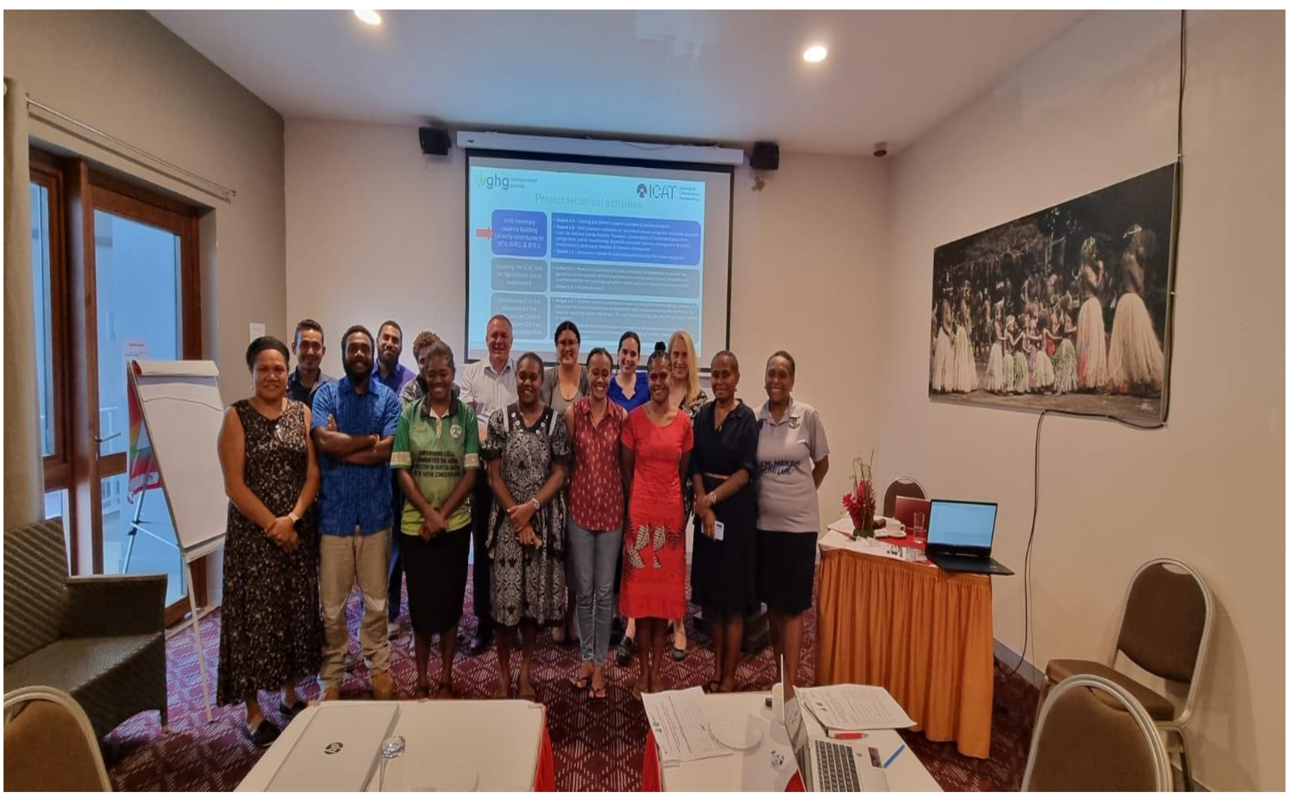
VANUATU GHG INVENTORY TRAINING FOR NATIONAL EXPERTS

Attend and coordinate GHG inventory training by GHGMI for the national experts (online courses, hands-on training workshops; workshop reports); monitor the progress of the national experts



APRIL 17, 2024

COMPILED BY PROJECT COODINATOR & NATIONAL EXPERTS

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)

Introduction

The Republic of Vanuatu has negligible GHG emissions and the forest sector act as a net sink; however, the Government of the Republic of Vanuatu is fully committed to effective, and transparent implementation of the Paris Agreement (PA). In order to comply with its treaties under the UNFCCC and the PA, Vanuatu prepared and submitted National Communication (NC) reports – NC1 (30 Oct 1999), NC2 (30 Aug 2016), and NC3 (22 Mar 2021), the First Biennial Update Report (BUR), (16 Dec 2021); Intended Nationally Determined Contribution (INDC), (29 Sept 2015).

The Initiative for Climate Action Transparency (ICAT) aims to help 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. ICAT's innovative approach is to integrate these two aspects.

ICAT focuses on countries that can highlight the benefits of increased transparency to demonstrate policy impact and evidence-based action. ICAT generates evolving methodological guidance and extracts best practices, to be publicly available to all actors, increasing the global knowledge base. ICAT's work is country-driven, efforts build on existing MRV systems and knowledge in countries and complement previous or ongoing activities by other initiatives, where applicable. Support provided is tailored to the country's context and priorities. ICAT´s work is aimed at engaging national expertise as much as possible while encouraging peer-to-peer learning.

ICAT is supporting Vanuatu in building national capacity for compiling GHG inventories, building a foundation for the NDC targets and tracking, and creating the evidence platform for the climate policies through improving Vanuatu's national inventory system for collecting GHG-related data and estimating GHG emissions from the categories prioritized by Vanuatu.

The project will discuss the potential for extending the sectoral coverage and fine-tuning the national targets by using the national data as the evidence base. The project will propose the potential indicators for the NDC tracking in light of the potentially extended targets and identify the required data sets and the applicable institutional arrangements to enable the relevant data.

This part of the project deliverable involves training on GHG Inventory Analysis and methodologies for the national experts from various relevant government and private sectors facilitated by the GHGMI from 12th – 15th February.

Training Content

The GHG Workshop of ICAT project was held in Port Vila on 12th to 15th February 2024 at the Ramada Resort. The Workshop was facilitated by Greenhouse Gas Management Institute (GHGMI) as the implementing partner of the project. The workshop gathered key stakeholders from Agriculture, Livestock, Forestry, Environment, Energy, Education, Vanuatu Bureau of Statistics, Civil aviation, South Pacific Petroleum, Vanuatu Action Climate Network, NAB and other relevant sectors, to build national capacity in GHG inventory for prioritized sectors in

Vanuatu. These four days training developed the knowledge of the participants in the different methodologies to calculate emissions in prioritized sectors. Understanding the key concepts and data requirements for prioritized sectors, know the data sources and how the data flows within the sectors and also working with the IPCC software to calculate emissions using related examples. All in all, the training was executed well and the participants expressed their enthusiasm for similar trainings if given the opportunity.

The objective of this training was well achieved as the participants came in with little to no knowledge at all regarding the GHG inventory, calculations of emissions, data sources and the IPCC software. However, leaving the training, participants accomplished all these objectives; somewhat understandings are met for the participants. Many reflected that this technical training was delivered and facilitated well in a manner that matched their level of understanding and easy to absorbed.

The training was successful, however if given a follow up training, the additional need that we will recommend is having more exercises done during the training so the participants could have a feel of what is expected when doing the GHG inventory.

See the annex below details the specifics of daily activities from 12th – 15th February.

Next steps and way forward

Going forward, the project team in country with the technical guidance from the GHGMI planned for to focus and deliver the following:

1. GHG Inventory Manual
   Status: The team is finalizing the GHG inventory manual.
2. GHG Data Collection
   i. Participate in GHG data collection and documentation activity for one or more of the prioritized sectors.
   ii. Peer- review and finalize documentation of Vanuatu's national activity data and emission factors available for estimating emissions from all prioritized categories following guidance from the GHGMI experts.
3. Climate Impact Policy Assessment Training
   i. Attend Policy Impact Training

Challenge and lesson learn

Below is a tabular presentation of the challenges and lesson learned from the training conducted.

Challenges	Lessons Learned
Duration of the training. The training timeframe was not enough for many; given that this is a new area of expertise and technical in its own content. Hence, recommended for two weeks should be enough	Common methods to calculate emissions for prioritized sectors
	Key concepts and data requirements prioritized sectors

given to absorb the content of training with its relevance to the specific sectors.	Data sources and data flows for prioritized sectors
	Working with IPCC software to calculate emissions using examples

Annex

Daily Meeting Minutes

Date: 12 February 2024
Venue: Ramada Resort
Time: 9:25am- 4:30pm

PURPOSE

Greenhouse Gas emissions Inventory Capacity Building in the Energy, IPPU, Waste and Agriculture sectors.

PARTICIPANTS

Dr. Olia Glade – Director MRV System, GHGMI
Nelson Kalo – Acting Director, DOCC
Alissa Benchimol – Senior Program Officer, GHGMI
Zechariah Bani – ICAT Project Coordinator, DOCC
Anita Kay – ICAT Project Consultant
Florancza Abel - ICAT Project Consultant
Matej Gasperis – SPM GHGI
Andrea Loli – Project Officer, Energy Department
Cynthy Hosea – Information Management System Officer, NAB/MOCC
Badggio M – Industry Coordinator, MOET
Amit Lal – HSSE, SSP
Patricia Cyrus – Environment/ Aerodrome, CAAV
Susie Mento – Senior statistician, VBS
Olivia Finau – Senior comms outreach partnership, DOCC

AGENDA

SESSION 1: Energy Sector Data Requirements for reference approach using Vanuatu's Energy Balance
Data requirements for reference approach using Vanuatu's energy balance.

Key points to note.

Fuels and energy sources

- Energy sources provide energy that can be transformed into usable forms to meet our needs.
- Fuels are anything that can be burnt to release energy.
- All fuels are energy sources.

Fuels can be primary or secondary.

- Primary: fuels found in nature and can be extracted, clean or captured.
- Secondary: fuels extracted from primary sources

Energy emission composition

- Fossil fuel represents 80% of total energy supply. Oil 30%, coal 27%, gas 24%, other 19%
- Global emissions from fuel combustion. Gas 22%, coal 45%, oil 33%
- GHG emissions from energy sector: Co2 93%, CH4 5%, N20 2%

Energy Sector: Basic sectoral structure

Energy sector – 1a Fuel combustion – Energy industries, Manufacturing industries, Transport/Mobile (Road, rail, aviation, and navigation), Commercial/Residential/Other.

Common methods to calculate emissions from energy sector.

Fuel combustion → Sectoral approach → E = AD x EF (EF = Emission factor AD= Activity Data)

→ All GHGs, 3 approaches → Tier 1 (default EF, AD detailed by source category), Tier 2 (C5, EF. AD detailed by source category), Tier 3 (further split by AD, EF, further specified).

Terms and Concepts

Primary energy sources

- Crude oil
- All types of coal
- Natural gas
- Solid biomass
- Municipal wastes, industrial wastes, and other solid wastes
- Peat

Primary fuels are transformed into secondary energy and Secondary fuel: Petroleum, Gasoline, Electricity.

Energy Value of fuels; NCV and GCV

NCV = Net calorific value
GCV = Gross calorific value
GCV > NCV
Gigagrams = kilotons

Calculations

Amount of energy (TJ) = Amount of fuel (GG or KT) x NCV (TJ/GG)

- Natural gas is most efficient in terms of energy.
- Natural gas produces more energy.

GHG emissions from energy sector

The energy sector reports the following direct GHGs:

- CO_2
- CH_4
- N_2O

Carbon Content of fuels

Carbon content: amount of carbon per unit of material (eg: fuel)

- Natural gas
- Oil
- Crude oil

Carbon content in fuel to CO_2 emission

CO_2 (tonnes) = Amount of C (Tonnes) x 44/12 In tonnes CO_2 divide by 1000 to get kt CO_2

REFERENCE APPROACH:

A top-down approach using national fuel supply data to calculate the CO2 emissions from the combustion of fossil fuels:

RA

- Does not split fuel by categories.
- Calculates CO2 only.
- Uses apparent consumptions.
- RA applies excluded carbon.
- Used as a check for sectoral approach.

Apparent Consumption = Production + Import – Export – International Bunker – Stock change

CO_2 emissions = (Apparent Consumptions – Excluded carbon) * EF

Basic steps for estimating CO_2 using national Energy Balance

- Collect fuel consumption data from the NEB for each fuel.
- Convert fuel data.

SESSION 2: CO_2 emissions estimation using 2006 IPCC Guidelines (Top-down Approach)

Instructions on excel workbook sent from email.

- *Analyzing the reference approach calculations template*
- *Analyzing tables in the background data tab containing available VNSO data*
- *Analyze the example of the national energy balance.*

<u>Task to do → Calculate emissions.</u>

Data for the Reference Approach can be collected from the Energy Department.

- Imports
- Exports
- Internation bunker
- Stock change.

Data that can be collected from IPCC guidelines.

- Apparent Consumptions
- Conversion factor
- NCV/GCV
- Carbon content
- Net Carbon emissions
- Fraction of carbon
- Actual CO_2 Emissions

SESSION 4: Estimating for emissions estimation in transport (Tier 1) based on Vanuatu Data

Transport

- **Civil Aviation**
  International Aviation
  Domestic Aviation
- **Road Transportation**
  Cars
  Light duty trucks
  Heavy duty trucks and buses
  Motorcycles
  Evaporative emissions from vehicles
- **Water borne navigation.**
  International water borne navigation.
  Domestic water borne navigation.

In Vanuatu the biggest source of emission mobile combustion is from Road Transports.

Road Transport

- All fuels sold in a country is included in national estimates even if a vehicle crosses a border or fuel exported in fuel tanks of vehicles.
- Biofuel carbon is removed from the total and reported separately.
- Caution with "fuel Sold" data:
  Overlaps with off road and potentially other sectors.
  Blended fuel
  Smuggling

CO_2 emissions from road transport

There is no Tier 3 for CO_2 emissions, only Tier 1 and 2. Vanuatu uses Tier 1.

Tier 1

1Gg = 1kt = 1000tonnes = 1,000,000kg

CO_2 from road transport.

Emissions = Sum ($Fuel_a$ x EF_a)

Exercise: Estimate CO2 emissions from road transport.

Fuel consumption (Kt) = Fuel density x Fuel consumption(L)/ 1000 to get m^3

= Answer/1,000,000 to get kt

Fuel consumption (TJ) = Fuel consumption (kt) x NCV

CO2 emissions (kt) = Fuel consumption (TJ) x Co_2 EF (Kg/TJ) /1,000,000

Non Co2 emissions

CH_4 emissions (kt) = Fuel consumption (TJ) x CH_4 EF (kg/TJ) / 1,000,000

N_2O emissions (kt) = Fuel consumption (TJ) x N_2O EF (kg/TJ) / 1,000,000

Emissions from road transport in CO2e

GAS	GWP
CO_2	1
CH_4	25
N_2O	298

Total Emissions (kt CO_2e) = CO_2 emissions (kt) + [CH_4 emissions (kt) x 25] + [N_2O emissions (kt) x 298]

Total Emissions from all fuels (ktCO_2e) = Add all total emissions

SESSION 5: Data flow mapping for transport sector.

SESSION 6: Instructor-facilitated group discussion

To be discussed with the National System Workshop.

NEXT TRAINING AGENDA

Date: 13 February 2024
Location: Ramada Resort
Sector: Industrial Process and Product Use (Focus on refrigeration and Air conditioning)

IPPU SECTOR, INDUSTRIAL PROCESS AND PRODUCT USE (FOCUS ON REFRIGERATION & AIR CONDITIONING)

DATE AND TIME: Tuesday, 13 February 2024

VENUE: Ramada Resort

REQUESTED BY: Initiative for Climate Action Transparency (ICAT) Phase II Project Technical Workshop

PURPOSE: To discuss Industrial process and product use (Focus on Refrigeration and air conditioning)

MEETING ATTENDEES

NAME	ORGANIZATION	POSITION
Mathias. B	Department of Agriculture	I.O
Florancza. A	DOCC	Consultant
Anita. K	DOCC	Consultant
Serah . C	Department of Energy	Appliance and Labeling Officer
Badggio M	MOET	Industry Officer
Matey. M	GMGMI	SPM
Alissa. B	GHGMI	SPO
Stephanie .S	DOF	Climate Change Officer
Patricia. N	CAAV	Environmental / Aerodromes
Susi. M	VBOS	Statistician
Zacky. B	DOCC	Project coordinator
Olia. G	GHGMI	Director, MRV
Richard Patterson	Project Cordinator	VCAN PACCCIL / OXFAM
Cynthy . H	NAB/MOCC	IMS Officer

AGENDA

Session 1: Key concepts and data requirements

Session 2: step-by-step estimation of HFC and PFC Emissions using IPCC Templates

Session 3: Discussion on data sources and data flows

Session 4: Using F-gases data for reporting for the Kigali Agreement under the Montreal protocol.

Session 5: exercise for building baseline and phase-out curve for HFC Kigali Agreement

DISCUSSION

Session 1

Key concepts and data requirements

Applications and sub-applications

Sub applications include

*Domestic

*Commercial

*Industrial transportation

*Stationary air-conditioning

*Mobile air conditioning

Life cycle of refrigerant

Vanuatu does not produce refrigerants

Fridge comes to Vanuatu comes to with refrigerant or it comes with the refrigerant by itself

- HFC leaks out of the fridge and needs to be topped up
- During export HFC leaks out
- During installation the HFC leaks out
- Decommission – leakage through destruction and Disposal

BANK

Fridges or equipment are the banks where they contain the HFC. They contain the HFC to which the gas eventually leaks out from.

Prompt emissions – emissions occur within first 2 years

Delayed emission – Emissions occur within the 2 years

Bank- gas consumed that is not emitted yet

ESTIMATING EMISSIONS FROM HFCs

EF → HFC consumption in the Base year (BY) + BANK

ACCOUNTING FOR PRODUCT BANKS

Reference approach

- **Calculations of emission = Net consumption * composted EFFY + total banked**

Annual Emission = Net Consumption * Composite EF_{FY} + Total Banked Chemical * Composite EF_B

- **Calculation of net consumption of a circle in a specific application**

Net consumption = production + Imports – Destruction

HYBRID APPROACH 1a/b:

- **EMISSION FACTORS AND ASSUMPTIONS**
- **Emissions from banked refrigerants average: 15%**
- **Servings for Equipment: 3 years**
- **Average Equipment lifetime: 15 years**
- **Transition till a new refrigerant technology: 10 years**

Approach assumption

- **Introduction year 2005**
- **Growth rate / New Equipment – 2% (remember to source the information)**
- **Emission Factor from installed base: 15%**
- **% Gas destroyed/ end life: 0 % (not sure is they are destroyed or not)**

DATA REQUIRMENTS FOR IPCC TIER 1/B APPROACH

- **Information on domestic production, imports and export of chemical agents in the year to be reported**
- **Year of introduction of refrigerant**
- **Growth rate in sales of new equipment**
- **Assumed equipment lifetime**
- **Remaining agent in retired equipment**

- **Destruction of agent in retired equipment**

ACTIVITY ASSUMPTION

Activity Data

- **Source: need to source the finding**
- **Commodity: refrigerators, freezers, refrigerating freezing equipment**

Session 2: STEP-BY-STEP ESTIMATION OF HFC AND PFC EMISSIONS USING IPCC TEMPLATES

refrigerators and refrigerating assumptions (1 of 2)

refrigerator and refrigerating assumptions (2 of 2)

refrigerator and AC assumptions (1 of 2)

calculation of individual chemical in kg within the HFC blend

calculate kg per HFC type

Tier 1a/b Approach Assumptions

IPCC software used as an alternate to Tier 1a/b Approach Assumptions

TYPES OF HFC ASSUMPTIONS

<table>
<tr><th>CHEMICALS THAT HAVE BEEN REPLACED</th><th>REPLACEMENT CHEMICALS</th><th>USE</th></tr>
<tr><td>CFC - 12</td><td>HFC - 134a</td><td>Domestic Refrigeration</td></tr>
<tr><td rowspan="2">HCFC - 22</td><td>R- 407</td><td rowspan="2">Stationary Air Conditioning</td></tr>
<tr><td>R - 410A</td></tr>
<tr><td>R - 502</td><td rowspan="4">R - 404</td><td rowspan="4">commercial refrigeration</td></tr>
<tr><td>HCFC</td></tr>
<tr><td>CFC - 22</td></tr>
<tr><td>CFC - 115</td></tr>
</table>

Session 3: DISCUSSION ON DATA SOURCES AND DATA FLOWS

Discussion question

- **What data:**
- **Units:**
- **From who:**
- **In what format:**

Session 4: USING F-GASES DATA FOR REPORTING FOR THE KIGALI AGREEMENT UNDER THE MONTREAL PROTOCOL.

How ozone depleting substances affect the atmosphere:

CFCs - ↑ GWP , ↑ ODP
HFC - ↑ GWP ↓ ODP

HFOs ↓ GWP ↓ ODP

- Kigali Amendment to the Montreal Protocol: HFC phase-down

Baseline calculation

- Base line made of two components

Specific Kigali requirements to A5 group 1

HFC baseline in Vanuatu

- Only one CFC is used R22
- Baseline HCFCs / Estimate 5.11 metric tones
- ODP (R -22) = 0.05
- ODP value baseline: 0.25tones
- Contribution of HCFC baseline to HFC / Vanuatu / 0.56 x 5.11 → 3.32t

Applying GWP for calculating the Kigali baseline

GWP of a blend

Calculating amounts of GHGs or blend in Kt CO2e

Example of calculating Kigali baseline

Calculating HFC phase-down under the Kigali –

Phase down schedule for Vanuatu

Phase down commitment: HFCs phasedown schedule

Data needed for baseline and further reporting

HFC consumption modeling

Session 5: EXERCISE FOR BUILDING BASELINE AND PHASE-OUT CURVE FOR HFC KIGALI AGREEMENT

Baseline calculations

Vanuatu phase-out calculations

ACTION ITEMS

- **None given from today's meeting**

NEXT MEETING

DATE AND TIME: Wednesday, 14 February 2024

VENUE: Ramada Resort

REQUESTED BY: Initiative for Climate Action Transparency (ICAT) Phase II Project Technical Workshop

WASTE SECTOR (FOCUSING ON SOLID WASTE DISPOSAL ON LAND DOMESTIC WASTEWATER)

MINUTE TAKING

Date: 14 February 2024
Venue: Ramada Resort
Time: 9:25am- 4:30pm

PURPOSE
Greenhouse Gas emissions Inventory Capacity Building in the Energy, IPPU, Waste and Agriculture sectors.

PARTICIPANTS
Dr. Olia Glade – Director MRV System, GHGMI
Alissa Benchimol – Senior Program Officer, GHGMI
Zechariah Bani – ICAT Project Coordinator, DOCC
Anita Kay – ICAT Project Consultant
Florancza Abel - ICAT Project Consultant
Matej Gasperis – SPM GHGI
Sali Stephanie – Climate change officer, DOF
Cynthy Hosea – Information Management System Officer, NAB/MOCC
Badggio M – Industry Coordinator, MOET
Serah Chillia – Appliance Officer, Energy Department
Julius Mala – Subsidy Officer, Energy Department
Rontex Mogen – Environmental Officer, DPC
Olivia Finau – Senior comms outreach partnership, DOCC

AGENDA (Discussions)

Key concepts and data requirements for solid waste disposal.
Basic sectoral structure

Waste sector → A Solid waste disposal → i. Managed waste disposal sites, ii. Unmanaged waste disposal sites, iii. Uncategorized waste disposal sites.

- Biological treatment: Composting and aerobic decomposition.
- Open waste burning
- Close waste burning

Waste Hierarchy

Prevention→Preparing and reuse→Recycling→Recovery→Disposal.

Basic Data Collection: Solid waste stats

We need to know:

1. Solid waste generation quantities
2. Waste composition.
3. Solid waste treatment and management practices

Solid waste disposal, biological treatment,

What should be reported in NC/GHGI.

- Activity data values for all waste types.
- Data sources (national statistics, surveys, IPCC defaults)
- Waste flows through the system and wastewater flows.
- Where data is not estimated (note this) and describe possible efforts to collect data in the future.

Activity Data in SWD on Land Category

Who produces waste on Land= Population.

Population produces Municipal solid waste.

Waste streams relevant regarding the GHG Emissions from MSW.

- Food waste
- Garden and park waste.
- Paper and cardboard
- Wood
- Textiles
- Glass
- Metal
- Plastics
- Nappies

Basic Activity data needed for FOD.

- Total Population and GDP to estimate CH4 emissions.
- Waste generation per capita.
- Waste generation per GDP.
- Waste composition.
- Types of solid waste management site and distribution (%) of waste between sites.

Key parameters

<u>Generation population and climate data</u>

- Country's population
- Total population this operation covers.
- Mean average temperature.
- Region considered dry or wet.?

<u>Characteristics of SWD in region</u>

- Aerobic

- Anaerobic

Information on total waste generation by population

- Total MSW generation
- Does MSW include industrial waste?

Waste flows: Fraction of total MSW collected (Should add to 100%)

% of

- amount collected that goes to SWD site.
- amount collected that fraction sent to composting.
- amount collected that fraction is open burned.
- amount collected that is incinerated.
- amount collected that sent to recycling.

Waste flows: Fraction of total MSW not collected (Should add to 100%)

Composition of waste (Should add to 100%)

- % food
- % garden
- % wood, textile, rubber, paper, cardboard

SWDs – Quality control checks

- Cross check country specific values for MSW generated.
- Where survey and sampling data are used to compile national value for solid waste activity data.

Introduction and practical exercise on the FOD model

First Order Decay (FOD)- The Basics

The amount of product is proportional to amount of reactive material.

Methane generated at the end of the year is a function of how much decomposable degradable organic carbon was there at the end of last year plus what is added to the current year.

Speed of decay based on half lifetime taken.

Step 1: Determine the amount of decomposable deposited in SWDs.

Step 2: Determine the amount of methane.

Step 3: Estimate methane emissions.

Estimating the mass of waste available for decomposition (DDOCm)

Equation: Decomposable DOC from waste disposal Data

$DDOCm = W \times DOC \times DOC_f \times MCF$

DOC and MCF values are default. From IPCC guideline.

Determining the time series of waste decomposition.

$DDOCma_r = DDOCmd_r + (DDOCmai_{r-1} \times e^{-k})$

$DDOCm\ decomp = DDOCma_{r-1} \times (1-e^{-k})$

<u>Converting DDOC to methane generated</u>

$CH4\ generated_T = DDOCm\ decomp_T \times F \times 16/12$

Note: F is default.

<u>Converting methane generated to methane emissions.</u>

CH4 emissions = [total CH4 generated.

FOD in Practice- Using the IPCC FOD Model

Need to collect data for:

- Population (million)
- GDP (kg/cap/year)
- Waste generation rate.
- Waste per capita.

Introducing software tools to calculate emissions on solid waste disposal (IPCC software)

Parameters: Subnational Disaggregation

Subdivision allows estimation of emissions at subnational level (eg: region by climate zone).

Waste Type Manager

- Contains list of waste categories.
- Waste components.
- Allows adding country specific waste.

Introducing software tools to calculate emissions in the waste sector (SAGE)

One of the biggest problems is DATA.

- Before calculating emissions, we need to obtain Activity Data which means:
  - ✓ The category.
  - ✓ where the data comes from, when it is collected and from whom.
  - ✓ The level of aggregation/coverage
  - ✓ Data values and unit of measurements
  - ✓ Additional parameters that affect emissions calculations from fuels: Density, calorific value, carbon content, water content.
- Were the data reviewed and approved? By whom? When?
- How do we deal with data gaps.

Sectoral Activity Data for Greenhouse gas Emission calculations (SAGE) Introduction

SAGE is a GHG inventory data collection tool to support national climate measurement, reporting and verification (MRV) systems, especially in developing countries, through robust data collection.

<u>Features:</u>

- Configuration tables adjustable to country level.
- Aligned with 2006 IPCC Guidelines.
- Excel import/export
- Units' conversion
- Detailed user guidance
- Cater for different user groups.
- Web based or can be installed on the intranet.
- SAGE video tour.
- Coverage: Energy, IPPU, Agriculture and Waste.

Key concepts and data requirements for waste -water disposal.

Key points to remember.

Waste sector→Wastewater treatment discharge→Domestic wastewater treatment and discharge.

- Domestic and industrial wastewater are accounted for separately depending on the parameters.
- CO2 is biogenic origin and not included. N2O emissions from sludge and wastewater spread on agricultural land.
- CH4 is produced when wastewater is treated or disposed of anaerobically.
- Wastewater may be treated on site, sewered to a centralized plant or disposed untreated.
- Sludge produced in wastewater treatment is treated further.
- CH4 generated can be recovered and combusted in flare or energy device.

Discharge pathways.

Waste water→Uncollected→Treated on site→Industrial: on site plant AND Domestic: Latrines or septic plant. →Untreated →Rivers, Lakes, Sea, Estuaries AND To ground.

Domestic Water: What is needed to estimate CH4.

Total Organic in wastewater (TOW) (kg BOD/yr.) = P x BOD x 0.001 x I x 365

P = Population in inventory year.

BOD = Country specific per capita BOD in inventory year g/person/day.

0.01 = Conversions from gram BOD to Kg BOD

I = 1.25

CH4 emissions = [Total (U x $T_{i,j}$ x EF_j)] (TOW -S) - R

Activity Data (AD) for estimating Nitrous oxide emissions.

- N2O emissions are associated with degradation of nitrogen components in wastewater. (Urea, nitrate, and protein).
- N2O can occur as direct emissions from treatment plants or indirect emissions from wastewater after disposal of effluent in waterways, lakes, or sea.

Methodological Choice

Tier 1: Allows default for AD (TOWs) and EFs.

Tier 2 and Tier 3.

N2O Emissions

N2O emissions = $N_{effluent}$ x $EF_{effluent}$ x 44/28

$N_{effluent}$ = (P x Protein x F_{npr} x F_{non} con x $F_{in\ con}$)-N_{sludge}

ACTIVITY DATA BASED ON CENSUS DATA

Discussion on data sources and data flows

What: Wastewater data collected in excel format.

When: 2 months.

Where:

- Department of Environmental Protection and Conservation
- Department of water resources.
- Port Vila city council
- Ministry of Health

How:

- Waterwaste taskforce
- Through email
- Dialogue
- Meetings
- RTI

Side note

Inventory needs to know what type of communication is used to collect data under the communication protocol.

Confidential agreements can be used when a company do not give data.

No raw data will be published. Only emission data will be published.

AGRICULTURE SECTOR (FOCUS ON LIVESTOCK ENTERIC FERMENTATION AND MANURE)

DATE AND TIME: Friday, 15 February 2024

VENUE: Ramada Resort

REQUESTED BY: Initiative for Climate Action Transparency (ICAT) Phase II Project Technical Workshop

PURPOSE: Agriculture Sector (Focuses on livestock enteric fermentation and manure management)

MEETING ATTENDEES

NAME	ORGANIZATION	POSITION
Anita . K	DOCC	Consultant
Florencza . A	DoCC	Consultant
Olia . G	GHGMI	Director, MRV
Alissa . B	GHGMI	SPO
Matez . G	GHGMI	SPM
Zacky . B	DoCC	Project Coordinator
Baggi . M	MoET	Industry Officer
Serah . C	DoE	Appliance and Labelling officer
Cynthy . H	NAB/MOCC	IMS Officer
Trevor . L	DoE	Intent (Conservation and Biodiversity)

Initiative for Climate Action Transparency | ghg management institute | Dept of Climate Change Govt of Vanuatu

AGENDA

SESSION 1: KEY CONCEPTS AND DATA REQUIRED FOE ENTERIC FERMENTATION EMISSIONS

SESSION 2: PRACTICAL EXERCISE ON CLASSIFYING LIVESTOCK AND ESTIMATING EMISSIONS USING 2006 IPCC GUIDELINES AND IPCC SOFTWARE (ENTERIC FERMENTATION)

SESSION 3: KEY CONCEPTS AND DATA REQUIREMENTS FOR MANURE MANAGEMENT

SESSION 4: PRACTICAL EXERCISE ON CLASSIFYING LIVESTOCK AND ESTIMATING EMISSIONS USING 2006 IPCC SOFTWARE GUIDELINES AND IPCC SOFTWARE (MANURE MANAGEMENT)

SESSION 5: DISCUSSION ON DATA SOURCE AND DATA FLOWS

CLOSING REMARKS

TOPIC DISCUSSION

SESSION 1: KEY CONCEPTS AND DATA REQUIRED FOE ENTERIC FERMENTATION EMISSIONS

BASIC CONCEPTS: LIVESTOCK POPULATION CHARACTERIZATION

BASIC METHOD TO ESTIMATE EMISSIONS

Emission Estimate = Activity data x Emission factor

IMPORTANCE OF HIGHER TIER LEVEL METHODS

TIER 1 uses default

- Good estimate
- Chances of over or under estimation
- ⬆ Uncertainties
- No annual changes

TIER 2 uses more detailed country specific data

- More accurate

AGRICULTURE: EMISSIONS: VANUATU

Livestock

- Enteric Fermentation (CH_4)
- Manure Management (CH_4 and direct N_2O)
- Indirect N_2O Emissions from manure management

INVENTORY RESULTS IN VANUATU (as in NC3)

NC_3 – no results collected/ shown by graph

ENTERIC FERMENTATION

- Three steps
  - 1. ACETATE PROPIONATE BUTYRATE
    Absorbed / used to grow and make products
  - 2. Methanogens
  - 3. Methane is passed out through the mouth and through the rear end

ESTIMATING FERMENTATION EMISSIONS

Estimating enteric fermentation emissions.

Emissions = $EF_{(T)} \times (N_t / 10^6)$

Total $CH4_{enteric}$ = Total E1

ENETRIC FERMENTATION: ACTIVITY DATA

- Population data is activity data.
- Poultry not included.
- Emission factor unit is Kg CH4 per head per year.
- Basic Tier 1

Annual average population = (# of livestock produced in a year /365 x number of days alive)

ENTERIC FERMENTATION: EMISSION FACTORS

TIERS 1: requires default EFs (EF_T) for the livestock subcategories

TOTAL EMISSION FORM LIVESTOCK

ENTERIC FERMENTATION – BASIC DATA

T1 :

- Livestock characterization
- Animal population
- Other animal types
- Region
- Uncertainties
- Data sources
- Frequency of data

ENTERIC FERMENTATION METOD SUMMARY

Tier 1

- Activity data
    1. Activity data
        a. Characterization of livestock population
    2. Emission Factors
        a. IPCC default

Tier 2

1. Activity data
   1.a Enhance population of livestock pop

2. Emission factors
   2.a Country specific EF / based GE and MCF

QUIZ: which factors affect CH_4 emission

- Quality and quantity of feed consumed
- Type of digestive tract in animal
- Feeding situation
- Animal weight

- All of the above

QUIZ: which category does not produce enteric fermentation

- Buffalo
- Horse
- Poultry
- Pigs

SESSION 2: PRACTICAL EXERCISE ON CLASSIFYING LIVESTOCK AND ESTIMATING EMISSIONS USING 2006 IPCC GUIDELINES AND IPCC SOFTWARE (ENTERIC FERMENTATION)

STEP-BY-STEP ESTIMATION EMISSIONS FROM ENTERIC FERMENTATION UDING IPCC SOFTWARE

ACTIVITY DATA

Source: Vanuatu national agriculture census (2022)

Other parameters:

- TAM IPCC default
- Annual Average Temperature in Vanuatu: 25 degrees Celsius
-

Used the IPCC software

- Entered activity data (population of animal)
- Calculated Emission factor [Kg CH_4/ (head yr.)]
- Calculated total emission [Gg CH_4/year]

Method Summary

Enteric fermentation → T1→ AD → Basic characterization of livestock population.

EF → IPCC Default

SESSION 3: KEY CONCEPTS AND DATA REQUIREMENTS FOR MANURE MANAGEMENT

HOW DO MANURE MANAGEMENT SYSTEMS PRODUCE GHGs

- Manure management refers to capture, storage, treatment, and utilization of manure.
- CH4 and N2O are produced directly from manure management systems due to manure decomposition.
- N can also leach or be volatized from MMS leading to indirect N2O emissions.
- Key MMS emissions determinants:
  - Aerobic and anaerobic
  - Liquid vs solid
  - Temperature and storage time

MANURE MANAGEMENT SYSTEMS (MMS)

1. Spread daily on croplands or pastures.
2. Stored as solid in stacks.
3. Stored on dry lot.

METHANE (CH4) EMISSIONS FROM MANURE MANAGEMENT

Methane one of the main GHG emitted form manure management

MANURE MANAGEMENT: CH4 EMISSIONS ESTIMATION

Emissions = activity data (AD) x Emission Factor (EF)

MANURE MANAGEMENT (CH4): ACTIVITY DATA

Tier 1

- Livestock population data / basic characterization
- Average annual temperature / Vanuatu / 25 degrees Celsius

Tier 2

- Livestock population / enhanced characterization
- Regional population/ major climatic zones/ average annual temperature

2006 IPCC DEFAULT EMISSION FACTORS – OCEANIA

- Table 10. 14 , V.4 , Ch. 10 , p.28

MANURE MANAGEMENT SYSTEM SUMMARY

Summary of Tier 1 and Tier 2 for Manure management CH_4 given on page 11 lecture slide

NITROUS OXIDE FROM MANURE MANAGEMENT

HOW N2O IS PRODUCED

-nitrification and denitrification

- availability of N and moisture affects nitrification and denitrification

DIRECT AND INDIRECT N2O EMISSIONS

- Occurs for both manure management and managed soils
- Direct emissions (directly to soils)
- Indirect Emissions:
  1. leaching (ground water/ surface runoffs)
  2. volitation & redeposited

MANURE MANAGEMENT: N2O EMISSIONS

- Occur for both manure management and managed soils.

Direct: Directly from soils to which the Nitrogen is added or released.

Results from nitrification and denitrification of N in manure.

N2O emissions affected by:

- Amount of manure produced.
- N content of manure
- Manure management system.
- Duration of storage

MANURE MANAGEMENT: N2O EMISSIONS NOTE

1. Inorganic N fertilizer
2. Organic N fertilizer
   - Animal manure applied to soils
   - Sewage sludge applied to soils
   - Other organic fertilizer to soils
3. Urine and dung deposited by grazing animals
4. Crop residues
5. Mineralization associated with loss/gain of soil organic matter

N2O EMISSIONS

Emissions = Activity data (AD) x Emission Factor

(Population, N excretion rate, Manure management data)

SESSION 4: PRACTICAL EXERCISE ON CLASSIFYING LIVESTOCK AND ESTIMATING EMISSIONS USING 2006 IPCC SOFTWARE GUIDELINES AND IPCC SOFTWARE (MANURE MANAGEMENT)

Calculate: emissions of N2O from each management system types

QUIZ DISCUSSION

Why is it important to improve the accuracy of livestock population and manure management usage data?

Used the IPCC software to calculate:

1. Enteric formation
- Total Enteric Fermentation
• CH4 Emission Factor (Kg CH4 / head / year)

2. Manure management
• Indirect N2O emissions from managed soils
• Indirect N2O emissions from manure managed soils
• Direct emissions from managed soils
• Methane Emission

For the following animals

- Swine
- Horse
- Sheep
- Cattle
- Dairy cattle
- Duck

SESSION 5: DISCUSSION ON DATA SOURCE AND DATA FLOWS

What Sources of data?

When to collect?

Who to get the data from?

How to access the data or through which means of communications?

NEXT MEETING

- Today is the last day of Initiative Climate Action Transparency (ICAT) Phase II Project Workshop.

ANNEX

See below Photos from GHG Training at Ramada Resort 12th-15th February 2024.

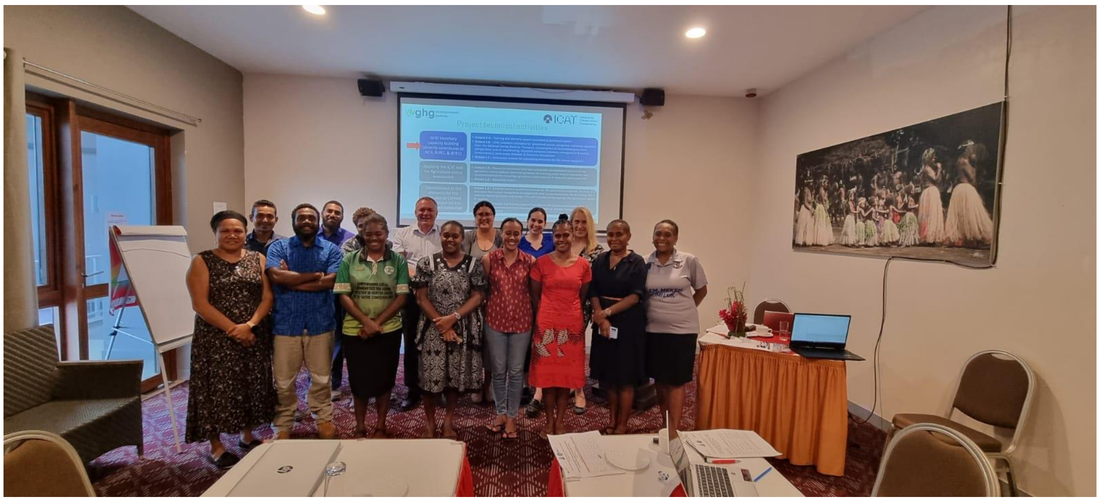


Figure 1: Group Photo Day 1.

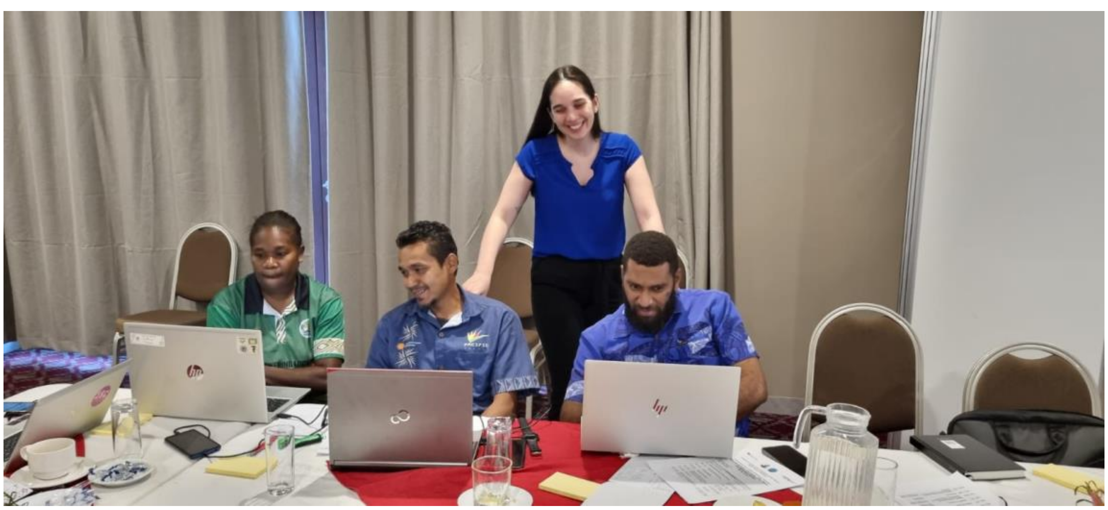
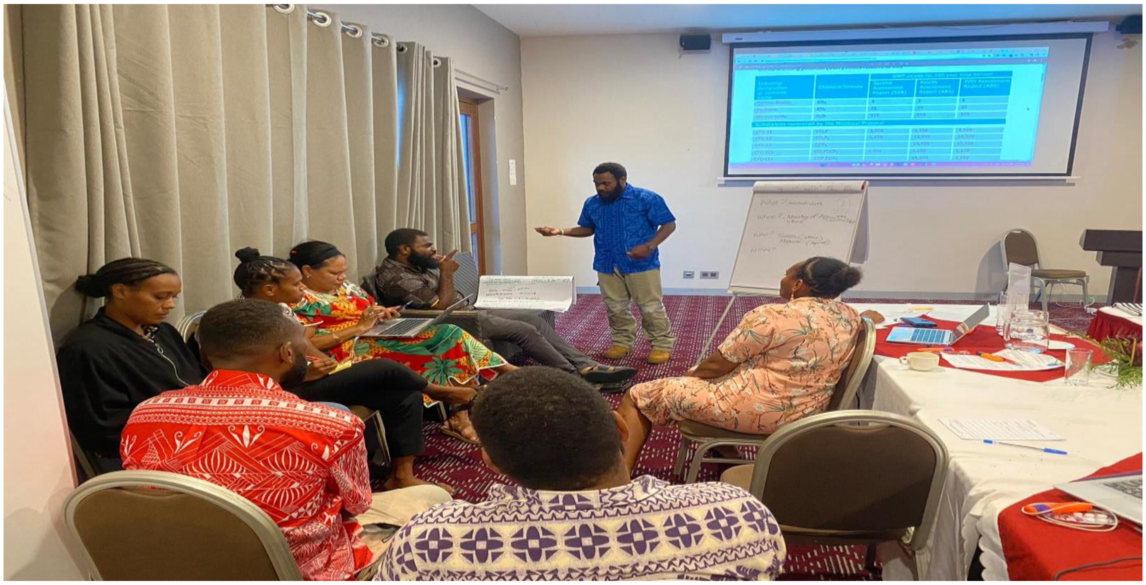
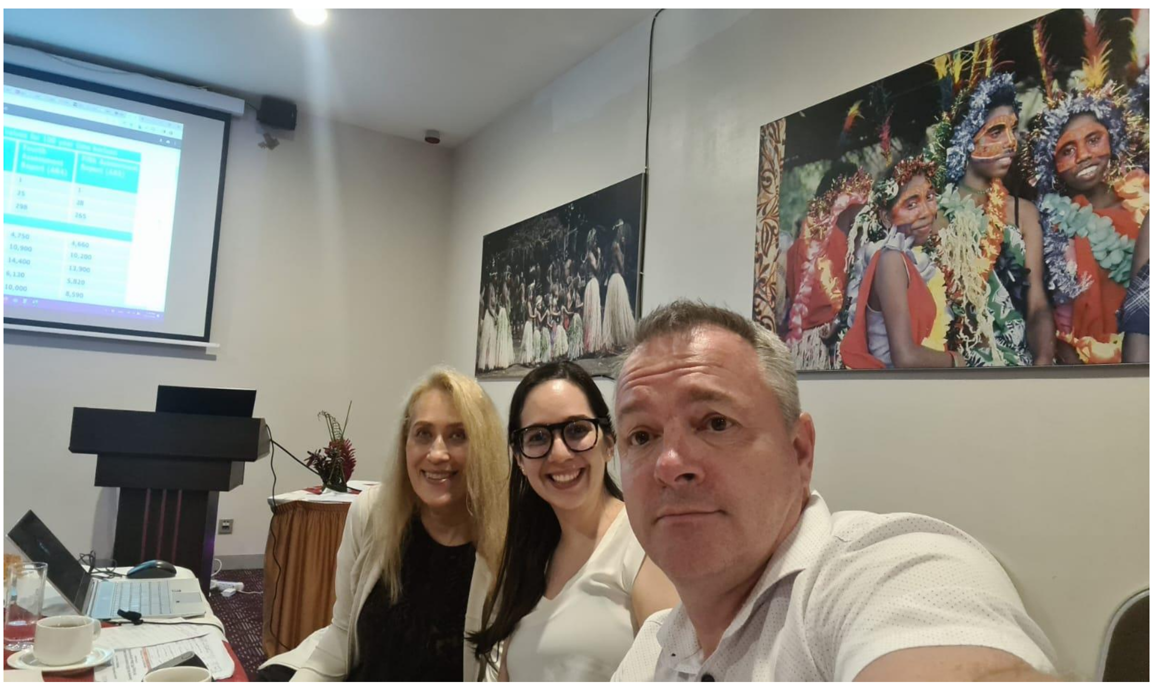


Figure 2: Alissa and stakeholders from DOF, DOET and Pacific Petroleum



<u>Figure 3:</u> Group discussion on Data source and Data flows



<u>Figure 4:</u> Training Facilitators