Monitoring, reporting and verification of greenhouse gas emissions: current overview

INSTITUTIONS, DATA FLOW AND SCHEMES

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Monitoring, reporting and verification of greenhouse gas emissions

Establishing a sustainable system for collecting the necessary data for greenhouse gas emissions is particularly important and represents the basis of all climate policies in the country. Monitoring, reporting and verification systems are important for strengthening transparency and meeting country's national and international obligations.

MRV systems can be grouped as follows:

1. MRV of greenhouse gas emissions at national levels: MRV of historical emissions and removals of greenhouse gas emissions, in order to understand the national emissions profile and to report on them in the form of an emissions inventory
2. MRV on mitigation actions: MRV of mitigation policies and measures, as well as the projections of anthropogenic greenhouse gas emissions by sources and removals by sinks, to monitor their implementation
3. MRV of support: financing climate change mitigation and adaptation, technology transfer and capacity building, to identify the provision and receipt of appropriate support, to monitor the results achieved and to assess/evaluate their effect

Identifying institutions, data flow and preparing schemes for each sector individually (energy, industrial processes, transport, waste, agriculture, forestry and other land use) is part of the CBIT project and data transparency for climate change actions in the country.

The main objective of this document is to provide an overview of the current situation of the national MRV system of greenhouse gas emissions by sector and the following approach has been used:

- Desk research on existing publications regarding MRV systems (First Biennial Report on Climate Change, Second Biennial Report on Climate Change and other documents) and relevant national legislation
- Informal consultations and webinars with responsible stakeholders in institutions and organizations involved in the process of inventory preparation

Based on the analysis, the shortcomings and obstacles of the inventory process preparation are pointed out and recommendations are given accordingly.

Legal basis for monitoring, reporting and verification

Under the UN Framework Convention on Climate Change, North Macedonia has an obligation to report to the Conference of the Parties as a control mechanism for the implementation of the state's obligations. Reporting to UNFCCC is done through national plans, biennial update reports and national greenhouse gas inventories with a predefined content. The preparation of the national inventory of greenhouse gas emissions together with the report are carried out in accordance with the IPCC framework guidelines for standardized form of reports, containing detailed information on national inventories, including measuring system, data collection system, assessment methodology, reporting and data system management.

Although the Republic of North Macedonia is a Non-Annex I country of the UNFCCC, as a country that began EU accession talks it must adhere to EU Climate Policy (Chapter 27) and Energy (Chapter 15) which in fact assumes the reporting obligations of countries that are part of Annex I. The country is also a signatory of the Energy Community Treaty (EnC).

According to the **Law on Environment**, the **Ministry of Environment and Physical Planning** is obligated to collect data and to cooperate with several bodies of the state administration: **State Statistical Office, Ministry of Economy, Ministry of Agriculture, Forestry and Water Economy, Ministry of Interior** etc. Strengthening the institutional cooperation for data exchange relevant for the preparation of the inventory is considered a key issue that would enable easy and successful preparation of the national reports.

According to the **Law on Environment**, the **Ministry of Environment and Physical Planning (MOEPP)** should establish, develop, manage and coordinate a national system for inventory of greenhouse gas emissions. This system will provide the necessary data for the preparation of the **Greenhouse Gas Inventory**, as well as for the monitoring of the implementation of the **National Climate Change Plan**. However, the Law does not regulate in detail the issue of monitoring, reporting and verification of policies and measures.

As part of the United Nations Framework Convention on Climate Change and the Kyoto Protocol, the European Union and its member states are obligated to report annually on their greenhouse gas emissions. They should also regularly report on their policies and measures for climate change through National Plans.

Regulation 525/2013 of the European Parliament and of the Council defines the establishment of accurate monitoring, reporting and regular evaluation of greenhouse gas emissions.

Two more regulations are related to the above mentioned. The first one is the **Regulation 666/2014** which establishes the key requirements for the Union's inventory system, considering changes in global warming potential and internationally agreed inventory guidelines. The second, **Regulation 749/2014**, defines the structure, format, processes of delivery and review of information reported by Member States. In terms of policies and measures, **Regulation 749/2014** distinguishes between reporting on national policy and measures systems and projections of anthropogenic GHG emissions by sources and removals by sinks, as well as on reporting of national policies and measures.

The transposition of the **Regulations 552/2013, 749/2014** and **666/2014** are the main objectives of the project **Preparation of a long-term strategy and Law for Climate Action** funded by the EU within the IPA 2014-2020.

Energy

Legal basis for monitoring, reporting and verification for the energy sector

Regarding the emissions from the energy sector, several institutions and energy entities collect information and/or prepare reporting towards various entities, in accordance with several laws and bylaws. Apart from the **Energy Law (2018)**, as the core law from which the regulation of the sub-sectors in the energy sector originates, for the purposes of the inspection of the current situation as well as the relevant institutions and entities for preparation of the greenhouse gas inventory in this sector, the following laws and bylaws were examined:

Table 1. Legal framework - energy sector

Sub sector	Law / Bylaw	Entity
	Energy Law (2018)	Ministry of Economy State Statistical Office Energy Agency Energy and Water Services Regulatory Commission Energy entities
Energy efficiency	Law on Energy Efficiency (2020) Rulebook on Marking Energy Consumption and Other Resources for Energy Products (2016) Rulebook on amending the Rulebook on energy performance of buildings (2015) Rulebook on the maximum amount of the fee for issuing a certificate confirming that the minimum requirements for energy efficiency contained in the core design are in accordance with the minimum requirements for energy efficiency set out in the Rulebook on energy performance of buildings and the maximum amount of compensation for issuance of a certificate for the energy characteristics of a building (2015) Rulebook on Energy Control (2013) Decree on eco product design (2011)	Ministry of economy
Renewable energy	Rulebook on Renewable Energy Sources (2019) Decree on the measures for support of the electricity generation from renewable energy sources (2019) Decision on the total installed capacity of the preferential producers of electricity (2019) Decision on the national mandatory goals for the share of energy generated from renewable sources in the gross final energy consumption and for the share of energy generated from renewable sources in the final energy consumption in transport (2019)	Ministry of economy Energy Agency
Energy balances	Rulebook on energy balances and energy statistics Statistical research program for the period of 2018-2022	Ministry of economy State Statistical Office
Energy markets	Rulebook on the manner and procedure for monitoring the functioning of energy markets	Energy and Water Services Regulatory Commission Operators of transmission and distribution systems related to the functioning of energy markets Other holders of licenses to perform energy activities

Although there is a legal basis for regulating energy efficiency and renewable energy sub-sectors, as well as energy markets and energy balance preparation, it was found that the exchange of some data between institutions and entities is not regulated in any law or rulebook; instead, it takes place on the basis of a long-standing mutual cooperation between institutions or memoranda of cooperation.

Preparation of greenhouse gas inventory from the energy sector

This is especially the case with sub-sectors relevant to preparing the energy sector inventory; energy data for the preparation of the inventory are mostly based on the data collected by the State Statistical Office and the Ministry of Economy of the Republic of North Macedonia for the preparation of the Energy Balance of the Republic of North Macedonia in accordance with the provisions of the Energy Law.

The type of data, the manner of their delivery, storage and analysis specifically in relation to the energy sector for greenhouse gas inventory are expected to be regulated by the Law on Climate Action which is under development and is expected to be completed in 2020.

Thus, the table in **Annex I** contains the data, the unit of measure and the entities in charge of their submission by subsectors from the energy sector. The basis for this is taken from **the Draft Report on preparation of legal provisions for greenhouse gas inventory**[1] and has been updated during the process of preparation of the **Law on Climate Action**, and for the purposes of this research is specifically taken from the draft **Decree on National Inventory System**.

Current situation: identification of institutions, data flow and preparation of a scheme for the energy sector

** The graphical content of the MRV scheme for this sector can be found in Annex IV: MRV scheme for energy sector*

The institutions that emerged as relevant during the examination of the legal basis regarding the process of collecting energy data are the Ministry of Economy, the State Statistical Office, the Energy Agency, The Energy and Water Services Regulatory Commission, the operators of the transmission and distribution systems related to the functioning of the energy markets, other holders of licenses for performing energy activities and other energy entities.

Regarding the process of preparing the greenhouse gas inventory from the energy sector, in addition to the energy data from the Ministry of Economy, the State Statistical Office and the Energy Agency, data from the Ministry of Interior are also taken (regarding the energy data from the transport sector - described in the next chapter) and from Macedonian navigation (M-NAV) (in terms of energy data from domestic aviation).

The **Annex IV** scheme (MRV scheme for the energy sector) presents the current situation regarding the flow of energy data from the relevant entities. The process itself is explained in the next section of this chapter.

[1] Draft report: Preparation of legal provisions for greenhouse gas inventory, Dr. Biljana Puleska, 2012

Legal framework and manner of collecting relevant data on energy balances

As we have mentioned, certain data collected in the process of preparing the greenhouse gas inventory from this sector to some extent overlaps with the data collected for the preparation of energy balances and/or reports prepared by the Ministry of Economy, State Statistical Office and the Energy Agency. Although some of the required data overlap, there is a difference in the analysis of it, as well as in the presentation of the final results of the analysis. The difference is that the energy balances calculate the total amount of greenhouse gas emissions, while for the needs of the inventory the data is analysed according to the sub-sectors listed in **Annex I**.

To understand the flow of energy data relevant to the inventory, below is a review of the collection of energy data relevant to the energy balances and reports by the Ministry of Economy, the State Statistical Office, the Energy Agency, and other relevant entities. The explanations below are visualized in the MRV scheme for the energy sector (**Annex IV**, MRV scheme for the energy sector) and refer to the manner the relevant entities collect data, which entities they collect the data from and which entities do they share the data with. The directions of the energy data flow are represented by the arrows on the diagram in Annex VI.

1. Ministry of economy

In order to collect the data for preparation of the greenhouse gas inventory from the energy sector that the team for preparation of the inventory partially receives from the Ministry of Economy (hereinafter: the Ministry), it is necessary to have a review of the data flow collected by the Ministry for the energy balance.

The Ministry of Economy prepares an energy balance in accordance with the Rulebook on Energy Balances and Energy Statistics (hereinafter: the Rulebook) published in the Official Gazette of the Republic of Macedonia No. 140/2015, and defined by Article 13, paragraph (4) of the Energy Law ("Official Gazette of the Republic of Macedonia" No. 96/18). Although according to the information gathered by conversation with relevant stakeholders in the sector, the above-mentioned rulebook will be subject to amendments based on the Energy Law of 2018, for now the rulebook on energy balances and energy statistics from 2015 is still the most relevant in terms of energy balance preparation. This rulebook defines the content, the manner and the deadline for submitting the data required for the preparation of the energy balance by the Ministry, as well as the methodology according to which it is prepared.

The flow of data between the ministry and entities on the left side of the MRV scheme (**Annex IV**, MRV scheme for the energy sector) marks the process of data collection by the Ministry of Economy. It is explained below:

- The Ministry of Economy prepares a letter and sends a request for submission of data for the preparation of the energy balance no later than September 15 to all energy entities that need to submit relevant data in accordance with Article 4 paragraph (5) of the Rulebook.
- These requests are sent through the archives of the energy entities (on the left side of the MRV scheme) and include the forms from Annex 2 of the Rulebook. They are sent with a request for submission of data from the forms no later than October 15, again through the archive, but also in electronic form to the Ministry of Economy in accordance with Article 4 paragraph (6) of the Rulebook.
- Although the electronic form is emphasized to be in excel, it happens that some of the energy entities send the answered questionnaires in .pdf or .jpg format to the ministry, which makes it difficult to analyze this data.
- The entities to which these letters are sent with a request for reporting this data to the Ministry are (left side of the MRV energy scheme): Ministry of Agriculture, Forestry and Water Economy,

Ministry of Environment and Physical Planning, Customs Administration, Commodity Agency reserves, operators of energy systems, energy suppliers, wholesalers of energy, energy producers and energy consumers. They report according to the table in **Annex II** (Article 4, paragraph (5) of the Rulebook on Energy Balances and Energy Statistics).
● Based on the submitted data referred to in paragraph (2) and (4) of Article 4 of the Rulebook, the Ministry prepares the energy balance.
● Regulated by the latest amendments to the Energy Law, the Ministry uses data from the State Statistical Office (presented with the arrow from the State Statistical Office to the Ministry of economy) to prepare its energy balance for the entire previous year and for eight months from the current year, while for the last four months of the current year and the whole next year they collect data from the holders of licenses for performing energy activity, from energy consumers and from some state institutions in accordance with Article 4 paragraph (2) and paragraph (3) of the rulebook.
● Three persons from the energy department of the Ministry of economy are responsible for the implementation of the process for preparation of the energy balance, which includes preparation and sending of letters, collection and processing of data and putting the data in the form required for the energy balance (Dedinec, 2016).[2]

Monitoring the realization of the energy balance
The monitoring of the realization of the energy balance is also regulated according to the **Rulebook on energy balances and energy statistics** (Article 5 of the Rulebook). For this purpose, the entities from **Annex II** (Article 4, paragraph (5) of the Rulebook) submit to the Ministry data on the realization of the energy balance for the last quarter of the previous year according to the forms from Annex 2 of the Rulebook, no later than January 31 of the following year. Also, the entities, no later than 20 days after the expiration of the half-year period, I.e. the month, submit to the Ministry data for realization of the energy balance of the forms from Annex 2 of the Rulebook. The data from paragraph 2 of Article 5 of the Rulebook is to be submitted by the operators of the energy systems on a monthly basis, while the other entities are to submit them on a quarterly basis.

The data from the Ministry of Economy, which are needed for the process of preparation of the greenhouse gas inventory, is taken on the basis of a long-term cooperation between the experts preparing the database, as well as between the institutions (Ministry of Economy and Ministry of Environment and Physical Planning). This data flow is also expected to be regulated by the Law on Climate Action.

2. State Statistical Office

The State Statistical Office publishes two types of energy balances: monthly and annual. The **monthly energy balance** do not include all energy sources but only electricity, natural gas, coal and oil and oil products; while the **annual energy balance**, which is published in October, covers all fuels used during the previous year. This energy balance is also called the **balance of realization** and is made in accordance with the EUROSTAT methodology. Questionnaires that are filled out by the energy entities as well as by the Customs Administration are used for the preparation of this energy balance, and research conducted by the employees of the State Statistical Office is used to control the accuracy of the submitted data (Dedinec, 2016).[3]

The data flow between the State Statistical Office (SSO) and the entities on the right side of the MRV scheme indicates the data collection process by the SSO. The SSO collects data from: the Customs Administration, power system operators, energy suppliers, wholesalers of energy, energy producers

[2] Feasibility study for establishing an electronic system for collection and exchange of energy balance data, Dr. Aleksandar Dedinec, 2016 (p.11)
[3] Feasibility study for establishing an electronic system for collection and exchange of energy balance data, Dr. Aleksandar Dedinec, 2016 (p.7)

and energy consumers. Data collection by the SSO is in line with the Statistical Research Program for the period 2018-2022 (pp. 220-).

Some of this data is key in the inventory development process, and it is collected for the purpose of preparation of the inventory on the basis of long-term cooperation between inventory developers, the Ministry of Environment and Physical Planning and the relevant departments of the State Statistical Office. This data flow is also expected to be regulated by the **Law on Climate Action** which is being prepared, i.e. in accordance with the relevant bylaws.

3. Energy Agency

The data required in the field of renewable energy sources and energy efficiency relevant to the preparation of the inventory is collected by the Energy Agency.
The Agency prepares different types of reports depending on the needs in the field of renewable energy sources and reports for implementation of energy efficiency measures. Pursuant to Article 184 paragraph (2) of the Energy Law, the Agency conducts:
1) register of power plants that produce electricity from renewable energy sources;
2) records of issued approvals for measuring the wind potential for electricity production; and
3) register of guarantees of origin.
The data on the reports collected by the Agency are obtained either from state institutions or from energy entities in accordance with the Law on Energy Efficiency (February 5, 2020), the bylaws in the field of RES and the Rulebook on RES.

Article 11 of the Law on Energy Efficiency regulates the Information System for monitoring and managing energy consumption. In accordance with Article 6 of the Law on Energy Efficiency, at the proposal of the Ministry of Economy, the Government adopts the National Action Plan for Energy Efficiency (NAPEE). Regarding the monitoring of the implementation of NAPEE, according to paragraph (5) of Article 6, no later than May 31 of each year, the Agency submits to the Ministry an annual report on the implementation of NAPEE. The Ministry of Economy then submits the annual report to the Government and the Secretariat of the Energy Community.
Pursuant to paragraph (6) of the same Article, at the request of the Agency, the public sector persons are obliged to submit data on the implementation of the measures and activities provided in NAPEE for the previous year, no later than March 31 of the current year. The agency submits the request for data collection by January 31 of the current year at the latest.[4]

The manner of submitting relevant data to the Agency by the preferential producers is regulated by Article 21 of the Decree on Measures to Support the Production of Electricity from RES adopted on the basis of Article 187 paragraph (3) of the Energy Law.

In addition to the data elaborated above, there is also data that is collected from the Ministry of Interior (the process of which is explained in the Transport sector section of this report), and from the Macedonian Navigation (M-NAV). This data is used for the process of preparation of the inventory, in accordance with a Decree that is under preparation during the process of preparation of the Law on Climate Action and the relevant bylaws. The data flow from these entities is shown by the arrows that lead from them to the Developer of the inventory of the MRV energy scheme in Annex VI.

Energy balances of various types are prepared by other institutions as well:

- Energy and Water Services Regulatory Commission (ERC) prepares an annual report showing energy balances for electricity, natural gas, heat and oil derivatives;
- MEPSO, as a transmission system operator, prepares an energy balance for electricity;

[4] Law on Energy Efficiency (p. 7-8)

- ELEM is preparing an energy balance for the consumption of coal and fuel oil as well as for the production of electricity.

The annual report prepared by the Energy Regulatory Commission (hereinafter: The Commission) for its work in the previous year is in accordance with Article 36 of the Energy Law. The Commission submits it to the Ministry of Economy (presented with the top arrow of the MRV energy scheme in Annex IV), the Government of the Republic of North Macedonia, the Assembly of the Republic of North Macedonia and the Energy Community, by April 30 at the latest. This data flow is visualized in the upper right corner of the MRV energy scheme in Annex IV.

According to Article 5 of the Rulebook on the manner and procedure for monitoring the functioning of the energy markets (hereinafter: The Rulebook), the Commission prepares reports on monitoring the functioning of the energy markets. According to paragraph (1) of this Article, and based on the data and information collected and analyzed in accordance with the Rules of Procedure, and in accordance with the Law on Energy, the Commission prepares and publishes reports on monitoring the functioning of energy markets at least once a year. In accordance with paragraph (2), in the reports referred to in paragraph (1), the Commission is to publish only aggregate data according to certain indicators. If for a certain indicator the aggregate information is obtained from less than three license holders for performing unregulated energy activities, that aggregate information will not be published in the reports.
The data for these reports is collected by the energy entities, while the manner in which it is currently done is through using questionnaires made in excel (Dedinec, 2016).[5]

In order to complete the questionnaire with which it reports to the Ministry of Economy and to plan the needs for import and export of electricity in the next year, MEPSO collects data from several entities such as ELEM, TETO, EVN, etc. (Dedinec, 2016).[6]

Existing platforms for monitoring and verification of energy data

To facilitate the collection process, as well as the process of energy data analysis there are several software tools and digital platforms for some of the relevant institutions mentioned in the above sections of this chapter. Details about the MVP software (Ministry of Economy, Energy Agency), the ExCITE software (Ministry of Economy, Community of Local Self-Government Units (ZELS), Energy Agency), and the web platform for monitoring the functioning of the Energy Market Regulatory Commission (ERC) are explained in the Report on the Mapping Results of Existing Relevant MRV Systems (hereinafter: the Report) which was prepared under the Second Biennial Climate Change Report, and they are briefly explained below.

MVP software
The MVP software is a tool developed in 2016 to enable the Ministry of Economy and the Energy Agency to effectively monitor the implementation of measures and activities of the National Action Plan for Energy Efficiency (NAPEE). This web monitoring and verification platform (MVP) was specially designed to monitor the implementation of NAPEE, to facilitate reporting to national and international institutions and organizations.
This platform enables monitoring of energy efficiency and plans to reduce CO2 emissions at different policy levels; both national and municipal plans. It is intended to serve as a registry for the

[5] Feasibility study for establishing an electronic system for collection and exchange of energy balance data, Dr. Aleksandar Dedinec, 2016 (p.16)
[6] Feasibility study for establishing an electronic system for collection and exchange of energy balance data, Dr. Aleksandar Dedinec, 2016 (p.18)

implemented projects and to contain the following data: general data, energy savings [KWh] and CO2 [t], as well as costs and data from calculations.

Regarding the monitoring of greenhouse gas emissions originating from the measures not provided for in the specific NAPEE, the Report proposes that their entry into the MVP system be done after prior harmonization between the relevant institutions, namely between the Ministry of Economy as MVP System user and MoEPP as a managing entity of the future system for monitoring, reporting and verification (MRV).[7]

The Energy Agency is the administrator of this MVP tool, but as a user of it, the Ministry of Economy has installed it on its existing servers. This software has not yet been put into use, but the legal basis for its use and maintenance is expected to be introduced in the bylaws of the Law on Energy Efficiency that are being prepared.

ExCITE software
The ExCITE software was installed on the Information Platform of the Association of Local Self-Government Units (ZELS), and trainings for its usage were conducted for employees in the municipalities and institutions of the central government.
This tool enables the collection of data on the physical characteristics of public buildings such as: doors, windows, wall structure, total heating area, lighting, etc., i.e. continuous monitoring of energy consumption, which would facilitate the process of planning and implementation of energy efficient measures as well as verification of the ones already implemented, as well as to access to aggregated data, and the calculation of greenhouse gas emissions.

Although the ExCITE software opens the possibility to generate various reports, including: indicators for specific CO2 emissions (kgSO2 / m2), general and individual report for greenhouse gas emissions from a building or construction unit, public lighting, etc., however, this software is not functional at the moment.

Web platform for monitoring the functioning of energy markets
The Energy Regulatory Commission in 2016 developed a special tool for monitoring the energy market in the country. The tool is based on a Microsoft® Excel spreadsheet program, and its use is supported by a web platform interface. The method of using the tool for collecting and processing relevant data is in accordance with the Rulebook on the manner and procedure for monitoring the functioning of energy markets (2019).

Methodology of preparation of the greenhouse gas inventory from the energy sector

The greenhouse gas inventory of the Republic of North Macedonia is being prepared according to the Guidelines for preparation of National Greenhouse Gas Inventories from 2006 by the Intergovernmental Panel on Climate Change (IPCC), using the latest version of IPCC Inventory (2.54 Software from July 6, 2017).[8]

In the 2006 guidelines, the preparation methodology is divided into three levels, the first two of which are: Level 1 (Tier 1) is the "standard method" that is the simplest and is usually applied when there are no specific emission factors available for each country; and Level 2 (Tier 2) which uses the same procedure as the Level 1 methodology, but also includes emission factors and/or parametric activity data specific to the country or at least one of its regions.

[7] Report on the Mapping Results of Existing Relevant MRV Systems (page 12)

[8] National Inventory Report (2019)

The emissions in the energy sector in the country are reported according to Tier 2 methodology for the activities in which fuel is burned; namely, for CO2 emissions in the combustion of lignite, fuel oil and natural gas, while for the remaining sub-sectors the standard method, Tier 1, is used.

EUROSTAT and IEA are the most commonly used methodologies for generating energy balances. EU countries apply the EUROSTAT methodology, while the IEA is used globally. The energy balances prepared by the Ministry of Economy and the State Statistical Office are prepared according to Tier 1 EUROSTAT methodology, but the energy balance of the Ministry of Economy also shows summary tables according to the IEA methodology (Dedinec, 2016).[9]

Recommendations and suggestions

This snapshot of the current state of the process for collecting data for the preparation of the greenhouse gas inventory from the energy sector indicates the need for a legal basis for regulating and systematizing this process. The numerous laws and bylaws governing the collection of some of the data needed to prepare the inventory come as no surprise given the breadth of the sector. However, an aligned and digital collection by all relevant institutions is of great importance.

The harmonized digital collection of the necessary energy data explained in this chapter would facilitate the work of all stakeholders involved in the process and would provide improved and more accurate data. Recommendations for improving this process consist of:

- Establishment of a legal basis for the process of preparation of the inventory by the energy sector (it is expected to be regulated by the Law and the bylaws for climate action that are in preparation);
- Creation of a functional web platform that can be used by all relevant institutions and stakeholders who prepare and collect energy data for the needs of the preparation of the above-mentioned reports, energy balance and the greenhouse gas inventory. It would allow:
    - Facilitated data collection;
    - Double reporting by some energy entities would be avoided;
    - Provide accurate, timely and consistent data in the relevant units of measures needed to prepare the various reports, energy balances and the inventory;
    - Increased, strengthened and joined capacities for data verification by several institutions and stakeholders; and
    - Facilitated storage, and further analysis, processing and reporting of data for the appropriate national and international needs (and reporting) of the country.

[9] Feasibility study for establishing an electronic system for collection and exchange of energy balance data, Dr. Aleksandar Dedinec, 2016 (p.4-5)

Road Transport

Legal basis for monitoring, reporting and verification for the road transport sector

**The graphical content of the MRV scheme for this sector can be found in "Annex IV"*

The Law on Vehicles regulates the issues related to the commissioning and start of use of vehicles, their registration and suitability for use, as well as the data required for the vehicle register kept by the Ministry of Interior. Unfortunately, the bylaw to prescribe the form, content, and manner of the register, as well as how to enter and publish data, has not been enacted yet.

Directive 2009/30 / EC of the European Parliament and the Council of 23 April 2009 concerning the specification of gasoline, diesel and gas, and the introduction of a mechanism for monitoring and reducing greenhouse gas emissions, as well as Commission Directive 1999/32 / EC since 26 April 1999 regarding the reduction of sulfur content in certain liquid fuels have been transposed into national legislation through the Rulebook on Liquid Fuel Quality.

The new **Energy Law** ("Official Gazette of the Republic of Macedonia", No. 96 of 28.5.2018) complements the requirements for national standards for fuel quality in Article 150. This Article obliges the Government, upon the proposal of the Ministry of Environment, to adopt a Regulation on the quality of liquid fuels. The decree was passed to a public hearing but has not been adopted yet.

In the context of light vehicle emissions, it is important to mention the Regulation 443/2009 / EC. The transposition of Regulation 443/2009 / EC on the reduction of CO2 emissions for light vehicles in the national legislation is not a high priority because no vehicles are manufactured in the country. However, given the fact that the country will have to report to the EU on the structure of imported (new) vehicles, the establishment of a database of the vehicle fleet and its fuel economy will be a good basis for this reporting to the EU in the future.

Shortcomings and recommendations from the inventory of greenhouse gases from road traffic

The greenhouse gas inventory for the transport sector was prepared for the period 1990-2018 according to TIER 2 methodology, while the greenhouse gas inventory from the road traffic was prepared for the period 2014-2018 according to TIER 3 methodology with the use of the software tool COPERT. The results obtained from the analysis with COPERT can also be used for the preparation of air quality inventories that the Ministry of Environment and Physical Planning submits to the European Environment Agency.

The most important institutions involved in the inventory preparation process are the State Statistical Office and the Ministry of Interior. Shortcomings arising from the inventory preparation process generally refer to data quality and availability.

Identification of institutions, data flow and preparation of a road traffic scheme

**The graphical content of the MRV scheme for this sector can be found in "Annex IV"*

Several institutions that provide data have been identified within this report.

The State Statistical Office provides data on fuel use (tons / year) by type of fuel (diesel, liquefied natural gas, compressed natural gas, biodiesel, bioethanol, etc.).
The Ministry of Interior keeps a register of vehicles. The vehicles database contains data on vehicle type, vehicle brand, manufacturing year, fuel type, but also data on engine power, volume, vehicle weight, vehicle payload, etc. The Ministry of Environment and Physical Planning in accordance with a signed memorandum provides the necessary data from the database, which as such, obtained from the Ministry of Interior, is unsorted and contains errors that are later revised manually.

According to the new **Law on Vehicles** (Official Gazette of the RM no. 140/08, 53/11, 123/12, 70/13, 164/13, 138/14, 154/15, 192/15, 39/16), the Ministry of Interior has a legal obligation to collect data on average annual kilometers per vehicle provided by the stations for technical inspection when registering the vehicle and the Ministry of Environment can access this data. However, the vehicle's mileage data is not available yet in the database. For the purpose of preparation of the GHG inventory for the road traffic (COPERT software tool), the mileage data is provided by a consulting company EMISIA.
Meteorological data (ambient data and humidity) are also required as inputs in COPERT. According to the **Law on Hydrometeorological Matters**, the Office for hydrometeorological affairs manages the data of the hydrometeorological system in the country. The hydrometeorological database is not publicly available, but the National Hydrometeorological Service provides the data to the Ministry of Environment.

Within this report, the institutions are grouped into two categories: **first category** and **second category**.

Technical inspection stations and the Ministry of Interior as the main stakeholders responsible for the vehicle database, together with the State Statistical Office which provides data on fuel consumption, are grouped as first category institutions **(Annex IV: Transport MRV scheme)**
Customs Administration and the Bureau of Meteorology are important in the process of importing vehicles and their first registration. The data is then submitted to the Ministry of Interior and entered in the vehicle register. However, when making a historical database of vehicles until 1990 or having a better insight into the import of vehicles, the dataflow from these institutions should be considered in the future, which are currently grouped as second category institutions.
The National Hydrometeorological Service provides data on the ambient temperature and humidity, which although necessary for TIER 3 methodology, within this analysis is classified as second category stakeholder.

Recommendations and suggestions

One of the main obstacles for providing the necessary data is the old register of vehicles. Even though a legal basis exists, there is no technical possibility to provide accurate and timely data to all stakeholders. The need for a new register of vehicles as the only long-term solution has been highlighted in many studies and reports. In that context, the proposals in this report aim to improve the quality of data only after being submitted to the Ministry of Environment (the way of processing

and sorting the data from the database). It is important to keep in mind that these suggestions offer a short-term solution.

Proposal No. 1: Automatic data processing and sorting
The process of preparation, cleaning and sorting the annual data obtained from the database of the Ministry of Interior is time-consuming. The proposal suggests automatic processing and sorting, which would achieve a categorization of 90% of the vehicles and would significantly reduce the time required to obtain the final table. This program script would allow for a short period of time to clear and sort the data for the following years, but also for the previous years (2008-2014).

Proposal No.2: Improving the interface application of the Ministry of Interior for entering and accessing the data from the database of the register of vehicles
A web application has been developed in the Ministry of Interior, which is used as an interface application for entering and accessing data from the database. The proposal consists in improving the interface application itself to avoid manual entry of incorrect entries (example: wrong year, wrong categorization).

Proposal No. 3: Adding a new category - average annual kilometers per vehicle, and specifying three subcategories - CNG, electric and hybrid vehicles in the vehicle type category
Although it is possible to record data of hybrid/electric vehicles, as well as those that use compressed natural gas (CNG) or liquefied petroleum gas (LPG) as fuel, they are not always accurately recorded in the vehicle register. There is no special categorization and the term "mixture" is used or the change is not made by the technical persons. It is necessary to prepare a manual for technical persons as an integral part of the interface application, in order to avoid errors such as: a hybrid vehicle registered as a vehicle that uses gasoline as fuel, a vehicle converted into liquid or compressed gas registered according to factory specifications, etc.

According to the Law on Amendments to the **Law on Vehicles** (Official Gazette of the RM no. 140/08, 53/11, 123/12, 70/13, 164/13, 138/14, 154/15, 192/15, 39/16), the data on kilometers traveled by the vehicle is entered by the technical service when registering the vehicle. By adding an additional column to the vehicle register, it will be recorded and can be submitted to the MOEPP. From a technical point of view, adding an additional column or additional type is not a complex task.

Waste

Introduction to Monitoring, Reporting and Verification on Waste Sector

**The graphical content of the MRV scheme for this sector can be found in "Annex IV"*

The categories reported under the waste sector are Solid Waste Disposal, Biological Treatment of Solid Waste, Incineration and Open Burning of Waste and Waste Water Treatment and Discharge.

The solid waste generated in Macedonia is mostly disposed of in non-compliant landfills. The landfill Drisla, serving the Skopje region, is the only permitted landfill in Macedonia and it is relatively well managed. At the municipal non-compliant landfills, dumpsites or in rural areas, the wastes are simply dumped by the Communal Enterprises with almost none standard landfilling activities, no operational costs, except some overheads and occasional waste consumption costs for the extinguishing of emerging landfill fires. There are around 50 operational municipal non-compliant landfills. Furthermore, there are around 1000 illegal disposal sites which need to be terminated.

The need for improvement of their waste management practices as well as data flow and quality has been recognized in the national, regional and local waste management strategic documents.

Identification of institutions and the data sources in the Waste sector

In accordance with the national legislative, The Ministry of Environment and Physical Planning is the competent authority to collect data from the following:

- Legal and natural persons who collect and transport communal and other non-hazardous waste;
- Legal and natural persons performing the activities of collection, transportation, storage, treatment, processing, disposal and trade (import, export and transit);
- Legal and natural persons who produce waste above a certain threshold (200 kg for hazardous, 150 tonnes for non-hazardous waste) annually should report their respective Municipalities as well as the competent authority for their programme on waste management;
- Mayors of municipalities and the City of Skopje are obliged to provide annual reports on the municipalities' management of non-hazardous waste;
- Legal or natural persons that produce and discharge wastewater.

The Ministry of Environment and Physical Planning releases annual reports on Quality of the Environment which include the amounts of composted waste. The industry product used as input in the category Industrial Wastewater Treatment and Discharge is obtained from the State Statistical Office Yearbook.

On the other hand, the State Statistical Office, through Surveys annually collects data from Communal Enterprises and business companies (local units that in accordance with the National Classification of Activities are registered according to the main activity in the respective sectors and have over 10 employees). The State Statistical Office has issued reports on Municipal Waste for the years 2012, 2013 and 2014. It contains information on quantities on generated, collected and waste disposed of in waste disposal sites.

Table 2. Data sources - waste sector

	Documents	**Data provider**
Municipal Solid Waste	Municipal Waste for 2014, 2015, 2016 Estimation of Population of R. Macedonia GDP at current prices	SSO MAKStat database
Biological Treatment of Solid Waste	Annual Report on Quality of Environment 2015-2016	MOEPP
Incineration and Open Burning of Waste		
Waste incineration	http://www.drisla.mk/page_detail.asp?lID=3&ID=25	Drisla website
Open Burning of Waste	Municipal Waste for 2014, 2015, 201 6	SSO
Wastewater Treatment and Discharge		
Domestic Wastewater Treatment and Discharge	Estimation of Population of R. Macedonia World Population Prospects: The 2017 Revision	MAKStat database United Nations Population Division
Industrial Wastewater Treatment and Discharge	Online database SSO 2007-2016 Statistical review: Industry and Energy 2002-2007 Statistical review: Industry and Energy 1999-2003 The industry in the Republic of Macedonia 1996-2000 The industry in the Republic of Macedonia 1993-1998 The industry in the Republic of Macedonia 1987-1992	SSO

Recommendations and suggestions

Using the momentum that the new **Draft Law on Waste Management** is being compiled, there are few amendment proposals and recommendations for the law and subsequent Rulebooks, which in more detail you can find on Annex V.

Digitalization of data

Proposals related to digitalization mainly focus on improving the accessibility of data, by adding an electronic (digital) format in the process of collecting data (all the relevant forms, records on waste management). The proposal for amendment involves both the **Law on Waste Management** as well as the **Rulebook on the format and the content of the records for waste management, format and**

the content of the forms for identification and transportation of waste and the format and the content of the forms for annual reports on waste treatment.

The digitalization is of great importance when collecting and analyzing data on hazardous and non - hazardous waste because it facilitates and speeds up the process of keeping accurate and up-to-date records. In this way, the delivery of data by data the holders (mayor, landfill operator and natural and legal persons who have the obligation to submit data) will be facilitated. On the other hand, the submitted data will be available in a useful form, ready for use and analysis by the competent authority.

The method of preparation and submission of annual data on waste management involves the use of an Internet based solution.

With this proposed solution contained in the proposed amendments, it will be possible to:

- encourage the facilitation of data delivery by data holders,
- easy and fast processing,
- reducing the time for processing and preparation of consolidated reports,
- quick and easy access to consolidated reports,
- fast and simple distribution of consolidated reports,
- avoiding errors in the preparation of consolidated reports.

The following steps need to be taken in order to implement the proposed changes:

- Preparation of an internet-based solution for reporting,
- Preparation of instructions / assistance for electronic notification,
- Informing the data holders about the possibility of electronic reporting.

Additional requirements on **The form for submitting data for monitoring the discharged wastewater**

The reporting and the monitoring of the discharged wastewaters is regulated with the **Law on waters** and **the Rulebook on the discharged wastewater**. However, the current form of reporting from the work of the wastewater treatment plants does not involve the second key data for wastewater treatment plants, which is the created sludge.

Considering that there is no national or other system-based solution for treatment of sludge from wastewater treatment plants, it is very important to have accurate data on it. This will enable and assist in the management of this type of waste, both locally, regionally and nationally, and will also help to report on other grounds where sludge contributes (ex. Emissions on air, etc.).

Since not all treatment plants can have a functional possibility for the treatment of the created sludge, it is necessary for the reporting to be on two grounds:

- Amount of created raw sludge from wastewater treatment (t / god) and
- Amount of sludge after its treatment (t / god).

Additional data requirements on the State Statistical Office (SSO) Annual Report on Communal Waste

Access to household waste collection services is the most important monitoring indicator for monitoring the situation with waste management in a municipality. In conditions when there are no precise data on the quantities of the collected waste, this data gives the closest data on these quantities.

Therefore, additional requirements are recommended in **Table 1: Collected municipal waste according to the place of occurrence in the municipalities**, such as:

- Number of households that have access to a waste collection service.
- Amount of municipal waste collected for disposal resulting from households, specifying the number of households;
- Amount of municipal waste collected for disposal resulting from the private sector, in mass (tons).

Additional requirements are recommended to be added **in Table 4: Waste disposal: Active landfills**, such as:

- Records of fires occurred on the surface of the landfill;
- The specification of the area covered by the fire in m2.

There are currently no accurate or approximate records of fire-related waste disposal (non-standard landfills), neither locally nor nationally. There is no practice for keeping records of fires, given that Communal enterprises are not registered as formal operators of landfills, so they have no formal obligation to do so. This results in a lack of this type of data, which is of great importance while planning. This data will significantly contribute to the management of landfills, the management of their future closure, as well as the management of emissions from waste disposal (non-standard landfills). Given that there is no precise way to obtain data on the affected areas from the fires, it is expected that Communal enterprises will make their best assessment of the fire and the area affected.

Industry and Industrial processes

**The graphical content of the MRV scheme for this sector can be found in "Annex IV"*

The industrial installations are obliged to report for their operation on various grounds, including reports of the environmental impact they create during their operation, to the Ministry of Environment and Physical Planning (MOEPP), the State Statistical Office (SSO), and the Local Self - government (LS).

According to the **Law on the Environment**[10], the industrial plants/installations may operate with previously obtained environmental permits. It states that A-integrated environmental permit is issued by the body of the state administration responsible for environmental affairs or B-integrated environmental permit issued by the municipality or the city of Skopje or the body of the state administration responsible for the affairs in the field of environment when it comes to installation located in a protected area, which is regulated by Article (123) of the same law.

The permits also define the obligations of the installations themselves, which include reporting on the environmental impact they create during their operation. An additional obligation to report on ambient air emissions from stationary sources, the manner of delivery time according to the installation capacity, is defined by a Rulebook that also defines the content and manner of keeping the log of ambient air emissions. This Rulebook was adopted on the basis of Article 45 paragraph (4) of the **Law on Ambient Air Quality** ("Official Gazette of the Republic of Macedonia" No. 67/04, 92/07, 35/20 and 47/11), published in the Official Gazette of RM no. 79 of 13.06.2011. According to the obligations stated in the integrated environmental permits, the installations with A-integrated environmental permit are obliged to submit reports to the MoEPP, while the installations with B-integrated environmental permit, report to the LS Unit. For the total data collection, the Law on Environment also defines that: The body of the state administration responsible for environmental affairs is obliged to keep and maintain a Register of A-integrated environmental permits[11] and the Mayor of The City of Skopje is obliged to keep a municipal register of B-integrated environmental permits[12] for its area, as well as to submit a copy to the body of the state administration responsible for the affairs of the environment.

On the other hand, the notification to the SSO comes from the legal obligation, defined by the Law on State Statistics "Official Gazette of the Republic of Macedonia" no. 54/1997, 21/2007, 51/2011, 104/2013, 42/2014, 192/2015, 27/16, 83/18, 220/18, 31/20.

Hence, theoretically, report creators should have easy and detailed access to the information needed to create those reports. However, the practical implementation of these laws and regulations is not always monitored, so the creators of the reports must almost always contact the industrial installations directly and again it is possible that they will not get the necessary information. This is often due to the lack of capacity in various aspects. Also, data

[10] Law on Environment (Official Gazette of the RM no. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16)

[11] A-integrated environmental permit - example

[12] B-integrated environmental permit - example

systems/conditions/requirements are not efficiently structured, nor sufficiently harmonized between institutions, nor adapted to the capabilities of the installations.

The installations report on an annual/semi-annual/monthly basis in accordance with legal obligations to the SSO, additionally at a semi-annual / annual / biennial level to LS and / or ministry and all that means various documents and obligations to fill in, and often duplicate reporting data. For now, the installations have a legal obligation to provide electronic report, which does not mean that it is digital and that it is usually laborious to process.

One of the biggest obstacles is that there is no legal obligation (legal framework/regulation) that will put in place a digital and unified way of data input by installations.

To change the complicated way and avoid repetitive obligations, as well as to reduce the reluctance to submit data by the installations, one way is to change the legal obligation for electronic delivery of information to **digital** delivery. In addition, in accordance with the existing support given to industrial plants from different aspects, from different institutions, guidelines/assistance/training can be added when using software for digital data entry.

In conclusion:

- There should be a change in the law in obliging the installations to deliver the reports digitally
- Obliging the installations to use the software tool for reporting
- Provide support for digitizing and digital reporting on the installation and the institutions receiving the reports

Agriculture, Forestry and Land Use (AFOLU)

**The graphical content of the MRV scheme for this sector can be found in "Annex IV"*

AGRICULTURE/ LAND USE

The next paragraph discusses the methods, the system and the level of transparency of reporting and the flow of information and data in the AFOLU group, specific to the field of agriculture. This brief description aims to capture the current picture of information and data circulation, to highlight relevant institutions from multiple categories such as creators and distributors, to accentuate opportunities and shortcomings, and finally to conclude how and where this data is used and delivered.

Firstly, the fundamental information and data is collected from the field, through **legal and individual entities** who have obtained a license for performing agricultural activities in the statistics regions of the Republic of North Macedonia. The specific (8) regions, composed of: Skopje, East, Northeast, Polog, Southeast, Southwest, Vardar and Pelagonia, collect information from the workers in their **regional units**. The regional unit is the first legal body where all information from the field is submitted in the form of an LPIS format. The second legal body that collects information from farmers, individuals or labor associations, but also from the regional units, is **the Agency for Financial Support of Agriculture and Rural Development.** The third body to receive information from the field **is the Food and Veterinary Agency**, and finally, as the fourth body that collects and distributes data from the field, but also data from **the customs administration** is **the State Statistical Office.**

The second phase of distribution and organization of information is a locus between the abovementioned institutions, **the preparation unit of the data inventory**, and the specific ministries that are in touch with the field of agriculture, such as **the Ministry of Agriculture, Forestry and Water Economy (MAFWE)** and **the Ministry of Environment and Physical Planning (MoEPP).** Practically, the Agency for Financial Support of Agriculture and Rural Development submits data to the MAFWE, which further submits it to the preparation unit of the data inventory, and to the MoEPP. The Food and Veterinary Agency also submits reports to inventory preparation unit, as well as the State Statistical Office and the Ministry of Environment and Physical Planning (MoEPP).

The third phase, or the final phase, is the preparation and issuing of the annual reports. This phase is a link between the **inventory preparation unit** and **the Ministry of Environment and Physical Planning (MoEPP).** Practically, the data inventory is taken over by the aforementioned ministry, which further processes, uses, and formalizes it as national strategic and planning documents, but also into reports which are further delivered to **UNFCCC, EEA, and EU.**

One significant remark is the need for improvement of the data-collection-form which the legal and individual entities, who have a license to perform agricultural activities in one of the statistical regions, are obliged to deliver. At the moment, a large amount of data is not collected due to the past lack of interest, however, this type of data is of great importance today. It should be noted that agricultural workers can submit a larger scope of data, especially in the process of communicating with the payment agency, aka the Agency for Financial Support of Agriculture and Rural Development.

In addition, the same data should be submitted in electronic format, in a digital template that will have electronic information that can be easily downloaded and further used for the needs of the inventory preparation processes and the creation of annual reports.

Another remark is that a complete segment of the AFOLU group is missing in our institutional framework. No data is collected for the area "LANDUSE". Practically, this same circular information diagram can be used to collect, distribute and use data related to land management, in other words, the LPIS template can have a new section that will review and collect exactly this type of data, simultaneously with the collection of agriculture-related data.

It must be notated that the regional units should carry out formal trainings with the agricultural workers about digitally submitting the LPIS forms, of course, after such software or platform has been created. This tool has to be easily accessible and useful to legal entities and individuals that are engaged in agricultural activities and activities related to land use and management.

As a main conclusion, 4 points summarize the situation and touch on opportunities for improvement:

- Expand the LPIS template to increase the inventory database from the field
- Expand the LPIS template to include the land use and management sector.
- Digitization and inter-institutional alignment between ministries, agencies and the Statistical Office, to unify a universal template that will be electronically completed by the legal and individual entities, in order to facilitate the process and reduce the confusion in the collection of the data.
- Improving the inter-institutional framework through which ministries, agencies, and the statistical office communicate, to achieve a coherent picture of the current situation in the country, as well as to ensure precision in the preparation of data inventories.

FORESTRY

**The graphical content of the MRV scheme for this sector can be found in "Annex IV"*

Depending on the activities carried out on the forest, it can have a positive or negative effect on greenhouse gas emissions.

The management of the forest area on the territory of North Macedonia is defined in the **Law on Forests**. Forests can be privately or state-owned, which is registered in the state real estate cadaster, which is regulated by a rulebook, from which the information about the situation with the forest territory is drawn. The Law defines the conditions for forest management, defining national inventory according to which data on forest condition will be collected, for the needs of forestry and forestry operations, ecology, hunting, environmental protection, nature protection, wood processing industry, as well as for the needs of state and international organizations.

Forest operations are controlled under several legal articles and defined rules, including that forest users and owners are required to carry out special plans and programs, to conduct an inventory of forests and forest land and report it. The body of the state administration responsible for the affairs of the forestry. Hence, the public enterprise "National Forests" is authorized to collect the above mentioned information and use it for reporting. This company receives the information according to

the rulebook for forest order and the rulebook for monthly report on performed works in the phase of felling, supply and transport. This public enterprise has a legal obligation with the statistical law to submit information to the State Statistical Office (SSO). Additionally, data on the processed wood are sent to the Ministry of Agriculture and Water Economy (MAFWE) through wood-selling warehouses, as well as sawmills. In agreement with MAFWE, Ss. Cyril and Methodius - Skopje, Faculty of Forestry - Skopje, defined in article of the Law, monitors forest ecosystems due to damage caused by weather and other natural disasters that affect the change of forest and forest land, the state administration body responsible for Forestry Affairs adopts a program of measures and activities for data collection on forest damage and establishes a register of forest damage.

Also, reporting is made through the so-called Information system in forestry, defined in the law on forests, which with its competence provides all the necessary information about the situation and changes in the forest fund for the needs of planning, monitoring and reporting.

The information received by MAFWE and the Ministry of Environment and Spatial Planning, as well as those from the SSO, is used to create reports, which is a complicated process due to insufficiently detailed data, as well as an unlicensed way of reporting.

However, despite the existence of regular procedures, many of these regulations are not applied in practice, which in the end does not give the obtained data and the real picture of the field conditions. One way to simplify is to separate the forest cadaster from the real estate cadaster, as well as to introduce a digital way to monitor the condition of forests, and thus do digital reporting.

The prescribed forms for reporting on the state of forests are recommended to be submitted electronically but not digitally, which entails a recommendation to change paragraph 4 in Article 77 of the Forest Law, where it is recommended to change **electronically** with **digitally**.

In conclusion,

- Implementation/creating a forest cadaster
- Digitizing of the reporting
- Creating a software tool for digitizing and simplifying the reporting and the forest control

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Conclusion

There are similarities in the shortcomings in the way data is collected by all relevant institutions in the analyzed sectors, as well as similarities in the opportunities for improving the process of collection of data and preparation of the GHG inventory.

The snapshot of the current state of the process for collecting data for the preparation of the greenhouse gas inventory from the energy sector indicates the need for a legal basis for regulating and systematizing this process. The numerous laws and bylaws governing the collection of some of the data needed to prepare the inventory come as no surprise given the breadth of the sector. However, an aligned and digital collection by all relevant institutions is of great importance.

The harmonized digital collection of the necessary energy data explained in this chapter would facilitate the work of all stakeholders involved in the process and would provide improved and more accurate data. Recommendations for improving this process consist of:

- Establishment of a legal basis for the process of preparation of the inventory by the energy sector (it is expected to be regulated by the Law and the bylaws for climate action that are in preparation);
- Creation of a functional web platform that can be used by all relevant institutions and stakeholders who prepare and collect energy data for the needs of the preparation of the above-mentioned reports, energy balance and the greenhouse gas inventory. It would allow:
    - Facilitated data collection;
    - Double reporting by some energy entities would be avoided;
    - Provide accurate, timely and consistent data in the relevant units of measures needed to prepare the various reports, energy balances and the inventory;
    - Increased, strengthened and joined capacities for data verification by several institutions and stakeholders; and
    - Facilitated storage, and further analysis, processing and reporting of data for the appropriate national and international needs (and reporting) of the country.

One of the main obstacles to providing the necessary data in road traffic is the old vehicle register. With the current register, there is no technical possibility to provide accurate and timely data to all stakeholders, although there is a legal basis. The need for a new vehicle register as the only long-term solution has been highlighted in many studies and reports. In that regard, the proposals from this report largely refer to improving the quality of data after they are submitted by the current registry, i.e. the way of processing and sorting the data from the database of vehicles. It is important to note that these suggestions offer a short-term solution:

● Proposal No. 1: Automatic data processing and sorting

● Proposal No.2: Improving the interface application of the Ministry of Interior for entering and accessing the data from the database of the vehicle register

● Proposal No. 3: Adding a new category - past kilometers of the vehicle, and specifying three subcategories - CNG, electric and hybrid vehicles in the vehicle type category

In the waste sector, the proposals for improving the current situation are in the direction of:

- Digitization of data
- Additional requirements in the Form for submission of data for monitoring the discharged wastewater
- Additional requirements in the Annual Report on Utilities of the SSO

For the industrial sector it is proposed:

- Legal obligation for digital reporting instead of electronic
- Use of existing software tools designed for industrial installations
- Support and assistance of industrial installations for digitalization and simplification of the reporting process

As a main conclusion in the sector of agriculture, forestry and land use and management, there are 5 points that summarize the situation and list opportunities for improvement:

- Expanding the LPIS template to increase the inventory database from the field
- Expanding the LPIS template to include the land use and management sector
- Digitization and inter-institutional alignment between ministries, agencies and the statistical office, to unify a universal template that will be digitally filled by first and foremost individuals, in order to facilitate the process and reduce the confusion in collecting data
- Improving the inter-institutional framework through which ministries, agencies and the statistical office communicate, to achieve a coherent picture of the current situation in the country, as well as to ensure precision in the preparation of data inventories.
- Creating a cadaster only for forests

Annexes

Annex I: Data, measuring unit and entities responsible for collecting data from the energy sub sectors

Sector: Energy

Indication	Sub sector		Measuring unit	Entity
1.1	**Energy industries**		Quantity of fuel used in kt, m^3 or TJ, by fuel type and energy production facility Net calorific value in TJ/kt ,TJ/m^3 or toe Carbon content C t/TJ or Fixed carbon 2 C fix (%) for solid fuels Detailed specification for the fuels used	State Statistical Office JSC Power Plants of North Macedonia
1.2	**Manufacturing industries and construction**		Quantity of fuel used in kt, m^3 or TJ, by fuel type and energy production facility Net calorific value in TJ/kt or TJ/m^3 or toe. Carbon content C t/TJ or Fixed carbon 3 C fix (%) for solid fuels Detailed specification for the fuels used	State Statistical Office
1.3	**Transport**	**Domestic aviation**	Quantity of fuel used for domestic flights in kt. Net calorific value in TJ/kt or toe _____ Number of domestic flights by aircraft type and route details	State Statistical Office _____ Macedonian navigation (M-NAV) GOJSC
1.4		**Road transport**	Quantity of fuel used in kt or m 3 by fuel type _____ Number of registered vehicles by category, subcategory, production year, fuel type, engine capacity (in cm^3), raw weight of the vehicle, gross weight of the vehicle and number of passengers	State Statistical Office _____ Ministry of Internal Affairs

1.5		**Railways**	Quantity of fuel used in kt Net calorific value in TJ/kt	State Statistical Office
1.6	**Other sectors**	**Commercial/ Institutional**	Quantity of fuel used in kt or m^3 Net calorific value in TJ/kt or TJ/m^3	State Statistical Office
1.7		**Housing**	Quantity of fuel used in kt or m^3 Net calorific value in TJ/kt or TJ/m^3	State Statistical Office
1.8		**Agriculture/ Forestry / Fishery**	Quantity of fuel used in kt or m^3 Net calorific value in TJ/k tot TJ/m^3	State Statistical Office
1.9	**Other (specified elsewhere)**		Quantity of fuel used in kt or m^3 Net calorific value in TJ/k tot TJ/m^3	State Statistical Office
1.10	**Fugitive emissions from fuels**		Amount of raw coal production in tones Amount of natural gas vented from the pipeline during the transmission and distribution processes in m^3 Amount of natural gas flared during the transmission and distribution processes in m^3	State Statistical Office

Annex II: List of entities according the Rulebook on energy balances and energy statistics

Data on	**Entities**
Electricity	Holders of licenses for energy activities: Operators of power transmission and distribution system, manufacturers, suppliers, preferential producers
Crude oil and oil derivatives	Holders of licenses for energy activities: - producers of oil derivatives and biofuels, - Wholesalers of oil and petroleum products and biofuels - producers of electricity and / or thermal energy Other importers who are not holders of licenses for performing energy activity, and who have the right to import for their own needs Agency for Commodity Reserves Directorate for mandatory reserves of oil and oil derivatives Customs Administration
Production, fuel consumption and import of coke, lignite and coal	Manufacturers of electricity Coal mines (independent and within the TPP) Large industrial consumers of coal and lignite Importers of coke, lignite and coal Customs Administration
Heat production, transmission and distribution	Holders of licenses for production and distribution of thermal energy
Imported mixtures of fossil and biofuels	Holders of licenses for energy activities: - Producers of oil derivatives and biofuels, - Wholesalers of oil and petroleum products and biofuels
Fossil gas	Operator of fossil gas transmission system, operators of fossil gas distribution system, suppliers of fossil gas
Biomass	Ministry of Agriculture, Forestry and Water Economy and Ministry of Environment and Physical Planning Customs Administration PE Macedonian Forests
Exploitation of geothermal waters	Legal entities with the right to exploit geothermal waters

Annex III: Additional recommendations on the Draft Law on Waste Management

At this moment, Annex III is available only in Macedonian language.

Annex IV: The graphical content (MRV schemes) can be found in an additional .pdf document to this report, named "Monitoring, reporting and verification of greenhouse gas emissions: current overview (Annex IV)"

Scheme 1 – Energy
Scheme 2 – Road transport
Scheme 3 – Waste
Scheme 4 – Industry and Industrial processes
Scheme 5 – Agriculture/ Land use
Scheme 6 – Forestry