Technical Support and Capacity Building for Applying ICAT Guidance in Sudan's Transport Sector

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The Higher Council for the Environment and Natural Resources

ICAT Initiative for Climate Action Transparency

Initiative for Climate Action Transparency – ICAT

Technical Support and Capacity Building for Applying ICAT Guidance in Sudan's Transport Sector

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Contents

List of Tables

List of Figure

List of Acronyms

BAU	Business-as-usual
BUR	Biennial Update Report
CBS	Central Bureau of Statistics
CC	Climate Change
CNG	Compressed natural gas
COP	Conference of the Parties
GEF	Global Environment Facility
GHG	Greenhouse gases
HCENR	Higher Council for Environment and Natural Resources (Sudan)
IPCC	Intergovernmental Panel on Climate Change
LEAP	Long-Range Energy Alternatives Planning System
M&E	Monitoring & evaluation
MPGs	Modalities, Procedures and Guidelines
MRV	Measurement, reporting and verification
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NC	National Communication
NCSA	National Capacity Self-Assessment
NDC	Nationally Determined Contribution
NGO	Non-governmental organization
POPP	Programme and Operations Policies and Procedures
QA/QC	Quality assurance/quality control
SCIA	Sudanese Chambers of Industries Association
SEHC	Sudanese Electricity Holding Company
SPC	Sudanese Petroleum Corporation
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Chang
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1 Background and objectives

Background: Addressing climate change stands as one of the most urgent and critical global challenges. Despite being a relatively low-emitting country, Sudan, similar to other developing nations, is grappling with the severe impacts of climate change. The country's commitment to climate action is articulated through its submissions to the United Nations Framework Convention on Climate Change (UNFCCC) in the form of the Nationally Determined Contributions (NDC). Sudan's foremost priorities in confronting climate change encompass the implementation of low-carbon development initiatives across the energy, forestry, and waste sectors, aligning with its national development agenda. In 2015, Sudan crafted its initial Intended Nationally Determined Contribution (INDC) within the framework of the Paris Agreement, and a revised NDC is anticipated shortly (an interim document was submitted by the government in 2021). These concerted efforts underscore Sudan's commitment to addressing climate change and aligning its strategies with international climate frameworks.

The Transport sector plays a pivotal role in shaping a sustainable and low-carbon future. With increasing urbanization and the growing demand for mobility, it is essential to align transport policies and actions with global climate commitments. This report outlines the technical support and suggestions for capacity building to apply the International Climate Action Transparency (ICAT) guidance to policies and actions within the Transport sector. The aim is to ensure that countries, regions, and cities have the necessary tools and knowledge to assess, track, and report on the emissions reduction progress of their transport systems.

Objective of the report: Use the ICAT guidance and tool to assess the potential of the mitigation activities and activities relevant for the transport sector, identified by Sudan in their NDC Implementation Plan, analyse the role of Pricing Policy for the transport sector in Sudan and generate policy recommendations for the development of relevant policy. These objectives will be accomplished by employing the use of the ICAT Transport Pricing Assessment Guides

Summary of the ICAT Pricing Assessment Guide and its application in the Sudanese transport sector:

The ICAT assessment guides are a series of methodologies for assessing the GHG, sustainable development and transformational impacts of policies and actions in an integrated and comprehensive manner across all levels of governance. The consideration brings to light that although Sudan has taken substantial steps in removing fuel subsidies during the fourth quarter of 2021, the full impact of these measures is constrained by a lack of policy integration and a comprehensive national transportation plan. While the removal of fuel subsidies is a significant move, the absence of a well-integrated and strategically aligned policy framework, coupled with the absence of a comprehensive national transportation plan, limits the effectiveness and potential positive outcomes of these policies. For a more substantial and sustainable impact, there is a crucial need for a coordinated approach that addresses the broader transportation landscape, ensuring that policies harmonize with overarching national goals and priorities.

The general pricing policy barriers: considering the GHG mitigation scenarios stated in Sudan's communications (2nd NC, 3NC and BUR) and NDC perspectives, there are significant barriers to pricing

and fuel switching policies that will challenge the transition from the use of conventional fuels to electric vehicles, the switching mode from private to public mobility or blending the fossil fuel with biofuel. The literature review has led to the identification of five major categories of barriers. These barriers include:

- Technical/Infrastructural Barriers which include lack of training, lack of charging infrastructure, implementation challenges and changing the system
- Economic Barriers which include Inflation concerns and inequality concerns
- Financial Barriers which include high price for the electric vehicles and lack of customer demand or customer preferences
- Institutional Barriers which include lack of proper national strategies and lack associated institutional structures.

2 ICAT Guidance and its application on the Sudanese Transport Sector

The ICAT guidance provides a comprehensive framework to enhance the transparency and accountability of climate actions. However, for the Transport sector, the guidance should be tailored to address sector-specific challenges and opportunities, ensuring that it becomes a fit-for-purpose MRV (Monitoring, Reporting, and Verification) toolbox.

2.1 Description of the ICAT Guidance

In the context of the Paris Agreement, the Initiative for Climate Action Transparency (ICAT) is designed to assist countries in assessing the impacts of their climate actions. Its overarching goal is to foster greater transparency, effectiveness, ambition, and trust in climate policies. ICAT achieves this by integrating methodological guidance, capacity-building, and knowledge sharing to enhance the transparency and effectiveness of climate policies and actions on a global scale.

The guidance provided by ICAT is versatile, catering to a diverse range of users, including governments, donor agencies, financial institutions, businesses, research institutions, non-governmental organizations (NGOs), and stakeholders affected by policies and actions. This inclusive approach acknowledges the importance of engaging local communities and civil society organizations in the climate action discourse.

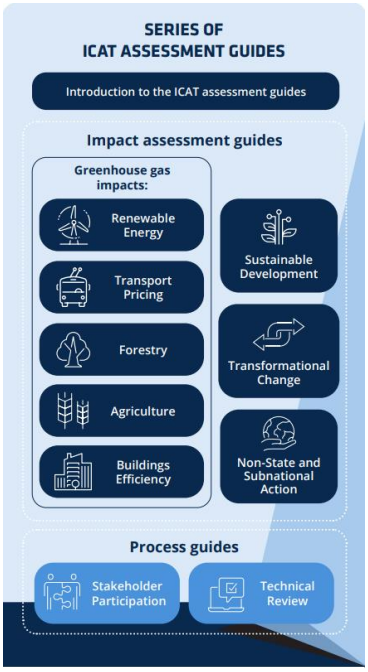


Figure 1 ICAT Aassessment Guides source: Overview of the ICAT series of Assessment Guides

The ICAT series encompasses a comprehensive set of tools, including Policy Impact Assessment. This tool facilitates evidence-based decision-making by enabling policymakers and stakeholders to comprehend the intricate relationship between policies and their anticipated greenhouse gas (GHG) and other impacts. Additionally, ICAT offers supporting guidance to ensure that users can effectively apply the tools provided, fostering a holistic understanding of the impact of climate policies and actions. A training session was held during October and November, 2023 by the ICAT experts to the Sudanese energy and transport working groups in order to explain ICAT toolbox for both energy and transport sectors. The training session report for the transport sector is shown in Appendix -A.

2.1.1Impact Assessment Guidance

The ICAT assessment guides consist of a set of methodologies designed to evaluate the greenhouse gas (GHG), sustainable development, and transformational impacts of policies and actions. This integrated and comprehensive approach is applicable across all levels of governance. Comprising 10 guides along with an introduction that offers an overview for assessment planning, the ICAT series ensures a flexible approach. This flexibility enables policymakers and other users to apply the guides

within the context of their specific objectives and circumstances.

Renewable energy: The Renewable Energy Methodology centers on commonly implemented and proven successful policies in promoting renewable energy deployment for electricity generation. These policies include feed-in tariff policies (including feed-in premiums), auction policies (including tenders), and tax incentive policies.

Transport Pricing: The Transport Pricing Methodology offers in-depth insights into transport pricing policies, encompassing measures like the removal of fuel subsidies, the augmentation of fuel taxes and levies, the introduction of road pricing, and the establishment of purchase incentive programs for more efficient vehicles. When effectively implemented, these policies contribute to a reduction in vehicle travel, promoting shifts toward more efficient transport modes like public transit, and encouraging the adoption of fuel-efficient and alternative-fuel vehicles.

The following sectors are not included in this project:

Forest: The Forest Methodology aids policymakers and other users in evaluating the impacts of forest policies targeting specific activities. This assessment assists in addressing uncertainties related to the effectiveness of such policies and the permanence of increased carbon stocks. Ultimately, this methodology supports countries in accessing REDD+ funding and finance.

Agriculture: The Agriculture Methodology centers on policies pertaining to cropland management, the restoration of organic soils, and grazing land management. Enhancing soil carbon stocks is achievable through practices like agricultural residue management, agroforestry, and transitioning to no-till or conservation tillage agriculture. To reduce methane emissions from ruminant livestock, effective strategies include improving feeding practices, enhancing herd management and breeding, and implementing silvopastoral systems.

Building Efficiency: The Buildings Efficiency Methodology is applicable to both new and existing buildings, emphasizing regulatory policies (such as building codes, energy performance standards for appliances, and energy labeling programs) as well as financial support policies (including grants and subsidies for energy-efficient investments, tax incentives, or reduced value-added tax for energy-efficient investments).

Sustainable Development: The Sustainable Development Methodology assists policymakers and other users in systematically evaluating various development and climate impacts. This process facilitates the advancement of policies that align with multiple Sustainable Development Goals (SDGs) and priorities. By assessing and effectively communicating impacts that resonate with national audiences, it helps garner support for climate actions. Additionally, the methodology informs the design and implementation of policies to maximize positive impacts while addressing or avoiding unintended or negative consequences.

Transformational Change: The Transformational Change Methodology establishes a framework for GHG mitigation and breaks down this concept into a step-by-step process for gauging the degree to which a policy exhibits true transformational characteristics. Financial institutions and programs have shown interest in this methodology as it serves as a foundation for evaluating the anticipated or realized transformational impact of policies and investments.

2.1.2Supporting Guidance

ICAT has a core objective of assisting countries in quantifying and evaluating the effects of their climate actions. A pivotal element in achieving this objective lies in the robust engagement of a diverse range of stakeholders and the inclusion of a Technical Review process. This multifaceted involvement plays a crucial role in enhancing transparency, effectiveness, trust, and ambition in climate policies. The active participation of various stakeholders, coupled with rigorous technical scrutiny, ensures a comprehensive and credible assessment of the impacts of climate actions, ultimately contributing to the advancement of more reliable and ambitious climate policies worldwide.

Non-State Subnational Action: The Non-State and Subnational Action Guide supports national policymakers and other users in evaluating the potential impact of these actions. This valuable information can be utilized to enhance the development of national greenhouse gas (GHG) trajectories, climate policies, and future targets. The guide is versatile in its application, allowing for the aggregation of contributions from non-state and subnational actors or the seamless integration of these actions into national projections.

Stakeholder Participation in design, implementation and assessment of policies and actions: The Stakeholder Participation Guide serves as a valuable resource for policymakers seeking to facilitate meaningful stakeholder engagement in the pursuit of their goals. Specifically designed to complement the ICAT impact assessment methodologies, this guide provides a comprehensive framework for policymakers to ensure that diverse stakeholders are actively involved in the decision-making process. By offering guidance on effective stakeholder participation strategies, the guide enhances the overall impact assessment process, fostering inclusivity, transparency, and the incorporation of varied perspectives. This collaborative approach ensures that policies and actions are not only well-informed but also enjoy broader support, ultimately contributing to more effective and sustainable outcomes.

Technical Review: The Technical Review Guide is a valuable tool for both policymakers and technical reviewers, providing guidance on conducting thorough and productive reviews that significantly enhance the quality of policy assessments. This guide facilitates a structured and effective collaboration between policymakers and technical experts, ensuring that the review process contributes positively to the overall assessment of policies. By promoting clarity, accuracy, and a comprehensive understanding of technical aspects, this guide plays a pivotal role in elevating the rigor and credibility of policy assessments.

2.2 Commitments of the Sudanese NDC

Following the adoption of the Paris Agreement in 2015, countries committed to revisiting and renewing their climate commitments, known as nationally determined contributions (NDCs), every five years. For nations with commitments originally stretching until 2025, new commitments were to be made, while those with commitments extending through 2030 were expected to communicate or update them. In response to this call under Articles 3, 4.2, 4.6, and 4.11 of the Paris Agreement, particularly referencing decision 4/CMA.1, para.7 of the 24th Conference of the Parties, Sudan submitted its interim update of its first NDC in May 2021.

This submission outlines Sudan's national priorities to address the impacts of climate change on its economy. Importantly, Sudan's updated contributions to both climate change mitigation and adaptation align with the country's national development planning processes. These contributions are crafted in harmony with the overarching objectives and priorities, taking into careful consideration

the unique national circumstances of Sudan.

2.2.1Summary of Plans

2.2.1.1 Energy Component

The mitigation component of Sudan's updated contributions spans key sectors, encompassing energy, forestry, and land use, with a targeted timeframe from 2021 to 2030. In the *energy* sector, Sudan aims to undergo a transformative shift in its electricity generation, with a focus on low-emission power sources.

The outlined contributions within the energy sector are diverse and comprehensive:

- The deployment of utility-scale solar and wind power plants, stand-alone systems, and mini-grids.
- Improvement in hydrogeneration.
- Enhancements in energy efficiency across the grid, residential appliances, and the transport sector.

Specifically, Sudan has set ambitious targets, such as achieving 2,140 MW from solar and wind power plants by 2030, resulting in an impressive emissions avoidance of 3,574,580 tCO2e. Additionally, stand-alone systems and mini-grids installations in various sectors are projected to reach 796 MW, leading to emissions avoidance of 1,086,360 tCO2e. Rewinding of two generator units, with a goal to increase hydrogeneration to 42 GWh/year by 2030, is anticipated to yield emissions avoidance of 26,221 tCO2e.

Further plans involve increasing energy efficiency and reducing grid losses in transmission and distribution, with a notable outcome of almost 6.5 MMtCO2e of avoided emissions. The estimated cost for these interventions is projected to be almost a billion dollars, with an expected increase in annual generation by 1,213 GWh by 2030.

These comprehensive and strategic interventions underscore Sudan's commitment to mitigating climate change and transitioning towards a sustainable and low-emission energy landscape. These planned interventions would result in almost 5.5 MMtCO2e of avoided emissions and almost three billion dollar as estimated cost.

2.2.1.2 Transportation Components

In the *transportation* sector, Sudan's plans are outlined as follows:

- Model Switching to Buses in Khartoum: Sudan aims to facilitate a shift in transportation models, particularly focusing on the adoption of buses in the city of Khartoum. This strategic move aligns with the broader goal of transitioning towards more sustainable and efficient public transportation systems.
- Fuel-Switching to Blended Fossil Fuels and Promotion of Fuel Efficiency: The plan includes initiatives for fuel-switching, emphasizing the use of blended fossil fuels. Additionally, there is a concerted effort to promote fuel efficiency across various modes of transportation. This

dual approach not only contributes to emissions reduction but also aligns with global efforts to enhance the environmental sustainability of transportation.

- Scaling up the use of Rail Transport: Sudan envisions a significant scaling up of rail transport usage. This involves expanding and improving rail infrastructure, encouraging a modal shift towards rail transportation, and harnessing the efficiency and environmental benefits that rail transport offers.

These strategic interventions underscore Sudan's commitment to addressing climate change within the transportation sector. By embracing a multi-faceted approach that includes model switching, fuel efficiency promotion, and the expansion of rail transport, Sudan aims to foster a more sustainable and resilient transportation system aligned with its broader climate goals. These planned interventions would result in almost 6.5 MMtCO2e of avoided emissions and almost billion dollar as estimated cost.

The following table summarizes the intended nationally determined contributions related to the transport sector in Sudan.

Table 1: NDCs related to the transport sector in Sudan

Policy	Description	Impact
Reduced/ eliminate Fuel Subsidies	Removal or reduction of subsidies that reduce the price of vehicle fuel below its fair market cost.	Increased fuel prices lead to reduced vehicle travel and/or increased purchase of more fuel-efficient and alternative-fuel vehicles.
Increased Fuel Tax/Levy	Includes general taxes that apply to many goods and special taxes specific to vehicle fuel.	Increased fuel prices lead to reduced vehicle travel and/or increased purchase of more fuel-efficient and alternative-fuel vehicles.
Increased Vehicle Tax/Levy	Comprises fees on motor vehicle purchases and ownership, including high fees (to ration or reduce vehicle ownership); high import duties on vehicles; and vehicle taxes and fees that increase with vehicle weight, engine size or fuel intensity.	Encourages the adoption of more fuel-efficient vehicles, contributing to a cleaner and more environmentally friendly transportation sector.
Mode Switching	Includes the switching to more fuel-efficient and alternative-fuel vehicles as well as increased switching to other transport modes.	Reduces GHG emissions from the transport sector.

In summary, the Sudanese NDCs in the transport sector involves:

1- In term of GHG mitigation: Sudan aims to achieve a 20% reduction in CO2 emissions from the transport sector by 2030 compared to a business-as-usual (BAU) scenario.

2- For adaptation:

Sudan also identifies several adaptation actions for the transport sector, focusing on:

a) Resilient infrastructure: Building roads and bridges that can withstand climate extremes like floods and droughts.

b) Sustainable transport modes: Promoting non-motorized and public transport options to reduce dependence on fossil fuels.
c) Climate-smart planning: Integrating climate considerations into transport policies and infrastructure development.

2.2.2Suggested indicators for tracking progress in the implementation of Transport related NDCs:

The following comprehensive set of indicators can track progress towards Sudan's transport-related NDC goals, ensure transparency and accountability, and inform effective implementation strategies for a sustainable and resilient transport system.

- CO2 emissions reduction: Track annual CO2 emissions from the transport sector compared to a BAU scenario and the NDC target.
- Renewable energy share: Monitor the percentage of renewable energy used in transport (e.g., biofuels, electric vehicles).
- Fuel efficiency standards: Assess the implementation and impact of fuel efficiency standards for new vehicles.
- Modal shift: Track the change in modal share towards sustainable modes like public transport, cycling, and walking.
- Vehicle electrification: Monitor the number and types of electric vehicles registered and deployed.
- Freight efficiency: Analyze improvements in logistics efficiency and reductions in empty truck kilometers.
- Climate-resilient infrastructure: Track the development and implementation of climate-resilient infrastructure projects for roads, bridges, and public transport systems.
- Vulnerability assessments: Monitor the vulnerability of transport systems to climate change impacts like floods, droughts, and extreme weather events (example: frequency of damage due to flash floods as for Omdurman- Bara road)
- Early warning systems: Assess the development and effectiveness of early warning systems for climate hazards impacting transportation.
- Emergency preparedness and response: Evaluate the capacity and preparedness of transport authorities to respond to climate emergencies.
- Integration of climate change into transport planning: Track the inclusion of climate change considerations in national and regional transport policies and planning processes.
- Financial resources: Monitor the allocation and disbursement of funds for transport-related NDC activities.
- Institutional capacity: Assess the capacity of government agencies and stakeholders to implement NDC commitments.
- Technology transfer and innovation: Track the adoption and development of new technologies and solutions for sustainable transport.

- Public awareness and participation: Evaluate public awareness of transport-related climate change issues and engagement in NDC implementation.
- Policy and regulatory environment: Monitor the development and implementation of policies and regulations that support the NDC targets

These indicators provide a holistic view of the progress being made towards NDC goals in the transport sector. However, it's important to note that data availability and quality can vary, so these indicators should be interpreted with caution.

3 ICAT Transport Pricing Guidance: Guidance for assessing the greenhouse gas impacts of transport pricing policies

This methodology is structured into four parts, as illustrated in Figure (2). Its methodological guidance is geared towards evaluating the greenhouse gas (GHG) impacts of pricing policies within the transport sector. The approach is delineated in a stepwise manner, focusing on estimating the effects of elevated fuel prices through the utilization of price elasticities of demand. While other methods for assessing the impacts of vehicle purchase incentives and road pricing policies are also provided, albeit in less detail, the overarching goal is to enhance impact assessment for the improvement of policy design and implementation.

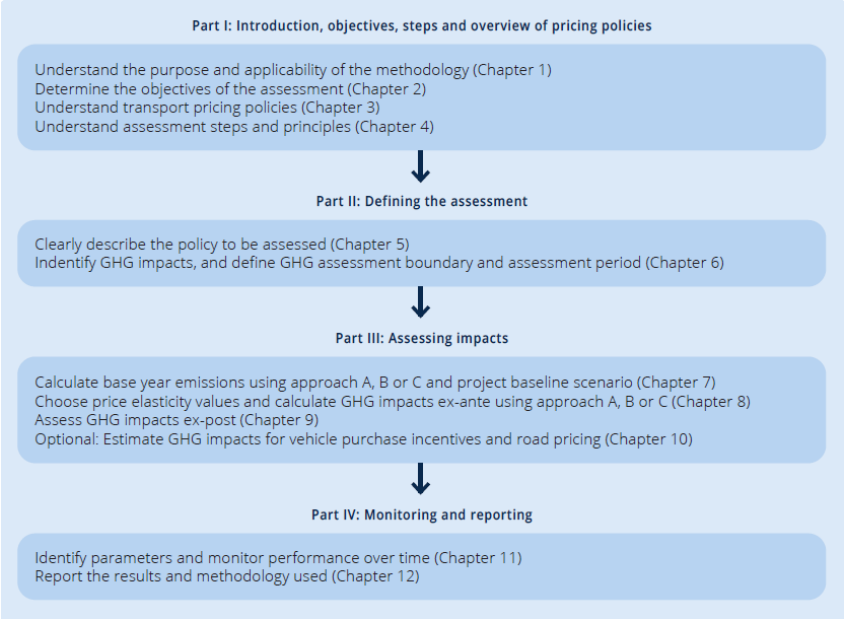


Figure 2: Overview of the methodology
source: TRANSPORT PRICING METHODOLOGY ICAT SERIES OF ASSESSMENT GUIDES

By offering a systematic approach, the methodology becomes a valuable resource for stakeholders involved in the formulation and execution of national transport policies, strategies, Nationally Determined Contributions (NDCs), or Nationally Appropriate Mitigation Actions (NAMAs). The intended users encompass a broad spectrum, including research institutions, businesses, and non-governmental organizations, fostering a collaborative and informed approach to the enhancement of national transport policies.

3.1 Background information about Sudan's proposed mitigation measures in the Transport Sector

Private and public passenger and goods transportation are the major non-renewable energy consumer in Sudan. Diesel, Gasoline and Jet Kerosene are the fuel used for railway, road and aviation types of transportation as per illustration in the figure below.

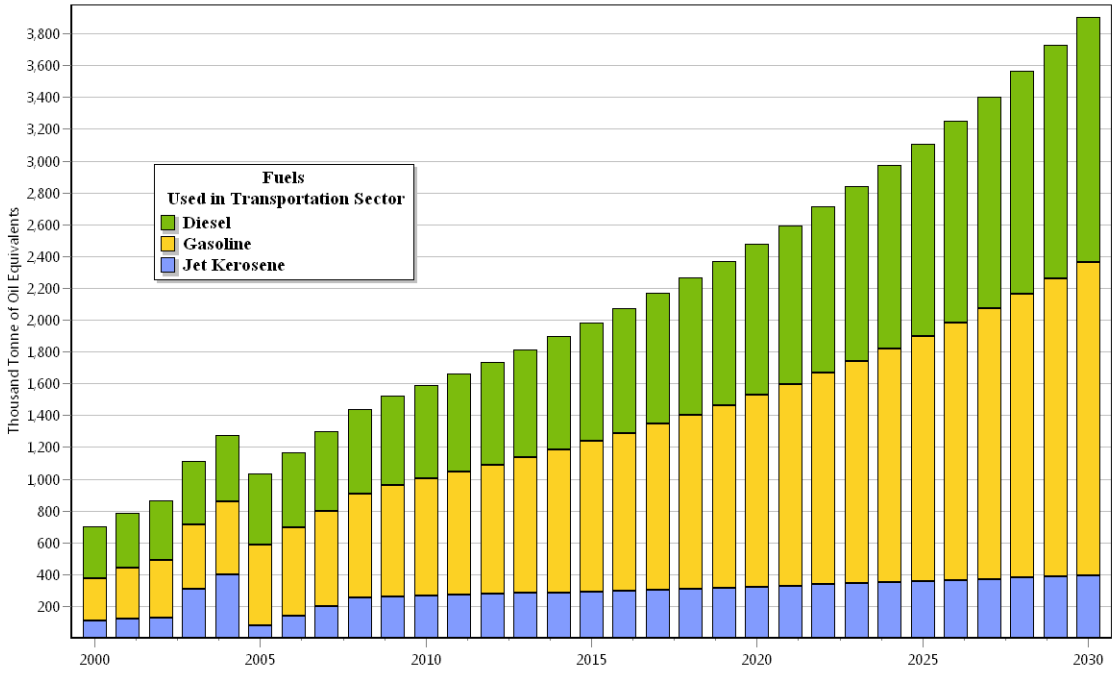


Figure 3: Total Energy Consumption in the Transportation Sector up to 2030 (Sudan's 2nd National Communication, 2013)

Different models were used to generate scenarios for different mitigation measures related to the transport sector in Sudan. The following basic data and assumptions were used to generate both business as usual (BAU) scenario and number of mitigation scenarios:

Table 2: Activity data and assumptions used to generate BAU scenario to model the transport sector in Sudan

No.	Parameter	2000	2030	Reference
1	Population	33 million	50 million	CBS
2	Persons per household	6 persons	6 persons	CBS + expert judgment
3	Urban % of population	26.7%	39.2%	CBS
4	Rural % of population	62%	57.8%	CBS
5	Nomad % of population	11.3%	3%	CBS
6	Number of private vehicles	93.2 thousands	Growth 5%Ann form year 2009 (342,424	Traffic Authority – Ministry of Interior +

			vehicles)	expert judgment
7	Number of public transportation vehicles	48.5 thousands	Growth 5%Ann	Traffic Authority – Ministry of Interior + expert judgment
8	Truck No.	10 thousands	Growth 5%Ann	Traffic Authority – Ministry of Interior + expert judgment
9	Passengers Train No.	100	Growth 5%Ann	Traffic Authority – Ministry of Interior + expert judgment
10	Freights Train No.	100	Growth 5%Ann	Traffic Authority – Ministry of Interior + expert judgment
11	Annual Avg. Distance Per Car	15000 km	15000 km	Experts judgment
12	Annual Avg. Distance Per public transport	25000 km	25000 km	Experts judgment
13	Avg Dis Per Train Ann	50000 km	50000 km	Experts judgment
14	Avg Dis Per Truck Ann	35000 km	35000 km	Experts judgment
15	Avg Dis Per Trailer Ann	25000 km	25000 km	Experts judgment
16	Car load factor	3 persons/car	3 persons/car	Experts judgment
17	Bus Load factor	25 persons/bus	25 persons/bus	Experts judgment
18	Car fuel Consumption	7 km/l	7 km/l	Technical Specifications
19	Bus fuel Consumption	3.5 km/l	3.5 km/l	Technical Specifications
20	Train fuel Consumption	0.5 km/l	0.5 km/l	Experts judgment
21	Truck fuel Consumption	2.5 km/l	2.5 km/l	Technical Specifications

Since year 2000 Sudan started to import massive amount of gasoline cars. That's why the market demand for gasoline increased by a factor of 3 between 2000 to 2008. Railway transportation has played a very minor role since the year 2000. A LEAP model was developed for a base year 2000 to simulate the mitigation scenarios starting form 2015 for the energy sector including Transport. The model outcome is shown in the following figure:

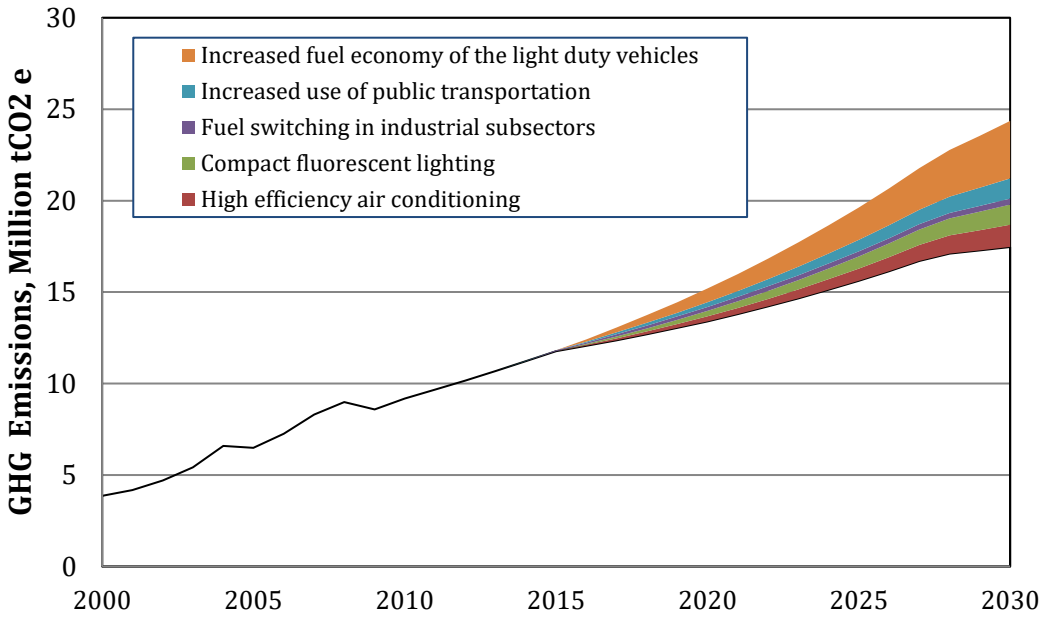


Figure 4: Projected GHG emissions in the GHG Mitigation Scenario (2nd NC, 2013)

According to the GHG mitigation analysis conducted during the 2010 by HCENR and University of Khartoum, number of mitigation measures were proposed for the transportation sector in Sudan as part of the Second National Communication Project. They are summarized in the following two groups:

1) Mitigation by improving the transportation efficiency:
   This scenario can reflect improvement of traffic system effectiveness and quality of running vehicles on roads. This scenario assumed to be applied by 2015, where the target in 2030, is one liter of fuel will be enough to drive a car for 12 km instead of 7 km in 2015. On the other hand the same liter will allow public transportation (buses) to travel 5 km. practically, this is can be done through the following policies:
   1. Specify service roads for the public transportation to increase its speed
   2. Upgrade traffic facilities such as installation of more traffic lights, change of road directions in certain hours to assure traffic flow with least traffic jam.
   3. Restrict car movement by legislation (i.e. downtown passage allowance days for even or odd plate numbers).
   4. Building flying bridges in crowded junctions
   5. Restrict the import of high fuel consumption vehicles.
   6. Spread public awareness of optimum tire air pressure
   7. Encourage of using solar films on car's glass windows to reduce car's AC usage.

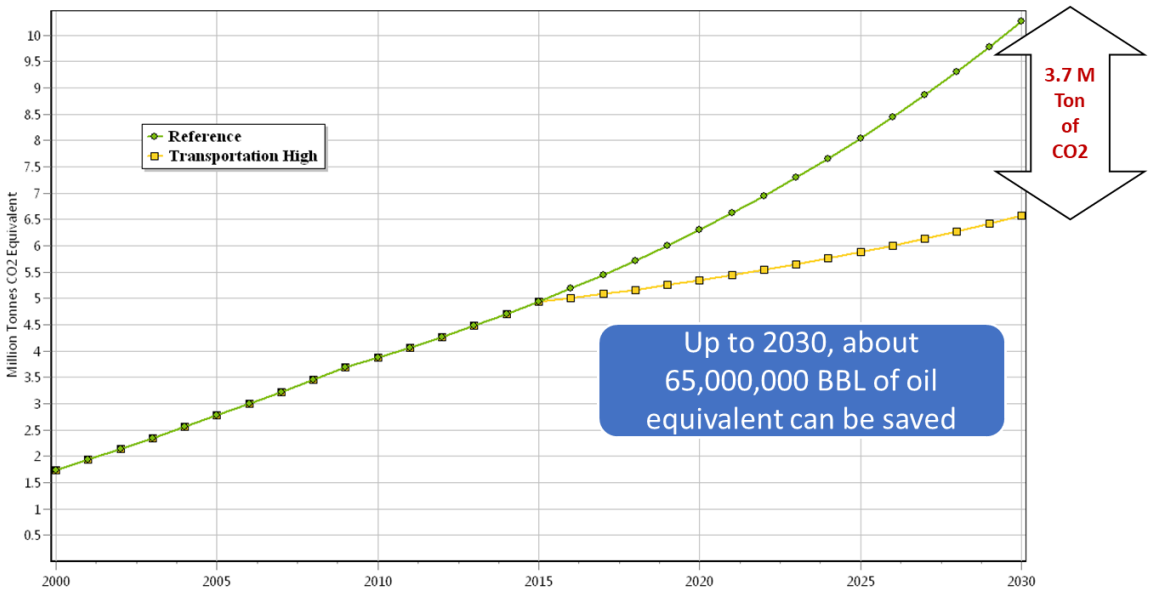


Figure 5: Comparison between BUA scenario (Reference scenario) and transportation efficiency mitigation scenario

2) Reducing private cars in favor of public transportation:
This policy is assumed to be applied by 2015. The main scenario is to shift passengers from using private cars to using public transportation instead. That's mean, the passenger kilometer is kept constant along the simulation time and rate of increase in number of private cars is reduced. On the other hand incremental rate of public transportation quantity is raised to substitute the shortage in car number. Practically that can be done throughout the following policies:
    - Create very restrict car importing policy and /or increase custom fees on private cars
    - Create new traffic registration policies for aged cars.
    - Encourage importing high-capacity buses.
    - Help establishment of new public transportation companies

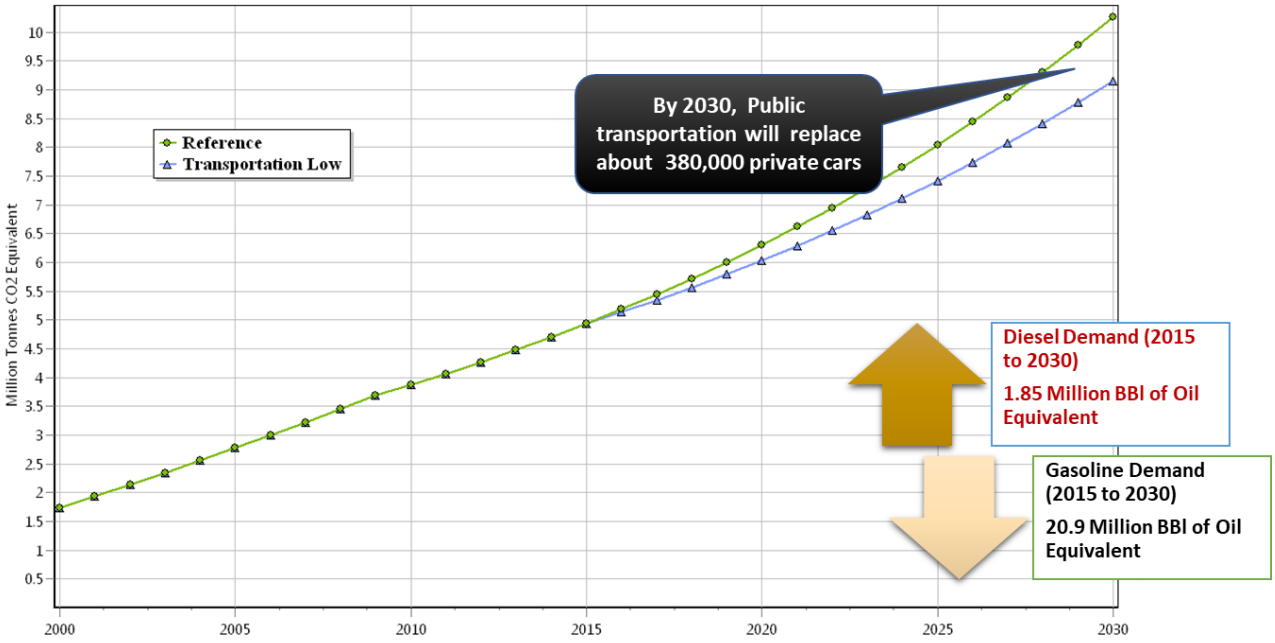


Figure 6: Comparison between BUA scenario (Reference scenario) and increase public transportation scenario

3.2 Overview of Transport Pricing Policies

3.2.1Reduced Fuel Subsidies

Policy Description:

This policy describes the removal or reduction of subsidies that reduce the price of vehicle fuel below its fair market cost. Fuel can be considered highly subsidized if it is priced below international crude oil prices, and moderately subsidized if it is priced below fuel production and roadway costs.

Sudan Status:

In Sudan, energy consumption is dominated by the household and transport sectors. For the transport sector, gasoline and diesel use accounts for about 34% of all energy use and has been growing more slowly at an average annual rate of about 3.3% per year (Sudan third National Communication, 2021). On 23 September 2013, the Sudanese government finally implemented its long-awaited fuel subsidy cuts. The price of petrol was increased by 68 per cent, from SDG12.5 to SDG21/gallon. Diesel prices rose by 75 per cent from SDG8 to SDG14/gallon, and the official price of a 12.5kg cylinder of LPG was boosted by two thirds, from SDG15 to SDG25.2 At the same time, the official exchange rate was also devalued. These were the sharpest price increases in domestic terms yet seen in the current series of austerity measures—although the recent depreciation of the black-market exchange rate significantly reduces their value in U.S. dollar terms[1]. In 2019, the government took a more decisive step, announcing a complete elimination of fuel subsidies. This decision was met with widespread protests and demonstrations, as the immediate impact was a significant increase in fuel prices, which in turn led to higher costs for transportation, food, and other essential goods. The

[1]The International Institute for Sustainable Development Published by the International Institute for Sustainable Development, 2014.

government responded by introducing a series of social safety nets, including cash transfers and subsidies for essential goods, to mitigate the impact of the subsidy cuts on low-income households. However due to the very high fluctuation in the exchange rate between the local currency and USD, the effect of lifting the subsidies was discounted. By the year 2021, the fuel price start to follow the international market price with minimal intervention of the government.

Despite the initial challenges, the government's decision to lift fuel subsidies has had some positive effects. The elimination of subsidies has reduced the government's fiscal deficit, allowing for more investment in other areas such as education, healthcare, and infrastructure. Additionally, the higher fuel prices have encouraged consumers to adopt more fuel-efficient practices, such as using public transportation and switching to alternative energy sources.

The lifting of fuel subsidies has also had a significant impact on the Sudanese economy. The higher fuel prices have led to increased inflation, which has eroded the purchasing power of consumers and businesses alike. Additionally, the subsidy cuts have contributed to a slowdown in economic growth, as businesses have faced higher costs for transportation and energy.

Despite the challenges, the Sudanese government remains committed to the policy of lifting fuel subsidies. The government believes that the long-term benefits of subsidy reform, such as reduced government spending, improved energy efficiency, and a more sustainable economy, outweigh the short-term costs.

3.2.2Increased Fuel Tax/Levy

Policy Description:

which includes increased taxes may include general taxes that apply to many goods and special taxes specific to vehicle fuel.

Sudan Status:

Sudan currently does not impose a nationwide fuel tax. Increased fuel prices lead to reduced vehicle travel and/or increased purchase of more fuel-efficient and alternative-fuel vehicles.

3.2.3Increased Vehicle Tax/Levy

Policy Description:

Comprises fees on motor vehicle purchases and ownership, including high fees (to ration or reduce vehicle ownership); high import duties on vehicles; and vehicle taxes and fees that increase with vehicle weight, engine size or fuel intensity.

Sudan Status:

Sudan's comprehensive automotive taxation system plays a significant role in regulating the country's vehicle ownership and usage patterns. While these taxes and fees can be burdensome for vehicle owners, they serve the dual purpose of generating revenue for the government and promoting environmental sustainability. The system's emphasis on vehicle weight, engine size, and fuel intensity encourages the adoption of more fuel-efficient vehicles, contributing to a cleaner and more environmentally friendly transportation sector.

Upon purchasing a new or used motor vehicle, individuals in Sudan are subject to a range of taxes and fees, including:

1- Registration Fee: This fee is charged to register the vehicle with the government and obtain a license plate. The registration fee is typically calculated based on the vehicle's type, value, and engine size (Ref.: Ministry of Finance and Economic Planning).
2- Road Fund Fee: This contribution to the Road Fund is used to maintain and develop Sudan's road infrastructure. The Road Fund Fee is typically a percentage of the vehicle's value.
3- Environmental and other fees: This fee is aimed at promoting environmental protection and mitigating the impact of vehicle emissions. The Environmental Fee varies based on the vehicle's fuel type, engine size, and emission standards (Environmental Protection Agency of Sudan, 2021).

In addition to purchase fees, motor vehicle owners in Sudan are subject to annual ownership taxes. These taxes are typically calculated based on the vehicle's type, value, and engine size. The purpose of these taxes is to generate revenue for the government and encourage vehicle owners to maintain their vehicles in good working condition. On June 22, the Sudanese General Authority of Customs announced that the exchange rate for customs clearance would also be unified with other exchange rates. At the same time, tariff rates, etc., were reviewed, and the tariff burden on many items was lowered. According to that, an additional fee, which ranged from 20% to 300% for vehicles, had been applied. However, this has now been cancelled, except for some luxury goods such as luxury vehicles.

3.2.4Mode Switching

Policy Description:

This includes the switching to more fuel-efficient and alternative-fuel vehicles as well as increased switching to other transport modes.

Fuel switching away from gas/diesel buses to CNG buses: This involves switching from diesel to the use of compressed natural gas (CNG) in city buses. Policies such as import subsidies for CNG buses; lower import taxes on high capacity CNG buses; lower vehicle registration fees for converting older buses to use CNG; and incentives for new public transportation companies based on CNG buses are expected to be operational. Starting in 2025, CNG buses are projected to be 10% of the total bus fleet by 2030, and 20% by 2050 (Sudan Second National Communication, 2013).

Introduction of high efficiency gas/diesel buses: This involves the introduction of more efficient gas/diesel city buses. Policies such as lower import taxes on high capacity, energy-efficient buses; lower vehicle registration fees for energy efficient double decker buses; and incentives for new public transportation companies based on using energy-efficient buses are expected to be operational. Starting in 2025, energy-efficient buses are projected to be 10% of the total bus fleet by 2030, and 25% by 2050. They are assumed to be 25% more efficient than conventional gas/diesel buses (Sudan Second National Communication, 2013).

Introduction of high efficiency gas/diesel trains: This involves the introduction of more efficient locomotives to replace conventional gas/diesel trains that are approaching the end of their useful life. Starting in 2025, energy-efficient buses are projected to be 5% of the total train fleet by 2030, and 15%

by 2050. They are assumed to be 5% more efficient than conventional trains (Sudan Second National Communication, 2013).

Fuel switching from gas/diesel buses and cars to electric buses/cars: This involves the introduction of electric city buses to replace conventional buses using diesel fuel. Policies such as lower import taxes on high capacity, electric buses; lower vehicle registration fees for electric buses; and incentives for new public transportation companies based on using electric buses are expected to be operational. Starting in 2025, energy-efficient buses are projected to be 3% of the total bus fleet by 2030, and 10% by 2050 (Sudan Second National Communication, 2013). It's worth noting that as of 2023, customs duties for electric cars in Sudan are set at 0% (Sudan Custom Authority).

3.3 The Pricing Policy Barriers

The success of reforming the transportation sector in Sudan to becoming more fuel efficient and less dependent on fossil fuel rests in imposing a pricing policy to affect both the institutional level as well the behavioral one to eliminate the main barriers to the implementation of the policy.

These barriers can be placed into Four major categories, these include Technical/Infrastructural Barriers, Economic Barriers, Financial Barriers, Institutional Barriers.

Table 3: The transport pricing policy barriers

Barrier classification	***Barrier***	***Description***	***Policy Affected***	***Impact***
Technical Barriers	Lack of training	Trained technicians are key stakeholders in the maintenance of CNG vehicles or electric vehicles.	Mode switching	The adoption of the policy and the consumer behavior
	Lack of charging infrastructure	Lack of essential facilities and support systems needed to accommodate the widespread use of electric vehicles such as charging station and speed	Mode switching	The adoption of the policy and the consumer behavior
	Implementation Challenges	The logistics of removing subsidies, such as adjusting pricing mechanisms, implementing targeted assistance programs, and ensuring a smooth transition, can pose technical challenges that require careful planning and execution	Reduced fuel subsidies	Ineffective policy implementation
	Changing the system	Transitioning from one tax system to another may involve certain costs, both for the government and businesses. Implementing new technologies, retraining staff,	Increased vehicle tax/levy	The reform of the policy

		and informing the public about changes all require financial resources.		
Economic Barriers	Inflation concerns	The removal of fuel subsidies can contribute to inflationary pressures, affecting the overall economy.	Reduced fuel subsidies	The adoption of the policy
	Inequality concerns	Vehicle taxes can have a disproportionate impact on different income groups. Policies that do not consider the income distribution may contribute to increased economic inequality.	Increased vehicle tax/levy	The reform of the policy
Financial Barriers	High price for the electric vehicles	The purchase price of electric vehicles, which is typically, higher than conventional vehicle.	Switching Mode	The adoption of the policy
	Lack of customer demand or customer preferences	Many consumers lack sufficient awareness and understanding of the benefits, capabilities, and total cost of ownership of electric vehicles. The lack of education about the advancements in electric vehicle technology may result in skepticism and reduced interest.	Switching Mode	Upscale the adoption
Institutional Barriers	Political issues	Fuel subsidy removal can face strong political opposition changes particularly in the developing countries.	All policies	The adoption/ineffective policies
	lack of proper national strategies	Lack comprehensive, well-defined, and coordinated plans at the national level to tackle climate change through the mainstreaming climate change into the transportation sector.	All policies	The adoption/ineffective policies
	Lack associated institutional structures	The deficiency in the establishment of organizations, mechanisms, and frameworks with limited data collection mechanisms.		

4 Example of transport pricing policy

This example outlines a comprehensive pricing policy framework for Sudan to eliminate greenhouse gas (GHG) emissions from the transport sector. The framework leverages fuel taxes, 8% on the diesel and 25% on gasoline to create an incentive-driven system that promotes cleaner transportation options and sustainable practices.

Using fuel consumption and emissions data from the National Greenhouse Gases Inventory report for the first BUR (2017). The analysis indicates that imposing taxes on fuel for road transport, railways, and waterborne navigation could result in significant reductions in diesel and gasoline demand, with predicted decreases of -2% and -6%, respectively, by 2050 saving up to 3,500 Gg of CO2e.

4.1 Introduction

In Sudan, the transport sector is a significant contributor to GHG emissions. The sector is responsible for emissions from the burning of fossil fuels in vehicles, which release CO2 and other pollutants into the atmosphere. Changes in urban form, reallocation of street space for cycling and walking, digitalization, and programs that encourage changes in consumer behavior can reduce demand for transport services and support the shift to more energy-efficient transport modes. Electric vehicles powered by low-emissions electricity offer the largest decarburization potential for land-based transport, on a life cycle basis. However, the adoption of electric vehicles requires continued investments in supporting infrastructure to increase the scale of deployment.

Effective pricing policies can play a crucial role in reducing GHG emissions from the transport sector. Pricing policies that internalize the social and environmental costs of transport, such as congestion, air pollution, and climate change, can incentivize the use of low-carbon transport modes and discourage the use of high-carbon modes. Such policies can include fuel taxes, road pricing, and emissions trading schemes. By reducing GHG emissions from the transport sector, effective pricing policies can contribute to mitigating climate change and promoting sustainable development.

As of June 2021, Sudan canceled its heavy subsidies of gasoline and diesel. Three-wheeler vehicles, such as passenger tuk-tuk rickshaws, are popular in the country, but drivers have had to contend with rising oil prices.

4.2 Current Situation of GHG Emissions in Sudan's Transport Sector

According to the preceding information disclosed in Sudan's third national communication (under publication), the emissions from transportation sector for the years 2012 to 2017 were recorded at 8,549 Gg and 10,904 Gg respectively, indicating a growth rate averaging 5.3% per year, this constitutes 27% of Sudan's overall emissions.

Based on the available data and a growth rate of 5.3%, we utilize extrapolation methods to estimate the emissions for the upcoming years, specifically 2025, 2030, 2040 and 2050.

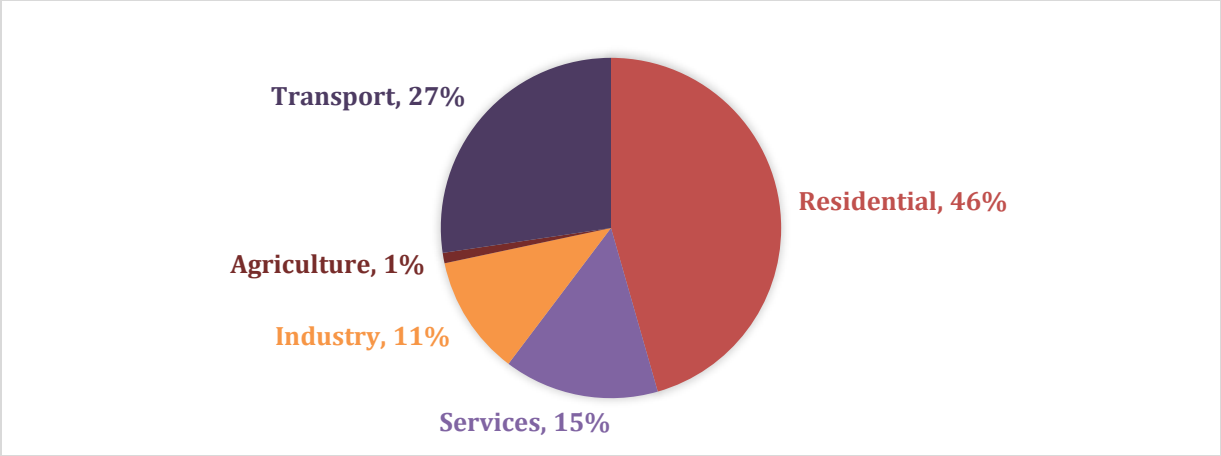


Figure 7: Sudan's Sectoral share of emissions over the period (2012-2017)

Table 4:Projection of the energy consumption in the transport sector

Category /Fuel, Tj	2015	2025	2030	2040	2050
Road Transport					
Gasoil	94,217	131,442	155,251	216,590	302,163
Motor Gasoline	41,602	69,162	89,175	148,251	246,464
Railway					
Gasoil	6,180	8,622	10,184	14,208	19,821
Waterborne Navigation (Domestic)					
Gasoil	11	16	18	26	36

4.3 Proposed Pricing Policy Framework

The suggested pricing strategy aims to elevate the overall cost of fuel employed in the transportation sector, with the objective of mitigating greenhouse gas emissions. The proposed policy entails a 8% increment in the price of diesel and 25% increment in the price of gasoline, implemented as a tax on the fuel utilized in transportation. Using approach B, the fuel price elasticities provided by ICAT to re-estimate fuel demand for gasoline and diesel in 2025 up to 2050. The baseline demand should be based on values for fuel demand calculated in in Sudan's third national communication under the United Nations Framework Convention on Climate Change.

Table 5: ICAT Price Elasticity for Approach B

Gasoline Price (2016 US Cent /Litter	Income per Capita (2016$)			Diesel Price (2016 US Cent /Litter	Income per Capita (2016$)	
	≤ 12,000$	12,000-24,000	≥ 24,000		≤ 18,000	≥ 24,000
≤ 30	-0.15	-0.11	-0.22	≤ 80	-0.22	-0.13

30-80	-0.22	-0.24	-0.22	≥ 80	-0.38	-0.27
≥80	-0.26	-0.32	-0.33			

Price elasticity of demand

$$= \frac{\%\ Change\ in\ goods\ own\ demand}{\%\ Change\ in\ goods\ own\ price}$$

4.3.1The Effect of the Policy on Fuel Demand

Following the utilization of Approach B within the ICAT tool, which involves assessing the price elasticity of demand and factoring in both the per capita income in US dollars and fuel prices, the impact on demand is delineated and presented in the table below

Table 6: The Impact of The Policy on Demand

Input Data	Unit	2015	2025	2030	2040	2050
Diesel	TJ	100,409	148,080	165,454	230,824	322,021
Gasoline	TJ	41,601	69,162	89,175	148,251	246,464
Elasticity						
Diesel			-0.22	-0.22	-0.22	-0.22
Gasoline			-0.24	-0.24	-0.24	-0.24
Change in Price						
Diesel			8%	8%	8%	8%
Gasoline			25%	25%	25%	25%
Impact on Demand						
% change in demand						
Diesel			-2%	-2%	-2%	-2%
Gasoline			-6%	-6%	-6%	-6%
Ex-ante Demand Fuel Tax Scenario						
Diesel	TJ		137,614	162,542	226,761	316,353
Gasoline	TJ		65,012	83,824	139,356	231,676

4.3.2The Emissions Subsequent to The Implementation of the Policy

After applying the ICAT tool to analyze the policy's impact on fuel usage in transportation, specifically for diesel and gasoline as indicated in table 3, the emissions reduction in CO2e (Gg) is estimated through calculations using the IPCC default emission factors, illustrated in both the table and the figure below.

Table 7: The Effect of The Policy on Emissions, Gg CO2

Scenario	2015	2025	2030	2040	2050
BAU emissions	10,596	15,413	18,882	28,037	41,932

Policy emissions	10,594	14,938	18,281	27,097	40,451

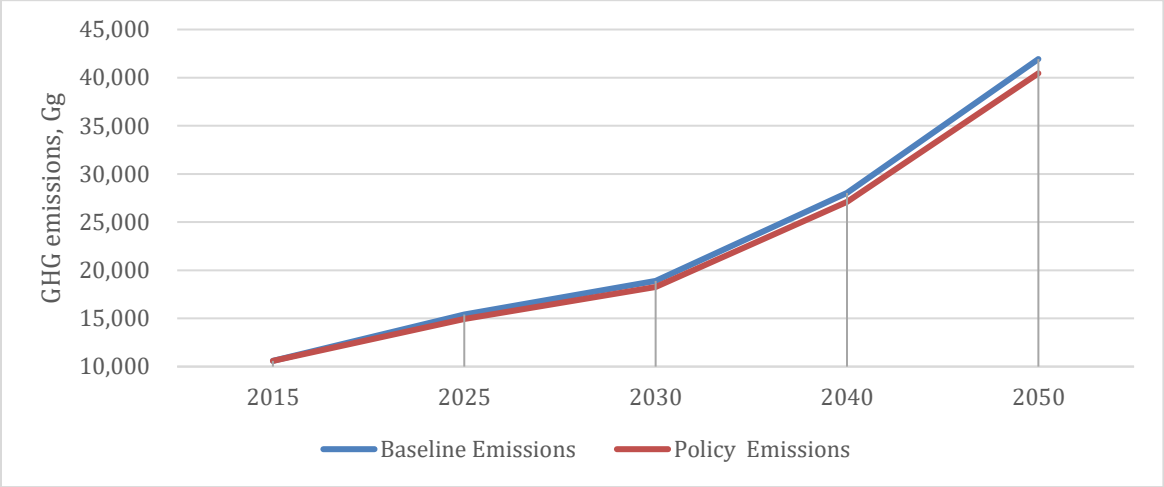


Figure 4: Projection of the transport emissions for both BAU and mitigation scenarios

The data presented in the figure above indicates that the implemented transport pricing policy had a negligible impact on the overall emissions from the business-as-usual scenario. This could be attributed to Sudan's status as a least developed country, where price elasticity tends to be low, resulting in minimal changes in actual transport demand despite fuel price fluctuations.

5 Capacity Building and Technical Support Needs

The Transport sector's contribution to climate mitigation is undeniable. By providing tailored technical support and capacity building, countries, regions, and cities can enhance their MRV processes within the Transport sector. The goal is to empower policymakers, planners, and practitioners to align the sector's policies and actions with broader climate objectives, ultimately achieving a more sustainable and low-carbon transport future. It is a collective effort towards a more transparent, accountable, and climate-resilient Transport sector.

Table 8: Technical support and capacity building needs

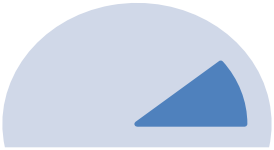
Policy/Action	***Interventions***	***Technical support***
Creating an enabling Environment (policy, Legislative) for Transport Sector	• Mainstreaming the climate change and the Sudan NDCs through designing national transport plan at the strategic level. • Developing guidelines to integrate transport plans in urban and regional development plans that enable the switching to rail or public mode of transport.	*Training modules and capacity-building programs:* Implement capacity-building programs to enhance the skills and knowledge of transportation professionals and decision makers in climate change concepts and adaptation strategies. This ensures that the key stakeholders are equipped to integrate climate considerations

	• Establishing and strengthening enforcement mechanisms to the national transport plan and NDC implementation	into their planning and decision-making processes.
Existing Policy and Regulatory Analysis	• Systematic examination of existing policies, regulations, and legal frameworks related to the transportation sector, with a specific focus on climate change considerations. • Identify strengths, weaknesses, gaps, and opportunities within the current policy landscape, facilitating the integration of climate considerations into national transport plans.	*Policy analysis frameworks*[2]*:* Conduct a thorough analysis of existing policies and regulations related to transportation. *Policy integration*: through scenario planning, policy dialogue and cross sectoral coordination.
Improve national public transport system through inner private cars model switching to bus in Khartoum	• Developing and implementing strategic roadmap for improved national public transport system • Developing and undertaking a fleet management programme for Public Transport	*Designing and implementing capacity-building programme:* for the related agencies such as the ministry of transport, Khartoum State, Custom authority in public transportation.
Fuel switching- Blending fossil fuels by 10 biofuel and promotion of fuel efficiency	• Support research and development for advanced biofuel production technologies. • Support to CNG switching programme. • Establish and enforce fuel efficiency standards for vehicles.	*Conduct public awareness campaigns* on the benefits of biofuels and the importance of fuel switching Expansion of *public awareness programmes* on CNG conversion and available fiscal incentives and funding schemes.

The ICAT Transport Pricing Guidance can be utilized to enhance the Sudanese MRV system in the energy and transport sectors by providing a structured framework for assessing the greenhouse gas (GHG) impacts of pricing policies within the transport sector. This methodology can be applied to evaluate the effectiveness of existing policies and inform the development of new ones. Additionally, the ICAT guidance can help to build capacity within Sudan's government agencies to design, implement, and monitor transport pricing policies.

[2] an ex-ante assessment, an ex-post assessment, or a combined ex-ante and ex-post assessment.

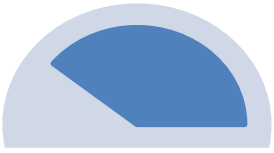
Tailoring ICAT Guidance: ICAT guidance should be adapted to address the unique characteristics of the Transport sector. This involves creating specific modules or chapters within the guidance that focus on transport emissions sources, data collection methodologies, and performance indicators.



Data Collection and Management: Capacity building programs should emphasize data collection, validation, and management. It should include training on monitoring vehicle fleets, fuel consumption, mode shifts, and the impact of transport infrastructure.

Emissions Factors and Calculations: Transport-specific emissions factors are vital for accurate emissions calculations. Technical support should include guidance on how to develop and use emissions factors specific to the transport modes and fuels used in a region.

Tools and Technologies: Training should cover the use of technological tools for data collection and analysis, including GPS tracking, telematics, remote sensing, and satellite imagery, to enhance data accuracy.



Reporting Protocols: Capacity building should guide policymakers and practitioners on developing standardized protocols for reporting emissions, ensuring consistency and comparability across regions.

Figure 8: Utilization of ICAT technical guidance for improving the Sudanese MRV system in the energy and transport sectors.

6 Conclusion and recommendation:

This report demonstrated the potential of applying the ICAT Transport Assessment Pricing Guide to assess the greenhouse gas (GHG) impacts of transport pricing policies in Sudan. By analyzing the relevance of these guidelines to Sudan's NDCs for the transport sector, the report provides a valuable tool for policymakers aiming to achieve their climate goals.

The report not only offers an overview of various transportation mitigation actions but also identifies potential implementation barriers. This comprehensive approach allows for a more informed and realistic assessment of these policies' effectiveness.

While the report emphasizes the importance of technical support and capacity building for successful

application of the ICAT framework, the transport pricing exercise conducted revealed a negligible impact on overall emissions compared to the business-as-usual scenario. This outcome necessitates further investigation and adaptation of the policy approach.

- **Recommendations**

Based on the findings of this report, the following recommendations are made for the transport pricing policy indicated in this report:

- Conduct a thorough **review of the implemented transport pricing policy**, considering factors such as the magnitude of the price increase, its targeting (specific fuels, vehicle types, etc.), and potential policy leakage (e.g., switching to lower-quality fuels).

- **Seek expert advice** to refine the policy design, potentially exploring a combination of pricing strategies (e.g., fuel taxes and vehicle scrappage programs) and ensuring sufficient price increases to incentivize behavioral change.

- Consider incorporating **local and contextual factors** that may have influenced the policy's limited impact, such as income levels, fuel availability, and existing transport infrastructure.

- **Maintain data collection efforts** to continuously assess the policy's effectiveness and inform future policy decisions related to the transport sector and its contribution to Sudan's Nationally Determined Contributions (NDCs).

7 References

1. Republic of the Sudan. First Nationally Determined Contribution under the Paris Agreement. UNFCCC. 2021.
2. ICAT Guidance and its application in the Sudanese transport sector. ICAT. 2023.
3. The ICAT Pricing Assessment Guide. ICAT. 2023.
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5. Sudan's Second National Communication to the United Nations Framework Convention on Climate Change, 2013.
6. Ministry of Finance and Economic Planning, Sudan.
7. Environmental Protection Agency of Sudan, 2021.
8. Sudan Custom Authority.
9. ICAT Transport Pricing Methodology, 2018.
10. NewClimate Institute, ICAT Policy Assessment Guides.

9 Appendix - A: Training Session on ICAT Toolbox for Transport Pricing Policy

[TYPE THE COMPANY NAME]

ICAT SUDAN CAPACITY BUILDING TRAINING TRANSPARENCY (MRV) SYSTEM BASED ON ICAT TRANSPORT PRICING METHODOLOGY

7-8 November 2023

Instructor:
Subash Dhar
Project Coordinator:
Alejandro Regatero Labadia

National Consultant: Quosay Awad Ahmed

1. Introduction

The ICAT Sudan project hosted the capacity building training on MRV transparency systems based on the ICAT renewable energy and transport pricing assessment guides. This is as part of the country's efforts in developing the information necessary to track progress made in implementing and achieving Sudan's NDC, under the Initiative for Climate Action Transparency (ICAT). This report is documenting the sessions conducted on the ICAT Transport Pricing Assessment Guide.

2. Specific Objectives

This Capacity building program was an intended event for the ICAT project undertaken under the ICAT Secretariat and the UNEP-CCC partnership. The objectives of the program were to build the capacities of all participants representing project's stakeholders to meet the ICAT reporting requirements to track progress made in implementing and achieving Sudan's NDC under the Initiative for Climate Action Transparency (ICAT) through an MRV system.

3. Training Sessions approach

The training sessions were preceded by provision of video recordings prepared by the Instructor and the IT team at the UNEP-CCC based on the Sudan NDCs and sector specific strategies. Then provided Power Point Presentations (in English), case studies and exercises facilitated by Dr. Qousay Awad Ahmed the ICAT National Consultant – Transport Sector. The discussion curried in Arabic to assure the participants' understanding of the objectives and outcomes of the project.

4. Instructor and Facilitator

The training sessions were led by the Instructor Mr. Subash Dhar (UNEP-CCC) and Mr. Alejandro Regatero (UNEP-CCC) was the facilitator.

5. The Program

ICAT Transport Pricing Assessment Guide- Two Days On-Line Sessions **Day 1 – 7 November 2023, 10:00 – 16:30, meeting link here**		
10:00 – 10:15	Introductory session and round of introductions	Alejandro Regatero (UNEP-CCC)
10:15 – 12:00	ICAT Transport Pricing Assessment Guide	Subash Dhar (UNEP-CCC)
12:00 – 13:00	*Lunch break*	
13:00 – 14:00	Q&A - Group exercise and examples ICAT Transport Pricing Assessment Guide	Subash Dhar (UNEP-CCC)
14:00 – 16:30	Group work session – exercises on Transport Pricing Assessment Guide	All participants
Day 2 – 8 November 2023, 11:00 – 14:00		
11:00 – 12:00	Group work session – exercises on Transport Pricing Assessment Guide	All participants
12:00 – 13:00	*Lunch break*	
13:00 – 14:00	Group exercise / Solution presentation – ICAT Transport Pricing Assessment Guide – Q&A	Subash Dhar (UNEP-CCC)

6. Exercise

Baselines for assessing the greenhouse gas impacts of transport mitigation actions

Group Exercise Cityland suffers severely from congestion and air pollution, which is caused primarily by private vehicles.

Context:

The government of Country land wants to mitigate these two problems by introducing a fuel pricing policy (increasing tax on gasoline and diesel) across Cityland to reduce private car usage and thereby, GHG emissions and congestion. However, the acceptability of the petrol tax is a major concern for policymakers and the government is therefore trying to quantify the impacts on demand for fossil fuels, GHG emissions and revenues for government:

Q1 a) Calculate fuel consumption of diesel and gasoline in TJ for base year (2020) if the diesel consumption was 8000 Gg and gasoline consumption was 7860 Gg.
Use NCV after IPCC default values of 44.3 TJ/Gg for gasoline and 43 TJ/Gg for diesel.
Hint: Fuel Consumption in TJ (FC = Fuel Consumption in Gg x NCV (TJ/Gg).
Q1 b) Calculate CO2 emissions from diesel and gasoline use using the following equation and make use of IPCC default values
Q2 The per capita energy demand for transport has increased at the compounded annual growth rate of 0.5% for last 10 years. The population is expected to increase from 650,000 in 2020 to 760,000 in 2030. The base year demand for gasoline is 348,198 TJ and for diesel 344,000 TJ.
Project the gasoline and diesel demand using the simplified projection method for 2025 and 2030.
Q3 The government is proposing a fuel tax on diesel and gasoline as part of measures to support the

reduction of CO2 emissions from the transport sector. The tax will increase price of diesel by 4% and petrol by 10%. The current prices of gasoline are 0.50 US $ per litre and 0.45 US $ per litre and per capita income (GDP) of country is US $ 13,000 in 2016 US $

Use the fuel price elasticities provided to re-estimate fuel demand for gasoline and diesel in 2025 and 2030. The baseline demand should be based on values for fuel demand calculated in question 2.

Q4 a) Calculate CO2 emissions from gasoline and diesel for the baseline scenario (using fuel demand from Q2) and fuel tax scenario (using fuel demand from Q3).

Q4 b) Draw baseline and ex-ante scenarios.

Q4 c) Calculate the tax revenues for the government from the taxes and propose measures that can further reduce CO2 emissions (optional).

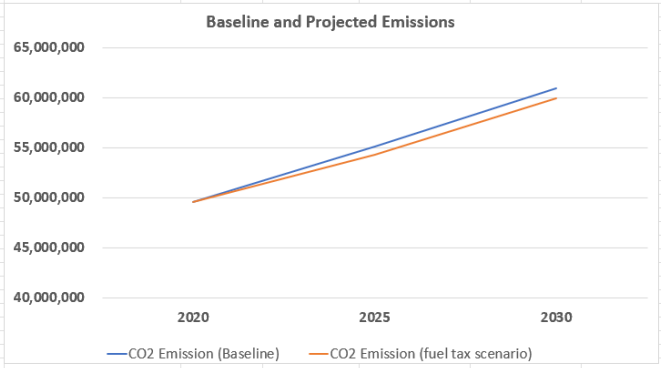
Solution:

Baselines for assessing the greenhouse gas impacts of transport mitigation Group Exercise

	Units	Diesel	Gasoline
Fuel Consumption	Gg	8000	7860
NCV	TJ/Gg	43	44.3
Fuel Consumption	TJ	344000	348198
Emission Factor	tCO2/TJ	74.1	69.3
CO2 Emissions	tCO2	25490400	24130121.4

	Unit	2020	2025	2030
Input Data				
Population	Number	650,000	705000	760,000
Gasoline	TJ	348,198		
Diesel	TJ	344,000		
Per Capita				
Gasoline	TJ/person	0.536	0.549	0.563
Diesel	TJ/person	0.529	0.543	0.556
Projections				
Per capita				
Growth in per capita energy	CAGR	0.50%		
Gasoline	TJ/person	0.536	0.549	0.563
Diesel	TJ/person	0.529	0.543	0.556
Total Demand				
Gasoline	TJ	348,198	387,197	427,944
Diesel	TJ	344,000	382,529	422,785
CO2 Emission (Baseline)	**tCO2**	**49,620,521**	**55,178,183**	**60,984,880**

	Unit	2020	2025	2030	Remarks (if any)
Input Data					
Gasoline	TJ	348,198	387,197	427,944	Take from q2
Diesel	TJ	344,000	382,529	422,785	Take from q2
Elasticity					
Diesel		-0.24	-0.24	-0.24	From Slide 13
Gasoline		-0.22	-0.22	-0.22	- do-
Change in Price					
Gasoline			10%	10%	
Diesel			4%	4%	
Impact on Demand					
% change in demand					
Gasoline			-0.024	-0.024	
Diesel			-0.0088	-0.0088	
Ex-ante Demand Fuel Tax Scenario					
Gasoline		348,198	377,904.58	417,673.52	
Diesel		344,000	379,162.87	419,064.23	
CO2 Emission (fuel tax scenario)	**tCO2**	**49,620,521**	**54,284,756**	**59,997,434**	



7. Stakeholders

Table 1: Stakeholders Targeted by ICAT Project

SN	Stakeholders Entities
1	Ministry of Interior
2	Ministry of Communications and Digital Transformation
3	Ministry of Finance and National Economy
4	Ministry of Energy and Petroleum
5	Ministry of Agriculture and Forestry
6	Ministry of Transport
7	Ministry of Urban Development, Roads and Bridges
8	Central Bureau of Statistics
9	National Research Centre
10	Energy Research Centre
11	Private sector and industrial facilities (Food Industry, Cement factories, Sugar companies, Energy, MOil & Gas industry)
12	Unions, chambers of commerce and other associations
13	The Higher Council of Environment and Natural Resources (HCENR)

8. Attendance

The two days on-line capacity building program was attended by 21 participants representing the two sectors Transport and Energy, nine apologies due to the situation in the country. The consultants will make sure to ensure the dissemination of information and training materials to those who did not attend.