EU4Environment in Eastern Partner Countries:
Water Resources and Environmental Data (ENI/2021/425-550)

RECOMMENDATIONS FOR AIR POLLUTANT EMISSIONS PROJECTIONS IN GEORGIA

Funded by the European Union

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ABOUT EU4ENVIRONMENT – WATER RESOURCES AND ENVIRONMENTAL DATA

This Programme aims at improving people's wellbeing in EU's Eastern Partner Countries and enabling their green transformation in line with the European Green Deal and the Sustainable Development Goals (SDGs). The programme's activities are clustered around two specific objectives: 1) support a more sustainable use of water resources and 2) improve the use of sound environmental data and their availability for policy-makers and citizens. It ensures continuity of the Shared Environmental Information System Phase II and the EU Water Initiative Plus for Eastern Partnership programmes.

The Programme is implemented by five Partner organisations: Environment Agency Austria (UBA), Austrian Development Agency (ADA), International Office for Water (OiEau) (France), Organisation for Economic Co-operation and Development (OECD), United Nations Economic Commission for Europe (UNECE). The action is co-funded by the European Union, the Austrian Development Cooperation and the French Artois-Picardie Water Agency based on a budget of EUR 12,75 million (EUR 12 million EU contribution). The implementation period is 2021-2024.

https://eu4waterdata.eu

CONTENTS

List of abbreviations

ADA ..... Austrian Development Agency

BQE ..... Biological Quality Elements

DoA ..... Description of Action

DG NEAR ..... Directorate-General for Neighbourhood and Enlargement Negotiations of the European Commission

EaP ..... Eastern Partners

EC ..... European Commission

EECCA ..... Eastern Europe, the Caucasus and Central Asia

EMBLAS ..... Environmental Monitoring in the Black Sea

EPIRB ..... Environmental Protection of International River Basins

ESCS ..... Ecological Status Classification Systems

EU ..... European Union

EUWI+ ..... European Union Water Initiative Plus

GEF ..... Global Environmental Fund

ICPDR ..... International Commission for the Protection of the Danube River

INBO ..... International Network of Basin Organisations

IOW/OIEau ..... International Office for Water, France

IWRM ..... Integrated Water Resources Management

NESB ..... National Executive Steering Board

NFP ..... National Focal Point

NGOs ..... Non-Governmental Organisations

NPD ..... National Policy Dialogue

OECD ..... Organisation for Economic Cooperation and Development

RBD ..... River Basin District

RBMP ..... River Basin Management Plan

Reps ..... Representatives (the local project staff in each country)

ROM ..... Result Oriented Monitoring

ToR ..... Terms of References

UBA ..... Umweltbundesamt GmbH, Environment Agency Austria

UNDP ..... United Nations Development Programme

UNECE ..... United Nations Economic Commission for Europe

WFD ..... Water Framework Directive

Country Specific Abbreviations Georgia

MENRP..... Ministry of Environment and Natural Resources Protection

NEA..... National Environment Agency

NWP..... National Water Partnership

Key messages

- The current Georgian air emission inventory provides already many details. However, as a starting point for projected emission data a further improved version of this inventory should be used.
- In order to be able to provide a better picture of how emissions will develop, the emissions inventory should be updated and those subsectors currently reported as NE should be made available.
- Also where possible higher tier methods that reflect the country specific conditions (country specific emission factors, abatement technologies) should be used at least for the most important emission sources (key categories)
- Once higher tier methodologies become available, it will be easier to depict future effects of the measures for these subsectors.
- There should be consistent reporting under the UNECE and UNFCCC of values that are relevant for both inventories (e.g. activity data, excretion rates, etc.). The differences between the inventories should be identified and harmonized for future submissions.

Executive Summary

The aim of this report is an analysis of the IIR (submission 2023, as 2024 is not yet available) and to analyse data that can be used by the Georgian air pollutant inventory team to calculate projections of emissions.

The following activities were carried out:

- Analysis of existing data, time series, tiers of calculation method for all sectors
- Analysis of projections of statistical data (where available), the GHG emission projections, and of IIASA models, and how they could be used for projections of the inventory.

The following results were achieved:

For all sectors, discrepancies between the inventory data, and the analysed data sets were found and are described in this report. When it comes to some of the modelled data for projections, additional research is necessary to understand the logic behind these models, before they can be coupled with the inventory data. The findings are described on the next pages. For sector 3, Agriculture, a proposal for a data set that could be used for projections has been made. For Energy and IPPU, additional information on the reasoning for the strong increase of the GDP is necessary before applying this data. For the Waste sector, additional data for the inventory is still necessary.

Generally speaking, it is necessary to work on a further improvement of the inventory. The higher the tier methodology applied, the more accurately emissions are reflected in the inventory, and the easier it is to tie results from the inventory to data sets for projections. Furthermore, the necessary information for projections should be collected, then, for instance, only the part of the GDP that reflects economical data (without the service sector) could be used for projections.

1. Sector Energy and IPPU

The following activities have been performed for the sector Energy and IPPU.

- Investigation of the current situation
- Identification of issues for improvement of Georgia´s air emission inventory
- Review of data for emission projections
- Review of IIASA´s air emission projections with Georgia´s current inventory data

1.1. Current situation

Georgia´s air emissions for NFR sectors Energy and IPPU are calculated using the EMEP/EEA Guidebook – 2019, tier 1 or tier 2 approach referring to Georgia´s IIR 2023[1] (June 2024 no IIR 2024 is submitted). Reported emission sources in Energy and IPPU are:

- 1A1a Public electricity and heat production (T2 since 2012)
- 1A2a Stationary combustion in manufacturing industries and construction: Iron and Steel
- 1A2b Stationary combustion in manufacturing industries and construction: Non-ferrous metals (T2)
- 1A2d Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print (T2)
- 1A2e Stationary combustion in manufacturing industries and construction: food processing, beverages and tobacco (T2)
- 1A2f Stationary combustion in manufacturing industries and construction: Non-metallic minerals (T2)
- 1A3bi Road transport: Passenger cars
- 1A3bii Road transport: light duty vehicles
- 1A3biii Road transport: Heavy duty vehicles and buses
- 1A3bv Road transport: Gasoline evaporation
- 1A3bvi Road transport: Automobile tyre and brake wear
- 1A3bvii Road transport: Automobile road abrasion
- 1A3c Railways
- 1A3dii National navigation (shipping)

[1] https://www.ceip.at/status-of-reporting-and-review-results/2023-submission

- 1A4ai Commercial/Institutional: Stationary
- 1A4bi Residential: Stationary
- 1A4ci Agriculture/Forestry/Fishing: Stationary
- 1A4cii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery
- 1B1a Fugitive emission from solid fuels: Coal mining and handling
- 1B2ai Fugitive emissions oil: Exploration, production, transport
- 1B2aiv Fugitive emissions oil: Refining/Storage
- 1B2av Distribution of oil products
- 1B2b Fugitive emissions from natural gas(exploration, production, processing, transmission, storage, distribution and other)
- 1B2c Venting and flaring (oil, gas, combined oil and gas)
- 2A1 Cement production
- 2A2 Lime production
- 2A3 Glass production
- 2A5a Quarrying and mining of minerals other than coal
- 2A5b Construction and demolition
- 2A6 Other mineral products
- 2B1 Ammonia production
- 2B2 Nitric acid production
- 2B10a Chemical industry: other (T2)
- 2C1 Iron and steel production
- 2C2 Ferroalloys production
- 2C3 Aluminium production (T2)
- 2C5 Lead production (T2)
- 2D3a Domestic solvent use including fungicides
- 2D3b Road paving with asphalt
- 2D3d Coating applications
- 2H1 Pulp and paper industry
- 2H2 Food and beverages industry (T2)
- 2I Wood processing
- 2K Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)

Please note that especially when it comes to the IPPU sector, in the National Inventory Report for Greenhouse Gas emissions, several sectors are calculated using a tier 2 methodology. Thus, an exchange between the GHG and air pollutant inventory teams could be beneficial.

1.2. Inventory improvement

There are a few subsectors in the Energy and IPPU sectors where activity data is not estimated (reported as NE):

- 1A2c Stationary combustion in manufacturing industries and construction: Chemicals
- 1A3biv Road transport: Mopeds & Motorcycles
- 1A3dii National navigation (shipping)
- 1A3ei Pipeline transport
- 1A4aii Commercial/institutional: mobile
- 1A4bii Residential: Household and gardening (mobile)
- 2A5b Construction and Demolition
-

Activity data for the above mentioned subsectors should be collected, wherever possible.

When it comes to NIR of GHG emissions in the IPPU sector, it seems that for most sectors (2A, Mineral Production, 2B Chemicals Industry, and 2C Metal Production) at least partially a Tier 2 methodology is available. In order to increase accuracy, it is strongly recommended to share the data available from these subsectors, so to increase completeness and accuracy of the IIR.

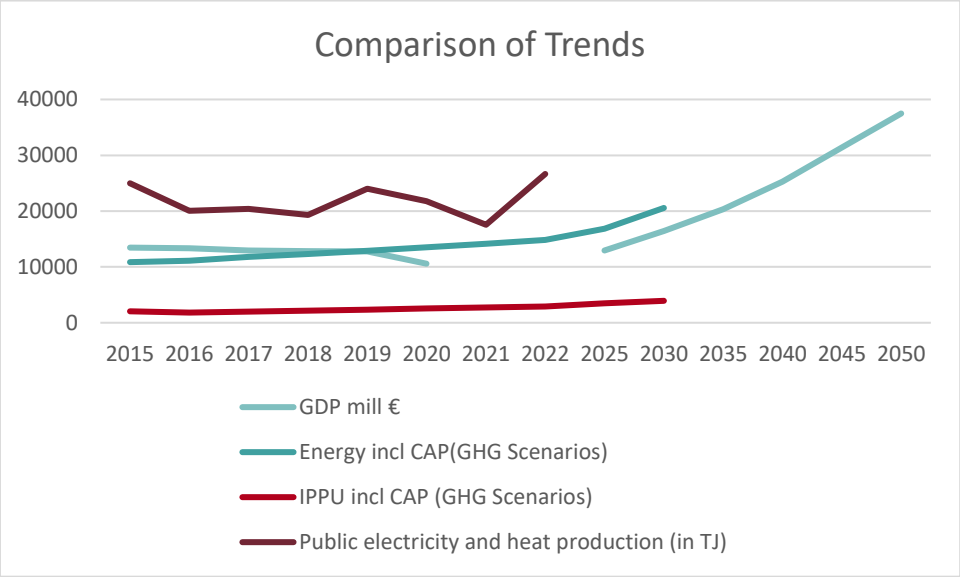
1.3. Projections

Several data sets are available that could in theory be used for the calculation of projections in Georgia:

1. Projections for the Total Primary Energy Consumption by Geostat, based on the Energy Balance and taking into account the NECP, and projections for the Gross Domestic Product in Georgia, based on the current GDP
2. Projection of the same kind from IIASA, and projections of several pollutants
3. The GHG projections performed by the experts providing information for the GHG projections.

The 2021-2023 Action Plan for Georgia's 2030 Climate Strategy foresees a final target of 87% renewable energy production until then. Therefore it is unclear, how this share is going to develop until 2050. The Geostat Data foresees an increase in total primary energy of 28% between 2020 to 2030, then 52% in 2040 and 83% in 2050 (all compared to 2020).On the other hand, in their projections of energy consumption, IIASA calculates the same amount of energy consumption in 2030 as in 2020, and an increase of 26% for 2050 (again compared to 2020). The GHG emissions scenario foresees an increase of 52% from 2020 – 2030 alone. As all three scenarios are so different to each other, it would be necessary to analyse the background data before using this data for the Energy projections.

Figure 1: Comparison of projection data for Energy production and GDP from Geostat, and projections from the GHG szenarios.



The situation is similar when it comes to the projected development of the Gross Domestic Product, which could serve as a basis for projections for a part of the Energy sector, and for the IPPU sector: the Geostat data predicts an increase of the total GDP of 55% between 2020-2030, and 254% increase from 2020 – 2050.

The GDP is a measure of the market value of all the final goods and services produced, so as a basis for the assumptions for the air pollutants projections it is necessary to analyse the data that has been used to provide this prognosis: the servicing industry can be expected to grow to a greater extent than the rest of the industry, but without knowing the assumptions and data that went into this prognosis, it is impossible to use this data for projections. Thus, it is necessary for the experts to approach Geostat to see if this data can be made available (i.e. the assumptions used for the prediction of the 254% increase of the GDP).

IIASA scenario ECLIPSE_V6b_CLE_base, which is based on information from the IEA, provides projections of the GDP/capita until 2030, with a projected increase of 38% of the per capita GDP. As for the data of Geostat, it is highly unlikely that the increase of industrial installations will increase by that amount in such a short time. Again, background data for the analysis are necessary for an analysis, for the use of the relevant part of the data as a basis for the assumptions for projections.

The IIASA Gains model (ECLIPSE_V6b_CLE_base) also provides information on development of SO_2, PM 2.5, VOC, NH3 and NOx emissions. This scenario uses energy data for historical years from IEA statistics, and for projections from the WEO2018 (IEA). Even though the total of e.g. NO_x shows an increase of total projected emissions of 50% between 2020 and 2050, there are several issues with the data, e.g. Residential Combustion emissions increase by 325% between 2015 and 2020, which is not reflected in the inventory. Light Duty vehicle NO_x emissions between 2005 and 2050 increase by 262%, again, there is no explanation for this development. Also, the data provided by IIASA and the Georgian inventory team do not match, this most probably has to do with different approaches. The following is a comparison of the emissions calculated by IIASA for Industrial Processes, and the total emissions reported under Sector 2, Industrial Processes in the Georgian NFR:

Figure 2: Comparison of IIASA data and data from Georgia's NFR, NOx for Sector 2 Industrial Processes

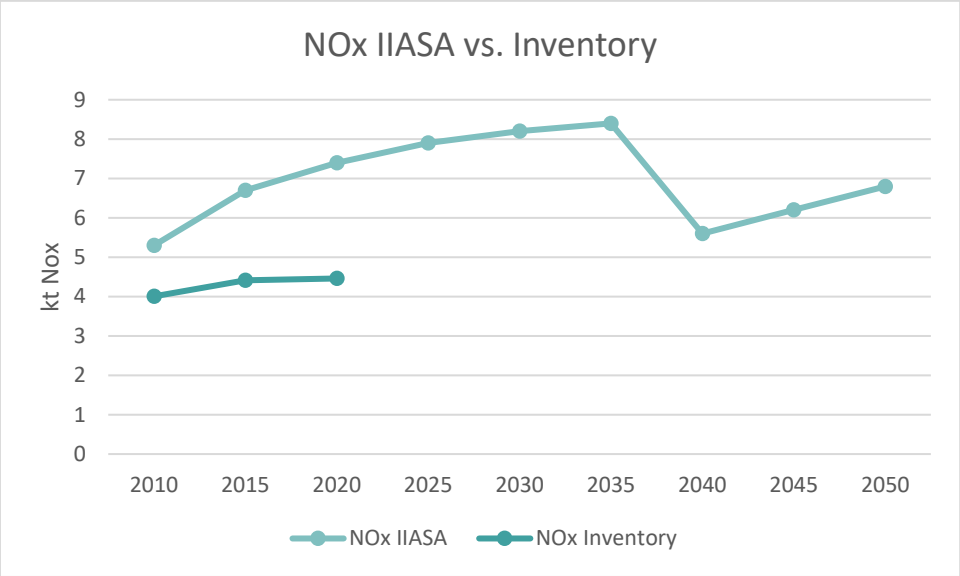


Figure 3: Comparison of IIASA data and data from Georgia's NFR, SOx for Sector 2 Industrial Processes

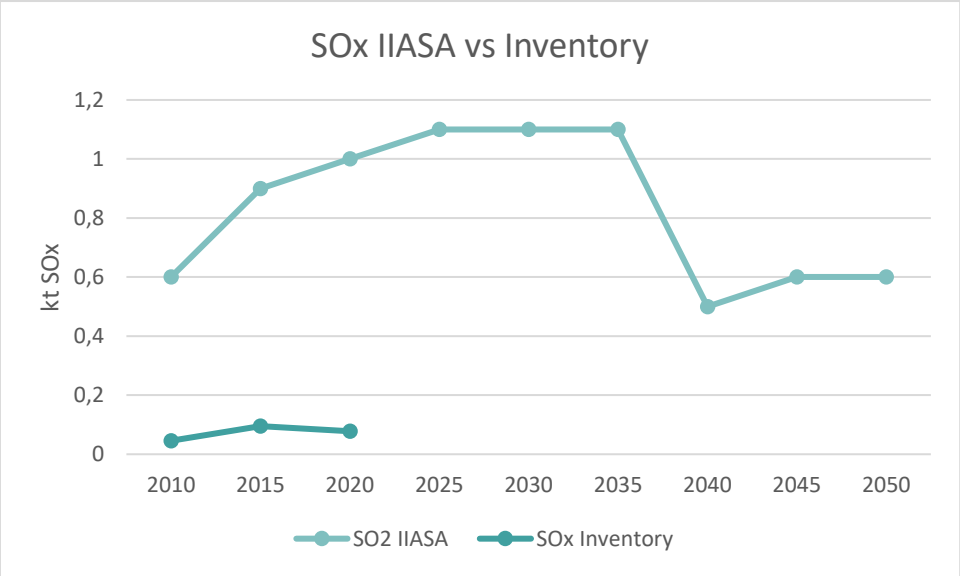
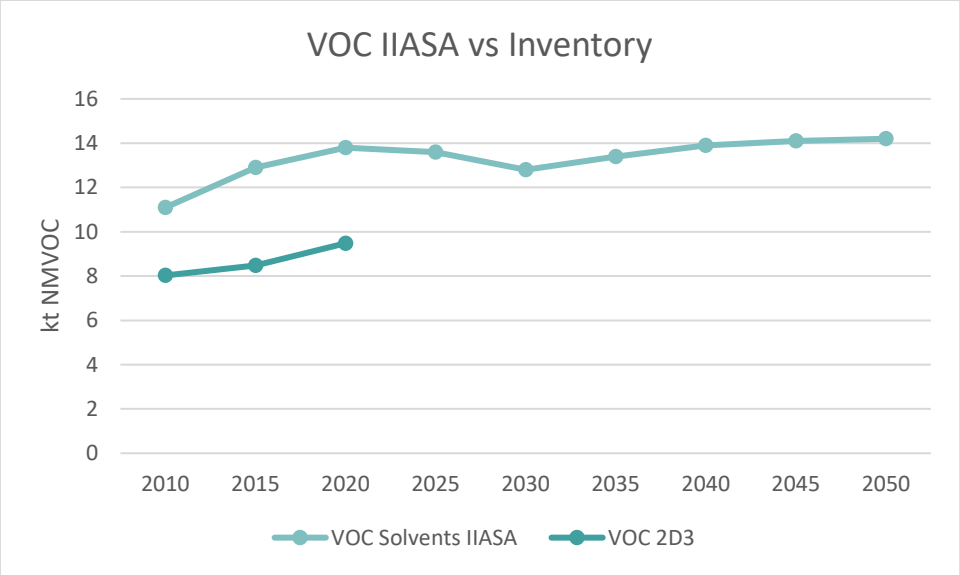


Figure 4: comparison of IIASA data and data from Georgia's NFR, NMVOC for Sector 2 Industrial Processes



The graphs above show that data reported in the IIASA Scenario (ECLIPSE_V6b_CLE_base) is very different from data reported in the NFR. In order to use IIASA data, it is necessary to understand, where these differences come from. Also, looking at the trend of the IIASA scenario, it is necessary to understand the assumptions behind the big decrease of emissions between 2035 and 2040 for NOx and SOx.

1.4. General recommendations:

- In order to be able to provide a better picture of how emissions will develop, the emissions inventory should be updated and those subsectors currently reported as NE should be made available. The trends should be the same as those of the GHG inventory, ideally, one set of Activity Data is used for both reports. Once higher tier methodologies become available, it will be easier to depict measures for these subsectors, based on the IED, and other legislations aimed at reducing emissions from these sectors.
- In order to use one of the above mentioned projections as a basis for emissions projections, it is important to understand the underlying information. As the increase of the GDP is very high and not representing historical trends, it is highly unlikely that industrial facilities will increase by several hundred percent. Thus, it would be necessary to obtain additional information from Geostat on the underlying assumptions, as it is necessary to obtain additional information from IIASA on their models. With this information for the GDP, as well as the increase in energy production, it should be possible to provide projections for the sectors Energy and IPPU.

2. Sector Agriculture

The following activities have been performed for the sector Agriculture.

- Investigation of the current situation and comparison of activity data with other data sources (IIASA, FAO, UNFCCC reporting)
- Identification of issues for improvement of Georgia´s air emission inventory
- Review of IIASA´s air emission projections with Georgia´s current inventory data
- Proposal for projected activity data for Georgia

2.1. Current situation

Georgia´s air emissions for NFR sector Agriculture are calculated using the EMEP/EEA Guidebook – 2019, tier 1 approach referring to Georgia´s IIR 2023[2] (currently no IIR 2024 is submitted). Reported emission sources in Agriculture are:

- 3B Manure Management for
  - Dairy cattle
  - Non-Dairy Cattle
  - Sheep
  - Swine
  - Goats
  - Horses
  - Broilers
  - Turkeys
  - Other Poultry
- 3Da1 Inorganic fertilizers,
- 3Da2a Animal manure applied to soils,
- 3Da3 Urine and dung deposited by grazing animals,
- 3Dc Farm-level agricultural operations including storage, handling and transport of agricultural products and
- 3De Cultivated crops.

[2] https://www.ceip.at/status-of-reporting-and-review-results/2023-submission

As the Tier 1 methodology does not take into account detailed country-specific feeding and management practices, specific abatement measures cannot be displayed in the calculations. So, for calculating the projections, the focus lies in projecting the activity data.

In the course of the investigation of the status to Georgia´s Agriculture inventory, there have been some issues identified that require improvement in the foreseeable future. These issues have been summarized in the following chapter of this report.

2.2. Inventory improvement

There have been some issues identified for improving the agriculture inventory in terms of completeness, consistency and accuracy.

2.2.1. Improvement of completeness consistency

For sector 3B Manure Management of livestock categories buffalo, mules & asses and poultry there are livestock numbers available, but no emissions are reported in the NFR tables of submission 2024[3].

- Buffaloes are reported as IE. In the report "Agriculture of Georgia" (Geostat, 2022) buffalo numbers are reported together with those of dairy cattle. However the FAO statistics[4] as well as the UNFCCC reporting provide animal statistics. In Georgia´s NIR 2021[5], the time series of livestock numbers since 1990 is provided.
- Mules & asses are reported as NE. There are FAO statistics for asses as well as for mules and hinnies from 1992 onwards.
- For poultry there is a need for further investigation of the different categories laying hens, broilers, turkeys and other poultry. In the NFR Table laying hens are IE. IIASA provides figures for broilers. FAO provides numbers for chicken (which is assumed to be both, layers and broilers). Turkeys are not estimated before 2016 in the NFR. There is a need to calculate a complete time series in the inventory. This could be done as FAO provides turkey numbers from 1992 onwards. For other poultry there are data from 2016 onwards in the NFR reported. An explanation on using the notation key of NA for the years before should be included in the IIR.
- Source categories that are currently not estimated, but are required to be reported in the inventory:
  - Sewage sludge applied to soils
  - Other organic fertilisers applied to soils (including compost)
  - Use of pesticides is currently reported as NA. However, there is an amount of pesticides used that is provided by the FAO starting from 1992. Values for

[3] https://www.ceip.at/status-of-reporting-and-review-results/2024-submission

[4] https://www.fao.org/faostat/en/#data/QCL

[5] https://unfccc.int/non-annex-I-NCs and https://unfccc.int/documents/271342

herbicides, insecticides and fungicides are available. So pesticide use is likely an emission source in Georgia.

- Field burning of agricultural residues

2.2.2. Improvement of accuracy

It is good inventory practice to use Tier 2 calculations at least for key categories.

With regard to emission projections, more detailed calculations enable the implementation of abatement measures (e.g. for feeding, manure management, N application techniques). In Tier 1 it is de facto not possible to include any abatement measures. So, currently, the only option for calculating agricultural projections is projecting the activity data.

When looking at ammonia, agriculture is the main emission source in Georgia. Key sources in the Georgian inventory are:

- 3B1a Manure management - Dairy cattle
- 3Da2a Animal manure applied to soils
- 3Da3 Urine and dung deposited by grazing animals
- 3Da1 Inorganic N-fertilizers (includes also urea application)
- 3B1b Manure management - Non-dairy cattle

So, it is highly recommended to move to Tier 2, at least for these sources. For manure management there is the N flow tool of the EEA available, a standardized N-flow tool, which is free to access: **3.B Manure Management N-flow tool - Jan 2021 — European Environment Agency (europa.eu)**.

- This tool enables Tier 2 calculations according to the EMEP/EEA GB 2023 methodology for all livestock categories for 3B Manure Management as well as for 3Da2a Animal manure applied to soils and 3Da3 Urine and dung deposited by grazing animals.

By using this tool and calculating in the N-flow methodology it would be technically possible to include abatement measures such as livestock feeding strategies, low-emission housing systems, low-emission manure storage systems and low-emission manure spreading techniques.

2.3. Projections

2.3.1. Activity data for Projections

With regard to the latest inventory, for the following activity data, projected values until 2030 (if possible 2050) would be required.

- Livestock numbers for all relevant animal categories
  - Dairy cattle
  - Non-dairy cattle
  - Sheep

- Swine
- Goats
- Horses
- Poultry: layers, broilers, turkeys, other poultry

- Information on manure management systems

Cattle or swine can be kept in solid-manure or liquid-manure systems. Even the Tier 1 methodology provides different EF for solid and liquid manure. There is no information on manure management systems (solid or slurry) in the Georgian IIR. The development of shares for the relevant livestock categories that are kept in solid-manure and liquid-manure systems should be considered. Increasing/decreasing trends should be indicated in the projections, if possible.

- Information on silage feeding

The share of animals (potentially cattle, sheep, buffalos, goats and horses and mules and asses) that is fed with silage should be considered in the projections, if possible.

- N-amounts from mineral fertilizers
- Grassland and Cropland areas for 3Dc and 3De (utilised agricultural area, which includes all cropland, permanent pasture and rough grazing land)

Key sources are of higher importance. So the focus lies in projecting livestock data and N amounts from mineral fertilizers.

2.3.2. Georgia´s GHG projections

Georgia´s GHG emissions projections could not be used in order to calculate air emission projections as there are only emission values available, but no projected activity data. Furthermore, there is no background information on the calculations and assumptions available that could be used for this purpose.

2.3.3. IIASA – GAINS Model

IIASA has already prepared air emission projections for Georgia. With regard to activity data, they projected livestock data and mineral fertilizer N amounts. This data can be accessed via the Website of the IIASA[6]. A user account is necessary, but can be requested easily.

Scenario: Baseline, Clean Air Outlook 2

IIASA calculated a baseline scenario for the Clean Air Outlook 2 study. The results are based on CAPRI agricultural projections, updates of historical 2005-2015 emissions using 2019 national submissions of emissions to UNECE and EU, and up to date current legislation. The scenario is defined for the period until 2050.

[6] GAINS Europe online (iiasa.ac.at)

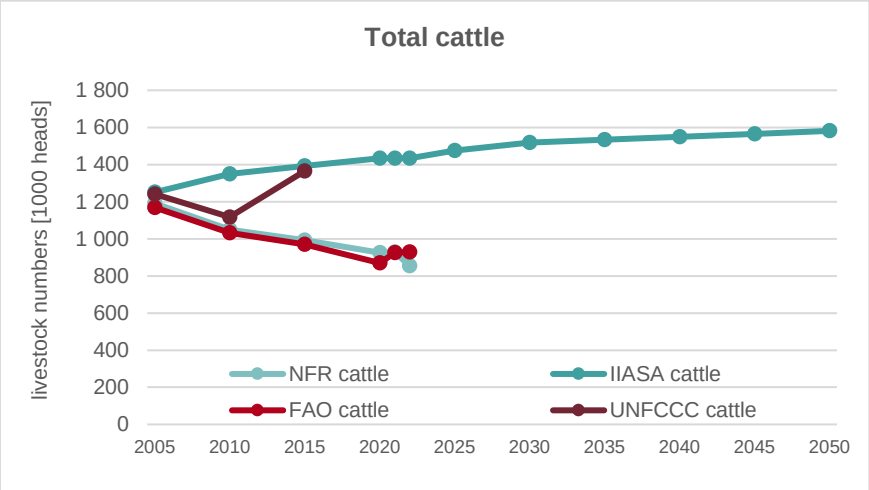
IIASA did projections for the livestock categories of cattle (dairy and non-dairy cattle), swine, sheep and goats, laying hens, other poultry, horses and buffaloes. N-amounts from mineral fertilizers have also been projected.

In the following graphs the livestock data and mineral fertilizer amounts reported by Georgia in the NFR, under the UNFCCC (Georgia´s NIR 2021), taken from the FAO statistics and the numbers from IIASA (GAINS Model) were compared.

The historical activity data taken from the GAINS model of IIASA is largely not in line with the data from the current UNECE submission 2024. Especially from 2010 onwards, there are different values and trends. The numbers of IIASA are defined as updates of historical 2005-2015 emissions using 2019 national submissions of emissions to UNECE. For the future years, the results are based on CAPRI agricultural projections. There are no further information given that would explain the data variances of the historical years.

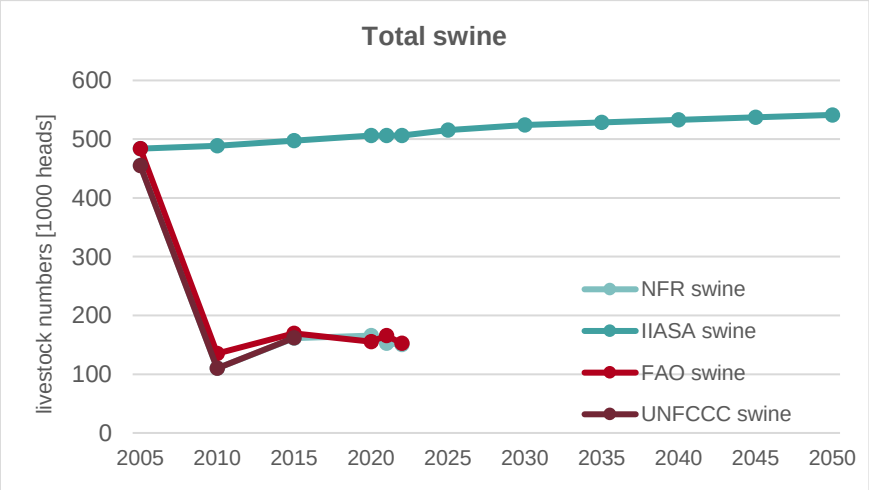
The numbers reported under the UNFCCC are also different from the NFR in most cases. In principal, FAO statistics show relatively good agreement to the numbers from the NFR, but in some cases there are also significant differences (e.g. mineral fertilizers).

Figure 5: Livestock data of total cattle



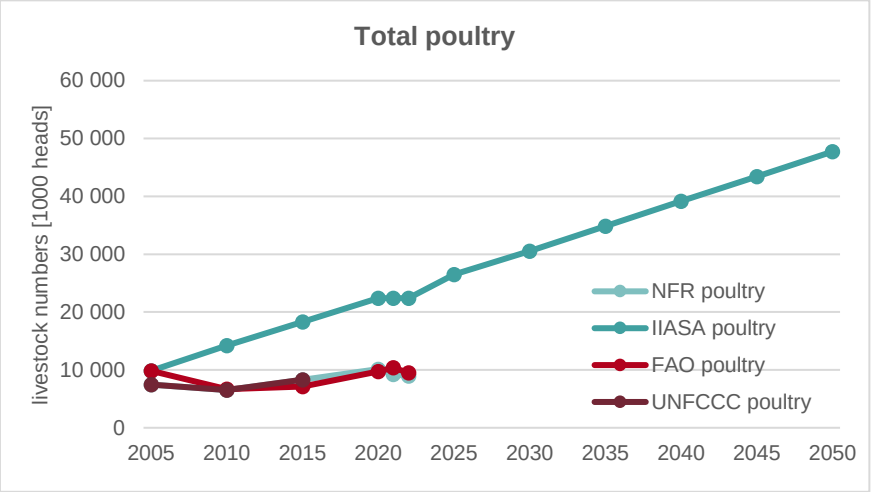
The numbers of the UNECE submission are similar to the FAO statistics, although there are some smaller differences for the years from 2020 onwards. The numbers taken from the NIR 2021 are completely different for 2015. It is recommended to check the numbers and to make efforts in order to have consistency of reporting under UNFCCC and UNECE.

Figure 6: Livestock data of total swine



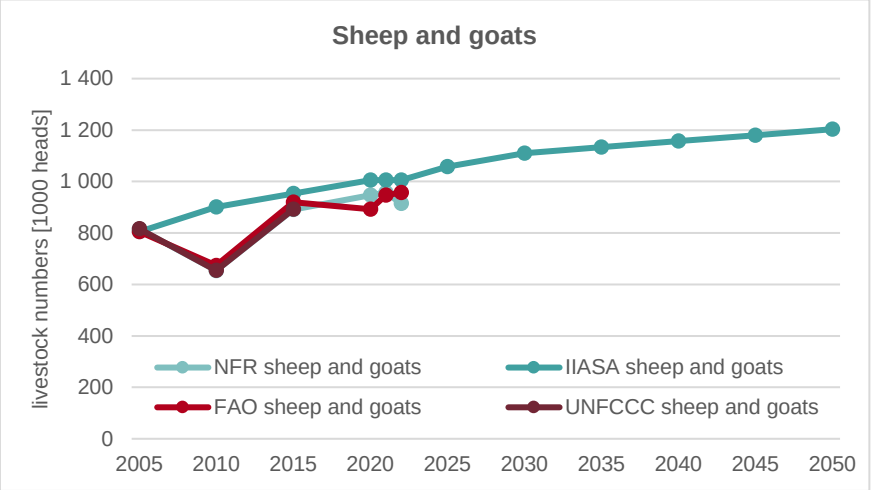
For swine the IIASA-numbers are completely different to the values of the UNECE and UNFCCC submission and the FAO statistics. In the national statistics, the swine numbers fell sharply between 2005 and 2010, whereas IIASA provides a relatively stable trend.

Figure 7: Livestock data of total poultry



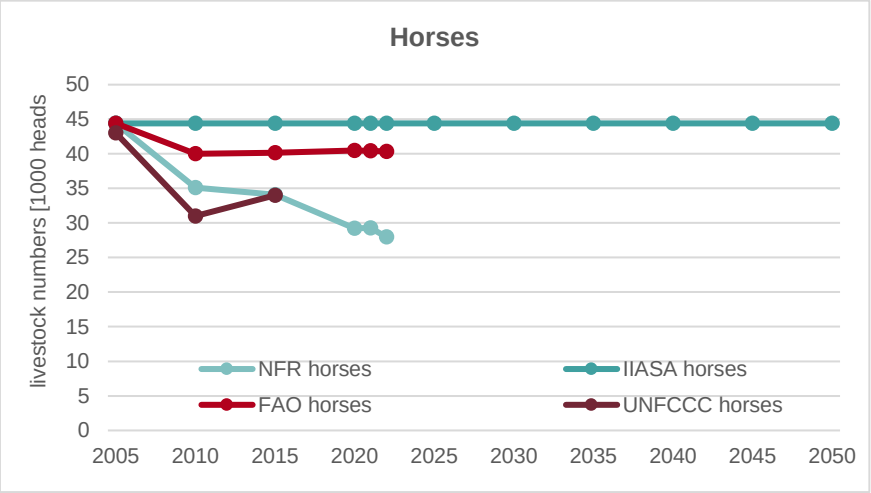
Total poultry numbers are similar between UNECE and UNFCCC reporting and FAO statistics. IIASA shows different numbers. The values of the subcategories of poultry (layers, broilers, turkeys and other poultry) are not clear as IIASA refers to broilers, in the NFR its layers. Turkeys are not complete in the inventory for the years before 2016 (please refer to

Figure 8: Livestock data of sheep and goats



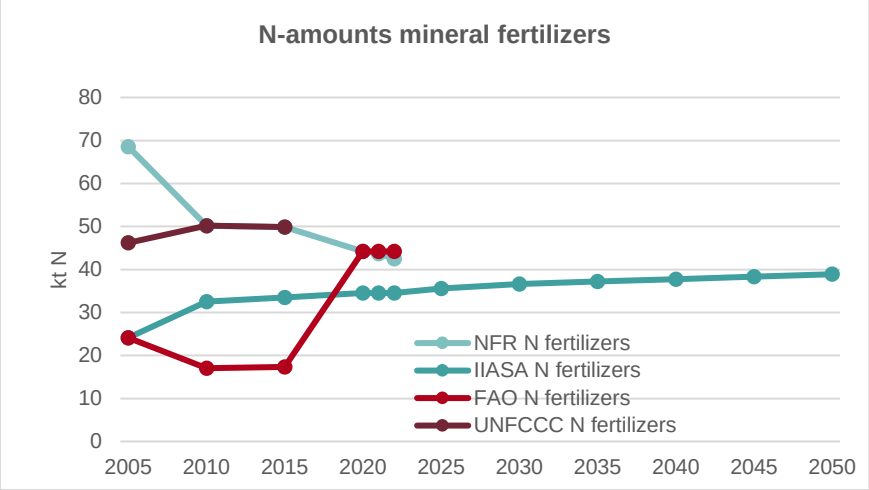
Sheep and goat numbers are similar between UNECE and UNFCCC reporting and FAO statistics. IIASA provides different numbers.

Figure 9: Livestock data of horses



For horses, the numbers and trend of the UNECE submission are different to the FAO statistics as well as UNFCCC reporting. It is recommended to check the numbers and to undertake efforts in order to have consistency of reporting under UNFCCC and UNECE.

Figure 10: N-amounts of mineral fertilizers



For mineral fertilizer, the numbers and trends show differences for all data sources. It is recommended to check the numbers and to undertake efforts in order to have consistency of reporting under UNFCCC and UNECE.

2.3.4. General recommendations

- In general, it is recommended to further investigate the differences between the IIASA historical data and the Georgian numbers. Due to time restraints during this project, it was not possible to further work on this issue and possibly exchange directly with IIASA in order to have a better understanding of the numbers. It is important to have reliable historical data that might possibly be used (as a base year) for reduction commitments in the future years. This is currently not relevant for Georgia for air emissions but could be in the future.
- Furthermore, there should be consistent reporting under the UNECE and UNFCCC of values that are relevant for both inventories (e.g. activity data, excretion rates, etc.). The differences between the inventories should be identified and harmonized for future submissions. It should be considered to establish quality procedures on a routine base.

Scenario: NAPCP_2030 and NAPCP_2050

IIASA calculated a baseline scenario with additional measures as defined in the National Air Pollution Control Programmes (NAPCP) submitted in 2019. The results are based on CAPRI agricultural projections, updates of historical 2005-2015 emissions using 2019 national submissions of emissions to UNECE and EU, current legislation extended to include additional measures reported in NAPCP. The scenario is defined for the period until 2030 (NAPCP_2030) and an extension to 2050 is also available (NAPCP_2050).

For Georgia, the results show no differences compared to the Baseline Scenario, except for mineral fertilizer amounts (slightly lower amounts only for 2050!). Georgia is not required to report a National Air Pollution Control Programme (NAPCP), which is only mandatory for EU Member States under the NEC Directive. Therefore no additional policies and measures could be taken into account.

2.3.5. Proposal for projected activity data for Georgia for a Baseline-Scenario

In this chapter an example is prepared how the Georgian activity data could be projected based on the available data sources.

The IIASA projections of activity data are currently the best available information, although there are differences when comparing the historical activity data until 2022 of the Georgian inventory with the data from IIASA. The results of IIASA are based on CAPRI agricultural projections. The Common Agricultural Policy Regional Impact (CAPRI) model is an agricultural sector model with a focus on Europe, but embedded in a global market model to represent bilateral trade between 45 trade regions (countries or country aggregates).

As described before, there is a need to check on the differences between the IIASA historical data and the Georgian numbers.

The IIASA data cannot be used without being adjusted to the current inventory of Georgia. One possible option could be using the growth rates from the IIASA numbers in order to determine the projected AD for Georgia. As examples, dairy and non-dairy cattle as well as mineral fertilizers are presented.

Table 1: Cattle numbers and mineral fertilizer N-amounts from the IIASA Baseline Scenario and growth rates 2020-2050

IIASA Baseline scenario	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Dairy cattle - Baseline IIASA [1000 heads]	735.6	809.3	820.1	830.8	841.5	852.3	859.7	867.2	874.6	882
Non-dairy cattle - Baseline IIASA [1000 heads]	515.1	540.9	572	603.1	634.2	665.3	673.9	682.4	691	699.5
Mineral N fertilizers use (excl. urea) - Baseline IIASA	24.12	32.5	33.49	34.5	35.55	36.63	37.18	37.74	38.31	39.31
Growth rates					**2020-2025**	**2025-2030**	**2030-2035**	**2035-2040**	**2040-2045**	**2045-2050**
Dairy cattle					*1.3%*	*1.3%*	*0.9%*	*0.9%*	*0.9%*	*0.8%*
Non-dairy cattle					*5.2%*	*4.9%*	*1.3%*	*1.3%*	*1.3%*	*1.2%*
Mineral N fertilizers use					*3.0%*	*3.0%*	*1.5%*	*1.5%*	*1.5%*	*2.6%*

In the following table a proposal how to project the Georgian AD of cattle and mineral fertilizer N-amounts is indicated. For determining the values for 2025 to 2050, the growth rates of the IIASA projections have been used. For example, the number of dairy cattle for 2025 is 1.3% higher than the number in 2020 by using the growth rate for dairy cattle for 2020-2025 of the IIASA data.

Table 2: Adjusted cattle numbers and mineral fertilizer N-amounts by applying the growth rates of the IIASA Baseline Scenario

Georgian inventory	**2005**	**2010**	**2015**	**2020**	**2021**	**2022**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Dairy cattle – NFR [1000 heads]	709.9	561.7	545	450.8	451.7	431.4	456.6	462.5	466.5	470.6	474.6	478.6
Non-dairy cattle [1000 heads]	480.7	487.7	447.1	475	476.9	422.3	499.5	524.0	530.8	537.5	544.2	550.9
Use of inorganic fertilizers (kt N/yr)	68.58	50.2	49.9	44.2	43.7	42.5	45.5	46.9	47.6	48.4	49.1	50.4

In the following graphs the projected AD for Georgia until 2050 for dairy and non-dairy cattle as well as N-amounts of mineral fertilizer are shown. The red line indicates the projected AD for Georgia that could be used for calculating the national emission projections. These are following the trend of the IIASA-Baseline projections but are adjusted to the national inventory.

Figure 11: Proposal for livestock projections for dairy cattle

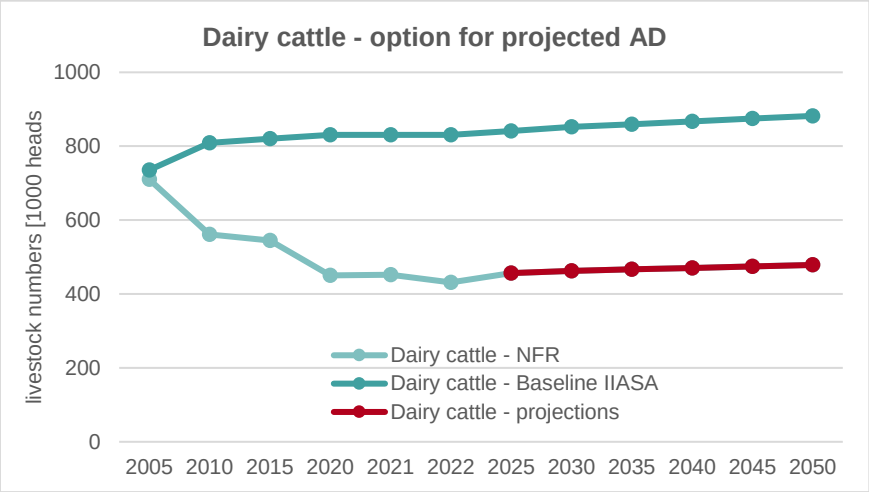


Figure 12: Proposal for livestock projections for non-dairy cattle

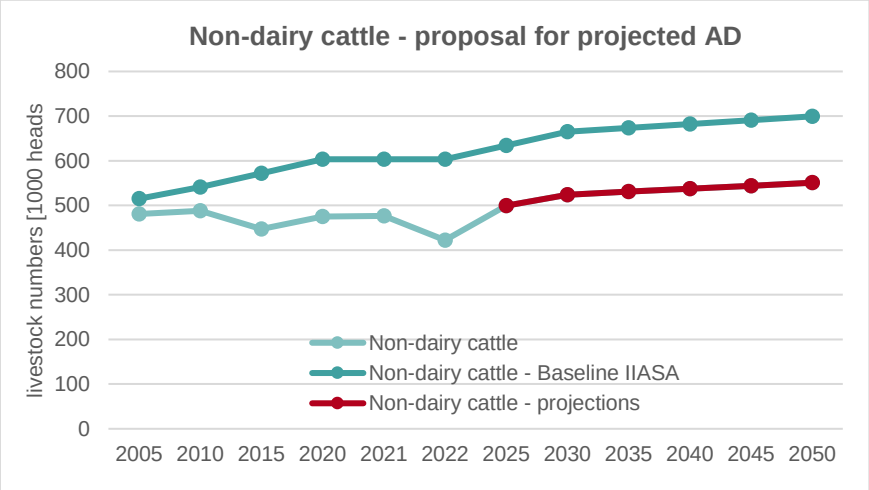
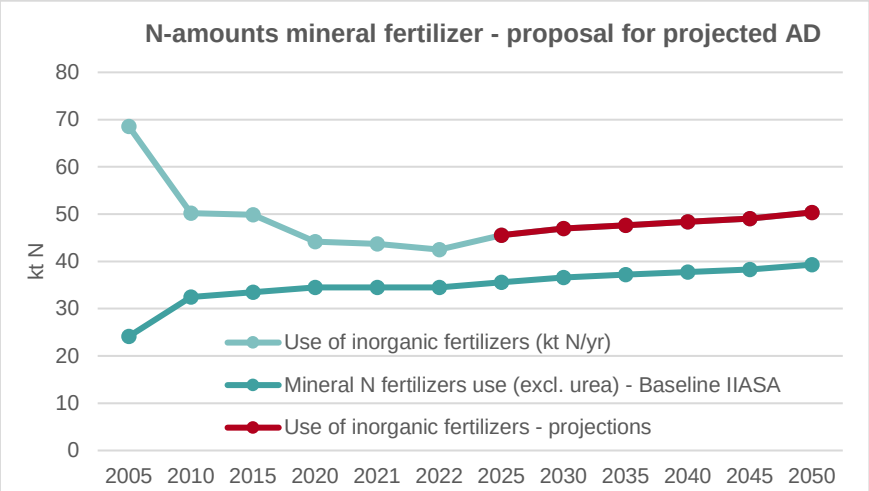


Figure 13: Proposal for projections of N-amounts of mineral fertilizer



2.4. Sector Waste

The following activities have been performed for the sector Waste.

- Investigation of the current situation
- Identification of issues for improvement of Georgia´s air emission inventory
- Proposal for projections

A comparison of Georgia´s current inventory data with IIASA´s air emission projections was not possible as IIASA does not provide data for this category. Moreover, GHG emissions projections data are not available on sub-category level too and would need to be requested.

2.4.1. Current situation

Georgia´s air emissions for NFR sector Waste are calculated using the EMEP/EEA Guidebook – 2019, tier 1 approach referring to Georgia´s IIR 2023[7] (currently no IIR 2024 is submitted). Reported emission sources in Waste are:

- 5A Biological treatment of waste - Solid waste disposal on land (NMVOC),
- 5C1bi Industrial waste incineration,
- 5C1biii Clinical waste incineration,
- 5D1 Domestic wastewater handling (NMVOC, NH3),
- 5D2 Industrial wastewater handling (NMVOC).

[7] https://www.ceip.at/status-of-reporting-and-review-results/2023-submission

No emissions are currently reported from categories 5B1 Biological treatment of waste – Composting, 5C1a Municipal waste incineration, 5C1bii Hazardous waste incineration, 5C1biv Sewage sludge incineration, 5C2 Open burning of waste as well as 5E Other waste (accidental car and building fires). PM emissions from 5A Solid waste disposal on land – covering emissions from mineral waste handling during disposal in landfills – are missing as well.

2.4.2. Inventory improvement

There have been some issues identified for improving the waste inventory in terms of completeness, consistency and accuracy.

Improvement of completeness

No emissions are currently reported ("NE") from categories

- 5B1 Biological treatment of waste – Composting,
- 5C1a Municipal waste incineration, 5C1bii Hazardous waste incineration,
- 5C1biv Sewage sludge incineration,
- 5C2 Open burning of waste as well as
- 5E Other waste (accidental car and building fires).

PM emissions from 5A Solid waste disposal on land – covering emissions from mineral waste handling during disposal in landfills – are not estimated as well.

Activity data necessary:

- Masses aerobically biologically treated waste
- Masses of mineral waste disposed of / handled as respective landfill sites
- incinerated masses of relevant wastes (MSW, hazardous waste, sewage sludge)
- open burned waste (agricultural – vineyard burning?)
- numbers of annual unwanted fires – cars and buildings (industrial, detached/undetached houses, apartments)

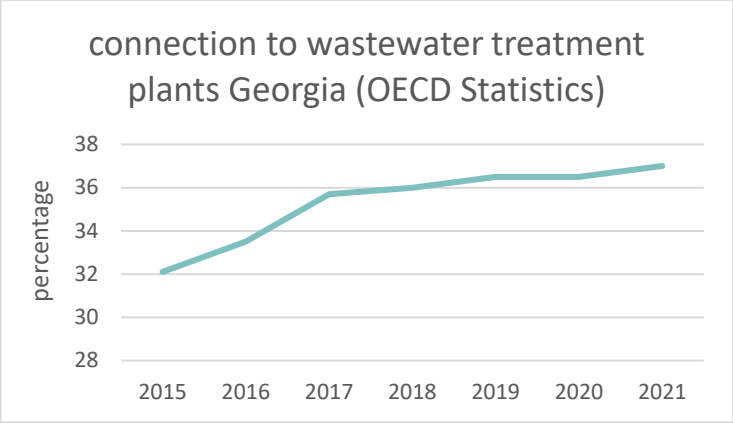
It has to be checked whether these sub-categories play a role in Georgia and to what extent. In the case of occurance of this activity, the respective activity data should be collected and emissions calculated, wherever possible. In cases where an activity is not practiced in Georgia(as e.g. for composting, refer to NIR, page 6-99) a change of the notation key to "NO" is suggested.

Time series:

Emissions from 5C, industrial waste incineration and clinical waste incineration, are only reported from 2013 on due to lack of historical data. Here assumptions on historical as well as future emissions should be made to achieve a whole time series. Regarding declining trend of NOx of the last two years an explanation (mitigation measures set?) should be added in the IIR.

NMVOC from wastewater treatment shows a decreasing trend since 2018 (refer to Figure 6.5 in the IIR), although the IIR states that since 2012 new WWTPs were built and the amount of treated wastewater increased. The increasing connection rates to wastewater treatment between 2015 and 2021 is also published by OECD.Stat (https://stats.oecd.org/Index.aspx?DataSetCode=WATER_DISCHARGE).

Figure 14: Development of the connection rate to wastewater treatment plants Georgia. Source: OECD (2024), Wastewater treatment (indicator). doi: 10.1787/ef27a39d-en, accessed on 10 June 2024



The activity data (m3 waste volume) applied for inventory calculation should thus be reviewed and questioned whether an increasing trend can be expected in line with the expanding capacities (new plants) and the population development.

NH3 from wastewater treatment, i.e. latrines, is only reported from 2015 onwards, due to lack of activity data on the number of population not connected to centralized wastewater collection system (referring to the IIR, page 57). As the use of this treatment path is expected also for earlier years gap filling based on available data should be done.

2.4.3. Improvement of accuracy

It is good inventory practice to apply the most recently published EMEP/EEA 2023 Guidebook. With the EMEP/EEA AR 2023 (Table 3-2), the standard method for calculating NMVOC from 5A has changed, directly linked to CH4 → 3.6 kg NMVOC per Mg CH4.

2.4.4. Projections

Unlike the sectors Energy, IPPU and Agriculture no information of waste projections data are available from IIASA, probably related to the marginal contribution of the sector “Waste” to national total air emissions (NMVOC: 0.5% share in national total 2022, NOx: 0.02% share in national total 2022, NH3: 8.5% share in national total 2022).

Data sets that could be used for the calculation of projections in Georgia:

1. Projections of the Gross Domestic Product in Georgia – please refer to 1.3 for constraints
2. Projections of population data in Georgia
3. Projection of GHG data

Georgia´s GHG emissions projections for solid waste disposal CRF 5.A (NMVOC) could be used for calculation of projections of air emissions, provided that GHG projections data is or can become available on sub-category level. Regarding the other sub-categories information on projected activity data (projected data on future wastewater volumes handled, alternatively the population connected to

wastewater treatment plants, etc.) would be needed. No background information on the calculations and assumptions is apparently available from the NIR that could be used for this purpose.

5A Solid waste disposal on land (NMVOC)

- - If projections for GHG are available, air emissions projections could be derived the same way as for historical emissions taking the standard equation from the EMEP/EEA Guidebook and national landfill gas emissions data as basis. However, the question has to be clarified whether/how the measures of the "Action Plan for Georgia's Climate Strategy" are taken into account in the GHG projections (- establishment of landfill gas collection, - closure of illegal landfills, - construction of new managed sites).
- - If projections of the GHG inventory could not be made available for 5A it is advised to get the FOD calculation model applied for GHG as (future) emissions are dependent on various factors that need to be considered: historical depositions (incl. waste composition), the period of time (i.e years of depositions) taken into account, degradation rates (half-lives, etc.). Based on the annual landfill gas formation, landfill gas recovery ("R") and methane oxidation ("OX") could then be taken into account, as well as the planned measures for the closure of illegal and new construction of modern ("managed") landfills ("MCF").

5C Waste Incineration

For this source more detailed input would be necessary, especially whether additional plants are planned and to what extent. In the absence of this information historical emissions data would need to be used for projections.

5D1 Domestic wastewater

- NMVOC: Volumes of waste water handled at municipal wastewater treatment plants; alternatively: population data (ideally part of population connected to wastewater treatment plants)
- NH3: Population data (not connected to the public sewage system, whereas: only population connected to dry toilets/latrines should be considered under this sub-category)
-

No information on the shares of population disposing to wastewater treatment plants and to latrines respectively could be found in the IIR. As also for 5A, assumptions made for GHG inventory projections of CH4 emissions from domestic wastewater treatment plants could give indications for projection of NMVOC from this source.

5D2 Industrial wastewater

- NMVOC: Volume of (industrial) waste water treated on-site; alternatively development of the GDP of relevant industries

3. Recommendations

For the **IPPU and Energy sector**, additional information, as described above, is still necessary. Once information on the GDP becomes available, and it is possible to estimate, how much of the GDP growth is related to the service industry, this information could be used to estimate projections. The same is true for the growth of Primary Energy Consumption, and how the increase will be met: information on the projected share of renewable energy, and projected import is still necessary. For the IIASA data, the discrepancies between the inventory data and that of IIASA's model need to be addressed and solved, besides, information on the IIASA trend is necessary, as there is a big dip in emissions in 2035 – 2040, which needs to be explained in published data.

For the **agriculture sector**, a proposition for how IIASA data could be used for projections has been made, however, like in the Energy and IPPU sector, a thorough analysis of historical inventory data should be made, because both FAO and IIASA data indicate higher numbers of animal stock.

For the **waste sector**, additional information, as described above, is necessary. Projected population development may be used for projections of emissions from domestic wastewater treatment, GDP data for industrial wastewater treatment (whereby certain aspects need to be clarified first (connection rates, relevant industries to be covered – see section on Energy and IPPU). When information on the GHG projections on sub-category level is/becomes available, this may be used to estimate projections of NMVOC from waste disposal.

Generally speaking, it is **necessary to work on improvement of the air emissions inventory**. The higher the tier methodology applied, the more accurately emissions are reflected in the inventory, and the easier it is to tie results from the inventory to data sets for projections. Furthermore, the necessary information for projections should be collected, then, for instance, only the part of the GDP that reflects economical data (without the service sector) could be used for projections. IIASA is currently working on an update of their projection data, which needs to be analysed once it is released.

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