CARBON LIMITS

Development of Background Information for Climate Change Monitoring, Reporting and Verification (MRV)

Final Report for UNDP-GCF Project (CBIT Project)

This report was prepared on behalf of UNDP Armenia by Carbon Limits AS in collaboration with Spherical

Project title:

Development of Background Information for Climate Change Monitoring, Reporting and Verification (MRV) Platform Design

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Carbon Limits works with public authorities, private companies, finance institutions and non-governmental organizations to reduce emissions of greenhouse gases from a range of sectors. Our team supports clients in the identification, development and financing of projects that mitigate climate change and generate economic value, in addition to providing advice in the design and implementation of climate and energy policies and regulations.

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Executive Summary

The project entitled "*Development of Background Information for Climate Change Monitoring, Reporting and Verification (MRV) Platform Design*" aims to meet enhanced transparency requirements in Armenia as defined in Article 13 of the Paris Agreement by strengthening institutional and technical capacity for measuring and reporting on emissions, mitigation and adaptation activities, and support received. This executive summary provides an overview of the findings and recommendations made by a team of consultants lead by Carbon Limits AS (based in Norway) in cooperation with Spherical (based in Germany) and with the support of Tigran Sukiasyan as local expert. The project is implemented by UNDP and the Ministry of Environment (MoE) of the Republic of Armenia.

To meet the enhanced transparency requirements in Armenia as outlined above, a Climate Change Monitoring, Reporting and Verification (CCMRV) platform is to be developed. The CCMRV platform will facilitate the preparation of the country's GHG inventory, consolidate and track climate change mitigation and adaptation actions, as well as identify the support received and required to promote those actions and policies, either in terms of financing, technology transfer or capacity building. The overall objective of this assignment was to conduct detailed stocktaking of data and institutions involved in climate MRV, to inform the system architecture of the proposed CCMRV platform and the supporting legislative and regulatory measures to ensure its successful operation.

This report provides a condensed summary of the main findings and recommendations which stem from the consultants' work. A comprehensive report which provides the background to the analysis and in-depth descriptions of the recommendations is also available (the "Main Report").

Main findings

The assignment highlighted the existing challenges to the effective implementation of the CCMRV platform that arise due to both gaps in the existing legal framework in Armenia and the current practices carried out to comply with international requirements according to the Paris Agreement. These challenges are mainly found in the lack of legal support to promote the establishment of official institutional arrangements that induce collaboration and the performance of MRV activities. However, there are other challenges that must be addressed jointly so that in the long term, the MRV system is reliable, precise, efficient and useful for the fulfilment of international obligations and particularly, to provide accurate data on the NDC progress, such as improving the quality of data inputs in the system. The following modules or components that make up the MRV system are identified, according to the needs of Armenia:

- GHG inventory (national emissions estimation module);
- Mitigation and Adaptation actions (registration module for policies and projects aimed at reducing emissions);
- Support (required and received) (registration module for policies and projects aimed at reducing emissions).

In simple terms, the MRV system will be made up of two main components:

1 a component to track GHG emissions, and

2 a component to track emission reductions, including the registration of mitigation projects, where the information related to the support (required and received) could also be included.

It is worth mentioning that Armenia's National Adaptation Plan (NAP) presents the adaptation policies and measures to be implemented in the country, and the second component mentioned above (for tracking of emission reductions and registration of mitigation projects) could also be used as a repository of relevant adaptation actions and measures. Although actions and measures for adaptation will not necessarily result in reduced emissions, the component to track emission reductions could serve to keep a record and control of the "projects" that are carried out in terms of adaptation. It should be noted, however, that some countries operate a separate system for Monitoring and Evaluation (M&E) of adaptation projects, although Armenia could choose to use the emission reduction component of the CCMRV platform for both mitigation and adaptation in the short term, with a view to developing a dedicated M&E system for adaptation actions and measures only which would then be a separate component within the CCMRV platform.

According to the analysis performed within the framework of this consultancy, 5 main recommendations are identified, within which other specific recommendations are included:

R1 - Establishment of a robust legal framework;

R2 - Establishment of a robust institutional structure for MRV system;

R3 - Management of climate change policies in a centralized system;

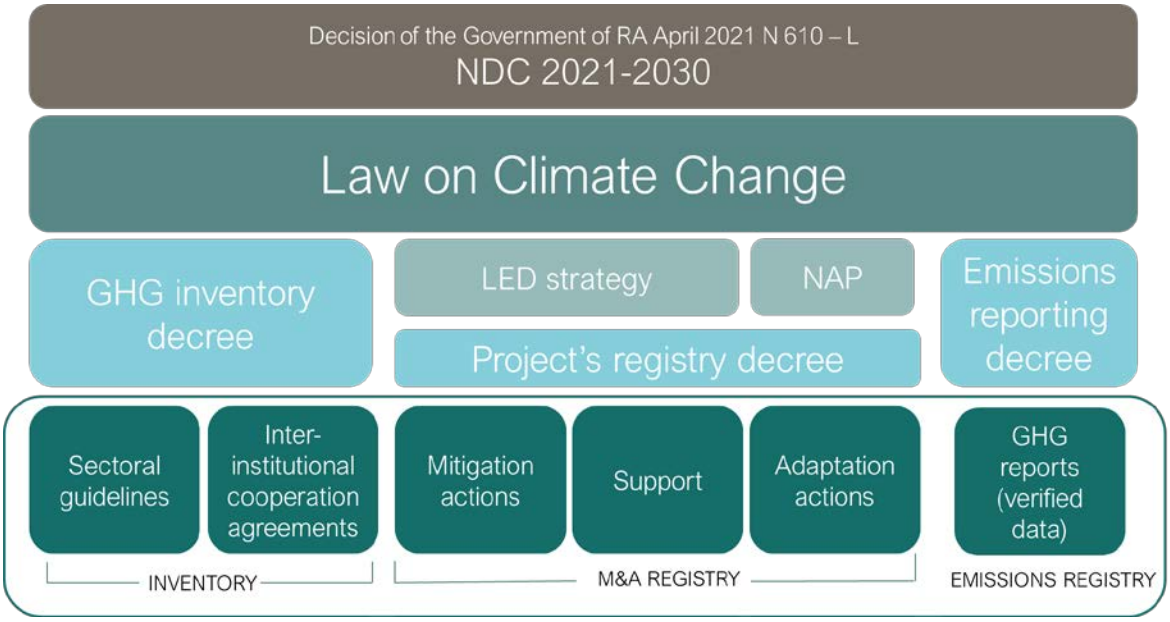
R4 - Implementation of a verification system to verify emission reductions related to mitigation projects and GHG emissions of private sector;

R5 - Data quality improvement.

Although all the recommendations made should be implemented to ensure the effective operation of the CCMRV platform, the establishment of a robust legal framework (R1) and the establishment of a robust institutional structure for MRV system (R2) are essential prerequisites to ensure and facilitate the effective and orderly adoption of all recommendations. Figure 1 therefore presents the proposed legal structure required for the effective implementation of the MRV system, which is built up of the following elements: the "NDC decree"[1] which serves as driver of the actions that lead to the reduction of emissions in the long term and that represents a ratified international commitment; a climate change law as the main legal basis at the national level, a decree to establish the bases for the preparation of the GHG inventory; a long-term low greenhouse gas emission development strategy (LT-LEDs) as support and means of centralization of national mitigation policies (adding to the existing NAP for adaptation policies); and a decree on an emissions registry for the private sector (not essential but suggested). Likewise, it shows the elements that would emanate from this legal structure (bottom "row") that would ensure that the CCMRV platform becomes operational

[1] Decision of the Government of RA April 2021 N 610 – L on approval of the nationally determined contribution 2021-2030 of the RA to Paris Agreement (NDC 2021-2030)

Figure 1 Legal framework required for the CCMRV platform



Each of these main recommendations is divided further into specific recommendations and presented in detail in Section 2 of this report. The comprehensive description of each of them can be found in chapter 6 of the Report.

Recommendations

The recommendations presented in this report seek to promote the implementation of the CCMRV with the elements described in the section above, based on international experience and according to the context of Armenia, considering the current policies and recent studies as well as the outputs of the stakeholder's consultations in Yerevan carried out in December 2021.

It is worth mentioning that the recommendations are interrelated, so it is required that all of them be implemented for the proper functioning of the system in the long term. However, it does not mean that they must necessarily be carried out sequentially (i.e., R1 to R5), and many components of each recommendation can be implemented simultaneously.

Gaps	Proposed solution	Related recommendation	Next steps
Needs and objectives			
Lack of reporting system to track NDC progress on the overall economy-wide emission reductions, sector and gas-specific emission reductions for the sectors under the scope of the NDC, installed renewable energy capacity, share of renewable energy in the power generation matrix, , energy efficiency action plan and the national forest stock inventory, GHG removals, storage capacity and forest coverage, among others.	MRV platform development and implementation (CCMRV) To meet Armenia's relevant needs, it is recommended that the system include the following components: 1. GHG inventory 2. Mitigation and adaptation actions • Include policies from different sectors according to a LT-LEDS 3. Support • Recording of support needed and received Adding to the above, include a registry of emissions from	This project aims to advice on the development of an MRV platform (R0).	Implement recommendations as follows: 1. Regulation related (R1 & R2) • Make working groups to develop new regulations • Incorporate MRV functions into the corresponding regulations • Amend Decree N719 -A to reflect specific issues to address for the different sectors • Sign inter-institutional cooperation agreements for data provision mechanisms 2. Follow-up to previous assessments recommendations and mitigation actions (R5 – data quality improvement) 3. Decision making related to mitigation and adaptation registry (R3.1) 4. Incorporation of Mitigation and Adaptation (M&A) policies into the MRV system (R3.2)

	private sector (industry, but others if possible).		5. Development of an Accreditation system in verification capabilities (R4)
R1 – Establishment of a robust legal framework			
There is no specific instrument or regulation that compiles mitigation and adaptation policies in the short, medium and long term that are the legal basis that guides mitigation and adaptation actions at national level, including the development of the GHG inventory and the financing-related information.	Develop a formal directive, a climate change law or regulation as a basis of climate policy and a strategy that establishes specific short-, medium- and long-term mitigation and adaptation actions. This would be the legal basis for the M&A component of the MRV system.	(R1.1) Development and implementation of a Climate Change Law (R1.2) Development and implementation of a Long-term Low Emissions Development Strategy (LT-LEDS) which will support and inform the need for and the development and adoption of new climate change legislation	Convene through the IACC the necessary political actors of the different ministries for the elaboration of the draft of a climate change law and a long-term strategy, in accordance with the policy formulation mechanisms established in Armenia. Climate change law should aim to establish the necessary elements for national climate policy and establishes attributions of ministries and entities while the strategy should establish specific policies and actions to a long-term horizon.
No specific regulation for the development of the GHG inventory. Lack of a legal basis to produce GHG inventory which makes it difficult to carry out monitoring, reporting (specially on data provision mechanisms) and quality control activities among the various actors involved. There is no fixed inventory team in Armenia, which can lead to gaps between inventory cycles and omissions in archiving the information necessary for	By developing a formal directive, a climate change law or regulation can legitimize resource requests and facilitate reforms and the formulation of new responsibilities. (UNFCCC, 2020). Fixed inventory team can be established through a regulation for GHG inventory (decree), where composition of the team, profiles, roles, and activities are defined to fill this gap. The elaboration of a QA/QC plan should be established by	(R1.3) Development of a specific regulation (decree) and guidelines for GHG inventory (R1.4) Sign inter-institutional cooperation agreements for data provision (R1.5) Establishment of MRV obligations for private sector (this can be done through the climate change law)	Development of a GHG inventory decree and guidelines, based on current practices aligned to UNFCCC principles. Then, work in establishing specific MRV processes for the different sectors and subsectors (related to emissions categories), reflected in sectoral guidelines. Finally, sign inter-institutional cooperation agreements to boost and facilitate the data provision between entities. It is proposed also to establish MRV obligations for private sector, to include the GHG emissions of all the industries in Armenia (business sector could be included too). The obligations for the private sector could be stablished in R.1.1 and

answering potential review questions (EU4Climate, 2021). There is no overall QA/QC plan (EU4Climate, 2021) Private companies are reluctant to share information due to confidentiality issues, making it difficult to collect.	law (R1.1); technical details (specifications) for this plan could be established by GHG inventory decree.		methodologies for estimations and other procedures for reporting and validation activities, can be set in technical guidelines.
There are no specific MRV functions established for the Ministry of the Environment, nor for the other ministries, agencies, committees or public or private entities that provide, report or validate information related to inventory, mitigation and adaptation actions and financing. There are no formal arrangements for collecting GHG Inventory activity data on a continuous basis (EU4Climate, 2021) There aren't any legal and contractual arrangements in place for data collection, and problems with private companies do exist (EU4Climate, 2021)	It is recommended that the legal basis be established in a climate change law, and that the functions of each ministry or agency be established in the corresponding regulations (regulation amendments are required). Likewise, inter-institutional cooperation agreements can be signed to facilitate the provision of high-quality information within the required timeframes and the conditions under which information will be shared. However, it is substantial that the legal basis for these agreements is established from the GHG inventory decree (R1.3) that provides the required robustness.	(R1.1) Development and implementation of a Climate Change Law R1.3) Development of a specific regulation or guidelines for GHG inventory (R1.4) Sign inter-institutional cooperation agreements for data provision (R1.5) Establishment of MRV obligations for private sector (R1.6) Establishment of MRV functions to all the actor involved.	Draft inter-institutional agreements for each ministry that provides data for the inventory, specifying reporting timeframes, templates for data provision (e.g., in excel files), technical support and justifications of the provided data. Establishment of the roles and competencies in the matter of climate change to every ministry in the climate change law, as well as MRV obligations for private sector (e.g., emissions reporting and verification). Establishment of the competences in MRV matters both for the Ministry of the Environment as coordinator of the MRV system, as well as the obligations for information providers and validators, including public and private entities, as well as the statistics committee and the IACC, in the climate change law and promote its integration in the laws of every ministry involved. (MRV suggested functions are presented in the annexes to the main report)

R2 - Establishment of a robust institutional structure for MRV system			
Legal / formal arrangements are still needed to specify particular obligations of corresponding institutions in terms of climate-related data provision and quality assurance as well as policies, projects and measures reporting. Obligations of the various designated institutions for climate-related data reporting, collection, storage and exchange are not regulated by any legally binding instrument (EU4Climate, 2021)	Institutional arrangements as well as specific obligations of the different actors involved must be established through the law (R1.1.) It is recommended to take as a basis the institutional mapping done under the framework of this project to establish institutional arrangements.	(R2.1) Establishment of institutional arrangements through R1.1. (R1.6) Establishment of MRV functions to all the actor involved.	Include different institutional arrangements in the law according to institutional mapping presented in Annex 2. MRV functions for different actors involved are suggested in chapter 6. Include these functions in the law to guide the activities of the ministries and agencies which contribution in MRV is relevant.
The IACC is not considered to be robust enough to deal broadly with climate policy issues, nor are the activities defined to address the issues adequately. The decree does not establish MRV tasks of the actors involved. Most of the topics would be included in working group 2, however, by not establishing working groups by sectors, , the decree is considered subjective, and this may represent an obstacle to the fulfillment of objectives.	It is proposed to include sectoral working subgroups that address both mitigation and adaptation, as well as financing in a cross-cutting manner. Groups should also contemplate inventory quality control and monitoring functions in NDC compliance. The IACC should be able to track the operation of the MRV system. It is important that the IACC integrates experts on a	(R2.2) Define role of IACC as the main institutional arrangement for ensuring establishment and operation of the national MRV and its activities, in regulation R1.1. (R2.3) Restructuring of the IACC and establishment of functions (amendment of the decree including specific MRV functions).	Discuss and determine the working groups and members that should integrate this council in order to obtain the expected results, considering their validation functions. Amend the current decree (Decree N719-A), indicating sub-working groups (topics and members), roles and remit of members and activities that must be carried out to help generate trust and certainty in the operation of the MRV system (recommended MRV functions for IACC are included in Chapter 6 of the main report). It is recommended to include the IACC as the main institutional arrangement for the management of the MRV system in the climate change law (R1.1).

	permanent basis to address issues by sector and that civil society, academia and the private sector are taken into account, as they could provide inputs to the system and identify gaps and needs in climate policies, as well as to help in solving them. For this, it is important to determine what the participation of the 'invited" will entail (according to the Decree N719-A), even if they are not members of the council.		It is important to highlight the quality control and validation functions that IACC members have in the system, which implies that these functions might not be limited to inventory but to all components (this is something that must be discussed; if having 3rd party verifiers, IACC could be mostly focus in inventory, and partially tracking policies).
R3 - Incorporation of climate change policies in a centralized system			
Collection and quality control of data needed for assessment of the mitigation actions and their effect. Many actors involved in implementation of mitigation actions at various levels, coupled with the lack of general coordination / monitoring of mitigation measures implemented in the country. Risks of overlooking some key actions or of double counting reductions. Lack of a formal MRV system for support does not provide for the accurate tracking of the	Climate policies should be centralized through a single planning instrument (LT-LEDS for mitigation, NAP for adaptation) so that all climate change policies reflect a common approach which facilitate monitoring of mitigation and adaptation actions. Should include implementation of a registry for Mitigation and Adaptation actions within the MRV system, with the aim of tracking progress and related emissions reductions. M&A actions component is directly linked to Financing component, where managing	(R3.1) Implementation of a registry for projects to track related emission reductions and financing information (R3.2) Analyze in detail the incorporation of policies and their goals in the system (registry) It would imply to develop a legal instrument such a decree. Ensure adoption of the "project portfolio system" (PPS, developed with support from the NDC Partnership) by the MoE. The PPS is considered to be a effective basis for the	Decision making of key aspects for the mitigation registry. See Chapter 6-related recommendation. Once the decisions were made, determine type of users and access of the CCMRV platform (i.e., verifiers and project developers). Prepare templates for data provision. Develop a decree where objective of the registry, requirements for project proponents and rules operation of the registry are clear. At the same time, analyze the climate-related policies that can be incorporated to the registry, to "tag" each registered project to a policy (when applicable). It is important to note that verification capabilities will be needed to track emission reductions (see recommendation R4).

climate-related financing received.	authorities, project developers and verification bodies will be providers of information.	Mitigation and Support parts of the CCMRV system, but will require further support for full implementation.	Review and assess the PPS in the light of the recommendations made in this report and develop a plan for its further development and implementation as needed.
R4 - Implementation of a verification system to verify emission reductions related to mitigation projects and GHG emissions of private sector			
There are no third-party verification bodies in Armenia to support the task of verification of emissions reductions, to ensure the impartiality of validation mechanisms. This mechanism is necessary when verifying emissions and reductions from individual projects, but these capabilities can also support verifying actions implemented by the government.	Develop national capacities in emissions verification, which involves developing an accreditation system for verification bodies. In addition, the program for verifiers should be promoted to open a verification market, for which requirements and rules of operation should be established, and verifiers technically trained. Finally, verification guides, templates, tools and other instruments necessary for the implementation of verifications should be developed.	(R4.1) Development of an accreditation system (R4.2) Development of national verification capabilities (R4.3) Development of tools and instruments needed for verification activities	The development of these capacities will take several years but is relevant to the effectiveness of the MRV system in the long term, since third-party verifiers ensure the accuracy of mitigation project reductions, ensuring that reductions have occurred. 1. Review accreditation requirements in accordance with applicable regulations in Armenia 2. Make a working group of interested parties to design the accreditation system. Key point in the design is the establishment of clear objectives (what Armenia pretends to achieve through the accreditation system) and adhere to international verification standards such as ISO-14064, 14065 and 14066. 3. Establish material and human resources that are required to implement the accreditation system 4. Establish requirements to be a verifier 5. Establish verification process (it is recommended to make a guide or standard) 6. Implement a training for verifiers with a focus on the sectors of interest. 7. Implement the accreditation program.

R5 - Data quality improvement			
There is no national forest inventory that provides reliable statistics on the country's sinks and removals - required to integrate the national inventory, to sustain forest management practices, and to support decision-making in policy development (according to the National Strategy for the inventory of Forests). The lack of local qualified specialists skilled in carrying out full-scale forest inventory, including the establishment and delimitation of forest boundaries, the valuation of forests and the designation of silvicultural activities is the key problem for forest inventory in RA.	The document compiles a series of findings and recommendations to improve and standardize a forest monitoring system in the country. It is considered that the implementation of these recommendations should be prioritized to have a higher quality AFOLU inventory, thus increasing the accuracy of the national inventory.	(R5.1) Continue with the implementation of the roadmap for the development of the forest recording system in Armenia	Implementation of: 1. Statistical forest inventory system 2. Stand forest inventory system 3. System of state accounting and cadaster of forests 4. Forest monitoring system – link to CCMRV 5. Computerized forest management system – DBMS (Database Management System) "Forest Resources of Armenia" Step by step activities are shown in chapter 4 of the main report, to implement those elements in a timeframe of 2 years.
Several inconsistencies between different official data sources for forest parameters, often the main drivers of LULUCF inventories, as stated by the Assessment of Land Use, Land Use Change and Forestry Sector Potential in Achieving Climate Change Mitigation Objectives in	Implement the 26 measures established in this study for inventory improvement. Section 4 of the technical report provides an overview of 26 possible mitigation actions for the Armenian LULUCF sector, divided by 4 key subsectors: land use change with 3 actions, forests with 9 actions, agriculture with 13 actions, and	(R5.2) Implementation of the 26 mitigation actions for LULUCF sector in Armenia.	Make a route map for the gradual implementation of these measures, to prioritize them for their relevance. It is recommended to introduce these measures in the LT-LEDS (R1.2) and make them mandatory from the climate change law (R1.1), in this way they become binding pushing its implementation, being reflected in the emissions inventory.

Armenia, issued on March 2021. High uncertainty, given the current limitations and challenges of monitoring forest ground and land use in the country. Is challenging to estimate real impact of forest sinks and is often underestimated in inventories due to illicit wood extraction, limitations in monitoring technologies, and overall challenges of the quantification in the forestry sector. As for emission factors, the report notes that the IPCC default values for emissions from grasslands, croplands and soils with low activity clay under cool temperate dry climates are too low for country-specific conditions.	peat extraction with 1 action. It is advisable for the Armenian MRV system to include these 26 categories within the 4 main subsectors in the reporting, accounting, and tracking platforms, and to prioritize actions with the highest mitigation potential		A thorough analysis must be made of the responsibilities that the implementation of these measures will entail for different offices / instances, so that these responsibilities are established in the corresponding regulatory instruments (laws of the ministries, regulation of climate change and GHG inventory, and even through coordination agreements).
Common, reliable, and user-friendly carbon measurement methodologies have been lacking in Armenia according to Forest Carbon Stock Measurements Guidelines (2020).	The Forest Carbon Stock Measurements Guidelines were developed in 2020 to fill this gap, but haven´t been implemented. It is proposed to include the application of these guidelines for the development of the national and local GHG inventory, AFOLU sector,	(R5.3) Implementation of the Carbon Stock Measurement Guidelines. These guidelines are key for enhancing the accuracy of estimations of national GHG sinks and removals reported in the NIR, since they provide guidance for the estimation of carbon stocks	Apply these guidelines for the national inventory, AFOLU sector as well as for local forest inventories. Include the use of these guidelines in the regulation (R1.1 and R1.3) to make them binding.

	within the regulation or guidelines for the GHG inventory.	in accordance with the requirements and provisions of the International Panel on Climate Change (IPCC).	
Waste sector: the inventory reports sector-specific emissions with some generic information from public reports that is not necessarily constantly updated.	It is recommended to consider this cadaster as first-hand activity data for the waste inventory, according to Waste Law. This information can also be used to promote emission reduction policies in the waste sector.	(R5.4) Improvement of the data quality for the estimation of waste sector emissions, through waste generation cadaster data	Analyze the relevance of taking as activity data, the data of the cadaster, whenever they are more accurate and current. In case it is decided to take this information for the GHG estimations, it has to be established through the decree of the inventory, and its guidelines - waste sector.
Statistical data Population and agricultural censuses are carried by Law every 10 years. Other censuses may be conducted more frequently with 2 years of planning. However, it is considered that for greater accuracy in the inventory, being data that contribute directly to the inventory, they should be carried out less frequently. From the interviews, it is identified that extrapolations are made that respond little to reality, and that the samples are not representative.	Through R1.1 deadlines to generate updated information can be set. But it might also require modifying the law of statistics. Survey frequencies should be set out in the law, as well as representative samples. On the other hand, it is relevant to implement the measures of the statistical roadmap (9 priorities to attend were identified).	(R5.5) Include statistical data quality improvement within regulations (R1, R3). It might require amending statistical law. It is recommended to promote the updating of certain statistical data at least every 5 years, to reflect best practice and the reliance on statistical data in Armenia for reporting purposes.	Prepare a list of inputs from SC and adequate frequency. Based on the needs, identify the censuses that should be prioritized according to the Statistics Law. Implement climate change law (and modify statistics law if possible) to make official the use of statistical data as inputs of the MRV system, establishing update frequency as well as reporting obligations for the SC (as for the rest of the data providers). Implement inventory regulation: determine sources of information identifying those that corresponds to statistics, frequency of surveys when applicable, representativeness, among others. Sign collaboration agreements with the statistics committee. Addressing actions that arise from the Road Map for the Development of Climate Change-related Statistics, specially #2 (increase the Statistical Committee's role in the GHG

	inventory production system) and #9 (make organizational changes in the Statistical Committee, the broader national statistical system and the national system to support the production of climate change-related statistics). See Table 8 of the main report for further information.

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Abbreviations

AME	Accountability, Monitoring and Evaluation
BTR	Biennial Transparency Report
BUR	Biennial Update Report
CBIT	Capacity-building Initiative for Transparency
CO_2eq	Equivalent carbon dioxide
CCMRV	Climate Change Monitoring, Reporting and Verification Platform
EMIS	Energy Management Information Systems
ETF	Enhanced Transparency Framework
GHG	Greenhouse Gases
GoA	Government of Armenia
IACC	Inter-Agency Coordination Council
IPPU	Industrial processes and product use
LT-LEDS	Long Term – Low Emission Development Strategy
M&A	Mitigation and Adaptation
MEMS	Municipal Energy Management System
MoE	Ministry of Environment
MRV	Measurement, Reporting and Verification
NAP	National Adaptation Plan
NC	National Communication
INDC	Intended Nationally Determined Contribution
NDC	Nationally Determined Contribution
NIR	National Inventory Report
OECD	Organization for Economic Cooperation and Development
PPS	Project Portfolio System
RA	Republic of Armenia
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

1.1. Background

The Republic of Armenia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1993, the Kyoto Protocol in 2002 and the Paris Agreement in 2017. Obligations of Armenia within the framework of the international multilateral instruments derive from the status of a developing country acting as a non-Annex I party to the UNFCCC. The country's position under the Convention and the Paris Agreement is set out in the "Intended Nationally Determined Contributions" (INDC), approved by the government of Armenia (GoA) Decision No. 41 of 10 September 2015, and submitted to the UNFCCC on 22 September 2015. With the ratification of the Paris Agreement, the INDC of Armenia became its NDC for the period of 2015 – 2050.

According to the NDC (Armenia, 2021), the country's total emissions for the period between 2015 and 2050 should not exceed the equivalent of 633 million tons of carbon dioxide (tons of CO_2 eq.). The Republic of Armenia strives to achieve ecosystem neutral GHG emissions by 2050 (2.07 tons/per capita annual) with the support of adequate international financial, technological and capacity building assistance.

Before 2021, a starting year of the NDCs implementation cycle, the countries had time to set up implementation frameworks and to review or enhance their first NDCs. Armenia initiated its NDC revision in January 2020, with the support of the "EU4Climate" UNDP-EU regional project, which allowed to involve local and international experts in the process. The updated NDC was approved by the Government on the 22nd of April and submitted to the UNFCCC Secretariat on the 5th of May of 2021. In the updated NDC, the timeframe of the implementation period has been reviewed and re-aligned with the Paris Agreement's requirement adhering to NDC guidelines, adopted in Katowice at the 24th Conference of Parties, as well as with that of the majority of countries, including the EU and its Member States which is 10 years, from 2021 till 2030.

Armenia maintains its 2050 mitigation goal of reducing its GHG emissions to at most 2.07 tCO_2eq/capita, which will be reflected in its Long Term - Low Emission Development Strategy (LT-LEDS). The new mitigation target to be achieved in 2030 equals a 40% reduction below 1990 emissions levels.

For the transparency framework for action and support, in its updated NDC Armenia underlines the introduction of a national MRV system which shall reflect modalities, procedures and guidelines referred to by Article 13 of the Paris Agreement (Decision 18/CMA.1). Such process involves:

- Biennial development of National Greenhouse Gas Emissions Inventory;
- Development and submission to the UNFCCC Secretariat of National Communications and Biennial Update Reports/ Biennial Transparency Reports (from 2024);
- Maintaining participatory process in the NDC review and public consultation mechanism during preparation of next NDCs, in a gender responsive manner;
- Open and accessible information system ensured through strengthening cooperation between public service providers and civil society organizations.

In addition, the establishment of a national adaptation planning (NAP) Accountability, Monitoring and Evaluation (AME) process is envisaged under the National Framework Strategy on Adaptation to Climate Change Impacts for 2021-2030 (adopted by the RA Government Decree 749-L from 13 May 2021), which marks the coordinated launch and implementation of a NAP process in Armenia that operationalizes the adaptation planning at all levels and on an ongoing and rolling basis.

According to the Third Biennial Update Report of Armenia from 17 May 2021 (BUR3) (Environment, 2021), the basic national MRV system has already been established in the country, with a horizontal inter-agency coordination and verification mechanism under the overall formal coordination of the Ministry of Environment (MoE). Nevertheless, legal / formal arrangements are still needed to specify obligations of corresponding institutions in terms of climate-related data provision and quality assurance. Such arrangements will be clarified within the framework of the already initiated Capacity-building Initiative for Transparency (CBIT) project, based on the experience gained and lessons learned through development of BURs, and as a result of consultations with the Statistics Committee, which is the major provider of activity data required for greenhouse gas emissions assessment for IPCC sectors and hence has an integral part to play in the domestic MRV system of GHG Inventory.

Last but not least, the establishment of a system for tracking national and international financial support received for development/implementation of climate-related mitigation and adaptation activities is essential for setting an efficient MRV framework that covers all four key reporting areas (i.e., inventory, mitigation, adaptation and support).

1.2. Needs of MRV for national and international reporting requirements

Quantifying GHG emission reductions through a robust MRV framework is a prerequisite for the monetization of carbon assets and participation in carbon markets. It also has standalone benefits in addition to supporting carbon pricing instruments, such as reporting and tracking progress toward NDC goals. Armenia recognizes the need to address the current complexities and the unbundling of emission and emission reduction monitoring and reporting systems in the country, and to build the MRV infrastructures necessary to support emission and emission reduction profiles in all main sectors of the NDC, namely the energy, agriculture, industry and waste sectors; monitoring and reporting on the progress of the NDC implementation; and implementation of the platform to track mitigation and adaptation actions as well as climate financing and other support mechanisms.

Regarding national requirements, the main objective of the MRV framework in Armenia is to support the implementation of the Climate Change MRV platform (CCMRV), which is the national climate transparency platform, proposed to track climate policies and NDC.

With regard to international requirements, prior to the Paris Agreement, reporting for developing countries under the UNFCCC included two main components: national communications (NC) and biennial update reports (BUR). The latter were introduced in 2010 and were intended to increase the frequency of reporting from developing countries. Non-Annex I Parties were to submit their first BUR by December 2014, and every two years thereafter. In reality, however, many countries only recently submitted their first BUR, and so far only 6 countries have submitted all 4 BURs which were to be submitted up to the current date. Armenia submitted its first BUR in April 2016 and is one of only 18 countries to have submitted their third BUR, in May 2021. In order to increase the transparency of

mitigation actions and their effects, the international consultation and analysis (ICA) process was established under the auspices of the UNFCCC. The ICA process consists of two steps, which are triggered by the submission of BURs: (i) a technical analysis of BUR by a team of experts (TTE) and (ii) a facilitative sharing of views in the form of workshop under the SBI. Armenia has already taken part in three rounds of technical analysis of BURs.

Although NCs are formally required every four years, in practice many countries present them less frequently. The Initial National Communication of Armenia was published in 1998, followed by the Second National Communication more than a decade later (2010). The Third National Communication was published in 2015 and the Fourth National Communication was submitted in 2020 (NC4). Following the Paris Agreement, all developing countries are expected to submit both National Inventory Reports (NIRs) and Biennial Transparency Reports (BTRs). As shown in Figure 1, the BUR includes reports on the national GHG inventory, mitigation actions and their effects, and financial, technical, and capacity-building support received. This figure also highlights that the reporting requirements in NIRs and BTRs create MRV requirements that go beyond what is necessary for NCs and BURs.

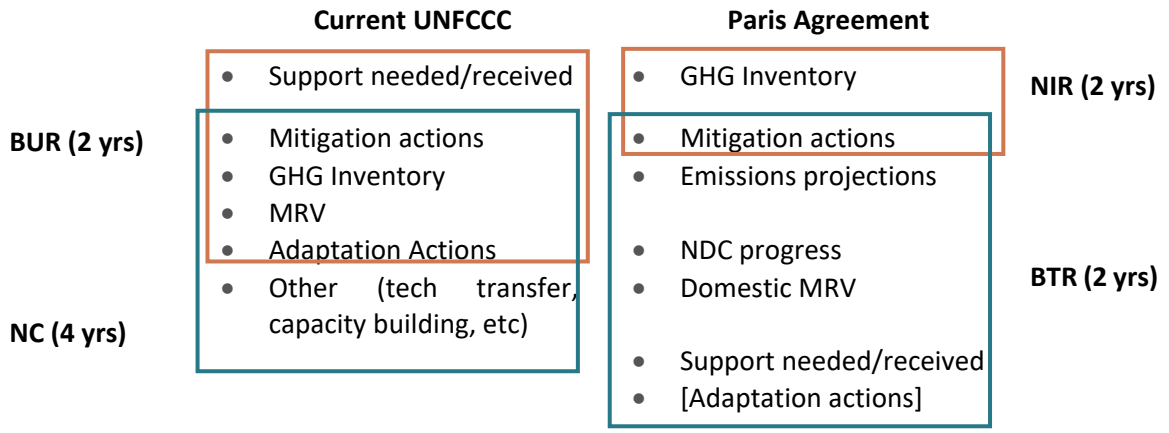


Figure 2: UNFCCC reports vs. Paris Agreement reports

Note: BUR: Biennial Update Report; NC: National Communication; NIR: National Inventory Report; BTR: Biennial Transparency Report; Bold text shows new requirements under the Paris Agreement; items in square brackets are not required.

As shown in Table 1, each of the BTR sections has specific MRV requirements, which will affect the scope and objectives of Armenia's integrated MRV framework.

Table 1 MRV requirements for all countries related to biennial transparency reports

BTR Section	MRV Requirements	Comments for Armenia
GHG Inventory	Same as existing GHG inventory, with 2006 IPCC guidelines and consistent time series	Armenia updated the GHG inventory (series 1990-2017) and it was presented through the BUR3.
Emission projections	MRV is not applicable for emission projections, as these are future projections of emissions that cannot be monitored but can only be modelled, but the emission projections should be based on the GHG inventory (see above)	Need to align GHG and NDC inventory sectors to develop baseline emissions projections and regular updates. Armenia has already presented projections of GHG emissions in its BURs using the LEAP-Armenia software. This practice should be carried over to BTR preparation
NDC progress (indicators, accounting)	MRV of selected indicators linked to NDC targets, along with baselines for those indicators	The NDC targets are emission reductions versus BAU by sector, so MRV requires methodologies to create baseline emission trajectories in these sectors. Reflecting impacts of policies on BAU can be particularly challenging
Mitigation actions	GHG impacts, costs, and other mitigation benefits of all actions that support NDC implementation	Armenia has identified a series of mitigation measures that are set out in Table 3.1 of the BUR3, some of which are ongoing. For these measures, aspects of coordination, support and financing have been identified, in addition to the mitigation potential in Gg of CO_2e..
[Support needed and received]	Monitoring of climate finance received	Not mandatory - government decision required If included, you would have to determine what is defined as climate finance and who tracks climate finance received.

[Adaptation actions]	Adaptation-specific monitoring & evaluation requirements	Not mandatory – decision needed from government.

Note: reporting on support and adaptation actions is not mandatory for developing countries.

The MRV system needs for a given notification requirement or policy objective can be defined along the following dimensions:

- What: this is the coverage of sectors, activities and types of GHG that will be monitored.
- Who: This covers the roles and responsibilities of the key stakeholders, not only who is responsible for the different levels of data collection, but also who is responsible for quality control, data aggregation, database administration, reporting and policy development.
- How: This refers to the choice of methodologies, data sources and assumptions (including baseline assumptions) and quality control procedures to calculate and / or measure emissions and emission reductions.
- When: This includes deadlines and milestones for MRV activities, including reporting deadlines.

Table 2 explains more specifically the system requirements related to the main requirements and reporting objectives of the national MRV system, namely the i) National Inventory Report, ii) BTR: Progress Indicators of the NDC, iii) BTR: Mitigation Actions and iv) Support needed and received.

Note that the Transparency Framework of the Paris Agreement allows "*Developing country Parties that need flexibility in light of their capabilities*" to request this flexibility. These countries "*will clearly indicate the provision to which flexibility applies, concisely clarify capacity limitations, noting that some limitations may be relevant to various provisions, and provide self-determined estimated time frames for improvements in relation to those capacity limitations.*" In the descriptions below, the flexibility that can be requested is shown in brackets (for example, "3 [4] years" means that the requirement is three years but developing countries can request flexibility and use four years as the norm).

Table 2 Requirements of the different types of reports

National Inventory Report	What - sectors, activities and types of GHG: • All standard GHG inventory categories (as in the Fourth National Communication) - "key categories" [1] that contribute to 95% [85%] of the national GHG inventory • Three gases (CO_2, CH_4, N_2O); four more gases (HFC, PFC, SF6, NF3) [not required if flexibility is requested]; optional precursor reports (CO, NOx, NMVOC) • Sectors according to IPCC guidelines: energy, industrial processes and product use, agriculture, LULUCF and waste. International aviation and marine bunker fuels as a note article. • Time series report from 1990 [2020] • Fuel and grid emission factors

	Who - roles and responsibilities: • Designate a national entity or coordination centre with general responsibility • Explain the inventory preparation process, including the responsibilities of all institutions involved. • Explain the process for official consideration and approval of the inventory How: methodologies, data sources and assumptions • 2006 IPCC Guidelines, using the recommended level whenever possible [request flexibility for the lower level] • Use 100-year GWP to convert all values to CO_2e (as opposed to NCs and BURs) • Recalculate previous years if the methodology changes significantly • Use of common reporting tables (CRT) and common tabular formats (CTF) for the electronic reporting of the information in the NIR When: deadlines and milestones • Report must cover data from 2 [3] years prior to publication date (for example, 2024 report must have inventory data from 2022 [2021]) • Filing required every two years, with first filing in 2024
BTR: NDC Progress Indicators	What - sectors, activities and types of GHG: • Description of NDC commitments: target rate (e.g., emissions, emission reductions, emissions intensity), target year and period (single or multi-year), benchmark (level, base year, benchmarks), timeframe of application, scope / coverage (sectors, categories, activities, sources, sinks, gases) • Progress in NDC indicators: Selected sectors, activities and indicators by country (eg GHG emissions, emission reductions, emission intensity, other non-GHG targets); indicator reference level (level, year) and most recent information on the indicator, compared to the commitment in the NDC; at the end of the commitment period, if the indicator is in line with the NDC target; and adjustments in the indicators based on the corresponding adjustments of the transfers of Article 6 • It also includes the obligation to report on relevant national circumstances (e.g., government structure, population, geography, economy, climate, and sectoral profile) and these affect GHG emissions and removals. Who - roles and responsibilities: • It should include a description of the institutional arrangements for MRV for the progress of the NDC • It should include the description of the legal, institutional, administrative and procedural provisions for internal

	implementation, MRV and stakeholder participation during the implementation of the NDC How: methodologies, data sources and assumptions • NDC Description: There are no specific requirements, but updates should be provided, when necessary, to information from previous reports • Progress on NDC Indicators: Explain the methodology and / or accounting approach for setting the baseline and for calculating actual performance, including key parameters, assumptions, definitions, data sources (consistent with the guidelines of the IPCC) and models, specific IPCC guidelines used, metrics used; methodologies for the impacts of policies and measures; and methodologies related to the cooperative approaches of Article 6; justify the consistency of indicator reporting with the NDC and how double scrutiny is avoided. When: deadlines and milestones • BTR is required every two years starting in 2024
BTR: Mitigation Actions	What - sectors, activities and types of GHG: • Actions, policies and measures that support the implementation of the NDC, organized by the IPCC sector, focusing on the measures with the greatest impact on emissions, should be reported • For each action, policy and measure: it is necessary to report the description, the objectives, the type of instrument, the status, the sector and the gases affected, the starting year, the executing entity; It was encouraged to report on costs, non-GHG mitigation benefits, and the interaction between actions, as well as how actions affect longer-term trends in GHG emissions and removals. • Estimates of expected and achieved emission reductions unless you request flexibility, must be provided Who - roles and responsibilities: • No specific requirements How: methodologies, data sources and assumptions • Report methodologies and assumptions used to estimate GHG emission reductions or removals for each action, policy, or measure (without specific guidelines) When: deadlines and milestones • BTR is required every two years starting in 2024 Note that the BTR also includes sections on summarizing GHG emissions and removals, and for providing projections of GHG emissions and removals.
Support needed and received	What - financial, technology transfer and capacity building support needed and received. It may include:

	• national public and private (financial) institutions • bilateral and multilateral development finance institutions Who - roles and responsibilities: • No specific requirements How • Currently, there are no guidelines on how to report on needed support, but different institutions have developed various approaches to quantify public climate finance, including: - OECD Development Assistance Committee Donor Report Database - "Common Principles for Monitoring Climate Finance" by MDB-IDFC - The different UNDP climate finance tools, including "Public Climate Expenditure and Institutional Reviews (CPEIR) and" Climate Budget Labelling " When: deadlines and milestones • Every two years with BUR and BTR (from 2024)

It should also be noted that the MRV system will also serve a variety of purposes in addition to facilitating compliance with national or international reporting requirements. The system will serve as a database of approved calculation factors, such as fuel emission factors and emission factors for the national / regional grid. The system can also support the monitoring and reporting of joint benefits of mitigation actions, such as jobs created, health benefits, socio-economic benefits and environmental benefits (e.g., reduction of air pollutants). The system could provide for the user to enter this information, if available, which could be further expanded or updated in the future if the relevant methodologies and protocols are accepted nationally or internationally.

The previous sections describe existing or proposed national and international monitoring and reporting requirements that will be addressed by the national MRV system. However, the system must be flexible and allow for upgrade / expansion to be applicable to other future GHG emissions reporting needs. These reporting needs could be related, for example, to carbon pricing instruments, such as a carbon tax or an emissions trading system.

1.3. Objective and approach

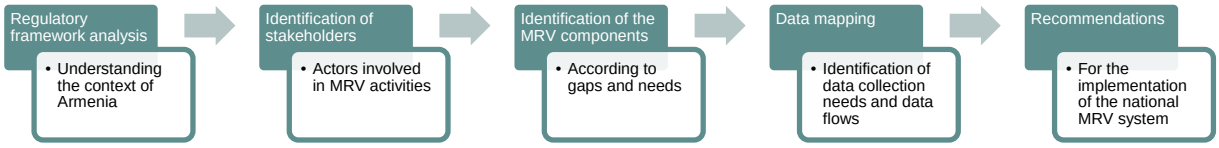
In order to provide advice to the competent entities of Armenia for the development of the structure of the MRV system taking into account the current context and the needs of the country, the objectives of this project are:

1) Strengthening national institutions for MRV and aligning transparency activities with country priorities;
2) Ensuring that organizations and individuals have the necessary training and tools to conduct MRV activities; and
3) Transitioning arrangements for data collection, analysis, and reporting from a

project-based cycle to a continuous process.

The applied approach consisted of the analysis of the regulatory framework (desk review of existing instruments), the relevant actors involved in the MRV, as well as the functions of committees and the potential links of the CCMRV with other systems that are currently operating. Subsequently, the components of the MRV system that are required according to the needs of the country were identified for a successful implementation, and an institutional and data mapping of the input and output information of the system was carried out, where both the type and the flow of information between the different entities involved are shown (see Figure 3).

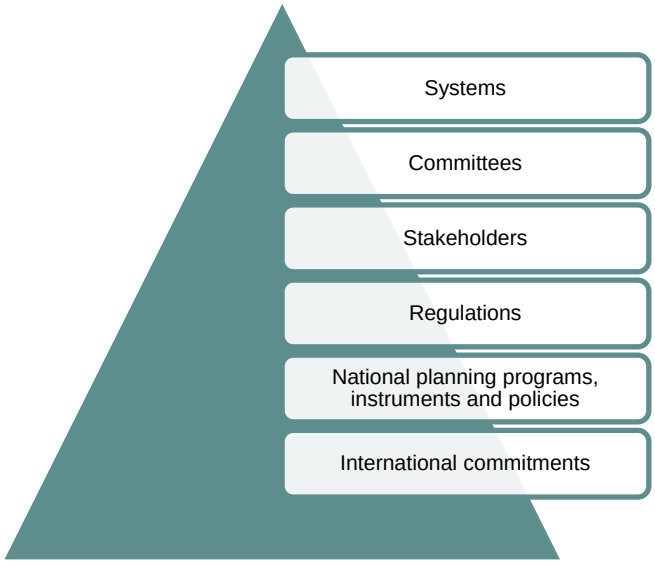
Figure 3 General approach to address the project needs



1.3.1. Regulatory framework analysis

This task aimed to identify both the barriers and the needs for the implementation of an effective MRV system in the long term, reason why it was necessary to start from international commitments and national policies and extend to the actors involved in the data collection and management, GHG reporting and QA / QC activities as well as in the existing systems with potential links to the CCMRV platform.

Figure 4 Public policy instruments to be analyzed in the context of Armenia



Section 2 of this report presents the results of the review of the regulatory framework analysis in Armenia.

1.3.2. Identification of relevant stakeholders

An analysis of relevant actors was carried out, including the identification of the main institutions, entities and institutional arrangements that play a role in the implementation of the National MRV System, taking into account the GHG inventory, ongoing and planned mitigation and adaptation actions as well as supporting needs.

In addition, after the desk review of the relevant regulatory and planning instruments, a stakeholder consultation was performed in order to collect information directly from key stakeholders on the barriers they identify in data collection and quality control processes, flows of information between entities, as well as the needs that must be covered with the CCMRV platform from their perspective. This consultation took place on November of 2021, with key stakeholders who provided the information that helped the consulting team to issue recommendations for the design of a robust MRV system capable of responding to the needs.

Both with the research of publicly available documentation of regulatory and planning instruments, as well as with outputs from the stakeholder's consultation, conceptual and operational barriers were identified for the implementation of the National MRV System, accompanied by detailed recommendations for improvement based on international requirements, national policy, global best practices and experiences. These recommendations are shown in Chapter 6 of this report and include the necessary steps to ensure the integration and alignment of the National MRV System with the sectoral processes and the collection of primary data.

Table 3 presents the instruments, technical reports, entities, committees and systems taken into account for the purposes of this analysis. However, for practical purposes, the review of these instruments is presented in Annex 1.

Table 3 Policy instruments, actors and systems considered for the analysis

Policy Instruments and reports	NDC and its implementation plan
	3rd BUR
	Covenant of Mayors
	Program of the Government 2017 – 2022
	Fourth National Communication (NC4)
	Law on Atmospheric Air Protection
	Law "On Substances Depleting the Ozone Layer"
	Law "On Waste" and related regulations on inventories
	Law on Statistics

	Government N49-8 Decree on "Activities by the Republic of Armenia for Implementation of the Obligations Emanated from a Number of International Environmental Conventions Ratified by Armenia Decree 955 -A “On Approving the composition and rules of procedure of the Inter-Agency Coordinating Council on Implementation of requirements and provisions of the UN Framework Convention on Climate Change” National Framework Strategy on Adaptation to Climate Change Impacts for 2021-2030 National Strategy for the inventory of Forests Forest Carbon Stock Measurements Guidelines Assessment of LULUCF Potential in Achieving Climate Change Mitigation Objectives National Energy Balance, 2021 Land Balance, Gov. Decree – N1732-N, 21.10.2021 EU-Armenia Comprehensive and Enhanced Partnership Agreement (CEPA) Implementation Roadmap Road Map for the Development of Climate Change-related Statistics
Public entities	Ministry of Environment Ministry of Territorial Administration and Infrastructure Ministry of Finance Ministry of Economy State Revenue Committee Public Services Regulatory Commission
Committees	Inter-Agency Coordination Council Statistics Committee
Systems	Energy Balance CEPA reporting National Statistics System

Section 3 of this report presents a first institutional mapping in support of the CCMRV platform design.

1.3.3. Identification of the MRV components

Based on the review of regulatory and planning instruments of Armenia, as well as on the international reports that the country has presented on climate change (i.e., BUR3, NC's), the needs for the national MRV system were identified, and the configuration of the system is proposed in Chapter 4 to be discussed and provided feedback by UNDP and the Ministry of the Environment. In addition, the MRV structure was adjusted according to the outputs of the stakeholder's consultations.

The government of Armenia has worked hard to build capacities in MRV as well as to implement processes and tools that serve to support and centralize the work carried out in different areas. However, up to now MRV actions constitute a system that is not entirely structured, as it is the result of specific efforts without a common backbone to support, simplify and automate tasks.

So far, the following actions in progress or planned in the short term can be mentioned for the implementation of the national MRV (BUR3).

- Within the framework of several projects implemented in Armenia under international funding, key elements of MRV system in specific sectors were implemented;
- Implementation of MRV system for mitigation actions in building sector
    - Energy Management Information Systems (EMIS) in public buildings, as well as the Report on monitoring methodology for calculation of energy savings and greenhouse gas reductions and detailed system of methods for calculation, normalization and validation of the gathered data have been finalized and submitted to the EPIU;
- Municipal Energy Management System (MEMS) establishment is initiated as a part of domestic MRV system. An agreement already has been reached with one of the urban communities on the introduction of the MEMS;
- "Approval of the National Framework Strategy on Adaptation to Climate Change for 2021-2030 and the Action Plan for 2021-2025";
- A monitoring and reporting system for GHG inventories and climatic actions on a municipal level has been established through the participation of 27 Armenian communities2 in the EC's "Covenant of Mayors for Climate and Energy" initiative.

Adding to the above, the following needs have been identified to be addressed toward the implementation of the MRV system:

- Identification of data providers and clarification of roles and responsibilities of the multiple stakeholders involved in development and implementation of mitigation actions;
- Analyze how other existing policies will be linked or centralized in the system (e.g. the monitoring reports of municipalities fit in national MRV; adaptation actions, action plans from Covenant of Mayors, among others).

[2] As of January 2021

- To establish NAP Accountability, Monitoring and Evaluation (AME) process for Adaptation:
    - The AME system will establish reporting processes and mechanisms for adaptation; monitor and track progress on implementation of adaptation processes for cross-sectoral, sub-national, and sectoral measures; promote feedback to foster continuous improvement of the policy and of its management; and assess the impact of interventions on reducing vulnerability;
- Support: development of a methodology, format and mechanism for the climate change expenditures identification, tagging and calculation, as well as to assess and expand the role of Ministry of Finance in terms of identification, coding, estimating and reporting costs associated with climate change:
    - it is important to explore possibilities for tracking financing for mitigation and adaptation activities implemented by municipalities, non-governmental organizations, private sector and donors, to ensure that any climate-related funding in Armenia is considered and consequently reported under the MRV system.
    - Important to avoid overestimation of received support in the national MRV system.

  It is worth mentioning that under the framework of the Climate Action Enhancement Package (CAEP) project in Armenia, it was developed the tool “Project Portfolio System”(PPS), aimed to track existing climate mitigation and adaptation projects in the country, which would help to approach this needs, as a database of planned and implemented emission reduction and climate adaptation projects, and of finance, to take over the projects that have received financing, keeping record of the type of finance (loan, equity, etc.), the amount financed and the investor/donor, among other relevant information.

Section 4 of this report presents a general structure on the main components that the national MRV system should contain, namely related to GHG inventory, mitigation and adaptation actions, and support.

1.3.4. Data mapping

Considering the detection of needs for the review of regulatory and planning instruments, as well as the stakeholder’s consultation and the conceptualization of the MRV system, the types of data by component were explored, with special emphasis on the mapping of data that are required as inputs (e.g., activity data and emission factors) and those that are produced as outputs (e.g., emissions) in the system. With the above, difficulties in obtaining specific data were identified. In chapter 5, advice is provided on the type of tools and their operation to simplify processes in building the inventory, identifying synergies both between information providers and with other systems (e.g., the national system of statistics).

The data mapping is presented as a diagram (Annex 2), showing the type and flows of information among the data provider, the coordinator of the MRV system, the sectoral

experts, and the IACC. It is also an institutional mapping since it shows specifically who the actors are for each inventory sector and system component.

1.3.5. Recommendations

Based on the analysis of the regulatory framework, the functions of the relevant actors, and the information and data exchange needs, MRV recommendations were issued for each of the system components (i.e., GHG inventory, mitigation and adaptation actions, support), for their implementation to be successful. Table 4 shows the questions that will be addressed as a starting point for issuing a series of recommendations.

It is worth mentioning that as a result of the analysis, 5 major recommendations were issued and developed in Chapter 6 of this report:

1. Establishment of a robust legal framework
2. Establishment of a robust institutional structure for MRV system
3. Incorporation of climate change policies in a centralized system
4. Implementation of a verification system to verify emission reductions
5. Data quality improvement

The recommendations are provided on instruments and activities to be carried out relevant to the implementation, effectiveness, and long-term operation of the MRV system.

Table 4 Approach for recommendations for MRV system implementation

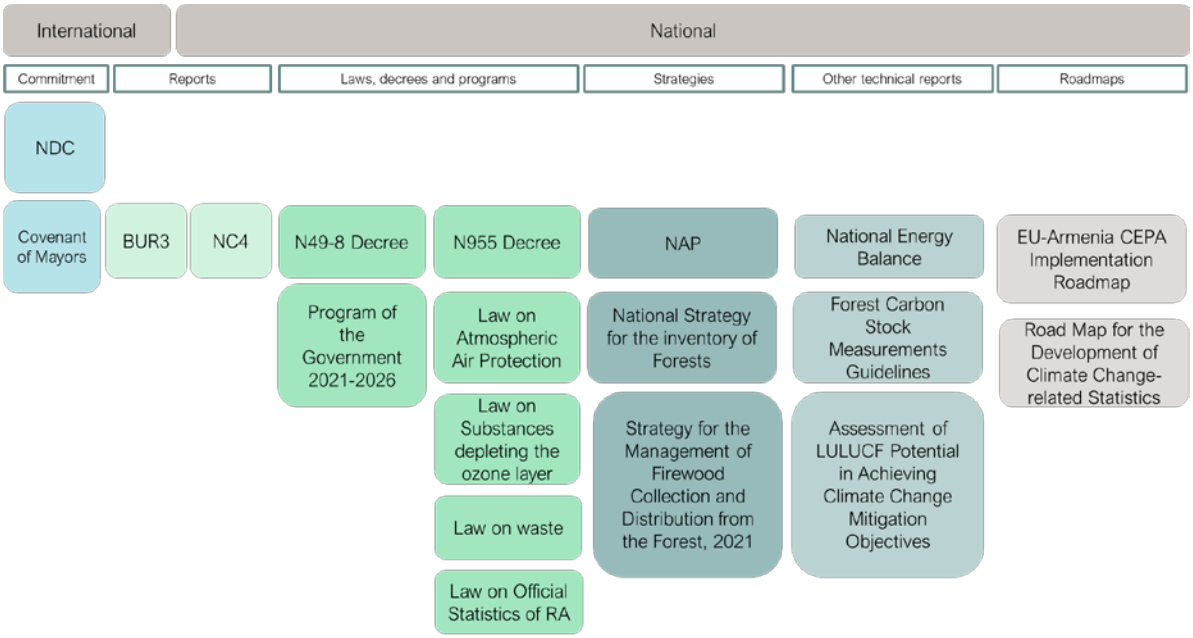
	Monitoring	Reporting	Verification
Who?	Responsible entities of the generation, collection and management of information. Main stakeholders responsible of monitoring activities are data providers: SC, MTAI, PSRC, SRC, ME.	Responsible entities of the emissions estimates and climate change related reports according to national and international obligations Main stakeholders responsible of reporting activities are data providers: SC, MTAI, PSRC, SRC, ME.	Responsible entities for the QA/QC procedures. For the GHG inventory, responsible of this activities is the IACC; for mitigation actions it is recommended to be a third party verifier.
How?	Data generation, collection, management and record keeping processes.	Activities to perform the different types of reports, schedules Reporting activities should be regulated by a Climate Change Law	QA/QC internal and external procedures QA/QC activities (aligned to IPCC guidelines) should be regulated by a Climate

	Current practices of data provision can be enhanced by signing inter-institutional coordination agreements.	and a GHG inventory decree.	Change Law and a GHG inventory decree. It is recommended to develop and accreditation system for third party verifiers for the verification of mitigation projects.
When?	Frequency and deadlines for data collection procedures must be addressed by the inter-institutional coordination agreements.	Frequency and deadlines for national and international reports must be established in the GHG inventory decree.	Frequency and timelines for QA/QC activities must be established in the GHG inventory decree

2. Regulatory Framework

A review of the instruments that constitute the regulatory framework related to the MRV system was carried out, among which are the NDC (international commitment), BUR3, NC4, the government program of Armenia as well as national laws and strategies related to climate change policies. Likewise, some reports were reviewed, such as the energy balance, assessments in the forestry sector and recent roadmaps that are relevant for the purposes of this report. A summary of the reviewed instruments and reports is shown in Figure 5. However, the description of these instruments and their relationship with the system is shown in Annex 1.

Figure 5 Climate policy related instruments and reports



It should be considered for the MRV system that there are objectives and targets that emanate from the different planning instruments, so the system can serve as a repository of those goals and should be useful to track progress in meeting these objectives and not only the NDC. Some of the relevant goals and findings identified in the review of the instruments are the following:

- The Strategic Program for the Development of the Energy Sector of the Republic of Armenia (until 2040), which contemplates solar and wind energy as the focus for the expansion of economically viable and technically available renewable energy. Through this strategic program, Armenia intends to increase its solar energy installed capacity from current 59.5 MW to 1000 MW before 2030 to increase both energy security and green energy share to at least 15% in 2030.
- The National Energy Efficiency and Renewable Energy Program 2021-2030, which will define new sectoral targets.
- The National Forestry Programme (2021), which includes the goal of increasing forest cover to 12.9% of the territory of Armenia by 2030.
- Government of the Republic of Armenia (up to 2022) intends to increase the share of solar energy generation to at least 15% of the total energy generation or 1.8 billion kWh by 2030. In addition, the Armenia Government also specifies the intention of promoting nuclear energy, energy efficiency projects, eco-friendly vehicles, and diversification of fuel supply chains as key priorities, as expressed through the BUR3.
- The NDC states that the Government intends to reach 12.9% of forest cover by 2030 as part of the National Forestry Programme published in 2021. The forest

cover is currently only 11% of the total territory of the country, according to the National Strategy.

- The Covenant of Mayors for Climate and Energy was first signed by an Armenian local authority in 2009. To achieve a common vision 2050 towards decarbonised and resilient territories, with universal access to secure, sustainable and affordable energy services for all, the mayors commit to reducing CO_2 emissions in their municipalities by at least 40% by 2030, mainly by increasing the use of renewable energy sources, improving energy efficiency, and “no-regret”, flexible measures.
- Signatories also commit to submit a baseline emissions inventory, a climate change risk and vulnerability assessment, a Sustainable Energy and Climate Action Plan (SECAP) outlining how the signatory intends to reach its commitments, within two years of adhering to the Covenant, as well as reports on progress every two years.

Furthermore, since the scope of the NDC includes HFCs, which are also part of the scope of the CEPA with the EU, it is particularly useful for the MRV components and reporting platforms to be able to track disaggregated emissions and emission reduction projects by type of HFC, which include: HFCs: HFC-32, HFC- 125, HFC-134a, HFC- 152a, HFC-143a, HFC-227ea. Under the new ETF, reporting of HFCs disaggregated by type of gas will be flexible. However, Armenia already has the institutional setup to report HFCs disaggregated by chemical and by applications and has been doing so this way in the National Inventory Report.

The system should ideally be able to identify new solar PV and other renewable energy installed capacity, as well as their contribution to the total share of solar energy in the total energy production in Armenia. This data would help track progress towards these goals, in case Armenia decides to include these indicators in their mandatory reporting under the ETF and would also provide an indicator of progress towards the qualitative goals of increasing national energy security and reducing reliance of imported fuels, which are also set forward in the BUR3.

Likewise, the National Circumstances section of the NC reports specific indicators for GHG emissions and energy intensity of the gross domestic product (GDP) by purchasing power parity (PPP) building from key social indicators and GDP structure, which are also reported in section 1 of the NC. Both the CO_2 emissions per unit of GDP by PPP and the GDP (PPP) energy intensity have been recorded in a downward trend since 2016. These indicators, derived from current data collection processes, can be used as indicators of progress towards the NDC under the new ETF if Armenia chooses to include them in the mandatory reporting.

Regarding the Substances Depleting the Ozone Layer, the customs authorities, (state agency authorized information on the import, export and transit of substances that deplete the ozone layer), must report the data on import, export or transit; the amount of substances that deplete the ozone layer and the names of the countries: exporters and importers. The registry of these substances includes annual reports on the use of individual quotas in their importation.

The Energy Balance, is one of the main sources for the collection of the initial data on greenhouse gas emissions in the energy sector, and is an essential instrument not only for the national MRV system, but also for the identification of key areas of development for climate policies and mitigation measures. The Energy Balance provides an updated balanced compilation of the renewable energy, electricity, natural gas, thermal energy, oil products, coal, wood and other biofuels produced and consumed in Armenia during the reported period. It is a very valuable tool for the assessment of the consumption volumes of the diverse fuels per sector and the degree of both energy independence and security in the country. It is also very valuable for the assessment of the degree of diversification of the energy supply, the share of renewable energy in the total energy generation and the trends in greenhouse gas emissions.

The Energy Balance is therefore a key tool for the evaluation of the progress towards achieving the qualitative and quantitative targets set forward in the national submissions to the UNFCCC under the Paris Agreements, many of which Armenia may choose to include in the mandatory reporting under the ETF.

On the other hand, the National Strategy for the Inventory of Forest is particularly relevant for the national MRV system in development, since strengthening the accounting and reporting of the AFOLU sector of the NIR is a key area of opportunity for Armenia.

The Strategy for the Management of Firewood Collection and Distribution from the Forest proposes an alternative to firewood collection from forests that meets the local population´s needs. Technical, economic, and social aspects are considered in the feasibility analysis of alternative sources of energy, and a roadmap with recommendations for the way forward is presented. The implementation of this strategy would promote the conservation of woody biomass from national forests, otherwise sourced as household fuel, and increase the capacity of forests areas to store and remove GHGs, contributing to the achievement of the NDC.

The MRV system in Armenia must therefore be able to distinguish and track the intended joint emission reduction measures, such as potential pilot projects hosted in the country under Article 6 of the UNFCCC Paris Agreements and whose emission reductions will not contribute to Armenia’s NDC commitments, projects issuing carbon credits for trading, as well as all the financing received from the EU under the CEPA, which will need to be reported under the new ETF.

In addition, Article 54 of the CEPA also sets out the intention to work on measures related to ozone-depleting substances and fluorinated gases (F-gases), which are part of the scope of the Armenian NDC, which is why the MRV system must be able to track the impact of these measures, disaggregated by type of gas (ODS and F-gases).

As for the Assessment of Land Use, Land Use Change and Forestry Sector Potential in Achieving Climate Change Mitigation Objectives in Armenia, issued on March 2021, it provides an overview of 26 possible mitigation actions for the Armenian LULUCF sector, divided by 4 key subsectors: land use change with 3 actions, forests with 9 actions, agriculture with 13 actions, and peat extraction with 1 action. It is advisable for the Armenian MRV system to include these 26 categories within the 4 main subsectors in the reporting, accounting, and tracking platforms, and to prioritize actions with the highest mitigation potential. In order to evaluate potential mitigation actions, the national LULUCF inventory was replicated for this study, with some features simplified, modified or corrected with the

purpose of providing the most accurate estimation of existing emissions and removals for the analysis.

According to the above, updating specific parameters would significantly change the carbon balance of forests, and would allow the Government of Armenia to have a clearer picture of the current volume of wood harvested, the actual potential of the national forests to act as sinks, and the real potential for mitigation actions in the LULUCF sector, which is underestimated with the NIR figures when compared to the GEF-UND figures.

In terms of support, the RA plans to substantially and drastically increase the foreign investments /GDP ratio. Any foreign investment on projects related to adaptation and mitigation measures, some of which may be the outcome of cooperative approaches under Article 6 of the Paris Agreements, may be tracked for the non-mandatory disclosure of support needed and received of the new BTR.

As for adaptation, some of the measures foreseen related to disaster risk reduction, such as reducing seismic risk in buildings, enhancing seismic resilience and assessing vulnerability, may be tracked and reported along with the adaptation actions when they are implemented, since they are part of the process of adapting human settlements to a changing environment, subject to stronger and more frequent natural disaster events.

See Annex 1 for more details on the planning and regulatory instruments, and reports reviewed.

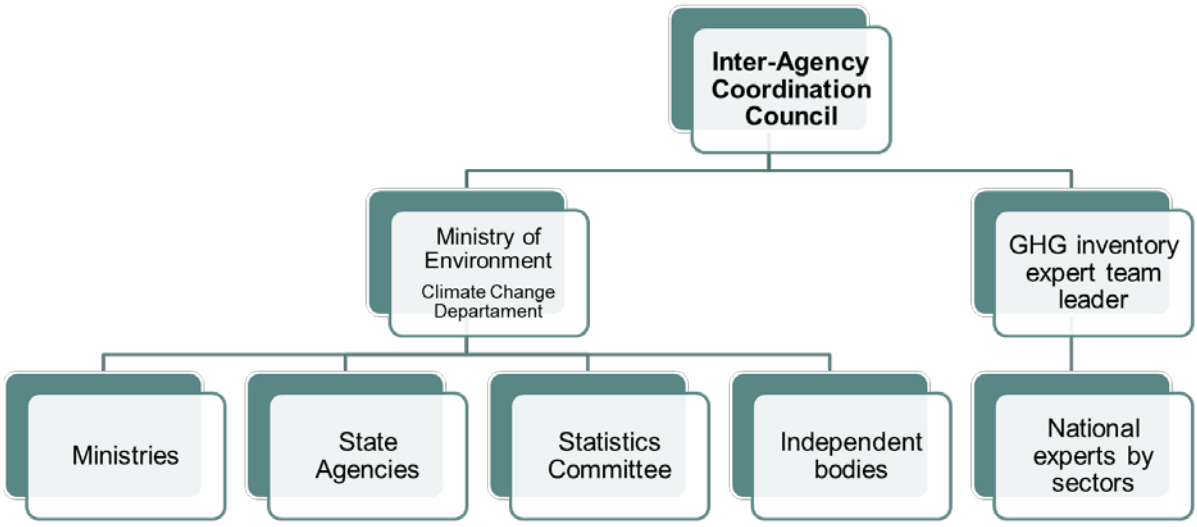
3. Institutional mapping in support of the CCMRV platform design

3.1. Identification of institutions and stakeholders

The national climate change policy in Armenia is based on the organizational structure presented in Figure 6, which establishes that the Ministry of the Environment is responsible for informing the UNFCCC of the activities and progress made in the matter, supported by the Inter-Agency Coordinating Council (IACC), whose main functions are to ensure the fulfilment of the obligations undertaken by the RA by the UNFCCC; the coordination of the Armenian NDC's under the Paris Agreement for the 2021-2030 period and the implementation of the 13th Goal of the United Nations 2030 Agenda for Sustainable Development (Climate Action). Likewise, there is an expert staff in charge of preparing the national inventory supported by UNDP, which reports directly to the Ministry of the Environment and that it is supposed to have a close relationship with the Inter-Agency Coordinating Council (IACC) since the inventory team delivers the reports to it for the purposes of QA / QC. However, the joint work between the team of experts and the IACC is still not carried out efficiently.

It should be noted that there are currently no officially established institutional arrangements for climate policy. Prevalent interactions occur among the MoE as coordinator, the information providers for the GHG inventory, and the IACC as validator. The MoE uses sectoral technical experts to carry out the inventory, who would potentially interact with the IACC for inventory validation. Therefore, the Figure 6 shows the current general institutional arrangement.

Figure 6 Current institutional arrangements to address climate change national policy

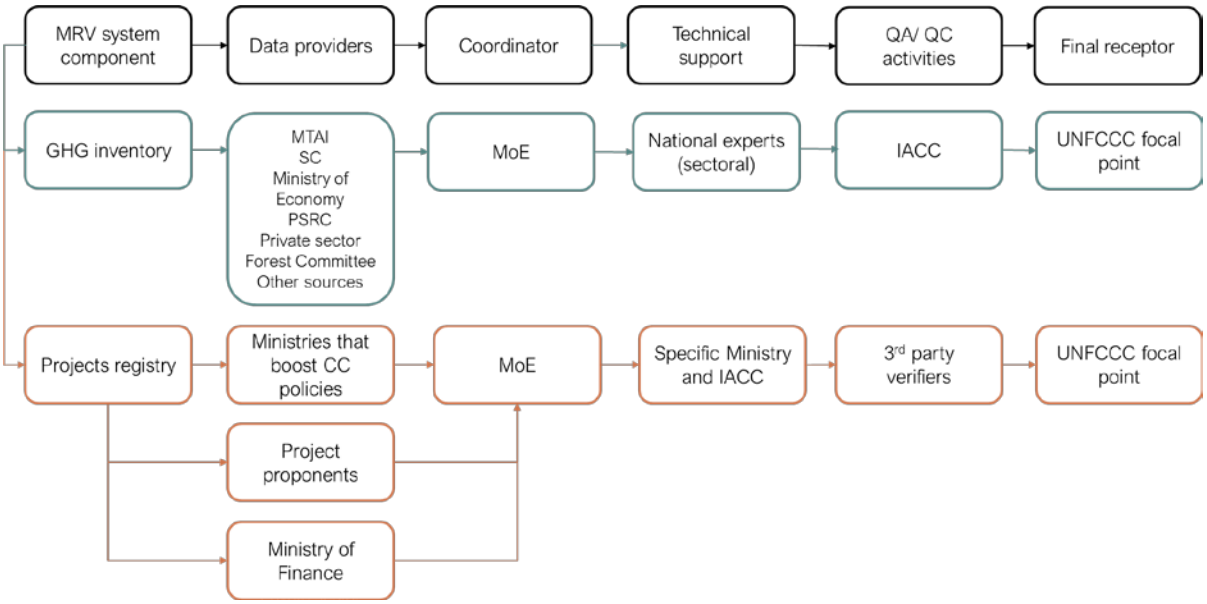


Source: Own elaboration based on BUR3

It should be noted that as for inventory information, there are other entities that report to the Ministry of the Environment or to the leaders of the expert groups of the 4 inventory sectors (energy, IPPU and product use, AFOLU and waste), the most important data providers being the Statistics Committee and the Energy Balance, from the Ministry of Territorial Administration and the Infrastructure (MTAI) of Armenia.

The type of input data required for inventory estimates and the interactions that occur in the elaboration process are shown in the institutional and data mapping presented in Annex 2. This mapping shows by sector of the inventory, the inputs, the data providers, the coordinator (MoE), the responsible of technical support and QA/QC activities, both for the inventory (the only component of the existing MRV), and for the registration of mitigation and adaptation projects (according to the configuration of the system proposed in Chapter 4). In summary, the institutional map breaks down the following information.

Figure 7 Institutional and data mapping of the MRV system (summary)



It should be noted that this mapping was carried out based on the available information and the outputs of the stakeholder consultation.

This consultation was carried out during the first week of December 2021 to the following areas:

Table 5 Stakeholder's consultation meetings

Date	Ministry and departament	Host
30.11.2021	Kick off meeting with UNDP Climate Change Programme	Diana Harutyunyan – Programme Coordinator David Shindyan – Expert Heghine Grigoryan – Legal Expert
30.11.2021	Meeting at the National Statistical Service	Nelli Baghdasaryan – Member of the Board (responsible for coordination of Environmental Section)

01.12.2021	Meetings in the Statistical Committee	Lusine Markosyan, Head of Households' Statistic Section; Arsen Avagyan, Head of Agricultural Statistic Section; Anahit Avetisyan, Head of Industry and Energy Statistic Section;
01.12.2021	Meeting at the Ministry of Economy	Levon Ter-Isahakyan, Head of Primary Agriculture Department of the Ministry of Economy
01.12.2021	Meeting at the Ministry of Environment	Nona Budoyan, Head of Climate Policy Department
02.12.2021	Hydrometeorology and Monitoring Center" state non-commercial organization of the Ministry of Environment of Armenia	Anna Zatikyan, Head of Information Department
02.12.2021	Meeting at the Ministry of High-Tech Industry	Arshak Kerobyan, Head of Digitalization Department
03.12.2021	Representatives of Forest Policy Department	Aram Sahakyan, Head of Department Artur Gevorgyan, Head of Section
03.12.2021	Wrap-up meeting with UNDP Climate Change Programme	Diana Harutyunyan – Programme Coordinator David Shndyan – Expert

The functions and roles of the main institutions and actors involved in MRV activities currently in Armenia are described below. However, institutional mapping is shown in Annex 2.

Ministry of Environment (MoE)

Responsible for the development and implementation of state policy addressing climate change issues and for fulfilling commitments under UNFCCC, including development of national communications, biennial update reports and GHG Inventories. The MoE is designated National Focal Point for the UNFCCC (Ministry of Environment of the Republic of Armenia, 2021).

Figure 8 presents the technical departments which make up the Ministry of Environment.

Figure 8 Ministry of Environment Departments

By its nature, the Department of Climate Policy is the one of interest for the purposes of the CCMRV platform; However, several of the departments may have an impact on issues of adaptation to climate change, so synergies can be sought to benefit the effectiveness of the MRV system.

According to the third BUR, in 2015 a Climate Change policy division and from June 2020 - separate department has been established with the main functions of coordinating the UNFCCC implementation including development of national communications and biennial update reports.

Ministry of Territorial Administration and Infrastructure (MTAI)

According to the Appendix N 1 of the N 633 Decision (May 19 of 2005 dated), the MTAI is in charge mainly of the development and implementation of the territorial policy in the country[3]: Adding to this, the MTAI ensures the governance and the safe operation of the State-owned water systems, the development and the implementation of the management policy of the water systems, the state regulation of the policy of the migration processes, as well as the investment and future development of municipal service system, among other functions.

The relevance of this public entity lies in the fact that former Ministry of Energy and Ministry of Transport is merged with this ministry that provides information on the energy consumption of the productive sectors as well as information on related to natural gas for the GHG inventory.

Ministry of Finance

The Ministry of Finance develops and implements the policy of the RA Government in the spheres of state revenue formation and spending, public finance management, including

[3] http://www.mtad.am/en/charter/

budgetary process organization, internal financial control (including internal audit), state regulation and coordination of the procurement process, financial-budgetary supervision, public debt management, accounting, audit activity, games, as well as ensuring the work done towards development and implementation of financial-economic, credit, financial market unified policy, regulation of the activity in the sphere of precious metals, formation of revenue of community budgets.[4]

Ministry of Economy

The Ministry of Economy is a central body of executive authority that develops the Government's economic policy and responsible for implementing and assessing the results of economic policy. Among its functions, this Ministry track matters related to the agricultural sector, which is why it is an important provider of useful information for the GHG inventory.

With regard to Agrarian policy, the Ministry of Economy is in charge of:

1. Support the development of cooperative agriculture and define the minimum prerequisites required for realization of cooperatives.
2. Create educational, scientific and research, industrial clusters and contribute to enhancement of cooperation between educational, scientific, scientific and production and consultation centers in agricultural and agrarian sector.
3. Support the introduction of agricultural and food system equipment, new technologies, as well as food safety systems.
4. Implement state support programs aimed at development of local seed breeding and seed production, intensive agriculture, and livestock breeding, as well as support establishment of pedigree farms.
5. Contribute to the expansion of non-agricultural activities in rural communities and development of agritourism.
6. Ensure the introduction of an effective system for prevention of animal and plant diseases.
7. Ensure the introduction of a system on dissemination of agriculture-related knowledge and experience and access to information among agricultural producers.
8. Ensure the introduction of insurance system in the agricultural sector.
9. Define the main principles, methodology, and strategy of assistance to agriculture.

State Revenue Committee

The State Revenue Committee is a tax and customs authority established under the RA laws "On Tax Service," "On Customs Regulations" and "On Customs Service."

The relevance of this entity within the MRV framework is as provider of data related to Ozone Depleting substances use to the GHG inventory.

[4] https://minfin.am/en/page/the_mission/

Cadastre Committee

The Cadastre Committee of the Republic of Armenia maintains state registry of real estate and geospatial information systems, promotes development of real estate market, as well as development and implementation of land policy.

Public Services Regulatory Commission

The PSRC provides tariff policy implementation and issues licenses, allocates radio frequencies; while in the water sector it implements the tariff policy and issues permits to use water systems; in the postal sector it performs tariff regulation of universal services; in the railroad transport sector – calculates and approves the fee for using of the infrastructure, in the field of technical checkup of transport vehicles – sets tariffs for provision of services.[5]

The relevance of this entity within the MRV framework is as provider natural-gas related data to the GHG inventory.

Inter-agency coordination council

The Council was created by the Prime Minister of the Republic of Armenia on October 2012 under the Decree 955 -A "*On Approving the composition and rules of procedure of the Inter-Agency Coordinating Council on Implementation of requirements and provisions of the UN Framework Convention on Climate Change*", and has the authority to coordinate reporting on climate change and ensure coherent policies for achievement of Armenia's commitments under UNFCCC and is the decision making body that approves the final drafts such as the national GHG inventories, NCs, BURs.

The Decree was recently annulled and replaced by Decree N719-A on July 6, 2021 and establishes an Inter-institutional Coordination Council ("the Council") in the application of the requirements and provisions of the UNFCCC and the Paris Agreement, in order to determine, on the one hand, its composition, and on the other, its internal operating regulations. The purpose of this Council is to ensure compliance with Armenia's obligations under the UNFCCC and the Paris Agreement, coordinate the NDC's for the 2021-2030 period and implement the goal 13 of the 2030 agenda.

The composition of the IACC is shown in while Table 6 shows a summary of the decree on the conformation and operating rules of the IACC.

Figure 9 Inter-Agency Coordinating Council structure

[5] https://erranet.org/member/psrc-armenia/

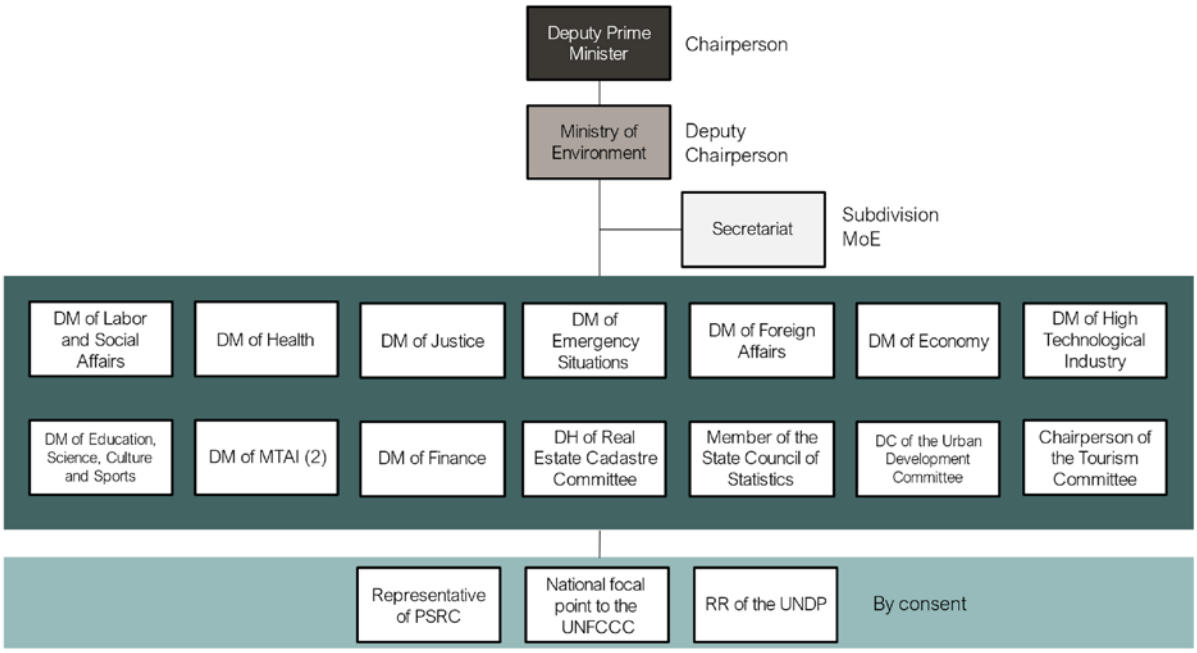
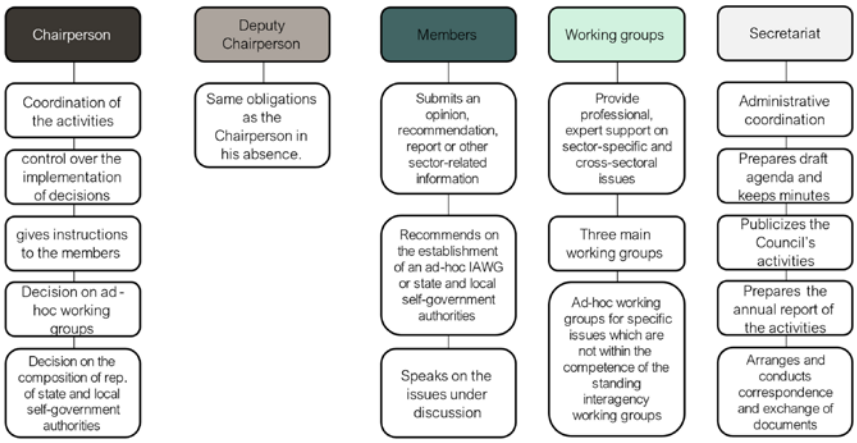


Table 6 Council objectives and functions

Objectives of the Council	1) to coordinate the fulfillment of the obligations undertaken by the RA deriving from the Convention and the Paris Agreement; 2) to regularly review the reports by the National Coordinator of the Convention and the Paris Agreement; 3) to make recommendations and provide consultation in relation to the measures for fulfillment of the obligations undertaken by the RA deriving from the Convention and the Paris Agreement, including – in relation to the development of innovative financial instruments on climate change; 4) to evaluate the progress and results towards fulfillment of the obligations undertaken by the RA and provisions deriving from the Convention and the Paris Agreement of the Convention. 5) to coordinate and control the adaptation and climate change mitigation measures at national level, as deriving from NDC of the RA under the Convention; 6) to submit recommendations to the relevant state and local self-government authorities, academic community, non-governmental organizations, legal entities representing in the relevant areas, related to the fulfillment of the obligations undertaken by the RA deriving from the Convention and the Paris Agreement; 7) to approve annual report on the Council activities; 8) to accept the reports on the results of the activities of the standing and ad-hoc inter-agency working groups.

Functions	The decree established the roles and responsibilities of the Chairperson, deputy chairperson, members, and Secretariat. The compositions and rules of procedure of the working groups are established by Deputy Prime-Minister Decree N 894-A from 04 Nov. 2021. 
Working groups	1) on national reporting commitments under the Convention; 2) on climate change mitigation and adaptation; 3) on financing issues.
Sessions	• One session at least once every six months • More than half of the members participation is needed to the session be valid. • Representatives of other state authorities, professionals on the issues included in the agenda of the Council, experts of inter-agency working groups, representatives of scientific, educational, international, non-commercial and commercial organizations, as well as mass media, may be invited. • At least 5 working days prior to the session, the Secretariat shall send (provide) the draft agenda of the session, including the required documents related to the issues to be discussed and other information to the members of the Council and other invited persons. • The Secretariat shall send (provide) the minutes of the Council sessions or the extracts from the minutes to all the members of the Council within 5 working days after the session
Dissemination	It must be published in the official websites of the Government of the RA and the MoE: • Decisions adopted by the Council and the summary outcomes of the discussion of the issues included in the agenda of the Council session, within 5 working days after the session. • The annual report on the activities of the Council, by January 31 of each following year.

According to the above, it is identified that this decree does not detail MRV functions or members of the working groups. It is considered relevant to make subgroups with more specific topics such as relevant sectors in terms of GHG and adaptation. Additionally, it is considered that due to the nature of the council, the central issue being climate change, the participation of other actors such as civil society, academia and the private sector is necessary, which may be present as observers who will be invited as agreed.

It is considered that the Council is a relevant institutional arrangement with the potential to carry out specific MRV activities and that it serves as a meeting point between those responsible for the issues involved in climate change, for which it is important to establish specific working sub-groups and functions, in order to make synergies that allow the efficient contribution and transfer of information, simplify efforts between the entities and actors involved and guarantee impartial quality control processes.

Recommendation R2 refers to establishing the IACC as the main institutional arrangement for addressing and managing the MRV system and the amendments that would be necessary to strengthen its functioning,

Statistics Committee

The Statistics Committee is the main producer of official statistics in the Republic of Armenia. The Committee coordinates all activities related to the development, production and dissemination of official statistics through the system of national statistics, except for the Central Bank of the Republic of Armenia. According to its website (https://armstat.am/en/?nid=51) the Statistics Committee has the following functions:

- Implements the development, production and dissemination of official statistics according to the statistical programs;
- Conducts sample surveys according to the methods, sampling and conduction order defined by the State Council;
- Conducts comprehensive censuses by the order defined by law;
- Collects statistical data (including from administrative registers) through statistical documents defined by the State Council;
- Maintains statistical, including business registers;
- Maintains statistical databases;
- Collects necessary statistical data from citizens on their living conditions, socio-demographic status, households, etc.
- Implements Statistical Information Collection Program each year at the expense of the means provided by the state budget of the Republic of Armenia by the order defined by law;
- Concludes cooperation agreements, memorandums of understanding, adopts joint orders with the bodies implementing official statistics of other states, international organizations, state and local self-government bodies in accordance with the procedure defined by law and other legal acts;

- Defines a systematic dissemination policy for other producers of official statistics according to the procedure defined by the State Council for the transparent application in the national statistical system, as well as a general terminology for dissemination of official statistics;
- Coordinates all activities related to the development, production and dissemination of official statistics in the national statistical system, except for the Central Bank of the Republic of Armenia;
- Examines cases of administrative offenses by the order defined by law.

Due to its powers and impact on policies, it is considered that this entity contributes substantially to the work carried out by the MoE regarding the inventory of GHG emissions, as one of the main providers of information, and that due to those powers that has by law, potentially its support could be greater. However, stakeholder consultation is required to establish the information gaps that can be covered with the support of the Statistical Committee, and how they can improve the information gathering processes.

Public Services Regulatory commission

The Public Services Regulatory Commission (PSRC) is relevant for several sectors in the country[6]:

- energy and telecommunications: provides tariff policy implementation and issues licenses, allocates radio frequencies;
- water sector: implements the tariff policy and issues permits to use water systems;
- postal sector: performs tariff regulation of universal services;
- railroad transport sector: calculates and approves the fee for using of the infrastructure
- transport vehicles: performs technical checkup and sets tariffs for provision of services.

Due to the above and being an operating entity that generates a large amount of information, it is an important provider of information for the GHG inventory.

3.2. Institutional arrangements for data exchange and reporting

The current institutional arrangements are not official but have allowed the systematic realization of a precise GHG inventory for compliance with international obligations. However, it should be considered that the MRV system will also include, in addition to the inventory, the monitoring of mitigation and adaptation actions, as well as the financing required and obtained for the implementation of climate policies.

[6] https://erranet.org/member/psrc-armenia/

3.2.1. GHG inventory

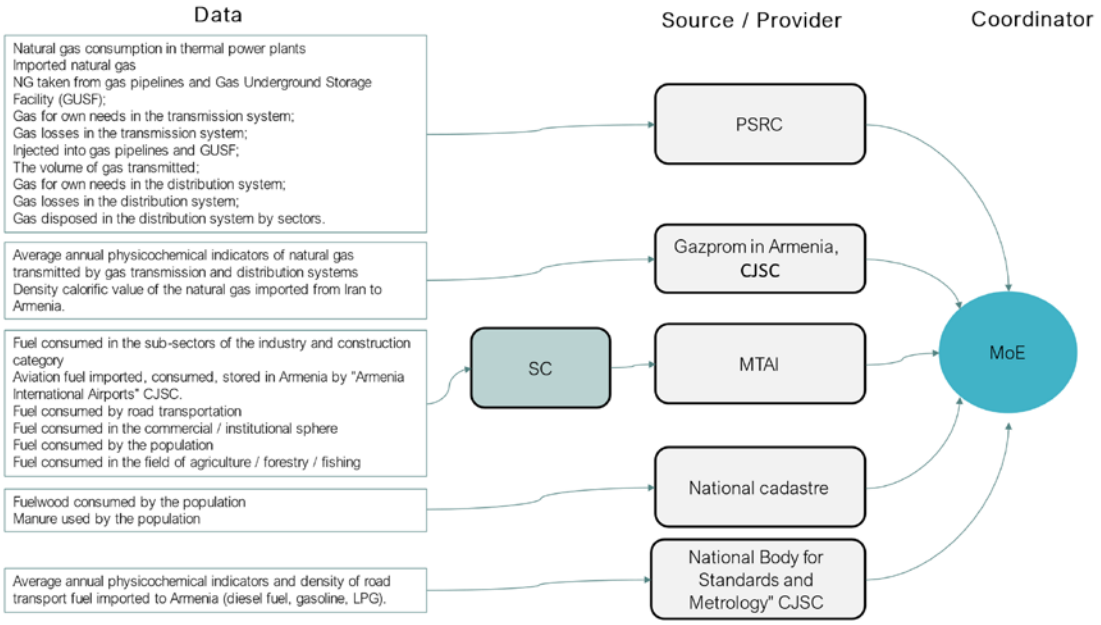
Typically, the inventory is carried out with contributions of information by various ministries, committees and from specific industries, which is collected by the MoE, who sends the information to sectoral experts, to finally be validated by the IACC.

Figure 10 Institutional arrangement for the GHG inventory

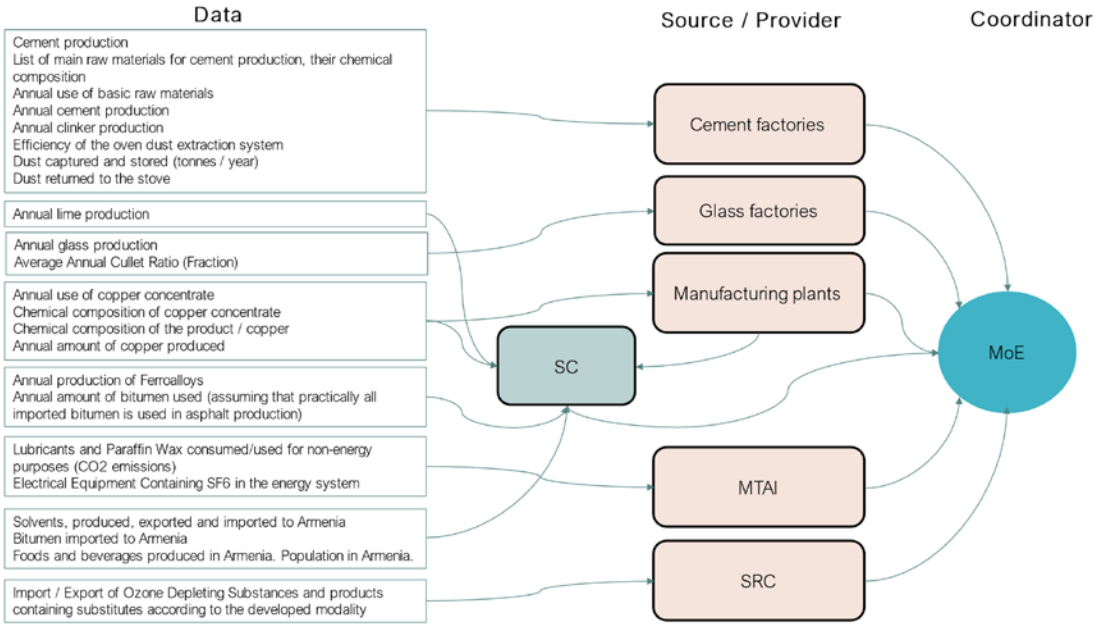
There are key stakeholders that provide information for various sectors and categories of emissions such as the MTAI and the statistics committee. However, there is also information that is taken directly from public reports or statistics. The following images show the specific data provided by the different actors and the flows and information up to the MoE.

Figure 11 Institutional arrangements of data provision for the GHG inventory

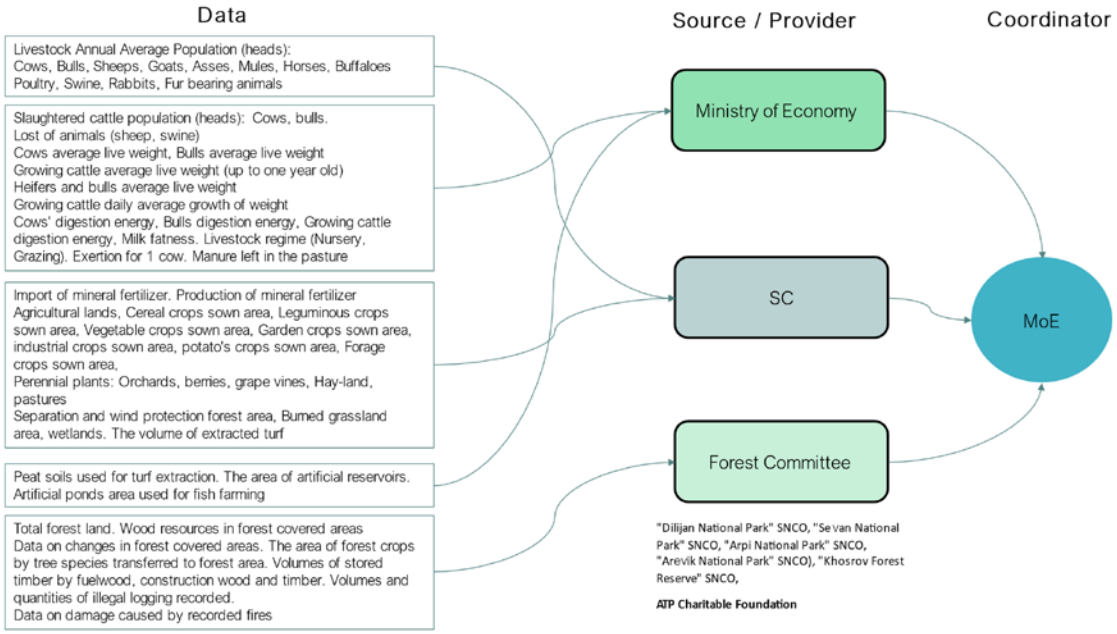
Energy


Data
Source / Provider
Coordinator
Natural gas consumption in thermal power plants
Imported natural gas
NG taken from gas pipelines and Gas Underground Storage Facility (GUSF);
Gas for own needs in the transmission system;
Gas losses in the transmission system;
Injected into gas pipelines and GUSF;
The volume of gas transmitted;
Gas for own needs in the distribution system;
Gas losses in the distribution system;
Gas disposed in the distribution system by sectors.
Average annual physicochemical indicators of natural gas transmitted by gas transmission and distribution systems
Density calorific value of the natural gas imported from Iran to Armenia.
Fuel consumed in the sub-sectors of the industry and construction category
Aviation fuel imported, consumed, stored in Armenia by "Armenia International Airports" CJSC.
Fuel consumed by road transportation
Fuel consumed in the commercial / institutional sphere
Fuel consumed by the population
Fuel consumed in the field of agriculture / forestry / fishing
Fuelwood consumed by the population
Manure used by the population
Average annual physicochemical indicators and density of road transport fuel imported to Armenia (diesel fuel, gasoline, LPG).
PSRC
Gazprom in Armenia, CJSC
SC
MTAI
National cadastre
National Body for Standards and Metrology" CJSC
MoE

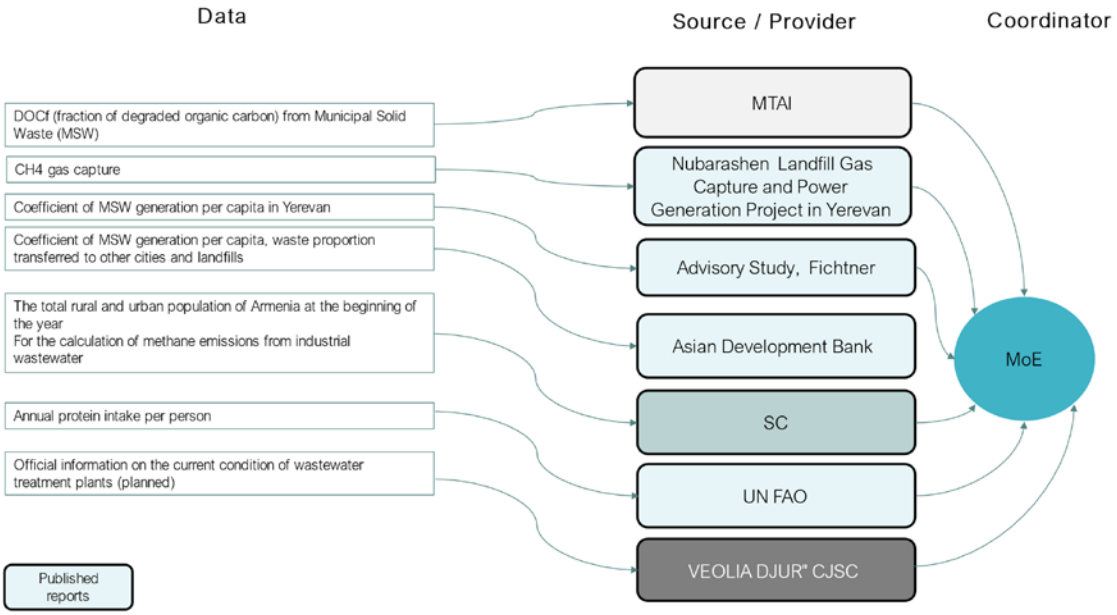
IPPU


Data
Source / Provider
Coordinator
Cement production
List of main raw materials for cement production, their chemical composition
Annual use of basic raw materials
Annual cement production
Annual clinker production
Efficiency of the oven dust extraction system
Dust captured and stored (tonnes / year)
Dust returned to the stove
Annual lime production
Annual glass production
Average Annual Cullet Ratio (Fraction)
Annual use of copper concentrate
Chemical composition of copper concentrate
Chemical composition of the product / copper
Annual amount of copper produced
Annual production of Ferroalloys
Annual amount of bitumen used (assuming that practically all imported bitumen is used in asphalt production)
Lubricants and Paraffin Wax consumed/used for non-energy purposes (CO2 emissions)
Electrical Equipment Containing SF6 in the energy system
Solvents, produced, exported and imported to Armenia
Bitumen imported to Armenia
Foods and beverages produced in Armenia. Population in Armenia.
Import / Export of Ozone Depleting Substances and products containing substitutes according to the developed modality
Cement factories
Glass factories
Manufacturing plants
SC
MTAI
SRC
MoE

AFOLU



Waste



As mentioned, although the sources of information are established, during the stakeholder consultation it was confirmed that the information exchange process occurs in most cases, through an explicit request for information from the different entities. However, who is responsible for generating and sharing the information, as well as response times, is not

regulated. Another relevant aspect to guarantee the quality of the information is that the MoE has access to the technical information that supports the shared data, so that it can trace it back to its origin, especially because there are several gaps and inconsistencies between different sources of information that has been identified (see recommendation R1.4 in Chapter 6).

It is considered that these activities should be regulated based on a regulation that establishes the roles of information providers in the inventory and information flows (R1.3) as well as deadlines in which the information must be shared (R1.1). Another alternative is to carry out inter-institutional agreements (R1.4) that make it possible to strengthen and, in turn, speed up the information exchange processes between various entities.

On the other hand, Armenia is recommended to implement an annual GHG reporting obligation to the industry (R1.5), including third party verification (R4). This will allow to have more precise activity data and include all or most of the industries in the inventory, which will provide relevant elements for the formulation of effective policies oriented to the sector, since specific industries are currently being included in the inventory, but not necessarily all the industries in the country. In addition, it is considered that due to data confidentiality issues, the industry is a difficult sector to approach when it comes to obtaining first-hand information, which can be solved by establishing an MRV obligation for industries as stated in R1.5 (see Chapter 6), where the scope between public and confidential information is clear.

3.2.2. Mitigation / adaptation actions and financing

This component of the MRV system does not currently exist in Armenia, but it is highly relevant for tracking progress towards compliance with the NDC in the long term. Moreover, there are various mitigation and adaptation actions that are currently being implemented.

A mitigation and adaptation project registry should be implemented to keep record of certain mitigation and adaptation actions, as well of supporting related information, where the PPS approach under CAEP project is useful. This registry will have the following purposes:

- Be a repository of information on mitigation and adaptation actions carried out in the country.
- Provide elements in monitoring the implementation of climate policies in Armenia, making it possible to know the status in real time
- Promote the reduction of emissions and vulnerability in all productive sectors of the country
- Verify reductions that are useful for carbon markets
- Registration of new project ideas;
- Review and approval of prospective projects;
- Registration of implemented projects
- Tracking project performance, including the generation of reports;
- Tracking of finance
- Tracking of potential emission reductions through proposed projects
- Generation of project related insights, performance indicators and transparency reports (with respect to Enhanced Transparency Framework (ETF) requirements under the Paris Agreement).

The registry will serve to centralize and automate the information and will have other relevant actors such as project proponents and verifiers, as it is essential to have a third-party verification system to review the project conditions and corroborate the related reductions. See recommendation R3 in the Chapter 6.

3.3. Institutional arrangements in terms of IT

The main question of data management systems setup for Armenia is the placement of responsibility for its IT systems. The responsible agency should be institutionally close to the CCMRV reporting mandate, have sufficient IT operational capacity and budget to carry out the necessary tasks, be recognized as a reliable data custodian and be a logical strategic choice for a potentially evolving mandate.

Table 7 IT recommendations for institutional arrangements

Agency	**Institutional proximity to CCMRV mandate**	**IT operational capacity / budget**	**Current data custodianship recognition**	**Logical strategic choice**
Ministry of Environment	Best choice. The ministry is responsible for the delivery of the corresponding international obligation	Practically non-existent. The ministry's IT is currently delivered by one very capable and dedicated person whose main tasks include end-user, desktop and network support. It is hard to imagine creation of a growth point for a mature IT organization in the coming years	The ministry is recognized for the ability to process and provide data but data is mostly sourced and exported to other entities. Most data custodianship tasks are outsourced to other agencies or, in the case of CCMRV, to UNDP.	Would be the best choice if it had an existing IT organization or a budget to create one.
Hydromet	Hydromet is a structure of the Ministry of	Hydromet possesses some	Hydromet does not act as a custodian of any	Could be considered an option for its

	environment and is therefore institutionally close to the mandate	operational capacity but the maturity of its IT organization is severely insufficient. Its approaches to funding IT mandates (e.g. the use of students) are not appropriate for systems that require sustainable operation.	systems of record at the moment; the system of record for the database it provides data for is maintained by the environmental inspectorate	institutional proximity to the Ministry of Environment but the limited maturity of the IT organization does not allow to call Hydromet a strategic choice.
Armstat	Armstat collects and currently provides the majority of information required of Armenia's climate reporting; it has an environmental statistics department and is as such institutionally close to the CCMRV mandate	There is a budget and a well-staffed IT team in place. Its operational practices are insufficiently mature but the team is aware and actively working to improve them. The capacity to perform the necessary functions appears to be in place, provided the necessary budget for any additional resources.	Armstat is a well-recognized custodian of data across governmental agencies. It is also trusted to handle and aggregate confidential data by the industry.	The best choice considering the existing IT and environmental statistics capacities
Ministry of High Tech Industry	Currently not involved and not aware of the environmental reporting	Has a number of IT resources and probably has mature IT capacity.	No information.	The mandate of MHTI is mainly related to IT governance; it has no plans to run any specific

	mandates			governmental systems either now or in the longer term.
Ekeng	A neutral data broker. Involved in the provision of some data relevant to climate reporting mandates but all such data are provided via third parties (mainly Armstat)	Has well-funded, highly mature IT organization	Recognized data custodian for many critical governmental applications such as taxes, customs, state register etc.	To be explored (not enough information / no meetings with Ekeng so far) Possible pros: the most mature government-owned IT organization, already handles some of CCMRV-relevant data Possible cons: lack of interest to host the CCMRV system, high costs
Ministry of Economy	Provider of a significant portion of inventory data	Most Ministry systems are operating on the basis of simple Microsoft Office based tools, email and EDI; the ministry does not possess a mature IT capacity	The ministry is recognized for the ability to process and provide data but data is mostly sourced and exported to other entities.	Insufficient proximity to the mandate and insufficient IT capacity.
UNDP Armenia	Currently, actual business owner of the CCMRV mandate and	Possesses a small but reasonably mature IT	De-facto custodian of GHG inventory data between	A viable option if the government is willing to continue to rely

	producer of all international climate reporting.	capacity and well-tested data management practices and processes of building the GHG inventory	reporting seasons.	on UNDP services in the long term.

4. MRV conceptualization (CCMRV)

4.1. Components of the MRV system

The Enhanced Transparency Framework (ETF) (presented in Article 13 of the Paris Agreement) establishes some of the new reporting requirements under the Paris Agreement. As a party to the Paris Agreement, Armenia will need to start reporting its emissions, as well as its progress towards achieving NDC, starting from 2024.

The ETF mentions both what needs to be reported (GHG inventory, NDC tracking) and what requirements there are for reporting. Under the current reporting UNFCCC scheme, a country's GHG inventory is reported under the National Communications, with a four-year reporting cycle for developing countries, as well as biennial update reports.[7] Reporting under the ETF is encouraged to take place every two years in the form of biennial transparency reports. The following reporting requirements apply:

- National inventory of GHG (anthropogenic) emissions
- Information necessary to track progress of the country's NDC
- Impacts of climate change and climate change adaptation
- Information on financial, technology transfer and capacity-building support needed and received

All development of new tools and procedures for data collection related to climate change should take into account the reporting requirements of the Paris Agreement.

For the design of an MRV system it is necessary to know the national context as well as the needs that are currently faced in the Ministry of Environment to determine the elements and components that the system must contemplate.

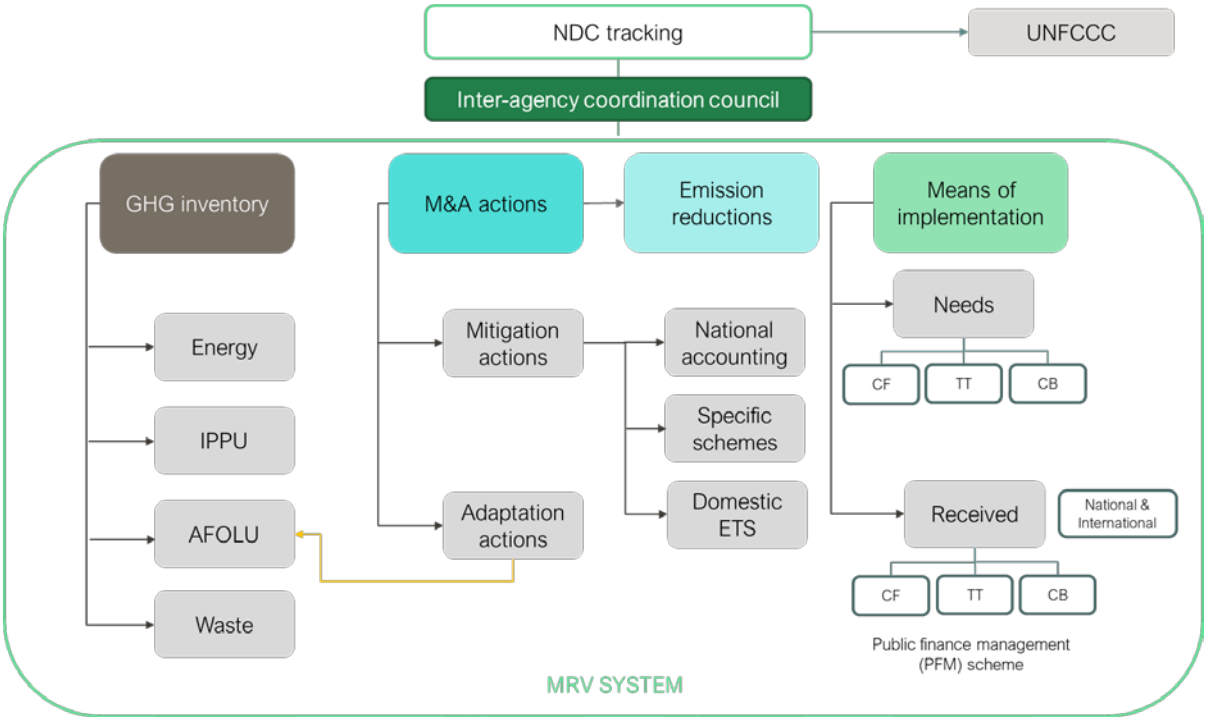
According to Armenia's third biennial update report (BUR3), the basic national MRV system comprises of horizontal inter-agency coordination and verification mechanism under the overall formal coordination by the Ministry of Environment, that has already been established in the country, as mentioned previously. However, legal / formal arrangements are still needed to specify obligations of corresponding institutions in terms of climate-related data provision and quality assurance. Considering this, the following main components are

[7] In practice, a substantial share of countries reported at a much lower frequency

identified: GHG inventory, Mitigation and Adaptation Actions and Support / Means of implementation.

Figure 12 presents the configuration of the components necessary for the MRV system and its subcomponents or elements. The consulting team proposes that the MRV system produces as an output the status of the NDC compliance. However, for the above, it is necessary to determine links between the different components and subcomponents of the system to avoid duplication of information and accounting for both, emissions and reductions.

Figure 12 MRV components according to needs in Armenia

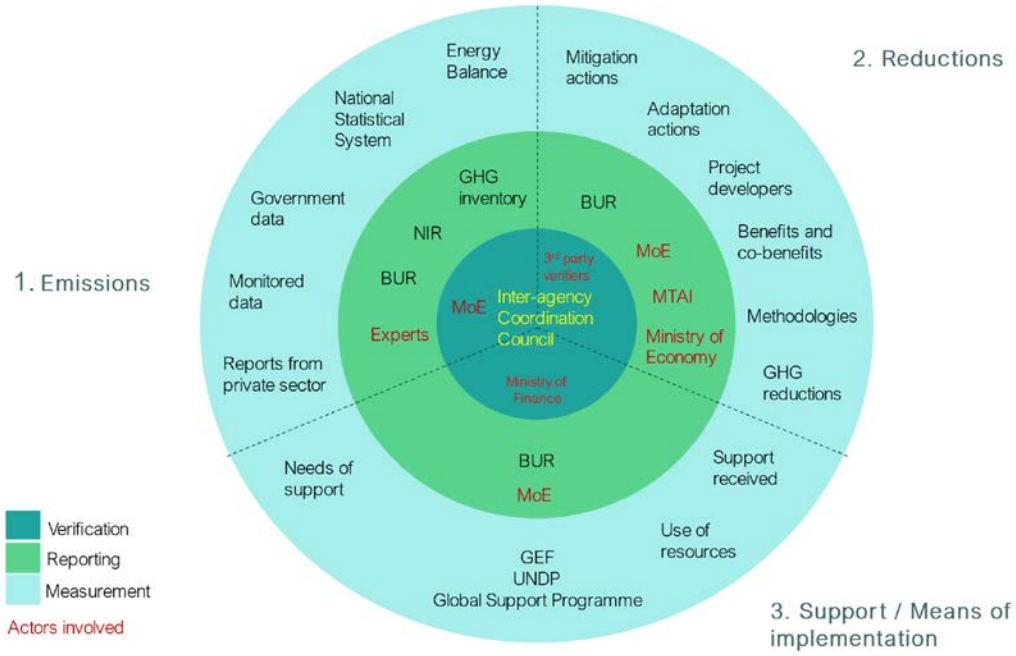


IPPU: Industrial processes and product use; AFOLU: Agriculture, Forestry and other land uses; M&A: mitigation and adaptation; CF: Climate finance; TT: Technology transfer; CB: capacity building; ETS: Emission Trading System

Source: Own elaboration based on information from the third BUR.

Another way to visualize how the MRV pieces fit into the entire system is the following diagram that summarizes the relevant aspects and actors in measurement, reporting and verification, based on the fact that the system will fulfill the function of repository of information for: 1) emissions (inventory), 2) reductions (relative to projects / policies), and 3) financing. The measurement part shows the milestones to be collected and the main sources of information; On the side of the reporting, it is shown where all this information will be reflected (e.g. BUR), and in the central part of verification is the IACC that corresponds to the main institutional arrangement that acts as a validator of the information. However, other actors must be added when incorporating a project registry (third party verifiers), in addition to the fact that there may be other instances that are validators of specific information (e.g. MoE).

Figure 13 MRV structure



The following sections establish the main characteristics of each component of the proposed MRV.

4.1.1. GHG inventory

The national GHG inventory is used to quantify the country's GHG emissions in the sectors: Energy, IPPU, AFOLU and Waste, which has been carried out from 1990 to 2017. The estimates of each sector in the different categories require various efforts for the generation, compilation, validation, management and safeguarding of information, in addition to the application of specific methodologies. In the case of Armenia, the inventory uses the 2006 IPCC guidelines.

The national GHG inventory includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrochlorofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) and they are expressed in units of mass and by carbon dioxide equivalent (CO_2 eq.) using the Global Warming Potentials (GWPs) in the IPCC Second Assessment Report (SAR).

In 2017, the national GHG emissions were 10,624 Gg CO_2 eq. (excluding Forestry and Other Land Use) and net emissions including sinks were 10,153 Gg CO_2 eq. 3% higher than the previous year, due to:

- Increasing in power generation – exports
- Cold winter (residential sector)
- More energy for transportation due to vehicle fleet growth
- Increasing of construction sector – more cement volume required

The categories that are included are shown in Table 8.

Table 8 GHG inventory covered sectors

Energy	IPPU	AFOLU	Waste
• Main Activity Electricity and Heat Production • Residential • Commercial / Institutional • Manufacturing Industries and Construction • Agriculture/Forestry/ Fishing/ Fish Farms • Road transportation • Other transportation • Fugitive emissions	• Mineral Industry - cement, lime and glass production • CO_2 emissions generated from lubricant and paraffin use, emissions of F-gases (HFCs) from refrigeration, air conditioning and other product use, as well as • Emissions of SF_6 from use of electrical equipment.	Agriculture • Urea application, CO_2 • Biomass burning, CH_4 • Indirect N_2O Emissions from manure management, N_2O • Manure Management, N_2O • Manure Management, CH_4 • Managed soils, N_2O • Enteric Fermentation, CH_4 Forestry and Other Land Use (Land category)	• Solid Waste Disposal • Incineration and Open Burning of Waste • Wastewater Treatment and Discharge

The inventory estimations are based on the following methodologies:

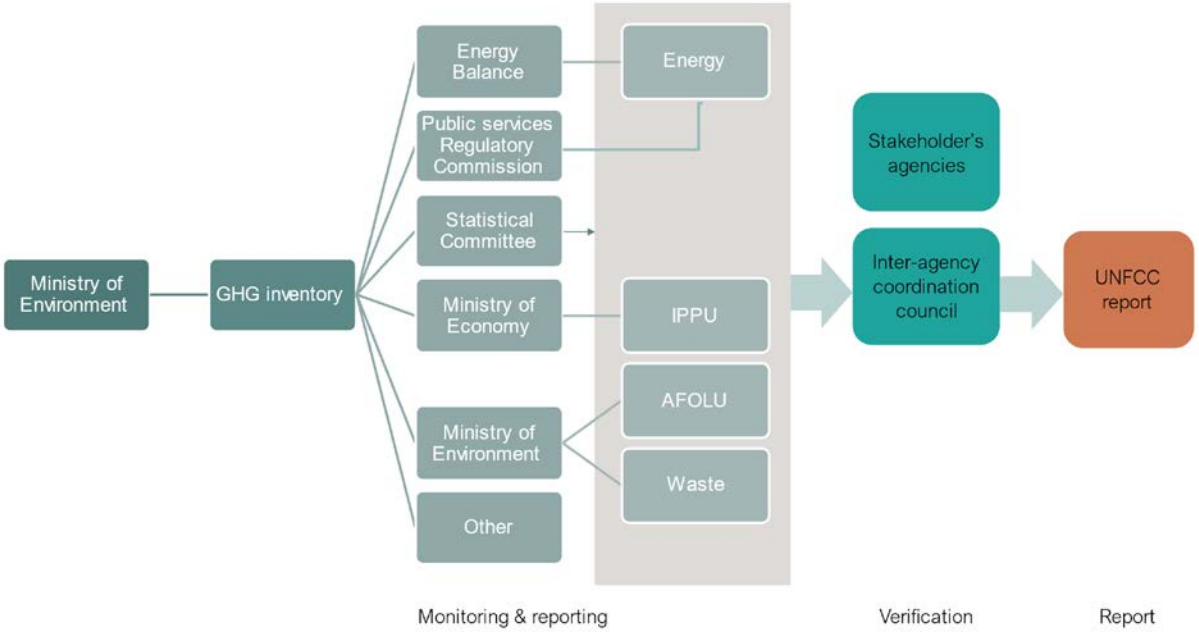
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The IPCC Inventory Software version 2.69.7235 was used for data entry, emission calculation, results analysis and conclusions.
- Good Practice Guidelines and Uncertainty Management in National Greenhouse Gas Inventories" (IPCC 2000)
- "Good Practice Guidelines for Land Use, Land Use Change and Forestry" (IPCC 2003) and
- 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetland as well as if needed "1996 IPCC Revised Guidelines for National Greenhouse Gas Inventories" were also used during the preparation of the National Inventory for default values of certain parameters.

GHG inventory institutional structure

Figure 14 shows that the Ministry of the Environment is the entity responsible for preparing the inventory and to coordinate the main information providers in the different sectors.

Likewise, it points out that the integration of the inventory implies the review of specific agencies and the IACC before sending it to the UNFCCC.

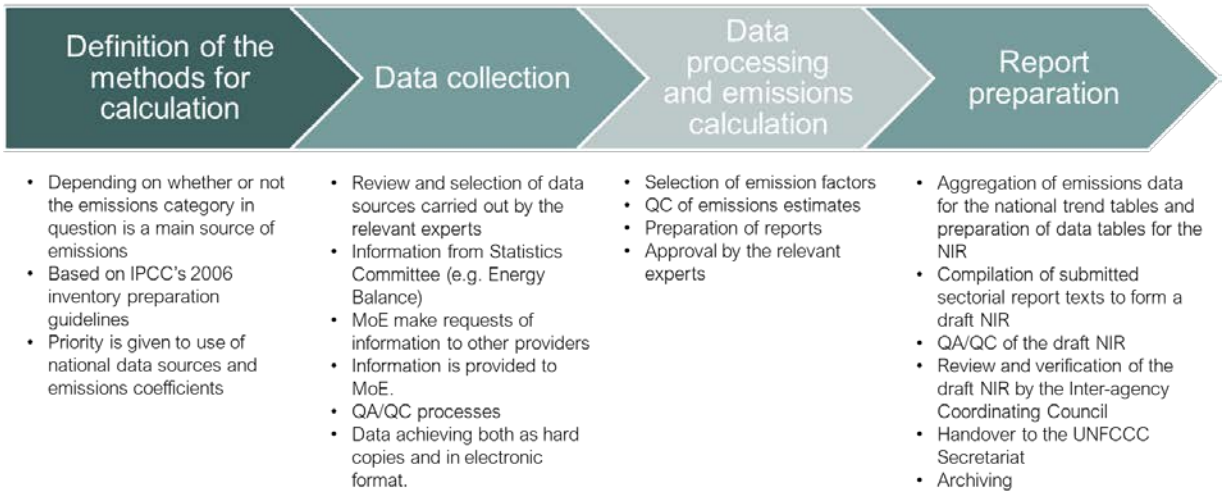
Figure 14 Main actors involved in data collection for GHG inventory



Data collection processes

The MoE, as the inventory coordinator, carries out various tasks related to the compilation, management and safeguarding of information from different sources of information, which entail efforts for its treatment, validation and methodological application. However, these functions are not officially established in any regulation. The main tasks related to data collection and management are found in the diagram in Figure 15.

Figure 15 GHG inventory data related processes



Source: BUR3

The activities carried out for the integration of the last inventory (2017) are mentioned below (based on BUR3).

- Development of "Questionnaires" by sectors to clarify requirements for activity data.
- Close collaboration has been established between the GHG Inventory development expert team and the Statistics Committee (SC) to improve the accuracy/quality and consistency of data collected by SC within Household Survey.
- Improvement of the accuracy of activity data on emissions and removals
- Improvement of the completeness of the inventory
- Improvement of the quality control processes.
- National capacity building for GHG Inventory development.

Armenia has made a great effort to comply with the obligations regarding the presentation of the NIR, carrying out the necessary activities and involving the necessary technical team. In particular, Armenia has been an active participant in the international consultation and analysis (ICA) process was established under the auspices of the UNFCCC. As stated by the UNFCCC8, "*The enhanced transparency framework (ETF) under the Paris Agreement builds on the existing transparency arrangements under the Convention including the ICA. The ICA process provides an essential learning opportunity for Parties and stakeholders to better prepare for the ETF*". Armenia has already taken part in three rounds of technical analysis of BURs (corresponding to the country's three BURs), the latest round of technical analysis being undertaken end November/beginning December 2021. This active

[8] https://unfccc.int/ICA

participation in the ICA should therefore have been valuable to Armenia with respect to preparations for the ETF.

However, it is required that the actions that are carried out in practice be established in a regulation that provides robustness to the procedure and institutional arrangements required for the preparation of the inventory. Likewise, issuing a regulation for the inventory will avoid regulatory gaps that cause delays or put the credibility and certainty of the information at risk. It should be noted that the establishment of a regulation will make it possible to include aspects that address the needs identified by the corresponding technical teams. The overall legal framework for the inventory requires a climate change law and a specific GHG inventory decree and technical guidelines, to properly address different type of aspects to regulate from the reporting obligation to UNFCCC to the specifications of the elaboration process. See details in recommendations R1.1 and R1.3 of Chapter 6.

4.1.2. Mitigation and Adaptation actions

The systematization of information related to both mitigation and adaptation actions that are being carried out in Armenia is required, as they are actions taken as a whole and represent the country's effort to mitigate the effects of climate change and reduce vulnerability. Currently, a large part of the mitigation actions is carried out in the Energy sector, however, the information is not centralized and is not necessarily quantified, so it is important that the MRV system has a component where it is easy to find the information by type of project, its status, cost and financing, characteristics and results.

According to the BUR3, data collection and quality control of mitigation measures that are being implemented in the country are the main challenges faced while developing BURs, as these measures are not coordinated and there are risks of overlooking mitigation actions or double counting reductions. To address these risks, quality control procedures have been performed, which included the analysis of obtained data and their cross-checking using the publicly available data, as well as assessing the progress of those mitigation actions, which have been reported in the BUR2. These are followed by discussions with the data providers and clarifying data as needed.

Within the MRV system, the component will act as a channel for recording information related to mitigation and adaptation actions as projects implemented under national or international schemes that are quantifiable, reportable and verifiable, promoting environmental integrity, transparency, accuracy, completeness, comparability and coherence. that avoid double counting of these reductions, including:

- Policy-related projects such as Energy Sector Development Strategic Program
- Nationally Appropriate Mitigation Actions (NAMA);
- Programs and Projects under the mechanism for Reducing Emissions due to Deforestation and Forest Degradation (REDD +);
- Projects that act under the Clean Development Mechanism (CDM) defined by the Kyoto Protocol;
- Projects within the framework of national and international markets, regulated and voluntary;
- Other reduction programs and actions with MRV systems for different sectors, admitted by the Ministry of the Environment.

Mitigation actions

The sectors in which mitigation actions are currently carried out in the country are:

Table 9 Mitigation actions planned or implemented in Armenia

Sector	Action
Power	• Construction of medium utility-scale solar PV power plants • Construction of the larger utility-scale solar PV power plants • Commissioning of Solar PVs with capacity of up to 5 MW • Commissioning of small Hydro Power Plants (SHPPs) • Upgrade of distribution networks implemented by the Electric Networks of Armenia
Transport	• Strategy program for the optimization of public transport (PT) • Re-equipment of public electric transport (trolleybuses) pool and infrastructure • Re-equipment of public electric transport (Yerevan Metro) • Conversion of Yerevan public and private vehicles to Compressed natural gas (CNG) • Improvement of road infrastructure • Optimization of municipal transport and improvement of management efficiency (including in terms of garbage-removal and sanitary cleaning vehicles and machinery) • Yerevan Bus Project • Promoting fuel switching to electricity in transport
Buildings	• "De-risking and Scaling-up Investment in Energy Efficient Building Retrofits" UNDP-GCF project • Yerevan Energy Efficiency in Public Buildings • Household Energy Efficiency Mortgage Loans • Investments for energy efficiency repair works and lighting in municipal buildings • Loan Mechanisms for Increasing Energy Efficiency in Multiapartment Buildings (MABs) • Access to Renewable and Efficient Energy in Municipalities Vayk and Spitak (AREEM) Project
Lighting	• Supporting Communities of Armenia to Adopt and Implement Climate Smart Solutions UNDP-GEF • Green Urban Lighting • Yerevan Street Lighting • Gyumri Street Lighting • State subvention program of the RA Government in 2018-2019 • Bright Border
Small and medium-sized	• Energy Efficiency Program for SMEs (GAF-EE) • Promotion of Renewable Energy • Investments in green technology (RE and EE) for Small and medium-sized enterprises (SMEs) and corporates

enterprise (SME)	• Support the development of EE lending product within the commercial banks, enabling households and business customers to take loans for EE improvements • "Enhancing SME competitiveness through promotion and wider use of sustainable innovative technologies"
Demand side renewables	• Autonomous power generators (up to 500 kW) • Reducing "energy poverty" in Armenia's non-gasified rural communities through supporting installation of solar water heaters and PV panels including "Model of accelerated implementation of the SDG 7 on Affordable and Clean Energy" component of the "Innovative Solutions for SDG Implementation in Armenia" Project • EU for Yerevan Solar Community • Community Energy Efficiency /EE/ Project • "EU 4 Armenia's Sustainable Energy" Project: Renewable Energy Promotion Program in Aparan and Artik Communities • GEF Small Grants Programme, UNDP-GEF
Industry	• Production of new type cement • Technology upgrading in cement factory
Agriculture and Land use	• Cattle Breeding Development Program in RA, 2019-2023 • Applying of a new system of pasture management and alternate grazing of animals. • Afforestation and reforestation works (planting). • Installation of solar photovoltaic panels and water heaters, provision of energy saving stoves. • Introduction of management system and restoration of degraded pastures, grasslands and arable lands
Waste	• Nubarashen Landfill Gas Capture and Power Generation CDM Project • Kotayk and Gegharkunik Solid Waste Management Project • Solid Waste Management in Yerevan • Integrated Solid Waste Management System in Vanadzor

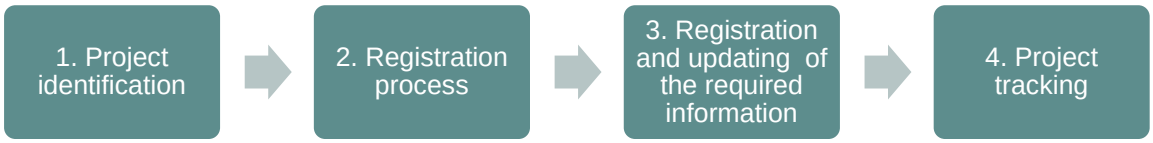
Source: BUR3

As a result of the experience in the implementation of mitigation actions in Armenia, the following barriers have been identified:

- Collection and quality control of data needed for assessment of the mitigation actions and their effect
- Many actors involved in implementation of mitigation actions at various levels, coupled with the lack of general coordination / monitoring of mitigation measures implementing in the country
- Risks of overlooking some key actions or of double counting reductions
- Lack of a formal MRV system for support does not provide for the accurate tracking of the climate-related financing received.

From the above, it can be concluded that most of the mitigation actions are related to the energy sector (mainly energy efficiency and renewable), although they are implemented in other sectors. To implement this component in the MRV system it is necessary to establish a registration process for project proponents that includes the following stages:

Figure 16 Mitigation projects registration in the MRV system



The description of the process is shown in the recommendation R3.1 in the Chapter 6 of this report.

4.1.3. Climate finance / Support / Means of implementation

This component within the MRV system, aims to collect, trace, and systematize storage of information pertinent to the means of implementation to carry out effective actions against climate change, facilitating the development, dissemination and deployment of technology, access to financing and aspects related to education, training, and awareness of Armenian society in a transparent, timely and clear manner.

The financing of climate mitigation and adaptation projects is often broadly divided into *carbon* and *climate finance*. We will in the following section describe each of these sources of finance and list some examples of each of these sources.

Carbon and climate finance

Carbon finance is defined as *"payment in exchange for transfer and ownership of verified greenhouse gas emission reductions, which can potentially be used to meet the purchasing country's emission reduction obligations"* (Carbon Limits 2018). This means, for example, that a solar project may earn revenues from delivery and sales of emission reductions to a carbon market (or through bilateral trade) in addition to revenue from energy generation.

Climate finance is, more broadly, defined as "*financial flows directed towards low-carbon and climate-resilient development interventions with direct or indirect greenhouse gas mitigation or adaptation benefits"* (Carbon Limits 2018). The Green Climate Fund is an example of an institution providing climate financing.

Carbon Finance

The principal source of carbon finance has until now been the **Clean Development Mechanism** (CDM) of the Kyoto Protocol. The first CDM project was approved and registered in 2004, and since then some 7500 projects have been registered. In many respects, the CDM has been a great success with a total of 400 billion US$ being invested

in projects and 1,500 million tonnes CO_2 emissions reductions being achieved. The price paid for emission reductions peaked at a level above US$ 30 per tCO_2eq emission reductions in 2009 and then gradually declined until the CDM carbon market collapsed in 2012 as demand fell sharply. The Kyoto Protocol expired in 2020, giving the floor to the new cooperative approaches under the Paris Agreement and its Article 6. Mechanisms under Article 6 go beyond a single market for emission reductions (which is established under paragraph 6.4 as a mechanism to contribute to mitigation and support sustainable development), but will also include opportunities for bilateral cooperation (paragraph 6.2) and allow for non-market approaches (paragraph 6.8).

Another type of carbon finance schemes outside the Paris Agreement and the CDM are the **voluntary carbon markets**. They cover sales of emission reductions to entities that voluntarily choose to reduce emissions using offsets. Unlike the CDM, projects and verified emission reductions are not reviewed and approved by UNFCCC institutions, but by independent governing bodies that oversee the respective voluntary standards. There are different market segments and standards for approval of voluntary offsets[9] which have similarities to the CDM rules and procedures, but typically are selective with respect to project types and sectors being eligible.

Climate Finance

Climate finance can largely be divided into the UNFCCC climate finance and other types of climate finance.

UNFCCC Climate Finance

Financial support to developing countries for climate change mitigation and adaptation has been an important issue since the UNFCCC entered into force in 1994. An important milestone was reached at the annual UNFCCC conference in 2011 with a target set for US$ 100 billion per annum by 2020 to be transferred from developed to developing countries, including both public and private climate-related financing. Below are some sources of UNFCCC climate finance:

Bilateral funding from developed countries is a significant source of climate finance. In addition to national development agencies and finance institutions of developed countries, this category includes funding to the Global Environmental Facility (GEF) and the Green Climate Fund (GCF). GEF has been in operation for more than 20 years following the “Earth Summit” in Rio 1992, and has a broader mandate than climate financing. For GCF, which is focused entirely on climate change mitigation and adaptation, the first funding decision was made in 2015 and, as of the beginning of 2021 some 158 projects have been funded with a total committed amount of GCF funds of US$ 7.2 billion, anticipating that 1.2 billion tonnes of CO_2eq have been avoided[10]. GCF offers a variety of financial instruments, including grants, concessional loans, subordinated debt, equity, and guarantees.

[9] Two important standards are the Verified Carbon Standard (VCS) and the Gold Standard. See http://www.v-c-s.org/ and http://www.goldstandard.org/

[10] https://www.greenclimate.fund/

Multilateral Development Banks include the World Bank Group, the Asian Development Bank, the African Development Bank, the Inter-American Development Bank, the European Bank for Reconstruction and Development and the Nordic Development Fund.

The third important category under UNFCCC Climate Finance is private finance being mobilized by public climate finance.

Other sources of climate finance

Other Climate Finance covers a broad range of funding sources, both public and private, and funds allocated both to investments in developed and developing countries[11]. The Climate Policy Initiative (2019) estimated average annual climate-related global finance flows at US$ 579 billion in the period 2017-2018. Financing of investments in renewables is the largest component of this and makes up close to 60 % in the years 2017-2018.

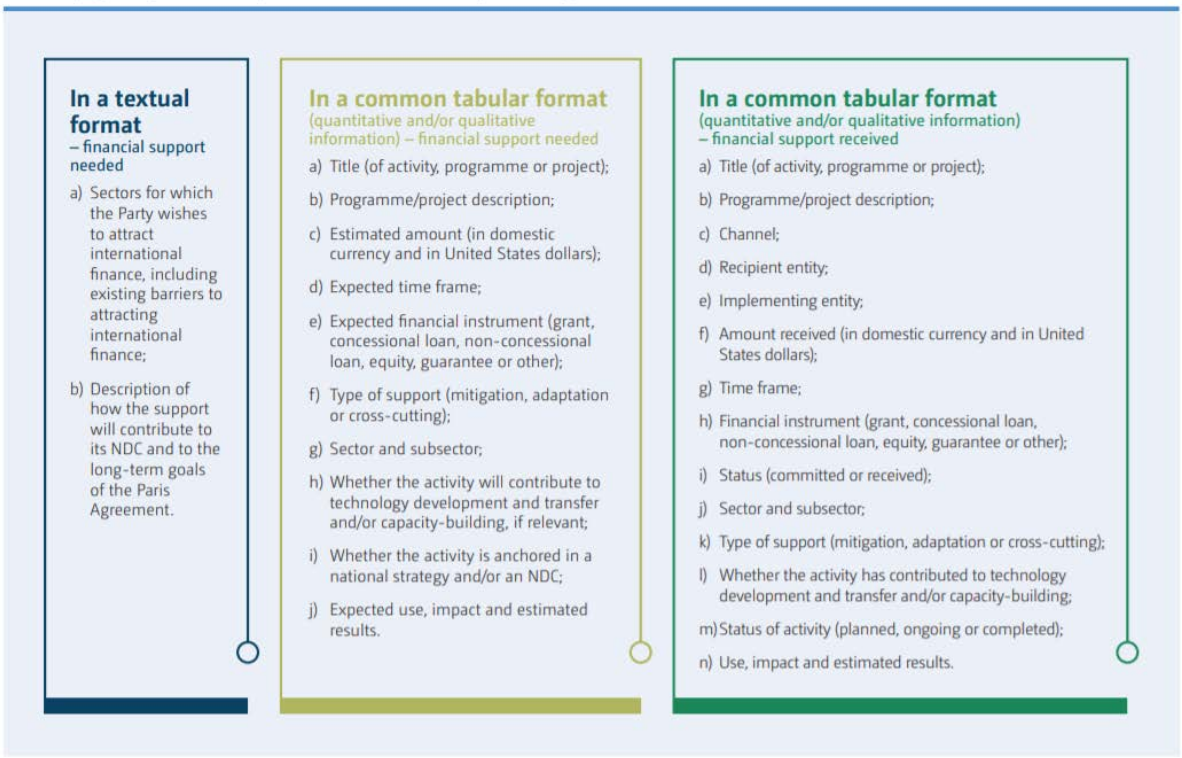
Green Bonds are falling into this category and are any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible “green projects”.

Under the Paris Agreement, the parties agreed to a standard format for developed countries to follow, when reporting on the carbon and climate finance they provide to developing countries. Similarly, developing countries should[12] report on carbon and climate finance received and needed in their Biennial Update Report. The information that needed to be reported on is shown in Figure 17.

Figure 17 Information to be reported on financial support needed and received

[11] Domestic climate financing in developed countries is currently a large part of total climate finance.

[12] The obligations of developing/receiving countries is not explicitly treated in the Paris Agreement but the Technical Handbook on reporting under the Enhanced Transparency Framework by UNFCCC (2020), uses the word “should”.



Source: Paris Agreement the Technical Handbook on reporting under the Enhanced Transparency Framework by UNFCCC (2020), p. 44

Armenia needs

According to the BUR3, the received international support is aimed at contributing to the country's low emission development through implementation of sectorial policies and priority programs, as well as the promotion of business solutions which best serve the country's economic and environmental development goals.

The type of received support can be bilateral (mostly grants) and multilateral (mostly debt instruments), in terms of climate finance, technology transfer and capacity building. Thus, the MRV system must contain and systematize this type of information.

Until now, in collecting the data on support received finance information was gained from database of Organization for Economic Cooperation and Development (OECD) and other publicly available sources (program documents and reports, periodic donor reports, financial institutions' data), as well as from the relevant state authorities (BUR 3).

It is worth mentioning that the energy sector received the largest amounts of climate-related development finance, as the key mitigation measures planned for implementation in the period 2017-2021 (being energy sector the substantial contributor to national GHG emissions). However, financial support was also provided in the areas of solid waste recycling, environment protection, agriculture and water resources management.

Based on the above, the needs for the implementation of the Support component in the MRV system are:

- Enhancing capacities to identify financial and technology needs for implementing mitigation and adaptation actions.
- Enhancing capacities to quantify the financial needs for implementation of mitigation and adaptation measures
- The development of a methodology, format and mechanism for the climate change expenditures identification, tagging and calculation, as well as to assess and expand the role of Ministry of Finance in terms of identification, coding, estimating and reporting costs associated with climate change.
- To explore possibilities for tracking financing for mitigation and adaptation activities implemented by municipalities, non-governmental organizations, private sector and donors, to ensure that any climate-related funding in Armenia is considered and consequently reported under the MRV system.
- Important to avoid overestimation of received support in the national MRV system.

This component must be linked to the Mitigation and Adaptation Actions one, in relation to the financing of the projects. For this reason, it is proposed that they are connected in the process of registration of mitigation and adaptation actions, where the information related to financing must be entered. The objective of the registry would be:

- To track emission reductions projects and climate adaptation projects as well as the financing of these projects;
- to attract finance for these projects;
- to facilitate reporting under the Paris Agreement, in particular of finance needed and received

Broadly, the registry would be a database of all climate mitigation and adaptation projects within Armenia, showing the phase status of the projects: idea phase, financed, under construction or constructed and operational. The most important data from the projects registry is primarily the finance needed for climate mitigation and adaptation projects. Secondly it is the expected and/or achieved amount of generated emission reductions (tonnes of CO_2 reduced) related to a project.

The project proponent must provide all the necessary information related to their projects such as sector classification, geographical region of the project, timeline of the project, and particularly the amount of expected and/or achieved emission reductions. The tool, in addition, can generate reports based on what the user (for instance the Ministry of Environment) is looking for. Some examples of reports and information that the tool can generate and what this can be used for in Table 10.

Table 10 Examples of reports

Example of Project registry	Why is this relevant?

Potential emission reductions. This is the equivalent of a report with *all* projects in the registry, irrespective of project status. This can, for instance, be generated for ERs that are to take place after a certain date.	How much the projects in the projects database *potentially* can contribute to in terms of meeting Armenia's NDC can inform climate policymaking
The finance needs for non-financed projects and these projects' mitigation potential	This is indicative of the finance needs that Armenia has in both reaching *and* enhancing its NDC. This can help policymakers encourage investment in this domain. Reporting on finance needs is also a reporting requirement under the Enhanced Transparency Framework (Paris Agreement Art. 13)
The projected annual emission reductions of projects that are either financed or already constructed	This can be an input to the amount of finance received and emission reductions, which are both reporting requirements under the Enhanced Transparency Framework (Paris Agreement Art. 13)
All of the above can be divided into regions or sectors	*This can inform policymakers dedicated to different regions and sectors. I.e., if the transport minister has a responsibility for reaching climate targets in the transport sector, he can use the tool to generate transport-specific reports, such as the potential for mitigation outcomes in the transport sector for years 2022-2030.*

The project also gives information on who the investors/donors are and who the project proponents are. The latter can be useful if a potential donor/investor wishes to approach a project proponent for a potential agreement of finance.

It is also recommended that every public or private person that designs or implements national mitigation or adaptation actions be requested to present the pertinent information on public or private financing, under their own efforts or from financing from international sources designed or implemented at the national and subnational level, including credit instruments, capacity building development and technology transfer, when applicable.

The information that is captured in this "Support" component will be public and available within the CCMRV platform and the accessibility of the entered data must be guaranteed, so that it can be consulted, reviewed and updated as necessary. It should be noted that the system must have the necessary mechanisms for the protection of confidential information and restricted access without violating Armenia's transparency guidelines, procedures or regulations.

For this component, it is recommended that each time a mitigation or adaptation activity is registered, three relevant aspects are identified:

- Type of scheme to which it belongs: Proper identification of the action, indicate if it emanates or is related to a climate policy. This will make possible to identify, and thereby monitor and quantify the emissions and reductions resulting from these policies over time.
- Specify if the reductions will contribute to the NDC compliance.
- Determine the Stage of the project or mitigation / adaptation action: The system will allow, from the registry, to establish the stage of the project in which it is located, from design to completion; This will generate traceability of each intervention in the long term, with which it will be possible to generate reports that contain the history and progress of the registered project, even when it has been concluded. The options of design, implementation and operation stages will be available in the project registry, which means that it will not be possible to register completed projects, but it will be possible to register their completion when this occurs. The design option is particularly important for the needs detection process, although needs can also be identified in the implementation and operation of projects.

4.1.4. NDC tracking

This component should reflect the balance between emissions from the inventory and reductions achieved from mitigation and adaptation actions and should be able to provide the status of NDC compliance.

NDC tracking must refer to unconditional target: 40% reduction below 1990 emissions levels, to be achieved in 2030.

Proper follow-up to the NDC will be reflected as the final output of the platform. For this it is necessary to consider the following.

The Project registry could only allow registration of projects using established and approved methodologies for calculating emission reductions. [13,14] Such a tool will allow for tracking of NDC performance that is also a requirement under the Enhanced Transparency Framework.

It is recommended to link the Project registry with the national inventory of GHG emissions. This allows for assessments of how the implementation of projects affects the total national GHG emissions. Note that this will require further development of the project registry and possibly of the national inventory to make sure that the methods for calculating emission reductions and emissions in the national inventory are aligned (this does not mean that the

[13] Requirements to methodology and verification procedures will vary according to a project's phase: For idea phase projects it may not necessarily be required to use a certain methodology as project proponents may only have a very rough idea of the mitigation potential at this early stage. Projects that are financed but not constructed will not yet be verified but the emission reductions can still be calculated using an approved methodology.

[14] These methodologies will have to be approved by the government of Armenia, and can for instance include CDM methodologies, the Gold Standard, or tailor-made methodologies for an Armenian context that may in part build upon existing methodologies such as the CDM methodologies.

methodologies always have to be the same, but they should allow for emission reductions to be captured in the national inventory).

After doing this, the next step would be to create a transaction registry which can be linked to the project registry. The project registry will include not only planned projects and those under implementation, but also the emission reductions units that are being generated by these projects. If emission reductions are calculated using approved methodologies and are verified for the projects under implementation, the registry could "push" this information to the national carbon registry for emission reduction units. The carbon registry could include information about the volume of units generated, traded, purchased, cancelled, etc. Such a system will require a lot of additional work and should only be implemented if Armenia decided to develop own carbon markets or engage in international cooperative approaches.

5. IT characteristics and requirements

5.1. Participating systems

The only IT system that participates in UNFCCC reporting directly is the inventory system which is based on the IPCC software controlled by UNDP. The Ministry of Environment is commissioning preparation of climate reporting (NCs and BURs) from UNDP in high-level terms; some staff of the Ministry participate in the preparation by providing data, but they are not involved in the preparation of reports directly.

Other systems that participate in the provision of data indirectly:

- Armstat home-grown system
- PX-Web system on armstatbank.am
- MS Access based system of Hydromet
- Systems that support the compilation of the energy balance

No system-to-system communication exists between participating systems and the inventory compilation system at the moment.

5.1.1. Armstat home-grown system

The Armstat system is one of the most advanced systems used by the government. Its backend is implemented in the postgresql database. The frontend is implemented as a number of web-forms producing XML files which are then loaded into the database using custom-crafted ETL jobs.

Armstat is receiving data from around 90 "administrative registers" such as ministries, other state agencies, banks, regional and municipal authorities.

Census data is currently collected using the "CS Pro" software. The software is developed by the US Census Bureau and fed into Armstat systems using custom-crafted ETL jobs. An implementation of another CAPI software is planned for the next census.

Data from larger and highly secure state systems such as the police, tax authority and state register are obtained via an API provided by the state-owned Ekeng data broker and system operations company.

Aggregation and reporting, as well as the preparation of data for display on armstatbank.am website, is implemented using internally developed software solutions.

The maintainers of the system are not aware of contacts between UNDP or the Ministry of Environment regarding the data: it is assumed that all data are either obtained from public reports, armstatbank.am website or through subject matter departments of Armstat without specialized IT support.

In general, the Armstat system comes across as well maintained and supported by a competent IT team. IT HR risks (see below) aside, Armstat systems should become dependable partners of the CCMRV systems and Armstat may be a good place to host and support the CCMRV system itself in future arrangements.

5.1.2. armstatbank.am

The armstat.am service is a system based on the proprietary PX-web software developed in ASP.Net and using a proprietary PX file format as data source. The software implements a generic browser for statistical data that returns data in HTML pages and may also export CSV and Excel files. The software is set up exclusively for human use i.e. it does not offer JSON outputs or any API that would be usable for system-to-system communication.

5.1.3. Hydromet database

Hydromet is collecting data about pollutants and greenhouse gases from a large number of observation points. The data is collected daily from 15 active monitoring stations which are capable of reporting levels of SO2, NO2, dust and ozone, and 220 passive observation points that are polled for samples on a weekly basis. Samples from passive observation points are processed in one of two laboratories which provide data in the form of MS Excel sheets sent by email.

There are also five automatic monitoring stations that are capable of reporting the levels of CO, but these stations are currently offline.

The database is kept in an MS Access database. In order to ensure the integrity of the master copy, the entry right belongs exclusively to the environmental inspectorate. Hydromet is sending collated data to the inspectorate and receives new versions of the MS Access database file for analysis.

The same database also keeps track of environmental permits and provides analysis and comparison between permitted pollution and monitoring data.

The permit system is working on the basis of “volume of air *used*” by a company i.e. the minimum volume of air that, having been polluted by the company, would still pass as having permitted levels of pollutants.

The inspectorate is the official holder of the administrative register and provider of Hydromet data to Armstat.

The present arrangements and the discussion of future development plans with Hydromet representatives paint a picture of insufficient IT organization maturity. Hydromet may indirectly benefit from the development of the CCMRV system but the reliance of the CCMRV system on Hydromet's databases, if any, should be very well circumscribed and limited, with backup arrangements in place wherever possible.

5.1.4. Energy balance

<tbd>

5.1.5. Project Portfolio System

The project portfolio system (PPS) was developed with assistance from the NDC Partnership using the services of Instigate Mobile, an Armenian software company. The aim of the PPS is to capture, track, monitor and report on mitigation and adaptation projects, as well finance needed and received. On the face value, the system presents itself as a valid choice for the MRV Mitigation and Finance parts of the CCMRV system.

At the moment of writing, the system has not been implemented by the government. The vendor is providing training and NDC Partnership facilitators support the government in undertaking the necessary steps to launch the system; at the same time, the future of the system is currently uncertain and there are no regulations mandating its use by any agency.

5.2. Independent development plans

A number of consultations have shown that governmental systems are currently undergoing a large amount of churn and evolution. Although these recommendations follow the provided by the UNDP to assume no change in the systems landscape, there are important independent developments that any implementer of the CCMRV system will need to take into account.

5.2.1. Upgrade of Armstat systems

There is an outstanding major upgrade and rewrite of Armstat systems for which a procurement action is outstanding. Armstat expects the procurement to result in a more integrated system and a reduction of internal manual data entry or email (or EDI) transfer of Excel files.

<tbd: data on APIs from ToR for the new system - pending ToR>

5.2.2. Upgrade of the Hydromet system

Hydromet is working on an in-house upgrade of its system. The new system will be based on the PHP Laravel framework and the MySQL database.

5.2.3. Introduction of IT governance guidelines

The Ministry of High-Tech Industry (MHTI) is responsible for IT governance arrangements in governmental systems. The ministry itself and the team in charge of IT governance are quite young and it is expected that the introduction of governance guidelines across the

government will be gradual and start around mid 2022, with the aim of full implementation in the beginning of 2023.

The ministries and other state agencies will be allowed some time (currently communicated as three to four months, which is unlikely to be realistic) to achieve compliance; at the same time, MHTI does not presently have an enforcement mandate or budget to support activities necessary to achieve compliance. The actual implementation of their governance guidelines will therefore depend on the willingness of other government agencies to comply and the availability of budget to do the necessary changes in their IT systems.

The governance regulations are expected to stay at a high level for the beginning of operation and mainly concentrate on:

- Basic architecture requirements for governmental systems;
- Accessibility standards;
- Basic security requirements, such as password security;
- System documentation and operational handover requirements;
- Data formats and data interoperability between governmental systems.

The questions of data interoperability and formats will probably be strongly influenced by existing practices, such as those used by Ekeng for larger governmental systems.

5.3. General business maxims

The general business maxims for a CCMRV system are similar to the the ones of most other business systems:

- Reliability and availability: the ability of the system to function continuously without frequent failures, limit the time when it is not available to a reasonable minimum and degrade gracefully under suboptimal operation and usage scenarios;
- Serviceability: the ability of the system to be serviced and supported in a timely and adequate manner, including the necessary service knowledge retention (documentation) and knowledge transfer (training of support personnel), as well as the possibility to monitor the system and generate service events, and recover from failures of intrinsic and extrinsic causes;
- Usability: the ability of the system to present a user interface that is friendly, intuitive, adequate to the intended users' level of knowledge and interest in using the system, and allow the user to accomplish the assigned tasks with minimal effort.

These general business maxims can be used as a basis for the development of non-functional requirements of the CCMRV system. The fact that currently, most of the relevant systems are operated manually or with the use of simple office productivity tools, the possibility of automation of business processes should be considered in conjunction with the

need to maintain reliability, availability, serviceability and usability (RASU) of the system even for manually operated parts.

5.4. Functional components

The CCMRV system will have six main components:

- GHG inventory system;
- Business Process Management System (BPMS);
- Project and Support database
- Interoperability layer
- Security and user management subsystem
- Reporting subsystem

The description of those components is shown in Annex 4 on IT requirements (see point 1).

5.5. Server and network architecture

The CCMRV system, at least for the web-based collaborative parts thereof, will require a hosting location. The choice is between:

- Hosting it on-site, in a government office;
- Hosting it with Ekeng;
- Hosting it in a data centre of an Armenian commercial hosting provider;
- Hosting it in a public cloud outside Armenia

Specific configurations and requirements for server infrastructure will need to be elaborated by the development contractor depending on the technology stack and specific components selected.

The final specifications will need to be adapted to the system requirements of the specific components to be implemented by the firm that will be providing development and system integration services.

Should all used components be available on the Linux platform (ideal case), containerized deployment is recommended with Docker as the enterprise container platform.

Installability requirements of the system assume that the system is easy to roll out in different scenarios. Though only one instance of the system will be considered “production”, it is important for the quality of both system development and operations to be able to reproduce system configuration easily for staging, quality assurance and development purposes.

Ideal case is assumed in the configurations described below. At the end of the section, alternatives to the ideal case are briefly discussed.

More details on these aspects are described in Annex 4, on IT requirements (see point 2).

5.6. Data design

The indicative data structure may be implemented in a relational database, non-relational database and a file storage. Database storage should be preferred whereas file storage is suitable only for primary documents and should generally be immutable for files once stored.

The choice of the database brand(s) should be guided by the following principles:

- The databases should respond to the expressed needs of business continuity and disaster recovery;
- The databases should be easy to integrate;
- The databases should provide for transaction integrity, ideally also for distributed transactions;
- The number of brands and types of databases used should be kept to a minimum, with the ideal situation being one database used for the entire system.

The detailed data design will be confirmed during early stages of implementation when all of the data requirements, entities, relationships and databases are constructed. These details are to be discovered by the development team in the early iterations of the CCMRV system development project. If the principle of minimising tailor-made code is adhered to, the majority of data structures will be embedded in the integrated solutions and managed by their respective vendors, freeing up resources to take care of components with Armenian specifics.

It is recommended that Posgresql is chosen as the main database brand as it is already successfully used by Armstat, which is one of the major CCMRV system's stakeholders.

5.7. Web interfaces

The web interfaces can be implemented using standard client-side technologies such as HTML 5, CSS and JavaScript. No additional plugins beyond what is present in standard web browsers should be required. The web interfaces will support all modern[15] versions of web browsers. The desktop interfaces will run on all major desktop operating systems.

Public-facing web interfaces should have responsive design and layout; internal interfaces may be desktop-only.

Web interfaces should be designed for high accessibility according to the standard to be set for governmental web systems by MHTI.

All web interfaces will be available exclusively via HTTPS. Attempts to access systems using unsecure protocols should lead to a redirect to the corresponding secure page.

More detail can be found in Annex 4 of this report (point 3).

[15] "Modern versions" are versions that (a) have been released reasonably recently and (b) are supported by their vendors.

6. Recommendations on MRV practices and CCMRV platform Implementation

According to the analysis performed within the framework of this consultancy, 5 main recommendations are identified, within which other specific recommendations are included:

R1 - Establishment of a robust legal framework

R2 - Establishment of a robust institutional structure for MRV system

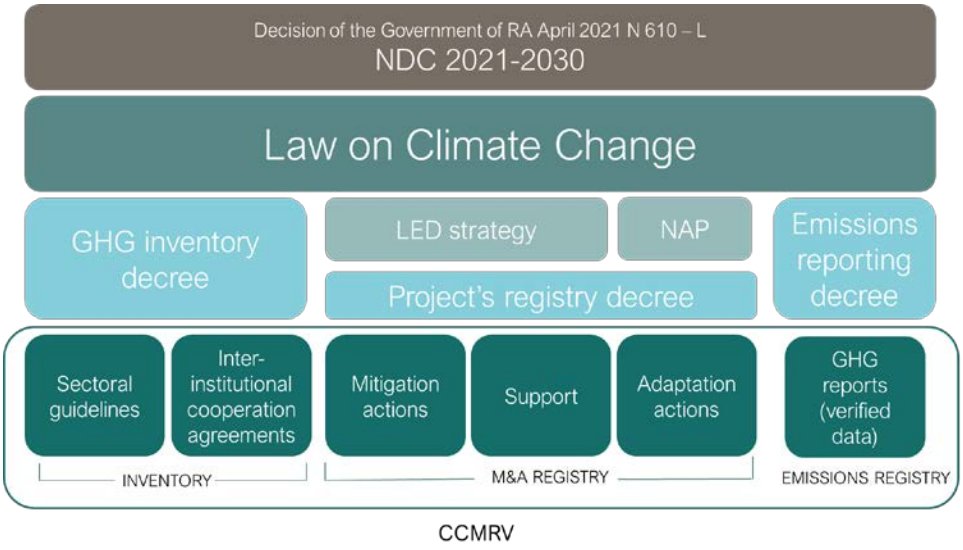
R3 - Management of climate change policies in a centralized system

R4 - Implementation of a verification system to verify emission reductions related to mitigation projects and GHG emissions of private sector

R5 - Data quality improvement

Although all the recommendations made should be implemented to ensure the effective operation of the CCMRV, the establishment of a robust legal framework (R1) and the establishment of a robust institutional structure for MRV system (R2) are considered to be essential prerequisites to ensure and facilitate the effective and orderly adoption of all recommendations. Figure 18 therefore presents the proposed legal structure required for the implementation and effectiveness of the MRV system: a climate change law as the main legal basis, a decree to establish the bases for the preparation of the GHG inventory, a long-term low greenhouse gas emission development strategy (LT-LEDs) as support and means of centralization of national mitigation policies (adding to the existing NAP for adaptation policies), and a decree on an emissions registry for the private sector (not essential but suggested). Likewise, it shows the elements that would emanate from this legal structure that would become operative the CCMRV platform.

Figure 18 Legal framework required for the CCMRV platform



Each of these main recommendations is divided further into specific recommendations and presented in detail in the following sections.

Due to their relevance, from the point of view of the consulting team, R1 and R2 are compelling to at least push for the rest of the recommendations to be carried out in an orderly and efficient manner.

6.1. R1 – Establishment of a robust legal framework

6.1.1. R1.1 Development and implementation of a Climate Change Law

Armenia's vulnerability to climate change with its socioeconomic impacts evokes an inclusive planning for current and future changing climatic conditions. Adaptation and mitigation actions are currently implemented at different administrative levels and are led by various actors in Armenia, including the Government, sub-national and sectoral authorities. These efforts of tackling climate change, however, are disjointed and mostly reactive. The establishment of coherent national level governance and coordination structures is one of the preconditions to facilitate the integration of climate change actions into fiscal, regulatory and development policies and programmes.

It is recommended to develop and adopt a legislative framework that will guide achievement of adaptation and mitigation objectives with MRV system across different sectors and state and non-state actors in Armenia. As such, the introduction of strengthened legislative framework is critical to sufficiently mainstream and integrate climate change consideration into national and sectoral development strategies. Developing and enacting a specific law on climate change will enable to have and implement national and sectoral development policies and strategies with stronger climate change consideration.

It is recommended to include the following topics in the law:

- Climate policy objective (e.g. regulation of the GHG emissions and reduction of the vulnerability of Armenia, promotion of research and knowledge transfer as well as the transition to a low carbon economy). Include specific objectives in mitigation and adaptation.
- Principles / drivers of climate policy
- Mechanisms for the evaluation and improvement of climate policy
- Competencies of national and local authorities in terms of climate change (e.g. publication of LEDs and NAP).
- The role of the Ministry of Environment in climate policy[16]
- The role of other ministries and agencies in climate related policies
- Functional institutional arrangements for climate policy (the IACC may be the main arrangement but not the only one). It is recommended to take institutional mapping (annex 2 of the main report) as the basis to this: arrangements for data provision (GHG inventory), arrangement for projects registry, arrangement for emissions registry, arrangement for coordination and management, and IACC arrangement (for the overall system).
- Implementation of a Long-term low emissions development strategy (LEDs), establishing frequency of review and updating

[16] Regulated by the Law of RA on "Structure and Activities of the Government". The RA Ministry of Environment is the state body responsible for the development and implementation of the national policy on climate change in Armenia. However, it is important that Law on Climate Change is in line with this.

- GHG inventory: establishment of responsible Ministry and staff, frequency of updating, reference to methods and principles (e.g. alignment to IPCC), determination of a fixed inventory team, elaboration of a QA/QC plan as a mandate.
- Sectoral policies and strategies incorporating climate risks and opportunities
- List of measures to fulfil obligations and provisions arising from the UNFCCC and Paris Agreement, assigning responsible state agencies
- Inter-Agency Coordination Council role in climate policy and role in climate policy (including role in MRV system)
- MRV obligations for private sector (it is recommended to set obligations at least for industry but sectors as transportation, waste management and disposal, agriculture and livestock as well as commerce and services can be included for a greater direct and indirect emissions coverage). Establish that specification for an emissions registry will be implemented in a decree.
- Creation of a Registry of mitigation and adaptation projects (financing information to be included in the same registry)
- Creation of the MRV system for mitigation policies
- Creation of M&E system for adaptation policies
- Flexibility for Long-term market mechanisms incorporation (long-term view)

The regulation will serve to lay the foundations, but it does not have to include technical details. The aim is to instruct the MoE to develop other regulations, decrees, guidelines, plans and specific programs, granting it the power to regulate in the matter.

Instruments that could arise from the Climate Change Law are:

- Long-term low emissions development strategy (LT-LEDS)(R1.2)
- GHG inventory decree and / or guidelines (R1.3)
- MRV regulation for private sector (R1.5)
- Regulation for Project's registry (R3.1)
- Verification guidelines (R4.3)

6.1.2. R1.2 Development and implementation of a Long-term low emissions development strategy (LT-LEDS)

As mentioned in the previous point, it is recommended to establish by law the publication of a long-term low greenhouse gas emissions development strategies (LT-LEDS). This strategy should guide climate policy to specific actions through short-, medium- and long-term sectoral targets, and will serve as a guidance toward obtaining funds for the implementation of mitigation and adaptation measures. The LT-LEDS of Armenia will also provide the government with a vision of the mid-century climate policy goals to be achieved on the pathway to carbon neutrality in the second half of this century and it will assist in the environmentally sound long-term planning in the following IPCC sectors: Energy, Industry, Transport, Waste, Agriculture, Land Use, Land-Use Change and Forestry. The midcentury goals of the LT-LEDS will guide the consecutive NDCs of the country and determine their ambition in line with the no-backsliding rule. The monitoring and evaluation of the NDCs will, on the other hand, inform the LT-LEDS review process and provide information on the

progress made towards the achievement of the mid-century goals. The LT-LEDS will be a living document, and monitoring, evaluation and update mechanisms will have to be built into the framework of the strategy.

This would be the legal basis to consolidate and boost specific mitigation interventions, and at the same time, it would help to centralize climate change policies, being the base (along with the NAP) for the M&A component of the MRV system. This way, every action or project could be identified by a specific policy and would be aligned to this strategy.

It is proposed a general structure for the strategy:

- Objective and scope
- Drivers of the strategy
- Short-, mid-, and long-term vision
- Process of elaboration of the strategy
- General pilars / items
- Diagnosis, strategic axes and lines of action (short-, mid-, and long-term targets)
- Review, Evaluation and Updating mechanism (it is suggested to engage IACC in this processes).

Mexican example – National Climate Change Strategy

Pilars of the strategy

P1. Have cross-cutting, articulated, coordinated and inclusive climate policies and actions

P2. Develop fiscal policies and economic and financial instruments with a climate focus

P3. Implement a platform for research, innovation, development and adaptation of technologies climate change and institutional capacity building

P4. Promote the development of a climate culture

P5. Implement Measurement, Reporting, Verification (MRV) and Monitoring and Evaluation (M&E) mechanisms

P6. Strengthen strategic cooperation and international leadership

Adaptation strategic axes

A1. Reduce vulnerability and increase the resilience of the social sector to the effects of climate change

A2. Reduce vulnerability and increase the resilience of strategic infrastructure and production systems in the face of the effects of climate change

A3. Conserve and sustainably use ecosystems and maintain the environmental services they provide

Mitigation strategic axes

M1. Accelerating the energy transition towards clean energy sources

M2. Reduce energy intensity through efficiency schemes and responsible consumption

M3. Transition to models of sustainable cities with mobility systems, comprehensive waste management and low carbon footprint buildings

M4. Promote better agricultural and forestry practices to increase and preserve sinkholes natural carbon

M5. Reduce emissions of Short-Lived Climate Pollutants and promote health and well-being co-benefits

This type of instrument would help to promote mitigation actions in the long term, and to link them to specific targets, so it would help to track the progress towards NDC compliance.

6.1.3. R1.3 Development of a specific regulation or guidelines for GHG inventory

Since the compilation of the GHG inventory is such a complex task, it is considered compelling to regulate the activities that involve various data providers and validators of the information, to limit the scope and establish time periods that allow to conclude in a timely manner with the national inventories. By developing a formal directive, a climate change law or regulation can legitimize resource requests and facilitate reforms and the formulation of new responsibilities. (UNFCCC, 2020).

Although the inventory has been carried out for several years as a systematic task and with the external support of the UNDP, a robust legal structure is required to promote its improvement, and above all, to grant power to the Ministry of the Environment to take decision-making and the adoption of leadership in the matter. Establishing the inventory obligations in a mandate will also help to obtain resources to perform the required activities.

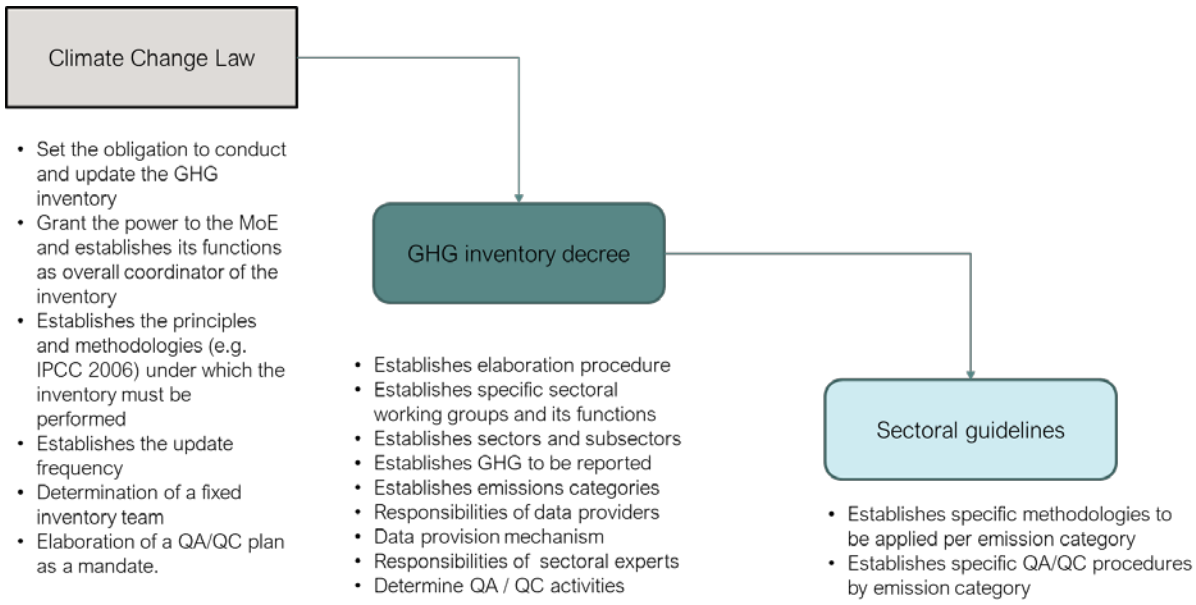
It is recommended to establish the obligation to make an emissions inventory, its update frequency, the Ministry and specific department responsible for this task, as well as the reference to calculation methods and QA/QC practices (QA/QC plan) in the climate change law (R1.1).

In addition, it is recommended to make another regulation or guidelines (such as a decree) where specific responsibilities are established in terms of data provision, emission estimation procedures, QA/QC activities, technical teams' members, as well as the establishment of emission categories, gases to be considered, methodologies, among others. This decree should include detail on the procedure of elaboration of the inventory.

Additionally, it is recommended to provide details in application of methodologies by emission category in sectoral technical guides that can be updated frequently without undergoing rigorous legal procedures, thus allowing the application of better methods whenever conditions allow, aligned with the best international methodologies and practices, and the use of local emission factors to the possible extent.

It is worth mentioning that the sectoral guidelines will be technical documents that, for practical purposes, may be updated as higher quality inputs and more appropriate and accurate methodologies applicable in the context of Armenia are available.

Figure 19 Framework required for GHG inventory



The inventory elaboration procedure to be established in the decree must consider the following stages: planning, data collection and emission estimation, preparation of reports, sectoral validation, quality assurance, final presentation and disclosure. It is recommended to establish those responsible for these activities at the department level.

The aspects that must be considered to implement a decree that establishes the scope of the inventory are mentioned in Table 11. It is worth mentioning that Armenia has developed GHG inventories and improved the practices since 1997, reason why most of the technical work has been properly done, but not established in a regulation that grants legal robustness to impulse the leadership of the Ministry of Environment, to facilitate effective data provision mechanisms, as well as to promote the updating and improvement of data quality.

It is worth mentioning that in the strict sense, everything related to GHG inventory could be included in the climate change law (R1.1) in a specific chapter. However, the consulting team perspective is that implementing both is the best way to build a robust regulatory framework, since normally a law is intended to lay the foundations such as granting power to a specific entity in a matter, introducing relevant concepts, setting objectives and roles, but technical issues are addressed in separate regulations that make the system more flexible and easier to handle in the long run (for example, when amendments need to be made).

Table 11 Required elements for GHG inventory framework

Aspects to cover in a GHG regulation	Comments and guidance questions for decision making
Scope	The mandate for climate policy could be driven by a domestic outlook on climate change targets and objectives or could be set within an international context, with explicit consideration for interlinkages of national efforts with international targets and approaches (UNFCCC, 2020). The recommendation is described in R1.1.
Sectors, subsectors, activities	In addition to the categories and subcategories covered by the GHG inventory (1990-2017), what other categories are relevant to include in the context for Armenia (that might have not been estimated due to technical barriers)? It is relevant to involve to private sector (i.e. industrial and commercial sectors) and municipalities as data providers? What are the barriers that have been caused that these sectors / subsectors aren't yet involved in data reporting activities? It is recommended that emissions from all industries be included in order to comply with the principle of completeness, since they are national emissions. Otherwise, the exemption of some of them must be technically justified. Not having enough information implies exploring alternatives to obtain it, but it does not justify excluding them in the long term. See recommendation R1.5 on reporting obligations to the private sector.
Responsible on data generation, transfer, management, and record keeping	To what extend have the responsibilities of each actor involved been identified? Are all the relevant actors involved in data collection activities? General functions for each ministry and entity involved must be settled in R1.1. while specific activities related to GHG inventory must be settled in a GHG inventory decree or similar regulation.
Responsibilities of the MoE on emission estimations	In the regulation R.1.1, MoE responsibilities should be clearly established as the coordinating unit for inventory activities.
GHG inventory elaboration frequency	It is established that GHG inventories must be performed every two years for their report to the UNFCCC. However, all the activities that derive from this need must have scheduled

	and sufficient times to complete the elaboration of the inventory in the adequate timeframe, considering the validation times, without jeopardizing the accuracy of the estimates. Elaboration frequency must be set by law (R1.1).
Reporting periods (data provision mechanisms)	Establish the data reporting periods for the different actors involved, in congruence with the data generation times. This must be set by inter-institutional cooperation agreements (see R1.4).
Experts' groups by sector	Define specific members and responsibilities of each expert group: type of information they require, as well as who and when they should provide it to make estimates in time. It is recommended to set team members specifications in the GHG inventory decree (R.1.3)
Data series	At the moment, the team in charge of the development of the inventory has identify the overall data needed as inputs, related to IPCC sectors, which can be specified in the decree (R1.3).
Institutional arrangements for the GHG inventory elaboration	Establish the specific institutional arrangements that are required for the preparation of the inventory, starting from the Climate policy department of the MoE as the coordinator unit, to the technical groups, considering the information providers of each subcategory of the inventory. It is recommended to stablish the general MRV structure and institutional arrangements for GHG inventory in R1.1, granting the power to MoE to designate the members of the technical teams. On the other hand, in the inventory decree, the detail of these structures can be provided.
Quality parameters with which you must comply inventory	Establish the quality parameters with which the inventory must comply: Transparency, completeness, coherence, comparability and accuracy. Likewise, establish the quality control processes to be applied to comply with these parameters. These quality control processes must be internal and external. If IACC will perform final QA/QC activities, it is important to be settled through regulation R1.1 (as main institutional arrangement) and detailed functions and interactions with technical teams in the decree. It is worth mentioning that 1990-2017 GHG Inventory improvements were done according to TACCC principles. It is

	suggested to establish the alignment to these principles in the decree.
QA/QC plan	According to 2006 IPCC guidelines, the key elements of the plan should include: • An outline for QA/QC and verification activities that will be implemented • Institutional arrangements • Roles and responsibilities for implementing the activities • A scheduled timeframe for the QA/QC activities that follows the inventory preparation from its initial development through to final reporting in any year • Data quality objectives (concrete targets to be achieved in the inventory preparation) Specifications (characteristics / requirements) of QA/QC plan must be established in R1.3. However, the plan itself could be added in the guidelines.
Methodologies	Refer to the methodologies to be applied for each emission category, by subsector, in such a way as to make the emission estimation approach clear and transparent. This will avoid obstacles in knowledge transfer and reduce the risk of misinterpretation when staff is turnover. In addition, it is suggested as a common practice to establish that methodologies can be changed as long as new more rigorous methodologies are available and there are the necessary conditions in Armenia to apply it.
Sectoral guidelines	It is recommended that sectoral guidelines are a kind of “procedure manuals” that specify the monitoring procedures, data collection, emission estimation (with methodological rigor), quality control processes (QA/QC plan) as well as those responsible for these tasks and the timeframe in which they will be carried out, be established. The above by according to the inventory sector.
Supporting tools	Development / improvement of the electronic platforms in which the inventory information will be hosted, as well as the spreadsheets that will be used for estimates and for quality control tasks, according to QA/QC plan.

6.1.4. R1.4 Sign inter-institutional cooperation agreements for data provision

Given the large amount of information to be handled for the emissions inventory, but also given the approach of tracking mitigation and adaptation policies -including supporting related subjects-, it is necessary to be able to conclude cooperation or inter-institutional

agreements to streamline the processes of providing information to the MoE as overall coordinator of the system.

The MoE is recommended to promote inter-institutional agreements for collaboration in the generation, collection, reporting and management of the necessary information according to each system component, taking as a reference the functions that each instance has within the scope of its attributions. The conclusion of these agreements must prioritize the generation of reliable information and transparent and efficient processes that contribute to generating the trust that the system requires in the long term.

Although there are currently some processes between entities that are carried out in practice, these are not officially implemented so that they could be interrupted at any time affecting the preparation of the emissions inventory and in the future, the implementation of the MRV. The fact that these procedures are not agreed upon by institutional means and official channels does not give the system the necessary robustness; these agreements will serve to ensure the continuity of the procedures through the administrations and their corresponding continuous improvement, thus ensuring a system that increases their quality and reliability over time.

Collaboration agreements are instruments through which continuity of practices that generate quality information over time can be ensured, so its implementation is urgent to induce the involvement of entities that have the capacity to generate information of truthful and reliable origin, and in turn, avoid duplication of effort triggering processes simplification.

According to the 3rd Biennial Update Report, the following approach is proposed for the further consideration based on lessons learned: (i) on a basis of a MoU signed between the Ministry of Environment and the Statistics Committee, the latter provides data within the same scope of information that is currently provided for GHG Inventory development; (ii) individual MoUs on data provision are signed with the state organizations possessing data in respective sectors (e.g. State Revenue Committee, PSRC, Ministry of Economy, etc.) to provide data not addressed by the Statistics Committee; (iii) individual MoUs are signed with utility companies and natural monopolies (e.g. ENA CJSC, Gazprom Armenia CJSC, etc.); (iv) any data from private sector entities that is needed for national reporting and is not covered by the above mentioned three channels, in case of non-adoption of the above mentioned Law, is to be obtained through the Statistics Committee, which will slightly expand the scope of data to be collected by the SC.

It is recommended to work on a framework agreement (template) that allows sharing information under terms of confidentiality between institutions, emphasizing that the information used for inventory or other purposes related to climate policy, must be accompanied by the corresponding technical support that allows to validate the information.

According to UNFCCC, these types of agreements can be drawn up between different organizations to ensure effective collaboration. When developing a framework contract or agreement, following aspects could be considered:

- **Objective.** The objective of the agreement from the perspective of all engaged parties;
- **Scope of cooperation.** The scope of the engagement should be defined (e.g. which outcomes are being targeted; data and information that will be gathered, processed and shared);
- **Forms of cooperation.** The 'how' of the cooperative agreement: the methods of, frequency of and any restrictions on the exchange of data and information or collaborative approaches;

- **Necessary resources.** If it is envisaged that the proposed cooperative approaches will require resources, then the agreement should highlight how the engaged parties are expected to access such resources;
- **Effective date, duration and termination.** The agreement should set out a start date, initial duration, the scope for amendments, if any, and the conditions for termination;
- **Contact points.** Key contacts (organization names or position titles are preferred over individual names for the sake of continuity) should be included. The agreement should also set out the expectations for these key contacts, including any resource commitment and communication and knowledge-sharing.

Data sharing agreements

Advantages

- Formalizes an arrangement between the national focal point, or designated coordinator, and the data supplier stakeholder, with technical expertise provided by the team of national experts.
- Can help secure data provision in the longer term
- Can assist data-supplying organizations by formally acknowledging the value of their data, which could promote the allocation of resources within such organizations to deliver reliable data on time.

Content:

- Background information on the needs and mandate of the transparency system;
- Reference to laws and terms of reference and cooperation between the data supplier and the transparency system representatives;
- Objectives of the agreement, with reference to an annex specifying the details;
- Handbook on institutional arrangements to support
- MRV/transparency of climate action and support
- Confidentiality provisions and commitments;
- Procedures that enable the receiving party (the data user, such as the national focal point or designated coordinator) to provide feedback to the data supplier on priorities for future improvement of the data set;
- Signatures of national focal point or designated coordinator representative and data supplier, if appropriate;
- A technical annex containing details of the data to be supplied, including:
    - Unique title of the data set (to avoid confusion with other data sets);
    - Confidentiality flags;
    - Description of the data, including format (electronic format) and scope (time series, detail, nomenclature, categories, geographies);
    - Supplying department or service;
    - Deadlines for the supply of data;
    - Details of QA/QC measures to be applied to the data prior to supply;
    - Uncertainties in the data.

Source: Consultative Group of Experts UNFCCC secretariat, 2020. Handbook on institutional arrangements to support MRV/transparency of climate action and support.

6.1.5. R1.5 Establish MRV obligations for private sector

It is recommended that an effort be made to incorporate emissions information from most industries in Armenia into the GHG national estimates, not only to know their emission levels and report them in the inventory, but to identify areas of opportunity for mitigation projects at large scale. It is considered that implementing a reporting obligation for the private sector in the regulation, will facilitate the data collection from the industry, taking into account that for reasons of confidentiality in production-related data, companies tend to be reluctant to share information. It is recommended to establish the MRV obligation for private sector in R1.1 and establish how it will work through a decree.

It should be noted that there are several decisions to be made from the government for the implementation of a regulation of this nature, for example, to regulate all industries (and even commercial and business sector if appropriate), or if the interest is only in certain industries. Likewise, analyze the relevance of regulating from an emissions threshold, and whether it is of interest to regulate several GHGs or only CO_2, methane and nitrous oxide, and / or others.

The advantage of taking into account various sectors is to have a greater collection of information from the source (i.e. a bottom-up approach), which in the long term would allow Armenia to have more accurate emissions information, which could contribute in the future to the implementation of other policies, such as carbon pricing instruments, in addition to identifying areas of opportunity to reduce emissions in specific sectors. This reporting obligation may even include indirect emissions from the consumption of electrical and thermal energy (scope 2).

In addition, it must be established under what methodologies companies would be instructed to report emissions (for example, aligned with 2006 IPCC guidelines).

It should be noted that the implementation of reporting obligations for the private sector would imply the establishment of an accreditation system for third-party verifiers, since it would be relevant that the information reported complied with quality and certainty parameters (e.g. aligned to ISO 14064-1:2018 and ISO 14065:2020 standards[17]). See recommendation R4.

Key aspects that must be considered to implement a regulation of this nature are:

- Decide the industries or sectors of interest: focus on large industries or include all activities in the country. It is recommended to carry out an analysis of the contribution of emissions, where it is possible to estimate how many and which industries contribute the greatest amount of emissions, so that the fewest number of companies with the greatest amount of covered emissions can be regulated, in case it is decided to take this approach.
- Decide on the gases to regulate: CO_2, CH_4, N_2O, fluorinated gases, and others.
- Determine reporting units: tons of GHG, and/or tons of CO_2e.
- Determine if activity data will be recorded: this will require more effort in terms of the platform, since each activity will require different data as input.

[17] ISO 14064:2018: Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals. ISO 14065:2020: General principles and requirements for bodies validating and verifying environmental information.

- Determine criteria to be a regulated company: Only sector and subsector, or specific activities, and/or a reporting threshold (e.g. only those companies that emit more than 3,000 tCO_2e).
- Determine scope of the information to be reported: total amount of emissions or including activity data (it is recommended to request activity data too, as this information could be useful to do recalculations). In this sense, it is important to establish what type of information will be of public domain, and what type of information will be share only for informative purposes to MoE (e.g. production related information).
    - It can be stated by law (R1.1) that aggregated information of the registry (GHG emissions in tons of CO_2e or tons of each GHG) will be publicly available on an annual basis by sector or subsector (if decided by government). Also, it could be stated by law that GHG emissions and activity data must be reported to MoE (no need no provide more details).
    - It can be stated in the registry decree specific activity data and GHG emissions to be reported in the registry (platform), by sector, subsector and activity. It is recommended to reiterate that activity data will remain confidential under certain terms and conditions related to data protection laws.
- Establish methodologies: they can be aligned with 2006 IPCC guidelines. This must be established in the decree, and to facilitate the estimation of emissions by regulated companies, it is recommended to elaborate simplified methodological guides can be consulted by regulated companies, including emission factors.
- Develop the platform for reporting emissions: due to the fact that there are obligations to report other atmospheric pollutants, it is suggested to analyze the potential of expanding that registry, adding the corresponding fields so that companies report in the same tool, and thus simplify this activity.
- It is recommended to consider third-party verification for this registry (see recommendation R4). This verification process would be performed to the emissions reported by the companies and would help improving the quality of the information in the long term, granting a high degree of certainty that allows the MoE to have a real diagnosis of its emissions, in light of its international commitments.

6.1.6. R1.6 Establishment of MRV functions to all the actors involved.

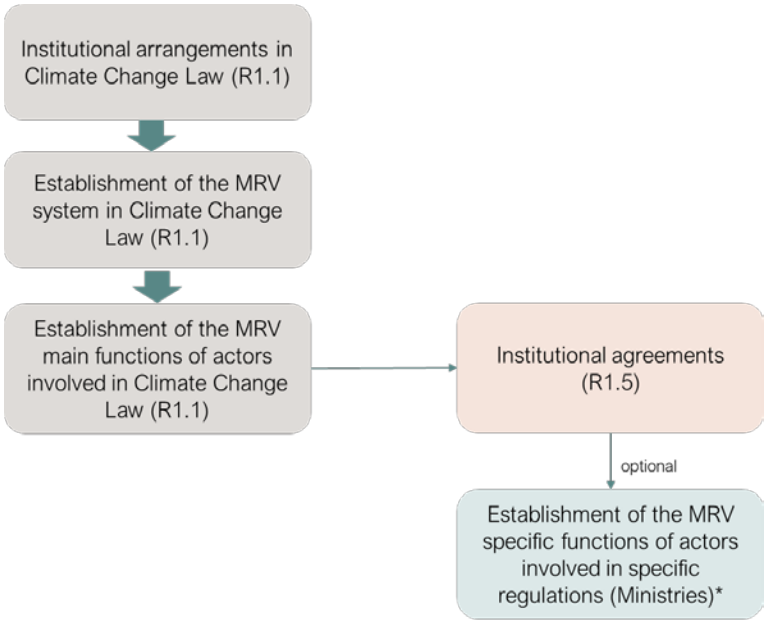
In the context of Armenia's international commitments, the MRV functions of each stakeholder are a priority. In this case, Armenia has been executing a series of actions that allow it to comply with its obligations, with the contributions of other government entities and external consultants. However, various challenges have arisen due to the complexity involved in the development of the national inventory, the national communications and the BURs that have to do with the lack of formal and official institutional arrangements, in which there is clarity of the responsibilities of the various tasks, periods of time, information to collect, quality controls, among others.

Due to the above, it is necessary to establish these institutional arrangements in a law or regulatory instruments, where the MRV functions to be carried out are explicitly defined (it is recommended to establish them in regulation R1.1). In this way, the information gathering and quality control processes, among the most important, will be streamlined, thus avoiding having information gaps such as duplicating efforts in different information provider entities.

Likewise, having established the MRV functions of each actor involved, will facilitate a better tracking of information in all the processes and entities involved, having an adequate control of it.

The sequence of steps to be carried out is:

Figure 20 Steps to be taken to establish MRV functions to the actors involved



The relevance to incorporate the functions of MRV within the regulations of each ministry involved as an information provider (mainly), is to grant the major robustness to the MRV structure in the long term and contribute to allocate human and financial resources so that in each ministry processes and mechanisms are formally implemented to generate and provide the necessary information in the different components of the system. However, it is considered that at least data provision mechanisms could be improved by only inter-institutional agreements.

It is important to consider that GHG inventory is not the only reason to involve other ministries, as climate change policies are cross-cutting and needs of other information related to mitigation and adaptation interventions must be attended too. For the above, the recommendation aims to engage other ministries in activities related to other climate policies within the MRV system, adding to the data provision for the inventory.

MRV functions in the context of the MRV system

Ministry of Environment

- Overall coordinator of MRV system
- Determination of the scope of the planned transparency system
- Development of legislative and policy instruments, as well as tools necessary to facilitate data flows between government agencies and from the private sector

- Elaboration of reports: BUR, NIR, NC
- Reporting to IACC
- Development and implementation of an accreditation system for verification bodies in Armenia
- Elaboration and implementation of a climate policy regulation
- Surveillance activities
- Support IACC in the organization of the sessions (prioritization of topics to attend)
- Development of IT systems, databases and archives.
- Determine features and requirements for QA/QC system
- Identify and categorize relevant institutions, experts, data suppliers, systems and stakeholders;

Stakeholders' engagement

- Identify and engage with stakeholders who hold, produce and could supply data (ministries and agencies, committees, the private sector, academia and subnational governments)
- Identification of experts needed for the transparency system and which agencies, government departments, academic institutions and private enterprises do they come from.
- Facilitate the stakeholder engagement (including the public, local governments and communities, businesses, and other decision makers)

Data management

- Identify gaps where documents are missing and/or experts are no longer available;
- Identify where existing documents lack sufficient detail to cover the thematic scope of the institutional arrangements and their objectives and outputs;
- Determine the needs of data sharing agreements by
    - Memorandums of understanding
    - Data Supply Agreements
    - Organizational Agreements or Contracts (MoUs)
- Identification of overlap between departments in data-collection activities
- Data collection as intermediate between national experts and data providers (for GHG inventory, mitigation and adaptation as well as regarding support).
- Elaboration of monitoring guidelines for data providers
- Elaboration of templates for data provision (i.e. Excel file)
    - For GHG inventory
    - For M&A actions
    - For support
- Standardize data-collection formats
- Determination of need for and uses of data
- Managing the delivery of the required datasets from a range of data providers on a regular basis and continuously improving data and reducing uncertainty.

- Securing reliable data flows

Resources

- Implementation of effective recruitment processes
- Contract external support to train and mentor the team of national experts
- Estimation of basic human and financial resources needs for climate action related transparency systems
- Identification of capacity building needs
- Implementation of capacity building activities according to needs

Data providers

- Designation of a focal point responsible for the data collection and transfer to MoE
- Attend the requests of information from MoE for the MRV purposes on time
- Inform the MoE about gaps and barriers detected, that affect the generation or compilation of the necessary information
- Be aware of the advantages and limitations of certain data sets and should be able to identify key improvements needed in the data-collection process when they understand the intended use of the data in the transparency system

Inter-Agency Coordination Council

- Responsible for the final QA/QC of the MRV transparency framework
- Make an annual QA/QC plan
- QA/QC log
- Ensures all the correct checks have been carried out on the data
- Make a QA/QC improvement plan for the transparency framework

MRV functions in the context of the GHG inventory

Ministry of Environment

- Development and implementation of the Decree (or regulation) for GHG inventory, as suggested in R1.3.
- Development and updating of sectoral guidelines for GHG inventory, as suggested in R1.3.
- Requests, reception, and review of information to the data providers by official media (inter-institutional agreements suggested)
- Turn the information to sectoral national experts
- Establish, share and update (as necessary) specific templates to collect information by GHG inventory category
- Routine reviews and coordination of the sectoral experts teams

- Turn the draft of GHG inventory to IACC for QA/QC activities
- Respond comments from the IACC, supported by sectoral experts.

Teams of national experts

- Responsible for collecting, processing and arranging the data and information for reporting of transparency themes
- Data analysis and calculations, and associated science and methods, including IPCC guidelines (methodologies application)
- Have a good understanding of the benefits and limitations of the data sets
- Regularly gathering and processing data in order to produce the agreed outputs in a timely manner
- Responsible to have suitable back-up expertise and access to relevant training materials
- Responsible for knowledge retention and transfer
- Training of junior experts
- Detailed review of information provided, making requests of additional information when needed
- Data flow management
- QA/QC procedures implementation
- Keeping data, estimates and technical support recording
- Report to MoE
- Using standard classification and nomenclatures for compiling estimates
- Including metadata in each file and maintaining a master list of the calculation files and their types, authors and versions;
- Using a standard file naming convention across categories and inventory cycles;
- Documenting in tools with evidence of the implementation of QA/QC procedures;
- Colour-coding or applying other visual formatting to differentiate between areas of data input, calculations, QA/QC checks, explanations and outputs (useful for spreadsheets);
- Documenting where historical data or methods have been revised;
- Documenting complex models;
- Following a standard output format for all reported data.

Data providers

- Provide required information as requested by the Ministry of Environment on a timely manner
- Identify and inform to MoE about gaps, barriers and challenges in data collection processes
- Within the scope of its attributions, identify and train the people involved in the generation and compilation of information and inform them of their responsibility in fulfilling the assigned

activities. It is suggested to make internal guidelines for these activities, so that knowledge transfer won't be a challenge when the staff is turnover.

- Form technical teams responsible for the generation, collection, management, safeguarding and quality control of the data that will be provided to the Ministry of the Environment.
- Hold internal follow-up meetings to review progress towards the next delivery of information (for the purposes of the subsequent emissions inventory). The points to be discussed will be work schedule, gaps, barriers or limitations, challenges that have arisen in the processes, training needs, resource needs. Based on the foregoing, it will be determined whether it is necessary to inform the MoE about the identification of barriers, technical challenges for the generation of information, and / or needs for human resources and training.
- When barriers to data collection are identified, the assigned team will conduct an analysis to determine the steps necessary to overcome the barrier.
- The meetings and their follow-up should be carried out by a team leader in each ministry. It is recommended that the meetings be held at least 3 times a year.

Inter-Agency Coordination Council

- Responsible for the final QA/QC of the overall GHG inventory, for what it is suggested to develop IPCC-based guidelines to drive the quality control activities (this will avoid challenges related to staff turnover).
- Approve final version of the NIR
- Define specific QA/QA procedures for each emission category and subcategory
- Inform the MoE about inconsistencies and make specific requests of clarifications to the different leaders of the expert groups
- Ensures all the correct checks have been carried out on the data and record keeping
- Prepare appropriate checklists for each sector
- Establish guidelines for inventory review (in this way the risk of losing expertise when there is staff turnover is reduced).
- Make sure that all findings were addressed satisfactorily.
- Discuss with the technical teams about controversial aspects that are identified in the inventory preparation
- Give an opinion on the quality of the data
- Issue recommendations to improve inventory quality.
- Record all the revisions that are carried out, documenting the responsible involved, the dates on which the revisions were carried out, and how a finding was resolved.
- Track information from the origin through blog review, database review, interviews with stakeholders, and other.
- Issuance of opinion about
    - New additions to the emission inventory
    - Adjustments to the existing inventory (e.g. recalculation) (if applicable)
- (Re) evaluation of the estimated uncertainties, when applicable.

MRV functions to track mitigation and adaptation actions

Ministry of Environment

- Identify links between adaptation and mitigation actions
- Identify common data sources and data-collection processes
- Identify potential data gaps to be resolved
- Maintain a common registry of actions
- Streamlines the reporting process and reduces the burden of reporting.
- Responsible for giving access to the different users in the system
- Build verification capabilities
    - Develop accreditation system for 3rd party verifiers (see recommendation R4)
- Develop verification guidelines
    - Define verifier profile
    - Determine the type of projects that will be accepted in the registry
    - Determine materiality level for verification (e.g. 5%)
    - Determine process of verification
- Develop guidelines for M&E in adaptation projects
- Tracking and reporting of adaptation projects

National Experts

A. Mitigation

- Support the MoE in the identification of relevant mitigation projects / policies and its tracking
- Experts should have an understanding of the energy, transport, waste, industry, agriculture and forestry sectors.
- knowledge in the development of historical and projected time-series of estimated emissions and removals;
- Data processing and analysis tools and models
- Articulate the gaps and resource constraints facing the data-collection process

B. Adaptation

- Support the MoE in the identification of relevant adaptation projects / policies and its tracking
- Perform analyses of climate trends and their impacts, translating these to vulnerability and climate change impact assessments
- Sectoral or overall risks, vulnerabilities and impacts of a changing climate;
- Knowledge in disaster response, hydro/ meteorology and thematic areas that are impacted by climate change such as agriculture, water, urban planning, health, transport and energy infrastructure;

- Social and economic development issues
- Hydro/meteorologists and climate scientists should have broad knowledge of trends in climate and extreme weather events and their impacts on the physical environment;
- Disaster response teams who focus on preventative measures need an understanding of the causes of natural disasters and how to avoid their impacts.

Project proponents

- Request for registration in the CCMRV platform
- Provide information of the project: description, location, methodology, emission reductions (expected and reached), financing
- Delivery of the monitoring plan to the authority, for approval
- Responsible of the verification of the project in the different stages (design, implementation)
- Notify to the authority about changes in the project

Third-party verifiers (for mitigation projects)

- Obtain accreditation as 3rd party verifiers
  - Comply with required experience
  - Develop a management system for verification activities (e.g. aligned to ISO standard 14064)
  - Comply with specific training in verification activities
- Could support authority to approve the monitoring plan
- Should have access to CCMRV platform
- Verify the projects according to verification guidelines
- Issue verification opinions of the projects
- Register verification information in the platform

Support-related activities

Ministry of environment

- Identification of needs for the implementation of mitigation and adaptation actions
- tracking of provided resources for the implementation of projects
- Request of financial information to project proponents and involved authorities
- Request for funding according to needs
- Report to IACC the use of resources provided
- Maintain communication with the ministries / agencies that implement climate policies

National Experts

- Support the MoE in the identification of needs for the implementation of mitigation and adaptation actions

- Support the MoE in the tracking of provided resources for the implementation of projects
- Understanding of the financial, technological and capacity-building support provided for climate actions (e.g. which projects have received support or funding, how much has been provided, how much is still needed and from who) from a bottom-up (by project) and top-down (by fund) perspective.

IACC with support of Ministry of Finance

- Verify the use of resources provided
- Identify gaps and inconsistencies in financial information and request appropriate clarifications.
- Guarantee that what is reported in the BUR obeys the principles of the transparency framework
- Ministry of Finance: oversees use of the resources and double check reports from project proponents

6.2. R2 - Establishment of a robust institutional structure for MRV system

6.2.1. R2.1 Establishment of institutional arrangements through R1.1

According to UNFCC, institutional arrangements can be organized around five separate components: Organizational mandates; Expertise; Data flows; Systems and tools; Stakeholder engagement.

Table 12 Key components of institutional arrangements

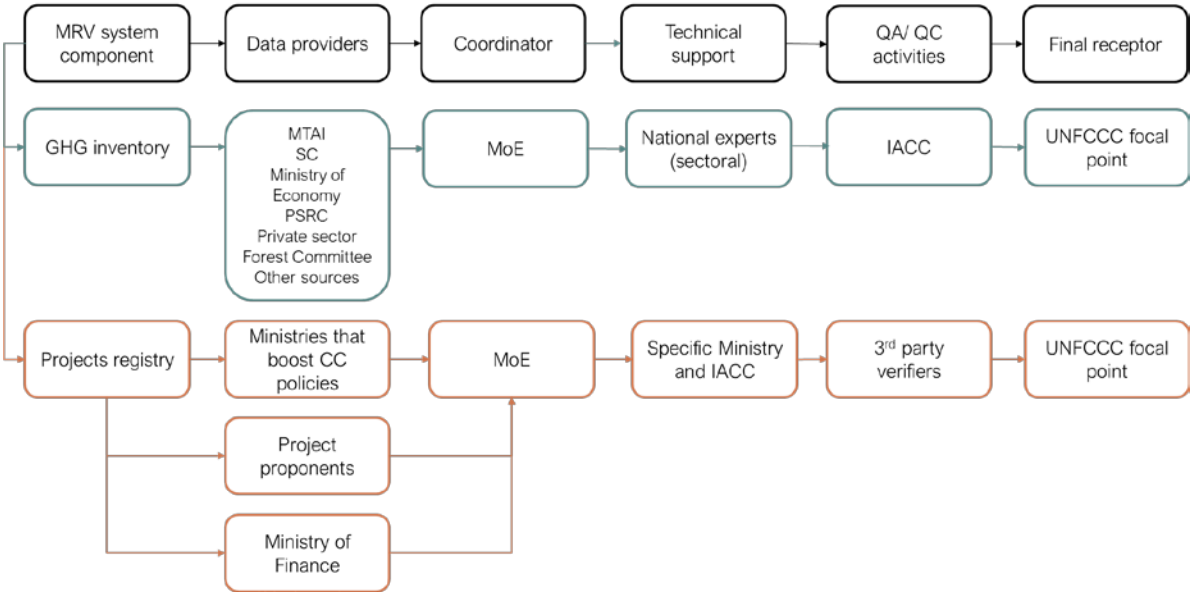
Components of institutional arrangements	How to address it	Description
Organizational mandates	Through a Climate Change Law (R1.1) and data provision agreements (R1.4)	It is important that the organizational structure, including roles and responsibilities of both the MoE and other ministries in climate policy, be established by law. However, technical aspects such as data provision can be detailed through inter-institutional agreements, as indicated in recommendation 1.4.
Expertise	Effective recruitment, retention and succession procedures in place	These mechanisms or procedures should be implemented to motivate the long-term and active involvement of experts in the reporting process and must be established in R1.1. However, detailed specifications can be set in other

		instruments as the GHG inventory decree (how sectoral experts teams will be composed and specific profiles).
Data flows	Established in specific regulations (e.g. R1.3, Projects registry decree or regulation, see R3.1).	The law (R1.1) should establish that data flows will be settled in corresponding regulations. Then, in the corresponding regulations about GHG inventory and the projects registry, should establish specific data flows. This includes defining the need for and uses of data, managing the delivery of the required datasets from a range of data providers on a regular basis and continuously improving data and reducing uncertainty.
Systems and tools	Law should stablish that the MoE is responsible of determining the systems and tools for the MRV system to be transparent	Institutional arrangements need to provide for the development and maintenance of workplans, engagement tools, databases, data analysis, indicators and reports. The specification of systems and tools can be outside of the regulation, but must ensure that the team of national experts are able to access the data and manage the data flow, perform QA/QC and produce timely outputs of a sufficient quality that improves over time.
Stakeholder engagement	Law (R1.1) must establish the key players and its role in climate policy. Other regulation will contain specifications about their activities within the MRV system.	Strong stakeholder engagement ensures that the transparency system reaches a broad range of stakeholders, including those from national government, local government, the private sector, academia, NGOs, the media and the public, so that data can be gathered from the most reliable and relevant sources and the outputs can inform their decision-making processes. All this must be established in the law (R1.1.) and reflected in the rest of the regulations.

For the purposes of this project, it is recommended to establish the IACC as the main institutional arrangement for the operation of the MRV system, which must be clearly and specifically established in regulation R1.1. However, there will be other institutional arrangements for each component of the system (GHG inventory, projects registry and emissions registry) that will be connected to the IACC as shown in the institutional mapping (Annex 1).

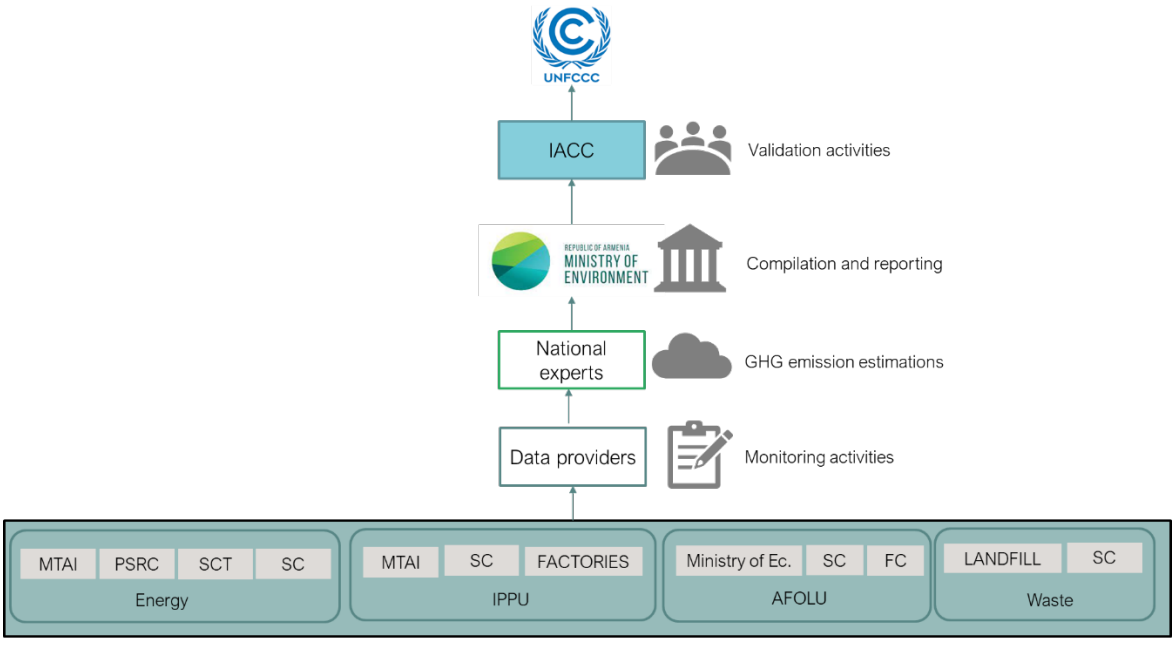
The Figure 21 shows the elements of the proposed institutional structure, showing the components of the system (it should be noted that the support component is found within the project registry), the main providers of information, the MoE as coordinator of each component, in addition to considering technical support from various actors, quality control activities and the UNFCCC as the final recipient of the outputs of this system.

Figure 21 General structure for institutional arrangements



The following image shows the general institutional arrangement for the development of the inventory. The institutional arrangements for the whole system can be found in the institutional map of the Annex 1.

Figure 22 Institutional arrangement for the development of the GHG inventory (summarized)



The institutional arrangements that must be established by law are:

- Inventory arrangements

    - For the provision of data by sector
- Arrangement for project registration
- Arrangement for emissions registry
- System wide arrangement
    - It includes all the arrangements, coordination, technical expertise and the participation of the IACC as the final validator of the system's outputs.

Institutional mapping is suggested as a basis for these purposes (see Annex 2).

6.2.2. R2.2 Include the IACC as the main institutional arrangement of the national MRV and its competences, in regulation R1.1.

Having shown through the institutional mapping what is foreseen in terms of institutional arrangements required for the MRV system, the first main recommendation is to establish that the IACC plays the main role of this arrangement, through the Climate Change Law in accordance to recommendation R.1.1.

Within this law, the role that this council will play in the operation of the MRV system must be established, its main function being the quality control and final approval of the inventory, the effective promotion of mitigation and adaptation policies (including technical advice to the ministries responsible for its implementation) and the monitoring of mitigation and adaptation actions that emanate from these policies, as well as independent actions that potentially contribute to compliance with the NDC.

It is not necessary to include more detail about the IACC other than its role and relevance in the MRV system within the Climate Change Law (R1.1). However, an amendment to the decree on the IACC that currently exists is suggested to establish specific functions and contributions both for the inventory and for the registration and monitoring of projects, including what is related to support required and received.

Specifications regarding institutional arrangements that must be included in the Climate Change Law to ensure IACC effectiveness in the long term:

- Grant power to MoE to establish institutional arrangements for MRV system
- IACC is the main institutional arrangement for the MRV system
- A specific regulation on IACC will determine specific member, activities and rules of operation
- The role of IACC in the climate change policy and in the MRV system.

Examples of general functions:

- Provide advice on national climate change mitigation and adaptation policies, as well as their incorporation into the corresponding sectoral programs and actions;
- Coordinate cross-cutting actions on climate change, between the ministries and other government entities involved.
- Promote the necessary actions to fulfill the objectives and commitments contained in the Convention and other instruments derived from it;
- Participate in the implementation and updating of the LT-LEDs and the NAP;
- Perform quality control activities in accordance with international reporting obligations.
- Disseminate their work and results as well as publish an annual activity report.

6.2.3. R2.3 Restructuring of the IACC and establishment of functions (amendment of the decree including specific MRV functions).

Although the fact that the decree which establishes the functions of the IACC was recently modified, it is considered that it does not contain specific functions of data validation and quality control, and that the working groups are so general that they could hinder the performance of the activities, in addition to not mentioning specific issues to be addressed in each group.

It is considered that the nature of a Council demands the participation of various social spheres and not only governmental, especially if the central issue to be addressed is climate change. However, relevant actors other than government as civil society, universities and research institutes, and the private sector can be invited as observers (as established in the decree). Their participation could be required to the identification of gaps, challenges and problems as well as to look for solutions to face climate change, reason why it is recommended that, obeying the principle of transparency and due to its potential contributions, these actors be invited frequently.

Adding to the above, it is suggested to create thematic subgroups that can focus on the different problems that emanate from an issue as transversal as climate change. It is considered that the three working groups established are not sufficient to technically address the diversity of issues that must be handled, so it is recommended that these subgroups be divided by sector and include experts in emissions from the sector.

The recommendations of the advisory group to the IACC, which will require their amendment, are described below.

<u>Working groups and Council members</u>

- The Council only includes members of the government, which may limit its vision towards issues that affect other sectors such as the private sector, academia, and civil society. It is considered relevant to invite them as observers and consider their participation since they can contribute relevant elements in climate policy from other spheres of society. They can be integrated as observers of subgroups, but it is important to determine the scope of its participation.

  E.g. Express local and specific concerns related to climate change; Express opinion on policies and projects related to climate change; Propose research, studies or analysis that contribute to expanding the knowledge necessary to solve specific problems.

- The decree does not specify sectoral working groups within the 3 groups created, so the issues it will handle are not clear. It is considered relevant to establish the topics that are required to be discussed in the Council so that the sessions are focused on the important topics, and involving the adequate members.

  In terms of topics, it is suggested to address the following with a sectoral perspective:

  - GHG emissions
  - Gaps of information
  - Challenges in data generation and quality

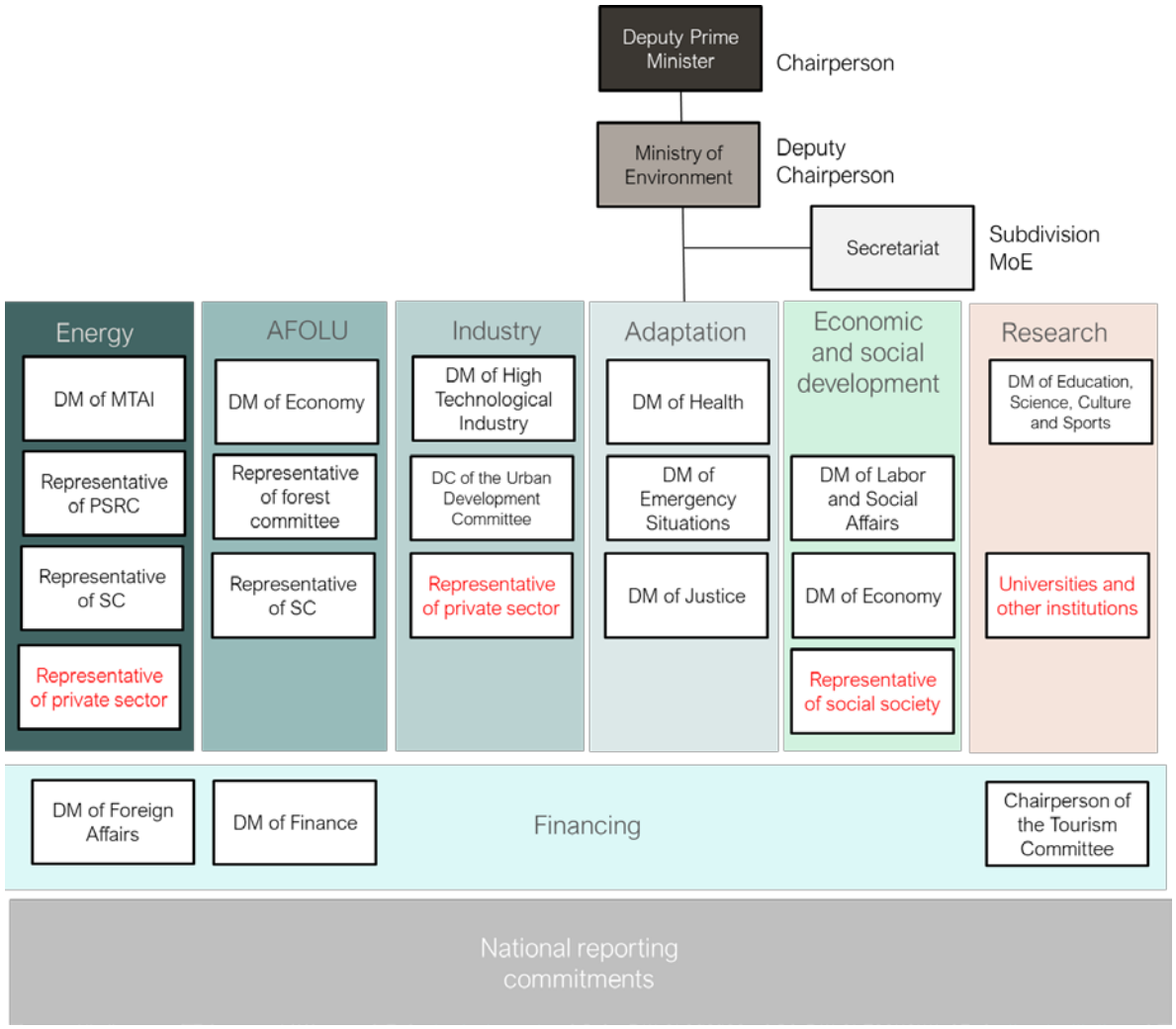
- Opportunities for emissions reduction
- Opportunities for vulnerability reduction
- Progress on related policies
- Support needs (technology transfer, capacity building, financing)
- Improvement for data management practices

- Make working subgroups by topic: Energy, AFOLU. Industrial Processes, adaptation to climate change, economic and social development, and research would be relevant from the consultant team point of view. Also, it is recommended that financing and national reporting commitments under the Convention groups keep a cross-cutting approach. It is important to keep impartiality, so it is suggested that the members of these working groups be different from the members that may support the technical inventory teams (e.g., providers of information in specific GHG inventory categories within the ministries). If it is not possible to apply this measure, specific rules must be established to avoid biases that may put at risk the results in the tracking of the different policies, including the GHG inventory but also mitigation and adaptation actions, and the financial balance of the support received in specific periods.
- It is recommended to consider the integration of the municipalities with a transversal participation in the different issues, particularly waste and economic and social development, which may be relevant. If it is not feasible in the short-term, plan in the long-term.
- Rules of operation: Frequency of meetings, internal communication modes, specific members and alternates.
- Specific rules for data validation activities: Information requests, information management, information confidentiality terms, define specific information requirements by MRV system component (in case that the Council participate in the entire MRV system). It is important to establish the specific information that will be handled in each working group for: 1) the GHG inventory, 2) mitigation and adaptation actions, 3) Climate financing, 4) NDC tracking.

  The suggested approach implies that every sub-working group addresses all components of the MRV system but with sectoral focus. In this way, involved representatives in each group will be familiar with the sector in the long-term which will help to simplify tasks and avoid double counting.
- The specific rules must detail the data evaluation techniques that will be applied for quality control activities such as cross-checks, internal audits, field reviews, or others depending on the different sectors and components of the system.
- Form working groups with specific topics that identify specific needs (for example, to discuss technical aspects of mitigation projects, carbon pricing instruments, implementation of a domestic carbon market in the future, etc.). It is suggested to invite representatives of entities that are not included in the committee such as the private sector, accreditation entities, and others that can be relevant depending on the matters handled. The working subgroups should be led by government ministries and agencies. However, the participation of other experts is relevant both to implement the climate policy, for the proper functioning of the system and to get reliable outputs of the CCMRV platform, particularly the NDC tracking.

- In the Figure 23, subgroups that the Council might contain are proposed. Note that red boxes correspond to invited representatives that the consulting team suggests including on a regular basis[18], which are no considered in the current IACC structure.

Figure 23 Proposed working subgroups for IACC (alternative 1)

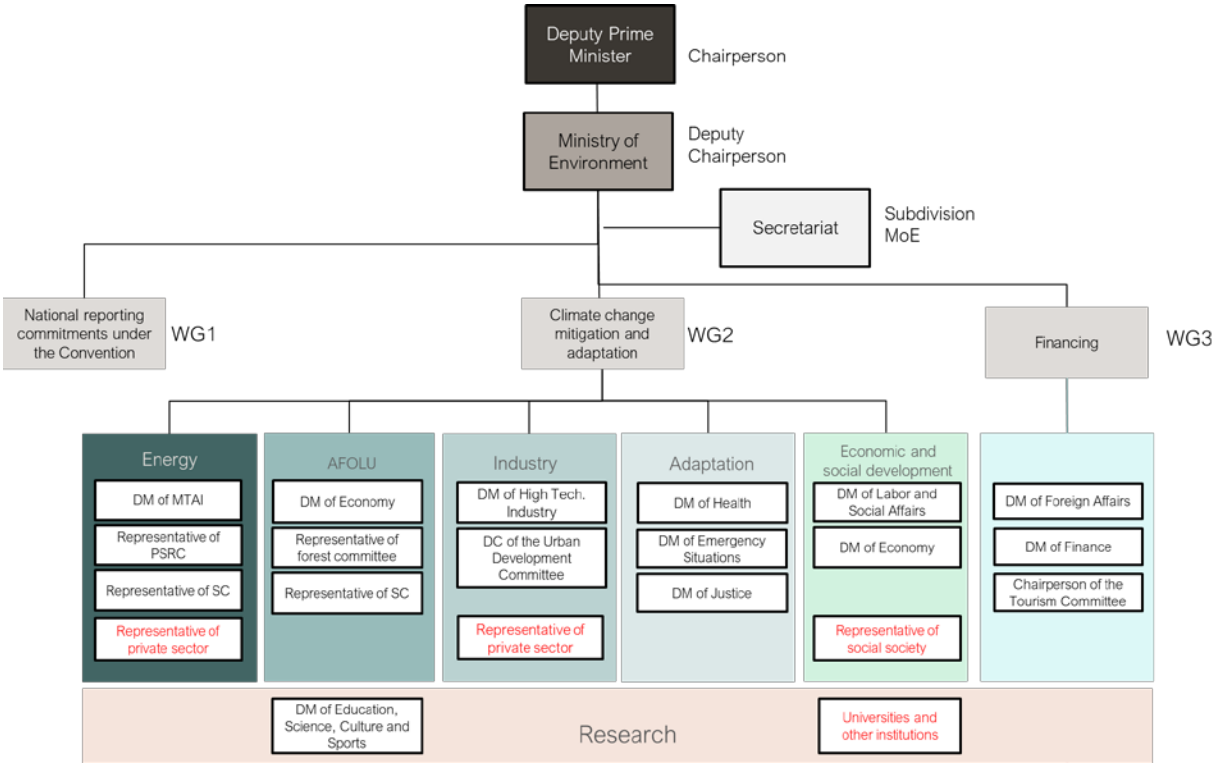


These 6 subgroups may be contained in group 2 (on climate change mitigation and adaptation) and it is recommended WG1 (on national reporting commitments under the Convention) and WG3 (on financing issues) to be cross-cutting. However, a second alternative for structure is provided in Figure 24, where 5 sectoral subgroups are derived from WG2, and WG1 and WG3 remain managing the reporting commitments to UNFCCC and financing related issues respectively. Adding to this, the subgroup of Research is

[18] Even as observers their participation could be relevant. It is important to define rules for observers, where they can speak and express their points of view.

including to have a cross-cutting participation in the Council as it is considered that the identification and development of certain climate change-oriented investigation is relevant in all the sectors in Armenia.

Figure 24 Proposed working subgroups for IACC (alternative 2)



It should be noted that it is only suggested to invite 4 additional actors to those already considered (marked in red) and establish sub-working groups by sector, so that each one addresses specific issues, establishing sector-oriented goals and functions for each group. It is recommended that participants with a technical profile be designated within each entity to address the issues, even though the heads of the council are the ministers. In this way, issues can be addressed more efficiently. It is important to specify the scope of the invitees, to clarify their participation.

Additionally, it is recommended that these experts in each group be different from the sectoral experts that contribute to the inventory, because part of their functions reside in quality control and thus the risk of impartiality in the reviews to be carried out is reduced, as a good international practice.

Inter-Agency Coordination Council operation

- It is suggested that the IACC adopt the following key functions for the climate policies of Armenia:
  - Promote the coordination of actions of government agencies and entities in matters of climate change;

- Provide advice to MoE on national policies for mitigation and adaptation to climate change, as well as their incorporation into the corresponding sector programs and actions;
- Promote and participate in updating processes of the LT-LEDS and the NAP that governs the actions to be undertaken in the long term in Armenia, and the Nationally Determined Contributions (NDC);
- Propose and approve the adjustments or modifications to the scenarios, trajectories, actions or goals committed in the LT-LEDS and NAP strategies, and in the NDCs at the National level for compliance with the Paris Agreement.
- Propose and support studies and projects of innovation, research, development and transfer of technology, development of statistics and others that contribute to reducing the problems linked to climate change, and disseminate the results.
- Promote the development of monitoring, reporting and verification capacities in the matter of mitigation and absorption of emissions.
- Convene organizations from the social and private sectors to express their concerns, opinions, and proposals regarding the fight against climate change.
- Request recommendations on policies, strategies, actions and goals on the effects of climate change for decision-making at different levels (local or national).
- Review of the climate change policy at least every 5 years in order to suggest the necessary adjustments based on the results obtained.
- Propose strategic projects that require financing.
- Promote the construction of national verification capacities.
- Celebrate agreements between social and private organizations to promote and implement actions aimed at reducing vulnerability and mitigating climate change.

• Establish procedures for continuous improvement: Establish the frequency and activities that will be carried out systematically to improve the Committee's operation, based on the results obtained. It is recommended to implement a continuous improvement process at least every 2 years.

- This implies to have scheduled feedback sessions to address the challenges that have been facing the members from different sectors, looking for the priorities to solve in the short term.
- It is recommended to have a written process to carry out these feedback sessions, identify the main challenges and discuss alternatives to solve them, to the extent that it is a priority (e.g. if the credibility of the system could be put at risk).
- It is recommended that this be applied at least once a year. It is important that these sessions are documented and that the aspects identified as priority are followed up.

• Preparation of annual work plans considering national planning instruments, so that they are in line with national purposes (prioritize actions based on national instruments)

• It is recommended that the meetings take place at least every three months to avoid that updates or relevant changes in national policies or priorities are discussed outside this timeframe, to avoid losing follow-up to any relevant matter. In addition, this will help to maintain a better follow-up and control in the progress of the activities planned in the IACC.

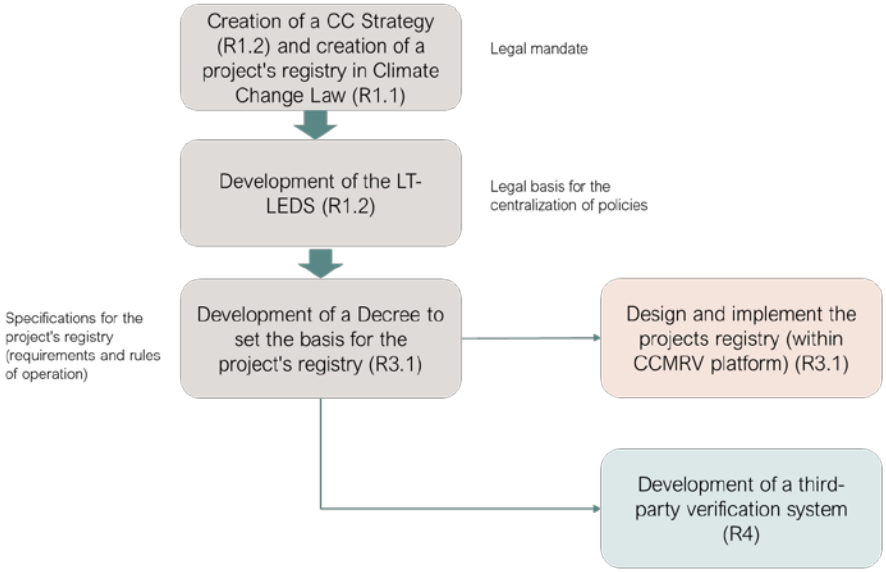
- Propose mechanisms for the incorporation of new members: how to integrate new members to the IACC whenever a greater technical contribution is required on the issues. Currently IACC can invite experts and consultants from academia, NGO sector and business on ad hoc basis. However, it is worth considering that unforeseen needs may arise that require a permanent contribution from key actors, so it is recommended to consider this type of mechanism in the operation of the council.
- Mechanisms for requesting information on technical assistance, when required.
- Follow up on the decisions of the negotiations on Climate Change that are discussed in the framework of UNFCCC and the IPCC.
- Promote the effective coordination of the committee, for which it is recommended to reduce the number of current entities or group members on key issues;
- Actively collaborate with the Statistical Committee to determine the information that feeds the National Statistical System and the MRV system, avoid duplication of efforts and information inconsistencies between both systems;
- Propose and support research, development and technological transparency studies related to climate change problems and disseminate the results;
- Identify mechanisms, instruments or regulations that are necessary for the implementation, operation and evaluation of the MRV system, and promote its preparation and implementation;
- Promote the strengthening of capacities in matters of monitoring, reporting and verification in government entities;
- Verification that validation methods are being properly applied, integration of technical experts to the committee, and capacity building / strengthening. Reporting that the validation was performed. Establish these specific processes by inventory category. For example: origin of the information, responsible for the generation, responsible for the collection, reviews carried out (cross-checks, audits, etc.), date of the reviews and results. Processes to request corrections / clarifications to the technical experts of the inventory

6.3. R3 - Management of climate change policies in a centralized system

It is recommended to centralize climate policies in a single planning instrument, configured as a LT-LEDS (R1.2) and NAP, so that all policies that lead to the reduction of GHG emissions and Armenia's vulnerability to effects of climate change, are moved towards a common approach, facilitating the monitoring of mitigation and adaptation actions, as well as that related to the support required and received, recognizing that climate change is a cross-cutting issue, and therefore requires not only from the leadership of the MoE, but from the participation of other entities in charge of energy, forestry, and other related policies, which will undoubtedly impact compliance with the NDC.

The first step requires establishing the creation and frequent review and updating of the LT-LEDS as mandatory, to subsequently develop and implement the strategy, involving the necessary ministries, agencies and actors, to finally create a registry of mitigation and adaptation projects where matters relating to support are included, and each action can be linked (when applicable) to specific policies, which will facilitate tracking of progress towards compliance with the NDC. The Figure 25 summarizes the steps to implement this recommendation:

Figure 25 Steps required to centralize climate change related policies



So far, the need to centralize in the system what is related to the following policies has been identified.

Energy related:

- The Strategic Program for the Development of the Energy Sector of the Republic of Armenia (until 2040), which contemplates solar and wind energy as the focus for the expansion of economically viable and technically available renewable energy. Through this strategic program, Armenia intends to increase its solar energy installed capacity from current 59.5 MW to 1000 MW before 2030 to increase both energy security and green energy share to at least 15% in 2030.
- The National Energy Efficiency and Renewable Energy Program 2021-2030, which will define new sectoral targets.
- Government of the Republic of Armenia, which intends to increase the share of solar energy generation to at least 15% of the total energy generation or 1.8 billion kWh by 2030. In addition, the Armenia Government also specifies the intention of promoting nuclear energy, energy efficiency projects, eco-friendly vehicles, and diversification of fuel supply chains as key priorities, as expressed through the BUR3.
- Covenant of mayors, where the mayors commit to reducing CO_2 emissions in their municipalities by at least 40% by 2030, mainly by increasing the use of renewable energy sources, improving energy efficiency, and “no-regret”, flexible measures. Signatories also commit to submit a baseline emissions inventory, a climate change risk and vulnerability assessment, a Sustainable Energy and Climate Action Plan (SECAP) outlining how the signatory intends to reach its commitments, within two years of adhering to the Covenant, as well as reports on progress every two years.
- Sustainable Energy for All Initiative

Forest related:

- The National Forestry Programme (2021), which includes the goal of increasing forest cover to 12.9% of the territory of Armenia by 2030.
- National Strategy for the inventory of Forests, 2020, is therefore particularly relevant for the national MRV system in development, since strengthening the accounting and reporting of the AFOLU sector of the NIR is a key area of opportunity for Armenia.
- Strategy for the Management of Firewood Collection and Distribution from the Forest, 2021, that proposes an alternative to firewood collection from forests that meets the local population´s needs. Technical, economic, and social aspects are considered in the feasibility analysis of alternative sources of energy, and a roadmap with recommendations for the way forward is presented. The implementation of this strategy would promote the conservation of woody biomass from national forests, otherwise sourced as household fuel, and increase the capacity of forests areas to store and remove GHGs, contributing to the achievement of the NDC.

6.3.1. R3.1 Implementation of a registry for projects to track related emission reductions and financing information

Taking into account that NAP was developed to address adaptation actions, it is recommended to implement separate systems to track mitigation and adaptation: MRV system for mitigation policies and actions and M&E system for adaptation policies and actions. Later, both can be operationalized within the CCMRV platforms as IT needs are met.

In terms of mitigation, once Armenia has -at least- the climate change law (R1.1), and desirable, the LT-LEDS, the MoE is instructed to draw up a decree to establish the functioning of the "projects registry" to track mitigation actions and policies in the country[19]. For the above, it is recommended to make decisions over the following aspects:

1) Which projects can be registered in the CCMRV, for example, NAMA, CDM, voluntary markets (VCS, GS), REDD+, projects framed in energy policies, others that the Ministry of Environment establishes?
2) What characteristics must be met by the projects that are registered in the CCMRV platform (have a solid baseline, a supported methodology, aligned to internationally recognized protocols, or others that the MoE considers relevant)
3) What requirements must be met for the registration of projects
4) Establish whether projects will be accepted at any stage (design, implementation, operation)

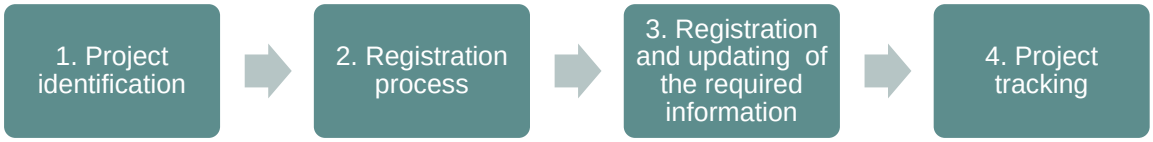
[19] It is recommended to implement the Project Portfolio System (CAEP) for these purposes.

5) What objectives this registry has (for example, to collect the information on mitigation projects to national account (linked to specific policies), to carry out long-term reduction transactions, etc.). The objectives must be set by the MoE.

6) Registration procedure: what the individual (developer) has to do to register their project (e.g. delivery of the monitoring plan and a validation opinion)

To implement the Project's Registry as one of the components in the MRV system it is necessary to establish a registration process for project proponents that includes the following stages:

Figure 26 Mitigation projects registration in the MRV system



1) Identification of projects by type, sector, subsector and associated policy

Proper identification of the project is key to maintaining the integrity of the mitigation action registry, since if the project is not properly identified, there may be the risk that the emissions accounting is not accurate, and even double counting, which may conflict with emissions from inventory and NDC tracking.

In this step it is relevant to specify if the project will contribute to compliance with the NDC, and the end use of the reductions.

2) Registration process

A procedure should be established for the registration of mitigation projects, that specifies the requirements to register the project on the CCMRV platform. Likewise, it has to specify the information that must be provided to the platform once the registration has been authorized, and the steps that correspond to the authority in this process.

In addition, a third-party verification and accreditation system must be developed to guarantee impartiality in accounting for emission reductions, in acceptable mitigation schemes within the national MRV system. There are international verification capabilities, but they may imply higher costs for project developers, so it is recommended to develop national verification capabilities.

Associated activities: make templates for project registration; approve / develop methodologies for mitigation projects; develop accreditation system for third-party verification bodies; develop verification guidelines. Additionally, it is recommended to prepare guidance documents for those who wish to register mitigation projects in CCMRV platform.

3) Information registration

The project developer / implementer must provide the necessary information about the mitigation project. The requirements must be established in a regulatory instrument, and for the development of the platform, the necessary fields for the registration of the project must be considered (IT requirements). Information requirements can be divided into 5 categories:

a. From the developer

Legal information about the project proponent / developer, either a private person or a incorporated company.

b. Project related

Project description, project stage at the time of project registration, geographic location; technology used; program / scheme in which the project is enrolled (if applicable); use of reductions.

c. Financing

Project financing scheme; entity that finances the project; public or private capital; financing term; financing conditions; type of support (adaptation, mitigation, cross-cutting); sector and subsector; estimated amount (in a specific currency); expected timeframe; expected financial instrument (grant, concessional loan, non- concessional loan, equity, guarantee or other); whether the activity will contribute to technology development and transfer and / or capacity building, if relevant; whether the activity is anchored in a national strategy and /or NDC; expected use, impact and estimated results.

d. Mitigation related

Emissions estimation methodology; establishment of the baseline; monitoring plan; annual and project-wide expected reductions; reductions achieved.

e. Emissions verification

Provide information regarding the verification processes to which the project has been submitted, registering at least the name of the verification body, the date of verification, the non-conformities, materiality and verified reductions.

It is necessary for the Ministry of the Environment to determine the methodologies under which mitigation projects can be registered on the CCMRV platform. A preliminary list of potentially relevant methodologies is presented in Table 13. The table also indicates whether a relevant methodology exists under the Clean Development Mechanism (CDM) of the UNFCCC. Relying on the MRV methodologies of existing international credit standards could facilitates the use of the mitigation action component of the MRV system to support international transfers, as potential buyers can have more confidence in verified and certified mitigation results using existing international standards, regardless of whether these methodologies (i.e. CDM methodologies) are formally incorporated into the Article 6 standards. Although guidance for the new crediting mechanism established by Article 6 includes more ambitious requirements for methodology design and baseline-setting than for the CDM, it is expected that existing CDM methodologies will act as the basis for any new methodologies. This is confirmed by the fact that at COP26 governments agreed that projects will be able to transition from the CDM to the new Article 6.4 mechanism, based on application of it current CDM methodology. Although the relevant CDM methodology may not be used or incorporated into the mitigation action component of the MRV system verbatim, could be used as the basis for a potentially simplified methodologies to be used in Armenia.

Table 13 Potential methodologies for mitigation projects in Armenia

Sector	Type of project/methodology	Relevant CDM methodologies
Energy	New renewable energy capacity – connected to the grid	AMS-I. D - Grid-connected renewable electricity generation (small scale)
		ACM0002: Grid-connected electricity generation from renewable sources (large scale)
	New renewable energy capacity: off-grid	AM0103: Power generation with renewable sources in isolated grids
	Demand-side energy efficiency (residential and commercial)	AMS-II.J.: Demand Activities for Efficient Lighting Technologies
		AMS-II.L.: Demand activities for efficient outdoor lighting and street lighting technologies
		AM0120: Energy-Efficient Refrigerators and Air Conditioners
	Demand-side energy efficiency (industrial)	AMS-II.C.: Demand-side energy efficiency activities for specific technologies
	Fuel change	ACM0011: Switching from coal fuel and/or oil fuels to natural gas in existing power generation plants.
Transport	Promotion of the use of electric vehicles	Unavailable
Industry	Change of raw material in cement production	ACM0005: Increased mixing in cement production
Waste/ Agriculture	Methane recovery in manure management systems	AM0073: Reducing GHG emissions through multi-site manure collection and treatment at a central plant
	Avoid landfill gas emissions	ACM0022: Alternative Processes for Waste Treatment
	Methane recovery in landfills	ACM0001: burning or use of landfill gases
	Alternative waste management practices	AMS III.F Avoiding methane emissions through composting
Forestry	A/R of land	AR-ACM0003: Forestry and reforestation of land, except wetlands

Note: CDM methodologies are in English only, see link below https://cdm.unfccc.int/methodologies/documentation/meth_booklet.pdf

It is worth mentioning that Armenia has registered standardized baseline for grid emission factor based on the CDM methodology tool v5, for the purpose of using it as national valid factor for mitigation impact assessment, approved by the CDM Board, which will help to simplify methodologies related to energy projects.

4) Project tracking

It should be noted that the above must be established in a regulatory instrument applicable to persons or companies developing and implementing mitigation projects interested in registering their projects in the MRV system, which establishes the requirements and the registration process.

This regulation must contain what is shown in Table 14. However, the government of Armenia should take some decisions before the implementation of a mitigation actions registry within the MRV.

Table 14 Minimum requirements for regulation in mitigation actions tracking in the MRV

Elements	Description	Decision making
Scope and applicability	Define sectors of mitigation activities implemented in Armenia to be registered in the MRV system. Determine also minimum requirements for the project developers to register the mitigation actions.	Define if the mitigation registry would be an “open” registry to all type of projects, or if what is needed is to limit the scope, i.e. Energy sector. It depends of the aim of the registry. Projects with a third-party verification opinion?
Objective of the registry	Define the purpose or purposes of the mitigation registry, according to the needs. The registry can serve to various purposes. It is important to determine it, since the technical and technological requirements for its implementation will be different, depending on what is being sought.	What is this registry for? e.g. to be a repository of information, to know the mitigation activities that are being carried out in the country, or it also has the purpose of accounting for reductions (in this case, only to account them or also to certify them and or to make transactions?).
User types	Depending on the objectives of the registry, it can have different types of users with limited functions each. For example, the MoE as the coordinating unit of the MRV with unlimited access; project proponents, verification bodies with limited access, among others.	Main users of a mitigation registry: • Coordinator (MoE in this case) • Other relevant authorities • Verification bodies • Project proponents • Donors

Types of projects	Define the types of projects relevant to Armenia, to be considered as mitigation activities. Consider national mitigation policies, and where appropriate, programs that are financing projects in specific sectors.	What types of projects will be acceptable as mitigation activities in the country?
Information requirements	Determine the information of the project that must be provided to be registered in the system.	Example of this information is: project developer data, description of the project, financial information, methodology, monitoring plan, information on mitigation, verification.
Accepted programs / schemes	Define whether it is within the authorities' interests to integrate into the registry projects that have been carried out in Armenia under mandatory schemes (i.e. CDM) or voluntary schemes (VCS, GS or others), although their reductions may be committed in such schemes. Consider REDD+ projects in the field of forestry.	It depends on the objective of the registry, to determine whether projects from other emission reduction schemes will be compiled.
Use of reductions	It is relevant that all projects that are registered as mitigation activities determine the use (destination) of the reductions for the purpose of avoiding double accounting of reductions.	It is recommended that the end-use of reductions be allowed to be recorded: as accounting only, contribution to NDCs or transactions in international markets.
MRV requirements	Define plan monitoring content, as well as characteristics and frequency of verification required.	To be discussed according to the purpose of the registry. It is recommended to build national verification capacities in the long term.
Methodologies	Establish methodologies for the estimation of baseline emissions and projected and actual reductions that are generated as a result of the implementation of mitigation activities. These	It is recommended to take as a basis approved methodologies while building capacities in the long term to develop own methodologies, if necessary. It is feasible to adopt a simplified

	methodologies can be standardized and based on approved schemes such as CDM, or they can also be created by the authorities themselves.	methodological approach that facilitates the application of these methodologies to project proponents (e.g. standardization of the grid emission factor).
Stage of the project	Mitigation actions can be accepted at all stages, or they can be limited to only implemented ones, to be registered. When the mitigation activity is registered, the stage of the project in which it is located must be specified: design, implementation, operation. Mitigation activities that are in the design stage can be counted as potential reductions.	It is recommended that a validation opinion be requested, even if actions at the design stage are accepted. Likewise, the term in which the project is implemented and when it is completed must be specified, to avoid overestimating of emission reductions.
Outputs (types of reports)	Specify the types of reports that the system is required to generate, by user type.	Examples of reports are: • Number of projects by type and sector • Potential reductions • Verified reductions • Contribution of mitigation actions to the NDC • Investments in mitigation actions
Transactions? – Cancellation of units	Determine whether the prospect of registering mitigation actions in the long-term is to generate reductions that can be transferred between carbon markets or even countries (i.e. ITMOs).	Armenia's potential for participation in carbon markets should be analyzed. At the moment, it is recommended that the related regulation, and the platform have the flexibility that allows it to join carbon markets.

It is recommended to establish the specifications and rules of operation of this registry in a legal instrument such as a Decree. In general terms, this decree should include:

- Objective and scope of the registry
- Coordination and other relevant roles
- Requirements for project proponents to register projects
- Registration request process

- Project registration process
- Use of information (including use of reductions, when applicable)
- MRV obligations for project proponents (e.g. monitoring plan, verification report).
- Specific information to provide through the registry (step 3 of Figure 26)

6.3.2. R3.2 Analyze in detail the incorporation of policies and their goals in the system (registry)

In order to be able to track compliance with the goals established in the various policies mentioned above (and others to be included in the future), it is recommended to register them in the system (sector, name of the policy, objectives and specific targets and timeframes), so that the projects that derive from these specific policies can be "labelled". In this way, projects would be linked to policies and the "real-time" status of meeting goals could be consulted at any moment.

It should be noted that mitigation and adaptation projects can be implemented through government agencies, private project developers, or other types of organizations / companies (according to what regulation allows), seeking that the system keeps a record from the time the project is registered until its completion.

Not all projects will necessarily be linked to a policy (there may be independent projects that serve for national accounting of reductions, or for trading purposes in a carbon market, as the system matures in Armenia), but this registry can centralize all actions, regardless of whether they stem from a specific policy.

The incorporation of policies into the system will be a task that must be carried out as existing policies are updated, and others related to climate change arise. The above in case it is in Armenia's interest to have control of all these actions[20] (it is recommended this is established through the Climate Change Law). For this reason, it would be appropriate to centralize all these policies in a LT-LEDS to be updated at least every 5 years, as suggested in R1.2.

6.4. R4 - Implementation of a verification system to verify emission reductions related to mitigation projects and GHG emissions of private sector

6.4.1. R4.1 Development of an accreditation system

The Ministry of Environment is recommended to build national verification capacities with the aim of implementing the MRV system that. This should be done throughout an accreditation system where trained people in verification / validation practices are certified.

The accreditation system can benefit all MRV system components, especially to the registry of mitigation projects (PPS), reducing costs to individuals who register emissions and / or mitigation actions and guaranteeing certainty and confidence in the information reported. To the extent that a third-party verification is required, the MRV will be more strengthened, since

[20] This will imply a great effort at the beginning to collect the policies and involve the various actors (e.g. those responsible for that policies), but in the long term, it will facilitate the operation and yield more precise results in the system.

third-party verification allows to guarantee a level of assurance in the verification and the impartiality of the process by aligning with international standards such as:

ISO 14064-1:2018 Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals)
ISO 14064-2:2019 Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements
ISO 14064-3:2019 Greenhouse gases — Part 3: Specification with guidance for the verification and validation of greenhouse gas statements
ISO 14065:2020 General principles and requirements for bodies validating and verifying environmental information.

As long as there are no national capacities, the costs of hiring foreign verifiers will be high for individuals (project proponents) when they need to validate or verify a project or its reductions, which may discourage them from voluntarily adhering to these processes.

In addition, it is considered that it would be very challenging for the IACC to take over of the validation activities, and that it will be profitable in the long term to have national capacities that, once they have acquired experience, will also be able to provide technical support to the council.

It should be noted that if MRV obligations are established for companies (R1.5), the verifiers will also help with the tasks of verifying reported emissions, thus guaranteeing a high level of assurance.

6.4.2. R4.2 Development of national verification capabilities

Building national verification capabilities requires adopting an accreditation and/or approval system that the MoE deems fit for purpose. It is recommended that this process adopt or align with the international standard ISO 14064 and 14065; however, the alignment to these standards although it is a good starting point, is considered to be insufficient in the long term since these standards lay the foundations for a verification process but are lax in some aspects, so the establishment of specifications is required, for example, in terms of degree of materiality allowed and level of assurance of verification, among others.

- This verification process should be established aligned with an international standard, but with specifications according to the needs of Armenia.
- This scheme must be built in conjunction with a national accreditation entity, which would be directly responsible for accrediting these bodies. The MoE of Armenia may also issue verification guidelines for the specific emissions verification process of the mitigation actions that are registered in the CCMRV.
- Specifications may include, but are not limited to:
    - Materiality and level of assurance of verification

  - Competencies required for the verification team (can be based on ISO 14066:2011 Greenhouse gases — Competence requirements for greenhouse gas validation teams and verification teams).
  - Impartiality criteria (ensuring that there is no conflict of interest between the verifier and the verified)
  - Specifications of the Verification Plan and Sampling Plan
  - Contents of the verification report
  - Documentation of verification results (data audit and site visit)
  - Issuance of verification opinion
- Develop corresponding templates and formats to document the process
- Promote the accreditation scheme among professionals working in the field of climate change mitigation
- Conduct training in the field

This scheme will take several years to build because it also depends on the interest of individuals to be accredited as verification bodies. However, it will bring the system the benefit of greater credibility and evict the workload from the MoE.

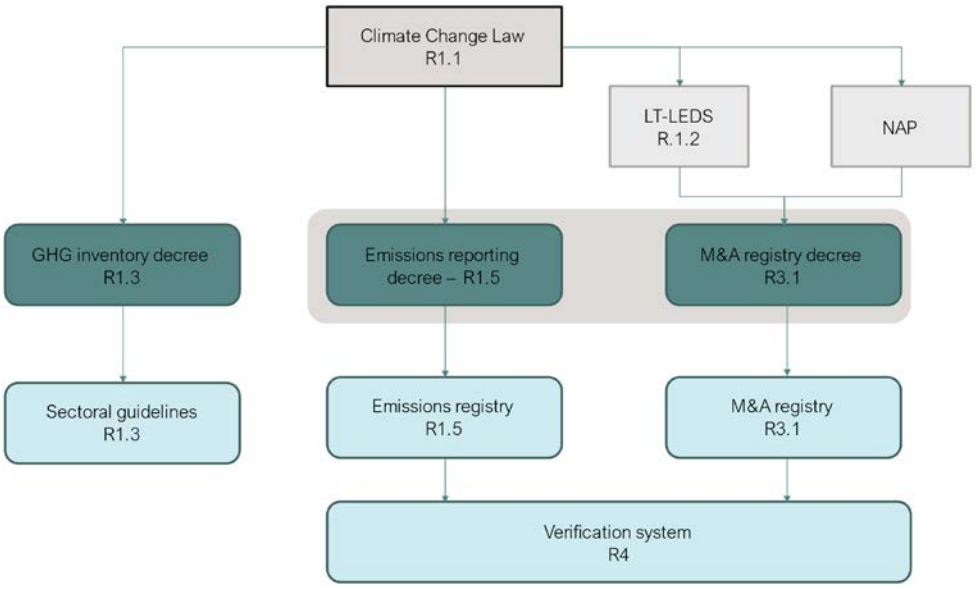
It would be advisable for a representative of verification bodies to join the IACC in the future.

It should be noted that the entire legal framework for the MRV system, if third-party verification is implemented, would be as shown in Figure 27.

It is considered that this structure is adequate to have an efficient MRV system in the long term. The Climate Change Law (R1.1) represents the legal basis for the development and implementation of the system and would grant the MoE's power to make decisions on the matter. The LT-LEDS (R1.2) would be the basis for the development and implementation of mitigation and adaptation policies, and therefore the basis for the implementation of specific actions, which would lead to the creation of a registry of projects, which should be supported by a third-party verification system (R4).

On the other hand, if a reporting obligation (and, desirably, verification) is implemented in order to have a greater coverage of emissions by the private sector, it is advisable to have a decree detailing the mechanisms for compliance, although the obligation must be established from R1.1. This would entail an electronic emissions registry and verification capabilities could be harnessed to count verified emissions to serve public policy.

Figure 27 MRV system legal framework



6.4.3. R4.3 Development of tools and instruments needed for verification activities

In accordance with the verification guidelines that are established to guide the work of the verifiers, the necessary tools will be developed so that all verifiers work under the same parameters and perform an approved job. It is recommended to develop the following tools:

- Template of letter of no conflict of interest
  - Verification plan template
  - Emission sources to review and methods to apply, indicating scheduled site visits.
- Verification report template
  - Reviews performed, findings, materiality (difference between verified and reported emissions)
- Verification opinion template
  - Conclusion of the verification.

It is recommended that these tools be part of the system and that the verifier have specific access to the registry, so that they can verify the emissions on the platform and avoid the MoE having to make additional efforts to collect the information and enter it into the system. In other words, it is recommended that all these verification processes be automated for a more efficient operation.

6.5. R5 - Data quality improvement

Over the course of the project, specific areas were identified where data could be improved for the GHG inventory, which is the only component of the system that currently exists. It is considered that work can be done progressively to improve the quality of this information, which will require the collaboration of providers, and in some cases may involve amendments to specific regulations.

It should be noted that as part of the desktop review, recent analyzes were identified that issued relevant recommendations in this regard, and that it is important to be taken into account for the operation and effectiveness of the system in the long term.

The quality of the inputs of the system must be a permanent and systematic task and be part of a continuous improvement process like any management system. For this reason, it is highlighted that these recommendations are in line with what was identified in this project, but the quality of the information will be a responsibility of the system coordinator (MoE according to what was proposed in the institutional mapping).

6.5.1. R5.1 Continue with the implementation of the roadmap for the development of the forest recording system in Armenia

The document compiles a series of findings and recommendations to improve and standardize a forest monitoring system in the country. It is considered that the execution of these recommendations should be prioritized in order to have a better inventory regarding AFOLU, thus increasing the accuracy of the national inventory.

1. Establishment of the National Statistical Forest Inventory System (13 actions)
2. Updating of the National Stand Forest Inventory System (20 actions)
3. Updating of the National System of State Forest Cadastre and State Forest Account (4 actions)
4. Update of the National Forest Monitoring System (1 action)
5. Creation or adaptation of the Computerized National Forest Management System – DBMS “Forest Resources of Armenia” (5 actions)

This will entail to link the monitoring system to the CCMRV platform, within GHG inventory component. Outputs from this system would be inputs for CCMRV that would support AFOLU inventory estimations.

6.5.2. R5.2 Implementation of the 26 mitigation actions for LULUCF sector in Armenia.

Section 4 of the technical report “Assessment of Land Use, Land Use Change and Forestry Sector Potential in Achieving Climate Change Mitigation Objectives in Armenia” provides an overview of 26 possible mitigation actions for the LULUCF sector, divided by 4 key subsectors: land use change with 3 actions, forests with 9 actions, agriculture with 13 actions, and peat extraction with 1 action. It is advisable for the Armenian MRV system to include these 26 categories within the 4 main subsectors in the reporting, accounting, and tracking platforms, and to prioritize actions with the highest mitigation potential.

Table 15 LULUCF mitigation envisaged actions

Land use change actions	**Other actions**
Prevention of soil sealing	

Prevention of grassland conversion Prevention of deforestation	Limitation of peat extraction
Mitigation potential: 504 tCO_2eq / ha	Mitigation potential: 552 tCO_2eq / ha
Agriculture actions Plantation of perennial crops Development of agroforestry and hedgerows Non cultivation of organic soils Limitation of exports of biomass from crops Development of non-till farming techniques Increase biomass productivity of crops Adjustment in the choice of cultivated species Introduction of more intermediate crops, intercrops, grassed strips Increase of manure application Optimization of water management Optimization of grassland management Restoration of degraded soils (acidified, eroded, salty soils) Spreading of "inert" carbon (e.g. biochars)	**Forest actions** Afforestation or reforestation Restoration of degraded forests Optimization of forest management practices Sawnwood wood harvest regulation Fuelwood harvest regulation Increase lifespan of harvested wood products Limitation of wood losses during harvesting Prevention of forest fire events Prevention of other natural disturbances (windfalls, snow breaks)
Mitigation potential: 114 tCO_2eq / ha	Mitigation potential: 332 tCO_2eq / ha

According to the study, there is a mitigation potential of 1,502 tCO_2eq / ha in the 2018-2050 period.

These measures would have to be "uploaded" (registered) in the system, within the "mitigation and adaptation actions" component (project's registry), and their status recorded until they are completed. In this way, within the system they will be accounted for as reductions when it is verified that the actions were carried out properly (each action has to be registered as a single project and the project proponent can be the assigned authorities).

6.5.3. R5.3 Implementation of the Carbon Stock Measurement Guidelines.

It is proposed to include the application of these guidelines for the development of the national and local GHG inventories, AFOLU sector, within the regulation or guidelines for the GHG inventory (R1.3).

The methodology and procedures to be used to estimate carbon stocks and their changes over time in forests are simple step-by-step procedures using standard carbon inventory principles and techniques.

The stages for measuring carbon in forests involve:

1. Delineation of boundaries
2. Stratification and boundary mapping of stratum
3. Pilot inventory
4. Capacity building and orientation of field teams
5. Field measurements in plots
6. Data analysis
7. Report preparation

It is suggested that in the law (R1.1.) the power be granted to the MoE to determine the best available practices and sources of information that will be used in the inventory and all the components of the MRV system and establish that the national inventory of the sector AFOLU will be carried out in line with the best international monitoring practices and considering the necessary adjustments that obey the conditions of the country. On the other hand, in the inventory regulation (R1.3) it is recommended to explicitly determine that these guidelines will be used as methodologies for forest carbon measurement, when applicable.

That means that, if Armenia decides to prepare for the application of this guidelines, then it can be used for the monitoring of carbon stocks. Required preparation has to do with proper technical expertise (trained staff) as well as equipment, so it might not be feasible in the short-term.

However, these guidelines are key for enhancing the accuracy of estimations of national GHG sinks and removals reported in the NIR, since they provide guidance for the estimation of carbon stocks in accordance with the requirements and provisions of the International Panel on Climate Change (IPCC). So, it is important to consider its implementation in the long run.

6.5.4. R5.4 Improvement of the data quality for the estimation of waste sector emissions, through waste generation cadaster data

It is noted that there is a Waste Law that requires the collection of information on waste generation. State waste cadastre comprises waste classification, lists of waste production, reprocessing and recycling structures, as well as a database on waste utilization and disinfection technologies and is performed by the state authorized body in the environmental protection sector.

This law also establishes that a register shall be kept by the state body authorized to receive, process, store and analyze information on the production, reprocessing and recycling of waste, containing, among others, the amounts of waste production, the qualitative and quantitative characteristics, information on waste treatment, all the above based on information from waste producers. This information will be verified annually.

It is recommended to consider this cadaster as first-hand activity data for the waste inventory, as current sources of information are variable and not necessarily the most recent ones. This information can also be used to promote emission reduction policies in the waste sector.

The technical team corresponding to the sector must analyze in detail with the area of the MoE that carries out the compilation of information, the feasibility of obtaining the necessary information. Relevant aspects to consider are:

- Is the waste law a regulation that is implemented in practice?

- Is there an updated waste record (according to the mandate)?
- If yes, as information is received is useful as input for the inventory, or how much this information should be treated / adjusted?
- Is this reliable information?
- What is the coverage of the waste registry in terms of generation?
- Is it considered that this information can replace what is currently used and that this replacement would imply a substantial improvement in data quality?

In the event that this mandatory registry by law does not yet exist, its incorporation or merger with the CCMRV platform, can be planned in the medium or long term, once reliable information on waste generation is systematically obtained.

In case it is decided to take this information for the GHG estimations, it has to be established through the decree of the inventory, and its guidelines - waste sector (R1.3)

6.5.5. R5.5 Include statistical data quality improvement within regulations (R1, R3).

Statistical data is one of the main sources of data for inventory estimates, so it is of the utmost importance to ensure it is updated and accurate.

Throughout the project, potential improvements were identified, based on desk review and stakeholder consultation. However, in terms of data quality, it is important to carry out a detailed analysis of each entry to the system (inputs), which is not within the scope of this project.

The consulting group noted that there is an adequate mapping of the information required to make the emission estimates. In terms of statistical data, there is even "The road map for the development of climate change-related statistics" that was prepared by the Statistical Committee in 2020. The roadmap identified and prioritized the needs to improve the generation, collection and management of the information required for the GHG inventory, based on consultations with stakeholders. As part of this analysis, gaps and solutions were identified pointing out those responsible for carrying out the required actions, establishing for each recommendation, the actions to be taken, those responsible and co-responsible, deadlines for implementation and frequency required. See Table 22 of the report to see the summary of those priorities.

It is considered that valuable work has been done, so it is recommended to take these 9 priorities and address them for the generation and improvement of statistical climate change information that is currently used only for the inventory, but that in the future, it can increase its usefulness, by being used as indicators in both mitigation and adaptation, which reflect the progress of policies and contribute to sustaining achievements as well as identifying areas of opportunity.

Based on what was identified, the following recommendations are made.

1. Prepare a list of inputs from SC and adequate updating frequency. Based on the needs, identify the censuses that should be prioritized according to the Statistics Law.

The consulting group noted that there is an adequate mapping of the input information required to make the emission estimates. In terms of statistical data, there is even "The road map for the development of climate change-related Statistics" that was prepared by the Statistical Committee in 2020, with specific recommendations to improve data quality.

The first thing to do is prepare a list where it is clear what data is missing for the estimates, what data needs to be improved and who is responsible.

On this basis, it should also be determined how often the information should be updated, taking into account that the inventory is carried out every two years. In this sense, it should be promoted that, as far as possible, certain information can be updated with the same frequency. However, when it is not feasible, an updating plan will be determined for each data series, to be discussed with the staff of the Statistics Committee involved. It is recommended to update the information that is input for the inventory no longer than every 5 years, but every 2 years when feasible.

It should be considered that amendments to the statistics law may be required, specifically regarding specific censuses and their frequency. Likewise, it must be ensured that the corresponding censuses are representative of the conditions in Armenia.

2. Implement law R.1.1 (and modify statistics law if required) to make official the use of statistical data as inputs of the MRV system, establishing update frequency as well as reporting obligations for the SC (as well as for the rest of the data providers).

3. Implement inventory regulation (R1.3) where they are defined: sources of information identifying which are statistics, frequency of surveys when applicable, representativeness, among others.

4. Sign collaboration agreements between MoE and the statistics committee (R1.4) to guarantee the effectiveness of the data provision mechanism.

Annex 1 Instruments reviewed for regulatory framework

7. Regulatory framework

7.1. International

7.1.1. NDC and its Implementation Plan

The Nationally Determined Contribution 2021-2030 of the Republic of Armenia, recently submitted to the UNFCCC in response to the Paris Agreements, approved under the Government Decision N 610-L on the 22nd of April 2021, reiterates the ratification of the Kyoto Protocol (KP) in 2002, the Doha Amendment to the KP in 2017, the Paris Agreements in 2017 and, most recently, the Kigali Amendment to the Montreal Protocol in 2019 for the phase down of HFCs.

The update of the NDC is based on considerations to maintain the growth of national economy, reduce poverty, protect the environment, support the achievement of the sustainable development goals (SDGs), increase national energy security and to ensure affordable and clean energy supply.

The NDC discloses the new economy-wide mitigation target to be achieved in the 10-year implementation period (2021-2030), which equals a 40% reduction below 1990 emission levels. The GHGs covered in this target are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), for which reporting is mandatory under the ETF, and F-gases (HFCs, SF_6), for which reporting is now flexible under the ETF. The sectors and sub-sectors of focus of the NDC are the following:

- Energy: Energy production and use.
- Industrial Processes and Product Use (IPPU): Mineral industry and F-gases.
- Agriculture: Enteric fermentation, direct and indirect N_2O emissions from managed soils.
- Waste: Solid waste management and wastewater.
- Forestry: Afforestation, forest protection and other land use.

The NDC also states Armenia´s intention to double its share of renewable energy in the energy generation matrix by 2030, on the path to achieve climate neutrality in the second half of this century, to develop a debt-for-climate innovative financial swap mechanism, and to participate in market and non-market mechanisms under Article 6 of the Paris Agreements, including cooperative approaches enabling the use of internationally transferred mitigation outcomes (ITMOs) under Article 6.2 by other Parties towards their NDCs, project mechanisms under Article 6.4, providing additional mitigation outcomes to support the achievement of NDC goals by other countries, and non-market approaches under Article 6.8 of the agreement.

In addition, the NDC reiterates the former long-term mitigation goal set out in the Intended National Determined Contribution (INDC), submitted to the UNFCCC in 2015, of limiting per capita emissions to 2.07 tCO_2eq in 2050, subject to adequate international financial, technological, and capacity-building support. This mitigation target will be reflected in the Long Term – Low Emission Development Strategy (LT-LEDS) to be developed by Armenia.

Furthermore, according to the NDC, Armenia is prepared to increase its ambition and in time go climate neutral with the help of international donors, in line with the Talanoa Dialogue of 2017-2018.

Implementation Plan

Furthermore, several national and sectoral strategies with quantitative and qualitative targets are mentioned in the NDC as part of the implementation plan, including the following:

- The Strategic Program for the Development of the Energy Sector of the Republic of Armenia (until 2040), which contemplates solar and wind energy as the focus for the expansion of economically viable and technically available renewable energy. Through this strategic program, Armenia intends to increase its solar energy installed capacity from current 59.5 MW to 1000 MW before 2030 to increase both energy security and green energy share to at least 15% in 2030.
- The National Energy Efficiency and Renewable Energy Program 2021-2030, which will define new sectoral targets.
- The National Forestry Programme (2021), which includes the goal of increasing forest cover to 12.9% of the territory of Armenia by 2030.

Reporting requirements

Since the ETF will require mandatory reporting of progress on the qualitative or qualitative indicators defined by the Party, the MRV system should ideally be able to track progress towards the qualitative and quantitative goals that are already in the NDC, mentioned above, and facilitate reporting the progress on the overall economy-wide emission reductions, sector and gas-specific emission reductions for the sectors under the scope of the NDC, installed wind and solar energy capacity, share of solar energy in the power generation matrix, the total share of renewable energy in the matrix, and the percentage national territory with forest cover.

In addition to the progress in meeting reduction targets and qualitative indicators, Armenia´s MRV system should also ideally be able to identify and track the impact of the collective mitigation measures related to Articles 6.2, 6.4, and 6.8, as well as financial support received from other Parties, since further cooperation with other Parties to the Convention is expected in addition to the ongoing cooperation agreement with the European Union.

Furthermore, since the scope of the NDC includes HFCs, which are also part of the scope of the CEPA with the EU, it is particularly useful for the MRV components and reporting platforms to be able to track disaggregated emissions and emission reduction projects by type of HFC, which include: HFCs: HFC-32, HFC- 125, HFC-134a, HFC- 152a, HFC-143a, HFC-227ea. Under the new ETF, reporting of HFCs disaggregated by type of gas will be flexible. However, Armenia already has the institutional setup to report HFCs disaggregated by chemical and by applications and has been doing so this way in the National Inventory Report.

Adaptation

The natural ecosystems adaptation approach described in the NDC is considered pivotal for Armenia´s adaptation strategy and the basis for the development of the National Adaptation

Plan. National project reporting platforms should ideally consider aspects related to this approach.

In addition, the ETF also includes adaptation features in the non-mandatory reporting requirements, including progress on adaptation actions and processes, cooperation, good practices, experience and lessons learned. Considering this reporting structure, although non-mandatory for non-Annex I Parties, it would be ideal for reporting and data collection platforms in Armenia to allow tracking progress in the adaptation sectors of national priority sectors, listed further below, and in particular, to allow identifying measures that support improved biodiversity and ecosystems services, income generation, poverty reduction, adoptive development or resilience of infrastructure and emission mitigation co-benefits of adaptation measures, all of which are intended to reduce the country´s overall vulnerability to climate change, according to the NDC.

The sectors of priority in Armenia, regarding adaptation to climate change, are those with the highest vulnerability, which are:

- Natural ecosystems: aquatic and terrestrial, including forest ecosystems, biodiversity and land cover
- Human health
- Water resource management
- Agriculture, including fishery and forests
- Energy
- Human settlements and infrastructure
- Tourism

7.1.2. 3rd Biennial Update Report (BUR3)

The 3rd Biennial Update Report (BUR3) was developed by the Ministry of Environment of the Republic of Armenia and submitted to the UNFCCC on the 17th of May 2021, accompanied with the stand-alone 1990-2017 National Inventory Report.[21] It provides updated information on national circumstances, greenhouse gas inventory, progress in mitigation policies and actions, measurement, reporting and verification system, as well as on support received and needs.

Quantitative and Qualitative Goals in the Energy Sector

The BUR3 also contains projections of GHG emissions in the energy sector up to 2030, based on recently adopted strategy papers. While the NDC states Armenia´s intention to double its share of renewable energy in the energy generation matrix by 2030, in the BUR3, the Government of Armenia sets a qualitative and quantitative target specifically for the share of solar PV energy, stating that the Government of the Republic of Armenia intends to increase the share of solar energy generation to at least 15% of the total energy generation or 1.8 billion kWh by 2030. In addition, the Armenia Government also specifies

[21] Armenia's Third Biennial Update Report to the UNFCCC" UNDP-GEF/00112638 Project

the intention of promoting nuclear energy, energy efficiency projects, eco-friendly vehicles, and diversification of fuel supply chains as key priorities, as expressed through the BUR3.

It would therefore be useful to design an MRV system and project reporting platform which is able to identify mitigation actions in these key priority sectors. The system should ideally be able to identify new solar PV and other renewable energy installed capacity, as well as their contribution to the total share of solar energy in the total energy production in Armenia. This data would help track progress towards these goals, in case Armenia decides to include these indicators in their mandatory reporting under the ETF and would also provide an indicator of progress towards the qualitative goals of increasing national energy security and reducing reliance of imported fuels, which are also set forward in the BUR3.

Measurement, Reporting and Verification (MRV)

Armenia's BUR3 states that the ongoing implementation of the CEPA agreement between the EU and Armenia includes the establishment of a comprehensive national MRV framework that will allow the country to track its progress in relation to its commitments under the NDC and ensure national reporting in line with The Convention and the Paris Agreement. This will be provided by the UNDP-GEF project to be executed within the framework of the Capacity Building Initiative for Transparency (CBIT). For these international cooperation efforts to be beneficial to Armenia, close coordination and communication between the teams carrying out the project is essential.

7.2. National regulatory framework

7.2.1. Fourth National Communication (NC4)

The 4th National Communication (NC4), published in 2020, was developed by the Ministry of Environment of the RA with funding from the Global Environmental Facility and support from the United Nations Development Programme in Armenia. It reflects the country's efforts and achievements in mitigating climate change by developing policies, improving investment climate in renewable energy and energy efficiency and by improving completeness and transparency of the National GHG Inventory. It also reflects the vulnerability of the country´s economy and ecosystems to climate change.

The NC4 of Armenia reports a summary of the national circumstances, GHG inventory, mitigation policies and measures, GHG emission projections, assessment of the potential for mitigation measures, climate change impact projections, vulnerability assessment, adaptation measures, systematic observations, and capacity building efforts, as well as of the gaps, constraints and capacity development needs for the implementation of the country´s commitments under the Convention.

In addition, through the NC4, the Government of Armenia highlights the country´s commitment towards increasing the share of renewable energy in the total energy supply, promoting energy efficiency and increasing forest land cover, all of which contribute towards achieving its NDC targets. along with other processes that have already been initiated, such as supporting the import of electric vehicles to the domestic market.

Furthermore, the National Circumstances section of the NC reports specific indicators for GHG emissions and energy intensity of the gross domestic product (GDP) by purchasing power parity (PPP) building from key social indicators and GDP structure, which are also reported in section 1 of the NC. Both the CO_2 emissions per unit of GDP by PPP and the

GDP (PPP) energy intensity have been recorded in a downward trend since 2016. These indicators, derived from current data collection processes, can be used as indicators of progress towards the NDC under the new Enhanced Transparency Framework if Armenia chooses to include them in the mandatory reporting.

On the other hand, the above-mentioned contents of the National Communication will be able to be submitted along with the Biennial Reports as a single report, provided that a Biennial Transparency Report (BTR) supplemental chapter is included with information on research and systematic observation, education, training, public awareness, and adaptation, when these are not reported under Chapter IV of the BTR.

7.2.2. Government N49-8 Decree on "Activities by the Republic of Armenia for Implementation of the Obligations Emanated from a Number of International Environmental Conventions Ratified by Armenia

While this report is being prepared, the consulting team was informed that there is no decree on the GHG inventory, either public or in draft.

The legal basis for conducting the inventory is currently the Government N49-8 Decree on "*Activities by the Republic of Armenia for Implementation of the Obligations Emanated from a Number of International Environmental Conventions Ratified by Armenia*". In the first section of the decree, it is presented a list of measures under the UNFCCC; specifically point 1.5 establishes the "*Biennially develop National Inventories of Greenhouse Gas Emissions and submit to the Secretariat of the Convention*".

Since the compilation of the GHG inventory is such a complex task, it is considered compelling to regulate the activities that involve various data providers and validators of the information, to limit the scope and establish time periods that allow to conclude in a timely manner with the national inventories. By developing a formal directive, a climate change law or regulation can legitimize resource requests and facilitate reforms and the formulation of new responsibilities. (UNFCCC, 2020).

7.2.3. Program of the Government 2017 – 2022

Although the new Program of the Government 2016 – 2021 has been provided, in Armenian only, the Program of the Government of the Republic of Armenia (RA) 2017-2022, annex to Decision No 646-A of 19 June 2017, provides insight, on the direction of the sectoral reforms led by the public administration, some of which are related to MRV, mitigation and adaptation.

<u>Energy Sector: Investment and Transparency</u>

The Energy Policy of the RA is aimed at ensuring energy independence and enhancing energy security in the country. The Energy Infrastructure and Natural Resources chapter of the Government Program reiterates the planned diversification of sources of supply in the energy matrix, and elaborates on plans to construct new large-scale installed capacity in solar PV energy in the Masrik area, support the private sector in the construction of wind power plants, explore the potential for new geothermal power plants in the Karkar area, and further develop nuclear energy capacity, all of which are means of implementation of the NDC and contribute towards the qualitative and quantitative goals expressed in the national

submissions to the UNFCCC, which is why projects in this sector should be identified, tracked and disclosed.

In addition to increased capacity in renewable power generation, the Program of the Government also details plans to expand the capacity of power transmission lines to interconnect Armenia with Iran and with Georgia. When the proposed new infrastructure in the energy sector comes into full operation, an increase in the national energy production may be expected, corresponding to the energy generated locally and supplied to Iran and Georgia, and an increase on the national GHG emissions from the energy sector may result, depending on the new share of renewable energy in the total energy supply.

On the other hand, the activities of the RA aimed at facilitating the sustainable development of the mining sector includes the implementation of the Extractive Industries Transparency Initiative (EITI) and the design of a road map for the disclosure of beneficial ownership. This initiative and disclosure mechanism should ideally be compatible with the national MRV system and inputs from the mining sector.

Business Environment

The RA plans to substantially and drastically increase the foreign investments /GDP ratio. Any foreign investment on projects related to adaptation and mitigation measures, some of which may be the outcome of cooperative approaches under Article 6 of the Paris Agreements, may be tracked for the non-mandatory disclosure of support needed and received of the new Biennial Transparency Report.

In addition, as part of the implementation of annual business environment improvement programmes, the Armenian Government plans to develop electronic reporting systems, focused on environmental reports and urban permits. Other national corporate reporting schemes could integrate indicators relevant to the MRV of GHGs and/or have compatible formats (units, reporting periods, reporting platforms, identification numbers, etc).

Water & Atmospheric Air

The 5-year programme proposed for the water economy features upgrading irrigation systems, an adaptation measure allowing efficient use of water resources which may be tracked as progress towards the NDC and reported under the ETF as mitigation co-benefits from adaptation actions.

In addition, any measures to improve efficiency in water management and sustainable use of water resources, which are detailed as part of the GP for the protection of nature in section 4.4, may also be tracked and included under adaptation reporting along with any other measure resulting from the adoption of the Climate Change National Adaptation Programme (NAP) for the purpose of protecting atmospheric air, which is likely to have mitigation co-benefits too.

Disaster Risk Reduction

Some of the measures foreseen related to disaster risk reduction, such as reducing seismic risk in buildings, enhancing seismic resilience and assessing vulnerability, may be tracked and reported along with the adaptation actions when they are implemented, since they are part of the process of adapting human settlements to a changing environment, subject to stronger and more frequent natural disaster events. There is an ongoing global dialogue regarding the inter-relation between adaptation and disaster risk, and this information may be part of the non-mandatory disclosure of progress on the implementation of adaptation.

Some other disaster-risk reduction measures mentioned in the Program of the Government involve building new capacity, developing early warning systems for disasters and increasing the use of automated hydrological and meteorological observations, all of which may be tracked and disclosed under the mandatory reporting of systematic observations, education, training and public awareness chapter of the Biennial Transparency Report (BTR).

Also, in this section of the BTR, the implementation of the new state forest monitoring program introducing modern technologies, which is part of the Program of the Government for the agriculture sector, may also be tracked and included in the mandatory reporting of systematic observations. This new monitoring capacity may result in a reduction of risk to forest fires and provide a transparency tool for the observation of changes in land use -an important source of GHGs reported in the NIR.

In addition, the new environmental surveillance system, which was planned for 2017, is also part of the new monitoring capacity that may be reported in the same BTR section as the other elements above and is also intended to reduce offenses to natural systems, which may contribute to reduce illegal logging and maintaining sink areas reported in the NIR.

Program of the Government of the RA (2021-2026)

According to the Program, the share of emissions of the "energy" sector comprises nearly 70%, one of the key components of which is electricity production, while industry share is nearly 5%. The penetration of natural gas in Armenia is at a super high level, even compared with countries such as the Netherlands, Norway and the United Kingdom.

The RA recognizes that restriction of carbon emissions volumes is a vital necessity for the sustainable development of economy.

In terms of resistance to disasters, climate change is identified as a key challenge along with natural-climatic, technogenic and man-made disasters, wars, epidemics and terrorist acts, weak institutional management and demographic shifts, that become a reason for the emergence of an unstable internal situation, the management of which requires additional efforts and resources from the State. In this regard, a *"harmonious and safe environment will be created through the introduction of an effective system for increasing resistance to disasters, reducing risks, raising awareness and educating"*.

Regarding economic development and social stability, a developing and taxable economy must generate the resources that are required to ensure security of Armenia. It is mentioned that only a competitive, inclusive and export-oriented economy that complies with the international standards of high technology, industry, manufacturing and nature protection can help secure such resources.

It is stated that the improvement of the social condition of citizens, social stability and the existence of effective healthcare and anti-epidemic systems are of pivotal significance for ensuring internal security.

In Table 16 it is shown some of the most relevant goals and specific targets of the program, in order to highlight the current priorities of the government, that are related to aspects related to climate policies.

Table 16 Goals and targets from the Program of Government in key sectors

Sector	Goals	Specific targets or actions
Economy	• To expand economic opportunities and ensure equal access to them; • To increase welfare of the middle class and reduce poverty by enhancing and using the creative skills of a person; • To ensure conditions promoting export and create an environment for this	• Reforms of the Land Code for formation of productive agriculture; • Water sector reforms for saving water resources and increasing effectiveness of water resource management; • Reforms in the urban development sector for expansion of the potential in the sector, proportionate territorial development, as well as modernization of processes and regulations.
Manufacturing industry	• To ensure ongoing growth of international competitiveness of manufacturing industry in Armenia; • To significantly increase financing for measures targeted at the development of manufacturing enterprises with the potential to create exportable products, by providing at least AMD 80 billion in the course of the coming 5 years, in accordance with the unified rules set by the Government; • To establish 3 industrial zones and enhance the already existing ones to ensure excellence of infrastructures and the environment; • To take steps for industrialization of Armenia and extend the production chain as much as possible, to foster the release of more complex and highly valuable products.	• Measures will be taken to promote the release of carbon-free goods by attaching importance to the introduction of energy-efficient and energy-saving technologies in the economy, as well as taking into consideration the current pace of development and the existing potential, steps will be taken to ensure further development of the solar energy industry.
Sustainable development and green economy	• Meet the electricity demand through renewable nuclear and aquatic energy. • To make sure the economy is ready for the new, low-carbon energy reality	• To continuously minimise the role of natural gas in the structure of electricity production by replacing it with sources of renewable and alternative electric energy; • To prepare the electric power transmission infrastructure for change in terms of growth of demand and structure;

	• To create preconditions for longer maintenance of natural resources in the economic cycle.	• To prepare the transition of infrastructures to alternative transportation; • To help the population to obtain electric systems for food preparation and heating.
Agriculture	• Intensification of agriculture, the increase of productivity, targeted use of land resources and the effective and economical use of water resources, the increase of the level of protection of food safety, the development of animal husbandry and plant breeding, the introduction of modern technologies, the sale of manufactured products and promotion of export of those products, the increase of revenues of entities included in the whole agricultural value chain — rural economies, cooperatives and persons processing agricultural products.	• To continue the programme for supporting leasing of agricultural machinery, by updating the set of technical equipment with at least 500 units of agricultural machinery every year; • To continue to support the establishment of greenhouse economies with credit, leasing and reimbursement tools; • Tto introduce the system of numbering and record-registering animals and support the improvement of pedigree; • To continue to provide available financial resources for cattle-raising in order to • Build livestock buildings of the new generation, obtain fodder, animals, particularly pedigree animals; • To continue the state support programme for leasing of agro-food equipment to support agro-processors within the scope of subsidised credit and leasing programmes • To promote targeted and effective use of agricultural lands, the process of placing unused lands into circulation and enlarging lands
Sustainable management of natural resources	• To ensure reasonable and complex use of subsoil and rule out over-exploitation of 5natural resources	• Ensure rational and proportionate extraction of resources, including by ruling out over-exploitation of natural resources; inventory-taking of water points (wells, sources) of underground mineral water mines and update of database; • Revise requirements for accountability for movement of mineral reserves for the purpose of receiving and monitoring the annual complete information about extracted and depleted reserves; • Create a digital cadastre of information on subsoil
Water economy	• Providing reliable, sustainable, safe and affordable services for supply of drinking water (water supply) and water disposal (wastewater treatment) and supply of irrigation water to the	• Programmes for construction of reservoirs for managing the superficial current of water resources will continue. • Inventory and assessment of irrigation systems (canals, reservoirs, deep wells, water pipelines, pump stations, buildings, constructions, mechanisms of machines,

	population, as well as advancing the reforms being implemented in the sector	other hydro-technical structures, etc.) will be carried out. • To promote the introduction of water-saving irrigation systems, including drip and rain irrigation systems, as well as the application of mechanisms for reimbursement of irrigation water fees through the introduction of new technologies.
Energy	• Raising the level of energy independence and security and providing consumers with reliable and quality supply of electricity and natural gas	• The activities for the formation of a common natural gas market and common electricity market of the Eurasian Economic Union will continue; • Solar power stations, including automatic solar power stations with a capacity of up to 1000 MW will be built with the purpose of making the share of production of solar power reach at least 15% by the year 2030; • Preparatory works will be carried out to build wind power stations with a capacity of nearly 500 MW; • To extend the projected period of operation of the second energy block of the Armenian Nuclear Power Plant, the works for modernisation will be completed in order to ensure the safe operation of the Armenian Nuclear Power Plant by 2026; • Large-scale implementation of energy efficiency and energy saving measures will be promoted, taking into consideration the requirements of the Armenia-European Union Comprehensive and Enhanced Partnership Agreement, including in the fields of transport, industry, agriculture, multi-apartment buildings, public budget sector, fuel-energy system and other fields;
Environmental protection	• Taking measures to prevent the harmful influences on all components of the environment and overexploitation of natural resources and to reduce this to a minimum; • The sector-specific policy will fundamentally be aimed at raising the level of resistance	• Sustainable management of forests — maintenance, protection, use of forests and expansion of wooded areas through forestation and forest restoration and ongoing strengthening of capacities for the implementation thereof; • Implementation of actions for adaptability to and mitigation of the consequences of climate change; • Creation of an eco-friendly system of management of chemical substances; • Improvement of the system of waste management (including subsoil use).

	of the country to climate change by contributing to the Introduction of the best practices of adaptability, actively participating in the global efforts for low carbonic development and properly fulfilling the international commitments assumed with respect to mitigation of climate change.	

Source: Program of Government of Armenia 2021 - 2026

7.2.4. Law on Atmospheric Air Protection

The law was published in 1994 with the aim of guaranteeing the maintenance of purity of atmospheric air and improvement of its quality, reduction and prevention of chemical, physical, biological and other harmful influences on a state of atmospheric air, regulation of public relations, and also strengthening of legality in this area.

Different actors in the government have the following attributions in the matter of atmospheric air protection as shown in Table 17.

Table 17 Competences in the matter of atmospheric air protection

Responsible	Competencies
Supreme Soviet of the Republic of Armenia	• establishment of substantive provisions and the order of protection of atmospheric air; • definition of the basic directions of protection of atmospheric air; • approval of the program of complex actions on protection of atmospheric air; • state control over atmospheric air protection and definition of the order of its realization.
State bodies	The management in the sphere of atmospheric air protection is carried out by the Government of the Republic of Armenia, local state bodies, and specially authorized state bodies in the sphere of atmospheric air protection in the order established by the legislation of the Republic of Armenia.
Government of the RA	• development of the program of complex actions on protection of atmospheric air; • establishment of specifications of maximum permissible concentration of substances polluting atmospheric air and maximum permissible physical harmful influences;

	• establishment of the order of development and approval of specifications of maximum permissible emissions of substances polluting atmospheric air and levels of maximum permissible physical harmful influences; • establishment of the order of the state account of emissions, organization of supervision (monitoring) over a state of atmospheric air, and • development and approval of state standards in this sphere, organization and realization of state expert appraisal of harmful influence on atmospheric air; • fixing of payment for pollution of atmospheric air, • realization of other powers established by the law.
Local state bodies	Participate in development and realization of actions on protection of atmospheric air.

This law regulates, among others, the following aspects for atmospheric air protection:

- Specifications of maximum permissible concentration of substances polluting atmospheric air and maximum permissible physical harmful influences are established for estimation of a state of atmospheric air;
- Issuance of air permits emissions by stationary sources of pollution of substances polluting atmospheric air;
- emissions of substances polluting atmospheric air by automobiles, planes, ships, other vehicles and installations in each case.

However, this law just had an updating process recently. According to the BUR3, "*the legal reforms currently in progress will facilitate development of greenhouse gas inventories on a continuous basis. The draft Law "On Atmospheric Air Protection" has been developed envisaging setting set up a unified system for the recording of hazardous substances and GHG emissions, which will contribute to compliance with the obligations of the RA under environmental conventions, as well as to the consistency of information provided under different conventions. The document has undergone intensive consultations with the Government and stakeholders. It is currently being finalized by the Ministry of Environment and will be submitted for the Government approval in 2021.*"

Adding to the above, there is a new revision being circulated and aimed to be adopted as soon as possible. It is significantly newer and, reportedly, incorporates international best practices. However, it doesn't provide any regulatory mechanism. It states that the MoE defines acceptable levels of pollution and provides organizations with quotas. Upon adoption of the law, a set of Government decisions will be required to secure enforcement of the new law.

7.2.5. Law "On Substances Depleting the Ozone Layer"

According to its first article, the law regulates the restrictions on the manufacture, import, export and transit of substances that deplete the ozone layer, and associated relations with

the countries that have ratified the relevant treaties concluded under the Vienna Convention on Ozone Layer Protection and the Montreal Protocol on Substances that Deplete the Ozone Layer.

The powers that the government has in the regulation of these substances are shown below.

Table 18 RA Government attributions in the matters of Ozone Layer Depleting substances

RA Goverment attributions	Authorized State body competencies
1) Approval of the list of substances that deplete the ozone layer; 2) establishment of general import quotas for substances that deplete the ozone layer; 3) the adoption of the procedure for establishing individual quotas on imports of substances that deplete the ozone layer; 4) approval of the procedure and form granting permission for the supply; 5) adoption of regulations related to the import, export and transit of substances that deplete the ozone layer; 6) ensure the implementation of policies in the use of substances that deplete the ozone layer.	1) the development of regulations related to the import, export and transit of substances that deplete the ozone layer; 2) Taking into account the quantity of substances that deplete the ozone layer; 3) establishment of individual quotas on substances that deplete the ozone layer; 4) The provision on the basis of the applications of permits for the supply of substances that deplete the ozone layer; 5) policy development in the use of substances that deplete the ozone layer; 6) control the use of substances that deplete the ozone layer, in accordance with the law of the Republic of Armenia.

Likewise, through this Law, restrictions on the use of substances that deplete the ozone layer were established, prohibiting its production as well as imports from countries that are not parties and exports to these countries. Adding to this, it is established:

1) The principles and procedures for establishing common import quotas;
2) The procedure for establishing individual quotas on imports;
3) The import, export and transit procedures, and
4) The procedure for registration of substances that deplete the ozone layer

The import, export and transit of these substances is allowed, as long as they have the corresponding approvals. The customs authorities, (state agency authorized information on the import, export and transit of substances that deplete the ozone layer), must report the data on import, export or transit; the amount of substances that deplete the ozone layer and the names of the countries: exporters and importers.

The registry of these substances includes annual reports on the use of individual quotas in their importation.

7.2.6. Law “On Waste” and related regulations on inventories

This law regulates the relations on waste collection, transportation, storage, processing, recycling, removal, volume reduction and other relations regarding these activities, as well as legal and economical bases for prevention of adverse effects of waste on human health and environment. According to its article 5, the main objectives of this law are:

a) Provision of main principles of the state unified policy in the area of waste management;
b) Provision of main conditions, requirements and rules of environmentally safe management of waste, as well as economic incentive measures for recourse-saving (activities);
c) Assurance of conditions for generation of minimal quantity of waste, promotion of waste utilization in the economical activity, mitigation of adverse effects of waste on human health and environment; and,
d) Legal regulation of relations in the area of waste management.

With regard to RoA Government competencies in the matters of waste management, a waste inventory, generation, removal (elimination, disinfection, disposal) and recycling procedure must be provided, among other functions.

In the other hand, the environmental sector state authorized body shall, among others, prepare target programs for the waste management sector; carry out inventory of waste; establish a database on quantity of waste generation volumes, and perform state waste cadastre.

Adding to the above, the territorial administration bodies in the area of waste management, shall prepare and update entries to register of waste production, processing and recycling structures and waste removal areas and carry out an inventory of waste production, processing, disinfection, recycling and removal.

These attributions are important in light of the implementation of a comprehensive MRV system that includes both the information necessary to carry out the GHG inventory and the monitoring of mitigation actions in the waste sector.

As mentioned in the chapter 3 of the law, legal entities involved in the waste management, are obliged to carry out initial inventory of produced, utilized, disinfected, transferred to or received from other entities and disposed waste.

State waste cadastre comprises waste classification, lists of waste production, reprocessing and recycling structures, as well as a database on waste utilization and disinfection technologies and is performed by the state authorized body in the environmental protection sector.

This law also establishes that a register shall be kept by the state body authorized to receive, process, store and analyze information on the production, reprocessing and recycling of waste, containing, among others, the amounts of waste production, the qualitative and quantitative characteristics, information on waste treatment, all the above based on information from waste producers. This information will be verified annually.

Additionally, based on waste passports and reports from waste producers, the record of waste disposal sites (active, closed or conserved) will be kept for inventory and description. This information is also verified annually.

It is considered that valuable actions should be carried out to collect information on the generation and final disposal of waste, in accordance with the provisions of the law. This information could be integrated into the MRV system, both to feed the emission estimates of the waste inventory, and to track mitigation actions in the sector.

7.2.7. Law on Official Statistics of the Republic of Armenia

This Law was adopted on March 18, 2018 and its relevance lies in the fact that the Statistics Committee of Armenia is one of the largest providers of information for the inventory of GHG emissions, therefore it is important to analyze the attributions of the actors that they serve as potential information providers.

The Law regulates the relations related to the formation of the National Statistical System, development, production and dissemination of official statistics, conducting censuses. The main participants in the National Statistical System are presented in Table 19, and their relevance to the MRV system is also summarized.

Table 19 Participants of the National Statistical System of the Republic of Armenia

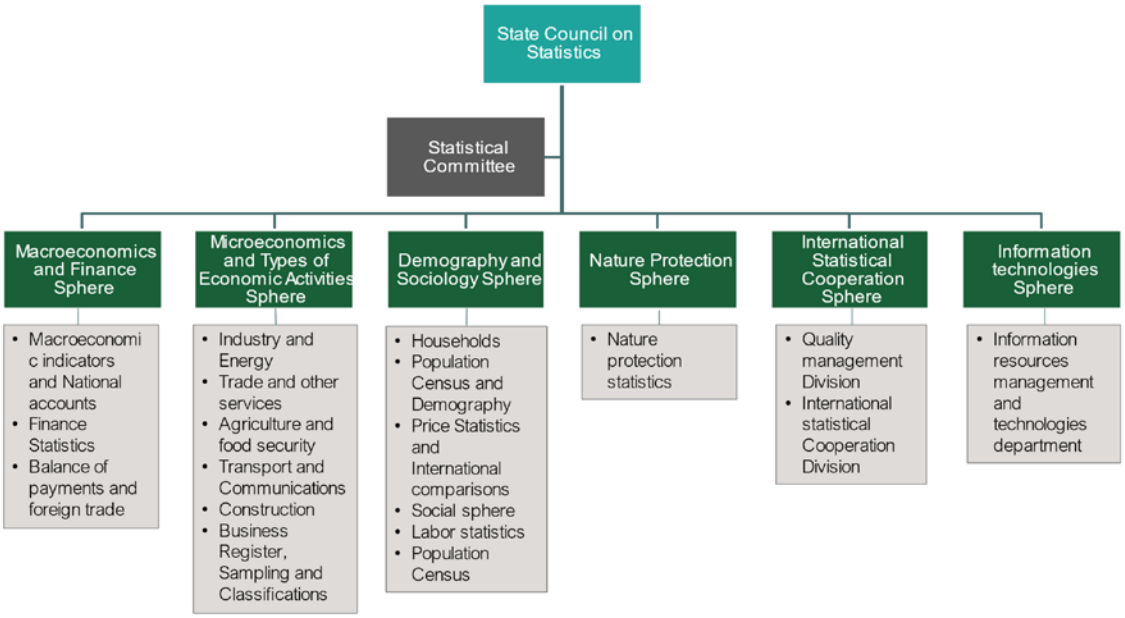
Statistics producers	Main functions	MRV relevance
Statistics Committee	Coordinates all activities for the development, production and dissemination of official statistics (except the Central Bank) Coordinates common practices across the national statistical system	Main producer of official statistics It can have an impact on the improvement of data generation and collection processes for MRV components, in particular for inventory.
Central Bank of the Republic of Armenia		Explore links about financing mechanisms
Other producers of official statistics (Organizational units of state and local self-government)	Bodies that are exclusively or mainly dealing with the development, production and dissemination of official statistics.	Explore other potential providers for GHG inventory and the other MRV components.
Respondents	Natural and legal persons considered as a statistical unit, including separate units operating in the national territory by foreign legal persons, individual	To review whether some companies could potentially be Respondents and contribute to the generation of information (e.g. activity

	entrepreneurs, households, state and local self-government bodies, state institutions without status of the legal person that are requested to provide information about themselves and their activities, through data collection carried out by producers of official statistics	data) of specific activities. The concept could also be applied to implementers of mitigation and adaptation actions.
Administrative data providers	State and local self-government bodies that provide producers of official statistics with data collected for administrative purposes.	Explore what kind of data these are to meet information needs in the MRV system.
Users of official statistics	Natural and legal persons, state and local self-government bodies, international organizations and authorities of other countries, who receive official statistics or have access to it;	MoE and other stakeholders are users of official statistics in the context of the MRV system. It can be assumed that some users of official statistics will need access to CCMRV platform, in some extent.
Advisory bodies of statistics	They are created with the purpose of providing strategic and methodological advice on the separate areas of official statistics.	Synergies could be created to respond to new information needs of the MRV system in the long term, within the scope of its capabilities.
Public Council of Users of Official Statistics	Main advisory body operating on a voluntary basis to the State Council, President of Statistical Committee and other producers of official statistics on strategic issues. Makes proposals on reflection of the priority information needs of society in statistical programs, implementation of statistical programs and strategic development.	The MoE could present information needs to this entity, for a long-term information generation planning on specific climate statistics.

According to Article 7 of the Law, the Statistical Committee is an independent state body, and the supreme body of governance of the national statistical system. However, State

Council is the supreme body of governance of the national statistical system, including the Statistical Committee, which approves the order of data collection by the Statistical Committee (methods, coverage and periodicity), among other functions established in the Article 10.

Figure 28 Organizational Chart of the Statistical Committee of Armenia



Source: Own elaboration based on Organizational Chart available in: https://alianzapacifico.net/wp-content/uploads/MRV_of_Climate_Finance_in_Mexico.pdf

Statistical programs include statistical information necessary for the observation of the economic, demographic, social and environmental situation of the country, taking into account the existing resource constraints, the amount of responsibilities given to statistical information providers and the cost- effectiveness, as stated in the Article 14. It is worth mentioning that five-year and annual statistical programs are developed as key tools for effective strategic and operational management and coordination for the entire national statistical system.

It is possible to include other producers of information approved by the State Council. Likewise, the Statistics Committee, in close cooperation with other producers of official statistics, is responsible for presenting the annual report of the statistical program, including, if necessary, improvement measures.

A five-year statistical program is established to define the conceptual approaches and development priorities of the national statistical system. Also, an annual statistical program is developed to define the surveys and activities necessary to implement to the production of the annual official statistics.

The annual program includes:

- the list of all official statistics to be released by each producer, type and frequency

- data collection methods
- administrative data sets by names and providers

The mandate for data collection is given in Article 18, where it is stated that producers of official statistics are entitled to select data sources, based on professional considerations, and collect the necessary data to compile official statistics directly from respondents if sufficient data are not already available in the national statistical system and they have not been obtained from databases -administrative registers, maintained by the state and local self-government bodies outside the national statistical system. This article also talks about the protection of the confidentiality of information in the transmission of data and metadata within the national statistical system.

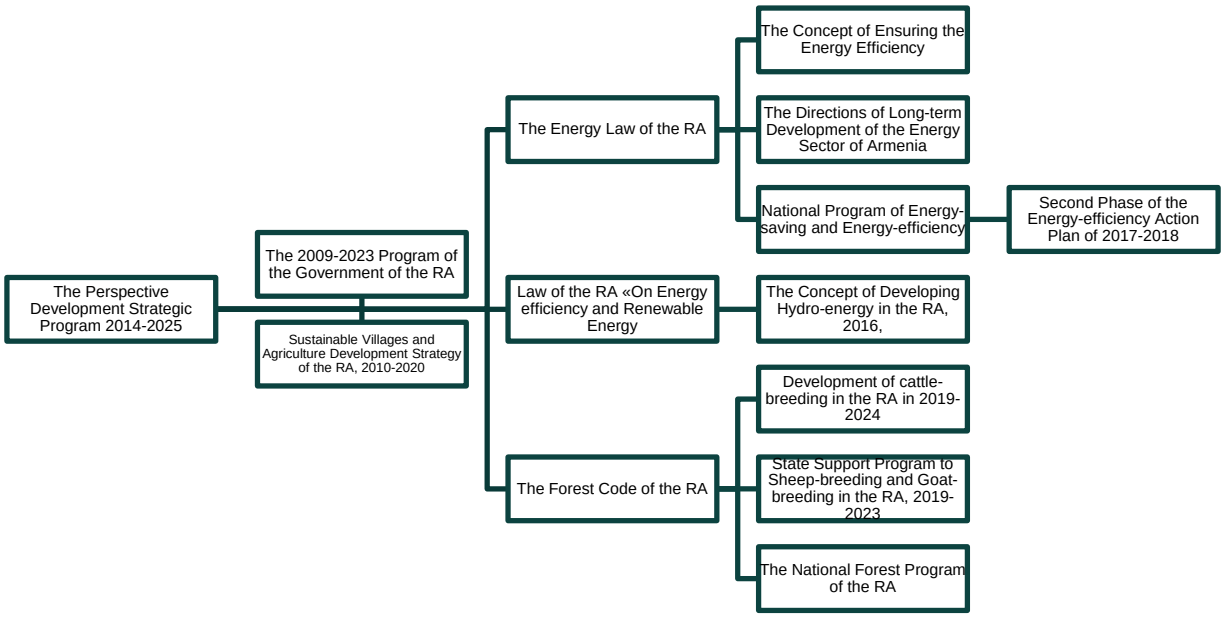
The censuses that are carried out in Armenia are population, agricultural and economic. Population and agricultural censuses are carried out at least every 10 years. However, other census can be carried out as long as they are planned at least two years in advance.

7.2.8. Policy Instruments in Energy and Agriculture towards the Low Emission Development Strategy

This section summarizes the document *"On Policy Instruments in Energy and Agriculture towards the Low Emission Development Strategy*" (EU4Climate UNDP-EU, 2020) which describes mitigation policies in the sectors that contribute most to GHG emissions in Armenia: energy and agriculture.

Figure 29 shows where the main planning instruments of both sectors emanate, from the Strategic program of development perspective, to be concluded in 2025, the current government program, the laws and codes that govern the sectors, and Figure 30 presents the specific programs that address sectoral development, energy efficiency and renewable energy policies and programs, forestry and agricultural activities.

Figure 29 Energy and Agriculture policy instruments in the national planning structure



Source: Own elaboration based on EU4Climate UNDP-EU, 2020

Figure 30 Mitigation policies in Energy and Agriculture sectors

Source: Own elaboration based on EU4Climate UNDP-EU, 2020

Energy policies

The energy sector in Armenia is a priority both for economic and social development as well as for the reduction of emissions and compliance with the NDC towards 2030, as a generator of 66.7% of the country's emissions according to inventory from 2017 (BUR3).

To understand how Armenia's energy policy is articulated, it is necessary to mention the European Climate Agenda, within which the Armenia's own agenda fits, derived from EU-Armenia CEPA, which was signed on 24 November 2017. In this document, the chapter on Energy Cooperation focuses on the use of renewable energy sources, the promotion of energy efficiency and energy savings, establishing 42 measures (34 of energy efficiency and renewable).

Based on this document, the energy policy "*will be aimed at fostering energy independence and security of the country, facilitation of regional integration process, sustainable development of the energy sector based on comprehensive use of local primary (renewable) energy sources, further development of nuclear energy, diversification of energy supply and introduction of new and energy efficient technologies*".

The two main policy instruments in this regard, are the following.

1. National Energy Efficiency and Renewable Energy Program of the Republic of Armenia for 2021-2030 (under development)
2. Strategic Development Program for the Armenian Energy Sector (up to 2040). Its new, revised draft is currently underway, at the stage of discussion by the Government.

This document has the following plans:

- Increase the operational life of the Metsamor Nuclear Power Plant to 2026 by implementing the relevant investment program, considering that "only with the existence of a *nuclear power plant in the system it becomes possible to achieve the lowest possible greenhouse gas emission levels*"
- Full market liberalization of the electricity system
- New standards of energy efficiency and energy saving will be set, including in energy labelling
- Development of National Energy Efficiency and Renewable Energy Program of the Republic of Armenia for 2021-2030.
- With regard to the management of state-owned companies, the Strategy sets out the goal of developing renewable and energy-saving production, whereby maximum utilization of alternative energy sources (wind power plants, solar photovoltaic plants) is envisaged with the introduction of a new management model.

The Draft Strategic Plan reflect the long-term vision of the energy sector by "clean and energy-saving sustainable development" objective.

The expectations of the implementation of this Strategy towards 2040 and ensuring appropriate investment flows, are summarized in the following lines:

- Economically feasible and efficient use of renewable energy resources in accordance with all environmental standards. Take efforts towards maximizing renewable energy share in the energy balance, with at least 10% to be attributed to solar energy.

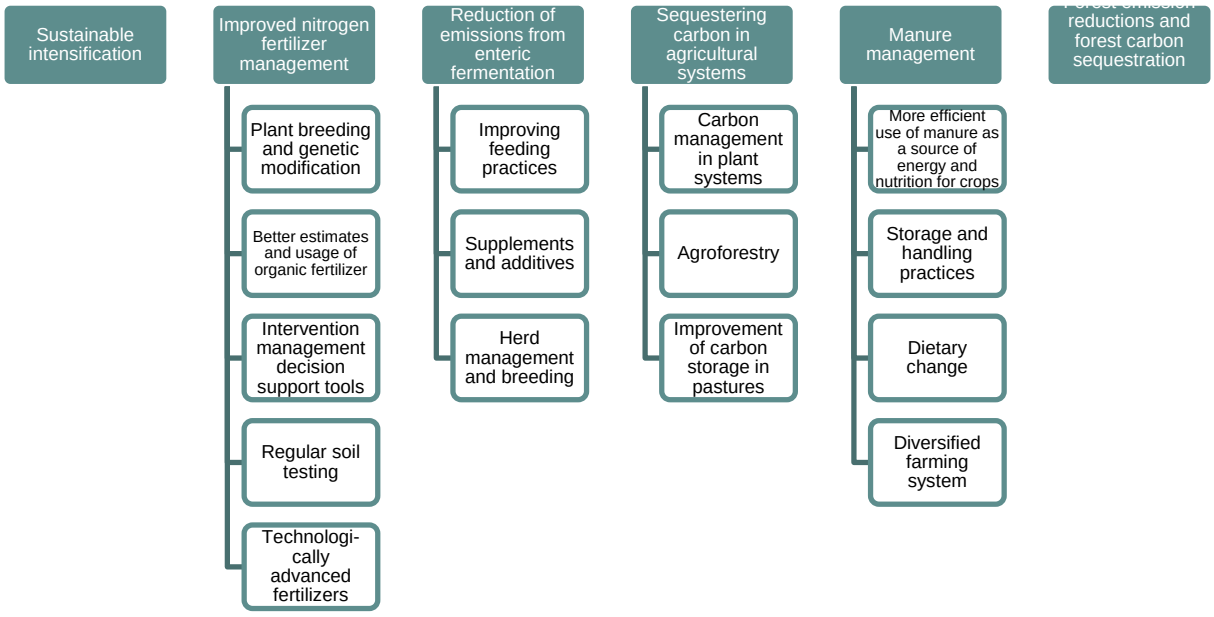
- Large-scale implementation of energy saving and energy efficiency measures, introduction of energy saving and energy efficient technologies in the transition to a green and knowledge-based economy.
- Liberalized electricity market based on the best international models.
- Development of nuclear energy for peaceful purposes, in particular, the construction of new nuclear power block(s) in Armenia.

Agriculture policies

Agriculture is the second largest sector on the GHG inventory in terms of emissions (18.5% in 2017), and for this reason it is relevant to address its impacts, through several approaches that can be applied to reduce GHG emissions related to agricultural and livestock products. Moreover, the Agricultural sector is important in terms of ensuring food security, processing industry (food, beverages, tobacco products, etc.), expansion of the export portfolio, as well as employment in rural communities (BUR3).

In terms of the supply in the field of agriculture, mitigation strategies can be outlined as shown in Figure 31.

Figure 31 Mitigation strategies considered in the agriculture sector



- The 2020-2030 strategy on main directions ensuring economic development of the RA agricultural sector

The strategy has prioritized the activities in the sector within the considered mitigation practices (Table 20. It is worth mentioning that these strategic priorities will be addressed as part as state assistance programs.

Table 20 Strategic priorities related to mitigation practices in Armenia

Mitigation practices	Strategic priority
Sustainable intensification	• Land reform (targeted policy related to the issue of abandoned land, includes also degraded land) • Improving the quality of seeds and seedlings, promoting use of modern practices for animal breeding (intensification, herd management and breeding) • Development of human and institutional capacities in the field of agriculture • Promoting digital agriculture and technological innovation (digital innovations, such as improved varieties, new pesticides / herbicides, solar autonomous grid systems, greenhouse construction materials, anti-hail grids, soilless, no-till and vertical cultivation systems
Improved nitrogen fertilizer management	• Sustainable development of organic farming (design and improvement of relevant infrastructures) • Development of human and institutional capacities in the field of agriculture • Support to sustainable development of rural communities (volunteer programs to promote good agricultural practices among agricultural exporters and consultants on soil erosion, soil organic matter, soil structure, minimum level of protection) • Promoting digital agriculture and technological innovation (digital innovations, such as improved varieties, new pesticides / herbicides, solar autonomous grid systems, greenhouse construction materials, anti-hail grids, soilless, no-till and vertical cultivation systems
Reduction of emissions from enteric fermentation	• Improving the quality of seeds and seedlings, promoting use of modern practices for animal breeding (intensification, herd management and breeding) • Sustainable development of organic farming (design and improvement of relevant infrastructures) • Development of human and institutional capacities in the field of agriculture
Sequestering carbon in agricultural systems	• Development of human and institutional capacities in the field of agriculture • Support to sustainable development of rural communities (volunteer programs to promote good agricultural practices among agricultural exporters and consultants on soil erosion, soil organic matter, soil structure, minimum level of protection) • Promoting digital agriculture and technological innovation (digital innovations, such as improved varieties, new pesticides

	/ herbicides, solar autonomous grid systems, greenhouse construction materials, anti-hail grids, soilless, no-till and vertical cultivation systems
Manure management	• Development of human and institutional capacities in the field of agriculture • Promoting digital agriculture and technological innovation (digital innovations, such as improved varieties, new pesticides / herbicides, solar autonomous grid systems, greenhouse construction materials, anti-hail grids, soilless, no-till and vertical cultivation systems)

Source: (EU4Climate UNDP-EU, 2020)

- Armenia's 2019-2024 livestock development program

According to EU4Climate UNDP-EU (2020), the purpose of the program is "*to provide affordable conditions to farmers, in particular by supplying breeding livestock at partially subsidized interest rates, which will motivate them to replace livestock of unknown ancestry or low-reproducing or low-reproducing livestock, produce animals in herds by purebred cattle with economically valuable characteristics, develop breeding, improve the performance of local animals through crossbreeding practices, increase milk and meat production, reduce the cost of milk and meat production and, finally, make it more competitive against similar imported products".*

7.2.9. National Framework Strategy on Adaptation to Climate Change Impacts for 2021-2030

The National Action Program of Adaptation to Climate Change and the List of Measures for 2021-2025 was approved based on the Law "On the Structure and Functioning of the Government", and the paragraph 9 of Article 7 of the Paris Agreement from 12 December, 2015.

According to this program that exposes the current situation of the country regarding the high vulnerability that it presents, highlighting the following facts:

- 90% of Armenia's territory is over 1,000m above sea level.
- More than a third of the population is rural, and the economy is heavily reliant on agriculture
- Armenia lost well over USD 1.5 billion due to natural hazards like floods, earthquakes, drought, hail, spring frosts and mudflows

During the elaboration of the National Action Program of Adaptation to Climate Change, the following barriers were identified:

1. Governance and institutional barriers that limit adaptive capacity by exacerbating drivers of vulnerability, as well as impeding action, decision-making, and the flow of resources to where they are needed.

2. Information, knowledge, and technology barriers that inhibit the efficiency of adaptation by hindering understanding of the need for adaptation
3. Financial barriers: high prevalence of low incomes and relatively low investment which frustrates the economic growth.

It is considered that the NAP can serve as a major vehicle for the implementation of the Armenia's commitments to international processes in terms of climate adaptation. It will be based on a 5-year cycle, as well as the NDC process.

The **general objective** of the NAP process is to promote the reduction and management of climate risks in Armenia. Adding to this, the **vision** underlying the NAP process is that "*all government-policy sectors considered vulnerable to the impacts of CC, in particular the sectors of natural ecosystems, water, agriculture, energy, health, human settlements, and tourism, will incorporate climate change adaptation considerations, to provide greater clarity, balance and direction for effective delivery of adaptation action".*

It is important to take into account that the program serves as a roadmap for ensuring the mainstreaming of adaptation and implementation of the NAP in the regional administration and local self-government, sector policy and financial planning processes, while providing a reference point for bringing together various adaptation planning efforts from different sectors.

The approach of the NAP is summarized as follows:

1. Develop a common evidence base on CC that can be referenced by stakeholders in various documents, including strategies and project proposals.
2. Articulation of the goals and principles and establishes the conditions necessary for creating a strong foundation for adaptation action through a series of cross-sectoral interventions to strengthen the capacity of institutions to plan adaptation actions, to create strategic linkages between climate considerations, adaptation, as well as national and regional development planning.
3. The sector and marz adaptation plans provide the foundation for operationalizing adaptation planning within the existing governance structures.
4. Adaptation Monitoring and Evaluation system (AME) establishes reporting processes and mechanisms for adaptation; monitors and tracks progress on implementation of adaptation processes and measures for cross-sectoral, regional, and sectoral measures; fosters continuous improvement of the policies and management; and assesses the impact of interventions on reducing vulnerability, as well as the extent to which such interventions improve development performance

According to the NAP Strategy and its action plan, "*a key deliverable of the first NAP cycle is the establishment of a uniform process and mechanism for effective monitoring and evaluation of the process of climate change adaptation. The Accountability, Monitoring and Evaluation (AME) system will build on the country's monitoring, reporting and verification system for CC mitigation, to avoid duplication*".

The measure 1.14 of the Action Plan, "*Development of the monitoring and evaluation guideline for the NAP process*" has the following expected outcome: "*Methodological*

assistance for monitoring and evaluation of the NAP process is ensured". The deadline for this measure is 2022 (4th trimester).

Moreover, there is the following expected output from the NAP project *"4. Mechanisms for Reporting, Monitoring and Review of NAPs and adaptation progress in place: identify existing monitoring and evaluation processes within the government and draft entry points for climate change adaptation into M&E system*".

The NAP project has the expected output related to MRV as well as NAP Framework Strategy indicates that adaptation MRV will build on mitigation MRV. The NAP project has the expected result related to MRV, just as the NAP framework strategy indicates that MRV of adaptation will be based on MRV of mitigation. Therefore, for the purposes of this project, the MRV focuses on mitigation actions, although it is expected that the adaptation MRV system will be built on the same structure.

7.2.10. National Energy Balance

The 2019 Energy Balance of the Republic of Armenia, published in 2020, was developed under the framework of the development of Armenia´s 4th National Communication (NC4) and 2nd Biennial Update Report, a project funded by UNDP-GEF.

The compilation and publication of the Energy Balance is defined by the Law on Energy Efficiency and Renewable Energy of the Republic of Armenia. It is one of the main sources for the collection of the initial data on greenhouse gas emissions in the energy sector and is an essential instrument not only for the national MRV system, but also for the identification of key areas of development for climate policies and mitigation measures.

The Energy Balance provides an updated balanced compilation of the renewable energy, electricity, natural gas, thermal energy, oil products, coal, wood and other biofuels produced and consumed in Armenia during the reported period. It is a very valuable tool for the assessment of the consumption volumes of the diverse fuels per sector and the degree of both energy independence and security in the country. It is also very valuable for the assessment of the degree of diversification of the energy supply, the share of renewable energy in the total energy generation and the trends in greenhouse gas emissions.

The Energy Balance is therefore a key tool for the evaluation of the progress towards achieving the qualitative and quantitative targets set forward in the national submissions to the UNFCCC under the Paris Agreements, many of which Armenia may choose to include in the mandatory reporting under the ETF.

7.2.11. Land Balance

According to Gov. Decree – N1732-N, 21.10.2021, the Land Balance is the following:

Table 21 Land Balance 2021

		Surface (*in thousand ha*)	**Arable**
	Territory of the Republic of Armenia	2974,26	209,14

	Including		
1.	Land type (by purpose)		
1)	Agricultural	2042,48	155,62
	Including		
a)	tillage	443,42	117,04
b)	perennial nursery	38,06	37,08
c)	grasslands	121,23	1,5
d)	pastures	1049,87	
e)	other soils	389,90	
2)	residential lands	152,32	53,12
3)	Industrial, mining and other production related lands	38,97	
4)	Land occupied by energy, transport, communication, utility infrastructure	14,05	
5)	Land of specially protected areas	335,47	
6)	Land of special designation	30,51	
7)	Forest land	334,01	0,4
8)	Water lands	25,83	
9)	Reserve land	0,62	
2.	Land type (by ownership structure)		
1)	Citizens	540,68	180,73
2)	Legal entities	37,82	5,97
3)	Municipal	1021,93	20,65
4)	State	1373,16	1,63
5)	Foreign states and international organizations	0,67	0,16

7.2.12. National Strategy for the inventory of Forests

The National Strategy for the Inventory of Forests (NSIF) in the Republic of Armenia, published in 2020, was developed by an International Forest Expert, under the auspices of the Ministry of Environment, considering the context of the Commonwealth of Independent States (CIS) and the peculiarities of its member states, some of which have experienced a negative impact on forests resulting from illegal extraction of wood driven by the energy crisis of the 90´s.

As part of the proposed National Forest Inventory Strategy, the document provides benchmarks, an assessment of the capacity building needs, and a roadmap with working steps to improve national forest inventories, forest accounting, forest cadaster and forest monitoring systems, including modern information technologies, such as digital databases, remote sensing, GIS, drones and web-based applications, as well as information on forest biodiversity, carbon counting systems and other ecosystem services.

The National Strategy for the Inventory of Forests is therefore particularly relevant for the national MRV system in development, since strengthening the accounting and reporting of the AFOLU sector of the NIR is a key area of opportunity for Armenia. According to the National Strategy, despite public recognition of the importance of forest ecosystems, there is no national forest inventory able to provide reliable statistics on the country's sinks and removals -required to integrate the national inventory, to sustain forest management practices, and to support decision-making in policy development-, which is why this National Strategy was developed.

In addition, the NDC of Armenia includes the mention of a qualitative target regarding the forest cover, which may or may not be chosen by the Party as an indicator of progress towards the NDC under the new ETF. The NDC states that the Government intends to reach 12.9% of forest cover by 2030 as part of the National Forestry Programme published in 2021. The forest cover is currently only 11% of the total territory of the country, according to the National Strategy.

7.2.13. Forest Carbon Stock Measurements Guidelines, 2020

The Forest Carbon Stock Measurement Guidelines, published in 2020, were prepared by an International Forest Carbon Expert in coordination with the Ministry of Environment of the Republic of Armenia within the framework of a broader project, "Mainstreaming Sustainable Land and Forest Management in the Mountainous Landscapes of North-eastern Armenia", funded by the Global Environment Facility (GEF) and implemented by the UN Development Programme (UNDP).

Successful forest policies and projects require reliable, accurate, and cost-effective methods for measurement and monitoring of forest carbon storage. Common, reliable, and user-friendly carbon measurement methodologies have been lacking in Armenia, according to this document, which is why these guidelines were developed, providing guidance for forest carbon stock measurements in a simple step-by-step procedure using standard carbon inventory principles and techniques in the context of Armenia.

These guidelines are key for enhancing the accuracy of estimations of national GHG sinks and removals reported in the NIR, since they provide guidance for the estimation of carbon stocks in accordance with the requirements and provisions of the International Panel on Climate Change (IPCC).

These guidelines may be applied to support the technical development of the national forest inventory, which in turn supplies statistics to policy developers and land-administrating organizations, as well as information on national sinks and removals for the AFOLU sector of the National Inventory Report. They may also be applied to support the development of forest administration inventories, where data collection efforts are designed to acquire information about properties under one management unit.

On the other hand, the guidelines are also intended to serve as user-friendly training material for forest users, and the procedures emphasize the need to train forest technicians and local resource persons on the procedures for data collection and analysis of carbon accumulations using state-of-the-art methods. This aspect of the deployment of the guidelines may be reported in the BTR supplemental chapters, when the NC and BRs are reported together under the new ETF, or under Chapter IV of the BTR.

7.2.14. Strategy for the Management of Firewood Collection and Distribution from the Forest, 2021

The Strategy for the Management of Firewood Collection and Distribution from the Forest, published in 2020, was developed under the auspices of the Ministry of Environment of the Republic of Armenia within the framework of a broader project, “Mainstreaming Sustainable Land and Forest Management in the Mountainous Landscapes of North-eastern Armenia”, funded by the Global Environment Facility (GEF) and implemented by the UN Development Programme (UNDP).

The strategy proposes an alternative to firewood collection from forests that meets the local population´s needs. Technical, economic, and social aspects are considered in the feasibility analysis of alternative sources of energy, and a roadmap with recommendations for the way forward is presented.

The implementation of this strategy would promote the conservation of woody biomass from national forests, otherwise sourced as household fuel, and increase the capacity of forests areas to store and remove GHGs, contributing to the achievement of the NDC.

7.2.15. Assessment of Land Use, Land Use Change and Forestry Sector Potential in Achieving Climate Change Mitigation Objectives in Armenia

The technical report of the Assessment of Land Use, Land Use Change and Forestry Sector Potential in Achieving Climate Change Mitigation Objectives in Armenia, issued on March 2021 under the EU4Climate UNDEP-EU regional project, identifies opportunities to reduce GHG emissions and to enhance removals. It also provides recommendations for the development of long-term targets in the Land Use, Land Use Change and Forestry (LULUCF) sector in the context of the (2018/841) regulation in the EU, which requires accounted emissions from land use to be compensated by an equivalent removal of CO_2 from the atmosphere.

Section 4 of the technical report provides an overview of 26 possible mitigation actions for the Armenian LULUCF sector, divided by 4 key subsectors: land use change with 3 actions, forests with 9 actions, agriculture with 13 actions, and peat extraction with 1 action. It is advisable for the Armenian MRV system to include these 26 categories within the 4 main subsectors in the reporting, accounting, and tracking platforms, and to prioritize actions with the highest mitigation potential.

In order to evaluate potential mitigation actions, the national LULUCF inventory was replicated for this study, with some features simplified, modified or corrected with the purpose of providing the most accurate estimation of existing emissions and removals for the analysis. Therefore, this report contains comments on the assumptions for some of the most relevant parameters for the estimation of emissions & sinks, which may help fine-tune inputs to the Armenian NIR and/or provide data to fill in current data gaps.

Section 1, in pages 5 to 9 of the report, explains the methodology followed for the study and the assumptions that were made. It also presents a synthesis on page 9, in which it is noted that the total emissions from the LULUCF sector is reported to be -446 Gg $CO_{2\,eq.}$ in the NIR 2017, but is estimated through this study to be only -184 Gg $CO_{2\,eq.}$, which is less than half of the figure reported to the UNFCCC, adjusting some parameters to reflect the conditions in Armenia. The report suggests that the capacity of Armenian forests to act as a sink are likely to be overestimated as a result of the assumptions chosen for land use matrix, wood removal and growth factor parameters. It is important to note that the Armenian NIR 2017 provides a summary of the GHG emissions with and without Forestry and Other Land Use for the AFOLU sector, leaving mainly emissions from agriculture for the latter. Emissions from Forestry and Other Land Use, alone, are reported in the summary of GHG emissions on Table 2 of the latest Armenian NIR to be -470.6 Gg $CO_{2\,eq.}$ for the year 2017, representing a downward trend since 1990.

The observations regarding the parameters related to the presented in the report are further discussed below.

Regarding forests, the report suggests that the growth value used in the inventory is low compared to international references, with further details explained on page 24, and that the harvest volume used in the NIR estimations may be underestimated by nearly 20 times, since another recent source (GEF-UND, 2020) estimated the volume of commercial wood for 2016 to be nearly 33,900 m^3, compared to 2,922 m^3 as indicated in the NIR for the year 2017, and 848,000 m^3 for energy wood, compared to 70,246 m^3 as indicated in the NIR for the year 2017. Updating the above parameters would significantly change the carbon balance of forests, and would allow the Government of Armenia to have a clearer picture of the current volume of wood harvested, the actual potential of the national forests to act as sinks, and the real potential for mitigation actions in the LULUCF sector, which is underestimated with the NIR figures when compared to the GEF-UND figures.

In addition, the report notes that forest parameters, often the main drivers of LULUCF inventories, are missing in the most recent period of the inventory and that there are inconsistencies between different official data sources. It also notes that the land monitoring shows more deforestation than reported in the NIR, and flags the estimation of emissions from forest fires, which are not currently accounted for in the emission sources. Natural forest fires, even though not of anthropogenic source, are a significant source of emissions and have a significant effect on the capacity of forests to act as sinks, which is reported and tracked in the NIR. Limiting forest fires is therefore a very relevant mitigation action that must be accounted for in the climate action plans of Armenia, and indicators should ideally be tracked and reported in the national systems.

Regarding croplands, the report indicates that the calculation of perennial crops and stock variation of soils, for both croplands and grasslands, are likely to be mistaken in the NIR, and must be adjusted to be in line with IPCC guidelines. The report also indicates that changes between grasslands and crops affect large areas and that the land use matrix of the NIR needs to be adjusted to reflect more accurate conditions, which triggers important changes in the estimation of emissions & sinks.

As for emission factors, the report notes that the IPCC default values for emissions from grasslands, croplands and soils with low activity clay under cool temperate dry climates are too low for country-specific conditions.

Finally, regarding the stocks of carbon in soils, the report notes that the emission rate for litter is high for forests and zero for other land uses, although they do not differ much between the different land uses.

Long-Term Strategy (LTS).

This report also identifies the key mitigation actions in the LULUCF sector and provides insight that may be used in the national planning processes and strategies, including the Long-Term Strategy to be submitted by Armenia to the UNFCCC.

The results of the analysis of the potential of these 26 project types to mitigate emissions from the LULUCF sector in Armenia, with the chosen assumptions, show that the actions with the highest potential are afforestation actions, although expensive and difficult to implement, since plantations on non-forest land often have high mortality rates and mixed results. Additional sinks may be generated from plantations of orchards and agroforestry, but there are challenges in the estimation of the potential too. An ambitious objective, such as achieving 20.5% of forest cover in 2050, which has been highly debated, would require afforesting nearly 250,000 additional ha. Section 4.2.1 of the report suggests that afforesting 1/5 of the proposed area (50,000 ha.) may be more realistic. The overall potential impact of afforestation is estimated to be up to 34,794 kt of CO_2 reductions for the period between 2018 and 2050, which is very high.

Furthermore, the regulation of the wood harvested for energy, if effectively implemented, can have significant impact on the sector. Fuelwood harvest, which is very low in the NIR, appears to be very high due to informal harvests. Therefore, actions to reduce informal harvest have a higher impact in reality than currently reflected in the NIR.

The other most significant measures are the optimization of grasslands and the restoration of degraded soils, although these actions are also difficult to carry out. The restoration of degraded forests, however, may be easier to implement than new plantations.

On the other hand, the report also notes that emissions from peat extraction appear to be rising very sharply and reaching significant levels for Armenia.

The above are the key opportunities to mitigate emissions from the LULUCF sector of Armenia, according to the report, and should be considered for the development of national policies, frameworks, and strategies. However, it should also be noted that the results have a high uncertainty, given the current limitations and challenges of monitoring forest ground and land use in the country.

In addition, insight on the challenges of estimating long-term forest sinks may also serve as useful input for the development of the Long-Term Strategy of Armenia. Forest activity, which has a much higher impact in the 2050 forest sink than the current forest emissions and removals, is challenging to estimate and is often underestimated in inventories due to illicit wood extraction, limitations in monitoring technologies, and overall challenges of the quantification in the forestry sector. Furthermore, the actual outcome for the 2050 forest sink may vary even if the forest activity stays constant from 2020 to 2050, due to the changing natural forest dynamics, adding complexity to the estimations. Another consideration for the Long-Term Strategy is that mitigation actions have a limited duration and are reversible, according to the major principles of LULUCF reduction techniques discussed in Section 5 of the technical report.

7.2.16. Covenant of Mayors for Climate and Energy

The Covenant of Mayors for Climate and Energy is open to all local authorities democratically constituted with/by elected representatives, whatever their size or state of their energy and climate policies, and currently has 10,773 signatories in 53 countries, impacting over 328 million inhabitants globally.

To achieve a common vision 2050 towards decarbonised and resilient territories, with universal access to secure, sustainable and affordable energy services for all, the mayors commit to reducing CO_2 emissions in their municipalities by at least 40% by 2030, mainly by increasing the use of renewable energy sources, improving energy efficiency, and "no-regret", flexible measures.

Signatories also commit to submit a baseline emissions inventory, a climate change risk and vulnerability assessment, a Sustainable Energy and Climate Action Plan (SECAP) outlining how the signatory intends to reach its commitments, within two years of adhering to the Covenant, as well as reports on progress every two years.

The Covenant of Mayors for Climate and Energy was first signed by an Armenian local authority in 2009, with the adhesion of Tsaghkadzor, followed by 27 more signatories in the period since then, impacting a total of 1,756,833 inhabitants in the Republic of Armenia today. The 28 signatories in Armenia, in decreasing order of population size, are the local governments of: Yerevan, Gyumri, Vanadzor, Ejmiatsin, Abovyan, Kapan, Hrazdan, Sisian, Sevan, Ashtarak, Goris, Masis, Ijevan, Gavar, Artik, Dilijan, Alaverdi, Spitak, Martuni, Vardenis, Paraqar, Tashir, Aparan, Kasakh, Vayk, Jermuk, Akhtala and Tasaghkadsor.

Historically, only 10 action plans have been submitted by signatories in Armenia, including mitigation and adaptation actions, according to the figures provided online by the Covenant initiative. There are no records of monitoring reports submitted by local authorities in Armenia since the adhesion of the first signatory in 2009. Signatories accept to be suspended from the initiative, subject to prior notice in writing by the Covenant of Mayors Office, in the event of non-submission of the committed documents.

Therefore, it is convenient to incorporate to the Armenian MRV system the elements of the reporting requirements under the Covenant, which will facilitate reporting of progress for the 28 signatories, as well as the elements of the SECAP required from the 18 signatories who have not submitted one yet.

Common methodological principles and reporting templates have been developed, enabling signatories to track, report, and publicly disclose their progress in a structured and systematic manner. The Mitigation Pathway, established under the framework for action, accommodates a certain degree of flexibility for signatories, including the baseline year, key sectors of the scope, emission factors and units used for the development of the emissions inventory and reporting. It is advisable for the MRV system to consider this flexibility under the Covenant and to set a common metric for the Armenian signatories, in order to increase comparability and to benefit from facilitated aggregation of municipal data into national datasets.

Link to other frameworks and agreements

The commitments from Covenant signatories are linked to the EU´s 2020 climate and energy package, for signatories who have joined between 2008 and 2015, and to the 2030 climate

and energy framework as well as the EU Strategy on Adaptation to Climate Change, for signatories joining after 2015.

Mitigation action reported under the Covenant of Mayors help provide secure, sustainable, competitive and affordable energy for all, reduce energy dependence and protect vulnerable consumers. They therefore contribute directly towards the 7th UN Sustainable Development Goal (SDG), the Sustainable Energy for All Initiative, launched by the UN Secretary-General in 2011, and support the Armenian NDC and BUR3 regarding the increase of renewable energy in the supply matrix, since the commitments by Covenant signatories

On the other hand, the assistance provided by other member states to local authorities in complying with their mitigation and adaptation commitments under the Covenant of Mayors, may be incorporated to the voluntary disclosure of assistance received under the new Enhanced Transparency Framework of the UNFCCC Paris Agreements.

Furthermore, achieving the commitments will require the establishment of long-term objectives going beyond political mandates, which provides the opportunity for the Government of Armenia to incorporate such planning from 28 local authorities' signatories of the Covenant into the Long-Term Strategy of Armenia to be communicated under the UNFCCC, and to stay in line with the 2050 Roadmap for moving to a competitive low-carbon economy adopted by the European Commission in 2011.

The Mayors of the Covenant of Mayors invites the national governments to involve the Covenant in the preparation and implementation of the national mitigation and adaptation strategies. Through this process, local governments may play a key role in the Armenian transition towards reduced emissions and a climate resilient economy.

7.2.17. Decree 955 -A "On Approving the composition and rules of procedure of the Inter-Agency Coordinating Council on Implementation of requirements and provisions of the UN Framework Convention on Climate Change"

The Council was initially created by the Decree of Prime Minister of the Republic of Armenia (955-A, 2 October 2012). This Decree was replaced by the Prime Minister Decree "*On Approving the composition and rules of procedure of the Inter-Agency Coordinating Council on Implementation of requirements and provisions of the UN Framework Convention on Climate Change*" (719-A, 6 July 2021), which updated the mandate and rules of procedures of the Council. The Council has the authority to coordinate reporting on climate change and ensure coherent policies for achievement of Armenia's commitments under UNFCCC. The Council is mandated to approve the final drafts of key reports such as the national GHG inventories, NCs, BURs.

The decree establishes the members and general functions of the Council. The Council is composed of high-level officials (deputy ministers) of 13 ministries, 3 state agencies, and 2 independent entities. The Council will be chaired by the Vice PM and co-chaired by the Minister of Environment. Figure 32 summarizes the composition of the Council.

Figure 32 Inter-agency Coordinating Council according to 2021 amendments

Furthermore, according to amendments of 2021 3 new Inter-agency standing working groups were established replacing the former working group of Inter-agency Coordinating Council and are mandated to facilitate the work of the Council and provide professional and expert support. The three working groups will cover the main areas of national reporting under the Convention and the Paris Agreement. Moreover, ad hoc working groups might be established to deal with the matters that are out of the competences of the standing working groups ((Ministry of Environment of the Republic of Armenia, 2021).

The results produced by working groups are subject to approval by the Council. However, legal / formal arrangements are still needed to specify particular obligations of corresponding institutions in terms of climate-related data provision and quality assurance.

[In the course of the project, the roles of and among the different members of the Council among the different members will be established, especially in terms of validation of inventory information, and their contribution in the other components of the MRV system will be analyzed. In terms of the CCMRV platform, each member of the Council shall have access according to its respective function to be established.]

See more detail about the Council in Chapter 3.

7.2.18. EU-Armenia CEPA Implementation Roadmap

The Comprehensive and Enhanced Partnership Agreement (CEPA) between the European Union (EU) and Armenia, which entered into force on the 1st of March 2021, provides a framework for the EU and Armenia to work together in a range of areas for the socio-economic recovery and long-term resilience in Armenia. The CEPA dictates a roadmap for collaboration to achieve a cleaner environment, better living standards, more choice in

education, and a fairer and safer society, but does not provide further details or specific aspects relevant to the MRV.

However, Article 52 on Chapter 4 of the CEPA states that cooperation shall promote measures regarding market and non-market mechanisms for addressing climate change. Article 53 states that the Parties shall, inter alia, implement joint activities at regional and international level, including with regards to the multilateral environmental agreements ratified, while Article 54 states that the cooperation shall cover measures to prepare for carbon trading.

The MRV system in Armenia must therefore be able to distinguish and track the intended joint emission reduction measures, such as potential pilot projects hosted in the country under Article 6 of the UNFCCC Paris Agreements and whose emission reductions will not contribute to Armenia's NDC commitments, projects issuing carbon credits for trading, as well as all the financing received from the EU under the CEPA, which will need to be reported under the new ETF.

In addition, Article 54 of the CEPA also sets out the intention to work on measures related to ozone-depleting substances and fluorinated gases (F-gases), which are part of the scope of the Armenian NDC, which is why the MRV system must be able to track the impact of these measures, disaggregated by type of gas (ODS and F-gases).

7.2.19. Road Map for the Development of Climate Change-related Statistics

The road map was prepared by the Statistical Committee following the 2014 Conference of European Statisticians Recommendations on Climate-change Related Statistics (the CES recommendations). Based on those recommendations, the road map focuses on priorities that are 1) directly related to the statistics required for the compilation of Armenia's GHG emissions inventory; 2) related to other statistics required for climate change analysis; and 3) related to the statistical "infrastructure" (e.g., statistical methods and standards) required to produce climate change-related statistics. The considered categories for the roadmap are:

- statistics measuring GHG emissions
- statistics measuring human activities that are the source of GHG emissions (e.g., industrial production)
- statistics measuring impacts of climate change on human and natural systems (e.g., damages to infrastructure from extreme weather)
- statistics measuring efforts to avoid the consequences of climate change (e.g., installation of solar, wind, geothermal power)
- statistics measuring efforts to adapt to the consequences of climate change (e.g., installation of residential air conditioning).

The roadmap identified and prioritized the needs to improve the generation, collection and management of the information required for the GHG inventory, based on consultations with stakeholders. As part of this analysis, gaps and solutions were identified pointing out those responsible for carrying out the required actions, establishing for each recommendation, the actions to be taken, those responsible and co-responsible, deadlines for implementation and frequency required.

Table 22 Priorities of the roadmap for the development of the climate change statistics

Priority		Recommendations
1	Improve statistics for the national GHG emission inventory	1.1. Enhance awareness in the national statistical systems of how official statistics are or could be used for GHG inventories 1.2. Ensure that GHG inventory calculations use existing official statistics as much as possible 1.3. Improve the quality of official statistics used for GHG inventories 1.1.1. Improve coherence of GHG inventories and official statistics where possible 1.1.2. Improve the quality of energy statistics 1.1.3. Fill gaps related to, among others, the agriculture, forestry and other land use sector 1.1.4. Improve data on municipal solid waste morphology and on liquid and solid waste generation and disposal 1.1.5. Improve the timeliness of activity data 1.1.6. Build longer and more consistent time series of official statistics 1.4. Draft, together with the agencies responsible for GHG inventories, a prioritized list of national data gaps and a road map on data development to improve the national GHG inventory
2	Increase the Statistical Committee's role in the GHG inventory production system	2.1. NSOs should be proactive in reaching out to national agencies responsible for greenhouse gas inventories 2.2. Facilitate collaboration between the statistical system and national inventory system 2.3. Create a national working group between the NSO, the GHG inventories agencies and other relevant organizations 2.4. Clarify the NSO's role in providing statistics and assist, as needed, in GHG inventory calculations 2.5. Support efforts at strengthening the quality of GHG inventories in line with the IPCC's guidelines on quality control and quality assurance and to ensure application of country – specific methods for calculation
3	Increase and deepen cooperation with international statistical community on climate change-related statistics	3.1. Seek closer collaboration of the statistical community and international organizations working on climate adaptation issues 3.2. Actively engage, at national level, with the national representatives delegated to the relevant UNFCCC forums and follow up on the outcomes of the UNFCCC conferences of the parties to the convention 3.3. NSOs to be actively involved at the outset of work when countries need to respond to new data needs from the convention

4	NSOs must improve the contribution of official statistics to climate change analysis by, among other things, facilitating access to existing statistics	4.1. Create national forums or events for discussions between users and producers of climate change statistics 4.2. Provide access to climate change-related statistics and indicators (including scientific data collected by others) using NSOs' dissemination channels, improve access to microdata for researchers working on climate change
5	Improve the usefulness of existing environmental, social and economic statistics for climate change analysis	5.1. Review statistical programs and data collections from the viewpoint of the data needs for climate change analysis and indicators 5.2. Address the difficulties in matching data from different statistical domains 5.3. Geo-reference all relevant data to support analysis of the spatial dimension of data linked to climate change 5.4. Produce statistics for new geographical areas
6	NSOs should consider development of new statistics based on a review of the key data needs of climate change policy makers and analysts in their country	6.1. Improve data for analyzing drivers of climate change 6.2. Develop statistics on the use of economic instruments 6.3. Develop statistics to address climate change related loss and damage 6.4. Consider how to contribute to the on-going efforts to monitor biodiversity and ecosystems
7	Existing classification systems, registers, definitions, statistical frameworks, products and services need to be reviewed to see that needs related to climate change analysis are appropriately addressed	7.1. Give consideration in future revisions of international statistical standards and classifications to the data needs of climate change analysis 7.2. Identify and address the obstacles to linking statistics across domains 7.3. Consider new approaches to preserving confidentiality 7.4. Consider the inclusion of explicit references to environmental statistics, including climate change-related statistics, in statistical laws
8	Statisticians should gradually develop new partnerships, expertise and ability to adopt new methodologies for producing climate change-related statistics	8.1. Build knowledge and understanding of the climate change related information importance within NSO staff 8.2. Develop knowledge, methodologies and tools for producing and using geo-referenced data across the statistical system 8.3. Ensure the effective transfer of knowledge and skills among NSOs internationally
9	Make organizational changes in the Statistical Committee, the broader national statistical system and the national system to support the production	9.1. Assign a person or group with the responsibility for ensuring the quality and availability of climate change-related statistics 9.2. Modify, in the longer term, the NSO's organizational structure 9.3. Define and clarify, if needed, the division of work and responsibilities between the different producers of climate-change related statistics and GHG inventories

of climate change-related statistics	9.4. Earmark sufficient resources for the development of environmental statistics and climate change-related statistics

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

This document was prepared in 2021 by EU4Climate and offers a summary of the international commitments in light of the Paris agreement, the legislative context, the reporting obligations, modalities, procedures and guidelines for the transparency structure, the principles of the inventory, the national circumstances and institutional arrangements, as a preamble to the Roadmap for the establishment of an MRV system of Armenia. This document offers a clear overview of the status of the policies and the prevailing gaps that potentially hinder the establishment of such a system in Armenia.

Among the outstanding findings cited in this report are the following:

- 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;
- Clear definition of roles and responsibilities of different ministries and agencies are not specified;
- There are a lot of activity data required for GHG emissions assessment which are not publicly available;
- There are no formal arrangements for collecting GHG Inventory activity data on a continuous basis;
- Limited financing of the responsible department in order to increase the staff;
- There is no overall QA/QC plan;
- 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;
- There aren’t any legal and contractual arrangements in place for data collection, and problems with private companies do exist;
- 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;
- Safe data storage and handling: calculation sheets, need to be stored in an orderly manner, with calculation sheets set to read-only at the end of an inventory cycle.

Among the conclusions of the report, it is proposed to carry out a series of trainings in which this consultancy will not deepen, since this need has already been identified.

However, the recommendations of this project will focus on the development of the necessary regulatory framework to be able to establish an effective MRV, including aspects of institutional arrangements both for the GHG inventory and for monitoring mitigation and adaptation actions.

This roadmap served as the basis for the development of this project. In fact, it was possible to corroborate these findings through the various regulatory instruments that were reviewed in this context and through stakeholder consultations. The implementation of the recommendations issued in chapter 6 is necessary to address these gaps and to be able to promote and establish a robust MRV system.

Annex 2 Institutional and data mapping

The institutional and data mapping is presented according to the MRV design proposed by the consulting team, which involves the components: GHG inventory, registry of mitigation and adaptation actions, and emissions registry of private sector. See Excel file attached.

Sheet “MRV system structure”

This sheet presents the main elements of the MRV system by sector (Energy, IPPU, AFOLU, waste and other), broken down by component.

Data providers, system users (coordination, leaders by sector, QA/QC, support and other stakeholders), related systems and outputs are shown, both for emissions (GHG inventory) and for reductions (registry of mitigation and adaptation actions).

It is worth mentioning that the structure of the MRV system is shown considering both the existing elements (e.g. inventory, existing related policies), as well as those suggested by this consulting team within the framework of this project (e.g. registry of projects).

Sheet “Institutional mapping”

This sheet shows by system component and sector, the data series and the information flows between the various entities involved. The components of the MRV that are considered are: GHG inventory and registry of private sector emissions (to track emissions) and registry of projects (to track reductions).

In these arrangements it can be seen the direct links to the IACC and its different working groups, according to the recommendation issued in chapter 6 (R2).

The aspects shown in this mapping are: System component, sector, data, information provider, coordinator, technical support and QA/QA.

Annex 3 Stakeholder's consultation meetings notes

Carbon Limit's mission to Armenian within the framework of UNDP/MRV Project

Inrerview *with Aram Ter-Zakaryan, Team Leader for National Adaptation Institutional Framework Enhancement, NAP UNDP-GCF project*

- NAP project has MRV component dealing with the adaptation, however, activities under the component just commenced and there are no results so far;
- Predecessor of the Inter-Agency Coordination Council has not became full-fledged operating entity taking into account the fact that it was mainly perceived as body reviewing and providing endorsement to the documents being sent to the UNFCCC Secretariat (such as National Communications, Bi-annual Update reports, etc). Subsequently, other ministries that were part of the Council were not bringing relevant issues to the latter's consideration. This was among the key reasons necessitated re-engineering of the Council. Success of the new Council is largely dependent on the willingness of other ministries/agencies to use it as a platform for raising issues related to their responsibilities. This, in its turn, is largely dependent on the (low) capacities of the ministries;
- 2 years ago, Environmental Project Implementation Unit state non-commercial organization (operating under the aegis of the Ministry of Environment), within the framework of Readiness and Preparatory Support Project financed by Green Climate Fund has developed the non-objection procedure for the projects to be submitted to the GCF consideration. According to the logic of the document Coordination Council should have been provided with the authority to decide on the non-objection. However, Ministry of environment is against empowering newly established Coordination Council with such authority;
- According to the recent decree on establishing Inter-Agency Coordination Council each member ministry/agency twice per year should submit information on their activities to the Council. However, the mechanism for doing so is not clear and should be further elaborated. Most probably, respective information will be submitted to the Climate Policy Department of the Ministry of Environment (designated to serve as Secretariat to the Coordinating Council), which will further summarize it and submit to the Coordinating Council;
- The respective Decree of the Deputy Prime Minister establishes working groups under the Coordinating Council and defines their operational modalities. However, so far there were no activities carried out by quoted working groups;
- Within the framework of the Project coordinated by Aram, it is envisaged to design new web-site for the "Hydromet" SNCO which will provide with new approach to the information dissemination among interested stakeholders.
- Capacity building needs of the newly established Coordination Council and working groups will be addressed through CBIT and NAP projects, under which respective training activities are being foreseen;
- Institute of 3rd party verifiers is critically important both for the overall development of the framework and activities of the Coordination Council;

- He has also informed about the further plans towards introduction of the MRV system;
- Identification of the next steps to establish the national MRV system with assistance of EAA and based on the MRV system gap analysis;
- Organization of a national workshop with support of EAA on the new transparency requirements;
- Preparation of training materials/guidance in national language;
- Organization of training sessions for sectorial experts, line ministries- nominated specialists, Statistical Committee;
- Development of training materials/guidance for private sector stakeholders on their contribution to national UNFCCC reporting in local language;
- Organization of training sessions for private sector and sharing the guidance on the public domain;

Day 1 – 30 December 2021

Meeting 1 – Kick off meeting with UNDP Climate Change Programme

Host:

Diana Harutyunyan – Programme Coordinator

David Shindyan – Expert

Heghine Grigoryan – Legal Expert

Carbon Limts

Francois Summut

Tigran Sukiasyan

Diana Harutyunyan

- UNDP Climate Change Programme has recruited international consultant to help with methodological issues related to the calculations of transport emissions, taking into account the fact that beneficiaries (Statistical Committee?) are not very much informed about IPCC requirements;
- 2-3 years ago roadmap on climate change information data processing has been designed by UNECE SEIS project (to serve as methodological guidance) and further adopted by the board of Statistical Committee. However, there is not much progress with regard to implementation of this document;
- Close cooperation with the Statistical Committee is critical from the perspective of latter's obligations under the Eurostat (on air accounting). There are lot of opportunities to improve not only environmental data but also information from climate mitigation domain;

- It is important to approach the issue of dividing overall information to open and confidential data, as well as understand how the second one should be part of inventory data;
- It is important to understand what proposed portal is and how it will be operated. What are the best international practices? Which countries/structures succeeded the most in building efficient framework;

  FS responded – the system is still evolving worldwide and there are no full best practices to consider.
- Other that describing the overall functionality and visualization of the portal, it is important to address some key fundamentals (e.g. energy balance) and provide with clear distribution of responsibilities (who will do what using which input);
- Proposed software shouldn't be operating as "black box" (one push the button and gets necessary data). It should rather be engineered on the clear cut operational procedures and protocols for information exchange;
- Previously the data from industrial companies was reported by Environmental Inspectorate operating under the aegis of the Ministry of Environment. Nowadays, it is independent body under the Government (Environmental and Subsoil Use Inspectorate). Entity is responsible on collecting statistical info on wastewater discharge and pollutions (CO2 emissions are not captured by the entity). At the meantime, information/data provided by the Ministry of Environment (on CO2 emissions?) is misleading;
- Few years ago, with support from UNDP Armenia recommendations to the Ministry were developed aimed changing the reporting format and introduction of the GHG reporting methodologies. Regretfully, these has not been implemented;
- It is important to understand (during the meetings with responsible ministries) how functional are Administrative Data Registries (operating by the ministries) and what the integration problems are. For example, Ministry of Environment (responsible for agricultural sector) has piloted **Anipass** system (cattle registration registry). It would be good to know the lessons learned;
- Ministry of territorial administration has information about the number of cars (confidential). This system is important for managing tax payment processes (property tax paid through local municipalities?);
- One of the most critical issues periodically raised by the Statistical Committee is absence of department-level statistics at the ministries' level. So, it is important to enhance capacities of the ministries to professionally process and analyze the data they are collecting for the purposes of further circulation; For example, the Ministry of Territorial Administration every year asks for UNDP support in designing energy balance, as there are zero human capacities and financial resources allocated for carrying out this important task;
- UNDP currently discusses the possibility of introducing special legislation that will require emission reporting by the businesses. If the country (and big entities) is willing to compete for attracting significant volume of climate finance (plus engagements under the Article 6), then this becomes mandatory requirement;

Meeting 2 – Meeting ate the National Statistical Service

Host:

Nelli Baghdasaryan – Member of the Board (responsible for coordination of Environmental Section)

Carbon Limts

Francois Summut

Tigran Sukiasyan

Nelli Baghdasaryan

- Environmental Department of the Statistical Committee administers 20 forms that provides information on the environmental protection fees, forestry, emergency situations. The sources of the information are: 1) Administrative Registries (databases designed by responsible ministries and shared annually on CDs), and 2) companies that in accordance with the law are considered as providers of statistical information (waste and emissions);
- The key Administrative registries are designed by the following agencies – Ministry of Environment, Environmental and Subsoil Inspectorate, Ministry of Emergency Situations, Ministry of Health, Ministry of Territorial Administration and Infrastructures (energy and mining), State Committee of Real Estate Cadaster and State Revenue Committee;
- The web-site of the National Statistical Committee has a specific section called Data Bank, which contains all information available. Chapter 8 (Environment) has been structured in accordance with UN classification - https://armstatbank.am/pxweb/en/ArmStatBank/?rxid=c3fe2922-b10e-44c8-8ed6-24fa02211ce2
- Diana Harutyunyan always complained about the quality of the forest data (commercial use volumes that seems to be unrealistic) coming from the Ministry of Environment;
- Water accounts available through the Databank are of acceptable quality. However, Air emission accounts left much to be desired and Climate Change Programme of the UNDP Armenia provides with periodical support. Specifically, Ministry of Environment uses wrong/outdated methodology for calculating pollution from auto-transport (they use assumption that all cars are using petrol/diesel, while the most part of vehicles in Armenia use CNG). This is big and systemic issue;
- Also, it is important to further break-down “transport” classification into heavy trucks, passenger vehicles, etc;
- Some experts suggested to use household surveys for collecting information about agricultural equipment, cars, fuel consume. But problem here is that this info could be used for determining overall ratio and not the specific data. That is why Statistical Committee rejected this approach;

- The easiest way to analyze the data received from the importers of the natural gas and fuel;

Day 2 – 01 December 2021

Meeting 1 – Meetings in the Statistical Committee

Host:

Lusine Markosyan, Head of Households' Statistic Section;

Arsen Avagyan, Head of Agricultural Statistic Section;

Anahit Avetisyan, Head of Industry and Energy Statistic Section;

Carbon Limts

Francois Sammut

Michael Vartanyan

Tigran Sukiasyan

Lusine Markosyan

- Department manages annual household survey (targeting 5184 households throughout Armenia out of 708,000 registered) carried out by around 50 surveyors that are full time employees of the Committee. Survey instruments includes comprehensive **questionnaire** on living conditions (water and electricity used, waste generated, heating methods and associated expenses, etc) and **dairy** (filled in by households during 2 weeks and capturing daily expenses and other behavioral patterns);
- Information on the monthly use volumes of the energy sources used by households is presented below:
    - **For heating purposes** - liquid gas, kerosene, diesel fuel, coal, fire wood, manure, other;
    - **Car fuel** – gasoline, diesel, CNG;
- Due to confidentiality issues, Department do not share raw data collected during the survey but rather carries out analysis per groups and further communicates information;
- Information discrepancy on fire wood used by households identified earlier – there is significant mismatch between the data on the volumes consumed by households (identified through households' survey carried out by the Committee) and reported by ArmForest state non-commercial organization (responsible for management of forest areas) explained by the interlocutor as follows – information on the fire wood consumed by 5184 household is extrapolated to the whole population of Armenia (even to the households from the capital city Yerevan and other big cities where use of fire wood is close to the zero);

Arsen Avagyan

- Information on the cattle headcount is collected in the following manner – specially established by the decrees of regional Governors municipal commissions carry out counting (at household level only) and submit information to the regional structures of the Statistical Committee. Central apparatus of the Statistical Committee collects information from regional offices and ads information received from agricultural companies (that directly send respective information to the Statistical Committee). This captures number of cattle only. Information on community level collected on the paper which is further transferred into the Excel tables and shared with the Central apparatus of the Statistical Committee.

  Ministry of Economy (also responsible for agricultural policy) is piloting **AniPass** portal (central database on the cattle) that from 2022 will become operational. Some additional information on the portal is provided by the Ministry of Economy (see points below). However, the Food Safety Inspectorate (responsible for the operations of the portal) should also be interviewed to understand the scope and the coverage of the platform;
- Information on the arable land is collected by the State Committee of Real Estate Cadaster;
- No information about fuel used by agricultural machinery is collected;
- They also do not collect information about fertilizers used. However, taking into account the fact that no fertilizers are produced locally data about the import volumes (collected by the State Revenue Committee) can be used;

Anahit Avetisyan

- Department is responsible for collection (monthly and annually) of the statistical on the industry and further sharing of the latter through the official portal of the Statistic Committee;
- Statistics Committee is sharing information collected from energy producers and transport with the Ministry of Territorial Administration and Infrastructures, which analyses the data and prepares energy balance;
- There are specific forms (available on the website of the Statistics Committee) for collection of the information from energy producers – general template, special template for hydro-power stations and thermal power station;
- There are no structural information exchange links with the Ministry of Environment. Information is being shared with the latter on per-request basis;
- There is established structural statistic sharing link with the Ministry of Territorial Administration and Infrastructures only. This is done with the purpose of sharing information for preparation of the energy balance (introduced within the framework of INNOGATE Project);
- Issue of collecting information about fuel consumption by agricultural machinery is in its way of resolution. Thus, recently the agricultural machinery has been considered as the mean of transport and respective responsibilities for control transferred to the Police of

Armenia. The latter will start to collect respective information and input into the database shortly;

Meeting 2 – Meeting at the Ministry of Economy

Host:

Levon Ter-Isahakyan, Head of Primary Agriculture Department of the Ministry of Economy

Carbon Limts

Francois Sammut

Michael Vartanyan

Tigran Sukiasyan

Levon Ter-Isahakyan

- Recently established department that is responsible for designing and implementing programmes in the agricultural sector related to the livestock;
- Data (number of the livestock) is being taken from Statistical Committee on yearly basis. The most recent data is – 650,000 cattle, 750,000 sheeps and goats (90% sheeps);
- Department analyses information (quoted in the point above) and produces quarterly estimates (technological approaches that takes into consideration the weather and fodder) on the meat and milk production and shares it with the Statistics Committee. The latter cross-checks this information through control farms
- Data on the import of fodder is received from the State Revenue Committee;
- Department is also able to calculate and communicate information about manure generation if necessary;
- From 2022 **AniPass** portal (central database on the cattle) will become operational and provide with more precise information;

Meeting 3 – Meeting at the Ministry of Environment

Host:

Nona Budoyan, Head of Climate Policy Department

Carbon Limts

Francois Sammut

Michael Vartanyan

Tigran Sukiasyan

Initially it was expected that key functions from the Ministry of Environment and Environmental Safety and Mining Inspectorate will attend the meeting, which never happened. Ms Nona Budoyan, Head of Climate Policy Department (responsible person for organizing the meeting), has informed that she is not aware about data collection processes and suggested to interview respective officials. It has been decided to target them individually during and after the mission.

Day 3 – 02 December 2021

Meeting 1 – "Hydrometeorology and Monitoring Center" state non-commercial organization of the Ministry of Environment of Armenia

Host:

Anna Zatikyan, Head of Information Department

Carbon Limts

Francois Sammut

Michael Vartanyan

Tigran Sukiasyan

Anna Zatikyan

- Information on air quality (CO2, NO2, dust) is being collected by 15 hydro-meteorological stations and 220 observation points in active (on daily basis) and passive (weekly) mode.
- Information is collected by stations and points in Excel sheets and shared with the Hydromet. However, currently platform is being designed by one of the Scientific-Research Centers to consolidate information about monitoring of emissions. This will be integrated with the database of State revenue Committee and representatives of the private sector will be able to input information directly;
- Data about emissions is collected by the Environmental and Mining Inspectorate and further transferred to the National Statistical Service (Environmental department);
- If the company operations consume more than 20 bln cubic meters of air annually then this should get permission from the Ministry of Environment. Consumption from 200 mln to 20 bln cubic meters of air annually by companies (around 1300 entities) requires only provision of respective information to the Ministry;
- Database (in Microsoft Access form) is being managed by the Environmental and Mining Inspectorate and Hydromet is periodically requesting information and receiving it through the Governmental intranet. The quality of database (structure and content) is rather good (collects information using NASA (?) methodology) which allows to track information by inhabited localities (air, water, waste). Hydromet is willing to get GIS distributed information/data on emissions to be available online;
- Biggest pollutants of the methane are gas fueling stations;

Meeting 2 – Meeting at the Ministry of High-Tech Industry

Host:

Arshak Kerobyan, Head of Digitalization Department

Carbon Limts

Michael Vartanyan

Day 4 – 03 December 2021

Meeting 1 – Representatives of Forest Policy Department

Host:

Aram Sahakyan, Head of Department

Artur Gevorgyan, Head of Section

Carbon Limts

Francois Sammut

Michael Vartanyan

Tigran Sukiasyan

Aram Sahakyan/Artur Gevorgyan

- The Governance structure is the following: 1) **Forest Policy Department** is responsible for implementation of state policies and programmes in the sector; 2) **Forest Committee** is entrusted with the sustainable management, conservation, protection, restoration, reforestation and effective use of forests, raising State forests' productivity, and conservation of biodiversity. The functions of the **Committee** are as follows: registration of State-managed forests and forest lands, keeping of the State forest cadaster, forest management, forest restoration and reforestation; 3) **Armforest** state non-commercial organization (through network of regional forestry entities) is responsible for implementation of forest protection, reforestation and afforestation activities;
- Forest monitoring activities are carried out by the "Hydrometeorology and Monitoring Center" state non-commercial organization of the Ministry of Environment of Armenia. Forestry issues at the special protected areas (approximately 25% of total forestry coverage) are handled by the Department of Special Protected Areas of the Ministry of Environment;
- Information flow on the forests: 1) information about forests of "municipal" essence is collected by Regional authorities and directly sent to the cadaster, 2) information about "national" forests is collected by Armforest and transferred to Cadaster;

- Latest official inventory of forests has been carried out in 1993 (outdated info). GIZ has carried out study in 2013 and reported 11.2% of forest coverage in Armenia;
- Each regional subdivision (out of 17) of Armforest is managed by 10 year development plan and annual operational plan;

Meeting 2 – Wrap-up meeting with UNDP Climate Change Programme

Host:

Diana Harutyunyan – Programme Coordinator

David Shndyan – Expert

Carbon Limts

Francois Sammut

Michael Vartanyan

Tigran Sukiasyan

- Mission members presented the activities carried out during the mission and early findings;
- UNDP suggested to submit the first draft of the Report by 15 December 2021;

Annex 4 IT requirements

8. Functional components

8.1. GHG Inventory System

The GHG inventory system is a subsystem of the CCMRV system that collects activity data and applies methods specified in the IPCC Guidelines for National Greenhouse Gas Inventories to calculate estimated emissions along with uncertainties and outcomes of various data analyses.

The GHG inventory system also produces reporting in the form of “common reporting tables” (CRTs) defined by the UNFCCC process on the basis of reporting tables defined by the IPCC in its guidelines.

Due to the high complexity of the methods and the need to maintain extremely specialised expertise in order to keep the solution up to date with the developments and reporting requirements emerging in the UNFCCC negotiation process, it is strongly recommended not to attempt to develop a GHG Inventory system from scratch.

Armenia is currently using the IPCC Inventory Software version 2.691 from January 2020 to prepare its reporting. This version of IPCC software will not be able to produce reporting required for BTRs. At COP26, the UNFCCC secretariat was mandated to implement new reporting tools taking into account the need to provide compatibility with IPCC software. The IPCC has communicated that it is working on a new version of its software that will not be compatible with the previous version. The new mandate to the UNFCCC, and particularly the funding made available to IT work on reporting tools by Parties in Glasgow, may change the development vector of IPCC software. The results remain to be seen.

Other standalone and MS Excel-based COTS systems are available on the market. One of such systems will need to be selected and integrated using its interoperability layer.

8.2. Business Process Management System

The Business Process Management System (BPMS) defines the workflows to be executed between the users and invigilated by the CCMRV system. The workflows are likely to be specific to the business needs of the Armenian government, so the definition (configuration) of workflows will have to be tailored specifically for Armenia.

The BPMS itself is a well-established niche of software development with numerous open source and COTS products to choose from. The selection criteria for BPMS should be:

- Maturity of the solution;
- Ease of configuration and evolution thereof;
- Ease of integration with external systems;
- Ease of integration with external directories defining user management and access levels.

8.3. Project and Support database

The Project and Support database is a subsystem of the MRV system that maintains data about mitigation projects, programmes and policies, including:

(for projects)

- Project name;
- Implementing agency/organisation;
- Responsible persons;
- Project boundary/location;
- Sector;
- Technology;
- Baseline and monitoring methods;
- NDC link(s);
- SDG link(s) for tracking of co-benefits;
- Support needed and received.

(for support)

- Title of the support initiative / pledge;
- Donor(s);
- NDC link(s);
- SDG link(s);
- Term;
- Support volume;
- Information about pledges and disbursements with links to projects.

The Project and Support Database also produces reporting in the form of “common tabular formats” (CTFs) defined by the UNFCCC process.

Due to the specificity of national processes and the need to maintain the extensive linkages between this component and BPMS, the ideal configuration for it is a COTS which is customized for Armenia’s needs.

A Project Portfolio System (PPS) has been developed in Armenia as part of the “Climate Action Enhancement Package” supported by the NDC Partnership. The functional review of the PPS shows that the system combines the functionality of the project and support database with basic BPMS functionality. The system was developed by a local company which is also capable of supporting the solution in the long term. The system should therefore be carefully considered as an option to implement, with some improvements, the respective parts of the CCMRV system in Armenia.

Finally, depending on the number of activities, the implementation of automated solutions for the BPMS and the Project and Support Databases may not make business sense. In this case, the same requirements may be implemented using simple Office applications and a

well defined data exchange protocol between participating agencies and other entities. It is recommended to be very cautious about taking this route as manual business processes are prone to intentional tampering, human error, and various issues with data safety.

8.4. Interoperability layer

Due to the high costs of bespoke development and the high level of standardization in requirements to individual system components, it is recommended to minimise bespoke development in the systems and concentrate on providing interoperability between open source and COTS components. The interoperability layer should deliver the following functionality:

- The toolset to control components of the system, including the ability to receive substantive responses from components to the commands sent;
- The toolset to query components of the system for arbitrary information contained therein;
- The toolset or a database arrangement to coordinate transaction integrity when business transactions require changes in data maintained by more than one subsystem;
- The toolset for batched extract-transform-load (ETL) tasks and import of third-party data into different components of the CCMRV system.

The recommended way of organising interoperability is through REST APIs.

8.5. Security and user management subsystem

The Armenian government has an EDI system that is able to identify all authorized users of governmental EDI. In the ideal scenario, the CCMRV system should be able to use the same system for identification of its users from the government and an extension for the provision of external users, such as the users of the Project and Support Database from the private sector and civil society organisations.

8.6. Reporting subsystem

The MRV system is expected to produce reports on various media, including:

- Web pages;
- Excel and other Microsoft Office files;
- PDF documents;
- CSV or XML formats for further loading into analysis softwares.

Multiple mature open source reporting systems, as well as systems already in use in Armstat provide necessary functionalities.

9. Server and network architecture

9.1. Development environment

In the ideal case, a development environment should be installable on the individual developers' machines and contain all the necessary system components, which means that the entirety of the technology stack should be able to run on a typical developer-grade PC:

- 4+ CPU cores
- 16+ GB RAM
- 100GB HDD or SSD space

9.2. Staging environment

Staging environment is an environment where new versions of the system are shipped for final testing and user acceptance before being released to the production environment. Staging environment has stable access features:

- Maintained, pre-provisioned user credentials;
- Stable URL for the web presence;
- Special setup for notification and emailing subsystem pointing out non-production status of any notifications sent.

Staging environment should be capable of demonstrating any functional feature of the system. It may lack in meeting any non-functional requirements. The minimum configuration of staging environments will depend on the final selection of components but should generally consist of the following:

Reverse proxy / web front end:

- 2+ CPU cores
- 4+ GB RAM
- 100GB HDD or SSD space

Database server:

- 4+ CPU cores
- 8+ GB RAM
- 500GB HDD or SSD space

Application server:

- 4+ CPU cores
- 16+ GB RAM
- 100GB HDD or SSD space

File/asset server:

- 2+ CPU cores
- 2+ GB RAM
- 1TB HDD or SSD space

9.3. QA environments

Quality assurance (QA) environments are used to investigate special situations and incidents observed in the production environment. These are only accessed by IT professionals in charge of operating and supporting the system and replicate the production environment in all aspects relevant to the investigation at hand. It is recommended that QA environments be transient and generated automatically from the backup of the production system each time they are required.

The configuration of a QA environment is generally equivalent to the configuration of the production environment but it can be reduced in power or functionality if the issue being investigated is of an understood nature and may be localised without invoking the entire production setup.

9.4. Production environment

Production environment is used to run the live system. It is the best equipped and most controlled environment with full operational rigour implemented for hosting, operations, support, monitoring, backup, business continuity and disaster recovery.

The exact configuration of the production environment will depend on the specific architectural components and products chosen, the reference configuration will include two of each:

Reverse proxy / web front end:

- 4+ CPU cores
- 8+ GB RAM
- 100GB SSD space

Database server:

- 4+ CPU cores
- 16+ GB RAM
- 500GB SSD space

Application server:

- 8+ CPU cores
- 16+ GB RAM
- 200GB SSD space

File/asset server:

- 2+ CPU cores
- 2+ GB RAM
- 1000GB SSD space

9.5. Redundancy and standby servers

The entire territory of Armenia is a zone of high seismic risk. There are other factors that make catastrophic service disruptions such as a complete site loss more likely in Armenia. It is therefore very important to provide the CCMRV system with excellent backup and operational redundancy arrangements. Redundancy of server arrangements is used in the production deployment architecture in order to assure continuity of operations in case of hardware or other low-level breakdowns. Three types of standby are considered:

- **Hot standby**: a hot standby system runs simultaneously with an identical primary system. Should the primary system fail, the hot standby system takes over immediately and continues operation. Data loss in hot standby arrangements is very rare. Implementation of hot standby is the most expensive and requires complex operational configurations and testing.
- **Warm standby**: a warm standby system runs in parallel with the primary system and receives a stream of data (state) changes from the primary system. Minor data loss is possible in warm standby arrangements but it is typically recoverable if streaming of state changes is set up correctly. Warm standby is reasonably easy to set up and arrangements for it come out of the box with major databases and enterprise-grade systems. Testing warm standby is reasonably straightforward.
- **Cold standby**: a cold standby system is a system that is not running in the normal scenario, it is only brought up if the primary system fails. In order to bring the state of the cold standby to the latest state of the primary system before failure, the latest backup of the primary system's state is updated with the recorded stream of state changing events. Cold standby is as reliable as warm standby, but it may require some time for it to become operational once failure condition is established. It is slightly more difficult to set up than a warm standby, but it is much cheaper to operate as most of the time the standby system is switched off (thus "cold")

9.6. Reverse Proxy

The reverse proxies are generally stateless; they require very infrequent updates and can be swapped out without worrying about saving the data/state they operate on. In a containerised, and even in simple virtual environments, it is possible to keep the second reverse proxy as a cold standby: it should be very quick to bring it up and data loss is a non-issue because it is stateless.

Reverse proxy's job is generally simple and it is therefore undemanding to hardware. It is important for the reverse proxy to have enough processor cores and a decent amount of

RAM. Most of its work does not involve interaction with disk or network storage; the only reason to provide it with a faster disk subsystem is to arrange for quick startup in case it is used in a cold standby configuration.

9.7. Database Server

All efforts should be made to keep all system state on the database server. It is possible that larger documents or files that may be necessary to store as records of the source of primary data. Though these are a part of the general system state, they are not good candidates for storage inside a database. Such documents and files may be stored in a specialised file storage in an append-only manner and with links to actual versions maintained in the database.

If the system is organised so that the database contains the entirety of the system's state, the database server becomes the only part that requires advanced failover arrangements. Hot standby should be considered for the database server; should this not be economical in combination with other operational provisions for failover (see below on business continuity), warm standby with good arrangements to record and transfer the state change event stream should be put in place.

The database server requires a fast, multi-core CPU, plenty of memory and quick SSD storage to be able to serve many database queries in parallel.

9.8. Application Server

The application server contains all server-side business code of the system. It is parametrized by configuration which remains unchanged throughout the functioning of the server so it is also, in essence, stateless.

Application servers may take a long time to start up, so depending on the desired operational parameters, e.g. recovery time objective (RTO), it may be advisable to keep a warm standby of the application server. An alternative is to keep all redundant operation servers as parts of a hot application server pool without dedicating primary and failover servers: both servers will serve users at all times, the failing server will be "caught" by monitoring arrangements, removed from the pool and notified for replacement.

Similarly to the reverse proxy, the application server should not depend a lot on the disk subsystem. It does however require a fast multi-core CPU and plenty of RAM to execute business logic.

9.9. Business continuity and disaster recovery

All production operational arrangements need to be organised to withstand the risks of:

- Site loss for any reason (earthquake, fire, acts of war/terrorism etc.)
- Site malfunction (electricity supply or network breakdown, industrial action etc.)
- Catastrophic hardware breakdown;
- Hacking.

Business continuity and disaster recovery are usually among the largest expenditures on operational arrangements and careful analysis of risks should be undertaken by the government and the developer in order to identify response strategies and whether some of the risks are acceptable in the view of their low probability.

Site loss

The site loss scenario assumes loss of all operational arrangements on the hosting site and all data that is stored on this site.

The biggest risk for Armenia are possible earthquakes; other typical scenarios of site loss include fires, floods, acts of war, terrorism and similar events.

The reasonable response measures include keeping failover arrangements at separate, geographically remote, data centres. Organisation of hot standby is particularly cumbersome and expensive on distance so if the risk of site loss is considered high enough, it should be assessed if the system will show sufficient recovery characteristics without hot standby.

For a small country like Armenia, sufficiently “geographically remote” may not be achievable. It is therefore recommended to consider options of hosting the system or its failover parts in public clouds with data centres outside Armenia.

Site malfunction

The site malfunction scenario assumes loss of all operational arrangements on the hosting site without losing data.

The typical scenarios of site malfunction are electricity supply or network breakdowns, epidemics, industrial action, staff walkouts and similar events. The assessment of probability should consider relevant statistics in the country in order not to underestimate the associated risks.

The reasonable response measures include keeping failover arrangements at separate, geographically remote, data centres. The main problem with site malfunction is that conditions for it may emerge gradually, with e.g. the system’s ability to work with users and update data working for a significant time after the replication of data to failover servers has stopped working. Good monitoring measures such as probes and “canary tests” to proactively shut off accumulation of state changes that cannot be replicated should be implemented to avoid such situations.

Catastrophic hardware breakdown

Catastrophic hardware breakdowns can be dealt with by keeping basic failover arrangements for all parts of the infrastructure.

Hacking

Detailed elaboration of response to hacking attacks is out of scope in this document. The basic steps include:

- **Lockdown**: the system must be isolated from the Internet and from other systems as quickly as possible to prevent further access of cybercriminals;

- **Protection of state**: the system's storage should be frozen and dumped (copied) to a backup medium;
- **Review of data integrity**: identification of the last modification of state that is believed to be made by the system without influence of malicious code or commands;
- **Identification and remedy of the attack vector**: figuring out how the cybercriminals went in and fixing the problem with deployment arrangements, configuration or code that made hacking possible; running of extensive security tests with concentration on the area of the identified vector;
- **Clean install**: setting up of a new, known-good configuration with the latest trusted dataset and updated software.

10. Web interfaces

10.1. Web page performance

Web interfaces should be fast enough for comfortable operation. In particular,

- All single-cell data entry operations and report loads should happen instantaneously[22];
- Multiple-cell operations which may trigger widespread data updates in the database should display a delay indication and should normally take less than 10 seconds.
- Large-scale data manipulation actions such as loading of inventory data, and network-dependent data exchange actions, such as the Monte Carlo based data analyses should provide proactive, substantive information about the progress and the current status and typically complete within one minute. Large-scale actions should not be required in normal operation of the software too often (more than twice a day on average).

10.2. Help and support systems

The web interfaces should include online context-specific documentation providing the users with instructions on how to perform their tasks in the system. Online help should also be provided in administrative areas of the system.

[22] A human with typical reactions perceives feedback within 200 milliseconds as instantaneous.

10.3. Configuration and Software Management

A configuration management database (CMDB) will be kept to store and version-control software and system parameters according to the ITSM best practices. The configuration management system should include:

- **Configuration auditing**: ensuring completeness of documentation and process integrity for all configuration items;
- **Build management**: management and automation of the software build process, related triggering, pipeline and reporting mechanisms;
- **Process management**: ensuring adherence to the organisation's development process and successful passing of all prescribed quality gates for anything to be considered for promotion into one of the controlled environments (staging or production);
- **Environment management**: Managing the hardware and the software up to the operating system level. This should be included in the managed hosting provider's offering.
- **Defect tracking**: Managing the lifecycle of defects from discovery to evaluation, prioritization, remedy, testing of remedy and the remediating update of the production system.

10.4. Security

The system is expected to be secure and security features should be implemented at the infrastructure level (servers and networks), the data layer (storage), the software layer and the application interfaces. Security-related incidents should be handled in accordance with a security control plan to be developed and trained with responsible staff.

Infrastructure

Server infrastructure should be kept up-to-date with the latest patches and security updates to ensure that the CCMRV system is not vulnerable to known exploits. Assuming that the system is hosted with a managed hosting provider, server and operating system patching should be included in the provider's offer. Should patches require system downtime, patching windows should be agreed between the provider and the system owner in the government, with involvement of other stakeholders as determined by the system owner.

Access to the CCMRV servers should be restricted to specific ports and from specific IP address ranges only. Access to web servers should be allowed from any IP address. All access should be logged in a detailed and auditable way.

Network traffic should be monitored for unusual activity and alerts triggered by any unusual event.

Data

Data should be encrypted at rest. Access to data and any server-to-server transfer should be established over encrypted connections. Data endpoints should be aware of system configuration and reject connections that are not configured for.

Access information

Security access information will be kept in one of the following ways:

- In specifically-designated secure storage devices;
- In protected process memory of processes requiring access to such information;
- On disk, in files requiring elevated privileges for access;
- In offline secure storages (such as recovery security envelopes).

Access information should never be hardcoded or otherwise stored together with code, including in the version control systems.

Application interfaces

All interfaces to the CCMRV system should make use of appropriate access controls and permissions settings. A general principle should be employed that users have the minimum set of permissions required in order to carry out their authorised tasks. Furthermore, web interfaces and server-side code should be configured to be resilient to common attack vectors such as SQL injections, cross-site scripting (XSS) and cross-site request forgery (CSRF).

Execution level

Application code should not require elevated privileges during normal runtime. It may require additional privileges on start-up in order to read the necessary secrets but it should drop them as soon as the necessary information is read.

System interventions

Manual interventions in the production system should not be allowed. Any required intervention should be evaluated on a QA environment, scripted, and released to the production environment in a controlled fashion.

Interoperability with external systems

All interoperability with external systems should be organised using encrypted channels and, ideally, without the use of shared secrets.

Passwords and other authentication methods

Password policies should be set in accordance with the governmental policies to be defined by MHTI for the systems handling data of similar classification levels. Good policies for secrets include:

- The use of multi-factor authentication;

- Longer passwords without enforcement of passwords that are hard to remember[23];
- Geometric progression of lock-out after unsuccessful login attempts;
- Reporting of repeated unsuccessful login attempts to the administrators;
- Logging of all successful and unsuccessful login attempts;
- Passwords to be stored using a hash function;
- Never send passwords by email;
- Session cookies should be cryptographically secure and not easy to manipulate, derive or guess;
- Cookies should not contain secrets.

Furthermore, web interfaces will implement the following policies:

- Users should be automatically logged out after a period of inactivity;
- The web interfaces should never display secrets.

10.5. Backup & Recovery

Data should be stored and retained according to the governmental policies for the retention of information of its level of classification. The following backup schedule is recommended:

Table 23 Backup and recovery features

Periodicity	Type	Retention
Nightly	incremental	1 month
Weekly	incremental	1 year
Monthly	full	1 year
Quarterly	full	2 years
Annual	full	In accordance with the policy for retention of information of this level of classification

All backups should eventually become offline and off-site.

[23] Simple reasoning confirms that passwords that are longer and easy to remember are harder to guess or brute force.

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