**The Regional Environmental Centre for the Caucasus (REC Caucasus) announces**

**a tender for the GHG Inventory Expert in Agriculture Field**

**within the GEF-funded project “Georgia’s Integrated Transparency Framework for Implementation of the Paris Agreement”**

REC Caucasus is executing the project “Georgia’s integrated transparency framework for implementation of the Paris agreement”, which aims to meet the enhanced transparency framework (ETF) requirements under the Paris agreement.

Overall objective of the project is to propose actions that will allow the country to use more detailed level of emissions calculation to better track the trend of emissions changes in the sector and to check the level of measurement, reporting and verification.

**TERMS OF REFERENCE**

**for GHG Inventory and Data Analysis Expert in Agriculture Field**

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| --- | --- |
| **Project Title:**   | Georgia’s Integrated Transparency Framework for Implementation of the Paris Agreement |
|  |  |
| **REC Caucasus Project ID:** | 024RECC/G/UNEP |
|  |  |
| **Contract type:**  | Consultancy Service Contract |
|  |  |
| **Position:** | GHG Inventory and Data Analysis Expert in Agriculture field |
|  |  |
| **Starting Date:** | 28 February, 2022 |
|  |  |
| **Duration:** | 5 months (28 February, 2022 – 28 July, 2022) |
|  |  |
| **Duty Station:**   | Tbilisi, Georgia |

**1. Project Background**

Contract is concluded for implementation of the GEF-financed Project (2019-2023) “Georgia’s Integrated Transparency Framework for Implementation of the Paris Agreement”.

The Paris Agreement, adopted at the 21st Conference of Parties (CoP) in December 2015, sets out a global action plan that puts the world on track to avoid dangerous climate change by limiting global warming to well below 2°C. The Agreement refers to ‘Nationally Determined Contributions’ (NDCs) that each individual country should make to achieve the worldwide goal set of reducing anthropogenic emissions of greenhouse gases. As part of this Agreement, all countries agreed to an Enhanced Transparency Framework (ETF) for action and support (Article 13), with built-in flexibility which considers Parties’ different capacities and builds upon collective experience. For Georgia there is a need to set up new transparency governance structures, develop and implement MRV procedures, and update, implement, and integrate new data and information flows with pre-defined periodicity. Two parallel ongoing climate activities at the central and local levels in the country need to be aligned under the Domestic Enhanced Transparency Framework. The clear, comparable, accountable and flexible MRV system should integrate mitigation strategies, measures and their effect into the national level. A key condition for successful implementation of the Paris Agreement’s transparency requirements is the provision requiring adequate and sustainable financial support and capacity building to enable developing countries to significantly strengthen their efforts to build robust domestic and regulatory processes. For the above purposes, the GEF-funded Project “Georgia’s Integrated Transparency Framework for Implementation of the Paris Agreement” is planned to be implemented in Georgia.

**The overall objective of the project** is to meet the ETF requirements under the Paris Agreement.

**Project Components:**

1. Strengthening vertical integration in Georgia for transparency-related activities;

2. Georgia’s National Greenhouse Gas (GHG) Inventory system and HFC data management system are aligned with the ETF;

3. Climate Change Mitigation in Georgia’s transparency system.

**Outset situation**

The Government of Georgia adopted its updated Nationally Determined Contribution (NDC) pursuant to decree #167 dated 8th of April 2021 and submitted to the United Nations Framework Convention on Climate Change (UNFCCC).

Within the adoption of the NDC, the economy-wide approach is selected for the low carbon development of the Country. Seven sectors such as transportation, building, energy generation and transmission, agriculture, industry, waste, and forest are taken into consideration for the mitigation of greenhouse gas emissions (paragraph 8, NDC).

Furthermore, the gases, including carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), contributing to the greenhouse effect, are in the scope of the country, to the extent possible. In accordance with the latest National GHG Inventory Report of Georgia (<https://unfccc.int/sites/default/files/resource/NIR%20%20Eng%2030.03.pdf>) the emissions from the Agriculture sector is about 18 per cent of the total national GHG emissions. **The categories of enteric fermentation (3.A.1), direct N2O emissions from managed soils (3.C.4), indirect N2O emissions from managed soils (3.C.5), and manure management (3.A.2) are selected as the key ones based on their level and trend of emissions** (NIR 1990-2017, Table 1-2, p.1-6).

In accordance with the IPCC 2006 guidelines, the tier 2 approach has to be applied for the enteric fermentation category if it is a key one and the livestock species are significant. As a rule of thumb, a livestock species would be significant if it accounts for 25-30% or more of emissions from the source category (Vol.4, Chap. 10, Fig.10.2, p.10.25). At the latest inventory year of 2017, the methane emission rates from the **cattle species** in the category of the enteric fermentation were about 93.2%. Hence, the cattle are the only specie that meets a rule of thumb and it would be a good practice to strengthen the tier 2 approach selected by the country with the country-specific data. The three types of cattle breeds are considered in Georgia’s National GHG Inventory, such as Early Maturing, Georgian Mountain and Red Mingrelian. Georgian Mountain and Red Mingrelian are native cattle breeds prevailing in Georgia. In 2017, their contribution in the GHG emissions from the enteric fermentation category were as follows: Early Maturing – 77.5%, Georgian Mountain - 9.6%, and Red Mingrelian – 6.1%.

In accordance with the IPCC 2006 guidelines, it is a good practice to identify the most detailed characterisation required for the particular tier approach. An ‘Enhanced’ characterisation should be used to estimate emissions across all the relevant sources if the Tier 2 method is used for either enteric fermentation or manure.

For each of the representative animal categories defined, the following information is required:

• annual average population;

• average daily feed intake (megajoules (MJ) per day and / or kg per day of dry matter); and

• methane conversion factor (percentage of feed energy converted to methane).

Generally, data on average daily feed intake are not available, particularly for grazing livestock. Consequently, the following general data should be collected for estimating the feed intake for each representative animal category:

• weight (kg);

• average weight gain per day (kg);

• feeding situation: confined, grazing, pasture conditions;

• milk production per day (kg/day) and fat content (%);

• average amount of work performed per day (hours day-1);

• percentage of females that give birth in a year;

• wool growth;

• number of offspring; and

• feed digestibility (%).

An emission factor for each animal category should be developed by following the equation below:

$$EF=\left[\frac{GE×\left(\frac{Y\_{m}}{100}\right)×365}{55.65}\right]$$

Where:

EF = emission factor, kg CH4 head-1 yr-1

GE = gross energy intake, MJ head-1 day-1

Ym = methane conversion factor, percentage of the gross energy in feed converted to methane

The factor 55.65 (MJ/kg CH4) is the energy content of methane.

Subsequently, the identification of the country-specific coefficients used in the estimation of the gross energy intake and analysing the scientific researches on methane conversion factor published after 2006 would allow to develop the national emission factors within the enteric fermentation category.

In accordance with the IPCC 2006 guidelines, similar to the category of the enteric fermentation, the tier 2 approach has to be applied to the manure management category if it is a key one and the species are significant. (Vol.4, Chap. 10, Fig.10.3, p.10.36). Moreover, a more complex method of estimation of the CH4 emissions from the manure management should be used when a particular livestock species/category represents a significant share of a country’s emissions. This method requires detailed information on animal characteristics and manure management practices, which are used to develop emission factors specific to the conditions of the country.

At the latest inventory year of 2017, the methane emission rates from the **cattle species** in the category of the manure management were about 60% and from **swine species** - 24.7%. Hence, the cattle are the only species that meet a rule of thumb and it would a good practice to strengthen the tier 2 approach selected by the country with the country-specific data.

In addition, good practice in estimating CH4 emissions from manure management systems entails making every effort to use the Tier 2 method, including calculating emission factors using country-specific information.

The Tier 2 method relies on two primary types of inputs that affect the calculation of the methane emission factors from manure:

**Manure characteristics** - include the amount of volatile solids (VS) produced in the manure and the maximum amount of methane able to be produced from that manure (Bo). Production of manure VS can be estimated based on the feed intake and digestibility, which are the variables also used to develop the Tier 2 enteric fermentation emission factors. Alternatively, VS production rates can be based on the laboratory measurements of the livestock manure. Bo varies by animal species and feed regimen and is a theoretical methane yield based on the amount of VS in the manure. Bedding materials (straw, sawdust, chippings, etc.) are not included in the VS modelled under the Tier 2 method. The type and use of these materials are highly variable from country to country. Since they typically are associated with the solid storage systems, their contribution would not add significantly to overall methane production.

**Manure management system characteristics** - include the types of systems used to manage manure and a system-specific methane conversion factor (MCF) that reflects the portion of Bo that is achieved. The system MCF varies with the manner in which the manure is managed and the climate, and can theoretically range from 0 to 100%. Both temperature and retention time play an important role in the calculation of the MCF. Manure that is managed as a liquid under the warm conditions for an extended period of time, promotes methane formation. These manure management conditions can have high MCFs of 65 to 80%. Manure managed as dry material in cold climates does not readily produce methane, and consequently has an MCF of about 1%.

Development of the Tier 2 emission factors involves determining a weighted average MCF using the estimates of the manure managed by each waste system within each climate region. The average MCF is then multiplied by the VS excretion rate and the Bo for the livestock categories. In equation form, the estimate is as follows:

$$EF\_{(T)}=\left(VS\_{(T)}×365\right)×\left[Bo\_{(T)}×0.67kg/m^{3}×\sum\_{S,k}^{}\frac{MCF\_{S,k}}{100}×MS\_{(T,S,k)}\right]$$

Where:

EF(T) = annual CH4 emission factor for livestock category T, kg CH4 animal-1 yr-1

VS(T) = daily volatile solid excreted for livestock category T, kg dry matter animal-1 day-1

365 = basis for calculating annual VS production, days yr-1

Bo(T) = maximum methane producing capacity for manure produced by livestock category T, m3 CH4 kg-1 of VS excreted

0.67 = conversion factor of m3 CH4 to kilograms CH4

MCF(S,k) = methane conversion factors for each manure management system S by climate region k, %

MS(T,S,k) = fraction of livestock category T's manure handled using manure management system S in climate region k, dimensionless

Even when the level of detail presented in the Tier 2 method is not possible in some countries, country-specific data elements such as animal mass, VS excretion, and others can be used to improve emission estimates. If the country-specific data are available for only a portion of these variables, countries are encouraged to calculate country-specific emission factors, using the data in Tables 10A-4 through 10A-9 from the IPCC 2006 Guideline (Vol. 4, Chap. 10) to fill the gaps.

**VS excretion rates**

Volatile solids (VS) are the organic material in livestock manure and consist of both biodegradable and nonbiodegradable fractions. The total VS (both degradable and nonbiodegradable fractions) as excreted by each animal species since the Bo values are based on total VS entering the systems. The best way to obtain average daily VS excretion rates is to use data from nationally published sources. If average daily VS excretion rates are not available, country-specific VS excretion rates can be estimated from feed intake levels. This will also ensure consistency in the data underlying the emissions estimates. For swine, country-specific swine production data may be required to estimate feed intake.

$$VS=\left[GE×\left(1-\frac{DE\%}{100}\right)+\left(UE×GE\right)\right]×\left[\left(\frac{1-ASH}{18.45}\right)\right]$$

Where:

VS = volatile solid excretion per day on a dry-organic matter basis, kg VS day-1

GE = gross energy intake, MJ day-1

DE% = digestibility of the feed in percent (e.g. 60%)

(UE • GE) = urinary energy expressed as fraction of GE. Typically 0.04 GE can be considered urinary energy excretion by most ruminants (reduce to 0.02 for ruminants fed with 85% or more grain in the diet or for swine). Use country-specific values where available.

ASH = the ash content of the manure calculated as a fraction of the dry matter feed intake (e.g., 0.08 for cattle). Use country-specific values where available.

18.45 = conversion factor for dietary GE per kg of dry matter (MJ kg-1). This value is relatively constant across a wide range of forage and grain-based feeds commonly consumed by livestock.

**Bo values**

The maximum methane-producing capacity of the manure (Bo) varies by species and diet. The preferred method to obtain Bo measurement values is to use data from country-specific published sources, measured with a standardised method. It is important to standardise the Bo measurement, including the method of sampling, and to confirm if the value is based on total as-excreted VS or biodegradable VS, since the Tier 2 calculation is based on total as-excreted VS.

**MCFs**

Default methane conversion factors (MCFs) may not encompass the potentially wide variation within the defined categories of management systems. Therefore, country-specific MCFs that reflect the specific management systems used in particular countries or regions should be developed if possible. This is particularly important for countries with large animal populations or with multiple climate regions. In such cases, and if possible, field measurements should be conducted for each climate region to replace the default MCF values. Measurements should include the following factors:

* Timing of storage/application;
* Feed and animal characteristics at the measurement site;
* Length of storage;
* Manure characteristics (e.g., VS influent and effluent concentrations for liquid systems);
* Determination of the amount of manure left in the storage facility (methanogenic inoculum);
* Time and temperature distribution between indoor and outdoor storage;
* Daily temperature fluctuation; and
* Seasonal temperature variation.

Direct emissions of N2O from managed soils are estimated separately from indirect emissions, though using a common set of activity data. The Tier 1 methodologies do not take into account different land cover, soil type, climatic conditions or management practices (other than specified above). Neither do they take account of any lag time for direct emissions from crop residues N, and allocate these emissions to the year in which the residues are returned to the soil. These factors are not considered for direct or (where appropriate) indirect emissions because limited data are available to provide appropriate emission factors. Countries that have data to show that default factors are inappropriate for their country should utilise Tier 2 equations or Tier 3 approaches and include a full explanation for the values used.

In accordance with the IPCC 2006 guidelines, similar to the categories of enteric fermentation and manure management, the tier 2 approach has to be applied for the direct emissions of N2O from managed soils category if it is a key one and the N source is significant. (Vol.4, Chap. 11, Fig.11.2, p.11.9). At the latest inventory year of 2017, the nitrous oxide emission rates from the **urine and dung decomposition** and **synthetic N fertiliser** in the category of the direst N2O emissions from managed soils were about 51% and 30% respectively. Hence, these N2O sources are those that meet a rule of thumb and it would be a good practice to strengthen the tier 2 approach selected by the country with the country-specific data.

**Applied synthetic fertiliser (FSN)**

Tier 1 approach is used. N2O emissions are calculated by multiplying fertiliser consumption by non-volatile fraction (available for nitrification and denitrification) and by an emission factor:

$$N\_{2}O\_{SN}=F\_{SN}×EF\_{1}$$

Where:

FSN = annual amount of synthetic fertilizer N applied to soils, kg N/year

EF1 = emission factor for N2O emissions from N inputs, kg N2O–N/kg N input

**Applied organic N fertilisers (FON)**

Organic N fertilizer includes applied animal manure, sewage sludge, compost and other organic amendments applied to soils. Organic N fertiliser (FON) is calculated as follows:

$$F\_{ON}=F\_{AM}+F\_{SEW}+F\_{COMP}+F\_{OOA}$$

Where:

FON = total annual amount of organic N fertiliser applied to soils other than by grazing animals, kg N yr-1

FAM = annual amount of animal manure N applied to soils, kg N yr-1

FSEW = annual amount of total sewage N (coordinate with Waste Sector to ensure that sewage N is not double-counted) that is applied to soils, kg N yr-1

FCOMP = annual amount of total compost N applied to soils (ensure that manure N in compost is not double-counted), kg N yr-1

FOOA = annual amount of other organic amendments used as fertiliser (e.g., rendering waste, guano, brewery waste, etc.), kg N yr-1

In accordance to the latest national GHG inventory of Georgia the sewage, compost and other organic amendments actually not in use as fertilizer (NIR, Chap. 4.14.1.2, p.4-50).

The term FAM is determined by adjusting the amount of manure N available (NMMS\_Avb) for the amount of managed manure used for feed (FracFEED), burned for fuel (FracFUEL), or used for construction (FracCNST). Data for FracFUEL, FracFEED, FracCNST can be obtained from official statistics or a survey of experts. Pursuant to the latest national GHG inventory of Georgia only insignificant amount of manure is used as fuel in the country, and there is no use of animal manure as feed and construction purposes.

$$F\_{AM}=N\_{MMS\\_Avb}×\left[1-\left(Frac\_{FEED}+Frac\_{FUEL}+Frac\_{CNST}\right)\right]$$

$$N\_{MMS\\_Avb}=\sum\_{S}^{}\left\{\sum\_{(T)}^{}\left[\left[\left(N\_{(T)}×Nex\_{(T)}×MS\_{(T,S)}\right)×\left(1-\frac{Frac\_{LossMS}}{100}\right)\right]+\left[N\_{(T)}×MS\_{(T,S)}×N\_{beddingMS}\right]\right]\right\}$$

Where:

NMMS\_Avb = amount of managed manure nitrogen available for application to managed soils or for feed, fuel, or construction purposes, kg N yr-1

N(T) = number of head of livestock species/category T in the country

Nex(T) = annual average N excretion per animal of species/category T in the country, kg N animal-1 yr-1

MS(T,S) = fraction of total annual nitrogen excretion for each livestock species/category T that is managed in manure management system S in the country, dimensionless

FracLossMS = amount of managed manure nitrogen for livestock category T that is lost in the manure management system S, %

NbeddingMS  = amount of nitrogen from bedding (to be applied for solid storage and deep bedding MMS if known organic bedding usage), kg N animal-1 yr-1

S = manure management system

T = species/category of livestock

Bedding materials vary greatly and inventory compilers should develop values for NbeddingMS based on the characteristics of bedding material used in their livestock industries. Limited data from scientific literature indicates the amount of nitrogen contained in organic bedding material applied for dairy cows and heifers is usually around 7 kg N animal-1 yr-1, for other cattle is 4 kg N animal-1 yr-1, for market and breeding swine is around 0.8 and 5.5 kg N animal-1 yr-1, respectively. For deep bedding systems, the amount of N in litter is approximately double these amounts.

**Urine and dung from grazing animals (FPRP)**

The term FPRP refers to the annual amount of N deposited on pasture, range and paddock soils by grazing animals. It is important to note that the N from managed animal manure applied to soils is included in the FAM term of FON. The term FPRP is estimated from the number of animals in each livestock species/category T (N(T)), the annual average amount of N excreted by each livestock species/category T (Nex(T)), and the fraction of this N deposited on pasture, range and paddock soils by each livestock species/category T (MS(T,PRP)).

$$F\_{PRP}= \sum\_{T}^{}\left[\left(N\_{(T)}×Nex\_{(T)}\right)×MS\_{(T,PRP}\right]$$

Where:

FPRP = annual amount of urine and dung N deposited on pasture, range, paddock and by grazing animals, kg N yr-1

N(T) = number of head of livestock species/category T in the country;

Nex(T) = annual average N excretion per head of species/category T in the country, kg N animal-1 yr-1

MS(T,PRP) = fraction of total annual N excretion for each livestock species/category T that is deposited on pasture, range and paddock

**2. Objective and scope of the assignment**

RECC engages national GHG inventory expert in **agriculture field** for coordinating the identification process of country-specific data (coefficients and parameters) based on appropriate assumptions for estimating annual GHG emissions from enteric fermentation of cattle, cattle and swine (by decision of expert) manure management and urine and dung decomposition and synthetic N fertilisers.

***Specific Objective of the Assignment***

The consultant will be responsible for identification of all parameters and possible measurement approaches that are reasonable to be estimated at the country-specific level in order to estimate annual emissions of CH4 from enteric fermentation of cattle, cattle and swine (by decision of expert) manure management and N2O emissions from urine and dung decomposition and synthetic N fertilisers, and also estimate GHG emissions for the sample year with upgraded data and prepare recommendations for applying the obtained research parameters at the national GHG inventory level and further improvement possibilities of the GHG inventory in Agriculture sector.

***Planned activities are as follows:***

The following work steps are needed within the assignment:

**Step 1**. Identify the parameters, coefficients and possible measurement approaches for the field work assignment in order to estimate country-specific cattle gross energy intake from the pile of parameters that include but not limited to weight (kg), average weight gain per day (kg), feeding situation: confined, grazing, pasture conditions, milk production per day (kg/day) and fat content (%), average amount of work performed per day (hours day-1), percentage of females that give birth in a year, wool growth, number of offspring, and feed digestibility (%). **[Project Activity: 2.1.9]**;

This task includes:

* identification of cattle breeds for the research assignment. The native cattle breeds such as Georgian Mountain and Red Mingrelian have to be considered to the extent possible.

**Step 2.** Identify the parameters, coefficients and possible measurement approaches for the field work assignment in order to estimate country-specific emission factors in cattle and swine (by decision of expert) manure management from the pile of parameters that include but not limited to digestibility of the feed in percentage, urinary energy, ash content of manure calculated as a fraction of the dry matter feed intake, maximum methane-producing capacity of the manure, manure timing of storage/application, feed and animal characteristics at the measurement site, length of manure storage, manure characteristics (e.g., VS influent and effluent concentrations for liquid systems), determination of the amount of manure left in the storage facility (methanogenic inoculum), time and temperature distribution between indoor and outdoor storage, daily temperature fluctuation, and seasonal temperature variation. **[Project Activity: 2.1.9];**

This task includes:

* selection of the species considered for the research, based on the trend assessment made by the expert;

**Step 3.** Identify the parameters, coefficients and possible measurement approaches for the field work assignment in order to estimate country-specific emission factors for the direct emissions of N2O from managed soils by applying synthetic fertilisers and urine and dung decomposition from the pile of parameters that include but not limited to annual amount of urine and dung N deposited on pasture, range, paddock and by grazing animals, number of head of livestock species/category T in the country, annual average N excretion per head of species/category T in the country, fraction of total annual N excretion for each livestock species/category T that is deposited on pasture, range and paddock. **[Project Activity: 2.1.9];**

This task includes:

* selection of the species considered for the research, based on the trend assessment made by the expert;

**Step 4.** Review the research results of the country-specific data by comparing them to the default values or cluster countries’ data by decision of expert. **[Project Activity: 2.1.10];**

This task includes:

* selection of the cluster countries for the review of the data;
* requesting research result approval documents from the field workers for supporting the recognition of the country-specific parameters.

**Step 5.** Estimate the CH4 emissions from cattle enteric fermentation, cattle (swine) manure management, and N2O emissions from managed soils and urine and dung decomposition and synthetic N fertiliser for the sample year. **[Project Activity: 2.1.10];**

**Step 6.**  Prepare recommendations for applying the obtained research parameters at the national GHG inventory level and further improvement possibilities of the GHG inventory in Agriculture sector. **[Project Activity: 2.1.10];**

**3. QUALIFICATIONS AND EXPERIENCE**

* Master’s degree in Exact and Natural Sciences, and/or related fields;
* Two years of working experience in climate change field;
* Working on GHG inventory *(will be an asset)*;
* Good analytical and managerial skills, ability to express ideas clearly and concisely both orally and in writing;
* Ability to plan and manage tasks independently;
* Good interpersonal and communication skills;
* Fully experienced with computer software and other office equipment.

**4. WORKING AND REPORTING LANGUAGEs**

working and reporting language shall be **English and/or Georgian**.

**5. SPECIAL REQUIREMENTS REGARDING REPORTING FORMAT**

All reports shall be produced in the following format:

|  |  |
| --- | --- |
| ***Alignment:*** | Justified |
| ***Font:*** | Arial for English / Sylfaen for Georgian |
| ***Font Size:*** | 11 |
| ***Lane Spacing:*** | single |
| ***Spacing before:*** | 0’ |
| ***Spacing after:*** | 0’ |
| ***At:*** | 0 |

**OTHER IMPORTANT DETAILS:**

Interested applicants should submit a current **CV** meeting the required qualification and a filled in **technical offer form** (see Annex 2) to the following e-mail address: vacancy@rec-caucasus.org with a copy to Project Administrative Assistant: sopo.gelashvili@rec-caucasus.org

**Email subject line:** GHG Inventory and Data Analysis Expert in Agriculture Field

**Deadline** for applications’ submission is **February 25, 2022, 15:00** (GMT+4).

**Only shortlisted candidates will be notified.**