Gap analysis and needs assessment on MRV system in the Transport Sector – Sudan

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Republic of Sudan
The Higher Council for the Environment and Natural Resources

ICAT Initiative for Climate Action Transparency

Initiative for Climate Action Transparency - ICAT

Gap analysis and needs assessment on MRV system in the Transport Sector – Sudan

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List of Acronyms

BCPR	Bureau for Crisis Prevention and Recovery
BUR	Biennial Update Report
CBD	Convention on Biological Diversity
CBIT	Capacity Building Initiative for Transparency
COP	Conference of the Parties
CSO	Civil Society Organization
DfID	Department for International Development (UK)
ERC	Evaluation Resource Centre
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GIZ	GesellschaftfürInternationaleZusammenarbeit (Germany)
GHG	greenhouse gas
HCENR	Higher Council for Environment and Natural Resources (Sudan)
M&E	monitoring & evaluation
MEAs	Multilateral Environmental Agreements
MPGs	Modalities, Procedures and Guidelines
MRV	measurement, reporting and verification
MTR	Mid-Term Review
MWRIE	Ministry of Water Resources, Irrigation, and Electricity (Sudan)
NAP	National Adaptation Plan
NBSAP	National Biodiversity Strategy and Action Plan
NC	National Communication
NCSA	National Capacity Self-Assessment
NDC	Nationally Determined Contribution
NGO	Non-governmental organization
PIR	Project Implementation Report
POPP	Programme and Operations Policies and Procedures
REDD+	Reducing Emissions from Deforestation and forest Degradation
QA/QC	Quality assurance/quality control
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TOR	Terms Of Reference
UNDP	United Nations Development Programme

UNFCCC	United Nations Framework Convention on Climate Change

Introduction

About Sudan

Sudan (official name: Republic of Sudan) is located in between Sub-Saharan Africa and the Middle East. The country is bordered by Egypt to the north, Libya, Chad, and the Central African Republic to the west, a 1,937 km long border with South Sudan to the south, and Ethiopia, Eritrea, and the Red Sea to the east (Figure 1).

Figure 1: Map of Sudan. Source: https://www.worldatlas.com/maps

The total land area is about 1.89 million square kilometers, making it the 3rd largest in Africa and Arab league, and 16th largest in the world. This corresponds to the land area following the separation in July 2011 into Sudan and South Sudan.

Prior to the division of the country, Sudan was considered as the 17th fastest growing economy in the world due to rapid development from oil profits. Since then, Sudan has experienced adverse economic impacts due to the loss of oil revenue which had accounted for the largest share of exports and over 50% of governmental revenue. This has contributed to markedly less economic growth, double-digit consumer price inflation, increased fuel prices, and decreased fuel availability.

Nevertheless, Sudan is endowed with abundant natural resources including fertile lands, ample water resources, livestock, diverse forests, minerals (e.g., gold, copper), and energy resources (e.g., oil, and natural gas). Khartoum is the capital of Sudan, lies at the confluence of the White and Blue River Niles.

Sudan's population has been growing rapidly. Since 2008, the year of it last census, the estimated population has grown to 45 million in 2022, an average annual growth rate of about 2.5% over that period. Total estimated GDP (based on purchasing power parity) in 2021 was USD 194.5 billion and USD 3,838 on a per capita basis (Source: https://tradingeconomics.com/).

The country continues to face severe environmental challenges. Primarily, these challenges are associated with an increasing variable climate has led to catastrophic floods and recurrent drought episodes. In many cases the environmental challenges are directly linked to governance issues.

The energy sector has an essential role in Sudan's economy. It supports activities different public services such as health care, education, public transportation, and household electrification, as well as meeting the fuel and electricity needs of the agricultural and industrial sectors. The main

sources of primary energy in Sudan are biomass, oil, and hydroelectricity. Coal, natural gas, and uranium are non-existent in Sudan. Currently, Sudan's primary energy mix consists of biomass, hydroelectric power,oil products, and a small amount of solar photovoltaic power.

Energy consumption is dominated by the household and transport sectors. Household energy use in the form of electricity, LPG, and biomass accounts for about 45% of all energy use and has been growing rapidly at an average annual rate of nearly 7% per year. For the transport sector, gasoline and diesel use accounts for about 34% of all energy use and has been growing more slowly at an average annual rate of about 3.3% per year. Combined, all other sectors (commercial, industrial, agricultural, others) account for only 20% although they are experiencing average annual growth of nearly 7% per year.

Contest for the ICAT study for Sudan

The Initiative for Climate Action Transparency (ICAT) aims to strengthen capacities in developing countries to assess the impacts of their climate policies and actions and to support greater transparency, effectiveness, ambition and trust in climate policies worldwide.

The Initiative works with countries to build capacities on understanding and applying tools and approaches to measure, report and verify (MRV) greenhouse gas (GHG) emissions reductions and adaptation action, as well as to strengthen existing institutional arrangements and processes for MRV of policies and actions.

The Paris Agreement marks a historic turning point in global climate action, committing all countries to limit global temperature rise, adapt to changes already occurring and regularly increase efforts over time. Countries also agreed on a process to prepare successive nationally determined contributions (NDCs) that raise ambition towards achieving the objectives of the Agreement. Mutual trust and confidence in the effective implementation of NDCs builds on enhanced transparency to support accelerated climate action. Article 13 of the Paris Agreement highlights the critical need for improved transparency to monitor the progress and assess the impacts of all climate actions to regularly increase efforts over time. ICAT seeks to address this need.

The immediate goal of the project is to meet enhanced transparency requirements as defined in Article 13 of the Paris Agreement by enhancing Sudanese institutional and technical capacity for measuring and reporting greenhouse gas emissions, GHG reductions from mitigation activities in Energy and Transport Sectors that can be achieved by meeting the stated objectives by ICAT-Sudan.

ICAT is designed to finance activities at the country, regional and global levels to drive immediate and long-term impacts that will result in sustained improvements to the administrative, legislative and institutional transparency infrastructure within countries. ICAT aims to facilitate effective decision making and policy design, rooted in credible data. it provides tools to collect more robust and consistent data on emissions, mitigation and adaptation efforts, capacity building and support. Therefore, better availability and quality of data will allow for assessment of the impact and effectiveness of domestic climate policies and set in motion an upward spiral of ambition and

implementation. In addition to providing the guidance and tools for policy evaluation, the Initiative will create a space for countries to share their experiences and lessons learned.

Combining broadly-applicable methodologies and tools with in-country capacity building, ICAT is uniquely positioned to use on-the-ground experiences to refine tools and guidance. With better information and data, ICAT enables countries to select the most efficient, cost-effective policies to achieve their sustainable development priorities and fulfill their reporting requirements.

The INDC, submitted by Sudan (Sudan the 2012 share of global GHG emissions is 0.85%) in 2015, did not quantified an GHG emission reduction target by 2030 although energy (Integration of renewable energy in the power system; Energy efficiency; Electricity thermal generation using Natural Gas), forestry (Afforestation and reforestation; National REDD+ strategy) and waste (Collection; Sanitary landfill; Zero waste concept) are the sectors covered by the program of action. Sudan's INDC goals depend on access to financial resources, including technology transfer and capacity-building. Sudan ratified the Paris Agreement on 2nd August 2017. However, according the lately submitted Sudan's First NDCs the targets in the energy sector are summarized as:

By working with countries' existing reporting commitments, ICAT also promotes harmonization with other transparency efforts and in-country strategies to help maximize the impact of country efforts.

1- Grid connect solar and wind power plants 2,140 MW (3,574,580 tCO2e avoided)
2- Standalone and mini grid (residential, agriculture and industry) 796 MW (1,086,360 tCO2e avoided)
3- Grid Loss in transmission & distribution 1,213 GWh (857,506 tCO2e avoided)
4- Promotion of using efficient appliances in residential 2,295 GWh (463,759 tCO2e avoided)

While, in the transportation sector:

1- Transition to public transportation
2- 10% biofuel blending
3- Switching to freight rail

In which 6,449,582 tCO2e will be avoided

Key official climate change policy/strategy document

The following official submissions to UNFCCC were made by Sudan:

1- NC1 submitted on 7th June 2003
2- NC2 submitted on 14th November 2013
3- NDC 28th October 2015
4- 3rd NC and 1st BUR (2022) competed but not officially published
5- Sudan NAMA framework submitted in 2015

ICAT Sudan objectives have been identified by the Government of Sudan via sharing of priority areas by Climate Change Unit to include the sectors of Energy and Transport. These have been expounded to develop the objectives as follows:

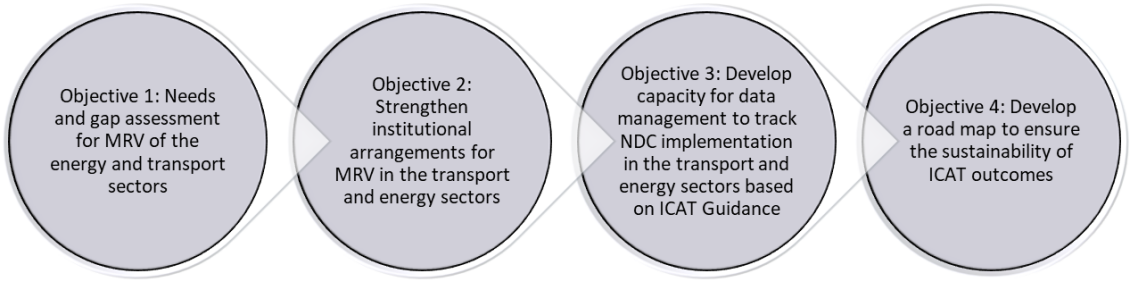


Figure 2: Objectives of the ICAT Sudan project

For coordination of all ICAT activities, the main institutional partner is the Climate Change Unit (CCU) at the Higher Council for Environment and Natural Resources (HCENR) constituting the ICAT focal point. The CCU will coordinate the work and deliverables of ICAT support to be implemented by national experts supported and contracted by UNEP-CCC.

The following chart summarize the flow of activities in this project as per the inception report.

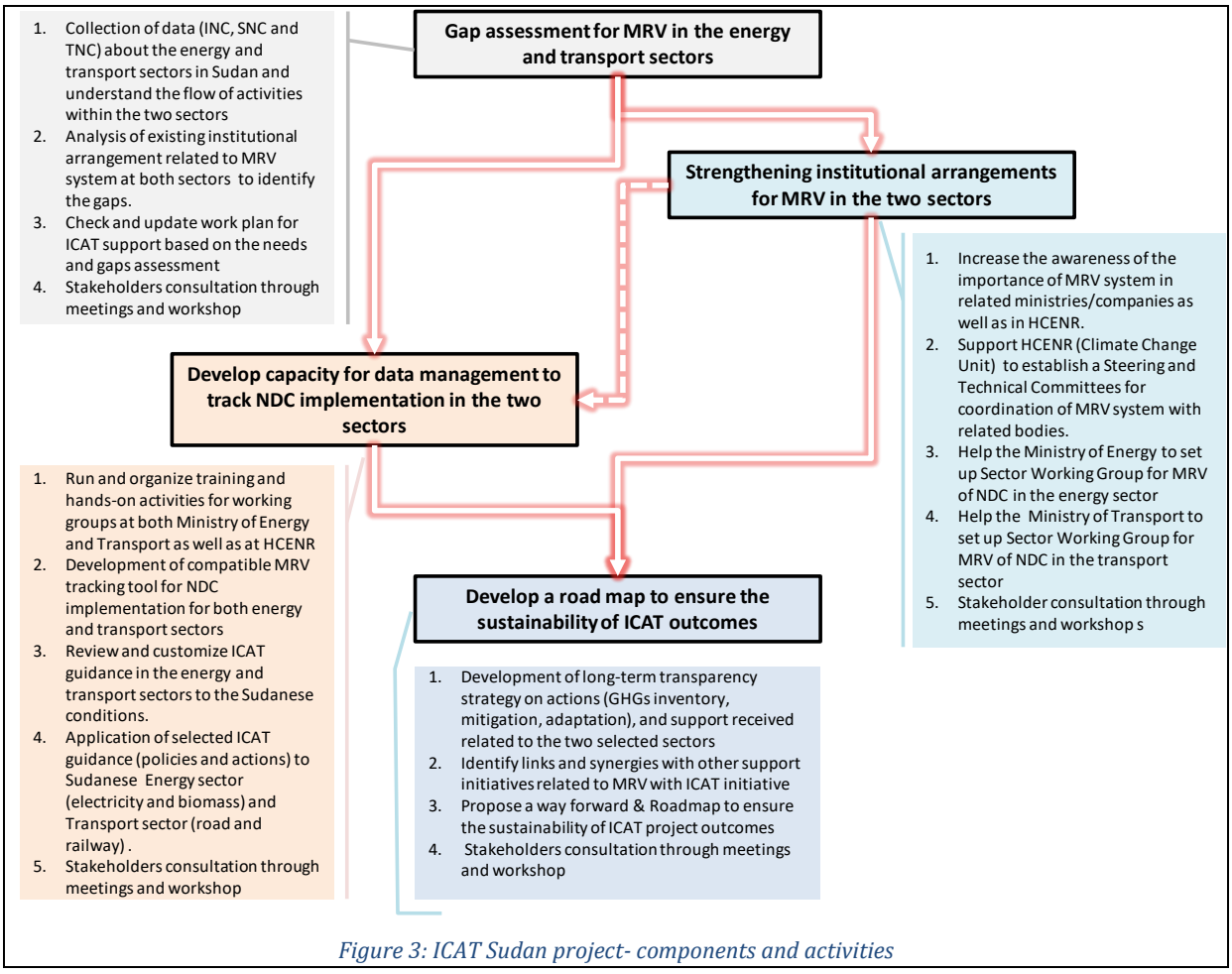


Figure 3: ICAT Sudan project- components and activities

Gap analysis objectives

ICAT objective is to provide policymakers around the world with tools and support to assess the impacts of their climate policies and actions, to further transparent and ambitious climate action and mobilize investment mainly with Two components ICAT series of guidance and Country support to build capacity. ICAT sought to support Sudan's efforts to establish a domestic Measuring, Reporting and Verification (MRV) system for tracking of progress with NDC implementation in the energy and transport sectors in line with the requirements of the enhanced transparency framework of the Paris Agreement.

The project aims to deliver a specific objective such Needs and Gap Assessment (MRV) of the NDC Implementation for the Energy and Transport Sectors in Sudan, strengthening Institutional Arrangements for (MRV) In the Energy Sector and development of a road map to ensure the sustainability of ICAT outcomes.

As shown in Figure 3 the gap assessment activity for energy and transport sectors is conducted through the following steps

1. Collection of data from all available sources (local and international) about the energy and transport sectors in Sudan and understand the flow of activities within the two sectors. Since the project kickoff, the local consultants started to collect data and information about the two sectors with the help from the HCENR focal point and the selected candidates from sector's related firms and authorities.
2. Analysis of existing institutional arrangement related to MRV system at both sectors: this step is discussed in a later section of this report.
3. Check and update work plan for ICAT support based on the needs and gaps assessment: the project workplan was updated several times due to technical and administrational issues.
4. Stakeholders consultation through meetings and workshop: workshop and number of meetings were held with the stakeholders as shown in Table 5.

Transparency framework

The Enhanced Transparency Framework (ETF) and MRV

The MRV system is a crucial part of the larger framework for climate action and accounting for emissions and achievement of the Nationally Determined Contribution. The MRV system is the method by which the stated ambitions of the Paris Climate pact go from hope to reality. This tool will help to keep us on track with our climate change commitments, both for reducing emissions as well as tracking climate resilience and adaptation.

Article 13 of the Paris Agreement, adopted in 2015 at the 21st Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC), established a requirement for an enhanced transparency framework for action and support. The article outlines the specific types of information required of Sudan as a non-Annex 1 Party which includes:

a) national inventory report detailing progress made in achieving nationally determined contributions (paragraph 7);
b) information related to climate change impacts and adaptation (paragraph 8); and
c) information on technology transfer and capacity building support needed and received.

According to paragraph 90 of Dec 1/CP.21, LDC Parties such as Sudan may submit the information referred to in Article 13 at their discretion.

Under the current international MRV Framework, all countries are submitting their National Communications (NCs) every 4 years (including the GHG inventory), Biennial Update Reports (BURs) every 2 years; present their NAPs and NAMAs and TNAs.

NCs are mainly to report on measures and policies undertaken to address climate change in the country. Besides information on GHG inventories, NCs are providing information on national circumstances, a general description of what steps and actions the country is taking or planning to mitigate and adapt to climate change, describing gaps and constraints and to state any needs for technical, financial or capacity building support.

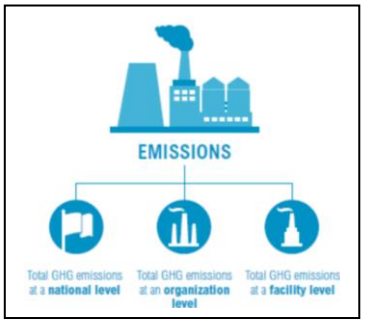
According to the enhanced transparency framework requirements, the main purpose of the NDC MRV system is to transparently demonstrate progress made towards the targets defined in the NDC (e.g. GHG emissions and GHG mitigation and adaptation impacts), tracking the progress made in the implementation of mitigation and adaptation actions, and tracking the use and results of means of implementation and support (e.g. capacity building and technical assistance, technology transfer, and finance).

> In order to meet the ETF requirements, in Sudan, we must fill the transparency gaps in data collection, quality assurance procedures, monitoring/reporting for GHG inventories, GHG mitigation, and adaptation effectiveness assessment.
>
> For GHG inventories/mitigation, these deficiencies have resulted in a lack of consistent progress in establishing credible metrics that could provide a basis for aggressive climate-related policymaking.

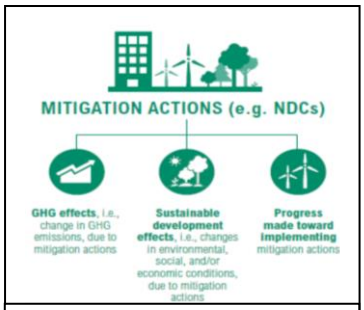
MRV of Support is traditionally an area where developed countries are required to track support provided for climate change mitigation activities but developing countries are demonstrating growing interest in the MRV of support received for reasons that include greater accountability of how allocated resources have been used as intended. One element which can benefit governments in data gathering, transparency, and verification is to create a national level centralized data and information reporting system which considers the linked MRV system. At present, there are often different data management systems used for different mitigation actions or on subsectoral and sectoral level. Creating this linkage to a master system on national level will require standards and guidelines for data inputs and aggregation, especially when including applicable sector and sub-sector information, and individual mitigation/adaptation actions. This system can start with core national level input/output data, and gradually expand into sectors, sub-sectors, and individual mitigation/adaptation actions (Source: www.transparencypartnership.net)

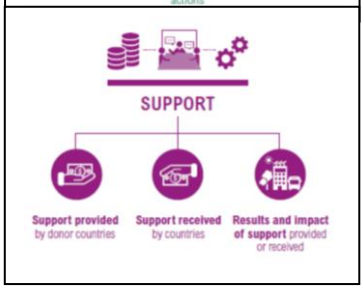
Elements of the MRV framework

From the World Bank prospective, the MRV refers to the multi-step process to measure the amount of greenhouse gas (GHG) emissions reduced by a specific mitigation activity, such as reducing emissions from fuel switching, over a period of time and report these findings to an accredited third party. The third party then verifies the report so that the results can be certified, and carbon credits can be issued. All nations' GHG emissions and reductions must be measured, reported and verified, therefore the MRV system is a structural mechanism to keep us on track with Paris Agreement climate commitments and is expected to be fully formalized in the legal framework to make emissions reporting mandatory. In general, MRV system shall include the followings:



a. GHG emissions inventory: To start, every emission reductions program must determine a "baseline" or "reference level" against which performance is measured periodically. The assumptions upon which these baselines are established and the accounting methodologies used to calculate emission reductions vary by sector and program scale.





b. Mitigation actions: Once a mitigation project or program activities are underway, data is collected and processed to calculate emission reductions achieved against the baseline during the monitoring period.

c. MRV of support: this shall include
Financial flows (from whom to whom, amount, type of financial instrument, private/public, new/additional), Type of support (financing, technology transfer/advice, capacity building), Supported activities and Impact of supported actions.

Institutional Arrangement

As the focal point for all Multilateral Environmental Agreements (MEAs), the HCENR is the leading institution coordinating Sudan's efforts to meet its MRV obligations under the UNFCCC and Paris Agreement. Initially, the HCENR undertook this responsibility under the auspices of its climate change unit which was established in 1998. Addressing Sudan's obligations under the UNFCCC is characterized by significant engagement of multidisciplinary teams of scientists, engineers, and planners representing relevant national institutions (i.e., federal ministries, universities, research centers, private sector entities, NGOs and other governmental bodies).

Based on the provisions of recent environmental legislation passed in 2020, HCENR is chaired by the Prime Minister of Sudan, and has an Inter-ministerial Committee comprised of ministers and heads of national institutions whose mandate includes environmental protection and conservation of natural resources. A new organizational structure for HCENR has been developed, approved and is currently being implemented. The new structure includes 5 General Directorates (Policies and Planning; Environmental Inspection; Sustainable Resources and Environment Protection; Climate Change, Desertification and Disaster Prevention; and Finance and Human Resources) and 15 departments/units across those Directorates.

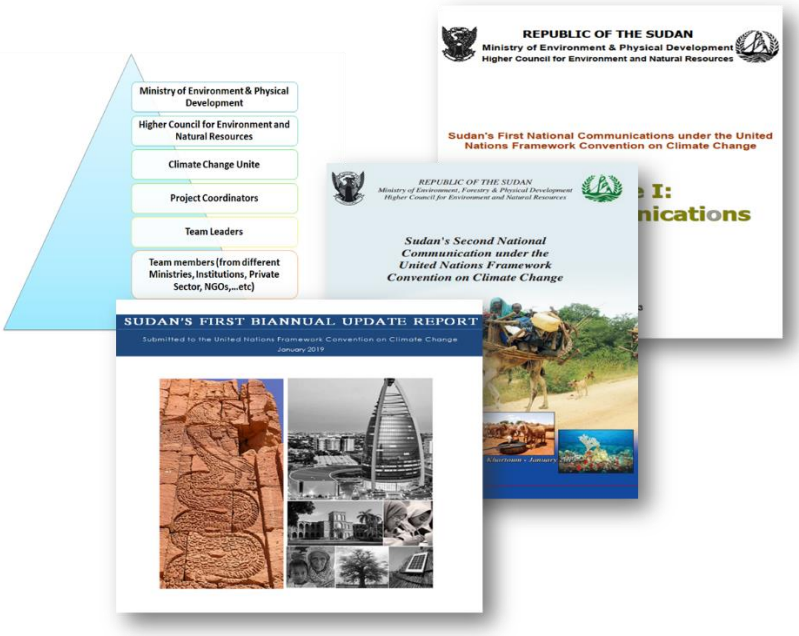
Under the 2020 legislation, the HCENR's Climate Change Unit operates as part of the General Directorate for Climate Change, Desertification and Disaster Prevention. It has five (5) major responsibilities as outlined below.

Planning, preparation, compilation and submission of the national climate change reports, such as National Communications, Biennial Update Reports, Biennial Transparency Reports, etc;
Establishment and coordination of the national climate change committee, as well as expert teams on GHG inventory development, GHG mitigation analysis, vulnerability assessment, identification of adaptation strategies, etc;
Establishment of formal working arrangements and procedures with climate related national institutions and stakeholders;
Definition and allocation of roles and responsibilities of the different institutions in meeting Sudan MRV obligations; and
Management of the GHG inventory preparation processes, including technical and institutional capacity building, data collection and archiving, quality controls, technical validation and the formal government approval process.

Benchmarking

Since the ratification of United Nations Framework Convention on Climate Change (UNFCCC) in 1993, the Kyoto Protocol in 2005 and Paris Agreement in 2017, Sudan is committed to international cooperation and the fight against the adverse effects of climate change. In 1998, Sudan established a Climate Change Unit within the Higher Council for Environment and Natural Resources (HCENR) to coordinate with different national institutions, including government, research, academia, the private sector and civil society institutions and organization in order to deal effectively with the challenge with respect to climate change actions and responsibilities. The HCENR mandate includes, among others, coordination of Sudan's efforts to join and implement the multilateral environmental agreements including climate change.

To date, Sudan has prepared its First and Second National Communications and finalized its Third National Communication and its First Biennial Update report to the UNFCCC. Sudan also prepared a National Adaptation Programme of Action (NAPA), a National Adaptation Plan (NAP), a Technology Needs Assessment (TNA) (including a Technology Action Plan, TAP) and a Nationally Appropriate Mitigation Actions (NAMA) framework. In line with its mandate as a coordinating body, the HCENR has taken the lead in coordinating Sudan's efforts to meet its obligations under the UNFCCC. The HCENR undertakes this responsibility through involving multidisciplinary teams representing its relevant member institutions and relevant national institutions, i.e., ministries, universities, private sector, NGOs and other governmental bodies.



1. First and Second National Communications

In compliance with the reporting commitments under the UNFCCC (Article 12 of the UNFCCC), Sudan has prepared and submitted its First National Communication (FNC) in 2003 and its Second National Communication (SNC) in 2013. The communications consist of an GHGs Inventory, assessment of vulnerability and adaption, mitigation measures for energy and non-energy sectors, besides other information considered relevant to achieve the UNFCCC objectives such as climate change research and systematic observations, education, training and public awareness. As per the GHG inventory for the second national communication which was based on IPCC revised 1996 guidlines, the total GHG emissions in 2000 were 77,650 GgCO2-equivalent (CO2e), which includes57,611Gg from agriculture, 9,392 Gg from LUCF, 8,539Gg from energy;2,015Gg from waste, and only 93Gg from industrial processes. Agriculture-related activities accounted for the dominant portion of GHG emissions in 2000. Approximately 74% of all CO2e emissions are associated with enteric fermentation and manure management.

2. National Adaptation Program of Action (NAPA)

Sudan's First National Communication identified agriculture, water and health as the highest priority sectors where urgent and immediate adaptation action is needed to confront increasing climatic variability and climate change. Therefore, the NAPA, which was prepared and submitted to the UNFCCC in July 2007, identified 32 urgent adaptation initiatives in these sectors to reduce the increasing vulnerabilities of the rural communities to current and future climatic risks. Some of the highest priority adaptation-focused interventions are currently being implemented to enhance food security through building adaptive management capacities of the rural population, particularly of rainfed farming and pastoral communities.

3. National Capacity Self-Assessment

The goal of the Sudan National Capacity Self-Assessment (NCSA) was to determine priority needs and establish a plan of action for developing Sudan's capacity to meet its commitments to national

and global environmental management. The NCSA was a highly participatory and consultative process that resulted in the production of several technical reports over a two-year period. These describe Sudan's capacity needs related to the "Rio Conventions" on biodiversity conservation, climate change, and desertification/land degradation in the context of the National Plan for Environmental Management (NPEM) in post-conflict Sudan. This Action Plan for Environmental Capacity Development in Sudan is the final product of the NCSA.

4. Sudan NAPA Follow-up Project:

Implementing NAPA Priority Interventions to Build Resilience in the Agriculture and Water Sectors to the Adverse Impacts of Climate Change in Sudan 2010-2014. The Project Objective was "to implement an urgent set of adaptation-focused measures that will minimize and reverse the food insecurity of small-scale farmers and pastoralists, thereby reducing vulnerability of rural communities resulting to climate change, including variability".

5. The National Adaptation Plan Process (NAP, 2014)

The NAP gave more emphasis to the most vulnerable sectors to the adverse impacts of climate change including the agriculture sector. Beside vulnerability assessment the NAP process also focused on the issues of mainstreaming of adaptation into national policies and plans. The aim was to enable broader and deeper explorations of the vulnerability of key livelihoods and development sectors to climate change in Sudan, together with developing a better understanding of potential adaptation strategies. The main outcome of the project is to develop a National Adaptation Plan (NAP) for Sudan in line with the UNFCCC Technical Guidelines for National Adaptation Plans, which describe Sudan's process for adaptation planning and implementation with clear priorities, actions, and direction for further investment and implementation modalities. A major achievement of the Sudan's NAP process was the establishment of adaptation-focused planning institutions in each of Sudan's 18 states. In each of the states, a focal point and inter-agency technical team of experts from related government, research institutions, academia and civil society organization, have been established. The capacity of these units has been strengthened during the NAP preparation through targeted training sessions; learning-by-doing programmes; and the establishment of networks to exchange knowledge and experience.

6. Sudan's Promoting Low Carbon Investment Project and Nationally Appropriate Mitigation Actions (NAMA) Framework (2015)

The development of the LCDS is recommended to be linked with a comprehensive Nationally Appropriate Mitigation Action (NAMA) framework. Various synergies can be achieved when synchronizing the design of NAMAs in different economic sectors in a NAMA framework under a LCDS umbrella, and ideally making NAMA identification the bottom-up process of elaborating the LCDS. To enable the setup of such a NAMA framework, detailed information about greenhouse gas (GHG) emission characteristics of relevant economic sectors is required. Based on that, elements of a Sudanese NAMA Framework, such as institutional set up, MRV system and NAMA identification process were established. Since mitigation actions require multi-stakeholder involvement from planning to implementation, the institutional arrangement for NAMAs needs a strong coordinating body with authority to set rules, roles and responsibilities. Stakeholders such as academic institutions, NGOs, financial institutions or other private players as well as governmental actors propose potential mitigation activities and submit their ideas to the authority level. A NAMA Project Management Unit (PMU) on domestic, governmental level represents the focal entity for NAMA institutional arrangement in Sudan. In case the idea is accepted, the NAMA

PMU informs the relevant stakeholders and identifies suitable implementation partners. Subsequently the NAMA will be fully developed and implemented - with the NAMA PMU supervising baseline establishment, identifying data gaps, and organizing the NAMA submission process, and with international support by consultants, international development agencies such as UNDP or developed country technical cooperation, if required. the MRV framework for an individual NAMA generates information that is relevant to the national context through the selection of appropriate indicators and methodologies. In this sense, some, but not all, parameters of MRV for the NAMAs could be determined top down by national governments – in accordance with the LCDS. Thus different NAMA activities are able to provide bottom-up data to the NAMA framework MRV that can than compile overall measurement results and report them to e.g. the LCDS and further to UNFCCC related platforms such as the NAMA registry or donors.

7. REDD+ Sudan

Reducing Emission from Deforestation and Forest Degradation; (REDD+) is a global mechanism to mitigate the climate change caused by forest loss or degradation, while mobilizing financial resources for socio-economic development in forest countries. The REDD+ project enabled Sudan to establish reference emissions levels / forest reference levels (ERL/FRL) and an MRV for the forestry sector

8. Sudan Nationally Determined Contribution to the Paris Agreement:

Sudan prepared and submitted its intended nationally determined contribution (INDC) to the Paris Agreement in 2015. Sudan's INDC consists of two components, mitigation contributions (M-INDC) and adaptation contributions (A-INDC). By its mitigation contributions, Sudan intends to pursue implementing low carbon development interventions in three sectors of energy, forestry and waste in line with national development priorities, objectives and circumstances. Sudan's M-INDC aims at contributing to the global mitigation efforts. These contributions are planned to ensure a deviation from the current development trajectory to a low carbon development. Currently, Sudan has neither an overall baseline emission scenario for all sources of emissions and removals in the three sectors covered in this contribution, nor sectoral baselines that can be used to define quantitative mitigation actions and assess their overall effects. As such, Sudan is planning to establish a baseline as part of its proposal for a low-carbon development strategy, of which its preparation is still pending availability of financial and technical support. Sudan is currently embarking on the implementation of its Readiness Preparation Proposal for REDD+, which will also enable Sudan to establish reference emissions levels / forest reference levels (ERL/FRL) and an MRV for the forestry sector. For the implementation of the intended contributions included in this INDC, Sudan foresees that sectoral or project level specific baselines should be established to enable a robust assessment of the effect of these mitigation contributions.

The overall aim of Sudan's A-INDC is based on the objective of the NAP, i.e. to pursue sustainable development and reduce poverty by reducing the long-term negative impacts of climate change. Having recognized the implications that climate change can have on national development the need for climate change adaptation in the context of sustainable development was identified as an area of a major concern. As such, Sudan's A-INDC is prepared with the view and in the context of achieving economic and sustainable development and poverty eradication, and in the context of Sudan's 25-year development strategy, the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs).

Sudan Context to MRV

Sudan's MRV system

Sudan became a Party to the UNFCCC when it ratified the convention in 1993. The country signed the Paris Agreement on April 22, 2016 and ratified the Agreement on August 2, 2017. Since becoming a Party to the Convention, Sudan has completed and continued working on numerous Enabling Activities coordinated by the Climate Change Unit in the Higher Council for Environment and Natural Resources (HCENR). There is substantial evidence that a lack of transparency exists in data collection, quality assurance procedures, monitoring/reporting for GHG inventories, GHG mitigation, and adaptation effectiveness assessment.[1] For GHG inventories/mitigation, these deficiencies have resulted in a lack of consistent progress in establishing credible metrics that could provide a basis for aggressive climate-related policymaking.

MRV protocols and systems are introduced to forestry sector in Sudan. In 2012, the Forest National Corporation (FNC) requested to join the Forest Carbon Partnership Facility. In the years since, Sudan has sought to continually strengthen its partnership with other countries in reducing its own emissions from deforestation and forest degradation, forest carbon stock conservation, the sustainable management of forests, and the enhancement of forest carbon stocks (i.e., REDD+).

For the forestry sector, the current status of MRV is well-advanced with institutional mapping, gap analysis and capacity needs assessment already carried to establish a functioning REDD+ MRV system. To date, the process has identified key objectives and policy requirements; roles/responsibilities of key institutions, gaps; overlaps and training/procurement needs; and proposed coordination mechanisms among responsible institutions. For all other sectors, the current status of MRV is merely nascent. On the other hand, the MRV development process for non-forestry sectors has essentially been ad-hoc, mostly reliant on external consultants associated with NAMA scoping activities.

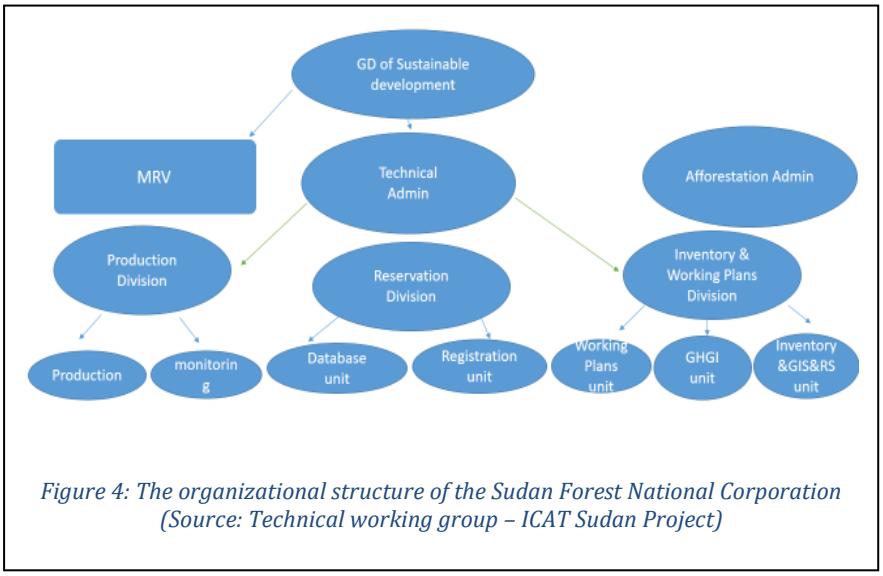


Figure 4: The organizational structure of the Sudan Forest National Corporation (Source: Technical working group – ICAT Sudan Project)

Another initiative for building an MRV system was in collaboration with the International Renewable Energy Agency (IRENA) for the electricity part of the Sudanese energy sector.

[1] Part II, Section 8 of the Project Identification Form for Sudan's Capacity Building Initiative for Transparency Project

Sudan is aiming to adopt digital MRV systems although they are still complex and expensive to implement, but long-term, they will help monitoring the support/finance received, reduce the cost of generating carbon credits while increasing transparency and meeting the ETF requirements. They will enable more efficient verification and the move toward real-time generation of carbon credits that will engage the private sector to invest and the energy and transport sectors.

Sudan needs to establish permanent transparency arrangements to communicate report and track progress in the implementation of its NDCs. Such arrangements can further be developed benefiting from knowledge exchange and sharing of lessons learnt at national as well as international levels through being actively engaged in the CBIT global coordination platform. Long-term transparency strategy on actions such as GHGs inventory, mitigation and adaptation is required. In addition, the integration of MRV and M&E systems into the related national institutions is highly required to track the implementation of Sudan's NDCs

Why MRV framework is needed

This lack of a functioning MRV system is particularly relevant to sustainable practices for Sudan's high-emitting agriculture sector as well to policies to promote renewable energy use in electricity production and adopt more energy efficient practices in transportation and other sectors. For adaptation, these deficiencies have led to entrenched imbalanced power relations among some groups due to lack of or unequal access to climate information, which has in turn led to widening disparities in access to social and economic opportunities. This is especially the case in rural areas where men and women's economic empowerment, participation, poverty reduction, and decision-making has lagged relative to urban communities.

The implementation of this ICAT project will coordinate with other GEF-funded and other projects funded by other organizations. This includes the ongoing GEF-funded project of Sudan's Capacity Building Initiative for Transparency (CBIT) . Overall coordination between the ICAT project and relevant projects will be augmented by maintaining regular communication with the CBIT project which is expected to support the development of a National Communications and Biannual Update Reports as well as the implementation of Sudan's NDCs.

An overview of previous and ongoing projects that will inform the implementation of this project are provided in the table below.

Table 1: Previous and ongoing projects that will positively impact the implementation of the ICAT Sudan project

Programme/ Project	Description	Period	Partners
Sudan's Capacity Building Initiative for Transparency (CBIT)	The overall goal of the project is to assist Sudan in mainstreaming climate change considerations into national and sub-national (i.e, state-level) development policies by strengthening and sustaining efforts to monitor, report, and verify mitigation and adaptation activities that address climate change.The immediate objective of the project is to meet enhanced transparency requirements as defined in Article 13 of the Paris Agreement and its modalities, procedures and guidelines (MPGs)by enhancing Sudanese	2021-2025	GEF/UNDP/HCENR

Programme/ Project	Description	Period	Partners
	institutional and technical capacity for measuring and reporting greenhouse gas (GHG) gas emissions, GHG reductions from mitigation activities, as well as the resilience-building effects of adaptation activities. The main components of the project are: 1) Strengthening of national institutions for transparency related activities; 2) Provision of tools, training and assistance for meeting the transparency provisions established in the Paris Agreement; 3) Improvement of transparency over time, and 4) Knowledge management and monitoring &evaluation. Key outputs include new MRV-related legal and procedural arrangements to enhance transparency; strengthened inter-institutional coordinating arrangements for transparency; strengthened institutional capacity for MRV, GHG inventory development, GHG mitigation analysis and adaptation assessment; and synthesis of lessons learned, and best practices shared via the newly developed online transparency platform. Taken together, these outputs will lead to an end-of-project situation that will reflect more accurate information and analysis of the policies, measures, and instruments that Sudan selects to mitigate and adapt to climate change.		
"Strengthening adaptation planning processes and capacity for implementation of adaptation actions in agricultural and water sectors in the Sudan"	The objective of this Readiness project is to strengthen climate change adaptation planning in the Sudan based on updated and reliable data. Data and information made available under this proposal will be absorbed and utilized through the 18 reactivated State-Level Technical Committees, which will operate in an inclusive participatory manner and inform the national-level adaptation planning in Sudan. The project's objectives overlap with several outputs of the CBIT project, namely the data management activities of Output 1.1.4 and the strategic planning aspects of Output 1.1.2. Efforts will be made to constructively exploit potential synergies while avoiding any duplicative efforts. Coordination between this project and the CBIT will be carried through consultative meetings between the respective project managers	2020-2022	GCF/FAO
"Leapfrogging Sudan's markets to more efficient lighting and air conditioners"	This project aims to transform Sudanese markets for energy efficient lighting and air-conditioners, thereby providing important greenhouse gas mitigation co-benefits and decreased energy poverty. Outputs include the development of standards, enforcement of regulations supporting energy efficient products, and building the institutional framework capable of maintaining steady market development, while mainstreaming gender into project activities.The project's mitigation objectives overlap with the MRV and M&E activities under Outcome 2.1. Efforts will be	2018-2022	GEF/UNDP/MWRIE

Programme/ Project	Description	Period	Partners
	made to constructively exploit potential synergies regarding tools and methods while avoiding any duplicative efforts. Coordination between this project and the CBIT will be carried through consultative meetings between the respective project managers		
"Promoting the Use of Electric Water Pumps for Irrigation"	This project promotes the use of solar PV-powered electric water pumps for irrigation in Sudan and it involved a large variety of stakeholders in its design phase. The project's major component calls for the installation of 28 pumps as part of a pilot phase, the establishment of a National PV Fund and coordinated loan facility and a minimum of 1,468 3off-grid PV pumps ranging in size from 3.12-29.6 kWp installed in farms in the Northern State of Sudan with support from the National PV Fund. The project's mitigation objectives overlap with the MRV and M&E activities.	2016-2022	GEF/UNDP/MWRIE
"Building resilience in the face of climate change within traditional rain fed agricultural and pastoral systems in Sudan"	This project seeks to support climate change adaptation efforts among subsistence agro-pastoralist and nomadic pastoralist communities in dryland zones across nine states in Sudan. The overall goal of the project to promote a paradigm shift in dryland pastoral and farming systems through an integrated approach to enhance water security in the face of changing climate conditions, climate resilient agriculture, climate resilient rangeland management, and gender mainstreaming. The project's approach to monitoring the impacts of adaptation interventions overlap with the review and application of M&E tools. Efforts will be made to constructively exploit potential synergies regarding tools and methods while avoiding any duplicative efforts. Coordination between this project and the CBIT will be carried through consultative meetings between the respective project managers.	2020-2025	GCF/UNDP/HCENR

Gaps in Sudan's MRV system

Building robust MRV systems in the NDC's related sectors are needed to meet the requirements of the enhanced transparency framework of the Paris Agreement.

Throughout the gap assessment, the following challenges that facing Sudan are identified:

1. Poor alignment between current institutional arrangements within national relevant institutions regarding monitoring/evaluation, data collection and reporting and the transparency obligations under Article 13;
2. Little to no awareness and knowledge by stakeholders and policy/decision makers regarding new transparency obligations;
3. Ineffective coordination and reporting arrangements between different institutions and stakeholders in term of communications, flow of information, and the delegation of responsibility;
4. Lack of proper data collection, data archiving, and Quality Assurance and Quality Control (QA/QC) systems across different institutions and stakeholders regarding GHG emissions.
5. Lack of a legal and procedural basis for an operational MRV system on GHG emission reductions compatible with Sudan's obligations on transparency under Article 13.
6. Inadequate institutional capacity for GHG inventory development in emitting sectors, specially ENERGY and TRANSPORT sectors; as well as for GHG mitigation analysis of priority policies and measures;
7. Inadequate institutional capacity for climate change vulnerability assessment and measuring the effectiveness of adaptation actions;
8. Need for transferring of tools and methods to help national teams collect and verify GHG emission activity data as well as to calculate and predict baseline emission trends and the impact of GHG mitigation measures; and
9. Need for financing technical support to develop and maintain effective institutional arrangements, M&E, and MRV systems for meeting Sudan's transparency obligations under Article 13.

Transport sector framework

Overview of Energy Sector in Sudan

The energy sector has an essential role in Sudan's economy. It supports activities different public services such as health care, education, public transportation, and household electrification, as well as meeting the fuel and electricity needs of the agricultural and industrial sectors. The main sources of primary energy in Sudan are biomass, oil, and hydroelectricity. Coal, natural gas, and uranium are non-existent in Sudan. Currently, Sudan's primary energy mix consists of biomass, hydroelectric power, oil products, and a small amount of solar photovoltaic power.

Sudan is one of the least developed countries, where energy use is increasing rapidly. The energy sector has an essential role in the sustainable development for Sudan. It helps in providing power to different public services such as health care, education, public transportation, and household electrification and other sectors as for agriculture, different industrial activities, mining… etc.

The main sources of primary energy in Sudan are biomass, oil and hydroelectricity. Coal, natural gas, and uranium are nonexistent in Sudan. Sudan primary energy consists of fossil fuel (about 40%), biomass (56%), hydroelectric (5%) and negligibly small portion of solar energy mainly

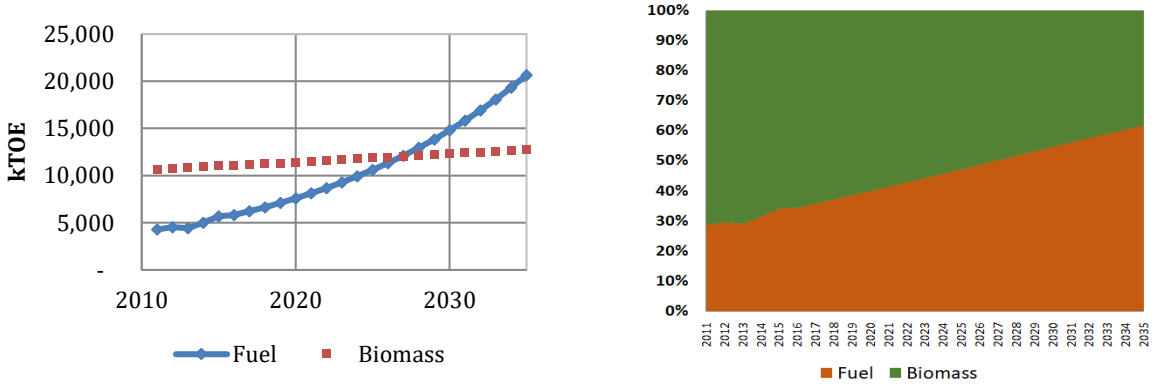


Figure 5: Shares of biomass and fossil fuels in Sudan's primary energy consumptions

photovoltaic.

Sudan has two operational oil refineries (Khartoum Refinery Corporation (KRC) and EL-Obied Refinery Corporation (ORC). The capacity of KRC 100,000 BPD and ORC is 15,000 BPD. The main products include fuel oil, gasoil, kerosene, gasoline, LPG, aviation fuel and Petroleum coke.

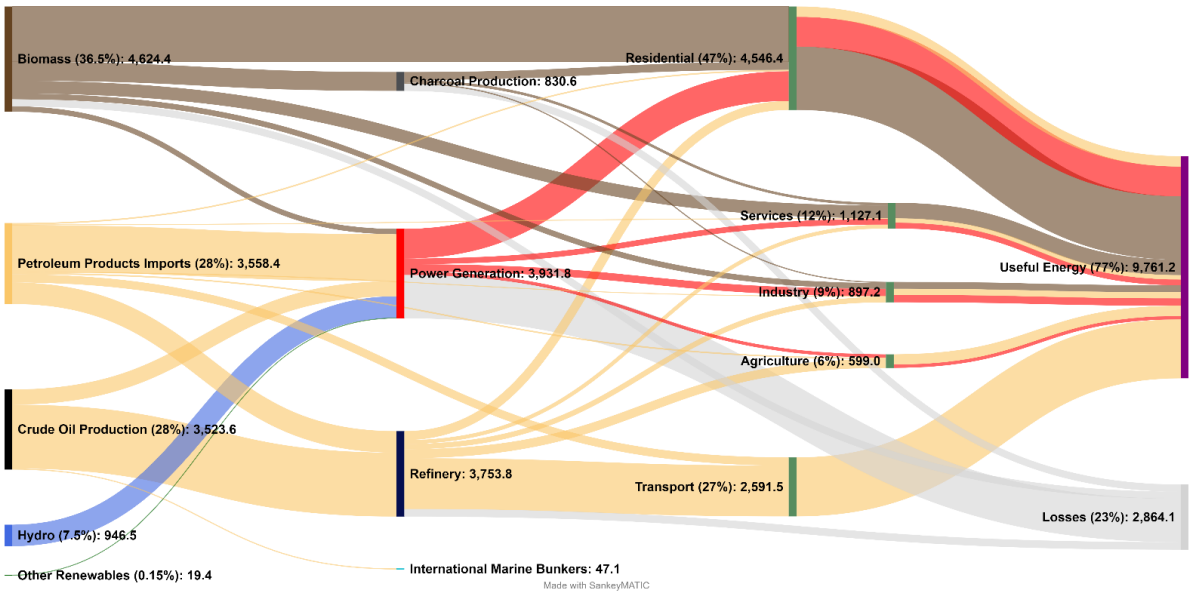
Table 2: Refineries in Sudan

#	Refinery Name	Location and Establishment	Specification	Capacity	Updates

1	Khartoum -Aljaili	Northen Khartoum, May 2000	Designed for low sulphur Nile Blend. Expansion 2006, handled heavier crudes	100,000 bbl/day	Upgraded for 50,000 bbl/d on 2006
2	El-Obaid	El-Obaid City, 1996	A small refinery which produces only three products: naphtha, diesel and fuel oil	15,000 bbl/day	
3	PortSudn	Portsudan, 1964	Under rehabilitation	21,700 bbl/day	Not working since early 1990's. Plans for upgrading
4	Abu Gabra	Abu Gabra	Small topping plant		Not working

Sudan is endowed with a significant amount of renewable energy resources such as solar, hydro, wind, geothermal, and biomass. At present, except for large hydro and biomass, renewable resources remain largely untapped.

The main sources of primary energy in Sudan are crude oil, hydroelectric and biomass. The main transformation and conversion process are electric power generation, oil refinery and wood to charcoal conversion. The following diagram shows the energy balance of Sudan in 2020.



1. Nodes									
1.1. Primary Energy Supply		***1.2. Energy Transformation***		***1.3. Final Energy Consumption***		***1.4. Useful Energy***		***1.5. Losses***	
Biomass		Charcoal Production		Demand Sectors					
Petroleum Products Imports		Power Generation		1.4. Useful Energy					
Crude Oil Production		Refinery		1.5. Losses					
Hydro									
Other Renewables									

2. Flows	
Crude oil and petroleum products	
Biomass	
Hydro	
Other renewables	
Electricity	

Figure 6: Sudan energy balance for year 2020 (After Quosay, Amr and Yasir Fadul, 2022)

As shown in the above figure, the refined products of the Sudanese crude oil in addition to the imported ones are feeding many sectors, which include:

1- Transport,
2- Commercial/Services,
3- Household,
4- Industry and
5- Agriculture.

The shares of these sectors out of the total petroleum products consumption in Sudan in 2017 (base year for the first BUR) are as shown in Figure 7.

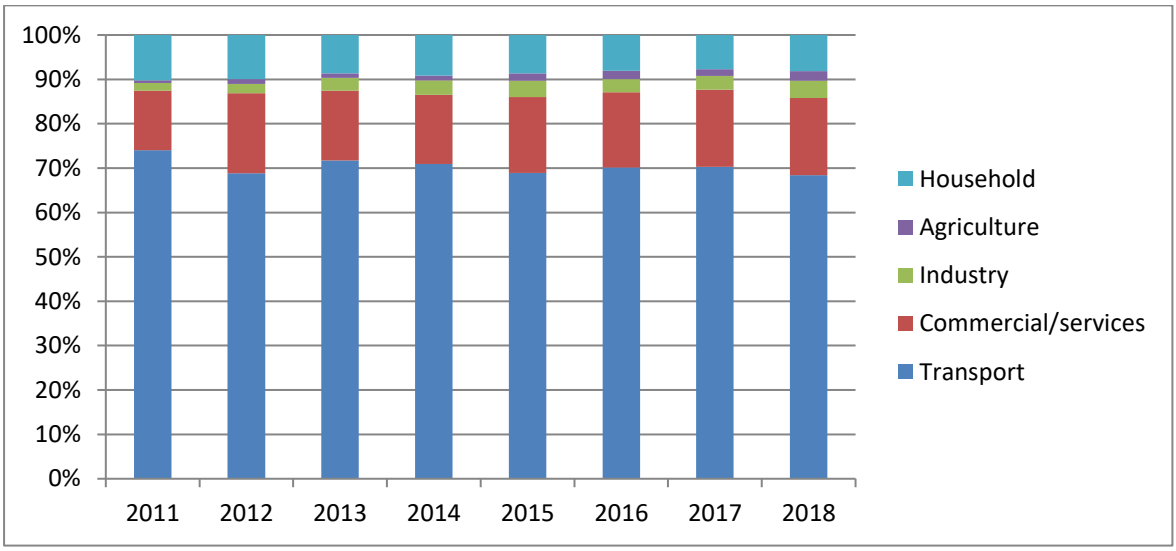


Figure 7: Shares of Sudan's Petroleum product consumption per sector from 2011 to 2018

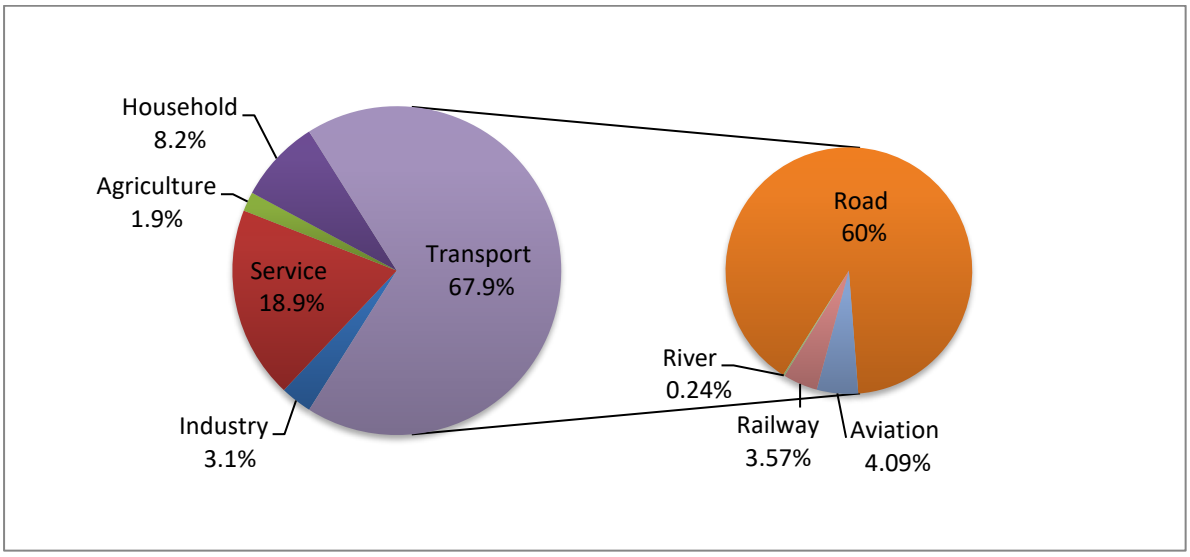


Figure 8: Sudan's petroleum product consumption by sector, 2017; Source: Ministry of Petroleum and Gas

While the share of each sector in the total final energy consumption (TFEC) is shown in the

following table:

Table 3: TFEC by sector

While the share of each sector in the final energy consumption *Unit: kTOE*	Residential	Services	Industry	Agriculture	Transport	Total
2012 – 2017 Average	5,470	1,768	1,336	118	3,282	11,974
Share%	**46%**	**15%**	**11%**	**1%**	**27%**	**100%**

Sudan is one of the least developed countries, where energy use is increasing rapidly. The Sudan was forced to begin importing petroleum products after the south seceded in 2011, taking with it three-quarters of what had been the country's oil output and its main source of foreign currency. Recently most residential and industrial areas in the capital Khartoum experience near-daily electricity outages for hours. The increasing blackouts occurred as Khartoum's temperatures soar to highs of 45 Celsius sometimes. Cars queued at almost every petrol station in Khartoum due to fuel shortage and increase in fuel demand for transportation, services, agriculture, industrial use and electricity production.

Figure 9: Birdseye view of automobiles queues waiting for fueling at patrol station 2019-2020

On the other hand, the cost of importing petroleum products is increasing every year. Hence, the country is in urgent need to manage and optimize fuels consumption especially in the transportation sector.

The level of car ownership has been increasing steadily in Sudanese urban areas. For most people, private transportation is more convenient, reliable, and clean when compared to public transportation. Lending programs launched by Sudanese banks during the past ten years have encouraged private car ownership; and in the process inadvertently contributed to high levels of traffic congestion and associated air pollution in urban areas. These lending programs have recently been curtailed to ensure that sufficient banking resources are available for lending in productive economic sectors.

Air pollution has become a serious problem in urban areas due to the number of vehicles on the road. Although the most congested city in Sudan, Greater Khartoum, is still far from reaching the disasters pollution and congestion levels reached in cities such as Bombay, India, several measures have been adopted to curb traffic congestion, including expanding the width of roads,

better management of parking and adoption of a Bus Rapid Transit (BRT) system (Zumrawi, 2021).

Sudan transportation sector

Several modes exist for the transport of people and goods, as briefly described in the bullets below.

• **Roads:** Road density in Sudan is among the lowest in Africa and the world. The existing road arteries are centered on Khartoum as the hub. However, the Sudanese Road network has extended over the past years. Over 90% of inland transport services in Sudan are on roads and the total road network in the country is estimated to be 32,425km of paved and unpaved roads spanning national highways, state roads and urban roads. As only 7,200km are paved roads. Roads account for almost three quarters of all commercial transport through heavy-duty trucks and light duty trucks. Annually, buses typically transport between 20 and 30 thousand people within and between cities. The roads are the joint responsibility of the federal, state and local (states) governments, and the National Highways Corporation makes policies and sets standards for all roads.

• **Rail:** Sudan has about 6,000 kilometres of narrow-gauge, single-track railroads that serve the northern and central portions of the country. The Sudan Railway Network is one of the longest systems in Africa and accounts for about 10% of all commercial transport. Annually, between 80 and 90 thousand people use rail service inter-city transport. Contracts have already been signed to link the Sudanese rail network with the one in Chad. A project to restore the rail link to Southern Sudan has been completed and Sudan is also looking at linking its rail system with Egypt. Another major pan-African project aims to use a railway line to link up Port Sudan and Dakar in Senegal. The railway system has been restructured into two: the public Sudan Railway Corporation (SRC) which owns the physical assets and a second group of operations in the private sector. The latter comprises ten private companies, and they run operations on different lines. In its Railway Strategy (2013-2017), the Sudan Railway Corporation proposed to restore a number of key lines, including the Khartoum-Port Sudan line, and to link more Sudanese regions by railway lines.

• **River:** Sudan has about 5,000 kilometres of navigable inland waterways on the River Nile and its tributaries. The Nile River Transport Company, a private sector company launched in 2008, operates a system that connects the cities of Kosti, Malakal, and Juba on the White Nile in the south (1,436 km) and connects Karima to Donglain the North (287 km). The annual volume of goods transported is typically between 70 and 90 thousand tonnes. Transport of passengers has been largely replaced by land-based options, dropping from 44 thousand passengers in 2008 to only 4 thousand passengers in 2009.

• **Air:** There are 88 airports in Sudan, 15 of which have paved runways. There is also one heliport. Passenger traffic reached nearly half a million people in 2009, and has been growing rapidly in recent years. Cargo transport is typically between 10 and 15 thousand tonnes per year.

• **Marine**: There are four seaports in Sudan, Port Sudan, Bashair, Oseef and Osman Digna. These ports accommodate roughly 8 million tonnes of goods per year. Port Sudan is the main port for the country, where 80% of the country's ocean transports passes. The port is equipped with 15 docks, and is divided into two sections: the main port serves ships bringing general cargo, and the southern port serves tankers, containers and liquid materials. The volume of goods transported

by the Sudan Shipping Line decreased from about 112 thousand tonnes in 2008 to only 33 thousand tonnes in 2009, primarily due to temporary maintenance. Sea Ports Corporation is a public enterprise that is the main authority in the marine transport sector. It was set up in 1974 to construct, develop and maintain Sudan's ports and harbours. The Sea Ports Corporation has plans to complete the construction of a new oil terminal for the exportation of oil products by 2020.

The Sudanese Ministry for Transport, Roads and Bridges has prepared a 30-year transport plan to guide the way with the development of transport infrastructure. It addresses all modes of transport, the major ones being roads, railways, river transport, air traffic and seaports. The Sudan National Transport Master Plan (NTMP) has conceptualised the development of a transport sector that not only serves Sudan but also the neighbouring land-locked countries: Chad, the Central African Republic and the Republic of South Sudan.

Energy used in the Transportation Sector

Sudan's transportation sector is the biggest consuming sector of petroleum products with a share of more than 60% of total consumption, in which 91% of this consumption is allocated to road transport. From historical data the consumption of road transport increased by more than 300% from year 2000 until now (Source: Ministry of Energy and Petroleum) which means that the GHG emissions also increased rabidly. Gasoil, Gasoline and Jet kerosene are fuels used for road, river, railway and air types of transportation.

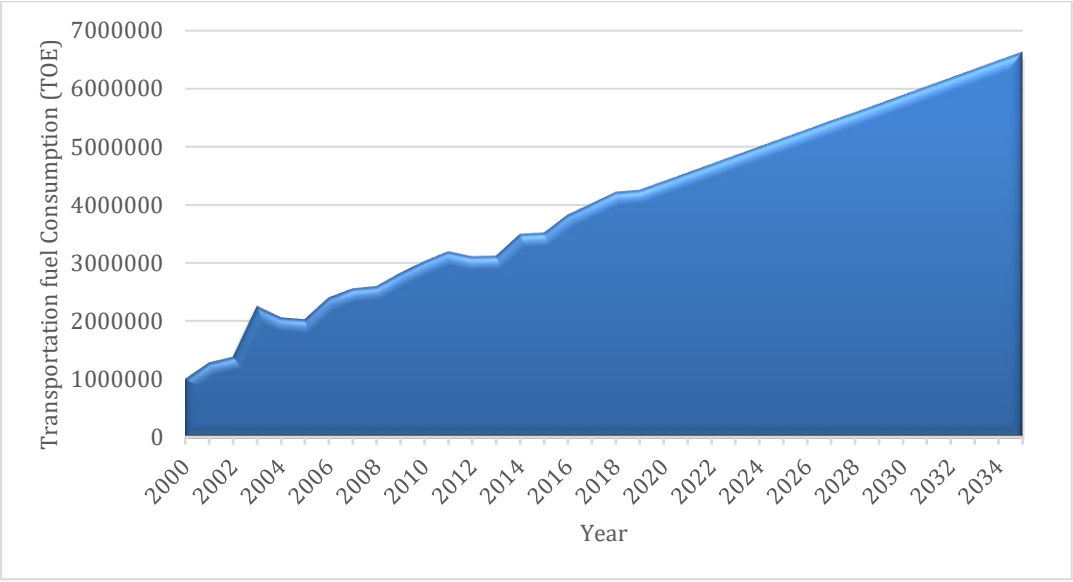


Figure 10: Transportation sector fuel consumption forecast up to year 2034

Figure 10 illustrates that fuel consumed in transportation sector over the period from 2000 to 2018 increased significantly from 1,004,730 (toe) in year 2000 to 4,216,478 (toe) in year 2018 (increased by 320%) due to the rising of population, increase of economic activities which enhance mobility, improving infrastructure (paved roads). At the low case forecast scenario the consumption of transportation sector will increase to 6,627,355 toe at year 2035 (increased by about 57% from year 2018) and at the high case scenario the consumption will increase to 7,973,969 toe at year 2035 (increased by about 89% from year 2018).

The road transportation includes all types of passenger cars, light-duty vehicles such as automobiles and light trucks, and heavy-duty vehicles such as tractor trailers and buses, and on-road motorcycles (including mopeds, scooters, and three-wheelers).

Fuel types used in vehicles are Gasoline and Diesel (Gas Oil). According to the data, the total number of cars that run on gasoline is much higher than that of gasoil, with gasoline representing 74.45% of the total as shown in Figure 11.

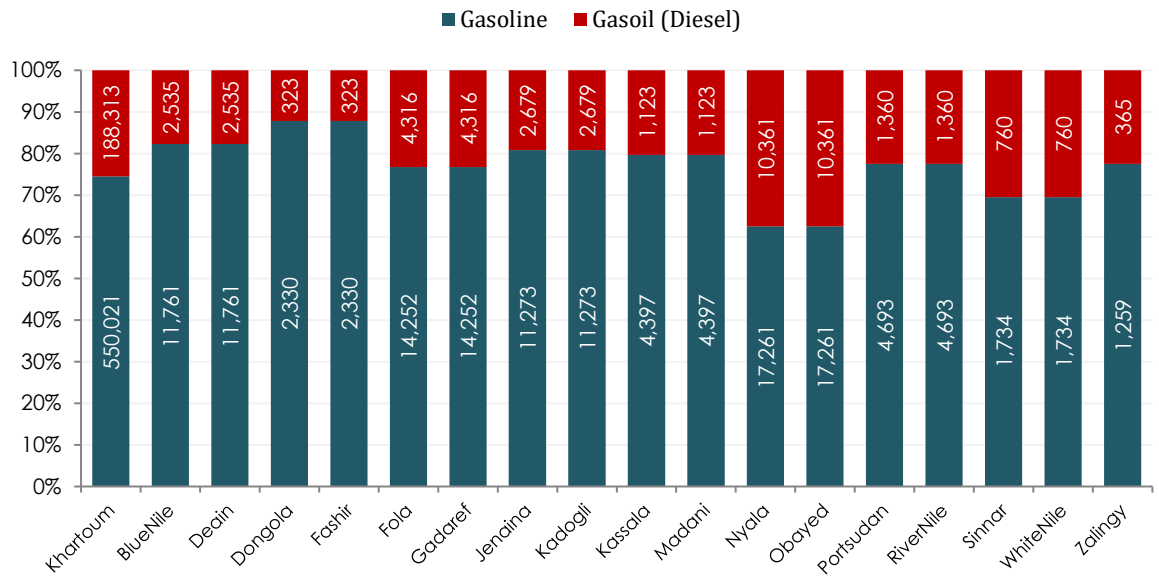


Figure 11: No. of vehicles by fuel type and state, and as fuel type percentage of state total. Data Source: General Administration of Traffic

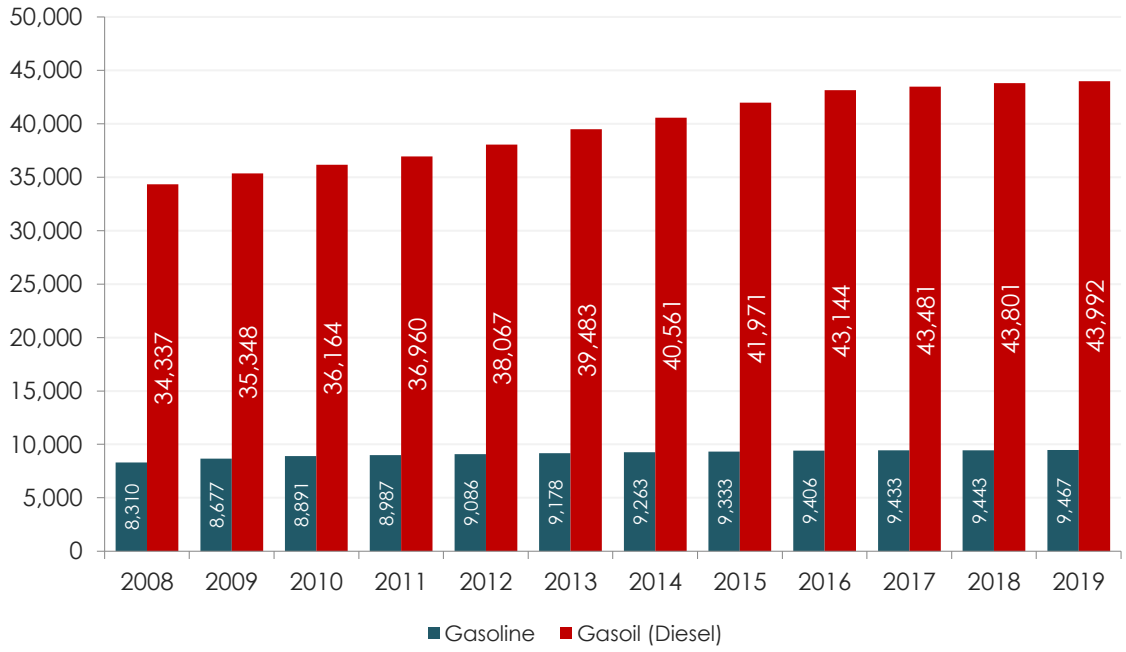


Figure 12: Heavy Duty Trucks and Buses by fuel type for Khartoum State. Data Source: General Administartion of Traffic

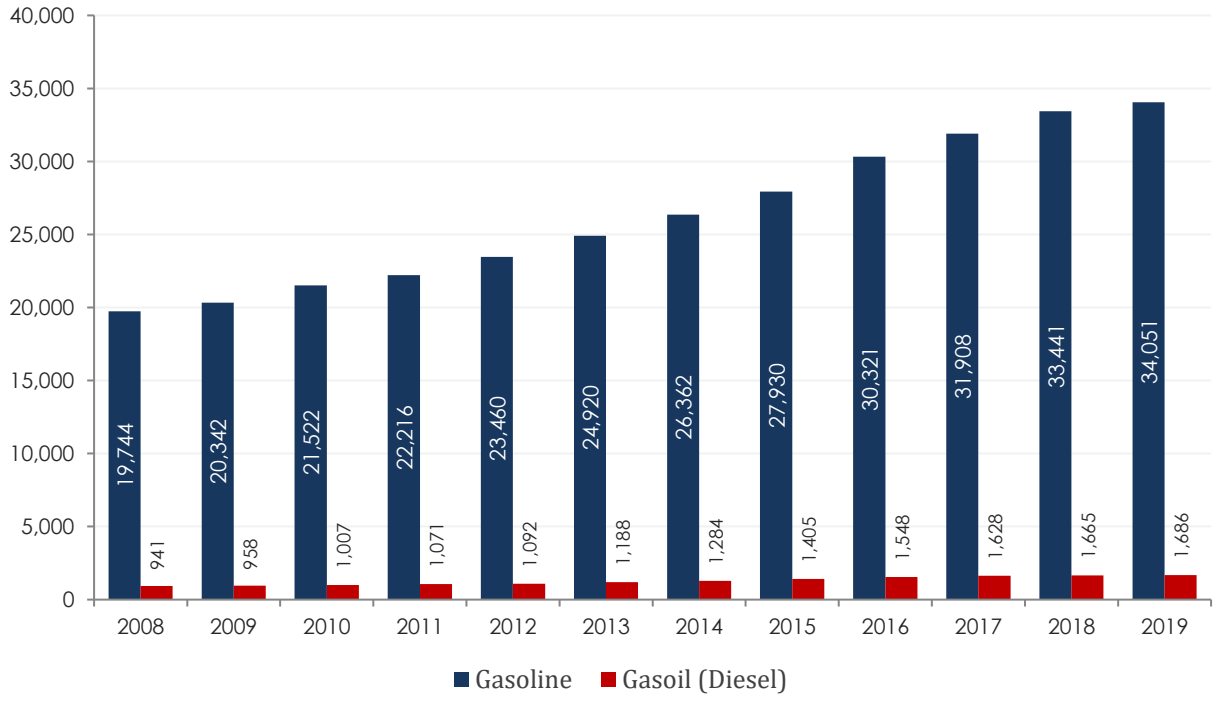


Figure 13:Motorcycles by fuel type for Khartoum State. Data Source(1): General Administration of Traffic

Number of cars is projected up to 2035. Two forecasting scenarios are modelled as they are illustrated in the following figure

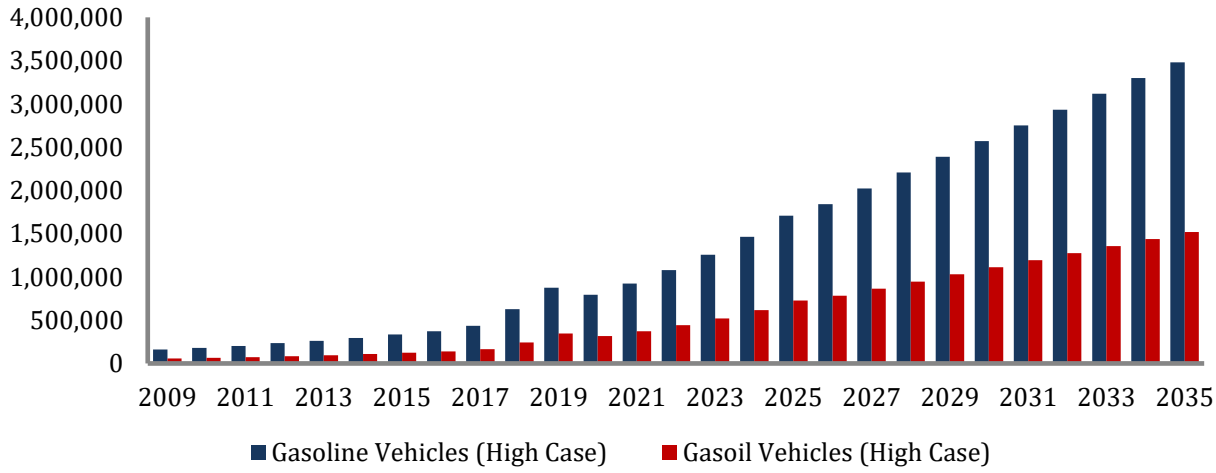


Figure 14: Projection of number of Vehicles by Fuel Type (Cumulative). Source: Bottom-up approach for estimating of activity data and GHG emissions for road transport in Sudan, 2020

GHG emissions from the transport sector

Sudan's Transportation Sector is the biggest consuming sector of petroleum products with a share of more than 60% of total consumption (Source: Ministry of petroleum and Gas Report, 2016). Lack of adequate mass transport systems, poor mechanical conditions of vehicles and bad roads are some of the major factors affecting efficiency in the transport sector. Gaseous emissions from vehicles also constitute a significant portion of pollutants in towns and greenhouse gas emissions. Private, public passenger and goods transportation is the major non-renewable energy consumer

in Sudan. Gasoil, Gasoline and jet kerosene are fuels used for railway, river, road and aviation types of transportation.

As a result the market demand for Gasoline has increased threefolds from year 2000 to 2008. It is expected that by 2030, according to the current vehicles importing rate, there will be about 1 million cars and more than 200,000 vehicles for public transportation. In comparison, in 2000 there were only about 93,150 private cars and about 48,500 public transportation vehicles.

Emissions from transport, and especially motor vehicles, add considerably to the levels of greenhouse gases in the atmosphere. Globally, transport accounts for approximately 24% of direct CO_2 emissions from fuel combustion. Road transport generally accounts for approximately 55-99% of greenhouse gases from transport. Of this, two-thirds are attributable to the private car – primarily in the form of CO_2. (IEA, 2020)

In Sudan emissions from the transport sector is considered as key category according to the 3rd National communication report of Sudan (2020) as shown in the figure below.

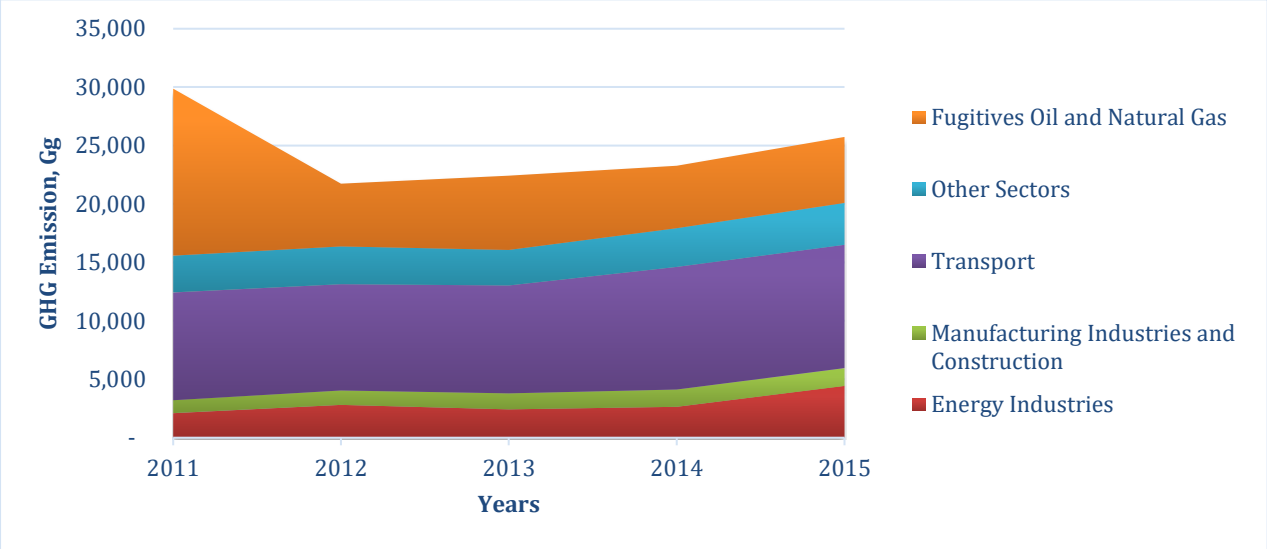


Figure 15: GHG Emission trends in Energy Sector (Sudan 3rd GHGs inventory report, 2020) (Source: Draft National GHG Inventory Report - 3rd National Communication project – HCENR)

The following figure illustrates the estimated GHGs emissions from the transport sector which includes: road, river, railway and aviation.

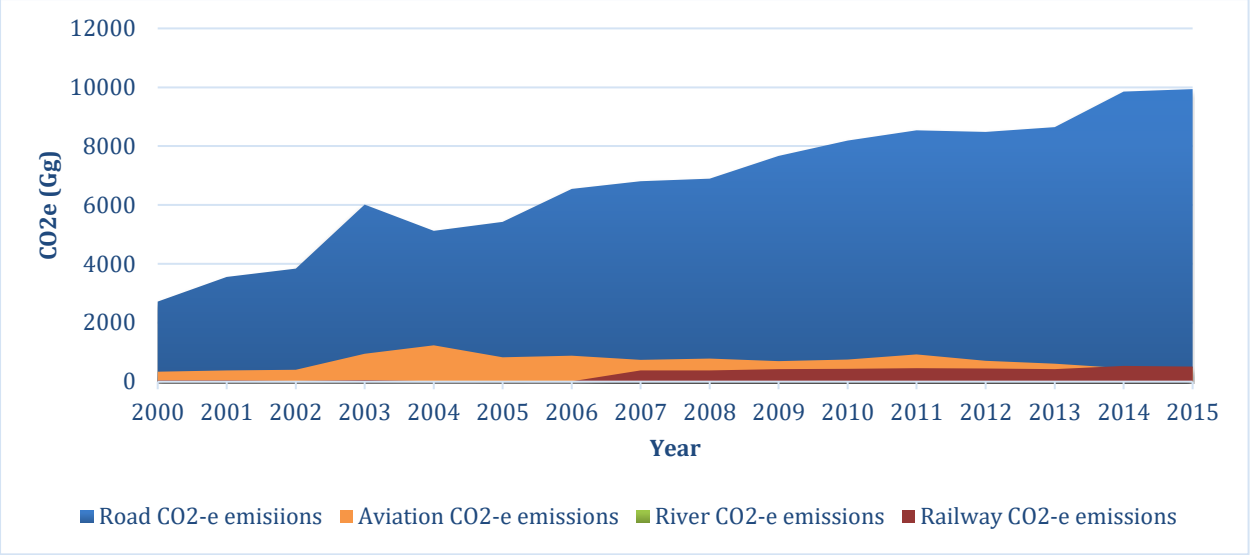


Figure 16: Trend of GHG emitted transport sectors (2000 - 2015) (Source: Draft National GHG Inventory Report - 3rd National Communication project – HCENR)

Situational analysis on Sudan's MRV systems- Transport Sector

General situational analysis

While Sudan has advanced relatively in capacity for GHG inventory development, mitigation analysis, vulnerability assessment, adaptation strategy formulation, and other information relating to climate change, there remain important technical, institutional, and financial barriers and limitations for achieving the transparency obligations under the Paris Agreement. A Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis has identified the following areas of need for meeting the transparency requirements under the Paris Agreement.

- Commitment. To improve policies and legal arrangements for planning and fulfilling Sudan's obligations towards the Paris Agreement, the proposed institutional arrangements need to have national long-term commitments and procedural arrangements on transparency, including adopting proper policies and legal arrangements to support the implementation of the country transparency obligations under the Paris Agreement in a regular and improved manner, without being affected by future institutional changes.
- Capacity. The climate change unit of the HCENR needs to be strengthened to enhance its role in coordinating transparency under climate change, including measurement, reporting and verification (MRV), monitoring and evaluation (M&E) for climate change actions and support and tracking of NDCs, as well as the current requirements, including national GHG inventories, communication reports, and biennial update reports and adaptation actions.
- Coordination. A national inter-institutional mechanism is needed for better coordination between national institutions in which policy/decision-makers and technical experts from relevant institutions. Key institutions include representatives from government institutions, research, academia, the private sector, and civil society, coordinated and supported by the HCENR.
- Knowledge. Gender-relevant knowledge-generating and sharing mechanisms need to be developed that are suitable for relevant stakeholders at different sectors (both public and private) and levels (including policy and decision-makers, technical and administrative personnel, new graduates, and students). This should also include accessing media and to support public awareness through designing and publishing of press materials and perform public awareness sessions.

Stakeholders Consultations

The relevant stakeholders in the transport and energy sector were identified in the public and private sectors, representing the main activity producers and relevant actors/stakeholders in the public sector. Consultations were conducted with the objective of ensuring that the ICAT project has broad stakeholders support and that beneficiary sectors have endorsed the project objectives and planned outcomes. Table 4 listing the stakeholders' entities targeted by the ICAT project – both energy and transportation sectors. Two technical working groups were formed one for the energy sector and the other for transportation sector, 15 representatives each.

Table 4: Stakeholders Targeted by ICAT Project for both Energy and Transport sectors

SN	Stakeholders Entities
1	Ministry of Interior
2	Ministry of Communications and Digital Transformation
3	Ministry of Finance and National Economy
4	Ministry of Energy and Petroleum
5	Ministry of Agriculture and Forestry
6	Ministry of Transport
7	Ministry of Urban Development, Roads and Bridges
8	Central Bureau of Statistics
9	National Research Centre
10	Energy Research Centre
11	Private sector and industrial facilities (Food Industry, Cement factories, Sugar companies, Energy, Oil & Gas industry)

Conducted stakeholders' consultation provided a platform to engage with different actors in order to confirm proper understanding of the project objectives and to ensure the fast and accurate data collection process.

The information gathered during consultations was used to support the gap identification and analysis, selection process for activities, training needs, and the general framework for the unified MRV system.

Interviews and meetings:

Stakeholders were briefed through a presentation by the project's targets and procedure, they're were informed by their roles, responsibilities and the rationale of each task.

Also, the challenges and the obstacles were highlighted and how to manage, inquiries were answered, generally the meetings cover the projects need, project objectives, description, outputs and outcomes Additionally, discussions took place on how a fixed data flow under fixed schedules could be sustained.

Legal framework and institutional arrangements: This cover the presence and clarity of a legal framework for the collection of energy and transport statistics, in terms of mandate and budget adequacy. For institutional arrangements, it covers data flows, data sharing processes between institutions, consultation processes, and monitoring and evaluation of transport and energy statistics.

Objectives and adequacy for project monitoring: For major actors in the energy sector, this aspect addresses the presence and clarity of objectives for producing transport and energy

statistics. Additionally, it also addresses their adequacy for policy making and project monitoring.

Methodologies and processes: This addressee the presence and viability of data collection and processing methodologies, in terms of standardised templates, questionnaires and sampling methods, estimation, data review, and validation. It also examines the manuals followed for all terms, in addition to documentation of all processes. This in turn reflects transparency, accuracy, completeness, consistency and comparability.

Data collection: For main activity producers, data was collected directly from the assigned focal points of this project (*i.e.*, the technical committee members) This activity involved outlining the required datasets to assigned representatives and then following up with them in terms of completing the missing data. Collected data sets were complemented by previous studies and reports carried out by the relevant institutions.

The following diagram shows the proposed structure for the transparency unit in HCENR, in which direct and indirect stakeholders of the energy related activities which include the sub sectors of: transport, oil and gas, power and services and commercial are identified.

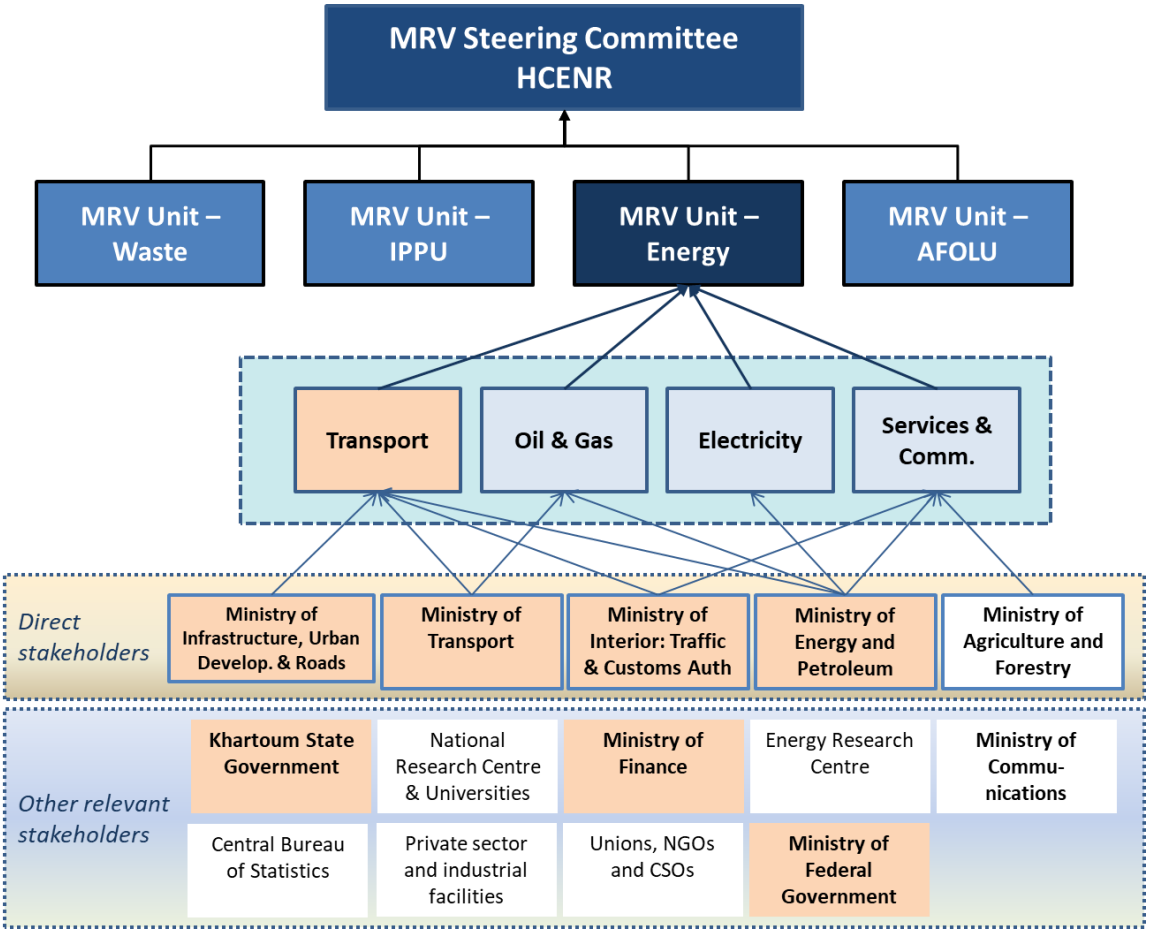


Figure 17: identified stakeholders' institutions related to the transport sector

Identified gaps by stakeholders

Ministry of Energy and Petroleum

The Sudanese Petroleum Corporation (SPC) collects data on oil production, imports, exports,

consumption, international marine bunkers, international aviation bunkers and stock changes as estimation reports on a monthly basis. Data focus on energy use. This is done through its various directorates, especially downstream: the General Directorate, Supplies and Marketing of Petroleum General Directorate and BAPCO and PETCO crude transportation companies. Data are provided and managed in files and papers. Oil data are considered confidential and official permission is required to obtain the data.

Data gaps identified in the Ministry of Energy and Oil and its relevant divisions/departments

Institutional arrangements:

- There is no lead institute to collect energy statistics.
- Structural changes of the different directorates lead to instability of the processes and results obtained.
- A lack of co-ordination between entities within the ministry leads to duplicated work and inefficient utilisation of funds.

Human resources:

- Insufficient numbers of staff are working on energy statistics.
- Staff lack understanding about energy processes and the information required to produce quality energy data.
- An absence of funding obstracts the establishment of effective data collecting, handling and disseminating systems.

Methodological and technical challenges:

- Different methodologies are used in calculations and estimations of energy balance.
- The application of international standards and methodologies is lacking.
- Tools required for energy data collection and management are insufficient.
- Linkages between databases from producers and users of energy data are absent.
- The production and publication of energy reports are delayed.
- Financial support is insufficient.

Ministry of Transport

The Ministry of Transport has many affiliated bodies that are related to the different modes of transportation.

1. The Sudan Railways Authority
2. The Sudan Sea Ports Authority
3. The Sudan Ships Portal
4. The Nile Valley River Navigation Authority
5. The Land Transport Unit
6. The Sudan Airways Company
7. The Sudan Shipping Lines
8. The River Transport Company
9. The River Navigation Department
10. The Roads and Bridges Corporation

Activity data related to GHG inventory and/or mitigation actions are not recorded. Reports about different units activities are not well communicated.

Data gaps identified in the Ministry of Transport

- The legal framework with respect to the collection of statistics regarding the transport sector is unclear.
- Different methodologies used in calculations and estimations of transport statistics in term of fuel consumption per unit traveled.
- There is an absence of linkages between different stakeholders
- Information on the methodology related to measurement units and conversion factors used in transport activity data need improvement.
- The number of trained staff is inadequate to manage data collection, tabulation, and reporting.
- A consultation process to facilitate data collection and review procedures is required.
- Financial support is insufficient.

Ministry of interior (National Custom Authority and General Traffic Directorate)

Detailed data sets about vehicles (quantity, types, specifications, etc.) can be obtained from the custom authority and the traffic directorate. Unfortunately, the formats of the data sets are not in line with the GHG inventory guidelines. The data are considered confidential.

Traffic data
There is no legal framework or any institutional arrangements in place for sharing custom and traffic data between ministry of Interior and HCENR. In order to effectively utilize the available data in the Ministry of Interior, templates shall be developed and capacity building program is needed for the appointed personnel.

Summary of gap analysis in the transport sector

Group	ID	Description
Missing or unclear legal framework	**Gap 1: Leading agency**	The most significant gap in Sudan's energy statistics is the absence of a lead agency with a mandate to collect energy statistics. Therefore, and as all respondents from the public and private sectors stated, there is no legal framework for the collection transport related data.
	Gap 2: Legal framework	Lack of clarity in legal frameworks can be seen in the relationship between companies (from public and private sector) and the ministries (and also between ministries) in relation to data sharing. The absence of a legal framework indicates that energy and transport data are not budgeted for in any of the related institutions. There is no obligation for any institution to submit any required data to any institution. For example, currently, HCENR collects transport data from different actors through requests.
No institutional arrangements	**Gap 3: Data collection**	The ramifications of the absence of a legal framework and a lead agency for transport related statistics extend to cause a lack of institutional arrangements within actors in the entire energy sector. This means that there is no coordination or consultations for the collection of energy statistics, in terms of methodologies, schedules for data collection, timelines for reporting, data quality control and assurance, and most importantly, consultations for improvement of activity data.
	Gap 4: Coordination	There is insufficient engagement between the public and private sectors when it comes to activity data. The lack of communication channels between institutions can lead to duplicate efforts, which is considered a mismanagement of resources. This could also be caused by a lack of understanding of roles between stakeholders/actors, especially from broad and imprecise mandates/terms of reference, and the lack of a lead agency in which energy statistics are centralized.

Insufficient budgets or financial support	**Gap 5: Financial support**	Institutions whose fulfilment of terms of references or mandates require activity data collection through surveys have stated that budgets are insufficient or lack financial support.
Insufficient skilled personnel	**Gap 6: Capacity building**	Institutions involved in transport activity data collection, have stated that the availability of skilled personnel is a challenge. This gap is strongly connected to lacking financial support.
Unclear or unenforced data collection methodologies/processes	**Gap 7: Standards and manual**	All institutions whose activities and terms of reference involve activity data collection do not use standardized templates and questionnaires. None of the institutions that collect activity data or produce energy statistics use proper manuals or international recommendations.
	Gap 8: QA/QC	There are no mechanisms present for checking, validating and reviewing the data collected and the methodologies used. This gap could be a result of the absence of a focal agency for transport activity data and an MRV system which underlies institutional, legal and procedural setups.
Archiving and dissemination of energy statistics	**Gap 9: Reporting and Publication**	Energy and transport reports from different actors are not published for the public regularly on a fixed timeline. Also, this gap group is linked to gap 1 of having no leading agency present with a legal framework and mandate for energy statistics, which, in turn, does not impose any obligation on any actor to submit energy data on a fixed schedule. On the other hand, no communication and consultations with energy statistics users take place for comments and feedback, when no fixed schedules are present for dissemination.
Energy and transport information are not adequate for policy and project monitoring	**Gap 10: Transparency**	This gap could be considered a result of all the preceding gaps and serves as a conclusion that current energy statistics practices and coverage are inadequate for policy making and monitoring national targets such as NDCs and the underlying information needed for clarity, transparency and understanding.

Areas of MRV improvements- Transport Sector

After identification of transport data gaps and analysis of probable causes of those gaps, key solutions were reached. Below is an explanation of those key solutions and their components and how the identified gaps can be covered or reduced.

Establishing a legal framework for sharing the transport activity data

Such a mandate, along with an adequate legal framework that covers public and private sectors, can at least ensure that the activity data used to estimated GHG emissions from different transportation modes are collected or submitted.

An adequate legal framework for energy statistics related to the transportation sector in the institutions involved in conducting surveys can guarantee a budget component specific to surveys.

Setting and maintaining institutional arrangements that are based on consultations, co-operation and mutual benefit between institutions

Utilizing a bottom-up approach in setting institutional arrangements would require extensive consultations between actors in the energy and transport sectors. These consultations can help reach data sharing agreements or any other form of agreement or understanding between actors that can sustain a certain agreed-upon data flow, with a fixed schedule that aligns with national data dissemination report timelines. This can be achieved through memorandums of understanding between different actors and the selected lead agency for energy statistics or the MRV unit.

These agreements or understandings also include sharing of data collection and estimation methodologies, which enhances transparency. Regular consultations can help improve methodologies used. They could also result in the avoidance of duplicate efforts, and thus, contribute to good management of resources.

Strengthening methodologies and processes

Actors involved in energy data collection using surveys must use standardised templates, across different target data groups, appropriate to Sudan. These actors should also be encouraged to follow IPCC guidelines in tabulating activity data. This contributes to the enhancement of the consistency and comparability principles for energy data.

Digitalization of archives and documentation, with the use of cloud storage and regular backups of data, can prevent data losses and ease access, retrieval and reuse of data.

Activities log

The table below provides the detailed log for the activates curried up to date.

Table 5: Implemented project activities

#	Date	Event	Notes
1	27 Sep. 2021	Project Kick off meeting : the work plan and budget was discussed and approved	Detailed budget breakdown of meetings and workshop is requested by the client
2	6th Oct. 2021 to 10th Dec. 2021	Submission and revisions of the project budget	The kick off the project implementation is subject of receiving workshops budget by the consultants
3	13th of Dec. 2021	Status meeting	Updates on institutional and political status in Sudan, status on processing of payments and preparation of Inception Workshop
4	10th of Jan. 2022	Agreement on bi-weekly meeting to track the project progress	The first bi-weekly meeting will be held on the 13th of Jan. 2022
5	13th of Jan.2022	The first bi-weekly meeting.	A short progress report was delivered to the DTU coordinator
6	19th of Jan 2022	First payments were received by the two consultants	The payments include USD5000 for each consultant to cover the cost of workshops and meetings
7	27th of Jan 2022	Initial suggested list of participants is prepared for the two sectors to attend the inception workshop	Communications with different stakeholders are ongoing while HCENR is preparing official letters to nominated candidates to attend the inception workshop
8	30st of Jan 2022	Contacted Key stakeholders and requested meeting with Undersecretaries	
9	7th of Feb. 2022	Bi-weekly meeting	Discussion covered the preparation for the inception workshop and changing the consultants contract with the new client's arrangement
10	12th of Feb. 2022	Termination letter of the existing consultancy contract was received	- New contracts will be furnished to both consultants in order to replace the previous one with the same conditions and terms.
11	24th of Feb. 2022	Bi-weekly meeting	- Fixing date for the inception workshop - Participation of ICAT secretariat in the workshop - Themes and materials to be presented in the workshop

12	15th of March 2022	ICAT project – Inception workshop	- Technical working groups (Energy and Transport sectors) were formed - Workshop report is submitted to the client
13	17th of March 2022	Bi-weekly meeting	- Was canceled as a quick update was given by consultants one day before.
14	30th of March 2022	1st TWGs meeting	- Meeting minutes were taken and some tasks were given to the two groups as per item 9 of the project's working plan
15	31st of March 2022	Bi-weekly meeting	- Quick update was given by national consultants on project's progress. Shed light on the tasks given to the TWGs' members. The consultants requested update on new contracts and agreed to be updated on that before next meeting.
16	14th of April 2022	Bi-weekly meeting	- Meeting postponed to the 21st of April
17	19th of April 2022	2nd TWGs meeting	- Collected data that requested last meeting (only 7 members submitted their data and right now it is under review by consultants). - Agreed to start meeting with each entity to expedite data collection so as before the next meeting (mid of May) all data collection must be completed. - Two presentations were presented by TWG members: MRV system developed for electricity sector and the MRV system for National Forest Corporation. - Meeting minutes were taken and some tasks were given to the two groups
19	May- Oct 2022	Ad Hoc meetings and interviews with Key Informants by phone,	- Continued working on data collection about the institutional arrangement and MRV systems in Sudan - Analysis of data collected - Conducted number of biweekly meetings with project management team
20	Nov -Dec 2022	Started working on the gap analysis report	- Conducted number of biweekly meetings with project management team - Signed the amended contract

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