





PROJECTION & MITIGATION TOOLS TRAINING WORKSHOP REPORT

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Executive summary

The Country Work Plan of the ICAT project in Uganda focuses on sustainably enhancing the GHG emission inventory, projections, and mitigation analysis modelling capability for the Transport and Waste sectors to enhance Uganda's ability to track the NDC actions in these two sectors. The Ministry of Water and Environment (MWE), with the support of the Greenhouse Gas Management Institute (GHGMI), organised a series of training activities on projections, and mitigation analysis modelling as one of the project planned activities in the work plan.

The training was aimed at building capacity within CCD (Climate Change Division, MWE), and amongst national experts and sectoral working groups to apply the selected models, namely the Greenhouse Gas Abatement Cost Model (GACMO) and Low Emissions Analysis Platform (LEAP), for projecting emissions and estimating mitigation actions and policy impacts. The training was conducted using a series of virtual sessions to basically introduce the tools to experts and a two days in-person training to enhance the knowledge and skills to use the selected tools. The participants from the waste and transport sector were able to attain basic skills and knowledge to conduct projections and mitigation analysis. However, more training sessions to enhance the skills further is required.





1 Introduction

The Country Work Plan of the ICAT project in Uganda focuses on sustainably enhancing the GHG emission inventory, projections, and mitigation analysis modelling capability for the Transport and Waste sectors to improve Uganda's ability to track the NDC actions in these two sectors. Key stakeholders will be capacitated to successfully apply good practice and relevant tools to integrate transparency on climate policies and actions within evidence-based policymaking, assessing the sustainable development impacts of climate plans, actions, policies, and measures.

The ICAT Uganda project (titled: "*Expansion of the National GHG Inventory Management System and Operationalization of NDC Tracking Framework*") focuses on the Transport and Waste sectors, and includes the following activities:

- 1) Strengthen sector working groups' capacity to manage sector GHG inventories for the Transport and Waste sectors
- 2) Strengthen sector working groups' capacity to conduct baseline emission and mitigation projections
- 3) Support data collection and processing to prepare GHG baseline and mitigation projections
- 4) Develop of an NDC tracking framework for the Transport and Waste policies and measures set out in Uganda's NDC
- 5) Implement NDC tracking and monitoring framework at a national and local government level

² Objectives of the tool training

The training was aimed at building capacity within the CCD, and amongst national experts and sectoral working groups to apply the selected models, namely $GACMO^1$ and $LEAP^2$, for projecting emissions and estimating mitigation actions and policy impacts.

³ Training workshop approach and agenda

The projection tool training adopted a hybrid approach with part of the training (five sessions) being completed virtually (Table 1), followed by a 2 day physical training session in Uganda (Table 2 and Table 3).

¹ Developed by UNEP-CCC

² Developed by Stockholm Environment Institute (SEI)





Date	Day	Time (EAT)	Format	Training session	Responsible person
5 th March	Tue	12:00 – 13:30	Virtual	 Introduction to and walkthrough of the GACMO tool Setting up the start year data Homework exercises on assumptions, energy balance and GHG balance sheets 	Luanne Stevens
7 th March	Thu	12:00 – 13:30	Virtual	 Run through of previous homework Setting up the BAU baseline BAU results Introduction to mitigation scenarios Homework to consider possible mitigation options for transport and waste. 	Luanne Stevens
13 th March	Wed	12:00 – 13:30	Virtual	 Run through previous homework & data requirements Setting up the mitigation scenarios for transport and waste How to interpret the results? Tracking progress 	Mike Bess
15 th March	Fri	12:00 – 14:00	Virtual	 Introduction to the LEAP model and its various components Introduction to various terms and expressions Homework on setting up a tree structure and developing expressions 	Luanne Stevens

Table 1: Agenda for virtual training series

Table 2: In-person training day 1 (Wednesday 20th March) agenda





Time (EAT)	Activity	Responsible person
09:00 - 09:30	Registration	CCD
09:30 - 09:40	Introductions	CCD
09:40 - 09:50	Welcome remarks	CCD
09:50 - 10:15	Revision of GACMO	GHGMI
10:15 - 11:00	Presentation and discussion of GACMO transport homework from virtual sessions	A11
11:00 - 11:20	Tea/Coffee break	
11:00 - 11:45	Presentation and discussion of GACMO waste homework from virtual sessions	A11
11:45 - 12:00	Final GACMO QA/QC session	GHGMI
12:00 - 12:15	Re-organise participants into groups and ensure all have access to LEAP	A11
12:15 - 13:00	Hands-on introduction to LEAP (SEI Ex 1 – Settings, Demand, Transformation, Emissions)	GHGMI
13:00 - 14:00	Lunch	
14:00 - 15:30	Hands-on introduction to LEAP (SEI Ex $1/Ex 2$)	GHGMI
15:30 - 15:50	Tea/coffee	
15:50 - 16:30	Hands-on introduction to LEAP (SEI Ex 2)	GHGMI
17:00	Close of Day 1	





Time (EAT)	Activity	Responsible person
08:30 - 09:00	Registration	CCD
09:00 - 09:05	Recap of previous day and activities for the day	CCD
09:05 – 10:30	Hands-on example of incorporating more detailed transport data	GHGMI
10:30 - 11:00	Hands-on example to incorporating emissions from non-energy sources	GHGMI
11:00 - 11:20	Tea/coffee break	
11:20 - 12:00	Continuation of incorporation of non-energy emissions	GHGMI
12:00 - 13:00	Waste sector projections (with spreadsheets and LEAP)	GHGMI
13:00 - 14:00	Lunch	
14:00 - 15:30	Continuation of Waste sector hands-on exercises	All
15:30 - 15:50	Tea/coffee break	
15:50 – 16:30	Open discussion on way forward (including discussion on further support needs).	All
16:30 - 16:40	Way forward	GHGMI/CCD
16:40	Close of workshop	CCD

4 Virtual training session activities

4.1 Training on GACMO (Day 1)

The Virtual training was facilitated by Dr. Luanne Stevens and Mr. Mike Bess of GHGMI.

Participants were sent the GACMO tool and additional materials ahead of time. This was useful for participants to install GACMO on their computers for the virtual training sessions. This was followed by introductions to the tool, demonstration, and follow-up exercises which were in the form of homework.

During the introductory session of the tool, Dr. Stevens informed the





participants about the expectations of the training session for Day 1 as;

- Understand what the GACMO tool is about and what it can do
- Understand the functionality of the GACMO tool
- Know what data are required to develop the BAU scenario
- How to input energy balance and GHG inventory data

In her introduction, the trainer informed participants that the GACMO tool stands for Greenhouse Gas Abatement Cost MOdel which was developed by UNEP CCC. The tool is an Excel-based tool developed following the IPCC and CDM methodologies and guidelines.

The tool is open access, hence it can be used by any interested stakeholder to:

- conduct GHG emissions projections for Business as Usual (BAU) scenario for 2025, 2030, 2035 and 2050.
- analyse Mitigation scenario as % reduction in the GHG emissions compared to the BAU in 2025, 2030, 2035 and 2050.
- determined expected and achieved emissions reduction (annual, cumulative) from specific mitigation options.
- estimate GHG reduction and the cost for each mitigation option compared to the technology used in the baseline.
- Obtain an overview of the total mitigation effort: on GHG reduction, total investment, and total annual cost.
- GACMO, therefore, enables countries to:
 - carry out rapid, but accurate, evaluations of how several mitigation options impact their countries' GHG emissions.
 - track progress towards emission reduction targets.
 - select from 119 mitigation options based on economic, financial, and social benefits.
 - develop a framework for national or sub-national investments in mitigation options.
 - prepare for:
 - National communications (NCs)





- Biennial update reports (BURs)
- Biennial transparency reports (BTRs)
- Long-term Strategies
- Nationally Determined Contributions (NDCs)
- Net Zero Carbon Scenarios

The trainer also presented the data requirements for the GACMO tool as:

- GHG emissions inventory by sectors (latest available year)
- Energy Balance (same year as GHG emissions inventory year)
- Emission factors by fuels for fuel combustion sectors (if national emission factors are available)
- Growth rates of energy consumption by sectors (annual % change up to 2025, 2030, 2035 and 2050)
- Mitigation actions by 2025, 2030, 2035, 2050. Examples of mitigation actions include installed capacity of renewable energy sources (solar, PV, wind, hydro), area covered by reforestation (hectares), etc.
- Technical and economical parameters of the technology/mitigation options (new technology and baseline technology)
- Key assumptions (e.g. grid emission factor, energy prices, etc.)

Dr Stevens then took participants through the GACMO step-by-step guide as shown in Figure 1.







Figure 1: Step-by-step guidance for the GACMO tool.

An exercise was given to participants at the end of the session to equip the trainees with skills and knowledge on how to enter data for a BAU (Business-As-Usual) scenario and to understand how to navigate the GACMO tool. Participants were provided with the information in Table 4 along with energy balance data for 2015. Participants were to use this information to complete steps 1-4 as shown in Figure 1.

Day 1 homework exercise			
General information			
Start year	2015		
Exchange rate	3300		
Discount rate	7		
Crude oil price	62	US\$/bbl	
LNG price	2.8	US\$/MBTU	
Coal price	58	US\$/ton	
GWP	SAR		

Table 4: Data provided for homework exercise on day 1.





Population	36.48	Million		
GDP	32.39	Billion USD		
Electricity consumption				
Non-metallic minerals	30%	of industry		
Food processing & beverages	25%	of industry		
Construction	20%	of industry		
Non-ferrous metals	15%	of industry		
Textile and leather	10%	of industry		
Growth rates				
	2015-2025	2025-2030	2030-2035	2030-2050
	2010 2020	1010 1000		
Population growth	3.1	3.2	3.3	3.5
Population growth GDP growth	3.1 5.3	3.2 5.4	3.3 5.6	3.5 5.7
Population growth GDP growth Industry energy growth	3.1 5.3 5	3.2 5.4 5	3.3 5.6 5	3.5 5.7 5
Population growth GDP growth Industry energy growth Transport energy growth	3.1 5.3 5 6	3.2 5.4 5 7	3.3 5.6 5 9	3.5 5.7 5 10
Population growth GDP growth Industry energy growth Transport energy growth Household energy growth	3.1 5.3 6 3.1	3.2 5.4 5 7 3.2	3.3 5.6 5 9 3.3	3.5 5.7 5 10 3.5
Population growth GDP growth Industry energy growth Transport energy growth Household energy growth Service sector energy growth	3.1 5.3 6 3.1 6	3.2 5.4 5 7 3.2 7	3.3 5.6 5 9 3.3 9	3.5 5.7 5 10 3.5 10
Population growth GDP growth Industry energy growth Transport energy growth Household energy growth Service sector energy growth Agriculture energy/emission	3.1 5.3 5 6 3.1 6	3.2 5.4 5 7 3.2 7 3.2 7	3.3 5.6 5 9 3.3 9	3.5 5.7 5 10 3.5 10 3.5
Population growth GDP growth Industry energy growth Transport energy growth Household energy growth Service sector energy growth Agriculture energy/emission growth	3.1 5.3 6 3.1 6 3.1 6 3.1	3.2 5.4 5 7 3.2 7 3.2 7 3.2	3.3 5.6 5 9 3.3 9 3.3	3.5 5.7 5 10 3.5 10 3.5

4.2 Training on GACMO (Day 2)

At the end of this training session participants were expected to:

- be able to interpret the BAU outputs from GACMO.
- understand the various mitigation options in GACMO.
- know how to incorporate country-specific information into the various mitigation options with a focus on transport and waste.
- know how to set up the mitigation scenarios.

Before diving into the day two content, the trainer took the participants through the homework exercise for day one to solve the challenges that participants faced. This was done by going through each of the steps (or tabs) in the GACMO tool one-by-one (Figure 2).





Let's look at the homework

 Any challenges with the Assumptions tab?

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	ten 1 - Assumptions													
	tep 2 resumptions													
1	Basic country information		_	1	The Assess	etions sheet inc	which will then	hasic country yes	t and tack	in al data t	but the GAC	And the CRA	as ineeds i	of the
	Base country mormation				calculation	L.	COAST BILLING	case county, cos	it, and the		THE ON CAL	The first internal	as ripers	2.114
	Soundry:	Country X	-		This sheet	must be filled in	by the aper.							
	Start year (latest inventory):	2015												
	Currency:	Currency Y			All the cells	in the eight tab	es displayed	I on the sheet mus	t be consid	ered by the	user. Some	o of these cells	rusy alread	ty include
1	Exchange rate used (1USS=):	4			OPERAT VALUE	es for serve cas	Dut son the	e can adjast trose	VALUES IT IS	DOLN CRU	es are availa	are.		
	Discount rate =	7.0%	-		Please role	r to the Guidanc	o for further d	fetails on the data	included in	this sheet	and en how!	to fill it in.		
	AUDOCHTALIEUR -	1.5476	-											
					Once all the	a data have been	inserted in t	the Assumptions s	heet, you o	an click "S	ie to step 2:	Energy balance	6	
	ergy prices used for the entire future period:													
C1	ude oil	50.	USS/bbl											
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		LPG	Gasoline	Biochanol	Jet Fuel	Diesel eil	Biodiesel	Heavy Fuel Oil	Kerusene	Coel	Cake	coke	Ligwie	Gat
D	stillate price/crude oil price [litre/litre]	0.90	1.40		1.40	1.20		0.80	1.40					
P.	el price (US\$/Titer)	0.28	0.44	0.8	0.44	0.88	12	0.25	0.44					_
	et er ce (USS/GD	11.1	181	0.74	12.8	10.4		8,4	12.3	2.0	1.0	1.0		31
	el calectile value (CIN)	47.5	44.8	26.8	44.6	43.3	26.8	40.2	44.8	25.0	28.0	31.0	18.5	33.0
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Figure 2: Example of the Assumptions tab for the homework from day 1.

Dr Stevens then moved onto the training for Day 2, which covered the following aspects:

- reading and interpreting BAU results
- looking at the mitigation actions and learning how to incorporate them into the mitigation scenarios
- understanding the technical data relating to the mitigation actions
- understanding the results sheet
- understanding the MAR (Marginal Abatement Revenue) curves

At the end of the session participants were given homework to conduct BAU and mitigation scenario analysis (Figure 3).



View the technical name related to this action and list the types of





Homework

Figure 3: Homework for Day 2 of GACMO training.

- Enter a value for penetration next to the selected mitigation action in the Mitigation Options tab in column I
- · Go to the Results tab and see what impact this had
- Now you can change the penetration values in the different years and see the impact

4.3 Training on GACMO (Day 3)

Day 3 was a shorter session where the trainer, Mr Bess, started by summarising what was done in the first two days. This was followed by a more detailed look at the various transport and waste mitigation options and looked at the costs and benefits of top-rated options determined from the MAR curves.

The trainer then had a question-and-answer session in which participants could raise any queries or challenges they had during the 3 day virtual training session.

4.4 Training on LEAP (Day 1)

There was a one day virtual training session on LEAP which was an introductory information sessions that presented the basics of the LEAP tool.

Dr Stevens introduced the LEAP tool and explained that the tool was developed by SEI. She acknowledged SEI and indicated that much of the materials were obtained from the SEI website and pointed participants to the supporting materials and training videos provided by SEI. Dr Stevens explained that LEAP was a tool for creating models. The tool was developed by SEI to support sustainable development, inform decisions, and empower stakeholders to perform their analyses. LEAP is capable of conducting quantitative modelling for energy systems, pollutant emissions from energy and non-energy sources, costs and benefits, health impacts, and sustainable development indicators and is well suited for medium and long-term





planning.

She explained to the participants the basic LEAP structure (Figure 4), the typical inputs required by the tool (Figure 5). Some of the typical outputs were also described (Figure 6).



Figure 4: Basic LEAP structure.³

Typical inputs

- Demographic and macroeconomic data and projections
- · Energy balances, surveys, and audits
- GHG inventories
 - Activity data
 - Emission factors
 - Emission totals
- Grid operator reports
- · Equipment stock, sales, and performance data
- Natural resource reserves and potentials
- · Plans and policies
 - Climate
 - Energy
 - Air pollution
- Costs
 - · Equipment capital, operation and maintenance
 - Fuel and other consumablesPolicy implementation

³ Information from SEI LEAP presentation given by Charles Heaps.





Figure 5: Typical inputs for the LEAP tool.⁴



Figure 6: Typical outputs of the LEAP tool.⁵

Dr Stevens also presented the LEAP user interface and explained how to interpret and formulate the demand analysis tree (Figure 7).

LEAP Information SEI presentation sourced from at https://weadapt.org/knowledge-base/climate-resilient-development/introductory-low-emissions-analysis-platform-leap-training-course-2021/ Information SEI LEAP sourced from presentation at https://weadapt.org/knowledge-base/climate-resilient-development/introductory-low-emissions-analysis-platform-leap-training-course-2021/







Figure 7: Interpreting and formulating the demand analysis tree for LEAP.

The trainer emphasised that, it's crucial to always plot out the tree before entering data. As a homework exercise that participants were provided with some information from the SEI training manual (Exercise 1) and asked to plot out the demand tree for these data.

5 In person training activities

The in-person training was conducted over 2 days on the 20th and 21st of March 2024 at Ridar Hotel Mukono district, to enhance the understanding of the tools. Additionally, the session was designed to clarify areas that were not understood during the virtual sessions and conduct deeper hands-on training for the LEAP tool.





5.1 Workshop proceedings (Day 1)

5.1.1 Introductory remarks from the Climate Change Department (CCD)

The project coordinator Mr. Senyonga Derick delivered remarks on behalf of the Commissioner, Climate Change Department. In his remarks, he welcomed all sector experts present for the 2 days' training workshop for the selected tools.

He reminded the participants that Uganda is a signatory to the UNFCCC⁶ and the Paris Agreement (PA). Following the signing of the Paris Agreement, countries were mandated to strengthen their reporting frameworks in line with Article 13 of the PA.

National governments are required, under the UNFCCC, to conduct accurate, transparent reporting towards their specific NDCs. However, the reporting requirements are very stringent for the developing countries, of which Uganda is one. Hence, there is need to build capacities of national experts to meet the reporting requirements.

Mr. Senyonga also mentioned that Uganda's National Climate Change Act, 2021, requires all implementing agencies to conduct annual reports to present to the MWE about the implementation of climate change actions in their jurisdictions, which include sector greenhouse gas emissions and statistics on mitigation and adaptation actions implemented by these agencies.

It was at this point during the workshop, that the Coordinator emphasized the objectives of the ICAT project in Uganda, namely to:

- Strengthen sector working groups' capacity to manage sector GHG inventories for the Transport and Waste sectors
- Strengthen sector working groups' capacity to conduct baseline emission and mitigation projections
- Support data collection and processing to prepare GHG baseline and mitigation projections
- Develop an NDC tracking framework for the Transport and Waste policies and measures in the NDC
- Implement NDC tracking and monitoring framework at national and local government levels

He informed members that the training exercise for the tools will be vital in their day-to-day work for assessing and quantifying GHG emissions and projection analysis for the sectors. This will inform Government policy of the

⁶ United Nations Framework Convention on Climate Change.





best mitigation actions to undertake to reduce the emissions. The coordinator therefore requested the experts for active participation by asking questions where they need more understanding.

5.1.2 Training session on GACMO

The training sessions started with the revision of the GACMO exercise. To add an additional layer of learning, the national experts were tasked with presenting the results of the homework (Figure 8) and explaining the tool as they went along to those that were not in the virtual training sessions. Guidance was given by GHGMI where the experts experienced challenges (Figure 9).



Figure 8: Participants presenting results of their homework on GACMO.

Based on the experts' feedback, it was noted that:

• the GACMO tool is a user-friendly tool and easy to access since no software license is required.





- GACMO can be used to conduct emissions and mitigation analysis at the project level in a very short period.
- the tool is quite static (in terms of the sector detail, sector sub-categories included, mitigation actions) and makes it difficult to add a national desired parameter.



Figure 9: Participants reviewing the GACMO tool exercise with Dr. Luanne Stevens.

5.1.3 Training session on LEAP

The LEAP hands-on training started with the CCD ensuring all participants had access to a licenced version of LEAP. Dr Stevens started by giving a recap of the presentation made during the online sessions to ensure that all participants were on the same page before proceeding. Participants, therefore all had an understanding of what LEAP is all about, its importance and use, and the data required.

The participants were taken through the various components of the LEAP tool, such as the Analysis View (Figure 10) and the Results page (Figure 11).











Figure 11: Components of the Results View in LEAP.





Following this, participants were provided with an exercise booklet which they could work through. The booklet took relevant exercises (exercises 1, 2 and 5) out of the SEI LEAP Training Exercises (Heaps, 2024)⁷, but additional annotations and tip notes were incorporated to provide further guidance to participants. The trainer worked through the exercises one-by-one with the participants, where they completed the exercises on their computers and one of the participants. Dr Stevens went around and assisted participants when they had queries (Figure 12) and also described each challenge with the group in case others were having similar difficulties.

The first day was all about setting learning about how to input data and how to set up current and baseline scenarios.



Figure 12: Participant interaction with the LEAP tool

6 Workshop proceedings (Day 2)

The agenda for day 2 is outlined in Table 3 and started with a summary of the

7 https://leap.sei.org





lessons from Day 1. Participants continued with exercises, but these started to focus more on the transport and waste sectors. The focus was also shifted to looking at developing mitigation scenarios.

Before lunch more detailed transport detail was incorporated into LEAP along with mitigation scenarios, while after lunch the focus was on the waste sector. Since LEAP was developed as an energy tool, the waste sector is part of the non-energy sector section. Exercises were completed on how to incorporate non-energy sector emissions. In addition, participants were shown how to do a projection in excel for the waste sector and then import the data into LEAP.

At the end of the day there was a discussion on the way forward, with CCD making the closing remarks.

7 Challenges experienced

- LEAP is quite a complex tool and there is a lot to learn so there may need to be more follow up training and use of the tool.
- The LEAP tool is not specifically tailored to waste, making incorporation of detailed waste data difficult.

8 Key Issues discussed and the way forward

- The participants suggested that there should be continuous training sessions and it was agreed that the organizers would organize further online sessions.
- The participants suggested that next time the data used during the training should be from Uganda so that it is more relevant to Uganda's situation.
- The team from waste suggested that wastewater should be incorporated into the examples during the next training.
- It was suggested that the training groups for transport and waste should be separated for the effectiveness of the training.
- The different groups that have been trained were encouraged to share knowledge with other colleagues in their respective sectors.
- The participants highlighted that the examples used in the training were easy, but that real data is not easy to deal with.
- Participants were encouraged to keep practicing using the tools such that they get more conversant with them. The participants were also





advised to practice using the tools in groups as group work is more efficient for learning.

9 Outcomes of the Workshop

- The participants from the waste and transport sectors attained basic skills and knowledge to use the LEAP and GACMO tools
- The MWE-CCD committed to organizing more online trainings for the participants to understand the tools further





