MINISTRY OF ENVIRONMENT, WATERS AND FORESTS

Romania's Fourth Biennial Report under the UNFCCC

December 2019

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I. INTRODUCTION

This is the fourth Biennial Report (BR4) of Romania, as required under Article 18(1) of Regulation (EU) No 525/2013, Regulation (EU) no. 749/2014 and Decision 2/CP.17 of the Conference of the Parties under the United Nations Framework Convention on Climate Change (UNFCCC)[1].

Tabular information as defined and required by the UNFCCC Biennial report guidelines are enclosed in the CTF annexes and submitted electronically through UNFCCC Application and Network Access Portal.

II. INFORMATION ON GHG EMISSIONS AND TRENDS

This section summarizes information on the Romania's greenhouse gases (GHG) emissions in the period 1989 - 2017. The GHG emissions data presented in this Biennial Report are consistent with the GHG emissions reported by Romania in 2019 under the Convention to the UNFCCC secretariat and correspond to the totals in the CRF tables under the Convention.

The presented data cover all sectors and all direct gases in the period 1989-2017 and is complete in terms of geographical coverage.

II.1. Summary information on GHG trend

The emission data presented here is based on national greenhouse gas inventory covering the period 1989 to 2017, submitted to the UNFCCC on May 7, 2019[2]. The inventory is in line with the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention (Decision 24/CP.19) and with Regulation (EU) No. 525/2013 (and Regulation (EU) no. 749/2014).

[1] An updated version of BR4 is expected, upon availability of new GHG emissions projections

[2] https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019

II.1.1. Trends in total GHG emissions

In 2017 total GHG emissions, excluding LULUCF, were estimated at 113,795.945 Gg $CO_{2\ eq}$. The values for the Global Warming Potential (GWP) used to convert GHG emissions into the $CO_{2\ eq}$ are from the IPCC Fourth Assessment Report (AR4) as are presented in Annex -Table 2 (c). Global warming potentials (GWPs) used (100 years time horizon), are as follows: CH4 = 25; N2O = 298; SF6 = 22 800; NF3 = 17 200; HFCs and PFCs consist of different substances, therefore GWPs have to be calculated individually depending on substances.

For Romania, the base year under Convention and Kyoto Protocol is 1989 based on Decision 24/CP.19[3], II.D in accordance with the provisions of Article 4, paragraph 6 of the Convention and Decisions 9/CP.2, 11/CP4 and 7/CP.12.

As a Member State of the EU, Romania has committed to contributing to the achievement of the joint EU economy-wide emission reduction target of 20 per cent below the 1990 level by 2020, the base year for this target and for all gases being 1990 for all Member States.

Between 1989 and 2017, total GHG emissions (excluding LULUCF) decreased by 62.90% and net GHG emissions (including LULUCF) decreased by 68.19 % (Figure II.1).

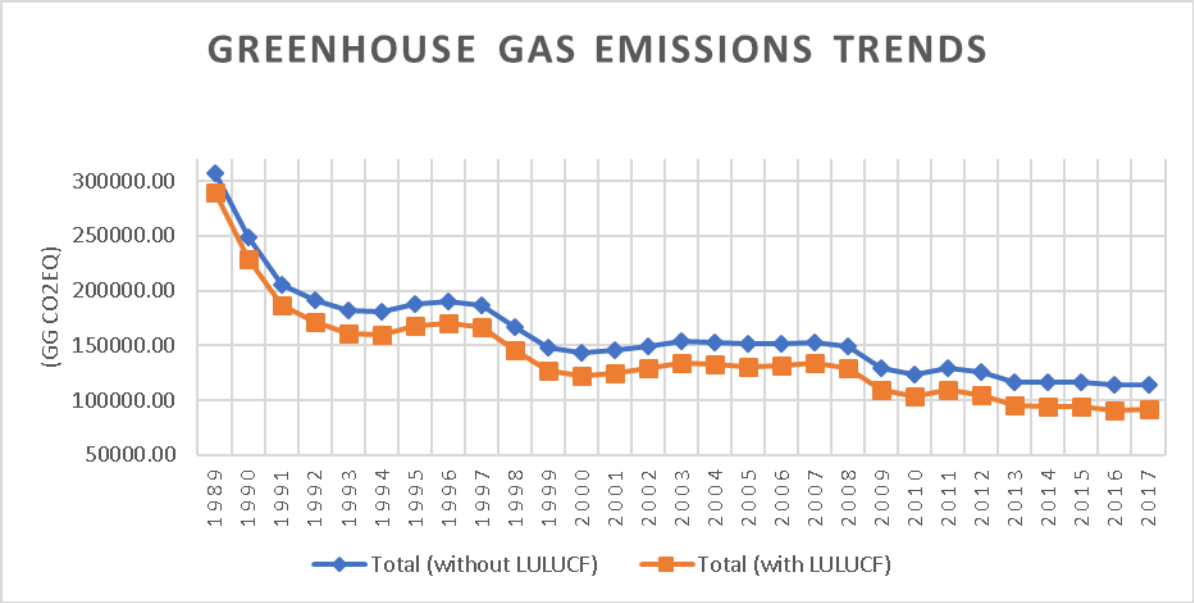


Figure II-1. Trends in total GHG emissions

3 Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention, Decision 24/CP.19, FCCC/CP/2013/10/Add.3, http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2

The general trend of GHG emissions in Romania shows a strong decrease compared to the base year; the evolution of GHG emissions can be divided into three periods: 1989-1999, 2000-2007 and 2008-2017.

The 1989-1992 period was characterized by a decrease in total GHG emissions, a direct result of the decline in economic activities and, in consequence in energy demand. The transition period at the economic level, involved the reduction of activities carried out by certain energy-intensive industries, which led to the decrease of GHG emissions. GHG emissions have seen an upward trend until 1996 because of revitalizing economic activity. In 1997, GHG emissions declined again due to the significant change in the energy mix after the start of operation of Unit 1 of Cernavoda nuclear power plant (1996); the decrease continued until 1999. After 1999, the GHG emissions trend reflects the economic development during the period 2000-2007. The decrease of GHG emissions in 2005, compared to the levels recorded in 2004 and 2006, was caused by a change in the energy mix due to a significant contribution of hydropower (hydrological year records).

The economic and financial crisis, GHG emissions decreased significantly in 2010 compared to 2008. In the period 2010-2017 the GHG emissions remained relatively constant.

II.1.2. Trends in emission by GHG

GHG emissions, excluding HFCs and SF_6, decreased compared to the base year. Regarding the contributions of different types of greenhouse gases to total GHG emissions, they did not register significant change over the reported period. CO_2 has the largest share of total GHG emissions, followed by CH_4 and N_2O.

In the base year, the share from total GHG emissions (without LULUCF), were: 68.13 % for CO_2, 24.15% for CH_4, 6.27% for N_2O and 1.45% for aggregated F-gases.

In 2017, registered shares, relative to total GHG emissions (without LULUCF) were as follows: 65.91 % for CO_2, 25.24% for CH_4, 6.89% for N_2O and 1.97% for aggregated F-gases.

Since 1991, F gases have started to be used as substitutes for ODS in air conditioning and refrigeration systems. In 2017, the contribution of these gases to the total GHG emissions is negligible: 1.91% HFCs and 0.05% SF6.

Total GHG emissions trends per gas type (without / with LULUCF) are presented in the next figure (figure II.2).

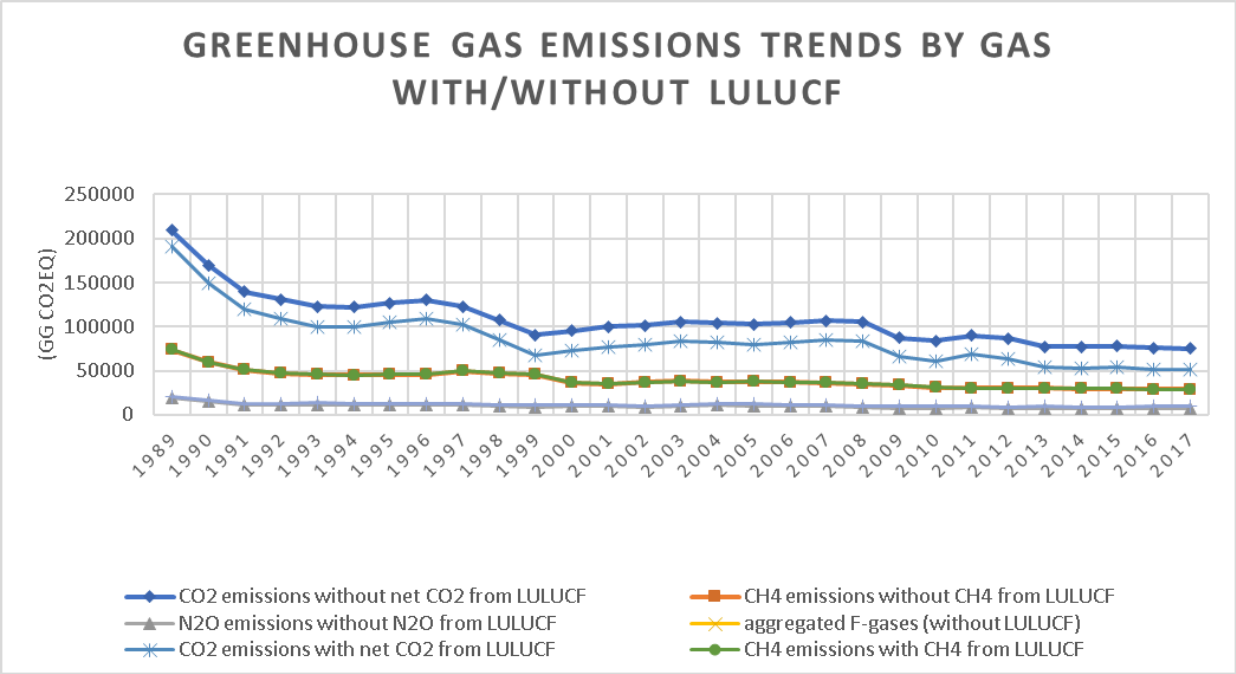


Figure II-2. GHG emissions trend (without/with LULUCF) by gas type

Carbon dioxide

Carbon dioxide (CO_2) is the most important anthropogenic greenhouse gas. The decrease in CO_2 emissions (64.11%, from 208,946.39 Gg $CO_{2\ eq}$ in 1989 to 74,998.25 Gg $CO_{2\ eq}$. in 2017) is mainly due to the decrease in the amount of fossil fuels used in the energy sector (mainly in the *Public electricity and heat production* and *Manufacturing industries and construction*), a result of the decline in economic activities.

Methane

Methane (CH_4) – methane emissions, mainly generated by fugitive emissions from the extraction and distribution of fossil fuels and livestock, fell by 61.22 % in 2017 compared to 1989 levels (from 74,073.58 Gg $CO_{2\ eq.}$ in 1989 to 28,725.39 Gg $CO_{2\ eq.}$ in 2017). The decrease in CH_4 emissions in the *Agriculture* sector is due to the decrease in livestock.

Nitrous oxide

Nitrous oxide (N_2O) – N_2O emissions are mainly generated by the *Agriculture* sector (*Agricultural Soils* activities) and *Industrial Processes and Product Use* (*Chemicals*

Industry activities). The evolution of N_2O emissions reflects the downward trend of these activities due to the decrease in livestock, the amount of synthetic nitrogen fertilizer applied to soils and the levels of crop production. In 2017, N_2O emissions decreased by 59.24 % compared to the emissions in the base year.

Fluorinated gases

Fluorinated gases - F gases have begun to be used as a substitute for ODS in refrigeration and air conditioning systems since 1995. PFC emissions generated in the primary aluminum production process declined significantly (by 99.87%) in 2017 compared to 1989.

II.1.3. Trends in GHG emissions by sector and sink categories

The emissions trends by sector and sink categories for the period 1989-2017 (Figure II.3) according to the latest National GHG Inventory submitted to the UNFCCC in 2019 is presented, in summary, below (more details can be noticed in Chapter 2.2 of the NIR – 2019 & CRF Tables).

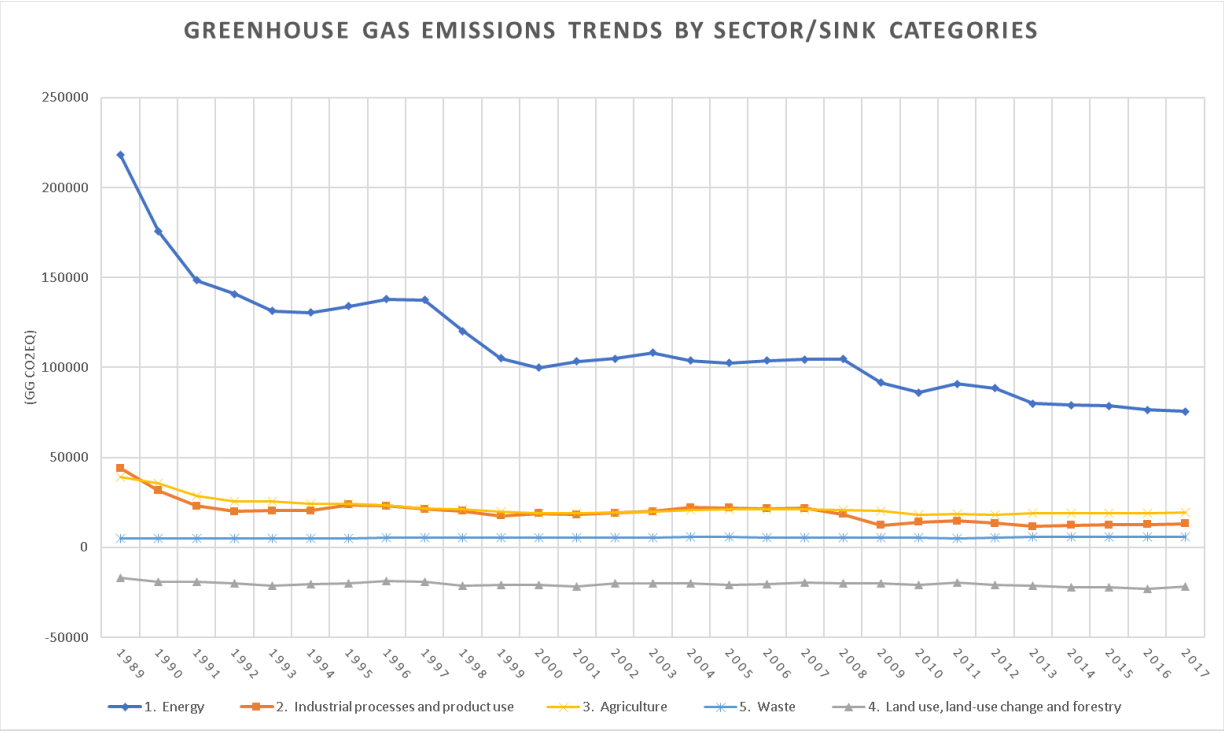


Figure II-3. GHG emissions trends by sector and sink categories

In 2017, total GHG emissions from the *Energy sector* accounted for the largest share (66.39%), followed by those from *Agriculture sector* with a share of 16.92 % and those from *Industrial Processes and Product Use sector* with a share of 11.52 %.

Energy Sector

Energy is the most important sector in Romania; in 2017, this sector had a share of approximately 66.39 % from total GHG emissions (without LULUCF), accounting for 75,543.75 Gg $CO_{2\ eq}$. Compared to the base year, GHG emissions in 2017 decreased by 65.41 %. The main reason for this trend is the process of transition to a market economy that has led to a sudden decrease in the demand for heat & power produced by power plants.

In the period 1989-2017 the total GHG emission trends is characterized by substantially decreasing in emissions from the *Manufacturing industries and construction* category (82.46 %), *Other* (72.33 %) and *Energy industries* category (70.29 %) and the significant increase in emissions related to *Transport* category (61.47 %) (Figure II.4).

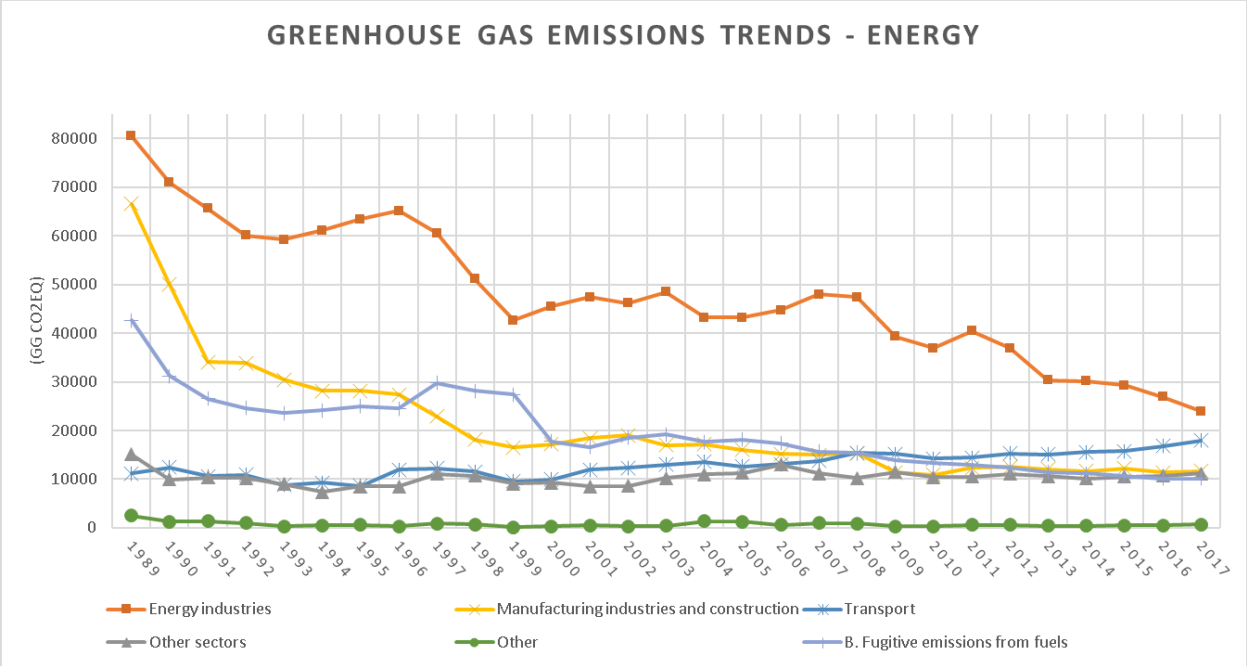


Figure II-4. Trends in GHG emissions from Energy sector, 1989-2017

In 2017, the total GHG emissions related to the *Energy Industries* category had the highest share (31.66%), followed by *Transport* category (23.8%) and *Manufacturing industries and construction* category (15.46%). Also, CO_2 emissions in the *Energy sector* accounted for 85.04% of total national GHG emissions (without LULUCF), CH_4 emissions

(calculated as $CO_{2\ eq}$) represent 14.13 % and N_2O (calculated as $CO_{2\ eq}$) represent 0.80%. Compared to 2016, in 2017 GHG emissions from the Energy sector decreased by 1.32%.

Industrial Processes and Product Use sector

In 2017, IPPU sector had a share of 11.52 % from total GHG emissions (without LULUCF), accounting for 13,105.38 Gg $CO_{2\ eq}$. Compared to the base year, GHG emissions in 2017 decreased by 70.23 %.

Since 1989, total GHG emissions from the IPPU sector have registered a downward trend due to restructuring and privatization processes, the effects of the economic and financial crisis and the implementation of specific policies and measures (i.e. EU-ETS). These have resulted in a decrease in production levels and in emission factors.

The trend of total GHG emissions over the period 1989-2017 is characterized by a significant reduction in emissions for the following categories: *Chemical industry* (90.12 %), *Metal industry* (81.13 %) and *Non-Energy products from fuels and solvent use* (53.18 %) and the significant increase in emissions from the category *Products used as substitutes for ODS* (Figure II.5).

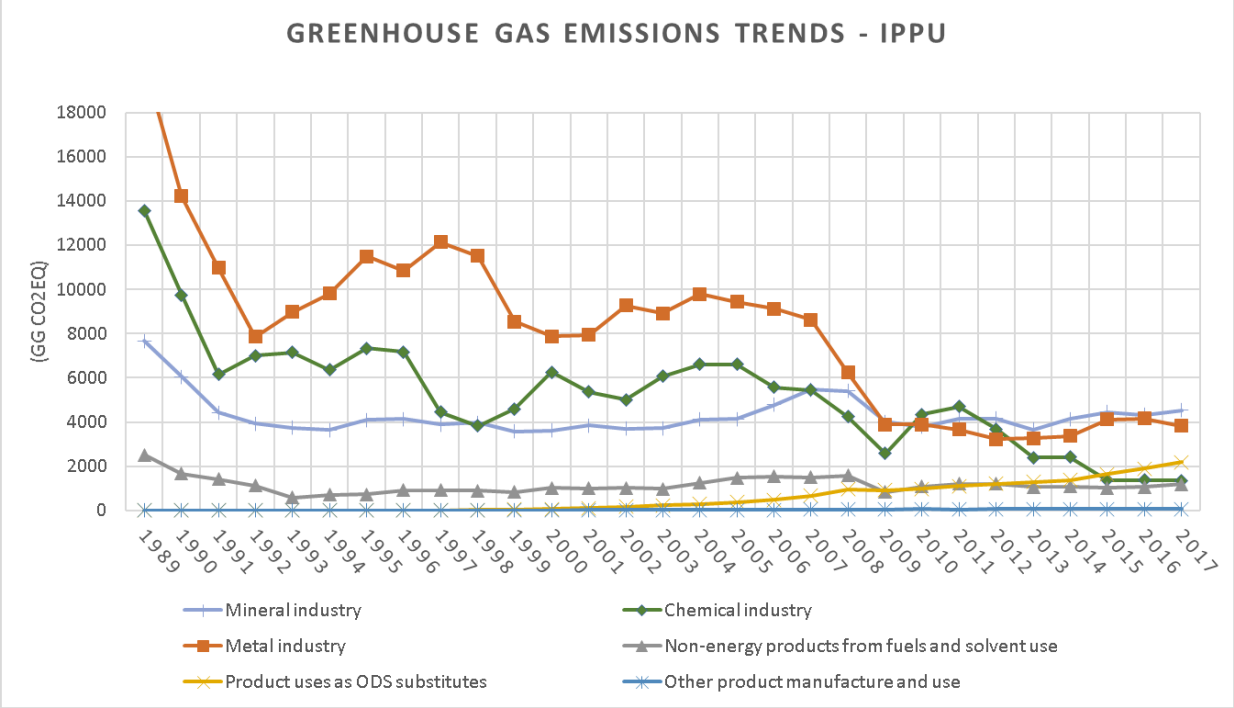


Figure II-5. Trends in GHG emissions from IPPU sector, 1989-2017

In 2017, total GHG emissions from *Mineral industry* category had the largest share (34.54 %), followed by those from *Metal industry* category (29.18 %) and those for the category

Products used as substitutes for ODS (16.62 %). CO_2 emissions also account for 80.93 % of total GHG emissions (without LULUCF), HFC emissions (calculated as $CO_{2\ eq}$) are 16.62% and N_2O (calculated as CO_2 eq.) accounted for 1.93%. Compared to 2016, in 2017, GHG emissions in this sector recorded an increase of 0.72%.

Agriculture sector

In 2017, total GHG emissions for the Agriculture sector accounted for 16.92 % of total GHG emissions (without LULUCF), amounting to 19,255.69 Gg $CO_{2\ eq}$. Compared to the base year, GHG emissions in 2019 decreased by 50.79 %.

Since 1989, total GHG emissions in the Agriculture sector have seen a downward trend due to the decrease in livestock, rice cultivated areas, crop production levels and the amount of synthetic nitrogen fertilizer applied to soils.

The total GHG emissions trends between 1989 and 2017 was characterized by a significant decrease in emissions from the following categories: *Liming* (61.50 %), *Rice cultivation* (72.98 %), *Manure management* (64.82 %), *Enteric fermentation* (50.49 %), *Agricultural soils* (42.76 %), *Urea application* (42.66 %) and *Field burning of agricultural residues* (43.30 %) (Figure II.6).

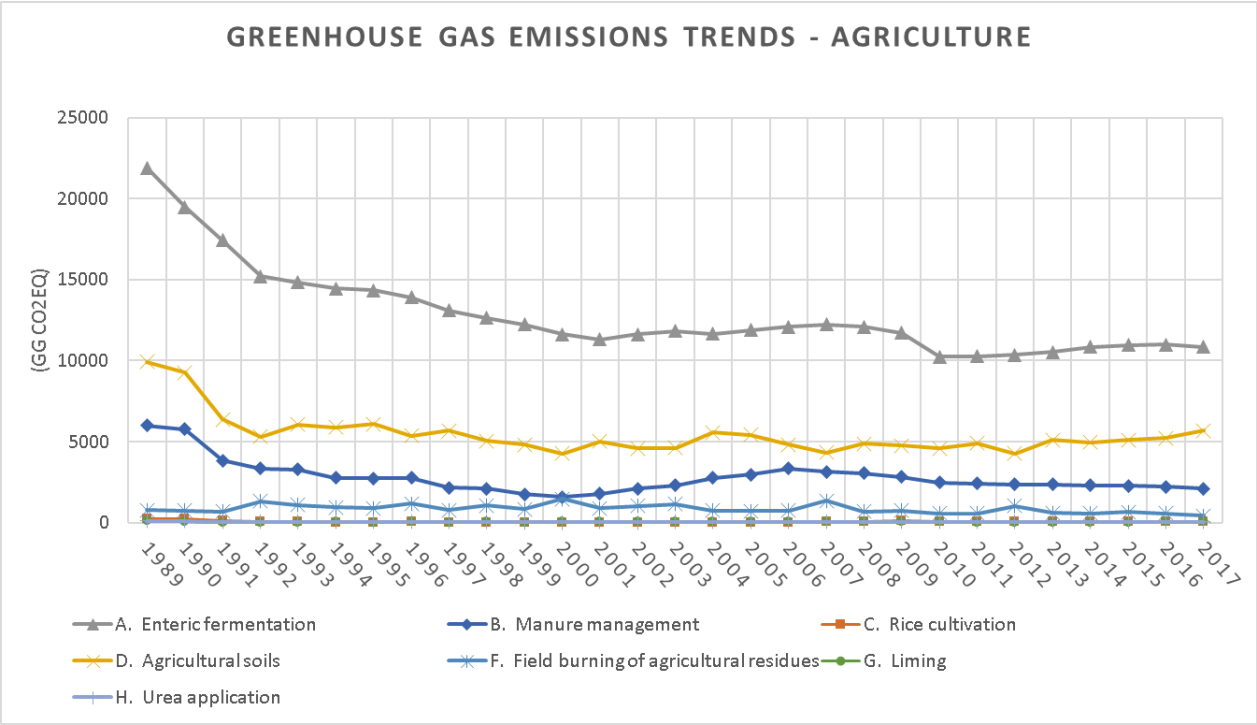


Figure II-6. Trends in GHG emissions from Agriculture sector, 1989-2017

In 2017, the total GHG emissions from *Enteric fermentation* category had the largest share (85.25 %), followed by the *Agricultural Soils* category (26.32 %) and the category of *Manure Management* (12.16 %). Also, CO_2 emissions in the *Agriculture sector* accounted for 0.08 % of total GHG emissions (without LULUCF), CH_4 emissions (calculated as $CO_{2\ eq}$) accounted for 10.98 % and N_2O (calculated as $CO_{2\ eq}$) for 4.93 %. Compared to 2014, in 2015, GHG emissions in this sector recorded an increase of 2.32%.

Land Use, Land-Use Change and Forestry

Agricultural lands, including arable, orchards, vineyards, pastures and hayfields makes up 62.22% of Romania's total national area. Forests cover 27.92% while constructed areas and road/railways, cover some 4.88%, humid areas, water and lakes some 3.53% and other land 2.1%.

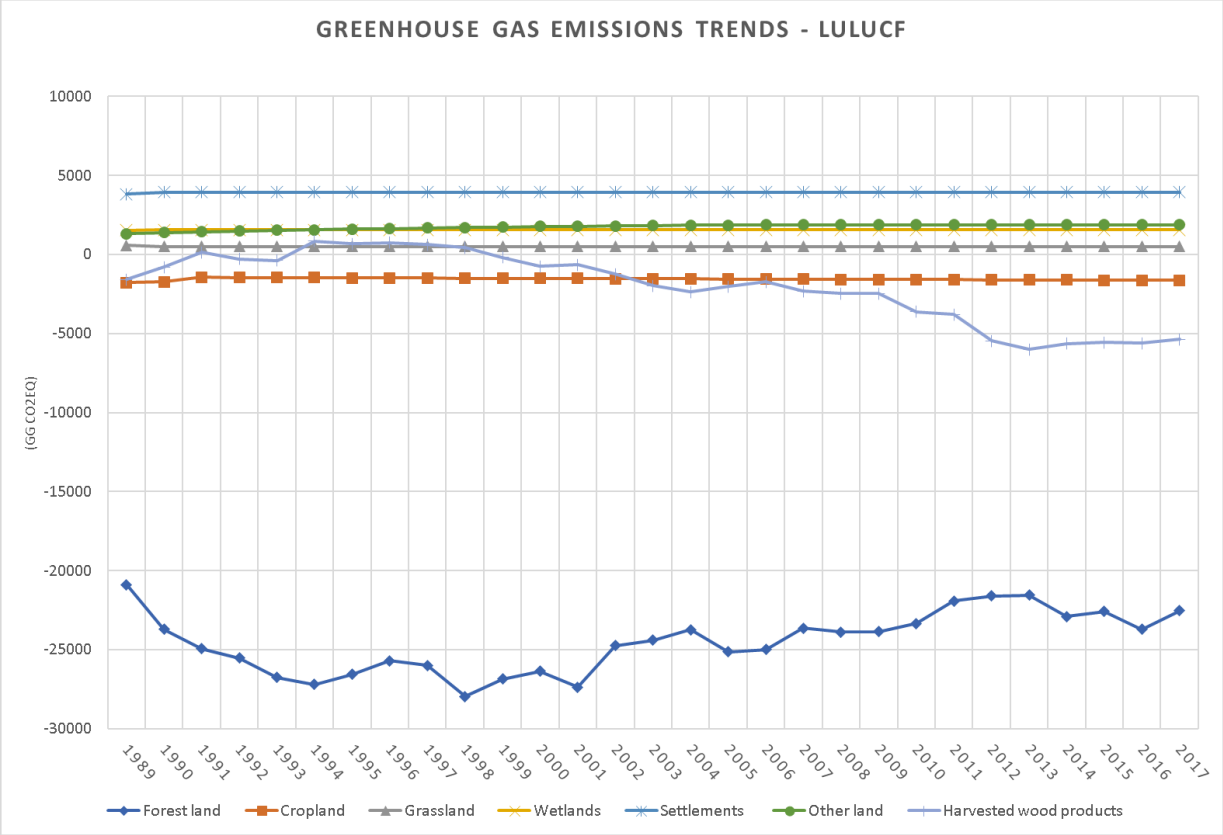


Figure II-7. Overall emissions trend for Land-Use, Land-Use Change and Forestry

Emissions from LULUCF comprise CO_2, CH_4 and N_2O emissions from biomass burning.

The net GHG removals/emissions level is 26.99 % higher in 2017 in comparison with the base year level due to the decrease trend of emissions from all other sectors. The Romanian land use sector acts as a net sink, at an average uptake of 21,680.03 Gg CO_2/year, being relatively stable over the last 28 years.

Waste

In 2017, total GHG emissions for the Waste sector had a share of 5.95 % of total GHG emissions (without LULUCF), accounting for 5,843.31 Gg $CO_{2\ eq}$. Compared to the base year, GHG emissions in 2015 increased by 13.78 %.

Between 1989 and 2015, total GHG emissions from the Waste sector increased because of increased population consumption, increased number of landfills and increased number of persons with access to sewage.

The total GHG emissions trends between 1989 and 2015 is characterized by a significant increase in emissions of the category *Solid waste disposal* (171.47 %) and the decrease in emissions of category *Waste water treatment and discharge* (42.00 %) (Figure II.8)

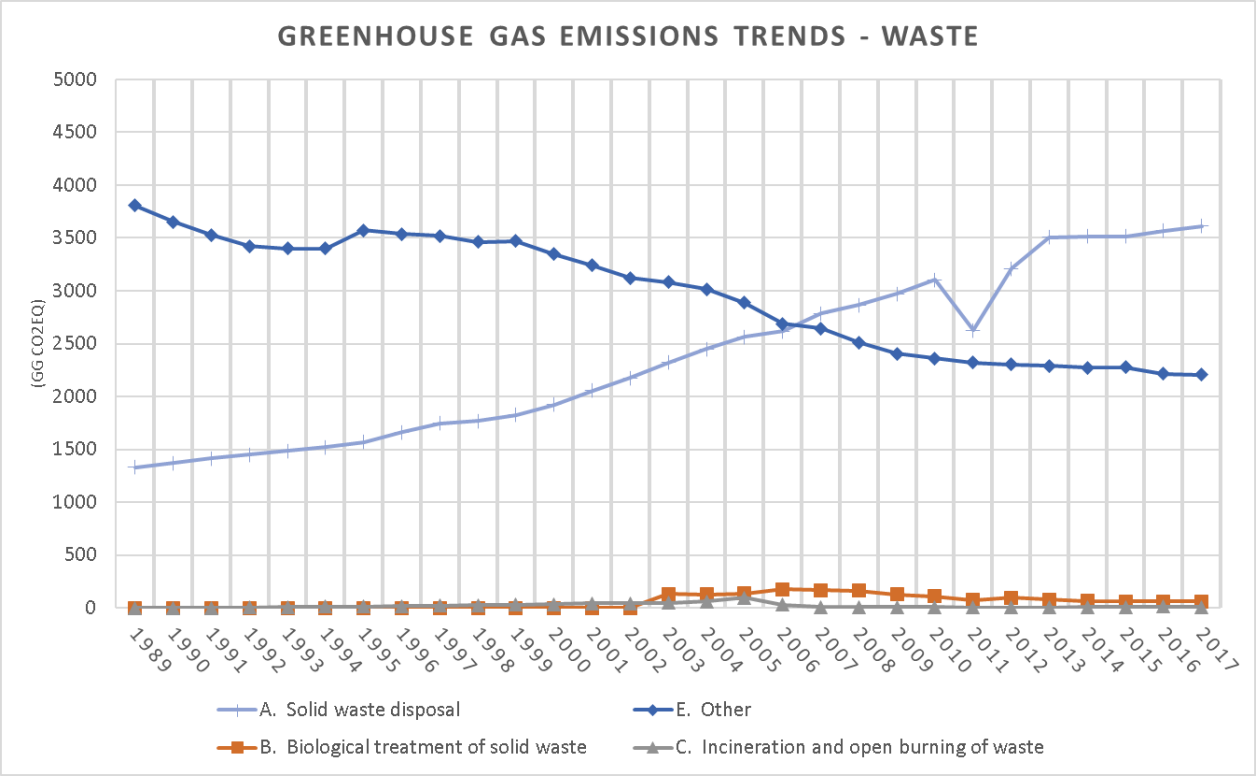


Figure II-8. Trends in GHG emissions from Waste sector

In 2017, the total GHG emissions of the *Solid waste disposal* category had the highest share (61.33 %), followed by the *Waste water treatment and discharge* (37.46 %) category. Also, CO_2 emissions in the Waste sector represent 5.18 % of total national GHG emissions (without LULUCF).

II.1.4. Change in emissions from Key Categories

The sections below present information about changes in the key categories, grouped according to GHG. The analysis of the changes in the key categories are based on the key category analysis presented in the 2019 GHG inventory. The percentages are calculated from the total GHG emissions (without LULUCF) and expressed in CO_2 eq.

Carbon dioxide

The largest key category for CO_2 emissions is category 1.A.1.a. - *Public electricity and heat production* accounting for 20.93% of total GHG emissions (without LULUCF). Between 1989 and 2017, the CO_2 emissions in this category decreased by 70.29%.

The second largest key category for CO_2 emissions in 2017 is 1.A.3.b. - *Road transportation* and accounting for 15.0 % of total GHG emissions (without LULUCF). Between 1989 and 2017, the CO_2 emissions in this category increased by 61.47%.

The third largest key category for CO_2 emissions in 2015 is Category 1.A.2. - *Manufacturing industries and construction*, accounting for 9.78 % of total GHG emissions (without LULUCF). Between 1989 and 2019, the CO_2 emissions in this category decreased by 82.46 %.

Methane

The largest key category for CH_4 emissions is category 3.A. - *Enteric fermentation* accounting for 9.52 % of total GHG emissions (without LULUCF). Between 1989 and 2017, the CH_4 emissions in this category decreased by 50.49 %.

The second largest key category for CH_4 emissions in 2017 is 1.B. - *Fugitive emissions from fuels* accounting for 7.34 % of total GHG emissions (without LULUCF). Between 1989 and 2015, the CH_4 emissions in this category decreased by 76.79 %.

Nitrous oxide

The most important key category for N_2O emissions is category 3.D. - *Agricultural soils* accounting for 4.96 % of total GHG emissions (without LULUCF). Between 1989 and 2017, N_2O emissions in this category decreased by 42.76 %.

Fluorinated gases

The most important key category (97.33% of total F-gases emissions) is category 2.F.1. - *Refrigeration and air conditioning* accounting for 1.91 % of total GHG emissions (without LULUCF).

II.1.5. Key drivers affecting emission trends

Romania is a constitutional democracy. The legislative power is held by the Parliament, while the executive power belongs to the Government, which is responsible for enforcing laws. The government is politically accountable to the Parliament for its entire activity.
The president of Romania is elected (for 5 yrs mandate) by universal, equal, direct, secret and freely expressed vote. The fundamental role of the President is to exercise the mediation function between the powers of the state, as well as between the state and the society.

Romania's territory is organized in counties, towns and communes. Romania has 41 counties and the capital city of Bucharest, which has a similar status to that of a county. The 41 counties are structured in 2,861 communes (for rural areas) and 320 cities (for urban areas), out of which 103 are municipalities. Communes are divided into villages (which do not have individual administration).

Population Profile

The evolution of the Romanian population shows a decrease of approximately 8% between 2005 and 2017 (Table II_2), with a slowdown of the decrease towards the end of the period (about 0.3% between 2016 and 2015 and 0.6% between 2017 and 2016)

Table II-1. Evolution of Romania's population, 2005-2017

Year	1990	2005	2010	2011	2015	2016	2017	2018
Population (000 inhabitants)	23,211	21,624	21,431	20,122	19,819	19,760	19,644	19,523

Source: National Institute of Statistics - Usually resident population by age group and ages, sex, urban/ rural area, macroregions, development regions and counties

The main cause of the decrease is migration, followed by the natural growth rate of the population, which, for many years was negative.

Geographical profile

Romania is situated in the northern hemisphere; at the intersection of 45° parallel Northern latitude with the 25° meridian Eastern longitude.
In Europe, Romania is situated in the South-Eastern Central Europe (Figure II.9), half the distance between the coast of the Atlantic Ocean and the Ural Mountains, inside and outside the Carpathians arch, within the lower basin of the Danube, having a gateway to the Black Sea (Figure II.10).
The Romanian territory is located between parallels 43°37'07" and 48°15'06" Northern latitude and between meridians 20°15'44'' and 29°41'24'' Eastern longitude. Having an area of 238,391 km2, plus 23,700 km² represented by the Black Sea platform.

Figure II-9. Romania on the EU map

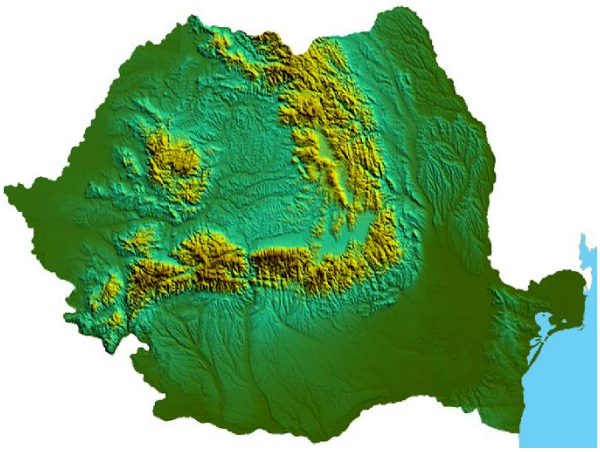


Figure II-10. Romania. Geographical profile

Romania's relief components are proportionally distributed, being estimated to: 35% mountains, 35% hills and plateaus and 30% plains.

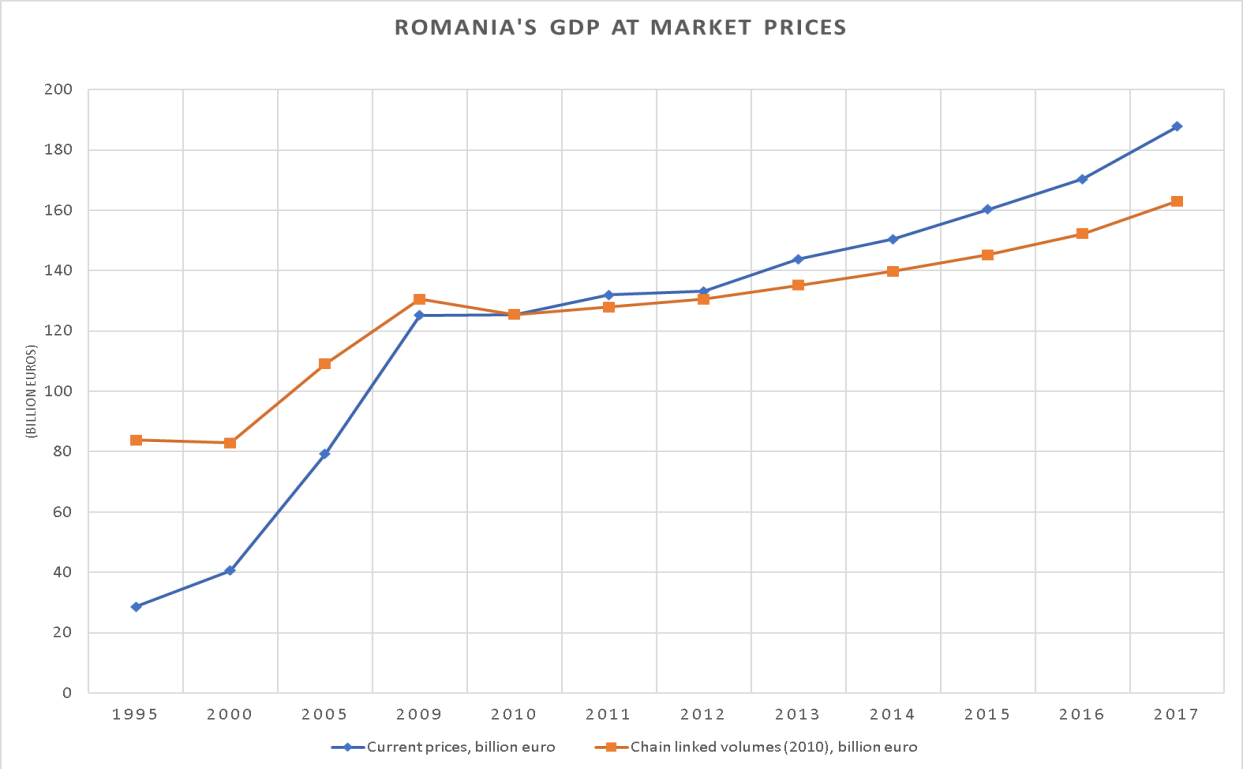
Climate profile

Romania's climate is a transitional temperate-continental one with oceanic influences from the West, Mediterranean modulations from the South-West and excessive continental effects from the North-East. Climate variations are modulated by geographical elements, the position of the mountains, elevation, the Black Sea.
The average annual temperature varies with latitude, from 8°C in the North to 12°C in the South, with around 2.6°C in the mountains and 11.7°C in the plains (see Figure II.11).
In the last 116 years, the warmest year was 2015 (with an average temperature of 11.6°C) and the coldest one, 1940 (with an average temperature of 8°C). The classification uses data from 14 meteorological stations with long series of observations.
An absolute minimum temperature of - 38.5°C was recorded in January 1942 at Bod in Brasov County and an absolute maximum temperature of 44.5°C recorded in August 1951 at Ion Sion location in the Bărăgan Plain.

Economic Profile

Since 2000, Romania has experienced 17 years of GDP growth. The last decade's global financial crisis affected Romania's GDP, marking two years of economic decline (2009-2010). The real economic convergence was among the strongest on the European continent, as in 2000, Romania's GDP was about EUR 40 billion (less than EUR 2,000 per capita), while in 2017 the values hit EUR 188 billion, or EUR 9,600 per capita.[4]
Within a decade of joining the EU (2007), the Romanian economy has grown quickly (Figure II.13) and has managed to become the largest in the region despite the (temporary) migration of millions of Romanians that have left the country in search of a better life in Western Europe.

[4] http://business-review.eu/money/br-analysis-romanias-economy-facing-uncertain-end-to-two-decade-growth-cycle-194160



Source: EUROSTAT http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do
Figure II-11. GDP trend - 1995 – 2017 period

Table II-2. Romanian GDP evolution within the 2000 – 2017 period

Year	1995	2000	2005	2010	2015	2016	2017
GDP [bill. Euro]	28.6	40.6	79.2	125.4	160.3	170.4	187.8
GDP [bill. Euro 2010]	83.9	82.9	109.1	125.4	145.2	152.2	163.0

In 2017, the year that also registered a significant intensification of the global economic activity, Romania registered the fastest growth rate since the beginning of the last global financial crisis (7.1%), placing itself among the most dynamic economies from the European Union. The main driver of the growth of the Romanian economy continued to be represented by population's consumption, driven by the stimulating conditions - from the perspective of wages and the degree of employment - of the labor market and of the relaxation measures in the fiscal-budgetary sphere. Population consumption has accelerated its growth rate to 9%, generating 90% of the real GDP advance. A positive contribution to the economic growth, but of a much smaller size than the one related to consumption (1.1 percentage points), was due to investments, whose dynamics approached 5%. The segment with the fastest development was the one of the residential

constructions (acceleration of rhythm up to about 70%). The intensification of the internal economic activity, but also the favorable external context, characterized by high values of the confidence of the economic operators at European level, were found in an acceleration of the equipment purchases (increase of almost 4%), especially in the automotive industry, the machinery and equipment industry, household appliances industry and in the metallurgical industry. These branches had a significant role in accelerating the industrial activity, the contribution of this sector to the real GDP growth reaching 1.9 percentage points in 2017 (+0.6 percentage points compared to 2016).

In 2017, public investments in construction projects have decreased with 21.7%, compared to 2016.

Given the intensification of the global economic activity, as well as the development of new domestic production capacities, exports of goods and services have accelerated their growth rate to 9.7%. Their advance, together with the need to cover expanding domestic demand, however, led to a boost of imports (+ 11.3%), so that the net external demand continued to erode the real GDP growth (by 0.7 percentage points). The dominant contribution to the expansion of supplies external, this year, belonged to companies producing cars, machinery and equipment, electrical appliances, rubber, these categories of goods accumulating half of the value of exports[5].

Trends of ***GHG emissions per capita and GDP per capita highlight a clear decoupling*** *(though in 2010 and 2011 – because of the financial crisis - they were quite similar)* and a decrease of the GHG emissions per capita (Figure II.14).

[5] http://www.insse.ro/cms/sites/default/files/field/publicatii/starea_economica_si_sociala_a_romaniei_2019.pdf

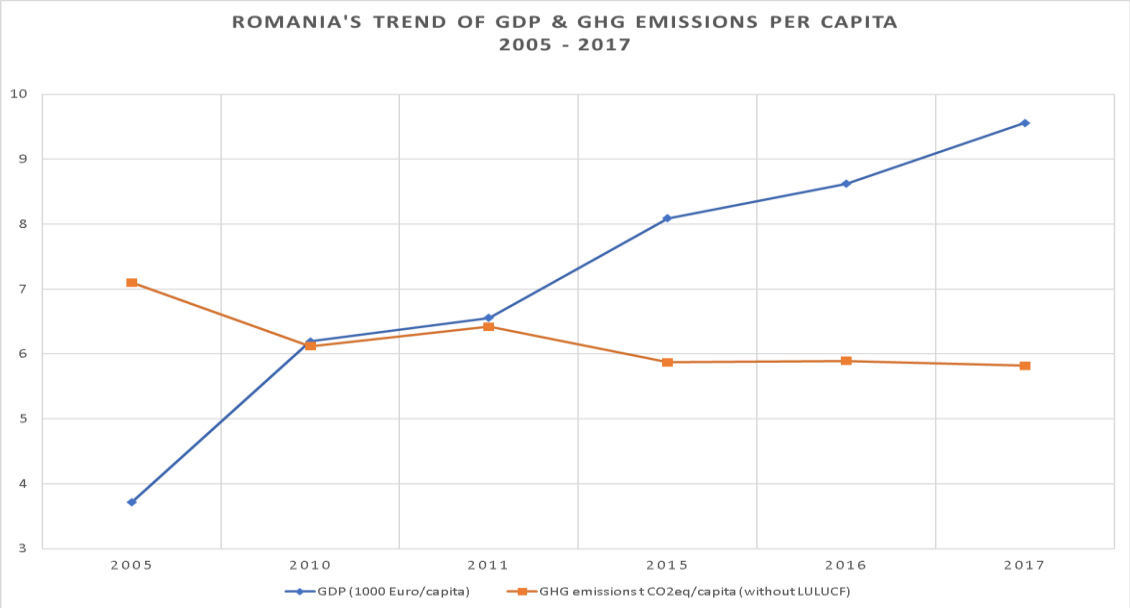


Figure II-12. Trends in GDP & GHG emissions per capita

With respect to the GDP formation, in can be noticed from Figure II.13 and Figure II.14, that Industry, followed by *Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; hotels and restaurants* cover more than 40% in the PIB, both in 2017 and the entire time series; however, in the most recent few years, the share of industry seem to be caped below 25%, while the share of services is increasing.

In terms of GHG intensity, Romania reached around 0.6 kg of CO2 equivalent per unit of GDP in 2017 compared with 1.8 kg of CO2 equivalent per unit of GDP in 2005.

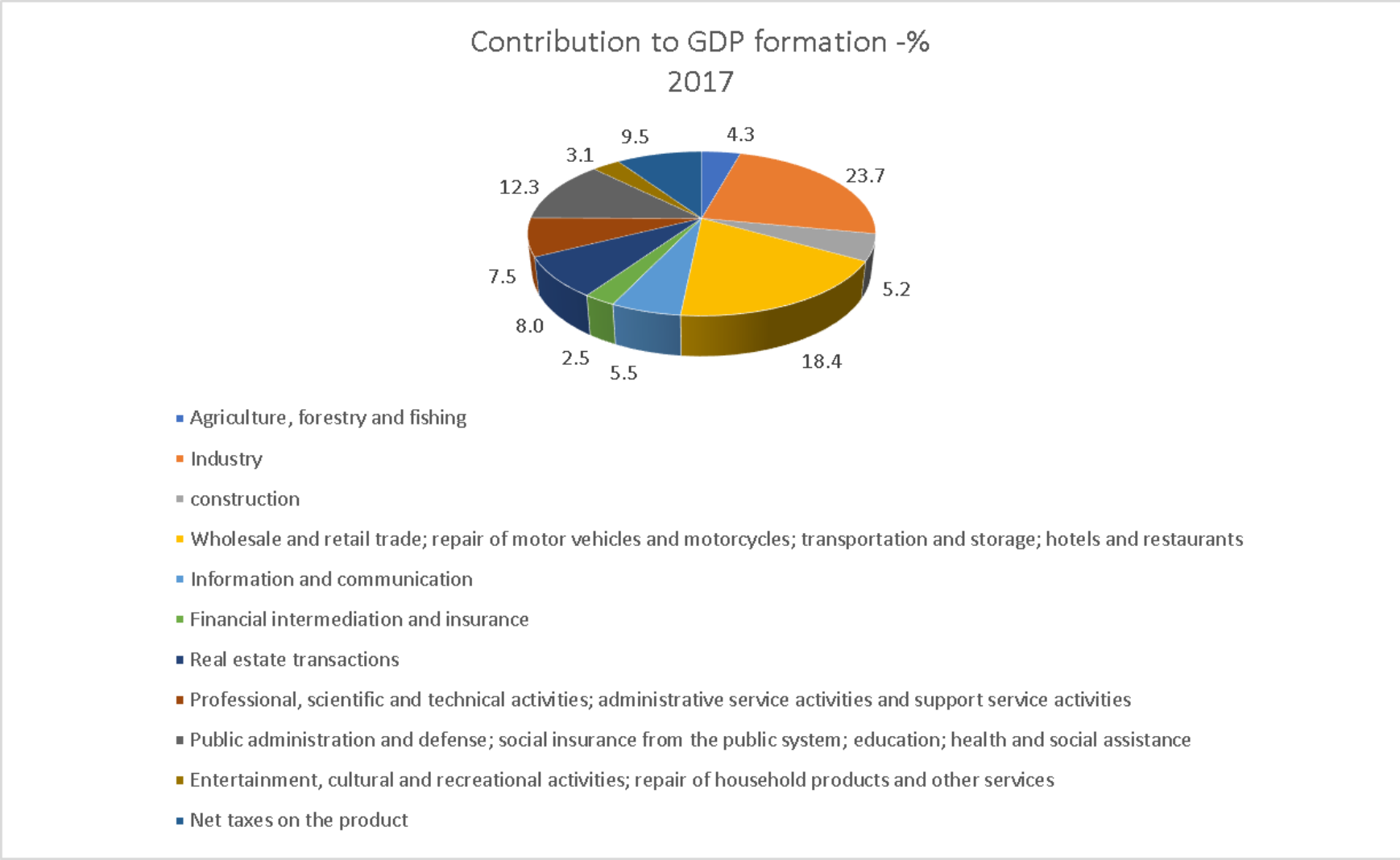


Figure II-13. Contribution of different sectors to the GDP formation in 2017
Source: The National Institute of Statistics

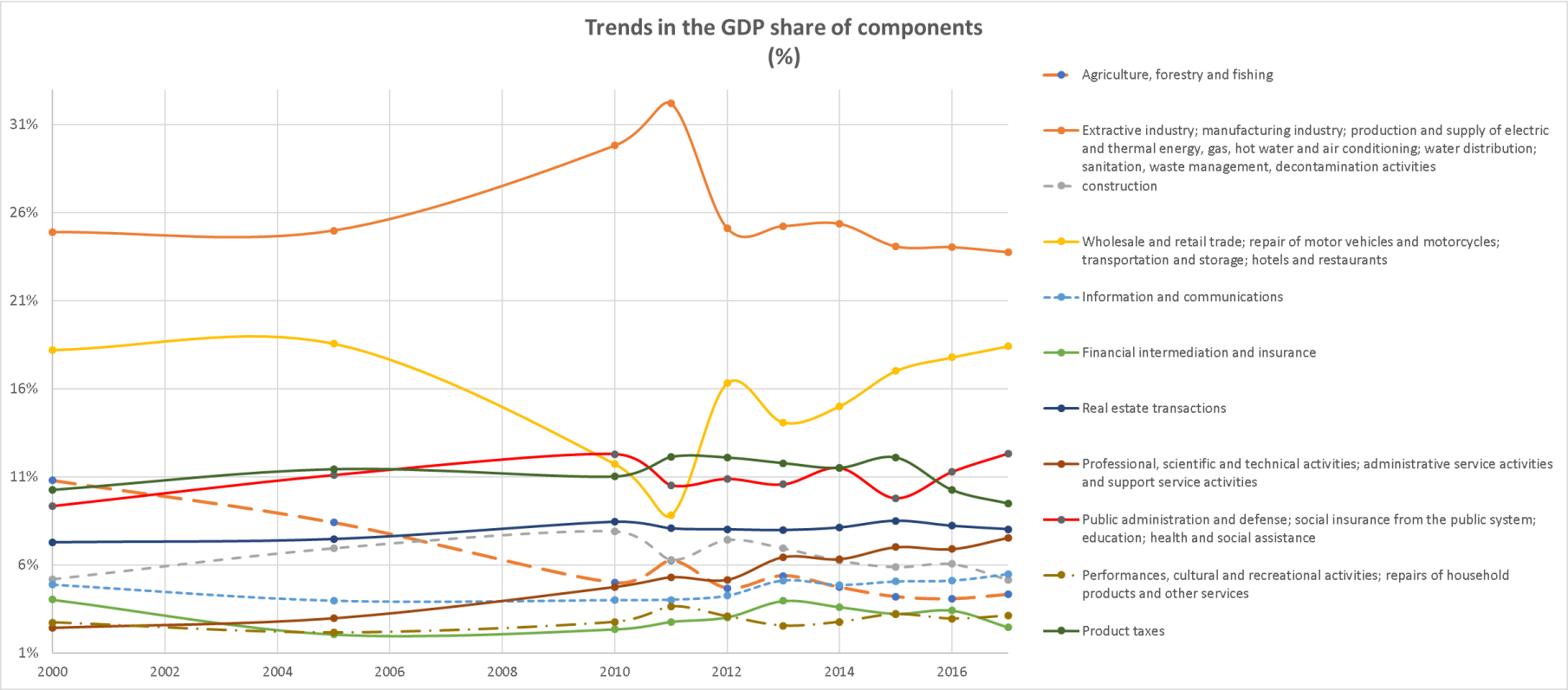


Figure II-14. Trends in the shares of the different components of GDP over the period 2000 - 2017
Source: The National Institute for Statistics

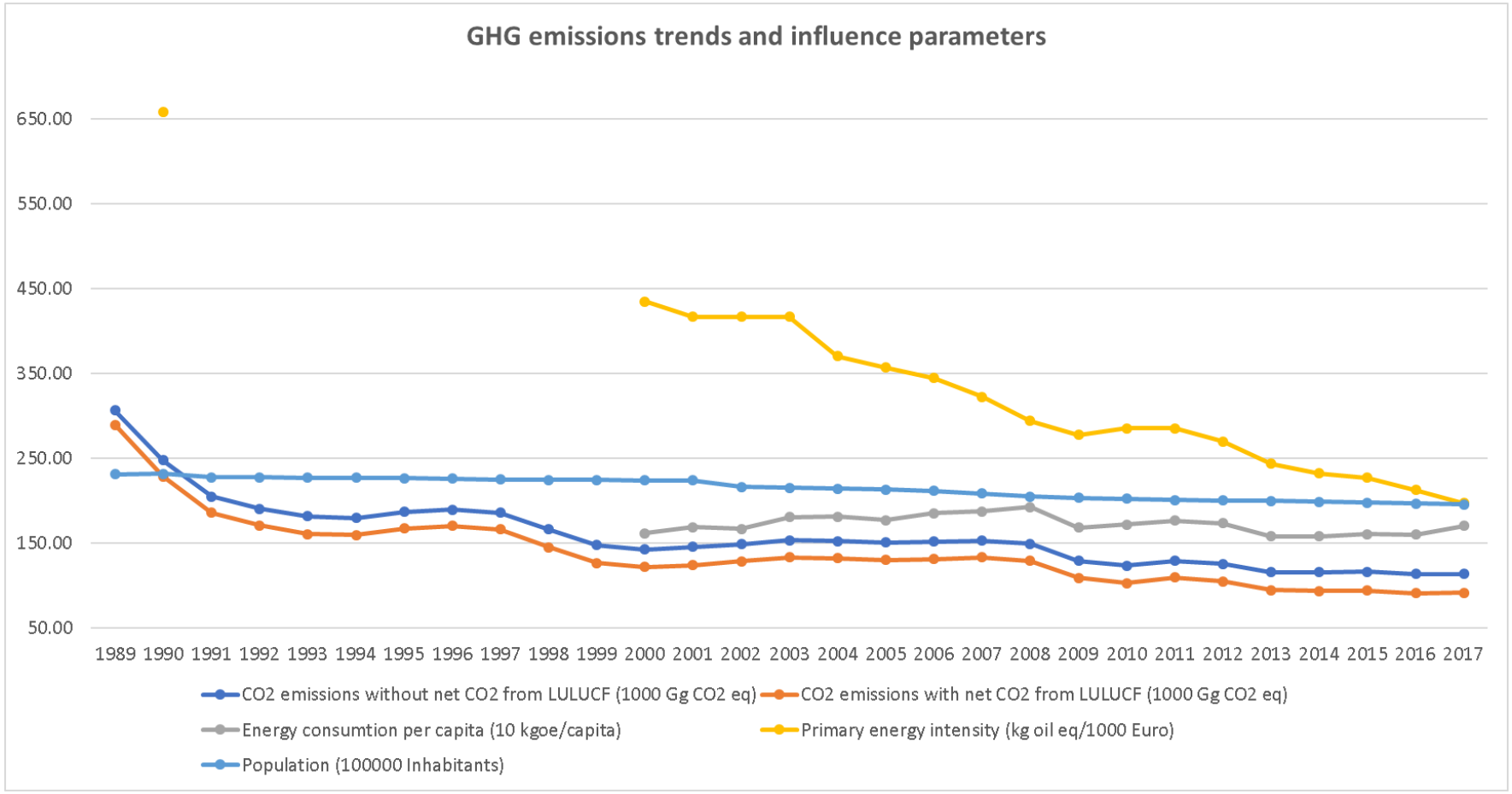


Figure II-15. GHG emissions trends and influence parameters 2000 - 2017
Source: The National Institute for Statistics

Energy

Among the industrial branches, one of the most important, due to its broad impact over the others, both in terms of costs and in terms of carbon emissions, is the energy industry.

Romania is endowed with diversified local energy sources, including natural gas, coal, oil, bioenergy, nuclear, hydro, and renewable energy. The country's primary energy supply in 2017 was 39.01 million tons of oil equivalent (mtoe), of which 34.85% was imported, and the rest supplied by domestic sources, with gas as the top at 33.87%, followed by hydro & nuclear electricity at 19.26 %, coal at 17.57 %, biofuels at 14.02 %, oil at 13.96 %, other fuels at 1.07 % and geothermal/wind/solar at 0.24 %.

The final energy consumption has been relatively stable during the period 2009 – 2017, varying between 23269 toe (in 2017) and 21736 toe (in 2014). Since 2014, it has been slowly increasing and the last two years registered an increase of 1.92% in 2016, compared to 2015 and 4.27% in 2017 compared to 2016.

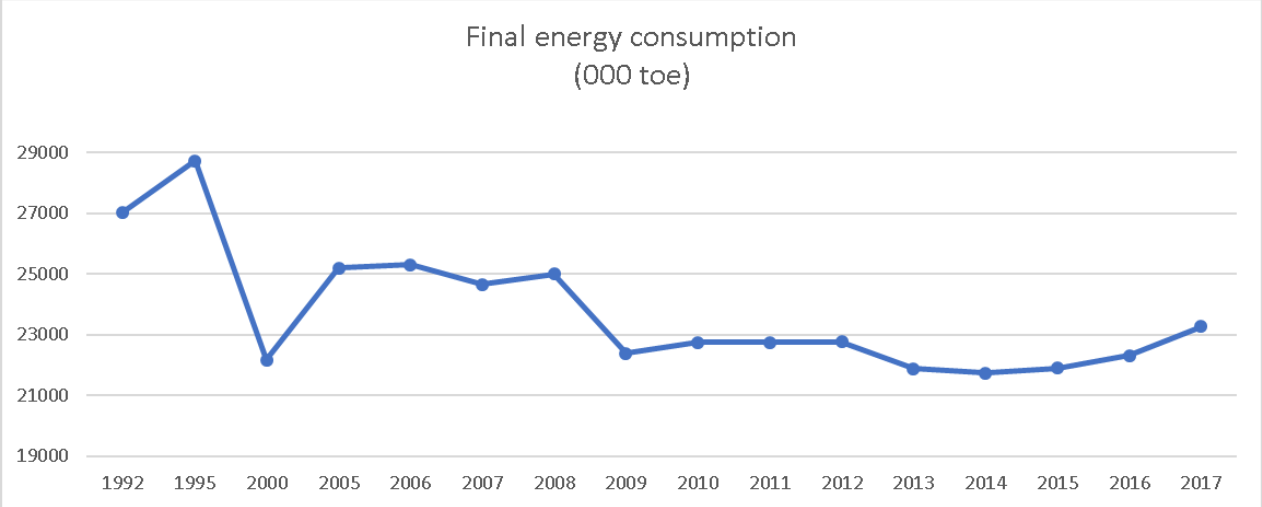


Figure II-16. Final energy consumption

Source: The National Institute for Statistics

In 2017, the final energy consumption of the population amounted for 33.11% and was followed by transport (29.76%) and industry (27.53%).

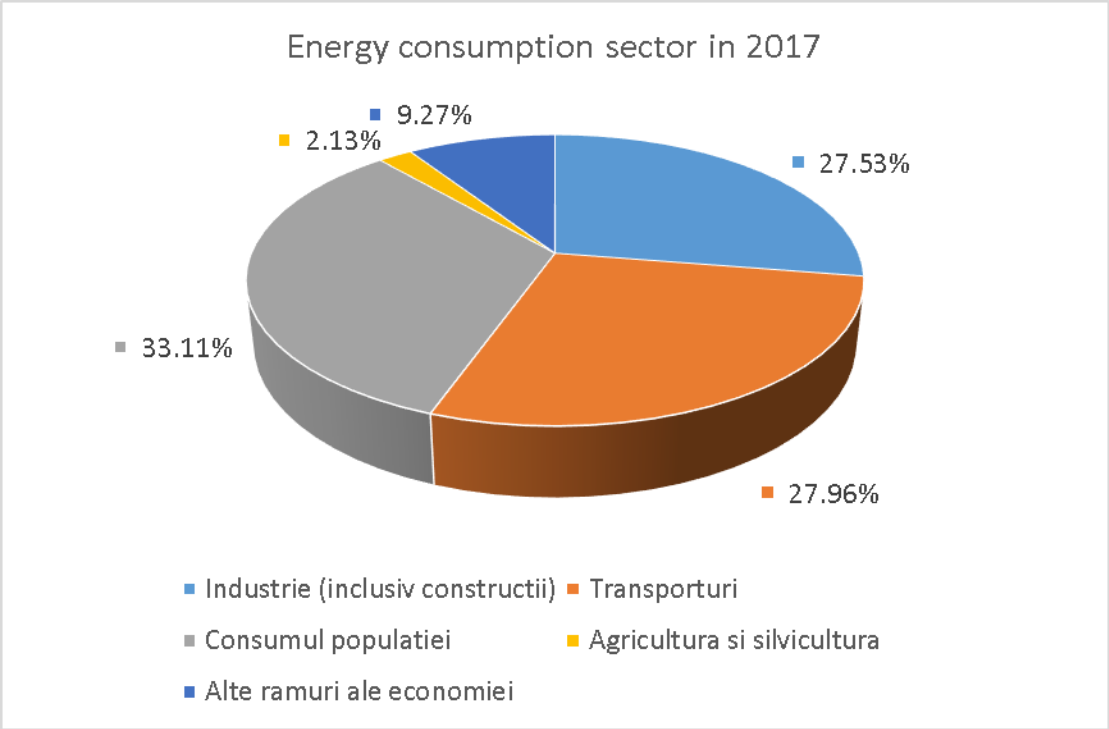


Figure II-17. Final energy consumption per sector

Source: The National Institute for Statistics

Electricity generation amounted for 61.32 TWh in 2017, of which about 4.7 % was (net) exported. The supplied energy was 57.48 TWh, while the domestic consumption was 54.59 TWh. The residential sector is the largest energy consumer (12.6 TWh or 23.08%), accounting for one-third of total energy consumption, followed by industry, transport, commercial services, and agriculture.

In terms of share in the electricity mix, coal was holding the largest share (almost 27%), followed by hydro (23%), nuclear (18%), natural gas (15%), wind (12%) and other resources (Figure II.18).

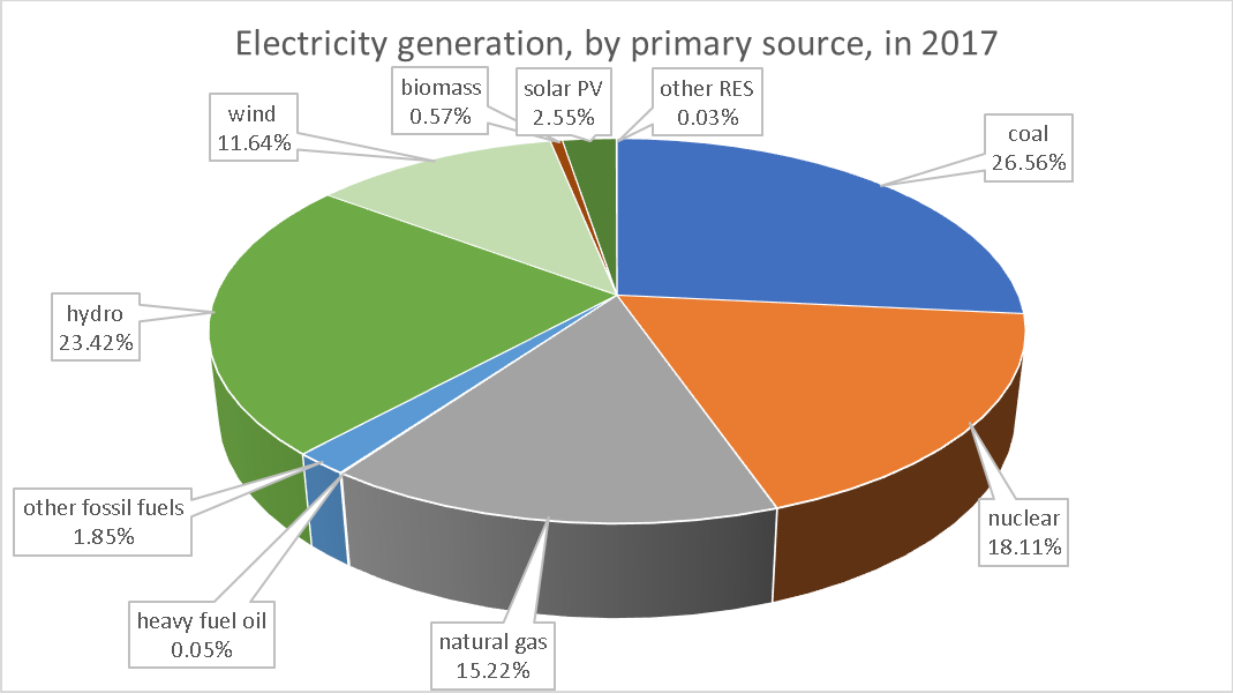


Figure II-18. Mix of electricity generation in 2017
Source: The National Energy Regulatory Authority

The reform progress has been limited in electricity generation—especially coal, gas, and hydro—where most generation capacity remains under Government ownership. The state-owned enterprises (SOEs) Termoelectrica and Hidroelectrica own older assets, most of which require an upgrade or need to be decommissioned. Their financial position is weaker than other entities in the electricity supply chain, partly because of less-performing assets, which constrain commercial financing options. However, large private wind and solar generation capacity has been added in recent years, supported by the Green Certificate subsidy scheme, which helped Romania exceed the EU renewable energy target. Thus, Romania has a significant overcapacity in the power generation and became a net exporter of electricity in the region.

The power grid is connected with all five neighboring countries—Hungary, Ukraine, Moldova, Bulgaria, and Serbia—and there are plans for additional connectivity. The gas grid is connected with Hungary and Ukraine for importing gas to Romania. Recently, a gas interconnector was built between Romania and Moldova, but it is not yet operational. For international gas transmission, the network already connects Ukraine, Romania, and Bulgaria, with more connectivity being planned.

District heating (DH) entities are largely owned by local governments and municipalities. However, the government has implemented various models—such as concessions and management contracts—of private participation in secondary cities. As a result, the DH

sector is fragmented, and recent attempts to harmonize DH regulation across the country and assure sustainability of DH systems have not yet proven successful.

In the natural gas sector, reform is progressing well across the value chain in line with the EU 3rd energy package. Gas transmission is a regulated monopoly, managed by Transgaz, which is listed on the stock exchange. Gas distribution is liberalized, although the market remains concentrated, with the top two distributors (GDF Suez and E.On) having 97 per cent of market share for households, and the top four distributors (Petrom, Romgaz, GDF Suez, and E.On) serving 90 percent of commercial customers.

*In terms of **primary energy intensity**, though the Romanian economy is still above the average EU 28, this has significantly decreased between 1990 and 2017, about 70%, from 658.8 to 197.6 kg oil eq/1000 Euro. The yearly average decrease rate is 4.3%.*

Transport

The energy consumption for transport has registered an increasing share, from 15.83% in 2000 to 27.96% in 2017 (almost double) in the final energy consumption in Romania and this is the sector growing the fastest; the energy consumption for road transportation represent about 90% in the total energy consumption for transportation and it seems to have decreased about 1% between 2014 and 2017. (Figure II.19 & Figure II.20)

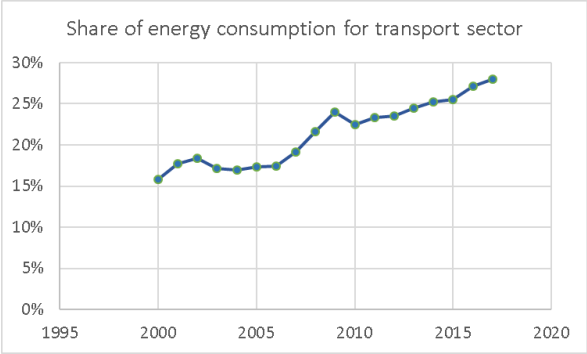


Figure II-19. Share of energy consumption for transport sector (in the total final energy consumption)
Source: The National Institute for Statistics

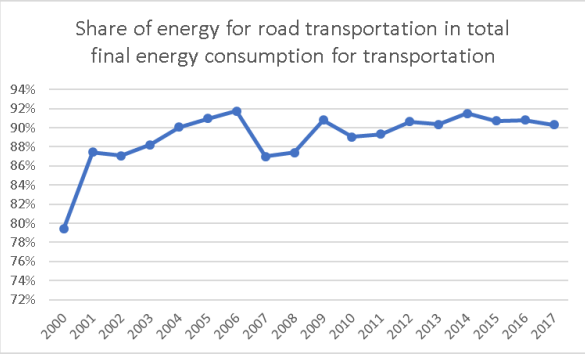


Figure II-20. Share of energy for road transportation in total final energy consumption for transportation
Source: The National Institute for Statistics

II.1.6. Accuracy/ Uncertainty of the data

Romania carried out the uncertainty analysis based on Approach 1 according to the provisions in Ch. 3, Vol.1, 2006 IPCC GLs. Considering the 2019 NGHGI and the Tier 1 method:

- the total NGHGI uncertainty for 2017 excluding LULUCF was 18.9%, while including LULUCF was 26.8%;
- the uncertainty introduced into the trend in total national emissions, for 2017, was 2.3% when considering excluding LULUCF criteria and 6.3%, including LULUCF.

II.2. National Inventory

Since the last submission, some changes have happened with respect to the LULUCF part of the GHG inventory. Further details on the NIS setup are provided below.

National systems in accordance with Article 5, paragraph 1, of the Kyoto Protocol

(a) Name and contact information for the national entity and its designated representative with overall responsibility for the national inventory of the Party

The contact information for the national entity, including its designated representative with overall responsibility for the national inventory are:

- National entity: National Environmental Protection Agency;
  Address: Splaiul Independenţei no. 294, Sector 6, Bucharest;

  Telephone: +40-21-2071101, fax: +40-21-207.11.03.
- Designated representative with overall responsibility:
  Name: Sorin Deaconu;

  Telephone: +40-21-2071101; fax: +40-21-2071103;

  e-mail: sorin.deaconu@anpm.ro.

(b) Roles and responsibilities of various agencies and entities in relation to the inventory development process, as well as the institutional, legal and procedural arrangements made to prepare the inventory

Based on Article 5 of the Kyoto Protocol, Romania established a National System (NS) for estimating the anthropogenic emissions for all greenhouse gases not covered by the Montreal Protocol. The system complies with the provisions of the subsequent decisions

of the CMPs of the Kyoto Protocol and with provisions of the Regulation (EU) no 525/2013.

In order to fulfil the obligations under the United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol and European Union legislation, in 2007 the Governmental Decision (GD) no. 1570 for establishing the National System for the estimation of anthropogenic greenhouse gas emissions levels from sources and removals by sinks was adopted, setting all institutional, legal and procedural aspects for supporting the Romanian authorities to estimate the GHG emissions/removals levels, to report and to archive the National Greenhouse Gas Inventory (NGHGI) information, including supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol.

The GD no. 1570/2007 was modified and completed, by GD no. 668/2012, GD no. 120/2014 and GD no. 1022/2016.

Before 1 April 2013, the competent authority was the National Environmental Protection Agency (NEPA), under the subordination of the Ministry of Environment and Climate Change (MECC, current Ministry of Environment, Waters and Forests - MEWF).

Based on the GD no. 48/2013, all NEPA climate change related structure, personnel, attributions and responsibilities were took over by MEWF, in order to improve the institutional arrangements and capacity within the climate change domain, thus increasing the efficiency in activities implementation also in respect to the NS/NGHGI administration; starting with 4 July 2016, NEPA is the competent authority for National System administration, according with GEO no. 9/2016 and GD no. 284/2016.

Institutional arrangements

The characteristics of the institutional arrangements include:

- Centralized approach – NEPA maintain a large degree of control and decision-making authority over the inventory preparation process;
- In-sourced approach, in majority – the major part of the inventory is prepared by NEPA (governmental agency); the LULUCF part is prepared by a consortia of research institutes as provided in GD 590/8.08.2019 (Figure II.22);
- Single agency – the single national entity is housed within a single governmental organization;
- Separate approach – the NGHGI related work is not integrated with other air pollutant inventories work; however, cross checking activities are periodically implemented.

The main institutional arrangements include:

- NEPA, as the competent authority, responsible for NS/NGHGI administration;

- Central and territorial public authorities, research and development institutes and other public organizations under the authority, in the subordination/coordination of central public authorities, owners and professional associations, economic operators and other relevant organizations, which have the obligation of providing to NEPA the necessary activity data, emission factors and associated uncertainty data;
- The National Institute for Statistics, as a main activity data supplier, through the yearly-published documents (National Statistical Yearbook, Energy Balance, other documents);
- Several sectors have been significantly improved during 2011 - 2014, as a result of implementation the studies [6] performed;
- The NGHGI Land Use, Land-Use Change and Forestry (LULUCF) Sector, both under the UNFCCC and KP, administrated during 2011 and 2012-2014 period by the National Institute for Research and Development in Forestry "Marin Drăcea" (INCDS), based on contract (for 2011) or Protocol of collaboration no. 2029/MMP-RP/3.07.2012 between Ministry of Environment, Waters and Forests, NEPA and INCDS (for period 2012-2014); also INCDS conducted during period 2011-2014 specific studies for LULUCF sector;[7]
- The preparation of Road transport category estimates, based on COPERT 4 model, administrated also based on the Protocol of collaboration no. 3136/MMP/9.07.2012 between Ministry of Environment and Forests, NEPA, Romanian Automobile Register and Directorate on Driving Licenses and Vehicles Registration in the Ministry of Administration and Interior. The period of collaboration is undetermined.

[6] *"Elaboration/documentation of national emission factors/other parameters relevant to NGHGI Sectors Energy, Industrial Processes, Agriculture and Waste, values to allow for the higher Tier calculation methods implementation"*, ISPE
"Determination of the biodegradable content industrial wastes amount and of sludge amount from wastewater treatment, deposited in managed landfills (for the period 1989-2012) and in unmanaged landfills (for the period 1950-2012). Determination of incinerated wastes type/amount and of parameters specific to their incineration, for the period 1989-2012. Wastes incineration N2O emissions estimation", 2013, ISPE
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the categories Lime production, Glass production and Ammonia production, according to the IPCC 2006 methodology", 2014, ISPE
"Elaboration and documentation of the parameters values relevant to the National Greenhouse Gas Inventory Industrial Processes Sector values to allow for the greenhouse gas emissions calculation methods, higher Tier methods, for the categories: Production of halocarbons and sulphur hexafluoride (HFCs, PFCs and SF6), Consumption of halocarbons and sulphur hexafluoride (actual emissions), Consumption of halocarbons and sulphur hexafluoride (potential emissions)", Denkstat

[7] *"NGHGI LULUCF both under the UNFCCC and KP obligations", 2011, INCDS;*
"Determination of emission/removal factors for the forest and for conversions from/to forest land associated pools both under UNFCCC and KP obligations" and "Compilation of the 2013 National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector both under the UNFCCC and KP obligations", 2012, INCDS;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2012 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Determination of emission-removal factors for the pools in forest areas and in areas in conversion from and to forest according with the obligations assumed as a Party to the UNFCCC and to the KP, for the 2014 year reporting", INCDS, 2013;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2014 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Administration of the NGHGI Land Use, Land-Use Change and Forestry Sector (CRF Sector 4), according to the obligations in the United Nations Framework Convention on Climate Change, including those in the Kyoto Protocol", 2014, INCDS.

The institutional arrangements currently used in Romania, presented in the Figure II.21., were updated during 2011÷ January 2012, based on the study[8], performed in 2011, which aimed to improve NS, develop the institutional capacity and establish the programs/measures for determining the emissions factors and other national relevant parameters.

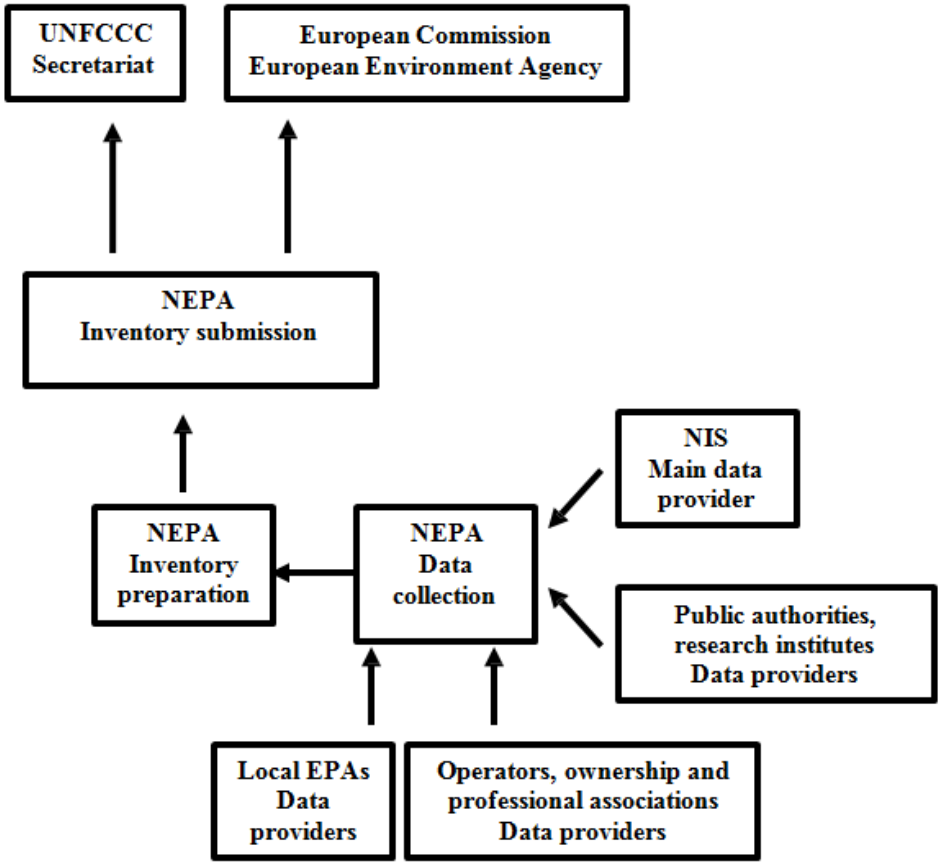


Figure II-21 Legal and procedural arrangements

[8] *"Support for the implementation of the European Union requirements on the monitoring and reporting of the carbon dioxide (CO_2) and other greenhouse gas emissions",* Institute for Studies and Power Engineering (ISPE)

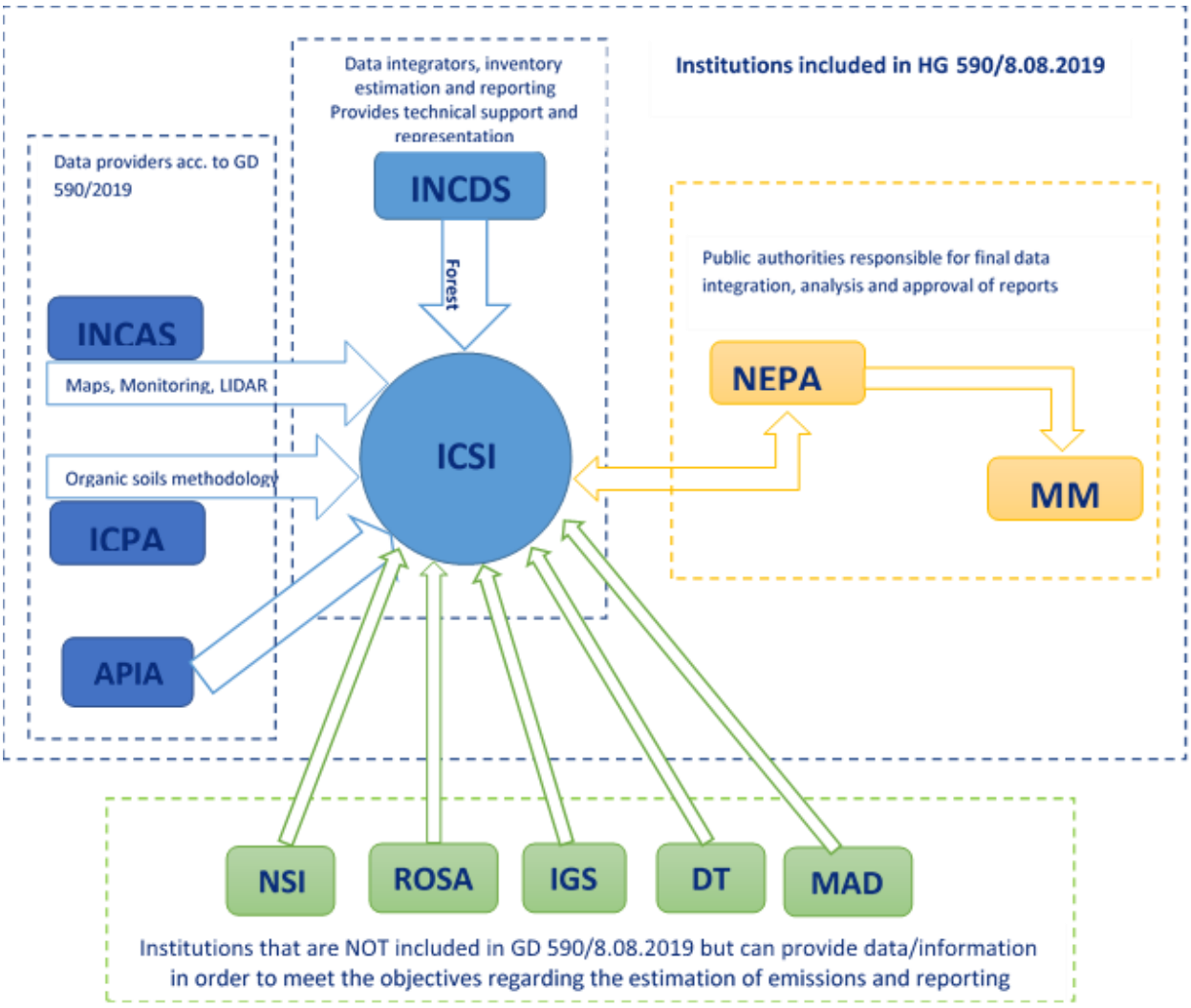


Figure II-22 Legal and procedural arrangements for LULUCF part of the NIS

MM - Ministry of Environment, Waters and Forests (MMWF)

NEPA - National Environmental Protection Agency

INCDS - National Institute for Research and Development in Forestry “Marin Drăcea”

INCAS - National Institute for Aerospace Research "Elie Carafoli"

ICPA - "National Research and Development Institute for Soil Science, Agrochemistry and Environment

APIA - National Agency of Payments in Agriculture

DT - Defense Geospatial Information Agency "General Division Constantin Barozzi" (AIGA)

ROSA - The Romanian Space Agency

IGS - General Inspectorate for Emergency Situations

LPIS - Land Parcel Identification System

MAD - Ministry of Agriculture and Rural Development

The legal and procedural framework specific to the NS include:

- GD no. 1022/2016 and GD no. 120/2014 for modifying and completing GD no. 1570/2007 for establishing the National System for the estimation of anthropogenic greenhouse gas emissions levels from sources and removals by sinks of all GHGs, regulated through the KP;
- GD no. 1000/2012 on the reorganization and functioning of the National Environmental Protection Agency and of the subordinated public institutions;
- GD no. 38/2015 on the organization and functioning of the Ministry of Environment, Waters and Forests;
- GD no. 668/2012 for modifying and completing the GD no. 1570/2007 for establishing the National System for estimation of anthropogenic greenhouse gas emissions levels from sources and removals of CO_2 by sinks, regulated through the KP;
- GD no. 1570/2007 for establishing the National System for the estimation of anthropogenic greenhouse gas emissions levels from sources and removals of CO2 by sinks, regulated through the KP;
- Government Urgency Ordinance no. 9/2016 for modifying and completing the Government Urgency Ordinance no. 195/2005 on the environment protection, as well as modifying Article 3 in the Government Urgency Ordinance no. 32/2015 on the establishment of Forestry Guards;
- Government Decision no. 284/2016 for modifying and completing the Government Decision no. 38/2015 on organization and functioning of the Ministry of Environment, Waters and Forests, as well as other normative acts;
- Ministry of Environment Order (MoEO) no. 1376/2008 for approving the Procedure on NGHGI reporting and the modality for answering to the observations and questions raised following the NGHGI review;
- MoEO no. 1474/2008 for approving the Procedure on processing, archiving and storage of data specific to the NGHGI;
- MoEO no. 1442/2014 for approving the Procedure on selection of the estimation methods and of the emission factors for the estimation of the GHG levels;
- MoEO no. 1602/2014 for aproving the QA/QC Procedure related to the NGHGI;
- Protocol of collaboration no. 3136/MMP/9.07.2012 between Ministry of Environment and Forests, NEPA, Romanian Automobile Register and Directorate on Driving Licenses and Vehicles Registration in the Ministry of Administration and

Interior, on the preparation of Road transport category estimates based on COPERT 4 model.

- GD 590/2019 for defining the management obligations of the Land use subdomain, land use change and forestry (LULUCF), part of the climate change field

(c) Description of the process for collecting activity data, for selecting emission factors and methods, and for the development of emission estimates

According to the GD no. 1570/2007 establishing the National System for the estimation of the GHG emissions levels from sources and removals by sinks, modified and completed, the implementation of the National System ensures the NGHGI quality in three phases:

- Planning;
- Preparation;
- Management of the NGHGI preparation activities.

Data collection process comprises the following steps:

- Identification of data requirements;
- Identification of potential data suppliers;
- Preparation of specific questionnaires;
- Submitting the questionnaires to the potential suppliers of data;
- Data collection;
- Data verification: activity data received are examined (time series discrepancies, large changes in values from the previous to the current inventory year).

Emission factors selection is performed according to the provisions of the MoEO no. 1442/2014 for approving the Procedure on selection of the estimation methods and of the emission factors needed for the estimation of the GHG levels.

Due to NEPA/ MEWF's work, for the implementation of the studies[9] performed in period 2011-2014 for several sectors (Energy, Industrial Processes, Agriculture, LULUCF and

[9] *"Elaboration/documentation of national emission factors/other parameters relevant to NGHGI Sectors Energy, Industrial Processes, Agriculture and Waste, values to allow for the higher Tier calculation methods implementation", 2011, ISPE;*
"NGHGI LULUCF both under the UNFCCC and KP obligations", 2011, INCDS;
Determination of emission/removal factors for the forest and for conversions from/to forest land associated pools both under UNFCCC and KP obligations" and "Compilation of the 2013 National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector both under the UNFCCC and KP obligations", 2012, INCDS;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2012 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Elaboration and documentation of the parameters values relevant to the National Greenhouse Gas Inventory Industrial Processes Sector values to allow for the greenhouse gas emissions calculation methods, higher Tier methods, for the categories: Production of halocarbons and sulphur hexafluoride (HFCs, PFCs and SF6), Consumption of halocarbons and sulphur hexafluoride (actual emissions), Consumption of halocarbons and sulphur hexafluoride (potential emissions)", Denkstat;
"Determination of the biodegradable content industrial wastes amount and of sludge amount from wastewater treatment, deposited in managed landfills (for the period 1989-2012) and in unmanaged landfills (for the period 1950-2012). Determination of incinerated

Waste) and implementation of Protocol of collaboration (for LULUCF sector and Road transport category), a significant amount of activity data and emission factors have been collected/processed/developed, enabling the development of higher estimates/tier estimates and a significant decrease of the number of categories characterized using the NE notation key.

Also, the informational fluxes for data collection from the operators from the Energy Sector (Energy Industries and Manufacturing Industries and Construction) and from the the Waste Sector (Solid Waste Disposal on Land and Waste Water Handling) were optimized, due to the implementation of an integrated informational system, developed according with the study[10] performed SC Asesoft International SA-SC Team Net International SA-SC Star Storage SRL consortium, based on a contract with NEPA.

The main data sources used for activity data are presented in the following table.

Table II-3. Data sources used for activity data

Sector	Data sources
Energy	National Institute for Statistics (Energy Balance) Energy producers Ministry of Economy Romanian Civil Aviation Authority Transgaz SA National Authority on Regulating in Energy National Agency for Mineral Resources
Industrial Processes and product use	National Institute for Statistics (Statistical Yearbook, other data sources) Industrial operators through 42 Local Environmental Protection Agencies Direct information from industrial operators

wastes type/amount and of parameters specific to their incineration, for the period 1989-2012. Wastes incineration N2O emissions estimation", 2013, ISPE;
"Determination of emission-removal factors for the pools in forest areas and in areas in conversion from and to forest according with the obligations assumed as a Party to the UNFCCC and to the KP, for the 2014 year reporting", INCDS, 2013;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2014 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the categories Lime production, Glass production and Ammonia production, according to the IPCC 2006 methodology", 2014, ISPE, UPB;
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the category Iron and steel production, according to the IPCC 2006 methodology" 2014, UPB, ISPE;
"Estimation of methane emissions from industrial wastewater according to the IPCC 2006 methodology", 2014, ISPE;
"Administration of the NGHGI Land Use, Land-Use Change and Forestry Sector (CRF Sector 4), according to the obligations in the United Nations Framework Convention on Climate Change, including those in the Kyoto Protocol", 2014, INCDS.

[10] *"Environmental Integrated Informational System"*, SC Asesoft International SA, SC Team Net International SA, SC Star Storage SRL

Agriculture	National Institute for Statistics
LULUCF	National Institute for Statistics (Statistical Yearbook) Ministry of Agriculture, Forests and Rural Development (MADR)-Forests General Directorate (2007-2008); Ministry of Environment and Forests-Forests General Directorate (2009-2011) National Forest Administration (RNP)
Waste	National Institute for Statistics National Environmental Protection Agency Public Health Institute National Administration "Romanian Waters" Food and Agriculture Organization Landfill operators through 42 Local Environmental Protection Agencies

The sources of the emission factors/increment rates used are: national studies, IPCC 2006, national research institutes and plants, in a limited number.

Data processing and emissions calculation

Data processing is performed according to the provisions of the Ministry of Environment, Waters and Forests Order no. 1474/2008 for approving the Procedure on processing, archiving and storage of data specific to the NGHGI.

Activities were carried out mostly by NEPA/MEWF, ISPE and INCDS, as contractors of studies mentioned above implemented in period 2011 - 2014; specific activities comprise:

- Primary data processing:
- Checking the completeness of all data and information for all years and categories within the analyzed period;
- Completing the datasets, using also default IPCC interpolation/extrapolation and/or alternative techniques;
- Checking the accuracy and consistency of datasets;
- Values transformation, in order to reach the measurement unit adequate within the method used;
- Data aggregation/disaggregation considering the IPCC classification;
- Calculation and/or adjustment of different parameters considering the available data;
- Selection of the emission factors and of the methods;
- Application of methods;
- Emissions/removals estimates, using the most recent data;

- Internal review (errors are rectified);
- Preparation of the national inventory report.

The previous activities were also implemented as part of collaboration between:

- MEWF, NEPA, Romanian Automobile Register and Directorate on Driving Licenses and Vehicles Registration in the Ministry of Internal Affairs, in the framework of the Protocol of collaboration no. 3136/MMP/9.07.2012, on preparation of Road transport category estimates based on COPERT 4 model;
- MEWF, NEPA and INCDS, in the framework of the Protocol of collaboration no. 3029/MMP-RP/3.07.2012, on administrating by INCDS of the LULUCF Sector, both under UNFCCC and KP.

The emissions from KP Annex A Sectors are estimated following the IPCC 2006.

Data archive

Data archiving is done according to the provisions of the Ministry of Environment Order no. 1474/2008 for approving the Procedure on processing, archiving and storage of data specific to the NGHGI.

NEPA team manages and maintains the NGHGI database and the documentation of specific inventory information. According to the provisions set by IPCC 2006, the NGHGI documentation includes:

- Assumptions and criteria for selection of AD and EF;
- EF used, including references to IPCC documents for default factors or to published references or other documentation for emission factors used in higher tier methods;
- AD or sufficient information to enable activity data to be traced to the referenced source;
- Information on the uncertainty associated with AD and EF;
- Rationale for choice of methods;
- Methods used, including those used to estimate uncertainty;
- Changes in data inputs or methods from previous years;
- Identification of individuals providing expert judgment for uncertainty estimates and their qualifications to do so;
- Details of electronic databases or software used for the inventory, including versions, operating manuals, hardware requirements and any other information required to enable their later use;
- Worksheets and interim calculations for category estimates, aggregated estimates and any recalculations of previous estimates;
- Final inventory report and any analysis of trends from previous years;

- QA/QC plans and outcomes of QA/QC procedures.

All inventory information, as far as needed to reconstruct and interpret inventory data and to describe the national system and its functions, is accessible at a single location – NEPA. While all information officially submitted according to the requirements of the Kyoto Protocol is translated into English, this is not possible for all background information made available during the review process, as the official inventory documentation language is Romanian.

Specific NGHGI data are archived as follows:

- Electronically – all available documents;
- On paper – the documents used for the NGHGI preparation unavailable in electronic format and the correspondence with different organizations.

In order to ensure the security of databases and the confidentiality of the background data, both paper and electronic data are kept under restricted access conditions (NEPA site). Furthermore, electronic data backup activities are undertaken on server with daily frequency during the generation of the official submission and weekly in rest of cases.

(d) Description of the process of key source identification and, where relevant, archiving of test data

The key category analysis (KCA) has been performed according to the provisions in Chapter 4, of IPCC 2006, vol. 1 following the Tier 1 approach.

Separate key category analysis was conducted taking into account both the exclusion and inclusion of the LULUCF sector and also both level and trend criteria; all IPCC sectors and categories, sources and sinks (as recommended in Table 4.1 of IPCC 2006), and gases were analyzed. KCA was conducted for every year of the characterized period.

(e) Description of the process for the recalculation of previously submitted inventory data

According to the relevant provisions in IPCC 2006 and the Ministry of Environment Order no. 1376/2008 for approving the Procedure on NGHGI reporting and the modality for answering to the observations and questions raised following the NGHGI review, the recalculations of the emissions/removals estimations are performed and applied in the following cases:

- Available data have changed;
- The previously used method is not consistent with good practice guidance for that source category;
- A category has become a key category;

- The previously used method is insufficient to reflect mitigation activities in a transparent manner;
- New methods become available;
- Inclusion of new source/removal categories;
- Changes in the activity data and emission factors acquisition and use;
- Correction of identified errors;
- Other cases, in accordance with the relevant good practices

Regardless of their magnitude, the recalculations are performed by NEPA for every year of the analyzed period, between the base year and the last reported year. Recalculations are performed using a single method for all years, including, when needed, alternative techniques as interpolation, extrapolation and other relevant techniques.

Based on IPCC 2006, Romania implemented significant recalculations in order to account for better AD and/or EFs, mainly based on NEPA's work, on the studies[11] implemented in 2011- 2014 period. The recalculations resulted in significant increase of the accuracy, completeness and consistency of data series.

The information on recalculations, reported within the CRF tables and within the NIR, contains the information on used procedures, methods applied, emission factors and activity data and information on source/removal categories not previously analyzed.

[11] *"Elaboration/documentation of national emission factors/other parameters relevant to NGHGI Sectors Energy, Industrial Processes, Agriculture and Waste, values to allow for the higher Tier calculation methods implementation", 2011, ISPE;*
"NGHGI LULUCF both under the UNFCCC and KP obligations", 2011, INCDS;
Determination of emission/removal factors for the forest and for conversions from/to forest land associated pools both under UNFCCC and KP obligations" and "Compilation of the 2013 National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector both under the UNFCCC and KP obligations", 2012, INCDS;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2012 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Elaboration and documentation of the parameters values relevant to the National Greenhouse Gas Inventory Industrial Processes Sector values to allow for the greenhouse gas emissions calculation methods, higher Tier methods, for the categories: Production of halocarbons and sulphur hexafluoride (HFCs, PFCs and SF6), Consumption of halocarbons and sulphur hexafluoride (actual emissions), Consumption of halocarbons and sulphur hexafluoride (potential emissions)", Denkstat;
"Determination of the biodegradable content industrial wastes amount and of sludge amount from wastewater treatment, deposited in managed landfills (for the period 1989-2012) and in unmanaged landfills (for the period 1950-2012). Determination of incinerated wastes type/amount and of parameters specific to their incineration, for the period 1989-2012. Wastes incineration N2O emissions estimation", 2013, ISPE;
"Determination of emission-removal factors for the pools in forest areas and in areas in conversion from and to forest according with the obligations assumed as a Party to the UNFCCC and to the KP, for the 2014 year reporting", INCDS, 2013;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2014 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the categories Lime production, Glass production and Ammonia production, according to the IPCC 2006 methodology", 2014, ISPE, UPB;
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the category Iron and steel production, according to the IPCC 2006 methodology" 2014, UPB, ISPE;
"Estimation of methane emissions from industrial wastewater according to the IPCC 2006 methodology", 2014, ISPE;
"Administration of the NGHGI Land Use, Land-Use Change and Forestry Sector (CRF Sector 4), according to the obligations in the United Nations Framework Convention on Climate Change, including those in the Kyoto Protocol", 2014, INCDS.

(f) Description of the quality assurance and quality control plan, its implementation and the quality objectives established, and information on internal and external evaluation and review processes and their results in accordance with the guidelines for national systems

Romania established the QA/QC Procedure based on the UNFCCC and Kyoto Protocol's provisions related to the NGHGI and the NS, the IPCC 2006 provisions, and on the GD no. 1570/2007 establishing the National System for the estimation of the anthropogenic GHG emissions levels from sources and removals by sinks, as modified and completed. QA/QC activities are both described within the QA/QC Programme and within the QA/QC Procedure related to the NGHGI, approved by the Order no. 1602/2014.

The QA/QC Programme and the QA/QC Procedure comprise information on:

- The national authority responsible for the coordination of QA/QC activities;
- The objectives envisaged within the QA/QC framework;
- The QA/QC Plan;
- The QC procedures;
- The QA procedures.

According to GD no. 1570/2007 establishing the national system, as modified and completed, and Order no. 1602/2014, NEPA, as competent authority responsible with the implementation of the QA/QC activities under the NGHGI, is performing the following activities:

- Ensures that specific QA/QC objectives are established;
- Develops and regularly updates a QA/QC plan;
- Implements the QA/QC procedures.

Considering the provisions of relevant regulations, NEPA designated a QA/QC coordinator.

The overall objective of the QA/QC Programme is to develop the NGHGI in line with the requirements of the IPCC 2006 and with the provisions of the Regulation (EU) no 525/2013 on a mechanism for monitoring and reporting greenhouse gas emissions and Regulation (EU) no 749/2014.

Romania QA/QC plan follows the definitions, guidelines and processes presented in Chapter 8 – Quality Assurance and Quality Control of the IPCC 2006. The QA/QC plan, as a main part of QA/QC procedures, outlines the current and planned QA/QC activities performed during all stages of the inventory preparation.

The QA/QC plan is reviewed periodically, if needed, and may be modified as appropriate when changes in processes occur or based on the advice from independent reviewers.

The QA/QC plan is intended to ensure the fulfilment of the NGHGI principles in Romania. The objectives of the plan include:

- Applying greater QC effort for key categories and for those categories where data and methodological changes have occurred recently;
- Periodically checking the validity of all information, as changes in reporting, methods of collection or frequency of data collection occur;
- Conducting the general procedures outlined in QC procedures (Tier 1) on all parts of the inventory over a complete exercise;
- Balancing efforts between development and implementation of QA/QC procedures and continuous improvement of inventory estimates;
- Customizing the QC procedures to the resources available and the particular characteristics of Romania's greenhouse gas inventory;
- Confirming that the National Statistical Institute and other agencies/companies supplying activity data have implemented QC procedures.

QC activities

QC activities were implemented by each sectoral expert during all phases of inventory preparation, focusing on key categories.

The following QC activities are conducted annually, before and during the preparation of estimates (15 September÷ 30 October):

- Checking the specific requirements regarding the reporting deadlines;
- Verification of the data collection against the information needed;
- Checking the correct transcription of input data into the calculation sheets;
- Checking the correctness of conversion factors used in calculation;
- Checking the data structures integrity and the disaggregation of activity data at calculation sheets level;
- Checking the concordance between the data measurement units in the calculation sheets and the equivalent data in the CRF Reporter format;
- Checking the consistency and the data values used in the AD and EF series, at the calculation sheets level;
- Identifying common parameters to multiple source or sink categories and checking the values consistency between source or sink categories;
- Checking the emissions/removals calculation into the calculation sheets, by reproducing a representative sample calculation;
- Checking the correctness of the aggregation of estimated emissions/removals at the calculation sheets level.

The following QC activities are conducted annually, during and after the preparation of estimates (15 October ÷ 10 January ÷ 10 March):

- Checking the emissions/removals estimates for all sources, sinks for the entire time series;
- Checking the explanations, when the emissions/removals estimates are lacking;
- Checking the correctness and consistency of choosing the AD, EF and methods used along the entire time series;
- Checking the trends for identifying the outliers and re-analyze the values;
- Checking the correctness of recalculations and the existence of explanations;
- Checking the recording and archiving of AD, EF and methods used;
- Checking the correctness and the completeness of the data transcription from the calculation sheets level to the CRF Reporter level;
- Checking the correctness and the completeness of the data transcription from the CRF Reporter level to the CRF tables level;
- Checking the data used in the NIR against the CRF tables and calculation sheets;
- Checking the correctness of applied methods descriptions, at the NIR's level;
- Checking the references completeness at the NIR's level;
- Checking the archiving of the CRF tables, NIR, CRF Reporter's specific databases and the calculation sheets;
- Checking the key categories persistency along the time series;
- Checking the adequate qualification of individuals providing expert judgments on the uncertainty estimates and the archiving of documentation regarding the qualification and the expert judgments;
- Checking the uncertainty calculation correctness, by partially replying the Monte Carlo analysis;
- Verification the implementation of ERT recommendations;
- Checking the completeness of archiving the QA/QC documentation (QA/QC programme, checklists, ERT report, improvements lists);
- Checking the performance of QA/QC Programme and propose improvements.

Within the specified deadlines, the previously mentioned activities are performed at sectoral level. Based on specific sectoral responsibilities allocated within the sector, the QC checks are performed for certain category by a sectoral expert not being involved in the administration, including estimating emissions/removals of that category (cross-checking approach).

The results of all checks outlined above are documented in the annual QC checklists for inventory preparation. For this purpose, QC checklists are used consistently throughout the years by all experts involved in the inventory preparation.

Additionally, during 2011- 2014 period, the QC activities were performed by contractors, as part of the studies[12] performed for improvement of the NGHGI.

QA activities

As part of EU Member State, starting with 1st of January 2007, Romania has the obligation to prepare and submit the NGHGI according to the Regulation (EU) no. 525/2013 and to the Commission Implementing Regulation (EU) no. 749/2014, which provides for a QA activity after the first submission (15th of January) and a final QA for all 28 EU Member States (first half of March for the preparation of the EC inventory). In this respect, starting with 2007, Romania has the possibility to verify the inventory twice before the official submission to the UNFCCC Secretariat.

In order to get an objective assessment of the inventory quality and for identifying areas where improvements can be made, involved third party reviewers at the QA activities level, according to the provisions in IPCC, depending on the availability of resources. In this scope, MEWF developed the specific procedural arrangements. NEPA through its international contacts and bilateral agreements identified the available processes for ensuring the implementation of QA activities.

[12] "*Elaboration/documentation of national emission factors/other parameters relevant to NGHGI Sectors Energy, Industrial Processes, Agriculture and Waste, values to allow for the higher Tier calculation methods implementation", 2011, ISPE;*
"NGHGI LULUCF both under the UNFCCC and KP obligations", 2011, INCDS;
Determination of emission/removal factors for the forest and for conversions from/to forest land associated pools both under UNFCCC and KP obligations" and "Compilation of the 2013 National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector both under the UNFCCC and KP obligations", 2012, INCDS;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2012 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Elaboration and documentation of the parameters values relevant to the National Greenhouse Gas Inventory Industrial Processes Sector values to allow for the greenhouse gas emissions calculation methods, higher Tier methods, for the categories: Production of halocarbons and sulphur hexafluoride (HFCs, PFCs and SF6), Consumption of halocarbons and sulphur hexafluoride (actual emissions), Consumption of halocarbons and sulphur hexafluoride (potential emissions)", Denkstat;
"Determination of the biodegradable content industrial wastes amount and of sludge amount from wastewater treatment, deposited in managed landfills (for the period 1989-2012) and in unmanaged landfills (for the period 1950-2012). Determination of incinerated wastes type/amount and of parameters specific to their incineration, for the period 1989-2012. Wastes incineration N2O emissions estimation", 2013, ISPE;
"Determination of emission-removal factors for the pools in forest areas and in areas in conversion from and to forest according with the obligations assumed as a Party to the UNFCCC and to the KP, for the 2014 year reporting", INCDS, 2013;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2014 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the categories Lime production, Glass production and Ammonia production, according to the IPCC 2006 methodology", 2014, ISPE, UPB;
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the category Iron and steel production, according to the IPCC 2006 methodology" 2014, UPB, ISPE;
"Estimation of methane emissions from industrial wastewater according to the IPCC 2006 methodology", 2014, ISPE;
"Administration of the NGHGI Land Use, Land-Use Change and Forestry Sector (CRF Sector 4), according to the obligations in the United Nations Framework Convention on Climate Change, including those in the Kyoto Protocol", 2014, INCDS.

Until now, NEPA was the beneficiary of technical support provided by the Austrian Environment Agency (as part of the twinning project RO/2006/IB/EN/09). One of the most important activities performed within this framework was the review of different NGHGI sectors. Austrian experts provided specific recommendations consisting in:

- Improvement of transparency at sectoral level, considering the trend and recalculations description;
- Improvement of transparency at sectoral level, by providing a cumulative table on the status of emissions/removals estimation for each sub-sector;
- Improvement on knowledge on practical ways for performing and documenting the QA/QC activities;
- Improvement of the NGHGI archiving structure.

Until first half of 2011, NGHGI team was the beneficiary of a Netherlands Government to Government (G2G) project. One of the main aims of the project was to develop the reporting capacity of the NGHGI team also by assessing the possibility to use higher tier methods. Specific activities comprised:

- Advices on improving the NGHGI sectoral data documentation (through the use of the documentation list);
- Training courses/presentations related to using of data specific to other reporting mechanisms at the GHG Inventory level (use of ETS data, use of COPERT model);
- Discussions/advices on methodological issues (data collection, emissions estimation) on GHG emissions recovery within the Industrial Processes and Waste activities;
- Advices on moving to higher Tier levels in the Energy Sector:
    - Calculation of specific emission factors;
    - Use of COPERT model in estimating the Road Transport emissions.
    - Advices on using national data for the calculation of natural gas transit fugitive emissions;
    - Advices on moving on Tier 2 at the Enteric Fermentation, Manure Management and Agricultural Soils levels:
        - ❖ Precise identification of activity data;
        - ❖ Workshop on elaborating the specific requirements for the emission factors/ other parameters study development;
        - ❖ Other relevant advices.
- Advices on moving on First Order Decay method at the Solid Waste Disposal Sites level and other relevant advices;
- Other advices relevant to the Waste Sector;
- Identification of the practical ways to complete the estimation of emissions/ removals specific to Kyoto Protocol's Art. 3.3 and 3.4 activities: afforestation/ reforestation/deforestation, forest management and revegetation.

QA activities were also performed in 2011-2014, according to the relevant provisions of IPCC 2006, as part of the studies[13] performed for improvement of the NGHGI.

Additionally, in 2012, the NGHGI has been subject to a thorough review within the European Union, review under the Decision no. 406/2009/EC on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020; also, in the period of 2015-2019, the inventory was reviewed in the context of annual monitoring and compliance cycle.

National inventory submissions to the UNFCCC Secretariat are subject to the review under Article 8 of the Kyoto Protocol and procedures defined in the relevant COP/MOP decisions.

All recalculations planned and performed (including those following the UNFCCC ERT review) are mentioned in the improvement lists.

The results of QA checks (excepting those of checks performed under Regulation no. 525/2013, Commission Implementing Regulation (EU) no. 749/2014 and 406/2009/EC and, respectively, by ERT) are documented in the annual QA checklists for inventory preparation. For this purpose, QA checklists are used consistently throughout the years by all inventory experts involved in the inventory compilation.

[13] "*Elaboration/documentation of national emission factors/other parameters relevant to NGHGI Sectors Energy, Industrial Processes, Agriculture and Waste, values to allow for the higher Tier calculation methods implementation", 2011, ISPE;*
"NGHGI LULUCF both under the UNFCCC and KP obligations", 2011, INCDS;
Determination of emission/removal factors for the forest and for conversions from/to forest land associated pools both under UNFCCC and KP obligations" and "Compilation of the 2013 National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector both under the UNFCCC and KP obligations", 2012, INCDS;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2012 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Elaboration and documentation of the parameters values relevant to the National Greenhouse Gas Inventory Industrial Processes Sector values to allow for the greenhouse gas emissions calculation methods, higher Tier methods, for the categories: Production of halocarbons and sulphur hexafluoride (HFCs, PFCs and SF6), Consumption of halocarbons and sulphur hexafluoride (actual emissions), Consumption of halocarbons and sulphur hexafluoride (potential emissions)", Denkstat;
"Determination of the biodegradable content industrial wastes amount and of sludge amount from wastewater treatment, deposited in managed landfills (for the period 1989-2012) and in unmanaged landfills (for the period 1950-2012). Determination of incinerated wastes type/amount and of parameters specific to their incineration, for the period 1989-2012. Wastes incineration N2O emissions estimation", 2013, ISPE;
"Determination of emission-removal factors for the pools in forest areas and in areas in conversion from and to forest according with the obligations assumed as a Party to the UNFCCC and to the KP, for the 2014 year reporting", INCDS, 2013;
"Compilation of the National Greenhouse Gas Inventory Land Use, Land-Use Change and Forestry Sector for the 2014 year associated reporting, according with the obligations assumed as a Party to the UNFCCC and to the KP", 2013, INCDS;
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the categories Lime production, Glass production and Ammonia production, according to the IPCC 2006 methodology", 2014, ISPE, UPB;
"Elaboration and documentation of values for the parameters relevant to the National Greenhouse Gas Inventory Sector Industrial Processes and Product Use, values to allow for the implementation of the higher tier greenhouse gas emissions calculation methods for the category Iron and steel production, according to the IPCC 2006 methodology" 2014, UPB, ISPE;
"Estimation of methane emissions from industrial wastewater according to the IPCC 2006 methodology", 2014, ISPE;
"Administration of the NGHGI Land Use, Land-Use Change and Forestry Sector (CRF Sector 4), according to the obligations in the United Nations Framework Convention on Climate Change, including those in the Kyoto Protocol", 2014, INCDS.

(g) Description of the procedures for the official consideration and approval of the inventory

According with provisions of the GD no. 1570/2007, modified and completed, and of the MoEO no. 1373/2008, the NGHGI verification and evaluation is performed at NEPA level.

NEPA personnel, with attributions/responsibilities of preparing the NGHGI, considers the observations/comments, and as appropriate, updates the NGHGI in order to improve it as soon as possible, considering the relevant reporting guidelines.

III. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

In 2010, the EU and its member states submitted a pledge to reduce its GHG emissions by 2020 by 20 % compared to 1990 levels, in order to contribute to achieving the ultimate objective of the UNFCCC: "to stabilize GHG concentrations at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system"[14], or, in other words, to limit the global temperature increase to less than 2°C compared to temperature levels before industrialization (FCCC/CP/2010/7/Add.1).

The definition of the Convention target for 2020 is documented in the revised note provided by the UNFCCC Secretariat on the "Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention" (FCCC/SB/2011/INF.1/Rev.1 of 7 June 2011). In addition, the EU provided additional information relating to its quantified economy wide emission reduction target in a submission as part of the process of clarifying the developed country Parties' targets in 2012 (FCCC/AWGLCA/2012/MISC.1)[15].

For Romania, as a Party undergoing transition to a market-based economy, the base year under both the Convention and the Kyoto Protocol is set as 1989. The use of carbon credits from international market-based mechanisms is explained in the EU submission from 2012. **The EU pledge does not include emissions/removals from LULUCF**.

Romania's emission reduction target for the years 2013-2020 is part of the joint target of the European Union. The EU quantified economy-wide emission reduction target is implemented through the EU Climate and Energy Package. Key assumptions and conditions related to the EU's target are included in the document FCCC/AWGLCA/2012/MISC.1 and under the EU Fourth Biennial Report (ch. 3).

14 First steps to a safer future: Introducing the United Nations Framework Convention on Climate Change, http://unfccc.int/essential/_background/convention/items/6036.php

15 European Union, its member states submission by Denmark and European Commission, http://unfccc.int/resource/docs/2012/awglca15/eng/misc01.pdf

Under the Climate and Energy Package, the EU is committed to reducing its greenhouse gas emissions by 20 per cent by 2020 from the 1990 level. The majority of the reduction will be reached as part of Directive 2003/87/EU- EU emissions trading scheme (EU ETS): in 2020, emissions from sectors covered by the EU ETS will be 21 per cent lower than in 2005. The Decision no. 406/2009/EC-Effort Sharing Decision established binding annual greenhouse gas emission targets for Member States for the period 2013–2020. These targets concern emissions from sectors not included in the EU ETS such as transport, residential, agriculture and waste. The emissions will be cut by approximately 10 per cent from the 2005 level by 2020 within the EU as a whole.

Romania's reduction obligation for the sectors not covered by the EU ETS is to limit its GHG emissions to +19 per cent in comparison with 2005 level.

It is up to each Member State to decide how these targets will be achieved, but domestic measures are needed to fulfil the targets. Certified emission reduction units from the clean development mechanism and emission reduction units from joint implementation projects, as well as units transferred from other Member States, can be used to fulfil the targets.

A Member State that fails to meet its annual target will be penalized with an additional 8 per cent emission reduction obligation for the following year. The Climate and Energy Package[16] also requires Romania to increase its use of renewable energy sources to 24 per cent of final energy consumption by 2020 and the share of biofuels in gasoline and diesel to 10 per cent by 2020.

Romania implemented the first commitment period (2008-2012) of the Kyoto Protocol to the UNFCCC, the emissions reduction commitment (8% in 2008-2012 compared to the base year emissions -1989) being fulfilled.

The description of the Romania's economy-wide emission reduction target is provided in the table III.1 and in the CTF tables 2 (a)-2 (f).

Table III-1. - Informations regarding Romania's economy-wide emission reduction target

Parameters	**Information**
Base year	1990
Gases covered	CO_2; CH_4; N_2O; HFCs; PFCs; SF_6
Sectors included	Energy; Transport; Industrial Processes and Product Use; Agriculture; Waste.
Global Warming Potential	AR4
Land Use, Land-Use Change, and Forests (LULUCF)	Emissions and removals from the Land Use, Land-Use Change and Forestry Sector are not included in the quantified economy-wide emission reduction target.

16 EU's Climate and Energy Package, http://ec.europa.eu/ clima/ policies/ package/ index_en.html.

Use of international credits (JI and CDM)	Romania does not plan to use market-based mechanisms under the Convention to achieve the target.
Other information	Not applicable

For the monitoring of GHG emissions at the EU and the Member State level, the Monitoring Mechanism Regulation has been adopted, see section 2.2.2.1 of the EU's second Biennial Report and the 4th EU BR, section 3.2.2.

IV. PROGRESS IN ACHIEVEMENT OF QEWER TARGETS AND RELEVANT INFORMATION

IV.1. Introduction

This chapter of the 4th Biennial Report briefly outlines policies and measures to reduce GHG emissions and progress in meeting the QEWER target.

From the chart below it can be noticed that Romania will not face difficulties in achieving its target for 2020. It is projected that emissions in 2020 to count 83.4 Mt CO_2 eq. the target of the non-ETS sectors being 89.91 Mt CO_2 eq, according to the compliance analysis at the EU level (see the following link:

https://ec.europa.eu/clima/ets/transactionsCompliance.do?languageCode=en&esdRegistry=RO&esdYear=&search=Search&currentSortSettings=. On the entire commitment period 2013-2020, the allocated budget of the non-ETS sectors under EU Effort Sharing Decision of 661.18 Mt CO_2 eq is forecasted to be overachieved with approx. 65 Mt CO_2 eq in 2020. However, Romania will have to considerably enhance its efforts in order to meet its current target for 2030.

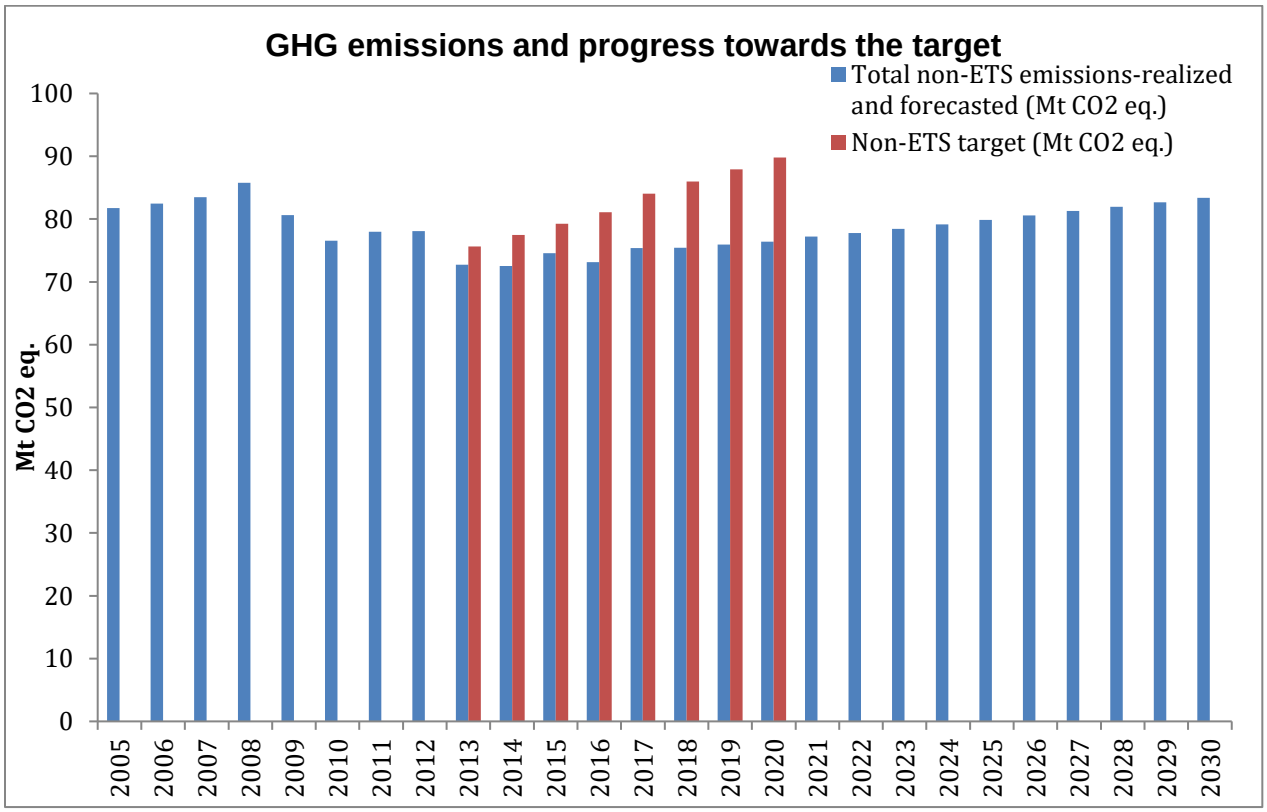


Figure IV-1. Progress in achieving the target

Further information on mitigation actions and progress is provided in CTF Tables, namely:

- Table 3: Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects;
- Table 4: Report on progress;
- Table 4(a)I: Progress in achieving the quantified economy-wide emission reduction targets - further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector.

This report focuses on updates or changes to the policies and measures at the EU and national level and does not attempt to include a comprehensive background to each policy. If more background is required, links are provided, or the reader can refer to EU and Romania's Third Biennial Reports/ 7th National Communication.

IV.2. Cross-cutting policies and measures

The current BR lists the policies and measures as presented in its previous version as not many changes in PaMs have happened since BR3. The most notable change is the approval, towards the end of 2019, of a new *National Strategy for the sustainable development of Romania 2030* (GD no. 877/2018); this policy document aims at better aligning the Romanian SD policies to the SDGs. Otherwise, all EU wide PaMs are valid for Romania as well; a good example for that is the Regulation of Energy Governance (1999/2018).

Most of the following policies and measures for reducing the GHG emissions in some sectors represent the reflection of EU policies and measures in the Romanian regulatory system:

Table V-1.Crosscutting PaMs

Policies and Measures	**Affected sector**					
	Energy Supply	Energy Consumption	Industry	Transport	Agriculture and forests	Waste
National Strategy for the sustainable development of Romania 2030 (GD no. 877/2018)	yes	yes	yes	yes	yes	yes
National Strategy on Climate Change and Economic Growth on the basis of Low Carbon Emissions for the period 2016-2030 and the National Action Plan for the implementation of	yes	yes	yes	yes	yes	yes

the National Strategy on Climate Change and Low-Growth Economy (PNASC) for 2016-2020 (GD no.739/2016)						
Law 278/2013 on industrial emissions	yes		yes			
GD no. 780/2006 on establishing the scheme for greenhouse gas emission allowance trading, modified by GD no. 133/2010, GD no. 399/2010, GD no.1300/2010, GEO no.115/2011 and GD no. 204/2013	yes		yes			
Law no. 121/2014 on energy efficiency and Law no. 1607/2016 on amendments and completions to Law 121/2014	yes	yes	yes	yes	yes	
National Energy Efficiency Action Plan 2014-2020	yes	yes	yes	yes	yes	
National Action Plan for Energy in Romania Renewable Sources	yes				yes	
Emissions Trading Scheme (GD no. 780/2006)	yes	interaction	yes			
Promoting Combined Heat and Power (CHP)	yes	interaction	interacti on			
Romanian Energy and Climate Change Fund	yes	yes				
The Eco-Design Directive	yes	yes	interacti on			
Biofuels Implementation Directive	interac tion			yes	yes	
Green Investment Scheme	yes	interaction		yes	yes	
Waste Framework Directive	yes	yes	interacti on			yes

The most relevant PaM for the climate change field at national level is the *National Climate Change and Low Carbon Green Growth Strategy for period 2016 – 2030* and the *National Action Plan for implementation of the National Climate Change and Low Carbon Green Growth Strategy for period 2016 – 2020***.**

The main objective of the National CC/LCGG Strategy is to reduce the GHG emissions from economic activities in alignment with EU targets and to adapt to the effects of climate variability and change, both current and future.

The National CC/LCGG Strategy, covering the period up to 2030 and outlining the roadmap for 2050, includes the following additional information:

- Presents detailed information related to the climate change impact in different sectors of economy (energy, industrial processes, transport, LULUCF, agriculture, etc.), formulate a vision statement of national objectives on climate change policies and how they are related to green development strategy and, respectively, formulate a set of objectives on specific areas of policy;
- The section related to GHG emissions mitigation includes data on targets for 2030 and 2050 and their implications for economic growth and distribution in Romania; also, information on the associated costs for GHG emissions mitigation and mitigation potential on economic sectors are included;
- Two new sections on financing the development with low carbon green growth and, respectively, monitoring and reporting;
- The section related to adaptation to the effects of climate changes provides more quantitative information about the potential impacts of climate change for agriculture and rural development, water, industry, energy, tourism, biodiversity, public health, public education, awareness and insurance.

For GHG emissions mitigation, the National CC/LCGG Strategy adopts quantifiable targets in line with EU targets for 2030 (40 % reduction of GHG emissions compared to 1990 levels and improving the energy efficiency with 27 %), and, respectively, considers the Romania's commitments for 2020, as an EU member state (increasing the share of renewable energy by 24% in final energy consumption, reducing primary energy consumption by 19% comparing with the reference value, the annual emission allocations for ESD sectors, the ETS).

The strategic objectives of the National CC/LCGG Strategy for GHG emissions mitigation on economic sectors are the following:

- ***Energy:***
  - ✔ Objective 1: Reducing the intensity of CO_2 emissions related to energy supply;
  - ✔ Objective 2: Improving end-user energy efficiency, particularly in buildings and industries;
  - ✔ Objective 3: Affordable energy for the economically vulnerable groups;
- ***Transport:***
  - ✔ Objective 1: Introducing strong economic incentives for a climate friendly transport system through pricing instruments;
  - ✔ Objective 2: Increasing the efficiency of urban transport;
  - ✔ Objective 3: Reversing the long-term decline of passenger and freight rail transport and development projects for intermodal terminals;

- ***Industry:***
  - ✔ Objective 1: Reducing the carbon intensity in industry;
  - ✔ Objective 2: Assessing the best available techniques (BAT) from the perspective of GHG emissions;
  - ✔ Objective 3: Exploring voluntary approaches, emissions trading, taxes;
- ***Agriculture and Rural Development:***
  - ✔ Objective 1: Promoting climate change knowledge transfer and advisory services among farmers;
  - ✔ Objective 2: Investment support for farm modernization;
  - ✔ Objective 3: Promoting best practices in agriculture;
  - ✔ Objective 4: Promoting carbon sequestration in agriculture;
- ***Urban development:***
  - ✔ Objective 1: Promote more compact, mixed use, and transit-oriented development measures as a way of reducing vehicle miles travelled, to develop the infrastructure and reduce maintenance costs;
  - ✔ Objective 2: Promote energy efficiency improvements in buildings and major urban infrastructure systems;
- ***Waste management:***
  - ✔ Objective 1: Promote waste prevention;
  - ✔ Objective 2: Increase the reuse or recycling of the materials included in the waste stream, reducing the amount of material that must be managed as waste by promotion of industrial synergy processes and application of the resource-efficient sustainable management of waste concept;
  - ✔ Objective 3: Separate collection and composting of biodegradable waste;
  - ✔ Objective 4: Produce energy from waste;
- ***Water:***
  - ✔ Objective 1: Reduce GHG emissions from water supply and waste water treatment;
  - ✔ Objective 2: Increase energy efficiency of pumping in large water delivery systems;
- ***Forestry:***
  - ✔ Objective 1: Managing existing forests to sequester carbon in the context of sustainable forest management;
  - ✔ Objective 2: Expansion of afforested areas;

- ✔ Objective 3: Promoting the sustainable management of private forest ownership;
- ✔ Objective 4: Opportunities for carbon stock management in forests in protected areas.

The National Action Plan 2016 – 2020, developed for implementation of the National CC/LCGG Strategy, includes actions, timelines, specific responsibilities for each sector and institution, and criteria and indicators to assess the achievement of proposed objectives.

The main objective of the National Action Plan 2016 – 2020 is drawing up concrete measures for implementation of the National CC/LCGG Strategy starting with the priorities mentioned herein.

IV.3 Sectoral policies and measures

Energy Sector

Considering the role of energy for the economy and society, the development of this sector is carried out under state supervision, through the development and implementation of a sectoral strategy.
Romania has two new strategic documents under preparation: the National Energy and Climate Action Plan and the *"Energy Strategy of Romania 2016 - 2030, with the perspective of 2050"*; the Strategy is currently undergoing the strategic environmental assessment phase.

Romania has transposed all EU Directives/Regulation with implications for primary energy consumption at national level.

Electricity and Heat Generation
The primary energy saving measures to be applied in the power generation and heating sector are as follow:

- Replacement of obsolete units with modern and efficient generation units;
- Repowering the 330 MW units operating on lignite-fired power plants;
- Promoting high efficiency cogeneration; gas turbines with a heat recovery boiler (GT+HRB) and a combined cycle (CC+GT) of approximately 1000 MW and 600 MW biomass-fired units;
- Continuing the upgrade works of district heating systems, respectively the heat generating units and networks to the consumer;
- Generating electricity from renewable energy sources;

- Distributed electricity generation and IT technologies.

High efficiency cogeneration support scheme is applied since 2011; the support scheme is in force till 2023.

The National Action Plan for Renewable Energy Sources indicates the targets for the installed power per types of technologies from renewable energy sources. In 2015 and 2016 the overall shares of energy from renewable sources in the gross final energy consumption, namely 24.79% and 24.22%, significantly exceed the shares established by the indicative trajectory of 20.59% for 2015-2016. According to the latest report of European Commission on renewables, Romania is among other 11 Member States of EU (Bulgaria, the Czech Republic, Denmark, Estonia, Finland, Croatia, Hungary, Italy, Lithuania, Romania, and Sweden) that have already achieved a share corresponding to their 2020 target (https://ec.europa.eu/commission/sites/beta-political/files/report-progress-renewable-energy-april2019_en.pdf) .

The main objectives for the utilization of the renewable energy are:

- Integration of renewable energy in the structure of the Romanian Power System;
- Integration of renewable energy in the requirements of the economic efficiency;
- Promotion of the sectoral policy for ensuring the energy security due to the increased share of the renewable energy in final energy consumption, determining lower dependence of imported energy;
- Energy access through utilization of the local energy resources for energy supply for the isolated localities.

Energy use

The third National Action Plan on Energy Efficiency (NAPEE) for 2014 - 2020 period takes into consideration the sustainable development of Romania and promotes measures that contribute to the efficient use of energy to meet the country's commitment to reducing primary energy consumption by 10 million toe compared to the baseline scenario, so that consumption is 42.99 million toe in 2020.

NAPEE III provides measures to increase energy efficiency in the energy supply system and final energy consumers (in industry, construction, services, agriculture and the residential sector). Thus, the current National Plan for Energy Efficiency includes 12 programs whose implementation is annually monitored, each of them contributing to the national target achievement. Among these programs are, as follows:

- Improvement of the thermal performance of buildings (in services and residential sectors);

- Modernization of the infrastructure for transport and distribution of heat in centralized system (“The National Program heating 2006-2015 - heat and comfort”, extended up to 2020);
- The program for the encouragement of the consumers for the acquisition of the electrical goods with high energy efficiency;
- Improving water supply systems to reduce energy and water consumption;
- Improvement of public lighting and buildings by using LED technology;
- Improvement of the freight and passenger transport system;
- Improvement of irrigation systems to increase energy efficiency, etc.

In terms of energy intensity, the industry performance was improved over the period 2005-2017 at the EU level, having overall about 22% energy reduction. Romania is among the Member States that recorded the biggest improvements (over 50%). According to the 2019 monitoring report on the implementation of the National Energy Efficiency Action Plan, Romania is among the Member States that are on the right track or have achieved more energy savings than planned for period 2014-2016. Romania’s GHG emissions/capita dropped from 10 tons in 1989 to 5.79 tons in 2017. For the post 2021 period, under the 2030 Framework EU target, Romania has to contribute to achieving the EU global target of at least 32.5%.

The application of the EU regulations laid down by the Ecodesign Directive leads to a reduction of electricity consumption in the service and residential sectors due to the use of efficient lighting technologies as well as efficient equipment.

In the Agriculture sector, there is a specific objective "Improving Energy Efficiency and Developing the Sector to Generate Energy from Renewable Resources". This objective is achieved by:

- The use of bio - liquid and biomass for obtaining the thermal energy in the farms;
- The implementation of the technologies for collecting and use of the agricultural residues;
- The achievement of the micro installations for obtaining biogas in farms or in groups of farms;
- The introduction of other renewable energies, such us: wind energy, solar energy, geothermal energy;
- The development of the deposits for the agriculture production.

Industry Sector

Evolution of the various med-term industrial sectors depends on:

- Maintain and develop an attractive business environment, enhancing investment flows stimulating technological upgrading, renewal processes and products;
- Consider environmental impacts of products throughout their lifecycle (from design, manufacture, assembly, marketing, sale and use to recycling and disposal);
- Support research, development and innovation in conjunction with the real needs of industry and market demand to achieve competitive advantages and reduce the technological gap from advanced countries in the EU;
- Promoting digital technologies at all stages from design to production, marketing management including the management of companies;
- Encourage direct investment as a source of capital, know-how, modern technology and management skills;
- Supporting the emergence of small and medium enterprises (SMEs) in the manufacturing sector, for achieving high quality products with low cost, in line with market requirements.

Industrial policy seeks to apply the best technologies to increase energy efficiency and ensure quality products at competitive prices while respecting environmental requirements.
In industry, the Government of Romania grants state aid under GD no. 495/2014 to large enterprises and SMEs demonstrating the reduction of energy consumption through measures to increase energy efficiency.

Financing investments to increase energy efficiency in industry can also be achieved through the 2014-2020 High-Performance Infrastructure Operational Program (POEM). Thus, in the Priority Axis 6 Promoting Clean Energy and Energy Efficiency to Support a Low Carbon Economy at the Specific Objective 6.2, Energy Efficiency Reduction for Industrial Consumers is allotted. The allocated budget is € 12,503,129 of which 10,627,660 Euro represents European Regional Development fund (ERDF).

Transport sector

In accordance with the EU White Paper on Transport 2050, a 20% reduction of GHG emissions is forecast by 2030, compared to 2008, and by 60% in 2050, compared to the level registered in 1990.

The general objective of the National Strategy for Sustainable Development is to assure that the transport systems satisfy the economic, social and environmental needs of society, with a minimum impact on the economy, society and environment.

In order to improve behavior in relation with the environment, the global impact of pollutant emissions generated by the transports sector shall gradually be decreased, in order to meet the objectives established for Romania (national emission ceilings). The emissions will be reduced with 5% by 2015 (case of the cities where air quality emissions limit levels

are exceeded), and with 15% (case of the cities where the transportation is the main source of pollution).

The national objective for 2020 is to meet the current EU average level in terms of the economic, social and environmental efficiency of transportation and to perform substantial progress for the development of the transport infrastructure.

The national objective for 2030 is to grow closer to the EU average level of that year in terms of all basic parameters of sustainability in transport.

In 2016, the Romanian Government approved the General Transport Master Plan, a strategic document setting out the main directions for the development of transport infrastructure in Romania over the next 15 years, on all modes of transport: road, rail, naval, air and multimodal.

The Romanian Master Plan of Transport will contribute significantly to Romania's long-term sustainable development by increasing intermodal connectivity (links created by combining all modes of transport) between regions, population and business access to the transport network and supporting development regions with potential for economic growth.

The adoption of the Master Plan is also conditionality for Romania's transport financing, through the Operational Program for Large Infrastructure.

The Master Plan for Rail Transport aims to increase the attractiveness of rail transport and to improve the conditions of travel by modernizing the national rail network and developing railway services. This document provides for the following projects:

- Rail modernization projects;
- Modernization of tourist railways projects;
- High-speed rail projects.

For the period 2016 - 2020, these projects accumulate over 2000 km.

The Master Plan in the Shipping field has the mission to increase the volumes of goods and passengers transported on water and to develop the port infrastructures and routes on the Black Sea, the Danube and the waterways.

The Master Plan for Airline aims to increase the number of persons and air freight and to develop airport infrastructure. The document states that between 2016 and 2018, the airports of Bucharest, Cluj Napoca, Timisoara, Sibiu, Bacau and aerodromes will be modernized. It follows that these upgrades will result in energy savings as a result of the purchase of energy-efficient installations and equipment and the adoption of constructive solutions that meet the requirements, the energy efficiency norms.

In 2011, the National Action Plan for the reduction of greenhouse gas emissions in the civil aviation sector for the period 2011 - 2020 was approved.

The Master Plan for Road Transport aims to increase the road connectivity between the economic growth poles of Romania and to improve the conditions of travel between the regions by developing the national road network and ensuring the maintenance of the existing road network. The documents define highway and expressway projects.

Measures to increase energy efficiency and reduce pollutant emissions in the transport sector are as follows:

- Using smart transport systems;
- Reducing road transport;
- The program for the renewal of the National car park, funded by the Environmental Fund budget;
- Measures applied by economic agents, local and central public administrative units, holding over 25 vehicles, for monitoring and management of fuels in order to reduce the fuel consumption;
- Upgrading railway cargo and passenger transport by procuring high energy efficiency rolling stock;
- Implementing a tele-management system of electricity and for the compensation of the power factor in electric traction substations;
- Implementing the level 2 European Railway Traffic Management System (ERTMS);
- Reducing the electricity consumption afferent to the generation of compressed air required for the operation of fixed subsystems testing train brakes by replacing old type compressors, with modern and efficient equipment;
- Upgrading underground transport by upgrading the electric train park and the public space lighting systems;
- Using biofuels (meeting the bio-fuel usage share amounting to 10% of the final national consumption by 2020);
- Promoting “clean passenger cars” and stimulating the manufacturing thereof. In order to encourage the procurement of such passenger vehicles, Emergency Ordinance no. 40/2011 on the promotion of non-polluting and energy-efficient road transport vehicles, amended by Emergency Ordinance no. 9/2013 on the environmental stamp for the passenger vehicle, stipulates the granting of a new environmental ticket for each electric passenger vehicle;
- Encouraging forms of alternative transport (cycling, car-pooling, car-sharing, etc.) through urban planning and the development of an adequate infrastructure for cycling (bicycle tracks, bicycle racks, special bicycle wagons/compartments in the subway and on trains, etc.) and expanding the pedestrian areas, particularly in large urban agglomerations;
- Increasing the degree of using public transportation, by optimizing means of public transport (trains, buses, trolley-buses, trams) and the infrastructure required for the proper operation thereof, expanding the underground network.

The National Action Plan for the reduction of GHG emissions in civil aviation has the following scopes:

- Improving the efficiency of fuel used, by at least 2%/year (reducing fuel consumption on average by 1.5% per hour of flight);
- Capping CO_2 emissions from civil aviation sector activities, starting with 2020.

Summarizing the provisions of Regulation no. 443/2009, the average CO_2 emissions for new passenger cars (light vehicles) will be:

- in 2012 ÷ 2013 of 130 gCO_2 / km;
- in 2020 of 95 gCO_2 / km.

Council Regulation (EC) no 510/2011 setting emission performance standards for new light commercial vehicles as part of the Community's integrated approach to reduce CO_2 emissions from new light commercial vehicles sets the average CO_2 emissions of new passenger cars at 175 g CO_2 / km, obtained through improved vehicle engine technology. Starting in 2020, the Regulation sets the objective for the fleet of new light commercial vehicles to achieve an average of 147 g CO_2 / km emissions.

Summarizing the provisions of Regulation no. 510/2011, the average CO_2 emissions for new light commercial vehicles will be:

- in 2014 ÷ 2017 of 175 gCO_2 / km;
- in 2020 of 147 gCO_2 / km.

These targets will become obsolete after 2020as new EU regulation will be applied.

Passenger car and light duty vehicle fuel efficiency: For the period after 2020, stricter new CO_2 emission standards will apply for new passenger cars and vans: 37.5% and 31% lower in 2030 compared to 2021, under the revised CO_2 and Cars Regulation (Regulation (EU) 631/2019).

Heavy duty vehicle (HDV) fuel efficiency: CO_2 emission performance standards for new HDVs are set for the first time in the EU through Regulation (EU) 2019/1242), adopted on 13 June 2019. The Regulation sets targets for fleet-wide average CO_2 emissions reductions from new HDVs of 15% in 2025 and 30% in 2030, both compared to the EU average in the reference period (1 July 2019-30 June 2020).

Industrial Processes and Product use sector

Through public funds, the Romanian Government shall support the increase of competitiveness in industrial enterprises, the production of high added value products, the production of exported products, and respecting the environmental operating permits.

The industrial policy aims to implement the best technologies to increase energy efficiency and provide quality products for competitive prices, in accord with environmental permits. The result is that industrial processes require re-engineering operations and the use of new technologies for the efficient processing of raw material and energy resources, leading to the reduction of GHG emissions.

Regulation no. 517/2014 on fluorinated greenhouse gases (F-gases) which repeal Regulation No. 842/2006 are applying since 1 January 2015 and aim to reduce these emissions by two thirds in 2030 compared to 2015 levels.

Regulation lays down rules on the containment, use, recovery and destruction of F gases and prohibits the sale of certain products containing F-gases. Also, sets an annual limit on the overall climate impact of HFC which will be phased out between 2015 and 2030.

The Regulation establishes the following obligations:

- Prohibits the deliberate release of gases F if it is not technically necessary for the intended use of a product; manufacturers must strive to limit emissions during production, transport and storage of gas F;
- Operators of equipment containing F gases must take every precaution possible to prevent any leakage and must ensure that equipment's are regularly checked for leakage; requirements vary depending on the potential impact on the climate or how hermetically sealed are;
- National authorities are responsible for establishing training and certification programs for businesses and individuals involved in the installation, providing the service, maintenance, repair or decommissioning of equipment containing F gases, and recovery;
- From 2015 until 2025, are phased ban on the sale of new items, such as certain types of refrigerators and freezers, air conditioning systems, foams and aerosols containing F gases, where safer and less polluting alternatives exist;
- Annual limit for HCF quantities placed on the market in 2030 represent 21% of 2009-2012 levels; to ensure the compliance with the limits the Commission allocates producers and importers annual quotas which must not be exceeded;
- Manufacturers, importers, exporters, users and businesses that destroy F gases must report annually to the Commission; importers of equipment containing F gases must do the same and, from 2017 must present evidence on accounting of the quantities of HFCs contained in imported equipment.

Directive 40/2006/EC (MAC Directive) on emissions from air conditioning systems of the motor vehicles provides the gradual replacement of air-conditioning systems using HFC-134a. It also limits the possibility of retrofitting motor vehicles with air conditioning systems designed to contain fluorinated greenhouse gases with a global warming potential higher than 150 and prohibit the charging of the air conditioning systems with such gases.

Automotive manufacturers must provide the competent authority all relevant technical information regarding the installed air conditioning systems and the gases used in the respective systems. If air conditioning systems designed to contain fluorinated

greenhouse gases with a global warming potential higher than 150, the manufacturer must make available the leakage rate of these systems. The measures provided for in this Directive are expected to take effect from 2011.

Agriculture

Agriculture continues to play an important role in ensuring the income of a significant part of the active population. It shall promote a sustainable production model, protecting the ecosystems and ensuring the sustainability of food production, the reduction and elimination of imbalances on the agricultural market, generated by the manner of using natural resources, ensuring an improved capitalization of the advantages held by the Romanian agriculture.

The following national aims are considered within the National Sustainable Development Strategy of Romania for agriculture and forestry:

- *2020*. Consolidating the structures in the agro-food and forestry field, with the economic and social development of rural areas for the continued reduction of gaps and in order to meet the current average performance level of EU member states; Romania's affirmation as an element of stability for food security in South-Eastern Europe;
- *2030*. The full adoption of community policies and practices on agriculture, forestry and fishing; completing the restructuring and upgrade of such sectors and of the rural space.

The National Rural Development Program 2014-2020 was approved according to the Implementing Decision of the European Commission no. C (2015) 3508 of 26 May 2015, as amended. This program continues the efforts needed to develop the rural area achieved through the previous program (2007-2013) through the strategic approach of the following objectives:

- Increasing the feasibility, upgrade and restructuring of agricultural holdings, particularly of small and medium-sized holdings, rejuvenating the population of farmers, developing the processing sector, and consolidating the market position of agricultural producers;
- The sustainable management of natural resources and actions against climate change;
- Diversifying economic activities, creating jobs, improving the infrastructure and services to improve life quality in rural areas.

These objectives are in line with the provisions of the Partnership Agreement and are in line with the Common Agricultural Policy and the Europe 2020 Strategy.
These objectives are met in 2014-2020 through the six EU priorities set out in the Rural Development Regulation (1305/2013):

- Encouraging the knowledge transfer and innovation in agriculture and forestry and in rural areas (P1);

- Increasing the holdings feasibility and the competitiveness of all types of agriculture in all regions and promoting innovative agricultural technologies and the sustainable management of forests (P2);
- Promoting the organization of the food chain, including the processing and trading of agricultural products, of animal welfare and the management of agricultural risks (P3);
- The restoration, conservation and consolidation of ecosystems related to agriculture and forestry (P4);
- Promoting the efficient use of resources and supporting the transition to a low carbon emission economy, that is resistant to climate changes in the agricultural, food and forestry sectors (P5);
- Promoting social inclusion, the poverty reduction and economic development in rural areas (P6).

All these priorities have been transposed by areas of intervention and facilitating the achievement of objectives related to innovation, environmental protection and mitigation and adaptation to climate change.

By GD no. 226 of April 2, 2015 establishing the general framework for the implementation of the measures of the national rural development program co-financed by the European Agricultural Fund for Rural Development and the state budget has been established in the general framework regarding the submission, evaluation, selection, contracting, control and monitoring of the projects foreseen in the NRDP 2014-2020.

In 2015, the Order of the Minister of Agriculture and Rural Development, of the Minister of Environment, Water and Forests and of the President of the National Sanitary Veterinary and Food Safety Authority no. 352/636/54/2015 was issued for the approval of the rules on cross-compliance in the schemes and measures support for farmers in Romania with subsequent amendments. The norms annexed to the Order are drafted pursuant to art. 93 and 94 and Annex II respectively of Regulation (EU) No. 1.306 / 2013 of the European Parliament and of the Council of 17 December 2013 on the financing, management and monitoring of the common agricultural policy and repealing Regulations (EEC) 352/78, (EC) No. 165/94, (EC) No. 2.799 / 98, (EC) No. 814/2000, (EC) No. 1.290 / 2005 and (EC) No. No 485/2008.

The Government of Romania, through GD no. 932/2016, approved the "National program for the rehabilitation of the main irrigation infrastructure in Romania". The MADR Order no. 5/2017 for establishing the implementation of the National Irrigation Infrastructure Rehabilitation Program in Romania shows that the program is carried out in three successive phases:

- Stage I, in which a number of 40 irrigation facilities are rehabilitated;
- Stage II, in which a number of 37 irrigation facilities are rehabilitated;
- Stage III, in which a number of 9 irrigation facilities are rehabilitated.

The Strategy on the medium and long term organization of the pasture improvement and operation at the national level by the joint Order no. 226/2003 of the Ministry of Agriculture, Food and Forests and the Ministry of Public Administration has the main goal of increasing the total production of green mass and the quality thereof, while increasing the economic efficiency of livestock farms, particularly of cow and sheep flocks.

The strategy for organizing the improvement and exploitation of meadows at national level in the medium and long term, approved by the joint Order no. 226/2003 of the Ministry of Agriculture, Food and Forestry and the Ministry of Public Administration, has the fundamental objective of increasing the total green mass production and its quality, in line with the increase in the economic efficiency of livestock, especially of cattle and sheep.

In December 2013 through GD no. 1081 endorsed the National Strategy and Action Plan for Biodiversity Conservation 2014-2020. According to these documents, the existence of measure 214, agri-environment payments, designed to encourage farmers to serve society as a whole, is introduced by introducing or continuing to apply environmentally compatible agricultural production methods. Payments for this measure are conditional on compliance with minimum conditions as well as specific requirements for extensive land use based on input reduction.

Among the operational objectives of this measure are:

- Protection of approx. 1,450,000 ha of high natural grasslands;
- Apply adequate management on approx. 173,000 ha of important meadows for the protection of bird species Crex crex, Lanius minor and Falco vespertinus;
- Encourage the use of green crops on approx. 700,000 ha for the protection of soil and water resources;
- Apply adequate management on approx. 25,000 ha of important butterflies.

Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources was transposed in the Romanian legislation by GD no. 964/2000 approving the Action plan concerning the protection of waters against pollution caused by nitrates from agricultural sources. GD no. 964/2000 stipulates that Romania shall re-examine, revise or supplement, at least every 4 years, the list of areas vulnerable to nitrates, appointed to consider the changes and factors occurring from the previous appointment. Therefore, the joint Order no. 1552/2008 of the Ministry of Environment and Sustainable Development and of the Ministry of Agriculture and Rural Development approves the list of localities per counties, where sources of nitrates from agricultural activities have been identified. Following the approved list, the Inter-ministry Commission on the enforcement of the Action Plan on concerning the protection of waters against pollution caused by nitrates from agricultural sources approved the Action program for areas vulnerable to nitrates by Decision 21130/DC/14.10.2010. According to this program, the provisions of the Code of good agricultural practices concerning the protection of waters against pollution caused by nitrates from agricultural sources approved by the joint Order no. 1182/1270/2005 of the Ministry of Environment and

Sustainable Development and of the Ministry of Agriculture and Rural Development are compulsory in areas declared to be vulnerable to nitrate pollution. The nutrient management plan is carried out under the guidance of the Soil and Agrochemical Study Offices, based on the nutrient framework management plan drawn up and provided by the Ministry of Agriculture and Rural Development.

It should be emphasized that Romania has an Integrated national system for soil monitoring, surveillance, control and decisions to reduce the share of pollutants resulting from agricultural and management sources of organic residues resulting from animal husbandry services in vulnerable and potentially vulnerable areas to nitrate pollution, within the structures of the National system on the integrated monitoring of water resources and of protected areas, managed by the National Research and Development Institute for Soil Science, Agro-chemistry and Environment.

Land Use, Land-Use Change and Forestry Sector (LULUCF)

Forest ecosystems have a multifunctional character, defined mainly by the multiple role they play. Thus, the ecosystem services provided by the forest are of significant importance both from an ecological and socio-economic point of view. The operationalization of this resource is achieved through concrete policies and measures that allow monitoring and evaluation of the forestry field and by ensuring the national normative framework in order to apply the obligations that Romania has assumed as a signatory part of the international agreements and treaties specific to the forestry field.

Implementing the activity of the sub-domain Land Use, Land Use Change and Forestry (LULUCF) is facilitated by the ratification of European Union regulations and by a multitude of national strategies and policies.

The newly adopted regulation targeting the LULUCF sector (EU) 2018/841 of the European Parliament and of the Council Under the LULUCF Regulation1, adopted in May 2018, consider greenhouse gas emissions and removals from LULUCF to be included into the 2030 climate and energy framework for the first time. The Regulation is in line with the Paris Agreement, which points to the critical role of the land use sector in reaching our long-term climate mitigation objectives. This brings a LULUCF target into the EU climate policy, establishing rules to measure the changes in carbon emissions and removals from this sector.

The national legislative framework supporting the forestry field is based on the National Forestry Strategy 2018-2027, the National Rural Development Program for the period 2014 - 2020 and the National Strategy on climate change and economic growth based on low carbon emissions for the period 2016-2020.

The National Forestry Strategy 2018-2027 includes an important series of actions with an impact on the magnitude of the effects of climate change. Developed to comply with the principles of sustainable development, the forest strategy has as a general objective "the harmonization of forest functions with the present and future requirements of the society [...] through the sustainable management of forest resources". The objectives of the

strategy covered by this report are relevant elements in the implementation of the policy on climate change, especially for the LULUCF sector, through the measures that address the following aspects: streamlining the regulatory framework for forestry activities; sustainable management of the national forestry fund in order to continuously adapt forests to climate change; measures providing for forestation and planting of forest protection curtains.

Within the National Forest Strategy, the evaluation and monitoring of the functions, forest resources and ecosystem services provided by the forest, which increase the capacity of the carbon storage forests in the context of a sustainable forest management, is established as a sub-activity, in order to create the framework for the recovery of the forest stocks. carbon. At the same time, there are defined means of increasing the competitiveness and sustainability of the forest industries, bioenergy and bioeconomy.

The National Forest Strategy does not include quantitative targets that could have been used in projections on the climatic impact of Romania's forests for the next twenty years, but the impact of social, political, legislative, financial and especially environmental impact is analyzed.

Forestry is an integral part of rural development, which is why within the National Program of Rural Development for the period 2014 - 2020 there are mentioned measures to support an efficient and sustainable forest management. In addition, areas of interest for promoting carbon conservation and sequestration in agriculture and forestry are outlined by increasing forest areas, but also for increasing biodiversity and reducing soil erosion on forest land. The National Rural Development Program also includes a series of activities with direct relevance in mitigating greenhouse gas emissions, which refer in particular to increasing the accessibility of forests and the development of special areas with a low level of intervention.

Complementary to these measures, within the National Rural Development Program, a financing plan is outlined to ensure investments in the development of forested areas and in improving the viability of forests. At the same time, it is proposed to finance forestry, climate and forest conservation services in accordance with European Union regulations.

The national strategy on climate change and economic growth based on low carbon emissions for the period 2016-2020 includes an entire chapter dedicated to the forestry field, which outlines the objectives corresponding to the process of reducing the impact of climate change. The measures proposed under this strategy are folded on the actions defined within the framework of the National Forest Strategy, most referring to the management of the forest field in a sustainable way, the extension of the forest areas and the extension of the sustainable management in the private property forests.

Based on the strategy, an action plan for its implementation was constructed, according to the following objectives, which were extracted in relation to the area of interest of this report:

Reducing the impact of climate change

- Managing existing forests for carbon storage in the context of sustainable forest management;
- Finalize the adoption of the Strategy for the development of the forestry sector, including measures to reduce GHG emissions and adapt the forestry sector to climate change, taking into account the economic aspects of the sector.
- Strengthening the national GHG estimation and forecasting system for the land use and forestry sector by ensuring the continuity of the National Forest Inventory.
- Promote carbon sequestration and conservation in forests, both state and private.
- Reducing emissions from forest vegetation fires.
- Updating the National Forestry Program and the National System of Forest Curtains to correspond to the availability of land and sources of financing, and to highlight the role of reducing greenhouse gas emissions from afforestation activities.
- Completion of the identification and operationalization of the national database of forest lands: degraded lands, degraded agricultural lands, agricultural lands and setting priorities for their afforestation, in relation to the initial size of the carbon deposits associated with the use and risk zoning.
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- Creating a system for promoting and stimulating the establishment of energy plantations and woody biomass with a short production cycle and for harnessing the residual biomass from logging.
- Afforestation of degraded land and afforestation of agricultural land.

Adapting the forestry sector to climate change

- Improving forest management to improve their ability to adapt to climate change
- Updating the technical norms based on robust research on forest management, in order to promote an efficient and effective management, able to support the process of adaptation to the effects of climate change
- Improving the economic knowledge and the functioning of the market for forestry operators and the wood products chain, in order to anticipate and ensure the resilience of the forest sector economy at local and regional level.
- Analysis of the scenarios regarding the effect of climate change on the forest and the needs of adapting the forest operations to new climatic conditions.

- Adapting forest regeneration practices to the needs imposed by climate change
- Updating the technical norms regarding the regeneration of forests, in order to integrate the latest scientific discoveries in the field of species distribution and the opportunity to use them in the context of climate change.
- Simulating the future distribution of species in the context of climate change and prioritizing areas where changes in forest composition may occur to adapt to climate change.
- Continuous research in the field of genetic resources and the implications of climate change for forest genetic resources.
- Reviewing the genetic resources network for forest species.

Waste Sector

Solid waste storage

The most important measure to reduce GHG emissions from non-compliant landfills is foreseen by GD no. 349/2005 regarding the waste disposal, transposing the Directive 99/31/EC regarding the waste disposal, as until 2017, 41 non-compliant landfills had to be closed.

As a member state of the European Union, Romania has to fulfill, by 2020, certain targets regarding solid waste management: at least 50% reuse and recycling rate of the total mass of the waste (paper, metal, plastic and glass) recycling and other material recovery operations of at least 70% of the mass of non-hazardous waste from construction and demolition activities, 60% recovery of the packaging waste from the total packaging placed on the national market. (Directive no. 2008/98/EC of the European Parliament and of the Council of Europe)

The regulatory work for the waste sector is evolving and many legal provisions need to be updated. The Circular Economic Package includes among others:

- Preparing for reuse and recycling 65% of municipal waste by 2030 (with an intermediate target of 60% in 2025). In order to achieve this objective, Romania can benefit from an additional period of five years provided that the necessary measures are taken to increase the reuse and municipal waste recycling rate by 2025 and 2030 respectively to at least 50% and 60% by weight;
- Preparing for reuse and recycling 65% of all packaging waste by 2025 and at least 75% by 2030 (with an intermediate target of 65% in 2025). Also, minimum targets for preparation for re-use and recycling of specific materials contained in packaging waste are set for both 2025 and 2030;
- Storage of up to 10% of municipal waste by 2030. Romania can benefit from an additional period of five years provided the necessary measures are taken to

reduce by 2030 the amount of municipal waste deposited to 20% of the total amount of waste generated;

- Prohibiting the storage of separately collected waste;
- Promoting economic instruments to discourage depositing;
- Simplified and improved definitions and methods for the calculation of harmonized recycling targets at EU level;
- Promoting reuse and stimulating industrial symbiosis;
- Economic incentives for manufacturers to market more environmentally friendly products and support recycling and recovery schemes (e.g. packaging, batteries, electrical and electronic equipment, vehicles);
- Reduction of food waste generation in primary production, processing and processing, in wholesale and retail, in restaurants and food services as well as in households.

The National Strategy for Waste Management 2014-2020 proposes to:

- Prioritize waste management efforts in line with the waste hierarchy (prevention, preparation for reuse, recycling, other recovery operations, e.g. energy recovery, disposal);
- Develop measures to encourage waste prevention and re-use, promoting the sustainable use of resources;
- Increase the recycling rate and improving the quality of recycled materials, working close to the business sector and the waste recycling units and enterprises;
- Promote recycling of packaging waste as well as other categories of waste;
- Reduce the impact of carbon generated by waste;
- Encourage energy generation from waste for non-recyclable waste;
- Organize the national database and streamlining the monitoring process;
- Implement of the concept of "lifecycle analysis" in waste management policy.

Wastewater treatment

The measures to limit and/or reduce GHG emissions arising from the wastewater treatment are the following:

- Increase the degree of connection to the sewerage and wastewater services
- Rehabilitation, upgrading & construction of new wastewater treatment plants;
- Use of modern technology with lower power consumption;
- Automation of the wastewater treatment plants operation, with beneficial implications for their optimal functioning, i.e. avoiding methane emission.

V. PROJECTIONS

Romania's projections consider all policies and measures undertaken at the national level (the EU ETS, the renewable energy target, the energy efficiency target, the promotion of clean an energy efficient road transport, etc.) as well as the GHG emission evolution established for non-EU ETS sectors.

The GHG projections for 2020, 2025, 2030, 2035 considered different scenarios related to the economic-social, demographic and technological evolution, to allow the highlight of the measures undertaken by Romania for implementing the EU Directive on environmental protection, and respecting its commitments as part of Kyoto Protocol.

For defining the assumptions regarding the evolution of Romania within the 2016 - 2035 period, a SWOT analysis for the 1989 ÷ 2015 period was performed, according to the following:

- Economic development;
- Demographic development;
- Social development;
- Structural adjustment of the economy;
- Structural adjustment of the industry;
- Technologic upgrade and decrease of the energy intensity in industry, agriculture, constructions;
- Development and upgrade of the transport sector;
- Development and upgrade of the services sector;
- Development and upgrade of the habiting conditions.

The GHG emission projections are based on assumptions related to macroeconomic indicators with high uncertainty on horizon until 2035, because of the economic crisis at nationally and globally level and the lack of updated 2035 strategy on industry, agriculture, transport, etc. Thus, economic development is a dominant factor affecting the results projected.

For each sector, according to the National Inventory, the technological processes determining GHG emissions and options for their reduction have been identified.

The hierarchy of options within a sector is based on detailed analysis using different criteria, namely:

- the degree of reduction of CO_2 and other GHG emissions;
- cost benefit ratio of the GHG emission reduction option;
- indirect economic impact (new jobs, decrease in imports);

- easy implementation possibilities;
- long-term support for the reduction option, etc.

For each analyzed sector it is specified how the reference scenario and the two alternative scenarios were defined considering the sector specificity.

Taking GHG emissions forecasts and evaluating alternatives to reducing them is particularly difficult, and therefore calls for special programs to identify areas of activity that are important for GHG emissions in correlation with the country's economic and social development.

The GHG forecasts for the Energy sector were established considering the energy demand subsector (industry, transport, agriculture, household and commercial consumption) and the supplying sub-sector (primary energy resources extraction, conversion in refineries, thermo-electric power plants, thermal power plants, transport and distribution of energetic products to consumers).

The projections are based on calculations carried out using the ENPEP (Energy and Power Evaluation Program) programs package, developed by Argonne National laboratory of US Department of Energy (DOE) and distributed to Romania by the International Atomic Energy Agency (IAEA) to perform an integrated energy analysis, economic and environmental.

The software development ENPEP determine the total energy demand and energy types for the three scenarios without measures, with measures, and with additional measures as defined by IPCC sectors: electricity and heat production, refining, transport sector, industry, agriculture, construction, services, residential, etc., which allows the determination of GHG emission projections using emission factors defined by types of fuels.

Further information on projections, including the projections methodology, is provided NC7 (chapter V) and CTF tables, namely:

- Table 5: *Summary of key variables and assumptions used in the projections analysis;*
- Table 6: *Information on greenhouse gas projections.*

The contribution of PAMs to GHG emissions reduction has been assessed against targets assumed by Romania for 2020, as EU member state, namely:

- GHG emissions reduction for ETS sector (-21 % comparing with 2005 level);
- GHG emissions increase for non ETS sector (+19 % comparing with 2005 level).

The quantified contribution of implementation of the ETS and ESD provisions, estimated as difference between GHG emissions in WEM and WOM scenarios, are presented in the following table.

Table V-1. Policies and measures contribution per NGHGI sectors in WEM compared with WOM scenario

	GHG emissions reductions, kt $CO_{2\ eq}$			
	2020	**2025**	**2030**	**2035**
Energy	27,287.74	33,146.78	32,374.88	33,123.65
Transport	410.59	474.51	1,104.82	811.6
Industrial Processes and Product Use	9,609.78	9,537.02	9,219.73	8,790.82
Agriculture	3,676.56	3,733.56	4,866.82	5,272.84
LULUCF	-3,160.8	-1,093.56	-2,761.2	-2,394.9
Waste	2,583.45	3,812.07	4,952.32	5,941.03

GHG emissions projected in WEM scenario (kt $CO_{2\ eq}$) are shown in the table V.2, which highlight that until 2020, GHG emissions for ESD sector are under the annual adjusted allocated emissions levels.

Table V-2. GHG emissions projected in WEM scenario for ETS and ESD sectors

	GHG emissions, kt CO2 eq					
	2018	**2019**	**2020**	**2025**	**2030**	**2035**
Total GHG emissions, from which:	117,374.48	117,793.38	118,209.70	119,000.13	126,330.06	130,857.42
ETS	41,795.64	41,738.99	41,675.81	39,129.13	42,939.73	44,254.43
ESD	75,578.84	76,054.39	76,533.88	79,871.00	83,390.33	86,603.00

VI. PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY BUILDING SUPPORT CONSISTENT TO DEVELOPING COUNTRY PARTIES

Romania is not a Party included in Annex II to the Convention and is therefore not obliged to adopt measures and fulfil the obligations defined in Article 4, paragraphs 3, 4 and 5, of the Convention.

However, Romania offer information on financial resources for the years 2017 and 2018 provided through multilateral and bilateral channels related to the implementation of the Convention in the tables 7(a) and 7(b) of the CTF tables. These tables include information on the financial support provided and/ or committed for the purpose of assisting non-Annex I Parties to mitigate GHG emissions and to adapt to the side-effects of climate change. The report of the financial support is provided in domestic currency - RON and USD. The USD was determined by using the average National Bank course of USD/ RON in 2017 and 2018 (4.0525 and 3.9416 accordingly - https://www.bnr.ro/Raport-statistic-606.aspx).

The Romanian bilateral and multilateral climate finance flows were fully counted towards ODA. The Romanian climate-specific funding in the years 2017 and 2018 consisted of contributions to the multilateral climate change funds and specialized United Nation bodies.

Romania did not use the Rio markers to assess the activities as climate related. Except UNFCCC which is assessed as climate specific, the rest of contribution are core/ general.

In the years 2017 and 2018 were not developed technology support and transfer and capacity-building activities. Thus, the table 8 and 9 of the CTF tables were not provisioned for these years.

VII. OTHER REPORTING REQUIREMENTS

VII.1. Domestic arrangements established for the process of the self-assessment of compliance with emission reductions in comparison with emission reduction commitments or the level of emission reduction that is required by science

The Ministry of Environment, Waters and Forests has provided funding for relevant studies with the objective to identify the most efficient institutional arrangements for the implementation of the Decision nr. 406/ 2009/ EC on effort sharing.

Under this Decision, the coordination between the central and local authorities and the self-assessment of compliance to evaluate the effects of policies and measures and estimate the projections of emissions are very important. The conclusions of the studies promoted give solutions to the process of the self-assessment of compliance with emission reductions in comparison with emission reduction commitments or the level of emission reduction that is required by science.

The close links with research institutes and the advice from the National Commission on Climate Change enhance our capacity for self-assessment.

For the process of the self-assessment of compliance with emission reductions in comparison with emission reduction commitments Romania also uses:

- the National Greenhouse Gas Inventory;
- the data and information on policies and measures to mitigate GHG emissions and enhance removals and, respectively, on GHG emissions/removals projections, submitted every two years as part of the Biennial Reports;
- data and information are included every four years in the National Communication on Climate Change, officially submitted to the UNFCCC Secretariat.

VII.2. Progress made in the establishment of national rules for taking local action against domestic non-compliance with emission reduction targets

So far except for the economic operators under the EU ETS which have to comply with relevant legislation for non-compliance, there is not in place yet a system for taking local action against domestic non-compliance with emission reduction targets. The rules and procedures for noncompliance are being established following the conclusions included in the studies mentioned in the previous section.

VII.3. Any other information that the Party considers relevant to the achievement of the objective of the Convention

Not applicable