Initiative for Climate Action Transparency

Development and Institutionalization of a Framework to Track NDC Action and Build Capacity in Relevant Areas

Mitigation Analysis Project Scope Report: Modelling Tools Justification

St. Kitts & Nevis

15th April 2024

Submitted to:

The Government of St. Kitts and Nevis' Ministry of Sustainable Development, Environment, Climate Action and Constituency Empowerment

Prepared by:

Caribbean Cooperative Measurement, Reporting & Verification Hub

DISCLAIMER

PREPARED UNDER

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

The ICAT Secretariat is managed and supported by the United Nations Office for Project Services (UNOPS)

Mitigation Analysis Project Scope Report: Modelling Tools Justification

Initiative for Climate Action Transparency – ICAT

Deliverable # C – Output 1.1.1

AUTHORS

Kalifa Phillip, CCMRVH

Ahyana Bowen, CCMRVH

Benise Joseph, CCRMVH

15th April, 2024

Table of Contents

List of Tables

Acronyms

BUR	Biennial Update Report
CCMRVH	Caribbean Cooperative Measurement, Reporting and Verification Hub
CNG	Compressed natural gas
CURB	Climate Action for Urban Sustainability
EV	Electric vehicle
GACMO	Greenhouse Gas Abatement Cost Model
GDP	Gross Domestic Product
GHG	Greenhouse gas
GHGMI	Greenhouse Gas Management Institute
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GREET	Greenhouse gases, Regulated Emissions, and Energy use in Technologies
ICAT	Initiative for Climate Action Transparency
LEAP	Low Emissions Analysis Platform
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
MRV	Measurement, reporting and verification
NDC	Nationally Determined Contributions
SIDS	Small Island Developing State
SKN	St. Kitts and Nevis
TNC	Third National Communication
TraCAD	Transport Climate Action Data Tool
TRACE	Transport sector climate action co-benefit evaluation tool
TrIGGER	Transport Inventory and Greenhouse Gas Emissions Reporting Tool
UNEP-CCC	United Nations Environment Programme – Copenhagen Climate Centre

1 Introduction

The Twin Island Federation, St. Kitts and Nevis (SKN) is a small island developing state (SIDS) in the Caribbean that is committed to combating the negative impacts of climate change. Fossil fuel imports have consistently been on the rise within the nation, given the increase in population and economic growth, and the heavy dependence on these imports to meet their energy needs. In the latest inventory for 2018, the energy sector, particularly the electricity generation and transport subsectors, was identified as the largest contributor to the total national emissions, with as much as 81.7% of the total emissions. As a result of this, SKN has identified the following key areas as major interventions which contribute to their overall economy-wide emissions reduction strategies in their updated 2021 Nationally Determined Contribution (NDC):

- Transition to 100% renewable energy in power generation
- Improve efficiency in the transmission and distribution of electricity
- Electrification of 2% of the total vehicle fleet
- Development of EV infrastructure

It is, therefore, critically important for the country to build the capacity to manage and track the implementation of its NDC, especially in the electricity generation and transport subsectors. As a result, the Government of SKN has sought project-level support under the Initiative for Climate Action Transparency (ICAT) to enable the analysis and capacity building towards the accomplishment of its NDC goals.

ICAT helps countries better assess the impacts of their climate policies and actions and fulfil their transparency commitments. It does this by increasing the overall transparency capacities of countries, including the capacity to assess the contribution of climate policies and actions on countries' development objectives, and providing appropriate methodological information and tools to support evidence-based policymaking.

The Government of SKN has undertaken this ICAT project, which is designed to support the development of the NDC tracking framework and establishment of sustainable capacity to conduct projections of GHG emissions for the electricity generation and transport subsectors.

The main objectives of the project are as follows:

- To develop an MRV framework for the electricity generation and transport subsectors with GHG emissions estimation, compilation and reporting
- To develop an NDC tracking framework that will manage and track the implementation of the NDC in the electricity generation and transport subsectors.

Including data collection for emissions and assessment of policies in the identified subsectors

- To develop appropriate indicators for reporting on NDC progress achieved
- To strengthen the capacity of the St. Kitts and Nevis Government to maintain the two frameworks and improve modelling capabilities

As a result of these objectives, one of the first activities is the development of a framework for projections of emissions and NDC tracking indicators for the energy sector. The first task within this activity involves the justification and selection of appropriate energy sector modelling tools, and training of key sectoral stakeholders on the chosen tool(s).

This report represents the first major deliverable within this activity, the "Mitigation Analysis Project Scope", which details the justification for the tool(s) selected to implement energy sector modelling for SKN. A multi-pronged approach was used to develop the justification for the selected tools. This included:

- Inception workshop with key stakeholders to identify the initial scope and SKN's priorities for chosen tools. The Inception Workshop Report is available in the **Annex**.
- Research into over forty (40) available modelling tools and deeper analysis of twelve (12) energy and transport-related tools to identify applicability to SKN based on initial scope.
- Modelling tool selection workshop with key stakeholders to present top tools, based on initial requirements, which are applicable to this analysis. This workshop also guided stakeholders through the identification of additional criteria which were used to further streamline the tool choices to a select few. The Modelling Tool Selection Workshop Report is available in the **Annex.**

The overall justification and tools selected are outlined in this report in the following sections:

- Overview of the tools assessed
- Scope requirements overview
- Comparison of tools based on scope requirements
- Justification of the tools selected
- Conclusions

2 Overview of Tools Assessed

Several energy sector modelling tools are available that can be used to address the scope of work for this project. These tools vary in data requirements, accessibility, outputs, and costs among others. Over forty (40) energy and transport-related modelling tools were identified and researched, with a total of twelve (12) tools were selected based on their accessibility and applicability to SKN. Considerations included cost, location restrictions, and sector applicability among others. These twelve tools were compared using criteria identified from the Inception meeting with stakeholders in SKN and the detailed descriptions of the tools were presented to stakeholders at the Modelling Tool Selection Workshop.

This section provides a general overview of the 12 twelve tools and a general overview of their data requirements.

- **Climate Action for Urban Sustainability (CURB)**
  - Tool developer: C40 Cities
  - Overview:
    CURB helps cities assess the implications of policy and technology interventions by allowing them to evaluate their cost, feasibility, and impact. CURB responds to local realities through a flexible and modular design, allowing users to focus on the information (e.g. energy or emission impacts, cost savings, etc.) that is most relevant to their priorities. The CURB tool is free to download and designed for Excel 2010 and later versions.
  - Website: https://www.worldbank.org/curb

- **Greenhouse gas Abatement Cost Model (GACMO)**
  - Tool developer: UNEP - CCC
  - Overview:
    This tool calculates and visualises the comparison of a business-as-usual scenario with selected mitigation scenarios to support the analysis of GHG mitigation options and their cost. The tool provides analysis in 5-year time steps.
  - Website: https://unepccc.org/gacmo-tool/

- **GHG Protocol Mobile Combustion Tool & Stationary Combustion Tool**
  - Tool developer: Greenhouse Gas Protocol
  - Overview:
    Mobile Combustion/Transport Tool: This is an Excel-based tool which calculates carbon dioxide, methane and nitrous oxide emissions from mobile

sources such as vehicles, public transportation, machinery and agricultural equipment.

Stationary Combustion Tool: This is an Excel-based tool which calculates emissions from the combustion fuels in boilers, furnaces and other stationary combustion equipment.

- Website: https://ghgprotocol.org/calculation-tools-and-guidance

- **GHGMI/CCMRVH On-Road Transport Data processor and Emission Calculator tool (On-Road Mobile Tool)**
  - Tool developer: Greenhouse Gas Management Institute/Caribbean Cooperative Measurement, Reporting & Verification Hub
  - Overview:

    This tool was developed to assist in the compilation of data into an IPCC-compatible format and to break down national data into those specific IPCC vehicle categories. This input data pre-processor tool is designed specifically to take vehicle registration data and compile it into a format compatible with the IPCC GHG inventory software or equivalent tools and also performs emission calculations based on national or regional assumptions.

- **Greenhouse gases, Regulated Emissions, and Energy use in Technologies (GREET)**
  - Tool developer: Argonne National Laboratory
  - Overview:

    GREET is a tool that assesses a range of life cycle energy, emissions, and environmental impact challenges and that can be used to guide decision-making, research and development, and regulations related to transportation and the energy sector.
  - Website: https://www.energy.gov/eere/greet

- **Low Emissions Analysis Platform (LEAP)**
  - Tool developer: Stockholm Environment Institute (SEI)
  - Overview:

    This tool is used mainly for integrated energy planning and climate change mitigation assessment. It jointly assesses greenhouse gases, short-lived climate pollutants (SLCP), and air pollutant emissions and builds mitigation

and baseline or business-as-usual scenarios. LEAP calculates the emissions and visualises the impact of these GHG emissions.

- Website: https://leap.sei.org

- **Energy PATHWAYS**
  - Tool developer**:** Energy and Environmental Economics (E3) Inc.
  - Overview**:**
    EnergyPATHWAYS is a comprehensive energy accounting and analysis framework, written in Python, specifically designed to examine large-scale energy system transformations.
  - Website: https://www.ethree.com/tools/pathways-model/

- **PROSPECTS+**
  - Tool developer**:** New Climate Institute
  - Overview**:**
    PROSPECTS+ is a sector-level, bottom-up Excel tool which uses decarbonisation-relevant activity and intensity indicators to track and project overall and sectoral GHG emissions trends.
  - Website: https://newclimate.org/resources/tools/prospects

- **Transport sector climate action co-benefit evaluation tool (TRACE)**
  - Tool developer: New Climate Institute
  - Overview:
    This tool supports the quantitative evaluation of selected non-climate impacts from decarbonising the transport sector. The tool assesses impacts on congestion, road accidents, fuel use, and health impacts from air pollution. Impacts are estimated in units such as travel delay, fatalities, and volume or weight of fuel types and monetised to allow aggregation of the different impacts. Scenarios for the development of urban transport systems over time are a critical input to TRACE and are not generated within the tool itself. However, the data collected through the ICAT Climate Action Data Tool can be used to provide input to TRACE.
  - Website: https://newclimate.org/resources/tools/trace-co-benefits-in-decarbonising-transpor

- **RETScreen Expert**
  - Tool developer**:** Government of Canada

- Overview:
  RETScreen Expert is a comprehensive Clean Energy Management Software platform which enables professionals and decision-makers to identify and assess the viability of potential energy efficiency, renewable energy and cogeneration projects.
- Website: https://natural-resources.canada.ca/maps-tools-and-publications/tools/modelling-tools/retscreen/7465

➢ **Transport Climate Action Data Tool (TraCAD)**

- Tool developer: Climate Smart Initiative (CSI)- ICAT
- Overview:
  This ICAT tool was developed for transport sector data collection, policy impact assessment and tracking, and mitigation cost analysis. The application can also be modified for use in other sectors, such as agriculture, energy, or waste. TraCAD provides a consistent and structured approach to data collection and assessment, which should improve the credibility of the impact evaluation of policies and actions to boost the country's capacity to meet its national climate and sustainable development targets, as well as provide the required information to deliver high-quality reporting under the Paris Agreement.
- Website: https://climateactiontransparency.org/our-work/icat-toolbox/tracad/

➢ **Transport Inventory and Greenhouse Gas Emissions Reporting Tool (TriGGER)**

- Tool developer: GIZ
- Overview:
  TrIGGER is a simple bottom-up spreadsheet model to calculate national transport GHG inventories. It is an open tool that can be easily adapted to any country's needs. In addition, it features multiple Excel sheets separated based on various transport categories.

Website: https://changing-transport.org/tool/trigger/

3 Data Needs & Outputs of Tools

Each of the modelling tools analysed has specific input data requirements. These data requirements were analysed for each tool and the major data needs per tool are recorded in ***Table 1*** below. In addition to the major data needs, the typical outputs produced by each tool were also analysed and presented in ***Table 2***.

Table 1: Data requirements for modelling tools

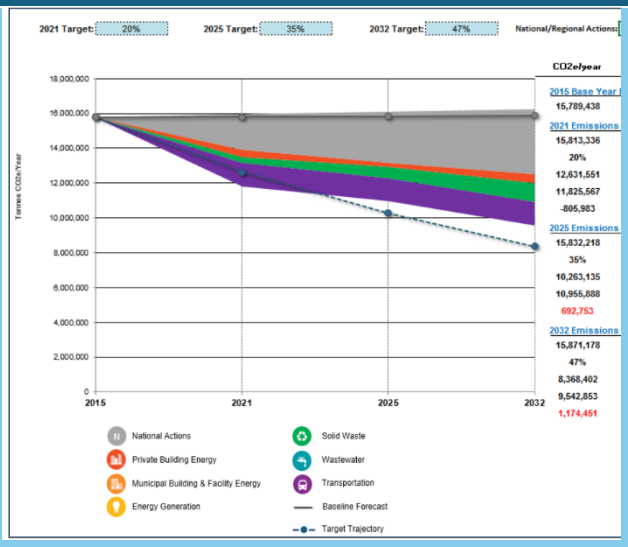
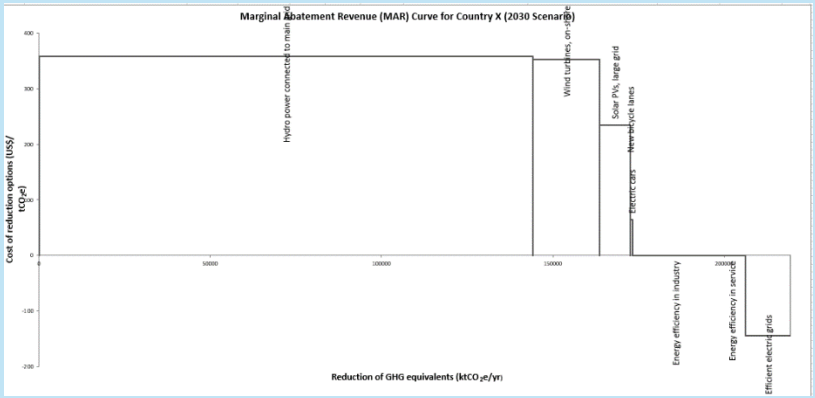
Tools	Input Data
CURB	[General inventory data] [City characteristics] [Population and Job growth rate] Population growth rates, average commuter growth rates, GDP growth rates [Commuter Activity Data] % Commuter activity per resident activity for each sector/subsector [Private Sector Building Data] Housing income data, housing types, electricity service saturation [Municipal Buildings and Public Lighting Data] Energy consumption by fuel type, streetlight data (consumption, avg. hours of operation), general public lighting data, traffic light data [Grid-supplied Electricity data] % of Generation mix by source, Grid emission factors [Solid Waste Generation and Management Data] Waste composition, total waste, waste types, wastewater management data, [Transportation data] Total trips, VKT, Distance, Fuel Type, Mode Shift, Efficiency Allows input from other transportation planning models [Energy Costs and other data] Electricity rates, fuel prices, $/kWh
EnergyPATHWAYS	[Demographic data] [Energy demand by subsector] [Demand scenarios & measures] [Road transport data]

Tools	Input Data
GACMO	Electricity Generation Data – generation and consumption data, grid emission factors, energy by fuel type Activity data on quantities and costs (eg. EVs) Transport data from energy balances by road, rail, domestic air, and navigation
GHG Protocol Tools: Mobile Combustion & Stationary Combustion	[Transport Activity data] - Fuel Use, Vehicle Distance, Passenger Distance, Weight Distance, Custom Fuel, Custom Vehicle, Vehicle Type, VKT, # of passengers, fuel type, fuel amount [Fuel combustion data]
GHGMI Mobile Source Data Pre-processing and Aggregation Tool	[Pre-processing tool] Weight, fuel type (gas or diesel only), Year, Vehicle Type, Count of aggregated vehicle types [Base tool] Vehicle weight, type, count, fuel type, catalyst type
GIZ TRIGGER	[Aviation] Fuel consumption, passenger/freight performance [Road] Vehicle stock, average VKT, Vehicle type, fuel type, emissions standard, vehicle size [Railways] Fuel consumption, VKT, transport performance [Maritime] Passenger volume, freight volume/weight, container volume, average trip length [Inland Shipping] Average engine power, stock, average operational hours, engine load factor, estimates [Top-Down mobile validation] Energy balance for fuel stock
GREET	[Fuels] Multiple in-depth metrics for fuel sourcing, including share of crude sources, petroleum refining efficiency, Ethanol blending, Biogas production, LPG/NG production, and electricity generation Fuel economy, basic car statistics. There are a lot of input parameters.

Tools	Input Data
LEAP	[Demographic and Macroeconomic data] [Electricity Generation Data] [Energy Balances] [Transport data] – Vehicle stock by type and fuel use, vehicle sales by type and fuel use, annual distance travelled, demand costs per type of vehicle, fuel economy, scrappage (fraction scrapped and value)
PROSPECTS+	[Energy Balances] [Electricity generation Data /Heat Generation] Electricity/heat generation by fuel type including renewables; emission intensity for each fuel type; electricity imports and exports; own use and losses; Fuel mix; percentage share of each use [GHG emissions for key sectors and captured with CCS] Emission intensities by fuel type [Activity Data] GHG emission factors; Per fuel [Transport] Energy demand (by mode) includes international aviation; electricity demand; fuel mix; %share of electrified transport [Building section for commercial and residential] Floor space; Electricity use for space cooling; Electricity use and; Direct energy use for water heating/space heating; Energy use for cooking/lighting /appliance; Fuel mix for direct energy use [Fuel Characteristics] Direct share fuel mix % (as identified in the various sectors)
RETScreen Expert	[Energy Model worksheet] - Location of the energy project, the type of system used in the base case, the technology for the proposed case, the loads (where applicable), and the renewable energy resource [Cost Analysis] - Initial, annual, and periodic costs for the proposed case system as well as credits for any base case costs that are avoided in the proposed case [Greenhouse Gas Analysis] - Base case technology and proposed technology energy data, transmission and distribution losses *CDM methodologies can be used for simplified analysis

Tools	Input Data
	[Financial Summary] - Financial parameters related to the avoided cost of energy, production credits, GHG emission reduction credits, incentives, inflation, discount rate, debt, and taxes
TraCAD	[GHG Impact Assessment] - Activity data is based on selected methodology but includes fuel type and consumption per vehicle, % share of type of vehicles, and kWh electricity for EVs. [Cost Module] - Emissions reduction attributed to mitigation action, cost-related data for mitigation action.
TRACE	[Activity Data] walking, cycling, light duty vehicles, two-wheel and three-wheel motored vehicles, buses, light rail, Large heavy-duty vehicles (HDV), HDV small- (the activity data is collected on the total person kilometre travelled by transport modes, vehicle types and fuel type) [Vehicle Occupancy Data] (person/vehicle)[Load Data] (tonne/vehicle) [Vehicle Distance Data] (vehicle/km) [Fuel Usage Data] time series for future fuel use projections, electricity, diesel, gasoline, compressed natural gas (CNG)/Liquified petroleum gas (LPG), (litres of diesel equivalent) [Other Mobile] road accidents (number of roads accidents), road types, congestion information (length of mixed roads, average no. lanes) [Other] population, Gross Domestic Product (GDP), income

Table 2: Typical data outputs for modelling tools

Tools	TYPICAL OUTPUTS
CURB	
GACMO	

Tools	TYPICAL OUTPUTS
GHG Protocol Tools (Mobile & Stationary Combustion)	

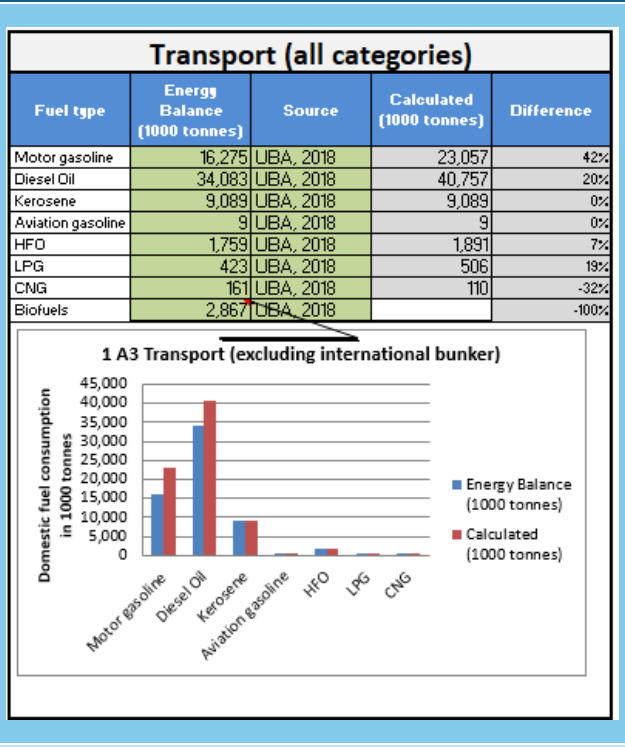
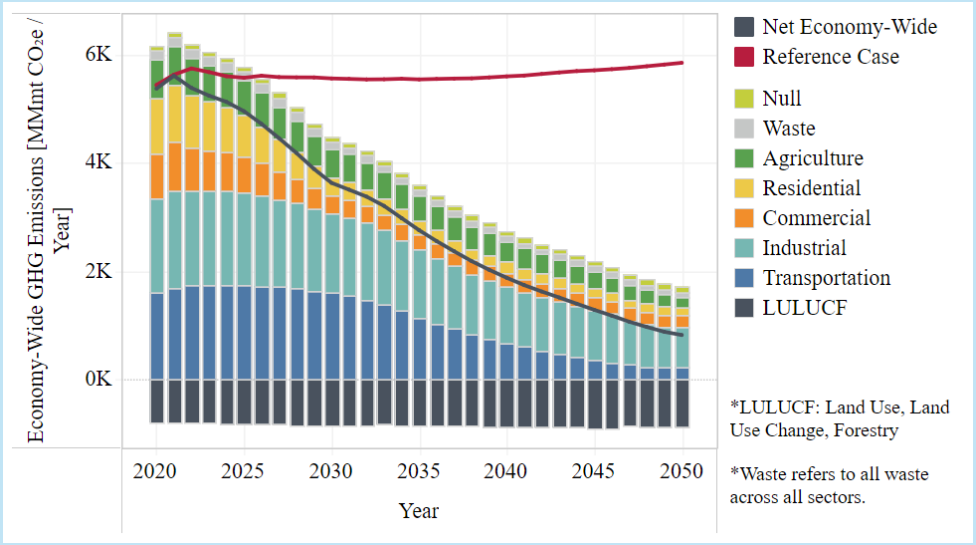
GREENHOUSE GAS PROTOCOL

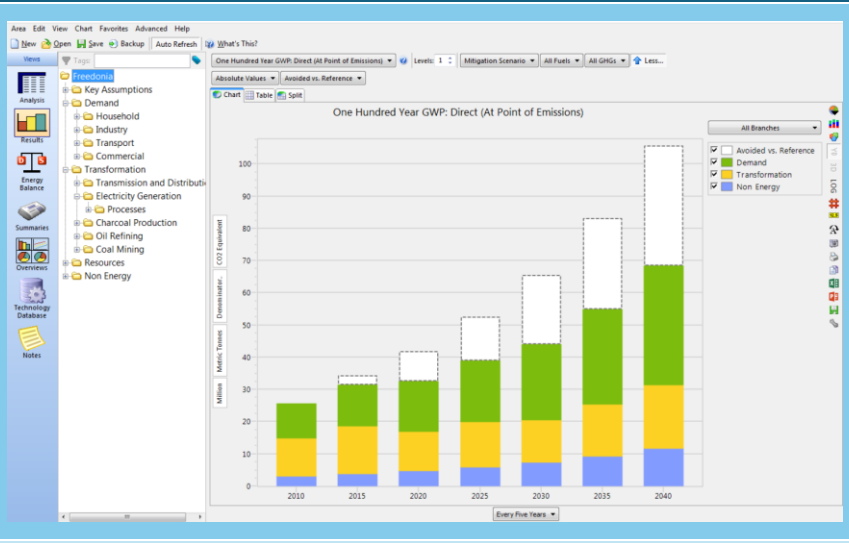
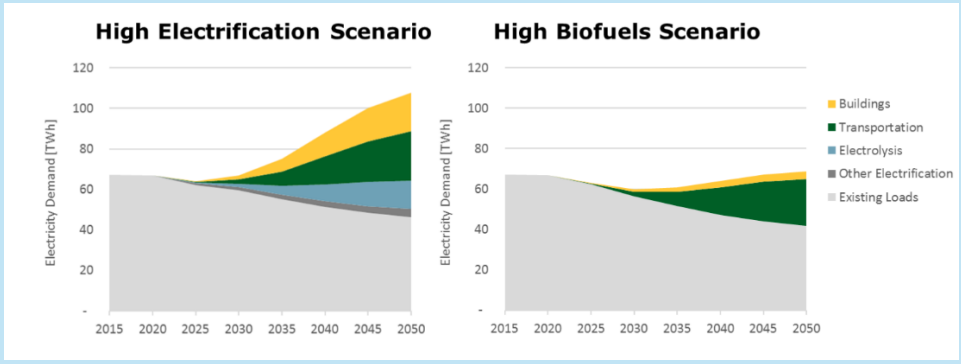
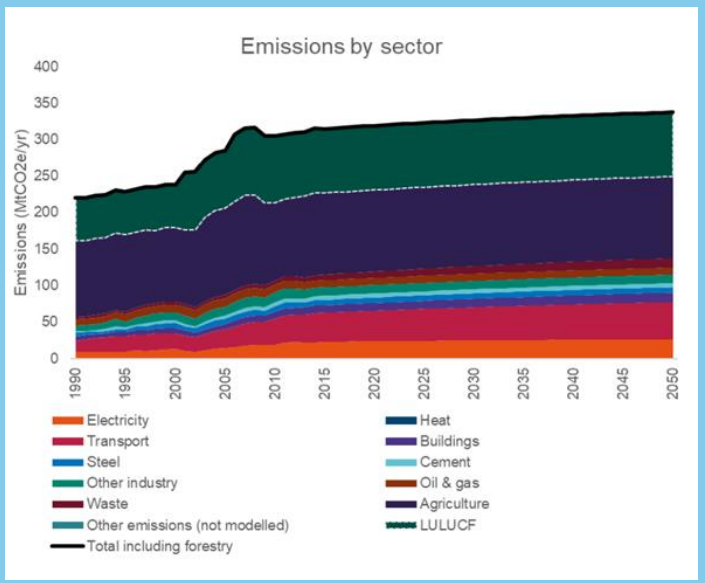
Summary: Emissions by Scope

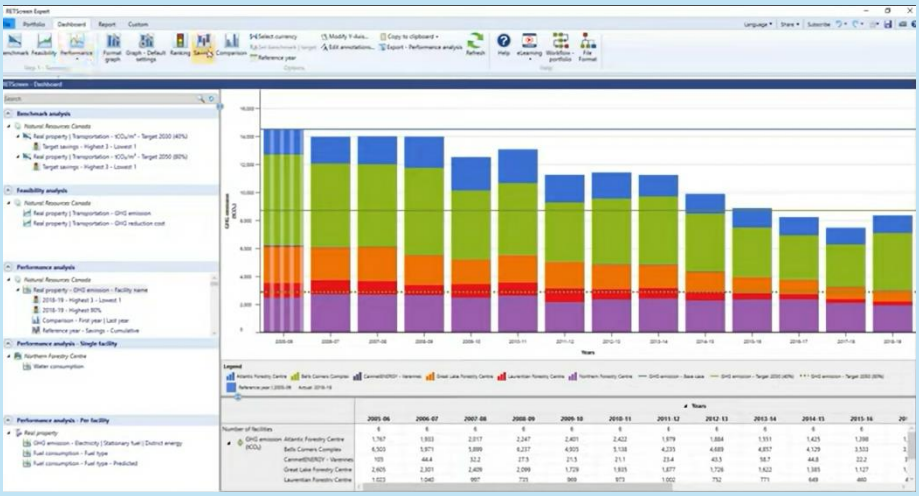
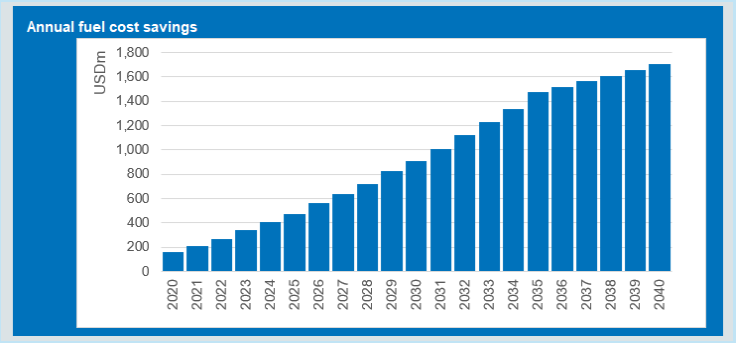
Calculation Method	Greenhouse gas	Fossil Fuel Emissions		Biofuel CO2 Emission (metric tonnes)
		Scope 1 (metric tonnes)	Scope 3 (metric tonnes)	
Fuel Use	CO2	0	0	0
	CH4	0	0	
	N2O	0	0	
Distance	CO2	0	0	0
	CH4	0	0	
	N2O	0	0	
Total (metric tonnes CO2e)		0	0	0

GHGMI Mobile Source Data Pre-processing and Aggregation Tool

2016	Consumption	EMISSIONS			EMISSIONS		
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	(T.J)	(mt)			(mt CO2e)		
b. Road transportation[11]	1226.92	88334	7.18	6.89	88334	213.94	1882.09
Gasoline	970.11	69044	6.16	5.88	69044	183.69	1604.92
Diesel oil	256.80	19290	1.02	1.02	19290	30.26	277.17
i. Cars	531.68	38055	3.19	2.99	38055	95.02	815.62
Gasoline	420.09	29636	2.75	2.54	29636	81.82	694.65
Diesel oil	111.58	8419	0.44	0.44	8419	13.21	120.97
ii. Light duty trucks	196.67	14203	1.05	1.05	14203	31.24	286.63
Gasoline	132.16	9334	0.79	0.79	9334	23.60	216.66
Diesel oil	64.51	4869	0.26	0.26	4869	7.64	69.97
iii. Heavy duty trucks and buses	464.43	33446	2.65	2.63	33446	78.95	719.06
Gasoline	384.60	27486	2.34	2.32	27486	69.60	633.42
Diesel oil	79.82	5961	0.31	0.31	5961	9.35	85.64
iv. Motorcycles	7.38	588	0.07	0.05	588	2.17	13.66
Gasoline	7.12	578	0.07	0.05	578	2.16	13.51
Diesel oil	0.26	10	0.00	0.00	10	0.02	0.15
v. Offroad Vehicles	26.76	2042	0.22	0.17	2042	6.56	47.12
Gasoline	26.14	2012	0.22	0.17	2012	6.51	46.69
Diesel oil	0.63	30	0.00	0.00	30	0.05	0.44

Tools	TYPICAL OUTPUTS
GIZ TriGGER	
GREET	

Tools	TYPICAL OUTPUTS
LEAP	
EnergyPATHWAYS	
PROSPECTS+	

Tools	TYPICAL OUTPUTS
RETScreen Expert	
TraCAD	
TRACE	

4 Scope Requirements Overview

This ICAT project like many others is country-driven, and therefore stakeholder input and feedback are essential in defining the scope and tools for this project. The St. Kitts & Nevis ICAT projected team consulted first with stakeholders during the inception workshop to identify key aspects for the scope of the project including preliminary selection criteria for the modelling tools. Stakeholders were again consulted during the Modelling Tools Selection workshop to obtain feedback on the assessments conducted of the various tools and to facilitate the decision-making process for the appropriate modelling tool selection. Effective engagement of stakeholders in the ICAT project process encourages stakeholder ownership of the process and activities and ensures better collaboration for data needs and project integration. Feedback during both workshops was obtained from stakeholders using various methods including the use of the Mentimeter platform, an interactive, online tool which can be used for live surveys.

A summary of the feedback obtained from stakeholders is outlined below. A more detailed analysis can be found in the Appendix.

Inception Workshop - During this initial workshop the stakeholders agreed to the following:

- The project's most important sustainable development impacts to assess should be resilience to **extreme weather events, economic and social impact, as well as impact on energy demand**.
- The most important timeframe to analyse should be **through 2030**, and the impact should be analysed **annually**.
- Stakeholders agreed that the main priority sectors for analysis should be the **energy and transport sectors**.
- The project's priority areas within the energy and transport sectors should be **energy security/energy independence and building resilience**.

Stakeholders also identified key policies which should be reviewed and additional stakeholders who should be consulted to further inform the analysis. In addition, they noted the major barriers to the adoption of renewable energy and EVs in SKN.

A full list of the guiding questions used, and results obtained during the two workshops can be found in ***Appendix; 1 – Mentimeter Results (Inception Workshop) & 2 - Mentimeter Results (Modelling Tools Selection Workshop).***

5 Comparison of tools based on the scope of requirements

The project workplan, along with the SKN NDCs were assessed and in consultation with the stakeholders during the Inception workshop and the SKN ICAT project team, the following criteria were developed to analyse the modelling tools selected:

- Ability to assess GHG emissions for electricity generation
- Ability to assess the level of energy independence/renewable energy penetration
- Ability assess GHG emissions of the transport sector
- Ability to assess electric vehicle impact in the transport sector
- Ability to undertake GHG projections
- Ability to assess interdependency of electricity generation and transport or impact on energy demand
- Ability to conduct Mitigation Cost Assessment (Economic impact)
- Ability to conduct Social Impact Assessment
- Ease of Access of tool for SKN
- Ability to provide annual results
- Ability to provide results in graphical and tabular format
- Ability to evaluate resilience to extreme weather events
- Data Requirement Intensity

Stakeholders were further engaged during the Modelling Tool Selection Workshop to guide the overall tool selection process. The twelve (12) tools analysed with short descriptions and overview of data requirements were presented to stakeholders. The list of tools was then further shortened to include six (6) tools which met most of the criteria previously established. Stakeholders then provided feedback on the list of tools and the criteria that should be prioritized during the analysis as well as their initial reactions toward the most suitable tools for the analysis based on the information provided and the criteria. The following outlines some of the stakeholder feedback obtained (see ***2 - Mentimeter Results (Modelling Tools Selection Workshop)***for more details):

- Stakeholders considered **GHG projections assessment capacity, ease of access and ability to assess the transport sector and electricity generation sector impact** as the most important criteria for the analysis.
- Stakeholders ranked **LEAP & TraCAD** as the top two tools, among the tools presented and equally indicated their interest in undertaking training in both tools.
- Most stakeholders indicated their desire to undertake training in **two tools**.

Table 4, below, presents a comparison of the top ranking modelling tools based on the criteria above.

It should be noted, that although analysis of resilience to weather systems was voted the most important sustainable development impact to SKN, none of the tools considered were able to perform a detailed analysis of this sustainable development impact. Therefore this sustainable development impact will be analysed through a qualitative analysis in the project and not through the use of the modelling tools.

Table 3: Assessment of the 12 Modelling Tools Based on Criteria

Criteria/Tools	CURB	GACMO	GHG Protocol Transport/Stationary Combustion	GHGMI Mobile Source Data Tool	GIZ Trigger	GREET	LEAP	Energy PATHWAYS	PROSPECTS+	RETSCREEN	TraCAD	TRACE
1. Can Assess GHG Emissions for Electricity Generation	YES	YES	NO	NO	NO	YES	YES	YES	YES	YES	NO	NO
2. Can Assess the level of Energy Independence/Renewable Energy Penetration	NO	NO	NO	NO	NO		YES	YES	YES	NO	NO	NO
3. Can Assess GHG Emissions of the Transport Sector	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES
4. Ability to assess electric vehicle impact	YES	YES	NO	NO	NO	NO	YES	YES	YES	NO	YES	Not explicit
5. Ability to undertake GHG projections	YES	YES	NO	NO	NO	YES	YES	YES	YES	YES	YES	NO
6. Can assess interdependency of electricity generation and transport or Impact on Energy Demand	YES	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
7. Mitigation Cost Assessment (Economic impact)	YES	YES	NO	NO	NO	YES	YES	YES	YES	YES	YES	Fuel savings

Criteria/Tools	CURB	GACMO	GHG Protocol Transport/Stationary Combustion	GHGMI Mobile Source Data Tool	GIZ Trigger	GREET	LEAP	Energy PATHWAYS	PROSPECTS+	RETSCREEN	TraCAD	TRACE
8. Social Impact	NO	NO	NO	NO	NO	NO	YES (Cost)					
9. Ease of Access of tool SKN	YES	YES	YES	YES	YES	YES	YES	Partial	YES		YES	YES
10. Ability to provide annual results	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
11. Ability to provide results in graphical and tabular format	YES	YES	NO	NO	YES		YES	YES	YES	YES	YES	YES
12. Resilience to extreme weather events	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
13. Data Requirement Intensity	High	Low	Low	Low	Low	Medium	Low/ medium/ high	Medium	Medium	Low	Low	Low
14. Other issues	Specific to cities	Requires energy balance					Energy balance is preferred	Suited for long-term analysis and requires Python programming	Energy balance is preferred			
No. of criteria met	**8**	**7**	**3**	**3**	**4**	**6**	**11**	**9**	**9**	**5**	**7**	**4**

Table 4: Assessment of top (6) ranking tools based on criteria

	Criteria/Tools	CURB	GACMO	LEAP	PATHWAYS	PROSPECTS+	TraCAD
1	Can Assess GHG Emissions for Electricity Generation	YES	YES	YES	YES	YES	
2	Can Assess the level of Energy Independence/Renewable Energy Penetration			YES	YES	YES	
3	Can Assess GHG Emissions of the Transport Sector	YES	YES	YES	YES	YES	YES
4	Ability to assess electric vehicle impact	YES	YES	YES	YES	YES	YES
5	Ability to undertake GHG projections	YES	YES	YES	YES	YES	YES
6	Can assess interdependency of electricity generation and transport or Impact on Energy Demand	YES		YES	YES		
7	Mitigation Cost Assessment (Economic impact)	YES	YES	YES	YES	YES	YES
8	Social Impact			YES (Cost)			
9	Ease of Access of tool SKN	YES	YES	YES	Partial	YES	YES
10	Ability to provide annual results			YES	YES	YES	YES
11	Ability to provide results in graphical and tabular format	YES	YES	YES	YES	YES	YES
12	Resilience to extreme weather events						
13	Data Requirement Intensity	High	Low	Low/ medium/ high	Medium	Medium	Low
	Other issues	Specific to cities	Requires energy balance	Energy balance is preferred	Suited for long-term analysis and requires Python programming	Energy balance is preferred	
	No. of criteria met	**8**	**7**	**11**	**9**	**9**	**7**

6 Selection of Modelling Tools

As a result of the stakeholder feedback, the assessment of the tools against the criteria elaborated in **Sections 4 and 5**, expert judgement, and in consultation with the complete SKN ICAT project team, the Low Emission Analysis Platform (LEAP) and the Transport Climate Action Data Tool (TraCAD) were selected as the modelling tools for this project.

As highlighted in ***Table 4*** above, LEAP and TraCAD were among the top 6 tools considered, which met a higher percentage compared to others of the established criteria. A total of 13 criteria were considered, 12 of which were determined through a yes/no system which was tallied.

LEAP was able to meet 11 of the 12 criteria (labelled "yes" or "no" in ***Table 4***) including the criteria, which represents ~ 92% of the criteria. In addition, it was found that LEAP had varying data intensity, however, requires a minimum amount of input data to conduct analysis. LEAP has been used previously in SKN for their mitigation analysis in their Biennial Update Reports (BUR) and their Third National Communications (TNC). The stakeholders in SKN have received previous training in LEAP and the tool is also being used in the electricity generation sector to undertake other assessments for energy planning.

In comparison, TraCAD met 7 of the 12 weighted criteria, which represents ~ 58%. TraCAD was also found to have low data intensity. Some members of the SKN ICAT team have received training in TraCAD and will be able to support the development of the model. The following list represents the 7 criteria which TraCAD met:

- Can Assess GHG Emissions of the Transport Sector
- Ability to assess electric vehicle impact
- Ability to undertake GHG projections
- Mitigation Cost Assessment (Economic impact)
- Ease of Access of tool SKN
- Ability to provide annual results
- Ability to provide results in graphical and tabular format
- Data Requirement Intensity

Although there were other tools which met a higher number of criteria compared to TraCAD, the stakeholders when presented with some of the other issues faced by these tools, prioritised the use of TraCAD for this project. The issues faced by the other tools are highlighted in ***Table 4*** and further explained below:

CURB: Has a high data intensity requirement, and was developed for usage in cities.

GACMO: Requires, like other tools a completed energy balance and inventory for the same year, and is only able to provide results for 2025,2030 and 2050 currently. These input requirements have a high data intensity which is not ideal in this context.

EnergyPATHWAYS: Requires Python programming knowledge and software, which is sometimes considered a complex programming language.

PROSPECTS+: Has a medium to high data requirement intensity and also requires a completed energy balance.

It is important to note that high data intensity requirements in modeling tools can introduce various practical obstacles and overheads, making them less convenient to use compared to tools with lower data intensity demands. Where data availability, accessability, and accuracy are in question, less data intensive data tools are recommended.

Based on the criteria presented, analysis of specific applicability and usage requirements, as well as feedback from stakeholders, the **LEAP** and **TraCAD** tools were found to be the most ideal tools for this component of the SKN ICAT project.

7 Conclusion

The modelling tools were chosen based on desk reviews, consultations with key public and private sector stakeholders and expert judgment. The **LEAP** and **TraCAD** tools were selected among the highest-ranked tools based on the criteria developed, as well as stakeholder feedback. The main tool to be used throughout the analysis is LEAP, given its ability to effectively cover both the energy and transport sectors. TraCAD will then be used for a more detailed look into the transport sector and comparison purposes. Training on both tools will be conducted within the second quarter of 2024.

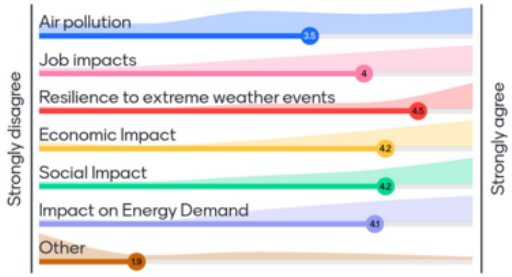
8 Appendix

8.1 1 – Mentimeter Results (Inception Workshop)

Priorities based on Stakeholder feedback

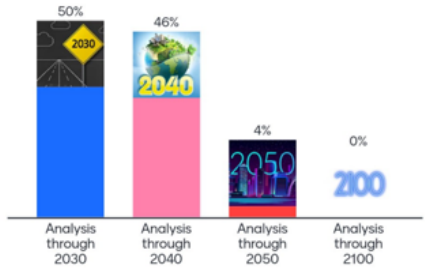
Sustainable Development Impact Prioritisation

1 Resilience to extreme weather events
2 Economic impact
2 Social impact
3 Impact on energy demand
4 Job impacts



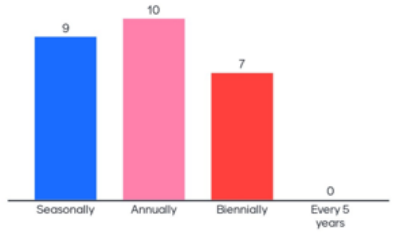
Time frame for analysis

1 up to 2030
2 Up to 2040
3 Up to 2050



Impact Years

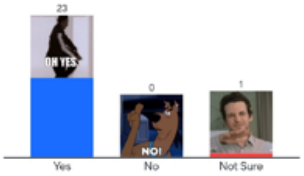
1 Annually
2 Seasonally
3 Biennially



Main Focus

1 Energy Sector
2 Transport Sector

The main focus of the project is the energy and transport sectors, do you these represent the priority sectors for St. Kitts and Nevis



Priority Area

1 Energy security/Energy independence
2 Building resilience
3 Achieving NDC Targets
4 Economic Analysis
5 Social Impact Assessments
6 Reducing air/non-GHG pollution
7 Tracking Implementation of NDC Targets

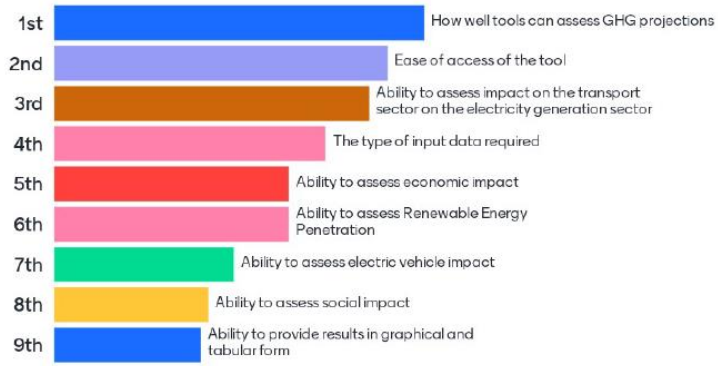
Other policies to be considered (not prioritised)

1 National Energy policy
2 Guidelines & policies related to vehicle purchases
3 Building code policy
4 Infrastructure and energy policies
5 Government subsidies for importation of Evs
6 National Development planning framework
7 Views of marginalized groups
8 Traffic facilities and maintenance policies

8.2 2 - Mentimeter Results (Modelling Tools Selection Workshop)

Mentimeter

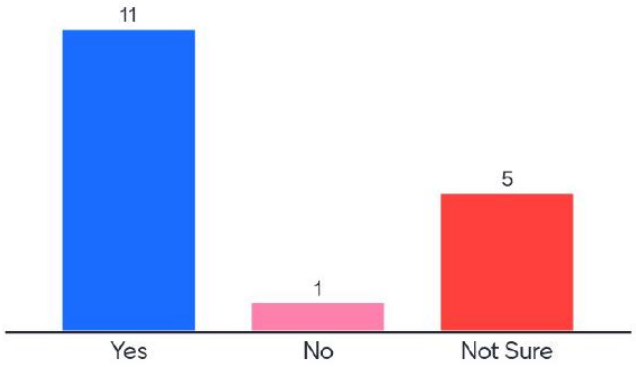
The criteria for tool selection was presented at the beginning. How would you rank the criteria in order of importance?



7 15

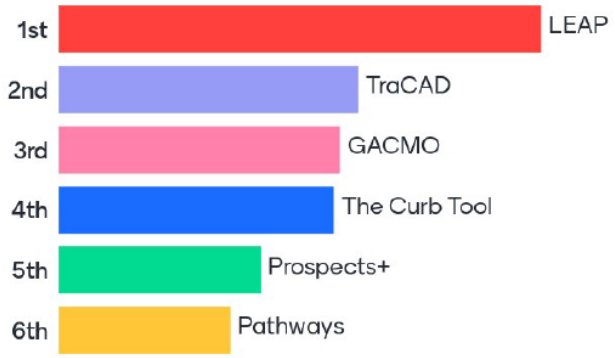
Mentimeter

Do you think that enough information has been presented to justify the selection of the most suitable tool?



Mentimeter

How would you rank the six (6) tools which met the criteria based on the information provided?



1 16

ICAT Initiative for Climate Action Transparency

Caribbean Cooperative MRV HUB Measurement Reporting & Verification

ghg management institute

Mentimeter

Which tool are you most interested in learning or undertaking training in?

16

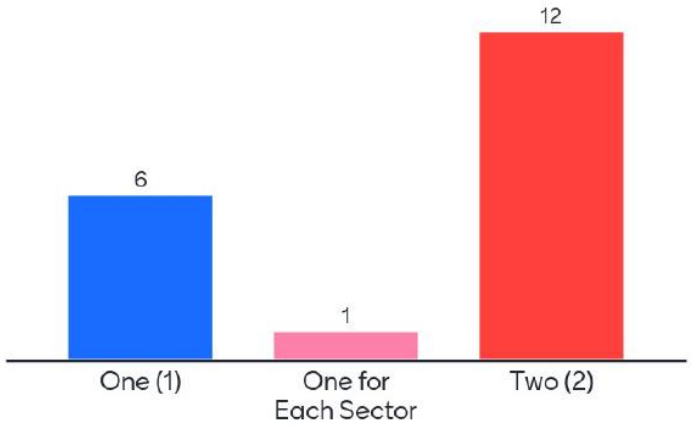
ICAT Initiative for Climate Action Transparency

Caribbean Cooperative MRV HUB Measurement Reporting & Verification

ghg management institute

Mentimeter

Six (6) tools were presented, noting the aim of ICAT is to build capacity, how many tools do you think should be analysed in this project?



3 19

9 Annex

1. Inception Meeting Report
2. Modelling Selection Tool Meeting Report