Recommendations for an MRV Toolbox and Long-Term Transparency Strategy in Sudan's Energy Sector

UN environment programme | copenhagen climate centre
supported by UNOPS

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

ICAT Initiative for Climate Action Transparency

Initiative for Climate Action Transparency – ICAT

Recommendations for the Development of a fit-for-purpose MRV Toolbox and Long-term Transparency Strategy in Sudan's Energy Sector

Deliverable #4

Contributors:

National Consultants:

Dr. Abdelrahman Eltahir Ahmed Musa	Energy Sector
Dr. Qousay Awad Ahmed	Transport Sector

Higher Council for Environment and Natural Resources (HCENR):

Dr. Hana Hamdalla	Director of Climate Change Directorate
Ms. Huyam Ahmed	Project Coordinator

Resource Persons and Contributors:

Dr. Arig Gafer Bakhit	NDCs Partnership
Dr. slam Mohammed Mahmoud Awad	Sudan CBIT Project, National Consultant - Institutional Arrangement
Eng. Amr Nasreldin Hussein Abdulhadi	Sudan CBIT Project, National Consultant - MRV
Eng. Shoroog Siddig	GHG emission inventory - Resource Person
Eng. Yasen Hatim Abass Ahmed	Mitigation Measures Modeling - Resource Person
Eng. Yousif Ibrahim Hamza Mohammed	Data collection and reporting - Resource Person

Technical working group:

Mr. Nader M. Khalifa	Ministry of Energy &Petroleum
Ms. Rihab Kamal Omer	Ministry of Energy &Petroleum
Mr. Mohamed Elmukhtar	Ministry of Energy & Petroleum
Mr. Mudathir Abdalla Adam	Sudanese Mineral Resources Company
Mr. Abdelhafiz f. Babiker	Electricity Regularity Authority
Ms. Amira Elnour	Ministry of Industry
Ms. Safaa Ahmed Beraima	Forest National Corporation
Ms. Khalda Abbas	Forest National Corporation
Mr. Mohamed Elfatih	TPRA
Mr. Mohamed Elmustafa	National Customs Authority

Ms. Remond Ali Mohamed	National Energy Research Centre
Prof. Muna Mahjoub	Institute of Environment Studies - University of Khartoum
Ms. Hind Mohamed	Haggar Group - Private Sector
Ms. Afaf Mohamed	Ministry of Energy &Petroleum
Mr. Awadelkareem Gafar Mohamed	Traffic Police - Ministry of Interior
Mr. Ahmed Awad	CTC Group Ltd- Private Sector
Mr. Hamad M.Elsharief	Ministry of Urban Planning, Roads and Bridges
Ms. Somaya Sirlkhatim M.	National Centre for Research
Ms. Nimat Mustafa Omer	Kenana Sugar Company
Ms. Amgaad Abdelwahab	Central Bureau of Statistics
Ms. Doa Abdalla Ibrahim	Central Bureau of Statistics
Ms. Ikhlass Nimer	Journalist

ICAT- Project Coordinator:
Alejandro Regatero Labadia

Date 4 January 2024

DISCLAIMER

PREPARED UNDER

The Initiative for Climate Action Transparency (ICAT), supported by Austria, Germany, Italy, the Children's Investment Fund Foundation and the ClimateWorks Foundation.

Supported by: Federal Foreign Office on the basis of a decision by the German Bundestag
IKI International Climate Initiative
CIFF Children's Investment Fund Foundation
Ministero dell'Ambiente e della Sicurezza Energetica
Federal Ministry Republic of Austria Climate Action, Environment, Energy, Mobility, Innovation and Technology
climateworks FOUNDATION
Environment and Climate Change Canada / Environnement et Changement climatique Canada
UNOPS

The ICAT project is managed by the United Nations Office for Project Services (UNOPS)

Table of contents

Table of Contents

List of Tables

List of Figure

List of Acronyms

BUR	Biennial Update Report
CBIT	Capacity Building Initiative for Transparency
CBS	Central Bureau of Statistics
CC	Climate Change
COP	Conference of the Parties
CSO	Civil Society Organization
CSP	Concentrating Solar Power
ERA	Electricity Regulatory Authority
FAO	Food and Agriculture Organization of the United Nations
FiT	Feed-in Tariff
FNC	Forests National Corporation
GEF	Global Environment Facility
GHG	greenhouse gases
HCENR	Higher Council for Environment and Natural Resources (Sudan)
ICAT	International Climate Action Transparency
IRR	Internal Rate of Return
M&E	Monitoring & evaluation
MEAs	Multilateral Environmental Agreements
MPGs	Modalities, Procedures and Guidelines
MRV	Measurement, reporting and verification
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
NLDC	National Load Dispatch Centre
POPP	Programme and Operations Policies and Procedures
PV	Photovoltaic
QA/QC	Quality assurance/quality control
RE	Renewable Energy
REDD+	Reducing Emissions from Deforestation and forest Degradation
ROI	Return on Investment
SCADA	Supervisory Control and Data Acquisition
SCIA	Sudanese Chambers of Industries Association

SEDC	Sudanese Electricity Distribution Company
SEHC	Sudanese Electricity Holding Company
SETC	Sudanese Electricity Transmission Company
SHGC	Sudanese Hydropower Generation Company
SPC	Sudanese Petroleum Corporation
STPG	Sudanese Thermal Power Generating Company
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

This technical report provides a comprehensive overview of the proposed tracking tool for monitoring the implementation of Nationally Determined Contributions (NDCs) in Sudan's energy sector. To effectively track progress, the report suggests a list of indicators that can be used to assess the implementation of NDCs in the Energy sector. These indicators will enable Sudan to monitor its performance and identify areas that require additional attention and action.

In addition to the tracking tool, the report outlines the design and features of a general tool that will support the long-term transparency strategy in the Energy sector. This tracking tool will facilitate data collection, analysis, and reporting, enabling Sudan to meet its transparency commitments, in addition of attracting climate action related investment for the Energy sector.

The report presents the development of a long-term transparency strategy for the Energy sector, highlighting its objectives and the recommended actions to enhance transparency efforts, strengthen Measurement, Reporting, and Verification (MRV) systems, and promote sustainable development.

The objectives of the long-term transparency strategy are clearly stated, focusing on the improvement of the greenhouse gas (GHG) inventory, the implementation of mitigation actions, and the adoption of adaptation measures. These objectives align with Sudan's commitment to addressing climate change and contribute to global mitigation and adaptation efforts through enhancing the accountability, providing data-driven decision-making to attract investment, and gaining global trust.

Moreover, the report highlights the linkages and synergies between the proposed transparency strategy and the ongoing Capacity Building Initiative for Transparency (CBIT) project. By leveraging the experiences and lessons learned from the CBIT project, Sudan can strengthen its transparency efforts and ensure coherence between different initiatives.

To ensure the sustainability of the project outcomes, the report suggests a roadmap for consolidating the institutional framework, capacity building, and knowledge transfer. This roadmap will guide the implementation of the transparency strategy, fostering collaboration among stakeholders and enabling effective utilization of resources.

Additionally, the report emphasizes the importance of consolidated long-term financing mechanisms to support the transparency objectives. It suggests exploring various funding sources and mechanisms to secure the necessary financial resources for sustained implementation.

Lastly, the report presents a roadmap for continuous stakeholder engagement and communication. This includes regular consultations, workshops, and information sharing to foster collaboration, build consensus, and maintain transparency throughout the process.

By following the recommended actions outlined in this report, Sudan can enhance its transparency efforts, strengthen its MRV systems, and promote sustainable development in the Energy sector. Continued collaboration, capacity building, and the establishment of long-term financing mechanisms will be key in achieving the country's long-term transparency goals and making meaningful contributions to global climate change mitigation and adaptation efforts.

Sudan NDCs in Energy Sector and a proposed tracking tool

NDCs in the energy sector

Sudan, a country facing significant climate challenges and development needs, has submitted its updated NDC to the UNFCCC under the Paris Agreement. This section outlines its ambitious goals for reducing greenhouse gas (GHG) emissions and enhancing climate resilience across various sectors, including a strong focus on the energy sector. Sudan's NDCs in the energy sector present a promising pathway towards a low-carbon and climate-resilient future. However, overcoming the significant challenges facing the implementation and tracking the NDCs will require a concerted effort from the Sudanese government, international partners, and all stakeholders. Effective monitoring, evaluation, and reporting mechanisms are crucial to ensure progress towards achieving the ambitious NDC goals. It is worth mentioning that Sudan's NDC is conditional on receiving international support in terms of provision of finance, technology transfer and capacity building, highlighting the importance of international cooperation in assisting developing countries achieve their climate goals.
From another perspective, the NDC recognizes the potential benefits of renewable energy beyond climate change mitigation, such as job creation and enhancement of rural development in vulnerable areas.

Key Commitments:
Emission Reduction Target: Sudan aims to achieve a 38% reduction in GHG emissions from the energy sector by 2030 compared to a business-as-usual (BAU) scenario. This translates to a reduction of 12.4 Mt CO2e. The NDC outlines several GHG mitigation strategies to achieve this target, including:

- Increase in renewable energy: Sudan aims to deploy 10 GW of renewable energy capacity by 2030, focusing on solar, wind, and hydro sources.
- Improve energy efficiency: Initiatives include promoting efficient appliances, industrial processes, and building standards.
- Modernize the electricity grid: Upgrading the grid infrastructure will reduce transmission losses and improve its reliability.
- Transition away from fossil fuels: The NDC emphasizes phasing out inefficient and polluting fossil fuel technologies.

The following figure illustrates simple analysis of the NDCs in the energy sector.

Figure 1: Analyzing NDCs for the Sudan's energy sector

NDC Tracking Tool for Sudan's Renewable Energy Target

In accordance with the Paris Agreement's Enhanced Transparency Framework (ETF), Sudan has committed to increasing the share of renewable energy in its energy mix to 40% by 2030. To track progress towards this ambitious target, an NDC tracking tool can be developed to monitor, analyze, and report on key metrics. This tool will enhance transparency and accountability, allowing stakeholders to assess Sudan's efforts and identify areas for improvement.
The NDC Tracking Tool can help Sudan collect and analyze the information required to track its progress in the energy sector, such as the baseline emissions, the mitigation actions and their impacts, the indicators and methodologies used, the data sources and quality, and the challenges and gaps. The tool can also facilitate the preparation of the biennial transparency report (BTR) that Sudan needs to submit to the UNFCCC Secretariat every two years, starting from Dec. 2024.

The tracking tool is a valuable instrument for monitoring progress, informing decision-making, and enhancing transparency. By overcoming the challenges and continuously improving the tool, Sudan can demonstrate its commitment to achieving its climate goals and contribute to global efforts to combat climate change.

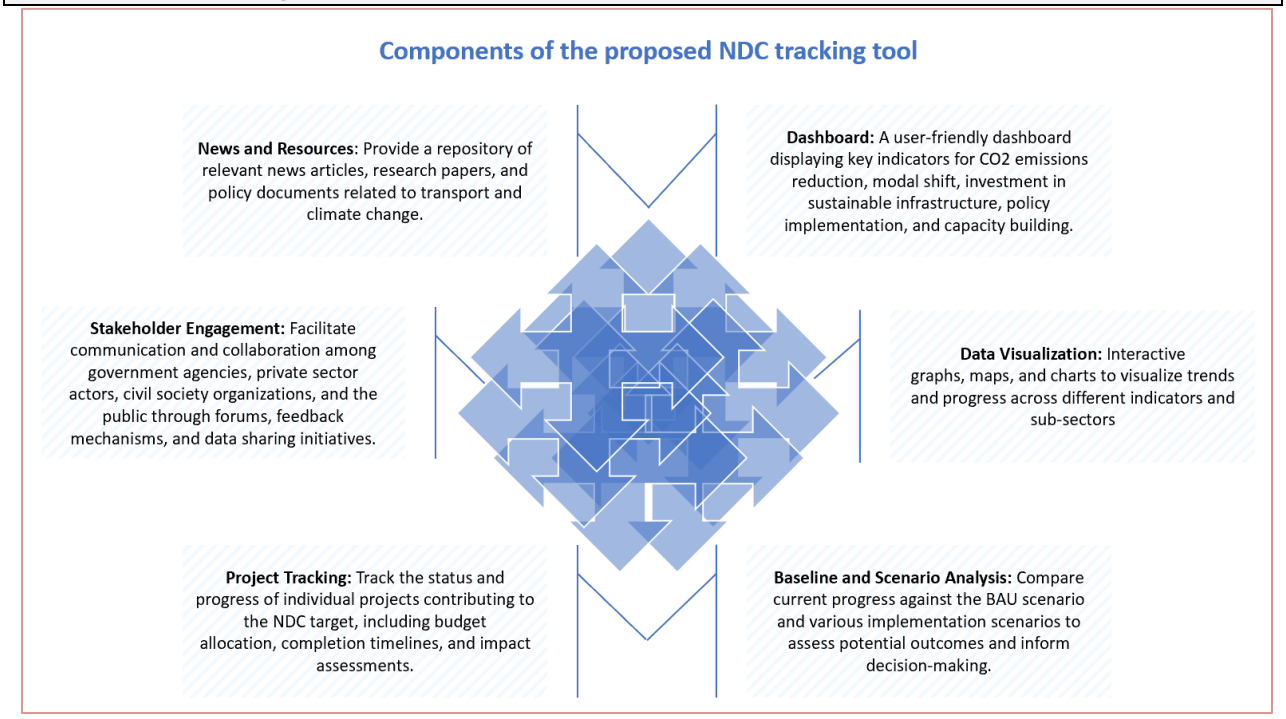


Figure 2: Components of the proposed NDC tracking tool - Sudan's energy and transport sectors.

Indicators for tracking progress in the implementation of RE related NDCs:

Tracking progress in the renewable energy sector involves several indicators. For Sudan, these indicators can be specific to the country's energy profile and its Sustainable Development Goals (SDGs). Here are some suggested key indicators by the authors:

1. **Total Energy Supply (TES):** This includes the total energy supply each year and the percentage of that supply which comes from renewable sources.
2. **Access to Electricity:** This measures the percentage of the population that has access to electricity.
3. **Annual Increase in Access to Clean Fuels and Technologies:** This tracks the yearly growth in the availability of clean fuels and technologies for both urban and rural areas.
4. **International Financial Flows:** This new indicator, 7.A.1, tracks international financial flows to developing countries in support of clean and renewable energy.
5. **Progress on Energy Efficiency:** This indicator measures the rate of improvement in energy efficiency.
6. **Current Share of Renewable Energy in the Energy Mix:** This measures the proportion of total energy consumption that is met through renewable sources.
7. **Installed Renewable Energy Capacity:** This tracks the total capacity of all renewable energy technologies installed in a given year.
8. **Investment Trends into Renewable Energy Projects:** This monitors the amount of public and private investment in renewable energy projects over time.
9. **Co Benefits such as rural development and Job Creation in the Renewable Energy Sector:** This measures the number of direct and indirect benefits jobs created in the renewable energy sector.
10. **GHG Emission Reductions:** This tracks the reduction in greenhouse gas emissions as a result of renewable energy policies and projects.

These indicators provide a holistic view of the progress being made towards renewable energy goals. However, it's important to note that data availability and quality can vary, so these indicators should be interpreted with caution. The International Energy Agency (IEA) and the World Bank provide comprehensive reports that track these indicators, such as the "*Tracking SDG7: The Energy Progress Report*". These reports can provide a detailed view of Sudan's progress in the renewable energy sector.

It is worth mentioning that these indicators are most effective when used together, as they provide a holistic view of the progress being made towards renewable energy goals. It's also important to note that data availability and quality can vary, so these indicators should be interpreted with caution by HCENR before submitting the upcoming BTR.

Tool Design and Features:

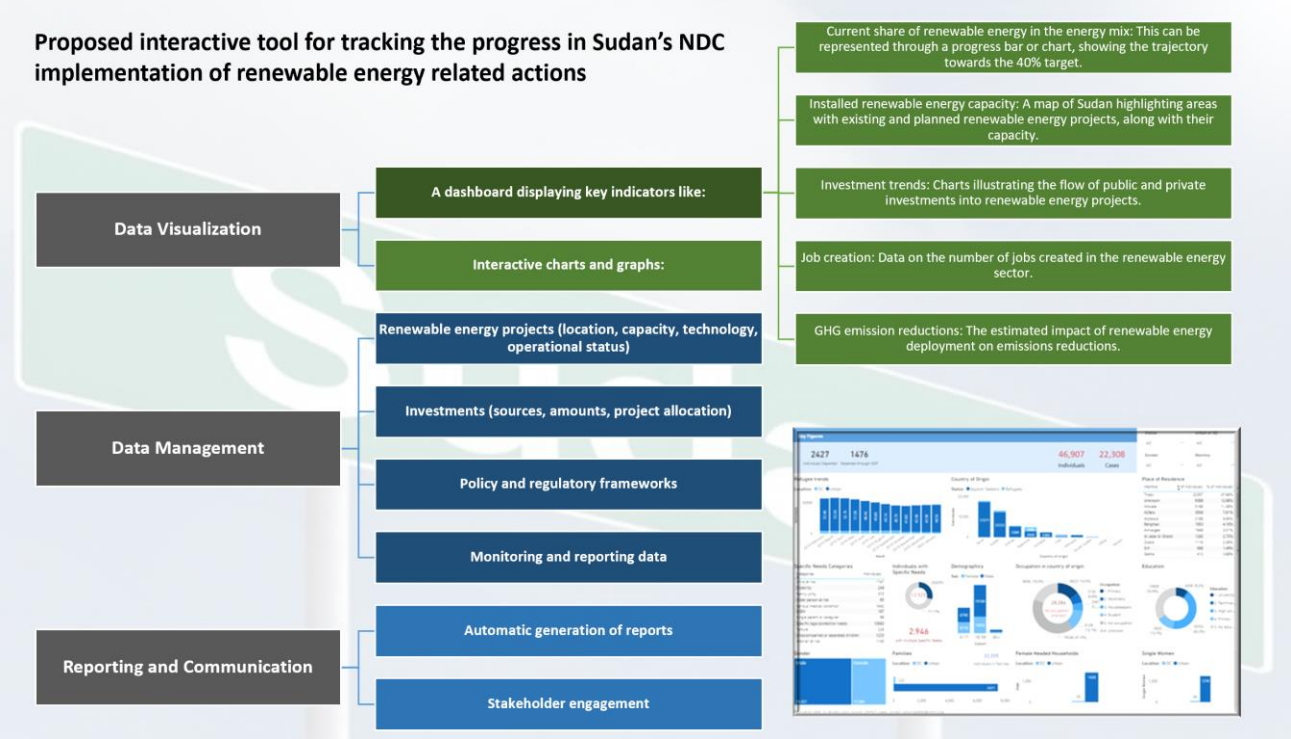


Figure 3: Schematic for the renewable energy tracking tool's elements and interface

The NDC tracking tool shall be designed as an interactive online platform hosted and operated by HCENR according to the proposed institutional arrangement presented in a previous report and also in the appendices of this report. The tool shall include the following features:

(1) Data Visualization:

- A dashboard displaying key indicators like:
    1. Current share of renewable energy in the energy mix: This can be represented through a progress bar or chart, showing the trajectory towards the 40% target.
    2. Installed renewable energy capacity: A map of Sudan highlighting areas with existing and planned renewable energy projects, along with their capacity.
    3. Investment trends: Charts illustrating the flow of public and private investments into renewable energy projects.
    4. Job creation: Data on the number of jobs created in the renewable energy sector.
    5. GHG emission reductions: The estimated impact of renewable energy deployment on emissions reductions.
- Interactive charts and graphs: Users can filter and explore data by region, energy source (solar, wind, hydro, etc.), and other relevant parameters.

(2) Data Management:

A comprehensive database storing disaggregated data on:

- Renewable energy projects (location, capacity, technology, operational status)
- Investments (sources, amounts, project allocation)
- Policy and regulatory frameworks

- Monitoring and reporting data

(3) Reporting and Communication:

- Automatic generation of reports: The tool can generate periodic reports summarizing progress towards the target, highlighting key achievements and challenges.
- Stakeholder engagement: Mechanisms for facilitating communication and collaboration among government agencies, private sector actors, civil society organizations, and the international community.

Benefits of the Tool:

- Enhanced transparency and accountability: The tool will make Sudan's progress towards its renewable energy target more visible and accessible to stakeholders.
- Improved decision-making: Data-driven insights can inform policy adjustments, resource allocation, and project development strategies.
- Attracting investment: The tool can showcase Sudan's commitment to clean energy and attract international investors and partners.
- Building trust and confidence: Transparency in climate action can strengthen international cooperation and support for Sudan's efforts.

Challenges and Considerations:

- Data availability and quality: Ensuring consistent and reliable data collection, reporting, and integration into the tool is crucial.
- Technical capacity: Building and maintaining the tool requires expertise in data management, web development, and communication.
- Resource mobilization: Funding is needed for developing, maintaining, and updating the tool.

Development of Long-Term Transparency Strategy on Actions related to the Energy Sector in Sudan

Background and objectives of the log-term Transparency Strategy

Sudan, as a developing country, recognizes the importance of transparency in addressing climate change. This section provides an overview of the development of a long-term transparency strategy, including the establishment of greenhouse gas (GHG) inventories, mitigation actions, and adaptation measures in the energy sector.

The overall objective of the long-term transparency strategy is to enable Sudan to achieve its national development goals, while effectively addressing climate change. Effective climate action requires strengthened institutional arrangements, that ensure the availability of sound data and information, as well as a sustainable flow of both. This would enable the country to design and implement evidence-based policies and programs, that constitute the country's climate action in line with the Paris Agreement. A strong transparency framework enhances climate action's national ownership, integration of stakeholders, and consequently, ensures accountability at national and international levels. Moreover, it allows climate action to be integrated into the national planning process, improves finance mobilization, and thus, enables transformational change.

Modalities, Procedures and Guidelines (MPGs) for the transparency framework for action and support – were adopted in the first CMA in December 2018. The adopted MPGs are contained in decision 18/CMA.1 and its annex. The reporting format has changed from Biennial Update Reports (BURs) to Biennial Transparency Reports (BTRs) (Figure 4), with stronger obligatory language of requirements, while maintaining certain flexibility provisions that considers different parties' resources and capacity. In addition, the main principle that guides the MPGs, is building on and enhancing the transparency arrangements under the Convention (Measurement, Reporting and Verification).

Each party **shall** provide a national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs), in accordance with the MPGs. Each Party **shall** provide the information necessary to track progress in implementing and achieving its NDC under Article 4 of the Paris Agreement, in accordance with the MPGs. As for Climate Change Impacts and Adaptation, each party **should** provide information under Article 7, in accordance with the MPGs. The term "should" indicates an expected course of action that is to be followed unless inapplicable due to a particular circumstance. Similarly, each party **should** provide information on financial, technology transfer and capacity-building support needed and received under Articles 9, 10 and 11, in accordance with the MPGs.

Sudan has submitted a First and Second National Communications reports, in 2003 and 2014, respectively, and the Third National Communications was drafted and awaiting Cabinet approval before submission to UNFCCC. In 2021, Sudan has updated its Nationally Determined Contributions.

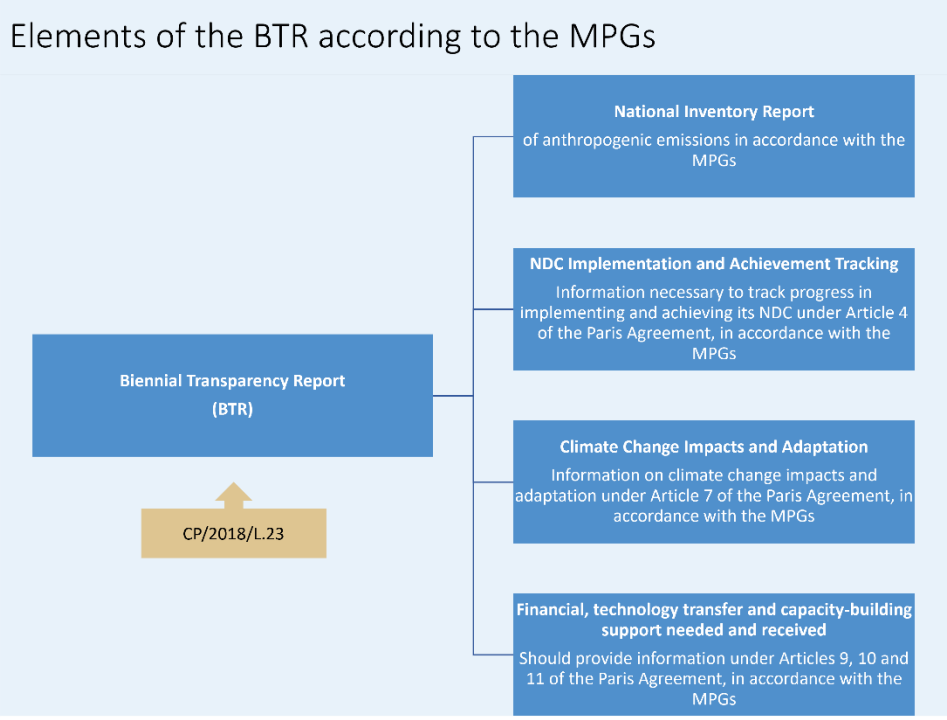


Figure 4: Key elements of the BTR as per the MPGs

The energy sector is the second largest contributor to Sudan's total emissions, with an upward trend from 7.6% in 2012 to 10.7% in 2017. Key GHG emissions categories in the energy sector were identified as Fuel Combustion and Fugitive Emissions (Table 1).

Table 1: Energy sector key categories

Category	Activity
Fuel Combustion	Electricity generation Petroleum refining Manufacturing industries and construction Domestic aviation Road transportation Railways Domestic water-borne navigation Commercial/institutional Residential Agriculture/Forestry/Fishing/Fishing farms
Fugitive Emissions	Venting Flaring Production and upgrading Transport Refining Distribution of oil products

Developing a long-term transparency strategy is crucial for Sudan to secure its future in a climate-conscious world. It is the roadmap to building trust with the international community, demonstrating Sudan's commitment to the Paris Agreement, and attracting vital investment for sustainable

development. This strategy, delivered under the ICAT project, will lay the foundation for:

I. Enhanced Accountability:

- Shine a spotlight on progress: Regularly track and report on climate actions in energy and transport to ensure clear lines of responsibility and optimal use of resources.
- Fuel effective policies: Use transparent data to inform and refine policies, driving their effectiveness and maximizing impact.

II. Data-Driven Decision Making:

- Empower evidence-based action: Build a robust MRV system to deliver accurate data on emissions, mitigation efforts, and adaptation progress, empowering informed decision-making and targeted interventions.
- Navigate towards informed solutions: Leverage data-driven insights to chart a clear course for effective climate action, maximizing results and minimizing resource strain.

III. Global Collaboration and Trust:

- Build bridges of trust: Openly share transparent data, strengthening Sudan's global reputation and fostering trust with international partners.

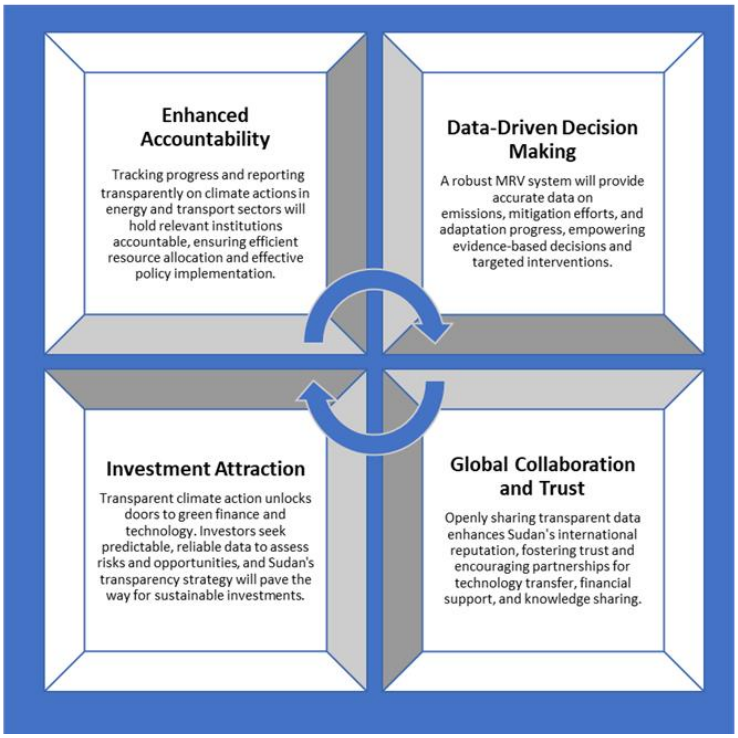


Figure 5: the objectives of the long term transparency strategy

- Unlock doors to collaboration: Attract partnerships for technology transfer, financial support, and knowledge sharing by demonstrating commitment to responsible climate action.

IV. Investment Attraction:

- Open the door to green investments: Secure green finance and technology by establishing Sudan as a reliable and predictable partner with a clear commitment to transparent climate action.
- Attract responsible investors: Provide investors with the confidence they need to support Sudan's sustainable development journey through transparent data and strong climate action.

GHG Inventory

The first step in the transparency strategy is the development of a comprehensive GHG inventory for

the energy sector in Sudan. This inventory will include emissions from various sources such as power generation, industry, and residential sectors. The data collection process will involve collaboration with relevant stakeholders, including government agencies, energy companies, and research institutions. The inventory will be developed based on internationally recognized methodologies, such as those provided by the Intergovernmental Panel on Climate Change (IPCC).

Building a long-term transparency strategy for the GHG emissions inventory in Sudan's energy sector requires a multi-step approach with specific formats for data collection, analysis, and reporting.

Planning and preparation stage:

The planning phase for the GHG inventory in the Energy sector will encompass several steps, as outlined below:

I. **Define Scope and Boundaries:**

a) Energy sources: Identify all relevant energy sources within the energy sector, such as fossil fuels (coal, oil, natural gas), renewable energy (solar, wind, hydro), and biomass.
b) Sector coverage: Specify whether the inventory covers the entire energy sector or specific sub-sectors, such as electricity generation, transportation, industrial processes, and residential and commercial sectors.
c) Geographic boundaries: Decide whether the inventory covers the entire country or specific regions.

II. **Identify Data Sources:** : Research and list available data sources for energy consumption, production, and emissions, including government reports, energy sector companies, and relevant institutions.

III. **Gather Data Collection Tools:** Develop or acquire data collection templates, questionnaires, and data management software compatible with IPCC guidelines for energy-related emissions.

IV. **Establish Communication Channels:** Define communication channels with relevant stakeholders (government agencies, oil and gas, energy companies, research institutions) for data collection and collaboration.

Here's a breakdown of the key steps and formats that must be considered for the upcoming GHG inventory for in both energy and transportation sectors:

1. Institutional Setup and Planning:

- Stakeholder Engagement: Establish a steering committee with representatives from relevant government agencies, private sector, academia, and civil society to ensure ownership and collaboration. The proposed stakeholders to be represented in the steering committee are:
    1. Ministry of Energy and Petroleum
    2. Electricity holding company
    3. Forest National Corporation (for biomass)
    4. State-level related ministers
    5. National bureau of statistics
    6. Rep. from HCENR and rep. from academia

- Institutional Capacity Assessment: Evaluate existing institutional capacities for data collection, analysis, and reporting within the energy sector. Identify gaps and needs for training or infrastructure development.
- Legal and Policy Framework Review: Analyze existing laws, policies, and regulations relevant to energy emissions inventory and identify any alignment needs with international standards.
- Define Scope and Boundaries: Clearly define the sector coverage (e.g., electricity generation, transportation, residential) and data collection boundaries (e.g., geographic, temporal).

2. Data Collection and Management:

- Develop Data Sources and Collection Methods: Identify and map relevant data sources for both:
  - The reference approach,
  - The sectoral approach.
- Establish Data Management System: Implement a robust data management system for secure storage, transfer, and analysis of collected data. Ensure clear data quality control and version control procedures.
- Develop Inventory Methodology: Choose an appropriate methodology for calculating emissions based on IPCC guidelines and national context (e.g., Tier 1, Tier 2, Tier 3). Utilize relevant tools and models for calculating emissions from different energy sources and sectors.

3. Reporting and Communication:

- Develop Reporting Format: Choose a reporting format consistent with international standards and national reporting requirements (e.g., Biennial Update Reports, National Communications, BTR). Develop templates for clear and concise presentation of data and results.
- Public Communication Strategy: Create a communication plan to share inventory results with stakeholders and the public. Design accessible materials and utilize diverse communication channels like reports, infographics, and public dialogues.
- Continuous Improvement: Implement a review and improvement process to regularly update the inventory methodology, data sources, and reporting formats based on technological advancements and evolving international standards.

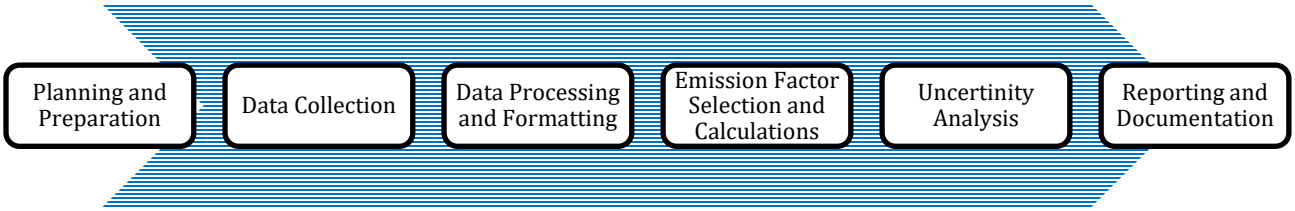


Figure 6:The Flow of Activities to conduct GHG inventory for the energy/transport Sectors in Sudan

Methodology

The methodology and sequence of activities will adhere to a systematic progression, starting with planning and culminating in the final report, in accordance with the IPCC guidelines.
According to the IPCC, there are three tiers of calculation methods for estimating greenhouse gas emissions from the energy sector:

- Tier 1 is the simplest method, using default emission factors and calorific values for different fuels.
- Tier 2 is a more refined method, using country-specific emission factors and calorific values for different fuels.
- Tier 3 is the most detailed method, using technology-specific emission factors and measurements for different combustion technologies and operating conditions.

Tier 1: A good starting point for initial inventory development and basic reporting.
Tier 2: A feasible option for improving accuracy and analysis with moderate resource investment.
Tier 3: A long-term goal as data availability and expertise increase.

While the highest accuracy is offered by Tier 3, a phased approach starting with Tier 1 and evolving towards Tier 2 is deemed more feasible for Sudan in the near future. The collection of readily available data, utilization of existing tools, and gradual capacity building for more complex analysis are focused on. The need for improved inventory accuracy is balanced with resource limitations, and Sudan's progress towards fulfilling its international climate reporting obligations is supported by this strategy.

It should be noted that the choice of tier should be a dynamic process, adapting to increasing data availability and capabilities over time. A robust and accurate GHG inventory for the energy sector in Sudan will be ensured through continuous improvement.
Due to the extensive nature of IPCC categories and equations, the following table focuses on key subcategories within the "Fuel Combustion" and "Fugitive Emissions" sectors with the energy sector.

Table 2: Energy Subcategories and GHG Calculation Equations (IPCC Guidelines)

Energy Sub-Category	Equation (Simplified)	Notes
1. Fuel Combustion - Activities		
1.A.1. Energy Industries	Σ (Fuels) {Activity Data * Emission Factor}	Separate equations for different fuels like coal, oil, gas, etc.
1.A.2. Manufacturing Industries and Construction	Σ (Fuels & Processes) {Activity Data * Emission Factor}	Separate equations for different processes and fuels within each industry.
1.A.4. Residential	Σ (Fuels) {Activity Data * Emission Factor}	Separate equations for different fuels used in residential consumption.
1.A.5. Commercial/Institutional	Σ (Fuels) {Activity Data * Emission Factor}	Separate equations for different fuels used in commercial and institutional buildings.
1.B. Fugitive Emissions from Fuels	Σ (Fuels & Sources) {Emission Factor * Specific Data}	Separate equations for specific sources like oil and gas production, transport, and storage.

Recommendations:

- Start with Tier 1 for a baseline assessment and initial reporting needs.

- Assess data availability and resource constraints to determine feasibility of Tier 2/3.
- Develop a data improvement plan to collect necessary data for higher tiers over time.
- Consider seeking technical assistance from international organizations for capacity building and expertise in Tier 2/3 methods.

Activity data collection and emission factors

I. Data Collection

The data collection process for the GHG inventory in the energy sector will be segmented into distinct categories for organizational clarity. These categories will encompass data on fuel consumption, fuel properties, and technological data.

1. Fuel Consumption:

Data collection will be categorized into two approaches: national level and sectoral level. Each level will acquire data according to the following illustration

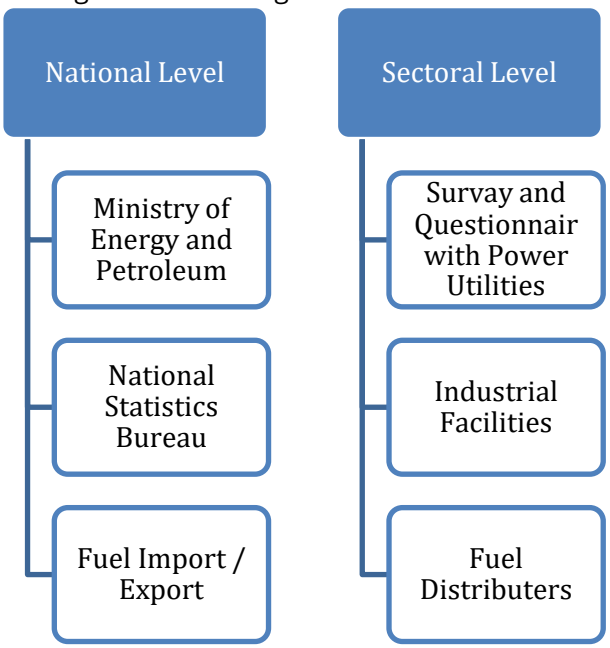


Figure 7: Fuel Data Source by Sector

2. Fuel Properties:
    - Request data sheets and technical specifications from fuel suppliers and oil companies (this data can be obtained from the Ministry of Energy and Petroleum).
    - For a number of fuel types we have to conduct laboratory analyses to obtain accurate calorific values and carbon content. This can be done through the National Research Centre or the Central Petroleum Laboratory (CPL) under the Ministry of Energy and Petroleum
3. Technology Data: the national GHG inventory team shall:
    - Collect information from power plant operators, industrial facility owners, and technical documentation on equipment used for energy production.
    - Conduct surveys or interviews to gather data on technology types, capacity, and operating parameters.

The following list outlines key activity data categories and suggested unit conversions based on the IPCC guidelines:

1. **Fuel Combustion:**
    - Activity Data:
      Total amount of fuel consumed by each fuel type (coal/petcoke, oil, natural gas, biomass, etc.) within various sectors (e.g., electricity generation, residential, industrial), Measured in **energy units** like Terajoules (TJ), PetaJoules (PJ), or Gigawatt-hours (GWh).
    - Unit Conversion:
      Convert the quantity of each fuel type to common units, such as gigajoules (GJ) using appropriate conversion factors.
        1. Coal: 1 tonne coal ≈ 27.7 GJ (lower heating value)
        2. Oil: 1 barrel (bbl) oil ≈ 6.1 GJ (lower heating value)
        3. Natural Gas: 1 cubic meter (m^3) natural gas ≈ 3.6 MJ (lower heating value)
2. **Activity Data for Specific Subcategories:**
   1.A.1.a Public Electricity & Heat Production:
    - Data: Electricity generated (MWh) from all on and off grid power generators. This data is available with sufficient level of accuracy in the Electricity Holding company.

   1.A.2.a Residential:
    - Data: Number of households and their average fuel consumption by type (e.g., LPG in kg, kerosene in liters, wood in tonnes).
3. **Fugitive Emissions:**
    - Production/Processing/Transmission Losses:
      This data quantifies the amount of fuel lost during various stages within the production and supply chain, typically measured in:Volume units: m^3 for natural gas, barrels for oil or Energy units: PJ for coal mining losses
    - Specific Data based on Emission Source:
      Detailed data on specific fugitive emission sources, like venting or flaring from oil and gas operations, may require specialized monitoring equipment and units relevant to the source (e.g., m^3/day for vented gas).

II. Data Processing and Formatting

Organize and clean data to Ensure consistency in units and definitions, address missing values, and identify and correct any inconsistencies through:

- Create IPCC-compliant tables: Format data into tables required for IPCC Tier 1 or higher if applicable.
- Document data sources and assumptions: Clearly document the origin of each data point, any assumptions made during processing, and limitations of the data.

Emission Factors:

In accordance with the IPCC Tier 1 methodology, all emission factors for the energy sector in Sudan will be sourced from the IPCC guidelines, as detailed in the table below:

Table 3: Tire 1 Energy Sector IPCC default Emission Factors

Fuel Type	CO2 (kg/TJ)	CH4 (kg/TJ)	N2O (kg/TJ)
Crude Oil	73,300	3	0.6
Liquefied Petroleum Gas (LPG)	63,100	1	0.1
Gasoline	69,300	3	0.6
Kerosene (Jet Fuel)	71,500	3	0.6
Diesel/Gas Oil	74,100	3	0.6
Residual Fuel Oil (Heavy Fuel Oil)	77,400	3	0.6
Natural Gas	64,200	3	0.6
Biofuels (e.g., Ethanol, Biodiesel)	Varies depending on feedstock and production process		

Mitigation Actions

To address GHG emissions in the energy sector, Sudan aims to develop a set of mitigation actions. These actions may include promoting renewable energy sources, improving energy efficiency, and implementing sustainable transportation systems. The strategy will outline specific targets, timelines, and responsible entities for each mitigation action.

Sudan has submitted its updated first NDC in May 2021, and it describes the mitigation component contributions and targets set for the period 2021 – 2030. The Third National Communications (yet to be submitted to the UNFCCC) describes the Business-As-Usual scenarios and NDC scenarios for all sectors, including energy, projected to the year 2050.

Table 4 combines the contributions programs defined in Sudan's NDC and the specific mitigation measures set in the draft third National Communication. The specific mitigation measures were matched as appropriate to the programs set in the NDC.

Table 4: Programs and measures as set in the NDC and the Third National Communication

Program/Contribution	Measure	Type of measure	Sector
Utility scale grid connected solar and wind power plants	Build new solar PV capacity	Renewable energy	Electric supply
	Build new CSP capacity with thermal energy storage	Renewable energy	Electric supply
	Build new wind capacity	Renewable energy	Electric supply

Stand-alone and mini grid covering: Residential, agricultural and industrial	Build new bagasse capacity for sugar industry	Renewable energy	Electric supply
	Build new waste-to-electricity capacity	Renewable energy	Electric supply
	Stand-alone rural electric renewable-based mini-grids	Renewable energy	Electric supply
	Build new geothermal capacity	Renewable energy	Electric supply
Hydro-generation improvement of the system: Rewinding of two generator units and increasing generation to 42GWh/year	Hydro-generation plant rehabilitation	Renewable energy	Electric supply
Energy efficiency: Grid losses in transmission and distribution.	Reduce transmission losses from 2016 level to 15% by 2050	Energy efficiency	Electric supply
	Reduce distribution losses from 2016 level to 8% by 2050	Energy efficiency	Electric supply
Promotion of use of efficient appliances in residential	Efficient lighting	Energy efficiency	Residential
	Efficient refrigeration	Energy efficiency	Residential
	Efficient air conditioning	Energy efficiency	Residential
Promotion of industrial fuel efficiency	Introduction of industrial fuel use efficiency	Energy efficiency	Industrial
Transport: Inner-city private cars model switching to buses in Khartoum. Blending fossil fuel by 10 biofuel and promotion of fuel efficiency. Good trucks, switching to rail transport.	Fuel switching away from gas/diesel buses to CNG buses	Fuel switching	Transport
	Introduction of high efficiency gas/diesel buses	Energy efficiency	Transport
	Introduction of high efficiency gas/diesel trains	Energy efficiency	Transport
	Mode switching from light duty vehicles to electric trams in Khartoum	Fuel switching	Transport
	Fuel switching from gas/diesel buses to electric buses	Fuel switching	Transport

Reducing biomass energy consumption	Biomass savings through improved cookstoves for over 300,000 rural households (REDD+ ERP)	Energy efficiency	Residential
	LPG as substitute for biomass/charcoal in 10% of urban population	Fuel switching	Residential
	Improved cookstoves as replacement for traditional inefficient wood stoves for 20% of rural population	Energy efficiency	Residential
	Fuel switching away from biomass and LPG to electricity	Fuel switching	Residential

These measures are projected to result in GHG emissions reductions compared to the Business-As-Usual as shown in Figure 8.

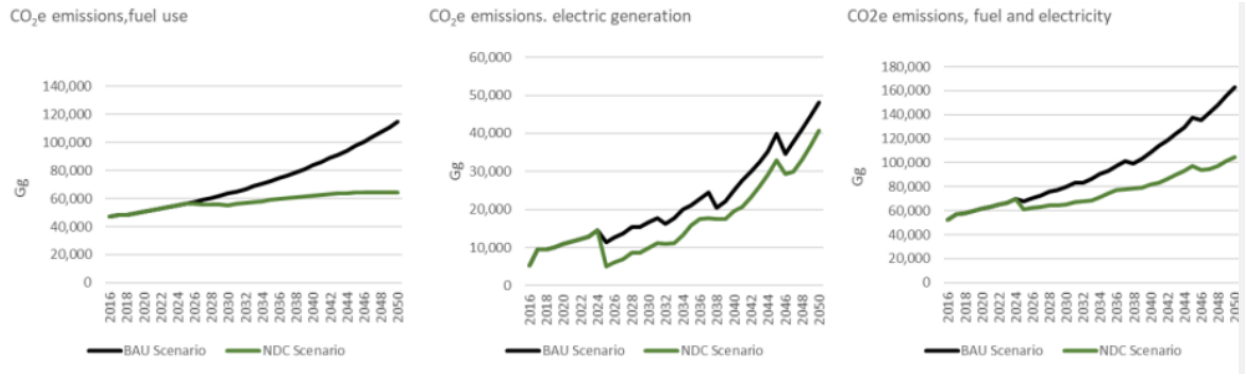


Figure 8: CO2e emissions (combustion and fugitive) in the BAU and NDC scenarios. Left: From fuel use. Middle: From Electricity generation. Right: From both (Higher Council for Environment and Natural Resources, 2022)

Transparency in mitigation actions comprises providing transparent, accurate, complete, consistent and comparable information on the components shown in (Figure 9). This, in turn, would allow the country to assess the progress made in mitigation actions implementation and the resulting changes in GHG emissions due to mitigation actions. Most importantly, the country can assess the effects on national development goals, through the indicators developed with each mitigation action, program, policy and measure. These may include environmental, social and economic indicators.

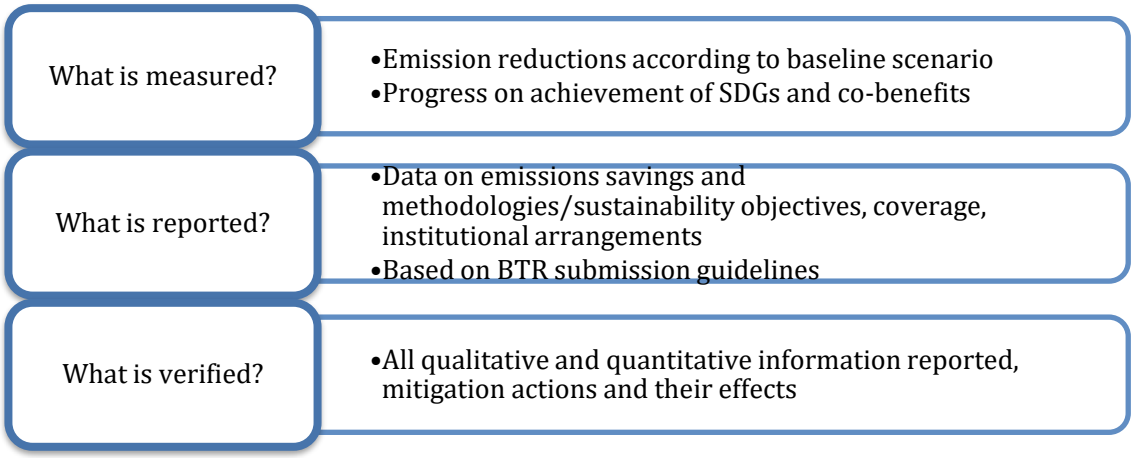
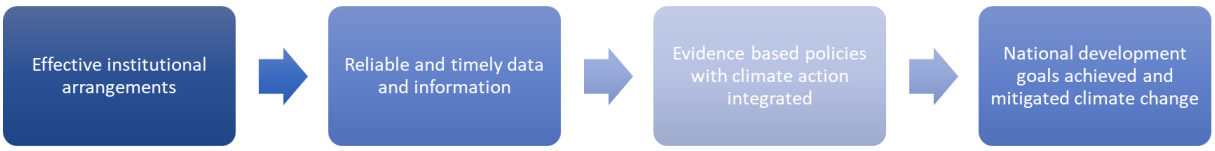


Figure 9: Mitigation actions transparency components

Accordingly, the involvement of the institutions that are directly involved and/or can assist in tracking of mitigation actions, assessing effects on sustainable development goals (social, environmental and economic) and assessing changes in GHG emissions resulting from the actions – is crucial. This would also require that the set institutional arrangements are effective, sustainable, and are able to ensure that the development of policies is evidence-based, with climate change mainstreamed into the national planning process.



The institutional framework under which the institutional arrangements must be set, consists of several components (Figure 10). At the very top, a body with authority (HCENR) is needed to lead and coordinate all the other aspects of the institutional framework.

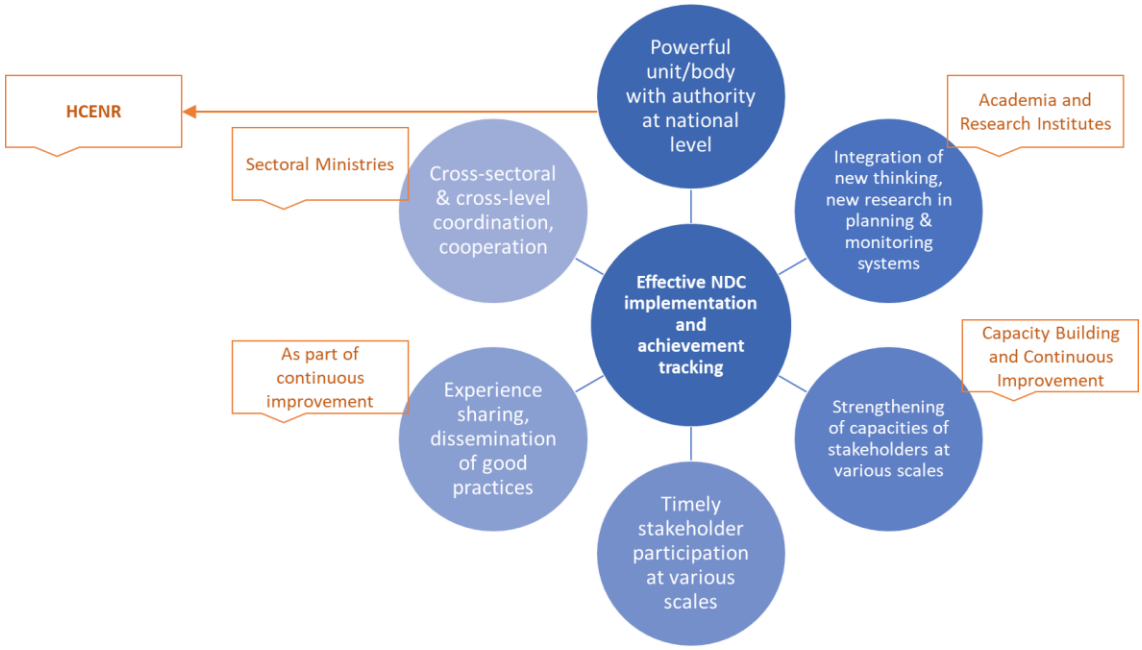


Figure 10: Institutional framework

Figure 11 shows the institutions involved in three aspects of mitigation actions transparency, and include ministries, private sector, governmental institutions and academia and research institutions.

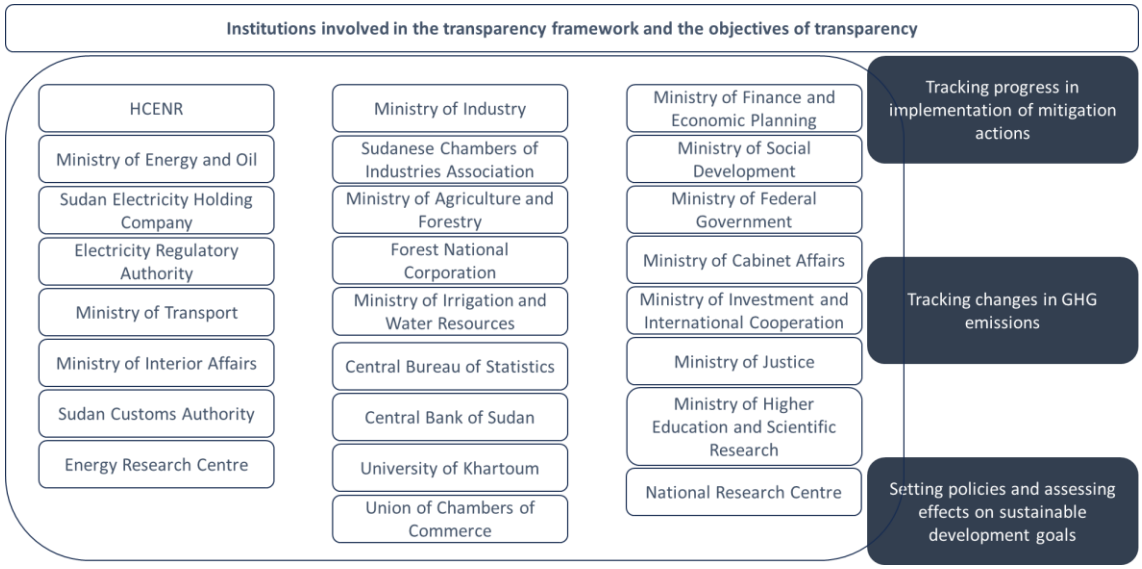


Figure 11: Institutions involved in the transparency framework

With that institutional framework in place, and involvement of all institutions mentioned the final output of the strategy is a continuous cycle as shown in (Figure 12).

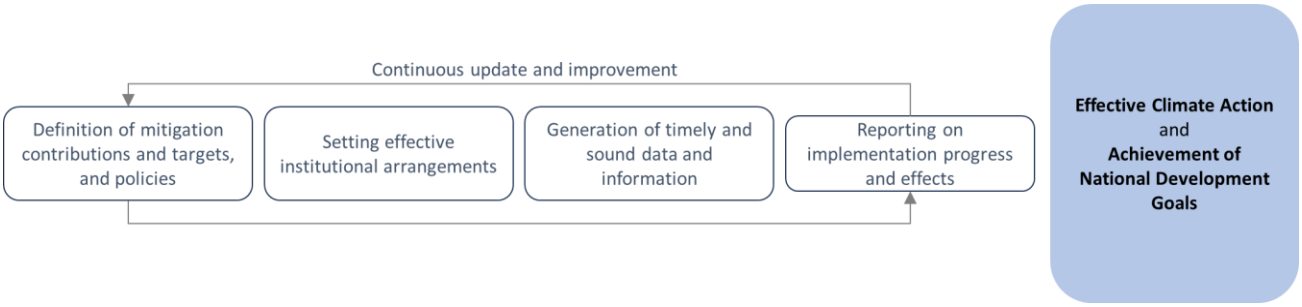


Figure 12: Long-term transparency setting

Adaptation Measures

In addition to mitigation actions, Sudan will incorporate adaptation measures into the transparency strategy. These measures will focus on building resilience to the impacts of climate change in the energy sector. Examples of adaptation measures may include enhancing infrastructure resilience, developing early warning systems, and promoting climate-smart technologies.

A long-term transparency strategy for adaptation in Sudan's energy sector should be considered, given the current security unrest and potential for escalation. The strategy should encompass the following aspects:

1- Flexibility and Resilience:

Adaptable solutions should be prioritized, such as the utilization of decentralized renewable energy sources like solar and wind, which are less vulnerable to disruptions. Smaller, community-based energy systems should be built to provide localized power and reduce dependency on centralized infrastructure.

System redundancy should be enhanced by developing diverse energy sources and grid connections to ensure backup options in case of infrastructure damage or outages.

2- Community-Centric and Inclusive:

Local communities should be empowered by involving them in planning and decision-making processes for energy adaptation measures. Capacity building should be emphasized by providing training to local people in the operation and maintenance of renewable energy technologies and adaptation strategies.

Energy access and affordability should be promoted to ensure that vulnerable populations have access to clean and reliable energy at affordable prices.

3- Data-Driven and Transparent:

Robust systems should be established for monitoring climate impacts on the energy sector and collecting data on adaptation measures. Transparent reporting mechanisms should be developed to regularly share data and progress on adaptation efforts with stakeholders and the public. On the other hand, an open data accessibility should be promoted by making data on climate risks, vulnerabilities, and adaptation measures easily accessible to researchers, policymakers, and the public.

4- Conflict-Sensitive and Peacebuilding:

Conflict sensitivity should be integrated into planning by assessing potential security risks associated with adaptation measures and developing strategies to mitigate them. Energy should be promoted as a tool for peace by supporting initiatives that utilize energy access and development to foster cooperation and understanding between different communities. Partnerships for peace should be

built by collaborating with local and international actors to promote peaceful conflict resolution and address the underlying drivers of conflict in the energy sector.

5- Additional Considerations:

- Prioritize adaptation measures with immediate benefits, addressing current vulnerabilities and providing tangible benefits for communities.
- Seek international support by leveraging funding and expertise to bolster adaptation efforts and enhance resilience in the energy sector.
- Continuously adapt and learn by regularly reviewing and updating the transparency strategy based on evolving security conditions, climate impacts, and technological advancements.

Identifying Links and Synergies with Other Support Initiatives

The Initiative for Climate Action Transparency (ICAT) is one of the support initiatives for Sudan's transparency strategy. This section highlights the links between the ICAT initiative for Sudan's energy sector with Capacity Building Initiative for Transparency (CBIT) . It emphasizes the potential for knowledge exchange, technical support, and alignment of methodologies between both initiatives.

Capacity Building Initiative for Transparency (CBIT)

The Capacity Building Initiative for Transparency (CBIT) is an important support initiative aimed at assisting developing countries in strengthening their Measurement, Reporting, and Verification (MRV) systems. Sudan recognizes the synergies between its long-term transparency strategy and the CBIT. This section outlines the specific areas of collaboration and coordination between Sudan's transparency strategy and the CBIT, including capacity-building activities, technical assistance, and knowledge sharing.

The project aims to enhance Sudan's capacities in transparency related to climate change, specifically focusing on the provisions of Article 13 and decision (18/CMA.1) of the Paris Agreement. It consists of four components: creating an enabling institutional environment for transparency, providing tools and training, developing a long-term plan for climate change research and reporting, and embedding knowledge in Sudanese institutions.

Component 1 focuses on strengthening national institutions for transparency activities. It involves analyzing current institutional arrangements, identifying gaps, and proposing suitable arrangements. It also aims to establish a monitoring, reporting, and verification (MRV) system with legal and procedural arrangements. The climate change department of the Higher Council for Environment and Natural Resources (HCENR) will be strengthened to enhance its coordination role. This includes capacity building, participation in training programs, and establishing steering and technical committees. Stakeholder consultations and workshops are planned throughout the project. In this component, the project aims to establish inter-institutional transparency coordination mechanisms in Sudan. This involves creating a national mechanism where policy/decision makers and technical experts from various institutions can collaborate to support transparency obligations. The mechanism will be coordinated by the climate change unit of HCENR and include representatives from government, research, academia, private sector, and civil society. Specific activities include establishing a data center, capacity building programs, and stakeholder consultations. The online transparency portal (which will include NDCs' tracking tools in a later stage) will disseminate materials and increase awareness of transparency obligations. The project focuses on improving awareness and knowledge of the transparency framework among national experts and stakeholders. Sudan will actively participate in the CBIT Global Coordination Platform and engage in workshops to align its project with other transparency initiatives. Activities include awareness plans, workshops, training sessions, and participation in regional/international workshops.

Component 2 of the project focuses on providing tools, systems, trainings, and assistance in line with the transparency provisions of the Paris Agreement. Sudan aims to enhance technical and institutional capacities related to transparency in various sectors, including government, research, academia, the private sector, and civil society. The project will develop comprehensive sector-specific training programs and materials in Arabic and English for stakeholders at different levels, including

subnational institutions. These programs will cover topics such as greenhouse gas (GHG)inventories, mitigation actions, vulnerability and adaptation, and supporting systems and tools. The project also aims to promote sustainable knowledge management by disseminating training results through existing information sharing networks and participating in relevant forums. Under Output 2.1.1, transparency training programs and materials will be prepared and implemented, targeting both technical and procedural aspects of the Paris Agreement's Measurement, Reporting, and Verification (MRV) system. The project will collaborate with universities, research institutions, and training centers to ensure the sustainability of capacity building efforts. Output 2.1.2 involves the development of tools and approaches to meet transparency requirements, including MRV systems, GHG inventories, and quantification of mitigation and adaptation actions. The project will conduct a comprehensive review of existing tools and customize them to meet Sudan's context. Activities include developing guidelines, protocols, and data management systems, as well as designing templates for data collection and dissemination of gender-relevant best practices. Output 2.1.3 focuses on establishing an information sharing mechanism and implementing a public awareness program. The project aims to build the knowledge base and capability of stakeholders, including line ministries, on MRV requirements and transparency obligations. An online transparency portal will be developed to provide accessible information, and public awareness activities will be conducted to highlight Sudan's obligations under the Paris Agreement.
Overall, Component 2 aims to build national capacity for transparency under the Paris Agreement by providing training, developing tools, and promoting information sharing and public awareness.

Component 3 of the project focuses on establishing long-term transparency arrangements to improve communication, reporting, and progress tracking of Sudan's Nationally Determined Contributions (NDCs). Sudan aims to develop a long-term transparency strategy that enhances the country's capacity in areas such as greenhouse gas (GHG) inventories, mitigation, adaptation, and support received. The strategy will align with Sudan's obligations under the Paris Agreement and involve consultations with national and international experts. Activities include developing TORs for consultants, integrating MRV (Measurement, Reporting, and Verification) into national institutions, and conducting stakeholder consultations. Output 3.1.2 involves integrating MRV into related national institutions and tracking the implementation of NDCs. This integration will ensure Sudan's regular compliance with climate change obligations and facilitate continuous improvement in meeting transparency requirements. Tasks include working with key institutions to incorporate climate obligations into their reporting systems and policies, developing a methodology and tracking tool to monitor progress, and ensuring gender equality issues are documented through sex-disaggregated data collection.

Component 4 focuses on knowledge management, monitoring, and evaluation. Output 4.1.1 involves monitoring and evaluating project results and outcomes through standard M&E activities. This includes conducting workshops, monitoring implementation, reporting progress to stakeholders, conducting reviews, and preparing final reports. Output 4.1.2 focuses on sharing lessons learned and best practices through the online transparency platform. Sudan aims to capture, document, and share data, information, and knowledge generated by project activities. Lessons learned will be shared with stakeholders, templates and best practices will be disseminated, and participation in training workshops and the CBIT Global Coordination Platform will be facilitated to leverage emerging knowledge for future climate change initiatives.

Links and synergies between CBIT project and ICAT Sudan

project

Based on the detailed objectives and activities of the ICAT Sudan project in the energy sector, here are some potential synergies and links with the CBIT project:

Component 1: Enabling Institutional Environment:

- ICAT's institutional strengthening activities can directly support CBIT in setting up Sector Working Groups for MRV of NDCs in the energy sector, as outlined in the ICAT approach.
- CBIT's established inter-institutional coordination mechanisms can be adapted to include relevant stakeholders from energy ministries, agencies, and technical bodies, aligning with ICAT's goal of strengthening institutional arrangements for MRV.

Component 2: Tools, Systems, Trainings, and Assistance:

- CBIT's training programs and materials on GHG inventories and mitigation actions can be tailored to specifically address needs identified in the ICAT Sudan project's needs and gaps assessment for the energy sector.
- ICAT's data and methodologies for energy sector emissions, MRV toolbox and models for impacts of renewable energy policies can be integrated into CBIT's tools and platforms for national reporting under the Paris Agreement.

Component 3: Long-Term Transparency Arrangements:

- CBIT's support for developing a long-term transparency strategy can be aligned with ICAT's road map for sustainability and future UNFCCC transparency requirements.
- CBIT's stakeholder consultations and public awareness efforts can be combined with ICAT's initiatives for tracking progress and enhancing reporting on energy sector contributions to NDCs.

Additional synergies and links:

- Both projects can collaborate on building national capacity for MRV of renewable energy projects, such as the household solar PV application mentioned in the ICAT project.
- CBIT's knowledge sharing and information dissemination platform can be utilized to promote ICAT's best practices and methodologies within the energy sector.
- Both projects can leverage joint activities to improve data collection and management systems for energy sector emissions, further strengthening the accuracy and reliability of reporting.

Proposing a Way Forward and Roadmap to Ensure the Sustainability of ICAT Project Outcomes

Consolidation of Institutional Frameworks

To ensure the sustainability of ICAT project outcomes, Sudan should focus on strengthening its

institutional frameworks related to climate change and transparency. This includes establishing clear roles and responsibilities, enhancing coordination between relevant ministries and agencies, and integrating transparency considerations into existing policies and strategies.

For the Energy Sector, the suggested institutional arrangement (IA) is designed to articulate the transparency obligations (Appendix -A: Suggested Institutional Arrangement for the Energy Sector – as presented in deliverable #2 in ICAT Sudan Project) . The framework shows the interaction between the identified key institutions involved in the MRV process (Refer to the proposed IA). Processes such as data collection, QA/QC, reporting of climate mitigation actions and GHG inventories. It is structured to define all the roles and responsibilities of the identified stakeholders and institutions involved.

To ensure the effectiveness and the applicability of the proposed IA for the Energy sector in terms of both the regulation and policy, as well as the commitment we suggest the following:

Table 5: The way Forward for effective institutional arrangement

	Data providers	*Central Bureau of Statistics (CBS)*	*Technical Working Group/expert (TWG)*	*HCNER-Climate change unit (CCU)*
Clear mandates and objectives	• Specify the types of data to be provided, frequency of reporting, and the level of granularity required. • Clearly articulate the scope of data collection, including emissions, fuel consumption, vehicle types, and other relevant indicators • Empower the data provider to implement robust quality assurance measures to guarantee the accuracy, completeness, and reliability of the collected data. • Establish protocols for data validation and verification to	• Define the CBS's role as the central authority responsible for coordinating, overseeing, and managing the collection, analysis, and reporting of climate-related data, with a focus on the Energy sector. • Ensure the legal backing for CBS role in collecting and provision of climate-related data management.	• Define the scope of the TWG's role within the MRV framework, specifying its responsibilities in coordinating, overseeing, and contributing to the collection, analysis, and reporting of climate-related data in the Energy sector. • Ensure alignment with the overall goals and objectives of the institutions nominating members to the TWG, fostering collaboration and a unified approach to climate-related data management.	• Clearly define a mandate for transparency emphasizing transparency as a primary objective. • Ensure alignment with international standards and commitments under the UNFCCC.

	enhance credibility.			
Monitoring and reporting system	• Develop a reporting template that aligns with ETF standards and includes key performance indicators for the Energy sector. • Design a template for annual reports summarizing Energy sector data, including trends, achievements, and areas for improvement.	• Implement a standardized data collection framework for the Energy sector, outlining the specific data points, formats, and methodologies to be used. • Integrate climate-related data collection and reporting mechanisms into the broader national statistical system managed by the CBS, ensuring coherence and efficiency.	• Organize regular workshops for TWG members to review data collection methodologies, reporting frameworks, and explore opportunities for improvement based on emerging best practices. • Establish knowledge exchange platforms, both within the TWG and with external experts, to share experiences, lessons learned, and insights on effective data management.	• Develop/design standardized data formats and reporting templates to facilitate consistency and comparability in reporting across different sectors and entities according to the UNFCCC reporting requirements..
Adaptability and review mechanism	• Regularly review and update data collection processes to stay aligned with evolving transparency requirement	• Within the CBS, encouraging the adoption of new technologies, methodologies, and best practices for climate-related data management. • Conduct periodic reviews of data collection methodologies and reporting frameworks.	• Encourage collaboration between TWG members from various sectors, regarding climate-related data that transcends institutional boundaries.	• Integrate a continuous improvement mechanism within the MRV system, allowing for regular reviews and updates to adapt to evolving scientific, technological, and policy standards.
Enhance accountability	• Activate the suggested independent verification mechanism conducted by external auditors or third-party	• Implement a system for monitoring compliance with reporting requirements, conducting regular assessments to	• Implement internal quality assurance mechanisms within the TWG to review and validate the accuracy and reliability of data	• Implement a verification processes, involving independent third-party assessments to enhance the credibility and

	entities to validate reported data and ensure transparency (Proposed IA).	identify and address any non-compliance issues.	before submission. • Conduct periodic self-assessment sessions within the TWG to evaluate its effectiveness, identify areas for improvement, and adjust strategies accordingly.	accountability of reported data.

Capacity Building and Knowledge Transfer

Capacity building plays a crucial role in sustaining ICAT project outcomes. Sudan should prioritize training programs and knowledge transfer activities to empower local stakeholders in implementing transparency measures. This includes workshops, technical trainings, and knowledge-sharing platforms to build technical expertise and enhance understanding of MRV systems.

Optimal prioritization of capacity-building programs and effective management of the knowledge transfer process can be achieved by establishing a comprehensive framework that forms the foundation for the proposed Institutional Arrangement (IA) in the Energy sector. This approach not only ensures the efficiency and functionality of the proposed IA but also expedites positive outcomes, presenting opportunities for further improvement.

Table 6: The comprehensive framework for the capacity building programs

	Data providers	*CBS*	*TWG*	*HCNER-CCU*
Capacity Building Needs	**Data collection Methods of Data Collection:** Create training modules and tools for capacity-building to instruct data providers in data collection protocols, GIS, tools, and templates. **Ensuring Data Quality:** Execute training initiatives dedicated to data quality assurance, with a focus on maintaining accuracy, completeness, and reliability in reported data. **BTR modalities:** Introduce data providers to international reporting methodologies and best practices, aligning Sudanese data with global expectations.	**Statistical Methodologies for Climate Data:** focus on capacity-building initiatives to enhance the CBS's expertise in climate-related data management, including training programs and knowledge-sharing sessions. **Integration of Climate Data in National Statistics:** Develop training programs to integrate climate-related data into the national statistical system, ensuring comprehensive reporting.	**Data collection expertise**: Facilitate ongoing capacity-building opportunities for TWG members to enhance their expertise in climate-related data collection, analysis, and reporting methodologies. **Cross-Sectoral Training:** Conduct cross-sectoral training programs to foster collaboration among TWG members from different sectors, promoting a holistic approach to transparency.	**MRV operation:** Participate in capacity-building collaborations with global partners to strengthen HCNER's proficiency methodologies and technologies for evaluating climate-related data, along with enhancing administrative skills to accelerate their administrative role.

Long-Term Financing Mechanisms

Sudan should investigate enduring financing mechanisms to maintain the results of the ICAT project. This involves pinpointing both domestic and international funding channels, forming partnerships with financial institutions, and incorporating transparency-focused activities into national budget processes. It is crucial to capitalize on climate finance opportunities and collaborate with pertinent donors to ensure the acquisition of resources for transparency initiatives.

Identifying international public and private funding sources:

Mapping the Climate Finance sources: this recommendation emphasizes the importance of conducting a comprehensive mapping of existing climate finance sources, both domestic and international, to identify potential funding streams for transparency initiatives. Figure (1) presents an overview of the global climate finance architecture, focusing particularly on public climate-related financing mechanisms. The main purpose is to identify the climate finance resources that are most relvant to Sudan particularly to the Energy sector. Financing for low-carbon Energy is increasing rapidly. Energy attracting 44% of total mitigation finance; transport receiving 29%). According to the Global Landscape of Climate Finance (2023), Mitigation investments in low-carbon energy systems reached USD 510 billion per year in 2021/2022 (or 44% of total mitigation finance), of which USD 490 billion went to renewable energy generation

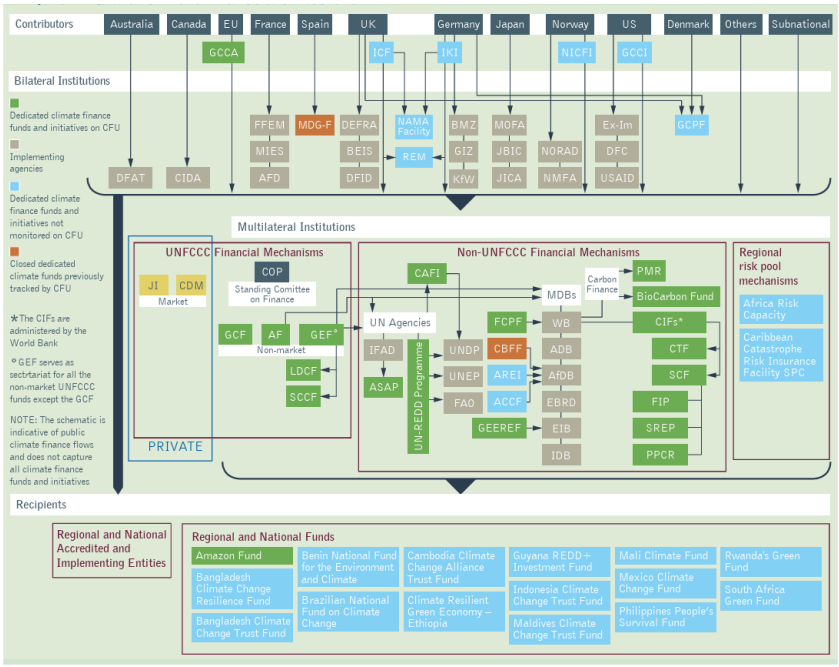


Figure 13: Global Climate Finance architecture

Source: CFU 2021

Gaining insight into the eligibility criteria, investment plans, and application processes for major funds such as GCF and CIF will improve accessibility to climate finance. Collaborating with international climate finance mechanisms is crucial to securing additional funding for extensive Renewable Energy infrastructure projects. This collaboration may entail forming partnerships with multilateral development banks and climate funds..

Diversification of Funding Channels:

The analysis of the available funding channels for Clean Energy under the mitigation action in Sudan will involves the following channels:

(1) Domestic public finance (public budget, public FIs):

Sudan's inflation is the third highest in the world, after Venezuela and Zimbabwe, negative trade balance; imports surpass exports by 50 percent. These two factors have contributed to currency devaluations. The struggling economic indicators show a critical public budget. In addition, the actual performance for the public budget in 2021, shows that development components account only for 19%. However, the public financial institutions such as National Social Insurance Fund (NSIF)and Public Service Pension Fund (PSPF) are considered potential sources and channels for Clean Energy projects

under the mitigation action. Pension funds make out an important portion of institutional investors in terms of assets under management. Unless appropriate investment options become available on the market, pension funds are not likely to take on a key role on the Energy finance landscape.

According to the International Energy Agency, concessional capital of around USD 28 billion per year is needed to mobilize the USD 90 billion of private sector investment by 2030 in the Sustainable Africa Scenario. The effective approach is allocating budget for Sustainable Energization through prioritize and allocate a portion of the national budget specifically for RE Energy projects. This demonstrates a commitment to the NDC and facilitates the implementation of climate-friendly initiatives. This will accelerate the mobilization of the private capital. In addition to the articulation of the relevant policies that allow for positive collaboration of the public institutional investor such as (NSIF) and (PSPF).

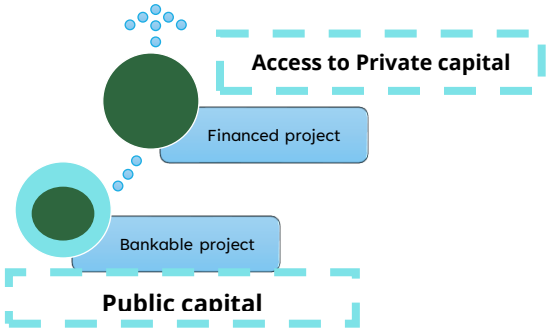


Figure 14:Role of public capital in mobilizing the private capital

(2) Domestic private finance

Domestic private finance in Sudan involves domestic credits, public private partnership, Corporate social responsibility, public philanthropy and Zakat.

Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, Revolving Credit. However, the domestic credit in Sudan is characterized by higher interest rates and high taxes, which together will reduce inflation, but at a cost of falling spending, investment and output.

Public Private Partnership, Sudan now has a PPP-specific policy and law in place. A PPP unit was set up recently, but it will require more staffing and resources in order to become fully operational. Nevertheless, a notable PPP project is the Omdurman water supply and optimization project, a design build-operate-transfer contract between a private company (Al Manara Water Company) and the Khartoum State Water Corporation.

Public philanthropy and Zakat: local philanthropy is widespread, focused mainly on tangible results – hardware and infrastructure like hospitals and wells, rather than softer programmes like capacity

building. Zakat tax is automatically deducted from the salaries of people, and the Sudanese government itself also makes significant contributions into the Zakat Fund.

Regarding the domestic private channel of finance, the following recommendations are suggested:

- **Introduce tax incentives for businesses and investors engaged in RE projects. These incentives can help offset the impact of higher taxes, encouraging more RE and energy efficiency investments.**
- **Consider government guarantees as well as the concessional finance to reduce the high perceived risk associated with investing in the RE projects. This can make projects more attractive to private investors and lenders which in turn reduce the cost of finance.**
- **Explore PPPs with private entities to co-finance and implement RE projects. This collaborative approach can leverage both public and private resources for greater project impact. This model ensures government buy-in but relies on private sector financing and expertise.**
- **Implement sustainable energy technologies and solutions while embracing innovative business models customized for Sudan. Prioritize the utilization of local energy resources, ensure a sufficient return on investment, and create income-generation opportunities through productive uses.**
- **Implement risk mitigation strategies to address concerns related to project uncertainties. This may involve insurance mechanisms or risk-sharing arrangements to protect investors and lenders, Sudan can make use of the available international risk sharing mechanisms offered by the WB and other FIs.**

(3) Sudan Banking sector

Sudan's financial sector comprises of:

- ✓ *Banks* (38).
- ✓ *Capital market* (The Khartoum Stock Exchange (KSE) is the country's main stock exchange where stocks and sukuk are traded).
- ✓ *Insurance and reinsurance* market (15).
- ✓ *Microfinance institutions* (45 MFIs).
- ✓ Other *non-bank financial institutions*

The next table shows the total loan and assets in SDG for the banking sector in Sudan:

Table 7: The total loan and assets in SDG for the banking sector in Sudan[1]

SDG/Year	*2017*	*2018*	*2019*	*2020*	*2021*
Total loans	**66,596,508,088**	**113,827,150,582**	**145,731,577,153**	**243,050,134,189**	**679,061,493,016**
Total Assets	**184,926,397,760**	**420,151,770,822**	**511,355,664,454**	**955,384,556,711**	**3,631,069,013,292**
Total	**150,804,762,930**	**332,374,685,472**	**407,744,840,207**	**775,651,810,582**	**2,782,045,485,669**

[1] Islam, M. M. (2023, February), National Finance Modalities for Sudan's NDCs. Workshop of "Assessment of constraints in plans, strategies and legal framework to enhance the implementation of nationally determined contributions," HCNER-UNDP.

Deposits

The total lending capacity of the banking sector is 1.15 billion dollars, the Loan-to-Deposit Ratio (LDR)[2] for the banking sector is around 25% which may reflect a conservative stance, excessively low ratios could imply underutilization of funds and missed revenue opportunities[3].

The Central Bank of Sudan (CBoS) has incorporated a new axle into its 2023 annual policies by emphasizing green financing. Additionally, a specialized committee has been established to address matters concerning climate change and green finance, fostering coordination with pertinent institutions. Consequently, green finance has emerged as a key priority within the CBoS policy framework.

The Financial institutions have the ability to direct capital and demonstrate to markets the opportunities, risks and potential returns of investments. They play a pivotal role in the implementation of low carbon, climate resilient development pathways. To deliver climate smart financing at scale, and to achieve core business objectives and obligations, financial institutions will need to integrate and mainstreaming climate change considerations systematically across all levels of its strategies, programs and operations. The banks need to clearly identify both the *transitional risks* which includes include policy, regulatory and legal changes initiated as a response to climate change, such as the green policy initiated by the CBoS. The *physical risks* which include risks from extreme weather events (classified as acute physical risks) and longer-term shifts in climate patterns, such as sustained higher temperatures or sea-level rise, these risks will affect the market, supply and demand.

(4) International private flows:

Foreign Direct Investment: Sudan has put in place a relatively open investment legislative framework with several of the existing laws being modern and in line with good practices. However, their implementation is often impeded by the absence of secondary legislation, insufficient institutional capacity and lack of coordination among different levels of the Government.

Attracting Foreign Direct Investment (FDI) in RE projects, aligned with the Nationally Determined Contributions (NDCs), requires a strategic approach starting from stablish a clear and transparent policy framework that supports RE investment initiatives. This includes regulatory incentives, tax breaks, and a stable legal environment. Ensure alignment with national climate goals and commitments.

Remittances: One of the important sources of fund is the attracting remittances of Sudanese working abroad. The difference between the official exchange rate and the black-market rate – meaning that significant amounts are channelled informally, denying the country the benefits of foreign currency reserves. This due to the underdeveloped banking sector, and the restrictions imposed by sanctions in the previous periods, which make it impossible to transfer funds.

There are potential opportunities to effectively re-direct the remittance fund, which can be directed toward enhancing the RE project particularly community-based projects. The

[2] A financial metric that expresses the proportion of a bank's loans in relation to its total deposits.
[3] Islam, M. M. (2023, February), National Finance Modalities for Sudan's NDCs. Workshop of "Assessment of constraints in plans, strategies and legal framework to enhance the implementation of nationally determined contributions," HCNER-UNDP.

cooperatives could be considered as opportunity to the community to participate in decision-making processes and share in the economic benefits and create job opportunities.

National finance tools

The national finance tools in Sudan are known as asset-backed Islamic debt instruments which are considered one of the most powerful investments. These tools include both, the instrument issued by the government and those by the corporation:

Finance tools by the government: the government (CBoS and MoFEP) issues a number of financial instruments that comply with Shariah instead of the conventional system. The goal of these instruments is to contribute to the developmental, economic, and social projects of Sudan and to assist in managing liquidity to keep the national economy afloat and finance the government budget deficit. Sukuk can be classified in a variety of ways. The most common types are Murabahah, Ijarah, Mudarabah, Musharakah.

Finance tools by the corporation: these include Khartoum refinery Ijarah Certificates (Shama) and Sudanese Electricity Distribution Company Asset Management Ijarah Certificates

Given Sudan's well-established experience in Islamic national finance tools, here are clear recommendations for redirecting these finance tools to finance the Energy sector as part of Sudan's Nationally Determined Contributions (NDC):

- ✓ **Actively promote and facilitate the issuance of Green Sukuk (Islamic Bonds) by the government and private entities. Ensure that the proceeds (following the criteria of greenness) from these Sukuk are exclusively directed toward financing projects, such as renewable energy and energy efficiency.**
- ✓ **Collaboration with Islamic banks in Sudan to integrate climate considerations into their financing portfolios. Support the development of financial products that adhere to Islamic principles while promoting RE project and products.**

Stakeholder Engagement and Communication

Effective stakeholder engagement and communication are vital for sustaining ICAT project outcomes. Sudan should prioritize building partnerships with civil society organizations, private sector entities, and local communities. Engaging stakeholders throughout the transparency process will foster ownership, collaboration, and awareness of climate action initiatives.
Recognizing the importance of stakeholder engagement in the ICAT project for Sudan's Energy sector, let's delve deeper into how this can be effectively achieved considering the nation's unique context.
Challenges and Opportunities:

- Current Situation: Sudan faces ongoing political instability, economic hardship, and internal conflicts. These create challenges for broad stakeholder engagement, but also opportunities to foster unity and resilience through collaborative climate action.
- Population and Governance: Sudan's diverse population necessitates inclusive engagement strategies that reach urban and rural communities, address gender disparities, and involve

youth and marginalized groups. The evolving governing system requires adapting engagement approaches to ensure alignment with current and future leadership structures.

- Economy and REDD experience: The economic situation necessitates prioritizing initiatives with tangible benefits for communities, like job creation and improved livelihoods. Building on existing experiences with REDD and other projects can provide valuable lessons and partnerships for stakeholder engagement in the Energy sector.

Prioritizing Partnerships:

- Civil Society Organizations (CSOs): Partnering with established and trusted CSOs can extend project reach, enhance community trust, and harness local knowledge. CSOs can play crucial roles in awareness raising, capacity building, and advocacy for sustainable Energy solutions.
- Private Sector: Engaging private sector entities like Energy providers, renewable energy companies, and technology developers can unlock crucial investments, expertise, and innovation for scaling up ICAT project outcomes. Public-private partnerships can drive market transformation towards cleaner and more efficient Energy systems.
- Local Communities: Directly involving local communities in project design, implementation, and monitoring builds ownership and ensures solutions address their specific needs and concerns. Community-based initiatives for walking, cycling, and public transport can be particularly effective.

Engaging throughout the Transparency Process:

- Information Sharing: Ensure transparency by actively sharing project updates, data, and results with all stakeholders through accessible channels like community meetings, local media, and online platforms.
- Capacity Building: Invest in capacity building workshops and training programs for stakeholders to understand the ICAT project, contribute to data collection, and participate meaningfully in discussions and decision-making processes.
- Feedback Mechanisms: Establish clear feedback mechanisms for stakeholders to voice their concerns, suggestions, and ideas for improvement throughout the project lifecycle.

Expected Outcomes:

- Enhanced Ownership and Collaboration: By effectively engaging stakeholders, the ICAT project can foster a sense of collective responsibility for achieving Sudan's Energy sector NDCs and climate goals. Collaboration across diverse groups can unlock synergies and lead to more effective and sustainable solutions.
- Increased Awareness and Action: Broad engagement creates broader awareness of climate action initiatives and empowers individuals and communities to adopt sustainable practices in their daily lives.
- Improved Project Outcomes: Through active participation and feedback, stakeholders can contribute to refining the project, ensuring its alignment with their needs and maximizing its positive impact on the Energy sector and climate action in Sudan.

In Sudan's complex context, prioritizing effective stakeholder engagement is not just a best practice, but a critical path to sustainable success for the ICAT project. By building partnerships, actively engaging throughout the transparency process, and prioritizing capacity building and

feedback mechanisms, the project can empower all stakeholders to become active participants in shaping a cleaner and more resilient future for Sudan's transport sector. Sector specific, detailed roadmap is needed for continuous stakeholder engagement and communication shall include regular consultations, workshops, and information sharing to foster collaboration, build consensus, and maintain transparency throughout the process.

Conclusion

This technical report lays the groundwork for achieving long-term transparency within Sudan's energy sector and ensuring the sustainability of the ICAT project's positive impacts. By implementing the proposed recommendations, Sudan can significantly enhance its transparency efforts, strengthen its Monitoring, Reporting, and Verification (MRV) systems, and advance its journey towards sustainable development.

Key contributions of this report include:

- Proposed NDC tracking tool: With a suggested list of indicators and general tool design features, this tool has the potential to effectively monitor progress towards Sudan's energy sector NDCs, enhancing accountability and informing future actions.
- Long-term transparency strategy: By outlining objectives related to greenhouse gas (GHG) inventory development, mitigation actions, and adaptation measures, this strategy provides a clear roadmap for increasing transparency within the energy sector.
- Synergies with CBIT: Identifying and leveraging collaborative opportunities with the Capacity Building Initiative for Transparency (CBIT) will maximize the combined impact of both projects in strengthening institutional frameworks and capacity within Sudan.
- Roadmap for ICAT project sustainability: The proposed roadmap details concrete steps for institutional framework consolidation, capacity building, knowledge transfer, and long-term financing mechanisms, ensuring the ICAT project's continued effectiveness beyond initial support.
- Continuous stakeholder engagement: Recognizing the importance of stakeholder involvement, the report proposes a roadmap for ongoing engagement and communication with civil society organizations, private sector entities, and local communities, fostering ownership and promoting collaborative action.

By putting these recommendations into action, Sudan can take significant strides towards achieving the following:

- Enhanced transparency and accountability: Improved NDC tracking, robust GHG inventory development, and continuous reporting on mitigation and adaptation measures will demonstrate Sudan's commitment to climate action and attract further support.
- Strengthened MRV systems: A well-defined, data-driven approach to MRV will provide reliable and comprehensive information on the energy/transport sector's performance, informing effective policy decisions and strategic adjustments.

- Sustainable development advancements: Integrating climate action considerations into the energy sector will contribute to achieving broader sustainable development goals, including improved air quality, energy security, and economic growth.

Continued collaboration, capacity building, and secured financing mechanisms will be essential for Sudan to maintain its momentum towards long-term transparency goals. Engaging with international partners, fostering local expertise, and diversifying funding sources will be crucial in sustaining the positive outcomes of the ICAT project and securing a path towards a cleaner and more resilient energy future for Sudan.

References:

- El Zein, E. M. A. (2017). Solar energy potential in Sudan. Renewable and Sustainable Energy Reviews, 75, 115-122.
- Energy Information Administration (USEIA), 2019. Executive Summary: Sudan and South Sudan, available at:https://www.eia.gov/international/content/analysis/countries_long/Sudan_and_South_Sudan/Sudan-South-Sudan-CAXS-2019.pdf
- ENERGY PROFILE Sudan - IRENA
- Energy Systems — IPCC
- Extended Report - UNSD
- GHG emissions inventories in energy sector - United Nations
- Global Forest Watch, 2021. Sudan statistics, https://www.globalforestwatch.org/dashboards/
- GoS, 2014. Sudan's Report, Ministry of Environment, Forestry and Urban Development, Government of Sudan (GoS) and UN-HABITAT
- GoS, 2019. Sudan's Constitution of 2019 (Subsequently amended)
- Government of Sudan (GoS). 2011. The Field of mineral potential of the Sudan. Available at https://goldsudan.files.wordpress.com/2015/03/mineral_en.pdf
- Higher Council for Environment and Natural Resources. (2022). Sudan's Third National Communication under the United Nations Framework Convention on Climate Change.
- https://www4.unfccc.int/sites/NDCStaging/pages/Party.aspx? party=SDN
- ICAT Methodology for GHG Inventories: https://climateactiontransparency.org/launch-of-a-new-guide-on-integrating-air-pollution-action-into-climate-transparency-frameworks/
- ICAT Mitigation & Adaptation tools: https://climateactiontransparency.org/our-work/icat-toolbox/icat-tool-and-guides-on-adaptation-and-loss-and-damage/
- ICAT Transport Sector resources: https://icat.mit.edu/
- IMF, 2021. World Economic Outlook Databases. https://www.imf.org/en/Publications/SPROLLs/world-economic-outlook-databases#sort=%40imfdate%20descending(Last access on 18 April, 2021)
- INTENDED NATIONALLY DETERMINED CONTRIBUTIONS (INDCs) - UNFCCC
- International Climate Action Transparency (ICAT) website: https://climateactiontransparency.org/
- International Monetary Fund (IMF).2018. World Economic Outlook, October.
- International Renewable Energy Agency (IRENA), 2019. Renewable Energy Statistics 2019. Retrieved from: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jul/IRENA_Renewable_energy_statistics_2019.pdf
- IPCC GHG Inventory software 2006
- IPCC Updates Methodology for Greenhouse Gas Inventories
- IRENA. (2019). Renewable Energy Capacity Statistics 2019.
- Lahmeyer International, 2012. Long-term Power System Planning Study 2012-2031,. Khartoum: Ministry of Electricity and Dams.
- Lahmeyer International. (2012). Hydropower potential in Sudan.
- Magdi M. E. Zumrawi " Assessing Causes and Impacts of Traffic Congestion in Khartoum, Sudan" FES Jornal of Engineering Sciences , November 2020
- Ministry of Water Resources, I. a. (2019). The Updating of Renewable Energy Master Plan. Khartoum, Sudan.

- Omer, A. M. (2005). Biomass energy resources in Sudan: an overview. Renewable and Sustainable Energy Reviews, 9(6), 573-582.
- Omer, A. M. (2018). Biomass energy in Sudan: Current status and future prospects. Renewable and Sustainable Energy Reviews, 90, 1023-1031.
- Omer, A., 2015. Evaluation of sustainable development and environmentally friendly energy systems: case of Sudan, E3 Journal of Environmental Research and Management Vol. 6(3). pp. 0237-0261
- REEEP. (2012). Renewable energy policies in Sudan.
- REPUBLIC OF THE SUDAN First Nationally Determined Contribution ... - UNFCCC
- Sebastian Hermann, A. M. (2014). Estimating the Renewable Energy Potential in Africa. International Renewable Energy Agency. Abu Dhabi: International Renewable Energy Agency.
- Sudan Meteorological Authority, 2021.http://www.ersad.gov.sd/index.php(Last accessed on 25 April, 2021).
- Sudan Second national Communication. (2013). Ministry of Environment, Natural Resources and Forests.
- Technical University of Denmark (DTU), 2019. Global Wind Atlas 3.0, available at https://globalwindatlas.info/about/introduction
- THE ENERGY PROGRESS REPORT 2020 - World Bank
- The Tracking SDG 7 Report: The Last Decade to Leave No One Behind
- The World Bank. (2020). Project Information Document: Sudan Energy Transition and Access Project.
- Tracking SDG7: The Energy Progress Report, 2021
- UNEP, 2017. Energy Profile – Sudan, United Nations Environment Programme. Retrieved from https://wedocs.unep.org/bitstream/handle/20.500.11822/20596/Energy_profile_Sudan.pdf?sequence=1&isAllowed=y
- UNEP. (2017). Renewable energy potential in Sudan: An assessment of solar, wind, hydro and geothermal resources.
- UNFCCC Paris Agreement Transparency Framework: https://unfccc.int/Transparency
- Use of the IPCC Inventory Software for the Energy sector - UNFCCC
- World Bank (WB), 2021. Sudan statistics, available at https://data.worldbank.org/country/sudan?view=chart
- WorldAtlas (2021). Maps of Sudan. https://www.worldatlas.com/maps/sudan(Last accessed on 28 April, 2021).

Appendices

Historical data for GHG emissions from the energy sector in Sudan

Based on the latest national ghg inventory conducted for the 3rd National communication report, the following charts are summarizing the outputs for the energy sector:

1- Emission sources:

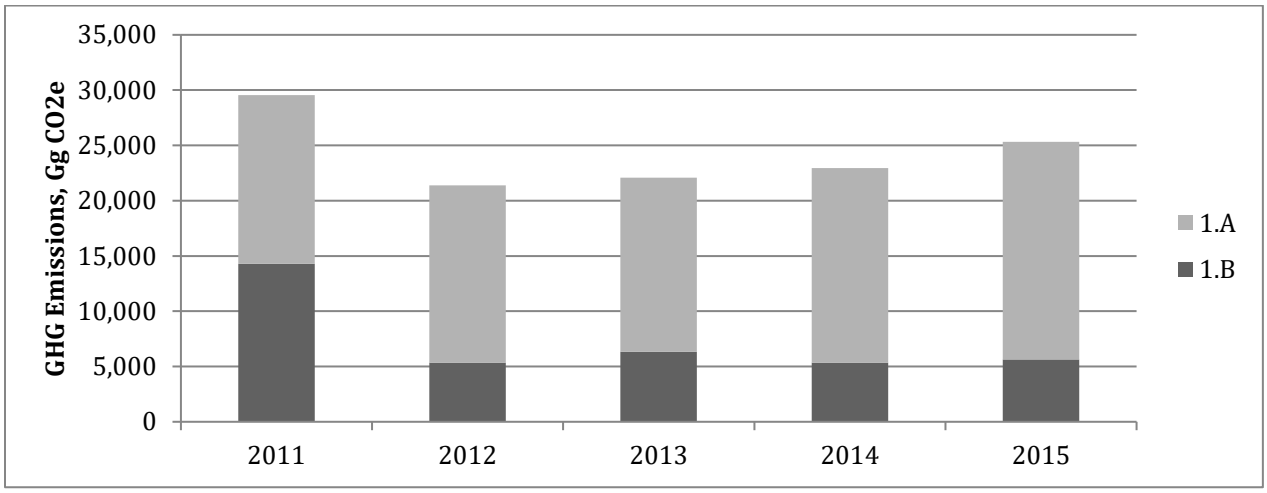


Figure 15:Trends in Sudan's energy sector emissions, 2011–2015 shown for fuel combustion (1.A) and fugitive emissions (1.B)

Key emissions sources within the energy sector in Sudan :

- Electricity generation: Largest contributor in the sector, primarily fueled by thermal power plants using oil and gas (accounting for about 80% of electricity generation).
- Oil and gas production: Emissions from production activities and associated gas flaring.
- Fuel consumption: Emissions from transportation, industrial processes, and residential and commercial sectors using fossil fuels (gasoline, diesel, fuelwood).

2- Comparison between calculation scenarios:

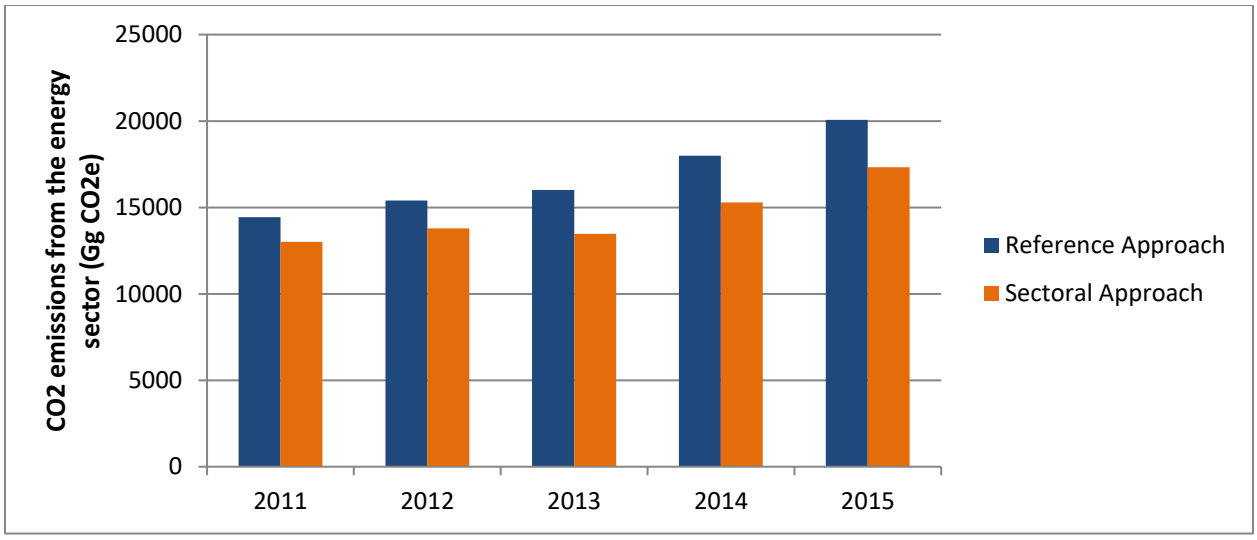


Figure 16: Comparison between sectoral and reference approach

Considerable differences between the calculated GHG emissions for the energy sector based on the two approaches: reference approach and sectoral approach. This can be justified as:

- Missing information on stock changes that may occur at the final consumer level. The relevance of consumer stocks depends on the method used for the Sectoral Approach.
- Distribution losses for fuels will cause the Reference Approach to be higher than the Sectoral Approach.
- Unrecorded consumption of fuel may lead to an underestimation of the Sectoral Approach.
- An inconsistency on the sources of activity data within the time series and in some cases the application of extrapolation.
- The misallocation of the quantities of fuels used for conversion into derived products (other than power or heat) or quantities combusted in the energy sector.

3- GHG emissions trends

The projected GHG emissions baseline for the energy sector is shown in the following figure

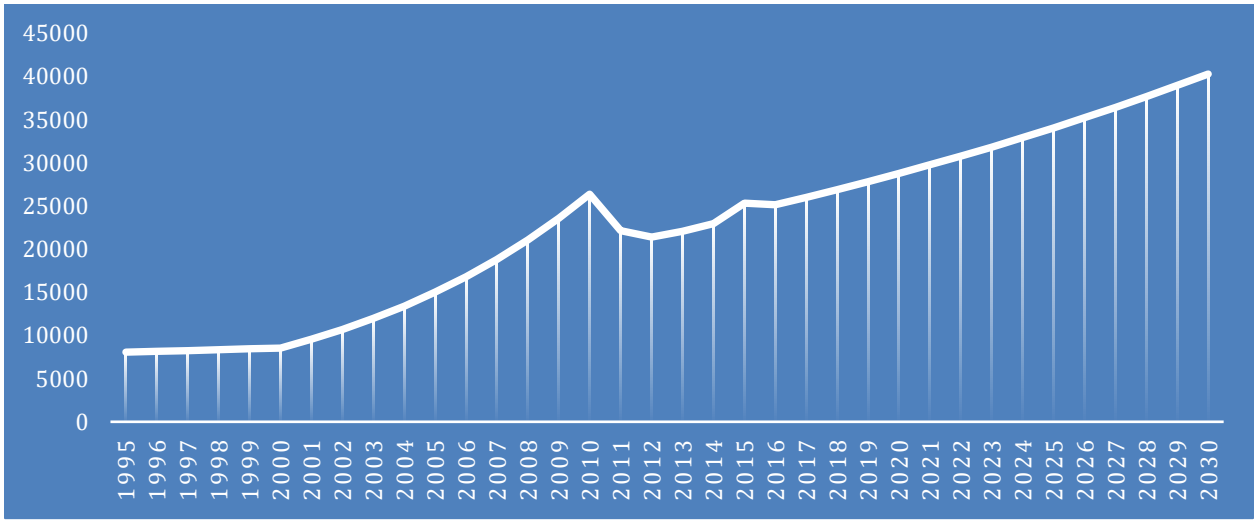


Figure 17: Baseline GHG emissions estimation for the energy sector in Sudan , Gg CO2e

Suggested Institutional Arrangement for Energy Sector

For effective implementation of a robust MRV system[4] for the in Sudan, the following schematic represents the proposed institutional framework. the framework has been developed based on the analysis of the existing situation, stakeholders' consultation relevant to addressing the issues, and the transparency objectives. All of these pointed to the need for a simple and autonomous design. The arrangement emphasizes all the sector Stakeholders include institutions and individuals that have financial, coordination, regulatory, operating, and/or reporting responsibilities regarding the activity data.

In addition, the arrangement considers the need for Co-ordination, in a multiple setting of different interests, motives, visions, missions; organizational mandates, is essential for climate MRV. Co-ordination is required to facilitate a seamless flow of data and information, cohesion, and integration in each sector.

Strong stakeholder engagement ensures that the transparency system reaches a broad range of stakeholders, including those from national government, local government, the private sector, academia, NGOs, the media, and the public, so that data can be gathered from the most reliable and relevant sources and the outputs can inform their decision-making processes.

[4] The proposed institutional arrangement has been developed based on consultation with the CBIT national consultants.

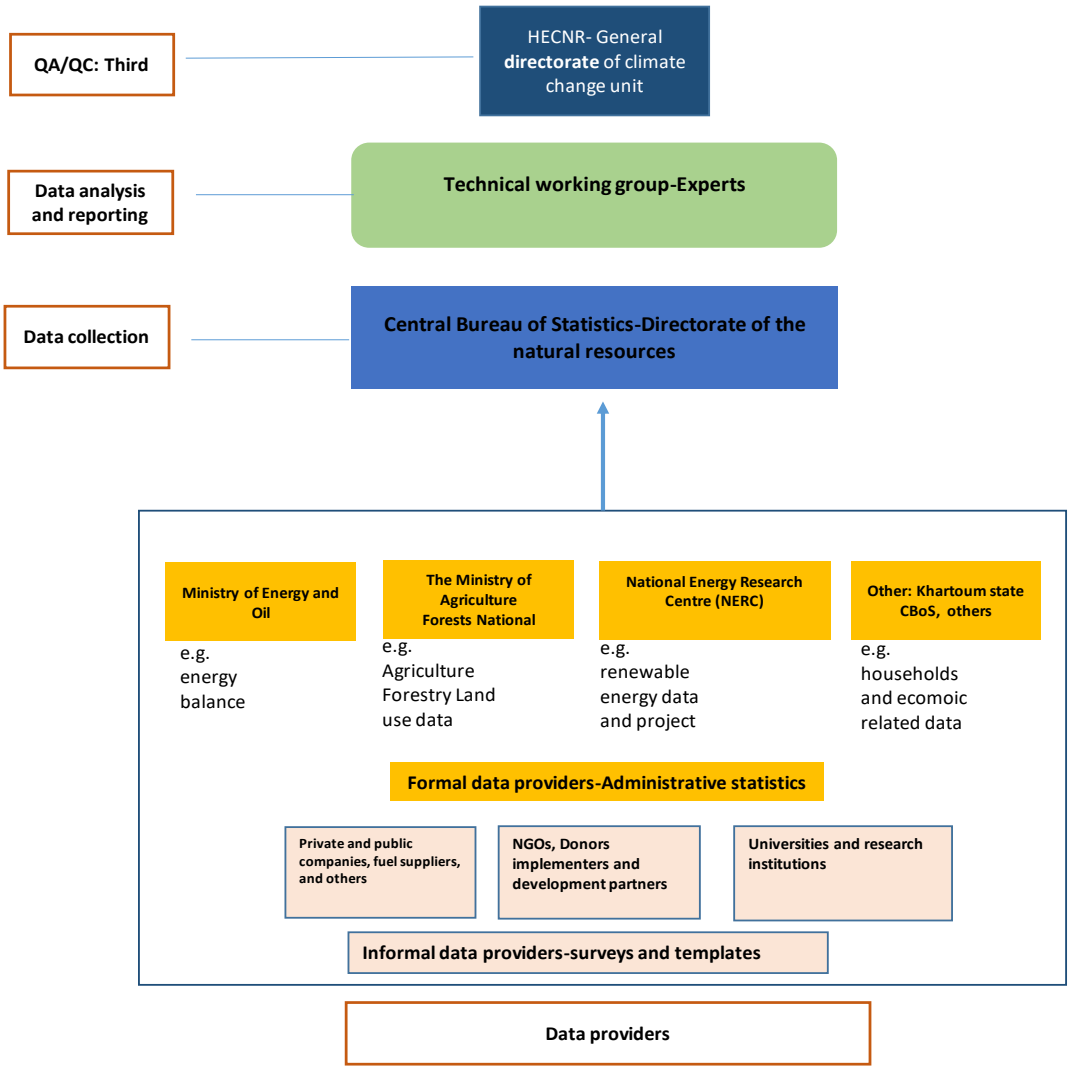


Figure 18- Proposed Institutional Arrangement for the energy sector

Roles and Responsibilities

HECNR-CCU is key link to the intergovernmental process and the international community responsible for the following:

- Setting the overall frameworks for national and international climate change related reporting. All information on climate impacts and action and will bring together information from a range of ministries and agencies, the private sector, academia and subnational governments.
- Identifying the methods, procedures and guidelines including the templates, format and quality assurance.

- Coordinates the activities needed to ensure that outputs are prepared and are of sufficient quality to meet the country's commitments.

Technical Working Group/expert, as HECNR operates in an administrative manner, technical functions are suggested to be delegated via clear mandates and terms of reference, to a specialized climate change, environmental or statistical experts/agency with the relevant technical expertise.

Central Bureau of Statistics CBS currently operates under the 2003 Statistics Act which empowers the Director General to collect, analyse and disseminate statistical information and provide technical advice to the government departments on statistical matters. The Central Bureau of Statistics is responsible for coordinating statistical activities throughout Sudan and for producing and disseminating official statistics on the country's population, economy, society, and environment. The 2003 Act contains some important new features, including the setting up of National Statistical Council, and makes the CBS responsible for the overall coordination and supervision of the production of statistics in the country.

The proposed institutional arrangement assumes a critical role for the CBS based on the 2003 Statistics Act as major data-generating agency in the country and, according to the Statistics Act, mandated to provide statistical advice to government departments. CBS is supposed to be the leader in terms of coordinating, collecting and gathering the climate related date form the relevant ministries and entities.

The Sudanese Statistical Law provides a legal framework for the collection, compilation, analysis, and dissemination of climate related data in a coordinated and integrated manner. The law aims to ensure that statistical data is of high quality and meets international standards.

Data providers can be divided into formal and informal. The formal data providers are the key ministries and governmental agencies e.g., ministry of transport, ministry of energy and oil and other relevant institutions including ministry of finance and economic planning and Central bank of Sudan. The other data providers include the private and public operator companies, universities and research institutes.

Glossary

Activities (related to inputs when describing policy)	Administrative activities involved in implementing the policy or action (undertaken by the authority or entity that implements the policy or action), such as permitting, licensing, procurement, or compliance and enforcement. Examples include provision of technical assistance or incentive payments
Activity data	Data on the magnitude of a human activity resulting in emissions or removals taking place during a given period of time. Data on land areas, management systems, and fertiliser use are examples of activity data
Adaptation	Strategies and measures to adjust and respond to the impacts of climate change. In the energy sector, adaptation may involve making
Adopted policies	Policies for which an official government decision has been made and there is a clear commitment to proceed with implementation, but implementation has not yet begun
Assessment boundary	The scope of the assessment in terms of the range of GHG impacts that are included in the assessment
Assessment period	The time period over which GHG impacts resulting from a policy are assessed
Assessment report	A report, completed by the user, that documents the assessment process and the GHG, sustainable development and/or transformational impacts of the policy
Barrier	Any obstacle to developing and deploying an RE potential that can be overcome or attenuated by a policy, programme or measure
Baseline Emission Level	The reference level of greenhouse gas emissions against which reductions or increases are measured. It serves as a benchmark for evaluating the effectiveness of mitigation actions
Baseline scenario	A reference case that represents the events or conditions most likely to occur in the absence of a policy (or package of policies) being assessed
Biennial Transparency Reports (BTRs)	Comprehensive reports submitted by Parties every two years that provide information on their greenhouse gas emissions, progress in implementing their NDCs, and support received or provided. BTRs are a key element of the transparency framework.
Biennial Update Report (BUR)	A report submitted by non-least developed countries to the United Nations Framework Convention on Climate Change (UNFCCC), providing updates on their climate actions, greenhouse gas inventories, and support needs
Bottom-up data	Data that are measured, monitored or collected at the facility, entity or project level
Building code	Sets of standards for buildings or building systems determining minimum requirements of energy performance
Capacity Building	Activities and support provided to enhance the knowledge, skills, and institutional capacity of countries to effectively implement the transparency framework. Capacity building helps countries meet their reporting requirements and improve the quality of their transparency-related information.
Carbon Neutrality	Achieving a balance between the amount of greenhouse gases emitted and removed from the atmosphere. This is often pursued through a combination of emissions reduction and offsetting activities
Carbon Offset	A reduction in greenhouse gas emissions or an increase in removals that can be used to compensate for emissions occurring elsewhere. Carbon offsets are often used to achieve carbon neutrality
Carbon pool	A system which has the capacity to accumulate or release carbon. The carbon pools involved in C stock changes include soil organic matter, biomass, and dead organic matter
Cash flows	The net amount of cash and cash-equivalents moving into and out of a business. Positive cash flow indicates that a company's liquid assets are increasing, enabling it to settle debts, reinvest in its business, return money to shareholders, pay expenses and provide a buffer against future financial challenges. Negative cash flow indicates that a company's liquid assets are decreasing. Some stakeholders will not implement an action that has a negative net cash flow at any time
Category of transformational change	A group of transformational characteristics that describe processes of change (technology, agents of change, incentives and norms) and outcomes of change (scale of outcome and sustained nature of outcome)
Causal chain	A conceptual diagram tracing the process by which the policy leads to impacts through a series of interlinked logical and sequential stages of cause-and-effect relationships
CBIT (Capacity Building Initiative for Transparency)	A program supported by the GEF and implemented by the UNDP that assists developing countries in strengthening their capacity to meet the enhanced transparency requirements under the Paris Agreement.
Characteristic of transformational change	An element or property of a system undergoing a transformation. A policy can result in changes of characteristics describing a system that lead to processes of change and outcomes of change
Climate Action	Any action or set of actions intended to address and respond to climate change, including both adaptation and mitigation efforts

Climate Action Transparency	The openness, clarity, accuracy, and completeness with which countries or entities communicate information related to their climate actions. Transparency is essential for building trust and accountability in the global response to climate change.
Climate Change	Refers to long-term changes in temperature, precipitation, and other atmospheric conditions on Earth. In the context of the energy sector, it encompasses efforts to mitigate and adapt to these changes.
Climate Finance	Financial resources provided by developed countries to support developing countries in their efforts to mitigate and adapt to climate change. Climate finance facilitates the transition to low-carbon and climate-resilient economies
Co-Benefits	Positive outcomes or advantages, beyond the primary goal, resulting from the implementation of climate mitigation or adaptation actions. Co-benefits may include improved air quality, health benefits, and job creation
Cross-elasticity of demand	The responsiveness of the quantity demanded for a good to a change in the price of another good, all other things being equal. The cross-price elasticity is used to estimate the indirect impact, or the gross effect, of a fuel price increase on transport demand in alternative modes. It is the percentage change in a good's demand divided by the percentage change in a substitute good's price
Current policy scenario	A scenario that represents the events or conditions most likely to occur in the presence of the current mix of policies and actions
Dimension	An overarching category of sustainable development impacts. There are three dimensions: environmental, social and economic
Discount rate	The interest rate you need to earn on a given amount of money today to end up with a given amount of money in the future. The discount rate accounts for the time value of money, which is the idea that a dollar today is worth more than a dollar tomorrow given that the dollar today has the capacity to earn interest
Drivers	Socioeconomic or other conditions, or other policies that affect an impact category. For example, economic growth is a driver of increased energy consumption. Drivers are divided into two types: other policies and non-policy drivers
Dynamic	A descriptor for a parameter that changes over time
Electricity grid (grid)	A network consisting of wires, switches and transformers to transmit electricity from power sources to power users. A large network is layered from low-voltage (110-240 V) distribution, over intermediate voltage (1-50 kV) to high-voltage (above 50 kV to MV) transport subsystems. Interconnected grids cover large areas up to continents. The grid is a power exchange platform enhancing supply reliability and economies of scale.
Emission factor	A factor that converts activity data into GHG emissions data.
Emission intensity	GHG emissions per unit of production.
Energy Carrier	A transmitter of energy, including electricity and heat as well as solid, liquid and gaseous fuels which occupy intermediate steps in the energy-supply chain between primary sources and end- use applications
Energy savings company (ESCO)	A commercial or non-profit business providing a broad range of energy solutions including designs and implementation of energy savings projects, retrofitting, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management. ESCOs guarantee that energy savings are able to repay the efficiency investment, which helps. overcome financial constraint to energy efficiency investments
Enhanced Transparency Framework (ETF)	A framework established under the Paris Agreement to enhance transparency in the reporting and review of climate-related information, including mitigation and adaptation actions
Ex-ante assessment	The process of estimating expected future GHG impacts of a policy (i.e., a forward-looking assessment)
Ex-ante baseline scenario	A forward-looking baseline scenario, based on forecasts of external drivers (such as projected changes in population, economic activity or other drivers that affect emissions), in addition to historical data
Expert judgement	A carefully considered, well-documented qualitative or quantitative judgement made in the absence of unequivocal observational evidence by a person or persons who have a demonstrable expertise in the given field (IPCC 2006). Users can apply their own expert judgement or can consult experts.
Ex-post assessment	The process of estimating historical GHG impacts of a policy (i.e., backward-looking assessment)
Ex-post baseline scenario	A backward-looking baseline scenario that is established during or after implementation of a policy
Facilitative, Compliance, and Implementation Committee (FCIC)	A committee established under the Paris Agreement to facilitate implementation and promote compliance with the Agreement's provisions. The FCIC provides guidance and assistance to Parties on matters related to transparency and other issues.
Feed-in tariff	The price per unit of electricity that a utility or power supplier has to pay for distributed or renewable electricity fed into the grid by non-utility power producers

GCF (Green Climate Fund)	A financial mechanism established under the UNFCCC to support developing countries in their efforts to mitigate and adapt to climate change. The GCF provides grants, loans, and equity investments to projects and programs that contribute to climate action.
GEF (Global Environment Facility)	An international financial institution that provides grants and concessional funding to support global environmental projects and programs. The GEF focuses on biodiversity conservation, climate change mitigation and adaptation, land degradation, and sustainable development.
GHG assessment boundary	The scope of the assessment in terms of the range of GHG impacts that is included in the assessment
GHG impacts	Changes in GHG emissions by GHG sources and carbon pools that result from a policy
Global Stocktake	A periodic assessment conducted under the Paris Agreement to evaluate collective progress toward the goals of limiting global temperature rise and enhancing climate action.
Global warming potential	Global Warming Potentials (GWP) are calculated as the ratio of the radiative forcing of one kilogramme of greenhouse gas emitted to the atmosphere to that from one kilogramme CO_2 over a period of time (e.g., 100 years)
Greenhouse Gas (GHG) Inventory	A comprehensive record of the emissions and removals of greenhouse gases from a country, region, or entity. It includes emissions from various sectors and serves as a basis for understanding the impact of human activities on the climate
Grid access	The acceptance of power producers to deliver to the electricity grid
Heavy-duty vehicle (HDV)	A vehicle designed for heavy work (bus or truck), which is generally powered by a diesel engine
Impact assessment	The estimation of changes in GHG emissions or removals resulting from a policy, either ex-ante or ex-post
Impact category	A type of sustainable development impact (environmental, social or economic) affected by a policy
Impact type	A result of transformational change that describes the process of change and the outcome of change
Independent policies	Policies that do not interact with each other, such that the combined effect of implementing the policies together is equal to the sum of the individual effects of implementing them separately
Indicator	A metric that can be estimated and monitored over time to understand the impact of non-state and subnational actions, and track changes towards targeted outcomes
Indicator value	The value of an indicator. For example, 500 is an indicator value for the indicator "number of jobs created
In-jurisdiction impacts	Impacts that occur inside the geopolitical boundary over which the implementing entity has authority, such as a city boundary or national boundary
Inputs	Resources that go into implementing the policy, such as financing
Intended effects	Effects which reflect the original objectives of the policy
Intended impacts	Impacts that are intentional based on the original objectives of the policy or action. In some contexts, these are referred to as primary impacts
Interacting policies	Policies that produce total effects, when implemented together, that differ from the sum of the individual effects had they been implemented separately
Intermediate effects	Changes in behaviour, technology, processes or practices that result from the policy, which lead to GHG impacts
Intermediate impacts	Changes in behaviour, technology, processes or practices that result from a policy, which lead to sustainable development impacts
International Consultation and Analysis (ICA)	A process that involves the review and assessment of the BTRs and other information provided by Parties. ICA aims to identify areas where support and capacity-building are needed and to facilitate the sharing of experiences and best practices.
IPCC (Intergovernmental Panel on Climate Change)	A scientific body established by the UN to provide policymakers with regular assessments of the scientific basis of climate change and its impacts. The IPCC's reports inform global climate policy discussions and decision-making.
Jurisdiction	The geographic area within which an entity's (such as a government's) authority is exercised
Key performance indicator	A metric that indicates the performance of a policy
Lead Reviewers	Experts designated by Parties to conduct the review of the transparency-related information provided by other Parties. Lead Reviewers are appointed based on their expertise and undergo training to ensure consistency and quality in the review process.
Levelized cost of electricity (LCOE)	The unique cost price of the outputs (US cent/kWh or USD/GJ) of a project that makes the present value of the revenues (benefits) equal to the present value of the costs over the lifetime of the project
Life cycle impacts	Changes in upstream and downstream activities, such as extraction and production of energy and materials, or effects in sectors not targeted by the policy, resulting from the policy
Light-duty vehicle (LDV)	Any motor vehicle with a gross vehicle weight rating of 10,000 pounds or 4,500 kg or less, which generally use gasoline fuel

Long-term impacts	Impacts that are more distant in time, based on the amount of time between implementation of the policy and the impact
Macroeconomic impacts	Changes in macroeconomic conditions – such as GDP, income, employment or structural changes in economic sectors – resulting from a policy.
Market impacts	Changes in supply and demand, prices, market structure or market share resulting from a policy
Measure	Implementation of technologies, processes, or practices outlined in policy instruments aimed at achieving mitigation
Minimum energy performance standards	Rules or guidelines for a particular product class that set a minimum efficiency level, and usually prohibit the sale of underperforming products
Mitigation	Actions and strategies aimed at reducing or preventing the emission of greenhouse gases (GHGs) to mitigate the impacts of climate change. In the energy sector, this includes transitioning to cleaner and renewable energy sources
Monitoring period	The time over which the policy is monitored, which may include pre- policy monitoring and post-policy monitoring in addition to the policy implementation period
MRV (Measurement, Reporting, and Verification)	A framework that outlines the processes and procedures for measuring, reporting, and verifying emissions and other relevant information related to climate actions. MRV enhances accountability and transparency
Multilateral Assessment (MA)	A process that provides a platform for Parties to present and discuss their progress in implementing their NDCs. MA sessions allow for peer-to-peer sharing of experiences and enable Parties to learn from each other's successes and challenges.
NAMA (Nationally Appropriate Mitigation Action)	Policies, projects, or programs that countries undertake voluntarily to mitigate greenhouse gas emissions while promoting sustainable development. NAMAs can be supported by international financing mechanisms.
National policy or action	An intervention taken or mandated by a national government, which may include laws, regulations and standards; taxes, charges, subsidies and incentives; information instruments; voluntary agreements; implementation of new technologies, processes or practices; and public or private sector financing and investment
Nationally Determined Contributions (NDCs)	Commitments made by countries under the Paris Agreement, outlining their climate action targets, policies, and measures. NDCs communicate each country's contribution to global efforts to limit temperature rise
NDC (Nationally Determined Contribution)	Each country's climate action plan submitted under the Paris Agreement. NDCs outline the country's emission reduction targets, adaptation measures, and other climate-related actions. They are updated every five years and are a key instrument for achieving the Agreement's goals.
Negative impacts	Impacts that are perceived as unfavourable from the perspective of decision-makers and stakeholders
Net impact	The aggregation of all impacts, both positive and negative, within a given impact category
Net metering	The practice of using a single meter to measure consumption and generation of electricity by a small generation facility (such as a house with a wind or solar PV system). The net energy produced or consumed is purchased from, or sold to, respectively, the power producer
Non-policy drivers	Conditions other than policies, such as socioeconomic factors and market forces, that are expected to affect the emissions sources included in the GHG assessment boundary
Non-state actor	Any actor other than a national or subnational government
Non-state commitments	Planned non-state action that has been publicly announced but, unlike non-state mitigation action, has not yet been implemented
Non-state mitigation action	Any kind of activity that is directly or indirectly aimed at reducing GHG emissions and that is led by non-state actor(s)
Other policies or actions	Policies, actions and projects – other than the policy or action being assessed – that are expected to affect the impact categories included in the assessment boundary
Outcome of transformational change	The change in GHG emissions reductions and sustainable development impacts at scale and sustained over time resulting from a policy
Out-of-jurisdiction impacts	Impacts that occur outside the geopolitical boundary over which the implementing entity has authority, such as a city boundary or national boundary
Overlapping non-state and subnational actions	Non-state and subnational actions that interact with each other or with national policies and that, when implemented together, have a combined effect less than the sum of their individual effects when implemented separately. This includes both actions that have the same or complementary goals (such as national and subnational energy efficiency standards for appliances), and counteracting or countervailing actions that have different or opposing goals (such as a national fuel tax and a subnational fuel subsidy)
Overlapping policies	Policies that interact with each other and that, when implemented together, have a combined effect less than the sum of their individual effects when implemented separately. They include both policies that have the same or complementary goals and counteracting or countervailing policies that have different or opposing goals.

Own-price elasticity	The own-price elasticity is used to estimate the direct impact, or the net effect, of a fuel price increase on fuel demand. It is the percentage change in a good's demand divided by the percentage change in that good's price.
Parameter	A variable such as activity data or emission factors that are needed to estimate GHG impacts
Parameter uncertainty	Uncertainty regarding whether a parameter value used in the assessment accurately represents the true value of the parameter
Parameter value	The value of a parameter. For example, 5 is a parameter value for the parameter "tonnes of SO2 emitted per kWh of electricity'
Paris Agreement	An international treaty adopted in 2015 under the UNFCCC. The Agreement aims to limit global warming to well below 2 degrees Celsius above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5 degrees Celsius. It establishes guidelines for countries to set and achieve their NDCs.
Peer-reviewed	Literature (such as articles, studies or evaluations) that has been subject to independent evaluation by experts in the same field before publication
Phase of transformation	A stage in the historical development of a system that undergoes an innovation and social transition process. Generic phases are pre-development, take-off, acceleration, and stabilization or relapse
Planned policies	Policy options that are under discussion, and have a realistic chance of being adopted and implemented in the future, but have not yet been adopted or implemented
Policies and/or actions	Interventions at various stages along a policy-making continuum, from broad strategies or plans that define high-level objectives or desired outcomes to specific policy instruments to carry out a strategy or achieve desired outcomes
Policy implementation period	The time period during which the policy is in effect
Policy instrument	A mechanism utilised by a government, institution, or other entity, which may include laws, regulations, and standards; taxes, charges, subsidies, and incentives; information instruments; voluntary agreements; implementation of new technologies, processes, or practices; and public or private sector financing and investment, among others
Policy or action, or policy and measures	An intervention taken or mandated by a government, institution or other entity, which may include laws, regulations and standards; taxes, charges, subsidies and incentives; information instruments; voluntary agreements; implementation of technologies, processes or practices; and public or private sector financing and investment
Policy scenario	A scenario that represents the events or conditions most likely to occur in the presence of the policy (or package of policies) being assessed. The policy scenario is the same as the baseline scenario except that it includes the policy (or package of policies) being assessed
Positive impacts	Impacts that are perceived as favourable from the perspectives of decision-makers and stakeholders
Power purchase agreement (PPA)	A contract between an electricity (power) producer and an electricity consumer (or distributor). Historically, PPAs have been signed between utilities and independent power producers as a way for the utility to procure additional generation. In recent years, PPAs have been used as a way for power consumers to purchase electricity, often from solar systems, from a third-party power producer (National Renewable Energy Laboratory definition).
Present value	The current worth of a future sum of money or stream of cash flows given a specified discount rate. Future cash flows are discounted at the discount rate, and the higher the discount rate the lower the present value of the future cash flows
Price elasticity of demand	A measure of the responsiveness of demand or supply of a good or service to changes in price. The price elasticity of demand measures the ratio of the proportionate change in quantity demanded to the proportionate change in the price
Pricing policy	Pricing policies in the transport sector incorporate external costs of transport into price signals that are intended to influence demand and reduce GHG emissions. They include increased fuel taxes and levies, fuel subsidy reductions, road pricing, vehicle purchase incentives, carbon taxes, vehicle taxes, parking pricing, distance- based pricing, public transit fare reforms, company car policy reforms and Smart Growth reforms
Process of transformational change	A series of events describing how elements or characteristics of a system interact and change to reconfigure a system. Elements of a transformational change process are technology, agents of change, incentives and norms
Propagated parameter uncertainty	The combined effect of each parameter's uncertainty on the total result
Qualitative assessment	An approach to impact assessment that involves describing the impacts of a policy or action on selected impact categories in numerical terms
Qualitative assessment boundary	The scope of the qualitative assessment in terms of the range of dimensions, impact categories and specific impacts that are included in the qualitative assessment
Quantitative assessment boundary	The scope of the quantitative assessment in terms of the range of dimensions, impact categories, specific impacts and indicators that are included in the quantitative assessment and estimated
RE addition	The additional installation of RE capacity or electricity generation from renewable sources realized via a policy, expressed in megawatts (MW) or megawatt-hours (MWh), respectively

Rebound effect	Increased consumption that results from actions that increase efficiency and reduce consumer costs
Regression analysis	A statistical method for estimating the relationships among variables – in particular, the relationship between a dependent variable and one or more independent variables
Reinforcing non-state and subnational actions	Non-state and subnational actions that interact with each other or with national policies and that, when implemented together, have a combined effect greater than the sum of their individual effects when implemented separately
Reinforcing policies	Policies that interact with each other and that, when implemented together, have a combined effect greater than the sum of their individual effects when implemented separately
Renewable energy	Any form of energy from solar, geophysical or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use. Renewable energy is obtained from the continuing or repetitive flows of energy occurring in the natural environment. It includes low-carbon technologies such as solar energy, hydropower, wind, tide and waves, and ocean thermal energy, as well as renewable fuels such as biomass.
Renewable portfolio standard	A legal mandate that requires utilities to procure a certain percentage or flat amount of renewable electricity or power, based on their total generation. Utilities can procure the RE via direct ownership or the purchase of RE credits (National Renewable Energy Laboratory definition)
Retrofit	Involves modifications to existing buildings that improve energy efficiency or decrease energy demand
Scenario uncertainty	Variation in calculated emissions resulting from methodological choices, such as selection of baseline scenarios
Sectoral Approach	A method of organizing and addressing climate actions by specific economic sectors (e.g., energy, agriculture) to streamline efforts and enhance effectiveness. It can be used also in the GHG inventory for the energy sector, in which the GHG emissions are calculated as a sum of the emissions from each energy sub-sector.
Sensitivity analysis	A method to understand differences resulting from methodological choices and assumptions, and to explore model sensitivities to inputs. The method involves varying the parameters to understand the sensitivity of the overall results to changes in these parameters
Short-term impacts	Impacts that are nearer in time, based on the amount of time between implementation of the policy and the impact.
Solar energy	Energy from the sun that is captured either as heat, as light that is converted into chemical energy by natural or artificial photosynthesis, or by PV panels and converted directly into electricity
Specific impact	A specific change that results from a policy or action
Stakeholders	People, organisations, communities or individuals who are affected by and/or who have influence or power over the policy
Starting situation	The current situation of a selected historical year before implementation of a policy that describes the phase of transition and the status of selected indicators as a benchmark for tracking performance
Static	A descriptor for a parameter that does not change over time
Subnational actor	Any form of government that is not a national government
Subnational commitments	Planned subnational action that has been publicly announced but, unlike subnational mitigation action, has not yet been implemented
Subnational mitigation action	Any kind of activity that is directly or indirectly aimed at reducing GHG emissions and that is led by subnational actor(s)
Sustainable development impacts	Changes in environmental, social or economic conditions that result from a policy, such as changes in economic activity, employment, public health, air quality and energy security
Technical Expert Review (TER)	A review process carried out by technical experts to assess the technical aspects of the transparency-related information provided by Parties. TER focuses on the completeness, accuracy, and consistency of the reported data and methodologies.
Technology impacts	Changes in technology, such as design or deployment of new technologies, resulting from a policy
Top-down data	Macro-level statistics collected at the jurisdiction or sector level, such as energy use, population, GDP or fuel prices
Top-down methods	Methods (such as econometric models or regression analysis) that use statistical methods to calculate or model changes in GHG emissions
Trade impacts	Changes in imports and exports resulting from a policy
Transformational change	A fundamental, sustained change of a system that disrupts established high- carbon practices and contributes to a zero-carbon society, in line with the Paris Agreement's 1.5–2 °C temperature goal and the United Nations SDGs
Transformational impact	Changes in system characteristics resulting from a policy, described by processes and outcomes of transformational change with regard to GHG and sustainable development impacts at scale and sustained over time
Transmission and distribution	The network that transmits electricity through wires from where it is generated to where it is used. The distribution system refers to the lower-voltage system that delivers the electricity to the end

	consumer
Uncertainty	1. Quantitative definition: Measurement that characterises the dispersion of values that could reasonably be attributed to a parameter. 2. Qualitative definition: A general term that refers to the lack of certainty in data and methodological choices, such as the application of non-representative factors or methods, incomplete data, or lack of transparency
UNFCCC (United Nations Framework Convention on Climate Change)	An international treaty established in 1992 to address climate change. The UNFCCC sets the overall framework for global efforts to combat climate change, including the negotiation of the Paris Agreement.
Unintended effects	The effects that fall outside of the policy's control and may amplify or diminish the impact of the policy
Unintended impacts	Impacts that are unintentional based on the original objectives of the policy. In some contexts, these are referred to as secondary impacts
Utility	An entity in the electric power industry that engages in electricity generation and distribution of electricity for sale, generally in a regulated market
Weighted average cost of capital (WACC)	The rate that a company is expected to pay, on average, to all its security holders to finance its assets, including the fraction of each financing source in the company's capital structure