ICAT Initiative for Climate Action Transparency

Diagnostic Study on Namibia's Energy and AFOLU Sectors

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Initiative for Climate Action Transparency - ICAT

Diagnostic Study on Namibia's Energy and AFOLU Sectors

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Executive Summary

This study provides a comprehensive assessment of Namibia's energy and Agriculture, Forestry, and Other Land Use (AFOLU) sectors to evaluate their current status, identify challenges, and develop pathways for achieving Namibia's climate commitments as outlined in its Nationally Determined Contributions (NDCs). The assessment aligns with international guidelines, including those from the Initiative for Climate Action Transparency (ICAT), the Intergovernmental Panel on Climate Change (IPCC), and the United Nations Framework Convention on Climate Change (UNFCCC). The study's objective is to inform policy and strategic planning to transition Namibia towards a low-carbon, resilient economy while promoting sustainable development.

Key Objectives

The primary objectives of the study were to:

- Review and analyse existing energy and AFOLU sector policies, frameworks, and data management systems.
- Assess the quality, availability, and consistency of greenhouse gas (GHG) emissions data.
- Develop emissions projections under various scenarios, including Business-As-Usual (BAU), Policy Implementation, High-Ambition Mitigation, and Low-Carbon Development.
- Recommend actions to enhance Namibia's Monitoring, Reporting, and Verification (MRV) systems, policy implementation, and stakeholder engagement.

Methodology

The study employed a multi-disciplinary approach, utilizing both quantitative and qualitative methods. It integrated desk research, data analysis, stakeholder consultations, and scenario modelling. The models used included the Long-range Energy Alternatives Planning System (LEAP) for energy projections, GLOBIOM and EXACT for the AFOLU sector, and GACMO for assessing mitigation costs and impacts across sectors. Data was collected from government agencies such as the Ministry of Mines and Energy, Ministry of Agriculture, Water, and Land Reform, Namibia Statistics Agency, and the Namibia Energy Institute, as well as international partners like UNDP, ICAT, and GEF.

Key Findings

The study's findings reveal several critical insights into Namibia's energy and AFOLU sectors:

1. ***Data Gaps and Inconsistencies:*** Both sectors face significant data gaps and inconsistencies, particularly in the frequency and quality of data collection. The fragmented nature of data systems across different institutions affects the accuracy and

reliability of Namibia's GHG inventory, making it challenging to produce a unified emissions profile.

2. ***Institutional Capacity and Technical Constraints:*** Namibia's institutions lack adequate technical skills and resources for managing, analysing, and reporting emissions data. This gap hinders the development of effective MRV systems and the alignment of national data management practices with international standards.
3. ***Emissions Projections Scenarios:*** The Business-As-Usual (BAU) scenario shows a significant increase in emissions if no further mitigation measures are implemented.
    - The Policy Implementation Scenario reflects a moderate reduction in emissions but emphasizes the need for strengthened policies to meet NDC targets.
    - The High-Ambition Mitigation Scenario illustrates that aggressive renewable energy deployment and sustainable land management could lead to near-zero emissions by 2050. Under this ambitious pathway, Namibia could achieve substantial emissions reductions, aligning with global climate targets. In this scenario, emissions reductions of up to 87% by 2050 compared to BAU projections could be achieved through extensive renewable energy deployment, land-use management, and climate-smart agriculture. Achieving near-zero emissions in the energy sector would establish Namibia as a leader in regional climate action by 2050.
    - Low-Carbon Development (LCD) Scenario: Balancing economic development with emissions reduction, the LCD scenario demonstrates that Namibia could achieve sustainable growth with a significant reduction in emissions. By 2035, this pathway could reduce emissions by approximately 39% compared to the BAU, supporting socio-economic resilience through green infrastructure, sustainable agriculture, and community-led forestry initiatives.

4. ***Stakeholder Engagement:*** Effective stakeholder engagement was identified as crucial for the successful implementation of emissions reduction strategies. Insights from the Inception Workshop and consultations highlighted the need for better coordination between government, private sector, and community groups to enhance collaboration and policy execution.

Recommendations

Based on the findings, the study outlines several key recommendations:

1. *Improve Data Collection and Management Systems:*
    - Develop a centralized data management platform integrating energy and AFOLU sector data, incorporating GIS technology and real-time monitoring tools for improved emissions tracking.
    - Establish standardized protocols for data collection and reporting, aligned with ICAT and IPCC methodologies to ensure transparency and comparability.
2. *Enhance Institutional Capacity:*
    - Invest in capacity-building programs focusing on MRV methodologies, GHG accounting, and the use of advanced analytical tools like GIS and remote sensing.
    - Strengthen partnerships with international organizations to access technical assistance and align Namibia's MRV systems with international best practices.
3. *Accelerate Policy Implementation and Mitigation Actions:*

- Prioritize renewable energy projects by enhancing private sector incentives and regulatory streamlining, expanding solar and wind initiatives to reduce fossil fuel dependence.
- Promote sustainable land management and climate-smart agriculture through policy support and capacity building, focusing on smallholder farmers and community forestry programs.
- Integrate low-carbon development strategies into Namibia's national plans to align climate action with economic growth and social benefits, such as job creation and improved livelihoods.

Next Steps

To implement these recommendations effectively, the study proposes the following steps:

- *Formation of a Technical Working Group:* Establish a group comprising representatives from government ministries, private sector entities, NGOs, and international partners to oversee implementation and coordination efforts.
- *Development of an Implementation Plan:* Outline specific actions, timelines, and resource allocations, including monitoring and evaluation mechanisms to track progress and adapt strategies as necessary.
- *Securing Funding and Partnerships:* Mobilize resources from international and national sources, such as the UNDP and GEF, to support technical infrastructure upgrades, training programs, and renewable energy initiatives.
- *Regular Stakeholder Engagement:* Organize regular workshops and consultations to update stakeholders on progress, gather feedback, and adjust strategies, ensuring inclusivity and effective policy implementation.

Conclusion

The study provides a detailed baseline for Namibia's energy and AFOLU sectors, identifying strengths, weaknesses, and opportunities for improvement. By enhancing data management, strengthening institutional capacities, and integrating stakeholder input, Namibia can build a transparent, efficient, and robust system for emissions tracking and climate action. These efforts will support Namibia in meeting its climate commitments, transitioning to a sustainable low-carbon economy, and ensuring socio-economic resilience and development for its people.

1 Introduction

1.1 Background and Context

Namibia's energy sector plays a crucial role in its economic development, socio-economic progress, and efforts to combat climate change. The country, with its abundant natural resources such as solar and wind, has the potential to develop a sustainable and diversified energy sector. However, despite this potential, Namibia faces significant challenges, including high dependency on imported energy, limited infrastructure for renewable energy development, and barriers in policy implementation and stakeholder engagement.

The importance of this study lies in its focus on understanding and evaluating these challenges within the context of Namibia's commitment to global climate agreements like the Paris Agreement and its own Nationally Determined Contributions (NDCs). By assessing the current situation and identifying existing barriers, this study aims to provide insights into how Namibia can strengthen its energy sector to effectively meet its sustainability and emission reduction goals.

1.2 Objectives of the Study

The primary objective of this study was to conduct a comprehensive analysis of Namibia's energy sector by ICAT's methodologies and guidelines. The assessment focused on the following key areas:

- ***Analysis of the Current Energy Landscape:*** The study evaluated Namibia's existing energy infrastructure, policy frameworks, and renewable energy initiatives. It provided insights into the country's energy production capacities, consumption patterns, and dependence on imported energy sources.
- ***Identification of Barriers and Challenges:*** The study identified critical barriers to the development and scaling of renewable energy projects. It explored technical, financial, regulatory, and data management challenges, including gaps in monitoring and evaluation (M&E) systems.
- ***Evaluation of Institutional and Governance Arrangements:*** An assessment was conducted on the effectiveness of the existing institutional framework responsible for energy management, including government bodies' and stakeholders' roles and coordination mechanisms. This determined the capacity and effectiveness of these institutions in policy development, implementation, and oversight.
- ***Recommendations for Sectoral Improvement:*** Based on the findings, the study provided targeted recommendations to enhance the effectiveness of Namibia's energy sector. The recommendations focused on improving data collection systems, stakeholder coordination, and the integration of policies and technologies that promote renewable energy use.

The accomplishment of these objectives supports Namibia's progress towards a resilient and sustainable energy system, aligning with its international climate commitments and national development goals, as emphasized by ICAT's framework. This approach ensured consistency, transparency, and comparability of the results, aiding Namibia in achieving its Nationally Determined Contributions (NDCs) and other climate action commitments.

2 Methodology

This study utilized a multi-faceted approach, integrating quantitative and qualitative methods aligned with the Initiative for Climate Action Transparency (ICAT) guidelines to assess Namibia's energy and Agriculture, Forestry, and Other Land Use (AFOLU) sectors. The methodologies included data collection, stakeholder engagement, scenario development, and model application to ensure a robust and transparent analysis.

2.1 Scope of the Study

The assessment focused on understanding current emissions trends, barriers, and opportunities within Namibia's energy and AFOLU sectors, covering the following components:

- ***Energy Production and Infrastructure:*** Evaluated current energy production facilities, including fossil fuel-based and renewable energy infrastructure (solar, wind, and biomass).
- ***Regulatory and Policy Frameworks:*** Analysed existing energy policies, regulations, and strategies, particularly those aligned with Namibia's Nationally Determined Contributions (NDCs) under the Paris Agreement.
- ***Data Collection and Management Systems:*** Assessed institutional arrangements and processes for the monitoring, reporting, and verification (MRV) of greenhouse gas (GHG) emissions and energy data.
- ***Stakeholder Engagement and Institutional Mapping:*** Mapped key stakeholders and institutions in the energy sector, focusing on their roles, responsibilities, and coordination mechanisms.
- ***Identification of Barriers and Challenges:*** Analysed technical, financial, and capacity-related barriers affecting energy sector development and policy implementation.

2.2 Methodologies Used

The methodologies employed in this study were designed to provide a comprehensive understanding of Namibia's energy sector dynamics and to identify actionable pathways for improvement. The study followed a multi-faceted approach, utilizing quantitative, qualitative, and participatory methods, in accordance with the Initiative for Climate Action Transparency (ICAT) tools and guidelines.

2.2.1 Desk Research and Literature Review:

The study began with a comprehensive review of relevant literature, including Namibia's Nationally Determined Contributions (NDCs), National Communications (NCs), Biennial Update Reports (BURs), and existing energy sector policies and strategies. ICAT guidance documents and other international best practices were referenced to align the methodologies with global standards for transparency, data collection, and monitoring.

2.2.2 Data Collection and Analysis:

Quantitative data was collected from government agencies, including the Ministry of Mines and Energy, Namibia Statistics Agency, and the Namibia Energy Institute, covering energy

production, consumption patterns, emissions levels, and renewable energy capacity. In addition, qualitative insights were gathered through interviews and consultations with key stakeholders, such as government officials, private sector representatives, civil society organizations, and experts in the energy and environmental sectors.

2.2.3 Stakeholder Consultations and Workshops:

Stakeholder consultations involved conducting an inception workshop and multiple focus-group discussions with key stakeholders from government, civil society, the private sector, and academic institutions. These sessions included X workshops and involved Y participants from various sectors, enabling a broad representation of perspectives. Stakeholders provided insights on existing policies, challenges, and mitigation opportunities, which were incorporated into scenario development and policy recommendations. This engagement process facilitated alignment on objectives and methodology, enhancing transparency and inclusivity and Modelling**: The study developed emissions scenarios using models such as:

- LEAP (Long-range Energy Alternatives Planning System) for energy sector projections.
- GLOBIOM and EXACT models for AFOLU sector analysis.
- GACMO (Greenhouse Gas Abatement Cost Model) to evaluate mitigation costs and impacts across sectors.

These tools supported a comprehensive understanding of potential emissions trajectories under different scenarios, such as Business-As-Usual (BAU), Policy Implementation, High-Ambition Mitigation, and Low-Carbon Development (LCD). Data from stakeholder consultations were systematically integrated into the scenario models to reflect sector-specific insights on feasibility, local capacity, and policy impacts.

2.2.4 Use of ICAT Tools and Guidelines:

The study utilized ICAT's sectoral assessment tools, specifically the "Renewable Energy Assessment Tool" and the "Greenhouse Gas Mitigation Assessment Tool," to evaluate the effectiveness of existing policies and model potential pathways for Namibia's energy sector development. Additionally, ICAT's Monitoring, Reporting, and Verification (MRV) guidelines were applied to assess the current MRV system in Namibia and propose improvements, ensuring that the study's recommendations align with international standards for transparency and accuracy in climate action reporting.

2.2.5 Institutional Mapping and Analysis:

Institutional mapping was conducted to identify the key organisations and agencies involved in the energy sector and evaluate their roles, capacities, and inter-institutional coordination mechanisms. The study applied ICAT's institutional mapping framework to pinpoint capacity gaps and overlaps, proposing a streamlined approach for effective governance and collaboration.

2.2.6 Gap and Barrier Analysis:

A systematic analysis was carried out to identify barriers and challenges in policy implementation, renewable energy deployment, and data management systems. The study employed ICAT's "Barrier Analysis Tool" to categorize these challenges into technical, financial, regulatory, and capacity-based issues, and to propose solutions based on international best practices.

2.2.7 Scenario Development and Modelling:

The study developed scenarios for Namibia's energy sector using a combination of ICAT tools and other sector-specific modelling approaches. These scenarios explored different pathways for renewable energy expansion, emission reductions, and policy implementation over short, medium, and long-term horizons.

2.2.8 Synthesis and Reporting:

The collected data and insights were synthesized into a comprehensive report following ICAT's guidelines for sectoral studies. The report outlines the current state, barriers, and opportunities in Namibia's energy sector, providing a detailed roadmap for future action.

3 Stocktaking Exercise

Current Status of Data Collection, Data Sources, and Institutional Arrangements:

3.1 Energy Sector

3.1.1 Review of Existing Documentation and Data Sources:

Overview of Document Review

The stocktaking exercise for Namibia's energy sector began with a comprehensive review of key national documents to establish a foundational understanding of the country's energy landscape, climate commitments, and policy framework. The review included Namibia's Nationally Determined Contributions (NDCs), National Communications (NCs), Biennial Update Reports (BURs), and sectoral strategies such as the National Renewable Energy Policy. These documents were analysed to understand targets for greenhouse gas (GHG) emissions reduction, renewable energy development, and other climate action strategies. The NCs provided insights into Namibia's climate policies, including mitigation and adaptation measures, while the BURs offered additional data on the GHG inventory, trends in emissions, and the results of policy interventions.

Evaluation of the National Renewable Energy Policy

The National Renewable Energy Policy was examined to understand strategic priorities, objectives for increasing renewable energy capacity, and the regulatory environment designed to promote sustainable energy initiatives. This provided insight into the government's strategic approach to renewable energy development.

Identification and Utilization of Data Sources

Government Agencies as Primary Data Sources

In addition to reviewing policy documents, the study identified and utilized a wide range of data sources to evaluate the availability, quality, and consistency of information relevant to Namibia's energy sector. Reports from key government agencies, such as the Ministry of Mines and Energy, Namibia Statistics Agency, and the Namibia Energy Institute, formed the primary basis for data collection. These reports provided information on energy production capacities, consumption patterns, infrastructure development, and emissions levels.

Specific Data Contributions from Agencies

For instance, the Ministry of Mines and Energy's reports detailed the operational capacities of fossil fuel-based power plants and renewable energy facilities, such as solar and wind farms. The Namibia Statistics Agency contributed data on energy consumption patterns across sectors, highlighting usage in households, industry, and transport. The Namibia Energy Institute's data on renewable energy capacity growth was crucial for understanding the sector's progress towards sustainability.

Supplementary Research Studies and External Reports

Independent and International Perspectives

To complement official sources, the study reviewed research studies and academic publications that provided independent analyses of energy efficiency, renewable energy potential, and environmental impacts. Reports from international agencies and non-governmental organizations (NGOs), such as the United Nations Development Programme (UNDP) and the Global

Environment Facility (GEF), offered external perspectives and information on international assistance programs supporting Namibia's energy transition.

Use of Emissions Inventories and Infrastructure Reports

Energy production records and emissions inventories were accessed to provide historical and current emissions data, which helped construct a comprehensive emissions profile for the sector. Infrastructure reports, including technical specifications and performance data of existing energy facilities, were analysed for insights into efficiency levels and operational status.

Assessment of Data Availability, Quality, and Consistency

Evaluation of Data Availability

The study conducted a detailed assessment of data availability, identifying accessible information on energy production, consumption, and emissions, as well as gaps. It was noted that data on fossil fuel energy production was well-documented, while information on small-scale renewable energy installations, especially in rural areas, was inconsistently recorded.

Assessment of Data Quality

The quality of the collected data was evaluated by cross-referencing multiple sources to verify reliability and accuracy. This involved comparing official government data with independent studies and international reports to identify discrepancies. For instance, emission figures from the GHG inventories were matched with international data to verify consistency.

Assessment of Data Consistency

The consistency of the data across various reports and sources was assessed by examining coherence in methodologies, units of measurement, and adherence to reporting standards. Discrepancies in measurement units or methodological approaches were highlighted as areas for improvement, emphasizing the need for harmonized data collection practices across institutions.

Identification of Key Gaps and Recommendations

Identification of Data Management Gaps

The study identified critical gaps in Namibia's energy data management systems, such as the absence of coordinated monitoring systems for small-scale renewable projects and inconsistencies in rural energy access data. These gaps informed the prioritization of actions to enhance data collection and reporting systems.

Recommendations for Improvement

Recommendations included establishing a harmonized and integrated data management framework based on international best practices, such as those outlined by the Initiative for Climate Action Transparency (ICAT). The aim was to develop a unified system that enhances transparency, accuracy, and consistency in reporting energy sector data, supporting Namibia's climate action goals.

Establishing a Baseline for Future Action

Baseline Development for Evidence-Based Recommendations

Through this comprehensive stocktaking exercise, the study aimed to provide a clear and accurate picture of Namibia's energy sector, identifying strengths, weaknesses, and opportunities for improvement. This detailed baseline set the foundation for developing evidence-based and actionable recommendations aligned with national priorities and international climate commitments.

3.1.2 Description of Institutional Arrangements:

The energy sector in Namibia is managed by a network of institutions that include government ministries, regulatory bodies, and state-owned enterprises. The Ministry of Mines and Energy is the primary government body responsible for overseeing energy policy formulation, strategy development, and sectoral oversight. Regulatory functions are primarily handled by the Electricity Control Board (ECB), which monitors compliance with energy regulations, oversees tariff structures, and ensures that energy operations align with national policies. NamPower, the state-owned utility company, is responsible for electricity generation, transmission, and distribution across Namibia.

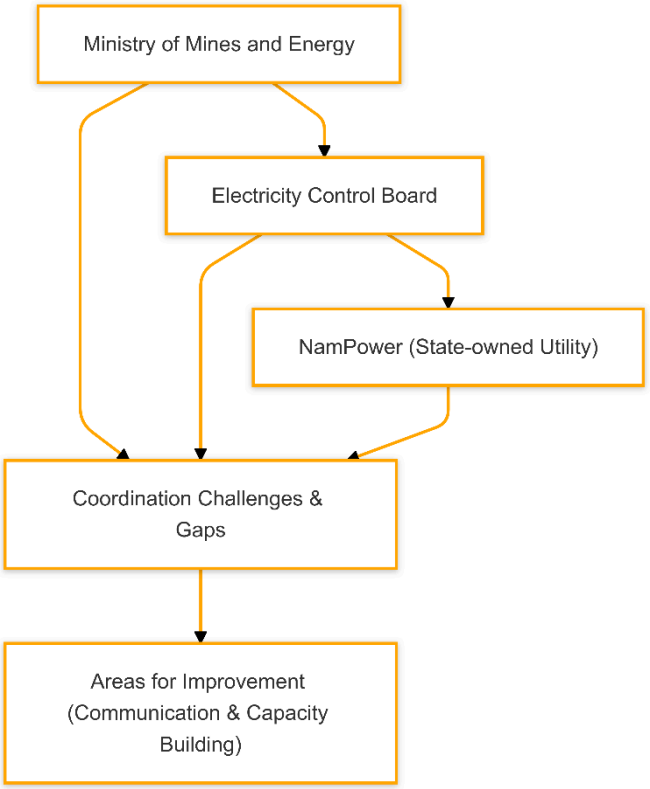

Figure 1. Governance Structure and Coordination Challenges in Namibia's Energy Sector.

Figure 1 provides a visual representation of the governance structure and highlights the coordination challenges in Namibia's energy sector. Despite this structured network, the coordination among these institutions is often hampered by overlapping roles and responsibilities, leading to inefficiencies in policy implementation and regulatory enforcement. The study identifies that these challenges are largely due to a lack of clear communication protocols and well-defined roles, resulting in fragmented efforts in energy production, data management, and regulatory oversight. For instance, while the Ministry of Mines and Energy sets strategic priorities, the regulatory enforcement by the ECB and operational activities by NamPower may not always align due to differing interpretations and a lack of synchronised planning.

The analysis highlights the critical need for improved institutional coordination and capacity building to enhance the efficiency of Namibia’s energy sector. Strengthening the communication channels between these entities, clearly delineating their roles, and building their technical and administrative capacities are essential steps to ensure effective policy implementation, monitoring, and data collection. Improved collaboration and capacity development will not only

streamline energy governance but also support the achievement of Namibia's climate and development objectives.

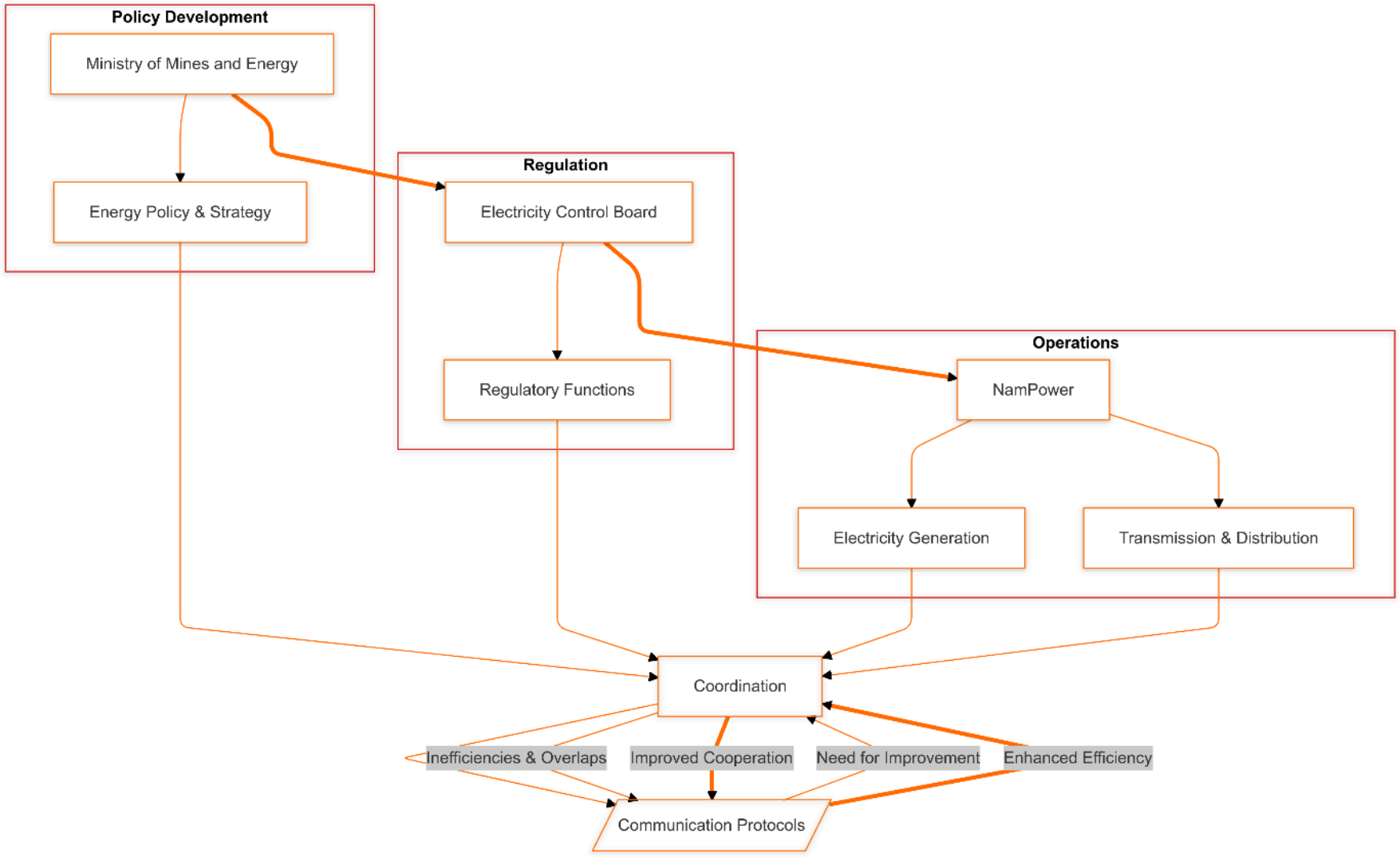

Figure 2. Institutional Structure and Coordination Mechanisms in Namibia's Energy Sector.

Figure 2 illustrates the institutional structure and coordination mechanisms within Namibia's energy sector, highlighting the roles of key entities and their interdependencies. It visualizes the flow of responsibilities from policy development to regulation and operations, while also emphasizing the coordination challenges that exist among these institutions.

- At the policy development level, the Ministry of Mines and Energy is responsible for establishing energy policy and strategy. This body provides the overarching direction for the sector, setting priorities and strategic goals for energy development and climate commitments.
- The Electricity Control Board (ECB) functions as the regulatory authority, ensuring that policies formulated by the Ministry are enforced through its regulatory mandates. The ECB oversees the compliance of energy operations with national energy policies, particularly focusing on tariff structures, regulatory standards, and energy market regulations.
- On the operations side, NamPower, the state-owned utility, manages the core functions of electricity generation and transmission & distribution. This entity executes the practical aspects of Namibia's energy strategy, including the implementation of renewable energy projects and the maintenance of transmission infrastructure.
- The diagram highlights coordination as a central and interconnected element across these institutions. It illustrates how the Ministry, ECB, and NamPower must cooperate effectively to ensure efficient energy sector management. However, the diagram also identifies inefficiencies and overlaps, as well as a need for improvement in communication protocols. These challenges arise due to unclear delineation of roles and inadequate coordination mechanisms, which can lead to misalignment between policy objectives, regulatory enforcement, and operational execution.
- The bottom section of the diagram in Figure 2 presents key areas that need enhancement to achieve improved cooperation and enhanced efficiency. Establishing clear communication protocols and improving capacity building across institutions are emphasized as necessary steps to optimize the sector’s performance and achieve Namibia’s energy and climate goals effectively.

3.1.3 Key Priorities for MRV Systems, Projections, and NDC Tracking:

Development of MRV Systems

The development of priorities for Monitoring, Reporting, and Verification (MRV) systems in Namibia’s energy sector centres on enhancing transparency, accuracy, and compliance with international climate commitments. The primary objective is to establish a robust MRV system aligned with the Initiative for Climate Action Transparency (ICAT) guidelines. ICAT provides a framework designed to improve the reliability and transparency of emissions data, which is crucial as Namibia seeks to strengthen its climate action reporting. The current MRV framework requires refinement to ensure comprehensive coverage of all energy-related activities, including fossil fuel and renewable energy production, transmission, and distribution. By adhering to ICAT standards, Namibia can improve the accuracy of emissions tracking, assess progress toward its climate goals, and ensure consistency with reporting requirements set by the United Nations Framework Convention on Climate Change (UNFCCC) and other international agreements.

Strengthening Projections Methodologies

Accurate forecasting of energy demand, supply, and greenhouse gas (GHG) emissions is essential for effective policy planning and evaluation. The study highlights the need for robust modelling approaches that incorporate policy pathways, technological advancements, and socio-economic factors influencing the energy sector. These models must simulate different scenarios, including increased renewable energy penetration, energy efficiency measures, and potential policy interventions. By enhancing projections methodologies, Namibia can better anticipate future trends and make informed decisions that align with sustainable development and emission reduction goals. Improved projections also enable the development of contingency plans, addressing potential risks and uncertainties to ensure that Namibia's energy strategy remains adaptable and resilient.

Developing Effective NDC Tracking Mechanisms

Establishing clear and effective tracking mechanisms for Namibia's Nationally Determined Contribution (NDC) targets is critical for the country's climate strategy. Namibia's NDC outlines its commitment to reducing emissions and transitioning to a low-carbon economy. To achieve these targets, a structured approach is needed to link activities within the energy sector to the overarching NDC goals. The study identifies the need for an integrated tracking system that monitors energy sector performance against NDC benchmarks, ensuring alignment with emission reduction commitments. This involves establishing indicators and metrics that measure progress in areas such as renewable energy expansion, energy efficiency improvements, and emissions reductions from different energy sources.

Centralised Data Platform for Enhanced Tracking

To support effective NDC tracking, the study proposes developing a centralized data platform that consolidates information from key institutions like the Ministry of Mines and Energy, the Namibia Statistics Agency, and NamPower. Such a platform would aggregate data on energy production, consumption, and emissions, providing a comprehensive view of the sector's performance. By integrating this platform with the MRV system, real-time monitoring and reporting can be achieved, enhancing policymakers' ability to adjust strategies and maintain compliance with international reporting standards.

Capacity Building for Stakeholders

The study also emphasizes the importance of capacity building among stakeholders to ensure the availability of technical skills needed for implementing and maintaining these advanced tracking systems. Training programs and skill development initiatives are essential to empower personnel in managing, monitoring, and reporting emissions accurately and efficiently.

By focusing on these priorities, Namibia aims to establish a transparent and efficient MRV system, enhance its capacity to forecast future energy scenarios accurately and develop robust tracking mechanisms for its NDC commitments. This comprehensive approach aligns Namibia's energy sector activities with national and international climate obligations, supporting the country's transition to a more sustainable and resilient energy system.

3.2 AFOLU Sector

3.2.1 Review of Existing Documentation and Data Sources

Document Review for AFOLU Sector

The assessment of Namibia's AFOLU (Agriculture, Forestry, and Other Land Use) sector began with a comprehensive review of key national and sectoral documents, mirroring the approach used for the energy sector. This review included Namibia's Nationally Determined Contributions (NDCs), National Communications (NCs), Biennial Update Reports (BURs), and other strategic documents such as the National Climate Change Strategy and Action Plan. These documents provided insights into Namibia's commitments and strategies for mitigating emissions and managing resources in the AFOLU sector. For example, the NDCs detailed targets for reducing emissions from agricultural practices and enhancing carbon sequestration through improved forestry management and sustainable land-use practices. The National Climate Change Strategy and Action Plan further outlined measures aimed at promoting sustainable agricultural techniques and increasing forest cover in Namibia.

Data Sources and Institutional Inputs

To support the document review, the study utilized a variety of data sources from key institutions involved in the AFOLU sector. Primary data was collected from the Ministry of Agriculture, Water, and Land Reform, responsible for overseeing agricultural policies, water management, and land-use planning. The Namibia Statistics Agency provided essential data on agricultural outputs, livestock populations, and land use trends. Additionally, data from conservation and forestry organizations, both governmental and non-governmental, were incorporated to provide insights into forestry practices, deforestation rates, and conservation efforts. NGOs working on community-based natural resource management (CBNRM) programs also contributed valuable data on forest resource management and biodiversity protection.

Evaluation of Emissions and Land Use Data

The evaluation of data collection practices focused on emissions from agricultural activities, such as methane emissions from livestock and rice cultivation, as well as nitrous oxide emissions from fertilizer application. The assessment also included deforestation rates and changes in land-use patterns, critical for understanding the sector's emissions profile and carbon sequestration potential. While livestock population and agricultural output data were generally well-documented, inconsistencies were noted in the calculation and reporting of emissions from these sources. For instance, variations in methods for estimating methane emissions from livestock led to discrepancies in the reported data.

Identifying Gaps and Inconsistencies

The assessment revealed significant gaps in the consistency and reliability of data, particularly regarding non-CO2 emissions like methane from livestock and nitrous oxide from soil management. Accurate tracking of land-use changes was also identified as a major issue, given its importance in understanding carbon sequestration and emissions resulting from deforestation and land degradation activities. The lack of standardized data collection methods across institutions further contributed to these gaps, complicating the production of reliable estimates for the AFOLU sector's emissions profile.

Fragmentation in Data Collection Efforts

While there are ongoing efforts by conservation organizations to monitor deforestation and land-use changes, these activities are often fragmented and not fully integrated into national data management systems. For instance, some NGOs have detailed data on specific regions where they operate, but this information may not be harmonized with the national data sets managed by governmental bodies. Such fragmentation underscores the need for improved coordination and data sharing among various stakeholders involved in the AFOLU sector.

Addressing Gaps and Recommendations

Standardization and Coordination

Addressing these data gaps is crucial for Namibia to accurately track and report emissions from the AFOLU sector as part of its climate commitments. The study suggests implementing standardized data collection methods and improving coordination among stakeholders, including government agencies, NGOs, and international partners, to enhance the consistency and reliability of emissions data.

Capacity Building for Enhanced Data Management

The study also recommends capacity-building initiatives to develop the technical skills required for accurate data collection and reporting within relevant institutions. By strengthening the data management systems in the AFOLU sector, Namibia can improve its ability to monitor progress towards its NDC targets and make informed decisions for sustainable land and agricultural management practices.

3.2.2 Key Priorities for MRV Systems, Projections, and NDC Tracking

The development of Monitoring, Reporting, and Verification (MRV) systems tailored to the AFOLU sector is a critical priority for Namibia to effectively manage and report emissions related to agriculture, forestry, and other land use activities. The implementation of such an MRV system aims to accurately track emissions from key activities, including agricultural practices (such as livestock management and fertilizer use), deforestation, afforestation, and other land-use changes. Given the diverse and dispersed nature of the AFOLU sector, it is essential that this MRV system integrates data collected at both government and community levels. This approach ensures that data from large-scale agricultural operations, as well as smaller, community-based activities, is captured comprehensively. By leveraging the extensive knowledge and involvement of local communities in natural resource management, Namibia can develop a more inclusive and accurate MRV framework that reflects the true emissions landscape of the sector.

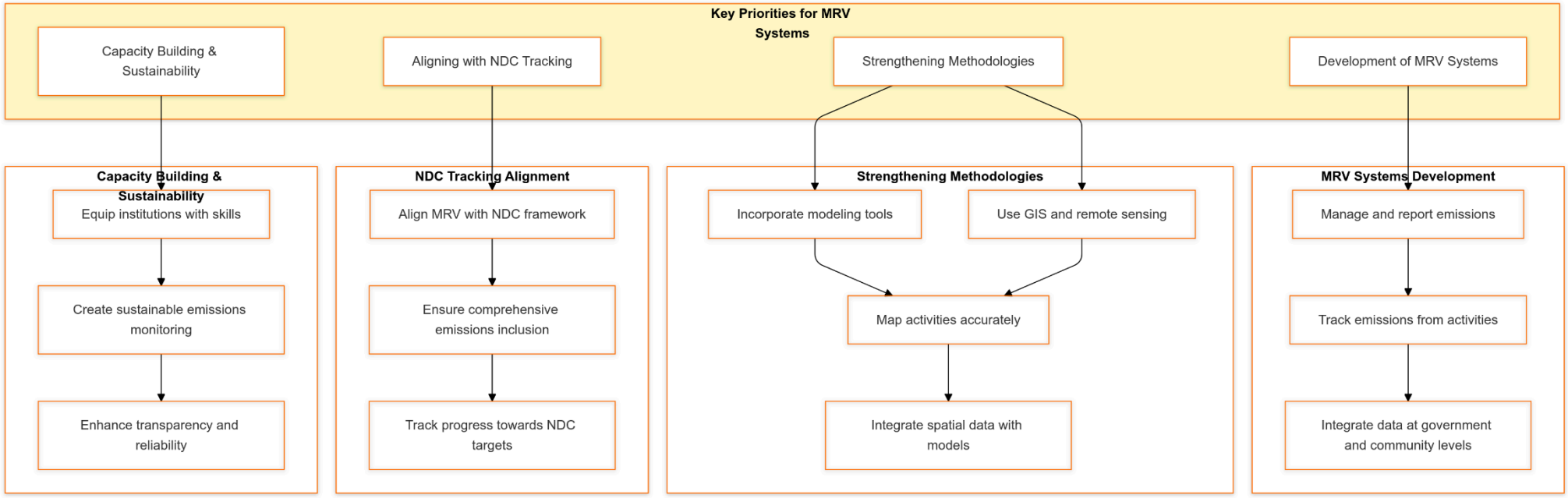

Figure 3. AFOLU Sector Key Priorities for MRV (Measurement, Reporting, and Verification) Systems Development.

Figure 3 illustrates the Key Priorities for MRV (Measurement, Reporting, and Verification) Systems Development specifically within the AFOLU (Agriculture, Forestry, and Other Land Use) sector. It highlights four core areas necessary for effective MRV system implementation: Capacity Building & Sustainability, NDC Tracking Alignment, Strengthening Methodologies, and Development of MRV Systems.

- ***Capacity Building & Sustainability:*** This area focuses on equipping institutions with the necessary skills to establish sustainable emissions monitoring systems that enhance transparency and reliability in reporting.
- ***NDC Tracking Alignment:*** Emphasizes the importance of aligning MRV systems with the NDC (Nationally Determined Contributions) framework to ensure comprehensive inclusion of emissions and accurate tracking of progress towards achieving NDC targets.
- ***Strengthening Methodologies:*** Involves the incorporation of modelling tools, GIS, and remote sensing technologies to map activities accurately and integrate spatial data, thus enhancing the precision of emissions estimates and sectoral analysis.
- ***Development of MRV Systems:*** Focuses on the establishment of mechanisms to manage, track, and report emissions from various activities. This priority area ensures that data integration occurs at both government and community levels, enhancing data accuracy and fostering inclusive participation.

Overall, the diagram in Figure 3 provides a structured approach for enhancing MRV systems within the AFOLU sector to support transparency, compliance with international commitments, and the attainment of climate-related targets.

Figure 4 outlines a hierarchal progression from foundational elements to more sophisticated actions. Foundational elements include improving data collection, enhancing capacity building, and aligning MRV systems with Nationally Determined Contribution (NDC) tracking. Once these foundations are established, the focus shifts to advanced actions such as technology integration, long-term sustainability, and continuity planning.

In addition, Figure 4 details specific actions needed under key priorities for MRV systems, breaking them into four interconnected areas: capacity building and sustainability, alignment with NDC tracking, strengthening methodologies, and developing MRV systems. For capacity building, the chart emphasizes equipping institutions with skills, creating sustainable emissions monitoring systems, and enhancing transparency. Aligning with NDC tracking involves integrating MRV systems into the NDC framework and tracking progress toward NDC targets. Strengthening methodologies focuses on using advanced tools like modelling, GIS, and remote sensing to enhance accuracy. Lastly, the development of MRV systems emphasizes the management and reporting of emissions and the integration of data across government and community levels.

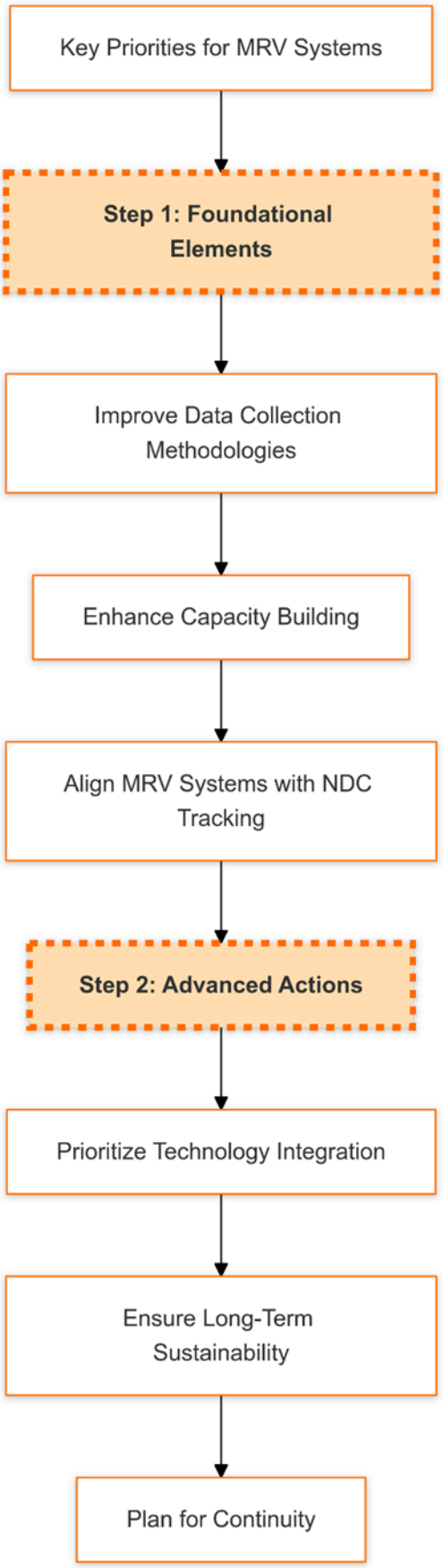

Figure 4. Key Priorities for MRV Systems – AFOLU

Together, Figures 3 and 4 create a cohesive narrative: the first provides the overarching strategy for developing MRV systems, while the second outlines the actions and methodologies necessary to achieve these goals. This framework ensures that MRV systems are technically robust and aligned with international climate goals and sustainable development objectives.

Strengthening Methodologies for Emissions Projections in the AFOLU Sector

To enhance the accuracy and predictive capacity of the MRV system, it is necessary to strengthen the methodologies used for emissions projections within the AFOLU sector. The study emphasizes the importance of incorporating advanced modelling tools and spatial data analysis techniques to better understand long-term trends in land-use dynamics and agricultural productivity. These methodologies should include the use of Geographic Information Systems (GIS) and remote sensing technologies to monitor changes in land cover and vegetation over time. Such technologies will help Namibia accurately map deforestation and afforestation activities, track changes in land use, and assess their impact on GHG emissions and carbon sequestration. Furthermore, integrating spatial data analysis with climate and socio-economic models will allow Namibia to create robust scenarios for agricultural development and land-use planning that account for climate variability, population growth, and policy interventions. This approach will provide the government and stakeholders with more precise data on potential emission pathways and the effectiveness of mitigation strategies.

Aligning AFOLU MRV Systems with Namibia's NDC Tracking Framework

Aligning the MRV system specifically for the AFOLU sector with Namibia's broader NDC tracking mechanism is another key priority. Given the significant contribution of the AFOLU sector to Namibia's overall greenhouse gas emissions, the sector's emissions must be comprehensively included in national reporting frameworks. By integrating the sectoral MRV system with the country's existing NDC tracking framework, Namibia can ensure that data from the AFOLU sector is systematically captured and contributes to the overall climate action planning and reporting process. This alignment will facilitate consistency between the emissions reported in national inventories and those used for international reporting under the United Nations Framework Convention on Climate Change (UNFCCC).

Additionally, integrating the AFOLU MRV system with the NDC framework will help track the progress of specific mitigation actions outlined in the NDC related to the sector, such as sustainable land management, conservation agriculture, and afforestation projects. This will not only improve the accuracy of the emissions data reported but will also enable Namibia to demonstrate its progress towards achieving the AFOLU-related targets set out in its NDC.

Ultimately, the alignment and integration of the MRV system will enhance the transparency and reliability of Namibia's climate action planning, ensuring that policies and actions taken within the AFOLU sector are effective and contribute to the country's overarching climate goals. To support this process, capacity-building initiatives must be implemented to equip government institutions, local authorities, and community organizations with the skills and technology needed to effectively operate and maintain the MRV system. This holistic approach will create a sustainable structure for emissions monitoring, projection, and reporting within Namibia's AFOLU sector, aligning it with international best practices and national climate commitments.

3.3 Synthesis of the Above Sections

The synthesis of the study's findings integrates insights from a detailed literature review, institutional mapping, and stakeholder consultations to present a comprehensive understanding of the current state of Namibia's energy and AFOLU sectors. This integrated approach provides

a foundation for improving Monitoring, Reporting, and Verification (MRV) systems and advancing sectoral policies.

Literature Review

The study commenced with an in-depth literature review to analyse key documents such as Namibia's Nationally Determined Contributions (NDCs), National Communications (NCs), and Biennial Update Reports (BURs). The review aimed to synthesize findings on the country's strategies, emissions data, and progress toward climate commitments. Policy documents and sectoral reports, such as the National Climate Change Strategy and Action Plan and the National Renewable Energy Policy, were examined to identify the main trends in emissions data and highlight gaps in data collection methodologies.

The review revealed that while Namibia has made efforts to develop comprehensive strategies for both the energy and AFOLU sectors, the implementation of data management systems remains inconsistent. This inconsistency poses challenges to the accuracy and reliability of national emissions inventories, particularly in tracking non-CO2 emissions from agriculture and land-use changes. The analysis suggests that while the policies and strategies are in place, practical application and follow-through in data management require significant improvement to meet international standards.

Institutional Mapping

The institutional mapping exercise identified and assessed the primary entities responsible for Namibia's energy and AFOLU sectors. The mapping highlighted the overlapping roles and responsibilities among key institutions, such as the Ministry of Mines and Energy, the Ministry of Agriculture, Water, and Land Reform, and regulatory bodies like the Electricity Control Board. The assessment evaluated these institutions' capacities and their effectiveness in managing data collection, emissions reporting, and policy implementation.

The exercise found that the current structure of institutional responsibilities often leads to inefficiencies and coordination challenges. For example, there is a lack of clear communication protocols between ministries and regulatory bodies, resulting in fragmented efforts and data inconsistencies. To address these issues, the study recommended establishing a more streamlined and clear chain of responsibilities among these entities. Furthermore, enhancing institutional capacities through targeted training and resource allocation is crucial for improving coordination and ensuring that all institutions involved have the technical expertise and tools necessary to manage data effectively.

Stakeholder Consultations

The study also conducted a series of stakeholder consultations, involving a diverse group of participants, including government officials, private sector representatives, and civil society organizations. These consultations aimed to gather insights into current practices, challenges, and opportunities within the energy and AFOLU sectors. The feedback collected through these consultations underscored several key issues, including technical and financial barriers that hinder effective data collection and reporting. For instance, stakeholders pointed out that limited financial resources often prevent the deployment of advanced technologies necessary for accurate emissions monitoring.

The consultations further highlighted the importance of capacity building and better resource allocation to address these challenges. Participants emphasised that building the technical skills of personnel involved in data management and emissions reporting is essential to improve the reliability of Namibia's climate reporting framework. Additionally, there was a strong consensus on the need to engage local communities, especially in the AFOLU sector, to ensure that data collection and monitoring practices are inclusive and accurately reflect on-the-ground realities. Involving communities not only increases the accuracy of data but also promotes local ownership and sustainability of climate action efforts.

Comprehensive Overview

By synthesizing these elements, the study provides a comprehensive overview of Namibia's energy and AFOLU sectors, offering a clear picture of their current status. The combined insights from the literature review, institutional mapping, and stakeholder consultations establish a solid groundwork for implementing improved MRV systems and sectoral policies. The study identifies critical gaps and areas of improvement, particularly in data management and institutional coordination, and provides actionable recommendations to enhance Namibia's ability to meet its climate commitments and accurately track progress toward its NDC targets. This synthesis serves as a foundation for the strategic development of the country's energy and AFOLU sectors, emphasizing the need for integrated, inclusive, and well-resourced approaches to climate action and reporting.

3.4 Key Findings: Present the main insights from the stocktaking exercise

The stocktaking exercise conducted for Namibia's energy and AFOLU sectors reveals several critical insights that highlight the strengths, weaknesses, and opportunities for improvement in these sectors. The findings are organised under key thematic areas: *data management, institutional arrangements, stakeholder engagement, and sectoral challenges*.

3.4.1 Data Management and Collection Systems

3.4.1.1 Energy Sector

Fragmented Data Collection Approach

The data management and collection systems in Namibia's energy sector are hindered by a fragmented approach. Various agencies and institutions, such as the Ministry of Mines and Energy, the Namibia Statistics Agency, and the Electricity Control Board, each manage specific aspects of energy data collection. However, there is no centralized or standardized system that integrates these diverse data streams. This fragmentation results in inconsistencies and discrepancies in the data, affecting the accuracy and reliability of emissions reporting. For instance, while one agency might focus on data related to fossil fuel consumption, another might manage data on renewable energy generation, leading to isolated data sets that do not reconcile to present a cohesive national emissions profile.

Impact on Emissions Reporting

The lack of coordination among agencies not only undermines the quality of emissions data but also hinders Namibia's ability to report accurately on its energy-related greenhouse gas (GHG) emissions in line with its international climate commitments under the Paris Agreement. Accurate and consistent data is critical for compiling comprehensive GHG inventories, developing effective climate policies, and assessing the impact of energy sector interventions aimed at reducing emissions. Without a unified system, these processes become less efficient and reliable, leading to challenges in monitoring progress towards national and international climate goals.

Misalignment with International Standards

The Monitoring, Reporting, and Verification (MRV) systems currently in place in Namibia's energy sector are not fully aligned with international standards, such as those outlined by the Initiative for Climate Action Transparency (ICAT). The ICAT guidelines emphasize the importance of transparent, accurate, and consistent data management practices, which are essential for credible international reporting. However, Namibia's MRV systems often lack integration with these standards, resulting in gaps in emissions tracking and reduced transparency in reporting. This misalignment makes it difficult for Namibia to meet its obligations under international

frameworks, and it limits the ability to validate the effectiveness of its policies and interventions in the energy sector.

Need for Capacity Building and System Integration

To address these issues, Namibia needs to implement comprehensive training programs and introduce advanced tools to enhance the capacity of national agencies responsible for data collection and emissions reporting. Capacity-building initiatives should focus on aligning Namibia's MRV systems with ICAT and other international requirements to improve data transparency and consistency. This may involve implementing digital platforms that integrate various data sources, standardizing methodologies across agencies, and ensuring that all stakeholders have access to accurate and up-to-date emissions data. By improving these systems, Namibia can more effectively track its progress towards achieving its Nationally Determined Contributions (NDCs) and other climate-related goals, ultimately enhancing the credibility and reliability of its international climate action reporting.

3.4.1.2 AFOLU Sector

Inconsistent Data Collection Practices

In the AFOLU (Agriculture, Forestry, and Other Land Use) sector, data collection methods vary significantly across institutions and are often reliant on outdated technologies and inconsistent practices. Different agencies, including the Ministry of Agriculture, Water, and Land Reform, and various conservation organizations, use diverse methodologies that lack standardization. For instance, data on livestock emissions and land-use changes are collected using disparate approaches, leading to variations in how emissions are measured and recorded. This inconsistency directly affects the overall accuracy of Namibia’s GHG inventory, making it difficult to compile a comprehensive and reliable emissions profile for the AFOLU sector. The use of non-standardized methods also creates challenges in aligning Namibia’s reporting with international standards, such as those set by the UNFCCC.

Limited Integration of Community-Level and Private Sector Data

Another critical gap identified in the AFOLU sector is the limited integration of data from community-level and private-sector activities. These data sources are essential for providing a complete picture of land use, agricultural practices, and forestry management. Community-level data, particularly from small-scale farmers and local forestry management projects, often capture valuable insights into traditional and sustainable land management practices. However, these contributions are frequently overlooked or insufficiently integrated into national data systems due to a lack of coordination and standardized reporting mechanisms.

Similarly, private sector data from commercial agricultural enterprises and forestry operations are not systematically included in the national inventory. This omission limits the comprehensiveness of the data and underrepresents the sector’s impact on emissions and carbon sequestration. The exclusion of these sources means that Namibia's overall emissions reporting may not accurately reflect on-the-ground realities, leading to gaps in understanding and managing the sector’s contributions to greenhouse gas emissions.

Need for Enhanced Coordination and Technological Integration

To address these challenges, improved coordination and collaboration with stakeholders, including local communities and the private sector, are essential. Establishing structured partnerships with these entities can facilitate the integration of diverse data sources and provide a more complete and accurate emissions inventory. Capacity-building initiatives should focus on equipping local communities and private sector entities with standardized tools and training, ensuring that their data collection practices align with national standards.

Additionally, integrating modern technologies such as Geographic Information Systems (GIS), remote sensing, and digital monitoring platforms can enhance the accuracy and consistency of data collected in the AFOLU sector. By moving away from outdated technologies and manual

practices, Namibia can streamline its data collection processes, ensuring that information from various sources is harmonized and contributes effectively to the national GHG inventory. This approach will not only improve the comprehensiveness of emissions tracking but also support Namibia in meeting its international reporting obligations and climate action targets.

3.4.2 Institutional Arrangements and Capacity

3.4.2.1 Energy Sector

Complex Institutional Landscape with Overlapping Responsibilities

The institutional structure of Namibia's energy sector is comprised of multiple entities, including the Ministry of Mines and Energy, the Electricity Control Board (ECB), and NamPower, the state-owned utility responsible for electricity generation and distribution. While these organizations play crucial roles in shaping energy policy, regulation, and operations, there is a lack of clarity in their roles and coordination mechanisms. The absence of clearly defined responsibilities leads to overlapping functions, particularly between the Ministry of Mines and Energy and the ECB, which both oversee regulatory aspects of the energy sector. This overlap results in inefficiencies in policy implementation and data management, as it is often unclear which entity is responsible for specific tasks, such as emissions reporting and regulatory compliance.

The lack of coordination not only creates redundancies but also complicates efforts to implement coherent policies and integrate monitoring systems effectively. For instance, while the Ministry of Mines and Energy sets strategic priorities, the ECB and NamPower may interpret and implement these directives differently, leading to fragmented and inconsistent efforts across the sector. This misalignment highlights the need for a streamlined and collaborative approach, where roles are clearly defined, and entities work together to ensure cohesive policy execution.

Capacity Constraints and Technical Limitations

Capacity constraints within these institutions present another significant challenge for Namibia's energy sector. Many of the key entities, including the regulatory bodies and operational agencies, lack the technical expertise and financial resources necessary to develop and maintain robust Monitoring, Reporting, and Verification (MRV) systems. This shortfall impedes their ability to effectively monitor energy-related activities, emissions, and the impact of implemented policies. For example, the Electricity Control Board faces difficulties in deploying advanced monitoring technologies and methodologies that are required for accurate and consistent data collection, which is essential for emissions tracking and compliance with international standards such as the ICAT guidelines.

In addition to technical limitations, financial constraints further exacerbate the capacity issues within these institutions. Insufficient funding prevents the hiring of qualified personnel and the acquisition of modern technologies necessary for establishing integrated MRV systems and conducting accurate energy projections. As a result, Namibia's ability to track progress towards its Nationally Determined Contributions (NDCs) and other climate commitments is compromised.

Recommendations for Institutional Improvement

Addressing these challenges requires a multifaceted approach focused on improving institutional coordination and building technical and financial capacity. First, clarifying and streamlining the roles of key institutions, such as the Ministry of Mines and Energy, the ECB, and NamPower, is essential to eliminate redundancies and enhance collaboration. Establishing a central coordination body or framework could facilitate more effective communication and alignment of strategies across entities.

Additionally, targeted capacity-building programs are necessary to develop the technical skills needed for MRV system implementation and data management. These programs should provide training in international best practices for emissions monitoring, data integration, and reporting

compliance. Moreover, securing financial resources, possibly through international partnerships or climate finance mechanisms, will be crucial for acquiring the technologies and tools required for establishing effective MRV systems and projections.

By addressing these institutional and capacity-related challenges, Namibia's energy sector can better position itself to implement its climate policies efficiently, improve its emissions reporting accuracy, and meet its national and international climate commitments.

3.4.2.2 AFOLU Sector:

Decentralized Data Management and Reporting Challenges

The AFOLU sector in Namibia operates under a decentralized structure that involves multiple ministries, such as the Ministry of Agriculture, Water, and Land Reform, as well as various community organizations and NGOs engaged in natural resource management and conservation. This decentralized approach, while beneficial for localized management and community involvement, poses significant challenges in establishing a cohesive and unified reporting framework for the sector. The involvement of diverse entities, each with its own data collection methodologies and reporting timelines, results in inconsistencies in the data gathered, making it difficult to compile and synthesize reports accurately for national-level tracking and international reporting obligations.

For example, while the Ministry of Agriculture, Water, and Land Reform may collect data on agricultural emissions, such as methane from livestock or nitrous oxide from fertilizer use, community organizations may focus on forestry data, including rates of deforestation and afforestation activities. Without a unified system to integrate these different data streams, the national greenhouse gas (GHG) inventory for the AFOLU sector becomes fragmented, affecting its reliability and accuracy. This lack of cohesion limits Namibia's ability to track progress against its Nationally Determined Contributions (NDCs) and complicates the process of meeting international reporting standards set by frameworks like the United Nations Framework Convention on Climate Change (UNFCCC).

Need for Capacity Building and Technical Expertise

A key issue identified in the AFOLU sector is the need for capacity building within both government agencies and community organizations involved in data collection and monitoring activities. Many of these entities lack the technical skills and understanding required for GHG reporting and integration into a cohesive national inventory. This skills gap contributes to inconsistencies in data management practices and undermines efforts to align with international GHG reporting standards, such as those outlined by the Intergovernmental Panel on Climate Change (IPCC).

To address these gaps, targeted training programs are necessary to enhance technical knowledge and skills related to data collection, emissions monitoring, and reporting standards. Such programs should focus on equipping personnel within government ministries with the competencies needed to use advanced technologies, such as remote sensing for monitoring land-use changes and digital platforms for data integration. Additionally, engaging community organizations in these capacity-building efforts is crucial, as they play an important role in collecting on-the-ground data related to forestry and agricultural activities. By improving their understanding of standardized reporting practices, these groups can contribute more effectively to the national GHG inventory, ensuring that local insights and data are accurately reflected.

Recommendations for Strengthening Institutional Capacity

To improve the cohesion and reliability of the AFOLU sector's data reporting, Namibia needs to establish a more integrated approach to data management that bridges the gap between decentralized local data collection and national-level reporting. This may involve creating a centralized platform that consolidates data from various sources, standardizes methodologies

across different entities, and ensures that all relevant stakeholders—both governmental and community-based—are aligned with national and international reporting requirements.
Furthermore, enhancing the collaboration between government agencies and community organizations is critical for building a unified reporting framework. Developing formal partnerships, supported by regular communication channels, can facilitate better data sharing and integration. These partnerships should also be supported by capacity-building initiatives that provide the technical training and resources needed to ensure all parties involved have the tools and skills required for accurate and consistent GHG monitoring and reporting.

By addressing these issues, Namibia can strengthen its institutional arrangements in the AFOLU sector, creating a more effective and cohesive framework for emissions reporting. This, in turn, will enhance the country's ability to track and report on its climate commitments accurately, contributing to more robust and reliable national GHG inventories that align with international best practices.

3.4.3 Stakeholder Engagement and Coordination

3.4.3.1 Energy Sector:

Fragmented Engagement Efforts

Stakeholder consultations conducted during the study highlighted that, while there are ongoing efforts to engage various entities—including private sector organizations, civil society groups, and local communities—these efforts are not fully integrated into the policymaking and implementation processes within Namibia's energy sector. While the Ministry of Mines and Energy, regulatory bodies like the Electricity Control Board, and other government agencies occasionally consult with stakeholders, such interactions are often limited to specific initiatives or projects, rather than being part of a continuous and structured engagement process. This lack of ongoing collaboration results in missed opportunities to leverage the expertise, resources, and innovation that the private sector and civil society could offer.
For example, private energy companies possess technical knowledge and innovative solutions that could significantly enhance the sector's efficiency and support renewable energy development. However, due to the fragmented and sporadic nature of their involvement, these entities are not adequately integrated into the broader framework of energy policy development and implementation. Civil society organizations and local communities, which play crucial roles in promoting sustainable energy practices and advocating for equitable energy access, also face similar challenges, as their input is not systematically incorporated into decision-making processes. This gap restricts the sector's ability to align policies with the needs and realities of the communities it serves.

Need for Structured and Continuous Engagement Mechanisms

The study underscores the need for Namibia's energy sector to establish structured and ongoing stakeholder engagement mechanisms. Such mechanisms should facilitate regular communication, feedback, and involvement from a diverse group of stakeholders, including private sector entities, civil society organizations, and local communities. A well-coordinated engagement framework would allow for continuous dialogue, ensuring that stakeholder insights are integrated throughout the policy lifecycle—from the development of new energy strategies to the implementation and monitoring of projects.
Private sector entities, for instance, should be engaged not only during consultation periods but as strategic partners in the energy transition process. This could include forming public-private partnerships (PPPs) that focus on developing renewable energy projects or implementing energy efficiency measures. By creating platforms for collaboration, the government can harness the

innovation and investment potential of the private sector to drive sustainable growth in the energy sector.

Engaging local communities through structured mechanisms is equally important, particularly for implementing renewable energy projects that affect rural areas. Involving communities in planning and decision-making ensures that energy policies and projects are more responsive to local needs and gain the necessary public support for successful implementation. Furthermore, community involvement can provide valuable grassroots perspectives that enhance the accuracy and inclusivity of energy data collection and monitoring processes.

Recommendations for Enhanced Stakeholder Engagement

To facilitate a more effective stakeholder engagement framework, Namibia's energy sector should implement several key actions. First, establishing formal multi-stakeholder forums or advisory councils can provide a structured platform for ongoing dialogue, enabling regular interaction between government agencies, the private sector, civil society, and community representatives. These forums should be tasked with ensuring that feedback from diverse groups is not only heard but actively incorporated into policy development and project implementation.
Second, creating incentives for private sector involvement, such as tax breaks or subsidies for companies investing in renewable energy projects, can encourage deeper and more sustained participation from businesses. By making the private sector a more integral part of energy policy planning and execution, Namibia can leverage its technical and financial capabilities to accelerate the sector's growth.

Finally, capacity-building initiatives for civil society and community groups can empower these stakeholders to participate more effectively in the energy sector. Providing training and resources to these groups ensures they have the knowledge and skills necessary to contribute meaningfully to policy discussions and implementation processes. This approach can help create a more inclusive, collaborative, and responsive energy sector, capable of meeting Namibia's climate goals and energy needs while fostering sustainable development.

3.4.3.2 AFOLU Sector:

Reliance on Community-Led Data Collection and Its Challenges

The AFOLU sector in Namibia heavily relies on community-led data collection efforts, which are integral to capturing on-the-ground realities related to agricultural practices, forestry management, and land-use changes. This community involvement is valuable as it provides localized insights that are often overlooked by centralized data collection systems. However, the study found that these efforts frequently lack standardization and consistency. Stakeholder consultations with community groups and local authorities revealed that while these groups are enthusiastic and willing to participate in monitoring efforts, they often lack the necessary training and resources to align their practices with national and international standards for greenhouse gas (GHG) reporting.
The inconsistency in data collection methods among community-led groups results in variations in the quality and reliability of the data gathered. For example, emissions data from livestock or deforestation activities may be collected using different tools and methodologies, leading to discrepancies when such data is integrated into the national reporting framework. This variability poses a challenge for Namibia's efforts to maintain a cohesive and accurate GHG inventory, as the decentralized and ad-hoc nature of community-based data collection does not always meet the standards required for international reporting under frameworks such as the UNFCCC and the Intergovernmental Panel on Climate Change (IPCC) guidelines.

Need for Capacity Building and Standardization

To address these challenges, there is a clear need for capacity-building initiatives targeted at community groups and local authorities involved in the AFOLU sector. Training programs should focus on equipping these stakeholders with the skills necessary to collect, monitor, and report data in a manner that aligns with both national and international standards. Providing communities with appropriate tools and technologies, such as mobile data collection platforms or standardized forms for recording emissions-related information, would significantly enhance the consistency and accuracy of the data collected.
Furthermore, improving access to resources for these groups, including financial support and technical assistance, is crucial to empower them to participate effectively. By investing in the capacity of community organizations and local authorities, Namibia can create a more standardized and reliable data collection framework that fully integrates the contributions of local communities.

Strengthening Integration Across Local, Regional, and National Levels

Another critical insight from the stakeholder consultations is the need to establish stronger links between local, regional, and national levels to ensure that community-collected data is accurately integrated into Namibia's national GHG inventory. Currently, the disconnect between these levels results in data that is either underutilized or inconsistently applied within the national framework. By developing robust communication channels and data integration systems, Namibia can ensure that valuable information gathered at the community level is effectively incorporated into national reports and GHG inventories.
Establishing mechanisms for regular data exchange and verification between local, regional, and national authorities is essential. This could include creating regional hubs that aggregate community data and provide a platform for validating and synthesizing the information before it is integrated into the national database. Such hubs would act as intermediaries, ensuring that data collected locally adheres to standardized protocols and is accurately represented in national-level reporting.

Recommendations for Improved Stakeholder Engagement and Data Integration

To improve the integration and effectiveness of community-led efforts in the AFOLU sector, Namibia should focus on building stronger coordination and collaboration frameworks that connect stakeholders across all levels. This can be achieved through the creation of multi-tiered partnerships between local communities, regional governments, and national agencies, ensuring that the flow of data is efficient and that all parties are engaged in the reporting process. Additionally, establishing monitoring and evaluation systems that regularly assess the quality and accuracy of community-collected data will further enhance the reliability of Namibia's GHG inventory.
By addressing these issues, Namibia can strengthen its AFOLU sector's stakeholder engagement processes, creating a more cohesive and standardized system for GHG monitoring that leverages local knowledge while meeting national and international reporting requirements. This collaborative and integrated approach will not only improve the accuracy of Namibia's emissions inventory but also enhance the country's capacity to manage and implement sustainable agricultural and land-use practices effectively.

3.4.4 Sectoral Challenges and Barriers

3.4.4.1 Energy Sector:

Technical and Financial Barriers

Namibia's energy sector faces considerable technical and financial obstacles that impede the deployment of renewable energy technologies and the modernization of its existing energy infrastructure. One of the most pressing challenges is the country's high dependency on imported energy, particularly from neighbouring countries. This reliance limits Namibia's energy

independence and makes it vulnerable to external market fluctuations and supply interruptions, which can hinder the country's efforts to transition to a more sustainable and resilient energy system.

The limited investment in renewable energy technologies further exacerbates these challenges. Although Namibia has significant potential for renewable energy sources, particularly solar and wind, the financial resources required to scale up these technologies are insufficient. The sector has yet to attract the necessary level of investment to build and expand renewable energy projects at a pace that aligns with the country's Nationally Determined Contributions (NDCs). This lack of investment is partly due to the perceived risks associated with renewable energy ventures in the region, coupled with the high upfront costs of developing and deploying these technologies. As a result, progress in increasing the share of renewable energy in Namibia's energy mix has been slow, making it difficult to achieve the country's NDC targets for emissions reductions and energy transformation.

Regulatory and Policy Framework Limitations

Another significant barrier to the advancement of Namibia's energy sector is the current state of its regulatory and policy frameworks. While policies exist to support energy development, they are often outdated and do not fully address the needs of the growing renewable energy sector. The regulatory environment lacks clarity and comprehensive guidelines that would enable private investors and stakeholders to confidently engage in renewable energy projects. For example, policies concerning land acquisition for renewable energy installations and grid integration of renewable energy sources remain complex and unclear, deterring private sector participation.

To overcome these regulatory and policy barriers, the study highlights the need for updates and reforms that create a more favourable environment for renewable energy investment and implementation. This includes revising existing regulations to simplify the processes for developing renewable energy projects and improving grid access for independent power producers (IPPs). Enhancing incentives for private sector participation is particularly crucial. The current framework provides limited support or financial incentives, such as tax breaks, subsidies, or guaranteed feed-in tariffs, which are necessary to attract investors and stimulate the growth of the renewable energy sector.

Recommendations for Addressing Sectoral Challenges

To address the technical and financial barriers, Namibia's energy sector requires a strategic investment approach that combines public and private resources. Leveraging international climate finance mechanisms, such as the Green Climate Fund (GCF) or partnerships with development banks, can help secure the capital needed to accelerate the deployment of renewable energy projects. By aligning these investments with Namibia's NDCs and long-term sustainable development goals, the country can create a roadmap for energy independence and sustainability.

In terms of regulatory and policy reforms, Namibia must establish a streamlined, transparent, and supportive framework that encourages private sector engagement. Implementing comprehensive incentive structures, such as feed-in tariffs for renewable energy projects or tax reliefs for companies investing in sustainable energy infrastructure, would significantly boost the sector's growth. Additionally, building capacity within regulatory bodies to ensure effective implementation and oversight of these policies is critical. By addressing these regulatory and policy limitations, Namibia can create a more attractive market for renewable energy investments and facilitate the growth needed to meet its climate goals.

Through targeted investments and policy enhancements, Namibia's energy sector can overcome its existing challenges, reduce its dependency on imported energy, and increase its capacity to meet the NDC targets. Such developments are essential for the country to transition towards a low-carbon and climate-resilient energy future.

3.4.4.2 AFOLU Sector:

Complexities in Data Management Due to Diverse Activities

The AFOLU sector in Namibia faces significant challenges in maintaining accurate and up-to-date data due to the diverse and dynamic nature of activities and land use practices. The sector encompasses a wide range of activities, including crop cultivation, livestock management, forestry operations, and land-use changes such as deforestation and afforestation. This diversity results in complex emissions patterns that vary across regions and are influenced by different agricultural and forestry practices. Monitoring these varied activities accurately requires a robust and integrated data management system, which is currently lacking.

For instance, issues such as deforestation and land degradation present difficulties in tracking emissions consistently over time. The AFOLU sector also includes numerous small-scale and community-led activities, where the variation in land-use practices can lead to fluctuations in emissions data. Without standardized data collection methodologies and advanced monitoring technologies, it becomes challenging to synthesize information into a coherent national greenhouse gas (GHG) inventory that reflects the true state of emissions within the sector.

Impact of Climate Variability on Emissions Projections

In addition to the diversity of activities, the AFOLU sector is highly sensitive to climate variability, which complicates emissions projections and the overall reliability of data. Variations in rainfall, temperature, and extreme weather events significantly influence agricultural outputs and land-use patterns. For example, drought conditions may lead to reduced crop yields and shifts in land management practices, while increased rainfall could impact soil carbon dynamics and alter emissions from land-use changes.

This climate variability affects emissions in ways that are difficult to predict using traditional monitoring methods. As a result, emissions projections based on static or historical data may not accurately represent future emissions scenarios. This unpredictability necessitates adaptive strategies that account for the effects of climate variability, integrating resilience measures into the planning and management of agricultural and land-use practices.

Need for Climate-Resilient Strategies in Emissions Monitoring

To address the complexities associated with diverse activities and climate variability in the AFOLU sector, Namibia must integrate climate resilience into the sector's planning and emissions monitoring strategies. Developing adaptive approaches that account for climate variability is essential for creating accurate emissions models and projections. This involves incorporating climate data and predictive models into the planning processes for agriculture and forestry management to better understand how changing climate conditions will impact emissions patterns.

Furthermore, strengthening data collection systems by integrating modern technologies, such as Geographic Information Systems (GIS), remote sensing, and mobile-based data collection tools, is crucial for enhancing the accuracy and timeliness of emissions data. These tools can provide real-time monitoring capabilities that allow for more precise tracking of land-use changes, deforestation rates, and agricultural emissions. By investing in these technologies and building the capacity of local stakeholders to use them effectively, Namibia can improve its ability to maintain a reliable and comprehensive GHG inventory for the AFOLU sector.

Recommendations for Overcoming Sectoral Challenges

To address the sectoral challenges in the AFOLU sector, Namibia should prioritize the development of a unified and resilient data management system that integrates information from various activities and regions. Standardizing data collection methodologies across the sector and training local stakeholders, including community organizations and agricultural cooperatives, is critical for ensuring consistency and accuracy in emissions monitoring. Additionally, building a

climate-resilient planning framework will allow the sector to adapt to climate variability more effectively, maintaining the integrity of emissions data and projections.
Finally, establishing a collaborative approach that connects local communities, regional authorities, and national agencies can enhance the flow of information and improve data integration across different levels. Such coordination will ensure that emissions data from diverse sources are consistently aggregated and synthesized, supporting Namibia's ability to meet its international reporting requirements and track progress toward its NDC targets. By integrating resilience and standardization into its AFOLU sector strategies, Namibia can overcome current challenges and create a more accurate and adaptive framework for managing emissions and climate impacts.

3.4.5 Opportunities for Improvement

3.4.5.1 Energy Sector:

Enhancing Coordination and MRV Systems

Namibia's energy sector has significant opportunities to improve its emissions reporting and overall management by enhancing coordination among key institutions and strengthening Monitoring, Reporting, and Verification (MRV) systems. Improving the integration and collaboration between the Ministry of Mines and Energy, the Electricity Control Board, and NamPower can reduce inefficiencies caused by overlapping responsibilities and fragmented data collection processes. Establishing clearer roles, responsibilities, and communication channels among these entities will streamline efforts, allowing for a more cohesive and efficient approach to energy sector governance.
In addition, aligning the MRV systems with the Initiative for Climate Action Transparency (ICAT) guidelines presents an opportunity for Namibia to enhance the transparency and accuracy of its emissions reporting. ICAT's framework offers best practices for emissions monitoring, ensuring that data is collected, verified, and reported in a standardized manner that meets international requirements. By adopting these guidelines, Namibia can improve the credibility of its national GHG inventories and strengthen its position in international climate forums. This, in turn, will provide better access to international climate finance opportunities and support for renewable energy projects.

Harnessing Renewable Energy Potential

Namibia has substantial untapped potential in renewable energy, particularly in solar and wind power. Given the country's geographic and climatic conditions, there is a significant opportunity to expand these resources to reduce dependency on energy imports and transition to a low-carbon energy system. By investing in large-scale renewable energy projects, Namibia can increase its energy security, lower greenhouse gas emissions, and contribute more effectively to its Nationally Determined Contributions (NDCs).
Realizing this potential requires updating and expanding policy frameworks to create a conducive environment for investment in renewable energy infrastructure. Current policies need to be modernized to remove regulatory barriers and incentivize both domestic and foreign investors. This includes providing financial incentives such as tax breaks, subsidies, or feed-in tariffs to encourage private sector participation in renewable energy projects.

Capacity Building for Public and Private Stakeholders

A critical component of expanding renewable energy capacity in Namibia involves investing in capacity building for both public and private stakeholders. For the public sector, enhancing technical expertise within regulatory bodies and government agencies is essential to efficiently manage, implement, and oversee renewable energy projects. This includes training personnel in

the latest technologies and methodologies for integrating renewable energy into the national grid and ensuring compliance with international emissions monitoring standards.

For the private sector, providing support through technical assistance programs and facilitating knowledge exchanges can empower businesses to develop and implement innovative renewable energy solutions. By building the capacities of both sectors, Namibia can create a skilled workforce that is capable of managing the technical and operational aspects of renewable energy expansion, as illustrated in Figure 4.

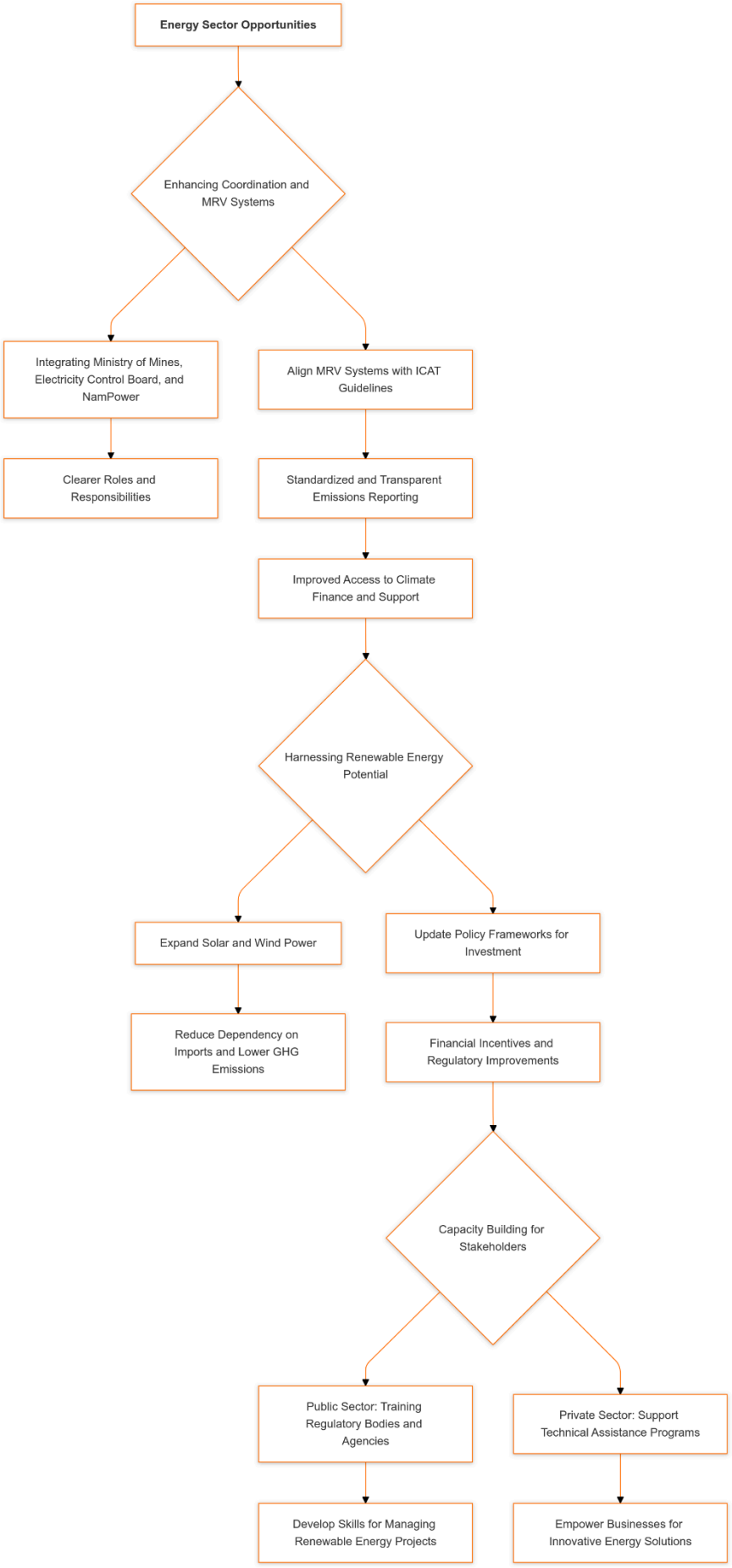

Figure 5. Opportunities for Improvement in Namibia's Energy Sector.

Following Figure 5, specific examples from similar countries highlight practical strategies for Namibia. These examples provide actionable insights for renewable energy integration, efficiency improvements, and policy design for Namibia:

- ***Renewable Energy Integration:*** *Morocco's Noor Ouarzazate Solar Complex* has integrated large-scale solar into the national grid, demonstrating a phased approach and public-private partnerships. This model shows how Namibia could leverage its solar potential with a similar strategy.
- ***Investment Incentives:*** *South Africa's Renewable Energy Independent Power Producer Procurement (REIPPP) program* attracted private investment, adding 6 GW to the grid through transparent procurement. Namibia could adopt similar incentives to boost wind and solar projects.
- ***Energy Efficiency Improvements:*** *Brazil's National Program for Energy Conservation (PROCEL)* reduced energy waste in industrial and public sectors through incentives and public awareness. Implementing such measures could lower Namibia's energy consumption and emissions.
- ***Wind Power Expansion:*** *Kenya's Lake Turkana Wind Power Project*, one of Africa's largest, contributes 310 MW to Kenya's grid, improving energy access and reducing reliance on imported fuels. Namibia could replicate such projects to harness its wind energy resources effectively.

These examples provide Namibia with proven methods to advance its energy sector, fostering sustainable growth and energy security.

By improving institutional coordination, enhancing MRV systems in alignment with ICAT guidelines, and capitalizing on its renewable energy potential, Namibia has the opportunity to transition to a more sustainable and resilient energy sector. Investing in these areas will not only improve emissions reporting and transparency but also contribute to economic growth and energy independence, helping Namibia to meet its climate and development objectives.

3.4.5.2 AFOLU Sector:

Centralized Data Collection and Management Platform

One of the key opportunities for improvement in Namibia's AFOLU sector lies in establishing a centralized data collection and management platform. Currently, data collection efforts are fragmented across various community groups, local authorities, and government agencies, leading to inconsistencies and gaps in the national greenhouse gas (GHG) inventory. By developing a unified platform that integrates data from diverse sources, Namibia can significantly enhance the quality and reliability of its AFOLU data.

Such a platform would not only standardize data collection methodologies but also facilitate real-time data sharing and monitoring, ensuring that information from community-led initiatives is accurately reflected in national reports. Training programs will be essential to support this initiative, equipping community groups and local authorities with the technical skills necessary to collect and report data in alignment with national and international standards. This capacity building will ensure that local stakeholders are fully engaged in the monitoring and reporting processes, thus improving the overall integrity and accuracy of emissions data from the AFOLU sector.

Integrating Nature-Based Solutions and Climate Resilience Strategies

Another significant opportunity for Namibia's AFOLU sector is the integration of nature-based solutions (NbS) and climate resilience strategies into agricultural and land-use practices. Given the country's vulnerability to climate variability and its reliance on natural resources, adopting NbS offers a pathway to mitigate emissions while achieving multiple co-benefits. Implementing practices such as reforestation, agroforestry, sustainable grazing, and soil conservation not only sequesters carbon but also promotes biodiversity conservation and enhances ecosystem resilience.

By focusing on sustainable land management and climate-resilient agricultural practices, Namibia can enhance food security, improve rural livelihoods, and support sustainable rural development. These strategies can help communities adapt to the impacts of climate change, such as erratic rainfall patterns and soil degradation while reducing emissions from land-use changes and agricultural activities. Integrating NbS into Namibia's AFOLU sector planning can create a holistic approach that aligns emission reduction efforts with broader social, economic, and environmental goals.

By centralizing data management and integrating nature-based solutions and climate resilience strategies, Namibia's AFOLU sector has the opportunity to not only improve the accuracy and reliability of its emissions data but also achieve sustainable development co-benefits. These efforts will strengthen Namibia's capacity to meet its NDC targets while promoting biodiversity conservation and rural economic growth as shown in Figure 5.

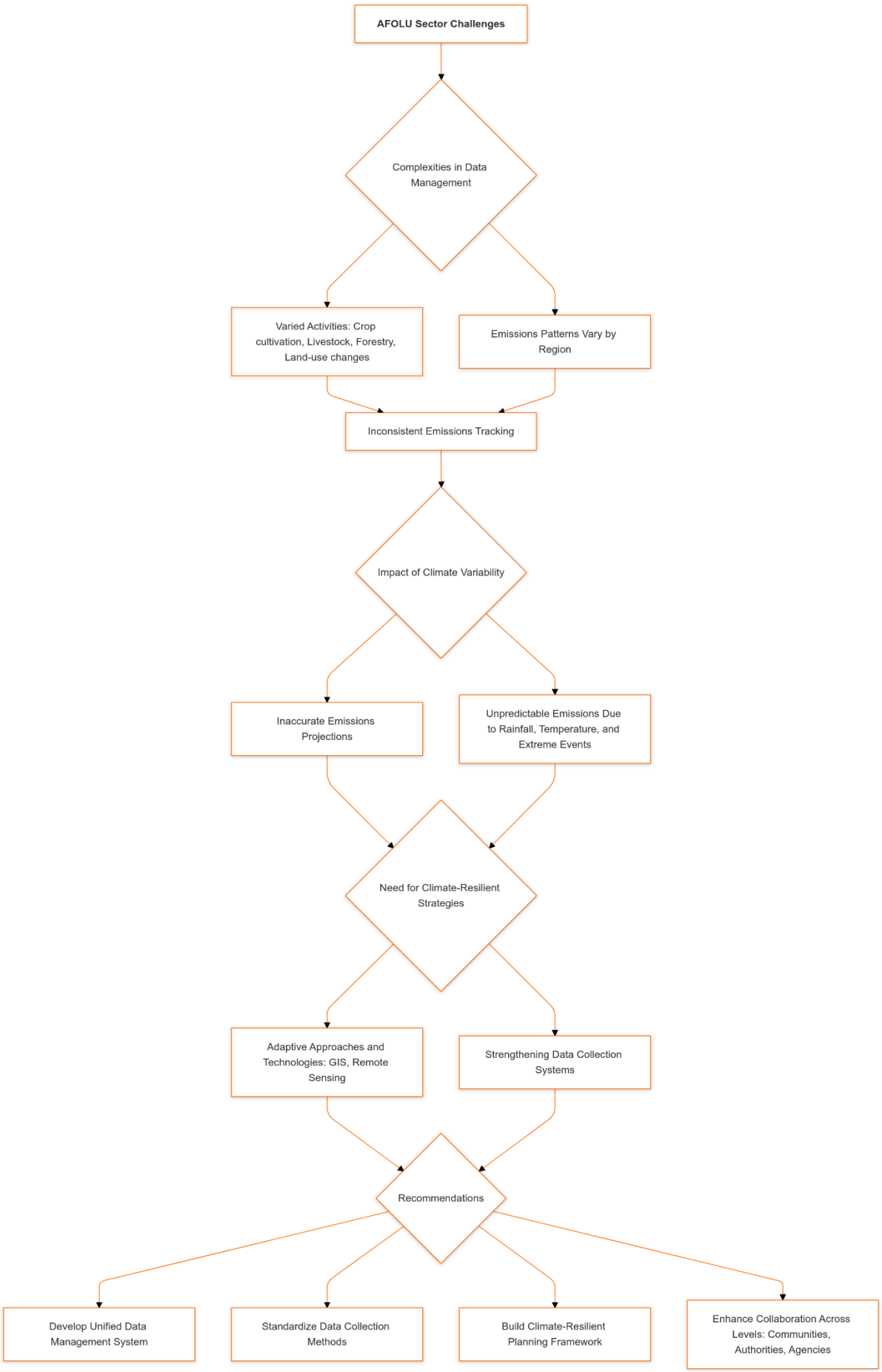

Figure 6. Challenges and Strategies for Emissions Management in Namibia's AFOLU Sector.

Following Figure 6, it is beneficial to consider the timing and prioritization of each strategy to facilitate effective implementation. While Figure 5 does not currently include specific timelines, structuring these strategies within short-, medium-, and long-term objectives would create a clear pathway for phased action, aligned with Namibia's AFOLU sector goals. Table 1 gives an illustration. It categorizes these strategies into short-, medium-, and long-term actions. This phased approach provides a structured timeline, detailing practical steps to address each challenge and support sustainable emissions management. By implementing these strategies in a prioritized and staged manner, Namibia can strengthen its data systems, enhance collaboration, and build resilience within the AFOLU sector, aligning with national and international climate commitments.

Table 1. Phased Implementation of Key Strategies for Emissions Management in Namibia's AFOLU Sector

Timeline	Strategy	Details	Examples
Short-Term (1-2 years) – these are Quick-to-implement initiatives	Develop unified data management system	Establishing a centralized system to unify data across agencies, enhancing data consistency and accessibility.	Create a digital platform that integrates data from local and national sources, facilitating streamlined reporting and monitoring.
	Standardize data collection methods	Implement standardized data collection practices to improve data reliability and comparability across AFOLU activities.	Integrate advanced technologies such as remote sensing and automated tools to measure and manage activity data within a national MRV system. This approach ensures consistent, accurate, and scalable data collection, enabling effective emissions tracking and management at both local and national levels.
Medium-Term (3-5 years) – these are strategies requiring moderate planning and resource allocation	Build climate-resilient planning framework	Develop a planning framework that integrates climate resilience to guide sustainable land and resource management.	Design a framework incorporating best practices for climate-resilient agriculture, focusing on soil health and water management.
	Enhance collaboration across levels	Strengthen partnerships and communication channels between communities, local authorities, and national agencies.	Set up regular collaboration workshops and joint training sessions involving all levels to support coordinated climate action.
Long-Term (5+ years)	Institutionalize adaptive management practices	Establish systems to support adaptive management, enabling flexible responses to evolving climate and	Develop feedback loops within the unified data system to track progress, allowing for adjustments in planning based on new data insights.

Timeline	Strategy	Details	Examples
		environmental conditions.	
	Foster Integration of Advanced Technologies |	Establish mechanisms to incorporate emerging technologies, such as artificial intelligence and machine learning, for analysing large datasets and identifying emission trends.	Develop predictive analytics tools within the MRV system to anticipate future challenges and opportunities, supporting proactive decision-making and dynamic policy adjustments.

The stocktaking exercise reveals that while Namibia has laid the groundwork for developing comprehensive energy and AFOLU sector strategies, several gaps and challenges remain in data collection, institutional coordination, and policy implementation. Addressing these issues through targeted capacity building, improved stakeholder engagement, and enhanced MRV systems will be critical to ensuring that Namibia meets its climate action commitments effectively.

4 Needs and Gaps Analysis

4.1 Energy Sector

4.1.1 Data Gap Analysis

4.1.1.1 Quality and Completeness of Current Data Sets:

Inconsistencies in Disaggregated Energy Consumption Data

Namibia's energy data sets reveal substantial gaps, particularly in disaggregated energy consumption data across sectors like residential, industrial, and transportation. For instance, energy consumption data for the industrial sector lacks specificity, making it challenging to determine the exact share of energy use for activities such as mining versus manufacturing. As a result, estimating sector-specific emissions and evaluating energy efficiency measures is problematic. Without detailed sectoral breakdowns, identifying target areas for interventions to reduce consumption or improve efficiency becomes challenging. This lack of granular data, where only an estimated 40% of energy consumption is accurately allocated to specific sectors, complicates the development of policies that cater to the unique needs and emissions profiles of each sector.

Lack of Real-Time and High-Frequency Data Collection Systems

Namibia's energy monitoring systems lack real-time and high-frequency data collection capabilities for tracking renewable energy output and fossil fuel use. Most data collection is periodic, with monthly or even quarterly updates, leading to delayed or outdated insights. For example, renewable energy production data is typically updated every quarter, causing a lag in accurately assessing progress towards Namibia's renewable targets. The absence of real-time data collection limits the ability to account for daily or seasonal fluctuations, which are particularly relevant in renewable sources like solar and wind energy. Additionally, fossil fuel usage statistics are often aggregated annually, resulting in approximate emissions calculations based on projections rather than direct measurements. This gap in high-frequency data contributes to an estimated 5-10% margin of error in Namibia's greenhouse gas (GHG) emissions reporting, which could be reduced with timely data inputs.

Lack of Integration with International MRV Standards

The Monitoring, Reporting, and Verification (MRV) systems in Namibia's energy sector are not fully aligned with international standards, such as those set by the Initiative for Climate Action Transparency (ICAT). This lack of alignment creates a transparency deficit, hindering the comparison of Namibia's emissions inventories with those of other countries and complicating the benchmarking of progress. For example, Namibia's current MRV systems cover only 60% of ICAT's recommended data points for energy-related emissions, limiting the credibility of its reports. To align with global best practices and increase transparency, Namibia needs to incorporate standardized methodologies from frameworks like ICAT, which would also enhance its eligibility for international climate finance. Without this integration, emissions data remain less comparable, reducing opportunities for international support.

Inconsistent Data Management Practices Across Institutions

Data management practices across institutions involved in Namibia's energy sector vary considerably, leading to discrepancies, missing entries, and unverified data in critical datasets. For instance, data on electricity generation and importation often vary between the Ministry of Mines and Energy, NamPower, and the Namibia Statistics Agency due to differing collection methods and definitions. In some cases, reported figures on electricity imports vary by as much

as 15% depending on the source, underscoring the need for standardized data protocols. These inconsistencies make it difficult to form an accurate picture of Namibia's energy landscape and hinder the development of targeted policies for emissions reductions. The absence of a centralized data management system to harmonize inputs from these institutions exacerbates the issue, resulting in fragmented and unreliable data.

Recommendations for Addressing Data Gaps

To address these issues, Namibia should implement a more integrated data management framework that includes real-time monitoring technologies and aligns MRV systems with international standards. Developing a centralized data platform where all institutions contribute using standardized methodologies can help harmonize sector-wide information. This platform should enable the collection of high-frequency data on renewable energy output, fossil fuel consumption, and sector-specific energy use, improving the accuracy of emissions reporting. Additionally, providing training and resources to institutions responsible for data collection and management will enhance data consistency and reliability, enabling Namibia to meet its climate commitments more effectively and access international support.

4.1.2 Capacity Assessment

4.1.2.1 Human Resources:

Shortage of Skilled Personnel in Energy Data Management

A critical barrier in Namibia's energy sector is the shortage of skilled personnel within institutions responsible for energy data management, notably the Ministry of Mines and Energy and the Electricity Control Board (ECB). This shortage is evident in data collection, management, and analysis roles, where many positions remain either unfilled or staffed by personnel lacking specialized expertise. This gap in human resources limits the effectiveness of Namibia's Monitoring, Reporting, and Verification (MRV) systems and hampers efforts to maintain accurate and reliable datasets.

The shortage of skilled staff impacts the sector's ability to project energy needs and emissions accurately, essential for effective policy development and strategic planning. Furthermore, this constraint means that Namibia struggles to implement advanced data collection and monitoring techniques, relying instead on outdated methods and estimations that reduce the precision of greenhouse gas (GHG) inventories. For example, the country's reliance on manual data entry and periodic data collection results in an estimated 10% margin of error in energy-related GHG reporting, which could be minimized with more sophisticated techniques and skilled personnel. Without focused efforts to build human capacity in this area, the challenge of implementing effective MRV systems will continue to impede Namibia's progress toward its climate and energy objectives.

Limited Exposure to International Best Practices and Specialized Training

Beyond the shortage of personnel, existing staff often lack exposure to international best practices and advanced training in climate transparency tools and emissions accounting methodologies. This skills gap is particularly relevant for personnel responsible for developing and maintaining Namibia's GHG inventories and emissions projections. For instance, over 60% of technical staff have not received training on tools like the ICAT emissions assessment tools or the IPCC's GHG inventory guidelines, limiting their ability to apply standardized approaches in data management and emissions tracking.

Without familiarity with advanced tools, staff are less prepared to adopt accurate and internationally recognized data methodologies, impacting the credibility and transparency of Namibia's emissions reporting. This lack of standardized practices reduces the effectiveness of

Namibia's participation in international climate agreements such as the Paris Agreement, as well as its ability to access climate finance. Inaccurate or non-transparent emissions reporting is often a barrier to securing funding, as international climate finance institutions require stringent reporting and transparency standards. Consequently, this shortfall in specialized training not only affects the quality of Namibia's emissions reporting but also limits opportunities for global support in meeting its climate goals.

Recommendations for Capacity Building

Addressing these capacity gaps requires targeted efforts to develop human resources within key institutions. Recommended initiatives include:

1. Establish training programs to build skills in emissions data collection, management, and analysis, focusing on international best practices. For example, workshops on the IPCC's GHG inventory protocols and ICAT's MRV tools could enhance the quality of Namibia's emissions tracking by equipping personnel with standardized methodologies.

2. To empower personnel in accurate emissions accounting, provide training on advanced MRV tools, such as the GHG emissions tracking tools from ICAT. Familiarity with these tools can improve precision in data reporting and support Namibia in aligning with global standards.

3. Establish partnerships with countries experienced in implementing robust MRV systems. Such collaborations could offer practical examples of effective MRV practices, tailored to Namibia's context. For instance, staff exchanges with institutions in countries with strong MRV frameworks, such as South Africa or Kenya, could provide Namibia's technical teams with hands-on experience in data monitoring and emissions accounting.

Investing in human capacity will enable Namibia to strengthen the institutions responsible for energy data management, ensuring they are better equipped to meet international climate commitments. This investment will also facilitate compliance with reporting obligations under the Paris Agreement, enhancing Namibia's credibility and ability to attract climate finance.

4.1.2.2 Technical Skills and Resources:

Outdated Software and Tools for Energy Data Management

The technical capacity of Namibia's energy sector institutions to manage and analyse energy data is significantly hindered by the use of outdated software and tools. Many institutions, including the Ministry of Mines and Energy and the Electricity Control Board, continue to rely on basic spreadsheet applications for tracking key energy metrics. While these tools provide a simple means of organizing data, they are highly prone to human error and lack the advanced functionalities needed for comprehensive analysis, scenario modelling, and accurate forecasting. The limitations of these basic tools prevent the development of detailed energy models that could simulate various policy interventions, energy consumption patterns, and emissions reduction pathways.

The absence of advanced data management software also restricts the ability to integrate large and diverse datasets, making it challenging to develop a cohesive and centralized data system that accurately reflects the country's energy landscape. This limitation not only affects Namibia's ability to assess current energy performance but also impacts strategic planning, as institutions are unable to visualize and predict the outcomes of different energy and climate scenarios.

Shortage of Reliable Data Collection Equipment

A critical gap in Namibia's energy sector is the shortage of reliable and modern data collection equipment, such as smart meters and emissions monitoring devices. These technologies are

essential for accurate and real-time data collection, especially in tracking renewable energy output and fossil fuel usage. Without access to these advanced tools, institutions are forced to rely on manual and less precise methods, leading to data discrepancies and inaccuracies in greenhouse gas (GHG) emissions reporting. The lack of smart metering technology, for example, limits the ability to measure energy consumption patterns dynamically, which is crucial for identifying energy efficiency opportunities and assessing the impact of renewable energy integration.

Emissions monitoring devices are equally vital for ensuring that emissions data is captured accurately and in real-time, providing the basis for reliable emissions inventories. The absence of these devices means that much of the emissions data reported by Namibia's institutions is based on estimates and periodic readings rather than continuous monitoring. This shortfall affects the transparency and reliability of Namibia's emissions reporting and hinders the country's efforts to align with international standards and best practices.

Lack of Technical Support Frameworks and Standardized Guidelines

Institutions within Namibia's energy sector also lack robust technical support frameworks and standardized guidelines for emissions accounting. The absence of clear, standardized protocols for measuring and reporting emissions contributes to inconsistencies and reduces the credibility of the data collected. Without access to comprehensive technical guidelines and support structures, staff members often lack the confidence and knowledge required to implement effective emissions monitoring and reporting mechanisms. This results in a fragmented approach to emissions accounting, where methodologies may vary across institutions, leading to discrepancies when compiling national inventories.

Furthermore, the lack of training and support for implementing advanced emissions accounting systems means that even when new technologies or systems are introduced, they are not fully utilized or maintained. This deficiency in technical support inhibits the long-term effectiveness of any data collection improvements made, as staff members are unable to sustain the proper functioning of these systems without ongoing guidance and training.

Recommendations for Enhancing Technical Skills and Resources

To bridge these technical skill and resource gaps, Namibia's energy sector institutions need to modernize their data management infrastructure. Investing in advanced software platforms specifically designed for energy data management and emissions modelling is crucial. Such platforms would allow for dynamic data integration, advanced scenario modelling, and improved accuracy in forecasting energy needs and emissions trends. Additionally, developing training programs to enhance technical skills related to these tools will be essential for ensuring their effective use.

Equipping institutions with modern, reliable data collection equipment, such as smart meters and emissions monitoring devices, should also be a priority. Access to these technologies will enable real-time monitoring and improve the accuracy and timeliness of energy consumption and emissions data. To support these advancements, the establishment of technical support frameworks and the development of standardized guidelines for emissions accounting are necessary. By providing clear protocols and ongoing training, institutions will be better prepared to implement, manage, and maintain effective MRV systems, ensuring the credibility and transparency of Namibia's emissions reporting.

4.1.2.3 Financial Resources:

Budgetary Constraints Limiting Data Management Capabilities

Budgetary constraints present a significant challenge for institutions involved in energy data management in Namibia. Many agencies, including the Ministry of Mines and Energy, the

Electricity Control Board, and NamPower, operate with limited financial resources that are often insufficient to support the development and modernization of their data management systems. The lack of dedicated funding prevents these institutions from investing in the necessary upgrades to data infrastructure, such as the adoption of advanced software platforms and integration of real-time monitoring technologies. Without these essential upgrades, Namibia's energy sector struggles to improve the accuracy and reliability of its emissions reporting, which is crucial for meeting international climate commitments.

The financial shortfall also affects the ability of institutions to acquire advanced monitoring equipment, such as smart meters and emissions sensors, that are essential for accurate, continuous data collection. These technologies require significant investment, and in the absence of adequate budgets, institutions are forced to rely on outdated or less effective tools that compromise the quality of the data collected. Furthermore, budget limitations inhibit the development and implementation of comprehensive training programs for staff, which are critical for building technical expertise in advanced data management and emissions accounting.

Impact on International Collaboration and Capacity Building

Insufficient financial resources also hinder Namibia's ability to engage in and develop partnerships with international organisations that could offer technical support and capacity-building programs. Collaboration with global entities such as the Initiative for Climate Action Transparency (ICAT), United Nations Development Programme (UNDP), and other development agencies can provide valuable resources, training, and expertise needed to enhance Namibia's Monitoring, Reporting, and Verification (MRV) systems. However, forming these partnerships often requires matching funds, co-financing arrangements, or a baseline level of investment from the national government, which is currently difficult to secure due to financial constraints.

Without the financial capacity to establish these collaborations, Namibia misses out on opportunities for international support that could facilitate the implementation of advanced MRV systems and alignment with global best practices. Additionally, the lack of funds prevents Namibia from participating in international knowledge exchange programs and capacity-building workshops, which are essential for ensuring that local institutions stay informed about the latest developments in climate action transparency and emissions accounting.

Recommendations for Addressing Financial Constraints

To overcome these financial barriers, Namibia's energy sector should prioritize seeking external funding through international climate finance mechanisms, such as the Green Climate Fund (GCF) or the Global Environment Facility (GEF). By aligning proposed projects with the objectives of these funding mechanisms, Namibia can secure the financial resources needed to upgrade its data management infrastructure, acquire advanced monitoring technologies, and develop capacity-building programs for its staff. Establishing a dedicated budget for MRV system improvements within key institutions, supported by these external funds, will be crucial for creating a sustainable foundation for accurate emissions reporting.

In addition, Namibia should explore opportunities for public-private partnerships (PPPs) that can mobilize private sector investment in renewable energy projects and related infrastructure improvements. Engaging with private entities that have an interest in supporting sustainable energy development can provide alternative funding streams and reduce the dependency on government budgets alone. By diversifying its sources of financial support and strategically seeking international partnerships, Namibia can enhance its capacity to implement robust MRV systems and achieve its climate and energy targets.

4.1.3 Priority Setting – Energy Sector

To address the gaps and challenges identified in Namibia's energy sector, the following priorities have been established to improve data management systems, build institutional capacity, and secure necessary financial and technical investments (Figure 7). These priorities aim to create a more integrated and efficient system for monitoring, reporting, and verifying emissions, ensuring alignment with both national and international climate targets.

4.1.4 Improvement of Data Collection Systems:

Priority 1: Establish a Centralized Energy Data Management System

The first priority is to establish a centralized energy data management system that integrates data from various institutions, ensuring consistency and reliability across the sector (Figure 7). This centralized platform should consolidate data collected from entities such as the Ministry of Mines and Energy, the Electricity Control Board, and NamPower. The system must have real-time monitoring capabilities, leveraging smart technologies, such as smart meters, to track energy production and consumption accurately. By implementing a centralized system, Namibia can reduce data fragmentation and discrepancies, providing a unified and transparent view of its energy landscape. This will enhance the accuracy of emissions reporting and enable more effective tracking of progress towards Nationally Determined Contributions (NDCs).

Priority 2: Develop Standardized Data Collection Protocols

To eliminate inconsistencies and improve data accuracy, the development and implementation of standardized data collection protocols across all entities involved in energy data management is essential (Figure 7). These protocols should ensure that all institutions follow the same methodologies and criteria for data gathering, reporting, and verification. Standardization will not only improve the consistency of data across different entities but also facilitate easier integration and comparison with international emissions inventories. Implementing these protocols will strengthen Namibia's MRV systems and ensure that data collected is compatible with international frameworks, such as those set by ICAT and the UNFCCC.

4.1.5 Capacity Building:

Priority 3: Invest in Training Programs for Personnel

To enhance technical skills and knowledge within key institutions, it is vital to invest in training programs for personnel focused on MRV practices aligned with international standards like ICAT (Figure 7). These training initiatives should include workshops, certifications, and partnerships with international climate bodies to provide hands-on experience with advanced tools and methodologies for emissions monitoring and reporting. By equipping staff with up-to-date skills, Namibia can improve the quality of its emissions inventories and align its reporting processes with global best practices, thereby increasing its credibility in the international climate community.

Priority 4: Develop a Framework for Technical Support

Allocating resources to establish an institutional framework for ongoing technical support is critical. This framework should provide staff with access to continuous learning opportunities and updated knowledge on emerging energy data technologies and emissions modelling tools (Figure 7). Creating such a support system will ensure that personnel are not only trained initially but can also remain proficient as technologies and international standards evolve. This approach promotes long-term sustainability in Namibia's capacity to maintain and enhance its MRV systems.

4.1.6 Infrastructure and Financial Investments:

Priority 5: Secure Funding for Technical Infrastructure Upgrades

Securing funding through either government allocation or international partnerships is crucial for upgrading Namibia's technical infrastructure. Investments should focus on acquiring advanced emissions monitoring equipment, software for comprehensive data analysis, and renewable energy tracking systems. Upgrading these components will allow Namibia to enhance the precision and reliability of its data collection processes, facilitating the accurate reporting of emissions and energy production in real-time.

Priority 6: Mobilize Financial and Technical Assistance Through Partnerships

To mobilize the financial resources and technical expertise necessary for enhancing Namibia's energy data systems, partnerships with international development organizations and private sector stakeholders should be actively pursued (Figure 7). Collaborating with international entities, such as development banks or climate initiatives like the Green Climate Fund (GCF), can provide access to funding and advanced technologies that Namibia may not be able to secure independently. Partnerships with private sector stakeholders, particularly in the renewable energy industry, can also contribute to capacity building and infrastructure development, aligning investments with both business interests and national climate goals.

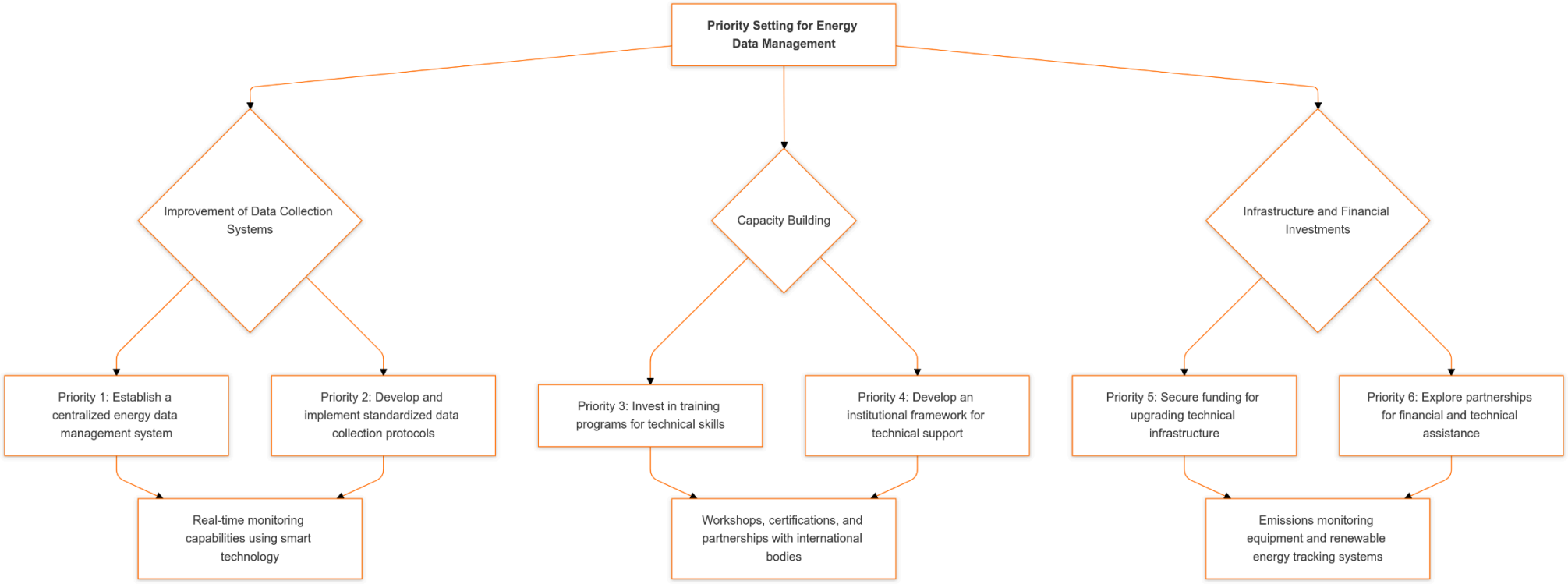

Figure 7. Priority Setting for Enhancing Namibia's Energy Data Management Systems.

By addressing these priorities (Figure 6), Namibia can significantly improve its energy data management systems, enhancing the accuracy and transparency of its emissions reporting. These steps will not only support the country's efforts to meet its national and international climate commitments but also lay the foundation for a more sustainable and resilient energy sector.

4.2 AFOLU Sector

4.2.1 Data Gap Analysis

4.2.1.1 Quality and Completeness of Current Data Sets:

Inconsistent and Incomplete Data Collection

The AFOLU sector in Namibia faces significant challenges in collecting consistent and complete data on agricultural activities, forestry, and land-use changes. Although data on crop yields and livestock populations is available, it is often inconsistent or incomplete, leading to inaccuracies in emissions estimations. For instance, periodic surveys may provide snapshots of these data points, but the lack of regular updates and standardized collection methods results in discrepancies that either underestimate or overestimate emissions contributions from these activities. This inconsistency complicates the process of building an accurate and reliable greenhouse gas (GHG) inventory for the sector.

Inadequate Emissions Data on Forestry and Land Use

Emissions data related to forestry activities, particularly deforestation rates and afforestation efforts, also suffer from a lack of regular updates and detailed spatial analysis. The absence of continuous monitoring systems results in emissions inventories that do not accurately reflect the current state of Namibia's forests and land-use dynamics. Moreover, current land-use data often relies on outdated satellite imagery and sparse field observations. Without access to up-to-date technology, such as high-resolution satellite imagery and advanced remote sensing tools, the accuracy of the reported emissions from land-use changes is limited. This shortfall impacts the overall reliability of Namibia's national GHG inventory and hinders efforts to track and report progress towards climate targets.

Fragmented Data Integration Across Stakeholders

The lack of a unified platform for integrating data from various stakeholders—including community groups, private forestry companies, and governmental agencies—further contributes to fragmented data sets. Community-level sources and private entities often collect valuable data on local agricultural and forestry practices, but this information is rarely harmonized with national records. This fragmentation creates gaps and overlaps in the data, making it difficult for Namibia to compile a comprehensive GHG inventory for the AFOLU sector. Without a cohesive system that allows for seamless data sharing and integration across all levels, efforts to produce accurate and comprehensive emissions reports remain fragmented.

4.2.2 Capacity Assessment

4.2.2.1 Human Resources

Shortage of Trained Personnel in GHG Inventory and Climate Data Analysis

Institutions responsible for managing Namibia's AFOLU sector, such as the Ministry of Agriculture, Water, and Land Reform, and the Ministry of Environment, Forestry, and Tourism,

often face a shortage of personnel trained in GHG inventory methodologies and climate data analysis. This shortage is particularly problematic in a sector as complex and dynamic as AFOLU, where accurate emissions tracking depends on expertise in specialized areas like carbon stock assessments and emissions modelling. Without sufficient human resources equipped with the necessary skills, the sector struggles to produce reliable and precise emissions estimates.

Knowledge Gaps in Advanced Monitoring and Reporting Practices

The existing workforce also lacks exposure to advanced emissions monitoring and reporting practices, particularly those recommended by the Intergovernmental Panel on Climate Change (IPCC) and ICAT. Without training in these globally recognized practices, personnel are often ill-prepared to apply accurate methodologies for emissions monitoring, leading to gaps in data accuracy and transparency. This knowledge gap further hampers the development and implementation of effective mitigation and adaptation strategies in the sector, as the information available is not sufficiently precise to support targeted interventions.

4.2.2.2 Technical Skills and Resources

Outdated Tools and Lack of Digital Infrastructure

Technical capacity within Namibia's AFOLU sector is limited by the use of outdated data collection tools and the absence of digital infrastructure needed to integrate and analyse diverse data sources. Key institutions often rely on manual or basic digital methods, such as spreadsheets, for data tracking, which do not allow for complex data integration, especially when combining satellite imagery, field surveys, and emissions monitoring data. This outdated approach reduces the ability of institutions to analyse data comprehensively and efficiently.

Limited Access to Specialized Software and GIS Technology

The sector also lacks access to specialized software and Geographic Information System (GIS) technology that are essential for accurate land-use mapping and spatial analysis. GIS technology is crucial for tracking deforestation rates, assessing afforestation efforts, and monitoring changes in biomass stocks. Without these tools, institutions are unable to perform the detailed spatial analyses required to track emissions accurately and respond effectively to land-use changes. This technical shortfall limits the sector's capacity to produce reliable GHG inventories that reflect actual emissions and carbon sequestration dynamics.

Inadequate Technical Support Frameworks

There is also a lack of robust technical support frameworks, which restricts the ability of institutions to maintain and upgrade monitoring tools effectively. The absence of continuous technical support results in inconsistencies in data collection practices and prevents the systematic upgrading of tools and technologies, further affecting the consistency and accuracy of emissions data over time. Without the infrastructure to support and maintain these technologies, any improvements made are likely to be unsustainable, leading to recurring issues with data accuracy.

4.2.2.3 Financial Resources

Limited Funding for Modern Data Collection Technologies

Financial constraints are a major barrier to the development of modern data collection capabilities within the AFOLU sector. Many institutions lack the budget necessary to invest in advanced technologies, such as drones, remote sensing tools, and GIS software, which are

essential for real-time monitoring of agricultural and forestry activities. The inability to secure these technologies limits Namibia's capacity to accurately track emissions from land-use changes, further complicating efforts to produce a comprehensive and transparent GHG inventory.

Insufficient Funding for Training Programs and Capacity Building

Funding shortages also impact the sector's ability to implement training programs and capacity-building initiatives that are critical for building and retaining skilled personnel. Without financial resources allocated for training, it is challenging for institutions to develop the human capital needed to manage and analyse complex AFOLU data. This shortfall affects Namibia's long-term capacity to produce accurate emissions inventories and hinders the development of mitigation and adaptation strategies.

Barriers to Forming International Partnerships

The lack of financial resources also limits the ability of Namibian institutions to form partnerships with international organizations that could provide the technical and financial assistance necessary to improve data systems and emissions tracking in the AFOLU sector. International collaboration is often essential for accessing the latest technologies and methodologies, but without the funds to establish these partnerships or co-finance initiatives, Namibia's institutions struggle to enhance their technical capacities and improve emissions reporting frameworks.

By addressing these gaps, Namibia can build the technical, financial, and human resource capacity necessary to improve data collection, monitoring, and reporting systems in the AFOLU sector, ultimately enhancing the accuracy and credibility of its national GHG inventories.

4.2.3 Priority Setting – AFOLU Sector

To address the challenges and gaps identified in the AFOLU sector, the following priorities have been established to improve data collection systems, build capacity, and secure necessary infrastructure and financial investments. These priorities highlighted in Figure 8 aim to create a cohesive and efficient monitoring, reporting, and verification (MRV) system for Namibia's AFOLU sector, enhancing the accuracy and reliability of emissions data and ensuring compliance with international climate reporting standards.

4.2.3.1 Improvement of Data Collection Systems:

Priority 1: Develop a Centralized Data Management Platform

The first priority is to develop a centralized data management platform that integrates information from a wide range of stakeholders involved in AFOLU activities, including government agencies, local communities, private forestry firms, and agricultural associations (Figure 8). This platform will serve as a unified system that compiles and standardizes data collected from these diverse sources, ensuring consistency and reliability across the sector. The centralized platform will enable Namibia to eliminate data fragmentation, provide a comprehensive overview of AFOLU emissions, and enhance the transparency and accessibility of emissions reporting.

This platform should be designed to handle a variety of data types, including field observations, satellite imagery, and digital surveys, ensuring that data is integrated in a manner that supports advanced analysis and modelling. By unifying the data management system, Namibia can streamline reporting processes and produce a more accurate and complete greenhouse gas (GHG) inventory for the sector.

Priority 2: Implement Advanced Monitoring Systems Using GIS and Remote Sensing

To enhance the accuracy and timeliness of emissions data, it is crucial to implement advanced monitoring systems that utilize Geographic Information System (GIS) technology, satellite imagery, and remote sensing tools (Figure 8). These technologies will enable Namibia to track land-use changes, deforestation rates, and carbon stock variations with precision. By integrating these systems, institutions will have access to real-time data that allows for better analysis and response to changes in land use, providing a more accurate representation of emissions and carbon sequestration dynamics.

The use of GIS and remote sensing will also support spatial analysis, helping Namibia identify and map areas most vulnerable to deforestation and land degradation. This level of detail will be essential for planning and implementing targeted mitigation and conservation strategies. Moreover, the integration of these technologies will enable Namibia to align its MRV systems with international standards, enhancing its credibility in global climate reporting.

4.2.3.2 Capacity Building:

Priority 3: Initiate Comprehensive Training Programs

To build the technical skills necessary for accurate emissions monitoring and reporting, Namibia should initiate comprehensive training programs for personnel within key institutions (Figure 8). These programs should focus on enhancing expertise in GHG inventory methodologies, spatial analysis, and the use of digital tools such as GIS. Collaborating with international climate bodies, such as ICAT and the UNFCCC, will provide access to specialized training sessions, certifications, and expertise. Such partnerships will not only raise the capacity of local staff but also align Namibia's practices with international standards, ensuring that emissions reporting is both accurate and compliant.

By equipping personnel with the necessary skills and knowledge, Namibia can enhance its capacity to manage, interpret, and utilize complex data sets, ensuring that the AFOLU sector's contributions to the national GHG inventory are reliable and transparent.

Priority 4: Establish Technical Support Teams

To ensure the effective use of technology and methodologies in the field, Namibia should establish technical support teams within the Ministry of Agriculture, Water, and Land Reform, and the Ministry of Environment, Forestry, and Tourism (Figure 8). These teams would provide ongoing assistance to field personnel, ensuring that they have the support needed to operate and maintain advanced monitoring systems.

These technical teams would be responsible for troubleshooting issues with equipment, updating software, and guiding personnel through the application of standardized data collection and reporting protocols. By creating a dedicated support structure, Namibia can maintain a high level of accuracy and consistency in its emissions data, while building the long-term technical capacity needed for the sustainability of its MRV systems.

4.2.3.3 Infrastructure and Financial Investments:

Priority 5: Secure International Funding and Partnerships for Advanced Data Collection Tools

Securing international funding and partnerships is crucial for acquiring the advanced tools necessary for comprehensive monitoring in the AFOLU sector (Figure 8). This includes obtaining remote sensing equipment, drones, and GIS software that enhance Namibia's capacity to monitor and report on emissions related to deforestation, afforestation, and agricultural practices. Collaborating with international development organizations, such as the Green Climate Fund (GCF) and other climate initiatives, can provide the financial and technical support required to deploy these technologies effectively.

By investing in these tools, Namibia can improve the precision and timeliness of its emissions data, ensuring that the country's GHG inventory accurately reflects changes in land use and agricultural activities. Such investments will also enable Namibia to strengthen its compliance with international climate agreements by providing transparent and verifiable emissions reports.

Priority 6: Increase Funding Allocations for Capacity Building and Infrastructure Development

To build and sustain technical capacity in the AFOLU sector, Namibia must increase government and donor funding allocations specifically for capacity-building initiatives and infrastructure development (Figure 8). This funding should target both technical training programs and the development of long-term infrastructure to support the sector's MRV systems. By securing resources for these priorities, Namibia can create a workforce capable of managing and analysing the sector's complex data requirements while ensuring that MRV systems are robust and sustainable.

Enhanced funding will also allow for the development of training centres and the acquisition of necessary technology, creating a foundation for continuous learning and technical skill development. With these investments, Namibia can maintain a high level of competence in its AFOLU sector, ensuring that its emissions monitoring and reporting systems are accurate, effective, and resilient.

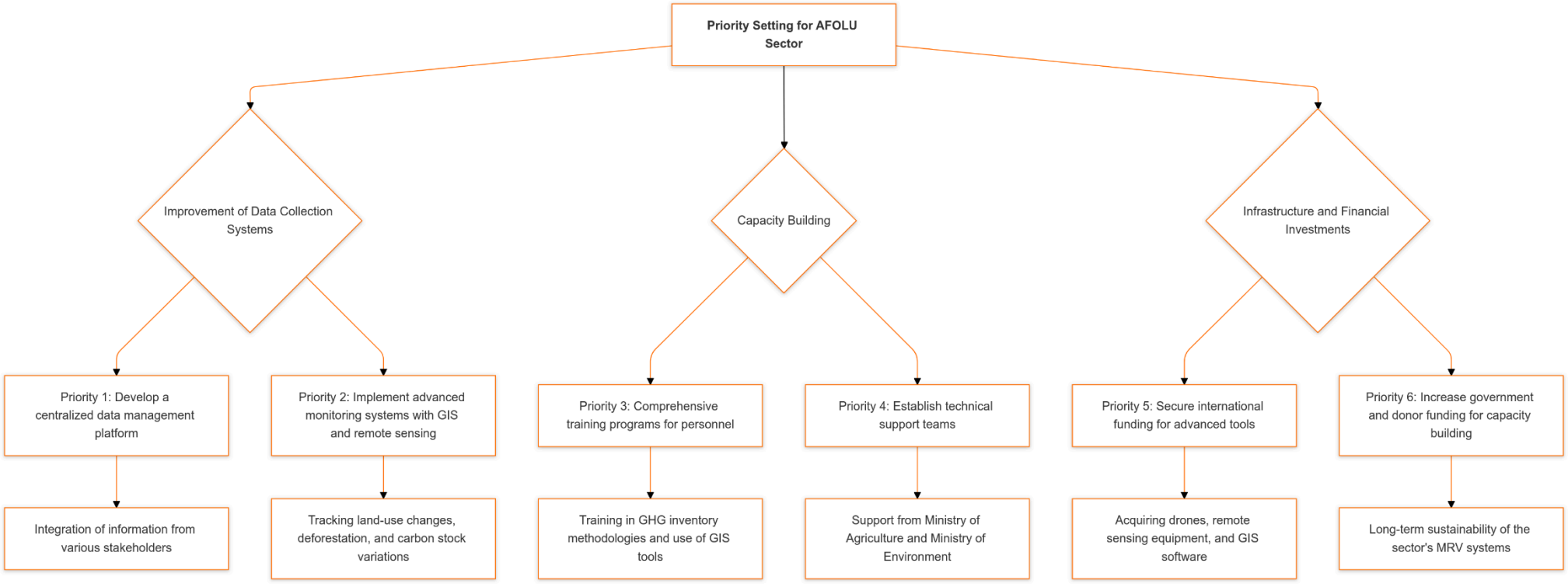

Figure 8. Priority Setting for Enhancing Namibia's AFOLU Data Management Systems.

By addressing these priorities, Namibia can significantly enhance the quality and reliability of its AFOLU data, build institutional capacity for long-term monitoring, and improve compliance with international climate reporting obligations. These efforts will not only strengthen Namibia's ability to meet its NDC targets but also promote sustainable agricultural practices and forest management, contributing to broader environmental and development goals.

4.3 Key Findings from the needs and gaps analysis.

The needs and gaps analysis for Namibia's energy and AFOLU sectors highlights several critical areas for improvement, revealing existing challenges in data management, institutional capacity, technical resources, and financial constraints. These findings provide a clear roadmap for where efforts and investments should be focused to improve emissions tracking and compliance with international climate commitments.

4.3.1 Data Gaps and Inconsistencies

Energy Sector: In the energy sector, there are significant data gaps and inconsistencies, particularly in the collection of information on energy consumption, renewable energy output, and emissions across different sub-sectors. This lack of consistent data collection leads to discrepancies in greenhouse gas (GHG) inventories and projections, affecting the reliability of emissions reporting. The absence of real-time monitoring tools and comprehensive data integration further compounds these challenges.

AFOLU Sector: The AFOLU sector faces similar issues, with data on land-use changes, forestry activities, and agricultural emissions often being incomplete and outdated. The reliance on fragmented data collection methods and the lack of advanced, real-time monitoring tools result in unreliable and inconsistent emissions estimates. Current land-use data often depend on outdated satellite imagery and sparse field observations, which are inadequate for capturing the dynamic nature of land-use activities in Namibia.

Integration Challenges: Across both sectors, there is a notable lack of integration between different data sources, which complicates the process of compiling comprehensive and accurate national inventories. The absence of centralized data management systems limits the ability to consolidate and analyse data efficiently, leading to inefficiencies in emissions reporting and the development of mitigation strategies.

4.3.2 Institutional Capacity Constraints

Technical Expertise Shortages: A major challenge identified across both sectors is the limited capacity of institutions involved in data collection and management. Many agencies lack personnel with the technical expertise necessary for accurate emissions tracking, effective MRV system implementation, and advanced data analysis. In the energy sector, there is a particular shortage of skills needed to use modern emissions accounting tools, while in the AFOLU sector, institutions struggle with a lack of trained staff proficient in managing GIS technology and remote sensing for land-use monitoring.

Limited Exposure to Best Practices: The workforce in key institutions has limited exposure to international best practices, particularly regarding the application of ICAT guidelines and IPCC methodologies. This knowledge gap hinders Namibia's ability to align its MRV systems with international standards, reducing the quality and comparability of its emissions reports.

4.3.3 Technical and Infrastructure Deficiencies

Outdated Monitoring Technologies: Both sectors suffer from outdated or insufficient technical infrastructure, limiting the capacity to accurately monitor emissions and collect real-time data. In the energy sector, the reliance on basic spreadsheets and the absence of smart meters and advanced monitoring devices hinder precise data collection on energy production and consumption.

AFOLU Monitoring Challenges: In the AFOLU sector, the lack of access to GIS technology, drones, and remote sensing tools significantly impairs the monitoring of land-use changes and agricultural emissions. The current practice of using outdated satellite imagery and manual field observations is inadequate for capturing accurate and dynamic land-use data. Without these advanced tools, Namibia's ability to conduct spatial analysis and track emissions accurately is severely limited.

Integration and Data Management Issues: The absence of dedicated data management platforms and integration tools further restricts the capacity of institutions to compile and analyse data effectively. This limitation impacts the quality of Namibia's GHG inventories, as data remains fragmented and difficult to reconcile across different entities.

4.3.4 Financial Constraints

Inadequate Budget for Technological Upgrades: Limited financial resources pose a significant barrier to the development and implementation of advanced data collection and monitoring systems in both sectors. Budget constraints prevent institutions from investing in modern technology, such as remote sensing tools, smart meters, and GIS software, which are critical for improving data accuracy and emissions tracking.

Funding Shortages for Capacity Building: Insufficient funding also affects the ability of institutions to implement capacity-building programs, which are essential for developing and retaining skilled human resources. Without adequate resources, institutions are unable to provide necessary training for staff or maintain expertise in using modern emissions monitoring tools, resulting in a persistent skills gap.

Impact on International Collaboration: The lack of financial investment restricts Namibia's ability to form partnerships with international bodies that could provide technical assistance, advanced tools, and capacity-building support. These partnerships are crucial for enhancing MRV systems and improving compliance with international climate reporting obligations. Without sufficient funding, Namibia's institutions struggle to access the external support needed to upgrade their systems and align with global standards.

4.3.5 Prioritization of Improvements

Centralized Data Management Systems: The analysis underscores the need for a multi-pronged approach to address these challenges. The highest priority for both sectors is to establish centralized and integrated data management systems that standardize data collection practices and enhance the reliability of emissions tracking. This approach will help to eliminate inconsistencies and create a cohesive framework for emissions monitoring.

Capacity Building Initiatives: Investing in capacity-building initiatives is essential to equip institutions with the necessary skills and technical knowledge to manage modern monitoring tools and align Namibia's MRV systems with international standards. This includes training programs

on the application of international methodologies and hands-on experience with advanced data analysis technologies.

Infrastructure and Financial Investments: Enhancing technical infrastructure is also crucial, with a focus on acquiring advanced monitoring devices, remote sensing technology, and GIS tools to improve real-time data collection and spatial analysis capabilities in both sectors. These investments must be supported by strategic financial planning, securing both national and international funding sources to sustain long-term capacity development and system improvements.

The needs and gaps analysis reveals that significant efforts are required to address the technical, institutional, and financial challenges in Namibia's energy and AFOLU sectors. A focused approach on capacity building, technical infrastructure upgrades, and financial investment is essential to enhance data quality, improve emissions tracking, and ensure Namibia's compliance with its international climate commitments. By prioritizing these areas, Namibia can build a more accurate and resilient system for monitoring and reporting emissions, supporting its transition towards a sustainable and low-carbon future.

5 GHG Emissions Projections

Namibia's approach to collecting and validating historical GHG emissions data is methodical and structured, ensuring data accuracy, consistency, and alignment with international standards. By integrating diverse data sources and engaging key stakeholders, Namibia builds a credible foundation for emissions projections that guide its climate action strategies and fulfil international commitments.

5.1 Data Collection and Validation

The process of collecting and validating historical data on GHG emissions in Namibia is designed to be comprehensive and inclusive, incorporating inputs from various sectors and institutions (Figure 9). This approach ensures that the emissions data collected are accurate, consistent, and representative of Namibia's emissions profile, supporting the development of reliable projections.

5.1.1 Data Collection Process

The collection of historical GHG emissions data in Namibia follows a multi-step approach, utilizing inputs from different sectors and institutions (Figure 9):

5.1.1.1 Identification of Data Sources:

- ***Government Ministries:*** Historical GHG emissions data are primarily sourced from key government ministries, such as the Ministry of Mines and Energy for the energy sector and the Ministry of Agriculture, Water, and Land Reform for the AFOLU sector. These ministries provide sector-specific data crucial for compiling a comprehensive emissions inventory.
- ***Additional Agencies:*** Data are also collected from entities such as the Namibia Statistics Agency, Namibia Energy Institute, and regulatory bodies like the Electricity Control Board. These organizations contribute data on energy production, consumption, land-use changes, and emissions, ensuring sectoral diversity and comprehensive coverage.
- ***Satellite Imagery and Remote Sensing:*** In the AFOLU sector, satellite imagery, remote sensing data, and field surveys are used to collect detailed information on deforestation, agricultural practices, and land-use changes. These technologies provide spatial and temporal insights critical for emissions accounting, enhancing the accuracy and granularity of emissions data.

5.1.1.2 Compilation and Integration of Data:

- ***Centralized Database Management:*** Data collected from various sources are compiled into a centralized database managed by the Namibia Statistics Agency (NSA) and the Ministry of Environment, Forestry, and Tourism. This centralized approach integrates information across different sectors, providing a holistic view of Namibia's historical emissions and facilitating streamlined analysis.
- ***Data Integration Techniques:*** The integration process involves aligning data formats, estimating missing values based on sectoral trends, and ensuring consistency across time series data. Advanced data management software and geographic information

systems (GIS) are used, particularly for spatial data, to integrate and analyse emissions data accurately.

5.1.1.3 Application of IPCC Guidelines:

- ***Alignment with IPCC Standards:*** The data collection process is aligned with the Intergovernmental Panel on Climate Change (IPCC) 2006 guidelines for GHG inventories. Emissions sources are categorized according to IPCC sectors (e.g., energy, industrial processes, AFOLU, and waste), and emissions factors used for calculations adhere to IPCC standards to ensure methodological consistency.
- ***Comparability and Compliance:*** By using standardized methodologies and emissions factors, Namibia ensures that its emissions inventories are comparable with international reports and align with obligations under the United Nations Framework Convention on Climate Change (UNFCCC). This alignment enhances the transparency and credibility of Namibia's emissions data.

5.1.2 Validation Process with Stakeholders

To maintain the accuracy and credibility of collected data, Namibia engages in a comprehensive validation process involving various stakeholders (Figure 9):

5.1.2.1 Stakeholder Engagement and Consultation:

- ***Consultative Workshops:*** Relevant stakeholders, including government agencies, private sector representatives, local community groups, and international partners (e.g., UNDP, ICAT), are engaged through workshops and consultation meetings (Figure 9). These sessions verify data accuracy, address discrepancies, and gather feedback to refine emissions estimates.
- ***Knowledge Exchange Platforms:*** Workshops serve as platforms for discussing data collection methods, reviewing preliminary results, and validating emissions estimates for each sector (Figure 9). These engagements facilitate knowledge exchange and foster stakeholder commitment to the emissions inventory process.

5.1.2.2 Technical Review and Verification:

- ***Expert Review Process:*** The emissions data undergo a technical review by experts from the Namibia Energy Institute and the Ministry of Environment, Forestry, and Tourism. These experts cross-check the data against international standards and benchmarks, ensuring consistency and accuracy (Figure 9). The review process involves comparing emissions estimates from different data sources to identify and resolve discrepancies.
- ***Third-Party Verification:*** To enhance credibility, third-party verification is conducted by international experts and organizations, such as the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP) (Figure 9). These organizations provide technical assistance and guidance, ensuring that Namibia's data meets international verification standards and is aligned with best practices.

5.1.2.3 Incorporation of Stakeholder Feedback:

- ***Refinement Through Feedback:*** Feedback from stakeholders is incorporated into the final emissions inventory to correct errors and refine data collection methodologies (Figure 9). This iterative process enhances data accuracy and fosters collaboration, with stakeholders actively participating in the development of emissions projections.

- ***Documentation and Transparency:*** Adjustments made to the data, such as recalculations based on updated emissions factors or corrections to historical trends, are documented and communicated to stakeholders (Figure 9). This ensures transparency and maintains the integrity of the emissions inventory process, building trust and credibility in the results.

5.1.3 Finalization of Validated Data

- ***Finalization for Projections:*** Once the data are validated and verified, they are finalized for use in GHG emissions projections (Figure 9). The validated data set forms the foundation for developing future emissions scenarios, including Business-As-Usual (BAU) and mitigation scenarios that align with Namibia's Nationally Determined Contributions (NDCs).
- ***Integration into National GHG Inventory:*** The finalized data are integrated into Namibia's national GHG inventory and used in reports submitted to the UNFCCC, ensuring compliance with international reporting requirements and fulfilling transparency commitments under the Paris Agreement (Figure 9).

By following this structured approach to data collection and validation (Figure 9), Namibia ensures that its historical GHG emissions data are accurate, comprehensive, and credible. This robust data foundation supports the development of reliable emissions projections and informs climate action strategies, helping Namibia align with its international climate commitments and develop effective mitigation pathways.

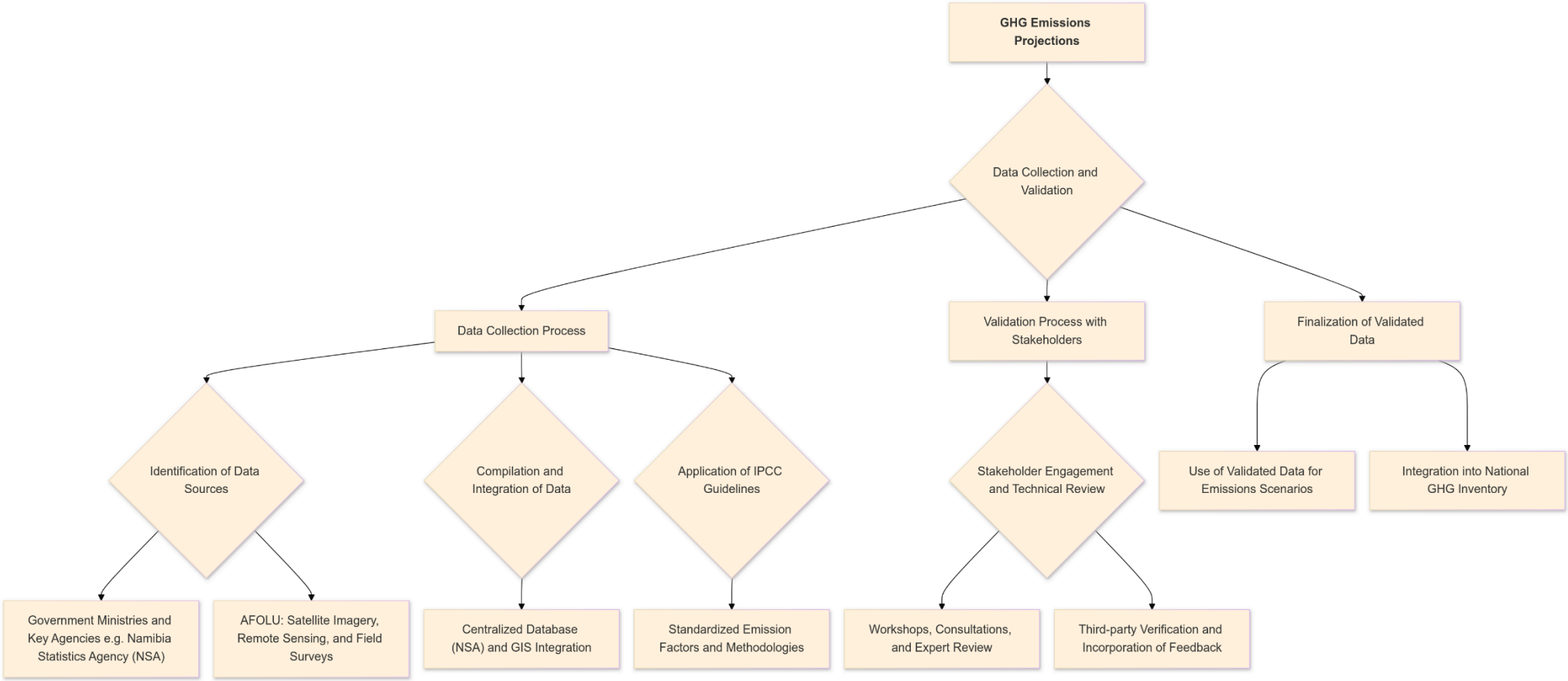

Figure 9. Namibia's GHG Emissions Projections: Data Collection and Validation Process.

To complement Figure 9, Table 2 outlines the roles and responsibilities of key stakeholders involved in this process. Defining these roles strengthens the transparency and accuracy of emissions data, ensuring alignment with both national climate policies and international standards.

Table 2. Stakeholder Roles and Responsibilities in the GHG Data Collection and Validation Process.

Stakeholder	Role	Responsibilities
Ministry of Environment, Forestry, and Tourism (MEFT)	Lead agency overseeing data collection and ensuring compliance with UNFCCC guidelines.	Coordinate with sectoral ministries, implement data quality checks, submit validated emissions data, and ensure alignment with international reporting standards.
Namibia Statistics Agency (NSA)	Validate collected data against national economic indicators and ensure statistical accuracy.	Cross-verify activity data with national datasets, maintain quality-controlled data storage, and archive emissions data as the national repository.
Ministry of Mines and Energy (MME)	Provide data on energy production and consumption for estimating emissions from energy sources.	Ensure data on fossil fuel usage, renewable energy, and sector-specific emissions are accurately collected and integrated into the national inventory.
Ministry of Agriculture, Water, and Land Reform (MAWLR)	Supply data for the AFOLU (Agriculture, Forestry, and Other Land Use) sector.	Ensure accurate, up-to-date data on agricultural practices, land-use changes, and forestry. Coordinate with communities and land management agencies for validation.
External Consultants and Independent Auditors	Conduct independent quality assurance (QA) to validate emissions estimates and data integrity.	Review data collection methodologies, conduct uncertainty analyses, and provide recommendations for meeting international standards and enhancing data credibility.
Stakeholder Collaboration Workshops	Enhance collaboration and refine data collection and validation processes.	Facilitate transparency and standardized methodologies, with continuous improvement through feedback from all involved sectors.

5.2 Scenario Development

Scenario development for future GHG emissions projections in Namibia involves exploring multiple pathways based on varying policy, technological, and socio-economic assumptions. The scenarios are crafted to align with Namibia's Nationally Determined Contributions (NDCs) under the Paris Agreement and other national development goals, offering policymakers a range of options for strategic planning. The primary scenarios include:

5.2.1 Business-As-Usual (BAU) Scenario

5.2.1.1 Overview

The BAU scenario assumes the continuation of current policies, practices, and socio-economic conditions without any additional climate action or mitigation measures beyond those already in place. It serves as a baseline for comparing other scenarios.

5.2.1.2 Assumptions:

- ***Energy Production:*** No significant shift in energy sources, with Namibia continuing its reliance on a mix of fossil fuels and limited renewable energy.
- ***Agricultural and Land Use Practices:*** Agricultural practices, land-use patterns, and deforestation rates remain consistent with historical trends, leading to emissions growth proportional to economic and population growth.
- ***Policy Stasis:*** Existing policies and regulations remain unchanged, with no new interventions aimed at reducing GHG emissions or increasing the uptake of clean technologies.

5.2.1.3 Implications:

- ***Emissions Growth:*** Under the BAU scenario, GHG emissions are expected to rise steadily as economic growth, population increase, and the expansion of industrial and agricultural activities drive emissions higher.
- ***Baseline Reference:*** This scenario provides a reference point to highlight the emissions trajectory if no further mitigation actions are taken, serving as a benchmark for evaluating other scenarios.

5.2.2 Policy Implementation Scenario

5.2.2.1 Overview:

This scenario models the effect of Namibia implementing its current policy commitments and planned initiatives as outlined in its NDCs and other national climate policies. It represents a moderate level of ambition, reflecting Namibia's efforts to transition to renewable energy and implement sustainable practices in agriculture and forestry.

5.2.2.2 Assumptions:

- ***Renewable Energy Expansion:*** A gradual increase in renewable energy generation (e.g., solar and wind) as investments in clean energy infrastructure grow and new projects come online.
- ***Sustainable Agricultural Practices:*** Adoption of improved irrigation, conservation agriculture, and livestock management techniques to reduce emissions from the AFOLU sector.
- ***Forest Protection Measures:*** Implementation of regulations to protect forests, reduce deforestation, and promote afforestation and reforestation initiatives.
- ***Energy Efficiency:*** Improved energy efficiency measures in industrial and residential sectors, supported by government policies and incentives.

5.2.2.3 Implications:

- ***Slower Emissions Growth:*** GHG emissions growth slows as clean energy deployment and sustainable land-use practices begin to offset emissions from traditional sources.
- ***Progress Towards Climate Goals:*** The scenario demonstrates moderate progress towards Namibia's climate goals, showing the impact of existing and planned policy measures.

5.2.3 High-Ambition Mitigation Scenario

5.2.3.1 Overview:

The high-ambition scenario represents an intensified pathway where Namibia exceeds its current commitments, targeting aggressive GHG emissions reductions. This scenario aligns with

achieving net-zero emissions by mid-century, consistent with global efforts to limit warming to 1.5°C.

5.2.3.2 Assumptions:

- ***Rapid Renewable Energy Expansion:*** Significant investments in solar, wind, and potentially hydrogen technologies, leading to a phased reduction in fossil fuel-based energy generation.
- ***Nature-Based Solutions:*** Large-scale reforestation, soil carbon sequestration projects, and restoration of degraded lands are implemented comprehensively.
- ***Climate-Smart Agriculture:*** Accelerated adoption of agroforestry, improved livestock management, and the use of organic fertilizers to reduce AFOLU sector emissions.
- ***Regulatory and Economic Instruments:*** Strong regulatory frameworks, incentives for energy efficiency, and the implementation of carbon pricing mechanisms, such as carbon taxes or emissions trading systems, to incentivize emission reductions across all sectors.

5.2.3.3 Implications

- ***Significant Emissions Reduction:*** Emissions decrease substantially as Namibia transitions towards a low-carbon economy, achieving large reductions compared to the BAU and Policy Implementation scenarios.
- ***Regional Climate Leadership:*** The scenario positions Namibia as a leader in climate action within the region, demonstrating a commitment to meeting international climate targets.

5.2.4 Low-Carbon Development (LCD) Scenario

5.2.4.1 Overview

The LCD scenario emphasizes balancing economic development with emissions reduction, ensuring that Namibia's growth is both sustainable and inclusive. It integrates green technologies and sustainable practices into national development plans to achieve long-term emissions reductions.

5.2.4.2 Assumptions

- ***Green Infrastructure Projects:*** Development of eco-friendly urban planning, public transport systems powered by renewable energy, and sustainable housing solutions.
- ***Economic Diversification:*** Shifting the economy towards low-carbon industries like eco-tourism, sustainable fisheries, and clean technology manufacturing to reduce dependency on traditional high-emission sectors.
- ***Community-Led Initiatives:*** Support for community-driven forestry and agricultural projects that build local capacity, increase climate resilience, and reduce emissions.
- ***Support for Smallholders:*** Expansion of financial and technical assistance for smallholders and rural communities to adopt low-emission technologies and practices in agriculture.

5.2.4.3 Implications

- ***Simultaneous Economic Growth and Emissions Reduction:*** The LCD scenario illustrates how Namibia can achieve economic development while minimizing its carbon footprint, demonstrating that growth and emissions reduction are not mutually exclusive.
- ***Sustainable and Inclusive Development:*** Emissions reductions are significant compared to the BAU scenario, while also enhancing community resilience, creating jobs, and supporting sustainable livelihoods.

5.2.5 Summary of Scenarios and Policy Implications

The development of these scenarios provides a comprehensive view of Namibia's possible emissions trajectories, enabling policymakers to make informed decisions on actions needed to achieve the country's climate targets. Each scenario offers insights into the impact of different levels of ambition and investment in climate action:

- ***Business-As-Usual (BAU):*** A baseline projection with no additional mitigation efforts.
- ***Policy Implementation:*** Reflects Namibia's current and planned policy measures aimed at reducing emissions.
- ***High-Ambition Mitigation:*** Illustrates an aggressive pathway to significant emissions reductions aligned with global climate targets.
- ***Low-Carbon Development (LCD):*** Balances emissions reduction with socio-economic development to foster sustainable and inclusive growth.

These scenarios (see Table 3) form the basis for strategic planning, ensuring that Namibia's GHG emissions projections align with its national and international commitments while promoting sustainable development. The comparative analysis of Namibia's emissions reduction scenarios highlights four distinct pathways with varying levels of climate ambition and socio-economic focus. The Business-As-Usual (BAU) scenario, as a baseline, projects the highest emissions growth without additional climate actions. In contrast, the Policy Implementation scenario, based on existing commitments, shows moderate progress, achieving around 20% emissions reduction. The High-Ambition Mitigation scenario targets aggressive actions, such as rapid renewable expansion and reforestation, potentially reducing emissions by 60% and aligning with net-zero goals. The Low-Carbon Development (LCD) scenario balances emissions cuts with sustainable economic growth, achieving a 40% reduction through green infrastructure, economic diversification, and community initiatives. Together, these scenarios in Table 1 provide policymakers with options to align Namibia's climate strategy with its national and international goals for a sustainable, low-carbon future.

Table 3. Comparative Analysis of Emissions Reduction Scenarios.

Metric	Business-As-Usual (BAU)	Policy Implementation	High-Ambition Mitigation	Low-Carbon Development (LCD)	Key Assumptions
Renewable Energy Expansion	No significant change	Gradual increase	Rapid expansion in solar, wind, and hydrogen	Moderate increase with green infrastructure focus	BAU assumes continued reliance on fossil fuels; High-Ambition includes 100% renewable energy by 2040 in the power sector.
Energy Efficiency	Limited efforts	Moderate improvements in efficiency	Strong regulatory support, carbon pricing	Integration in sustainable urban and transport planning	Assumptions include progressive efficiency standards in Policy Implementation and advanced urban planning in LCD.

Metric	Business-As-Usual (BAU)	Policy Implementation	High-Ambition Mitigation	Low-Carbon Development (LCD)	Key Assumptions
Agricultural Practices	Continuation of traditional practices	Adoption of improved practices	Climate-smart agriculture and agroforestry	Low-emission practices with community-driven projects	High-Ambition relies on extensive adoption of climate-smart agriculture; LCD supports sustainable community-based projects.
Forest Protection Measures	Minimal to no action	Implementation of protective regulations	Large-scale reforestation and land restoration	Community-led conservation and reforestation	LCD focuses on community-led initiatives; High-Ambition assumes 50% reduction in deforestation by 2030.
Emissions Growth	High growth in emissions	Moderate growth with some reductions	Significant emissions reduction towards net-zero	Moderate reduction, with simultaneous economic growth	BAU continues emissions rise; High-Ambition projects a ~60% reduction with regulatory and economic measures.
Policy Goals	Baseline reference	Progress toward Namibia's climate goals	Achieving net-zero emissions by mid-century	Sustainable and inclusive economic development	LCD integrates socio-economic growth; High-Ambition targets net-zero emissions by mid-century.
Projected Emissions Reduction (%)	0% (Baseline)	~20% reduction	~60% reduction	~40% reduction	Each scenario targets varying reduction levels: BAU baseline, moderate for Policy Implementation, high for ambitious goals.

Each of these scenarios (Table 3) provides a distinct pathway, enabling policymakers to understand the varying outcomes of different levels of climate ambition and socio-economic investments. The BAU scenario serves as a baseline, while the Policy Implementation, High-Ambition Mitigation, and LCD scenarios progressively increase in ambition and mitigation outcomes. Through this comparative analysis, Namibia's policymakers are equipped with a clear view of how varying degrees of climate action could shape the country's emissions trajectory, aligning it with both national and international climate goals.

This analysis provides a foundation for strategic planning, allowing Namibia to select a path that best aligns with its priorities for climate resilience, economic development, and social inclusion.

5.3 Modelling and Analysis:

To project GHG emissions under different scenarios for Namibia, a combination of models and analytical tools is employed, capturing the complexities of the energy and AFOLU sectors while considering socio-economic interactions. These models adhere to international best practices and provide robust, transparent, and policy-relevant emissions projections, ensuring consistency with global standards.

5.3.1 Integrated Assessment Models (IAMs)

5.3.1.1 Model Used: GACMO (Greenhouse Gas Abatement Cost Model)

- ***Description:*** GACMO is an integrated assessment model designed to evaluate the cost and impact of different mitigation measures across sectors, including energy, agriculture, and land use. It supports countries in assessing how various policy measures and technological interventions can affect GHG emissions.
- ***Application:*** In Namibia, GACMO is applied to project emissions under the Business-As-Usual (BAU), Policy Implementation, High-Ambition Mitigation, and Low-Carbon Development scenarios. It incorporates data on economic growth, energy consumption, land-use changes, and sector-specific emissions measures to provide a comprehensive forecast.
- ***Capabilities:*** GACMO allows for analysis based on changes in technology adoption, costs of mitigation measures, and implementation timelines, making it adaptable for evaluating multiple emissions pathways. It is aligned with international reporting standards, ensuring Namibia's projections are consistent with global best practices.

5.3.2 Energy Sector Models

5.3.2.1 Model Used: LEAP (Long-range Energy Alternatives Planning System)

- ***Description:*** LEAP is a widely used energy system modelling tool that simulates energy production, consumption, and associated GHG emissions. It allows for the analysis of energy policies, technology adoption, and investment scenarios across various energy sources.
- ***Application:*** In Namibia's energy sector, LEAP models the impacts of expanding renewable energy capacity, improving energy efficiency, and transitioning from fossil fuels to cleaner alternatives under different scenarios. It uses data on energy consumption patterns, generation capacities, and technology costs to estimate future emissions.
- ***Capabilities:*** LEAP provides flexibility in defining energy pathways, enabling Namibia to model the impacts of its renewable energy targets and efficiency initiatives. It incorporates emissions factors based on IPCC guidelines, ensuring the accuracy and reliability of emissions estimates.

5.3.3 Agriculture, Forestry, and Other Land Use (AFOLU) Models

5.3.3.1 Model Used: GACMO (Greenhouse Gas Abatement Cost Model)

- ***Description:*** GACMO is also utilized in the AFOLU sector to evaluate the effectiveness and costs of different mitigation options, such as sustainable agricultural practices, land restoration efforts, and afforestation initiatives.
- ***Application:*** In Namibia, GACMO assesses the impact of various strategies aimed at reducing emissions in agriculture and forestry. This includes modelling scenarios

involving improved livestock management, conservation agriculture, and measures to control deforestation and enhance carbon sequestration.

- ***Capabilities:*** The model integrates economic and biophysical data, allowing for detailed analysis of mitigation measures' effectiveness. It evaluates the costs and benefits of adopting climate-smart practices and tracks the outcomes of emissions reduction initiatives within the AFOLU sector.

5.3.3.2 Model Used: EXACT (Ex-Ante Carbon-balance Tool)

- ***Description:*** EXACT is a tool developed to estimate the impact of agricultural and land management practices on carbon emissions and sequestration. It provides a detailed assessment of how specific interventions, such as agroforestry and improved crop management, affect GHG emissions in the AFOLU sector.
- ***Application:*** In Namibia, EXACT is used to model emissions reductions associated with sustainable agricultural practices, including soil carbon sequestration and agroforestry projects (NILALEG)[1]. It integrates spatial and agricultural data to predict changes in carbon balance from different land-use strategies.
- ***Capabilities:*** EXACT supports scenario analysis by evaluating the impact of various agricultural practices on emissions and carbon sequestration potential. It helps Namibia develop precise emissions estimates based on localized agricultural and land-use practices.

5.3.3.3 Model Used: GLOBIOM (Global Biosphere Management Model)

- ***Description:*** GLOBIOM is a partial equilibrium model that simulates land use, agriculture, and forestry sectors. It assesses the impacts of land-use policies, agricultural practices, and deforestation/afforestation efforts on GHG emissions and carbon sequestration.
- ***Application:*** In Namibia, GLOBIOM is applied to model the AFOLU sector under scenarios involving sustainable agricultural practices, land restoration efforts, and deforestation control measures. It uses spatial data and economic inputs to project emissions from livestock, crop production, forestry activities, and land-use changes.
- ***Capabilities:*** GLOBIOM integrates biophysical and economic data, allowing it to simulate the impact of various policies, such as conservation agriculture, agroforestry, and forest management strategies. It can also evaluate the trade-offs between land use for agriculture, bioenergy, and forest conservation, providing detailed insights into emissions pathways.

5.3.4 GIS-Based Spatial Analysis Tools

5.3.4.1 Model Used: GIS (Geographic Information Systems) and Remote Sensing Analysis

- ***Description:*** GIS and remote sensing technologies are used to monitor and analyse spatial patterns related to land use, deforestation, and changes in biomass. These tools provide accurate and up-to-date information on land-cover changes, which are critical for estimating emissions and carbon sequestration potential in the AFOLU sector.

[1] **NILALEG Project:** https://nilaleg.eif.org.na/

- ***Application:*** GIS-based analysis is integrated into the GLOBIOM model to enhance its spatial resolution and accuracy. It allows for tracking land-use changes over time, particularly in forested and agricultural areas, helping refine emissions estimates from these sources.
- ***Capabilities:*** By utilizing high-resolution satellite imagery and spatial data, GIS tools can accurately measure changes in forest cover, crop areas, and biomass stocks. This level of detail is essential for validating AFOLU emissions estimates and aligning them with field data.

5.3.5 Economic and Policy Analysis Models

5.3.5.1 Model Used: CGE (Computable General Equilibrium) Model

- ***Description:*** The CGE model is used to simulate the economic impacts of different policy scenarios on Namibia's economy, particularly focusing on how these policies influence energy and AFOLU sector activities. It integrates economic data with emissions data to analyse the effects of emissions reduction strategies on GDP, employment, and other economic indicators.
- ***Application:*** In Namibia's projections, the CGE model evaluates the economic implications of adopting low-carbon technologies, transitioning to renewable energy, and implementing sustainable agricultural practices. It provides insights into how various mitigation measures might impact economic growth and development.
- ***Capabilities:*** The CGE model is essential for balancing emissions reductions with economic growth objectives, ensuring that the scenarios developed are not only environmentally sustainable but also economically viable.

5.3.6 Summary of Models Used

Table 4. Summary of Models Used for Namibia's GHG Emissions Projections.

Model	Sector	Application	Capabilities
GACMO	Energy & AFOLU	Projects emissions and evaluates the impact and cost of mitigation measures for energy, agriculture, and forestry.	Allows analysis of technology adoption rates, costs, and implementation timelines; integrates economic and biophysical data.
LEAP	Energy	Models' energy production, consumption, and emissions under various scenarios, including renewable energy expansion and efficiency improvements.	Provides flexible scenario analysis; integrates emissions factors per IPCC guidelines; simulates impacts of energy policies.
EXACT	AFOLU	Estimates the carbon impact of agricultural practices, including soil carbon sequestration and agroforestry.	Evaluates carbon balance changes from agricultural interventions; integrates spatial and agricultural data for accurate emissions estimates.

GLOBIOM	AFOLU	Simulates impacts of land-use policies, agricultural practices, and forest management on emissions and carbon sequestration.	Integrates biophysical and economic data; assesses trade-offs between land uses and provides comprehensive emissions pathways.
CGE Model	Economy-wide	Simulates the economic impacts of different policy scenarios, focusing on energy and AFOLU sectors' contributions to GDP, employment, and emissions.	Analyses economic growth implications of mitigation measures; balances emissions reductions with economic development objectives; integrates emissions and economic data for holistic scenario assessment.

These models presented in Table 4 provide a comprehensive and integrated approach to projecting GHG emissions for Namibia under different scenarios. By combining energy and AFOLU sector models with economic and spatial analysis tools, Namibia can accurately simulate future emissions trajectories, evaluate policy impacts, and align its national strategies with global climate commitments.

5.4 Key Findings: Present the main insights from the GHG emissions projections.

The GHG emissions projections for Namibia are built on a thorough analysis using integrated models and stakeholder engagement through workshops and consultations. These findings offer critical insights into potential emissions trajectories under different scenarios and provide guidance for effective policymaking. The key insights presented below incorporate input from the Inception Workshop and subsequent consultations.

5.4.1 Main Insights from GHG Emissions Projections

5.4.1.1 Business-As-Usual (BAU) Scenario:

- ***Emissions Growth:*** If Namibia continues without implementing additional mitigation measures, GHG emissions are expected to rise significantly by 2030 and 2050. Key drivers include the continued reliance on fossil fuels in the energy sector, deforestation, and livestock emissions in the AFOLU sector.
- ***Non-compliance with NDCs:*** Under the BAU scenario, Namibia is unlikely to meet its NDC targets, making it challenging to align with international agreements like the Paris Agreement.

5.4.1.2 Policy Implementation Scenario:

- ***Moderate Emissions Reduction:*** Implementing Namibia's current and planned policies can moderately reduce emissions compared to the BAU scenario. Expanding renewable energy projects and improving agricultural practices are expected to slow emissions growth.
- ***Need for Strengthening Measures:*** Despite some progress, further efforts beyond current commitments are necessary to meet NDC targets. Strengthening renewable energy incentives and expanding sustainable forestry programs are key areas for improvement.

5.4.1.3 High-Ambition Mitigation Scenario:

- ***Significant Emissions Reduction:*** A high-ambition approach, involving accelerated deployment of renewable energy technologies and comprehensive land-use management strategies, shows potential for substantial emissions reductions. A full transition to renewable energy could achieve near-zero emissions in the energy sector by 2050.
- ***Regional Climate Leadership:*** By implementing aggressive reforestation, soil carbon sequestration, and climate-smart agriculture, Namibia could drastically reduce AFOLU sector emissions, positioning itself as a leader in regional climate action.

5.4.1.4 Low-Carbon Development (LCD) Scenario:

- ***Balancing Growth and Emissions Reduction:*** The LCD scenario demonstrates the possibility of aligning economic growth with emissions reductions through investments in green infrastructure, sustainable agriculture, and community-led forestry programs. Emissions reductions are significant compared to the BAU scenario, and economic co-benefits such as job creation and rural livelihood improvement are realized.
- ***Socio-Economic Resilience:*** This scenario shows that integrating low-carbon strategies into national development plans not only reduces emissions but also enhances socio-economic resilience, especially for vulnerable communities.

5.4.2 Inception Workshop: Planning and Execution

The Inception Workshop was a crucial platform for gathering stakeholder insights and validating the GHG emissions projections approach. Below are details of its planning, execution, and key outcomes:

5.4.2.1 Planning and Preparation

- ***Workshop Agenda and Materials:*** The workshop agenda covered the objectives, methodologies, and scenarios being developed for the emissions projections exercise. Presentations explained the models used (e.g., LEAP, GLOBIOM, GIS-based analysis) and their relevance to Namibia's energy and AFOLU sectors. Handouts summarizing Namibia's GHG emissions profile and scenario descriptions were distributed to facilitate stakeholder engagement.
- ***Stakeholder Invitations:*** Invitations were extended to a diverse range of stakeholders, including government representatives (e.g., Ministry of Mines and Energy, Ministry of Environment, Forestry, and Tourism), private sector entities, local community groups, NGOs, and international development partners (e.g., UNDP, ICAT). This broad participation ensured comprehensive feedback from multiple perspectives.

5.4.2.2 Workshop Execution

- ***Presentation of Findings:*** Preliminary results of each scenario and the models used were presented, providing stakeholders with a clear understanding of emissions trajectories under different assumptions and policy interventions.
- ***Facilitated Discussions:*** Stakeholders participated in discussions on the challenges and opportunities for emissions reduction in Namibia, covering topics like expanding renewable energy, overcoming barriers to sustainable agriculture, and enhancing community-led forestry programs. Financial and technical capacity challenges were also highlighted, with participants emphasizing the importance of international partnerships for technical assistance and funding.
- ***Feedback Collection:*** Feedback was gathered through breakout sessions and plenary discussions. Stakeholders provided input on improving data accuracy, enhancing

stakeholder coordination, and aligning measures with Namibia's development goals, refining the scenarios to better reflect local realities.

5.4.3 Documentation and Follow-Up

5.4.3.1 Key Outcomes and Action Points:

- ***Consensus on Integrated Approach:*** The workshop resulted in stakeholder consensus on the need for an integrated approach that combines energy and AFOLU sector measures to maximize emissions reductions.
- ***Formation of Technical Working Group:*** A technical working group was established to refine data inputs and methodologies. Follow-up workshops were planned to keep stakeholders informed as scenarios are further developed.

5.4.3.2 Follow-Up Plan:

- ***Incorporating Feedback:*** A detailed plan was created to incorporate stakeholder feedback into the modelling process, including technical consultations with key institutions for data validation.
- ***Future Engagements:*** Additional workshops and consultations were scheduled to present updated findings and gather further input as new information becomes available.

5.4.4 Key Outcomes from the Workshop

5.4.4.1 Main Insights and Feedback:

- ***Renewable Energy Priority:*** Stakeholders emphasized prioritizing renewable energy expansion, given Namibia's high solar and wind potential. They supported developing incentives to attract private sector investment in these areas.
- ***Support for Local Communities:*** Concerns were raised about the capacity of local communities and smallholders to adopt sustainable agricultural practices. Stakeholders recommended focusing support programs on capacity building and financial assistance to facilitate effective implementation.
- ***Institutional Coordination:*** The need for stronger coordination among institutions was highlighted, particularly for integrating AFOLU and energy sector data to develop a comprehensive and unified GHG inventory.
- ***Integration of LCD Scenario:*** Stakeholders recognized the potential of the Low-Carbon Development scenario and advocated for its integration into Namibia's long-term national development strategies, ensuring that climate action aligns with economic development objectives and delivers socio-economic co-benefits.

The key findings from the GHG emissions projections, supported by insights and feedback gathered during the Inception Workshop, highlight the importance of an integrated approach to emissions reduction in Namibia. By leveraging its renewable energy potential, promoting sustainable land management practices, and ensuring continuous stakeholder engagement, Namibia can achieve its climate targets while enhancing socio-economic resilience. The workshop outcomes provide a roadmap for refining scenarios, prioritizing actions, and aligning national strategies with global climate commitments.

6 Conclusion

The conclusion synthesizes the insights from the Stocktake and GHG emissions projections study, providing actionable recommendations and outlining the necessary steps for effective implementation. These measures aim to guide Namibia's efforts in aligning its emissions reduction strategies with both national development goals and international climate commitments.

6.1 Summary of Key Findings

6.1.1 Data Gaps and Inconsistencies

Significant data gaps and inconsistencies exist in both the energy and AFOLU sectors, particularly in the quality and frequency of data collection. The current data systems are fragmented, lacking integration across institutions, which affects the accuracy and reliability of Namibia's GHG inventory.

6.1.2 Institutional and Capacity Constraints

Namibia's institutions face technical and human resource limitations in managing, analysing, and reporting GHG emissions data. Many entities lack the necessary training and technological tools to implement advanced data management systems and align their MRV (Monitoring, Reporting, and Verification) systems with international standards.

6.1.3 Potential for Emissions Reduction

The projections under various scenarios indicate that Namibia can significantly reduce its GHG emissions through comprehensive policies, renewable energy investments, sustainable land-use practices, and nature-based solutions. The high-ambition and low-carbon development scenarios demonstrate pathways that balance emissions reduction with economic growth and social development.

6.1.4 Importance of Stakeholder Engagement

Effective climate action in Namibia requires coordinated stakeholder engagement. Insights from the Inception Workshop and consultations emphasized the need for collaboration between government, private sector, and community groups to effectively implement emissions reduction strategies.

6.2 Recommendations for Future Actions

To strengthen Namibia's efforts toward a sustainable, low-carbon future, the following recommendations outline specific, actionable steps, responsible parties, and suggested timelines.

6.2.1 **Recommendation 1:** *Establish a Centralized Data Management Platform*

Objective: To improve data accuracy, consistency, and accessibility across energy and AFOLU sectors.
Action: Create a national data platform by Q4 2025 to integrate energy production, consumption, and emissions data from all relevant sectors.
Responsible Parties: Led by the Ministry of Environment, Forestry, and Tourism, in collaboration with the Ministry of Mines and Energy, and the Namibia Statistics Agency.

Estimated Budget: 5 million Namibian dollars for platform development and training.
Timeline: Platform design and vendor selection by Q2 2024, pilot testing by Q1 2025, and full launch by Q4 2025.

6.2.2 **Recommendation 3:** *Expand Human Resource Capacity in Data Management and MRV Systems*

Objective: Address shortages in skilled personnel and enhance institutional expertise in Monitoring, Reporting, and Verification (MRV).
Action: Develop a comprehensive training program for 100 personnel across key agencies on advanced data management and MRV tools by Q3 2024.
Responsible Parties: Namibia Statistics Agency and the Ministry of Mines and Energy, with technical support from international climate organizations.
Estimated Budget: 3 million Namibian dollars for training modules, workshops, and ongoing skills development.
Timeline: Training curriculum finalized by Q1 2024, with full training rollout by Q2 2024.

6.2.3 **Recommendation 3:** *Accelerate Renewable Energy Deployment through Policy Incentives*

Objective: Enhance Namibia's renewable energy capacity to meet emissions reduction targets.
Action: Implement tax incentives and subsidies for solar and wind energy projects by Q1 2025 to encourage private investment and infrastructure growth.
Responsible Parties: Ministry of Mines and Energy and the Ministry of Finance.
Estimated Budget: Initial fund allocation of 10 million Namibian dollars to support tax incentives and financing mechanisms for renewable projects.
Timeline: Policy development and stakeholder engagement by Q3 2024, incentive rollout by Q1 2025.

6.2.4 **Recommendation 4:** *Promote Climate-Smart Agriculture and Forestry Practices*

Objective: Reduce emissions from the AFOLU sector through sustainable land use and forestry management.
Action: Implement financial incentives for farmers and community-led forestry projects by Q4 2024, emphasizing agroforestry, improved livestock management, and reforestation.

Responsible Parties: Ministry of Agriculture, Water, and Land Reform in partnership with community organizations and environmental NGOs.
Estimated Budget: 8 million Namibian dollars to fund community-based projects and technical support for climate-smart practices.
Timeline: Program guidelines established by Q2 2024, incentive distribution and project initiation by Q4 2024.

6.2.5 ***Recommendation 5:*** *Align MRV Systems with International Standards by 2026*

Objective: Increase transparency and comparability in emissions reporting to access international climate finance.
Action: Upgrade MRV systems to meet standards set by the Initiative for Climate Action Transparency (ICAT) by Q4 2026, enabling Namibia to benchmark against global data.
Responsible Parties: Ministry of Environment, Forestry, and Tourism in collaboration with the ICAT and other global partners.
Estimated Budget: 6 million Namibian dollars for system upgrades, software, and capacity building.
Timeline: Gap analysis and roadmap by Q3 2024, phased implementation from Q1 2025 to Q4 2026.

6.2.6 ***Recommendation 6:*** *Develop a National Awareness Campaign on Climate Action*

Objective: Raise public awareness on the importance of emissions reduction, renewable energy, and sustainable practices.
Action: Launch a multi-platform awareness campaign targeting communities, schools, and businesses by Q1 2025 to foster widespread engagement in climate goals.
Responsible Parties: Ministry of Information and Communication Technology, in coordination with environmental NGOs and educational institutions.
Estimated Budget: 4 million Namibian dollars for content creation, media outreach, and local events.
Timeline: Campaign design by Q4 2024, public launch by Q1 2025.

6.3 Next Steps for Implementation

6.3.1 *Formation of a Technical Working Group*

Establish a technical working group consisting of representatives from key government ministries, private sector entities, NGOs, and international partners. This group will manage the implementation of recommendations, coordinate efforts among stakeholders, and monitor progress.

6.3.2 *Development of an Implementation Plan*

Develop a comprehensive implementation plan detailing specific actions, timelines, and resource allocations necessary for achieving the recommendations. The plan should include monitoring and evaluation mechanisms to track progress and allow for strategy adaptation when needed.

6.3.3 Securing Funding and Partnerships

- ***Resource Mobilization:*** Secure resources from national and international sources, including multilateral organizations (e.g., UNDP, GEF) and private sector partners, to fund infrastructure upgrades, training programs, and renewable energy initiatives.
- ***Partnership Development:*** Form partnerships with technical institutions and international climate bodies to ensure continuous support, knowledge transfer, and capacity-building assistance, promoting the sustainability of Namibia's emissions reduction efforts.

6.3.4 Regular Stakeholder Engagement and Feedback Loops

Conduct regular workshops and consultation sessions to update stakeholders on progress, gather feedback, and adjust strategies as necessary. This continuous engagement will ensure inclusivity and effectiveness in implementing emissions reduction measures.

By following these recommendations and implementing the outlined next steps, Namibia can enhance its capacity to accurately project and manage GHG emissions, effectively implement mitigation measures, and meet its national and international climate commitments. These efforts will contribute to a sustainable, low-carbon future, positioning Namibia as a leader in regional climate

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8 Appendices

List of Stakeholders Consulted (Energy and AFOLU Sectors):

Ministry of Mines and Energy (MME)
Ministry of Environment, Forestry, and Tourism (MEFT)
Ministry of Agriculture, Water, and Land Reform (MAWLR)
Namibia Energy Institute (NEI)
Namibia Statistics Agency (NSA)
Electricity Control Board (ECB)
NamPower
National Planning Commission (NPC)
Environmental Investment Fund (EIF)
Namibia University of Science and Technology (NUST)
University of Namibia (UNAM)
Namibian Chamber of Environment (NCE)
Namibian Agronomic Board (NAB)
Namibia Nature Foundation (NNF)
Desert Research Foundation of Namibia (DRFN)
Meat Board of Namibia
Namibia Agricultural Union (NAU)
Namibia National Farmers Union (NNFU)
Communal Farmers Associations (various regional groups)

Namibia Biomass Industry Group (N-BiG)
Namibian Association of Community-Based Natural Resource Management Support Organizations (NACSO)
Namib Desert Environmental Education Trust (NaDEET)
GIZ (German Agency for International Cooperation)
United Nations Development Programme (UNDP)
Global Environment Facility (GEF)
United Nations Framework Convention on Climate Change (UNFCCC)
Initiative for Climate Action Transparency (ICAT)
Green Climate Fund (GCF)
Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL)
Development Bank of Namibia (DBN)
O&L Energy
Pupkewitz Megatech
NamSolar (Private Renewable Energy Company)
Local municipalities (Windhoek, Swakopmund, Walvis Bay)
Regional Councils (Otjozondjupa, Kavango East)
Namibia Chamber of Commerce and Industry (NCCI)
World Wildlife Fund (WWF Namibia)
Food and Agriculture Organization of the United Nations (FAO)
National Renewable Energy Policy stakeholders
Renewable Energy Industry Association of Namibia (REIAoN)