REPUBLIC OF MALAWI

Ministry of Natural Resources, Energy and Mining

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Activity 1 Report: Guidance Report on Malawi's GHG Impact Assessment of Policies and Measures.

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Development of a Framework for Tracking Nationally Determined Contributions for Malawi

Submitted to

Initiative for Climate Action Transparency (ICAT)

UN Campus, Platz der Vereinten Nationen 1, Bonn 53113, Germany

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RICARDO

ICAT Initiative for Climate Action Transparency

Guidance report on GHG impacts of selected policies and measures

Activity 1 Report: Inclusive of Outputs 1.1, 1.2, 1.3 and 1.4.

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1. Introduction

1.1. Background

This first guidance report has been developed as part of the technical assistance delivered under Malawi's ICAT support programme on NDC tracking. It provides a comprehensive overview of the GHG impact assessment of policies and measures undertaken across three priority sectors: energy, transport, and agriculture. In addition to presenting the methodological approach and key findings, the report highlights the capacity-building efforts aimed at strengthening national capabilities to quantify the GHG impacts of climate-related policies. The energy, transport, and agriculture sectors were selected at the outset of the project due to their critical contribution to Malawi's emissions profile and their strategic importance in achieving the targets set out in the country's Nationally Determined Contribution (NDC). Malawi's NDC includes an unconditional target of a 6% reduction in GHG emissions below the Business-As-Usual (BAU) scenario by 2040 – equivalent to approximately 2.1 million tonnes of CO_2 equivalent (tCO_2e). The conditional target seeks a more ambitious 45% reduction relative to the BAU by the same year, representing a mitigation potential of approximately 15.6 million tCO_2e. Collectively, the energy (13%), transport (11%), and agriculture (54%) sectors account for a significant portion on Malawi's national emissions inventory, underscoring the importance of targeted mitigation actions in these areas to advance national climate and development goals.

This report constitutes the second in a series of three activity reports under the Malawi ICAT support programme. It focuses specifically on the quantification of GHG impacts resulting from the implementation of policies and measures identified in Malawi's NDC. The subsequent report will address the development of an NDC tracking framework, including the refinement and identification of new and revised indicators to support ongoing monitoring and report efforts.

1.2 Contributors to the Report

This report is submitted by the Government of Malawi to the Initiative for Climate Action Transparency (ICAT). It reflects collaborative work between Malawi's national experts and Ricardo technical consultants. The purpose of this section is to transparently outline the contributions made by each party, indicate where national input is pending, and provide a clear overview of the report's structure. Table 1 shows contribution to the activity by Ricardo and Malawi team.

Table 1: Contributions to the Report by Report Section

Report Section	Lead Contributor	Malawi Working Group Role	Pending Input?
1. Introduction	Ricardo	Reviewing and validating the contents	No
2. Methodology	Ricardo	Validated stakeholder engagement.	
3. GHG Impact Assessment of Policies and Measures	Shared	Selected PAMs by mapping the causal chain for the energy, transport and agriculture sectors.	No
4. Policy Assessment Workshop Outcomes	Shared Working Group	Ricardo led on the workshop delivery and facilitation of group exercises. Malawi working group completed the group exercise.	No
5. Recommendations for the NDC Tracking	Shared		

Framework			
6. Appendix			

1.3 Purpose and Objectives of the Guidance Report

This guidance report is developed to support and strengthen the capacity of the sectoral working groups within the energy, transport and agriculture sectors to effectively evaluate and track the impacts of Malawi's policies and measures. It outlines a series of targeted activities aimed at enhancing institutional and technical readiness for conducting a full GHG impact assessment as part of Malawi's NDC 3.0. The key objective of this guidance report is to highlight efforts that have been undertaken throughout this activity to strengthen the technical and institutional capacities of GHG impact assessments and NDC tracking. Specifically, this activity has focused on the following areas:

a) **Delivering capacity-building training on policy scenario development**

Workshop sessions were conducted to equip sectoral working groups with the skills to develop and analyse 'with policy' and 'without policy' scenarios, enabling a clear understanding of the potential GHG effects of sector-specific interventions.

b) **Supporting stakeholders in quantifying policy impacts**

Technical support was provided to help stakeholders apply methodologies and tools for estimating the GHG impacts of relevant policies, ensuring consistent and credible assessments across the energy, transport and agriculture sectors.

c) **Reviewing and refining causal chain mapping developed during the inception phase**

Initial causal chain mapping, which links policy inputs to expected outcomes and GHG effects, were reviewed and refined to strengthen the logic and transparency behind each intervention.

d) **Engaging ministries and agencies to assess data availability, gaps and institutional arrangements**

Sectoral working groups were composed of government individuals from key ministries and were able to evaluate the availability and quality of data, identify key data gaps, and understand the institutional roles and coordination mechanisms already in place.

e) **Developing recommendations for integrating indicators into the NDC tracking framework**

Based on the findings of this activity, recommendations are detailed within this report to support the inclusion of relevant and measurable indicators into the national framework for tracking NDC implementation and progress.

Altogether, these capacity-building efforts have contributed to building a robust foundation for policy impact evaluation and climate reporting for Malawi, supporting transparent and effective implementation of Malawi's national climate objectives and commitments.

2. Mitigation Measures and Policy Assessment Workshop

The workshop was aimed at building national capacity to assess and track Greenhouse Gas (GHG) impacts of mitigation measures and policies in priority sectors, specifically supporting Malawi's National Determined Contributions (NDC) Tracking Framework. The objectives were to enable participants to:

a) Identify the GHG effects of measures.

b) Estimate the GHG effects in different policy scenarios.

c) Develop indicators to feed into Malawi's NDC Tracking Framework.

By the end of the workshop, participants were expected to map and identify GHG effects of selected mitigation policies and measures in the energy, transport, and agriculture sectors; estimate GHG mitigation effects for "with policy" and "without policy" scenarios; develop indicators and a monitoring plan; and collaboratively assess data availability, gaps, and institutional arrangements. The participants were also expected to track NDC measures in the GACMO tool. The learning outcomes from the workshop will assists policymakers and decision-makers to:

a) Assess GHG mitigation effects of specific policies and actions, incorporating principles of accuracy, consistency, transparency, completeness, and comparability.

b) Develop effective strategies for managing and reducing GHG emissions through a better understanding of impacts.

c) Support consistent and transparent public reporting of emissions impacts and policy effectiveness.

d) Create more international consistency and transparency in estimating GHG effects of policies and actions.

Participants were taken through on the process of assessing GHG mitigation effects. Before implementation of the measure or policy, the assessment process includes performing the following: selecting policy options; improving policy design; estimating potential reductions; and attracting financial support. After implementation, the assessment process involves: assessing effectiveness of the implemented measure of policy, enhancing policy implementation, determining continuation or expansion of activities, sharing best practices, evaluating contributions to GHG reduction goals, and ensuring cost-effectiveness. Workshop activities and flow structure included the following:

a) Recapping of key steps in mapping the impact of mitigation measures and an overview of policy impact causal chains.

b) Estimating GHG mitigation effects by comparing effects from business-as-usual (BAU) and mitigation scenarios.

c) Participants were organised into groups (based on sectors: Transport, Energy and Agriculture) and were given exercises to work on to provide practical competence in assessing mitigation impacts from policy measures. Participants were given exercise to worked in the sectoral groups to map policy scenarios and estimate GHG mitigation impacts, followed by group presentation and getting feedback from the rest of the participants.

d) Live Demonstration: The GACMO Tool and Malawi NDC tracking Excel were demonstrated for tracking NDC implementation.

e) Monitoring Progress of NDCs: Tracking NDC progress over time, with sectoral examples of data collection and monitoring.

f) Open Discussion: Stakeholders discussed data availability, gaps, and existing institutional arrangements for data collection for indicators, as well as opportunities and challenges.

Performance Monitoring during policy implementation serves to track implementation progress (whether the policy is on track or not) and to estimate GHG mitigation effects through collecting data for ex-post assessment. Participants were taken through developing a monitoring plan to ensure necessary data are collected and analysed, detailing measurement methods, data sources, frequency, units of measure, data nature/uncertainty, responsible entities, and verification procedures. Key steps identified for Malawi's NDC Tracking Framework included:

a) GHG impact assessment: Identifying key policies, defining "with and without policy" scenarios, and quantifying impacts for energy, transport, and agriculture sectors while developing GACMO modelling.

b) Identifying indicators: Reviewing draft causal chain mapping and policy impacts, developing technical guidance for policy tracking, drafting a report of methods, data, and results, and developing recommendations for including indicators into the NDC tracking framework.

2.1. Summary of discussions, inputs, and recommendations to NDC Tracking Framework

The workshop included an "Open Discussion: Gathering and Collecting Data for Indicators for tracking NDC implementation" session. During this session, participants were invited to share their experiences regarding data collection across sectors and highlight challenges encountered. Key experiences and challenges discussed included:

a) Some data collected were incomplete and inconsistent data across different tata sources (including government departments)

b) There is need for clear identification of ministries, department or agencies responsible for collecting, managing, and reporting data for indicators.

c) Data sharing was also a challenge. A recommendation on assessing efficiency of existing coordination mechanisms between institutions that would include data sharing was made.

d) Hoarding of data by data sources/providers, which could be solved through enforcement of access to information bill

Discussions explored opportunities to make data collection efficient or reliable, including "low hanging fruits," and what capacity or resources are needed to improve data collection and reporting. These inputs are critical for developing robust recommendations for Malawi's NDC Tracking Framework, aiming at enhancing the institutional arrangements and data flows necessary for effective monitoring and reporting.

2.2. Lessons learned and next steps

The workshop highlighted importance of continued efforts in building national capacity for GHG impact assessment and NDC tracking. Key next steps identified include:

a) GHG impact assessment of mitigation policies and measures: Continue developing the GACMO modelling to identify key policies and establish "with policy" and "without policy" scenarios for evaluating GHG effects in the energy, transport, and agriculture priority sectors. This includes quantifying policy impacts for these sectors.

b) Identification of indicators for policies and measures: Review and refine the draft causal chain mappings and policy impacts. This involves developing technical guidance for policy tracking and drafting a comprehensive report on the methods, data used, and results of the policy impact assessment. Crucially, recommendations will be developed for integrating indicators into Malawi's NDC Tracking Framework.

The process underscored the need for collaborative assessment of data availability, gaps, and institutional arrangements to ensure robust tracking and data collection.

3. Methodology

ICAT Policy Assessment Guides were used to assess impacts of GHG removals measures and polices, covering the agriculture, transport and energy sectors. This section outlines both technical and participatory approaches used to assess mitigation impacts. It includes scenario modelling methods, stakeholder engagement processes, and methodological approaches to estimation mitigation impacts.

3.1. Stakeholder engagement approach

Stakeholders were engaged directly in remotely delivered workshops as well as via bilateral with sectoral working groups and WhatsApp chats for live troubleshooting where necessary. All workshop sessions were recorded and shared with the participants. The stakeholders were called together in Mponela for a physical workshop in Mponela, where they listened to presentation from Ricardo consultants via online platform (Google Meet). Challenges concerning breakdown in communication due to internet connectivity problems limited the full interaction between stakeholders and the Ricardo team. The recording and sharing of presentation afterwards help share the materials to be learnt by the participants. Amongst themselves, local teams worked in groups and met virtually using Google Meet to carryout assignments presented to them as part of the learning process.

3.2. Approach to developing with and without policy scenarios

The Policy and Action Standard outlines a comprehensive approach for estimating greenhouse gas (GHG) effects of policies and actions. Refer to Figure 1. It is an accounting and reporting standard for estimating the greenhouse gas (GHG) effects of policies and actions. Its primary objective is to support evidence-based decision-making by enabling policymakers and stakeholders to understand the relationship between policies and actions and expected or achieved changes in GHG emissions. The standard plays a crucial role in evaluating the GHG impact of policies and measures by providing a framework to:

a) **Assess the GHG effects before policy implementation**. This helps policymakers choose among policy options, improve policy design by understanding the GHG effects of different choices, and inform GHG reduction goals by estimating potential reductions. It also helps in reporting on expected future GHG effects for domestic or international purposes and attracting financial support for mitigation actions by estimating potential reductions.

b) **Evaluate whether policies and actions are effective in delivering intended results during or after policy implementation**. This allows for informed decisions on whether to continue current activities or implement additional policies, learn from experience, share best practices, and evaluate contributions toward broader GHG reduction goals. It also helps ensure policies are cost-effective and resources are invested efficiently, and allows for reporting on GHG effects over time, including meeting funder requirements.

c) **Quantify changes in GHG emissions or removals** resulting from interventions taken or mandated by various entities, which can include laws, regulations, taxes, incentives, information instruments, technology implementation, and financing.

d) **Assess policies that may have objectives unrelated or even contrary to climate change mitigation**, including those that might increase GHG emissions. Policymakers can use the standard to understand or minimize such increases, not just to assess mitigation policies.

The approach to assessing GHG effects before policy implementation involves a series of steps (refer to Figure 1) to ensure accurate and complete assessment. When the policy or action to be assessed is selected, the first step is to define the policy or action to be assessed. This foundational step involves clearly describing the intervention being assessed and determining the scope of the assessment. Thereafter, the GHG effects are defined, estimated, verified, and reported.

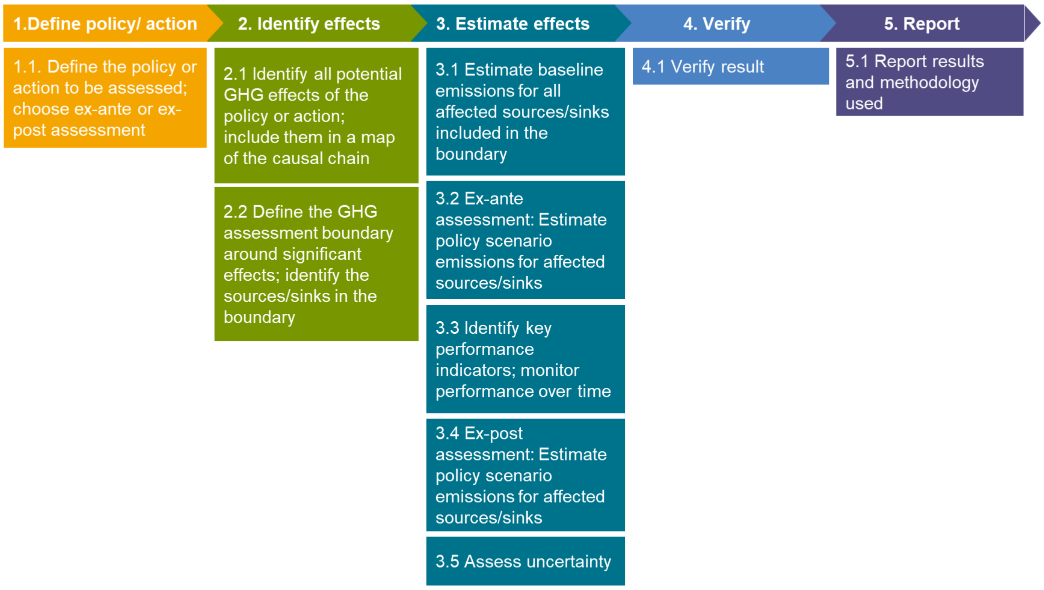

Figure 1: General Approach for developing with and without policy scenarios

Work undertaken

Considering the reporting of the BTR, in particular the reporting of information related to tracking of progress towards the implementation and achievement of Malawi's NDC, actions of the NDC were taken as the starting point. These actions are well defined in the implementation plan for Malawi's NDC. The focus of this assessment is on projected GHG impact of selected policies and measures so ex-ante assessment was chosen as the priority. The approach was that sectoral working groups for energy, transport and agriculture were established and each of these groups identified relevant NDC policies and measures (refer to Figure 2) from their sectors.

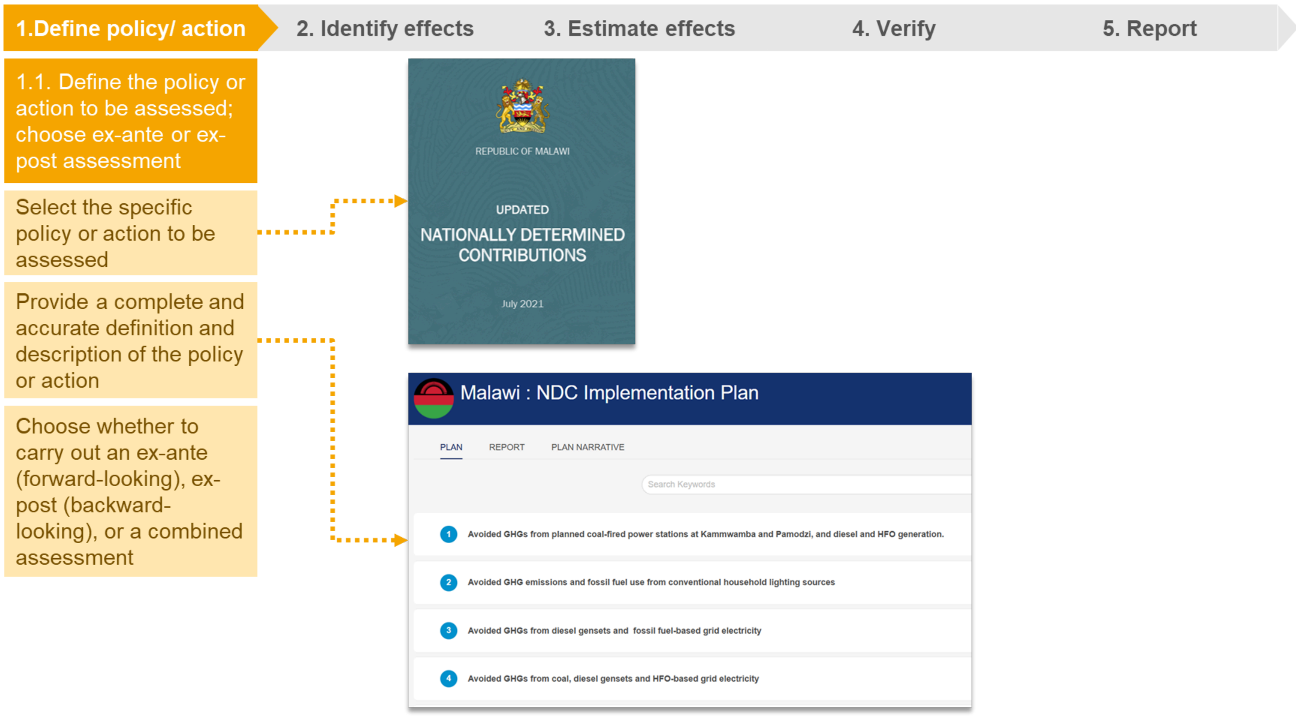

Figure 2: Details on Step 1 (defining policy or action) on general approach for developing policy measures

After identifying polices, the next focus focused on understanding effects of the policies or actions if implemented, and the resulting sources, sinks, and gases. Types of effects could include in-jurisdiction and out-of-jurisdiction effects (spill-over or leakage); short- and long-term effects; intended and unintended effects (for example, rebound effects); likely, possible, and unlikely effects; and GHG increasing and decreasing effects. During a previous workshop in-country, participants were trained on identifying effects of policies and measures and mapping these in causal chains. Participants then mapped causal chains for key policies and measures (refer to Figure 3) allowing them to clearly identify the relevant effects in order to then determine the GHG assessment boundary and then assess the significance of potential GHG effects of these measures.

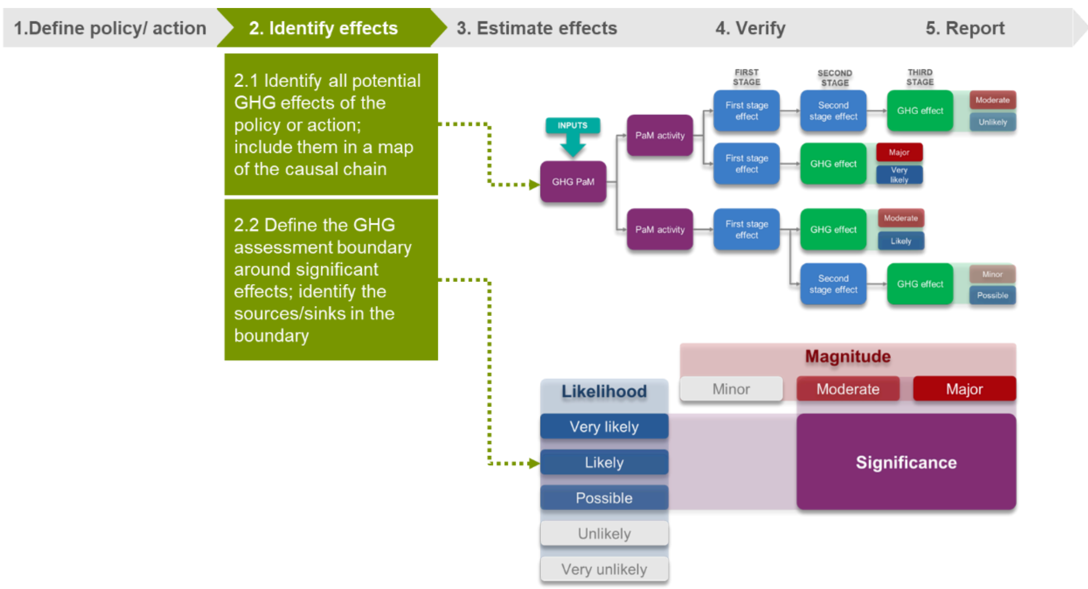

Figure 3: Details on Step 2 (identifying effects) on general approach for developing policy measures

Estimation of effects was the core quantitative assessment of the policy's impact on GHG emissions, which is broken down into defining the assessment boundary, estimating baseline emissions, and estimating policy scenario emissions (both ex-ante and ex-post). It involved defining the GHG assessment boundary. This step determines which identified effects are significant enough to be included in the quantitative assessment. After the defining the boundary, the following were carried out:

a) Assess the significance of potential GHG effects: assessment of likelihood and relative magnitude.
b) Determine which GHG effects, source/sink categories, and greenhouse gases to include in the GHG assessment boundary.
c) Define the GHG assessment period.

Estimating baseline emissions involved establishing a reference case, which represents emission scenario that would happen without the policy being implemented (thus not assessed). Using scenario method, it involved the following:

a) Defining the most likely baseline scenario.
b) Defining the emissions estimation method(s) and parameters.
c) Estimating baseline values for each parameter.
d) Estimating baseline emissions for each source/sink category.

Baseline emissions across all source/sink categories were aggregated. Estimating GHG Effects Ex-Ante detailed calculation of emissions in the presence of the policy and the final GHG effect. The following were done, as follows:

a) Defining the most likely policy scenario. This scenario represents conditions with the policy in place.
b) Identifying parameters to be estimated.
c) Estimating policy scenario values for parameters.
d) Estimating policy scenario emissions.
e) Estimating the GHG effect of the policy or action.

Identification of key performance indicators (KPIs) in order to monitor performance over time was also carried out. Monitoring is crucial for understanding policy implementation progress and collecting data for ex-post assessment. It involved the following:

a) Defining key performance indicators
b) Defining parameters for ex-post assessment
c) Creating a monitoring plan
d) Monitoring parameters over time

This structured approach ensured that GHG assessments are consistent, transparent, and provide meaningful insights for decision-making regarding emission reduction strategies.

Use of GACMO Tool

The GACMO (Greenhouse Gas Abatement Cost Model) is tool developed by UNEP Copenhagen Climate Centre. The tool evaluates GHG emission reductions from mitigation options by comparing a mitigation scenario to a business-as-usual (BAU) scenario. The procedure that was followed in using GACMO tool is as follows:

1. Inputting Initial Data, which is data for Start Year. The data inputted are:

   a) Country data (population, GDP, energy prices, etc.) and emission factors in the assumptions sheet were entered.

   b) Sectoral energy consumption in the Energy Balance sheet and non-fuel combustion emissions (e.g., Agriculture, Waste) in the GHG Balance sheet were provided.

   c) GACMO calculated GHG emissions from fuel combustion from the energy data.

2. Business as Usual (BAU) Scenario formulation involved inputting growth rates for energy use, emissions, population, and GDP in the Growth sheet. GACMO projected future energy and calculated GHG emissions for target years (for example, 2025, 2030, 2050) to create the BAU scenario.

3. Define Mitigation Scenario involved the following:

   a) GACMO has already embedded mitigation options. Potentials mitigation options were chosen from the from 119 predefined choices in the Mitigation Option sheet, specifying units implemented by target years.

   b) Default technical and economic parameters in Technology sheets with country-specific data were adjusted accordingly.

   c) GACMO calculated emission reductions, costs, and subtracts them from BAU to form the mitigation scenario.

4. Analysis involved getting results from GACMO results sheet, which shows BAU and mitigation scenario emissions by year, sector, and gas, with graphs. Outputs can be exported for use in Biennial Transparency Reports (CTF Tables 7 and 9) to track NDC progress.

5. Monitoring of NDC implementation Progress (Ex-Post) involved making use of the NDC Tracking sheet, input implemented units for mitigation actions. GACMO calculated actual emission reductions and tracks progress toward NDC goals over time.

Work carried out

For Malawi, the GACMO tool was used for the estimation of baseline emissions and of the GHG effects of the policies and measures ex-ante. This presented limitations as the exact definition of the parameters of each of the GHG policies and measures were defined by the model itself. It was also not possible to model several of policies and measures within GACMO as there were no exact equivalent measures, however the stakeholders were given training as to how to use the infrastructure of the GACMO tool to model the effects of measures that were not present by manipulating some of the inputs available.

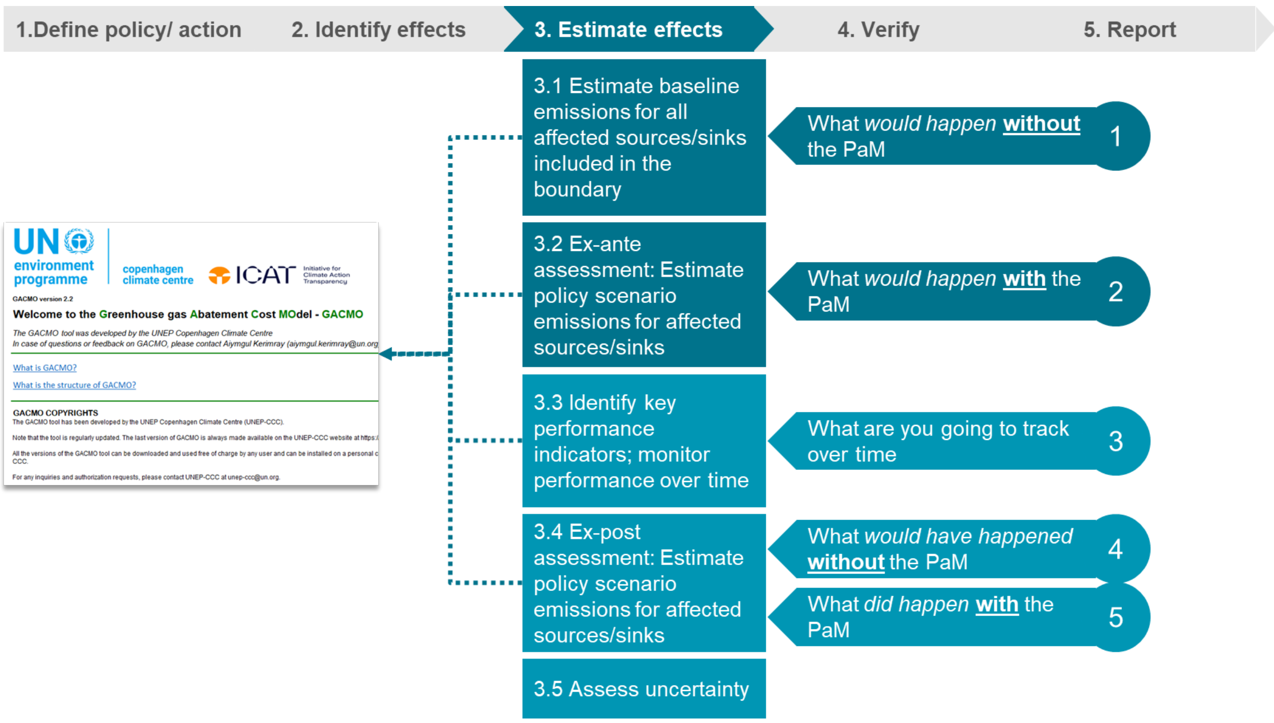

Figure 4: Details on Step 3 (estimating measures) on general approach for developing policy measures

3.3. Additional use of the ICAT sectoral methodology

Although the capacity-building efforts primarily focused on developing a policy impact assessment using the quantified outputs from the GACMO tool, the ICAT sectoral methodologies were also introduced as complementary resources. These methodologies offer sector-specific guidance that can enhance the robustness of future assessments. We recommend that each of the sectoral working groups explores these ICAT sectoral assessment reports in greater detail when developing the policy impact assessment under Malawi's NDC 3.0, to ensure a more comprehensive and context-specific analysis.

For example, in the agriculture sector, the **ICAT Policy Assessment Guide for Agriculture**[1] provides detailed guidance on evaluating the GHG impacts of key mitigation measures, including livestock management, fertilizer application, soil carbon pool enhancement, and rice cultivation practices. The guide outlines principles, concepts, and step-by-step procedures for quantitatively estimating GHG impacts from these major emission sources and carbon pools, offering a practical framework to support evidence-based policy assessment in the agricultural sector.

For the energy sector, the ICAT Policy Assessment Guides focus on two key subsectors: renewable energy and building efficiency. The **Renewable Energy Methodology**[2] supports decision-makers by providing methodological guidance to estimate emissions pathways and reductions resulting from energy sector policies. It specifically covers three common policy interventions: feed-in tariff policies, auction-based policies, and tax incentive policies, offering tools to assess their impact on greenhouse gas (GHG) emissions. In parallel, the **Buildings Efficiency Methodology**[3] provides detailed guidance for assessing the GHG impacts of energy efficiency policies in the building sector. It focuses on built-in energy loads such as space heating, cooling, lighting, and hot water, and is applicable to policies including mandatory building codes for new and existing buildings, voluntary codes for new buildings, and financial support schemes for renovating existing building stock. Together, these guides offer a

[1] Assessing agricultural policies
[2] Assessing renewable energy policies
[3] Assessing building policies

comprehensive framework to support the development and evaluation of impactful energy policies.

3.4. Limitations and assumptions

Measures in Malawi's NDC were matched to reduction options available within GACMO as best as possible. Where exact matches were not available, recommendations were made to the Malawi team as to possible relevant measures that could be adapted to account for the impacts for the measures. Table 2 presents an overview of the mapping of the measures and where adaptations can be made to accommodate Malawi NDC actions within the GACMO framework.

Table 2: Matching of Malawi NDC measures to GACMO reduction options

Sector	Type	Reduction option	NDC measure
ENERGY	CCS	CCS plant	**Clean Coal technology - 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	EE households	Efficient wood stoves	**Improved firewood cookstoves - rural households (b)** Introduction of 2 million improved high efficiency stoves, resulting in carbon sink preservation through reduction in use of unsustainable biomass fuel.
ENERGY	EE households	Efficient charcoal stoves	**Improved charcoal cookstoves - rural households (a)** Deployment of efficient charcoal cookstoves to urban households; increasing from 20% to 30% efficiency thereby reducing demand for charcoal and CH_4 and N_2O emissions.
ENERGY	EE industry	Energy efficiency in industry	**Power Factor Correction** Reduced generation of reactive power at power plants resulting in avoided GHG emissions from reduced fossil fuel combustion to generate reactive power.
ENERGY	EE industry	Building materials	**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.
ENERGY	EE supply side	New high efficiency coal power plant	**Clean Coal technology - high efficiency coal-fired power plant** Installation of highly efficient super ultra-critical coal plant, resulting in reduced GHG emissions from coal use in electricity generation.
ENERGY	Fugitive	Leak reduction in natural gas pipelines	**Efficient charcoal production:** Production of charcoal to meet energy demand using less wood feedstock through use of efficient kilns, resulting in reduced CH_4 and N_2O emissions.
ENERGY	Transport	20% Biodiesel blend in all diesel	**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	Transport	15% Bioethanol blend in all gasoline	**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	Transport	Bus Rapid Transit (BRT)	**Modal shift: private to passenger transport:** Increasing the share of passenger transport from around 10% at present to around 30% in 2040, reducing GHG emissions from gasoline and diesel use.
ENERGY	Transport	Shifting passengers from car to rail	**Modal shift: private to passenger transport:** Increasing the share of passenger transport from around 10% at present to around 30% in 2040, reducing GHG emissions from gasoline and diesel use.
ENERGY	Transport	Shifting freight transport from road to rail	**Modal shift: road to rail freight:** Increased use of rail under the National Transport Master Plan, resulting in reduced diesel consumptions and GHG emissions from road freight transport.
ENERGY	Transport	Better maintenance and use of motor bikes	**Grid connected wind power** Displacement of GHG emissions from fossil fuel power generation, including coal-fired, diesel and HFO generation.
IPPU	Cement	Clinker replacement	**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.**

Sector	Type	Reduction option	NDC measure
IPPU	Cement	Clinker replacement	**Alternative low carbon cement processes:** Potential use of emerging lower-carbon cement production processes such as belite ye'elimite-ferrite (BYF) clinker with reduced GHG emissions compared to conventional process.
AGRICULTURE	Agriculture	Rice crop CH4 reduction	**Improved rice management practices** Deep organic fertiliser application and improved biomass and fertilizer management in rice and nitrification inhibitors application, resulting in reduced N_2O emissions from mineral N-fertilizer use.
AGRICULTURE	Agriculture	Zero tillage	**Conservation tillage within for commercial crop farming** Use of conservation or zero tillage farming, resulting in avoided GHG emissions from diesel use in tractors used in ploughing and tilling before crop planting.
AGRICULTURE	Agriculture	Zero tillage	***ADAPTED: 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	Agriculture	Zero tillage	***ADAPTED: 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	Agriculture	Nitrification inhibitors (1000 ha)	***ADAPTED: 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_2O emissions from mineral N-fertilizer use.*
AGRICULTURE	Agriculture	Fat supplementation in ruminants diets (%DM fat added)	***ADAPTED: 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	Agriculture	Fat supplementation in ruminants diets (%DM fat added)	***ADAPTED: 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	Agriculture	Tobacco curing	**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 avoided CH_4 and N_2O emissions from fuelwood combustion.
FORESTRY AND LAND USE	Forestry	Reforestation	**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.
WASTE	Landfills	Landfill gas plant with power production	**Landfill gas (LFG) utilisation** Generation of up tp 95 GWh of electrical power from landfill gas extraction, collection and utilization applied to sanitary landfills, resulting in reduced CH_4 from landfill sites and avoided CO_2 from displacement of fossil-based electricity use.
WASTE	Landfills	Landfill gas flaring	***ADAPTED: 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	Landfills	Landfill gas flaring	***ADAPTED: Improved farm management*** *Establishing biogas digesters, promotion of collective farms, improved manure management and promotion of slurry systems, resulting in reduced or avoided N_2O and CH_4 emissions.*
WASTE	Landfills	Incineration plant	**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 CH_4 emissions from landfill sites and avoided CO_2 from displacement of grid power.
WASTE	Landfills	Incineration plant	***ADAPTED: 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 CH_4, and N_2O emissions from waste-water and sewage.*

4. GHG Impact Assessment of Policies and Measures

4.1. Summary of selected policies for energy, transport and agriculture

As part of the process of evaluating the GHG impact of selected policies and measures, sectoral working groups identified priority measures from the full list of Malawi NDC measures. Table 3 presents matching of NDC measures GHG emission reduction options as in GACMO.

Table 3: Matching of Malawi NDC measures to GACMO reduction options

Sector	Type	Reduction option	NDC measure
ENERGY	CCS	CCS plant	Clean Coal technology - 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	EE households	Efficient wood stoves	Improved firewood cookstoves - rural households (b) Introduction of 2 million improved high efficiency stoves, resulting in carbon sink preservation through reduction in use of unsustainable biomass fuel.
ENERGY	EE households	**Efficient charcoal stoves**	**Improved charcoal cookstoves - rural households (a)** Deployment of efficient charcoal cookstoves to urban households; increasing from 20% to 30% efficiency thereby reducing demand for charcoal and CH_4 and N_2O emissions.
ENERGY	EE industry	Energy efficiency in industry	Power Factor Correction Reduced generation of reactive power at power plants resulting in avoided GHG emissions from reduced fossil fuel combustion to generate reactive power.
ENERGY	EE industry	Building materials	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.
ENERGY	EE supply side	New high efficiency coal power plant	Clean Coal technology - high efficiency coal-fired power plant Installation of highly efficient super ultra-critical coal plant, resulting in reduced GHG emissions from coal use in electricity generation.
ENERGY	Fugitive	Leak reduction in natural gas pipelines	Efficient charcoal production of charcoal to meet energy demand using less wood feedstock through use of efficient kilns, resulting in reduced CH_4 and N_2O emissions.
ENERGY	Transport	20% Biodiesel blend in all diesel	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	Transport	15% Bioethanol blend in all gasoline	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	Transport	**Bus Rapid Transit (BRT)**	**Modal shift: private to passenger transport** Increasing the share of passenger transport from around 10% at present to around 30% in 2040, reducing GHG emissions from gasoline and diesel use.
ENERGY	Transport	**Shifting passengers from car to rail**	**Modal shift: private to passenger transport** Increasing the share of passenger transport from around 10% at present to around 30% in 2040, reducing GHG emissions from gasoline and diesel use.
ENERGY	Transport	Shifting freight transport from road to rail	Modal shift: road to rail freight Increased use of rail under the National Transport Master Plan, resulting in reduced diesel consumptions and GHG emissions from road freight transport.
ENERGY	Transport	Better maintenance and use of motor bikes	Grid connected wind power Displacement of GHG emissions from fossil fuel power generation, including coal-fired, diesel and HFO generation.
AGRICULTURE	Agriculture	Rice crop CH4 reduction	**Improved rice management practices** Deep organic fertiliser application and improved biomass and fertilizer management in rice and nitrification inhibitors application, resulting in reduced N_2O emissions from mineral N-fertilizer use.

Sector	Type	Reduction option	NDC measure
AGRICULTURE	Agriculture	Zero tillage	**Conservation tillage within for commercial crop farming** Use of conservation or zero tillage farming, resulting in avoided GHG emissions from diesel use in tractors used in ploughing and tilling before crop planting.
AGRICULTURE	Agriculture	Zero tillage	***ADAPTED: 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	Agriculture	Zero tillage	*ADAPTED: 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	Agriculture	Nitrification inhibitors (1000 ha)	*ADAPTED: 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_2O emissions from mineral N-fertilizer use.*
AGRICULTURE	Agriculture	Fat supplementation in ruminants' diets (%DM fat added)	*ADAPTED: 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	Agriculture	Fat supplementation in ruminants' diets (%DM fat added)	***ADAPTED: 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.*

The following priority measures were identified to explore further in this process:

a) Agriculture: Land resources
b) Agriculture: Crops
c) Agriculture: Livestock
d) Energy: Improved charcoal cookstoves
e) Transport: Public Transport Project

These priority measures can be mapped to the measures in GACMO as in Table 3. As previously stated, measures cannot be perfectly matched to GACMO in all instances therefore where possible guidance was provided to stakeholders as to how the framework of GACMO could be used to model measures that weren't directly included. Table 4 presents matching of priority NDC measures to GACMO reduction options.

Table 4: Matching of priority Malawi NDC measures to GACMO reduction options

Sector	Type	Reduction option	NDC measure
ENERGY	EE households	**Efficient charcoal stoves**	**Improved charcoal cookstoves - rural households (a)** Deployment of efficient charcoal cookstoves to urban households; increasing from 20% to 30% efficiency thereby reducing demand for charcoal and CH_4 and N_2O emissions.
ENERGY	Transport	**Bus Rapid Transit (BRT)**	**Modal shift: private to passenger transport** Increasing the share of passenger transport from around 10% at present to around 30% in 2040, reducing GHG emissions from gasoline and diesel use.
ENERGY	Transport	**Shifting passengers from car to rail**	**Modal shift: private to passenger transport** Increasing the share of passenger transport from around 10% at present to around 30% in 2040, reducing GHG emissions from gasoline and diesel use.

Sector	Type	Reduction option	NDC measure
AGRICULTURE	Agriculture	Rice crop CH4 reduction	**Improved rice management practices** Deep organic fertiliser application and improved biomass and fertilizer management in rice and nitrification inhibitors application, resulting in reduced N_2O emissions from mineral N-fertilizer use.
AGRICULTURE	Agriculture	Zero tillage	**Conservation tillage within for commercial crop farming** Use of conservation or zero tillage farming, resulting in avoided GHG emissions from diesel use in tractors used in ploughing and tilling before crop planting.
AGRICULTURE	Agriculture	Zero tillage	***ADAPTED: 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	Agriculture	Fat supplementation in ruminants diets (%DM fat added)	***ADAPTED: 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.*

4.2. Application of methodology to assess GHG impact

For each step of the methodology previously described, participants were taken through the process and for the priority measures identified, were supported in developing an overview of the key data needs and building out a GACMO model with the results of their work.

Estimating baseline emissions for priority measures

The methodology, as previously described, for estimating baseline emissions starts by estimating baseline emissions. This involves establishing a reference case representing what would happen without the policy being assessed. Then, using the scenario method, define the most likely baseline scenario; define the emissions estimation method(s) and parameters; estimate baseline values for each parameter; estimate baseline emissions for each source/sink category; and finally, aggregate baseline emissions across all source/sink categories. These steps are presented in Table 5. The sectoral working groups identified the following parameters for the baseline scenario for the priority measures:

Table 5: Baseline scenario key parameters for priority measures

1. Identify scenarios, activities and data		
1.1 Baseline scenario		
Scenario	**Activities to be modelled**	**Data required**
	E.g. organic waste disposed	*E.g. KG of organic waste disposed annually*
Improved charcoal cookstoves		
Baseline scenario	Traditional charcoal cookstoves used for cooking	Number of traditional charcoal cookstoves used for cooking
Baseline scenario 2 *(optional)*	Increased use of charcoal	Mass (kg) of charcoal used annually
Land resources		
Baseline scenario	10 % of arable land under Zero tillage	Hectarage,
Baseline scenario 2 *(optional)*	10 % soil carbon emissions	tonnes of CO2 equivalents
Crops		

Baseline scenario	30% of rice crop under CH4 reduction	Hectarage, Gg of CO2 equivalents
Livestock		
Baseline scenario	30 % of livestock dung composted	Tonnes of manure composted
Baseline scenario 2 *(optional)*	20 slurry stores covered	number of slurry stores, farmers by species covering slurry stores
Public Transport Project		
Baseline scenario	Passengers using private vehicle	Number of passengers travelling using public transport
Baseline scenario 2 *(optional)*	Buses using diesel	Litres of diesel used, Number of buses

Estimating mitigation scenario emissions for priority measures

Methodology for estimating GHG effects (emissions) for the mitigation priority measures was based on ex-ante approach. This approach describes calculation of emissions in the presence of the policy and the final GHG effect in steps as follows: defining the most likely policy scenario. This scenario represents conditions with the policy in place; identifying parameters to be estimated; estimating policy scenario values for parameters; estimating policy scenario emissions; and estimating the GHG effect of the policy or action. The sectoral working groups identified parameters for the mitigation scenario for the priority measures, presented in Table 6.

Table 6: Mitigation scenario key parameters for priority measures.

1.2 Mitigation scenario			
Scenario	**Scenario relative to**	**Activities to be modelled**	**Data required**
	E.g. baseline scenario, another mitigation scenario	*E.g. Number of vehicles deployed*	*E.g. Vehicle fleet composition*
Improved charcoal cookstoves			
Mitigation scenario	Improved charcoal cookstoves distributed	Number of improved charcoal-cookstoves distributed	Number of improved cookstoves used for cooking
Mitigation scenario 2 (optional)	Increased use of sustainable charcoal	Number of improved charcoal-cookstoves distributed	kg of charcoal used annually
Land resources			
Mitigation scenario	15% of arable land under Zero tillage	Number of hectares under zero tillage	Hectares under zero tillage, Fuel used by farm machinery, Labour hours reduced
Mitigation scenario 2 (optional)	Reduced soil carbon emissions by 5%	Percentage of build-up of organic matter in the soil	Soil data
Crops			
Mitigation scenario	60% of rice crop under CH4 reduction	Number of hectares and Gg of Co2 Equivalents	Hectares under CH4 reduction, Labour hours reduced
Livestock			

Mitigation scenario	40% of livestock dung composted	Tonnes of manure composted	Tonnes of manure by livestock species
Mitigation scenario 2 (optional)	40 slurry stores covered	number of slurry stores, farmers by species covering slurry stores	Number of slurry stores, farmers covering slurry stores by species
Public Transport Project			
Mitigation scenario	Passengers using public transport/BRT	Number of buses deployed	Capacity of Diesel buses, number of passengers, Diesel consumed, distance travelled
Mitigation scenario 2 (optional)	Switch from diesel to electric buses	Number of electric buses deployed	Capacity of electric buses, distance travelled

4.3. Review and refinement of causal chain mappings

Agriculture Sector

Causal chain mapping for the agriculture sector is presented in Figure 5. The mapping was done in a participatory manner by the agriculture working group, allowing for discussion and presentation of agreeable inputs, activities and effects. Some of the effects (second stage) were created from corresponding earlier effects (first stage) in order to better describe the effects that are complex.

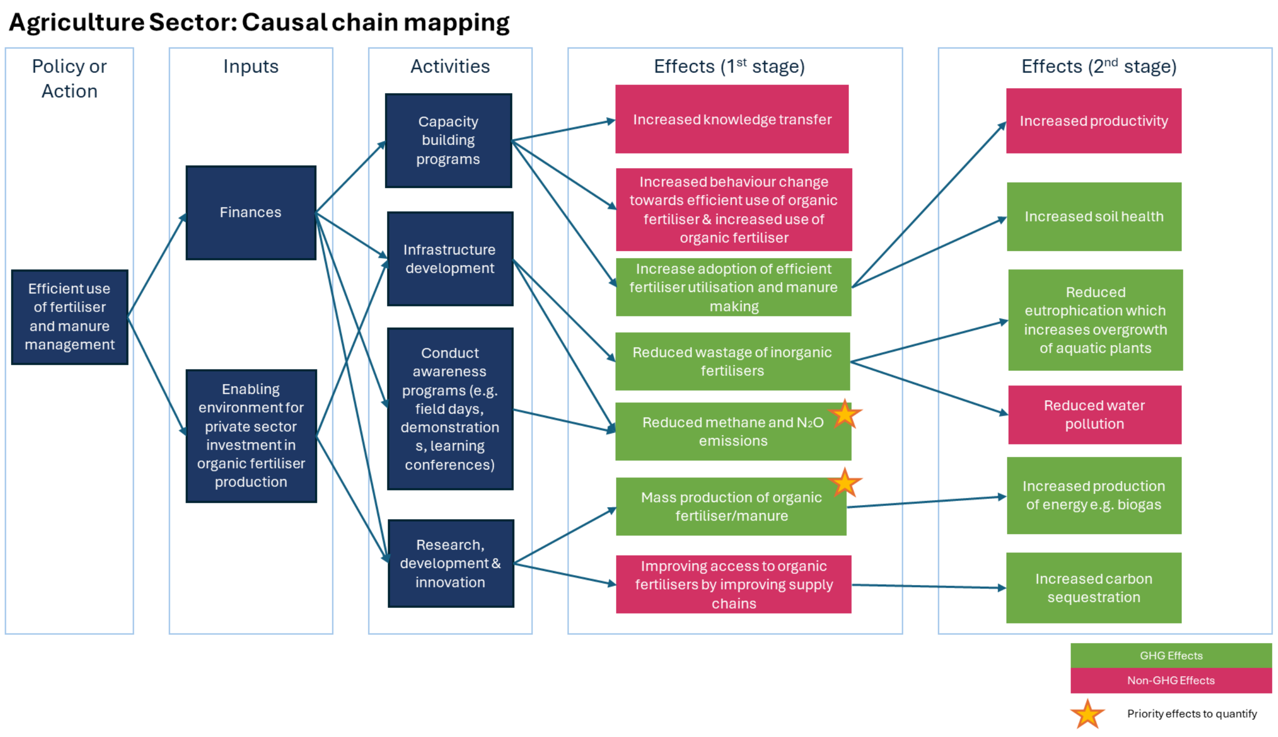

Figure 5: Causal chain mapping for the agricultural sector

The causal chain mapping for the agriculture sector outlines how policy or action influences inputs (finances, efficient fertilizer/manure management, enabling environment, private sector investment) and activities (capacity building, infrastructure development, conduct awareness programs, research/development & innovation). The activities lead to effects, which can be first stage and second stage. First-stage effects include the following: increased knowledge transfer; behaviour change towards efficient organic fertilizer use; adoption of efficient fertilizer utilization; reduced wastage of inorganic fertilizers; reduced methane and N_2O emissions; mass production of organic fertilizer/manure; and improved access to organic fertilizers. Second-stage effects include increased productivity; improved soil health; reduced eutrophication; reduced water pollution; increased energy production (e.g., biogas); and increased carbon sequestration. As presented in Figure 5, priority effects to quantify are marked with a star.

When converting this causal chain to modelled actions within GACMO, all actions available within GACMO were modelled for the agriculture sector. GHG reduction options and their units inputted into GACMO are presented in Tables 7 and 8 respectively.

Table 7: GHG reduction options inputted for Agriculture Sector from GACMO.

Total GHG mitigation in	Malawi									
			Emission reduction	Investment	Annual costs	Units penetrating	Emission reduction in 2025			
							Per option	Added		
Type	Reduction option	Sub-type unit	tCO2e/unit	Million US$	MUS$/year	in 2025	ktCO2e/year	ktCO2e/year	Frac.of total
Agriculture	Rice crop CH4 reduction	Rice crop CH4 red.(1000 ha)	1,974	51	9.93	30	59.22	59	1.5%
	Zero tillage	1000 ha	67	- 1	- 0.78	60	4.04	63	1.6%
	Cover crops	1000 ha	1,490	-	6.62	60	89.40	153	4.0%
	Nitrification inhibitors (1000 ha)	1000 ha	400	-	-	30	12.00	165	4.3%
	Covering slurry stores (1 slurry store)	1 slurry store	0.20	0	0.00	51	0.01	165	4.3%
	Fat supplementation in ruminants diets (%DM fat added)	%DM fat added	108	-	0.03	1	0.11	165	4.3%
	Tobacco curing	100 t tobacco/yr	472	0	- 0.96	96	45.36	210	5.5%
# GHG reduction options:	119		Totals:	51	15				

Table 8: GHG Reduction options and units modelled for Agriculture Sector from GACMO

Reduction option	Sub-type unit
Rice crop CH4 reduction	Rice crop CH4 red (1000 ha)
Zero tillage	1000 ha
Cover crops	1000 ha
Nitrification inhibitors (1000 ha)	1000 ha
Covering slurry stores (1 slurry store)	1 slurry store
Fat supplementation in ruminants’ diets (%DM fat added)	%DM fat added
Tobacco curing	100 t tobacco/yr

Energy Sector Causal Chain

The energy sector causal chain mapping, presented in Figure 6, shows how policy or action drives inputs (finance, human resources, land resources, policy/regulatory framework) and activities (conduct feasibility study, increase the scale of large solar PV electricity generation mix, review policy/regulatory frameworks to promote large-scale solar PV).

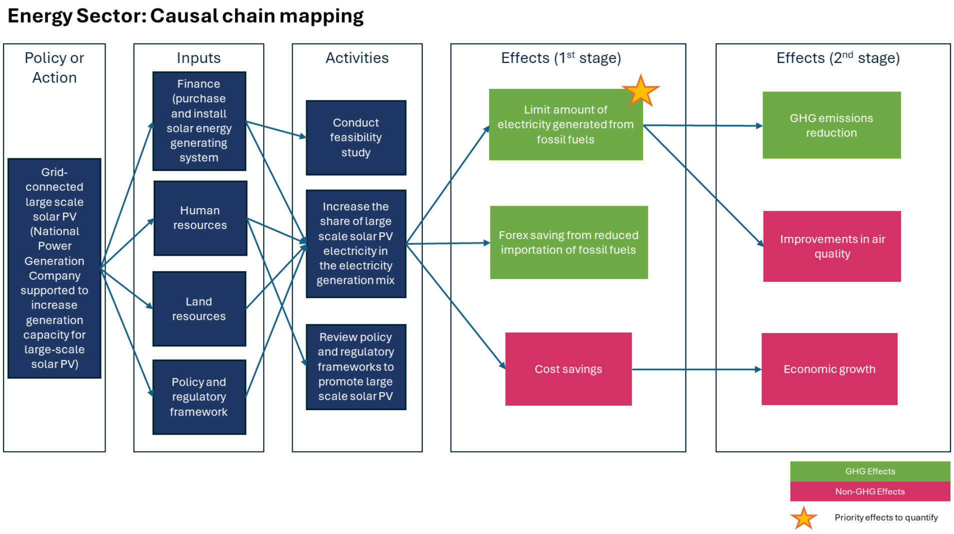

Figure 6: Energy sector Causal chain mapping

The first-stage effects are as follows: limiting electricity generated from fossil fuels (priority effect); forex savings from reduced importation of fossil fuels; and cost savings. The second-stage effects include GHG emissions reduction; improvements in air quality; and economic growth.

Selected year: 2025

Total GHG mitigation in Malawi

Type	Reduction option	Sub-type unit	Emission reduction tCO2e/unit	Investment Million US$	Annual costs MUS$/year	Units penetrating in 2025	Emission reduction in 2025: Per option ktCO2e/year	Emission reduction in 2025: Added ktCO2e/year	Emission reduction in 2025: Frac. of total
Biomass energy	Rice husk cogeneration plants	1 MW cogeneration	9,719	-	-		-	77.31	0.6%
	Biomass power from biomass residues	1 MW CHP plant	2,428	-	-		-	77.31	0.6%
	Bagasse power	100 kt sugar cane/year	6,791	-	-		-	77.31	0.6%
EE households	Efficient residential airconditioning	1000 Airconditioners	766	-	-		-	77.31	0.6%
	Efficient lighting with CFLs	1000 Bulbs	37	-	-		-	77.31	0.6%
	Efficient lighting with LEDs	1000 Bulbs	76	-	-		-	77.31	0.6%
	Efficient lighting with LEDs replacing CFL	1000 Bulbs	9	-	-		-	77.31	0.6%
	Efficient wood stoves	1000 stoves	1,434	8		1,296.6	1,859.25	1,936.57	13.8%
	Efficient charcoal stoves	1000 stoves	293	18	-3.76	295.4	86.54	2,023.11	14.4%
	LPG stoves replacing wood stoves	1000 stoves	2,055	7	36.68	219.0	450.08	2,473.19	17.7%
	Efficient electric stoves	1000 stoves	152	11	-0.82	170.4	25.93	2,499.13	17.8%
	Induction based cooking	1000 stoves	11	-	-		-	2,499.13	17.8%
	New passive home	1000 new homes	8,344	-	-		-	2,499.13	17.8%
	Efficient refrigerators	1000 refrigerators	1,199.4	-	-		-	2,499.13	17.8%
EE industry	Efficient electric motors	1 kW	0.6	-	-		-	2,499.13	17.8%
	Energy efficiency in industry	10% red. of energy demand	41,182	-	-		-	2,499.13	17.8%
	Building materials	1 million bricks	520	-	-		-	2,499.13	17.8%
EE own generation	Waste heat recovery at cement plant	1 Cement plant	39,853	-	-		-	2,499.13	17.8%
	Waste heat recovery at steel plant	1 Steel plant	36,704	-	-		-	2,499.13	17.8%
EE service	Efficient electric motors	1 kW	0.6	-	-		-	2,499.13	17.8%
	Efficient office lighting with CFLs	1000 lights	38	-	-		-	2,499.13	17.8%
	Efficient office lighting with LEDs	1000 lights	44	-	-		-	2,499.13	17.8%
	Efficient street lights	1000 lights	385	-	-		-	2,499.13	17.8%
	Efficient water pumping	4 Million m3 water	749	-	-		-	2,499.13	17.8%
	HVAC	100,000 m2 floor area	4,557	-	-		-	2,499.13	17.8%
	Efficient Chiller > 300 TR	1 TR	2.0	-	-		-	2,499.13	17.8%
	Efficient Chiller < 300 TR	1 TR	0.8	-	-		-	2,499.13	17.8%
	Efficient room airconditioner	1 Airconditioner	0.7	-	-		-	2,499.13	17.8%
	Efficient commercial dishwashing machine	1000 meals/day	10.9	-	-		-	2,499.13	17.8%
	Efficient hotel refrigerator	1 refrigerator	0.4	-	-		-	2,499.13	17.8%
	Efficient hotel washing machine	100 Guest Nights (GN)	0.05	-	-		-	2,499.13	17.8%
	Energy efficiency in service	10% red. of energy demand	9,001	-	-		-	2,499.13	17.8%
	New office building with central cooling	1000 m2	34	-	-		-	2,499.13	17.8%
EE supply side	New natural gas power plant	1 MW	159	-	-		-	2,499.13	17.8%
	Switch from fuel oil to diesel	1 MW	124	-	-		-	2,499.13	17.8%
	Switch from fuel oil to natural gas	1 MW	1,454	-	-		-	2,499.13	17.8%
	Cogeneration in industry	1 MW	542	-	-		-	2,499.13	17.8%
	Single cycle to combined cycle	100 MW increase	75,738	-	-		-	2,499.13	17.8%
Energy distribution	Efficient electric grids	1 GWh loss reduction	486	-	-		-	2,499.13	17.8%
	Connection of isolated grid to central grid	1 GWh consumption	486	-	-		-	2,499.13	17.8%
	Power factor increase	1000 commerce/industry buildings	94,590	-	-		-	2,499.13	17.8%
	District heating network rehabilitation (100,000 flats supplied)	100,000 flats supplied	33,649	-	-		-	2,499.13	17.8%
	District cooling network (1 million m2 new city area covered)	1 million m2 new city area covered	13,726	-	-		-	2,499.13	17.8%
Fossil fuel switch	Switch from coal to natural gas in industry	100 TJ fuel use/year	3,850	-	-		-	2,499.13	17.8%
	Switch from fuel oil to natural gas in industry	100 TJ fuel use/year	2,127	-	-		-	2,499.13	17.8%
Fugitive	Reduced flaring at oil field	1 MMSCF/day	22,613	-	-		-	2,499.13	17.8%
	Reduced flaring at oil refineries	1 MMSCF/day	20,797	-	-		-	2,499.13	17.8%
	Leak reduction in natural gas pipelines	1 Mm3 CH/year leaking	15,078	-	-		-	2,499.13	17.8%
	Charcoal production	100,000 ton charcoal/yr	141,005	16	3.25	6.62	933.45	3,432.58	24.5%
Geothermal	Geothermal power	1 MW	3,066	-	-	0	-	3,432.58	24.5%
	Geothermal heat	1000 m2 heated area	17	-	-		-	3,432.58	24.5%
HFCs, PFCs, SF6	Reduced PFCs from aluminum production	100,000 ton Aluminium/yr	111,888	-	-		-	3,432.58	24.5%
Hydro	Hydro power connected to main grid	1 MW	1,923	453	-32.30	398	765.38	4,197.96	30.0%
	Mini hydro power connected to main grid	1 MW	1,942	-	-	0	-	4,197.96	30.0%
	Mini hydro power off grid	1 MW	3,232	1	0.08	0.24	0.78	4,198.74	30.0%
Marine	Tidal	1 MW of tidal power	1,276	-	-		-	4,198.74	30.0%
	Wave	1 MW of wave power	1,489	-	-		-	4,198.74	30.0%
Methane avoidance	Biogas at rural farms using kerosene	1000 units	1,228	-	-		-	4,198.74	30.0%
	Biogas at rural farms using non-renewable fuelwood	1000 units	11,274	1	0.12	22	24.80	4,223.54	30.2%
	Biogas at big farms	84000 pigs	71,321	-	-		-	4,223.54	30.2%
	Biogas from industrial waste water	1 plant	25,805	-	-		-	4,223.54	30.2%
Solar	Solar water heater, residential	1000 locations	804	0	-0.00	27	21.97	4,245.51	30.3%
	Solar water heater, large	1 unit	30	-	-		-	4,245.51	30.3%
	Solar PVs, large grid	1 MW	886	124	8.60	124	109.87	4,355.38	31.1%
	Solar PVs, large grid with 24h storage	1 MW	886	-	-		-	4,355.38	31.1%
	Solar house PVs	500 W	0.4	-	-		-	4,355.38	31.1%
	Solar cottage PVs	50 W	0.04	-	-		-	4,355.38	31.1%
	Solar/diesel mini-grid	40 kW from solar	58	-	-		-	4,355.38	31.1%
	Solar LED lamps	1000 lamps	94	-	-		-	4,355.38	31.1%
	Solar PVs, small isolated grid, 100% solar	2 MW	2,628	1	0.27	0	0.29	4,355.67	31.1%
	Solar street lights	1000 locations (0.05 MW)	454	-	-		-	4,355.67	31.1%
	Parabolic through CSP, no storage	1 MW	728	-	-		-	4,355.67	31.1%
	Solar tower CSP, with storage	1 MW	728	-	-		-	4,355.67	31.1%
Wind	Wind turbines, on-shore	1 MW	1,214	-	-	0	-	4,572.23	32.7%
	Wind turbines, on-shore with 24 storage	1 MW	1,328	-	-		-	4,572.23	32.7%
	Wind turbines, off-shore	1 MW	1,554	-	-		-	4,572.23	32.7%
# GHG reduction options:	119		Totals:	816	76				

Figure 7: GACMO reduction options inputted for Energy sector for 2025

GHG reduction options, as modelled in GACMO, are presented in Figure 7. It shows units of penetration, as supplied by experts. Table 9 presents GHG reduction options and units modelled for energy sector.

Table 9: GHG reduction options and units modelled for energy sector

Reduction option	Sub-type unit
Efficient wood stoves	1000 stoves
Efficient charcoal stoves	1000 stoves
LPG stoves replacing wood stoves	1000 stoves
Efficient electric stoves	1000 stoves
Charcoal production	100,000-ton charcoal/year
Hydro power connected to main grid	1 MW

Mini hydro power off grid	1 MW
Biogas at rural farms using non-renewable fuelwood	1000 units
Solar water heater, residential	1000 locations
Solar PVs, large grid	1 MW
Solar PVs, small isolated grid, 100% solar	2 MW
Wind turbines, on-shore	1 MW

Transport Sector

Causal chain for the Transport Sector is presented in Figure 8.

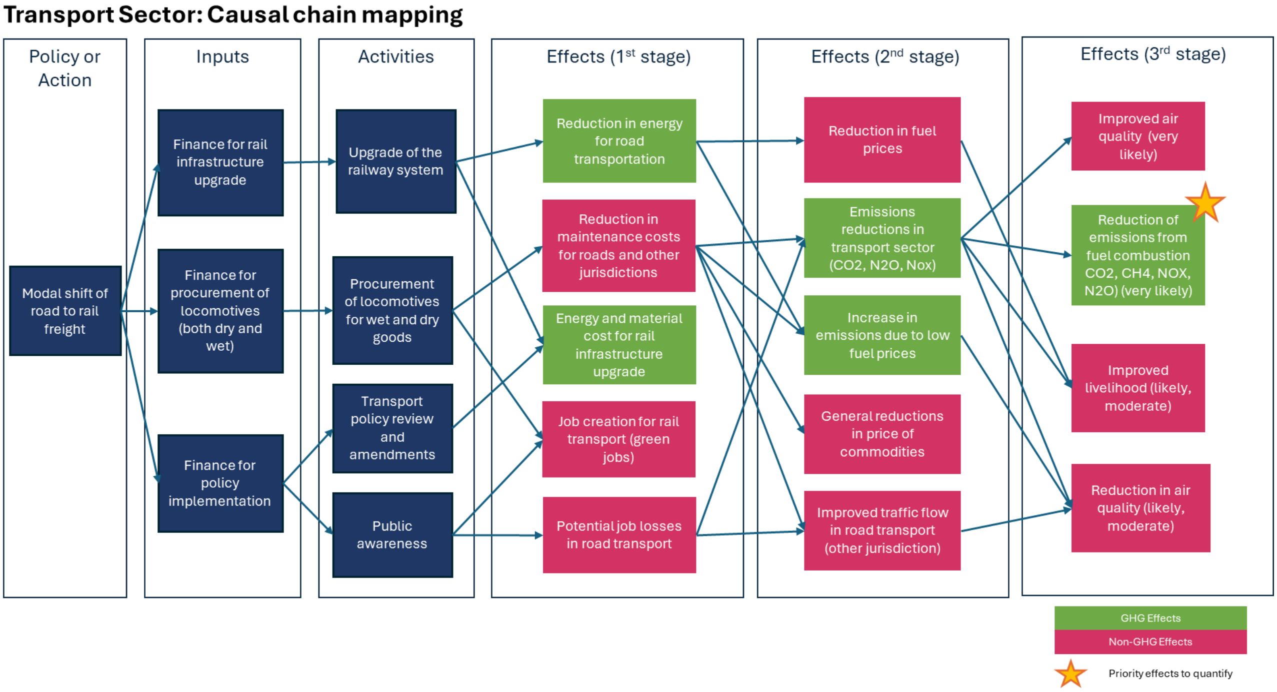

Figure 8: Transport sector: Causal chain mapping

The transport sector causal chain mapping shows how policy or action drives inputs (finance for rail infrastructure upgrade, finance for locomotives, finance for policy implementation) and activities (upgrade of the railway system, procurement of locomotives, transport policy review and amendments, public awareness). In the causal chain, there are inputs and outputs, which produce effects: first stage and second stage (refer to Figure 9), as follows:

a) First-stage effects: reduction in energy for road transportation, reduction in maintenance costs for roads and other jurisdictions, energy and material cost for rail infrastructure upgrade, job creation for rail transport (green jobs), and potential job losses in road transport.
b) Second-stage effects include reduction in fuel prices, emissions reductions in transport sector (CO_2, N_2O, NOx), increased emissions due to low fuel prices, general reductions in price of commodities, and improved traffic flow (another jurisdiction).
c) Third-stage effects are improved air quality (very likely), reduction of emissions from fuel combustion (CO_2, CH_4, N_2O) (very likely), improved livelihood (likely, moderate), and reduction in air quality (likely, moderate). Priority effects to quantify are marked with stars.

Total GHG mitigation in Malawi

Type	Reduction option	Sub-type unit	Emission reduction tCO2e/unit	Investment Million US$	Annual costs MUS$/year	Units penetrating in 2025	Emission reduction in 2025 Per option ktCO2e/year	Emission reduction in 2025 Added ktCO2e/year	Emission reduction in 2025 Added Frac.of total
Transport	15% Biodiesel blend in all diesel	10% blend in transport	104,513	-	-		-	5,900.25	42.1%
	20% Bioethanol blend in all gasoline	15% blend in transport	157,586	-	40.63	0.6667	105.06	6,005.31	42.9%
	Bus Rapid Transit (BRT)	1 km BRT line	1,983	135	20.35	41.72	82.75	6,088.06	43.5%
	More efficient gasoline cars	1000 cars	409	-	-		-	6,088.06	43.5%
	More efficient diesel cars	1000 cars	180	-	-		-	6,088.06	43.5%
	Natural Gas cars	1000 cars using natural gas	778	-	-		-	6,088.06	43.5%
	Electric cars	1000 cars	953	0	0.03	0.05	0.05	6,088.11	43.5%
	Electric 18m buses	1000 buses	36,777	-	-		-	6,088.11	43.5%
	Electric 12m buses	1000 buses	13,373	-	-		-	6,088.11	43.5%
	Electric heavy trucks	1000 trucks	10,498	-	-		-	6,088.11	43.5%
	Electric light trucks	1000 trucks	6,066	-	-		-	6,088.11	43.5%
	Electric rail	1 Million trainkm/year	3,282	-	-		-	6,088.11	43.5%
	Shifting passengers from car to rail	1 Million personkm/day	35,458	-	-		-	6,088.11	43.5%
	Shifting freight transport from road to rail	1000 tonkm/day	241	-	-		-	6,088.11	43.5%
	Restriction on import of used cars	1000 cars	931	-	-		-	6,088.11	43.5%
	New bicycle lanes	1 km bicycle lane	687	2	- 4.29	41.72	28.64	6,116.75	43.7%
	Electric three-wheelers	1000 three-wheelers	293	-	-		-	6,116.75	43.7%
	Electric two-wheelers	1000 two-wheelers	196	0	0.10	0.28	0.06	6,116.81	43.7%
	Better maintenance and use of motor bikes	1000 bikes	116	-	-		-	6,116.81	43.7%

Figure 9: GACMO reduction options inputted for Transport sector

GHG reduction options modelled in GACMO are presented in Table 8. The options are Bus Rapid Transits (BRT) system, electric cars, new bicycle lanes, and electric three-wheelers. The units modelled were brainstormed and agreed upon by the transport group. Table 10 presents Reduction options and units modelled for transport sector.

Table 10: Reduction options and units modelled for transport sector

Reduction option	Sub-type unit
Bus Rapid Transit (BRT)	1 km BRT line
Electric cars	1000 cars
New bicycle lanes	1 km bicycle lane
Electric two-wheelers	1000 two-wheelers

4.4. Quantification of GHG impacts by sector

This section aims to summarise the primary findings from the quantification of Greenhouse Gas (GHG) impacts of selected policies and measures. The core principle of estimating effects involves calculating the difference between baseline (Business-As-Usual or BAU) scenarios and mitigation (with policy) scenarios. The assessment focused on priority sectors: agriculture, energy, and transport. For the agriculture sector, the quantification compared baseline emissions against those resulting from measures like rice crop CH_4 reduction, zero tillage, cover crops, nitrification inhibitors, covering slurry stores, fat supplementation in ruminant diets, and tobacco curing. In the energy sector, the assessment modelled options such as efficient wood and charcoal stoves, LPG stoves, hydro power, biogas, solar PVs, and wind turbines. For the transport sector, measures like Bus Rapid Transit (BRT), electric cars, and new bicycle lanes were quantified against baseline scenarios. The detailed quantifications for each sector, showing the projected GHG reductions in the mitigation scenarios compared to BAU, are presented in figures within the report. These results directly support evidence-based decision-making for Malawi's climate policies.

Agriculture Sector

The graph (Figure 10) for the agriculture sector shows Business-As-Usual (BAU) scenario emissions steadily increasing over time, indicating rising GHG emissions. The mitigation scenario emissions, also increase but at a slower rate, indicating a reduction in emission compared to BAU up to 2050. The reduction in 2030 is estimated to be 102 ktCO2e/year while in 2050 is 272 ktCO2e/year.

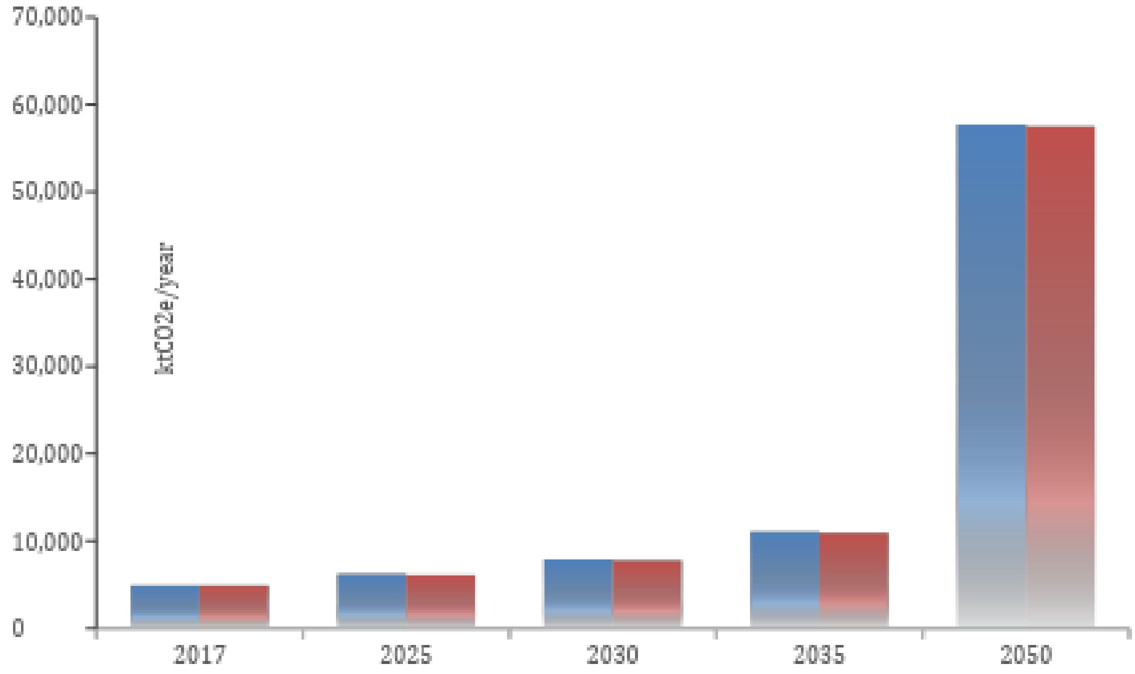

Figure 10: BAU scenario and Mitigation scenario emissions in the agriculture sector

It is important to note that several NDC measures for the agriculture sector have not been modelled under the WEM scenario due to the absence of corresponding mitigation options within the GACMO model. See Table 11 below for the NDC measures currently not included in the WEM scenario. As a result, the outputs from the GACMO modelling exercise likely underestimate the full mitigation potential of the WEM scenario for the agriculture sector. This limitation should be considered when interpreting the results and assessing progress towards NDC targets. However, the Agriculture WG can address this gap by manually editing the GACMO model to include custom mitigation actions using a proxy mitigation option in the tool, thereby enabling a more accurate representation of sector-specific measures aligned with national priorities. Guidance has been provided in the agriculture-specific Step 7 guidance.

Table 11. NDC measures not included in the WEM scenario in GACMO currently

Sector	GACMO Reduction option	Malawi NDC measure
Not covered in GACMO	N/A	**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_2O emissions from mineral N-fertilizer use.
	N/A	**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.
	N/A	**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.
	N/A	**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.

	N/A	**Improved farm management** Establishing biogas digesters, promotion of collective farms, improved manure management and promotion of slurry systems, resulting in reduced or avoided N_2O and CH_4 emissions.

The next step for the GACMO modelling process is to compile all penetration values for the identified mitigation options across all sectors into a single, consolidated GACMO file. This will enable the country to clearly assess the gap between the BAU and WEM scenarios. In turn, this will help to quantify the level of residual greenhouse gas emissions and inform the identification of additional, more ambitious mitigation measures needed to further reduce emissions. These insights will support the development of the With-Additional-Measures (WAM) scenario, which represents a more ambitious pathway for achieving long-term climate goals.

Energy Sector

The graph for the energy sector shows the solid black line (Business-As-Usual, BAU) increasing steadily from 2017 to 2050, from 2,236 tkCO2e/year in 2017to 16,432 tkCO2e/year in 2050. Mitigation measures analysed by GACMO did not include measure from biomass cookstoves and from services sector due to limitation to handle non-renewable biomass and limitation of data, respectively. In the power sector, planned coal powered power plants and diesel plants are replaced by hydropower and large-scale hydropower mitigation measures as well as other small-scale renewable energy power systems. As it can be seen from Figure 11, mitigation scenario emissions are significantly lower than BAU, which indicate effectiveness of the measures.

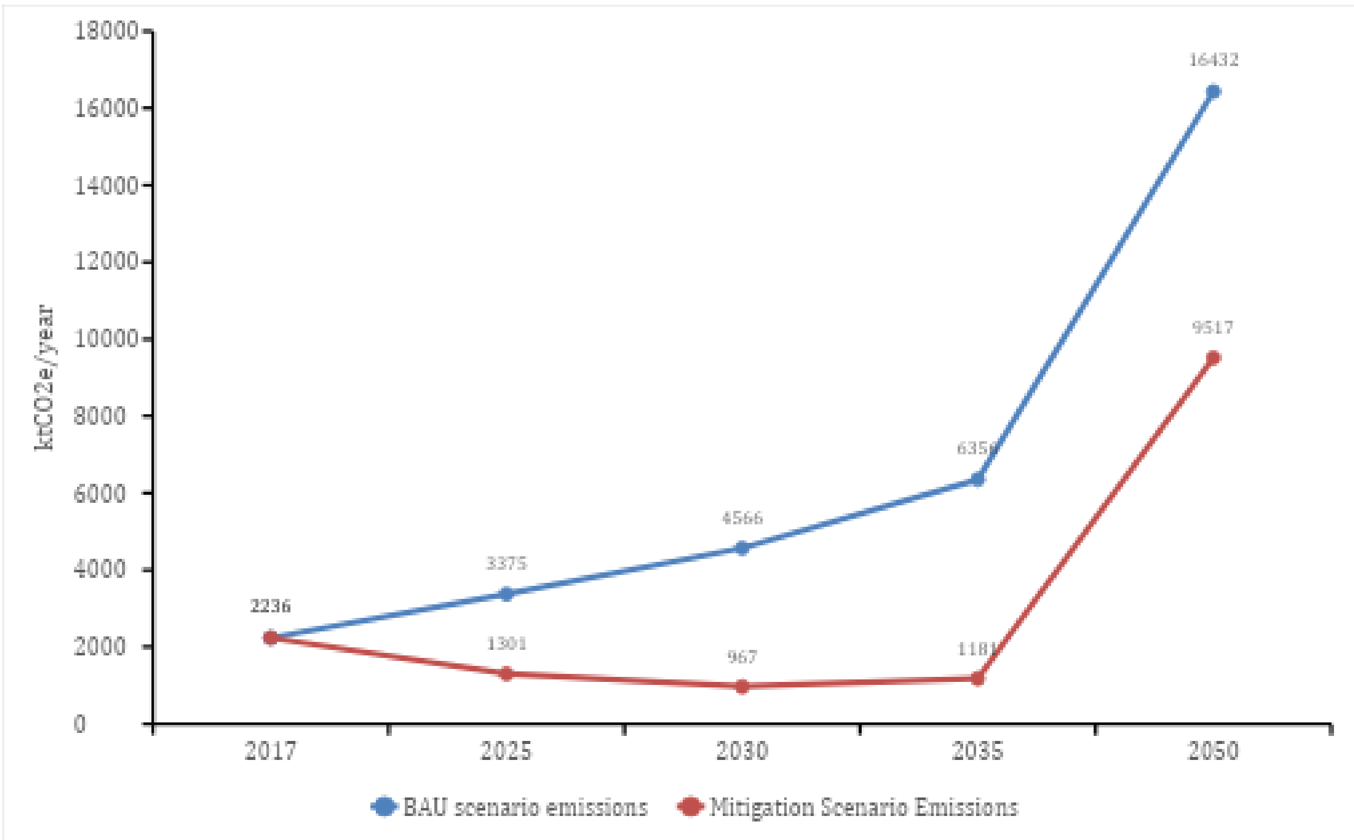

Figure 11: Baseline (BAU) scenario vs mitigation (policy) scenario for energy sector

Transport Sector

Transport sector contributes significant amounts of GHG emissions, as it can be seen from BAU scenario emissions in Figure 12. The graph for the transport sector (Business-As-Usual, BAU) increasing steadily over time, indicating rising GHG emissions from 1009 ktCO2e in 2017 to 3875 ktCO2e in 2050. The mitigation measures analysed in GACMO are 20% bioethanol blend in petrol, Bus Rapid Transit (BRT), Electric cars, New Bicycle lanes and electric two-wheelers. The hashed line, representing a mitigation scenario, also increases but at a slower rate, suggesting somewhat limited amounts of emission reductions for the selected mitigation measures. Overall, the mitigation scenario results in lower emissions compared to BAU, with the effectiveness increasing over time.

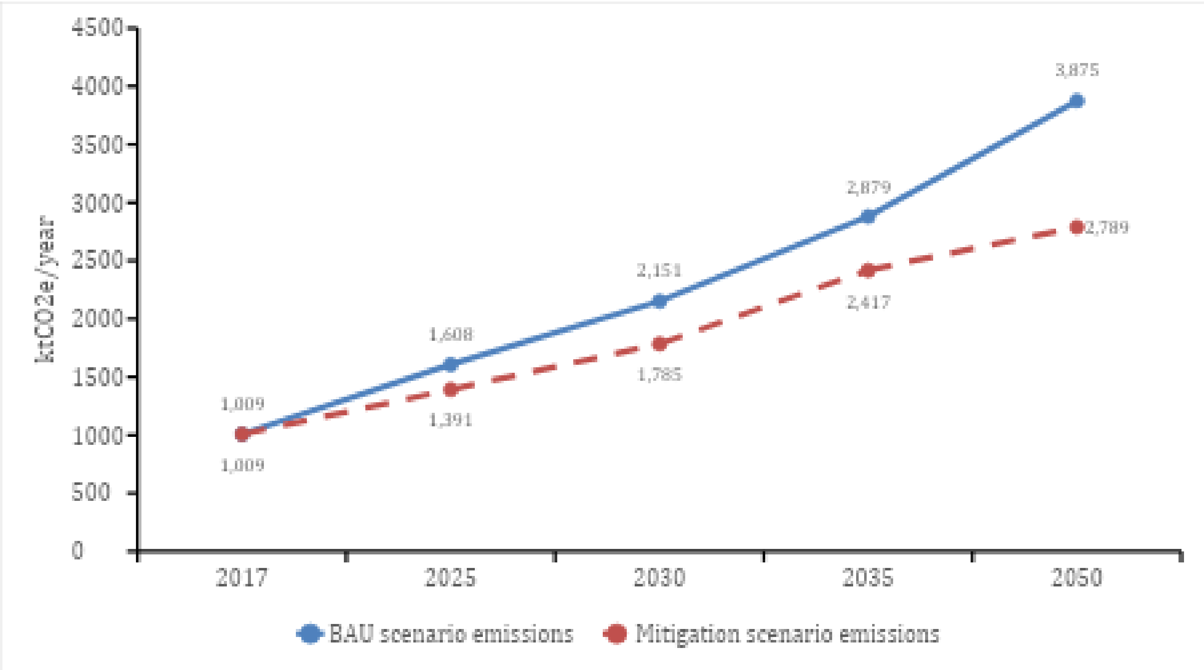

Figure 12: Baseline (BAU) scenario vs mitigation (policy) scenario for transport sector

GHG emissions from all sectors

Emissions under both BAU and Mitigation scenarios for all the sectors combines are presented in Figure 13. BAU scenario emissions rose from 10,212 ktCO2e in 2017 to 112,214 ktCO2e in 2050, an absolute increase in emissions of 102,002 ktCO2e, representing an almost a ten-fold increase in emissions over a period of 33 years. This also represents a simple increase of 3,091 ktCO2e/year over the period. Emissions under Mitigation scenario, also known as emissions under Existing-Measures, the emissions rose from 10,212 ktCO2e in 2017 to 92,687 ktCO2e in 2050, at all years being less that emissions under BAU scenario. The total effect of all listed mitigations measures from all the three sectors are aggregated together result in reduction of 19,527 ktCO2e in 2050 up from 4,572 ktCO2e in 2025. Mitigation potential is likely to be higher than this considering that some sectors and other measures with the sectors have not been considered in this GACMO emissions reduction exercise.

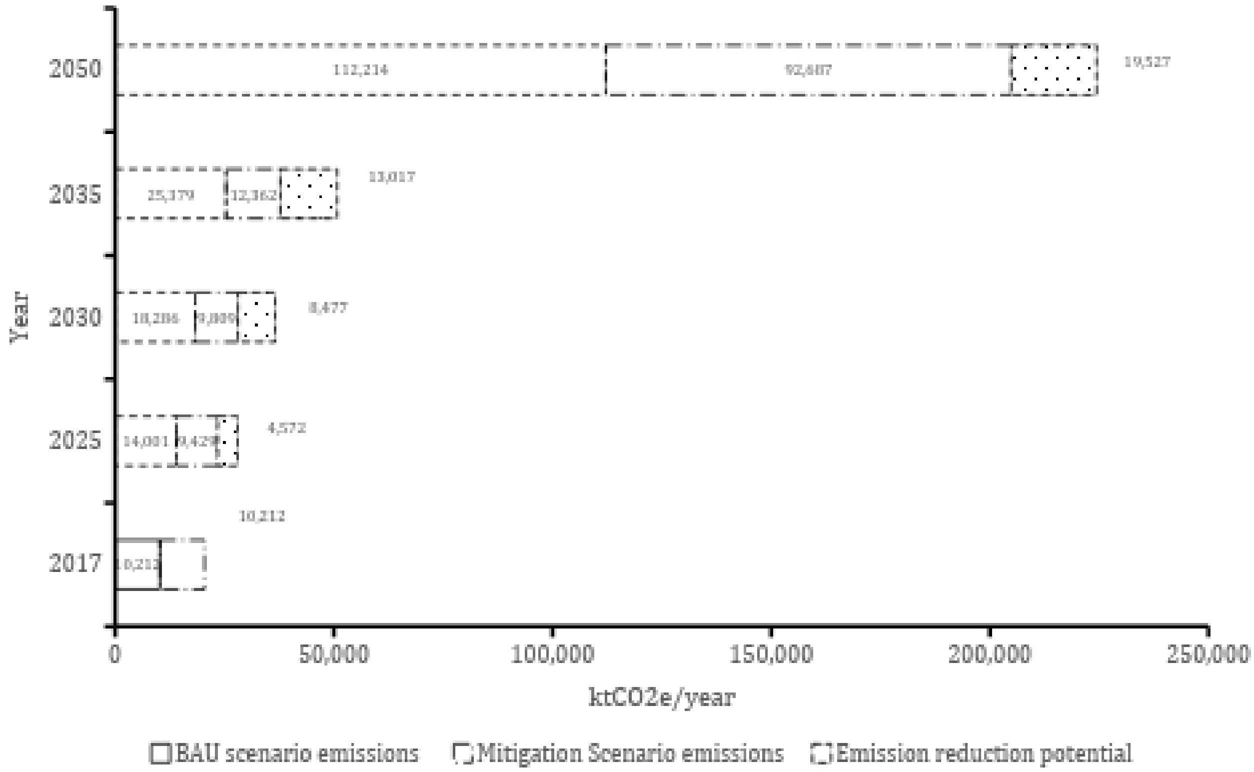

Figure 13: Emissions under both BAU and Mitigation scenarios for all the sectors combines

From the analysed mitigation options, significant emission reduction was from the energy sector because of large scale hydropower projects that would avoid a significant amount of emission from the power industry. This therefore points to where the Government of Malawi and other stakeholders should focus on to achieve meaningful emission reduction in the country. The least mitigation measure in terms of mitigation potential is came from the transport sector despite the sector being the top-source of emissions. This is due to mitigation options identified in the transport and the associated penetration levels: the emission potential and the values are relatively small. The mitigation measures in the transport sector, being a key category, would results in benefits both in terms of emission reduction and sustainable development.

4.5. Draft guidance on sector-specific indicator tracking

The methodology, as previously described, for progress tracking is as follows. Firstly, is identification of Key Performance Indicators (KPIs) in order to Monitor Performance Over Time. Monitoring is crucial for tracking policy implementation progress and collecting data for ex-post assessment and is done in these steps: define Key Performance Indicators; define parameters for ex-post assessment; create a monitoring plan; and monitor Parameters Over Time. More specifically guidance was provided to participants on how to identify and clearly define progress indicators, this was based on the guidance: NDC Progress Indicators: a guidance for practitioners. This guidance detailed the approach, as follows:

1. Identify NDC Targets.

This step involves listing all mitigation (e.g., emission reductions, renewable energy share) and adaptation (e.g., water storage, forest cover) targets from the latest NDC. Thereafter, it involves documenting them in in a table on the following: target, value/description, scope, unit, timeframe, and baseline.

2. Make Targets SMART

The second step involves ensuring that targets are Specific, Measurable, Ambitious, Relevant, and Time-bound. Then clarifying scope, units, and baselines (e.g., for "28% renewable power," specify generation or capacity). For qualitative targets, components clearly with stakeholder input must be defined.

3. Select Indicators

This step involves the following: Choosing quantitative (e.g., % forest cover) or qualitative indicators to track targets; using the Intervention Logic Framework for qualitative targets to identify indicators at action, output, outcome, and impact levels. (examples: GHG emissions (kt CO2 eq), renewable energy share, forest cover, or policy implementation status); and involving stakeholders for credibility.

4. Define Data and Methodology

This step involves creating a data collection plan: what's measured, sources, methods, collectors, frequency, and reporting; using existing data (e.g., GHG inventories, national statistics, FAO, IEA) and ensure quality and consistency; and applying standards like 2006 IPCC Guidelines or WRI Policy and Action Standard.

5. Compile, Report, and Archive

This approach involves integrate data collection into existing systems and apply quality control; ensuring consistent reporting; recalculate time series if methods change and document reasons; reporting in BTR Common Tabular Formats with definitions, methodologies, and values; and archiving data, methodologies, and assumptions clearly, addressing gaps transparently.

This process ensures robust NDC progress tracking, transparency, and informed policy adjustments. The sectoral working groups identified the following indicators for the priority measures. Table 12 presents indicators for key parameters for priority measures.

Table 13: Scenario, indicators for key parameters for priority measures and data required

Scenario	Scenario relative to	Indicators to be tracked	Data required
	E.g. baseline scenario, another mitigation scenario	*E.g. Number of vehicles deployed*	*E.g. Vehicle fleet composition*
Improved charcoal cookstoves			
Mitigation scenario	Improved cookstoves distribute	Number of improved cookstoves distributed	Number of improved cookstoves distributed
Mitigation scenario 2 (optional)	Increased use of sustainable charcoal	Number of improved charcoal-cookstoves distributed	kg of charcoal used annually
Land resources			
Mitigation scenario		Area (hectarage)	Hectares under zero tillage, Fuel used by farm machinery, Labour hours reduced

Mitigation scenario 2 (optional)		Percentage of build-up of organic matter in the soil	Soil data
Crops			
Mitigation scenario		Number of hectares and Gg of Co2 Equivalents	Hectares under Ch4 reduction, Labour hours reduced
Livestock			
Mitigation scenario		Tonnes of manure composted	Tones of manure by livestock species
Mitigation scenario 2 (optional)		number of slurry stores, farmers by species covering slurry stores	Number of slurry stores, farmers covering slurry stores by species
Public Transport Project			
Mitigation scenario	Passengers using public transport/BRT	Number of passengers redirected to using public transport per year	Capacity of Diesel buses, number of passengers, Diesel consumed, distance travelled
Mitigation scenario 2 (optional)	Switch from diesel to electric buses	Vehicle km travelled by electric vehicles	Capacity of electric buses, distance travelled

6. Recommendations for the NDC Tracking Framework

6.1. Summary of assessment findings

This guidance report summarises the efforts undertaken to strengthen Malawi's technical and institutional capacities for Greenhouse Gas (GHG) impact assessments and Nationally Determined Contributions (NDC) tracking. The assessment focused on the energy, transport, and agriculture sectors, recognizing their significant contribution to Malawi's emissions profile and their strategic importance for achieving NDC targets. Key findings include:

a) Capacity building: Training sessions equipped sectoral working groups with skills to develop and analyse 'with policy' and 'without policy' scenarios.

b) Quantification support: Stakeholders received technical support in applying methodologies and tools (including the GACMO tool) to estimate the GHG impacts of relevant policies, ensuring consistent and credible assessments.

c) Causal chain refinement: Initial causal chain mappings linking policy inputs to outcomes and GHG effects were reviewed and refined to enhance logic and transparency.

d) Data assessment: Engagement with ministries and agencies helped assess data availability, identify gaps, and understand existing institutional arrangements and coordination mechanisms for data collection.

e) Indicator development: Recommendations were formulated for integrating relevant and measurable indicators into the national framework for tracking NDC implementation and progress.

Collectively, these activities have laid a more robust foundation for evaluating policy impacts and climate reporting in Malawi, supporting the transparent and effective implementation of the nation's climate commitments.

6.2. Integration of results into the existing or proposed NDC tracking framework

A primary objective of this initiative is to integrate the results of the GHG impact assessment into Malawi's NDC Tracking Framework. The quantified GHG impacts of selected policies and measures, alongside the developed indicators, are designed to directly feed into this framework. This integration will support the transparent reporting of progress towards Malawi's unconditional target of a 6% reduction in GHG emissions below Business-As-Usual (BAU) by 2040, and the more ambitious conditional target of 45% reduction. By providing clear methodologies and data for tracking, the framework will enable policymakers and decision-makers to monitor whether policies are on track and delivering expected results, allowing for informed decisions on policy continuation, expansion, or adjustment.

6.3. Proposed sectoral indicators for tracking progress

Indicators are crucial tools for monitoring performance, allowing stakeholders to understand how something changes compared to an alternative situation or a target. Indicators should be SMART: Specific, Measurable, Achievable, Relevant, and Time-bound. The sectoral working groups identified the following indicators for key priority measures:

a) Improved charcoal cookstoves: Indicators are number of improved cookstoves distributed; and kilograms of charcoal used annually. Data required: Number of improved cookstoves distributed; Kilograms of charcoal used annually.

b) Land resources (e.g., Zero Tillage/Conservation Agriculture). Indicators are Area (hectarage) under zero tillage and percentage of build-up of organic matter in the soil. Data required: Hectares under zero tillage, Fuel used by farm machinery, Labour hours reduced; Soil data.

c) Crops (e.g., Rice crop CH_4 reduction). Indicators are number of hectares; and Gg of CO_2 Equivalents under CH_4 reduction. Data required: Hectares under CH_4 reduction, Labour hours reduced.

d) Livestock (e.g., Improved livestock husbandry, manure management). Indicators are tonnes of manure composted; Number of slurry stores, farmers by species covering slurry stores. Data Required are tonnes of manure by livestock species; Number of slurry stores, farmers covering slurry stores by species.

e) Public Transport Project (e.g., Modal shift to public transport/BRT, Switch to EV fleet). Indicators are number of passengers redirected to using public transport per year; and vehicle kilometres travelled by electric vehicles. Data required are Capacity of Diesel buses, number of passengers, Diesel consumed, distance travelled; Capacity of electric buses, distance travelled.

These indicators are intended to facilitate the tracking of policy implementation progress and provide data for ex-post assessment of GHG effects.

6.4. Suggestions for institutional strengthening and data flow improvements

Based on stakeholder discussions regarding data availability, gaps, and institutional arrangements, several suggestions for institutional strengthening and data flow improvements are crucial:

a) **Addressing Data Gaps and Inconsistencies:** Implement strategies to enhance data completeness, timeliness, and consistency across various regions and departments, as issues with incomplete, outdated, or inconsistent data were identified.

b) **Clarifying Roles and Responsibilities:** Clearly define and communicate which ministries or agencies are responsible for collecting, managing, and reporting specific data for indicators. This ensures accountability and avoids duplication or gaps in data stewardship.

c) **Strengthening Coordination Mechanisms:** Establish or enhance formal coordination mechanisms, such as inter-institutional working groups or data sharing agreements, to facilitate seamless and efficient data flow between responsible entities.

d) **Capacity Building:** Invest in **training and resources** for personnel involved in data collection, management, analysis, and reporting. This includes improving technical skills and providing necessary tools to handle data effectively.

e) **Developing Robust Monitoring Plans:** Encourage the systematic development and implementation of detailed monitoring plans for each policy or measure. These plans should specify measurement and data collection methods, data sources, monitoring frequency, units of measure, and verification procedures.

- **Agriculture Policy Assessment for Malawi (Livestock):** Globally agricultural policies are often deemed essential to meeting the increasing demand for sustainable food and nutrition safety. The increasing demand for food presents an opportunity for local government ministries to develop agricultural policies

7. Appendix

Agenda from the Policy Impact Assessment Workshop

Time Slot *(Malawi Time)*	**Session**	**Description**	**Lead**
08:30 – 09:00	Registration and Coffee		Yamikani
09:00 – 09:15	Welcome - Session Purpose and Objectives.	• Overview of the session's purpose and what we aim to achieve today.	Ricardo - Charis
09:15 – 09:45	Steps 1 & 2: Identifying Effects of Measures	• Recap of key steps in mapping the impact of mitigation measures • Overview of policy impact causal chains	Ricardo - Sabina
09:45 – 10:15	Step 3.1 – 3.2: Estimating GHG Effects	• Understanding and estimating the GHG effects of measures • Comparing Business-As-Usual (BAU) and mitigation scenarios	Ricardo - Dom
10:15 – 11:00	Group Exercise 1: Estimating GHG Effects	• Group work to map out policy scenarios and estimate GHG impacts	Sectoral Groups
11:00 – 11:15	Group Feedback	• Presenting outputs from group discussions	Yamikani and Sectoral Leads
11:15 – 11:30	Break		
11:30 – 11:55	Live Demonstration: GACMO Tool and Malawi NDC tracking Excel	• Demonstration of how to track NDC implementation using the GACMO tool	Ricardo – Dom & Charis
11:55 – 12:15	Step 3.3: Monitoring Progress of NDCs	• Tracking NDC progress over time • Sectoral examples of data collection and monitoring	Ricardo - Sabina
12:15 – 12:45	Open Discussion: Gathering and Collecting Data for Indicators	• Stakeholders to discuss and assess the availability of relevant data, data gaps, and existing institutional arrangements for collecting.	Sectoral Groups
12:45 – 12:55	Q&A		Yamikani and Ricardo
12:55 – 13:00	Next Steps & Workshop Close	• Summary of key takeaways and integration into Malawi's NDC Tracking Framework	Yamikani and Ricardo