate this. The judiciary plays a crucial role in good governance by interpreting and applying the law, resolving disputes, and ensuring equal justice under law.

In terms of Local Government, Local Government, Malawi is governed based on mandate enshrined in the Constitution (1994), the Local Government Act (1998), and the National Decentralization Policy (1998). The country operates a single-tier local government system; and it comprises of 28 district councils, 4 city councils, 2 municipal councils, and 1 town council. Local authorities are responsible for local governance and development. The local Government affairs are under the Ministry of Local Government. Following the enactment of the Local Government Act and coming up of Decentralization Policy, most of the Government Departments have incorporated decentralization, which helps in managing activities related to implementation of Government development activities, such as projects related to implementation NDC measures at local levels. Local Governments play a crucial role in development, because they act as a bridge between citizens and the Central Government structure. They are responsible for promoting local development, including infrastructure and economic growth, and ensuring effective service delivery to citizens. Local Governments also facilitate citizen participation in development initiatives, promoting accountability and responsiveness.

Despite having governance structures in place, Malawi has experienced more environmental damage (forest degradation and deforestation) in the multiparty democratic era than during the one-party era, manifested by unabated cutting down of trees for charcoal and individuals selling charcoal that is displayed openly along the main roads. This could point to challenges in regulation and enforcing of laws during this democratic era.

3.1.1.2 Population profile

Population of Malawi, in 2024, was estimated to be around 22.216 million people and is growing at a rate of 3% per year (Statista, 2025). With a land area of 94,280 km², this gives a population density of close to 240 people per km², placing the country among African countries with high population density: Rwanda, 561 people per km², Burundi, 560 people per km²; Nigeria, 261 people per km²; and Uganda 257 people per km² (Wordometer, 2025). Spatially, 44% of the population lives in the south, 43% in the center, and 13% in the north. In regard to the population distribution in urban areas vs rural areas, 16% of the population live in the urban areas while the rest, 84%, live in the rural areas. Women comprise 51% and men 49% of the population (World Bank, 2025). About half of the population is 18 years or older. Average life expectancy is approximately 63 years as of 2023, which is still below the average life expectancy for Africa, which is estimated at 64.5 years in 2023 (World Bank, 2025).

High population density would lower investment cost to implement some of the NDC measures cost per unit of people served. For example, in a densely populated township, the distribution cost of grid-based electricity supply per unit number of people is lower. Also, a high population would provide market to NDC measures that are implemented using market approach, for example, biomass cookstoves. On the other hand, high population density exerts pressure on natural resources (like trees and forests) for a livelihood. For example, charcoal trade in Malawi, which could erode gains in the emission reduction realized from implementation of NDC measures. further, population profile where majority are in rural areas (where most of trees and forests

degradation and deforestation take place), make implementation of NDCs measures that result in arresting forest degradation and deforestation meaningful. Implementation of such measures is likely to be supported by key stakeholders like development partners.

3.1.1.3 Geographical profile

Malawi is a landlocked country, located in southern-eastern Africa, nestled along the southernmost part of the East African Rift Valley System. The country is bordered by Tanzania to the north and northeast, Mozambique to the south, southwest, and east, and Zambia to the west. Stretching about 910 kilometers in length and ranging from 60 to 161 kilometers in width, Malawi covers a total area of 118,484 square kilometers. Of this, 80% of square kilometers) is land, while the remaining 20% is water taken up by the vast Lake Malawi. Malawi is divided into three main regions: Northern, Central, and Southern regions, each with distinct geographical and cultural characteristics. The Northern Region, known for its highlands and mountains, including the Nyika Plateau, has Mzuzu as its administrative and commercial center. The Central Region, dominated by the capital city Lilongwe, is a hub of political and economic activities and is experiencing rapid urbanization and infrastructure development. The Southern Region, the most densely populated, includes the commercial capital Blantyre and Zomba, the former capital city, known for its attractive plateau.

Being a landlocked, the country faces logistical and transportation challenges, which affect implementation of projects. Most of the imported goods and materials come via Beira and Dar es Salaam ports in Mozambique and Tanzania respectively. With logistical and transportation challenges, timely completion of power plants construction to implement NDC measures related to hydropower and solar PV would be affected, making projects longer to construct and relatively expensive. Currently, the Government of Malawi is prioritizing rail transport, demonstrating it through investment in the Nacala Corridor. The Nacala Corridor has started to be used in transporting oil from Nacala port into the country, Lilongwe (NOCMA, 2024). However, being a demonstration project, it is hoped that the Government and other business partners will increase usage of the Corridor as one of the important import routes. Doing so could lower transportation costs.

3.1.1.4 Economic profile

Malawi is one of the least developed countries, with a GDP per capita (current US\$) of 602.3 USD in 2023 (World Bank, 2024). The country faces several chronic challenges including poverty, reliance on donor funding, limitation on foreign dominated currency, and vulnerability to climate shocks. This scenario would limit the buying power for energy products related to NDC measures. According to the World Bank and reported by Lloyds Bank, in 2023, real GDP grew by just 1.6% year-on-year, constrained by limited access to inputs due to foreign exchange shortages and the effects of Tropical Cyclone Freddy (Lloyds Bank, 2024). Forex challenges would also delay completion of projects, and would therefore affect implementation of project based NDC measures like large-scale hydropower and grid connected solar PV. The economy continues to face serious difficulties. In 2024, the real GDP growth slowing to 1.8% amid a severe drought and persistent foreign exchange constraints. Real GDP is projected to grow modestly by 2% in 2025, supported by a partial recovery in the agricultural sector. However, growth in the industrial and services sectors is expected to remain subdued due to ongoing foreign exchange shortages, which continue to limit the import of production inputs. In 2026, GDP growth is forecast at 2.4%.

The economy of Malawi is a predominantly agricultural-based one, with the sector contributing about 30.4% of GDP, 80% of export revenue, and 61.7% of employment (Lloyds Bank, 2024). Agriculture remains the greatest contributor to employment. Tobacco is the most important export crop providing most of forex, followed by tea, sugar, and coffee. Agricultural sector is dominated by rain-fed, which is vulnerable to droughts and flooding. The other economic sectors are mining, tourism and industry. Despite poor showing on economic performance, the country is endowed with several policy documents to turn around the economic situation of the country. For example, The Government of Malawi has come up with Agriculture, Tourism and Mining (ATM) Strategy to recover and boost the country's economy, in line with the overarching economic development policy: The Malawi 2063. Through the ATM Strategy (which is budgeted), the Government supports investments in various agricultural projects such as mega farms for increased production in the agricultural sector. Mega farms require enormous amounts of chemical fertilizer for example urea, which increases GHG emissions in the agriculture sector. Also, the Government is promoting irrigation on large scale through the same ATM Strategy. Commercial irrigation requires energy to power irrigation pumps. This provides opportunity to apply off-grid solar in irrigation, providing opportunity for implementation of NDCs measure on off-grid solar PV.

The growth rate for agriculture industry in 2022 was recorded at 0.9% from 3.8% recorded in 2021. This positive but slow growth was largely attributed to the adverse weather conditions experienced in 2022 as the country was hit by Tropical cyclones, Anna, Gombe, Dumako and Freddy which affected crop and animal production. The cyclones also affected large-scale agriculture, such as tobacco and sugarcane production. The industry's growth rate for 2023 was estimated at 0.8%, a slight decline in performance compared to 2022. The country experienced unfavourable weather conditions in form of Tropical Cyclone Freddy (TCF) and incessant rainfall which affected crop and animal production. This resulted in poor production in the main crops such as soybean. According to the 2023 Post-Disaster Needs Assessment (PDNA) report, losses caused by TCF to the crop and livestock industry were estimated at USD55.01 million and USD3.04 million, respectively, across all the 16 affected districts. Furthermore, the northern region was affected by dry spells, which undermined rice production. In addition, the government experienced operational challenges in the procurement and distribution of affordable inputs prior to, and during the farming season. This had a detrimental impact on small-scale agriculture, hence affecting production.

Tourism sector is considered a priority economic sector in the country's long-term development plan, the Malawi 2063. The sector contributed 6.7% to GDP in 2024 (MCCCI, 2024). However, it is affected by climate change impacts through destruction of infrastructure such as access roads to tourism sites such as national parks and game reserves, loss of biodiversity that attract tourists, and increased illegal livelihood activities on protected sites arising from surrounding communities as part of climate change adaptation endeavors of the communities. Cyclones and floods affect the sector. In 2024, rising water levels in Lake Malawi has disrupted activities of most hotels along Lake Malawi leading to closure of notable hotels. Also, prevailing economic environment of higher macroeconomic imbalance evidenced by rising fuel and food costs has not only affected the operational costs for businesses in the sector but also reduced demand for accommodation services. Higher inflation has eroded the buying power of consumer income thereby reducing the amount of income allocated towards domestic tourism. Therefore, NDC measures related to adaptation would find relevance and supported.

Mining sector is among the sectors prioritized in the ATM Strategy to contribute significantly to economic development. Government has established a public company to spearhead mining trade in the country, called The Malawi Mining Investment Company (MAMICO). The company, launched in February 2025, is a body corporate established with the mandate of promoting the optimal development of the mining sector and maximization of national revenue and social benefits. MAMICO aligns with national development goals, notably the Malawi Vision 2063, which highlights mining as a priority sector under the Industrialization pillar. Previously, from 2009 to 2014, the mining sector contributed a significant share (around 10%) to the GDP, from the Kayelekera Uranium Mine in Karonga District (north of Malawi). However, since 2014, the uranium mine went into care and maintenance phase due to a depressed international uranium market. In 2021, Lotus Resources Limited of Australia, bought Kayelekera Uranium Mine from Paladin Africa Limited; the company stated that it is ready to start uranium mining in the third quarter of 2025 (Lotus Resources Limited, 2024). In the years 2000s, the country has registered several mining interests in rare earth minerals, the country being one of the countries endowed with rare earth mineral resources. Kangankunde in Balaka District and Songwe Hill in Phalombe District are key examples of areas with notable rare earth mineralization in Malawi. Kangankunde project, implemented by the Lindian Resources (an Australian Company), is one of the largest rare earth deposits in the world, and mining activities are stated to commence in 2026 (Times Malawi Limited, 2024). The planned extractive mining activities require firm energy supply, which is currently limited. Therefore, implementation of NDC measures related to large scale hydropower and grid connected solar PV would provide firm energy for mining activities.

3.1.1.5 Climate profile

Scientific evidence in Malawi shows increase in the frequency, intensity and magnitude over the last two decades of extreme weather events (GoM, 2016). Further, it is also reported that Malawi is progressing to a warm climate system with increase in average temperatures. The country has witnessed increased incidence of extreme temperatures (heatwaves), and has high levels of unpredictability with respect to onset and duration of precipitation. All these point to climate change. The warm climate increases the cooling load during summer, and thus increases energy demand for heating ventilation and air-conditioning (HVAC) systems especially in urban areas. Malawi is vulnerable to impacts of climate change; particularly to floods, droughts and strong winds associated with tropical cyclones. Most of the drought episodes that Malawi experiences are caused by the El Nino and the Southern Oscillation phenomena, with serious impacts on crop and livestock production. Additionally, the country experiences long dry spells that occasionally disrupt the rainfall season and cause crop failure. The pattern of rainfall results in the seasonality of crop production, and forces farmers to stay idle during the dry season. This gives basis for the Government and other stakeholders to prioritize irrigation, which require considerable large amounts of energy, and off-grid solar PV are favored in this situation. Flooding, which occurs on annual basis, significantly impact power production by damaging hydroelectric power stations which are located along Shire River. The damage caused power outages and reduced electricity generation, impacting the national grid and causing disruptions to economic and social activities. One way of adapting to impacts of climate change on power system, The Government is diversifying power generation sources. Therefore, implementation of NDC measures on large scale hydropower that are away from Shire River would get support from Government and other development partners.

3.1.1.6 Sector details

Malawi's revised NDC identifies agriculture, energy, industrial processes and product use (IPPU), forestry and other land use (AFOLU), and waste as sectors for emission and removal of greenhouse gases. This section presents details that are necessary for tracking NDC implementation. It starts with presenting on agricultural sector, then energy, IPPU, FOLU, and Waste. In third national communication (TNC), agriculture accounted for by far the largest share of the total emissions excluding FOLU (5.07 million tCO_{2e}, 54% of total), followed by Energy (2.34 million tCO_{2e}, 25% of total) and waste (1.67 million tCO_{2e}, 18% of total). Emissions from IPPU represented just 0.24 million tCO_{2e}, equivalent to around 3% of total emissions in 2017 (mainly associated with calcination CO₂ emissions from minerals production). Emissions from livestock, predominantly methane from enteric fermentation in cattle, represented the largest emissions source category, followed by N₂O emissions from managed soils in crop production. Following these agriculture sources, major sources included CO₂ emissions from fossil fuel use in transport, which accounted for 11% of the total, and methane emissions from unmanaged waste disposal site (dumps), which accounted for 13% of the total. Dependence on chemical fertilizer coupled with support from Government for small-scale household farmers to access chemical fertilizer, increases N₂O emissions. This would affect achievement of emission reductions in the agriculture sector.

The energy sector is an important sector in the social and economic development of any country. In Malawi, the energy supply sub-sector is characterized by predominant supply of biomass energy in form of firewood and charcoal, which are sourced from trees and forests unsustainably. Modern form of power, electricity contributes less than 3% to the energy supply mix. Almost all of electricity is generated from hydropower plants that are in the Shire River, south of the country. The installed hydropower electricity is around 400 MW. While hydropower is a renewable energy resource, generation of hydropower electricity in Malawi is challenged by impacts of climate change that damage the power infrastructure, such as flooding and droughts. The power sector is one of the sectors that is vulnerably to climate change in the country. The Government plans to develop other power systems away from Shire River to diversify sources of electricity.

Malawi's energy supply mix is dominated by biofuels, mostly fuel wood and charcoal. Other biofuels are bagasse used in generation of electricity used at sugar producing companies (Illovo Nchalo, and Illovo Dwangwa), as well as fuel-grade ethanol which is produced by Presscane Limited¹ and Ethanol Company Limited². The other sources where energy is supplied from are petroleum products (petrol, diesel, aviation fuels and liquefied petroleum gas (LPG)), which are wholly imported. A considerable share of energy is also supplied from renewables: hydropower and solar radiation, which are mostly into generation of electricity both on-grid and off-grid. Finally, coal is also a form energy supply used mostly in tobacco processing and beverage industries for supplying process steam. A significant amount of coal used in the country is mined in the northern part of the country. Some of the coal is imported into the country from neighboring countries, mostly from Mozambique. The Government planned to construct a 350 MW coal powered thermal power plant in Kam'mwamba. Neno District (southern part of Malawi). The plan is now with Electricity Generation Company to source financing for the project. If this coal powered project materializes, coal will contribute a significant share in the energy supply mix.

¹ <https://presscane.com/>

² <https://ethanolmw.com/>

Petroleum products According to the 2020 energy balance produced by the ministry of energy, the energy supply mix for a total of 4902 kToE was as follows: biofuel 85.6%, petroleum products 10.2%, hydropower and solar radiation 3.3%, and coal 0.9%. There are plans to import electricity once the Mozambique-Malawi Interconnector Project finalizes, that will add electricity supply of 150 MW.

In terms of energy consumption sub-sector, the household sector consumes the largest share of energy supplied (80%). Industry and transport sectors both consume 9% respectively while other sectors (commercial and agriculture) account for about 2% of the total energy use by the consumers³. Energy consumed in the mining sector is quite minimal, though it would pick up once planned mining projects are materialized. Electricity is used in all economic sectors, but the main ones are the food and tobacco and services (or commercial) sectors who are estimated to be consuming over two-thirds of the electricity supplied to business. Petroleum products (petrol, diesel, aviation fuels and LPG are mostly consumed in the transport sector (petrol and diesel), road transport (petrol and diesel) being dominant, followed by civil aviation (aviation fuels; aviation gas and jet kerosene), rail and waterborne navigation. The manufacturing, industry and construction (in the category of other sectors) also consumes petroleum products for self-generation of electricity and shaft power to run machines/plants such as those in the construction sector.

Malawi's mining sector is in its infancy stage compared to neighboring countries like Zambia and Tanzania. It is mainly into quarrying and small-scale mining of precious stones like gold, which cause environmental degradation. Small-scale mining of gold is regulated, but the country finds challenges in controlling the illegal mining activities, which have created gullies along river banks and other areas. In the early 2010s, mining activities contributed significant contributions to countries GDP, mainly from Kayelekera Uranium Mining in Karonga District, which is now under care and maintenance. Malawi is reported to possess relatively huge deposits of rare earth minerals, which could be used as critical minerals in producing components used in renewable energy industry. Also, it is reported that there are prospects of oil in the Lake Malawi, but exploration for it has not yet started. Mining sector would be among major energy consumers in the near future, favouring implementation of NDC measures on grid-connected hydropower and solar energy.

Malawi faces a decrease in tree and forest cover due to deforestation. This could lead to desertification, if it is not controlled. The forest cover was 47% in 1975, 36% in 2005 (Mauambeta, et al., 2010) and 33% in 2015 (FAO, 2015). The deforestation rate is at 2.8% per year, thus losing about 250,000 ha of forest cover per year (GOM, 2016). The human activities are the major causes of deforestation and forest degradation, such as expansion of farming land and other land uses, extensive biomass harvesting for household fuel and tobacco curing energy supply, selective tree felling for timber and curios, uncontrolled forest fire (which is also blamed on arsonists, especially in industry forest like Viphya Plantations), and tree debarking for herbal medicine and bee keeping. Deforestation and forest degradation are exacerbated by population pressure, poverty and limitations in alternative livelihoods.

3

<https://www.energy.gov.mw/statistics/#:~:text=MALAWI%20ENERGY%20STATISTICS%20OVERVIEW,electricity%20and%201%25%20for%20coal>.

3.1.2 Institutional Arrangements

Government of Malawi has put in place robust national planning process involving pillar, enabler, sector and district level coordination structures that are coordinated by the National Planning Commission (NPC) for medium to long term plans and strategies, and the Ministry of Finance and Economic Affairs, and Public Sector Reforms (MOEDP&PSR) through sector working groups (SWGs) that track the short term implementation of sector priorities aligned with the goals of the national vision, The Malawi 2063. Implementation of NDC measures falls under Environmental Sustainability enabler for achievement of Malawi 2063. Given the cross-cutting nature of environmental sustainability matters, there is a National Steering Committee on Climate Change (NSCCC) and the joint Technical Committee on Climate Change and Disaster Risk Management (TCCC&DRM) that define multi-year pillar and enabler priorities as well as advising Government on the resources required for meeting the defined Vision priorities within their respective pillars and/or enablers. The NSCCC and TCCC&DRM shall receive policy and implementation oversight from the NPC through the Enabler Coordination Group on Environmental Sustainability (ECGES). The NSCCC comprises all key ministries and departments and provides strategic direction and inter-ministerial coordination on national climate change policy including Malawi’s NDC. Figure 3-1 summarizes the institutional arrangements for tracking of NDC implementation in a transparent manner.

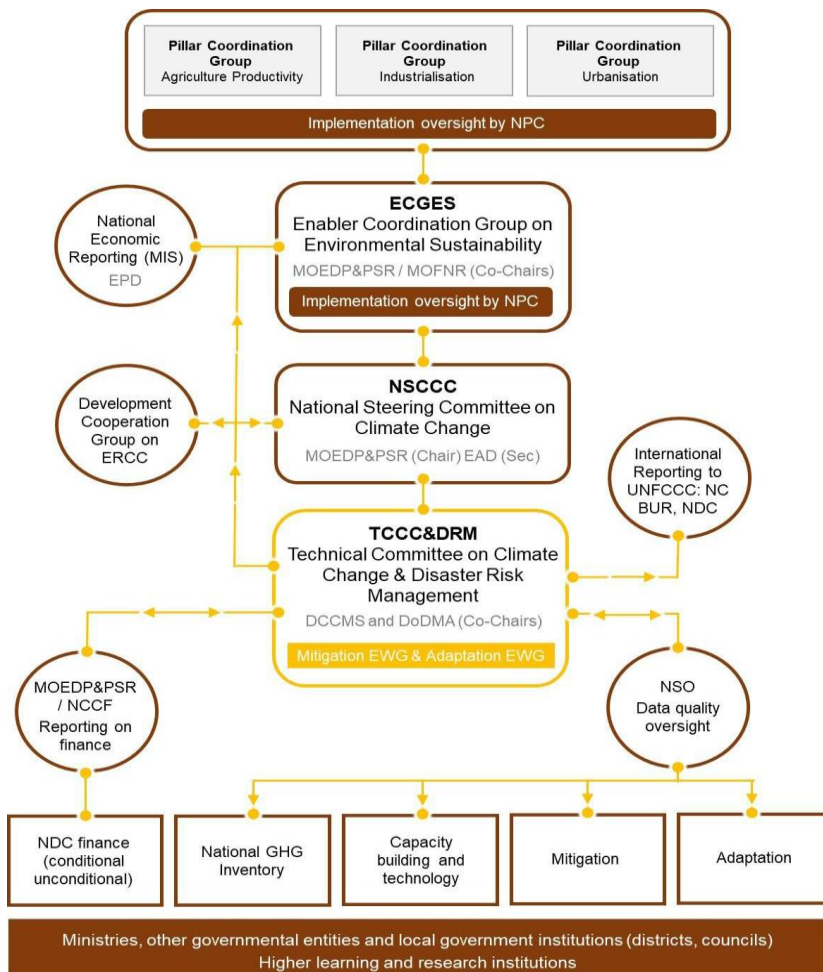


Figure 3-1: Institutional arrangements for tracking Malawi’s NDC implementation

In relation to MPG paragraph 61, the institutional arrangements available in Malawi to track progress made in implementing and achieving its NDC measures are presented and explained in Table 3-1. Basically, the two Government departments listed in the table are mandated to firstly assess impacts of any project that can affect the environment and climate system in Malawi, before the project can proceed to construction stage. The institutions are also involved in monitoring and reporting impacts of such projects on environment and climate system. These arrangements therefore, are central in tracking progress made in implementing NDC measures.

Table 3-1: Institutional Arrangements to track progress made in implementing Malawi’s NDC under article 4 of Paris Agreement

Arrangement/Institution	Role in tracking progress made in implementing and achieving its NDC measures
Environmental Affairs Department in the Ministry of Natural Resources and Climate Change	<ol style="list-style-type: none"> 1. It is a focal point for handling all of climate change related activities in Malawi, including implementation of NDCs measures. It is a requirement of the Government that all climate change activities are recorded and reported to EAD 2. EAD is the authority in policies on environment and climate change management. The institution provides policy guidance to public and private organizations/companies that implement NDC measures. Documentation of engagements in policy guidance provides useful information on tracking of progress made in implementing the NDCs 3. Thirdly, the EAD performs the role of supervision, monitoring and coordination over all matters relating to the environment, natural resources and climate change management. This provides space to track and record progress in implementing NDCs 4. EAD has a unit to record and archive data related to project they carryout and reported to them, such as those related to NDC implementation.
Malawi Environmental Protection Agency (MEPA)	<ol style="list-style-type: none"> 1. MEPA is a newly institution, established by the Environment Management Act (2017) with the mandate as the principal agency for the protection and management of the environment and sustainable utilization of natural resources in Malawi. 2. One of the functions of MEPA review and approve environmental and social impact assessment, strategic environment environmental assessments and other relevant environmental assessments in accordance with Environment Management Act (2017). In this, NDC measures such as those involving large scale hydropower projects and grid connected solar PV undergo assessment of it impacts including its GHG and non-GHG impacts. 3. It also the function of MEPA to supervise, monitor and coordinate over all matters relating to the environment, natural resources and climate change management. 4. Further, MEPA is mandated to prepare and publish a National State of the Environment and Outlook Report every five (5) years and annual report on the status of the environment. The process of preparing the report involves analyzing impacts that projects on the environment and climate system of Malawi. This provides space for projects related to NDC implementation to have its impact evaluated and published for dissemination, helping to track its implementation progress.

In terms of arrangements necessary to track internationally transferred mitigation actions (ITMOs), firstly as a Party, Malawi recognizes that participation in ITMOs is on voluntary basis. In accordance to Article 6 of the Paris Agreement, Parties participating in ITMOs must apply a robust accounting system to avoid double counting, and must ensure proper governance structure to oversee ITMOs transaction and to ensure transparency in reporting ITMOs in BTRs. In terms of accounting for ITMOs, Malawi has adopted a GHG Inventory Management System, where data

providers for quantifying mitigation outcomes (emission reductions and removals) are identified and engaged. These would isolate data for tracking implementation of Malawi's NDC and data for ITMOs from the various carbon trading projects in Malawi. The office of Environmental Affairs Department has a separate unit for managing ITMOs in Malawi. Among others, this unit is responsible for estimating carbon credits from carbon trading application projects in Malawi, using 2006 IPCC Guidelines for National Greenhouse Gas Inventories. There is need for capacity enhancement to measure and validate emissions and removals for proper management of ITMOs.

Government of Malawi has put arrangements to manage ITMOs. Firstly, Malawi is a Party to Paris Agreement, therefore, the country is legally allowed to participate in cooperative approaches such as the ITMOs. There is an established Environmental Affairs Department (EAD) that coordinates and prepares GHG Inventories, NDCs and their revisions, and BTRs. Adjustments and accounting for ITMOs with respect to these reporting documents is handled by the EAD. In addition, Malawi is in the advanced process of developing regulatory framework to guide in engagement in international carbon market. The framework, will among others provide for the following key guidance:

- a) The Ministry responsible for Climate Change Management will authorize and oversee all proposed projects.
- b) A Carbon Registry System will document and manage all carbon credit projects.
- c) Project developers are required to submit a Mitigation Activity Idea Note (MAIN), detailing project objectives, alignment with Malawi's NDC priorities, proposed technologies, financial and technical requirements, and a monitoring, reporting, and verification plan.
- d) Upon positive evaluation of the MAIN, the Ministry will issue a Letter of No Objection.
- e) Developers must then submit a Mitigation Activity Design Document for each project, accompanied by an administration fee, which undergoes verification and validation.
- f) Projects must adhere to guiding principles, including environmental integrity, transparency, sustainable development, and generating social and economic co-benefits.
- g) Regarding the upcoming auction scheduled for July 16, 2024, aligned with the Paris Agreement principles of multilateral trust and leadership:
- h) 12.5% of auction proceeds will directly support Malawi's environmental, climate, and carbon initiatives.
- i) Additional proceeds will be allocated to local entrepreneurs, ensuring reinvestment in Malawi's sustainable development.

It is reported that the Government is also reviewing all existing carbon credit projects to align with the new framework. In terms of structures that would help track progress and impacts of carbon credits, The Government has established the National Planning Commission, (NPC) an office that tracks development projects in the country in relation to achievement of Malawi 2063 (Malawi's overarching development strategy). The Malawi 2063, implemented via medium terms strategies or implementation plans, has prioritized projects that create enabling environment for thriving of economic and industrial activities. Some of these projects are on transitioning to low-emission development in the power sector, for example. With NPC in place, carbon trading projects, hence ITMOs, would therefore be tracked accordingly. Furthermore, trading of carbon is being identified by the Government of Malawi as one of the revenue generation to bolster the economy (and expected proceeds from carbon Malawi are reflected in the national budget), and has subsequently

developed the Malawi's carbon credit regulatory framework, which would be finalized in 2025. Through this regulatory framework, Government of Malawi will have a proper platform for managing carbon projects and markets in Malawi. Lastly but not least, Malawi is developing legislation and regulations for the carbon trading landscape that was commissioned in 2022. The content of the legislation and regulations is under design. The legislative framework is expected to cover the following aspects:

- a) Monitoring, reporting, and verification mechanisms.
- b) A carbon credit registry.
- c) An oversight agency for carbon credit trade.
- d) Registration requirements for businesses involved in carbon trade.
- e) Mandated benefit-sharing agreements with minimum ratios.
- f) Renegotiation of revenue sharing for existing projects

In terms of information on institutions, legal, administrative and procedural arrangement for supporting domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to implementation and achievement of NDCs in relation MPG paragraph 62, Table 3-2 and Table 3-3 present the information.

Table 3-2: Institutions for domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to implementation and achievement of NDCs

Arrangement/Institution	Role
Ministry of Energy	<ol style="list-style-type: none"> 1. Oversees the energy sector and establishes energy policies and sets strategic direction for the sector. 2. Policy guidance in implementation of NDC measures related to energy 3. Ensuring there are effective energy legislation and policy frameworks in place 4. Supervision, monitoring and coordination over all matters relating to NDC measures related to energy 5. Established an IPP framework for private sector development in the renewable energy sector, to provide a conducive environment and framework for awarding and implementing renewable energy projects in Malawi. 6. Data source on GHG and non-GHG impacts of NDC implemented measures
Ministry of Finance and Economic Affairs	<ol style="list-style-type: none"> 1. provides sovereign guarantees to Independent Power Producers for the development of power generation projects, 2. is responsible for negotiating the implementation of such power projects in Malawi.
Directorate of Road Traffic and Safety Services	<ol style="list-style-type: none"> 1. Policy guidance in implementation of NDC measures related to road transport, for example modal-shift 2. Supervision, monitoring and coordination over all matters relating to road transport. 3. Data source on GHG and non-GHG impacts of NDC implemented measures
Renewable Industry Association of Malawi (REIAMA)	<ol style="list-style-type: none"> 1. Implementation of NDC measures related to renewable energy, such as grid connected solar PV, and largescale hydropower 2. Data source on GHG and non-GHG impacts of NDC implemented measures
Electricity Supply Corporation of Malawi (ESCOM)	<ol style="list-style-type: none"> 1. Implementation of NDC measures related to supply and distribution of electricity e.g efficient electric motors 2. Data source on GHG and non-GHG impacts of NDC implemented measures
Electricity Generation Company	<ol style="list-style-type: none"> 1. Implementation of NDC measures related to supply and distribution of electricity e.g efficient electric motors 2. Data source on GHG and non-GHG impacts of NDC implemented measures
Department of Forestry	<ol style="list-style-type: none"> 1. Policy guidance in implementation of NDC measures related to energy 2. Supervision, monitoring and coordination over all matters relating to NDC measures related to energy

	3. Data source on GHG and non-GHG impacts of NDC implemented measures
Ministry of Agriculture,	1. Policy guidance in implementation of NDC measures related to agriculture 2. Supervision, monitoring and coordination over all matters relating to NDC measures related to agriculture 3. Data source on GHG and non-GHG impacts of NDC implemented measures
National Planning Office,	1. Tracking progress in implementation of NDC measures 2. Data source on GHG and non-GHG impacts of NDC implemented measures 3. Archiving of archiving of information and stakeholder engagement related to implementation of NDC
National Statistical Office,	1. Data source on GHG and non-GHG impacts of NDC implemented measures 2. Archiving of archiving of information and stakeholder engagement related to implementation of NDC
City Councils (Mzuzu, Lilongwe, Zomba and Blantyre)	1. Supervision, monitoring and coordination over all matters relating to NDC measures related to waste 2. Data source on GHG and non-GHG impacts of NDC implemented measures
Council for Non-Governmental Organizations in Malawi (representing all local non-governmental organizations in Malawi)	1. Advocacy on implementation of NDC measures 2. Advisory role on implementation of NDC measures 3. Implementation of NDC measures 4. Data source on GHG and non-GHG impacts of NDC implemented measures
Universities and other Research Institutions (1. Analysis of GHG and non-GHG impacts of NDC measures 2. Implementation of NDC measures
Malawi Energy Regulatory Authority (MERA)	1. Regulating energy sector, thus regulating implementation of NDC measures related to energy, for example-grid connected solar PV and large-scale hydropower 2. Data source on GHG and non-GHG impacts of NDC implemented measures
Ministry of Trade and Industry	1. Tracking progress of NDC implementation related to industrial processes and product use 2. Implementation of NDC measures on industrial processes and product use 3. Data source on GHG and non-GHG impacts of NDC implemented measures
National Water Resources Authority (NWRA)	1. Regulation and management of water resources and issuance of permits for hydro power projects.
The Ministry of Lands	1. Facilitates the acquisition of land for energy infrastructure development.

Table 3-3: Policies related to domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to implementation and achievement of NDCs

Type of Instrument	Exact name of Instrument	Role
Policy	Malawi 2063	1. This is the overarching long-term development Policy for Malawi. 2. Aims to transform Malawi into a wealthy and self-sufficient nation by 2063 3. Has environmental sustainability as one of the key enablers for achieving Malawi 2063 developmental objective 4. All development policies, strategies and projects (including NDC measures) are designed to achieve Malawi 2063. 5. Arrangement for tracking progress of implementation of Malawi 2063 development activities is in place, managed by the National Planning Commission
Programme	National Energy Compact for Malawi	1. It sets out Malawi's vision and commitment to increasing access to electricity, promoting clean cooking solutions, and increasing the share of renewable energy by 2030.
Policy	Nacional Climate Change Management Policy of 2016	1. Provides a strategic framework for addressing climate change impacts and promoting sustainable development. 2. It focuses on integrating climate change considerations into all economic sectors, emphasizing adaptation, mitigation, technology transfer, and capacity building.

		<ol style="list-style-type: none"> It aims to align Malawi's climate change management efforts with international agreements like the UNFCCC and Paris Agreement.
Policy	National Energy Policy of 2018	<ol style="list-style-type: none"> The energy policy of 2018 gives strategic direction on implementation of NDC measures related to energy. The policy promotes renewable energy and universal access to affordable and clean energy for all Malawians in line with SDG 7. The policy creates space for private sector participation in the energy market, which encourages implementation NDC measures that designed as conditional implementation in the form of direct investment, public private partnerships (PPPs), independent power producers (IPPs) or other participation vehicles. The policy is currently being reviewed. The review process gives opportunity for tracking of the GHG and non-GHG impacts of energy projects some of which are NDC implemented measures.
Policy	National Forestry Policy of 2016	<ol style="list-style-type: none"> This policy provides strategic direction for all actions related to forest management in Malawi, including NDC measures on mitigation and adaptation related to forestry It aims to sustainably manage forest resources for the benefit of the nation, addressing issues like deforestation, climate change, and biodiversity conservation Promotes community-based conservation and sustainable utilization of the forest resources through promoting communal and individual ownership of forests
Strategy	National Charcoal Strategy (2017 to 2027)	<ol style="list-style-type: none"> Presents a framework of actions to promote clean cooking through promotion of efficient cookstoves and use of alternative fuel for cooking to control deforestation and its related impacts Aims to address linked problems of deforestation and high demand for household cooking fuel Seeks to move Malawi towards a diversified, sustainable, and regulated household energy sector while mitigating deforestation and its associated impacts. Provides a suitable environment for implementation of NDC measures related for fuelwood cookstoves
Strategy	Renewable Energy Strategy, 2017	<ol style="list-style-type: none"> Gives direction on increasing share of renewable energy in electricity generation mix, particularly through off-grid and mini-grid systems in order to improve energy access and reduce reliance on traditional biomass. The strategy focuses on promoting private sector investment, expanding mini-grids, and encouraging the sustainable use of biomass.
Strategy	Malawi National Electrification Strategy	<ol style="list-style-type: none"> presents a guidance on expansion of grid and off-grid electricity interventions to support achievement of National Energy Policy.
Strategy	Malawi Integrated Resource Plan	<ol style="list-style-type: none"> Presents implementation tool to guide and facilitate investments in the energy sector
Administrative	National Cookstove Steering Committee	<ol style="list-style-type: none"> Oversees initiatives and other cleaner cooking interventions to implement the Malawi Cleaner Cooking Energy Compact, which sets ambitious universal clean cooking target for 2030. Advocates cleaner cooking sector in line with the country's policies and vision. Members of the committee include NGO's working in the energy sector, academia and research institutions chaired by the Ministry of Energy.

Regulatory and Informative	Independent Power Producer (IPP) Framework for Malawi	<ol style="list-style-type: none"> 1. The IPP Framework provides interested parties with a clear understanding of how to invest in Malawi’s power sector, includes structures and processes covering IPP Roles, Responsibilities and Rules of Engagement. 2. It also covers step-by-step IPP Framework Solicitation Processes including for Solicited IPP (SIPP) procurement and Unsolicited IPP procurement (UIPP). 3. It also provides information on the process for project evaluation, including steps such as risk assessment and due diligence, technical evaluations, tariff structures and analysis, and financial evaluation.
Regulatory	<ol style="list-style-type: none"> 4. Energy Laws, as follows 5. Energy Regulation Act 2004, 6. Electricity Act 2004 7. Electricity Amendment Act 2016 	<ol style="list-style-type: none"> 1. MERA is mandated under the Energy Regulation Act 2004, together with the Energy Regulation Bylaws to regulate the energy sector as well as approve energy tariffs etc. 2. Electricity Act 2004 and the Electricity Amendment Act 2016 provide a requirement for a licence from MERA for generation, transmission, distribution, importation, exportation, system and market operation, single buyer, and distribution licence. 3. Under the Electricity Amendment Act 2016, MERA has the power to issue further system and market operation, single buyer, and distribution licences to other applicants other than ESCOM.

Despite having institutional arrangements for domestic implementation, monitoring, reporting, archiving information and stakeholder engagement related to the implementation of NDC under article 4 of the Paris agreement, there are some challenges that prevents their full realization of benefits to NDC implementation. Some of the challenges those related to policies and other arrangements do not complement each other; limitation of financial resources to implement activities related to supervision and monitoring; and limited awareness about the available instruments and institutions.

3.2 Description of Malawi’s nationally determined contribution under Article 4 of Paris Agreement, including updates

Description of Malawi’s NDC Measures in relation to Decision 18/CMA.1 paragraph 64 and definitions to understand the NDC measures (Decision 18/CMA) is hereby presented. The revised NDC for Malawi has 34 mitigation measures, including those from Forestry and Other Land Use (FOLU) sector. FOLU sector 4 measures, namely; afforestation (protective forests, woodlots and urban forests), riparian restoration, agroforestry, and sustainable forest and landscape management. Means of implementation of the measures is based on the source of financing. The measures that would be implemented from domestic generated financial resources are unconditional measures, while those that would be implemented with financial resources from international support are conditional measures. As it can be seen from Table 3-4, energy sector has almost half of the measures (grid connected hydropower, grid connected large scale solar PV, off-grid small scale solar PV systems, grid connected wind power,) are fully conditional measures: only one measure (efficient charcoal production) is a fully unconditional measure, and the rest of the measures are both conditional and unconditional. In general, for mitigation NDC, including FOLU, 14 measures out of 34 require full international support to be implemented. This overdependence on international support is somewhat a challenge in implementation of mitigation measures because the support is conditional. Referring to the revised NDC report for Malawi submitted in 2021 (GoM, 2021; UNFCCC, UNFCCC NDC submitted reports, 2021), the total

budget for implementing mitigation measures (including FOLU) over the implementation period (2015 to 2040) is 41,782 million USD (representing 79% of the budget), from which 32,808 USD is from budgeted to be contributed from international support (conditional), and 8,974 USD is to be sourced from domestic resources.

Table 3-4: Description of Malawi's Mitigation NDC measures

NDC Measure	Aim of the measure	Sector	Means of Implementation	
			Conditional	Unconditional
Grid-connected hydropower generation	To displace GHG emissions from the current diesel-electric generators and from planned coal-fired thermal power plants that will produce electricity (Kam'mwamba and Salima coal-fired thermal power plants)	Energy	100%	-
Grid connected large scale solar PV	To displace GHG emissions from the current diesel-electric generators and from planned coal-fired thermal power plants that will produce electricity (Kam'mwamba and Salima coal-fired thermal power plants)	Energy	100%	-
Off-grid small scale solar PV systems	Installation of PV systems for domestic solar heating and lanterns, resulting in avoided GHG emissions from kerosene and unsustainable charcoal use.	Energy	100%	-
Grid connected wind power	To displace GHG emissions from the current diesel-electric generators and from planned coal-fired thermal power plants that will produce electricity (Kam'mwamba and Salima coal-fired thermal power plants).	Energy	100%	-
Clean Coal technology – High efficiency coal-fired power plant	high efficiency coal-fired power plant Installation of highly efficient super ultra-critical coal plant, result sing in reduced GHG emissions from coal use in electricity generation.	Energy	100%	-
Efficient charcoal production.	Production of charcoal to meet energy demand using less wood feedstock through use of efficient kilns, resulting in reduced CH4 and N2O emissions	Energy	-	100%
Clean Coal technology- Carbon Capture and Storage (CCS)	Carbon Capture and Storage (CCS) Deployment of carbon capture to sub-critical coal power stations in the north of Malawi with permanent geological storage within in-situ coal seams.	Energy	100%	-
Power Factor Correction	Reduced generation of reactive power at power plants resulting in reduced GHG emissions from reduced fossil fuel combustion to generate reactive power.	Energy	100%	
Modal shift: private to passenger transport	To increase share of passenger transport from around 10% at present to around 30% in 2040, reducing GHG emissions from gasoline and diesel use.	Energy	70%	30%
Modal shift: road to rail freight	To increased use of rail under the National Transport Master Plan, resulting in reduced diesel consumptions and GHG emissions from road freight transport.	Energy	50%	50%
Increasing ethanol blending with gasoline as a transportation fuel	Achieving an average national blend rate of 20% ethanol, resulting in reduced GHG emissions from gasoline consumption in road transport.	Energy	50%	50%
Blending biodiesel with diesel as a transportation fuel	Commercial production of biodiesel fuel reaching 55 million litres and resulting in reduced GHG emissions from diesel consumption in road transport.	Energy	50%	50%

Improved charcoal cookstoves - rural households	Deployment of efficient charcoal cookstoves to urban households; increasing from 20% to 30% efficiency thereby reducing demand for charcoal and CH4 and N2O emissions	Energy	-	100%
Improved firewood cookstoves - rural households	Introduction of 2 million improved high efficiency wood stoves, resulting in carbon sink preservation through reduction in use of unsustainable biomass fuel.	Energy	-	100%
Use of efficient barns for tobacco curing	Reduced demand for fuelwood required in tobacco curing from 2025-2040 by use of efficient barns, resulting in reducing CH4 and N2O emissions from fuelwood combustion.	Energy	-	100%
Increased use of rice husk ash (RHA) in blended cement	Reduction in demand for cement in construction industry through; increased blending in cement production resulting in reduced calcination emissions from domestic clinker production.	Industrial Process and Product Use	100%	-
Earth stabilised blocks (ESBs) as building materials	Wider promotion of ESBs as materials within institutional and domestic building projects to replace cement stabilised blocks within construction, reducing emissions from cement production.	Industrial Process and Product Use	100%	-
Alternative low carbon cement processes	Potential use of emerging lower-carbon cement production processes such as <i>belite ye'elimate-ferrite</i> (BYF) clinker with reduced GHG emissions compared to conventional process.	Industrial Process and Product Use	100%	-
Support industries involved in carbon capture utilisation and storage (CCUS)	Support for companies assessing, developing or implementing CCUS from suitable facilities, resulting in stored or avoided CO2 emissions	Industrial Process and Product Use	100%	-
Landfill gas (LFG) utilisation	Generation of up to 95 GWh of electrical power from landfill gas extraction, collection and utilization applied to sanitary landfills, resulting in reduced CH4 from landfill sites and avoided CO2 from displacement of fossil-based electricity use.	Waste	100%	-
Waste Reduction Practices	Solid and water waste reduction practices at household, institutional and industry level to reduce waste generation, resulting in reduced CH4 and CO2 emissions.	Waste	Not quantified	
Waste to Energy (WtE)	Installation of waste to energy incinerators to generate up to 250 GWh of electricity per year in Lilongwe and Blantyre, achieving reduced CH4 emissions from landfill sites and avoided CO2 from displacement of grid power.	Waste	100%	-
Waste-water treatment and reuse	Rehabilitation and construction of sewerage network and wastewater treatment plants in Lilongwe, Blantyre, Mzuzu and Zomba, achieving a reduction in CH4, and N2O emissions from waste-water and sewage.	Waste	100%	-

Conservation agriculture: crop residue and rotation	Support and implementation of the planned expansion targets for crop residue and crop rotation to improve soil conservation, resulting in increase of soil carbon stock and improved crop yields.	Agriculture	50%	50%
Conservation agriculture: conservation tillage	Support and implementation of the planned expansion targets for conservation tillage to improve soil conservation, resulting in increase of soil carbon stock and improved crop yields.	Agriculture	50%	50%
Promotion of efficient fertiliser use and manure management	Improved fertiliser management through increased use of organic waste in soil fertilizers and compost manure, increasing carbon stock retention in soils, and reduced N ₂ O emissions from mineral N-fertilizer use	Agriculture	40%	60%
Improved rice management practices	Deep organic fertiliser application and improved biomass and fertilizer management in rice and nitrification inhibitors application, resulting in reduced N ₂ O emissions from mineral N fertilizer use.	Agriculture	70%	30%
Improved livestock husbandry	Improved livestock husbandry through expansion of new fodder area under Brachiaria and Napier, reducing CH ₄ emissions from enteric fermentation and increasing biomass carbon stock.	Agriculture	40%	60%
Improved livestock and breed management	Improved breeding management to increase meat and milk yields, including through species replacements, encouragement of semi-intensive feeding system and diversification, resulting in reduced CH ₄ emissions from enteric fermentation.	Agriculture	70%	30%
Improved farm management	Establishing biogas digesters, promotion of collective farms, improved manure management and promotion of slurry systems, resulting in reduced or avoided N ₂ O and CH ₄ emissions	Agriculture	10%	90%
Afforestation (protective forests, woodlots and urban forests)	Production and planting of native Eucalyptus and Pinus trees in 45,000 Ha of areas, with potential to be scaled-up to 600,000 Ha with international support, based on NFLRS targets.	Forestry and Land Use	93%	7%
Riparian restoration	Around 36,000 Ha of native species and bamboo to be planted within riparian zones and wetland borders to enable higher ecological productivity and sustainable harvesting.	Forestry and Land Use	Not quantified	
Agroforestry	Targeted planting of an additional 25 trees/ha on 155,000 Ha of crop fields, equivalent to 20% of total arable land, 31,784 Ha of village forest areas; and expansion of new fruit area on 27,000 Ha to achieve at least a 10% tree cover. Scaled-up potential for all agroforestry types estimated at 700,000 Ha.	Forestry and Land Use	1%	99%
Sustainable forest and landscape management	Production and planting of native trees in conservation areas, and protection of areas with tree-site matching species for a total of up to 132,000 ha, with potential to be scaled up to around 600,000 Ha with international support, based on NFLRS targets.	Forestry and Land Use	85%	15%

Malawi's NDC covers the following GHG gases, carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (NO₂). NDC measures are from four sectors, namely: energy, industrial processes and product use (IPPU), Agriculture and Waste. Referring to Figure 3-2, energy sector dominates

the number of mitigation measures (15) representing a share of 44% of the total measure, seconded by agriculture (7) representing 20%. IPPU, Waste and FOLU each has 4 measures representing a share of 12%. This shows that Malawi’s NDC-mitigation is energy-centred.

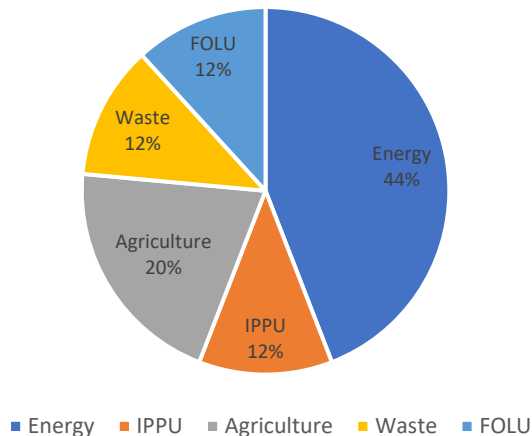


Figure 3-2: Share of number of sectoral mitigation measures over all mitigation measures

Accordingly, with energy sector dominating list of NDC measures, a 35,994 million USD (representing 86%) of the total implementation budget for mitigation measures, is for implementing energy-related mitigation measures. Energy measures are project-based that require relatively huge capital to construct and commission. Malawi, as with the case with other least developed country, faces challenges in financing mitigation and adaptation measures due to limited domestic budget for the implementation of climate actions, and the limited involvement of private sector investment in environment and climate change activities. In response to these factors, Malawi has come up with a resource mobilization strategy which identifies sources of finance and strategies to fund and support the prioritized measures.

As indicated in the updated Malawi’s NDC submitted to UNFCCC in 2021 (UNFCCC, 2021), NDC mitigation contribution takes the form of a reduction in GHG emissions relative to a business-as-usual (BAU) emissions baseline over the period to 2040. The base year in the updated NDC analysis is 2017. This base year was chosen because the GHG inventory that was available as most recent during updating of the initial NDC was the 2017 GHG inventory, extracted from Malawi’s Third National Communication (TNC) (GoM, 2021). Target year for Malawi’s NDC is 2040, thus, modelling of the emission pathways was from 2017 to 2040. The reference year is also the target year. In the base year (2017), GHG emissions were assessed to be 9.3 million tCO₂e as in TNC report (GoM, 2021). Modelling of emission pathways in absence of updated NDC measures, also known as business as usual scenario (BAU), show emissions rising from 9.3 million tCO₂e in 2017 to 34.6 million tCO₂e in 20240. Emissions under mitigation scenarios are those emissions that are described when NDC measures are implemented. There are two categories of updated NDC measures, resulting into two mitigation scenarios. The first mitigation scenario is the one that describe emission pathway resulting from implementing NDC measures that are to be funded by domestic financial resources only. NDC measures that are to be funded from domestic resources are defined as ‘*conditional measures*’ and emission reductions that result from implementing *conditional measures* are defined as ‘*domestic contributions*’. Similarly, NDC

measures that are to be implemented with international support are defined ‘*unconditional measures*’, and emission reduction resulting from mitigation with additional measures is defined ‘*total contribution*’ or contribution from all ‘*NDC measures*’. When describing emissions pathways in the absence of NDC measures (BAU scenario) and when NDC measures are implemented as planned (Mitigation scenario), assumptions are made. In general, for the energy sector, assumptions were on increased emissions from planned coal-fired thermal power plants and from diesel generators for production of electricity, increased demand for wood fuel, and increased demand for transport services and hence for liquid fossil fuel (petrol and diesel). Further, it was noted that there would be increased agricultural productivity as well as industrial productivity up to 2040. Details on assumptions and other modelling metrics used to project emission pathways and under BAU, mitigation with measures and mitigation without measures scenarios are in the submitted updated NDC report for Malawi.

The summary of emission pathways (scenarios), as detailed in updated NDC, as presented in Table 3-5 for the base year (2017), 2020, 2030 and 2040 (the target year), without emissions from FOLU. As it can be seen from the Table 3.5, under business as usual scenario, emissions are increasing steadily from 9.33 million tCO₂e in to 10.71 million tCO₂e in 2020, 19.25 million tCO₂ in 2030, and 34.61 million tCO₂e in 2040, the target year. Further, emissions under mitigation all NDC measures are also increasing: increasing from 9.33 million tCO₂e in 2017, to 10.68 million tCO₂e in 2020, 12.78 million tCO₂ in 2030, and 16.92 million tCO₂ in 2040 the target year. Therefore, if all NDC measures are implemented, there will be emission reductions (contribution) as follows: 0.03 million tCO₂ in 2030, 6.47 million tCO₂e in 2030, and 17.69 million tCO₂e by the target year of 2040.

Table 3-5: NDC emission reduction scenarios and relative reductions against business as usual scenario excluding emissions from FOLU

Emissions under different Scenario <i>Emission reduction under difference scenario</i>	Emissions for the particular year in million tCO ₂ e (Emission reduction for the particular year in million tCO ₂ e)			
	2017	2020	2030	2040
Emission under Business as Usual (BAU)	9.33	10.71	19.25	34.61
Emission under unconditional NDC measures	9.33	10.7	18.07	32.56
Emission under conditional contribution NDC measures	9.33	10.69	13.96	18.97
Emissions under all NDC measures	9.33	10.68	12.78	16.92
<i>Emission reductions from unconditional NDC measures only</i>	0	0.01	1.18	2.05
<i>Emission reductions from conditional NDC measures only</i>	0	0.02	5.29	15.64
<i>Total emission reductions for all NDC measures</i>	0	0.03	6.47	17.69
Relative contribution (relative emission reduction) to BAU				
Unconditional contribution	0%	0.1%	6%	6%
Conditional contribution)	0%	0.2%	27%	45%
Total contribution	0%	0.3%	34%	51%

Furthermore, as it can be seen from Table 3-5 that conditional measures result in more contribution (15.64 million tCO₂e) than unconditional measures (2.05 million tCO₂e). This is because Malawi’s NDC is premised on international support to implement most of its measures. If that support is not provided as planned, it is difficult for Malawi to achieve its NDC target of reducing

17.7 million tCO₂e by 2040. Therefore, the resource mobilization strategy must consider ways on how acquire international financial support. Also, mainstreaming of NDC measures in national policies and strategies should be supported. In addition, from Table 3-5, the Malawi contribution (emission reduction) by the target year, is 51% emission reduction relative to BAU emissions in 2040. This is a higher emission reduction ambition, compared to initial NDC submitted in 2015. This target is made up of 6% from unconditional NDC measures and 45% from conditional NDC measures. Table 3-5 also shows that much of absolute amounts of reduction is more noticeable after 2030 than before 2030.

It has already been stated that Malawi’s NDC covers all sectors except FOLU. Emissions from FOLU were not considered because of its high uncertainties and large variations noted from different FOLU GHG inventories conducted the same period (GoM, 2021). In summary, sectoral contributions (emission reduction after implementation of NDC measures) by target year (2040) are presented in Figure 3-3. As it can be shown, from the Figure, energy sector would contribute 15.1 million tCO₂e reduction by 2040, representing above 85% of the total contribution (17.7 million tCO₂e). Other sectors combined would contribute the remainder (2.6 million tCO₂e). Again, this shows that Malawi’s NDC is energy based.

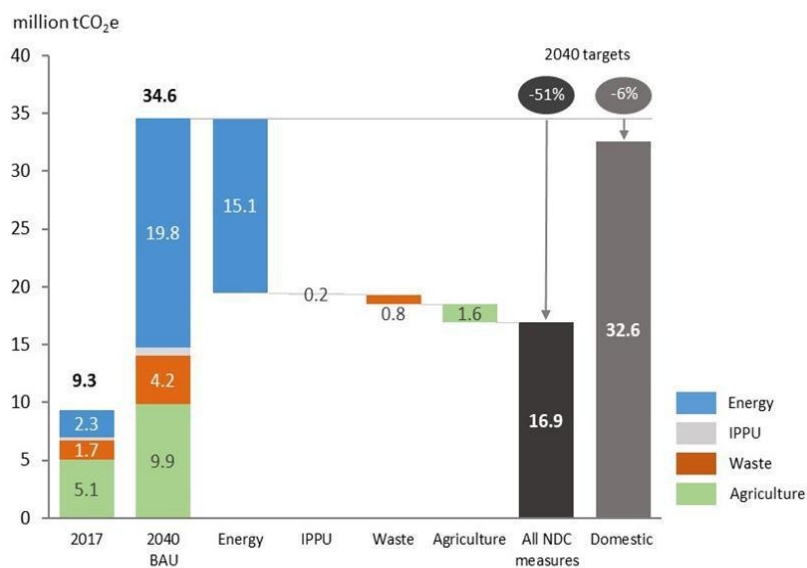


Figure 3-3: Summary of GHG emissions under business as usual and mitigation scenarios, with sectoral reductions with respect to implementation of NDC measures for base year (2017) and target year (2040) for each sector

The dominance of contribution from energy sector stems from actions to reduce emissions that would come from coal-fired thermal power plants at Kam’mwamba (300 MW) and in Salima (120 MW) as well as from the diesel electric generators that were installed and planned to be installed to provide extra electricity generation in future. At the time of compiling this BTR, the coal-power plants have not yet been installed, nor construction works started. These power generation projects are still at the stage of looking for financial resources.

Malawi is participating in internationally transferred mitigation outcomes (ITMOs) via carbon credits that are traded on the carbon market, with independent verification of the credits and their adherence to the rules of the respective standards to avoid doubt counting related to global

assessment of NDC effects. The country has established arrangements that are consistent with Article 6, paragraph 2, guidance and relevant decisions of the conference of parties serving as a meeting of members to Paris Agreement (CMA) for tracking ITMOs. Related information on Malawi's internationally transferred mitigation outcomes is presented in the attached Malawi's Initial Report. Further, the country has no any update or clarifications of previously reported information to present such as those related to GHG inventory, methodologies on emission reduction estimation, and use of cooperative approaches. In this NDC reporting phase, Malawi is engaged in sale of carbon through Hestian Innovation Limited, although other organizations have submitted interest to invest in carbon trading. The programme, developed by Hestian, is based on extensive work since 2008 specifically on cleaner cooking in Malawi, where the technology promoted is designed and developed to meet local user needs and preferences. Gradually the *Chitetezo Mbaula* is becoming 'business as usual' in communities where it has been adopted and the Program is promoting a shift away from open fire cooking to efficient, cleaner and more cooking sustainable practices. The Programme that is on ITMOs is not limiting Malawi's efforts to achieve their NDC. Specifically, the Programme was authorised having considered the technical recommendations from the country's Mitigation Expert Working Group (MEWG) as the Article 6 Technical Advisory Unit. Secondly, there is transfer of knowledge, skills and expertise with local experts coming from this Programme, which would enable Malawi enhance its NDC implementation.

3.3 Information necessary to track progress made in implementing Malawi's Nationally Determined Contribution under Article 4 of the Agreement

3.3.1 Indicators for Tracking Progress

Decision 18/CMA.1, in paragraphs 65 to 97, mandates parties to provide information for tracking progress and achievement of their NDCs. Before providing this information, it is important to recognize that BTR submitted by Parties to Paris Agreement, among others, is intended to track progress on implementing their nationally determined contributions (NDCs). This tracking of NDCs is done using indicators, which can be quantitative or qualitative depending on its nature. Decision 18/CMA.1 (MPGs) do not provide a definition of an indicator but guides that the indicator must be self-determined by the Party (Malawi), must be relevant for the NDC implementation, and may be quantitative or qualitative. The indicator is simply a measure that is used to assess and evaluate status of a project that is implemented. The indicator not only tells the status of the implemented project, in this case NDC implemented measures, over a given period of time, it also specifies whether or not associated policy objectives are being met and quantitative targets reached. Where these are not being achieved, the indicator discusses the reasons for this. For BTR, the process for tracking starts by firstly identifying the indicators. Secondly, once indicators are identified, then the second step is to produce information on each of the identified indicator for reference points, levels, baselines, and base year. Thirdly, the most recent information (that is for the reporting years) for each of the identified indicator is provided for the BTR NDC tracking reporting years, which is 2 years. This reporting period of 2 years, considering that GHG Inventory has to cover 2 years prior to reporting of BTR, gives reporting period for NDC Tracking as 2021 and 2022. Once the current information is provided, the fourth step is compare the second step and third step to track progress made in implementing NDC.

For Malawi’s NDCs, for the type of NDC target chosen (the absolute GHG emission reduction of 17.7 million tCO₂e relative to baseline emission in 2024), the indicator for NDC implementation is the absolute amount of GHG emissions (million tCO₂e) reduced in the current year expressed as the difference between the business as usual scenario presented in the NDCs document (baseline) and the current emission as per latest GHG inventory. The updated NDC measures for Malawi are mostly in the energy sector with mitigation out being reduction in GHG emission, and thus, all measures are grouped together and progress assessed using an umbrella indicator of absolute GHG emission reduction relative to the baseline (BAU emission). The emission during the baseline formulation (BAU scenario) were calculated using Tier 1 methodology, following the 2006 IPCC Guidelines for conducting national GHG inventories. The base year being 2017 and the emission reduction is zero. Target year is 2040 and the emission reduction for the target year is 17.7 million tCO₂e. Reference years are reporting years for the BTR, in this case, 2021 and 2022. The reference levels are the baseline emissions (BAU) in 2021 and 2022. Between base year and reference year, emissions under BAU are provided, as extracted from the updated NDC document for Malawi. Projection of the planned absolute GHG emission reduction when all NDC measures are implemented is presented, in relation to BAU emissions (baselines) and under implementation of NDC measures, is presented in the last row of Table 3-6.

The baselines, Table 3-6, (BAU scenario) were constructed from extrapolation of data in submitted 2021 updated NDC (NDC.2) in Microsoft excel. Further, it can be seen from Table 3-6 that GHG emissions when all NDC measures are implemented are 10.89 and 11.1 million tCO₂e in 2021 and 2022 respectively. These are reference emissions in the NDC tracking. Under BAU scenario, the emissions in 2021 and 2022 were 11.564 and 12.418 million tCO₂e, giving a planned reduction when all NDC measures are implemented (domestically and internationally supported NDCs) as 0.674 million tCO₂e and 1.318 million tCO₂e in 2021 and 2022 respectively. Domestically implemented measures are planned to reduce 0.127 and 0.244 million tCO₂e in 2021 and 2022 respectively.

Table 3-6: Projection of absolute emission reductions in relation to emission pathways (business as usual and under implementation of NDC measures

Inventory Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2028	2030	2032	2034	2036	2038	2040
GHG emissions without NDC measures (BAU Scenario)	9.33	9.79	10.25	10.71	11.564	12.418	13.272	14.126	14.98	15.834	17.542	19.25	22.322	25.394	28.466	31.538	34.61
GHG emissions with only domestic supported NDCs measures	9.33	9.79	10.24	10.70	11.437	12.174	12.911	13.648	14.385	15.122	16.596	18.07	20.968	23.866	26.764	29.662	32.56
GHG emissions with domestic and international supported NDCs measures (all NDC measures)	9.33	9.78	10.23	10.68	10.89	11.1	11.31	11.52	11.73	11.94	12.36	12.78	13.608	14.436	15.264	16.092	16.92
Reductions (domestic support)	0.000	0.003	0.007	0.010	0.127	0.244	0.361	0.478	0.595	0.712	0.946	1.180	1.354	1.528	1.702	1.876	2.050

Reductions (domestic plus international support)	0	0.01	0.02	0.03	0.674	1.318	1.962	2.606	3.25	3.894	5.182	6.47	8.714	10.958	13.202	15.446	17.69
--	---	------	------	------	-------	-------	-------	-------	------	-------	-------	------	-------	--------	--------	--------	-------

Recent information for the identified indicator (absolute emission reduction relative to the baseline emission) is obtained from the recent GHG inventory for years 2021 and 2022. The calculated current inventory from 2017 to 2022 is presented in Table 3-7.

Table 3-7: Comparison between GHG emissions for reference years (during NDC.2 estimation) and current GHG Inventory for reporting years of 2021 and 2022

Inventory Year	Energy (Gg CO2e)	Industrial Processes and Product Use (Gg CO2e)	Agriculture (Gg CO2e)	Waste (Gg CO2e)	Total (Gg CO2e)	Total emission in the Current Inventory (million tCO2e) $E_{Inventory,y}$ (million tCO2e)	Total Emission Under Mitigation scenario where all NDC-2 measures implemented $E_{MIT,NDC.2,y}$ (million tCO2e)	Relative difference between emissions when all NDC-2 measures are implemented and actual emissions (%)
2017	1,366.32	89.38697	4,056.55	14,631.92	20,144.18	20.144	9.33	-116%
2018	1,629.07	107.5394	4,489.38	15,635.91	21,861.90	21.862	9.78	-124%
2019	1,693.66	146.0092	4,258.79	16,125.19	22,223.65	22.224	10.23	-117%
2020	1,859.69	179.4682	4,638.31	16,622.88	23,300.36	23.300	10.68	-118%
2021	1,697.86	194.8529	5,113.06	17,124.02	24,129.79	24.130	10.89	-122%
2022	1,810.16	188.3158	5,714.96	17,547.87	25,261.30	25.261	11.1	-128%

In relation of MPG 64, comparison of recent information for the indicator with information on reference points is presented in Table 3-7. From Table 3-7, it can be seen that emissions are above the reference emissions (mitigation scenario with all NDC-2 measures implemented) for reporting years of 2021 and 2022. Tracking of NDC implementation in terms of relative reduction in GHG emissions is given by the equation (1). If the relative reduction, as in equation (3-1) is positive, then the current emissions (from GHG Inventory) are less than what was described in the NDC-2 as mitigation scenario when all NDC measures are implemented. This indicates good progress in NDC implementation. However, if the relative emission is negative, it means that the actual emission levels are higher than those described in NDC-2 mitigation scenario. This shows that NDC implementation is not progressing well.

$$RD (\%) = \left(\frac{E_{MIT,NDC.2,y} - E_{Inventory,y}}{E_{MIT,NDC.2,y}} \right) \times 100 \quad (3-1)$$

Where RD is relative difference between emissions when all NDC-2 measures are implemented and actual emissions

$E_{MIT,NDC.2,y}$ is the GHG emission under mitigation scenario where all NDC measures are implemented for the inventory year y, as estimated in NDC.2

$E_{Inventory,y}$ is the actual GHG emission for the inventory year y, as estimated the BTR GHG Inventory Chapter for inventory year, y.

As it can be seen from Table 3-7, actual GHG emissions in 2021, and 2022 (from latest GHG inventory) are higher than emissions under mitigation scenario, as described in NDC-2, when all measures are implemented, for all the years. Further, it can be seen that relative difference between emissions when all NDC-2 measures are implemented and actual emissions are -122%, and -128% of the emissions under NDC-2 mitigation scenario. Further analysis of emissions as in Table 3-7 shows that actual emissions are more than double the emissions described when all NDC-2 mitigation scenario, and that the difference in emissions are increasing. This shows that Malawi is not making any progress to achieve emission reduction of 17.7 million tCO₂e in 2040 relative to the BAU emission in 2040. This result was discussed during stakeholder consultations and it was stated that the problem could be on estimation of GHG emissions from the Waste Sector in the most current GHG Inventory (for this BTR). It was noted that Waste emissions could have been overestimated.

3.3.2 Methodologies and Accounting Approaches

As it has been pointed out in section C1, the indicator for Malawi NDC is GHG emissions relative to baseline emissions, with a target of reducing 17.7 million tCO₂e in 2040. In line with MPG paragraph 74 “*Each Party shall provide a description of each methodology and/or accounting approach used, as applicable for: (a) Target(s), as described in paragraph 64 above; (b) The construction of baselines, as described in paragraph 64 above, to the extent possible; (c) Each indicator identified in paragraph 65 above*”, emissions of gases covered in Malawi’s NDC-2 creation of its indicator, target and construction of baselines, were estimated basing on the 2006 IPCC Guidelines for national greenhouse gas inventories. Tier 1 of the methodology (use of IPCC default emission factors) was employed because of absence of country specific emission factors in all the key categories. Malawi plans to use its country specific emission factors in its second BTR for some key categories in energy- road transport and other sector-biomass different sectors. The country was implementing a GEF supported Project on “*Capacity Building Initiative for Transparency (CBIT)*” to develop emission actors in these key categories. Emissions of the covered gases (CO₂, CH₄ and N₂O) were aggregated using the 100-year time-horizon global warming potential on the basis of the values stipulated in the Fifth Assessment Report of the IPCC. The methodologies, including assumptions, employed in estimating GHG reductions from implemented measures and their projected emission reductions, are detailed in Section D.

During this BTR reporting period, Malawi was involved in cooperative approaches (under Article 6.2 of the Paris Agreement) where some of its CO₂e reduced were traded involving internationally transferred mitigation outcomes (ITMOs). The accounting approach used was that one used by Gold Standards (which was involved in certification of carbon credits from Malawi), to ensure adherence to its core-principles of avoidance of double counting, environmental integrity, transparency, accuracy, consistency, comparability, and completeness.

3.3.3 Contribution from Land Use, Land-Use Change and Forestry

Contribution from Land Use, Land-use Change and Forestry (LULUCF) was estimated in Malawi’s NDC.2 to be equal to 59.8 million tCO₂e through a range of LULUCF interventions covering an area of up to 2 million hectares, of which 22% is unconditional (with domestic support) and 78% is conditional (with international support) (GoM, 2021). However, uncertainties in estimation of emission reductions were considered to be too high, qualitatively, and thus, contributions from LULUCF were not considered in Malawi’s NDC-2 but were recommended to

be considered contributions. Therefore, in reference to MPG 77 (c) “*Contribution from the LULUCF sector for each year of the target period or target year, if not included in the inventory time series of total net GHG emissions and removals, as applicable*”, information that was used to track progress of NDC-2 implementation, did not include contribution from LULUCF.

3.3.4 Cooperative Approaches that Involve the Use of Internationally Transferred Mitigation Outcomes

Paris Agreement in its Article 6.2 allows countries to pursue, on voluntary basis, cooperative approaches that involve the use of internationally transferred mitigation outcomes (ITMOs) towards nationally determined contributions, promote sustainable development and ensure environmental integrity and transparency, including in governance, and shall apply robust accounting to ensure, inter alia, the avoidance of double counting, consistent with guidance adopted by the Conference of the Parties serving as the meeting of the Parties to this Agreement. Accordingly, MPG paragraph 77 (d) directs that “*Each Party that participates in cooperative approaches that involve the use of internationally transferred mitigation outcomes towards an NDC under Article 4, or authorizes the use of mitigation outcomes for international mitigation purposes other than achievement of its NDC, shall also provide the following information in the structured summary consistently with relevant decisions adopted by the CMA on Article 6; (i) The annual level of anthropogenic emissions by sources and removals by sinks covered by the NDC on an annual basis reported biennially; (ii) An emissions balance reflecting the level of anthropogenic emissions by sources and removals by sinks covered by its NDC adjusted on the basis of corresponding adjustments undertaken by effecting an addition for internationally transferred mitigation outcomes first-transferred/transferred and a subtraction for internationally transferred mitigation outcomes used/acquired, consistent with decisions adopted by the CMA on Article 6; (iii) Any other information consistent with decisions adopted by the CMA on reporting under Article 6; (iv) Information on how each cooperative approach promotes sustainable development; and ensures environmental integrity and transparency, including in governance; and applies robust accounting to ensure inter alia the avoidance of double counting, consistent with decisions adopted by the CMA on Article 6*”.

As pointed out in section 3.3.4, Malawi is involved in ITMOs under carbon credit trade arrangement. During the reporting period of NDC-2, the following information is provided in line with MPG 77 (d).

3.3.4.1 Malawi’s Engagement in cooperative approaches in the reporting period 2021-22

Between 2021 and 2024, Malawi took part in ITMO activities by issuing and trading carbon credits. These ITMOs have not used to track Malawi’s progress in meeting its NDC goals, in line with rule on corresponding adjustments. So far, there are only a few ITMO projects in the country: Hestian Innovation Limited, EKI Energy Services, and Burn ECOA Capital. But with creation of a conducive environment for carbon trading, number of ITMO projects is expected to grow. Hestian Innovation Limited has provided clear, verifiable data on the number of carbon credits issued and traded. All of the current ITMO projects focus on cleaner cooking solutions. They involve replacing traditional three-stone open fire stoves with efficient cookstoves or using alternative fuels instead of firewood and charcoal. Firewood and charcoal are viewed as non-renewable sources of biomass energy.

Promoting clean cookstove initiatives has important co-benefits. They help reduce exposure to household air pollution, they help reduce expenditure on fuel, protect forests and reduce environmental damage. Therefore, ITMO projects play a key role in achieving these goals. This aligns with the ITMO requirement of additionality. ITMO projects also support The Government of Malawi's focus on clean cooking as a national priority, as detailed in the Energy Compact for Malawi. In the Compact, there is a target of reaching all households with cleaner cooking by 2030, with an associated target of reducing firewood consumption and associated emissions by 40%.

According to ITMO trading rules, Malawi is entitled to receive a share of the proceeds from ITMO sales. This funding can support NDC implementation and other environmental and climate-related activities. In addition, ITMO projects can create jobs and bring in much-needed foreign exchange through the sale of carbon credits. Government of Malawi has prioritized carbon trading as one of the sources for alternative income generation. The Government encourages carbon trading and has set-up structures to make sure that carbon trade projects properly guided. For example, The Government has established a new agency to oversee carbon trading, aiming to leverage the country's potential in the carbon market, for details, kindly refer to information in section 1.6.

Malawi has provided detailed information about the mitigation activities, their authorization status and the authorization and first transfer of any of their issued mitigation outcomes. The Initial Report is accessible on the CARP⁴. Quantitative data about the authorized projects and any action in relation with Article 6 such as authorization, transfer, use, etc. is contained in the annual reports in the digital format, also accessible on the CARP (Annual Information Reports). The project activity in Malawi and the detailed information contained in the Initial Report and the in the Tables 3-8, 3-9, 3-10, and 3-11. Table 3-8 provides an overview of the projects that intend to become authorized under Article 6. The resulting corresponding adjustments are calculated using the single year / averaging method as indicated in the Initial Report (Refer to the attachment).

⁴ <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement/cooperative-implementation/carp/reports#Initial-reports-and-updated-initial-reports>

Table 3-8: Projects intending to become authorized under Article 6

ID	Project Title	Sector	Activity Type	Owner	Standard	Standard ID
002	EKI Energy Services					
003	Burn ECOA Capital					
004					Swiss Standard	n./a.
005					Swiss Standard	n./a.

Table 3-9: Projects authorized under Article 6

ID	Project Title	Cooperative approach	Sector	Activity Type	Owner	Standard	Standard ID	Authorisation of project	ITMOs authorised	First Transfer
		If available	Common Nomenclature	Common Nomenclature ⁵	As per IR					Common Nomenclature
006	GS Biomass Energy Conservation Programme				Hestian	Gold Standard	11677	8. 11. 2023 ⁶	1,552,755	Issuance

Table 3-10: ITMOs authorised under Article 6 (refer to Table 2 for project title) in reporting period

ID	Project Title	ITMOs authorised		ITMOs first transferred		Identification underlying standard – 2021		Identification underlying standard – 2021		Authorisation of ITMOs date
		2021	2021	2021	2022	First ID	Last Unit ID	First ID	Last Unit ID	
006	GS Biomass Energy Conservation Programme	989,219	563,536	989,219	563,536	Block start ID	Block ID end	Block start ID	Block ID end	N.A
Total		989,219	563,536	989,219	563,536					

Table 3-11: Corresponding Adjustments (averaging method) in t CO2e for CTF Table 4

ID	Project Title	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	Elapsed years	1	2								
006	GS Biomass Energy Conservation Programme	989,219	563,536								
	Aggregate issued MOs	989,219	1,552,755								
	Average CAs to be reported	989,219	776,377								

⁵ <https://unfccc.int/sites/default/files/resource/Common%20nomenclature%20initial%20list.pdf>

⁶ Authorisation Statement GS11677 <https://assurance-platform.goldstandard.org/project-documents/GS11677>

3.3.4.2 Authorised Mitigation Activities

C4.2.1 0001 GS Biomass Energy Conservation Programme

Detailed project information in relation with integrity of the project and the methodology, as well as how the risk for a net increase of emissions is addressed, is discussed in the initial report (refer to the attachment). Additional information about the compliance with the carbon standard can be found at the standard's website as follows:

Standard: Gold Standard

Project ID: GS11677 - GS Biomass Energy Conservation Programme

Project Documentation: <https://registry.goldstandard.org/projects/details/3915> and <https://assurance-platform.goldstandard.org/project-documents/GS11677>

Hestian Innovation Limited is the project developer of a project on biomass conservation that involves promotion of household cookstove. The mitigation outputs are emission reduction of non-CO₂ GHG emissions (CH₄ and N₂O) from use of improved/efficient cookstoves and CO₂ removals through trees and forests that are conserved. Through a Letter of Authorisation granted on Nov 8th 2023, Government of Malawi through the Ministry of Natural Resources and Climate Change has allowed the organization to market the carbon credits as ITMOs. The LoA states that the generated credits, Table 3-12, are not used for Malawi's NDC and that Malawi Government is to receive 12.5% share of proceeds. Out of the issued credits reported in Table 4 the vintages 2021 and 2022 will be reported as authorised and first transferred, and subtracted from total GHG reduction from the NDC.

Table 3-12: Issued carbon credits to Hestian Innovation Limited as of May 2025

Year	tCO ₂ e issued under GS11677
2021	989,219
2022	563,536
2023	207,295
2024	18,425
Total	1,778,475

Source: Hestian Innovation Limited data provided in May 2025

The Hestian Project on biomass conservation is to reduce emissions and increase removals up to 2031. A carbon credit is equal to one metric ton of carbon dioxide equivalent (CO₂e) emissions reduced or removed from the atmosphere. Hestian Innovation Limited reports that actual trading of the carbon credits by started in 2024, with 103,412 credits sold in 2024 on the CTX Trading Platform. Therefore, under this ITMOs, by the time of compiling this BTR, out of 1,778,475 credits issued, 1,675,063 credits (equivalent to 1.675 million tCO₂) remain to be traded under the international carbon market, less 2% of credits paid to Gold Standard as share of proceeds.

The methodology used to compute reduced emissions on improved cookstoves project by Hestian Innovations Limited involved quantifying the difference in emissions levels between 3-stone open fire stoves (baseline technology) and the improved cookstoves (the mitigation technology). The programme of activities (PoA), Gold Standard PoA 11677, transitioned from UNFCCC Clean Development Mechanism PoA 10182, and applies methodology AMS-II.G. ver. 12 - Energy

efficiency measures in thermal applications of non-renewable biomass and has been audited by UN accredited independent auditors and the credits , detailed above, have been issued by the Gold Standard Foundation in 2021 and 2025.

Information from the most recent monitoring report dated 23/7/2024 revealed that the programme was reaching 237,032 households in Malawi, all of whom claimed to be saving time on sourcing of fuel. The programme created 759 jobs, and was saving 199,071 tonnes of wood per annum, resulting in an estimated \$47 savings per household. This demonstrates role of carbon trading in job creation and environmental management, subsequently contributing to achieving developmental objectives stipulated in Malawi 2063.

3.3.4.3 Projects that are not yet authorized

The following subsections presents projects that have not yet obtained authorization to trade as ITMOs.

C4.3.1 ITMOs via EKI Energy Services

Another Malawi reported to have registered ITMOs project is with EKI Energy Services, a private company that is yet to implement an improved cookstove project that has a potential to generate credits as Internationally Transferred Mitigation Outcomes (ITMOs). The company will distribute 50,000 improved cookstoves⁷ that is calculated to reduce 1.4 million metric tonnes of carbon dioxide equivalent (making a total tradable carbon credit of 1,400,000)⁸. The company, based in Nashik in India, stated in 2024 it already had distributed 25,000 improved cookstoves in Malawi⁹. The current status, as of early 2025, the Environmental Affairs Department reported that reported that Government has made commitment through offering the company a Letter of Authorization to auction the carbon credits but the credits have not yet been sold.

C4.3.2 ITMOs via Burn ECOA Capital

Another Project for trading carbon in Malawi will be implemented by BURN, a Kenya based company that manufactures of clean cookstoves and is into carbon credit project developing. As in their expertise, BURN will invest in clean cooking using clean cookstoves to generate carbon credits for trade. The organization applied and received Letter of Authorization from Government of Malawi through Ministry of Natural Resources and Climate Change to implement the project. The specific technologies they will implement in clean cooking and cookstoves are natural and forced draft biomass stoves, and electric induction cooking suites. The company plans to distribute 2 million of these technologies. In 2024, the company committed to establish a factory in Lilongwe City to produce the technologies. Apart from reducing emissions and enhancing removals (hence carbon credits), this project will help decrease indoor air pollution, and create employment. It is reported that company would be in Malawi for a period of 5 years. The Project by BURN is

⁷ <https://www.outlookbusiness.com/economy-and-policy/eki-energy-services-to-distribute-25000-cookstoves-in-malawi>

⁸ <https://www.outlookbusiness.com/economy-and-policy/eki-energy-services-to-distribute-25000-cookstoves-in-malawi>

⁹ <https://www.outlookbusiness.com/economy-and-policy/eki-energy-services-to-distribute-25000-cookstoves-in-malawi>

planned to 3,000,000 carbon credits (thus, 3,000,000 metric tonnes of CO₂e) as ITMOs. However, the Project has not yet started, despite Letter of authorization granted by the Government.

3.3.4.4 Article 6.2 initial report (AIR) for Malawi

An Article 6.2 initial report is a mandatory submission by countries participating in cooperative approaches under Article 6.2 of the Paris Agreement. This report provides detailed information on the cooperative approach being undertaken, including authorization arrangements, tracking systems, and how it contributes to the participating country's Nationally Determined Contribution (NDC). The initial report is submitted prior to or in conjunction with the first transfer of Internationally Transferred Mitigation Outcomes (ITMOs). The Ministry of Natural Resources and Climate Change through the Environmental Affairs Department - Government of Malawi, prepared the Article 6.2 Initial Report prior to Authorization to the United Nations Framework Convention on Climate Change (UNFCCC), in June 2025, and is attached as an Appendix to this BTR Report.

From Malawi's AIR, it is seen that the country is making an ambitious plan to increase in trade in ITMOs through the Biomass Energy Conservation Program beyond 2024. The projected (expected) GHG mitigation from cooperative approaches is presented in the following Table 3-13, as extracted from Malawi's Initial Report. Since the emissions traded under ITMOs come from improved cookstoves, the net emission reduction that can be reflected in Malawi's NDC is found by subtracting expected emission traded under cooperative approach from absolute emission reduction from improved cookstove. This has been done and is reported in Section D2.4.3.

Table 3-13: Expected GHG mitigation from the cooperative approach

Year	Net GHG emission reductions (tCO ₂ e)	Net GHG emission reductions (million tCO ₂ e)
2021	989,219	0.989
2022	563,536	0.564
2023	207,295	0.207
2024	18,425	0.018
2025	1,000,000	1.000
2026	1,000,000	1.000
2027	1,000,000	1.000
2028	1,000,000	1.000
2029	1,000,000	1.000
2030	1,000,000	1.000
Total	7,778,475	

3.3.4.5 Governance of ITMOs in Malawi

As a Party, Malawi recognizes that participation in ITMOs is on voluntary basis. In accordance to Article 6 of the Paris Agreement, Parties participating in ITMOs must apply a robust accounting system to avoid double counting, and must ensure proper governance structure to oversee ITMOs transaction in Malawi and to ensure transparency in reporting ITMOs in BTRs. In terms of accounting for ITMOs, Malawi has adopted a GHG Inventory Management System, which data providers for emission reduction and removal sources are identified and engaged. These would isolate data for tracking implementation of Malawi's NDC and data for ITMOs from the various carbon trading projects in Malawi. The office of Environmental Affairs Department has a separate

unit for managing ITMOs in Malawi. Among others, this unit is responsible for estimating carbon credits from carbon trading application projects in Malawi, using 2006 IPCC Guidelines for National Greenhouse Gas Inventories. There is need for capacity enhancement to measure and validate emissions and removals for proper management of ITMOs in Malawi.

Government of Malawi has put arrangements for management of ITMOs. Firstly, Malawi is a Party to Paris Agreement, therefore, the country is legally allowed to participate in cooperative approaches such as the ITMOs. There is an established Environmental Affairs Department (EAD) that coordinates and prepares GHG Inventories, NDCs and their revisions, and BTRs. Adjustments and accounting for ITMOs with respect to these reporting documents is handled by the EAD. In addition, the country has developed framework to guide in engagement in international carbon market. The Government has established the National Planning Commission, the office that tracks development projects in the country in relation to achievement of Malawi 2063 (Malawi's overarching development strategy): ITMOs via carbon trading projects would therefore be tracked accordingly. Furthermore, trading of carbon is being identified by the Government of Malawi as one of the revenue generation to bolster the economy (and expected proceeds from carbon Malawi are reflected in the national budget), and is subsequently developing the Carbon Market Regulatory Framework, which is in the final stages (at cabinet level for approval). Further, in terms of regulatory set-up in Malawi, The Government is developing Climate Change Act, which is in final stages of consultations (on the draft).

3.3.5 The Structured Summary

The structured summary is central to any Party's reporting of the information necessary to track progress in implementing and achieving its NDC. It summarizes the Party's reported information in a uniform and consistent manner, which assists external stakeholders, including other Parties and the international community, in viewing each Party's progress towards meeting its NDC targets. The MPGs define the content of the structured summary. Note that in addition to the specific reporting requirements for the structured summary set out in paragraph 77(a)-(d), the structured summary must also provide the information stipulated by paragraphs 65–76, such as indicators, definitions, methodologies and accounting approaches. Most of the reporting elements related to the structured summary is described in sections above on indicators, methodologies and accounting approaches, contribution from the LULUCF sector and use of ITMOs. The structured Summary is presented in the Appendix in form of CTF Tables.

3.3.6 Mitigation Co-benefits of Adaptation actions and economic diversification plans

In relation to MPG paragraph 78. *“Each Party with an NDC under Article 4 that consists of adaptation actions and/or economic diversification plans resulting in mitigation co-benefits consistent with Article 4, paragraph 7, of the Paris Agreement shall provide the information necessary to track progress on the implementation and achievement of the domestic policies and measures implemented to address the social and economic consequences of response measures”*, as it has been pointed out earlier under description of NDC measures, Malawi's NDCs also include adaptation actions, which have mitigation co-benefits outcome. GHG emission reduction from such co-benefit outcomes were not been quantified in the NDC.2. On the other hand, in NDC.2 all listed mitigation measures with identified adaptation measures mapped to them, but again, adaptation effects from mitigation actions have not been quantified. In this NDC.2 implementation period, qualitatively, mitigation effects (GHG reduction) from implementation of adaptation

measures have been achieved, as described in Table 3-14. Mitigation benefits from other adaptation actions have not been reported because of limitation in information.

Table 3-14: Mitigation co-benefits from adaptation actions

Adaptation Action	Mitigation co-benefit
Climate proof infrastructure	<p>Protection of assets that promote low carbon development, thus enhancing emission reduction.</p> <p>Low carbon development infrastructure refers to creation of physical structures and systems that minimize carbon emissions, promote energy efficiency, and support a transition towards a low-carbon economy. For example, access roads to energy crop plantations/sugarcane plantation for ethanol production, and bridges/barrages that control water levels for hydropower production. Transport infrastructure including roads and bridges are vulnerable to climate induced flooding in Malawi. In the implementation period of NDC.2 (2017 to 2024) construction of climate proof infrastructure include the Liwonde barrage on Shire River in Machinga District, which was upgraded to enhance its water storage capacity and regulate water flow for hydropower generation and other water uses along the Shire River in 2018. Upgrading of the barrage assists in sustainable and efficient hydropower generation, helping to achieve emission avoidance from use of diesel power generators.</p> <p>The other mitigation benefit from climate proof as an adaptation is in use of renewable energy in powering some infrastructure associated with climate change adaptation, for example use of solar PV energy in irrigation systems. Irrigation with use of solar PV pumps is implemented in most parts of Malawi that face climate induced water shortages; mostly in the lower Shire districts of Chikwawa and Nsanje. These districts greatly suffer from impacts of droughts and flooding and are among climate change hot spots in Malawi. Within the NDC.2 implementation period, projects funded by non-governmental organizations and Government of Malawi have installed solar water pumps in water-stressed areas like Chikwawa and Nsanje. For example, UNICEF installed of 45 solar powered water systems targeting schools and healthcare facilities, as well as nearby communities, reaching an estimated 135,000 people in the period of 2017 to 2020 period (UNICEF, 2020). Using solar energy, GHG emissions from use petrol power water pumps, which would have been used in water supply, has been avoided as communities have access to water.</p>
Flood management	<p>Malawi is prone to climate induced disasters from flooding, some of which destroy transport and power infrastructure. The destruction of these systems, as already stated, limited low carbon development activities. The Government of Malawi is implementing several measures and projects to manage floods. For example, The Government is implementing a multi-sectoral Malawi Resilience and Disaster Risk Management Project (MRDRMP), a three Year- Project, from 2021 to January 2024. It is being implemented by government ministries, departments and agencies including the Ministry of Water and Sanitation sources (MWS), Department of Disaster Management (DODMA), various departments in the Ministry of Agriculture (MoA), district councils, PMU and all potential beneficiaries. It also involves the participation of other service providers on the ground involved in flood risk management under the Shire River Basin Project.</p> <p>Further, multiple hydropower projects, including the Mpatamanga Hydro Power Project, commencement of construction work starts in 2025, are designed to not only generate electricity but also to regulate river flow and mitigate flood risks. Furthermore, dam rehabilitation and sediment management at existing plants like Kapichira Hydropower contribute to both energy security and flood resilience.</p>

<p>Smart Agriculture, livestock and fisheries</p>	<p>Use of renewable energy in Smart Agriculture, makes a direct mitigation benefit from Smart Agriculture as an adaptation action. In Malawi, solar water pumping is a key technology for smart agriculture, enabling farmers to irrigate their land more efficiently and sustainably. These projects, often supported by international and local non-governmental organizations, are also helping to improve food security, livelihoods, and economic opportunities for smallholder farmers. As already stated, use of solar energy instead of petrol to power water pumps avoids GHG emissions.</p> <p>Further, use of biogas technology from livestock waste help to reduce methane emissions. During the NDC.2 implementation period, private companies have ventured in generating gas from biogas reactors that use waste from animal husbandry. One of such organisations is ECO Gen. EcoGen, a Malawian start-up, is transforming animal waste into biogas and bio-fertilizer, providing farmers with sustainable energy and farming solutions. This initiative reduces reliance on firewood and chemical fertilizers, offering a cleaner, more affordable alternative. EcoGen's biogas systems, particularly their portable domestic digesters, are becoming increasingly popular across Malawi, including among cattle and pig farmers. A study by Kulugomba and others found out that Malawi had a biogas installation of 343 biogas systems in Malawi with all of them using livestock waste as feed material, 92 of the were installed by EcoGen (Kulugomba, et al., 2023). Most of these biogas systems have been installed during NDC.2 implementation period. Biogas, is mostly used for cooking, and the substrate is used as organic manure. Therefore, this adaptation action in livestock agriculture as they get manure for fertilizer application and conservation of moisture, trees saved from using biogas saves tress and enhances carbon removal.</p>
<p>Integrated watershed management through afforestation and reforestation</p>	<p>Apart from treating and restoring degraded catchment through afforestation and reforestation, one of the outcomes of this mitigation outcome is enhanced forest cover, thus, achieving carbon removal. Government of Malawi, through its Ministry of Natural Resources, Energy and Mining, in 2017, developed the National Forest and Landscape Restoration Strategy, and Landscape Restoration Opportunities Assessment for Malawi. These policy measures provide ambitious, nationwide programme for land restoration, focusing on: (1) agricultural technologies (e.g. agroforestry); (2) community forests and woodlots (restoring and managing cover on customary common lands); (3) forest management (restoring and managing reserves, natural forests and plantations); (4) soil and water conservation (stabilising soils and increasing infiltration through terracing, check dams etc.); and (5) river and stream bank restoration (natural regeneration and tree planting along ‘in-stream’ buffer zones. The ambition is to restore 4.5 million hectares of degraded landscapes by 2030 at an estimated cost of US\$ 385 million (US\$ 86/hectare) (GoM, 2017). This strategy is implemented through support from international and domestic support. For example, Germany Government provided support that resulted in a total of 5,000 hectares of land being restored in Ntcheu District in the period of 2021 to 2024 (FAO, 2024).</p> <p>Further, The Government of Malawi implements the annual National Tree Planting Programme with the goal of restoring forests and land to secure food production. While the program faces challenges such as livestock damage, dry spells, and floods affecting tree survival, a percentage of trees survive and the programme has positive impacts such as benefits like job creation and reforestation of degraded areas. Verifiable numbers of trees planted and are surviving are hard to get.</p>

In relation to MPG 79 “Each Party shall report the information referred to in paragraphs 65–78 above in a narrative and common tabular format, as applicable. Such common tabular formats should accommodate all types of NDC under Article 4, as appropriate”, CTF tables are attached to this BTR report.

3.4 Mitigation policies and measures, actions and plans, including those with mitigation co-benefits resulting from adaptation actions and economic diversification plans, related to implementing and achieving a nationally determined contribution under Article 4 of the Paris Agreement

Paragraph 80 of the MPGs mandates that “*Each Party shall provide information on actions, policies and measures that support the implementation and achievement of its NDC under Article 4 of the Paris Agreement, focusing on those that have the most significant impact on GHG emissions or removals and those impacting key categories in the national GHG inventory. This information shall be presented in narrative and tabular format*”. The NDC.2 for Malawi presents a list of measures, some of which the Government of Malawi and other stakeholders including internal partners have implemented. All of the measures are of project type of action, and their aims and information on implementation details are already presented in Table 3-4. Since the measures are many and that some are not implemented, a prioritization process was conducted to identify measures that would be reported on. Methodology used to prioritize the measures was as follows. Firstly, factors to be used selection were identified and given equal weighting. Three factors were identified, as follows: availability of data (targeting those measures those that are implemented); those that have potential for GHG reduction/removal; and those from affect emissions from key categories according to GHG inventory from Third National Communication (TNC). This is the criteria for selection/prioritization where all the three factors had to be satisfied. The second step in the prioritization methodology was to select the measures. The selection was done by the consultant and two Government officials from Environmental Affairs Department. Four measures prioritized for analysis, and were large scale hydropower, grid connected solar PV, off-grid solar PV, and biomass/fuelwood cookstoves. All measures are from the Energy Sector and cover the following greenhouse gases: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). These measures are analyzed, including estimation of GHG reduction, in the following subsections:

3.4.1 Grid-connected hydropower generation

Grid-connected hydropower generation is one of the measures reported in 2021 revised NDC for Malawi, that would significantly contribute to achievement of emission reduction targets in 2040. Among other reasons, the NDC on grid connected electricity was prioritized to mitigate the would-be GHG emissions in the power sector from the planned coal-fired power stations at Kam’wamba (in Neno District) and Pamodzi (in Salima District). This NDC measure was also prioritized to reduce emissions from diesel-powered electric generators. There is a share of electricity generated using diesel fuel especially by the Electricity Generation Company (EGENCO) and the auto-generators for example the anticipated resumption of Kayelekera Uranium Mining in Karonga District which used diesel generators to generate electricity for the mining activities. In the absence of grid-based electricity, it is expected that mining projects in the pipe-line would also generate part of the electricity for their mining operations using diesel generators.

However, despite completing conducting Environmental and Social Impact Assessment (ESIA) and technically designing these two coal-powered power plants, actual construction works have not yet started reportedly due to lack of financing. The Kam’wamba coal power plant (300 MW), which was initially planned to be financed from a loan from Export and Import Bank of the People’s Republic of China¹⁰. The project, whose construction was expected to start by 2016, was scheduled to start feeding 10% of its output into the national grid by 2019 and the balance of 90% by 2021. However, this Chinese financing did not materialize and Government of Malawi started looking for alternative financing. It is now one of power projects by EGENCO to diversify sources

¹⁰ <https://www.engineeringnews.co.za/article/malawi-tedzani-2016-02-19>

of power away from Shire River¹¹. EGENCO planned to have Kam’mwamba power project completed in 2024, but financing is not yet secured. Kam’mwamba thermal power plant project is listed as a priority flagship project in Malawi 2063 Implementation Strategy 1 in the period 2021 to 2030¹² as one of the economic infrastructures to be developed to support industrial activities.

Pamodzi coal-powered plant (120 MW) was planned to be installed at Chipoka in Salima District, by Intra Energy Corporation (IEC), a committed developer. Its construction permit was granted in 2016. However, IEC cancelled project¹³ in 2023 and another developer is not found. Inability of construction of Kam’mwamba and Pamodzi coal-fired power plants therefore affects business as usual scenario (BAU) GHG emission projections, from which the 2040 NDC target for Malawi was based. Further, Malawi expects that securing financing for coal-fired power plants from international community would be difficult because many funding organizations are not willing to provide finance to a GHG-emitting power project such as the coal-fired power plant. Since tracking of progress and target for the 2021 revised Malawi NDC is based on a dynamic baseline target, subsequent revision of NDC would into consider such changes to produce a revised plausible future emission scenario from the power sector.

With respect to planned NDC activities (refer to Table 3-15), there has been progress pertaining to grid-connected hydropower during this step implementation period (2017 to 2024). During this period, there has been activities on planned grid-based hydropower projects with the aim of increasing the installed electricity capacity for Malawi, and diversifying grid electricity generation away from the Shire River. During the period, there has been feasibility studies (technical and financial) on the potential grid-based hydropower potential sites in the country. There has also been activity with respect to designing the listed grid-based hydropower plants. Furthermore, there have also been activities related to securing of financing to develop these power projects. According to the 2021 revised NDC for Malawi, grid-connected hydropower has a target of adding an extra 410 MW by 2030.

Table 3-15: Activities for Grid-connected hydropower NDC for period (2017-2024)

Activity	Status
Review and update (as needed) hydropower component of Malawi’s IRP (2015 - 2035) by 2021	This activity has not been done
Mobilize resources for project preparation studies for priority grid-connected hydropower projects by 2022	Resources for preparation for priority projects have been done, as discussed in the following sections
Initiate project preparation studies for priority grid-connected hydropower projects by 2023	Project preparation studies for priority projects have been done, as discussed in the following sections
Complete and approve project preparation studies for priority grid-connected hydropower projects by 2024	Priority grid connected projects have been identified and feasibility studies conducted. These projects are discussed in the following sections.
Secure funding (financial close) for priority grid-connected hydropower projects and commence development by 2025	Securing of funding for priority grid connected projects in in progress

All of the listed grid-based hydropower projects, discussed and tracked in the following sub-sections, belong to EGENCO. EGENCO being a state-owned power generating company. The

¹¹ <https://www.egenco.mw/portfolio/full-images-left-sidebar/>

¹² <https://npc.mw/wp-content/uploads/2021/11/MIP-1-Web-Version-8-November-2021-Fast-view.pdf>

¹³ https://www.gem.wiki/Pamodzi_power_station

feasibility studies financed by international organizations, for example World Bank and Africa Development Bank. This gives firm assurance of attainment that these projects will be materialized as planned. From Table 3-16, activity on NDC grid-connected hydropower pertaining to Review and update (as needed) hydropower component of Malawi's IRP (2015 - 2035) by 2021, has not been carried out. As part of tracking the NDC, the following sub-sections present on prioritized grid-connected hydropower projects and their statuses, starting with description of the grid-connected hydropower projects that have been prioritized by the Government of Malawi.

In general, most of planned energy projects aimed at increasing national installed power capacity, is enough to meet its national development activities as stipulated in the Malawi 2063, are hydropower-based. Prioritization of hydropower projects in Malawi's integrated energy resource master plan does not come as a surprise. Firstly, Malawi has relatively large hydropower capacity to generate power to the grid to meet national power demand and for export. Secondly, hydropower projects are favored by international development partners and financing institutions because of their being a renewable energy source for generating electricity. Prioritized hydropower projects reported in this initial Biennial Transparency Report (BTR), are planned to be financed from domestic and international sources. Domestic sources include those from EGENCO and through Public Private Partnerships, where the private are local based institutions. This is stated in the 2021 revised NDC. The international sources include international based power companies and other organizations/institutions that would want to investment in the power sector in Malawi. All of the activities (currently studies, designs and documents preparation for seeking for funding) for prioritized hydropower projects are monitored by the Ministry of Energy, which also provided policy and strategic guidance. Further, Government of Malawi has produced strategic documents and created power sector regulatory framework to create an enabling environment to attract funding to develop the planned grid-connected hydropower projects.

Despite having a characteristic of relatively small operational cost compared to other power generation technologies, initial investment cost for a hydropower project per MW of installed is high compared to other power generation technologies like coal-fired electric power station and solar PV. Process of acquiring financing for such a high initial investment project and the project that is associated demanding works to satisfy environmental and social mitigation requirements, a large-scale (grid-connected) hydropower project take long period of time to construct and commission. In the following sub-sections, description and status of grid-connected hydropower projects that that are being implemented in the country are presented. As it can be seen from the following presented projects, all of the grid-connected hydropower projects are waiting for construction. The positive observation is that the Government and development partners support these grid-connected hydropower projects because they are aligned with the objective of the Malawi 2063. In Malawi 2063, first implementation strategy, known as Malawi 2063 Implementation Plan 1 (MIP1) for the period 2021 to 2030, identification of hydropower sites for increased energy generation and access is listed as one of the activities to be carried¹⁴.

3.4.1.1 Extension of Wovwe Small Hydropower Plant

Extension of Wovwe Hydropower Plant is one of the grid-connected projects that is currently implemented by the Energy Generation Company (EGENCO), a state-owned company. The

¹⁴ <https://npc.mw/wp-content/uploads/2021/11/MIP-1-Web-Version-8-November-2021-Fast-view.pdf>

existing Wovwe Hydropower Plant is of installed 4.5 MW, being installed in 1995. It is located along the Wovwe River in Karonga District, northern part of Malawi. Wovwe hydropower plant is of run-of-river type. It is the only grid-connected hydropower plant that is located away from Shire River¹⁵. The plant, using impulse turbine, gets water flow from rivers/streams originating from Nyika Highlands, with an effective head of more than 100 m. In 2024, EGENCO carried out a feasibility study, with own financial and human resources, to find out if the plant could be extended in terms of power generation. The feasibility study showed that the Wovwe plant could be expanded to generate a further 4.5 MW. This would make the Wovwe plant generate 9 MW in total, which is enough to supply almost half of the electricity load in the northern region of Malawi because electricity demand for entire northern region is currently at around 20MW. The status of the project is that full technical and economic feasibility studies and technical designs of the plant are completed. As at the time of reporting this BTR, the project was at financing stage. This is the Project that EGENCO has committed to develop using own funds. Considering amount of work required for a constructing a hydropower project, it is unlikely that construction of the project could be completed by the end of 2025.

Expansion of Wovwe Hydropower project to generate 9 MW that would serve the northern region, is long overdue. The extra power would help to connect a considerable number of unconnected households in the northern region. There are planned extractive mining activities in the northern region that would benefit from this power; directly showcasing productive use of electricity leading to economic development. Furthermore, it would help consumers in the northern region access reliable electricity because grid-electricity from hydropower stations located in the Shire River become more unreliable in the northern part of Malawi than the rest of the country due to frequent breakdowns of power infrastructure, exacerbated by long distance of transporting electricity from hydropower power stations.

Government of Malawi plans to diversify power generation sources so that the country does not rely on hydropower stations located in the Shire River only. This is clearly stated in the Integrated Resource Planning (IRP) of 2017. Hydropower plants installed along the Shire River suffer damage from flooding of the river, which carry silt and debris from a heavily deforested and harvested land of the Shire River catchment area. Therefore, extension of Wovwe hydropower plant would demonstrate a country's resolve on power supply diversification.

3.4.1.2 Mpatamanga Hydropower Project

Mpatamanga Hydropower Project is scheduled to be constructed at Mpatamanga Gorge, along the Shire River, in southern Malawi. The hydropower plant will be installed at a location that is between Tedzani and Kapichira Hydropower Power stations. The gorge was identified as one of the potential sites along the Shire River to harness further hydropower to feed to the grid. Initially, a feasibility study revealed that the project would generate 358 MW. A recent (2024) feasibility study validated the initial study and showed that a generation potential 361 MW could be realized. By the time of reporting the initial BTR, Mpatamanga Hydropower Project had the status of having the feasibility studies (technical and financial) and ESIA completed. Process of securing financing started and Ministry of Energy expects that the financial closure to be concluded by end of 2025.

¹⁵ Shire River is the outlet from Lake Malawi. Hydropower stations are located in the middle part of the river. Thus, they are all located in the southern Malawi. Installation of hydropower away from Shire River is one of the power sector adaptation measures because the Shire River suffers from climate related flooding which affects hydropower production

Technical design of the hydropower plant is completed. Initial works on the project site has started (for example construction of Baily Bridge is done) in readiness for actual construction works in 2026. Assuming financing is secured as planned, The Mpatamanga Hydropower Project is expected to be commissioned by 2031. A 361 MW installed capacity from this grid-connected hydropower project alone, once commissioned, will contribute more than 85% of the grid-based hydropower NDC target of 410 MW by 2040. Also, in Malawi 2063, MIP 1, development of Mpatamanga Hydropower Project is listed as a highly priority project under economic infrastructure. This means therefore, that Malawi and other partners have to put to special attention to have Mpatamanga Hydropower project completed as planned.

The project is being developed through a Public Private Partnership Model of which EGENCO will hold a 30% shareholding capacity on behalf of the Government of Malawi. A special purpose vehicle, Mpatamanga Hydro Power Limited (MHPL), was established in 2022 to develop, finance, construct, own and operate the hydropower project¹⁶. The other partners include the World Bank's International Finance Corporation (IFC), Scatec ASA, and EDF International. The Mpatamanga Hydro Power Limited is currently owned by SN Malawi BV (owned by Scatec ASA and its partners British International Investment (BII) and Norfund), and EDF International (owned by EDF SA) each owning 50%. The planned ownership structure for MHPL is EDF 27.5 % and Scatec and its venture partners 27.5%, Government of Malawi GoM 30 % and IFC 15% of the Project. The project is to be developed on a Build-Own-Operate-Transfer (BOOT) basis by MHPL and the GoM. MHPL will be responsible for developing, constructing and operating the project for a period of 30 years, after which period it will be transferred to (GoM) for continued operations. Once commissioned, Mpatamanga Hydropower Station will significantly increase Malawi's power generation capacity, contributing to enhancing energy security and generation of renewable energy in Malawi (hence avoiding GHG emissions from the energy sector) some of which would be exported. Export of excess electricity from renewable energy would help directly reduce GHG emissions in countries away from Malawi, in cases where this electricity replaces electricity generated from non-renewable energy industries, for example, the coal fired thermal power plants. The country has potential to export electricity using the arrangements of Southern African Power Pool¹⁷, with already the Malawi-Mozambique interconnection project about to be operationalized in 2025. In order to prepare for this, The Government of Malawi, through its Malawi Energy Regulatory Authority has come up of Market Rules for the Malawi Electricity Market¹⁸. By the time of writing this BTR (May 2025), the World Bank provided financing of Mpatamanga Hydropower Project amounting to 350 million USD in form of a grant¹⁹. Therefore, Mpatamanga Hydropower Project, being a priority project, the NDC target related to grid-connected hydropower will likely be achieved in 2040 and Malawi is progressing well to achieve it.

¹⁶ <https://www.egenco.mw/350mw-mpatamanga-hydro-power-plant-contract-signed/>

¹⁷ <https://times.mw/malawis-power-export-potential-at-150m-european-union/>

¹⁸

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.egenco.mw%2Fdownload%2F69%2Fresources%2F3960%2Fmarket-rules-for-the-malawi-electricity-market.pdf&psig=AOvVaw1a9QjCiHACcDEYMgmt57T0&ust=1745570599486000&source=images&cd=vfe&opi=89978449&ved=0CAQQn5wMahcKEwiIh6muo_CMAxUAAAAAHQAAAAQBA

¹⁹ <https://www.worldbank.org/en/news/press-release/2025/05/15/malawi-afe-world-bank-approves-grant-financing-for-landmark-358-5-megawatt-mpatamanga-hydropower-storage-project>

3.4.1.3 Kholombidzo Hydropower Project

Just like the Mpatamanga Hydropower Project, Kholombidzo Hydropower Project is one of firm hydropower generation projects planned by the Malawi Government. It is also listed as a highly prioritized project in the Malawi 2063 Implementation Strategy for the first period (2021 to 2030) as one of the key economic infrastructures to be developed. Kholombidzo Hydropower Project is planned to be constructed along the Shire River, after the Liwonde Barrage, along the Kholombidzo Falls. The technical and financial feasibility studies were carried out in 2013, with support from African Development Bank. The technical feasibility study showed that a firm power capacity of 210 MW could be generated at this hydropower scheme. The technical designs of the power station also developed. By the time of reporting this initial BTR, the Kholombidzo Hydropower project construction works are yet to be started despite being planned to commence them in 2018 and be completed in 2021²⁰. The reason is that the financing is not yet secured. The Government of Malawi is expecting financing arrangement from Independent power producer (IPP) alone or through engagement with them through the Public Private Partnership (PPP) arrangements. However, the Government prefers the PPP arrangement²¹. The Ministry of Energy reports that the project will be implemented using a build-own-operate and transfer (BOOT) model with a thirty years long concession period. Further, the Government of Malawi plans to have a Special Purpose Vehicle (SPV) to oversee the implementation of the project.

3.4.1.4 Fufu Hydro Power Project

Fufu hydropower project is located in the Northern Region of Malawi, on South Rukuru River in Rumphi District. Fufu Project is also a planned grid-connected hydropower project, but the project is not included in MIP 1, as one of the key economic infrastructure key priority projects. Despite not being included in MIP 1, Fufu Hydropower Project would be convenient power supply source for the northern region. This is so because the region is prone to poor quality electricity supply that come due to challenges with long-distance-transmission of electricity from hydropower stations located in the Shire River in the southern part of Malawi. Technical and economic feasibility studies for Fufu hydropower project are already conducted, in 2016. The studies show that a firm electricity generation capacity of 146 MW is possible²².

Fufu Hydropower Project is designed as designed as a pumped-stage hydropower plant. Pumped-storage hydropower plants have advantages over other hydropower plants because apart from generating electricity, they generated electricity when not needed in form of potential energy of water. When more electricity is needed, for example, during the peak hours, the potential energy of water is released to generate electricity using the same turbines. Fufu hydropower project would therefore provide relatively quick response to fluctuating electricity demand, helping to stabilize the grid, which is currently compromised by the grid-feed-in of variable solar PV electricity. However, in general, pumped storage hydropower project is associated with higher investment cost compared to the traditional hydropower stations. Of course, the actual investment cost is site specific. The financial feasibility study of Fufu Hydropower project revealed investment cost of

²⁰ <https://nation1514.rssing.com/chan-25972360/article7740.html>

²¹ <https://mitc.mw/invest/index.php/investment-opportunities/investment-projects/projects-energy/108-kholombidzo-power>

²² <https://mitc.mw/invest/index.php/investment-opportunities/investment-projects/projects-energy/109-fufu-hydro-electric-power>

US\$702.5²³ million for a firm power output of 261 MW²⁴. In relative terms, this is much higher compared to the conventional hydropower projects. This could probably explain why Fufu was prioritized as one of the power projects to be done in MPI 1.

Apart from Fufu Hydropower Project being a reliable source of electricity supply in the northern region, and its grid-stabilizing characteristics, it would also provide opportunity to diversify sources of electricity away from Shire River, which suffers from impacts of climate (flooding). Shire River is also sensitive to water levels in Lake Malawi, a water source that is projected to be affected by impacts of climate change. Therefore, construction of Fufu hydropower station could be one of the climate change adaptation measures in the hydropower sub-sector. However, the positive attributes about Fufu hydropower project are not investor-attractive characteristics to construct the hydropower plant. Of course, Fufu hydropower project is listed as one of the viable projects for investment in the energy sector by Malawi Investment and Trade Centre (MITC). The Government through the Ministry of Energy need to continue wooing private investors for a possible PPP arrangement to develop the power plant. The project is planned to be implemented through public-private partnership, with the construction period spanning for 5 years commencing in 2024²⁵. The Ministry of Energy indicates that the project would be implemented following a build-own-operate and transfer (BOOT) model. By the time of reporting this BTR, a Special Purpose Vehicle (SPV) to oversee the implementation of the project is yet to be established.

3.4.1.5 Songwe Hydropower Project

Songwe Hydropower Project is one of the outputs of the Songwe River multipurpose dam that is planned to be constructed jointly by Malawi and Tanzania. The dam would stabilize the meandering Songwe River, which serves as a boundary between Malawi and Tanzania. Songwe River drains its water into Lake Malawi, also known as Lake Nyasa. Feasibility study, environmental and social impact assessment, and the technical designs of the plant layout were conducted in 2017. The studies showed that the project is both technical and economic viable. The firm power generation capacity is 180 MW to be shared equally between two countries. Thus, power generation from Songwe Hydropower Project for Malawi is 90 MW. Construction work was expected to start in 2022 with costs between two countries, planned to 5 years to complete²⁶. This power project is one of the priority projects by both countries. The Ministry of Energy reports that a bi-national company, called SONGWECOM has been established by Malawi and Tanzania to plan, implement, and manage the project on behalf of both nations.

The status report provided by the Songwe River Basin Development Programme in 2008, in preparation for financial support by African Development Bank stated that the Project had conducted a second feasibility study from 2012 to 2015 to update the 2003 one²⁷. The second feasibility study for the project recommended, that out of three flood control dams that would be

²³ [https://mitc.mw/invest/index.php/investment-opportunities/investment-projects/projects-energy/109-fufu-hydro-electric-power#:~:text=A%20Bankable%20feasibility%20study%20conducted%20for%20the,project's%20Net%20present%20Value%20is%20US\\$123%20million.](https://mitc.mw/invest/index.php/investment-opportunities/investment-projects/projects-energy/109-fufu-hydro-electric-power#:~:text=A%20Bankable%20feasibility%20study%20conducted%20for%20the,project's%20Net%20present%20Value%20is%20US$123%20million.)

²⁴ <https://www.energy.gov.mw/hydropower/>

²⁵ <https://www.energy.gov.mw/portfolio-item/fufu-hydropower-project/>

²⁶ <https://www.energy.gov.mw/songwe-dam-and-hydropower-plant/>

²⁷ <https://ilejedc.go.tz/storage/app/uploads/public/5b2/fe2/754/5b2fe275431d2616024163.pdf>

constructed, the lower dam would be the one where the hydropower generation would be incorporated with a planned generation capacity of 180 MW. However, by the time of preparing this BTR, construction works had not yet started. It is likely that this project would require another feasibility study to update the 2015 design data. With interest from development partners, including the African Development Bank (AfDB), the World Bank, and the Global Environment Facility (GEF), it is likely that the project will be constructed. The partners and the two governments view Songwe multipurpose dam project as a model for sustainable, transboundary resource management. The Government of Malawi has prioritized this project in the MIP1 as one of the flagship projects under economic infrastructure, with duration implementation being 2016-2063.

3.4.1.6 Chasombo and Chizuma Hydropower Project

Chasombo hydropower project is another hydropower-connect project that is planned to be constructed during the revised NDC implementation period. The Project is located on the Bua River, in Nkhotakota district in the central region of Malawi. According to Ministry of Energy, technical and financial feasibility studies for the project were conducted lately, in 2024. The studies show that is feasible, both technically and financially. Environmental and Social Impact Assessment (ESIA), were also conducted. The project aims at generating 50 MW. There is another proposed grid-connected hydropower project close to Chasombo on Bua River, known as Chizuma. Feasibility studies were also conducted for Chizuma hydropower project. The Ministry of Energy intends to explore combining Chasombo and Chizuma into one power plant with an aggregate capacity of 83 MW. Increase hydropower capacity of Malawi and diversify power generation away from the Shire River. Again, as with other grid-connected hydropower projects, Government of Malawi prefers to develop the project through a Public-Private Partnership (PPP) arrangement, following a build-own-operate-transfer model. A Special Purpose Vehicle (SPV) is yet to be established to oversee the project's implementation.

3.4.1.7 Estimation of emission reduction/avoided from Grid-connected hydropower projects

All of the discussed six grid-connected hydropower electricity projects discussed in subsection D1 are all in the stage of securing financing except Mpatamanga Hydropower Project has had financing secured and construction is set to start in 2025 (World Bank, 2025). Hydropower projects take long to construct; accordingly, the revised NDC activities for this implementation period (2017 to 2024) are focused on studies and securing financing. Finances for conducting studies have been sourced, with technical designs of most of the projects done. The Government of Malawi is continuing to woo investors to invest in the power market with almost all of the grid-connected projects listed in the Malawi Trade and Investment Centre list of opportunities to invest in Malawi. Malawi Investment and Trade Centre (MITC) is a trade and inward investment promotion agency, established to promote Malawi as an ideal destination for trade and investment in Africa and beyond. MITC operates as a One-Stop Service Centre for business start-ups as mandated by the Investment and Export Promotion Act of 2012.

The NDC target for the grid-connected hydropower projects is a total of 410 MW by 2030. Unless construction of hydropower projects with large capacity starts this year or next year (2026), realization of this NDC target would be difficult to achieve. The Government of Malawi is therefore, recommended to do more in securing financing to construct the planned hydropower

projects accordingly. In case the projects are constructed, GHG avoided and reduced would come from the saving of fossil fuels that is used to generate electricity in Malawi and the region, since with Malawi will be able to trade excess power with the region using Southern African Power Pool. Estimation of the GHG reduced is done using fuel and energy generation technologies will be replaced by the grid-connected hydropower projects. The methodology and its assumptions used in this BTR in estimating GHG to be reduced is described in the following section.

3.4.1.7.1 Methodology and assumptions in estimating GHG reduction for Grid-connected hydropower NDC measure

As stated in the NDC report, grid-connected hydropower projects will reduce emissions from the planned coal-fired electric power plants, and from the diesel electric generators. In other words, grid-connected hydropower projects will replace electricity that would be generated from these thermal plants that use fossil fuels. GHG emissions in the power sector depends on the fuel and on the electricity generation technology (type of the power plant). In the case of coal fired electric power plant, the technology used is a typical thermal power plant operating on Rankine power cycle technology. A coal-fired thermal power plant operating using Rankine power cycle has typical efficiency values generally lower than 50%, thus, a considerable amount of coal is not directly converted into electrical energy, it is lost to the environment as per second law of thermodynamics. However, this loss of energy in coal would also contribute to increased emissions. If the power plant is inefficient, it will be associated with increased levels of emissions per unit electricity generated. The coal to be used for electricity generation would be sourced locally in Malawi and outside (especially Moatize in Mozambique). The CO₂ emission factor of such coal is not yet established. Thus, tier 1 methodology of estimating emissions would be used: where default emission factors are used, such as those published by the Intergovernmental Panel on Climate Change (IPCC).

Default emission factor for coal was obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, under stationary combustion in the sub-category of energy industries – Electricity generation, where fuel is coal²⁸. Assuming sub-bituminous coal (which is available in Malawi and in Mozambique), the default emission factor for CO₂ is 96,100 kgCO₂/TJ. Emission factors for methane (CH₄) and nitrous oxide (N₂O) are relatively small and are not included in estimation in the electricity generation using coal.

Efficiency of the thermal power plant determines amount of coal or any fuel needed to produce the required amount of electricity. Further, it is required to produce emission factor of coal-fired power plant, per unit of electric energy produced (for example MWh). It is better to do so in order to estimate CO₂ emissions using its emission factor and amount of electric energy produced in a given time (usually a year). Since the emission factor from IPCC is provided as kgCO₂/TJ, the emission factor in terms of tCO₂/MWh can be converted. Emission factor in tCO₂/MWh for coal in electric power plant could then in the same units with electricity grid emission factor. The thermal efficiency is introduced to include the increased amount of coal (or any fuel) due to lowering in efficiency to generate unit electric power. Equation (2), on thermal power plant emission factor (kgCO₂/MWh) is formulated accordingly (to be used to for coal and diesel in

²⁸ https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

electric power generation). This approach was used by in calculation of emission factors in power sector in Indonesia²⁹.

$$\text{Thermal Power Plant Emission Factor} = \text{Emission Factor of Fuel Source} \left(\frac{\text{kgCO}_2}{\text{TJ}} \right) \times 10^{-3} \left(\frac{\text{t}}{\text{kg}} \right) \times \frac{3.6 \times 10^{-3}}{\eta_t} \left(\frac{\text{TJ}}{\text{MWh}} \right) \quad (2)$$

Thermal efficiency η_t of a typical coal fired power plant is around 45%³⁰, though with modern coal pulverization technologies, the efficiency could reach 55%. But the pulverization technologies increase investment cost, and it is unlikely that the coal-fired power plant in Malawi would use ultra-advanced coal combustion technologies. Once the emission factor in kgCO₂/TJ is found and the thermal efficiency is known, equation (2) can be used to find the emission factor of the power plant in tCO₂/MWh.

To estimate CO₂ emissions using equation (2) in tCO₂/MWh, there is a need to estimate electric energy generated by the hydro-electric power plant in MWh (whose electricity production replaces electricity from thermal-electric power plant. Planned installed power for all grid-connected discussed in section 3.4.1 are presented in Table 3-17. Power plants do not operate at rated capacity all the all the time. Also, they may operate at less than rated capacity due to limited in resources and or responding to lowering demand for electricity. A plant capacity factor is usually introduced to consider actual energy generated relative to energy that would be generated if power plant was being run at 100% rated power over the time. Capacity factor of the proposed grid-connected hydropower projects are provided in some designs, while capacity factor for other projects are assumed.

Table 3-17: Electric energy generated from grid connected hydropower planned projects

Grid-connected Project	Planned Capacity (MW)	Availability	Capacity factor	MWh
Wovwe expansion	4.5	0.9	0.5	17,739.0
Mpatamanga	361	0.9	0.49	1,394,600.8
Kholombidzo	210	0.9	0.65	1,076,166.0
Fufu	261	0.9	0.49	1,008,284.8
Songwe	90	0.9	0.77	546,361.2
Chasombo and Chizuma	83	0.9	0.5	327,186.0
Total				4,370,337.80

Further, power plants do not operate all the time; at other times the plant is down for aa scheduled maintenance procedure. A plant availability factor is introduced to consider amount of time the plant is available to generate power. The availability factor for hydropower plants varies significantly. However, proposed hydropower projects would be providing base load, except the Fufu which would provide peaking load, but since it is a pumped storage hydropower plant, it would operate most of the time. Base load electric power plants are generally run almost all the time. Therefore, a conservative figure of 90% availability factor for the proposed hydropower plant is assumed. The number of hours the plant would generate power in a year is therefore the product of availability factor and the number of hours in a year (8760 hours). The electric energy (in MWh)

²⁹ https://www.jcm.go.jp/id-jp/methodologies/66/attached_document1

³⁰ <https://www.sciencedirect.com/science/article/abs/pii/S0196890415007657>

generated is the product of installed capacity, capacity factor and the number of hours the plant generate power. The electric energy (MWh) is calculated for all the grid-connected electricity and listed in Table 3-17.

The emission factor for a coal-fired electric power plant is calculated from Equation (1) taking the emission factor of coal in kgCO₂/TJ as 96,100 and thermal efficiency as 45%, the emission factor in tCO₂/MWh is 0.7688, as demonstrated in the following solved equation.

$$\text{Coal-fired Thermal Power Plant Emission Factor} = 96,100 \left(\frac{\text{kgCO}_2}{\text{TJ}} \right) \times 10^{-3} \left(\frac{\text{t}}{\text{kg}} \right) \times \frac{3.6 \times 10^{-3}}{0.45} \left(\frac{\text{TJ}}{\text{MWh}} \right) = 0.7688 \left(\frac{\text{tCO}_2}{\text{MWh}} \right)$$

Since the emission factor in tCO₂/MWh, and the energy in MWh are calculated, estimation of emission reduction from grid-connected hydropower is possible. Apart from replacing electricity generated from coal-fired power plants, the grid-connected hydropower projects would replace electricity generated from diesel electric generators. Therefore, there is need to estimate the MWh from diesel electric generators and the diesel generator emission factor, using equation 1. For stationary combustion in energy industries, diesel has a default IPCC emission factor, in kgCO₂/TJ of 74,100. The efficiency of diesel electric generator is around 40%³¹ if operated in the designed optimum operating range, usually up to 80% of total load capacity. Therefore, the emission factor for diesel electric generator in tCO₂/MWh is 0.6669, as exemplified in the following calculation.

$$\text{Diesel Generator Emission Factor} = 74,100 \left(\frac{\text{kgCO}_2}{\text{TJ}} \right) \times 10^{-3} \left(\frac{\text{t}}{\text{kg}} \right) \times \frac{3.6 \times 10^{-3}}{0.40} \left(\frac{\text{TJ}}{\text{MWh}} \right) = 0.6669 \left(\frac{\text{tCO}_2}{\text{MWh}} \right)$$

3.4.1.7.2 Potential emission reduction from grid-connected electricity projects

Emission reduction will be achieved when grid-connected power would replace electricity from coal-fired power plants and diesel electric generators. However, the grid-connected hydropower plants are also associated with emissions themselves, which are estimated using grid-emission factor. Therefore, to calculate the potential emission reduction from grid-connected hydropower, it is required to find the net emissions reductions. This can be achieved by subtracting grid emission factor from the power plant emission factor

From UNFCCC harmonized grid emission factor database, the grid-emission factor for hydroelectric power for Malawi is 0.243 tCO₂/MWh³². Therefore, the net emission factor for coal-fired power plant is 0.5258 tCO₂/MWh and for a diesel electric generator is 0.4239 tCO₂/MWh. Since energy from grid-connected electricity (MWh) is calculated, the share of this that would replace electric energy from coal fired power plants and diesel generator can be assumed to be 90% coal and 10% diesel (because diesel generators are mostly for peaking purposes). The emission reduced are calculated and presented in the following Table 3-18. The total GHG reduced is 2,253,389.83 tCO₂.

³¹ <https://www.genpowerusa.com/blog/diesel-generator-vs-gas-generator-which-is-more-efficient/#:~:text=How%20Efficient%20are%20Diesel%20Generators?,deciding%20which%20generator%20to%20buy.>

³² https://unfccc.int/sites/default/files/resource/Harmonized_Grid_Emission_factor_data_set.xlsx

Table 3-18: GHG reductions from the NDC measure on grid-connected hydropower projects

Name of grid connected hydropower project	MWh from hydropower	Energy replaced from coal	Energy replaced from diesel generators	GHG reduction from coal power plants (tCO ₂) Emission factor = 0.5258 tCO ₂ /MWh)	GHG reduction from diesel power plants (tCO ₂) Emission factor = 0.4239 tCO ₂ /MWh	Total GHG reduced (tCO ₂)
Wovwe expansion	17,739.0	15,965.10	1,773.90	8,394.45	751.96	9,146.41
Mpatamanga	1,394,600.8	1,255,140.68	139,460.08	659,952.97	59,117.13	719,070.10
Kholombidzo	1,076,166.0	968,549.40	107,616.60	509,263.27	45,618.68	554,881.95
Fufu	1,008,284.8	907,456.28	100,828.48	477,140.51	42,741.19	519,881.71
Songwe	546,361.2	491,725.08	54,636.12	258,549.05	23,160.25	281,709.30
Chasombo and Chizuma	327,186.0	294,467.40	32,718.60	154,830.96	13,869.41	168,700.37
Total						2,253,389.83

The emission reductions from this NDC measure related to grid-connected electricity would be spread out up to 2040 according to the discussed realistic time they would be commissioned, as presented in Table 3-19. Wovwe expansion project is likely to be commissioned in 2027 with funds from EGENCO, Mpatamanga in 2030 with funding from local and international, Kholombidzo is likely to be commissioned in 2035, Chisombo and Chizuma in 2037, while Fufu is likely to be commissioned in 2038. Songwe Hydropower project is likely to be commissioned in 2040 with funding from Malawi, Tanzania and international organization.

Table 3-19: Grid-connected hydropower projects, likely year of commissioning and correspond GHG reduced

Name of grid connected hydropower project	Year likely to be commissioned	Total GHG reduced (tCO ₂)	Total GHG reduced – cumulative (tCO ₂)
Wovwe expansion	2027	9,146.41	9,146.41
Mpatamanga	2030	719,070.10	728,216.51
Kholombidzo	2035	554,881.95	1,283,098.46
Chasombo and Chizuma	2037	168,700.37	1,451,798.83
Fufu	2038	519,881.71	1,971,680.54
Songwe	2040	281,709.30	2,253,389.84
Total by 2040		2,253,389.83	

It is a requirement to project how the indicator will be changing over the entire NDC period. For the grid-connected electricity, as an NDC measure, the realistic year of implementation/commission is 2027 with Wovwe Expansion., contributing 9,146.41 tCO₂. Total GHG emissions for the other years is taken as cumulative emissions, calculated from Table 3-19. The progression of the indicator (total GHG reduced) is therefore presented in Figure 3-4.

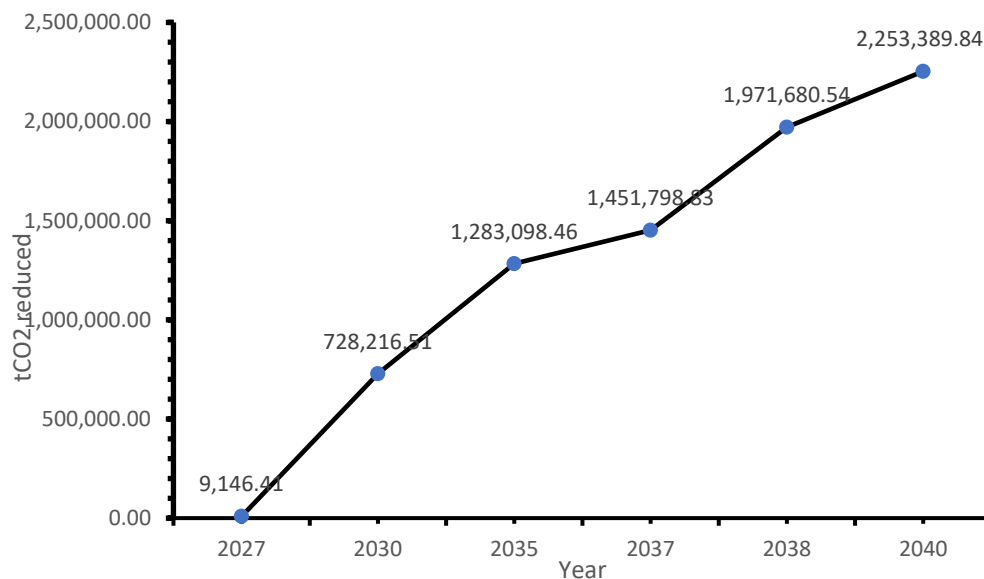


Figure 3-4: Projection of Indicator (Total GHG reduction) on grid-connected hydropower from 2027 to 2040

The cumulative GHG reduction by 2040 (2.25 million tCO₂e) represents a share of 13% of the NDC target (17.7 million tCO₂e) for Malawi for both unconditional and conditional measures.

3.4.2 Off-grid small scale solar PV systems

A typical solar home system comprises a solar PV panel, battery, radio, light bulbs and phone charger. By placing the solar PV panel in sunlight during the day, the solar energy can be stored (in a small battery) and used to power lights and small appliances. Unpublished sources and expert opinion state that Malawi has achieved a lot in terms solar home system installations arising from projects and individual installations. Solar Home Systems (SHS) are off-grid energy solutions on household level. They use one or more solar panels (PV modules) to generate electricity for lighting and appliances such as radios or TVs. SHS usually operate at 12 Volt direct current for low power DC appliances and include a charge controller (distributes power and protects the batteries and appliances from damage) and at least one battery (stores energy for use when the sun is not shining). SHS for larger appliances come with an inverter to change the current. During this NDC implementation period, coordination plan among stakeholders including donors is developed through a special unit (Rural Electrification Unit) in the Ministry of Energy in the office of the Director of Electricity, and new off-grid small scale solar PV systems have been installed throughout the country.

In Malawi SHS, just like other categories of off-grid solar PV systems, are difficult to monitor and record because there are various players that are involved, but not coordinated. These players include the Government of Malawi, non-governmental organizations, individuals (households and institutions), and numerous renewable-energy based industries. The other players are the institutions such as the energy sector-wide regulating authority, the Malawi Energy Regulatory Authority (MERA), the Malawi Bureau of Standards (MBS), Malawi Revenue Authority (MRA), and an association of renewable energy industries, named renewable energy industries association of Malawi (REIAMA). These institutions form important part of institutional framework for off-grid solar PV market in Malawi. It is important therefore that these activities of these institutions

are well coordinated and inform each other to create a vibrant solar PV off-grid in the country where data for monitoring, reporting and verification purposes is systematically collected and archived.

Off-grid solar PV is considered as one of the firm sources of power to electrifying rural areas that are far away from the main ESCOM grid. However, the off-grid solar PV has had challenges such as the sector having unregulated market landscape, suppliers not having accountability on quality and poor service, users/consumers affordability constraints, difficulties in sourcing solar PV system parts locally, and management of the resulting e-waste resulting from off-grid solar PV components. Despite the challenges, Malawi has registered a booming of solar home systems (SHS) especially for as small-scale solar PVs for lighting. The Government of Malawi has put in place policies and strategies to promote off-grid solar PV energy. Some of these are Malawi Renewable Energy Strategy that sets the country to achieve an electrification level of 45% in 2030 where off-grid solar PV via private sector/industries is mentioned as one of the significant technologies to be promoted to achieve this target. One of the implementation strategies to achieve the target is Government increasing level of affordability of solar PV components through removal of import taxes and excise duties on all renewable energy components.

3.4.2.1 Numbers of Solar Home System Installed in Malawi

MERA, being the energy-sector wide regulator has mandate to regulate the renewable energy industry, both for solar home systems, small-scale solar PVs, mini-grids and large-scale solar PVs (grid connected). Important details on regulation would provide useful data to track the progress of the off-grid solar PV NDC. However, installation and trade/market on solar home systems and small-scale solar PVs are unregulated, and no reliable data is available. Because these are done at individual level purchasing them from off the-shelf (shops) or are brought into the country through unchartered routes, and inability of MRA and MBS to record some small-scale solar energy components at entry points into Malawi. Solar mini-grids are regulated. The NDC on off-grid solar PV has a target of 50,000 of additional off-grid PV SHS / lanterns by 2025. Information to estimate SHS was aided from literature on Government based projects, with Ministry of Energy officials validating the estimates.

According to the June 2024 World Bank Report on its the project it finances on Malawi Electricity Access Project (MEAP), which was approved in 2009, in 2024, the MEAP registered 115,000 connections of which one-third was from SHS since the restructuring of the project ed in 2022³³. This means that by closing of the reporting date of 30 June 2024, over 38,000 SHS were installed through MEAP. This was achieved through the NgweNgweNgwe Fund³⁴ (established in May 2023), administered through the Ministry of Energy where five solar companies were contracted to install at least 244,500 SHS of Tier 1 category. According to the Project, Tier 1 category of SHS are those of a solar lantern that meets Tier 1 on the multi-tier framework (MTF) for a household, if it provides at least 1,000 lumen-hours (lm-hr) / day and sufficient energy to keep a well-used mobile phone operational. Through interviews with some of the contracted companies (Zuwa

³³

<https://documents1.worldbank.org/curated/en/099050724110519939/pdf/P1643311e2468709c1b43a14253e502c6d8.pdf>

³⁴ NgweNgweNgwe is a term in vernacular Malawian language of Chichewa meaning “*having light all night*”

Energy Limited and Green Impact Technologies), it was established that provision of after-sale services and repairing of defunct SHS systems were done, monitored by the Ministry of Energy.

Also, the number of SHS will also increase during the implementation phase of this NDC from the 2025 approved The Government of Malawi sustainable energy financing application to the World Bank. This is the project, titled Accelerating Sustainable and Clean Energy Access Transformation in Malawi (ASCENT-Malawi) Project with implementation period from 2025 to 2030³⁵. The project will be implemented by Ministry of Energy and Electricity Supply Corporation of Malawi (ESCOM). The general project development objective is to increase clean and sustainable energy access in Malawi, aligning with ASCENT's Program Development Objective of increasing clean and sustainable energy access in Eastern and Southern Africa. The ASCENT project has five components but, the Malawi component will implement the following components: Off-grid Connection through Solar Home System (SHS); Energy Access for Schools and Health Facilities; and Clean Cooking Solutions, respectively; and on Technical Assistance and Capacity Building. With respect to off-grid connection through SHS, the ASCENT Project will expand the deliverables of the NgweNgweNgwe Fund under the MEAP to provide solar home systems (SHS) to over 800,000 households contributing towards a 70% electricity access level by 2030³⁶. Therefore, with only these two projects (MEAP and ASCENT) achievement of the NDC on off-grid SHS target of 50,000 of additional off-grid PV SHS / lanterns by 2025 is on track and will be exceeded.

Further, the other renewable energy projects on solar PV give data on numbers of SHS that are installed in Malawi. A report from the USAID Solar Home System Kickstarter Programme in Malawi show that a number of SHS have been installed in Malawi. The report states that for the period of 2019 to 2022 over 108,000 SHS were sold³⁷ through the market activities of 4 renewable energy-based companies that were awarded to implement the programme: The four grant winners (national and international) were SolarWorks, VITALITE, Yellow, and Zuwa Energy. In 2019, Power Africa launched the "Solar Home System Kick-Start Program for Malawi" to expand energy access in order to grow the private sector. Kick-Start grantees have measurably increased their presence in Malawi and are still actively growing their operations following the end of the grant program in the country, and attract qualified international solar home system players into the Malawian market.

The other regulated and documented off-grid solar -PV installation that can be tracked towards achievement of the NDC on off-grid solar installations are the solar PV mini-grids, presented as follows.

3.4.2.1.1 Estimation of emission avoided/reduced from use of Solar Home Systems

Most of the solar home systems are used for lighting, almost all of them are used in off-grid communities. SHS are also used in grid-based communities where electricity supply is unreliable for provision of lighting and phone charging. The power rating for each of the SHS vary because the SHS depends on application, for example on lighting, entertainment, and phone charging. In

³⁵ <https://projects.worldbank.org/en/projects-operations/procurement-detail/OP00350240>

³⁶ <https://times.mw/250-million-clean-energy-project-rolls-out-mid-year/>

³⁷ <https://sun-connect.org/wpcont/uploads/PA021SBM.pdf>

Malawi, power rating of SHS typically range from 6W to 55W³⁸. Taking the average of 30W for each of SHS, and typical time usage of 4 hours per day (thus, 1460 hours in a year) according to an expert opinion from a renewable energy expert based in Ministry of Energy, the annual electricity consumption from SHP can be calculated. Firstly, verifiable information from installed SHP is used, which basically indicates minimum number of installations in the country. This information is collected from the above discussed status of SHS in Malawi. Total power installed from SHS is then calculated from the product of power wattage of a SHS (30 W) and number of installed SHS, as presented in Table 3-20.

A SHS, being part of Solar PV systems are known for their durability and long-lasting performance. On average, a solar PV system can last between 25 and 30 years³⁹. However, their efficiency will gradually decline over time, typically at a rate of about 0.5% to 1% per year⁴⁰. This information is considered when calculating number of SHS installed and their contributions towards renewable energy power supply for Malawi up to 2040, being target year for Malawi's NDC. This means that SHS installed in 2019 would still be in used up to 2040, thus accumulative installation totals can be determined. SHS installation per year (annual installation rate) has increased tremendously in Malawi, for example a study done in Lilongwe revealed that annual installation rate increased from 1% in 2010 to 12% in 2020⁴¹. It is also assumed that since these project-based SHS are disseminated through market-approach, the numbers after end of the project would grow by an annual rate equal to the installation rate: which is assumed to be an average of 5% nationally (guided by the Lilongwe SHS installation rate and from an expert opinion). The calculations of the installed SHS and energy in MWh (power in MW multiplied by number of hours) from it are presented in Table 3-20.

Table 3-20: Number of installed solar home systems and energy generated from installed solar home systems

Project	2019	2020	2021	2022	2023	2024	2025	2026	2028	2030	2032	2034	2036	2038	2040
ASCENT	0	0	0	0	0	0	133,333	266,667	533,333	800,000	882,000.00	972,405.00	1,072,076.51	1,181,964.36	1,303,115.70
USAID Solar Home System Kicks tarter Programme	27,000	54,000	81,000	108,000	113,400.00	119,070.00	125,023.50	131,274.68	144,730.33	159,565.19	175,920.62	193,952.48	213,832.61	235,750.46	259,914.88

³⁸ <https://www.mphamvu-now.info/home-solar-systems/>

³⁹ <https://sunshinesolar.co.nz/how-long-does-solar-last/#:~:text=On%20average%2C%20a%20solar%20PV,%25%20to%201%25%20per%20year.>

⁴⁰ <https://sunshinesolar.co.nz/how-long-does-solar-last/#:~:text=On%20average%2C%20a%20solar%20PV,%25%20to%201%25%20per%20year.>

⁴¹ https://eppsa.cpc.unc.edu/wp-content/uploads/2023/09/23-7236-CPC-EPPSA-Malawi-Baseline-SHS-Report_Final.pdf

Mala wi Electr icity Acce ss Proje ct	0	7,60 0	15,2 00	22,8 00	30,40 0	38,00 0	39,90 0.00	41,89 5.00	46,18 9.24	50,92 3.63	56,14 3.31	61,89 8.00	68,24 2.54	75,23 7.40	82,94 9.23
Total	27, 000	61,6 00	96,2 00	130, 800	143,8 00	157,0 70	298,2 57	439,8 36	724,2 53	1,010 ,489	1,114 ,064	1,228 ,255	1,354, 152	1,492, 952	1,645, 980
Power from SHS (W)	810 ,00 0	1,84 8,00 0	2,88 6,00 0	3,92 4,00 0	4,314 ,000	4,712 ,100	8,947 ,705	13,19 5,090	21,72 7,587	30,31 4,665	33,42 1,918	36,84 7,664	40,62 4,550	44,78 8,566	49,37 9,394

Projection of the indicator for tracking NDC measure, in terms of kW of electricity installed is presented in Figure 3-5. It can be seen that the power installed from solar home systems is increasing steadily from 2019 to 2024 and then from 2025 to 2040 during which period planned installments and an application of growth rate of 5% is employed

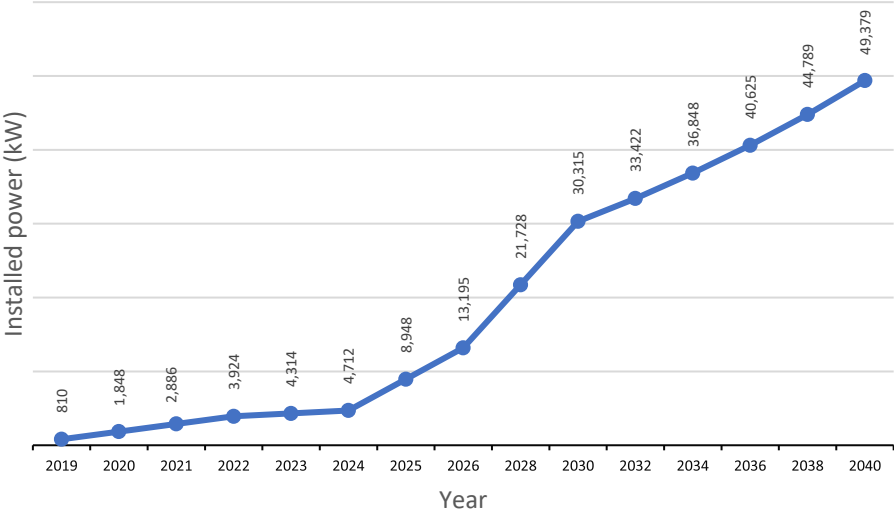


Figure 3-5: Installed power from solar home systems

Emission reduction from SHS systems, just like in grid-connected hydropower, is calculated from knowledge of energy that the SHS systems substitutes. Ideally SHS provides power for lighting, phone charging, powering radio and TVs. Most of the SHS are installed in areas without access to grid-connected electricity, and the services that use SHS are not provided before SHS installations. However, it can be estimated in terms of avoided emissions from use of SHS. For the case of lighting (almost all of SHS are used for lighting), in off-grid communities in Malawi, baseline lighting technologies include a mix of traditional and modern sources. Traditional methods like candles, kerosene lamps, and torches are still used. While torches use chemical batteries (non-renewable source of energy), kerosene and candles are not only non-renewables, but also emit GHGs: candles are made of kerosene wax. Therefore, it can be modelled that SHS will substitute kerosene in provision of lighting services in off-grid rural areas. Taking kerosene lamp as

stationary combustion, the default emission factor for CO₂ is 71,900 kg CO₂/TJ⁴², obtained from 2006 IPCC Guidelines in Table 2.2 on default emission factors for stationary combustion in the energy industries (kg of greenhouse gas per TJ on a net calorific value basis). However, the technology for lighting using kerosene can be using a wick-based lamp or a lantern. The latter is more common in Malawi currently. Kerosene lamps, as sources of light, are highly inefficient with about 0.59% of input used to generate light while the rest are spent as heat. According to the Joint Crediting Mechanism (JCM), the emission factor for kerosene lamp as used in CDM Methodology is 6.8tCO₂/MWh⁴³. The CO₂ emissions are then calculated from the product of emission factor (tCO₂/MWh) and energy (MWh). The calculated values are presented in Table 3-21.

Table 3-21: CO₂ emission reduction from solar home systems

	2019	2020	2021	2022	2023	2024	2025	2026	2028	2030	2032	2034	2036	2038	2040
Power from SHS (W)	810,000	1,848,000	2,886,000	3,924,000	4,314,000	4,712,100	8,947,705	13,195,090	21,727,587	30,314,665	33,421,918	36,847,664	40,624,550	44,788,566	49,379,394
Energy (MWh)	1,182.60	2,698.08	4,213.56	5,729.04	6,298.44	6,879.67	13,063.65	19,264.83	31,722.28	44,259.41	48,796.00	53,797.59	59,311.84	65,391.31	72,093.92
Emissions reduction (tCO ₂ e)	8,041.68	18,346.94	28,652.21	38,957.47	42,829.39	46,781.73	88,832.82	131,000.86	215,711.48	300,963.99	331,812.80	365,823.61	403,320.53	444,660.89	490,238.63

Solar home systems, despite having relatively smaller capacity to reduce emissions (for example, 8,041.68 tCO₂ in 2019, and projected 490,238.63 tCO₂ in 2040), have greater social benefits compared to grid-connected solar energy systems. SHP provide lighting and communication services, which are need for social development, and for enhancement of businesses in off-grid communities. It is expected that as economic status of rural households increase, SHS installations will increase from household self-installations.

3.4.2.2 Solar PV Mini-grids in Malawi

A mini-grid can be defined as a standalone energy system producing electricity to an off-grid community. Mini-grids can be grouped in terms of energy source, for example a solar PV mini-grid, a hydropower mini-grid, and a diesel generator mini-grid. In Malawi, the majority of mini-grids are of solar PV and hydropower (not hybrids). There have been examples of hybrid mini-grids of solar PV and wind in the country. These are the early mini-girds installed by the Government of Malawi with support from GEF during the UNDP/GEF project on Barrier Removal to Renewable Energy in Malawi (BARREM). Under BARREM Project, in 2004, Government installed 3 solar PV-wind hybrid mini-grids in Thyolo (Kadzuwa), Nkhotakota (Chagunda) and Mzimba (Elunyeni), but these are all not functioning now ⁴⁴.

⁴² Table 2.2 Stationary Combustion in the 2006 IPCC Guidelines available on https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

⁴³ https://www.jcm.go.jp/ke-jp/methodologies/30/methodology_file#:~:text=2.2%20Calculation%20method%202:&text=CO2%20emission%20factor%20of%20the%20lighting%20from%20kerosene%20lamps.,monitoring%20in%20the%20project%20activity.

⁴⁴ https://strathprints.strath.ac.uk/64868/1/Eales_Unyolo_2018_Renewable_Energy_Mini_grids_in_Malawi.pdf

Most of the solar based mini-grids are in operational state by the time of reporting the first BTR. The challenges encountered are that most of them depend on international support in terms of parts for repair. Also, mini-grids operators complain about logistical challenges to bring into the country mini-grid parts/components from outside Malawi despite the fact that import duties are waived on such components. Training in mini-grids is happening in the country, but still more critical skills in design and manufacture of parts and components are lacking, exacerbating the challenges of relying on imports of such parts/components. Through mini-grids assessment using snow-balling techniques, the available solar pv mini-grids in Malawi, which are operated in off-grid mode, by the time of initial BTR report are as follows.

3.4.2.2.1 Mthembanji solar PV mini-grid

Mthembanji solar PV mini-grid, and is located in Dedza District has an installed capacity of 12 kW and supports more than 70 consumers since 2020 and the demand for off-grid power is increasing. It is owned and operated by United Purpose Malawi with technical support from University of Strathclyde. It was funded by Scottish Government International Development Program under Rural Energy Access through Social Enterprise and Decentralization (EASE) project. It was initially implemented/operated by the project support from 2018 to 2023. But after 2023, it is operated as an independent entity with technical support from United Purpose (an international NGO), under social enterprise business model. As it is typical of all solar PV based mini-grid in Malawi, installation of this plant faced number of barriers due to lack of local capacity, supply chain issues, and regulatory hurdles. However, the mini-grid has data management and smart metering system and is well monitored by Ministry of Energy and regulated by MERA. The Mthembanji mini-grid has brought positive social and economic benefits to the community. It is still in operation by the time of reporting in the first BTR for Malawi.

3.4.2.2.2 Sitolo Solar PV mini-grid

Sitolo mini-grid is located in Mchinji District, installed and operated by Community Energy Malawi with support from UNDP/GEF. It was commissioned in 2018, with an installed capacity of 80 kW. It is the largest solar PV mini-grid power system in Malawi. The off-grid solar power system supports a community (Sitolo) with 750 consumers/customers in a cluster of 3 villages, who include maize mills, agro-processing local activities and shops, as a well as households for lighting. The mini-grid demonstrate productive use of solar energy and the demand for off-grid power is increasing. Technical challenges with inverters were reported, and the mini-grid in operational state by the time of reporting the first BTR. Just like Mthembanji solar mini-grid, Sitolo solar PV mini-grid is well regulated and monitored renewable energy power plant.

3.4.2.2.3 Mwalija solar PV mini-grid

Mwalija Solar PV minigrid is based in Chikwawa District. The project was funded by European Union and installed in January 2019 with support of Practical Action, Hivos, Environment Africa, and CARD (Churches Action in Relief and Development)⁴⁵. However, the minigrid was destroyed by floods in 2021 and is not in operational by the time of report the first BTR. The installed

⁴⁵

https://cesetproject.com/sites/default/files/Fieldwork%20visit%20CES%20project%20Malawi_October%202023.pdf

capacity for the dysfunction mini-grid is 55 kW. There is potential to refurbish the off-grid power system.

3.4.2.2.4 Oleole solar mini-grid

This solar mini-grid, with installed capacity of 30 kW is in Chikwawa District in the Oleole Community. Just like Mwalija, this mini-grid was also developed with support from CARD and got damaged by the 2021 floods. This demonstrates the need to make power system resilient to impacts of climate change. The Oleole minigrd can be refurbished to continue generating much needed installed power to off-grid community of Oleole, just like it is for the Mwalija solar PV mini-grid. However, this would need an external support which is relatively not easy to get.

3.4.2.2.5 Nyamvuwu solar mini-grid

The Nyamvuwu solar mini-grid is located in Nsanje District, servicing the off-grid community of Nyamvuwu. It has an installed capacity of 30 kW, and a considerable number of the consumers are the irrigation farmers; thus, the power system is used for productive purposes. Just like Mwalija mini-grid, this mini-grid was also developed with support from CARD. However, the mini-grid is not operational because under the MAREP program, Nyamvuwu is not grid-connected and most of the household customers have shifted to using the grid electricity, making the power system more available for irrigation. This shows that the system displaces petrol for irrigation of crops, contributing directly to GHG emission reduction.

3.4.2.2.6 Chimombo Solar PV mini-grid

This minigrd is also located in Nsanje. Just like Nyamvuwu, Oleole, and Mwalija, Chimombo mini-grid was constructed with the support from CARD. The four mini-grids implemented by CARD, in 2019, were funded by the European Union under the Sustainable Energy for Rural Communities project. It has an installed capacity of 15 kW, and provides electricity to the Chimombo off-grid community.

3.4.2.2.7 Rural Off-Grid Energy Kiosks

Energy kiosk is an approach used to provide electricity to low-income households especially in the rural areas. In Malawi, most of the kiosks are solar PV and serve off-grid communities. In 2022, the number of solar PV kiosks in Malawi were estimated to be around 10 (refer to an example shown in Figure 3-6).



Figure 3-6: A picture showing an example of solar PV energy kiosk that will be used for small scale irrigation and water supply, battery charging, lighting: constructed by RENAMA in Thyolo District

The pioneer work was done by Renewable Malawi (RENAMA), who with support from Scottish Government installed demonstrational solar pv kiosks at Bvumbwe (in Thyolo District) and at Dzenje Primary School (in Phalombe District). In Malawi, by the time of report this BTR, there were now over 10 solar kiosks stationed in the rural areas⁴⁶. During the period of the 2021-2024 NDC implementation phase, a number of projects have implemented these off-grid energy kiosks. For example, in 2024, EKO Energy supported construction of a 10-kW solar PV plant in Thyolo District, including a 10-kWh battery pack⁴⁷. The system provides power to the local schools and also powers an energy kiosk, making energy more easily accessible for many people.

3.4.2.3 Estimation of emission reduction from solar off-grid power systems

Solar off-grid power installed power system other than SHS serve a larger community through a mini-grid. The systems described above (section 2.2). Sitolo mini-grid contributes 80kW and was commissioned in 2018. The four mini-grids commissioned in 2019 (Mwalija, Oleole, Nyavuwu and chimombo) altogether constructed 130 kW. Mthembanji contributes 12 kW, commissioned in 2020, and Energy Kiosks contribute 10 kW of off-grid electricity, installed in 2022. A Table 3-22 is created to analyze the installations, assuming an 8 hours operation in a day (typical design operating hours for a solar system, reflecting a capacity factor of 33%), energy collected in a year with an annual availability factor of 90%, the energy collected from solar off-grid projects can be calculated. Details of power and energy collected are calculated and presented in Table 3-22, which are calculated from number of installations as discussed already.

Table 3-22: Power and energy from installed solar off-grid power systems

	2019	2020	2021	2022	2023	2024	2025	2026	2028	2030	2032	2034	2036	2038	2040
Total kW	210	222	222	244	244	244	244	256	282	311	343	379	417	460	507
Energy MWh	551.9	583.4	583.4	641.2	641.2	641.2	641.2	673.3	742.3	818.4	902.3	994.8	1,096.7	1,209.1	1,333.1

Solar PV off-grid of such sizes are used for cooking, small-scale irrigation, lighting, phone-charging, and radio. These services have different power requirements and without solar PV energy, the services would have to be obtained mainly from firewood for cooking, petrol for pumping, and kerosene for lighting. Information about these off-grid solar PV is that they are mostly used for lighting and other productive uses such as irrigation, and welding. Corresponding emission reduction are calculated from the fuel that the off-grid solar PV would substitute, in this case petrol and kerosene. Biomass have a net zero CO₂ reduction. If it is assumed that alternative energy to off-grid solar is in the ratio of 3:1 for petrol and kerosene, it is possible to estimate reduction in CO₂ emissions. The emission factor for petrol powered water pump is to be determined first. Petrol pump uses an internal combustion engine with a thermal efficiency of around 20%⁴⁸. The default CO₂ emission factor for petrol is 69300 kg/TJ, from IPCC. Using equation 1, the petrol pump emission factor is calculated as 1.2474 tCO_{2e}/MWh.

⁴⁶ https://cesetproject.com/sites/default/files/An%20Overview%20of%20CES%20in%20Malawi_Nov21.pdf

⁴⁷ <https://www.ekoenergy.org/wp-content/uploads/Climate-Fund-leaflet-2024-RENAMA-Malawi.pdf>

⁴⁸ https://www.greencarreports.com/news/1091436_toyota-gasoline-engine-achieves-thermal-efficiency-of-38-percent

$$\text{Thermal Power Plant Emission Factor} = \text{Emission Factor of Fuel Source} \left(\frac{\text{kgCO}_2}{\text{TJ}} \right) \times 10^{-3} \left(\frac{\text{t}}{\text{kg}} \right) \times \frac{3.6 \times 10^{-3}}{\eta_t} \left(\frac{\text{TJ}}{\text{MWh}} \right)$$

$$\text{Petrol Pump Emission Factor} = 69300 \left(\frac{\text{kgCO}_2}{\text{TJ}} \right) \times 10^{-3} \left(\frac{\text{t}}{\text{kg}} \right) \times \frac{3.6 \times 10^{-3}}{0.2} \left(\frac{\text{TJ}}{\text{MWh}} \right) = 1.2474 \text{ tCO}_2\text{e/MWh}$$

The calculated estimate avoided GHG emission from implementation of solar off-grid power systems are presented in Table 3-23. The avoided emissions in 2021 and 2022 are 727.75 and 799.87 tCO₂e respectively. The projected emissions avoided are 1,020.86 and 1,662.88 tCO₂e in 2030 and 2040 respectively.

Table 3-23: Estimated energy production and avoided GHG emissions by solar-off-grid power systems systems

	2019	2020	2021	2022	2023	2024	2025	2026	2028	2030	2032	2034	2036	2038	2040
Energy MWh	551.9	583.4	583.4	641.2	641.2	641.2	641.2	673.3	742.3	818.4	902.3	994.8	1,096.7	1,209.1	1,333.1
Emission tCO ₂	688.42	727.75	727.75	799.87	799.87	799.87	799.87	839.87	925.95	1,020.86	1,125.50	1,240.87	1,368.05	1,508.28	1,662.88

3.4.3 Grid connected large scale solar PV

3.4.3.1 Status of grid-connected large-scale solar PV in Malawi

Malawi is well endowed with solar radiation for generation of solar PV electricity, which can be fed into the national electricity grid. Generation of electricity from solar energy is one of the strategic focuses of the Malawi Government to ensure availability of power for economic development. ESCOM electricity grid is able to allow independent power producers feed their generated power into the grid above a threshold. Large-scale power stations are those defined to generate power of at least 10 MW – which can be grid connected or stand alone with its own min-grid system. Previously, there was no large-scale grid-connected solar power project. With enabling the environment for private sector participation in the power market, for example through favorable energy sector-wide policy of 2018, putting in place regulatory system, power purchase agreements, the first implementation period of NDC (2021 – 2025), saw a number of negotiated large-scale solar projected installed and commissioned, presented as follows.

- v). Installation of the 60 MW Salima Solar PV power station by JCM Solar company of Germany and commissioned. This plant was commissioned in 2021;
- vi). Installation of 20 MW solar PV power systems installed by JCM company at Golomoti in Ntcheu District, commissioned in 2022;
- vii). Serengeti Energy installed 21 MW Solar PV, and commissioned in 2023 in Nkhotakota;
- viii). Votalia Company installed 40 MW of solar PV in Dwangwa in 2023.

Addition of solar PV electricity has enabled Malawi to decommission diesel power electric generators of 78MW installed capacity, contributing to avoiding related carbon emissions from the electricity generation industry. The Ministry of Energy reported that installation of battery-based energy storage system in Lilongwe would be commissioned in mid-2025. This battery storage power system will enable Ministry of Energy to integrate more solar PV based electricity to the grid.

At a time of reporting this BTR, Press Corporation Malawi Limited was negotiating with Ministry of Energy to install 50 MW solar PV electricity in Lilongwe. Also, Atlas Energy company was negotiating to install 20 MW to be installed in Balaka. These two projects would put 70MW of electricity into the grid by 2027.

A summation of installed and commissioned grid connected large scale solar PV give an installed capacity of 141 MW (by 2024). Together with planned installed of 70MW, there would be at least 210 MW of grid-connected large-scale PV by 2027. Therefore, grid-connected large-scale solar PV as an NDC measure, is progressing well and would surpass the target of 200MW before its NDC target year of 2030.

3.4.3.2 Estimation of emission reduction from grid-connected solar PV

The grid-connected solar PV intervention was designed to address the critical shortage of power supply and displace expensive diesel-electric generators. Indeed, as stated already, all of the diesel electric generators are decommissioned with coming in or grid-connected solar electricity. Therefore, the emissions avoided are those that would have been emitted by the diesel generators for the same electricity energy provided by the solar energy system. In order to estimate this, we have to establish the emission factor of the diesel generator, using the following equation.

$$\text{Thermal Power Plant Emission Factor} = \text{Emission Factor of Fuel Source} \left(\frac{\text{kgCO}_2}{\text{TJ}} \right) \times 10^{-3} \left(\frac{\text{t}}{\text{kg}} \right) \times \frac{3.6 \times 10^{-3}}{\eta_t} \left(\frac{\text{TJ}}{\text{MWh}} \right)$$

$$\text{Diesel Generato Emission Factor} = 74100 \left(\frac{\text{kgCO}_2}{\text{TJ}} \right) \times 10^{-3} \left(\frac{\text{t}}{\text{kg}} \right) \times \frac{3.6 \times 10^{-3}}{0.4} \left(\frac{\text{TJ}}{\text{MWh}} \right)$$

For diesel, the emission factor from IPCC guidelines is 74 100 kg CO₂/JT. The thermal efficiency of diesel generators is around 40%. Using the equation gives emission factor of diesel generator as 0.6669 tCO₂/MWh.

Energy in MWh can be estimated from solar availability factor and capacity factor. It is assumed that the solar PV would be operational for an average of 7 hours a day, and 90% of the year. This gives emission of 92,012.19 tCO₂ and 122,682.92 tCO₂, as in Table 3-24.

Table 3-24: GHG avoided from grid-connected solar PV installed systems

	2021	2022	2023
JCM Salima	60		
JCM Golomoti	-	20	
Serengeti	-	-	21
Votalia	-	-	40

Installed per year (MW)	60	20	61
Cumulative (MW)	60	80	141
MWh	13,7970	183,960	324,229.5
tCO ₂ reduced	92,012.19	122,682.92	216,228.65

3.4.4 Improved Biomass Cookstoves (Charcoal and Firewood)

Improved biomass cookstove (for charcoal and firewood), goes together with clean cooking. It is therefore important to look at the status of clean cooking in Malawi, where units of biomass cookstoves are discussed.

3.4.4.1 Status of Clean Cooking in Malawi and Projects

Clean cooking, others call it modern cooking, is a relatively new intervention in the country, mostly implemented by projects led by/supported by non-governmental organizations working on environmental and climate management. Most of the clean cooking interventions has been on policy measures, cooking-fuel switch and stacking, and demonstration of higher-tier stoves for fuelwood. It is now the plan of the Government of Malawi to transition to clean cooking as a way to manage environmental and climate related challenges. The transitioning is exemplified by inclusion of clean cooking related mitigation measures in the revised Malawi’s Nationally Intended Contributions (NDCs) submitted to United Nations Framework Convention on Climate Change (UNFCCC) Secretariat in 2021. The cooking restated NDCs are introducing high efficiency firewood and charcoal cookstoves. There are also projects in clean cooking implemented by Ministry of Energy, Development Partners and Other non-governmental organizations.

Most of the clean cooking projects have been implemented by development partners and non-governmental organizations. According to 2023 Malawi Multi-Tier Framework Survey⁴⁹, high-tier biomass cookstoves are mostly (65%) distributed for free, and the rest (35%) for sale. Those distributed for are for demonstration purposes mainly by non-governmental organizations (mostly) and the Government of Malawi. Those higher-tier biomass stoves that are sold are mostly sold at subsidized prices, supported by international non -governmental organizations to induce market for the stoves. Some of the projects on clean cooking are listed as follows, detailing what they are doing in 2024 on going.

- a) UK Government and USA Government are implementing a project called Modern Cooking for Healthy Forest (MCHF) Programme. The programme is for 5 years, from 2019 to 2026 and focusses primarily on reducing the consumption of illegal, unsustainably harvested charcoal which is mainly focussed in urban areas. It is implemented in the districts of Mzimba, Salima, Dedza, Nkhatabay and Lilongwe, by a company known as Tetra Tech. The company works together with other non-governmental organizations as subcontractors namely: Centre for Environmental Policy

⁴⁹

and Advocacy (CEPA), Lilongwe Wildlife Trust (LWT), mHub, Winrock International and World Resources Institute (WRI).

- b) EU through EnDev Country Programme. They provide subsidies to companies selling efficient cookstoves and modern fuel cookstoves so that these stoves are sold at cheaper prices to increase uptake and use. There is also the EnDv Core Project that supports market-based energy access through cooking solar energy interventions covering the entire country, working with micro and small-scale energy service companies.
- c) the Norwegian Government Energy for Development Programme for Malawi will also look at alternative energy for cooking,
- d) Centre for environmental policy and Advocacy (CEPA), Oxfam and Civil Society Network on Climate Change (CISONECC) working on the “Promoting equitable access to clean energy” – which promotes clean cooking technologies stoves among other energy projects.

The ministry of energy has also been involved in distribution of clean cooking technologies with the help of development partners as follows: From 2022 to 2024, The Ministry of energy with support from supported by the Japanese Government under the Japanese Supplementary Budgets (JSB), distributed LPG stoves in Lilongwe and Zomba in 2022 to 2024 to reduce deforestation in the Bua River catchment area through limiting usage of charcoal and firewood. Most of the work they do is to demonstrate use of higher-tier fuelwood stoves so that communities can shift from open fire stoves to these stoves. They also support creation/stimulation of market for efficient stoves by subsidizing the stoves so that households buy them at relatively cheaper prices. Further, they provide international expertise to build capacity in high-tier stoves and help in GHG emission reduction calculations for carbon trading. The development partners also introduce use of alternative cooking fuels, for example LPG with their stoves so that households are able to stack fuel for cooking and lessen pressure on charcoal and firewood.

3.4.4.2 Estimation of emission reduction from implementation of efficient biomass cookstoves

Efficient biomass stoves, also known as improved biomass stoves are improved version from the traditional inefficient 3-stone open fire stoves. The 3-stone open fire stoves are still widely used, with a thermal efficiency of around 10%⁵⁰, meaning that a considerable amount of wood energy is lost and that a lot more wood is needed to cook a unit amount of food. Improved biomass cookstoves usually have efficiencies of more than 20%⁵¹, thus switching from 3-stone to improved cookstove could save wood energy by more than 50%, which is quite significant for a country like Malawi that relies more than 90% of its cooking energy from biomass. Numbers for biomass cookstoves are difficult to get, because of limitations in data collection on stoves. There are several players involved in distribution of efficient biomass cookstoves in the country, including Ministry of Energy (formerly known Department of Energy Affairs), NGOs, and lately companies that want to trade in carbon market. There are conflicting numbers of stoves that are reported to be in

⁵⁰ <https://www.sciencedirect.com/science/article/pii/S0973082620303215>

⁵¹ https://rippleafrica.org/wp-content/uploads/2025/03/Ripple-Africa-Non-Technical-Summary_VPA.pdf

Malawi, possibly because there is lack of tracking and recording of information related to implementation of wood fuel cookstoves. The most reliable information is those from the Ministry of Energy, reporting that up to 2 million improved cookstoves were distributed in Malawi by October 2020 through a presidential decree in 2013 to intervene to control deforestation through popularizing use of efficient biomass cookstove⁵². A committee, National Cookstove Steering Committee was formed to oversee implementation to achieve the target. However, data from ex-ant data from Malawi Energy Compact document data on available improved biomass cookstoves in 2020 that are less than the 2 million reported to have been achieved. Since the Malawi Energy Compact was validated through a rigorous process, this BTR uses the data from this source.

Estimation of emission reduction from wood fuel cookstove over use of 3 stone-open fire cookstoves used methodology described in AMS-II.G, Energy efficiency measures in thermal applications of non-renewable biomass, version 5.0. This is a small-scale methodology used to quantify greenhouse gas emission reductions from projects that introduce energy-efficient technologies (for example cookstoves, ovens, dryers, or other heating devices) for heating or cooking using non-renewable biomass. Non-renewable biomass is biomass that is not harvested sustainably. These projects typically involve replacing or retrofitting existing, inefficient biomass-fired devices with more efficient ones. Emission reductions are calculated by comparing the biomass consumption of the old, inefficient devices with the new, efficient ones. Under AMS-II.G version 5, emission reduction for introduction of efficient woodfuel cookstoves were estimated using the following equation

$$ER_y = B_{y,savings} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\ fossil\ fuel} \times N_{y,i}$$

Where

ER_y is emission reductions during the year y in tCO₂e, which is to be estimated

$B_{y,savings}$ is quantity of woody biomass that is saved in tonnes per wood fuel stove. This value is taken as 2.168 tonnes/device/year from a similar CDM Project in Nkhatabay, Malawi⁵³

$f_{NRB,y}$ is fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass. This has a value of 0.81 as obtained from UNFCCC CDM website as a default Malawi specific value available on the CDM website as approved by CDM EB and the Malawi DNA⁵⁴.

$NCV_{biomass}$ is net calorific value of the non-renewable woody biomass that is substituted. The Net calorific value. From 2006 IPCC Guidelines for conduction of GHG inventory, default for wood fuel taken as 0.0156 TJ/Tonne.

$EF_{projected_fossilfuel}$ is emission factor for the substitution of non-renewable woody biomass by similar consumers. The value is taken as is 81.6 tCO₂/TJ. This is a default value provided in AMS-II.G.

$N_{y,i}$ is number of project devices of type i operating in year y

Using data on stoves from Malawi Energy Compact, the emissions are calculated using equation above and the parameters given. The emissions from cookstoves are presented in Table 3-25.

⁵² <https://www.energy.gov.mw/cooking-energy-2/>

⁵³ <https://cdm.unfccc.int/UserManagement/FileStorage/EBP7TRMDAZ3LGXNC4H2UI0WF1JVQO6>

⁵⁴ <https://cdm.unfccc.int/DNA/fNRB/index.html>

Table 3-25: Number of wood fuel cookstoves and their emission reductions

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Perc entag e of hous ehold s with acce ss to Impro ved Cook stove s	22.43	23.8	23.61	23.43	23.24	23.5	24.57	26.64	28.71	30.79	32.86	34.93	37
	0.2243	0.238	0.2361	0.2343	0.2324	0.235	0.2457	0.2664	0.2871	0.3079	0.3286	0.3493	0.37
Hous ehold s	3,984,929	4,096,507	4,211,209	4,329,123	4,450,339	4,574,948	4,703,047	4,834,732	4,970,104	5,109,267	5,252,327	5,399,392	5,550,575
Num ber of impro ved cook stove s	893,820	974,969	994,266	1,014,314	1,034,259	1,075,113	1,155,539	1,287,973	1,426,917	1,573,143	1,725,915	1,886,008	2,053,713
Emis sions reduc tion (tCO ₂)	1,998,061.79	2,179,464.07	2,222,602.81	2,267,416.35	2,312,002.10	2,403,328.17	2,583,113.48	2,879,159.10	3,189,758.12	3,516,635.55	3,858,143.24	4,216,018.31	4,590,909.61
Emis sions reduc tion (milli on tCO ₂ e)	2.00	2.18	2.22	2.27	2.31	2.40	2.58	2.88	3.19	3.52	3.86	4.22	4.59

3.4.4.3 Estimation of Emission from cookstoves considering ITMOs transferred

The ITMOs first transferred are from biomass conservation using efficient stoves (refer to section C4.4). According to MPG 77 (d,ii) “An emissions balance reflecting the level of anthropogenic emissions by sources and removals by sinks covered by its NDC adjusted on the basis of corresponding adjustments undertaken by effecting an addition for internationally transferred mitigation outcomes first-transferred/transferred and a subtraction for internationally transferred mitigation outcomes used/acquired, consistent with decisions adopted by the CMA on Article 6”; actual emissions from NDC measure on improved biomass cookstoves and their projections, are the estimated emission reduction (in Table 3-25) less the amount of ITMOs transferred. Net GHG emission reductions and their projection from improved cookstoves considering ITMOs transferred are presented in Table 3-26.

Table 3-26: Net GHG emission reductions and their projection from improved cookstoves considering ITMOs transferred

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
--	------	------	------	------	------	------	------	------	------	------	------	------	------

Emissions reduction (million tCO ₂)	2.00	2.18	2.22	2.27	2.31	2.40	2.58	2.88	3.19	3.52	3.86	4.22	4.59
ITMOs (Million tCO ₂ e)	-	-	-	0.989	0.564	0.207	0.018	1.000	1.000	1.000	1.000	1.000	1.000
Net Emissions reduction from improved cookstoves (million tCO ₂ e)	2.000	2.180	2.220	1.281	1.746	2.193	2.562	1.880	2.190	2.520	2.860	3.220	3.590

3.4.5 Analysis of emission reduction from all implemented NDC measures

During the NDC-2 implementation period, measures involving solar PV and improved biomass cookstoves have been implemented and emissions reductions have been estimated (refer to sections D2). The emissions reductions in 2021, 2022, and 2023 are summarized in Table 3-27. As it can be seen from, emissions reduction from implemented NDC-2 measures are increasing, from 1.4 million tCO₂e (representing 7.9% of absolute emission reduction of 17.7 million tCO₂e by 2040) in 2021, 1.91 million tCO₂e in 2022 (representing 10.8%), and 2.45 million tCO₂e in 2023 (representing 13.8 million tCO₂e). This shows contribution to emissions reduction. However, since the emissions, as per GHG emissions inventory conducted as part of this BTR submission, the current emissions (2021 and 2022) are far above emission described by NDC-2 with all measures implemented.

Table 3-27: Summary of emission reductions in NDC-2 from measures in solar PV and improved cookstoves

	2021	2022	2023
Solar Home Systems (tCO ₂ e)	28,652.21	38,957.47	42,829.39
Off-grid power systems (mini-grids) (tCO ₂ e)	727.75	799.87	799.87
Grid connected solar (tCO ₂ e)	92,012.19	122,682.82	216,228.65
Total on solar PV measures in tCO ₂ e	121,392.15	162,440.16	259,857.91
Total on solar PV measures in million tCO ₂	0.121	0.162	0.260
Improved cookstoves million tCO ₂ e	1.281	1.746	2.193
Total emission reduction on NDC measures million tCO ₂	1.40	1.91	2.45

3.5 Summary of greenhouse gas emissions and removals

In line with MPG 91 “Each Party that submits a stand-alone national inventory report shall provide a summary of its GHG emissions and removals. This information shall be provided for those reporting years corresponding to the Party’s most recent national inventory report, in a tabular format”. Malawi has submitted national inventory of its greenhouse emissions and removals as a chapter in this first BTR.

3.6 Projections of greenhouse gas emissions and removals

The projections on greenhouse gas emissions and removals are derived from NDC-2. The emission without measure scenario are those emission under business as usual scenario. “Emissions with

measures” are those under domestic implemented NDC measures. “Emissions with additional measures” are those that are implemented with international support. The projections are presented in Figure 3-7.

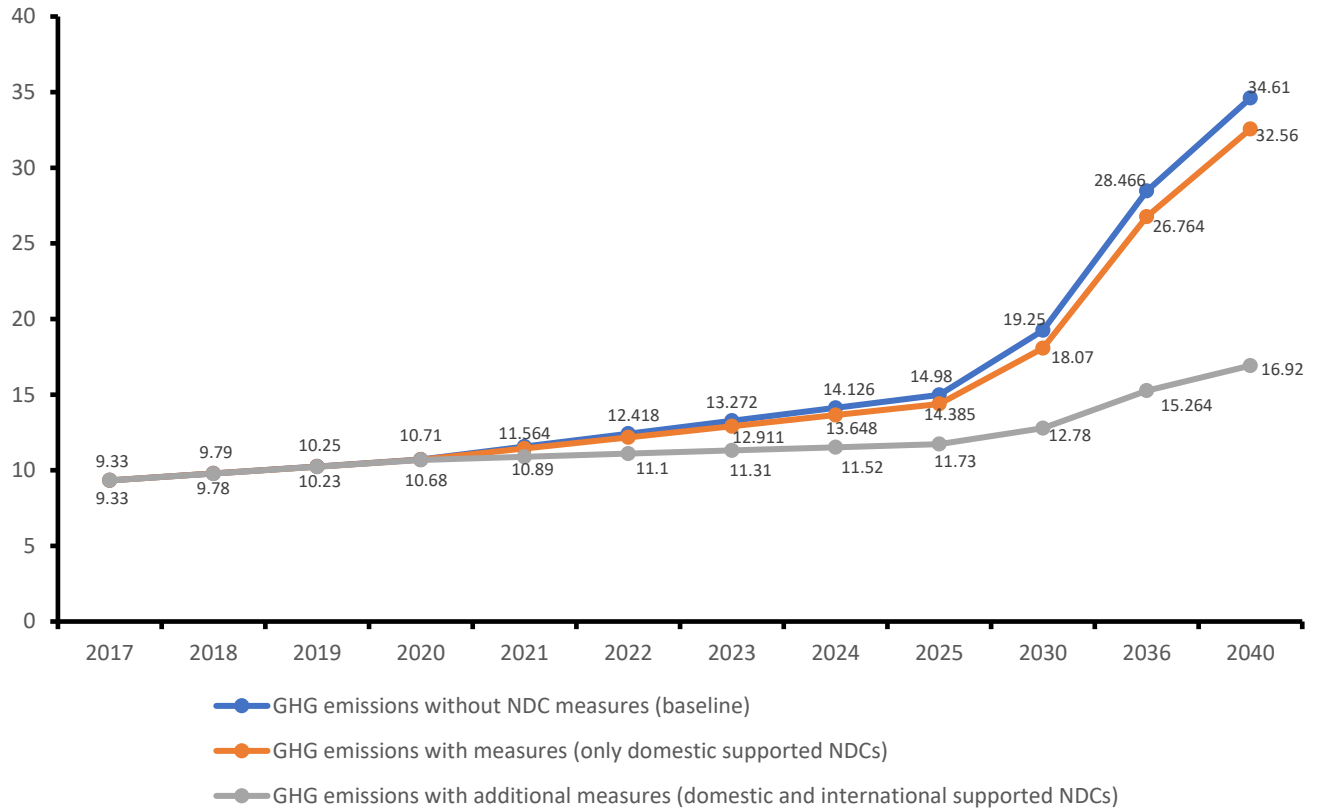


Figure 3-7: Projections of greenhouse gas emissions and removals

Emissions without measures are increasing, from 13.272 million tCO₂e in 2023, to 19.25 million tCO₂e in 2030, and 34.61 million tCO₂e in 2040. On the other hand, emissions with measures emissions raise from 12.911 million tCO₂e in 2023 to 18.07 million tCO₂e in 2030 and to 32.56 million tCO₂e in 2040. With additional measures, the emission projections are much reduced compared to emission without measures: the emissions are 11.31 million tCO₂e in 2023, 12.78 million tCO₂e in 2030, and 16.92 million tCO₂e. This means that international support is crucial for Malawi to meet its NDC target by 2040.

3.7 Other information

In line with MPG 103 “Each Party may provide any other information relevant to tracking progress made in implementing and achieving its NDC under Article 4 of the Paris Agreement”, Malawi has developed the following tools to help in tracking NDC implementation: Malawi NDC score-card; NDC implantation plan, and resource mobilization strategy. However, the following are the challenges that limits implementation of NDC measures: financing challenges; limited collaboration among NDC stakeholders, and limited awareness on NDC measures especially at local level.

References

- African Union. (2013). *Agenda 2063: The Africa we want (Popular version)*. Retrieved November 4, 2019, from https://au.int/Agenda2063/popular_version
- FAO. (2024). *Forest and Landscape Restoration Mechanism*. Retrieved 2025, from <https://www.fao.org/in-action/forest-landscape-restoration-mechanism/activities/countries/malawi/en>
- GOM. (2009). *Malawi Biomass Energy Strategy*. Retrieved November 10, 2019, from <http://www.euei-pdf.org/en/seads/policy-strategy-and-regulation/biomass-energy-strategy-best-malawi>
- GoM. (2016). *National Climate Change Management Policy*. Lilongwe: Ministry of Natural Resources, Energy and Mining.
- GOM. (2016). *National Climate Change Management Policy*. Retrieved June 5, 2019, from <https://cepa.rmportal.net/Library/government-publications/national-climate-change-management-policy-2016/view>
- GOM. (2017). *Ministry of Natural Resources, Energy and Mining in the Government of Malawi: Integrated Resource Plan (IRP) for Malawi*. Lilongwe: Ministry of Natural Resources, Energy and Mining.
- GOM. (2017). *National Charcoal Strategy: 2017 to 2027*. Retrieved November 4, 2019, from file https://afr100.org/sites/default/files/Restoration_Malawi_Charcoal-Strategy_lowq.pdf
- GoM. (2017). *National Forest Landscape Restoration Strategy*. Lilongwe: Ministry of Natural Resources, Energy and Mining.
- GoM. (2021). *The Third National Communication of The Republic of Malawi to To the Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC)*. Lilongwe: Ministry of Forestry and Natural Resources.
- GoM. (2021). *Updated Malawi's Nationally Determined Contributions*. Lilongwe: Ministry of Forestry and Natural Resources.
- GOM. (n.d.). *Department of Energy Affairs: Policies and Strategies*. Retrieved October 29, 2019, from <https://energy.gov.mw/index.php/resource-centre/documents/policies-strategies>
- Kulugomba, R., Mapoma, H., Gamula, G., Blanchard, R., & Mlatho, S. (2023). Opportunities and Barriers to Biogas Adoption in Malawi. *Energies*, 17.

- Lloyds Bank. (2024). *Malawi: Economic and Political Overview*. Retrieved from <https://www.lloydsbanktrade.com/en/market-potential/malawi/economical-context#:~:text=With%20about%2080%25%20of%20the,cotton%2C%20sorghum%2C%20and%20potatoes.>
- Logistical Capacity Assessment. (2025). *Malawi Railway Assessment*. Retrieved from <https://lca.logcluster.org/malawi-24-malawi-railway-assessment>
- Lotus Resources Limited. (2024). *Kayelekera Overview*. Retrieved from <https://lotusresources.com.au/projects/kayelekera-overview>
- MCCCI. (2024). *Malawi Confederation of Chambers of Commerce and Industry*. Retrieved from Introduction on Malawi Tourism Sector: <https://www.mccci.org/business/tourism-sector/>
- NOCMA. (2024). *National Oil Company of Malawi*. Retrieved from Revival of Rail Transport: A Game-Changer for Malawi's Fuel Industry: <https://www.nocma.mw/revival-of-rail-transport-a-game-changer-for-malawis-fuel-industry/>
- SEforALL. (n.d.). *About Sustainable Energy for All organisation*. Retrieved November 1, 2019, from <https://www.seforall.org/about-us>
- Sikhosana, H. (n.d.). *UNFCCC*. Retrieved from How Institutional Arrangements can enhance the capacity of developing country parties: https://unfccc.int/sites/default/files/how_institutional_arrangements_can_enhance_the_capacity_of_developing_country_parties.pdf
- Statista. (2025, June). *Total population in Malawi from 1980 to 2030*. Retrieved from <https://www.statista.com/statistics/520538/total-population-of-malawi/>
- Times Malawi Limited. (2024). *News: Kangankunde Mine to open in 2026*. Retrieved from <https://times.mw/kangankunde-mine-to-open-early-2026/>
- UNFCCC. (2016). *Announcement: Paris Agreement Signatories Rise to 187*. Retrieved November 4, 2019, from <https://unfccc.int/news/malawi-armenia-zambia-and-chile-sign-paris-agreement>
- UNFCCC. (2021). *UNFCCC NDC submitted reports*. Retrieved from Updated Malawi's nationally Determined Contribution: <https://unfccc.int/sites/default/files/NDC/2022-06/Malawi%20Updated%20NDC%20July%202021%20submitted.pdf>
- UNICEF. (2020). *Wash Field Notes*. Retrieved from Scaling-Up Climate Resilient Sustainable Solar-Powered Systems for Institutions and Communities in Rural Malawi: <https://www.unicef.org/malawi/media/2741/file/Scaling-Up%20Climate%20Resilient%20Sustainable%20Solar-Powered%20Systems%20for%20Institutions%20and%20Communities%20in%20Rural%20Malawi%20.pdf>
- Wordometer. (2025, June). *African Countries by Population (2024)*. Retrieved from <https://www.worldometers.info/population/countries-in-africa-by-population/>

World Bank. (2024). *Data for Malawi*. Retrieved from <https://data.worldbank.org/country/malawi>

World Bank. (2025). *Malawi*. Retrieved from Climate Change Overview: Country Summary: <https://climateknowledgeportal.worldbank.org/country/malawi>

World Bank. (2025, June). *World Bank*. Retrieved from Malawi: World Bank Approves Grant Financing for Landmark 358.5 Megawatt Mpatamanga Hydropower Storage Project: <https://www.worldbank.org/en/news/press-release/2025/05/15/malawi-afe-world-bank-approves-grant-financing-for-landmark-358-5-megawatt-mpatamanga-hydropower-storage-project>

World Trade Organisation. (2024, September 4). *Trade Policy Review Report by Malawi*. Retrieved from https://www.wto.org/english/tratop_e/tpr_e/g460_e.pdf