



National Greenhouse Gas Database Management System (NGHGDMS)

User Manual

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ACKNOWLEDGEMENT

National Greenhouse Gas Database Management System (NGHGDMS) is managed by Department of Climate Change (DCC) of Ministry of National Resource and Environment (MONRE) and supported by Capacity Building Initiative for Transparency Project (CBIT) of the Global Environment Facility (GEF) via the United Nation Environment Programme(UNEP).

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We would like specially to extend our sincere thanks to developer Dr. Saysoth Keoduangsine, National Consultant, and his team members who have been developed this NGHGDMS successfully and wrote this manual.

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Many thanks extend to National and International MRV Experts on Monitoring, Reporting and Verification (MRV) for their advice, comments, supports and provision on GHG and MRV information.

FORWARD

We are pleased to introduce the User Manual of the National Greenhouse Gas Database Management System (NGHGDMS). This manual is intended to provide guidance to general end-users and system administrators, on the use of the database system step-by step, introducing the tools and functions of data analysis and generating greenhouse gas data reports. This user manual can be downloaded from the NGHGDMS website: <https://ghg.monre.gov.la>.

On behalf of the Department of Climate Change, I would like to sincerely thank the United Nations Environment Program (UNEP) for supporting the development of this greenhouse gas database system for Lao PDR. I would like also to express my gratitude to the staff of the Department of Greenhouse Gas Mitigation, technical working group members from relevant ministries who provided information to the database system and supported the National Consultant in designing and developing this greenhouse gas database system.

On behalf of the Department of Climate Change, I would like also to express my deepest gratitude to the staff of the Department of Greenhouse Gas Mitigation who worked and supported the National Consultants who designed and developed this NGHGDMS. I would like to express my gratitude to the national and International MRV consultants on this achievement for their guidance on the development of NGHGDMS.

I believe that all stakeholders working on GHG reduction will use this system for data analysis to monitor GHG impacts and prepare reports to the UNFCCC such as National Communications (NC) and Biennial Transparency Reports (BTR.).

Department of Climate Change
Ministry of Natural Resources and Environment

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ACRONYMS

DCC	Department of Climate Change
IPCC	Intergovernmental Panel on Climate Change
Lao PDR	Lao People Democratic Republic
MAF	Ministry of Agriculture and Forestry
MES	Ministry of Education and Sports
MLSW	Ministry of Labor and Social Welfare
MH	Ministry of Health
MEM	Ministry of Energy and Mines
MONRE	Ministry of National Resource and Environment
MPWT	Ministry of Public Work and Transportation
NGHGDMS	National Greenhouse Gas Database Management System
UNEP	United Nations Environment Programme
AD	Activity Data
AWMS	Animal Waste Management System
BOD	Biochemical Oxygen Demand
C	Carbon
C₂F₆	Hexafluoroethane
CF₄	Tetrafluoromethane
CH₄	Methane
CO	Carbon Monoxide
CO₂	Carbon dioxide
COD	Chemical Oxygen Demand
Dm	Dry matter
Gg	Gigagram
Ha	Hectare
HFC	Hydrofluorocarbon
hl	Hectolitre
K	kilo
Kg	kilogram
Kha	Kilo hectare
Kt	Kilo tonne

LTO	Landing/Take Off
LUCF	Land-Use Change and Forestry
LULUCF	Land Use, Land-Use Change and Forestry
M³	Cubic meter
MCF	Methane Correction Factor
Mg	Megagram
Mha	Mega hectare
MSW	Municipal Solid Waste
N	Nitrogen
N₂O	Nitrous Oxide
NFP	National Focal Point
NH₃	Ammonia
NMVOC	Non-Methane Volatile Organic Compound
NOX	Nitrogen Dioxide
PFC	Perfluorocarbon
RA	Reference Approach
SE	Sectoral Expert
SF₆	Sulphur Hexafluoride
SO₂	Sulphur Dioxide
SWDS	Solid Waste Disposal Site
T	Tonne
Tg	Tera-gram
TJ	Terajoules
XML	Extensible Markup Language

1. Introduction

The National Greenhouse Gas Database System (NGHGDM) is led by the Department of Climate Change, Ministry of Natural Resources and Environment, supported by the Capacity Building Initiative for Transparency (CBIT) of the Global Environment Facility (GEF), through the United Nations Environment Program (UNEP).

The CBIT project supports the Government of Lao PDR in strengthening its transparency framework by improving the accuracy, completeness, and consistency of greenhouse gas inventory, and increasing its capacity to monitor and evaluate mitigation measures and related financial assistance. as well as creating the necessary technical factors for medium and long-term planning that contribute to decision-making on climate-related issues in Lao PDR.

This greenhouse gas system will help the relevant ministries and agencies to input information into the system according to their responsibilities defined under the organizational system. The Department of Climate Change is the coordinating agency in managing the database, including data review, revision, and use for analysis. The NGHGDMS Greenhouse Gas System supports Lao PDR in updating its greenhouse gas inventory data to prepare the National Communication (NC) Report and the Biennial Update Report (BUR).

This greenhouse gas system is an online system that directly calculates greenhouse gas emissions and monitors quality and accuracy within the system. The system was designed based on the IPCC software and the IPCC 2006 guidelines.

This greenhouse gas system is a tool for data analysis and reporting of greenhouse gas data for four (4) sectors: energy, industry, agriculture and land use, and waste. And the system is open to the public at <http://ghg.monre.gov.la>

1.1 Purpose and Scope of this Manual

This user manual is for end-users from line ministries, also for authorized users (administrator or super user) which attend to manage the database at the backend of the system, but not limited to public users who just want to find general information. This user manual provides descriptions step by step of using each NGHGDMS functions of each sub-sectors such as data entry, data edit, data delete, data management and generate a report.

1.2 Technical requirements to run NGHGDMS.

The supported browsers and minimum requirement to run NGHGDMS are listed below:

- Supported web browsers include Microsoft Edge 20.0 or greater, Mozilla Firefox, Google Chrome, and Safari 11.1 or greater;
- Stable internet connectivity to public network: 2Mbps or more; and
- Wireless connectivity: 802.11b/g/n or later with frequency of 2.4Ghz-5.0GHz.

1.3 NGHGDMS limitation

The NGHGDMS was developed based on the IPCC 2006 software, but it does not support Tier-2 greenhouse gas emission calculations and uses default emission factors. The front-end page of the system supports both Lao and English, but the back-end page supports only English.

2. Home Page

The home GHGDMS page shows summary of GHG data in form of graphs, news and events, and documents for downloading including user manuals, data entry template and other GHG related documents. It supports two languages, English and Lao version. The information on this home page is updated by authorized users from DCC of MONRE.

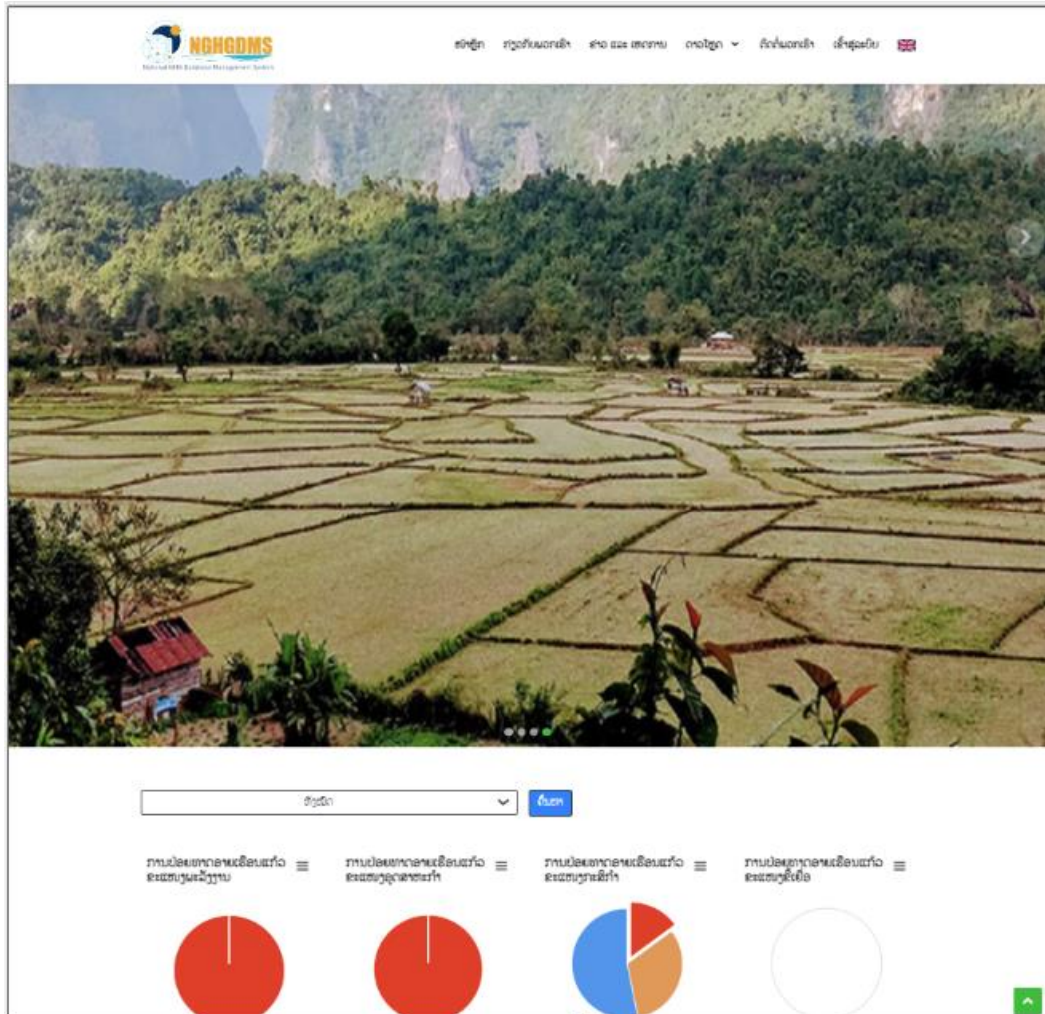


Figure 1: Home page

2.1 Changing language

On the right-top corner, just click on the icon  to change to Lao OR click on  to change to English.

2.2 Document download

In order to find the document in this GHG system to be downloaded, just click on “Download”, the specific document is scrolling down. In this case, there are 3 types of document categories including BUR, NSCC and NDC. Then click any desired document for being downloaded.

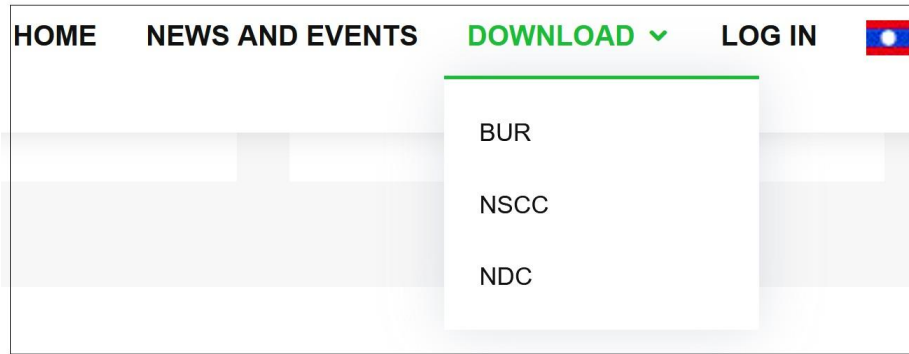


Figure 2: Document Download

2.3 Reviewing “News and Events”

Click on “News and Events”, then scrolling down. The list of news and events show by categories such as Energy, Resources news, and general news. Meanwhile user can search for a specify news or event by typing a key word in the searching box, then click on"search".

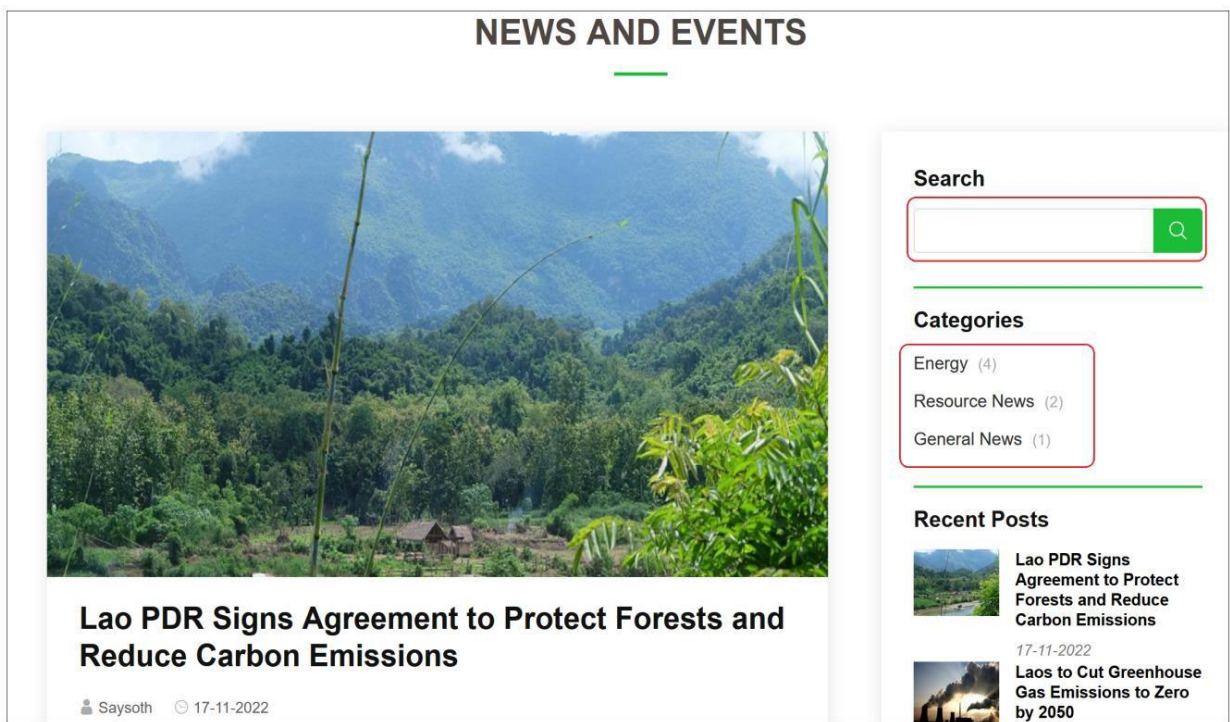


Figure 3: News and Events

3. System Access

3.1 How to log in

To log in, click on the link to “Log in” located at the upper right corner of the home page.

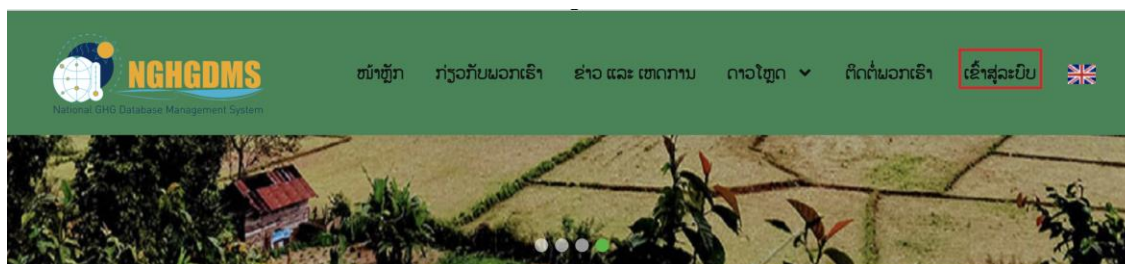


Figure 4: Login page

The supply the provided username and password:

Figure 5: Login form

- Select one of the existing inventory years that you want to access for data entry or create the new one. In this case, the existing Inventory Year 2021 is selected.

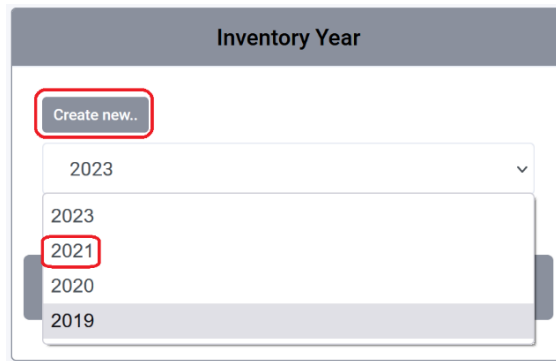


Figure 6: Inventory Year

After logging in, the administration page will be displayed with 5 main functions on the left side as shown in the image below.

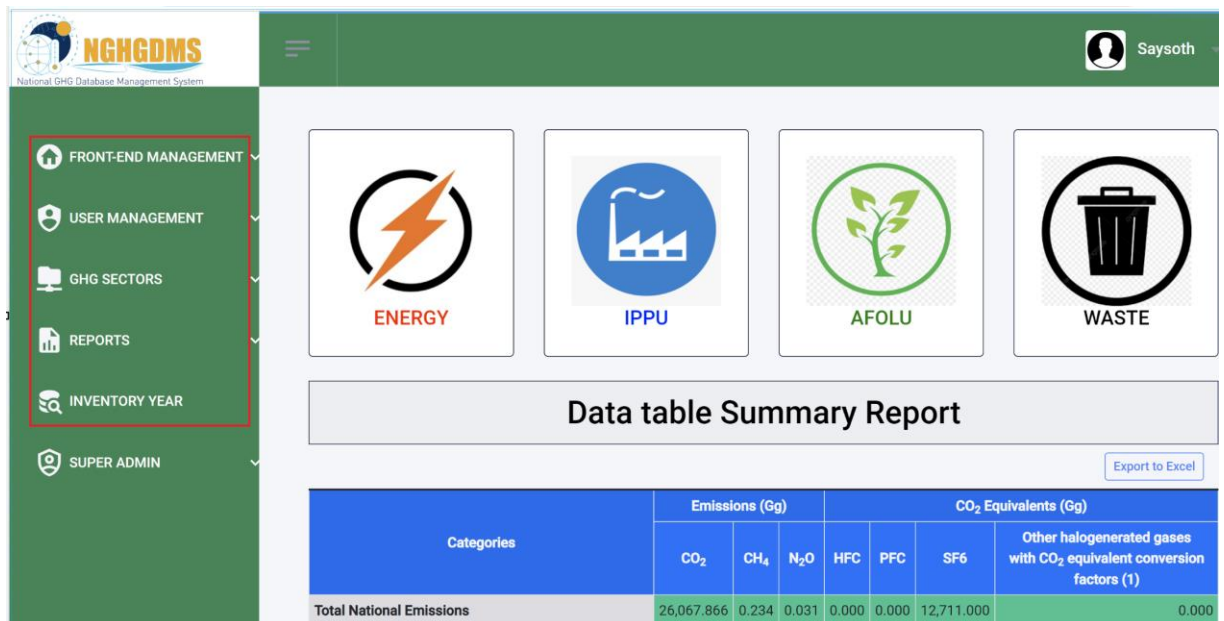


Figure 7: Administration page

- **Front-End management:** for manage all functions that display at the front-end home page;
- **User management:** is for managing users to access the system and assign their role for accessing the system;
- **GHG Sectors:** for review or data entry of each sector/sub sectors;
- **Report:** is for creating reports of all sectors; and
- **Inventory year:** to change/create new inventory year of each sector.

3.2 How to Log out

To log out from the system, just select the drop-down list next to your profile name, then click on “Log out” as shown below image.

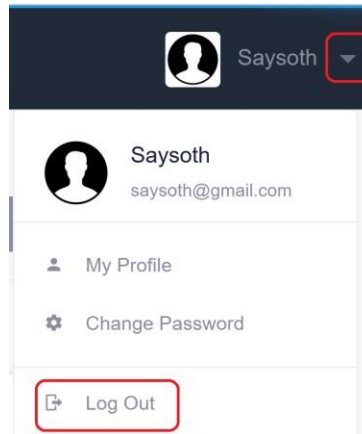


Figure 8: Log out form.

3.3 Home Page management

Only authorized users (admin users) can manage the home page, to do so just click on “Front-end management” will shows 4 front-end data categories to be managed including:

- **Slider:** manage slides of the home page;
- **Document Categories:** to add and manage document group;
- **Document:** add and manage the document in a specific document group; and
- **News and Events:** management news and events which displays on the home page.

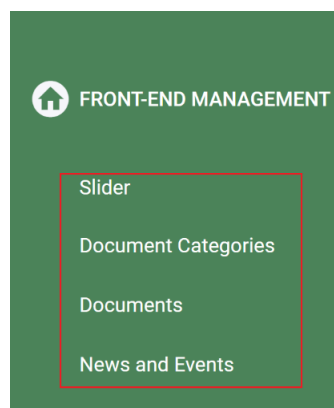


Figure 9: Front-end management form

3.3.1 Manage slides.

By selecting “Slider” the management page is pop up, authorized users can add a new slide, edit and delete the existing slides.

SL	Title	Description	Image	Action
1	Waste management	Waste management		Edit Delete
2	Agriculture	Agriculture		Edit Delete
3	Waste management	Waste management		Edit Delete
4	fire	Slash-and-burn agriculture in Laos and other Southeast Asian countries is a major source of air pollution throughout the region		Edit Delete
5	Energy	Energy		Edit Delete

Figure 10: Slider management

Image preparation: the image/picture is good enough with around resolution 1920x1080px and size is not more than 300kb;

Add a slider: Just click on “Add New”. Then add a name of title and description, then click on “Save”.

Create Slider

Title
Coal-fired power plants

Description
Air pollution from coal-fired power plants is linked with asthma, cancer, heart and lung ailments, neurological problems, acid rain, global warming, and other severe environmental and public health impacts

Image
[Browse...](#) No file selected.

[Save](#) [Cancel](#)

Figure 11: Editing slider.

Edit the existing slide: similarly with adding a new slide, just select the edit button, then update the requirement information, then click on “Save”.

Deleted the existing slide: Click on “Delete”, the delete confirmed box is popped up which asking, “are you sure to delete”, then click **OK**.

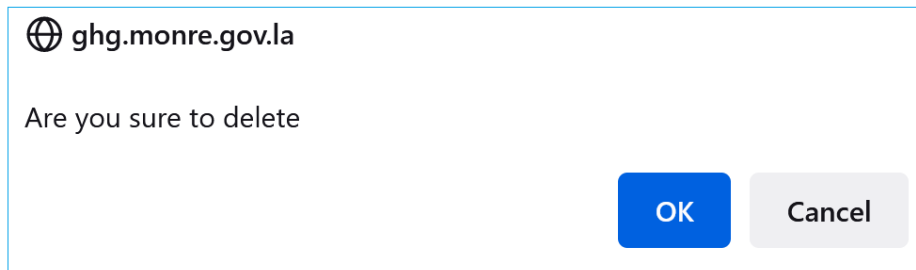


Figure 12: Delete Confirmation Box

3.3.2 Manage document.

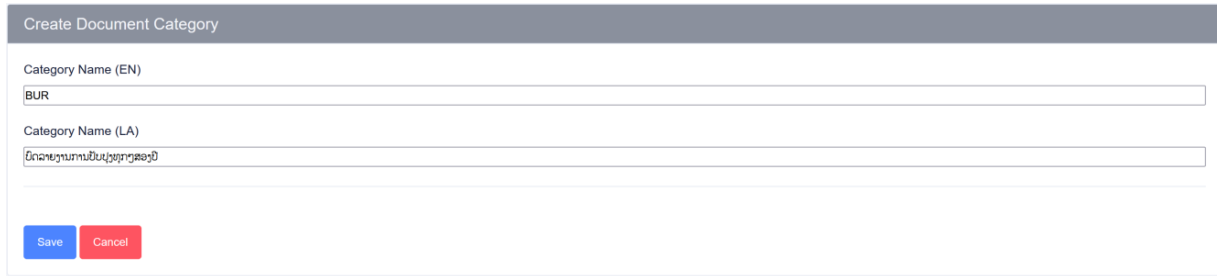
3.3.2.1 Adding document

First document category needs to be added, then document can be uploaded accordingly by document category(group), below image shows document category.

Document Category				
+Add New				
No.	Category Name in English	Category Name in Lao	Created User	Action
1	User Guideline	ຄູ່ມືໃນເນະນຳ	Saysoth	Edit Delete
2	Data Collection Form	ຟອມເກັບກຳຂໍ້ມູນ	Saysoth	Edit Delete
3	Report	ບົດລາຍງານ	Saysoth	Edit Delete
4	User Manuals	ຄູ່ມືຜູ້ໃຊ້	Saysoth	Edit Delete
5	Strategy	ແຜນຍຸດທະສາດ	Saysoth	Edit Delete
6	Biennial Transparency Reports(BTR)	ບົດລາຍງານປະຈຳ 2 ປີ	Admin	Edit Delete
7	Year Book	ຂໍ້ມູນປະຈຳປີ	Saysoth	Edit Delete

Figure 13: Document category

To add a document category, just click on “Add New” then supply document category name in Lao and English, browser to select document, then click on “Save”.



3.3.2.2 Editing document

Similarly with the addition of a new document, just select on “Edit”, then update information to be edited, finally click “Save”.

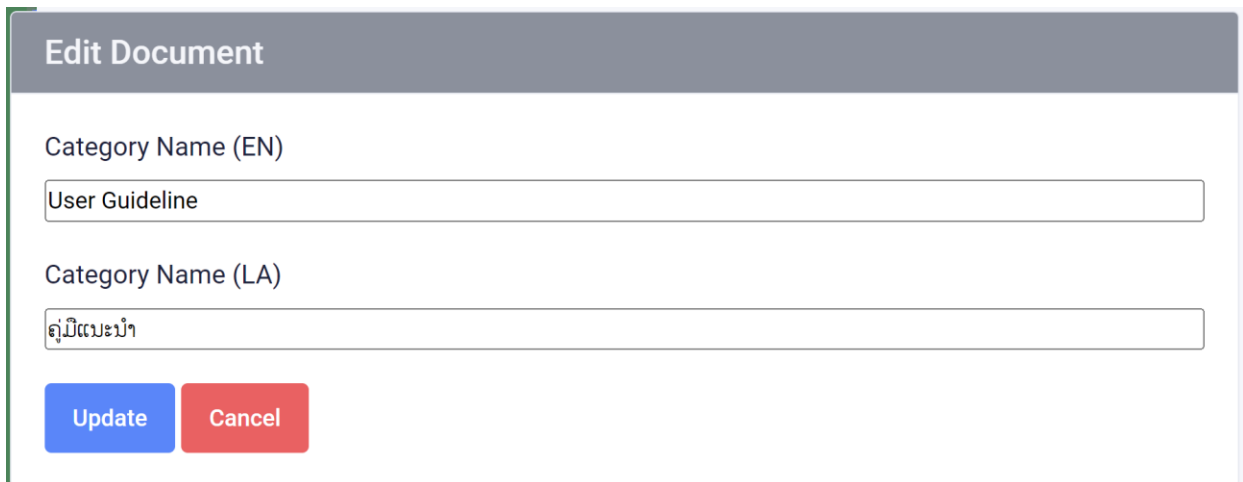
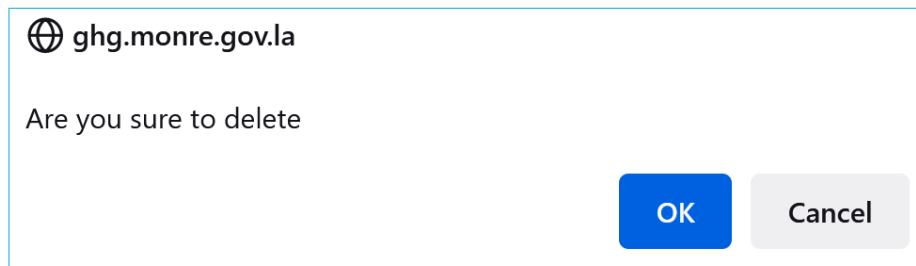


Figure 14: Editing document.

3.3.2.3 Deleting document

To delete the existing document, just **click** on “Delete”, the delete confirmed box is popped up which asking, “are you sure to delete”, then click **OK**.



3.3.3 Manage news and events.

Below image shows “News and Events” can be add, edit, and delete. a user can view the status of a news or event: the "draft" status means the news or event is drafting only, while publish means it is currently online.

No.	Title	Preview	Post Date	Status	Action
1	Lao PDR Signs Agreement to Pro...		17-11-2022	PUBLISH	Edit Delete
2	Lao PDR's NDC targets 60% GHG...		05-10-2022	DRAFT	Edit Delete
3	Laos to Cut Greenhouse Gas Emi...		05-10-2022	PUBLISH	Edit Delete

Figure 15: News and Event Management

3.3.2.4 Information preparation

Before adding any news or events, it is required to prepare the information needed with specify requirement including.

For creating Category

In order to add the category for news or an event, the name in both Lao and English must be given into the system. Therefore, user should prepare category's name in Lao and English before adding it.

For creating a News

- **Image:** the image/picture is good enough with around resolution 1024x700px and size is not more than 150kb;
- **Title and Tag** is for showing on the home page as a title of the news or events. This title and tag must translate in Lao as well. The maximum size is 100 words;
- **Description(details):** is for describe more details of the news or events in Lao and English; and
- **Status:** the user can choose either the news will publish or just draft only.

3.3.2.5 Adding

To add “News or Event”, by click on “Add”, the information table is popped up, a user can

supply information as following steps:

1. Select “Category” from the top-down list, if there is not category on the list, then create the new category by clicking on “Add New Category”;
2. Supply names of title, description and tips of both Lao and English;
3. Navigate the image to be uploaded by click on “Browse”;
4. Select the status of the news or even: draft means the news or event is not yet online website, while “Publish” means the news or event will be shown on website; and
5. Then “Submit”.

3.3.2.6 *Editing*

Similarly, to edit the existing the news or event, just click on “Edit”, then modify or update the information, then click on “Update”.

3.3.2.7 *Deleting*

Similarly, for deleting the news or event, click on “Delete”, the delete confirmed box is popped up which asking, “Are you sure to delete”, then click OK.

4. Administration Page

This section provides a description of administration page(back-end) with main functions of the system and how to use them. After login into the system, the management functions can be seen at the left hand side of the administration page including front-end management, user management, GHG sectors(data entry), reports, and inventory year as displayed in below image.

Categories	Emissions (Gg)			CO ₂ Equivalents (Gg)			
	CO ₂	CH ₄	N ₂ O	HFC	PFC	SF ₆	Other halogenated gases with CO ₂ equivalent conversion factors (1)
Total National Emissions	26,067.866	0.234	0.031	0.000	0.000	12,711.000	0.000

Figure 16: Back-end home page

4.1 Navigation tree

By selecting the specific sector, the navigation tree displays. To expand or collapse the tree, click on the **+** or **-** signs in front of the nodes, respectively. You can also expand or collapse the entire tree of the sector by clicking the plus and minus signs at the bottom of the tree.

The black color node represents the title of the activities and sub-activities, only blue color represents the active node.

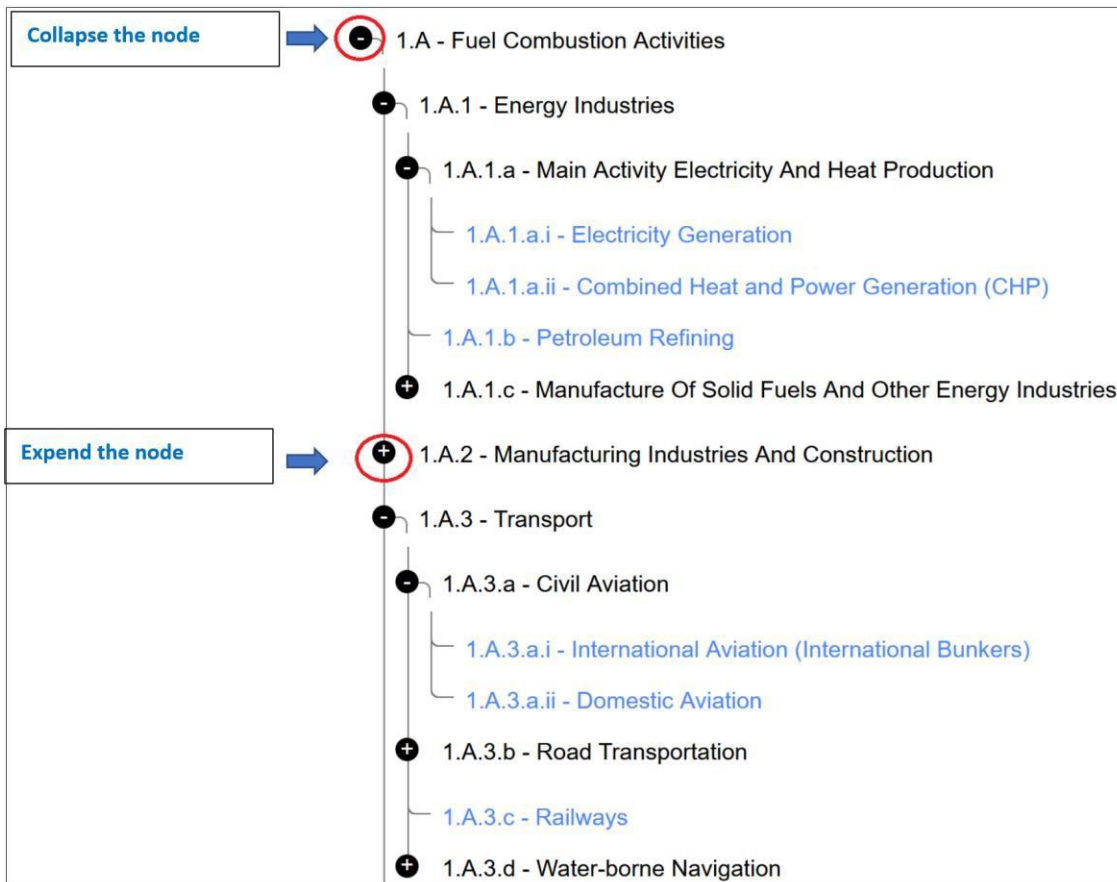


Figure 17: Navigation tree

4.2 Notation keys

Notation keys are used in the forms this system where data is absent or incomplete, to indicate why data is lacking. The use of notation keys is an internationally recognized good practice. Based on IPCC guideline a notation key can be used if the actual emissions have not been estimated, there are five (5) type of notation keys in below table.

NE	Not Estimated	Emissions and/or removals occur but have not been estimated or reported
NO	Not Occurring	An activity or process does not exist within a country.

IE	Included Elsewhere	Emissions and/or removals for this activity or category are estimated and included in the inventory but not presented separately for this category. The category
		emissions and removals are included should be indicated (for example in the documentation box in the correspondent table).
C	Confidential	Emissions and/or removals are aggregated and included elsewhere in the inventory because reporting at a disaggregated level could lead to the disclosure of confidential information.
NA	Not Applicable	The activity or category exists but relevant emissions and removals are considered never to occur. Such cells are normally shaded in the reporting tables.

Figure 18: Notation Key explanation

During adding data into the form, user can choose the Notation Key into the online form by selecting the options from top-down list as shown below image.

Figure 19: Notation Key option








4.3 Category Grids

After selecting any sub-sectors, the form table will be appeared including as activity data, other relevant information, and emissions/removals data.

- Top header of the form (grey background) are not editable by user, it includes names of sector, category, sub-categories, sheets, and inventory year;
- Top headers (blue background) are not editable by user which represents names of activity data, emission factors, emissions estimation with description of calculation formulas.
- Small red square button icon is the Notation Key for related parameter which a user can add during data entry;
- Editable cells (white background) - fields enabling to edit activity data, emission factors and other parameters; and
- Calculated cells (green background): emissions calculated from activity data and emission factors using the relevant formula from top headers. These are not editable but automatically calculated.

Sector : Energy													
Category : Fuel Combustion Activities													
Subcategory : 1.A.1.a.i - Electricity Generation													
Sheet : CO ₂ , CH ₄ , and N ₂ O from fuel combustion by source categories - Tier1													
Inventory Year: 2022													
+Add Categories  0													
Fuel	Energy Consumption				CO ₂			CH ₄		N ₂ O		Remark	Action
	Consumption (Mass, Volume or Energy Unit)	Unit	Conversion Factor (TJ/Unit) (NCV)	Consumption (TJ)	Emission Factor (Kg CO ₂ /TJ)	Amount Captured (Gg CO ₂)	CO ₂ Emission (Gg CO ₂)	Emission Factor (Kg CH ₄ /TJ)	CH ₄ Emission (Gg CH ₄)	N ₂ O Emission Factor (Kg N ₂ O/TJ)	N ₂ O Emission (Gg N ₂ O)		
	A		B	C = A*B	D	Z	E = C*D/10 ⁶ - Z	F	G = C*F/10 ⁶	H	I = C*H/10 ⁶		
Other Bituminous Coal			25.8	0.0	0	0	0.00000	0	0.00000	0	0.00000		 
Aviation Gasoline		TJ	1	0.0	70000		0.00000	3	0.00000	0.6	0.00000		 
Natural Gas (Dry)		2 Gg	48	96.0	56100	3	2.38560	1	0.00010	0.1	0.00001		 

Figure 20: Category Grid table

-  is for adding new data of the current category;
-  is to change to other category of the current sector(e.g. change from 1.A to 1.B);
-  is to show how many records are deleted, and they are still located in the bin;
-  is a notation key which can be (C, IE, NO, and None);
-  is comment/remark that a user may take note for clarification;
-  is for editing the exiting data record; and
-  is for deleting the existing data record.

4.4 Data Entry Template

Data Entry Template (DET) is data collection form for recording the approved Activity Data (AD) and relevant emission factors (EF) of each subcategory to support for data entry after being approved from relevant line ministries/stakeholder. The DET includes three (3) type sheets:

- 1. Introduction: includes introduction of DET and instruction how to fill in the data;
- 2. Table of content: is links of each sector and sub-category sheets; and
- 3. Sectorial data sheets: sheets of all subcategories of 4 sectors.

[Back to table of contents](#)

Sector: Energy
Category: Fuel Combustion Activities
Subcategory: 1.A.1.a.i - Electricity Generation
Sheet: CO2 CH4 and N2O from fuel combustion by source categories-Tier1
Inventory Year: 2022

Sectorial Information

Please enter amount for each applicable fuels

Fuel Type	Fuel	Consumption (A)	Unit(TJ/Gg)	Amount Captured	Conversion Factor(B)	CO2 Emission Factor(D)	CH4 Emission Factor(F)	N2O Emission Factor(H)
Liquid Fuels	Crude Oil	100	TJ	0	42.3	73300	3	0.6
Liquid Fuels	Ormulson							
Liquid Fuels	Natural Gas Liquids							
Liquid Fuels	Motor Gasoline	500	Gg	45	44.3	69300	3	0.6
Liquid Fuels	Aviation Gasoline							
Liquid Fuels	Jet Gasoline							
Liquid Fuels	Jet Kerosene							
Liquid Fuels	Shale Oil							
Liquid Fuels	Gas/Diesel Oil							
Liquid Fuels	Residual Fuel Oil							
Liquid Fuels	Liquefied Petroleum Gases							
Liquid Fuels	Ethane							
Liquid Fuels	Naphtha							
Liquid Fuels	Bitumen							
Liquid Fuels	Lubricants							
Liquid Fuels	Petroleum Coke							
Liquid Fuels	Refinery Feedstocks							
Liquid Fuels	Refinery Gas							
Liquid Fuels	Paraffin Waxes			3				
Liquid Fuels	White Spirit and SRP							

Example of data collection

English (United States)
US

Introduction | Table of contents | 1.A.1.a.i-Electricity Generation | 1.A.1.a.ii - Combined Heat and | 1.A.1.b - Petroleum Refining | 1.A.1.ci - Manufacture of Soli | 1.A.2.a - ... | To switch input methods, press Windows key + space.

Figure 21: Data Entry Template

4.4.1 Use as a data collection form

This DET is to fill/collect the approved activity data, to do so following steps:

1. Go to Table of content (each page has a link to table of contents called “back to table of contents);
2. Browser/scroll down for your desire subcategory to be filled the data in;
3. Save.

4.4.2 Use as a data entry form

In order to enter the approved data into system with specific subcategory, do following steps

1. Login the system, and open online data entry form of the desired sub-category;
2. Open the DET of that sub-category with the approved activity data.
3. Compare and make sure that the data of DET and data of online form are the same;
4. Fill in/copy the data from DET to the online form; and
5. then Save.

5. Data Entry

The sectors for data entry can be found by selecting the “GHG sectors” on the left navigation of the administration page, then the drop-down list of each sector. For entering the data, just select the desired subsector that want to enter the data.

5.1 Energy Sector

Energy sector consists of three main categories including 1.A, 1.B, 1.C. which has different data

grid and different calculation for GHG emission.

5.1.1 Fuel Combustion Activities

This category covers all sub-sector of category 1.A:

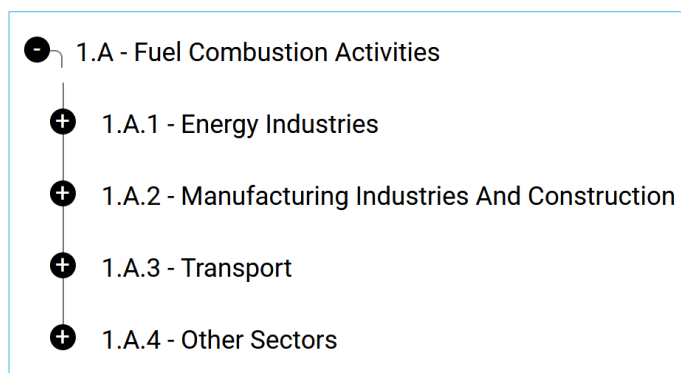


Figure 22: Fuel Combustion Activities

5.1.1.1 Adding Data

The data entry form of this sector varies from category by category which is applying for all sub-categories (1.A, 1.B, 1.C.). The form and its functionality are based on IPCC software which has validation functionality such as for checking Emission factor value, range of GHG unit, and notation key options.

- To access into a data entry form, just click on each section on horizontal icon OR expand “GHG Sectors”, and “Energy” sector is selected. Expand or collapse the navigation tree, click on the or signs in front of the nodes, respectively. You can also expand or collapse the entire tree by clicking the plus and minus signs at the bottom of the tree;
- Click on a desired sub-sector(blue), in this case “Electricity Generation” is clicking, the data information of the selected sub-sector is shown;






Figure 23: Adding data of field combinations activities.

- Click on , then the form is appearing as it shows below;


- Select “NCV” as default of conversion factor type;
- Fill in all information on the form, and choose a notation key (if any); and
- Click on “Save”.

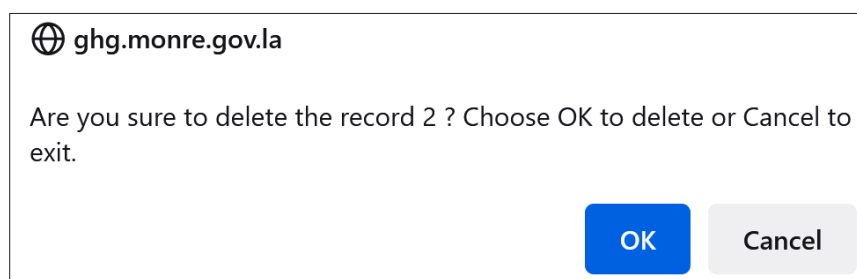
5.1.1.2 Editing data


The existing data can be edited by click () on the right-hand side of the table. Modified row is saved into database as soon as the user press the  button. Validation of entered data is

performed before the row is updated in the database, e.g., any error in the supplied data, user will be informed to correct it. The added data can be canceled by using  action button.

5.1.1.3 *Deleting data*

To delete the existing data row, click on “”, the delete confirmed box is popped up which asking, “are you sure to delete”, then click OK, otherwise click on “Cancel”.



The number of deleted data can be seen at the bin (), in this case no deleted data on the bin. The deleted data can be restored back when it is required into the original location.

5.1.1.4 *Example: Electricity Generation*

To estimate CO2 emission from “1.A.A.a: Electricity Generation” with Diesel fuel consumption of 500 tonne(0.5Gg) without any capture. Do follow below steps:

1. select " GHG sectors" on the left hand side of the administration page;
2. Check the subcategory(1.A.A.a);
3. Select” Fuel type” in this case “Liquid Fuel” is selected;
4. Select Fuel, in this case “Diesel “ is selected;
5. Fill total consumption of fuel: 0.5;
6. Choose Fuel Unit (Gg);
7. Amount capture is 0(because assume that there is not capture technology available);
8. Put any remark if any; and
9. Save.

All factors are automatically pop up when all data is entered, the online form is shown as below.

Sector : Energy
 Category : Fuel Combustion Activities
 Subcategory : 1.A.1.a.i - Electricity Generation ¹
 Sheet : CO₂, CH₄ and N₂O from fuel combustion by source categories - Tier1
 Inventory Year: 2023

Fuel Type
 ² Conversion Factor Type ³ NCV GCV

Fuel ⁴ Consumption (A) ⁵ Unit ⁶ Conversion Factor (B)

CO₂ Emission Factor (D) Amount Captured (Z) ⁷ CH₄ Emission Factor (F) N₂O Emission Factor (H)

Remark
 ⁸

⁹

After saving the data record, it will be added into the system, and it is on the top of table data row.

Sector : Energy
 Category : Fuel Combustion Activities
 Subcategory : 1.A.1.a.i - Electricity Generation
 Sheet : CO₂, CH₄ and N₂O from fuel combustion by source categories - Tier1
 Inventory Year: 2023

Fuel	Energy Consumption			CO ₂			CH ₄		N ₂ O		Remark	Action	
	Consumption (Mass, Volume or Energy Unit)	Unit	Conversion Factor (TJ/Unit) (NCV)	Consumption (TJ)	CO ₂ Emission Factor (Kg CO ₂ /TJ)	Amount Captured (Gg CO ₂)	CO ₂ Emission (Gg CO ₂)	CH ₄ Emission Factor (Kg CH ₄ /TJ)	CH ₄ Emission (Gg CH ₄)	N ₂ O Emission Factor (Kg N ₂ O/TJ)			N ₂ O Emission (Gg N ₂ O)
	A		B	C = A*B	D	Z	E = C*D/10*6-Z	F	G = C*F/10*6	H			I = C*H/10*6
Gas/Diesel Oil	0.5	Gg	43	21.5	74100	0	1.59315	3	0.00006	0.6	0.00001		
Lignite	15	Gg	11.9	178.5	101000	2	16.02850	1	0.00018	1.5	0.00027		

5.1.2 Fugitive Emission from Fuel

This sub-category covers all sub-categories of category 1.B

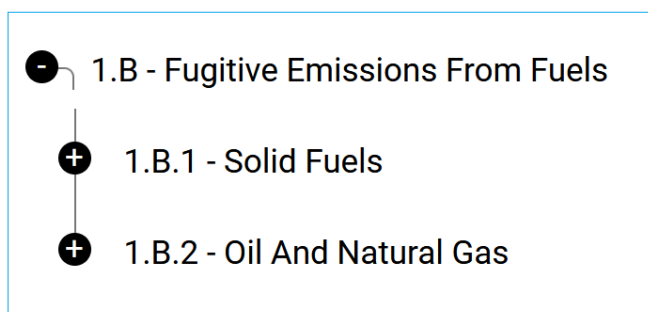



Figure 24: Energy Sector-Fugitive Emissions

This sub-category has a specific form of data entry (1. B.1.a.ii.1-surface mining and 1.B.1.a.ii.2-post- surface mining). Particularly, it has fixed data entry record forms of two gas types, Carbon Dioxide and Methane for an inventory year.

5.1.2.1 Adding/Editing/Deleting data

Adding or editing data is identical for this sub-category. To enter data for these sub-categories do the following:

- Choose the gas type: Carbon Dioxide or Methane;
- Select “” then fill in the data into the pop-up form;
- Click on “Save” ; and
- However, there is no deleting data option.

Sector :		Energy						
Category :		Fugitive Emissions From Fuels						
Subcategory :		1.B.1.a.ii.1 - Mining						
Sheet :		CO ₂ emission from underground and surface coal mining and handling - Tier1						
Inventory Year:		2021						
Gas								
<div style="border: 1px solid red; padding: 2px;"> CARBON DIOXIDE CARBON DIOXIDE METHANE </div>								
		(A) Amount of Coal Produced(tonne)	(B) Emission Factor (m3/tonne)	(C) CO ₂ Emissions(m3) (C=A*B)	(D) Conversion Factor(Gg CO2/m3) (1.83*10 ⁻⁶)	(E) CO ₂ Emission(E=C*D)	Remark	Action
Surface	Mining	1000	0	0	0.00000183	NE 0.00000		
Surface	Post-Mining	1000	2	2000	0.00000183	0.00366		
Total				2,000		0.00366		

5.1.3 Carbon Dioxide Transport and Storage

This sub-category covers all sub-categories of category 1.C.

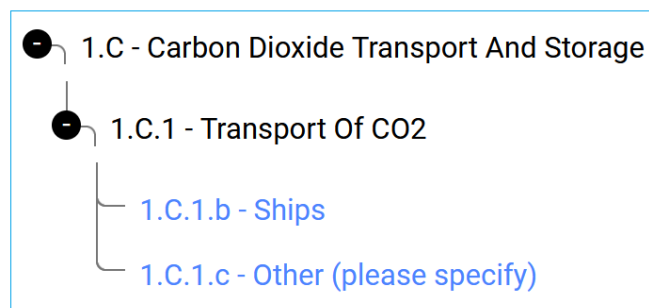



Figure 25: Carbon Dioxide Transport and Storage

5.1.3.1 Adding/Editing/Deleting data

This sub-category has a also specific form of data entry (1. C.1.b-Ships and 1.C.1.c-Other) which has fixed data entry record forms for an inventory year.

To enter data for these sub-categories, do the following:

- Choose the gas type: Carbon Dioxide or Methane;
- Select “” then fill in the data into the pop-up form; and
- Click on “Save” to that the data is saved into that inventory year.

Add 1.C - CO₂ Transport, Injection and Storage

Sector : Energy
 Category : 1.C - CO₂ Transport, Injection and Storage
 Sheet : Table 1.4a Energy Background Table: 1.CO₂ Transport, Injection and Storage
 Inventory Year: 2021

1.C.1.B - SHIPS

Annual Mass Of CO₂ Transported Annual Mass Of Fugitive CO₂ Emissions To The Atmosphere Or Sea Bed (Gg)

Remark

5.2 IPPU Sector



IPPU sector consists of eight (8) main categories including (2.A;2. B;2.C;2. D;2. E;2. F;2. G; and 2.H) which have different data grid and different calculation forms.

- 2.A-Mineral Industry
- 2.B-Chemical Industry
- 2.C-Metal Industry
- 2.D-Non-Energy Products from Fuels and Solvent Use
- 2.E-Electronics Industry
- 2.F-Product Uses as Substitutes for Ozone Depleting Substance
- 2.G-Other Product Manufacture and Use
- 2. H-Others








5.2.1 Adding data

The data entry form of this sector varies from category by category which is applying for all sub-categories (2.A;2. B;2.C;2. D;2.E;2.F;2.G; and 2.H). The form and its functionality are based on IPCC software which has validation functionality such as for checking Emission factor value, range of GHG unit, and notation key options.

- To access into a data entry form, just click on each section on horizontal icon OR expand “GHG Sectors”, and “IPPU” sector is selected. Expand or collapse the navigation tree,

click on the  or  signs in front of the nodes, respectively. You can also expand or collapse the entire tree by clicking the plus and minus signs at the bottom of the tree;



- Click on a desired sub-sector(blue), in this case “Ammonia Production” is clicking, the data information of the selected sub-sector is shown;

Sector : Industrial Processes and Product Use Category : Chemical Industry Subcategory : 2.B.1 - Ammonia Production Sheet : 1 of 1 Inventory Year :2021										
+Add Categories 										
A	B	C	D	$E = (A * B * C * D) * 44/12$	F	$G = F * 44/60$	$H = E - G$	$I = H / 10^6$	Remark	Action
Amount of Ammonia Produced (tonne)	Fuel Requirement for Ammonia Production (GJ/tonne ammonia produced)	Carbon Content of Fuel (kg C/GJ)	Carbon Oxidation Factor of Fuel (Fraction)	CO ₂ Generated (kg CO ₂)	Amount of Urea Produced (kg)	CO ₂ Recovered for Urea Production (kg CO ₂)	CO ₂ Emissions (kg CO ₂)	CO ₂ Emissions (Gg CO ₂)		
2	3	1	1	22.00000	4	2.93333	19.06667	0.00002		 
3	4	4	1	176.00000	4	2.93333	173.06667	0.00017		 
Total										
5				198.00000	8	5.86667	192.13333	0.00019		

- Click on , then the form is appearing as it shows below;

Add Ammonia Production

Sector : Industrial Processes and Product Use
Category : Chemical Industry
Subcategory : 2.B.1 - Ammonia Production
Sheet : 1 of 1
Inventory Year :2021

Ammonia Production (A)  Fuel Requirement (B) 




Carbon Content Of Fuel (C) Carbon Oxidation Factor Of Fuel (D) Urea Production (F)

Remark


Enter remark here..

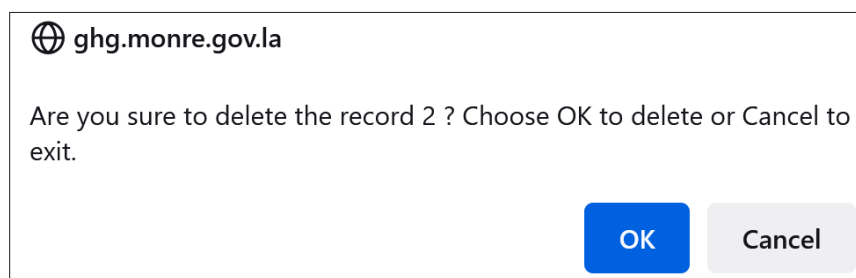
- Fill in all information on the form, and choose a notation key(if any); and
- Click on “Save”.


5.2.2 Editing data

The existing data can be edited or deleted by click () on the right-hand side of the table. Modified row is saved into database as soon as the user press the  button. Validation of entered data is performed before the row is updated in the database, e.g., any error in the supplied data, user will be informed to correct it. Adding of data can be canceled by using  action button.

5.2.3 Deleting data

To delete the existing data row, click on “”, the delete confirmed box is popped up which asking, “are you sure to delete”, then click OK, otherwise click on “Cancel”.



The number of deleted data can be seen at the bin () , in this case no deleted data on the bin. The deleted data can be restored back when it is required into the original location.

5.2.4 Example: Cement Production

Calculate the CO₂ greenhouse gas emissions from the national cement production of 3,000 tons including 1,000 tons of Portland cement and 2,000 tons of Green Bull. But import clinker 100 tons and export clinker 300 tons.

Recording of cement production into the system In order for the system to calculate greenhouse gas emissions, perform the following steps:

Update Mineral Industry - Cement Production

Sector : Industrial Processes and Product Use
 Category : Mineral Industry
 Subcategory : 2.A.1 - Cement production 1
 Sheet : 1 of 1
 Inventory Year :2023

Type Of Cement Produced: Portland Cement(ပတ်လန်ဇင်) 2
 Cement Produced (A): 1000 3
 Clinker Fraction In Cement (B): 0.95 4

Remark
 Enter remark 5 here..

6

Update Reset Back

1. Check the subcategory;
2. Type for cement type(in this case, it is Portland cement);
3. Fill amount of cement production (1000 tonne);
4. Select the clinker fraction in cement(if don't know this value check with guideline of this category(2.A.1));
5. Put any remark if any; and
6. Save.

Similar process for “Green Bull” cement. After save the data record, the data grid shows as below.

	A	B	C = A * B				
Individual Type of Cement Produced	Mass of Individual Type of Cement Produced (tonne)	Clinker Fraction in Cement (Fraction)	Mass of Clinker in the Individual Type of Cement Produced (tonne)	Remark	Action		
Portland Cement(ກະຍິງແດງ)	1000	0.95	950		 		
Green bull(ກະຍິງຂຽວ)	2000	0.75	1500		 		
Total	3000		2450				
Cement Production - CO₂ Emissions							
D	E	F	G = (D - E + F)	H	I = (G * H)	J = (I / 1000)	Action
Mass of Clinker in the Individual Type of Cement Produced (tonne)	Imports for Consumption of Clinker (tonne)	Export of Clinker (tonne)	Mass of Clinker in the Country/Territory (tonne)	Emission Factor for the Clinker (tonne CO ₂ /tonne Clinker)	CO ₂ Emissions (tonne CO ₂)	CO ₂ Emissions (Gg CO ₂)	
2450	100	300	2650	0.52	1378	1.378	

5.3 AFULO Sector

AFULO sector consists of four (4) main sub-sectors including (3.A;3. B; 3.C; and 3.D) which have different data grid and different calculation forms.

- 3.A-Livestock
- 3.B-Land
- 3.B-Aggregate Sources and Non-CO2 Emissions Sources on land
- 3.D-Others

5.3.1 Livestock

This category covers all sub-sector of category 3.A:

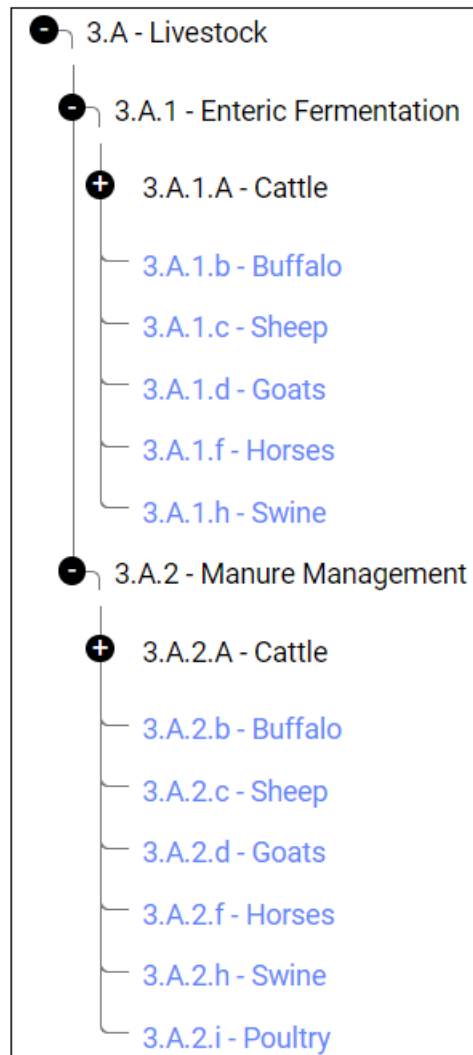


Figure 26: Livestock

5.3.1.1 Adding Data

The data entry form of this sector varies from category by category which is applying for all sub-categories (3.A.1 and 3.A.2). The form and its functionality are based on IPCC software which has validation functionality such as for checking Emission factor value, range of GHG unit, and notation key options.

- To access into a data entry form, just click on each section on horizontal icon OR expand “GHG Sectors”, and “Energy” sector is selected. Expand or collapse the navigation tree, click on the or signs in front of the nodes, respectively. You can also expand or collapse the entire tree by clicking the plus and minus signs at the bottom of the tree;

- Click on a desired sub-sector(blue), in this case “Diary Cow” is clicking, the data information of the selected sub-sector is shown;

Sector : Agriculture, Forestry and Other Land Use
 Category : Livestock/Enteric Fermentation
 Subcategory : 3.A.1.a.i - Dairy Cows
 Sheet : 1 of 1
 Inventory Year:2021

Gas

METHANE (CH4) 1

Livestock Manager Categories 2

T	N(T)	EF(T)	CH4 = N(T) * EF(T) * 10 ⁻⁶	Remark	Action
Species/Livestock Category	Number of Animals (Head)	Emission Factor [Kg CH ₄ /(Head yr)]	CH ₄ Emissions (Gg CH ₄ /yr)		
Dairy cows	1500	20	0.03000		
Dairy cows	500	58	0.02900		
Total			0.05900		

Figure 27: Adding livestock.

Take the following steps to add new data:

- Choose “Methane (CH₄), then select “Livestock Manager”
- Fill in the information as required
- Click on “Save”

Category
Dairy Cows

Livestock Subcategory (T) 1 Annual AV Population N(T) 2

Typical Animal Mass(T) 3 Excretion Rate Per Mass Per Day 4


Remark
Enter remark here..



Save Reset Back 5

Categories


T	N(T)	TAM(T)	ER	Nex(T) = TAM(T)/1000 * 365 * ER	Remark	Action
Livestock Subcategory	Annual Average Population (Head)	Typical Animal Mass (Kg)	Excretion Rate per mass per day [Kg N/(1000Kg animal mass day)]	Excretion Rate per animal per year [Kg N/(animal yr)]		
Dairy cows	1500	250	50	4562.5		
Dairy cows	500	300	40	4380		

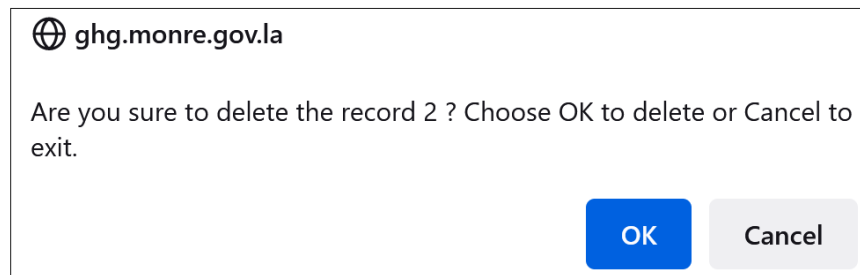
5.3.1.2 Editing data

The existing data can be edited or deleted by click () on the right-hand side of the table.

Modified row is saved into database as soon as the user press the  button. Validation of entered data is performed before the row is updated in the database, e.g., any error in the supplied data, user will be informed to correct it. Adding of data can be canceled by using  action button.

5.3.1.3 *Deleting data*

To delete the existing data row, click on “”, the delete confirmed box is popped up which asking, “are you sure to delete”, then click OK, otherwise click on “Cancel”.



5.3.2 **Land**

This category covers all sub-sector of category 3.B(3. B.1;3. B.2; 3.B.3; 3.B.4; 3.B.5; 3.B.6).

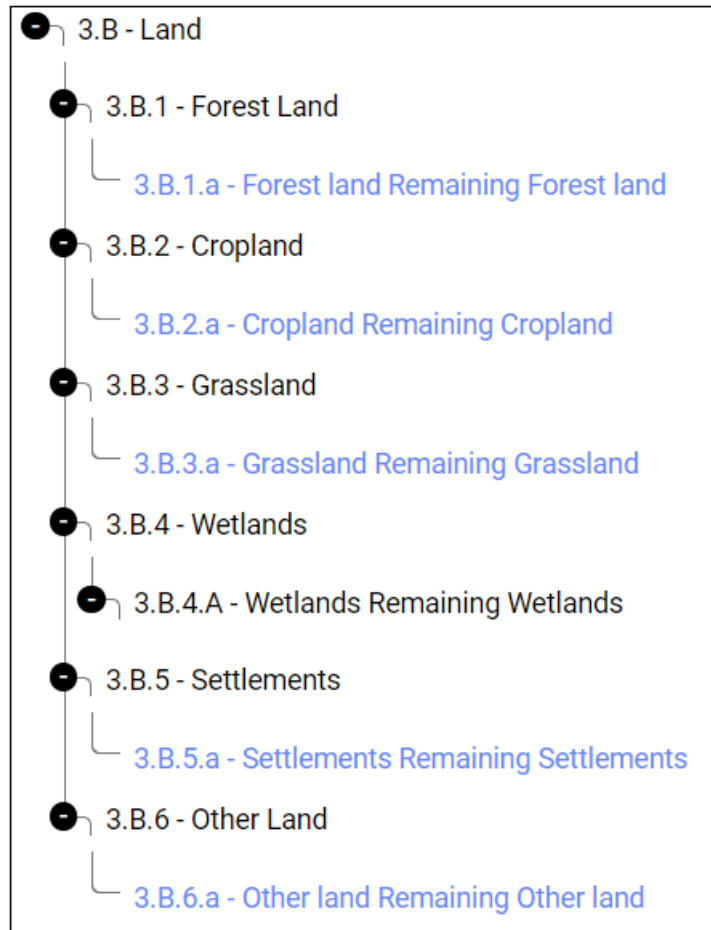


Figure 28: Land

Before adding the data into the each “Land Type” category, it requests to identify them namely Land Forest, Cropland, Grassland, Wetland, Settlements, and other land.

5.3.2.1 Create Land type

To create the land type, do the following steps. In this case we create Land Forest for “Conifer Forest”. The information for land type manager can be found in Annex 3.

- Just on “Land Type Manager”

Sector : Agriculture, Forestry and Other Land Use
 Category : Land
 Subcategory : 3.B.1.a - Forest land Remaining Forest land
 Sheet : Area Entry Table
 Inventory Year:2025

Land Type Manager

Categories

- Fill in information for each Land type as below.
- Save by clicking on “Submit” button.

Update Common Land Type Data

Land Use Subcategory

Climate Region

Soil Type

Forest Land Data

Ecosystem Type

Continent Type

Species

Age Class (Yr)

Natural Forest Plantation

Growing Stock Level (M3/Ha)

Carbon Fraction Of Aboveground Forest Biomass (Tonne C/Tonne D.M.)

Ratio Of Below-Ground Biomass To Above-Ground Biomass (R) (T Root D.M./T Shoot D.M.)

Biomass Conversion And Expansion Factor For Wood And Fuelwood Removal (BCEFr) (T / M3 Wood Volume)

Above-Ground Biomass In Forest (T D.M./Ha)

Above-Ground Biomass Growth In Plantation/Natural Forests (T D.M./Ha./Yr)

Abandoned Managed Land

Relative Stock Change Factor
 Land Use (FLU)

Management (FMG)

Input (FI)

Figure 29: Land Type Manager

5.3.2.2 Adding data

After creating the “Land Type Manager”, the activity data can be added in any forest type, do the following steps:

5.3.2.2.1 Tap 1: Area Entry Table

The area of available specific type of land is added by a user (in this case, 500 ha of bamboo)

1 Area Entry Table	2 Annual increase in carbon stocks in biomass	3 Loss of carbon from wood removals	4 Loss of carbon from fuelwood removals
5 Loss of carbon from disturbance	6 Total CO ₂ Emissions		
Sector : Agriculture, Forestry and Other Land Use Category : Land Subcategory : 3.B.1.a - Forest land Remaining Forest land Sheet : Area Entry Table Inventory Year:2025			
Land Type Manager Categories			
Land Use	Area (ha)	Action	
Bamboo	<input type="text" value="500"/>	Save	

5.3.2.2.2 Tap 2: Annual increase in carbon emissions.

After adding land area, the system will calculate the Biomass Carbon stock in tonne per year(tonne C/yr).

Lan Use Category	Equation 2.9	Equation 2.10			Equation 2.9		
	Area of Forest Land Remaining Forest Land (ha)	Average annual above-ground biomass growth (tonnes dm / (ha * yr))	Ratio of below-ground biomass to above-ground biomass [tonnes bg dm/(tonne ag dm)]	Average annual biomass growth above- and below-ground (tonnes dm / (ha * yr))	Carbon fraction of dry matter [tonnes C / (tonne dm)]	Annual increase in biomass carbon stocks due to biomass growth (tonnes C / yr)	
Land use during reporting year	National statistics or international data sources	Table 4.9, 4.10, 4.12	Zero (0) or Table 4.4	Gtotal = Gw * (1+R)	0.5 or Table 4.3	$\Delta CG = A * Gtotal * CF$	Remark
	A	Gw	R	Gtotal	CF	ΔCG	
Bamboo	500	9	0.2	10.8	0.47	2538	Comment
Total	500			10.8		2538	

5.3.2.2.3 Tap 3: loss of carbon from wood removal.

Then, a user needs to add the area from bamboo removal, so that to calculate the loss carbon from wood removal, in this case the removal area is 50 ha.

Area Entry Table	Annual increase in carbon stocks in biomass	Loss of carbon from wood removals	Loss of carbon from fuelwood removals	Loss of carbon from disturbance	Total CO ₂ Emissions		
Sector : Agriculture, Forestry and Other Land Use Category : Forest Land Subcategory : 3.B.1.a - Forest land Remaining Forest land Sheet : 2 of 4 Loss of carbon from wood removals Inventory Year:2025							
Land Type Manager Categories							
Lan Use Category	Equation 2.12						
	Annual wood removal (m ³ /yr)	Biomass conversion and expansion factor for conversion of removals in merchantable volume to total biomass removals (including bark) (tonnes of biomass removals/m ³ of removal)	Ratio of below-ground biomass to above-ground biomass [tonnes bg dm/(tonne ag dm)]	Carbon fraction of dry matter [tonnes C / (tonne dm)]	Annual carbon loss due to biomass removals (tonnes C / yr)		
Land use during reporting year	National statistics or international data sources	Table 4.5	Zero (0) or Table 4.4	0.5 or Table 4.3	$Lwr = H * BCEF * (1+R) * CF$	Remark	Action
	H	BCEFr	R	CF	Lwr		
Bamboo	50		10	0.2	0.47	282.000	Save
Total	50					282.000	

5.3.2.2.4 Tap 4: Loss of carbon from fuelwood removal.

The estimate annual carbon loss from fuelwood removal, a user should add the volume of fuelwood removal of whole tree and a tree parts, and value of wood density as below screen.

Area Entry Table	Annual increase in carbon stocks in biomass	Loss of carbon from wood removals	Loss of carbon from fuelwood removals	Loss of carbon from disturbance	Total CO ₂ Emissions			
Sector : Agriculture, Forestry and Other Land Use Category : Forest Land Subcategory : 3.B.1.a - Forest land Remaining Forest land Sheet : 3 of 4 Loss of carbon from fuelwood removals Inventory Year:2025								
Land Type Manager Categories								
Lan Use Category	Equation 2.13							
	Annual volume of fuelwood removal of whole trees (m ³ /yr)	Biomass conversion and expansion factor for conversion of removals in merchantable volume to total biomass removals (including bark) (tonnes of biomass removals/m ³ of removal)	Ratio of below-ground biomass to above-ground biomass [tonnes bg dm/(tonne ag dm)]	Annual volume of fuelwood removal as tree parts (m ³ /yr)	Basic wood density (tonnes/m ³)	Carbon fraction of dry matter [tonnes C / (tonne dm)]	Annual carbon loss due to fuelwood removal (tonnes C / yr)	
Land use during reporting year	FAO statistics	Table 4.5	Zero (0) or Table 4.4	FAO statistics	Tables 4.13, 4.14	0.5 or Tables 4.3	$Lwr = [FGtrees * BCEFr * (1+R) + FGpart * D] * CF$	
	FGtrees	BCEFr	R	Gpart	D	CF	Lwr	
Bamboo	20		10	0.2	1500	10	0.47	7,162.800

5.3.2.2.5 Tap 5: Loss carbon from disturbance.

Then calculate the carbon loose from disturbance such as bushfire, erosion, land slide, flood etc.




A user should add the area of disturbance and fraction of loss biomass from disturbance.

Area Entry Table		Annual increase in carbon stocks in biomass	Loss of carbon from wood removals	Loss of carbon from fuelwood removals	Loss of carbon from disturbance	Total CO ₂ Emissions				
Sector : Agriculture, Forestry and Other Land Use Category : Forest Land Subcategory : 3.B.1.a - Forest land Remaining Forest land Sheet : 4 of 4 Loss of carbon from disturbance Inventory Year:2025										
Land Type Manager		Categories								
Lan Use Category	Equation 2.14						Equation 2.11	Remark	Action	
	Available Area (ha)	Area affected by disturbances (ha/yr)	Average above-ground biomass of areas affected (tonnes dm/ha)	Ratio of below-ground biomass to above-ground biomass [tonnes bg dm/(tonne ag dm)]	Carbon fraction of dry matter [tonnes C / (tonne dm)]	Fraction of biomass lost in disturbance	Annual other lossess of carbon (tonnes C/yr)			Annual decrease in carbon stocks due to biomass loss (tonnes C / yr)
Land use during reporting year	National statistics or Internation data sources		Table 4.9	Zero (0) or Table 4.4	0.5 or Tables 4.3		Ldisturb = A*Bw* (1+R)+CF*fd	$\Delta CI = Lwr + Lfw + Ldisturb$		
		Adisturb	Bw	R	CF	fd	Ldisturb	ΔCI		
Bamboo	500	200	180	0.2	0.47	1	20,304.000	27,748.800		
Total		200					20,304.000	27,748.800		

5.3.2.2.6 Finally, it is calculated the total of CO₂ emission from this land areas

Area Entry Table		Annual increase in carbon stocks in biomass	Loss of carbon from wood removals	Loss of carbon from fuelwood removals	Loss of carbon from disturbance	Total CO ₂ Emissions
Sector : Agriculture, Forestry and Other Land Use Category : Forest Land Subcategory : 3.B.1.a - Forest land Remaining Forest land Sheet : Total CO ₂ Emissions Inventory Year:2025						
Land Type Manager		Categories				
Lan Use Category	Annual increase in biomass carbon stocks due to biomass growth (tonnes C / yr)	Annual carbon loss due to biomass removals (tonnes C / yr)	Annual carbon loss due to fuelwood removal (tonnes C / yr)	Annual decrease in carbon stocks due to biomass loss (tonnes C / yr)	Net Biomass Carbon Stock	Total CO ₂ Emissions
	A = ΔCG	B = Lwr	C = Lfw	D = ΔCI	E = A - (B+C+D)	F = E * (44/12)
Forest Land	2,538.000	282.000	7,162.800	27,748.800	-32,655.600	-119,737.200

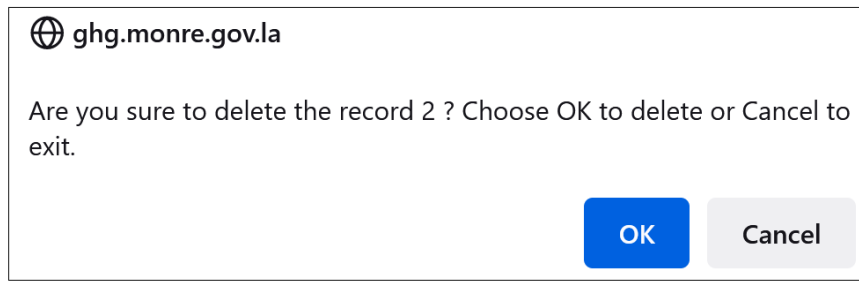
5.3.2.3 Editing data

Available data can be edited by clicking () on the right side of the table. The modified row will be saved in the database immediately when the user clicks the button  . The system function will check the validity of the data that has just been entered before the data is saved in the database, and any error in the data that has just been detect, the system will inform the user to correct it. And the entered data can be canceled by using the button  . in this case, data in area entry table is editing.

Area Entry Table	Annual increase in carbon stocks in biomass	Loss of carbon from wood removals	Loss of carbon from fuelwood removals	Loss of carbon from disturbance	Total CO ₂ Emissions
Sector : Agriculture, Forestry and Other Land Use Category : Land Subcategory : 3.B.1.a - Forest land Remaining Forest land Sheet : Area Entry Table Inventory Year:2025					
<input type="button" value="Land Type Manager"/> <input type="button" value="Categories"/>					
Land Use	Area (ha)				Action
Bamboo	500				<input type="button" value="Save"/>

5.3.2.4 Deleting data

To delete a specific land type, just go to "Land Type Manager", then click the button . A deletion confirmation message will appear, which asks, "Are you sure to delete", then click "OK", otherwise click "Cancel".



5.4 Waste Sector

Waste sector consists of three (3) main sub-sectors including (4.B;4.C; and 4.D) which have different data grid and different calculation forms.

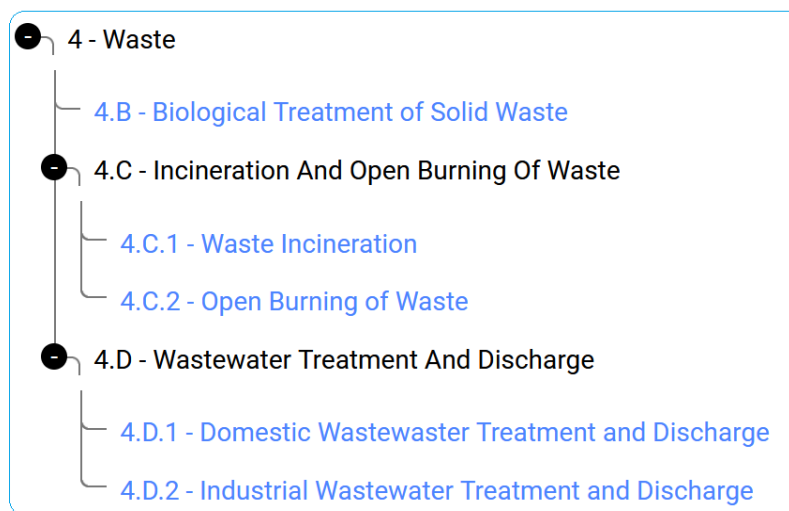




Figure 30: Waste Sector

5.4.1 Adding data

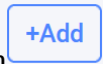
The data entry form of this sector varies from category by category which is applying for all sub-categories (4.A;4. B;4.C and 4.D). The form and its functionality are based on IPCC software which has validation functionality such as for checking Emission factor value, range of GHG unit, and notation key options.

- To access into a data entry form, just click on each section on horizontal icon OR expand “GHG Sectors”, and “Waste” sector is selected. Expand or collapse the navigation tree, click on the  or  signs in front of the nodes, respectively. You can also expand or collapse the entire tree by clicking the plus and minus signs at the bottom of the tree;
- Click on a desired sub-sector(blue), in this case “Biological Treatment of Solid Waste” is clicking, the data information of the selected sub-sector is shown;

Sector : Waste
 Category : Biological Treatment of Solid Waste
 Subcategory : 4.B - Biological Treatment of Solid Waste
 Sheet : 1 of 1 Estimation of emissions from Biological Treatment of Solid Waste
 Inventory Year : 2021

Gas: Waste Basis:

			A	B	C = (A*B)/100	D	E = (C-D)		
Biological Treatment System	Waste Category	Type of Waste	Total Annual amount treated by biological treatment facilities (Gg)	Emission Factor [g CH4/kg waste treated]	Gross Annual Methane Generation (Gg)	Recovered/Flared CH4 per year (Gg)	Net Annual CH4 Emissions (Gg)	Remark	Action
Composting	Municipal Solid Waste	Paper/cardboard	46	5600	2576		2576		 
Anaerobic digestion at biogas facilities	Municipal Solid Waste	Textiles	89	50	44.5	9	35.5		 
Total							2611.5		

- Click on , then the form is appearing as it shows below;

Add Biological Treatment of Solid Waste

Sector : Waste
 Category : Biological Treatment of Solid Waste
 Subcategory : 4.B - Biological Treatment of Solid Waste
 Sheet : 1 of 1 Estimation of emissions from Biological Treatment of Solid Waste
 Inventory Year : 2021


Biological Treatment System **1** Waste Category **2** Type Of Waste **3**

Total Annual Amount (A) **4** Emission Factor (B) Recovered/Flared (D) **5**


Remark

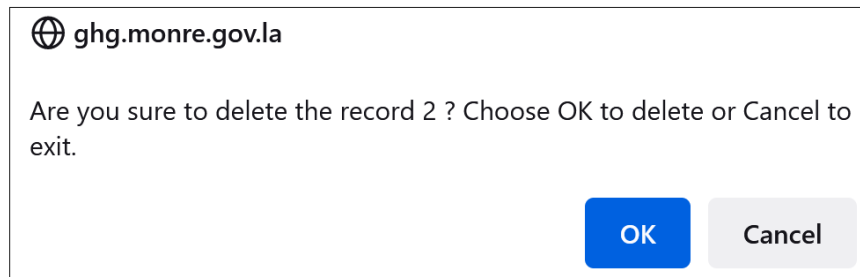
- Select the linking lists from 1 to 3;
- Fill in all information on the form, and choose a notation key(if any); and
- Click on “Save”.

5.4.2 Editing data

The existing data can be edited or deleted by click () on the right-hand side of the table. Modified row is saved into database as soon as the user press the button. Validation of entered data is performed before the row is updated in the database, e.g., any error in the supplied data, user will be informed to correct it. Adding of data can be canceled by using action button.

5.4.3 Deleting data

To delete the existing data row, click on “”, the delete confirmed box is popped up which asking, “are you sure to delete”, then click OK, otherwise click on “Cancel”.



The number of deleted data can be seen at the bin (), in this case no deleted data on the bin, the deleted data can be restored back when it is required.

6. User management

This section describes users' management functions defined in the database which is divided into three (3) user groups:

Super Admin User is a full control user to manage all functions of the system, database management and manage all user category and their privilege roles;

Admin user is an authorized user who manage front-end and back-end, but cannot manage database;

Sector Users is an authorized user who can see and manage the data of one or more sectors only (depending on assigned tasks).

Only Super Admin and Admin users can access User Management functions to create new users, editing and deleting existing users. The main component of User management include:

- **Username:** the name of a user which was designed by administrator, and it shows as the current account when logging in;
- **User Sign-In:** is an email was created for this system only as a login username, but could be a real email;
- **User roles:** are roles of users to work with functions of the system for specific sectors; and
- **Action:** is for edit and delete the existing users.

#	User Name	User Sign-in	User Roles							Action	
1	Saysoth	saysoth@gmail.com	ENERGY	IPPU	AFOLU	WASTE	OTHER	FRONTEND MANAGEMENT	USER ROLE MANAGEMENT	REPORT	Edit Delete
2	Sodsada	sodsada@gmail.com	ENERGY	IPPU	AFOLU	WASTE	OTHER	FRONTEND MANAGEMENT	USER ROLE MANAGEMENT	REPORT	Edit Delete
3	IPPU	ippu@gmail.com	IPPU	REPORT							Edit Delete
4	AFOLU	afolu@gmail.com	AFOLU	REPORT							Edit Delete
5	WASTE	waste@gmail.com	WASTE	REPORT							Edit Delete
6	OTHER	other@gmail.com	OTHER	REPORT							Edit Delete
7	Energy	energy@gmail.com	ENERGY	REPORT							Edit Delete
8	DCC	dcc@gmail.com	ENERGY	IPPU	AFOLU	WASTE	OTHER	FRONTEND MANAGEMENT	USER ROLE MANAGEMENT	REPORT	Edit Delete

Figure 31: User Management panel

6.1 Creating a new user

Take following steps to define new user:

- Login as administrator user;
- Select “Add User”;
- Supply all new user information;
- Select user role for specific requirement (e.g. if create new user to manage Energy sector, just tick “Energy” only); and
- Click on “submit”.

Create User

Name

Email

Password

Confirm Password



USER ROLES

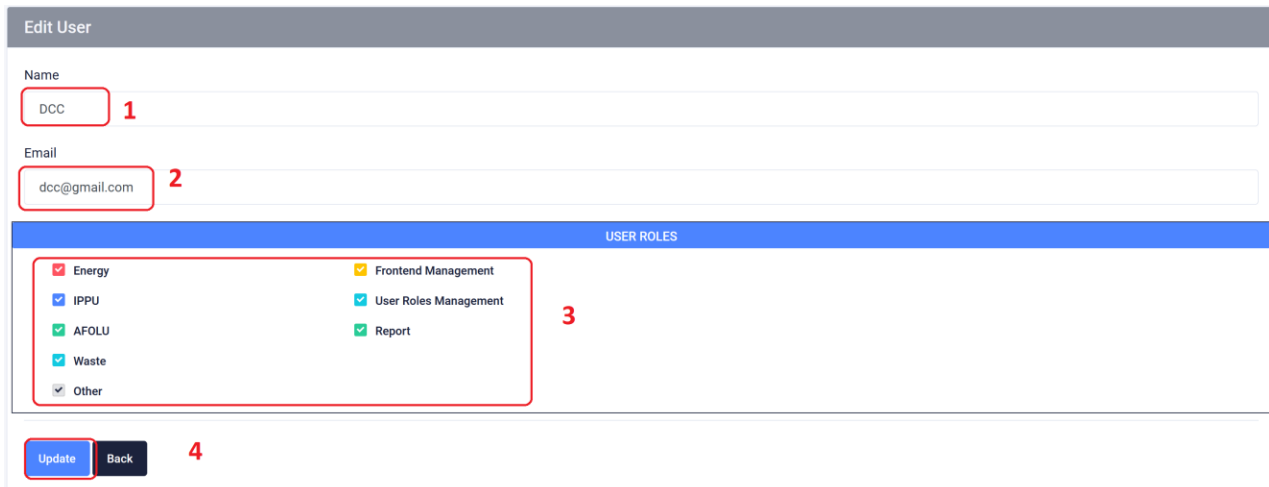
<input checked="" type="checkbox"/> Energy <input type="checkbox"/> IPPU <input type="checkbox"/> AFOLU <input type="checkbox"/> Waste <input type="checkbox"/> Other	<input type="checkbox"/> Frontend Management <input type="checkbox"/> User Roles Management <input type="checkbox"/> Report
---	---

Figure 32: Create a new user

6.2 Editing existing user

Take following steps to edit existing user:

- Login as administrator user;
- In User management navigation, click on “ View all user”;
- Select the button ;
- Modify the information; and
- Click on .




The screenshot shows the 'Edit User' interface. At the top, there is a header 'Edit User'. Below it, there are two input fields: 'Name' with the value 'DCC' (callout 1) and 'Email' with the value 'dcc@gmail.com' (callout 2). Below these fields is a section titled 'USER ROLES' containing a list of roles with checkboxes: Energy, IPPU, AFOLU, Waste, Other, Frontend Management, User Roles Management, and Report (callout 3). At the bottom of the form, there are two buttons: 'Update' (callout 4) and 'Back'.

Figure 33: Editing the existing user

6.3 Deleting existing user

Take following steps to edit existing user:

- Login as administrator user;
- In User management navigation, click on “View all user”;
- Select the button ;
- A deletion confirmation message will appear, which asks, "Are you sure to delete", then click "OK", otherwise click "Cancel".

ghg.monre.gov.la

Are you sure to delete this user?

OK

Cancel

7. Reports

User to view the report of data entered in the system for sectors . The report cannot be modified, but it can be done through the data entry form of each sector by the admin users.

There are two types of reports: summary report and sectorial report. The summary report is summary reporting of all sectors up to 2 level categories, while the sectorial report is the report all category data of a sector. both reports can be downloaded into Excel format.

7.1 Summary Report

Take following steps to view a summary report of each sector:

- Login as administrator user;
- Select “Reports Navigation tree”;
- Select “summary report”; and
- Select " Download to Excel" if want to download.

The screenshot displays the NGHGOMS National GHG Database Management System interface. The left sidebar contains navigation options: FRONT-END MANAGEMENT, USER MANAGEMENT, GHG SECTORS, REPORTS, and INVENTORY YEAR. Under REPORTS, 'Summary Reports' is highlighted. The main content area shows a 'Data table Summary Report' with an 'Export to Excel' button. The table lists various categories and their corresponding emissions and CO2 equivalents.

Categories	Emissions (Gg)					CO ₂ Equivalents (Gg)		
	CO ₂	CH ₄	N ₂ O	HFC	PFC	SF ₆	Other halogenated gases with CO ₂ equivalent conversion factors (1)	
Total National Emissions	1,447,563.273	7.517	0.444	0.000	0.000	12,471.600	0.003	
1 - Energy	35,607.634	7.500	0.431					
1.A - Fuel Combustion Activities	35,607.570	7.500	0.431					
1.B - Fugitive emissions from fuels	0.064	0.000	0.000					
1.C - Carbon dioxide Transport and Storage	0.000							
2 - Industrial Processes and Product Use	1,287.424	0.000	0.014	0.000	0.000	12,471.600	0.003	
2.A - Mineral Industry	31.424							
2.B - Chemical Industry	0.000	0.000	0.014	0.000			0.003	
2.C - Metal Industry	1,256.000	0.000			0.000	0.000		
2.D - Non-Energy Products from Fuels and Solvent Use	0.000							
2.E - Electronics Industry				0.000	0.000	0.000	0.000	

Figure 34: Summary Report

7.2 Sectorial reports

Take following steps to view a sectorial report of each sector:

- Login as administrator user;
- Select “Reports”; and
- Select the desired report, in this case “Energy sectorial report” is selected.
- Select " Download to Excel" if want to download.

Categories	Emissions (Gg)						
	CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOCs	SO ₂
1 - Energy	35,607.634	7.500	0.431	0.000	0.000	0.000	0.000
1.A - Fuel Combustion Activities	35,607.570	7.500	0.431	0.000	0.000	0.000	0.000
1.A.1 - Energy Industries	34,171.800	7.248	0.388	0.000	0.000	0.000	0.000
1.A.1.a - Main Activity Electricity and Heat Production	3,671.900	5.919	0.122	0.000	0.000	0.000	0.000
1.A.1.a.i - Electricity Generation	3,671.900	5.919	0.122	0.000	0.000	0.000	0.000
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.b - Petroleum Refining	30,499.900	1.329	0.266	0.000	0.000	0.000	0.000
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.c.i - Manufacture of Solid Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 - Manufacturing Industries and Construction	1,435.770	0.252	0.043	0.000	0.000	0.000	0.000

Figure 35: Sectorial report

8. Inventory Year

Inventory Year is annual records of GHG data of all sectors in a year. In other words, Inventory Year of NGHGDMS is for recording GHD data year by year.

8.1 Creating inventory year

In order to create a inventory year, take the following steps:


- Log in as the system administrator;
- Click on “Create New”;

- The new inventory year is pop up as below screen;
- Select the year from “top down” list; and
- Click on “Save”.
- Alternatively, an inventory year can be created from back-end system by clicking on “Inventory Year”.

ID	Inventory Year	Action
2	2020	[Edit] [Delete]
3	2021	[Edit] [Delete]
4	2022	[Edit] [Delete]
5	2023	[Edit] [Delete]

Figure 36: Create Inventory Year

8.2 Editing the existing Inventory Year

The authorized admin users can edit the existing Inventory Year (but data should be backup before doing this task). To do so just click on () on the right-hand side of the table, update the

information, then press the  button.

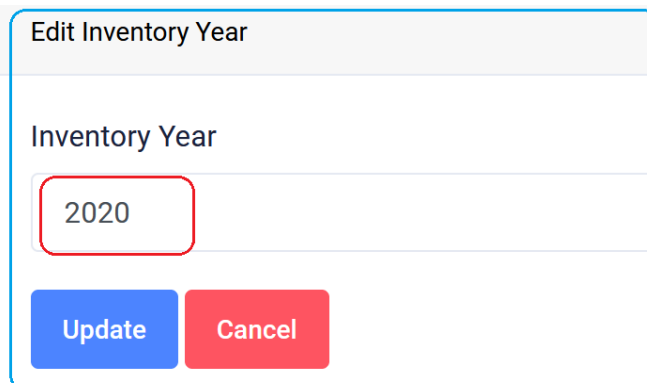

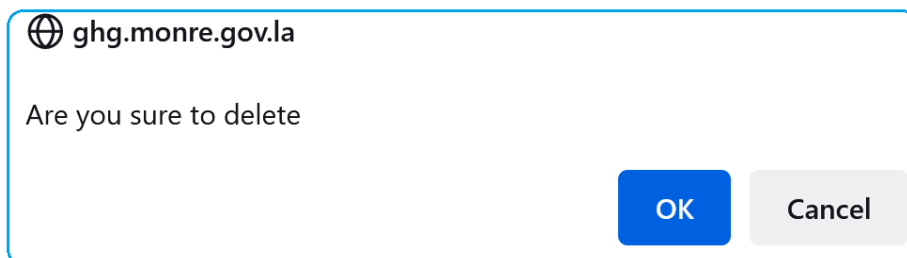


Figure 37: Editing the Inventory Year

8.3 Deleting existing inventory year

The authorized admin users can delete the existing Inventory Year (but data should be backup before doing this task) by click on “”, the delete confirmed box is popped up which asking, “are you sure to delete”, then click OK, otherwise click on “Cancel”.



9. Conclusions

The National Greenhouse Gas Database System (NGHGDM) is led by the Department of Climate Change, Ministry of National Resources and Environment, supported by the Capacity Building Initiative for Transparency (CBIT) of the Global Environment Facility (GEF), through the United Nations Environment Program (UNEP).

The CBIT project supports the Government of Lao PDR in strengthening its transparency

framework by improving the accuracy, completeness and consistency of greenhouse gas inventory, and increasing its capacity to monitor and evaluate mitigation measures and related financial assistance. as well as creating the necessary technical factors for medium and long-term planning that contribute to decision-making on climate-related issues in Lao PDR.

This greenhouse gas system will help the relevant ministries and agencies to input information into the system according to their responsibilities defined under the organizational system. The Department of Climate Change is the coordinating agency in managing the database, including data review, revision, and use for analysis. The NGHGDMS Greenhouse Gas System supports Lao PDR in updating its greenhouse gas inventory data to prepare the National Communication (NC) Report and the Biennial Update Report (BUR).

This greenhouse gas system is an online system that directly calculates greenhouse gas emissions and monitors quality and accuracy within the system. The system was designed based on the IPCC software and the IPCC 2006 guidelines.

This greenhouse gas system is a tool for data analysis and reporting of greenhouse gas data for four (4) sectors: energy, industry, agriculture and land use, and waste. And the system is open to the public at <http://ghg.monre.gov.la>

10. References

1. 2006 IPCC Guideline for National Greenhouse Gas Inventory
<https://www.ipcc-nggip.iges.or.jp/public/2006gl/>
2. IPCC Inventory Software User manual Version 2.88
https://www.ipcc-nggip.iges.or.jp/software/files/IPCCInventorySoftwareUserManualV2_88.pdf
3. Emission Factor Database
<https://www.ipcc-nggip.iges.or.jp/EFDB/main.php>
4. TFI Presentation
<https://www.ipcc-nggip.iges.or.jp/presentation/presentation.html>
5. Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
<https://www.ipcc-nggip.iges.or.jp/public/gp/english/index.html>
6. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
<https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html>

11. Annex

11.1 Annex 1: GHG Default Value

- **Fraction of carbon stored for reference approach.**

Bitumen – 1

Coal oils and tars (from coking coal – 0.75 Ethane
– 0.8

Gas/Diesel oil – 0.5

LPG – 0.8

Lubricants – 0.5

Naphtha – 0.8

Natural gas – 0.33

- **Conversion factors**

CH₄ volume → CH₄ Gg = 0.67

Conversion factors for energy

From	To	Multiply by
J	TJ	10 ⁻¹²
KJ	TJ	10 ⁻⁹
MJ	TJ	10 ⁻⁶
GJ	TJ	10 ⁻³
TJ	TJ	1
cal	TJ	4.1868 x 10 ⁻¹²
kcal	TJ	4.1868 x 10 ⁻⁹
Mcal	TJ	4.1868 x 10 ⁻⁶
Gcal	TJ	4.1868 x 10 ⁻³
Tcal	TJ	4.1868
kWh	TJ	3.6 x 10 ⁻⁶

MWh	TJ	3.6×10^{-3}
GWh	TJ	3.6
Btu	TJ	1.0551×10^{-9}

kBtu	TJ	1.0551×10^{-6}
MBtu	TJ	1.0551×10^{-3}
GBtu	TJ	1.0551
toe	TJ	41.868×10^{-3}
ktoe	TJ	41.868
Mtoe	TJ	4.1868×10^4
TJ	J	1012
TJ	KJ	109
TJ	MJ	106
TJ	GJ	103
TJ	cal	238.8×10^9
TJ	kcal	238.8×10^6
TJ	Mcal	238.8×10^3
TJ	Gcal	238.8
TJ	Tcal	238.8×10^{-3}
TJ	kWh	277.8×10^3
TJ	MWh	277.8
TJ	GWh	277.8×10^{-3}
TJ	Btu	947.8×10^6
TJ	kBtu	947.8×10^3
TJ	MBtu	947.8
TJ	GBtu	947.8×10^{-3}
TJ	toe	23.88
TJ	ktoe	23.88×10^{-3}
TJ	Mtoe	23.88×10^{-6}

- **Emission factors**

Ozone precursors and SO₂ from oil refining – Crude oil throughput

NO_x = 0.06

CO = 0.09

NMVOC = 0.62

SO₂ = 0.93

Ozone precursors and SO₂ from oil refining – Catalytic cracker throughput

NO_x = 0.2

CO = 42.6

NMVOC = 0.6

SO₂ = 1.5

NMVOC emissions from storage and handling – Crude oil throughput

Secondary seals = 0.2

Primary seals = 0.7

Fixed Roof = 4.9

SO₂ from Sulphur Recovery Plants – 139 kg/t

- **CKD correction factor = 1.02**

- **Methane Correction Factor (MCF)**

Managed — 1.0

Unmanaged – deep ($\geq 5\text{m}$) — 0.8

Unmanaged – shallow ($< 5\text{m}$) — 0.4 Methane

Correction Factor — 0.6

- **Inventory time period** (for Cropland remaining Cropland – Carbon stock change – Mineral soils) = **20 years**

11.2 Annex 2: Global Warming Potentials (GWP) for CO₂ Equivalent

Greenhouse gas	Chemical formula	1995 IPCC GWP
Carbon dioxide	CO ₂	1
Methane	CH ₄	21
Nitrous oxide	N ₂ O	310
HFC-23	CHF ₃	11,700
HFC-32	CH ₂ F ₂	650
HFC-41	CH ₃ F	150
HFC-43-10mee	C ₅ H ₂ F ₁₀	1,300
HFC-125	C ₂ HF ₅	2,800
HFC-134	C ₂ H ₂ F ₄	1,000
HFC-134a	CH ₂ FCF ₃	1,300
HFC-152a	C ₂ H ₄ F ₂	140
HFC-143	C ₂ H ₃ F ₃	300
HFC-143a	CF ₃ CH ₃	3,800
HFC-227ea	C ₃ HF ₇	2,900
HFC-236fa	C ₃ H ₂ F ₆	6,300
HFC-254ca	C ₃ H ₃ F ₅	560
Perfluoro methane	CF ₄	6,500
Perfluoro ethane	C ₂ F ₆	9,200
Perfluoropropape	C ₃ F ₈	7,000
Perfluoro butane	C ₂ F ₁₀	7,000
Perfluorocyclobutane	c-c ₄ F ₈	8,700
Perfluoro pentane	C ₅ F ₁₂	7,500
Perfluoro hexane	C ₆ F ₁₄	7,400
Sulphur hexafluoride	SF ₆	23,900

11.3 Annex 3: AFOLU Land type manager

11.3.1 Land Forest

Land Use Subcategory	Climate region	Soil type	Ecosystem type	Continent type	Species	Age class(yr)	Natural forest/plantation	Growing stock level(m ³ /ha)	Carbon fraction of aboveground forest biomass (tonne C/tonne d.m.)	Ratio of below-ground biomass to above-ground biomass@(t root d.m./t shoot d.m.)	Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr)(t/m ³)	Above-ground biomass in forests (t d.m./ha)	Above-ground biomass growth in plantation/natural forest(t d.m./ha/yr)	Reference soil organics carbon (SOC) stock (t C/ha)	Litter carbon stocks of mature forest (t C/ha)	Relative stock change factor (FLU, FMG, FI)
Bamboo/ <i>ໄມ້ປ່ອງ</i>	Tropical Moist, Short	Law Activity Clay	Tropical moist deciduous	Continental	Other Broadleaf	<20 y	Natural forest	<10	0.47	0.2	10	180	9	47	2.1	1
Coniferous forest <i>ປ່າໄມ້ປູນ</i>	Tropical Moist, Short Dry Season	Law Activity Clay Mineral	Tropical moist deciduous forest	Continental	Pinus	<20 y	Natural forest	<10	0.47	0.24	4.44	180	2	47	5.2	1
Dry dipterocarp forest <i>ປ່າໄມ້ດອກ</i>	Tropical Moist, Short Dry Season	Law Activity Clay Mineral	Tropical moist deciduous forest	Continental	Other Broadleaf	>20 y	Natural forest	<10	0.5	0.2	10	180	2	47	0	1
Evergreen Forest/ <i>ປ່າໄມ້ຂຽວ ຕະຫຼອດປີ</i>	Tropical Moist, Short Dry Season	Law Activity Clay Mineral	Tropical moist deciduous forest	Continental	Other Broadleaf	<20 y	Natural forest	<10	0.47	0.24	10	180	2	47	2.1	1
Plantation forest <i>ປ່າປູກ</i>	Tropical Moist, Short Dry Season	Law Activity Clay Mineral	Tropical moist deciduous forest	Continental	Eucalyptus	<20 y	Plantation forest	10-20	0.47	0.24	4.44	180	9	47	2.1	1

Mixed coniferous and broadleaves/ <i>ປ່າປະສົມໃບແຫຼມ ແລະ ໃບກ້ວາງ</i>	<i>Tropical Moist, Short Dry Season</i>	<i>Law Activity Clay Mineral</i>	<i>Tropical moist deciduous forest</i>	<i>Continental</i>	<i>Other Broadleaf</i>	<20 y	<i>Natural forest</i>	<10	0.47	0.24	10	180	2	47	2.1	1
Mixed deciduous forest <i>ປ່າປະສົມໃບແຫຼມ</i>	<i>Tropical Moist, Short Dry Season</i>	<i>Law Activity Clay Mineral</i>	<i>Tropical moist deciduous forest</i>	<i>Continental</i>	<i>Other Broadleaf</i>	<20 y	<i>Natural forest</i>	<10	0.47	0.2	1.39	280	7	47	5.2	1
Regeneration forest <i>ປ່າພື້ນຜູ້</i>	<i>Tropical Moist, Short Dry Season</i>	<i>Law Activity Clay Mineral</i>	<i>Tropical moist deciduous forest</i>	<i>Continental</i>	<i>Other Broadleaf</i>	<20 y	<i>Natural forest</i>	10-20	0.5	0.2	4.44	180	9	47	2.1	1

11.3.2 Cropland

Land Use Subcategory	Climate region	Soil type	Perennial crop/annual crop	Above-ground biomass(t d.m./ha)	Cropland type	Reference organic carbon (SOC) stock(t C/ha)	Harvest/Maturity cycle(yr)	Biomass carbon loss(L) (t C/ha/yr)	Biomass accumulation rate(t C/ha/yr)	Carbon fraction of dry matter(t C/t d.m.)	Relative stock change factor		
											Land use	Tillage (FMG)	Input (FI)
Agriculture plantation/ ດົນປູກກະສິກໍາ	<i>Tropical moist, Short Dry Season</i>	<i>Law Activity Clay Mineral</i>	<i>Perennial crop</i>	45	<i>All perennials</i>	47	8	21	2.6	0.5	0.48	N/A	0.92
Other agriculture <i>ດົນກະສິກໍາອື່ນໆ</i>	<i>Tropical moist, Short Dry Season</i>	<i>Law Activity Clay Mineral</i>	<i>Annual crop</i>	10	N/A	47	N/A	N/A	N/A	0.5	1	1	1
Rice paddy <i>ທົ່ງນາ</i>	<i>Tropical moist, Short Dry</i>	<i>Law Activity Clay</i>	<i>Annual crop</i>	10	N/A	47	N/A	N/A	N/A	0.5	1	1	1

Upland crop <i>ດິນປູກເນີນສູງ</i>	<i>Tropical moist, Short Dry Season</i>	<i>Low Activity Clay Mineral</i>	<i>Annual crop</i>	10	N/A	47	N/A	N/A	N/A	0.5	1	1	1
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1.1.1 Grassland

Land Use Subcategory	Climate region	Soil type	Vegetation type	Reference soil organic carbon (SOC) stock (t C/ha)	Relative stock change factor			Herbaceous biomass stocks present on land(t d.m./ha)	Woody biomass stocks present on land(t d.m./ha)	Herbaceous biomass stocks after conversion from other land use(t d.m./ha)	Woody biomass stocks after conversion from other land use(t d.m./ha)	Carbon fraction of dry matter for herbaceous biomass(t C t d.m.)	Carbon fraction of dry matter for woody biomass(t C/t d.m.)
					Land use (FLU)	Management (FMG)	Input						
Grassland	Tropical Moist, Short Dry Season	Low Activity Clay Mineral	Tropical		1	1	n/a	16.1	0	16.1	0	0.47	0.47
Scrub	Tropical Moist, Short Dry Season	Low Activity Clay Mineral	Tropical moist deciduous forest	Continental	Pinus	<20y	Natural forest	10	0.47	0.24	4.44	180	2