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# EU4Climate

Armenia, Azerbaijan, Belarus, Georgia, Republic of Moldova, Ukraine

# Roadmap for the development of a functional National Greenhouse Gas Emissions Inventory System and MRV system for Armenia

**Final Report**

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The purpose of this report is to support to the operational system of the National Inventory of Greenhouse Gas Emissions in Armenia, based on the country's experience and applying international best practice, according to the Comprehensive and Enhanced Partnership Agreement signed with the EU.

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## List of Abbreviations:

| | |
|---|---|
| BTR | Biennial Transparency Report |
| BUR | Biennial Update Report |
| CEPA | Comprehensive and Enhanced Partnership Agreement |
| CMA | Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement |
| COP | Conference of the Parties |
| CRF | Common Reporting Format |
| CTF | Common Tabular Format |
| EF | Emission Factor |
| ETF | Enhanced Transparency Framework |
| GHG | Greenhouse Gas |
| IPCC | Intergovernmental Panel on Climate Change |
| MPGs | Modalities Procedures and Guidelines |
| MRV | Monitoring, Reporting and Verification |
| NC | National Communication |
| NDCs | Nationally Determined Contributions |
| NIR | National Inventory Report |
| PA | Paris Agreement |
| QA/QC | Quality Assurance/Quality Control |
| RA | Republic of Armenia |
| UNFCCC | United Nations Framework Convention on Climate Change |

# 1. Context:

The aim of this Roadmap is to provide Armenia with an overview of the necessary arrangements and components of an MRV system for greenhouse gas emissions inventories that will become necessary under the Paris Agreement. It is based upon a first version of the document issued in July 2021 and updated with the outcome of regional workshops (May 2022) and a national workshop (July 2022).

## 1.1 Measuring, Reporting and Veification (MRV)

Measuring, Reporting and Verification of GHG emissions is an important tool in combating climate change. MRV is a term used to describe all measures that countries take to collect data on emissions, mitigation action, and support. In order to be able to see progress of a country's struggle to lower emissions, and to compare its efforts with that of the global community, it is necessary to have an MRV system in place that adheres to the same principles as that of other countries.

The three letters stand for the following principles:

- Measure or monitor (M) data and information on emissions, mitigation actions and support. This can entail measured GHG emissions, estimating emissions or emissions reductions utilizing activity data and emission factors, calculating changes relevant to sustainable development, and collecting information about support for climate change mitigation
- Report (R) by compiling this information in inventories and other standardized formats to make it accessible to a range of users and facilitate public disclosure of information
- Verify (V) by periodically subjecting the reported information to some form of review or independent assessment to establish completeness and reliability. Verification helps to ensure accuracy and conformance with any established procedures and can provide meaningful feedback for future improvement.

MRV can be applied to emissions of GHG, on a national, organizational and/or facility level, and can be reported in the form of an emissions inventory. However, MRV can also be applied to mitigation actions (e.g., policies or projects) in order to assess their effects on emissions, but also on sustainable development or the implementation of climate-related projects, without estimating emissions. This can also be applied to support tools, like climate finance, technology transfer and capacity building, in order to track provisions and receipt of climate support and in order to assess the impact of this funding.

This gap analysis focuses on the MRV of GHG emissions on a national level.

The basis for an MRV system is GHG emissions reporting that provides information about the emission trends and is published in the National Inventory Report (NIR). In its NIR, a country provides information about the development of GHG emissions from the different source and sink categories, based on the methods outlined in the guidelines provided by the IPCC. As this is an international framework that is binding to all parties to the UNFCCC that have to report their emissions, emissions timelines are comparable between countries and allow for a global overview of emissions. The reporting obligations for developed countries and those on the path of development are different, which will be described in the next chapter.

## 1.2 The Paris Agreement

The Paris Agreement, which was signed by Armenia in 2015 and ratified in 2017, was decided upon with the objective to lower global emissions in a way that global temperatures will not rise above +2°C by 2050 (whilst aiming for a maximum of 1.5°C). It follows the Kyoto protocol, that was ratified by Armenia in 2002. The Paris

Agreement aims to do so by strengthening the global response to climate change in general, including by: committing to a long-term temperature goal; enhancing adaptive capacity and climate resilience; and making finance flows consistent with low-emission development pathways. Differing national circumstances1 will be taken into account, which is a shift away from the differentiation between developed and developing countries, which also increases obligations of developing countries.

Each Party to the Paris Agreement is obliged to determine at the national level the actions they are able and willing to take in order to achieve the objective of the Paris Agreement. These so called "Nationally Determined Contributions" (NDCs) can contain efforts on mitigation and adaption, but also by providing the means of implementation (finance and technology transfer, as well as capacity building) to developing countries.

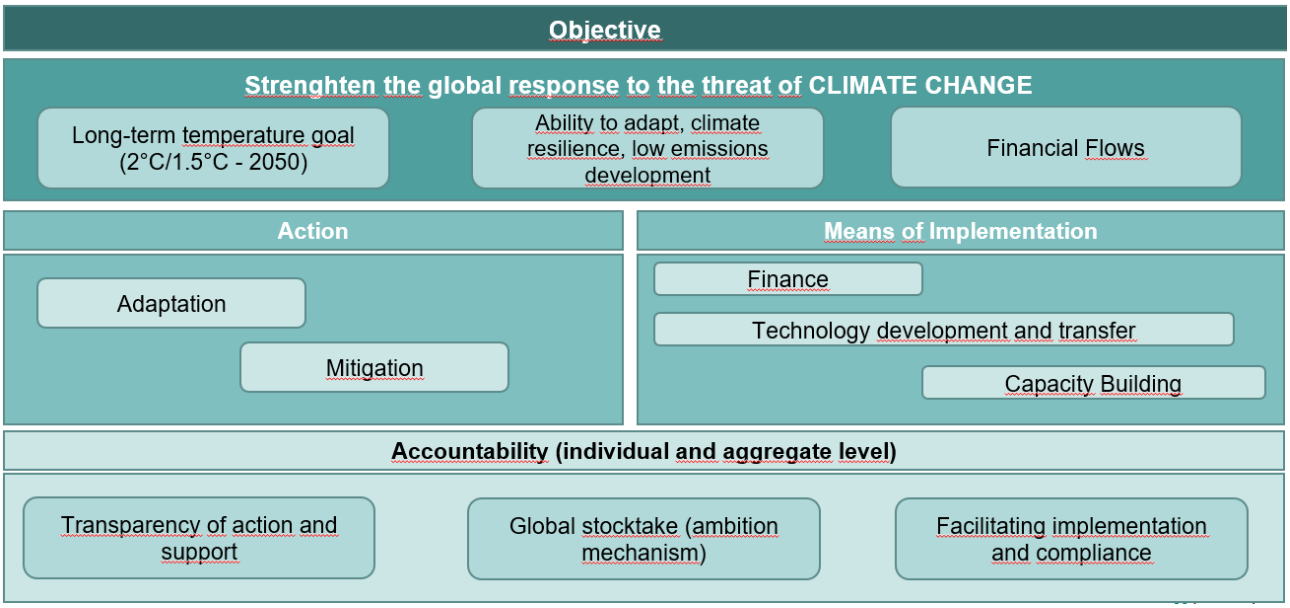



*Figure 1: Paris Agreement: the bigger picture*

Parties will have to report NDCs every five years and will have to put domestic mitigation measures into place in order to achieve them. Every five years, a global stocktake will take place, where the CMA2 will take stock of the implementation of the Paris Agreement and assess the collective progress towards achieving the purpose of the PA and its long-term goals.

NDCs should be clear and transparent, in accordance with guidance from the CMA, while taking into account existing methods and guidance under the UNFCCC. NDCs will be recorded in a registry (handled by the UNFCCC Secretariat). Countries can always adjust their existing NDCs in order to enhance their level of ambition over time but have to meet the minimum as described in their NDCs, that were put forward by the parties when joining the Paris Agreement (as Intended National Contributions, or INDCs). Depending on the timeframe of the INDC, parties will have to report new NDCs or updates of their NDCs in 2020 and every 5 years onwards.

For the CMA to be able to follow track on the implementation of NDCs, Parties to the PA will have to report on their progress in a transparent manner. This is why the *Enhanced Transparency Agreement* was decided upon, its *Modalities, Procedures and Guidelines (MPGs) for the Transparency of Action and Support* contain all necessary obligations for how, when and what parties will have to report.

[1] It should be noted that there is no definition of „national circumstances "

[2] the Conference of the Parties serving as the Meeting of the parties to the Paris Agreement, so all states that are Parties to the Paris Agreement

A solid MRV system will help the country to be able to report on the implementation of its NDCs, the changes in emissions and also to report projections of emissions with measures in place.

## 1.3 Legislative Context

The "Gap analysis of the existing legal framework in the Republic of Armenia and development of a road map for approximation with the EU acquis related to climate action" by Svetlana Zhekova, as part of the EU4Climate project, provides an extensive overview of the existing legal framework, abridged findings for which are presented here for easier reference.

**Development and sharing of GHG emission data** in Armenia, needed for implementation of the UNFCCC transparency requirements, is regulated by:

- ✓ Commitments under the UNFCCC, in particular articles 4.1 and 12.1, which provide the legal basis for developing the GHG inventory.
- ✓ Government Decree No 49 from 8 December 2016, which includes measures to implement the commitments taken by the RA pursuant to international treaties, including: UNFCCC and the Paris Agreement, Vienna Convention on Protection of the Ozone Layer, the UN Convention on Biodiversity and the Cartagena Protocol on Biosafety. It specifies that the National Greenhouse Gas Inventories shall be developed biennially while the Ministry of Environment has the overall responsibilities for the national inventory.
- ✓ The Comprehensive and Enhanced Partnership Agreement (CEPA) between the European Union and Armenia of 24 November 2017 (entered into force on 1 March 2021). The Agreement emphasizes the importance of strengthening the multilateral cooperation on the further development and implementation of the international climate-change framework under the UNFCCC and agreements and decisions related thereto, including the Paris Agreement. Particularly, it requires the establishment of a national greenhouse gas inventory system and of a national MRV mechanism by 2026.
- ✓ CEPA also provides framework for alignment with selected EU climate acquis acts including the Art. 14, 15, 16(1) and 17 of the ETS Directive, Regulation on Monitoring and Reporting (EU 601/2012), Art. 5&12 of MMR (EU 525/2013), ODS and F-gasses regulations, as well as Industrial Emissions Directive and CAFÉ Directions, which all have implications for the MRV national system.

The **Statistical Committee** is in charge with handling and disseminating official statistical information, including climate-related data, in the country. The **Roadmap for the Development of Climate Change-related Statistics** (adopted in the beginning of 2020) recognizes the need to acquire new knowledge and expertise through training and building partnerships with other information providers and experts. It also recognizes that there is a need for organizational changes to support the development of climate change-related statistics across the entire statistical system, including data reporting, collection, storage, and exchange. EU4Climate may contribute to setting up the basis for such organizational changes.

The MoE is responsible for the overall coordination of the NIR, BUR and NC development, while **national verification and approval** thereof is carried out by the Inter-agency Coordination Council, pursuant to Decree No 49/08.12.2016.

It is acknowledged that as a non-Annex I Party to the UNFCCC Armenia has already established the **basic national system for MRV** under the existing transparency arrangements. It has designated a formal coordinating body (MoE), as well as other institutions involved in the process, and has established a horizontal inter-institutional coordination and verification mechanism.

However, **obligations of the various designated institutions for climate-related data reporting, collection, storage and exchange are not regulated by any legally binding instrument**. A legal/formal mandate is needed to assign specific roles to each appointed institution and to facilitate the various stages of the process. A legal/formal mandate can also help the coordinating body to mobilize necessary expertise, in particular through appointment of the focal points among the stakeholders concerned. It could be in the form of implementing regulation (on MRV) or legally binding guidelines adopted by Government Decision.

The establishing an MRV system in the scope of the ETS Directive (Annexes I and II) is examined in detail in the report "Gap analysis of the existing legal framework in the Republic of Armenia and development of a road map for approximation with the EU acquis related to climate action", which provides extensive and exhaustive suggestion for further action. Please refer to this document for more information on the legislation and necessary alignments of the MRV system to the EU acquis.

## 1.4 Reporting Obligations now and then

Under the current climate framework, Parties were split into two groups: Annex-I countries, i.e., industrialized countries that were members of the OECD in 1992 plus countries with economies in transition, like the Russian Federation, the Baltic States, and several Central and Eastern European countries.3 By virtue of exclusion, all other countries obtained the status of Non-Annex I Parties. While most were developing countries, some were also in advanced stages of industrialization.

This meant that Armenia, as a non-Annex I country, so far had the following reporting obligations that were the key elements of the MRV Framework under the Climate Convention.

1. **National Communications (NC):** which should be submitted every four years and contain chapters on national circumstances and institutional arrangements; a National GHG inventory; a description of steps taken or envisaged to implement the Convention; other information considered relevant to the achievement of the objective to the Convention, constraints and gaps, and related financial, technical, and capacity-building needs; and an optional technical annex. Armenia submitted the first NC in 1998* and the fourth in 2020.
2. **A Biennial Update Report (BUR):** which should be submitted every two years, with chapters on national circumstances and institutional arrangements relevant to the preparation of the national communications on a continuous basis; a National inventory of all GHG (except F-Gases), including a National Inventory Report (NIR) as a stand-alone document or part of the BUR); Mitigation actions and their effects, including associated methodologies and assumptions, objectives, progress of the implementation and estimated outcomes, international market mechanisms and their measurement, reporting and verification; constraints and gaps, and related financial, technical and capacity needs, including a description of support needed and received; description of support needed and received, also information on support received for the preparation of the BUR; information on domestic MRV, any other information that the Party considers relevant to the achievement of the objective to the Convention; and an optional technical Annex. Armenia has so far submitted the first BUR in 2016, second BUR in 2018 and third BUR in 2021 (May). The BUR is then subjected to the International Consultation and Analysis (ICA), which is conducted in a manner that is non-intrusive, non-punitive and respectful of national sovereignty that aims to increase transparency of mitigation actions and their effects. It consists of two steps, namely a technical analysis by a team of technical experts in consultation with the Party, resulting in a summary report, and a facilitative sharing of views.

[3] A list of all parties to the Kyoto Protocol can be found here: https://unfccc.int/process/parties-non-party-stakeholders/parties-convention-and-observer-states

3. Armenia underwent the first ICA cycle in 2017 (https://unfccc.int/ICA-cycle1), the second in 2019 (https://unfccc.int/ICA-cycle2).

The ICA, i.e., the review process, is an important part of reporting, when reports are subjected to a peer review. This should not be seen as an embarrassing test a country needs to pass, or a way of unveiling incompetence of inventory compilers, but as a chance to being able to improve the quality of inventories. In this process, reviewers, who themselves are inventory compilers of other countries, take a critical look at inventory reports of other countries and compare them to the reporting guidelines and rate them according to the "TACCC" principles of transparency, accuracy, completeness, consistency, and comparability (see next chapter for a description of inventory principles). Review findings always help an inventory team to increase transparency and the overall quality of their work. Becoming reviewers themselves help inventory compilers to understand their own work better, and to also tackle their own inventory report from the point of view of a reviewer, thus again increasing the quality of their own work.

Reporting under the Enhanced Transparency Framework (ETF) of the Paris Agreement means that current non-Annex I Parties will have the same reporting obligations as Annex I Parties, with a few flexibilities to those developing country parties that will need them in light of their capacities, and with longer intervals between reports.

From 2024 onwards, all Parties will have to submit:

1. National Communications every 4 years, as a stand-alone report, or as an annex to the Biennial Transparency Reports (BTR) in those years a BTR is published. Differences between NCs under the Kyoto Protocol and the Paris Agreement are not yet finalized but can be considered minor.
2. Biennial Transparency Reports (BTR): will contain chapters on GHG emissions and removals (with the NIR as a stand-alone report, or part of the BTR); the NDC tracking progress; Adaptation, Support needed and received; and on areas of improvement where parties can improve their reporting.
3. National Inventories (incl. National Inventory Reports) every two years (see chapter on National Inventory Systems).
4. Undergo a Technical Expert Review every two years, which consists of a technical review of the consistency of the information submitted by Parties, taking into consideration the Party's implementation and achievement of its NDC, as well as information on support, etc. This means that the national inventory report will be reviewed, most probably similar to the reviews of Annex I countries that have been performed under the Kyoto protocol, as well as the information necessary to track progress made in implementing and achieving NDCs.

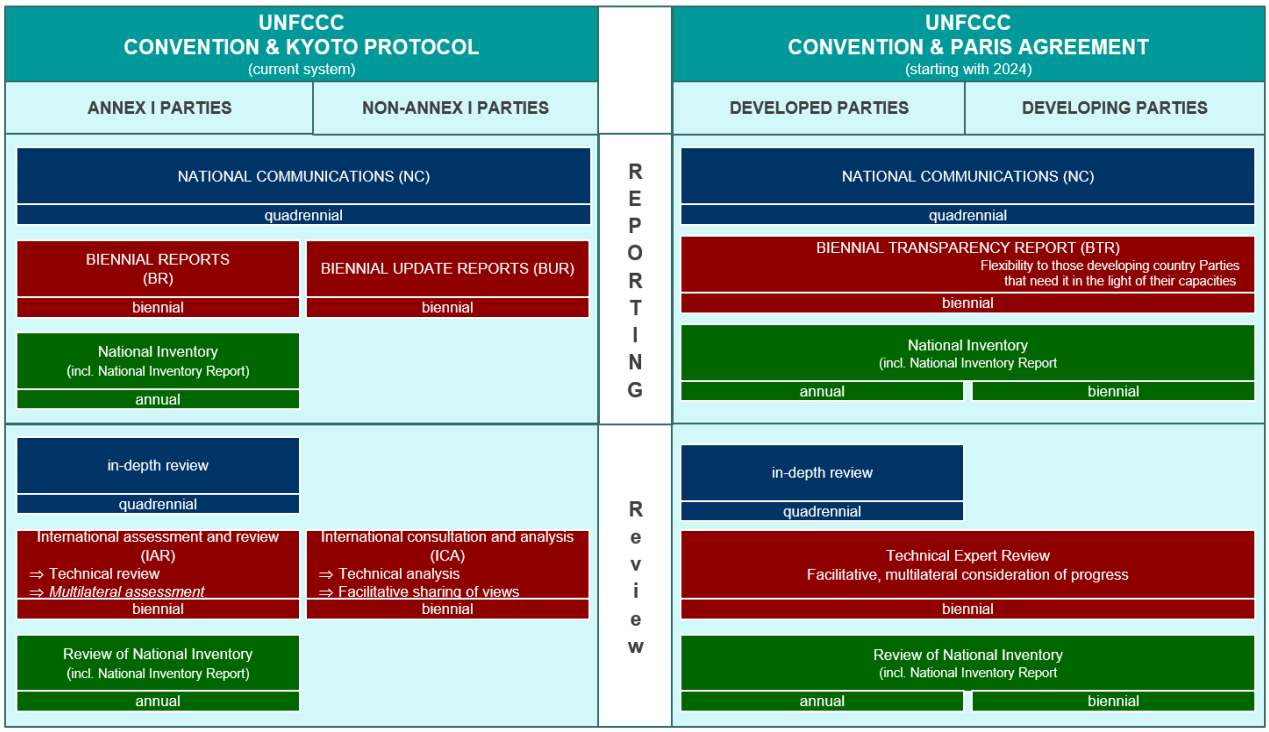



Figure 2: Reporting requirements for developed and developing countries under the UNFCCC Convention & Kyoto Protocol, and changes under the Paris Agreement, source: WRI (2017) Designing the Enhanced Transparency Framewrok, Part 2: Review under the Paris agreement, modified

## 1.5 Modalities, procedures, and guidelines for the transparency framework

To ensure that all Parties to the PA report in a comparable and transparent manner, the Conference of the Parties (COP)s decided on modalities, procedures and guidelines for the transparency framework (MPGs)4. In it, all basic rules are put forward for all Parties on how to report from 2024 onwards. The MPGs provide a framework for the reporting obligations. In the chapter below, necessary information on national inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases are described.

### 1.5.1 GHG inventory principles

The GHG inventory principles as laid out in volume 1, section 1.4 of the IPCC 2006 Guidelines are still applicable. They provide the basis for transparent, accurate, complete, consistent and comparable inventory reporting (TACCC), i.e. a high quality of reporting.

***Transparency***: information on the compilation of inventories should be available in a report, in such a way, that individuals or groups other than the inventory compilers can understand how the inventory was compiled, and that documentation and reporting is done according to the guidance in chapter 8 of volume 1, and that emissions were calculated using methods laid out in the IPCCC guidelines, volumes 2-6.

***Accuracy:*** Emissions are estimated in a correct manner, with neither over- or underestimates, so far as can be judged.

***Completeness:*** Estimates are reported for all relevant categories of sources and sinks, and gases, as well as for all relevant years. Where data is not available, the absence of this estimate should be clearly documented, together with justification for exclusion.

[4] 18/CMA.1 Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement; Report on the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on the third part of its first session held in Katowice from 2 to 15 December 2018; Addendum, p. 18ff

***Consistency:*** Estimates for different inventory years, gases and categories are made in such a way that differences in the results between years and categories reflect real differences in emissions. Inventory annual trends, as far as possible, should be calculated using the same method and data sources in all years and should aim to reflect the annual fluctuations in emissions or removals and not be subject to changes resulting from methodological differences.[5]

***Comparability:*** the inventory is reported in a way so that it can be compared with other national greenhouse gas inventories of other countries. This means the key categories need to be chosen appropriately[6] and emissions should be calculated based on the IPCC reporting guidance.

### 1.5.2 National circumstances and institutional arrangements

According to the MPGs, each Party should[7] implement and maintain national inventory arrangements, including institutional, legal and procedural arrangements for the continued estimation, compilation and timely reporting of national inventory reports in accordance with these MPGs. National inventory arrangements can vary by Party depending on their national circumstances and preferences and change over time. Each Party shall report on the following functions related to inventory planning, preparation, and management:

(a) Its national entity or national focal point with overall responsibilities for the national inventory.

(b) Its inventory preparation process, including division of specific responsibilities of institutions participating in the inventory preparation to ensure that sufficient activity data collection, choice and development of methods, emission factors and other parameters are in accordance with the IPCC guidelines referred to in the MPGs (§20).

(c) Its archiving of all information for the reported time series, including all disaggregated emission factors and activity data, all documentation about generating and aggregating data, including quality assurance/quality control (QA/QC) review results and planned inventory improvements.

(d) Its processes for the official consideration and approval of the inventory.

### 1.5.3 Documentation and archiving, Quality Assessment

The MPGs in Chapter C paragraph 6 refer to a QA/QC system, in which basic specifications are provided. Even though developing country Parties are given flexibility and are encouraged only to establish such a system, it should be noted that a QA/QC system with good documentation and archiving is not an unnecessary addition to a National System, but a foundation: the better a QA/QC system, the easier it becomes to enhance the quality of reports, to find references and to make sure that information does not get lost with changes in staff.

The MPGs also stipulate a QA/QC system as a requirement for all parties when it comes to key categories and those categories where significant methodological changes and /or data revisions have been applied. The IPCC guidelines provide information on what a basic QA/QC system should contain.

[5] The IPCC guidelines provide guidance on data collection in chapter 2, methodological choice and identification of key categories in chapter 4, and time series consistency in chapter 5 of volume 1 of the 2006 guidelines

[6] According to Volume 1, Chapter 4 of the 2006 guidelines

[7] Please note: „should ", in the context of climate negotiations, means that an action is not required, but advised. "shall", on the other hand, means that an action is required. More information on the terminology of climate negotiations can be found here: 10148IIED.pdf

# 2. Roadmap for establishing an MRV system in Armenia

## 2.1 Aim

The aim is to build a strong, competent and sustainable National System with defined roles, and experts that are able to provide the necessary reporting at a high standard. A well-established National System will assure long lasting quality, with increasing competence from experts. Depending on financial and legal backing of the country, this should be a team with clearly defined roles and rights, which is also important when it comes to data collection. A thorough QA/QC system that includes documentation and archiving is necessary as a foundation for continuous improvement, ensuring that the system survives changes in staff, as well as making quick and concise responses during a review process possible.

## 2.2 Specific situation in Armenia – The existing National System[8]

A strong National System with defined roles, functioning data flow, good quality data, a strong QA/QC system is paramount for TACCC.

The Ministry of the Environment (MoE) is responsible for GHG inventory development coordination according to a Government Protocol Decision from 2016.[9] However, clear definition of roles and responsibilities of different ministries and agencies are not specified. The MoE is the statutory entity responsible for the development and implementation of the reporting obligations. The MoE heads the Inter-agency Coordinating Council for Implementation of Requirements and Provision of the UNFCCC, which has the authority to coordinate reporting, and approves the final NIR.

National statistics and existing legal arrangements (with the inspectorate) ensure availability of certain activity data including ones for the Energy Balance, industrial emissions, the waste, or agriculture sector, on forests and land use (LULUCF). However, there are a lot of activity data required for the GHG emissions assessment which are not publicly available. The collection of the rest of the required activity data is carried out by the MoE, through official enquires to data providers, as there are no formal arrangements for collecting the GHG inventory activity data on a continuous basis. During the discussion in the workshop, it was specified that information could also be collected through the inspectorate but that software for the aggregation of data was not available.

Currently, the GHG inventory reports are developed by the expert group hired under the UNDP-GEF funded projects and consists of experts that were engaged in the preparation of previous inventories and familiar with the 2006 IPCC Guidelines and software to ensure continuity and quality of the inventory process. New experts are trained before a new inventory cycle starts and supported by lead experts. The Climate Change Department of the Ministry of the Environment is the responsible department for collection of activity data as needed, and for validation of the draft NIR with the key activity data providers before the publication of the NIR.

The constraining factor currently seems to be the limited funding of the responsible department in order to increase the number of staff of the corresponding divisions of the Ministry of Environment, and there are no budget allocations in order to outsource specific tasks to external experts or expert institutions. The budget necessary for the compilation of the BURs and the NCs (as well as the inventory) currently comes from the GEF. The other constraining factor is data availability, and unclear roles of who should collect what.

[8] For additional information please refer to the Report "Gap analysis of the existing legal framework in the Republic of Armenia and development of a road map of approximation with the EU acquis related to climate action"

[9] Government Protocol Decision #49, from 08.12.2016

There is no QA/QC plan, even though there are several checks in place, performed by the inventory compilers and data managers, but there is no overall QA/QC plan. The establishment of a QA/QC plan would allow for data to be stored and information on how the inventory was compiled and the rationale behind it. It would improve the overall quality of the inventory and the related reports. Such QA/QC system should ensure archiving, providing minimum requirements for information stored in calculation files, an archive for relevant correspondence with data providers, clear roles and chain of commands, training plans for sector experts (e.g. becoming reviewers themselves), a structured and robust system of ensuring timely and concise response to review questions (by making sure that sector experts or deputies are available, and necessary information can be accessed, even years later). This last point is also necessary for ensuring time series consistency of calculations.

## 2.3 Gaps and Barriers

A strong National System with defined roles, functioning data flow, good quality data, a strong QA/QC system is paramount for TACCC. This section of the report describes in detail each of the main gaps and barriers that have been identified in the general overview. The subsections cover different aspects of building a sustainable national system with a clear chain of command, where experts are nominated, trained, and can provide continuous work throughout the inventory cycle.

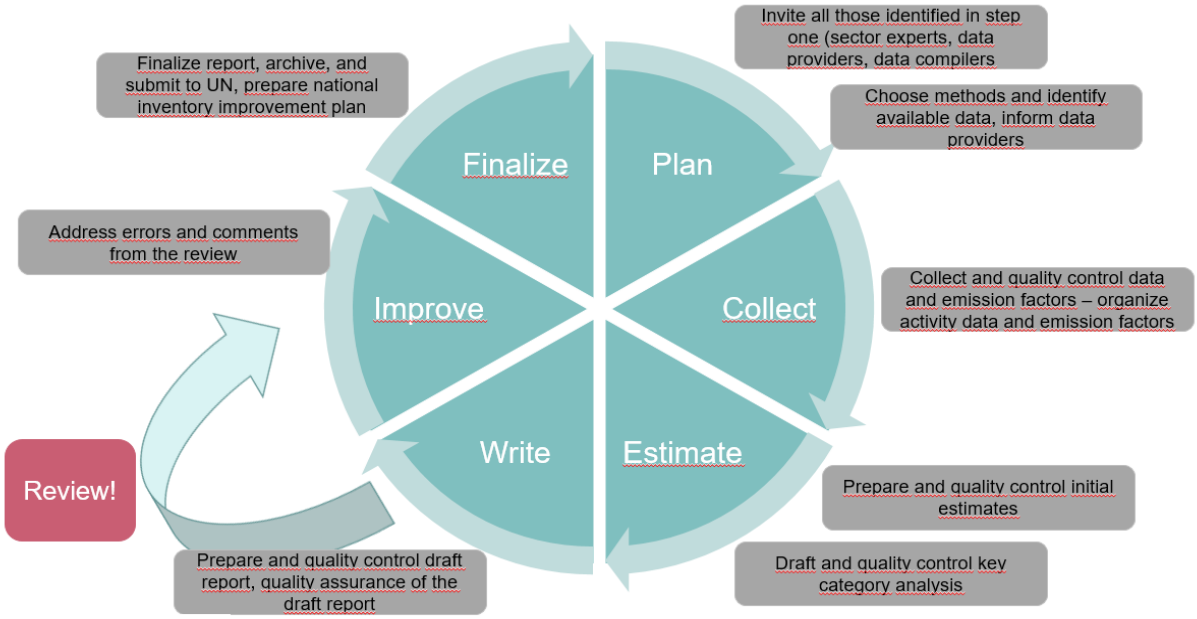



*Figure 3[10]: Inventory cycle*

### 2.3.1 Gaps in Legal Mandate and Delegated Responsibilities

As described above in chapter 2.2, the MoE has the overall responsibility for MRV in Armenia. The Ministry has to define by regulatory act a subordinated entity within the MoE to host the team responsible for MRV of GHG emissions.

[10] : under the PA, Armenia will have to report every 2 years. This graph demonstrates the additional steps that will be required of the inventory team beyond the compilation of the inventory and the related report. These steps include implementation of the review findings, trainings of experts, and improvement of the processes before the next cycle.

Currently, however, the NIR is compiled by a team hired under the GEF-UNDP cooperation, which means that currently there are no arrangements for a long-term structured team with defined roles, or a chain of command.

### National System:

Above all, there needs to be detailed regulatory framework that:

1) appoints a national entity responsible for the compilation of the inventories and submission of reports under the Paris Agreement's Enhanced Transparency Framework (which has already been done)
2) establishes procedures and principles for their preparation, and
3) assigns clear responsibilities and obligations among the government agencies as well as from the private sector to facilitate preparation of such reports through provision of data and information.

At the moment there is no fixed inventory team in Armenia, which can lead to gaps between inventory cycles and omissions in archiving the information necessary for answering potential review questions. It also means that an important part of the inventory cycle dealing with improvement of the system cannot be covered: once the report and the accompanying tables are submitted, there will be a review of the submitted data under the Paris Agreement. This consists of a team of sectoral experts, peer-reviewing the report, to see if it follows the principles of TACCC. During the review week, in-depth questions are asked. In order to be able to answer these questions, experts have to be available, and all background documentation on the methodologies used for the inventory compilation needs to be centrally stored so that it is easily available. Review findings are then submitted in an assessment report, and those findings then should be implemented as part of the improvement of the inventory. Improvements sometimes only concern parts of the report that need to be rewritten to increase transparency, but sometimes they can pertain to an improvement of the methodology. In that case, additional research becomes necessary for the sector experts, or studies will have to be drafted, commissioned and supervised. All of this requires time and experience.

It is paramount that the team is supported by enabling legislation obligating other government agencies to share information and provide the data necessary for the preparation of the inventories. Such legislation should include inclusion of reporting obligations in appropriate framework laws as well as enabling executive decisions setting up the necessary procedures and addressing issues such response timelines and confidentiality concerns.

**A fixed inventory team would mean that:**

- Experts could improve their skills and to help their peers in improving their part of the inventory, and possibly to have two sector experts working on it.
- Data collection and surveillance of data quality is only possible, if inventory processes are understood. The more knowledge an expert has of inventory compilation and sectoral needs, the more it is possible for them to look for other data sources that might be more feasible, thus increasing the quality of the inventory and accuracy of inventory preparation.
- There would be room for improvement of the inventory between cycles, by looking for additional data sources, in order to apply higher tier methodologies for all sectors
- Stability in the team leaves room for additional trainings for team members, which will also improve answers to the review team.
- Synergies with the team reporting under the LRTAP convention could be used, which could benefit both inventories, as data very often comes from the same data providers. This would lead to more streamlined efforts, which are also beneficial in building trust and support with data providers.
- The overall quality of the inventory would be improved, as each party knows what to do.

### 2.3.2 Issues related to data collection:

Quality of inventory data depends on the availability of robust and accurate data. GEOSTAT is the main data provider, and the cooperation between the inventory team and the statistical agency is close and functional. However, there are still some obstacles to applying higher tier methodologies, which will become more important in reporting of key categories under the PA.

There aren't any legal and contractual arrangements in place for activity data collection in Armenia, and problems with private companies do exist. Data is provided by the Statistical Committee via the statistical yearbooks, energy balance, etc.

- A legal mandate for the inventory team or the entity would allow the inventory team to access data more easily. Data collected and published by the Statistical Committee often differs to the needs of inventory compilers. Also, often information on technologies used are necessary to report using a higher tier methodology, which is necessary for so called key categories (the biggest polluters). Often, measured data is available in different plants, but this information should also always be accessible to the inventory team.
- Data collection is currently partially performed by chemical inspectorates that have no legal provision for data collection. This means that experts in other fields rather than inventory experts collect data that are provided on a good-will basis. Thus, no quality check of data can be made.
- Data is often not available for the whole time series, which means that additional work will be needed to ensure time series consistency.
- A good understanding with official data providers is important as often publication of statistical data can be used by the inventory team. This should be formalized via a Memorandum of Understanding, or similar, until Armenia implements the Emission Trading System Directive, under which measured data will become available for some sectors. The implementation of PRTR Directive would also provide some information on technologies used by the biggest emitters.

### 2.3.3 Reporting:

In Armenia's BUR2, Chapter 1, National Circumstances describes the need to improve the corresponding institutional arrangements in Armenia, enabling development of the biennial update reports and national communications on a continuous basis for timely provision of information in a reliable, complete and transparent way. Several steps are mentioned as having been implemented, however, there is no description of those steps.

Report compilation, other than that of the NIR, which should be provided by the inventory team, is an important part of the requirements of the obligations' vis a vis the UNFCCC. Roles need to be defined in advance; the tasks should clearly be assigned to individual experts that also get the chance to participate in trainings for report compilation. Reports undergo a review, which means that improvement of reports should also be part of the verification process.

### 2.3.4 Verification:

Verification strongly depends on the QA/QC system in place. Armenia so far has no QA/QC plan.

Such QA/QC system constitutes the backbone of a national system, which means that several issues are being taken care of:

1. **Safe data storage and handling:** in order to calculate a robust inventory, sensitive data is often necessary to describe production processes, and the amount of product produced, as well as other information. Often, data providers do not feel at ease to share such data with inventory compilers. IPCC guidelines suggest possible ways of reporting sensitive data. However, in order to be able to

work with sensitive data, data storage needs to be secure and in a centralized place. This concerns not just sensitive data, but all data that goes into the inventory: reviews take place years after the compilation of the NIR, and even though something seems to be clear at the time of inventory compilation, this memory tends to get lost quickly. Thus, all data that goes into the inventory, plus calculation sheets, need to be stored in an orderly manner, with calculation sheets set to read-only at the end of an inventory cycle.

2. **Documentation:** thorough documentation makes it easier to follow-up calculation processes after the end of the inventory cycle. This documentation should contain information on where data was obtained, additional information from the data providers, e.g. on unusual fluctuations, and information on recalculations. It should also contain information on emission factors (EFs) used, the rationale behind applying a particular EF, or information on the emission data used. Anything that could be of use for future years, even thoughts on amelioration of calculation methodologies etc. should be written down and stored centrally. This documentation can also help to facilitate answering questions during a review.

   **3. Checks and improvements:** there should always be a 4-eye principle involved in order to avoid mistakes, either in calculation or in reporting. Thus, sector experts should always have a counterpart, either a deputy or another expert from another sector, who basically does an internal audit of the calculations or report chapters. This is to avoid petty mistakes that lead to a multitude of recommendations or encouragements. The better the report, the more constructive review recommendations will be, because they will address a higher level of reporting. Report recommendations should then be collected in an improvement list, which allows sector experts to work on improvements of methodologies, data or approaches used between the different reporting cycle, thus improving the overall quality of the reports.

3. **Data transfer:** inventories consist of a huge amount of different data. A way should be found of compiling and storing data and transferring it into the CRF reporter or its replacement, the common tabular format (CTF). This should be done in an organised and structured manner to avoid mistakes during transferral of data.

4. **Organisation of the team:** the team for inventory compilation should be structured, roles should be clear, and also communication to the data providers should be coordinated and concise. This means that the team should have a good understanding of processes, and their continuing training in issues close to the inventory should be ensured. QA/QC plans should be established, and performed during each and every inventory cycle, to ensure that all data is kept and can be accessed in the future.

5. **Reporting:** roles should be established for the compilation of reports, and it should be clear how responsibilities are shared, down to the layout of the report. Sectoral chapters should be cross checked by deputies or other sector experts to make sure that information in the chapters is correct and concise. As reports are the basis for reviews, this approach ensures that minimum information gets lost, which will then make future reviews easier.

# 3. Roadmap for the MRV System

## 3.1 Overview:

This part of the document is an update to the draft roadmap provided in 2021. Additional information was collected during a regional workshop in May 2022, which consisted of an overview of the findings from the different roadmaps of the region, and a workshop on a QA/QC system, presenting the case study of the inventory team of the Environment Agency Austria. This was followed up by a regional workshop which focused on the QA/QC system as the heart of the MRV system of a country, which was discussed in another

national workshop in July 2022. This document will present summary of key findings stemming from those workshops and discussions.

## 3.2 Background:

A robust inventory is the heart of all mitigation action of the Paris Agreement. It is the fundament upon which projections are based, and it is necessary for NDC tracking and the Global stocktake. The more disaggregated and accurate data is available, the more measures leading to emissions mitigation can be depicted. The lower the uncertainty of the emissions inventory of a subsector, the more accurately mitigation actions can be illustrated. This will play a vital role when it comes to article 6 mechanisms of the PA, where Internationally Transferred Mitigation Outcomes (ITMOs) will be the unit that is directly linked to funding of mitigation actions by a donor country in a beneficiary country. The exact mechanisms are still under discussion at the time of writing of this document, however, it is already clear that the inventory of the beneficiary country will play a vital role: so, investing in a strong MRV system will help the beneficiary country acquiring direct funding on their mitigation action. Donor countries, however, will look for beneficiaries with a robust MRV system in order to make sure that all CO2 equivalents saved (=ITMOS) will be accountable for their own mitigation actions.

## 3.3 Structure and Legal Mandate

The current legal situation in Armenia does not foresee a team of experts working on the inventory, nor does any legal basis exist for this team to actively try to access data. Data is currently collected by the Chemicals inspectorate, as well as the Statistical Agency, both performed by experts in fields other than inventory compilation. This leads to the fact that inventory experts have to work with data that is often not collected in the right format. This also means that not all possible data sources are explored.

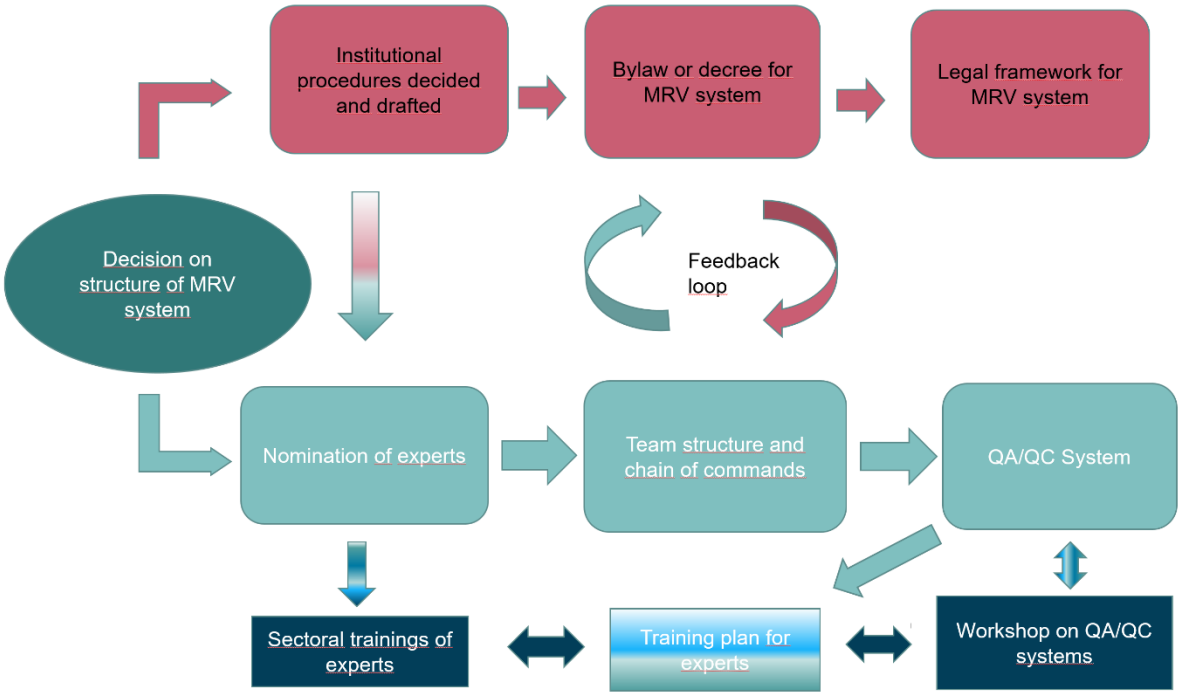



Figure 4: Possible steps for a legislative basis for an MRV system

In order to achieve a functioning MRV system, the Armenian government should aim to build a legislative basis for this system, that nominates a team – either within the MoE, or trans-institutional, or even as a separate entity of experts from different fields that work together for the purpose of inventory compilation.

Once the experts are nominated, a team structure and chain of commands should be designed, and a QA/QC system should be put into place. This team should have a legal basis to collect data, and the legal basis should be designed to be aligned with the relevant EU legislation, such as the ETS or PRTR that allows the team to ask for additional information, wherever needed.

A general decision should be taken of how the inventory system should work in future, by either extending contracts of existing inventory compilers, or by setting up a fixed team inside MoE or another institution that focuses on inventory compilation. Their work should continue after publication of the inventory report, by improving methods used. This would include searching for country specific, or plant specific data between inventory cycles, as well as commissioning and overseeing studies on country specific emission factors.

Having split responsibilities between institutions is quite common in several countries, where one institution (usually the Ministry where climate action is based) has the political mandate and another institution is responsible for the technical support. Political mandates include, for example, responsibilities and participation in COP and SB events, preparing laws affecting climate change or adaptation, finance, implementation of measures etc. The technical support refers to inventory preparation on sectoral level, which includes data collection, choice of methodology, contact with data providers, QA/QC, as well as data management, and National Inventory Report compilation etc.

If the mandates are split, it is necessary that there is ample exchange between the institutions that goes both ways.

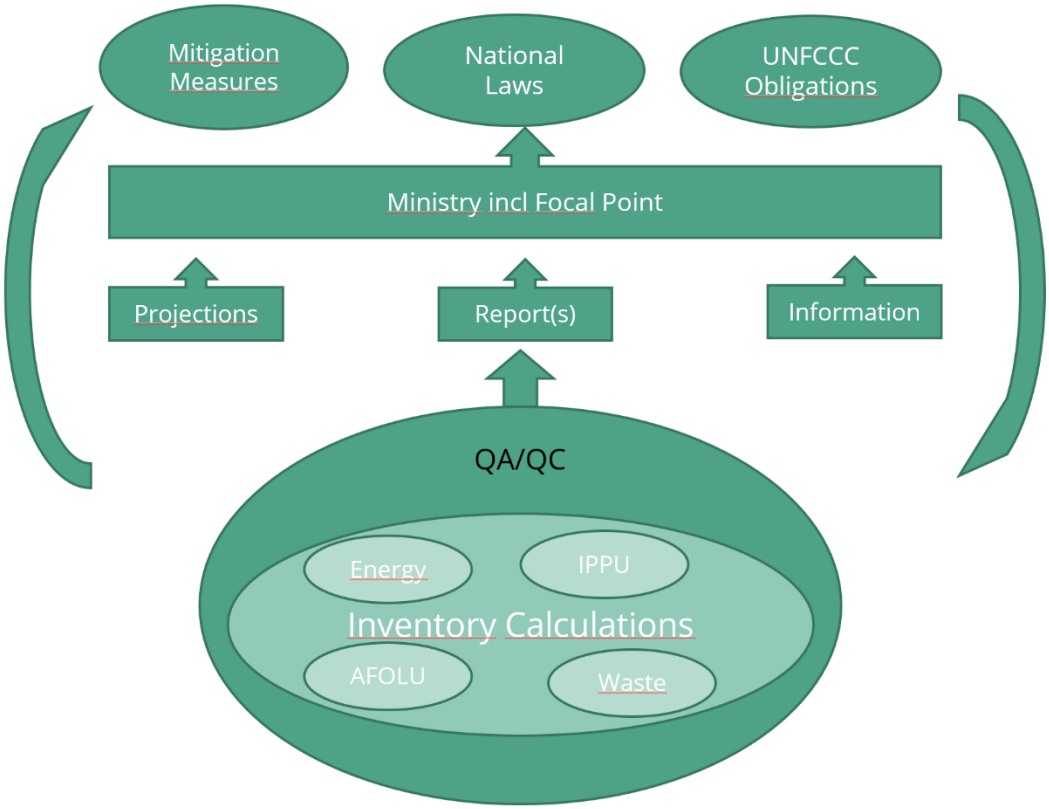



*Figure 5: Workflows between political and technical aspects of MRV systems*

Figure 5 shows, how inventory calculations and political aspects of the work go together. Whether the team compiling inventories is a part of the Ministry or not is of no relevance, but some sort of continuity is crucial. The understanding of the work of the other party and having enough resources to establish a robust inventory system is the foundation for the final inventory.

Main aspects for the structure of the inventory team are:

- Competence of experts: Experts working on the inventory do not necessarily need to have a technical background in the sector they are working on, any technical or natural sciences background is welcome for the general understanding of the science behind the calculations and to be able to understand and apply the guidelines. It is most important that inventory experts understand the general inventory principles, as additional calculation and research can be done by research institutes, university departments and other ministries, if necessary. Such advanced studies still need to be supervised by inventory experts.
- Resources: Inventory experts need the time and resources to dive into the work related to their sector, find data suppliers, collect data and to apply the methodology used. This is very similar to the work of those experts working on the Air Pollutants inventories under the CLRTAP convention. They will need to work together, and approach data providers together. Inventory compilation, especially in the beginning, is not something that is done quickly on the side. Experts will need time and resources to be able to understand their sectors.
- Continuous training of the inventory experts is another issue that should be invested in. Experts should be able to understand and work in English, and should become UNFCCC reviewers, as this will increase their competence. The UNFCCC Secretariat estimates that another 600+ reviewers will be needed after 2024 to carry out the work under the different review cycles. Working as reviewers will provide experts with the opportunity to get to know methodologies applied in other countries, to liaise with experts from other countries, and to fully understand how the TACCC principles should be applied in reporting and thus improve the quality of their own work. A certain level of proficiency in scientific English is necessary. Improvement of language skills could also be defined as trainings for those experts that need them. Experts should also be proficient users of calculation software like MS Excel or should be given trainings.
- Further structuring the inventory team: some bigger sectors, like Energy, will need to be broken down into different parts: emissions from buildings, stationary energy production, fugitive emissions and transport can be quite challenging subsectors, where several experts should be working together – or these experts should find a way to split the workload amongst themselves. Also, agriculture and LULUCF sector might need several experts working on the reporting. This could also include research facilities, external experts, university department working on studies etc. As this work requires experts to be able to grow into the work, new ways of structuring teams should be thought about. It is possible that inventory experts pursue another occupation outside the inventory, either within the same institution but in a different aspect of the work, or something outside the entity, like e.g., at universities or as freelance consultants. The aim should be to build a stable team where experts stay for a certain number of years, in order to increase the quality of work, rather to start anew each and every inventory cycle. So, providing conditions for the team to stay and to be able to grow into the work is of interest.
- Four-Eye Principle: there should always be a main sector expert and a deputy for each sector (or subsectors, if bigger sectors are split into more than one part). This deputy could also be from the team responsible for the CLRTAP reporting, or another expert from the same team. This is to make sure that a second person knows all necessary procedures and should one sector expert be unable to perform the necessary work, can take over immediately and make sure that there is no delay in the reporting.
- Independence: inventory experts should have the clear mandate to only base their work on technical aspects, they should be able to work independently from political views to achieve an inventory that lives up to all quality objectives and strengthens the trust in the inventory results which is crucial. An inventory only based on tier 1 methodologies which does not adhere to the international standards

set out in the IPCC principles might slow down processes inside a country, but also fundings for mitigation projects through external facilitators.

- Data management: a data manager from the team, or from the outside, but with good understanding of inventory processes, needs to be nominated. This is to provide data security, professional submissions, and the compilation of comparison sheets, e.g., recalculation sheets, where sector experts can check on whether recalculations were actually performed, or if it was a submission error.

## 3.4 QA/QC System:

A QA/QC System needs to be established, and to be followed. Chapter 8 of the IPCC Good Practice Guidance defines the following elements of a QA/QC system:

- An inventory agency responsible for coordinating QA/QC activities: the agency responsible for inventory preparation also needs to be responsible for coordinating QA/QC activities. As QA/QC deals with the running of the QA/QC system, which should include an archive of information and where the final responsibility for the results of the inventory is placed, this would allow for a smooth running of the QA/QC system.
- A QA/QC plan: this plan should outline the QA/QC activities that are about to be implemented. Roles should be clearly defined, and one person should be designated Quality Manager, having overall responsibility coordinating QA/QC activities of the other team members. This QA/QC plan can be aligned with guidelines from the ISO 9000 series or contain elements thereof.
- General QC procedures (= tier 1): the IPCC Good Practice Guidance provides an overview of basic checks that should be implemented in Table 8.1. This should be seen as a minimum that is done with data from at least all key categories. As Tier 1 QC focus on formal aspects no technical knowledge on sectoral level is required, it can be performed by a sector expert and their deputies, or by a sector expert vis à vis the data manager.
- Source category-specific QC procedures (=tier 2) focus on technical aspects as applicability of methodologies, accuracy of estimates and plausibility of input data: these checks should be done during inventory preparation by the sector experts themselves. It might also include verification of emission data (e.g., with statistical data, or between sites, or order of magnitude comparisons); verification of activity data (which deals with comparing country/site specific EFs with similar data, or IPCC default data); and the QC of uncertainty estimates. The IPCC provides information in its Inventory Guidance on several checks that should be performed.
- QA and review procedures: wherever possible a four-eye principle should be applied before submission of the inventory, report. This means that a second expert goes through the description of the methodologies described in the report and also checks tables and graphs that are being reported. This should contain a general test on whether what is reported is transparent and understandable and factually right, and whether all trends and developments are sufficiently documented. The second review will be the IPCC review, where peers from other countries will go through the report and ask questions where necessary. This should be seen as a chance to receive an outsider's view on the reporting, and the report recommendations can then be used to secure funds to improve the reporting where necessary. As QA and review procedures typically are time consuming and need long term planning, they are usually made independently of the inventory routine. This means that e.g., national experts are involved at an earlier stage that might be the best available experts to judge applicability and accuracy of the applied methodologies. It is also possible to arrange for informal reviews with other countries with similar circumstances, for single sectors, to be able to look at the different models applied and to profit from an outsider's view. It is also possible

to form regional or superregional working groups of experts that can meet on a voluntary basis and exchange views and discuss how to get and share data etc. These exchanges might help in those sectors where it is difficult to get data, or where experts would like to move to a higher tier methodology and could profit from the experience of others. Please note that these are voluntary exchanges, there is no formal format in place. Please also note that in case a voluntary review is being conducted and sensitive data shared, non-disclosure agreements have to be signed beforehand.

- Archiving: all information necessary to reconstruct the inventory needs to be archived. It needs to be understood that depending on the special focus a reviewer has, source categories might be looked at with more scrutiny during future reviews or during an in-country review. Reviewers might ask questions about a decision that was taken several years ago, and possibly not by the same sector expert that is in charge at the time of the review. Thus, documentation and archiving should aim at being complete, to contain all exchanges with data providers and a document where information that could be important for future years and the reasoning behind recalculations, as well as information on where information is stored. This can be done with simple word files however, sector experts have to understand the importance of these files, and this needs to be checked for completeness after each inventory.

It should be noted that a QA/QC system does not require expensive software, data bases or similar. IT needs time to be developed, and dedication by the team in question to follow the rules, to make sure that information is stored, that estimates reflect reality as accurately as possible, and that no information gets lost.

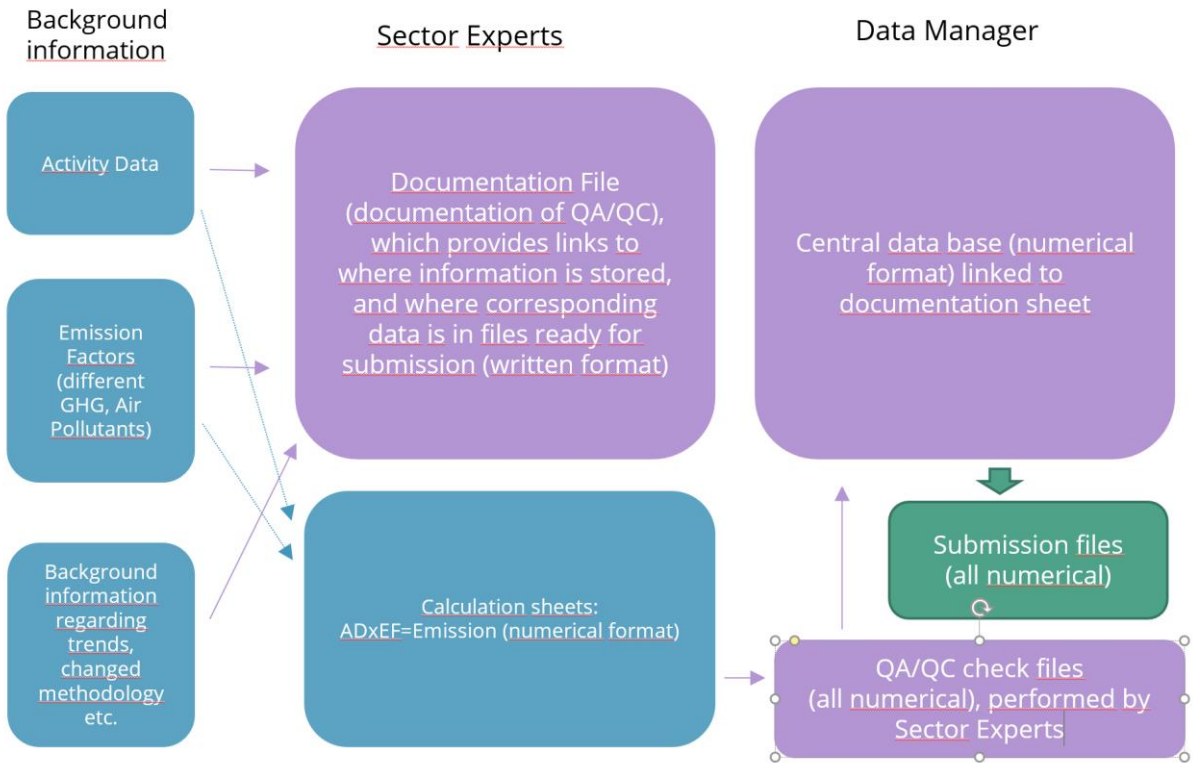



*Figure 6: Aspects of an exemplary QA/QC system for emissions monitoring. "Sector Experts" and "Data Manager" refer to the final responsibility for the elements.*

Figure 6 describes different aspects of an exemplary QA/QC system

- Background information: activity data is collected and stored, information on emission factors (studies, IPCC guidelines etc) as well. If background information is collected, like information on a particular trend (strong increase or decrease of AD, newspaper articles about closing of an industrial plant, construction of additional sources, email exchange with data providers), this information is

also centrally stored. Activity Data and EFs will then be used in calculation sheets that allow a calculation of emissions according to IPCC guidelines, per sector.

- A documentation file is written by sector experts per sector, where information is documented on where and when background information was collected, and where it can be found. Also, decisions that lead to recalculations, or changes in methodology, need to be documented and stored in the file.
- Calculated emissions and all numerical data is then put into a format provided by the data manager, where the data manager is then able to extract files for QA/QC checks. The checks are performed, and mistakes are then reported back to the data manager, and – where necessary – corrected data is put into the system.
- Once the final data is quality checked, the Data Manager is able to extract submission files that will then be submitted via the CTF reporter.

Please note that this is just an example for a QA/QC system and the different aspects that could be implemented. Additional elements or varieties are always possible.

## 3.5 Data collection and Data handling

The National Inventory Report (NIR) submitted with the 3rd BUR shows that Armenia already is on the right track in emissions estimation. In Chapter 1.6 applied methodologies are described and it shows that a lot of tier 1 estimation methods are still being applied. This emphasizes the lack of data that needs to be filled.

The more accurate the data, the higher the tier methodology applied. Parties should aim for reporting with tier 2 or 3 data for key categories, which means that information on activities needs to be accurately reflect the IPCC sectors, information on applied technologies need to be available to allow for the use of IPCC default emission factors, or even measured data should be available in order to be able to report country or plant specific data.

Data collection should always be performed by the sector experts themselves, or they should be closely involved to the data collection. It is necessary that over time, a good relationship with data providers is achieved, so that questions about trends etc. can be asked and are answered. Trust with data providers has to be built and maintained.

Data needs to be stored on a secure server, especially as for higher tier methods, sensitive data is being used. It has to be made sure that there is no security breach, neither in getting sensitive raw data, nor in reporting sensitive data. The IPCC provides information on how confidential data can be reported without providing information on processes and single companies.

Data should then be handled by one or two data managers with advanced IT skills. They need to understand how the CTF reporter, once it is finished, works, and have all data ready for submission. Before coming to that stage, they should provide sector experts with files that make checks possible. This could be, for instance, a comparison of the numbers submitted during the previous inventory cycle, compared to the current one, which makes it possible for experts to reflect on what was a recalculation and what was a glitch in data submission.

For data gaps described above, resources should be made available that allow for closing the identified gaps. This can be done by contracting studies, as well as help from the outside. Sector experts should be able to provide their input in what is needed. In the cases where data is not provided due to data sensitivity, bilateral talks between data provider, MEPA, the head of the MRV team, and sectoral experts should take place, where handling of confidential data is discussed (security of data storage, options in reporting sensitive data etc.). Where this does not work, the ministry should have a mandate in obtaining data.

In order to obtain the best available data, all experts involved in data collection need to be trained in inventory compilation and understand the sector at hand. All experts involved in a sector should work closely together, which would allow for quick responses to questions during the review process and take recommendations and encouragements of a review as an incentive to improve the quality of their respective sectoral chapters.

In any case, synergies should be used and CLRTAP and UNFCCC reporting should be coupled in order to avoid differing sets of activity data, and to avoid double work, in those sectors where calculation is based on the same activity data. Studies should be commissioned to improve data situation for those sources where it is necessary.

# 4. Recommendations:

As the first reports under the Paris Agreement will need to be submitted in 2024, preparatory work, i.e., data collection, update of the National Inventory Report etc. will have to start in 2023.

**Therefore, the establishment of a National System in Armenia should be prioritized, also to possibly allow for additional training of inventory experts.** It needs to be understood that this work will need resources for the experts involved in inventory compilation – and they should be allowed to use these resources. This work needs dedicated people that understand the importance of what they are doing, and are willing to invest themselves, to learn, and to continuously improve reporting. This should be supported, and an experienced team leader should be in charge. After publishing a report and waiting for the next reporting cycle to start, experts should be allowed to pursue training in their field of expertise, and to work on improving the inventories. Exchange with those experts working on CLRTAP reporting should be institutionalised, and they should be working together in those fields where it is possible – or GHG inventory experts should be calculating both sets of data, as it is usually not a lot of additional work.

**Inventories are only ever as good as the available data.** Taking into consideration the Internationally Transferred Mitigation Outcomes (ITMOs) that will serve as a mechanism under article 6 of the Paris Agreement, and the necessity to track a country's NDCs, also to obtain funding for mitigation projects, it is in the interest of Armenia to establish a legal basis for the collection of data that will allow for a higher tier methodology. This could, ideally, mean that it will become mandatory for entities connected to the different sectors, like enterprises linked to the industry sector, but also e.g., municipalities to collect and provide data that can be used for inventories. This could also help in the future implementation of the ETS, which will lead to facilities having to measure data. It will take time and understanding of inventory compilation to define the best possible data providers, so this should be taken into consideration when drafting a legal basis for data collection. It will also be necessary to provide funding for studies, e.g., for closing data gaps, and for setting up a system that records changes and developments in all sectors, as they are dynamic. Projections of emissions are based on these systems, so they should be modelled in a way that the effects of policies and measures that are under consideration, can be estimated.

It should be taken into account that all of these issues are mandatory under the different EU reporting regulations, like the EU Governance regulation (Regulation (EU) 2018/1999), and the Monitoring Mechanism (Regulation (EU) 525/2013), as well as the ETS, which are relevant under the Armenia -EU Comprehensive and Enhanced Cooperation Agreement. Special attention will have to be paid to those sectors that are not covered by the ETS, and efforts to increase data availability for AFOLU and Waste should be taken.

**The third pillar of a good inventory, a thorough QA/QC system** will help compilers in their work, will make data providers trust the handling of sensitive data, and will increase the overall quality of the inventory. It will also help during future reviews to be able to refer to the source of calculations and help with keeping

mistakes to a minimum. It should also contain a training plan for inventory compilers that is adapted in time, according to their specific needs.

As reporting progresses, keeping staff turnovers to a minimum will also increase the quality of the work. Thus, circumstances should be created that allow for experts to stay involved for as long as possible, because the more experienced the experts, the better the reports.

Taking into consideration all of the above, the legal basis for all of that should be created as soon as possible. Trainings for the inventory team, wherever necessary, should also be seen as a priority, once the team is established, and adapted to the specific needs of that team. If necessary, outside help for the establishment of a QA/QC system should also be made possible, by follow up projects or other funds aimed at the establishment of an MRV system.

**In any case, the quality of the inventory will increase with time.** Developed countries have had a 20- year head start in inventory compilation, so the quality of an MRV system should not be judged by a comparison to another country but should be seen as improving in quality with time and experience – and should therefore be supported by the Armenian government in its growth.

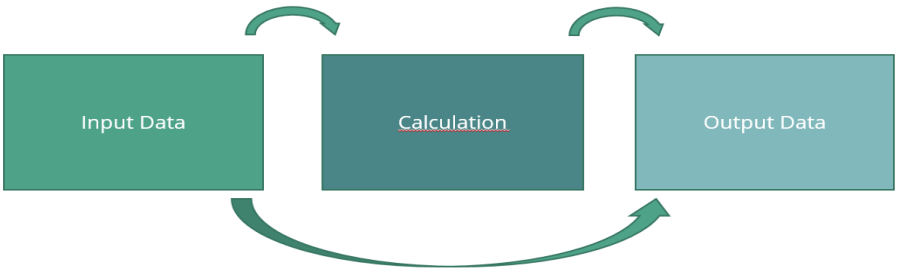
# 5. ANNEX I: Elements for consideration for a QA/QC system

The GHG emissions inventories consist of a multitude of elements, for each IPCC subsector. This document aims at providing the key information that will need to be considered in the architecture of a functioning QA/QC system that goes beyond the information provided in the IPCC guidelines. This architecture can then be transferred into a QA/QC system based on databases and on-line portal or taken as the logic behind a system that uses office products, like MSWord or MSExcel only.

It should be noted that information that goes into the calculation for emissions is sensitive data, therefore, the data needs to be stored on a secure server, where a necessary minimum of assigned experts can access this data. Information that goes into the inventory must never be stored on private email accounts, or computers, but on a server that is secured and behind firewalls. Regular back-ups should prevent severe data losses. Sector experts should also sign confidentiality agreements and be aware of all security measures in place.

In any case, there will have to be a documentation on a sectoral basis that brings all the information together, this “log file” summarizes methodologies and data sources used, along with information on where the folders or physical places information is stored and any other relevant information necessary for preparation of future inventories and for full reproducibility of the inventory. The log file should be completed and added to from year to year, so that information on recalculations or changes in methodologies remains traceable, so that for future reviews or new sector experts, this information is available and comprehensible.

Relevant information for the calculation of emissions needs to be divided into different aspects, because emissions inventories come with a multitude of data that can roughly be divided into 3 main parts that need to be looked at in detail:



## 5.1 Input Data:

It is necessary to differentiate between these three types of data as the general approach for calculating emissions consists of the formula:

**Activity Data x Emission Factor = Emissions,**

Activity data in general is data that correlates with emissions and is usually collected on an annual basis to produce a time series of emissions. It can be collected from statistics, reports, directly from an enterprise, or commissioned studies etc. In any case, the source of activity data is very important and needs to be documented. It is also important that data is checked, once received, for plausibility, i.e. whether it fits into the general time series, or if there is an increase or decrease higher than the deviation of year-to-year data of the years before. In case there is a deviation that's significantly higher or lower, sector experts need to go back to the data provider and ask for information on the trend. This information also needs to be documented and added to the trend description of the report.

It is also important to sufficiently document and archive these conversations to be able to know where to ask during a review, if a reviewer would like to gain additional information and to find this information quickly during an in country review, when reviewers might take a critical look at estimation methodology.

So, in whichever way the information is stored, two things are of importance:

1. Address list, also for future inventory cycles
2. A safe, central server, where this information can be stored, with a way of naming files (emails, reports etc) that is short and in line with that of other sectors, and easily identifiable.

Emission factors can come from different sources:

1. For those calculations, where EFs are applied, either from national studies (country specific), the IPCC guidelines (default), plant specific, etc. or
2. Implied emission factors, where measured emissions data is available. In this case, implied emission factors need to be checked for plausibility, i.e. that they are compared to default emission factors or those of other countries, and larger deviations need to be explained in the NIR/NID

Background information on EFs used need to be treated like information on activity data. In case of implied emission factors, they have to be checked for consistency with the rest of the time series, and information on why they changed (e.g. abatement methods, change of processes etc.) needs to be documented.

In some cases, emission data are directly reported, especially once access to ETS is possible. Emissions data should be documented like activity data and emission factors as described above.

## 5.2 Calculation files:

All sectors consist of several subsectors, and once higher tier methodologies are applied that are more complex than the basic formula of ADxEF=E, calculation files should be generated to be able to follow the logic of calculations. This also helps to be able to double check the calculation (see four eye principle in the main document). Calculation files should contain information on the methodology used, which should be critically discussed with peers whenever possible.

In cases where input data changes, methods used for adapting the time series must be applied and need to be transparently documented. Time series inconsistencies need to be avoided, so whatever changes of data sources, surveys, or methodologies that bring about changes within the time series need to be archived. The IPCC GL, chapter 5 describes good practice in ensuring a consistent time series. Reasoning behind methods

used, etc, can either be stored in the log file or within the calculation file. In any case, it should be easily found.

In case of a recalculation, the information for that recalculation has to be documented in the log file.

In those cases where sector experts work on both greenhouse gas emissions and air pollutants, or where the sectors overlap, a master file containing both calculation results on GHG and air pollutants is feasible.

## 5.3 Output Data:

Information on emissions calculations will have to be put into a format that can be fed into the CRT reporter (or the CRF reporter, until the CRT reporter becomes available).

This should only be controlled by data managers that have final responsibility for the data transfer. It is up to them to set up files in the right format, where sector experts will have to feed the final sectoral results into. Quality checks at this stage should become part of a QA/QC system, in the form of automated checks and checks by sector experts. This should particularly focus on recalculations, where results from the previous are compared to the result of the latest inventory. Changes indicate that a recalculation must have occurred, and sector experts should be able to explain why this recalculation took place. Sometimes, data get lost or is not fed into files the right way, thus this check helps to identify mistakes.

Once the reports are written, sector experts should check if data depicted in the report is consistent with the reported data in the CRF/CRT software.

# 6. ANNEX II: Armenia - Questionnaire on National Inventory System as a basis for gap analysis

| Question | Answer by Armenia | Open questions – for discussion at the workshop |
|---|---|---|
| **National GHG Inventory System** | | |
| 1. Is a single national entity with overall responsibility for the national inventory designated? If yes, what is the name of the institution and what is the legal basis? If not, please explain how the national system works in your country. | Ministry of Environment is responsible for GHG Inventory development coordination according to the Government Protocol Decision #49, from 08.12.2016 | |
| 2. Is the single national entity also responsible for QA/QC and reporting? | Ministry of Environment, is authorized agency for UNFCCC commitments implementation coordination in Government of Armenia | |
| 3. Are roles and responsibilities in the inventory preparation, QA/QC and reporting process defined? This definition shall specify the roles of, and cooperation between, government agencies and other entities involved in the preparation of the inventory, as well as the institutional, legal and procedural arrangements made to prepare the inventory. | The said roles and responsibilities are included in the Organizational Charts presented in NIR and BUR2 [BUR2, p27, NIR2014 Ch1.1.3] and also set forth in the Government Decree #49, from 08.12.2016, see answer # 1<br><br>However, the roles and responsibilities of different ministries and agencies are not specified through any regulatory document related GHG Inventory preparation.<br><br>There are legal arrangements for activity data collection on regular and continuous nature, e.g. development of Energy Balance, data collection and reporting for monopoly utility services under Public Services Regulatory Commission delegated functions, reporting of private sector on emissions of polluting and hazardous substances and effluents to water objects under Air Protection Law and Water Code , as well as reporting and publication of the Statistical Committee – in accordance with the law of the Republic of Armenia “On the Official Statistics” and “On the State Governance System Bodies” and with “Statistics Program for 2020” of the Statistical Committee. | What are the problems with data collection (accessibility?<br><br>Data formats? Is specific data lacking?) and how can it be solved? |
| 4. ~ Does an inventory compilation team exist? Or are new consultants contracted for each reporting year? Please describe the set-up, whichever is the case. | GHG inventory expert group is hired under UNDP-GEF funded project.<br><br>The team is formed with the involvement of experts engaged in the preparation of the previous inventories, who are familiar with 2006 IPCC Guidelines and software trying to keep “professional memory” and ensure continuity and quality of the assessment process. | Is status quo to be kept? Can this process be ameliorated?<br><br>What are the advantages and disadvantages of this way |

| Question | Answer by Armenia | Open questions – for discussion at the workshop |
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| | All experts pass introductory training before each (biennial) cycle of GHG preparation. The new experts also are involved after appropriate instruction and provision of all reference and background documents, guidelines, etc. | forward? |
| 5. ~ Are emission inventories for GHG estimated within the same team or project as the emission inventory for air pollutant? | The former focal point of LRTAP convention is involved in expert team for IPPU sector.<br>The Inventory team closely cooperate with corresponding division of the Ministry of Environment. | |
| 6. ~ Who is currently in charge of the Inventory Management? Is this the same person for subsequent years, or is someone new nominated for each inventory round? | The Inventory preparation currently is done in the frames of the UNDP-GEF project. The same Task Leader managed the development of 2012, 2014, 2016 Inventories (and currently is coordinating the work with preparation of NIR2017). | Is status quo to be kept? Can this process be ameliorated?<br>What are the advantages and disadvantages of this way<br>forward? |
| 7. ~ Are the legal and contractual arrangements in place sufficient to collect data and information needed for inventory preparation? In other words: does obtaining data work in your country, or do you have problems in getting data? Please identify those sectors where this is working well, and those, where problems are occurring. | The main activity data necessary for the Inventory preparation are collected and mostly reported in National Statistical Yearbooks, Energy Balance, published by the Public Services Regulatory Commission. The rest is collected by the Ministry of Environment through enquire send to data owners (Ministry of Economy, Statistical Committee for not publicly available information, State Revenue Committee, private sector).<br>There are certain problems with some private companies. | What are the problems with private companies, and how<br>can this be solved? |
| 8. ~ Does the inventory agency (single national entity) have a good understanding with the national agency for statistics? Does the inventory team obtain data from them? Is the statistical agency ready to provide data in a way the inventory team can use them? | The Ministry closely cooperates with the Statistical Committee, especially on exchange of data. | Is statistical data available in a format that helps inventory<br>compilers? Are there certain thresholds that might lower<br>activity data? Is data complete and accessible, or is more<br>Information needed (e.g. by disaggregating information) |

| Question | Answer by Armenia | Open questions – for discussion at the workshop |
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| 9. ~ Which institution/department is responsible for the preparation of your BUR, NC (and NIR, if stand alone report). | Till 2020 it was Climate Change and Air Protection Policy Division under Environmental Policy Department of the Ministry of Environment. After structural changes in the Ministry of Environment, the UNFCCC related policy issues are delegated to the Climate Change department. | Was continuity (i.e. same experts in a different department) ensured, or did an official transfer of information take place? Is sufficient staff available? |
| 10. ~ Is there a plan on how any national system will transition into the Enhanced Transparency Framework from 2024 onwards? If yes, please provide information on this plan. | Ministry of Environment has applied for financial support to GEF under Capacity Building for Initiative for Transparency window. Under that project it is planned to ensure legal regulatory and institutional capacity building for proper reporting under Paris Agreement Article 13. | Please provide more information before the workshop. |
| 11. ~ In case of an encountered problem, what is the chain of command, and who is responsible for whom in order to find a solution for that problem? | The relevant department mentioned # 9 on behalf of the Ministry of Environment and UNFCCC Focal Point. | |
| 12. ~ What is, in your view, the most crucial improvements needed to establish a functioning national inventory system? | There are no legal obstacles as the regular reporting and GHG inventory development requirement is envisaged by the Government decree #49, form 09.12.2016.<br>However, the main obstacles are considering limited financing for increasing the staff of corresponding division of the Ministry of Environment and no budget allocations for outsourcing specific task under GHG inventory preparation to external experts or professional institutions.<br>The GHG Inventory preparation and reporting under UNFCCC still needs financial assistance from the Convention financial mechanism – GEF.<br>Development of the legal document which will clearly define roles and responsibilities of key institutions, proper timeline/cycle for GHG inventory preparation. It will be necessary to define department/division in each stakeholder ministry/agency and nominate focal person for certain area of GHG Inventory preparation, including data provision, QA/QC etc. | In order to come up with a concise list of needed improvements, this should be at the heart of the discussion of the workshop. |
| ELEMENTS OF A QA/QC AND VERIFICATION SYSTEM | | |

| Question | Answer by Armenia | Open questions – for discussion at the workshop |
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| 13. Is a person responsible for coordinating QA/QC activities designated? | QC was done by the inventory sector responsible expert in close cooperation with Data manager, followed by the GHG Inventory Task leader review. QC check includes internal review of the draft NIR by the Ministry of Environment and by the working group of the Inter-agency Council. The internally cleared NIR is submitted for the review and comments to the stakeholder ministries and companies and is uploaded on the Ministry website for public comments. All received comments are thoroughly reviewed and addressed in the final version of the NIR. | |
| 14. Is there a QA/QC plan? | No, there is no plan. | What should/could such a plan entail? |
| 15. Are general quality control procedures that apply to all inventory categories and the national total estimates in place? | General inventory QC checks included routine check of the integrity, correctness and completeness of the data, as well as identification of errors. This was done by the sectoral experts and data manager. | |
| 16. Are category specific quality control procedures in place and documented (performed by the inventory experts during inventory preparation)? | Category-specific QC checks including technical reviews of the source categories, activity data, emission factors and methods were applied on a case-by-case basis focusing on key categories and on categories where significant methodological and data revision have taken place. This was done by the sectoral experts and task lead expert. | |
| 17. Are quality assurance and review procedures, e.g. a peer review prior submission, in place and documented? | The QA reviews are performed after the implementation of QC procedures for the finalized NIR.<br>The QA review was performed for 3 GHG Inventory reports (2010, 2012, 2014) by the external international expert. The expert was involved due to the support of the Global Support Program. | |
| 18. Are verification activities planned/undertaken and documented? | The verification of the finalized NIR is done by the Inter-agency Coordinating Council.<br>After which the NIR is considered as final for submission to UNFCCC and publication on the Ministry of Environment and www.nature-ic.am websites. | |
| 19. Is there a procedure for official approvement before submission? | see answer above, #18 | |
| 20. Are reporting, documentation and archiving procedures defined? | They are described in the NIR, however they do not constitute a formally defined protocol. | |

| Question | Answer by Armenia | Open questions – for discussion at the workshop |
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| 21. Is a list of terms, definitions and abbreviations available? | Yes | |
| 22. Is the QA/QC system following or in line with international standards or comparable requirements? | All the necessary quality control procedures for all subcategories were implemented in compliance with Chapter 6 "Quality Control/Quality Assurance and Verification", Volume 1 "General Instructions and Reporting" of 2006 IPCC Guidelines. | |
| 23. Is the QA/QC system audited in any way, and if yes, following which procedures? | An example of such type of audit is the QA/QC workshop organized by UNFCCC in November 4-8, 2019, in Armenia and summary recommendation report submitted to the Ministry of Environment. | |
| 24. How well are your inventory estimations documented? If one expert leaves, and another one takes over, would expert no.2 be able to understand methods and data sources of his or her predecessor? | Armenia submits stand-alone National Inventory Report along with BUR1 and BUR2, which describes all used methods, data sources and thus any predecessor expert has well documented information in his disposal. Obviously, also knowledge stays with task leader expert and data manager. | |
| **25.** Is any feedback on the national GHG inventory such as complaints and appeals from national players or issues raised during the review process documented? Are procedures for this inventory improvement process defined and is the outcome documented? | See answers #13 and #18 | |
| **26.** Do these issues - if justified - trigger improvements of the GHG inventory? Who has the responsibility to define, implement and document the measures? | The comments received to the draft NIR are considered, the relevant changes are adopted as needed, otherwise, a proper justification is provided, and all the amendments are documented in summary table, which is archived in the Ministry of Environment. | |
| 27. Please provide information on any potential improvement that you think are especially important. | Establishment of institutional arrangements enabling activity data collection in continuous manner.<br>Continuous training of the key nominated specialists of the corresponding ministries and agencies, recognition of their work through certain encouragement mechanism.<br>Establish roster of national experts and institutions for outsourcing certain work under GHG Inventory with responsibility on confidentiality of information they can access during Inventory preparation. | |

| Question | Answer by Armenia | Open questions – for discussion at the workshop |
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| **Resources (Personnel and facilities and equipment) and resource planning** | | |
| 28. Are sufficient resources (personal / time) available/allocated for the(a) preparation of the emission inventory, (b) performing/conducting QA/QC activities and implementing appropriate measure and (c) the preparation of reports? | See answer #6 | |
| 29. Are roles within the inventory team c (e.g. quality manager, inventory expert, data manager)? Can you provide an organisational chart to describe the hierarchical structure within the inventory team? | The organizational chart is reported in the NIR2014 and in NC4, although there is no chart on roles within the team. | Why is this? Could/should this be ameliorated? |
| 30. Are duties, responsibilities and authorizes of the different roles defined? Can you provide a responsibility matrix for the different steps in inventory preparation? | The ToRs for each expert involved in the Inventory preparation clearly define the role and responsibility for certain task. | |
| 31. Has the personnel involved in inventory preparation adequate education, training, skills and experience and where is this documented (e.g. personal file, CV)? | The experts are selected for GHG inventory preparation according to their education, experience and evaluation of their performance (if they are previously involved in GHG inventory development). | |
| 32. Is a fallback option defined in the case of sudden and unexpected absence of personnel, e.g. such as designation of deputies? | There is a roster of experts involved in the GHG Inventory preparation and consistent effort is in place to involve young specialists from universities. | |
| 33. How is it ensured that the personnel / inventory team is informed about the latest updates / versions of the guidelines, reporting requirements etc.? | The UNFCCC Focal point is sharing all the information received from the Secretariat with the BUR/NC development team. | |
| 34. Is it ensured that the personnel responsible for inventory preparation, QA/QC and reporting is free from any commercial, financial and other pressures that might influence their technical judgment? | This issue is not observed considering that GHG Inventory development team has no commercial or financial interest in any aspects related to the GHG Inventory data.<br>However, for future it must be taken in consideration; see answer #27. | |
| 35. In order to ensure the planning, preparation and management of the emission inventory in a timely and professional manner are all technical resources necessary (personal computers and supporting IT infrastructure (providing data security and a backup system) provided and maintained? | Yes, relying on the effort under the UNDP-GEF project to allocate the necessary equipment, backup system, data archiving on server, and save those on a separate hardware, as detailed in new NIR2017.<br>All the data are incorporated in the IPCC software, which is backupped. | |

| Question | Answer by Armenia | Open questions – for discussion at the workshop |
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| 36. What kind of data integrity and security measures are taken by the National Inventory Compiler and each member of the inventory team? | The database manager archives the files on the hard drive as well as on an external memory support, while also ensures automatic data backup in the Google Drive cloud. | |
| 37. Is there an annual process for resource planning, e.g. in the process of an annual management review? | See answer #6 | |
| **Subcontracting** | **See answer #6** | |
| 38. Are parts of the inventory contracted out/prepared by someone not within the inventory team? | | |
| 39. If yes, are quality procedures describing the process for contracting out studies in place? | | |
| 40. If yes, how is ensured that the quality objectives and the requirements for the preparation of emission inventories are followed by the subcontractor? | | |
| 41. If yes, is there a procedure regarding the handling with confidential data? | | |
| 42. If yes, is a procedure defined regarding the handling of results and reports (ownership/publication)? | | |
| **Contacts for further questions:** | | |
| 43. All questions are necessary for tier 1 of our gap analysis. Depending on your answers, we might have to ask further questions. Could you please provide names and contact detail of the following roles, and information, whether we can contact them directly for an interview, or if those questions should be sent to the UNDP coordinator? | | |
| **44. Head of Inventory Team** | **Marina Sargsyan, marinasargsyan@mail.ru** | |
| **45. QA/QC responsible** | | |
| 46. **Responsible for reporting on BURs and NCs under UNDP projects** | **Diana Harutyunyan,** diana.harutyunyan@undp.org | |
| **47. Responsible for reporting in MoE** | **Nona Budoyan head of Climate Change Department nona.budoyan@env.am** | |