SLOVAK REPUBLIC

FOURTH BIENNIAL REPORT

In accordance with the Decision 1/CP.16 and the Decision 2/CP.17

Slovak Hydrometeorological Institute

Ministry of Environment of the Slovak Republic

Bratislava, December, 2019

PREFACE

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1 INTRODUCTION

In accordance with decision 2/CP.17 taken at the seventeenth session of the Conference of the Parties (COP 17), developed country Parties shall submit their Fourth Biennial Reports (BR4) by 1 January 2020. By the decision 2/CP.17 it was decided that the developed country Parties should enhance reporting in national communications and submit biennial reports outlining their progress in achieving emission reductions and the provision of financial, technology and capacity-building support to non-Annex I Parties, building on existing reporting and review guidelines, processes and experiences.

This Fourth Biennial Report of the Slovak Republic (4BR SVK) was prepared under the decision 2/CP.17 of the Conference of the Parties under the UNFCCC (Annex 1).

As defined in the UNFCCC biennial reporting guidelines for developed country Parties and referring Annex I to UNFCCC decision 2/CP.17, the information is structured as follows:

- INFORMATION ON GREENHOUSE GAS EMISSIONS AND TRENDS (**Section 2**) including summary information from the national greenhouse gas (GHG) inventory on emissions and emission trends and summary information on the national inventory arrangements;
- QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET (**Section 3**) including description, conditions, architecture and progress of the target;
- PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS AND RELEVANT INFORMATION (**Section 4**) including mitigation actions and their effects, estimates of emission reductions and removals and the use of units from the market-based mechanisms and land use, land-use change and forestry activities;
- PROJECTIONS (**Section 5**) including updated projections and description of models;
- PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY-BUILDING SUPPORT TO DEVELOPING COUNTRY PARTIES (**Section 6**) including new and additional support to non-Annex 1 Parties;

Tabular information as defined in the common tabular format (CTF) for the UNFCCC biennial reporting guidelines for developed country Parties (UNFCCC decision 19/CP.18) are submitted separately attached to this submission. For the CTF submission to the UNFCCC, the electronic reporting facility provided by the UNFCCC Secretariat has been used as required by UNFCCC decision 19/CP.18 and decision 9/CP.21 (replace tables 7, 7(a) and 7(b)).

Tabular information and list of tables can be found in the Annex 1 of the 4BR of the Slovak Republic.

2 INFORMATION ON GREENHOUSE GAS EMISSIONS AND TRENDS

The legal basis for the compilation of GHGs emissions´ inventory and the methodology for GHGs emissions´ estimation as well as data sources are described in the National Inventory Report of the Slovak Republic 2019, (Chapter 1), submitted to the UNFCCC ***on April 30, 2019****.*

The greenhouse gas data presented in this Section are consistent with the 2019 GHG inventory submission of the Slovak Republic to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat submitted on April 11, 2019 in the CRF Tables and with the National Inventory Report of the Slovak Republic 2019 published on the UNFCCC website ***on April 30, 2019****.*

Summary tables of the GHG emissions of the Slovak Republic for emission trends by gas and by sector in the common tabular format are presented in the Tables 1(a) and 1(b) of the CTF Tables attached to this submission. Due to the reporting requirements provided in the CTF manual, the information in the CTF Table 1 and CTF Table 4 should come from the CRF Table 10 from the latest official GHG inventory submission. This is the re-submission made on October 16, 2019 in the reflection to the Preliminary Main Findings (Saturday Paper) of the ERT sent during the annual review 2019 of Slovakia. However, the Annual Review Report 2019 was not published by the date of the submission this Fourth Biennial Report of Slovakia 2020, the CTF included data submitted to the UNFCCC ***on April 30, 2019****.*

Therefore, there is no difference in the total GHG emissions between the Section 2 of this 4BR and the CTF Tables.

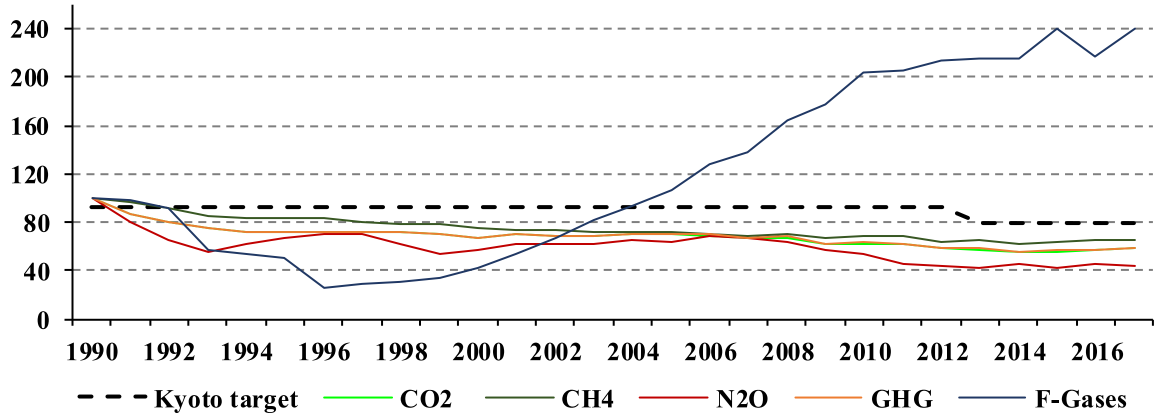
2.1 SUMMARY INFORMATION ON GHG EMISSIONS AND TRENDS

2.1.1 Overall GHG emissions trends

Total GHG emissions were 43 316.45 Gg of CO_2 eq. in 2017 (without LULUCF). This represents a reduction by 41% against the base year 1990. In comparison with 2016, the emissions increased by 2.8%. The increase in total emissions of 2017 compared to 2016 was due to increase in energy, industrial processes and waste sectors in the reaction to increasing economy growth in Slovakia. This trend was slightly corrected with the inter-annual increase of removals in the LULUCF sector.

The emissions without LULUCF in 2017 slightly increased compared with 2016. During the whole period 1991 - 2017, the total greenhouse gas emissions in the Slovak Republic did not exceed the level of 1990. The ***Figure 2.1*** shows trends in the gases without LULUCF comparable to the Kyoto targets in relative expression. The emissions of F-gases are only emissions from consumption HFCs, PFCs and SF_6 in industry with increasing trend since 1990 (despite decrease of PFCs gases from aluminium production).

Figure 2.1: *GHG emission trends compared with the Kyoto targets (in %) in the Slovak Republic*



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Slovakia has decreased its emissions by around 13% between 2008 and 2017. The latest available GHG emission projections proposed emissions stabilization as an evidence of the successful implementation of the policies and measures and their effect on the improvement in energy intensity and industrial production efficiency. However, during the whole period 1991 – 2017, the total greenhouse gas emissions in the Slovak Republic did not exceed the level of 1990.

According to the International Energy Agency in-depth review performed in 2018,[1] the Slovak Republic has made significant progress on several fronts of energy policy. In addition, the energy intensity of the Slovak economy has declined, and the share of renewable energy in energy supply has increased. Energy-related carbon dioxide emissions have been reduced as well and can be decreased further, thanks to investments in nuclear energy. Energy efficiency is improving, the share of renewable energy is increasing, and energy-related carbon dioxide (CO_2) emissions are declining.

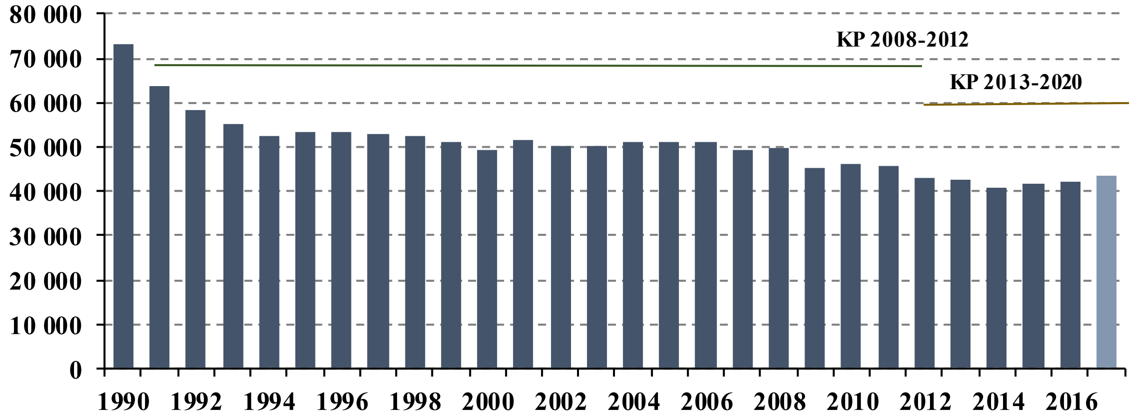
Reduction of emissions in Slovakia in past years was conjunction of different impacts starting from impressive industrial and technological restructuring connected with the fuel switching of fossil fuels from coal and oil to the natural gas (air pollution legislation since 1991 was the main driving force), economy restructuring towards the less energy intensive production (mostly in recent years) and also by temporary changes in production intensity (driven by global and EU markets). Transport (mostly the road transport), with continuously increasing emissions is an important exception. The continuous pressure is being made in formulating the effective strategy and policy to achieve further reduction of emissions in this sector, too. For example, combination of regulatory and economic instruments (toll pay for freight vehicles based on their environmental characteristics in combination with fuel and emission standards for new cars). The car tax system and the level of fuel taxation, which is close to the EU average, contribute to limit the increase of greenhouse gas emissions in the transport sector.

In Slovakia, the structural changes in the manufacturing industry towards less energy intensive industries such as machinery and automotive industry can explain why after 2009, the energy consumption did not pick up the same pace as prior to that year and which led to a significant decrease in primary energy intensity (the GDP grew twice as fast as primary energy consumption). Therefore, the trend observed particularly in primary energy consumption is mainly due to other factors although some energy efficiency improvements did take place particularly during the period 2005 – 2008. The policy package as well needs significant improvements across sectors.

[1] http://www.oecd.org/slovakia/

Although this optimistic trend recognised in previous years, it is visible since last 3 years, that the improvement of several indicators such as GHG per capita or GHG/GDP started slowed down and reached minimum level. GHG emission level reached minimum in 2016 and trend is stabilised, fluctuated with increases in transport, households, waste and some industrial categories in the latest year.

Figure 2.2: *The aggregated GHG emission trends compared with the Kyoto target (%)*



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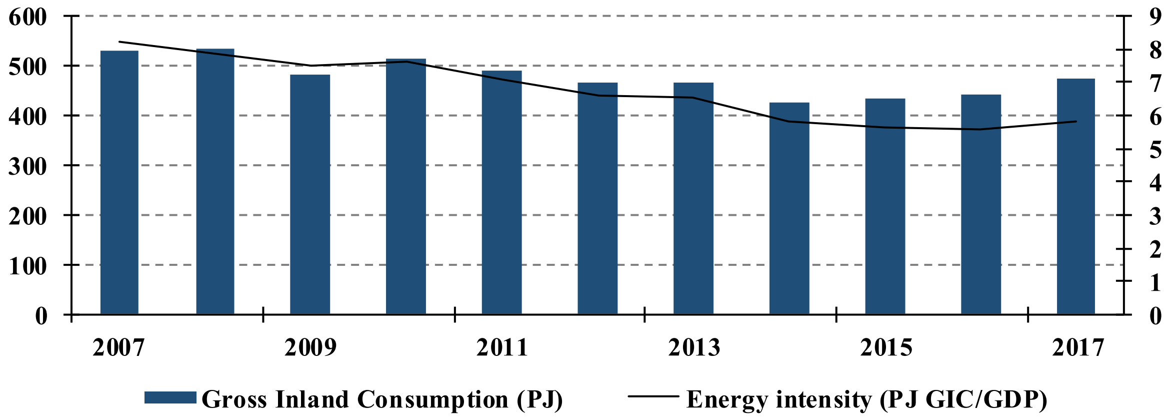
This important emissions reduction has resulted above all from the strong, although temporary decrease in economy activities, followed by restructuring of economy joined with implementing new and more effective technologies, reducing the share of the intensive energy industry and increasing share of services in GDP generation.

Structural changes in energy sector and the implementation of economic instruments have played an important role in achieving the current level, when the trend of GHG emissions does not copy the fast of GDP growth. In this context, the most important measure seems to be the adoption of the national legislation on air quality, which was approved in 1991 and it has initiated the positive trend in the reduction of the emissions of basic air pollutants and indirectly also GHG emissions. At the same time, the consumption of primary energy resources as well as total energy has decreased.

According to the statistical information from the Statistical Office of the Slovak Republic – information database Slovstat, energy industry including industrial processes (production and distribution of electricity, natural gas and water) reached 28% share on total GDP of the Slovak Republic in 2017. Energy intensity as the ratio of the gross inland consumption and the gross domestic product (GDP) for a given calendar year is an important economic indicator of the national economy. It measures the energy consumption of an economy and its overall energy efficiency. Energy intensity in the Slovak Republic had a declining trend in the past 10 years as the significant progress in reduction of energy intensity was achieved. In the period 2007 – 2017, the Slovak Republic reduced, in addition, its energy intensity by 11%. It is the second biggest reduction in terms of percentage among all EU Member States. Additionally, according to the Joint Research Centre of the European Commission, the highest reduction in the energy intensity values during the 15-years period from 2000 to 2014 was found in the Slovak Republic, which has undergone a growth rate of 82.5%.[2]

[2] Joint Research Centre: Energy Consumption and Energy Efficiency Trends in the EU-28 2000-2014 2016). p. 19. URL: http://iet.jrc.ec.europa.eu/energyefficiency/node/9145

Figure 2.3: *The trend of energy intensity (right y-axis) in the period 2007 - 2017 (estimated by the revised statistical approach NACErev.2)*



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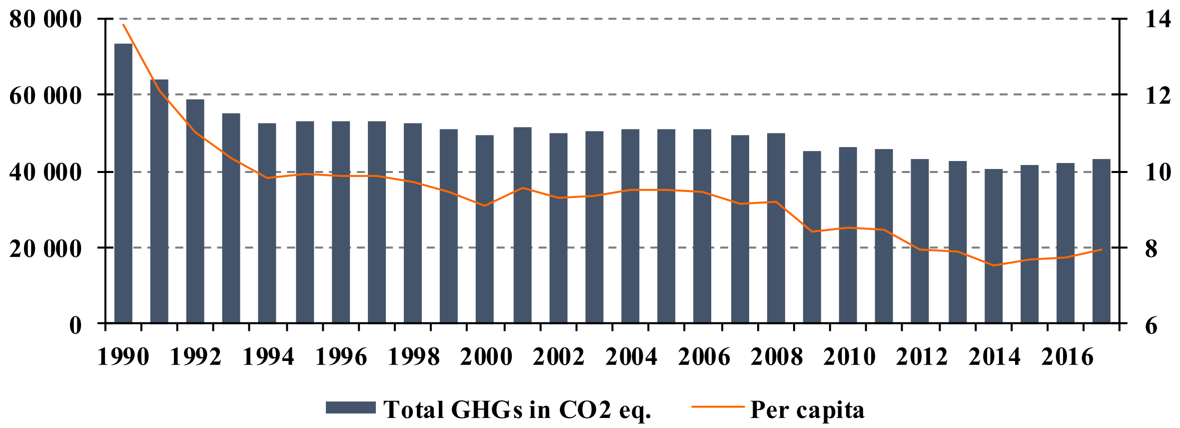
Beside the basic macroeconomic indicators as GDP, GDP per capita, foreign and domestic trade development, inflation or employment, there are also mentioned the data on the amount of investment in environmental protection and activities in the area of science and research, without specifying their orientation. The economic crisis, which began in 2008, has brought a significant weakening of the external demand, causing a decreasing dynamics of the Slovak export, manufacturing, labour market and total domestic demand. The debt crisis in the Eurozone that broke out in 2012 again caused a decline in external demand. The Slovak Republic managed to avoid recession due to new investments in the automobile industry, which supported exports. After this period, full recovery began, growth was mainly driven by household consumption. The increase in the number of people employed reduced the unemployment rate under the 5% in the end of the year 2019 (Central Office of Labour, Social Affairs and Family).

Continuous pressure is being put on formulating the effective strategy and policy to achieve further reduction of the emissions. While the indicator of carbon intensity can be changed much more rapidly in the situation of a high economic growth, GHG per capita is a different case where you can get very impressive results even without any measures, just by higher population growth rate. However, this is not the case of the Slovak Republic right now. It will take much longer time to change numerator by the impact of new technologies implementation namely in combination with high dynamic of development in the energy intensive industries.

Figure 2.4: *Total GHG emissions in Gg of CO_2 eq. per capita in 1990 - 2017*



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2.1.2 Emission trends by gases

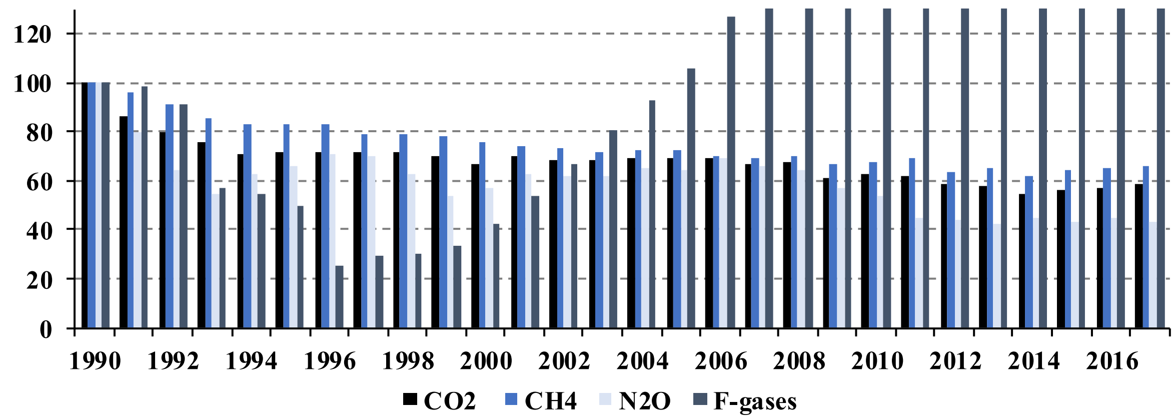
Total anthropogenic emissions of carbon dioxide excluding LULUCF have decreased by 41.5% in 2017 compared to the base year (1990). Nowadays the amount is 36 033.64 Gg of CO_2 without LULUCF. Compared to the previous inventory year 2016, the increase was above 3%. The reason for the increase in CO_2 emissions in 2017 is caused mainly by increasing CO_2 emissions in energy, transport and industrial processes sectors due to increase in economy and productivity in Slovakia. In 2017, CO_2 emissions including LULUCF sector are almost at the same level compared to the previous year and decreased by 43.2% compared to the base year.

Total anthropogenic emissions of methane without LULUCF decreased compared to the base year (1990) by 34.2% and currently the emissions are 4 601.17 Gg of CO_2 eq. In absolute value, CH_4 emissions were 184.05 Gg without LULUCF. Methane emissions from LULUCF sector are 0.85 Gg of CH_4 caused by forest fires. The trend has been relatively stable during the last years with a slight decrease in the year 2012 due to the emissions decrease from energy. Trend of methane emissions is influenced by the implementation of new waste legislation and measures in agriculture.

Total anthropogenic emissions of N_2O without LULUCF decreased compared to the base year (1990) by 57.0% and currently the emissions are 1 926.87 Gg of CO_2 eq. Emissions of N_2O in absolute value were 6.47 Gg without LULUCF. Emissions of N_2O from LULUCF sector are 0.12 Gg. In contradiction with the increasing trend in CO_2 and methane emissions, N_2O emissions decreased compared to the previous year 2016 by 4% due to the decrease in chemical industry. The trend depends on the nitric acid production. Overall decreasing trend is mainly driven by the decrease in agriculture due to declining number of animals and making use of fertilizers.

Total anthropogenic emissions of F-gases were 754.76 Gg, from it 739.06 Gg of HFCs, 8.62 Gg of PFCs and 7.08 Gg of SF_6 in CO_2 eq. Emissions of HFCs have increased since 1995 due to the increase in consumption and the replacement of PFCs and HFCs substances. Since that time, first decrease occurred in the last inventory year (2016). Decrease occurred in all F-gases and this is effect of implemented legislation of the EU in line with F-gases regulation. Emission trend of PFCs is decreasing and emissions of SF_6 are slightly increasing due to the increasing consumption in industry. Decrease of F-gases emissions in previous inventory year (2016) and increase in 2017 was caused by the biannual interval of servicing equipment.

Figure 2.5: *Emission trends by gas for the years 2000 – 2017 relative to the 1990 level (in %)*



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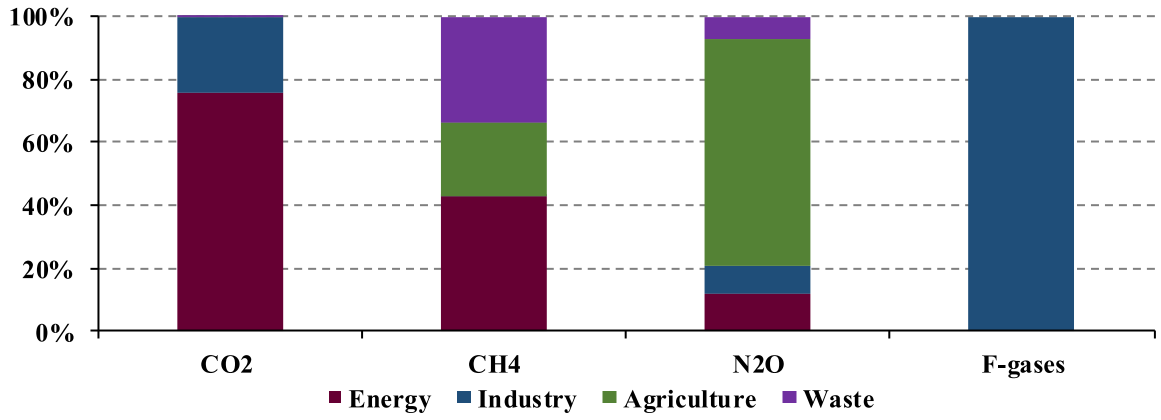
The major share of CO_2 emissions comes from the energy sector (fuel combustion, transport) with the 76% share from the total carbon dioxide emissions in 2017 inventory, 24% of CO_2 is produced in industrial processes and product use sector and negligible amount is produced in agriculture (0.2%) and waste (0.01%) sectors. The energy related CO_2 emissions from waste incineration are included in energy sector. Almost 34% of CH_4 emissions is produced in waste sector (SWDS), 43% of methane emissions is produced in energy sector and 24% in agriculture sector. More than 72% of N_2O emissions is produced in agriculture sector (nitrogen from soils), 9% in industrial processes sector (nitric acid production), 7% in waste sector and 12% in energy sector. F-gases are produced exclusively in sector industrial processes (***Figure 2.6***).

Figure 2.6: *Emission trends by gas in sectors in 2017*



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2.1.3 Emissions trends by main source and sink categories

Aggregated GHG emissions from energy sector based on sectoral approach (combustion) data in 2017 were estimated to be 27 706 Gg of CO_2 eq. including transport emissions (7 660 Gg of CO_2 eq.), which represent the decrease by 49% compared to the base year and 3.4% increase in comparison with 2016. Transport sub-sector increased by 2% compared to 2016 and in comparison with the base year it increased by almost 13%.

Total emissions from industrial processes and product use sector were 9 646.59 Gg of CO_2 eq. in 2017, which was decreased by 1% compared to the base year and the increased by 3% compared to the previous year. This sector covers also emissions from solvents use.

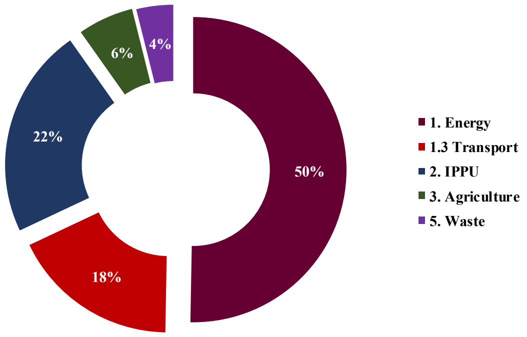
Emissions from agriculture sector were estimated to be 2 546.79 Gg of CO_2 eq. It is 57% decrease in comparison with the base year and 0.5% decrease in comparison to the previous year. The agriculture sector is the sector with the most significant decrease compared to the base year 1990, because of the decreasing trend in cattle numbers and fertilisers use.

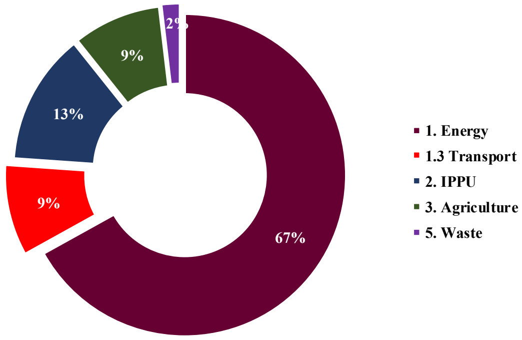
Emissions from waste sector were estimated to be 1 680.72 Gg of CO_2 eq. The increase is almost 2% compared to the previous inventory year and the time series are stable for last years. Compared to the base year, the increase was more than 17%, because of increased methane emissions from solid waste disposal sites. The emissions from waste incineration with energy use are included into energy sector, categories 1.A.1.a (waste incineration in electricity and heat generation), 1.A.2.f (waste incineration in cement industry) and 1.A.2.c (waste incineration in chemical industry).

International bunker emissions of the inventory are the sum of the aviation bunker and maritime bunker emissions. These emissions are reported as memo items but excluded from national totals. Emissions of greenhouse gases from international aviation increased constantly between 1992 and 2008. Between 2009 and 2014 international bunker emissions decreased, partly reflecting the economic recession. Total

GHG emissions from international transport reached 185.06 Gg of CO_2 eq. in 2017. Emissions from international aviation have more than 95% share.

Figure 2.7: *The share of individual sectors in total GHG emissions in 2017 (left) and in 1990 (right)*





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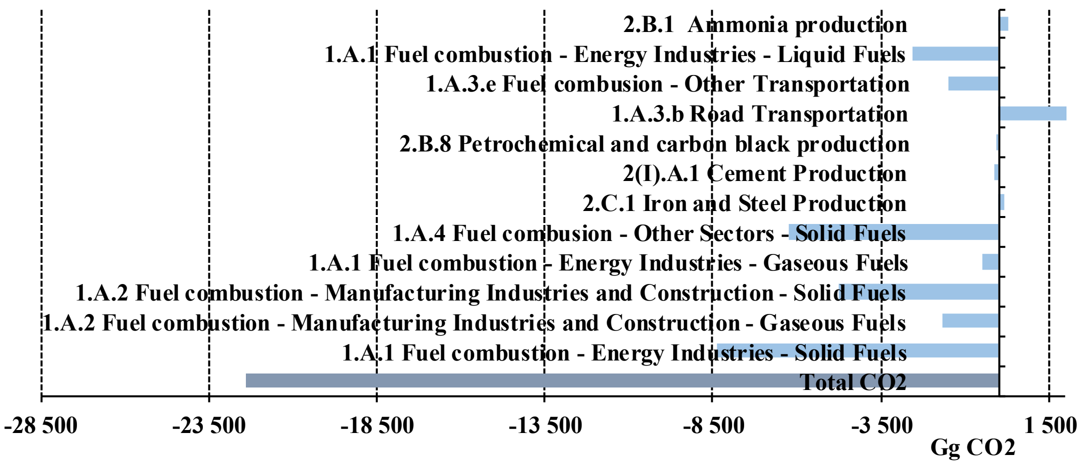
CO_2 emissions from the category 1.A.3.b - Road Transportation – diesel fuel are the largest key source remains accounting for 24% of total CO_2 emissions without LULUCF in 2017. Between 1990 and 2017, CO_2 emissions in road transportation increased by 2.6 Mt of CO_2, which is almost 60% increase due to an increase in fossil fuel consumption in this key category (***Figure 2.8***). Since 1990, the large increase in 'road transportation' related CO_2 emissions was recognized. The ***Figure 2.8*** below shows that, solid fuels from the category 1.A.1 Fuel combustion - Energy Industries, solid fuels is the second largest key category without LULUCF (15%) and the decrease (35%) is between 1990 and 2017. The main explanatory factors of emissions decrease is in improvements in energy efficiency and (fossil) fuel switching from coal to gas. A shift from solid and liquid fuels to mainly natural gas took place and an increase of biomass and other fuels has been recorded. CO_2 emissions from fuels in the category 2.C.1 - Iron and Steel Production are the largest key category without LULUCF in the IPPU sector, accounting for 15% of total CO_2 emissions in 2017. Emissions remain almost stable since the base year. CO_2 emissions from the category 1.A.2 in energy sector are the third largest key source in the Slovak Republic, accounting for 14.5% of total GHG emissions in 2017. Between 1990 and 2017, emissions from this category showed the decrease by 47%.

Figure 2.8: *Absolute change of CO_2 emissions by large key categories 1990 to 2017*



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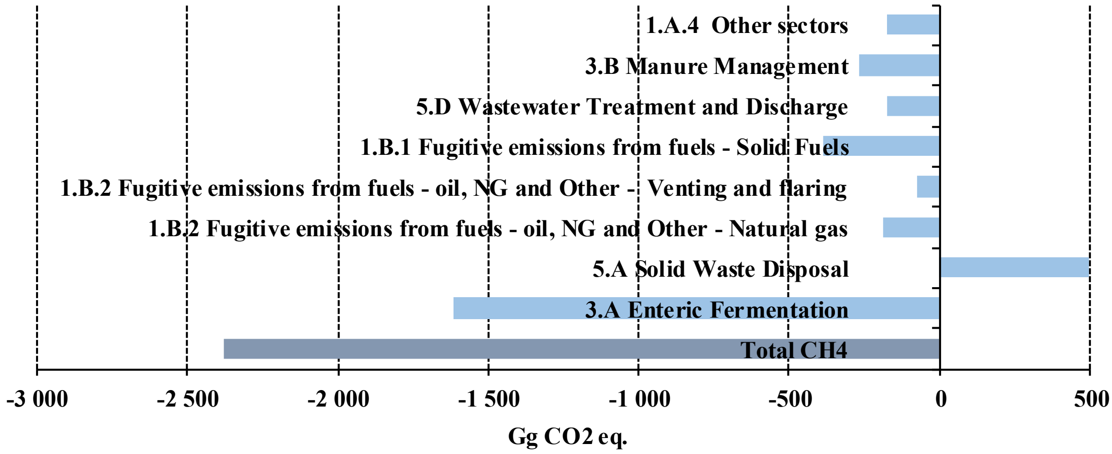
Methane emissions account for 11% of total GHG emissions in 2017 and decreased by 34% since 1990 to 184.05 Gg CH_4 in 2017. The three largest key sources (5.A Solid Waste Disposal at 25%, 3.A Enteric Fermentation at 21% and Fugitive Emissions from Fuels – natural gas at 20% of total CH4 emissions in 2017) account for more than 60% of CH_4 emissions in 2017. ***Figure 2.9*** shows that the main reasons for declining CH_4 emissions were reductions in enteric fermentation mainly caused by the decreased of animal numbers and use reductions in fugitive emissions and coal mining. ***Figure 2.9*** shows significant decrease in the category 3.A and 3.B and increase in 5.A waste sector caused by the change of IPCC methodology used for solid waste disposal sites which considers time layer since 1960.

Figure 2.9: *Absolute change of CH_4 emissions by large key categories 1990 to 2017*



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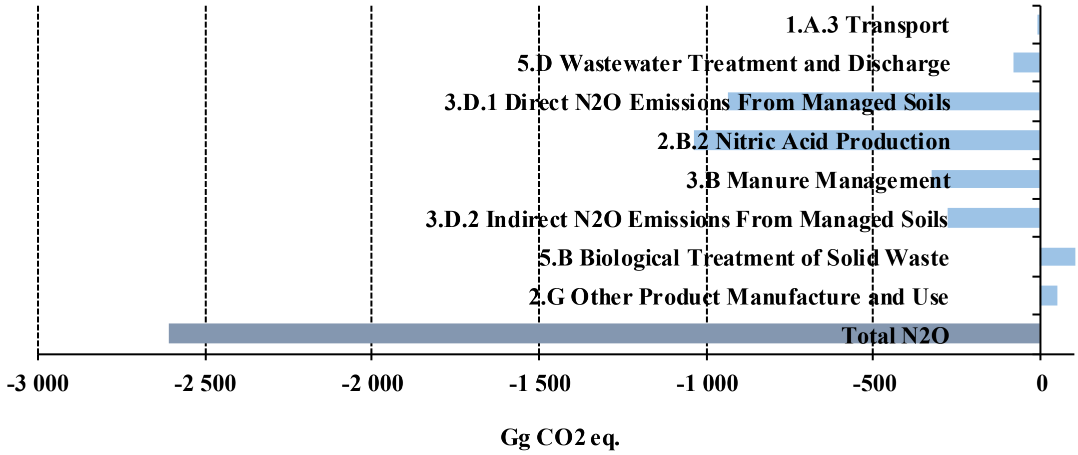
N_2O emissions are responsible for 4.5% of total GHG emissions and decreased by 57% to 6.47 Gg of N_2O without LULUCF in 2017 (***Figure 2.10***). The three largest key sources causing this trend – 3.D.1 Direct N_2O Emissions from Managed Soils 47%, 3.D.2 Indirect N_2O Emissions from Managed Soils at 16% and 5.B Biological Treatment of Solid Waste at 15% of total N_2O emissions in 2017. The main reason for large N_2O emission cuts were reduction measures in the "nitric acid production" and decreasing agricultural activities ***(Figure 2.10***). N_2O emissions increased in Biological Treatment of Waste and Other Products Manufactured categories. This increase was caused by increase of operationalise and production.

Fluorinated gas emissions account for 1.7% of total GHG emissions. In 2017, emissions were 754.76 Gg CO_2 eq., which was 142% above 1990 levels. The largest key source is 2.F.1 Refrigeration and Air Conditioning and accounts for 93.5% of fluorinated gas emissions in 2017. HFC emissions from the consumption of halocarbons showed large increases between 1990 and 2017. The main reason for this is the phase-out of ozone-depleting substances such as chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs (mainly in refrigeration, air conditioning, foam production and as aerosol propellants). On the other hand, PFC emissions have decreased substantially since the base year. The decrease has started in 1996 and peaked in 1999 and 2000.

Figure 2.10: *Absolute change of N_2O emissions by large key categories 1990 to 2017*



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The Slovak Republic has selected as threshold values for the forest definition for reporting under Article 3.3 (ARD activities: afforestation, reforestation and deforestation) the following: forest land includes the land with minimum tree crown cover of 20% for trees capable to reach minimum height of 5 m in situ. The minimum area for forest is 0.3 ha. Temporarily unstocked areas are included (forest regeneration areas). For linear formations, a minimum width of 20 m is applied.

Table 2.1: *Selected parameters defining forest in the Slovak Republic for reporting under the KP*

PARAMETER	RANGE	SELECTED VALUE
Minimum Land Area	0.05 - 1 ha	0.3 ha
Minimum Crown Cover	10 - 30%	20%
Minimum Height	2 - 5 m	5 m

The selected threshold values are consistent over the first and second commitment periods (CP), as well as with the values used in the reporting to the Food and Agriculture Organisation of the United Nations (the GFRA 2005), the National Forest Inventory, and the MCPFE criteria and indicators of sustainable forest management).

The Slovak Republic was reporting and accounting on the mandatory activities under Article 3.3 (afforestation and reforestation; deforestation, also referred as ARD in the further text) for the first (CP1) as well as for the second commitment period (CP2).

The Slovak Republic has decided not to elect any voluntary activity under Article 3.4 (cropland management, grazing land management, revegetation or wetland drainage and rewetting) for meeting its commitment under the CP2 of the Kyoto Protocol. For the CP2 the Slovak Republic reports also on the activity forest management under Article 3.4 (FM) as it became mandatory.

The afforestation/reforestation activities represented the total net removals of -1 968.51 Gg CO_2 eq. for the first commitment period. Total CO_2 removals from afforestation/reforestation activities were -543.92 Gg of CO_2 eq. in 2017 (changes in 45.05 kha to the end of 2017). Total CO_2 emissions from deforestation were 57.20 Gg of CO_2 eq. in 2017 (changes in 8.56 kha to the end of 2017). The activities under Article 3.3 of Kyoto Protocol represent the net removal of -486.71 Gg of CO_2 eq. with the changes on the area 1 977.47 kha at the end of 2017.

The CO_2 removals from forest management were related to the changes in living biomass. The net removals in this activity were -4 927.09 Gg CO_2 in 2017. The emissions from biomass burning are associated with FM as well. The emissions of CH_4 and N_2O in 2017 were 0.85 Gg CH_4 and 0.05 Gg N_2O in 2017. The net removals were -4 892.02 Gg CO_2 eq. in 2017.

Table 2.2: *Emissions and removals (Gg of CO_2 eq.) from 2013 to 2017 resulting from activities under the Articles 3.3 and 3.4 of the Kyoto Protocol*

ACTIVITIES	2013	2014	2015	2016	2017	TOTAL
Total 3.3 and 3.4	**-6 945.95**	**-5 001.24**	**-5 589.25**	**-5 469.08**	**-5 378.74**	**-28 384.26**
A. Article 3.3 activities	**-399.93**	**-400.23**	**-435.98**	**-494.60**	**-486.71**	**-2 217.46**
A.1Afforestation/ Reforestation	-443.28	-462.92	-497.16	-523.25	-543.92	-2 470.53
A.2 Deforestation	43.35	62.69	61.19	28.65	57.20	253.08
B. Article 3.4 activities	**-6 546.02**	**-4 601.01**	**-5 153.27**	**-4 974.48**	**-4 892.02**	**-26 166.81**
B.1 Forest Management	-6 546.02	-4 601.01	-5 153.27	-4 974.48	-4 892.02	-26 166.81

Submission 30.04.2019

2.2 NATIONAL INVENTORY ARRANGEMENTS

The main institutions involved in the compilation of the GHG inventory of the Slovak Republic together with their relationships and linkages for data flows are described in the SVK National Inventory Report 2019, Chapter 1.2.

The Ministry of Environment of the Slovak Republic (MŽP SR) is responsible for development and implementation of national environmental policy including climate change and air protection objectives. It has the responsibility to develop strategies and further instruments of implementation, such as acts, regulatory measures, economic and market based instruments for cost efficient fulfilment of adopted goals. Both, the conceptual documents as well as legislative proposals are always annotated by all ministries and other relevant bodies. Following the commenting process, the proposed acts are negotiated in the Legislative Council of the Government, approved by the Government, and finally by the Slovak Parliament.

The Ministry of Environment of the Slovak Republic is the main body to ensure conditions and to monitor progress of Slovakia to meet all commitments and obligations of climate change and adaptation policy.

According to the Governmental Resolution No 821/2011 Coll. from 19 December 2011, the interministerial High Level Committee for the Coordination of Climate Change Policy was established. This Committee was created at the state secretary level and replaced previous coordinating body, i.e. the High Level Committee on Climate-Energy Package established in August 2008. Committee is chaired by the State Secretary of the Ministry of Environment, other members are the state secretaries of the Ministry of Economy, Ministry of Agriculture and Rural Development, Ministry of Transport and Construction, Ministry of Education, Science, Research and Sport, Ministry of Health, Ministry of Finance, Ministry of Foreign Affairs and the Head of the Regulatory Office for the Network Industries.

Main objective of the Coordination Committee is an effective coordination at developing and implementation of mitigation and adaptation policies and selection of appropriate measures to fulfil international obligations. An important output of its activities is also "Report on the Current State of Fulfilment of the International Climate Change Policy Commitments of the Slovak Republic" ("Správa o priebežnom stave plnenia prijatých medzinárodných záväzkov SR v oblasti politiky zmeny klímy"), annually (from 2017 every two years) submitted to the Government, with aim to inform it on the basis of a detailed analysis of current progress on this issue. The first was in June 2012[3], another in April 2013[4], in April 2014[5], in April 2015[6], in April 2016[7], in April 2017[8] and in April 2019[9].

Articles 4 and 12 of the UNFCCC require the Parties to the UNFCCC to develop, periodically update, publish, and make available to the Conference of the Parties their national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled under the Montreal Protocol. Moreover, the commitments require estimation of emissions and removals as a part of ensure that Parties are in compliance with emission limits, that they have a national system for estimation of sources and sinks of greenhouse gases, that they submit an inventory annually, and that they formulate national programs to improve the quality of emission factors, activity data, or methods. The obligation of the Slovak Republic to create and maintain the national inventory system (NIS) which enables continual monitoring of greenhouse gases emissions is given by Article 5, paragraph 1 of the Kyoto Protocol.

Setting up the National Inventory System (NIS) of emissions in compliance with the Kyoto Protocol requirements was framed with functions which it should fulfil according to the decision 19/CMP.1 The basic characteristics of the NIS are as follows:

- To ensure linkages and co-operation among involved institutions, bodies and individuals to perform all activities for monitoring and estimation of GHG emissions from all sectors/categories according to the UNFCCC guidelines and relevant decisions and according to the approved IPCC methodologies. To enable using of all relevant data from national and international databases for preparing and improving GHG emission inventory.
- To define role and competencies of all involved stakeholders including the role of National Focal Point to the UNFCCC.
- To define and regularly implement quality assurance and quality control (QA/QC) process in two lines; both internally and also externally by appropriate body.
- To ensure ongoing process of development capacities; financial, technical and expert sources in relation to QA/QC but also in relation to new tasks rising from the international process.

The National Inventory System of the Slovak Republic (http://ghg-inventory.shmu.sk/) has been established and officially announced by Decision of the Ministry of Environment of the Slovak Republic on 1 January 2007 in the official bulletin: Vestník, Ministry of Environment, XV, 3, 2007[10] In agreement with paragraph 30(f) of Annex to Decision 19/CMP.1 which gives the definitions of all qualitative parameters for the national inventory systems, the description of quality assurance and quality control plan according to Article 5, paragraph 1 is also required. The revised report of the National Inventory System dated on November 2008 was focused on the changes in the institutional arrangement, quality assurance/quality control plan and planned improvements. The regular update of the National Inventory System with all qualitative and quantitative indicators is provided in the National Inventory Reports and

[3] http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=21144

[4] http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=22264

[5] http://www.rokovanie.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=23392

[6] http://www.rokovanie.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=24429

[7] http://www.rokovanie.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=25426

[8] http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=26360 (No 151/2017)

[9] https://rokovania.gov.sk/RVL/Material/23680/1

[10] "Vestnik" (Official Journal of the Ministry of Environment), XV, 3, 2007, page 19: National inventory system of the Slovak Republic for the GHG emissions and sinks under the Article 5, of the Kyoto Protocol.

was also provided in the Seventh National Communication of the SR on Climate Change, published in December 2017.

On the ***Figure 2.11*** is shown a structure of the NIS, where the Committee on CCP is intergovernmental body responsible for climate change policy implementation on cross-ministerial level.

2.2.1 Information on changes in the National Inventory System

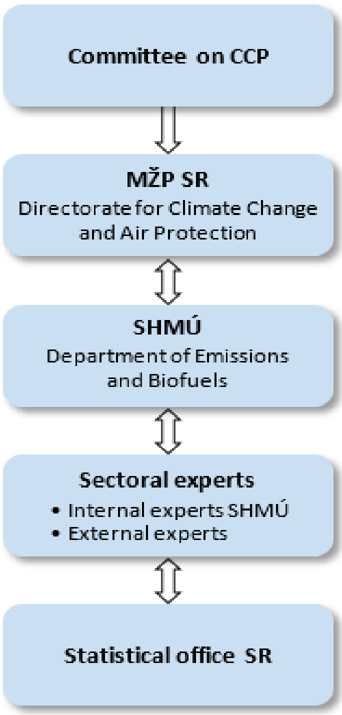
No significant changes in the arrangement or structure of the National Inventory System of the Slovak Republic occurred since the Third Biennial Report. The SVK NIS is operational, functioning and fulfilling all main tasks and obligation in the line with the approved plans. Standard actions regarding the personal and financial capacity took place and the activity is guarantee.

In line with the recommendation from the previous review of the National Communication to improve transparency of reporting changes in our SVK NIS structure and arrangement following information is available.

- Organisational changes occurred in the 1.1.2017 at the SHMÚ (the new structure of SHMÚ at http://www.shmu.sk//File/Org_Struktura_SHMU/Struktura_bezVO_1_1_2017.pdf. They resulted in establishment of the Department of Emissions and Biofuels (OEaB). The OEaB has two main tasks: emission inventories (GHG, NECD, and CRLTAP) and National System of Biofuels.
- The OEaB was defined as the Single National Entity of the National Inventory System of the Slovak Republic.

This institutional updates and steps led to increase of robustness and sustainability of the National Inventory System taken place in the years 2016 and beginning of the year 2017. These changes were initiated by the new Government after spring (2016) elections and pushed by the Slovak Presidency of the European Council (2016).

Figure 2.11: *Institutional arrangement of the National Inventory System of the Slovak Republic*



2.2.2 Quality management

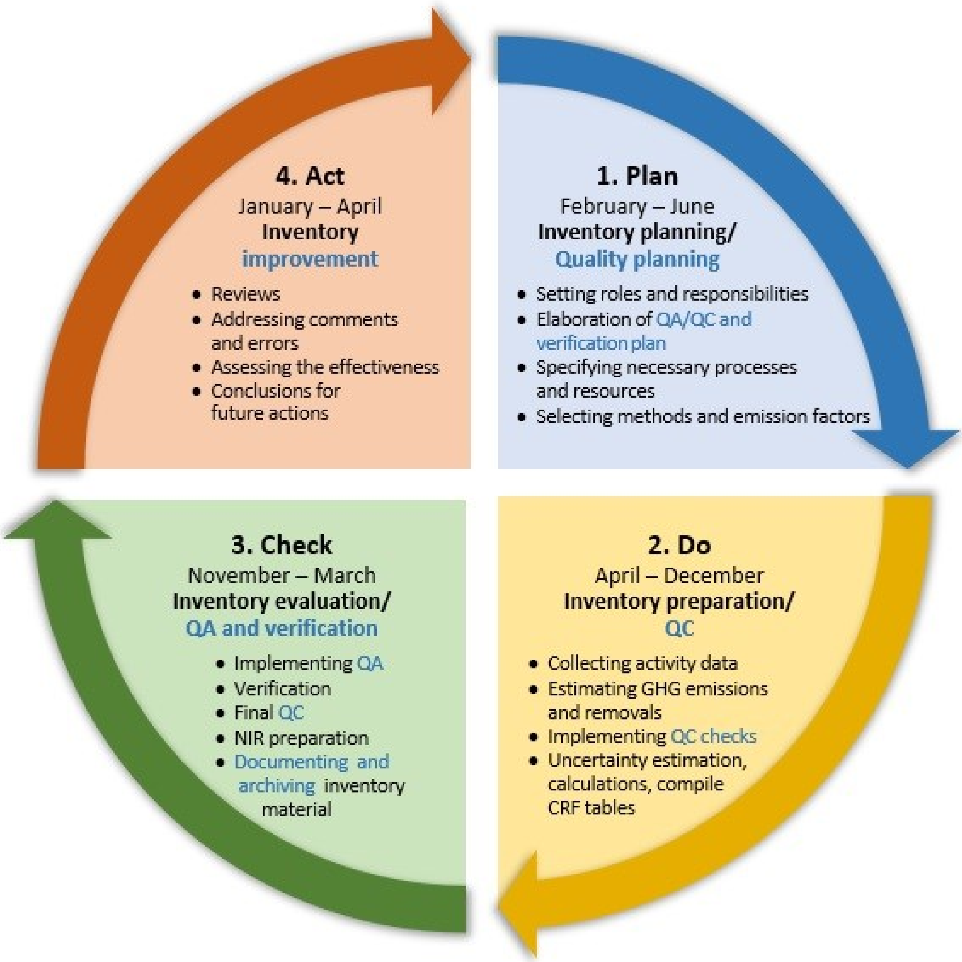
The Slovak Hydrometeorological Institute has built and introduced the quality management system (QMS) according to the requirements of EN ISO 9001:2008 standard of conformity. In the frame of introduction of the QMS for the SHMÚ as a global standard, the certification itself proceeds according to the partial processes inside of the SHMÚ structure. The process of Emission Inventories was the subject of internal and external audits during March 2010 by the certification body ACERT, accredited by the Slovak National Accreditation Service. The quality manager completed several trainings regarding QMS. A recertification process takes place every two years.

The objective of the National Inventory System (NIS) is to produce high-quality GHG inventories. In the context of GHG inventories, high quality provides that both the structures of the national system (i.e. all institutional, legal and procedural arrangements) for estimating GHG emissions and removals and the inventory submissions (i.e. outputs, products) comply with the requirements, principles and elements arising from UNFCCC, the Kyoto Protocol, the IPCC guidelines and the EU GHG monitoring mechanism (Regulation No 525/2013/ of the European Parliament and of the Council).

The starting point for accomplishing a high-quality GHG inventory is consideration of the expectations and requirements directed at the inventory. The quality requirements set for the annual inventories - transparency, consistency, comparability, completeness, accuracy, timeliness and continuous improvement - are fulfilled by implementing the QA/QC process consistently.

The ***Figure 2.12*** shows a model for the timeline steps provided in the inventory process, QA/QC activities and verification procedures.

Figure 2.12: *PDCA cycle (Plan, Do, Check, Act)*



3 QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

The Slovak Republic, as a one of the EU Member State, participate in the EU 2020 and EU 2030 emission reduction targets under the UNFCCC and the compliance architecture set up within the EU in order to meet that targets, and gives an overview of other EU environmental targets. The Slovak Republic also inform about the national circumstances and the progress in the fulfilment of the national mitigation policy.

3.1 DESCRIPTION OF THE QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS

In 2010, the EU 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 stabilise GHG concentrations at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system, 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 EU had also committed to raising this target to a 30% emission reduction by 2020 compared with 1990 levels, provided that other developed countries also commit to achieving comparable emission reductions, and that developing countries contribute adequately, according to their responsibilities and respective capabilities. This offer was reiterated in the submission to the UNFCCC by the EU-28 and Iceland on 30 April 2014.[11]

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).

The EU's accounting rules for the target under the UNFCCC are more ambitious than the current rules under the Kyoto Protocol, for example, including international aviation, and adding an annual compliance cycle for emissions under the Effort Sharing Decision or higher Clean Development Mechanism (CDM) quality standards under the EU Emissions Trading System (EU ETS) (FCCC/TP/2013/7). Accordingly, the following assumptions and conditions apply to the EU's 20% target under the UNFCCC:

- The EU Convention pledge does not include emissions/removals from Land Use, Land Use Change and Forestry, but it is estimated to be a net sink over the relevant period. EU inventories also include information on emissions and removals from LULUCF in accordance with relevant reporting commitments under the UNFCCC. Accounting for LULUCF activities only takes place under the Kyoto Protocol.
- The target covers the gases CO_2, CH_4, N_2O, HFCs, PFCs and SF_6.

[11] European Union, its Member States and Iceland submission pursuant to par 9 of decision 1/CMP.8 http://ec.europa.eu/clima/policies/international/negotiations/docs/eu_submission_20140430_en.pdf

- The target refers to 1990 as a single base year for all covered gases and all Member States. Emissions from international aviation to the extent it is included in the EU ETS are included in the target.[12]
- A limited number of CERs, ERUs and units from new market-based mechanisms may be used to achieve the target: in the ETS, the use of international credits is capped (up to 50% of the reduction required from EU ETS sectors by 2020). Quality standards also apply to the use of international credits in the EU ETS, including a ban on credits from LULUCF projects and certain industrial gas projects. In the ESD sectors, the annual use of international credits is limited to up to 3% of each Member State's ESD emissions in 2005, with a limited number of Member States being permitted to use an additional 1% from projects in Least Developed Countries (LDCs) or Small Island Developing States (SIDS), subject to conditions.

In 2015 the Paris Agreement was adopted and provides a framework to revisit and raise ambition in the future. Countries will now have to come together regularly to review their climate plans and collectively ensure that the necessary action is being taken to tackle climate change and limit global temperature rises to below 2°C, and pursue efforts for 1.5°C; and countries strive to prepare long-term low GHG emission development strategies. European Union has ratified the Paris Agreement on 5 October 2016. In pursuit of the temperature goals in the Paris Agreement, the Union should aim to achieve a balance between anthropogenic GHG emissions by sources and removals by sinks as early as possible and, as appropriate, achieve negative emissions thereafter.

The European Union has adopted Regulation 2018/1999 on the Governance of the Energy Union and Climate Action in December 2018. This Regulation sets out the necessary legislative foundation for reliable, inclusive, cost-efficient, transparent and predictable governance of the Energy Union and Climate Action (governance mechanism), which ensures the achievement of the 2030 and long-term objectives and targets of the Energy Union in line with the Paris Agreement. In this line, EU endorsed a 2030 Framework for Energy and Climate for the Union based on four key Union-level targets:

- a reduction of at least 40 % in economy-wide greenhouse gas (GHG) emissions;
- an indicative target of improvement in energy efficiency of at least 27%, to be reviewed by 2020 with a view to increasing the level to 30% - 32,5%;
- a share of renewable energy consumed in the Union of at least 27% with a view to increasing the level to 32%;
- and electricity interconnection of at least 15%.

3.2 CONDITIONS OR ASSUMPTIONS OF THE TARGET

The Global Warming Potentials (GWPs) used to aggregate GHG emissions up to 2020 under EU legislation were those based on the Second Assessment Report of the IPCC when the target was submitted. In accordance with the CMP Decision to revise the GWPs to those from the IPCC Fourth Assessment Report (AR4) revised GWPs from AR4 were adopted for the EU ETS. The revised GWPs were taken into account for the revision of the ESD target. For the implementation until 2020, GWPs from AR4 will be used consistently with the UNFCCC reporting guidelines for GHG inventories.

[12] In the EU, the sum of emissions covered by categories 1.A.3.a 'domestic aviation' and memo item “international bunkers – aviation” go beyond the scope of the EU target, as emissions from international aviation are included in the EU Climate and Energy Package and the EU target under the UNFCCC to the extent to which aviation is part of the EU ETS.

Table 3.1: *Key facts of the Convention 2020 targets of the EU-28*

PARAMETERS	TARGET
Base Year	1990
Target Year	2020
Emission Reduction target	-20% in 2020 compared to 1990
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6
Global Warming Potential	AR4
Sectors Covered	All IPCC sources and sectors, as measured by the full annual inventory and international aviation to the extent it is included in the EU ETS.
Land Use, Land-Use Change, and Forests (LULUCF)	Accounted under KP, reported in EU inventories under the Convention. Assumed to produce net removals.
Use of international credits (JI and CDM)	Possible subject to quantitative and qualitative limits.
Other	Conditional offer to move to a 30% reduction by 2020 compared to 1990 levels as part of a global and comprehensive agreement for the period beyond 2012, provided, that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities.

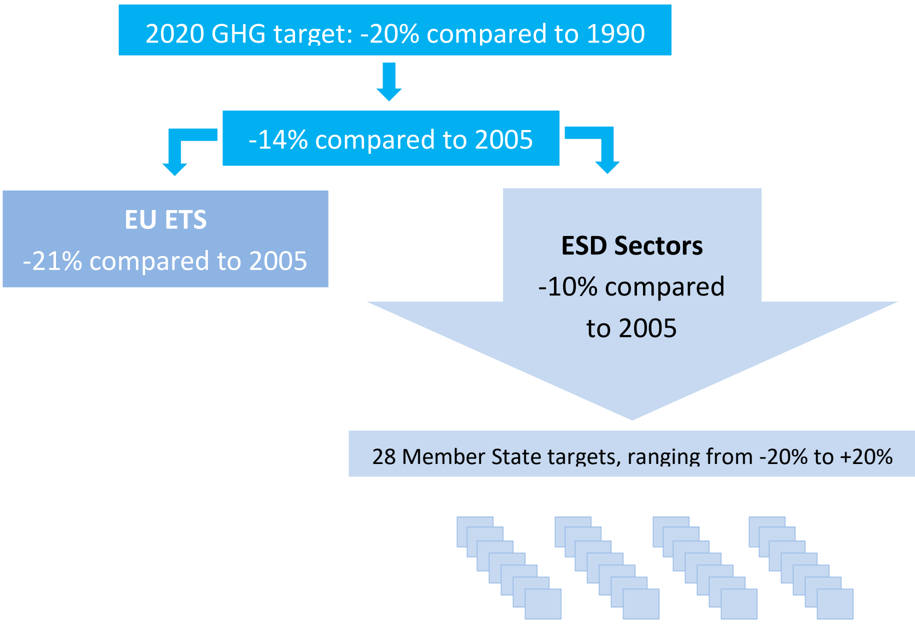
As this 2020 target under the Convention has only been submitted by EU-28 and not by each of its Member States (MS), there are no specified Convention targets for single MS. Due to this, Slovakia as part of the EU-28, takes on a quantified economy-wide emission reduction target jointly with all Member States.

With the 2020 climate and energy package the EU has set internal rules which underpin the implementation of the target under the Convention. The 2020 climate and energy package introduced a clear approach to achieving the 20% reduction of total GHG emissions from 1990 levels, which is equivalent to a 14% reduction compared to 2005 levels. This 14% reduction objective is divided between two sub-targets, equivalent to a split of the reduction effort between ETS and non-ETS sectors (ESD).

These two sub-targets are:

- 21% reduction target compared to 2005 for emissions covered by the ETS (including domestic and international aviation);
- 10% reduction target compared to 2005 for ESD sectors, shared between the 28 MS through individual national GHG targets.

Figure 3.1: *GHG targets under the 2020 climate and energy package*



Under the revised EU ETS Directive,[13] one single EU ETS cap covers the EU Member States and the three participating non-EU Member States (Norway, Iceland and Liechtenstein), i.e. there are no further differentiated caps by country. For allowances allocated to the EU ETS sectors, annual caps have been set for the period from 2013 to 2020, these decreases by 1.74% annually, starting from the average level of allowances issued by Member States for the second trading period (2008 – 2012). The annual caps imply interim targets for emission reductions in sectors covered by the EU ETS for each year until 2020. For further information on the EU ETS and for information on the use of flexible mechanisms in the EU ETS see the EU-BR1 (Chapter 4.2.2), EU-BR2 (Chapter 3.1) and EU-BR3 (Chapter 3.2).

Non-ETS emissions are addressed under the Effort Sharing Decision (ESD).[14] The ESD covers emissions from all sources outside the EU ETS, except for emissions from international maritime, domestic and international aviation (which were included in the EU ETS from 1 January 2012) and emissions and removals from land use, land-use change and forestry (LULUCF). It thus includes a diverse range of small-scale emitters in a wide range of sectors: transport (cars, trucks), buildings (in particular heating), services, small industrial installations, fugitive emissions from the energy sector, emissions of fluorinated gases from appliances and other sources, agriculture and waste. Such sources currently account for about 55% of total GHG emissions in the EU.[15]

While the EU ETS target is to be achieved by the EU as a whole, the ESD target was divided into national targets to be achieved individually by each Member State (***Figure 3.1***). In the Effort Sharing Decision national emission targets for 2020 are set, expressed as percentage changes from 2005 levels. For Slovakia, this percentage changes from 2005 levels are +13%. These changes have been transferred

[13] Directive 2009/29/EC of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community.

[14] Decision No 406/2009/EC.

[15] European Commission. Commission Staff Working Document - Accompanying the document: Report from the Commission to the European Parliament and the Council on evaluating the implementation of Decision No 406/2009/EC pursuant to its Article 14. (SWD(2016) 251 final) 2016 https://ec.europa.eu/transparency/regdoc/rep/10102/2016/EN/10102-2016-251-EN-F1-1-ANNEX-1.PDF.

into binding quantified annual reduction targets for the period from 2013 to 2020 (EC 2013),[16,17] expressed in Annual Emission Allocations (AEAs). The quantified annual reduction targets 2013 – 2020 of Slovakia are set from 24.02 million AEAs in 2013, and increasing to 25.95 million AEAs in 2020. In the year 2017, verified emissions from stationary installations covered under the EU-ETS in Slovakia summed up to 22.1 Mt CO_2 eq. With total GHG emissions of 43.3 Mt CO_2 eq. (without LULUCF), the share of EU ETS emissions is around 51%.

As part of the flexibilities allowed under the ESD Member States are able to make: carry-over of over-achievements to subsequent years within each Member State, transfers of AEAs between Member States and the use of international credits (credits from Joint Implementation and the Clean Development Mechanism). MS exceeding their annual AEA, even after taking into account the flexibility provisions and the use of JI/CDM credits, will face inter alia a penalty – a deduction from their emission allocation of the following year (excess emissions, multiplied by 1.08). In 2017, the Slovak Republic used the carry-over flexibility under the ESD. According to results of compliance cycle for 2013, 2014, 2015 and 2016 ESD emissions the Slovak Republic carried-over its surplus AEAs to the subsequent years of the compliance period 2013 – 2020 (2013 and 2015 surplus AEAs was carried-over to 2020 and 2014 surplus AEAs was carried-over to 2016. Subsequently the 2016 surplus (including 2014 surplus) was carried-over to 2020).

The monitoring process is harmonized for all European MS, especially laid down in the Monitoring Mechanism Regulation.[18] The use of flexible mechanisms is possible under the EU ETS and the ESD. For the use of CER and ERU under the EU ETS, please refer to the Fourth Biennial Report of the European Union.

For more detailed explanation on how the EU climate and energy package, as well as the EU target under the Convention and the KP are set up and related, please also refer to the EU-BR4. A further target has been pledged to the Convention through the EU's Nationally Determined Contribution submitted under the Paris Agreement, and has been adopted by the EU under the 2030 Climate and Energy Framework.[19] The emission reduction target is a pledge to reduce emissions by at least 40% (compared to 1990 levels) by 2030, enabling the EU to move towards a low-carbon economy and implement its commitments under the Paris Agreement. In order to achieve this target:

- EU emissions trading system (ETS) sectors will have to cut emissions by 43% (compared to 2005) by 2030. This has been agreed under the Revised EU ETS Directive (2018/410).[20]
- Effort Sharing sectors will need to cut emissions by 30% (compared to 2005) by 2030 – this has been translated into individual binding targets for Member States. The target for the Slovak Republic is 12% emissions reduction against 2005. This has been agreed under the Effort

[16] Commission Decision of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (2013/162/EU).

[17] Commission Implementing Decision of 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/ EC of the European Parliament and of the Council (2013/634/EU).

[18] Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC.

[19] Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions. A policy framework for climate and energy in the period from 2020 to 2030 COM(2014) 015 final.

[20] Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814.

Sharing Regulation (2018/842).[21] While the Effort Sharing Regulation does not cover the LULUCF sector as such, it does allows Member States to use up to 280 million credits from the land-use sector over the entire period 2021-2030 to comply with their national targets. Slovakia has approved the Slovak EviroStrategy 2030, which sets a voluntary increase of the legislative target up to 20% emission reduction target for Slovakia until 2030 against 2005 (described in Chapter 4.2.2).

- Emissions and removals from the LULUCF sector are included for the first time in the EU climate target through the so-called LULUCF Regulation (2018/841).[22] Each Member State will have to ensure that the LULUCF sector does not create debits, once specific accounting rules are applied. This is known as the "no debit" rule.

Table 3.2: *Key facts of the Convention 2030 targets of the EU-28*

PARAMETERS	TARGET
Base Year	1990
Target Year	2030
Emission Reduction target	-40% in 2030 compared to 1990
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6
Global Warming Potential	AR4
Sectors Covered	All IPCC sources and sectors, as measured by the full annual inventory and international aviation to the extent it is included in the EU ETS.
Land Use, Land-Use Change, and Forests (LULUCF)	Accounted under KP, reported in EU inventories under the Convention. Assumed to produce net removals.
Use of international credits (JI and CDM)	Possible subject to quantitative and qualitative limits.
Other	Conditional offer to move to a 45% reduction by 2030 compared to 1990 levels as part of a global and comprehensive agreement for the period beyond 2020.

For tabular summary of the information provided in this Section please see SVK CTF 2020 Table 2.

[21] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013.

[22] Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU.

3.3 TARGET COMPLIANCE ARCHITECTURE

For the monitoring of GHG emissions at the EU and the Member State level, the Monitoring Mechanism Regulation has been adopted (see below). Also for the effective operation of the EU ETS, robust, transparent, consistent and accurate monitoring and reporting of greenhouse gas emissions are essential, therefore an annual procedure of monitoring, reporting and verification (MRV) is implemented. Installations and aircraft operators have to monitor, report and verify their annual emissions in accordance with two EU Regulations, the Monitoring and Reporting Regulation (MRR) and the Accreditation and Verification Regulation (AVR).

3.3.1 Monitoring Mechanism Regulation

The Monitoring Mechanism Regulation 525/2013 (MMR) was adopted in May 2013 and entered into force on July 8, 2013. The main aims of the MMR are to improve the quality of the data reported and assist the EU and Member States with the tracking of their progress towards emission targets for 2013 – 2020. The mechanism refers to the following reporting elements:

- Reporting on historical GHG emissions and removals, including national and Union inventory systems and approximated inventories;
- Reporting on low-carbon development strategies;
- Reporting on policies and measures and on projections of GHG emissions and removals;
- Member States reporting on financial and technology support provided to developing countries;
- Member States' use of revenues from the auctioning of allowances in the EU ETS;
- Member States' reporting on adaptation to climate change.

In 2014, the Implementing Regulation (EU) 749/2014 and Delegated Regulation (EU) 666/2014 were adopted to enable the implementation of the Monitoring Mechanism Regulation in several of its provisions, specifying in more detail the structure of the information, reporting formats, and submission procedures.

3.3.2 LULUCF Decision

LULUCF Decision 529/2013/EÚ was adopted in May 2013 sets out accounting rules applicable to emissions and removals from the LULUCF sector. It sets out the obligation for Member States to provide information on their LULUCF actions to limit or reduce emissions and to maintain or increase removals.

3.3.3 Monitoring and reporting under the EU Emission Trading System

The reform of the EU Emission Trading System in Phase III (2013 – 2020) has resulted in important changes with regard to domestic institutional arrangements for the monitoring and reporting of GHG emissions under the EU ETS. EU ETS MRV now requires complying with two Commission Regulations, one specific to monitoring and reporting (EU) No 601/2012 and the other to verification and accreditation (EU) No 600/2012 – which was from 1 January 2019 replaced by the Commission Implementing Regulation (EU) No 2018/2067 on the verification of data and on the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council). The latter introduces a framework of rules for the accreditation of verifiers to ensure that the verification of an installation's or an aircraft operator's emission report is carried out by a verifier that possesses the technical competence to perform the entrusted task in an independent and impartial manner and in conformity with the requirements and principles set out. These regulations have direct legal effect in the Member States and their provisions apply directly to operators or aircraft operators, verifiers, and accreditation parties. The regulations provide clarity on the roles and responsibilities of all parties (i.e.

industrial installations and aircraft operators are required to have an approved monitoring plan) which will strengthen the compliance chain.

3.3.4 Effort Sharing Regulation

In October 2014, EU leaders set a binding economy-wide domestic emission reductions target of at least 40% by 2030 compared to 1990. The sectors of the economy not covered by the EU ETS must reduce emissions by 30% by 2030 compared to 2005 as their contribution to the overall target.

The Effort Sharing Regulation translates this commitment into binding annual greenhouse gas emission targets for each Member State for the period 2021 – 2030, based on the principles of fairness, cost-effectiveness and environmental integrity. The resulting 2030 targets range from 0% to -40% compared to 2005 levels. For Slovakia, this means a 12% reduction in greenhouse gas emissions for the period 2021-2030 compared to 2005. Slovakia considers this objective realistic.

The regulation maintains existing flexibilities (banking and borrowing, transfers between Member States), and proposes two new flexibilities: a limited use of net removals from certain LULUCF accounting categories towards the targets in the effort-sharing sectors; and the possibility for certain Member States to use a limited number of ETS allowances (in total 100 million) to offset emissions in the effort sharing sectors.

3.3.5 LULUCF Regulation

Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU simplifies and upgrades the current accounting methodology under Decision No 529/2013/EU (Decision No 529/2013/EU of 21 May 2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities) and the Kyoto Protocol. The regulation builds on the existing accounting rules, updates and improves them for the period from 2021 to 2030. It covers all land uses and ensures that accounted emissions from land use are entirely compensated by an equivalent removal of CO_2 from the atmosphere through action in the sector. The regulation also allows EU Member states to offset some of their emission reductions in the Effort Sharing Regulation sectors (i.e. buildings, road transport) with forestry credits.

3.4 OTHER EMISSIONS REDUCTION TARGET

In addition to the EU target under the Convention, the EU also committed to a legally binding quantified emission reduction commitment for the second commitment period of the Kyoto Protocol (2013 – 2020). In the ***Table 3.2***, all relevant GHG reduction targets for the EU and their key facts are displayed in an overview. First table includes the international commitments under the Kyoto Protocol and the UNFCCC. Second table includes the Slovak Republic commitments under the EU Climate and Energy Package until 2020 and the Climate and Energy Framework until 2030.

Table 3.2: *Overview, comparison of international, and EU targets for Slovakia*

ITEM	INTERNATIONAL COMMITMENTS			
	KYOTO PROTOCOL		UNFCCC	PARIS AGREEMENT
Target year or period	First Commitment Period (2008-2012)	Second Commitment Period (2013-2020)	2020	2030
Emission reduction target	-8%	-20%	-20%	-40%
Further targets	-	-	Conditional target of -30% if other Parties take on adequate commitments	-
Base year	1990 KP Flexibility rules (Art 3(5)) regarding F-Gases and Economies in Transition	1990, 2000 used as the base year for NF_3	1990	1990
LULUCF	Included ARD and other activities not elected	Includes ARD and forest management, other activities if elected (new accounting rules)	Excluded	LULUCF in the scope of the LULUCF Reg. included
Aviation	Domestic aviation included. International aviation excluded	Domestic aviation included. International aviation excluded	Aviation in the scope of the EU ETS included. In practice total aviation emissions considered	Aviation in the scope of the EU ETS included
Use of international credits	Use of KP flexible mechanisms subject to KP rules	Use of KP flexible mechanisms subject to KP rules	Subject to quantitative and qualitative limits	No contribution from international credits
Carry-over of units from preceding periods	Not applicable	Subject to KP rules including those agreed in the Doha Amendment	Not applicable	Not applicable
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3

<table>
<tr><th rowspan="2">ITEM</th><th colspan="4">INTERNATIONAL COMMITMENTS</th></tr>
<tr><th colspan="2">KYOTO PROTOCOL</th><th>UNFCCC</th><th>PARIS AGREEMENT</th></tr>
<tr><td>Sectors included</td><td>Annex A of KP (Energy, IPPU, agriculture, waste), LULUCF according to KP accounting rules for CP1</td><td>Annex A of KP (Energy, IPPU, agriculture, waste), LULUCF according to accounting rules for CP2</td><td>Energy, IPPU, agriculture, waste, aviation in the scope of the EU ETS</td><td>Energy, IPPU, Agriculture, Waste, LULUCF</td></tr>
<tr><td>GWPs used</td><td>IPCC SAR</td><td>IPCC AR4</td><td>IPCC AR4</td><td>IPCC AR4</td></tr>
</table>

<table>
<tr><th rowspan="2">ITEM</th><th colspan="2">EU DOMESTIC LEGISLATION CLIMATE AND ENERGY PACKAGE</th><th colspan="2">EU DOMESTIC LEGISLATION CLIMATE AND ENERGY FRAMEWORK</th></tr>
<tr><th>EU ETS</th><th>ESD</th><th>EU ETS</th><th>ESR</th></tr>
<tr><td>Target year or period</td><td>2013 – 2020</td><td>2013 – 2020</td><td>2020 – 2030</td><td>2020 – 2030</td></tr>
<tr><td>Emission reduction target</td><td>-21% compared to 2005 on the EU level</td><td>Annual target +13% target in 2020 for Slovakia (-10% for EU) compared to 2005 for non-ETS emissions</td><td>-43% compared to 2005 on the EU level</td><td>Annual targets trajectory with the 12% for Slovakia target in 2030</td></tr>
<tr><td>Further targets</td><td colspan="2">Renewable Energy Directive: 14% share of renewable energy of gross final energy consumption in 2020; Energy Efficiency Directive: : indicative target to decrease Final Energy Consumption to 378 PJ and Primary Energy Consumption to 686 PJ in 2020</td><td colspan="2">Renewable Energy Directive: 32% share of renewable energy of gross final energy consumption in 2030; Energy Efficiency Directive sets a 32,5% energy efficiency target for 2030</td></tr>
<tr><td>Base year</td><td colspan="2">1990 for overall emission reduction target; 2005 for renewable energy and energy efficiency target; as well as for targets broken down into ETS and non-ETS emissions</td><td colspan="2">1990 for overall emission reduction target; 2005 for renewable energy and energy efficiency target; as well as for targets broken down into ETS and non-ETS emissions</td></tr>
<tr><td>LULUCF</td><td colspan="2">Excluded</td><td colspan="2">Included (LULUCF Regulation)</td></tr>
<tr><td>Aviation</td><td>Domestic and international aviation, as in the scope of EU ETS</td><td>Aviation generally excluded, some domestic aviation included (operators below ETS de Minimis thresholds)</td><td>Domestic and international aviation, as in the scope of EU ETS</td><td>Aviation generally excluded (CO_2 emissions from IPCC sources category '1.A.3.A civil aviation' shall be treated as zero)</td></tr>
<tr><td>Use of international credits</td><td>Subject to quantitative and qualitative limits, as set in EU Regulation 1123/2013</td><td>The annual use of credits by Slovakia shall not exceed a quantity equal to 3 % from 2005 levels</td><td>International credits are no longer compliance units within the EU ETS</td><td>Use of credits by Member States without quantitative limit</td></tr>
</table>

ITEM	EU DOMESTIC LEGISLATION CLIMATE AND ENERGY PACKAGE		EU DOMESTIC LEGISLATION CLIMATE AND ENERGY FRAMEWORK	
	EU ETS	ESD	EU ETS	ESR
Carry-over of units from preceding periods	EU ETS allowances can be banked into subsequent ETS trading periods since the second trading period	No carry-over from previous period	EU ETS allowances can be banked into subsequent ETS trading periods since the second trading period	No carry-over from previous period
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6		CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	
Sectors included	Power & heat generation, energy-intensive industry sectors, aviation (Annex 1 of ETS directive)	Transport (except aviation), buildings, non-ETS industry, agriculture (except forestry) and waste	Power & heat generation, energy-intensive industry sectors, aviation (Annex 1 of ETS directive)	IPCC source categories of energy, transport (except aviation), non-ETS industry, agriculture (except forestry) and waste
GWPs used	IPCC AR4		IPCC AR4	

3.5 PROGRESS TO QUATIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

For the quantification of the progress to 2020 targets, the development of GHG emissions is the key indicator. The Convention target of a reduction of emissions by 20% from 1990 to 2020 only refers to the emissions of the EU-28 as a whole. GHG emissions of EU-28 are calculated as the sum of MS emissions. With this, GHG emissions of Slovakia are part of EU-28 emissions with a percentage of 1.0% in the year 2017.

The development of GHG emissions in Slovakia is reported in CTF Table 4. Emissions in the sector of LULUCF are not included under the convention target, therefore they are not included in CTF Tables 4 and 4(a). The latter shall be filled with “NA” for not applicable, with the explanation “Numbers for LULUCF are not reported because this sector is not included under the Convention target”.

The use of flexible mechanisms takes place on the one hand by operators in the EU ETS, on the other hand by governments for the achievement of ESD targets. For information on the use in the ETS please see the Fourth Biennial Report of the European Union (Chapter 4.4.1). The use of flexible mechanisms in Slovakia currently takes place only by operators in the EU ETS. Slovakia is not planning to use international credits in the ESD scheme for meeting the annual trajectory target.

Slovakia is well on track for meeting its emission reduction targets resulting from international and EU commitments. In 2017 anthropogenic GHG emissions decreased by 40.95% compared to 1990. Considering EU commitment for sectors covered by the EU ETS and sectors not covered by the EU ETS and covered by the ESD to decrease its emissions by 20% compared to 1990. Slovakia is also on the track to meet its commitments. GHG emissions in the ETS decreased in 2017 by 12.56% compared to 2005 and ESD emissions, even Slovakia has positive target of 13% up to 2020, decreased in 2017 by 18.00% compared to 2005.

Table 3.3: *Evaluation of ETS and ESD GHG emissions in 2015 – 2017*

EMISSIONS	2015	2016	2017
Total GHG emissions (Gg CO_2 eq.)	40 906.37	41 037.12	43 316.45
ETS emissions (Gg CO_2 eq.)	21 181.22	21 264.05	22 063.23
ESD emissions (Gg CO_2 eq.)	20 084.62	19 758.69	21 249.80
Ratio ETS/ESD in %	51.78/49.10	51.82/48.15	50.93/49.06

Submission 30.04.2019

With regard to other targets resulting from Renewable Energy Directive Slovakia is also on track to meet its EU commitments. The share of Renewable Energy Sources on gross final energy consumption in 2017 was 11.5%, meaning that Slovakia not only outperformed the interim target for 2015/16 (10%), but the 2017/2018 target (11.4%) as well, and it is right on track to meet its 2020 target (14%).

Slovakia is well on track to meet its 2020 targets on energy efficiency. Its primary energy consumption (16.1 Mtoe in 2017) was already under the 2020 target of 16.4 Mtoe. The final energy consumption (11.1 Mtoe in 2017) still shows a remaining gap to the 2020 target of 9 Mtoe. Both numbers marked a increase in 2017 compared to the previous year (with +5.1% and +7% respectively). The trend over the past ten years was of general decrease (with some 13% for final energy consumption). However, the limits in decreasing the country's energy consumption were clearly visible in the last two years. Therefore, further efforts are needed for lowering the final energy consumption in Slovakia.

According to the emission inventory submitted in April 2019, the Slovak Republic total anthropogenic emissions of greenhouse gasses expressed as CO_2 eq. decreased by 40,95% without LULUCF, compared to the base year 1990. This achievement is the result of impacts of several processes and factors, mainly:

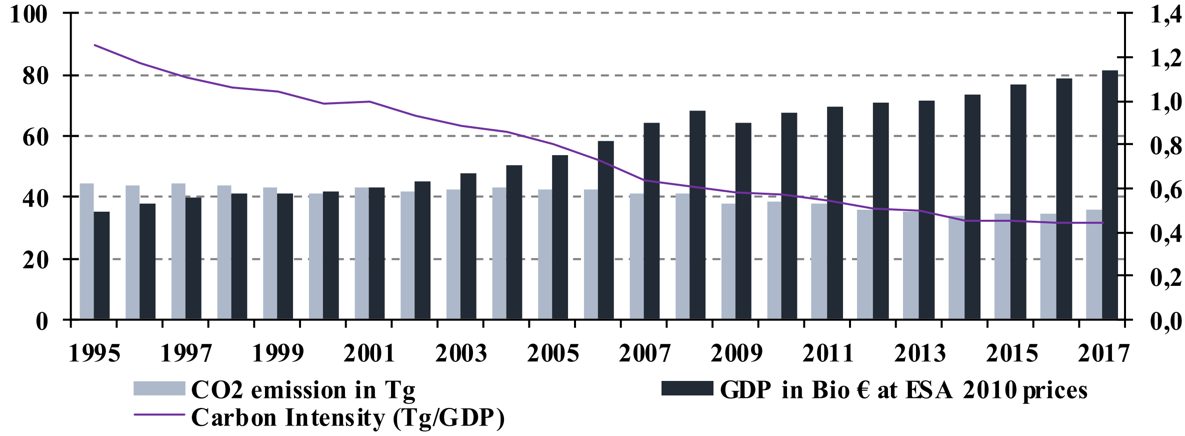
- Higher share of services on the GDP;
- Technological restructuring and change in structure of industries;
- Higher share of gaseous fuels on consumption of primary energy resources;
- Gradual decrease in energy consumption for certain energy intensive sectors (except for metallurgy);
- Impact of air protection legislation, which regulates directly or indirectly generation of greenhouse gas emissions;
- Global economic and financial crises started in 2009 and the short term crises in oil and natural gas supply from Ukraine at the beginning of 2009 (January - February);
- Increase of energy efficiency and share of the renewable energy sources on final consumption;
- Implementation of strict policies and measures in climate change and international agreements up to 2030.

Table 3.4 and ***Figure 3.2*** show the most significant trend indicator of GDP and GHG emissions decoupling which was achieved in Slovakia in past years. Also development in the last inventory year (2017) is an evidence of continuation of decoupling process started in the 1997 and continuing also after economic crises in 2009. With the recovery of economy, carbon emissions did not follow GDP growth. This is a signal of total reconstruction of Slovak economy and industry. It is also expected, that similar trend will continue in the future, while there are planned investments in energy saving and efficiency and step by step building a carbon neutral economy.

Table 3.4: *Decrease of carbon intensity per GDP in the Slovak Republic*

YEAR	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
CO_2 emission in *Tg*	42.05	42.38	42.87	42.85	42.61	41.00	41.40	37.65
GDP in Bio € at ESA 2010 prices	45.24	47.69	50.20	53.59	58.12	64.40	68.02	64.33
Carbon Intensity *(Tg/GDP)*	12.37	11.86	11.06	10.58	9.48	8.25	7.84	7.50
YEAR	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
CO_2 emission in *Tg*	38.50	38.07	35.98	35.57	33.64	34.47	34.89	36.03
GDP in Bio € at ESA 2010 prices	67.58	69.48	70.63	71.69	73.66	76.73	79.13	81.65
Carbon Intensity *(Tg/GDP)*	7.61	7.07	6.59	6.53	5.81	5.64	5.60	5.80

Figure 3.2: *Comparison of CO_2 emissions per GDP (carbon intensity)*



4 PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS AND RELEVANT INFORMATION

Methodology used for policies and measures (PaMs) reporting and emission projections was aligned with the Low-Carbon Study prepared with the cooperation of the World Bank in 2018. Only selected PaMs on sectoral level were taken into consideration in the Study. These PaMs could also be quantified and their mitigation effect was modelled and used in the emission projections.

This Section provides information on the most important policies and measures related to the reduction of the greenhouse gas emissions with the base year 2016. Both existing and planned measures are described. More information on policies and measures is provided in the CTF Table 3.

4.1 OVERARCHING POLICIES AND MEASURES: EU ETS AND ESD

4.1.1 EU Emission Trading System (EU ETS)

The EU ETS was established by Directive 2003/87/ES and has undergone several revisions to strengthen its implementation in the course of its three trading periods (2005 – 2007, 2008 – 2012, and the current one, 2013 – 2020).

Phase one (2005 – 2007) was a three-year pilot period of learning-by-doing to prepare for phase two, when the EU ETS would need to function effectively to help ensure that the EU and Member States meet their Kyoto Protocol emission targets.

Before the start of the first phase, the Slovak Republic had to decide how many allowances to allocate to each EU ETS installation on its territory. This was done through the first National Allocation Plan. The Slovak Republic prepared and published the National Allocation Plan on May 1, 2004. The European Commission's Decision on the Phase I National Allocation Plan of the Slovak Republic was adopted on October 20, 2004. Statistics from the phase one:

- 175 installations;
- 38 installations closed their accounts;
- 1 installation's permit revoked.

Table 4.1: *Statistics from the Phase I of the National Allocation Plan (in tons)*

YEAR	2005	2006	2007
Allocation	30 299 021	30 357 450	30 357 404
Verified emissions	24 892 813	25 200 029	24 153 151

Source: MŽP SR

The second phase of the EU ETS was the five years period from 2008 – 2012 and it corresponded with the first commitment period of the Kyoto Protocol. The EC Decision on the Phase II National Allocation Plan of the Slovak Republic was adopted on November 29, 2006 and amended by the Decision from December 7, 2007.

Statistics from the phase two:

- 193 installations;
- 30 installations closed their accounts;
- 1 installation's permit revoked.

Table 4.2: *Statistics from the Phase II of the National Allocation Plan (in tons)*

YEAR	2008	2009	2010	2011	2012
Allocation	32 166 094	32 140 581	32 356 123	32 617 164	33 432 258
Verified emissions	25 336 706	21 595 209	21 698 625	22 222 534	20 932 903

Source: MŽP SR

The third phase of the EU ETS began from January 1, 2013 and it introduced several changes to the EU ETS. It brought harmonized rules for free allocation, introduced auctioning as the main instrument to comply with the reduction target, added additional sectors under its scope (i.e. civil aviation, aluminium) and set an annual reduction target of 1.74%. The Slovak Republic has notified the EC with a list of installations covered by the Directive in its territory to Commission on August 17, 2012.

Table 4.3: *Statistics from the Phase III of the National Allocation Plan (in tons)*

YEAR	2013	2014	2015	2016	2017	2018
Allocation	16 466 336	15 821 315	15 029 434	14 522 533	13 849 714	13 658 304
Verified emissions	21 829 374	20 918 069	21 181 280	21 264 045	22 063 225	22 193 396

Source: MŽP SR

In July 2015, the Commission presented a legislative proposal to reform the EU ETS for the period after 2020 (i.e. Phase IV). This was followed by a series of consultations on the proposal, including an expert meeting to discuss technical aspects of the proposed free allocation and carbon leakage rules, and separate consultations with stakeholders around the proposed Innovation Fund. The Council of EU Environment Ministers agreed its negotiating position (general approach) for the review of the EU ETS for Phase 4 on February 28, 2017. The European Parliament had adopted its position in support of the revision of the EU ETS half a month earlier (on 15 February). The proposal was discussed in the so called "trialogues process" with the goal of reaching a common position between the European Parliament and the Council from April to November 2017. On February 6, 2018, the EU ETS reform was adopted by the European Parliament plenary session with a majority of votes. Member States formally endorsed reform in the Council on February 27, 2018. The revised EU ETS Directive (Directive (EU) 2018/410) entered into force on April 8, 2018.

- **New Entrants Reserve**

A maximum of 5% of the EU-wide quantity of allowances over the period of 2013 to 2020 will be reserved for new entrants. To this day, the Slovak Republic registers ten official requests.

- **New Entrants Reserve 300**

None of the carbon dioxide capture and geological storage or innovative renewable project from the Slovak Republic has participated at New Entrants Reserve 300 first or second announcement.

- **Auctioning**

Auctioning is a new way of distributing allowances in phase three. Preliminary auctioning started in 2012 with the auctioning of 120 million EUAs, from which the Slovak Republic's share was 1.8 million EUAs. The auctions are held at the European Energy Exchange every Monday, Tuesday and Thursday. The whole auction revenue has been income of the Environmental Fund of the Slovak Republic since 2015. The Slovak Republic's auctioning share in 2018 was 14.9 million EUAs.

Table 4.4: *The Slovak Republic's revenue from auctions during the period 2012 – 2018*

PERIOD	2012	2013	2014	2015	2016	2017	2018
	EUR						
Revenue (EUAs)	12 193 290	61 702 620	57 590 625	84 312 060	64 991 430	87 007 265	229 635 710
Revenue (EUAAs)	-	-	44 590	197 300	55 815	57 205	178 950
Total SVK Revenue	**12 193 290**	**61 702 620**	**57 635 215**	**84 509 360**	**65 047 245**	**87 064 470**	**229 814 660**

Source: MŽP SR

- **Backloading**

Backloading is a term used for describing the process to temporarily withhold a larger amount of allowances from the auctions in the years 2014 - 2016 and loading them back to the auctions in the years 2019 - 2020. The main objective is to eliminate the current surplus of allowances in the EU ETS and to ensure the rise in the price of carbon on the market. According to the Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve (MSR) the quantity of 900 million allowances deducted from auctioning volumes during the period 2014 - 2016 shall not be added to the volumes to be auctioned in 2019 and 2020 but shall instead be placed in the reserve.

- **Connecting the EU ETS with other GHG trading schemes, i.e. linking**

Directive 2009/29/EC contains provisions, which enable the linking of the EU ETS with other similar schemes created at regional or national levels outside the EU. The EU and Switzerland have signed an agreement to link their systems on November 23, 2017. Once the agreement has entered into force, linking would result in the mutual recognition of EU and Swiss emission allowances.

- **MSR**

Market stability reserve was introduced as a long-term solution to solve the existing surplus of allowances within the EU ETS. An automated mechanism will decrease the auctioning volume of the allowances if there is a significant surplus on the market. If there is need for additional allowances, the MSR will be used to increase the auctioning volume. The MSR started to operate in 2019 and all backloaded allowances became part of this reverse. This will cause a continuous increase of carbon price in the EU ETS and a stable environment for investors for the next decade.

On May 15, 2018, the Commission published the total number of allowances in circulation in 2017, amounting to around 1.65 billion allowances. In line with MSR rules, following this publication, 264 731 936 allowances will be placed in the reserve over the first 8 months of 2019 starting on January.

In line with the MSR rules, over a 12-month period - from 1 September 2019 to 31 August 2020, total of 397 178 358 allowances will be placed in the MSR. The next publication will be made in May 2020 to determine reserve feeds from September 2020 until August 2021.

GHG affected: CO_2, CH_4, N_2O, HFC, PFCs and SF_6
Type of the measure: regulatory

4.1.2 Effort Sharing Decision

The Effort Sharing Decision establishes annual targets for GHG emissions of Member States between 2013 and 2020 which are legally binding and only refer to GHG emissions that are not included within the scope of the EU ETS, i.e. transport (except aviation), buildings, agriculture (excluding LULUCF) and waste. Each Member State must define and implement national policies and measures, such as the promotion of public transport, energy performance standards for buildings, more efficient farming practices and conversion of animal waste to biogas, in order to limit the GHG emissions covered by the Effort Sharing Decision. The emission limit for the Slovak Republic is +13% by 2020 compared to 2005 levels.

Table 4.5: *Evaluation of the EU ETS and ESD GHG emissions in 2016 and 2017*

CATEGORY	UNIT	TOTAL GHG EMISSIONS	EU ETS EMISSIONS	ESD EMISSIONS	RATIO ETS/ESD IN %
			2016		
GHG emissions	Gg of CO_2 eq.	42 153.87	21 264.05	19 758.69	50.44/49.56
CO_2 emissions	Gg	34 893.50	21 136.23	13 757.27	60.57/39.43
N_2O emissions	Gg of CO_2 eq.	2 010.99	121.33	1 889.66	6.03/93.97
PFCs emissions	Gg of CO_2 eq.	6.49	6.49	0.00	100/0
			2017		
GHG emissions	Gg of CO_2 eq.	43 316.45	22 063.23	21 249.80	50.93/49.07
CO_2 emissions	Gg	36 033.64	21 949.62	14 084.02	60.91/39.09
N_2O emissions	Gg of CO_2 eq.	1 926.87	104.98	1 821.89	5.45/94.55
PFCs emissions	Gg of CO_2 eq.	8.62	8.62	0.00	100/0

Projected progress to 2014 – 2020 targets in ESD

Transport and residential heating are the most treated sectors covered and regulated under the ESD. Total aggregated GHG emissions in transport are at the same level as in the base year even though the intensity of the transport has increased. Transport currently contributes 16.3% to the total GHG emissions (in CO_2 eq.) and its share of total emissions increased from 1990. Therefore, it is necessary to pay continuous attention, implement effective policies and measures for control, and reduce road transport emissions in the Slovak Republic. National projections also indicate that 2020 ESD emissions are expected to be below the 2020 ESD target, with the current existing measures.

Table 4.6: *Progress towards GHG targets Decision (ESD emissions) based on projections*

2020 ESD target (% vs 2005)	+13%
2015 ESD emissions (% vs 2005)	-21.0%
2020 ESD projections WEM (% vs 2005)	-22.1%
2020 ESD projections WAM (% vs 2005)	-26%

In accordance with the Article 14 of the Decision, the European Commission prepared an evaluation of the implementation of the Effort Sharing Decision up to 2015. The evaluation concluded that the commitments under the Decision have contributed to stimulating new national policies and measures promoting effective reductions of greenhouse gas emissions. It also found that the Decision has resulted in Member States becoming more active in considering new measures to reduce emissions in those sectors within the Decision's scope, as well as in improved coordination between national, regional and local governments.

The Commission when preparing its legislative proposal, the "Effort Sharing Regulation", setting out binding annual GHG emissions target for individual Member State for the period 2021 – 2030, used the results of the evaluation. The proposal was presented on July 20, 2016. The proposed Regulation maintains the main elements of the ESD architecture, including the binding annual GHG emissions target for each Member State. The main changes in the proposed regulation from the current decision are as follows:

Existing flexibilities under the Effort Sharing Decision (e.g. banking, borrowing, buying and selling) are retained, and two new flexibilities are added to allow for a fair and cost-efficient achievement of the targets. These are:

- a one-off flexibility to transfer a limited amount of allowances from the EU ETS: This allows eligible Member States to achieve their national targets by covering some emissions in non-ETS sectors with EU ETS allowances which would normally have been auctioned;
- a new flexibility to transfer a limited amount of credits from the land use sector (LULUCF): In order to stimulate additional action in the land use sector, the proposal permits Member States to use up to 280 million credits over the entire period 2021 – 2030 from certain land use categories to comply with their national targets.

Emission limits will be set for each year in the 10 years-period up to 2030. The limit for each year is set according to a decreasing linear trajectory. This ensures year on year reductions and adds integrity to the 2030 target because it is the culmination of reductions over 10 years rather than a stand-alone point.

GHG affected: CO_2, CH_4, N_2O and PFCs
Type of measure: regulatory

Other relevant information about EU policies and measures (linked with the Energy Union) are described in the Sections 3.1 and 3.3.

4.2 OTHER CROSS-CUTTING POLICIES AND MEASURES

4.2.1 Energy policy of the Slovak Republic adopted by the Government Resolution of the Slovak Republic No 548/2014

The Energy Policy of the Slovak Republic (Energy Policy) is the strategic document defining the energy sector's primary objectives and priorities to 2035 with a view to 2050. The Energy Policy is a component of the Slovak Republic's national economic strategy, given that ensuring sustainable economic growth is conditioned by the reliable supply of affordable energy. The Ministry of Economy of the Slovak Republic is responsible for completing the Energy Policy. The Energy Policy is intended to ensure the sustainability of Slovak energy sector to contribute to the sustainable growth of the national economy and its competitiveness. The priority from this perspective is ensuring the reliability and stability of the energy supply, efficient energy utilization at optimum costs and ensuring environmental protection. A well-functioning energy market with a competitive environment will be strengthened by Energy Policy implementation. As a result, the Energy Policy signals certain measures aimed at decreasing final electricity prices, including the phase-out by 2020 of feed-in tariffs for electricity from renewable energy sources, focus on the use of renewable energy sources in the production of heat, and certain efficiency-enhancing changes to feed-in tariffs applicable to the co-generation of electricity and heat.

GHG affected: CO_2, CH_4 and N_2O
Type of measure: regulatory

4.2.2 Greener Slovakia - Strategy for the Environmental Policy of the Slovak Republic

The Slovak Government approved this strategy in February 2019. Envirostrategy 2030[23] sets concrete and measurable targets, which should be met by 2030 and for greenhouse gas emission a target "to reduce greenhouse gas emissions by 20% in non-ETS sectors by 2030 compared to 2005 level" was set.

[23] http://www.minzp.sk/files/iep/greener slovakia-strategy of the environmental policy of the slovak republic until 2030.pdf

As background for strategy preparation, a number of studies were conducted, stakeholders were consulted across a broad front, and citizens were reserved a possibility of influencing the strategy's contents. For the material of the strategy work, visit website http://www.minzp.sk/files/iep/03 vlastny material envirostrategia2030 def.pdf

4.2.3 Proposal for an Integrated National Energy and Climate Plan of the Slovak Republic

A new EU regulation on the Governance of the Energy Union and Climate Change Actions (Regulation (EU) No 2018/1999) requires that every EU Member State prepare a national integrated energy and climate plan. Slovak republic has submitted its national draft integrated energy and climate plan[24] that is to the Commission on December 2018.

4.2.4 Low-Carbon Development Strategy

Currently MŽP SR in cooperation with the World Bank completed the project concerning preparation of low-carbon study. The main output of the project is A Low-Carbon Growth Study for Slovakia.[25] Implementing the EU 2030 Climate and Energy Policy Framework", which has a basic role for the preparation of Slovak LCDS.

Slovak LCDS will include measures related to all relevant sectors (energy, energy efficiency, industry, transport, agriculture including LULUCF and waste sector), sources and greenhouse gases. The process of preparation of the Slovak LCDS will include comprehensive participation of stakeholders (relevant ministries and institutions) and civil society. The MŽP SR plans to submit the new Slovak LCDS for approval to the government by the end of December 2019.

The focus of the "Slovak LCDS" will be the transformation of the energy sector. The main pillars are the expansion of the use of renewable energy for electricity generation and the increase in energy efficiency.

Information according to the Article 13(1)(b) of the Monitoring Mechanism Regulation on Slovakia's low-carbon development strategy and progress in implementation was submitted for the first time in January 2015. Information on updates has been provided in the reporting templates in 2015 and 2019.

4.2.5 Biofuels policy

Directive of the European Parliament and of the Council 2009/28/EC on the promotion of energy from renewable sources, amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, was adopted on 23 April 2009. Directive (EU) 2015/1513 of the European Parliament and of the Council amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources was adopted on 9 September 2015. The body responsible for the implementation of both directives is the Ministry of Economy of the Slovak Republic. The Ministry of Environment is responsible for the area of compliance with the sustainability criteria for biofuels and bioliquids, calculations to determine the impact of biofuels and bioliquids on quantities of greenhouse gas emissions and calculation of greenhouse gas emissions released during the life cycle of fossil fuels.

The Slovak Republic implemented articles 17, 18 and 19 of Directive 2009/28/EC and substantively identical articles 7b, 7c and 7d of Directive 2009/30/EC and the relevant articles of Directive 2015/1513 via Act No 309/2009 Coll. as amended and Ordinance of the Ministry of Environment of the Slovak Republic No 271/2011 Coll. as amended concerning the sustainability criteria. The Act No 181/2017

[24] https://www.economy.gov.sk/energetika/navrh-integrovaneho-narodneho-energetickeho-a-klimatickeho-planu

[25] http://www.minzp.sk/files/oblasti/politika-zmeny-klimy/2019 01 low-carbon-study.pdf

Coll. and the Ordinance of the Ministry of Environment of the Slovak Republic No 191/2017 Coll. (the amendment to the Act No 309/2009 Coll. and to the Ordinance No 271/2011 Coll.) came into force in 2017. These implemented provisions of the Directive 2015/1513 and the Directive 2015/652. The Act No 309/2009 Coll. as amended addresses the basic roles and responsibilities of the competent authorities and economic operators in the context of demonstrating compliance with the sustainability criteria for biofuels and bioliquids, which are the conditions for their accounting towards the national target for renewable energy sources.

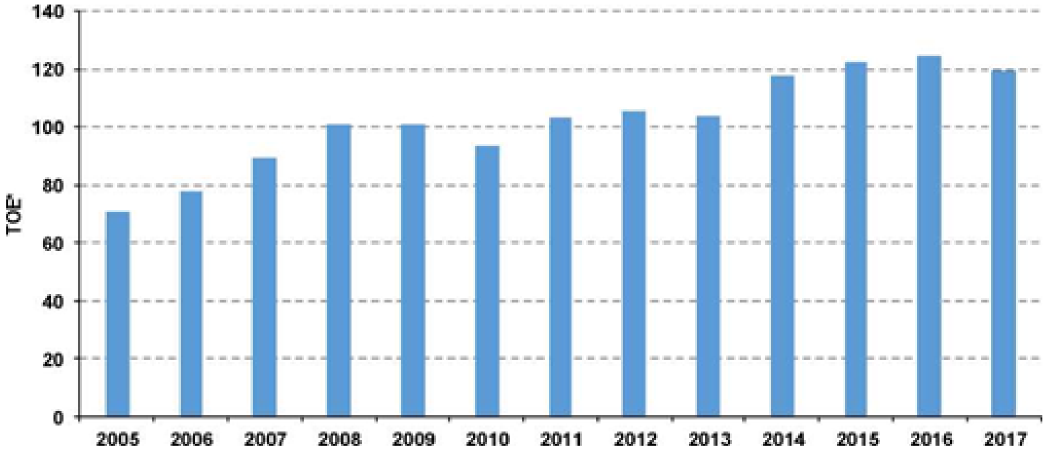
Ordinance of the Ministry of Environment of the Slovak Republic No 271/2011 Coll. as amended establishing sustainability criteria and targets to reduce greenhouse gas emissions from fuels has been in force since September 2011. The ordinance deals with the details of proving compliance with the sustainability criteria for biofuels and bioliquids. For assessing compliance with the sustainability criteria throughout the production chain of biofuels and bioliquids, voluntary schemes were established. The schemes are subject to European Commission approval and therefore not subject to national approval and national control, while each Member State has to accept the results of these schemes unreservedly. Ordinance of the Ministry of Agriculture and Rural Development No 295 Coll. of September 6, 2011 laying down a detailed declaration of producer and supplier of biomass for producing biofuels or bioliquids has been in force since October 2011. The Slovak Republic has been running a national system of demonstrating compliance with the sustainability criteria for biofuels and bioliquids since 2011. The system is based on independent verifiers whose training is organized and who are subject to mandatory examination and registration by the MŽP SR.

GHG affected: CO_2, CH_4 and N_2O
Type of measure: regulatory

4.2.6 Taxation of energy products and electricity

The most significant in terms of generating tax revenue is the tax on mineral oils. Income from electricity, coal and natural gas is relatively low. The Slovak Republic raises relatively little revenue from environmentally related taxes (***Figure 4.1***) and the implicit tax rate (***Figure 4.2***) on energy is low. There is substantial scope for environmentally related tax reforms. Heating and process energy use accounts for the largest share in total energy use and CO2 emissions in the Slovak Republic. As a result, a more harmonized tax treatment of heating and process energy use would raise substantial tax revenues and provide incentives to mitigate CO2 emissions. This could be achieved by increasing taxes on all fuels used for heating and processing up to the standard rate per unit of energy for natural gas. Ad quantum excise duties could also be indexed for inflation to help prevent the decline in environmentally related tax revenues in real terms over time. Moreover, the Slovak Republic should consider eliminating the gasoline-diesel taxation differential. A gradual increase in the taxation of diesel could also be used to lower the burden from direct taxes, although there might be limited scope for such an increase in the short run without similar rate increases in neighbouring countries to prevent fuel tourism. Company cars should also be taxed more effectively within the personal income tax (PIT). Lastly, the support for electricity production with lignite should be eliminated. Instead, the tax on electricity consumption could be increased and the exemption of the electricity tax for households could be abolished to increase incentives for a more efficient use of electricity. The government could compensate lower income households through targeted tax or benefit measures.

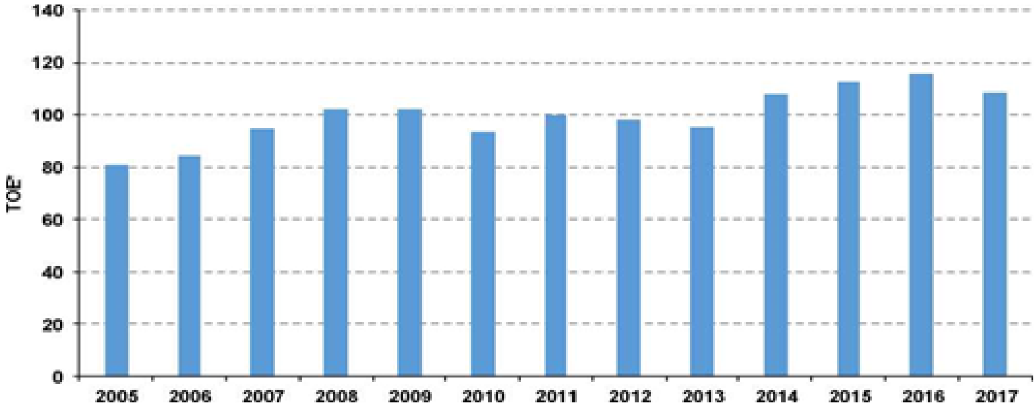
Figure 4.1: *Tax revenues from energy product taxation in 2005 – 2017*



**TOE - Energy taxes in Euro per tonne of oil equivalent*

Source: DG Taxation and Customs Union, based on Eurostat data

Figure 4.2: *Development in implicit tax rate on energy product in Slovakia in 2005 – 2017*



**TOE - Energy taxes in Euro per tonne of oil equivalent*

Source: DG Taxation and Customs Union, based on Eurostat data, base year 2010

GHG affected: CO_2, CH_4 and N_2O
Type of measure: regulatory

4.2.7 National Emission Ceilings

Existing NEC Directive 2001/81/EC has been replaced from 1 July 2018 by revised NEC Directive 2016/2284. Its overarching aim is to reduce adverse health impacts of air pollution, including reducing cases of premature deaths per year due to air pollution by more than half. This revised directive includes national emission reduction commitments for each Member State for 2030 (with interim targets also set for 2025) for six specific pollutants: NO_x, SO_2, NMVOC, NH_3, $PM_{2.5}$ and CH_4. The NEC Directive is transposed into national legislation through Act No 137/2010 Coll. on air protection and complemented with the Act No 401/1998 Coll. on charges for air pollution.

GHG affected: Atmospheric pollutants: NO_x, SO_2, NMVOC, NH_3, $PM_{2.5}$ and CH_4
Type of measure: regulatory

4.3 INFORMATION ON SECTORAL POLICIES AND MEASURES

Methodology used for PaMs reporting and emission projections was aligned with the Low-Carbon Study prepared with the cooperation with the World Bank last year. Only selected PaMs on sectoral level were taken into consideration. These PaMs could also be quantified and their mitigation effect was modelled.

This Section provides information on the most important policies and measures related to the reduction of the greenhouse gas emissions with the base year 2016. Both existing and planned measures are described. More information on policies and measures is provided in the online reporting tool.

All the aforementioned PaMs were considered in scenarios for modelling of emission projections in the Slovak Republic up to 2040. Synergy effects of PaMs have been reflected in the modelling. Quantifications of the PaMs' impacts on GHG emission reduction are given in the CTF Table 3.

The Energy Policy of the Slovak Republic (adopted in November 2014) as referred to in the Section 4.2.1.

4.3.1 Sectoral policies and measures – Energy sector

An important role, in addition to the legislative instruments on the trading of greenhouse gas emission allowances, is played by Act No 137/2010 on Air Protection, as amended. This Act is supplemented by Act No 401/1998 on air pollution charges, which serve to control and regulate emission limits for basic air pollutants. Monitoring and reporting of emissions from stationary sources of air pollution as well as the charging system which is mandatory for operators of medium and large air pollution sources have had a positive effect on the reduction of greenhouse gas emissions and have contributed to the separation (greenhouse gas emissions do not track GDP growth) of the emission trajectory in the Slovak Republic since 1997.

Energy efficiency improvements

Energy consumption measures, under which energy savings are manifested as a reduction in final energy consumption, are broken down by sector (buildings, industry, the public sector, transport and appliances). The measure is determined minimum requirements as regards the energy performance of new and existing buildings, the renovation of buildings, which constitute the most important source of possible energy savings.

GHG affected: CO_2

Type of measure: regulatory

Status: in force since 2014

Implemented in scenario: WEM

Implementation of the EU Winter Package

The Winter Package is part of the implementation of the Energy Union, and it is expected that the Winter Package will mean a revision of the RE directive and that there will be specific recommendations on how the EU Commission will meet the Union's target of 27% renewable energy in 2030. The EU Winter Package' support the transition to clean energy. Impact of RES in heat and electricity generation. Impact of renewable energy sources in heat and electricity generation. Increase the share of electricity production from RES in power system. Increase in consumption of biomass for the production of electricity and heat.

GHG affected: CO_2

Type of measure: economic and regulatory

Status: in force since 2016

Implemented in scenario: WEM

National Renewable Energy Action Plan, Government Resolution of the Slovak Republic No 677/2010

The plan has determined national objectives regarding the percentage of energy from renewable sources consumed in sectors of transportation, power production, and heat and cool production in 2020, curves of expected growth of the use of RESs in individual sectors in years 2010 - 2020, measures to achieve the objectives, support systems, as well as overall expected contribution of the measures in individual RES energy production technologies and in the field of energy efficiency and cost-saving in order to achieve the binding objectives. Action Plan for RES 2020 of Slovakia set the RES targets (also for biomass, support for fast growing trees and regulatory measures for technological innovation in harvesting of wood etc.). However, the overall target for 2020 is 10% share RES on the gross final energy consumption: 14.6% of heat consumption met by renewable sources; 24% of electricity demand met by electricity generated from renewable energy sources; 10% of energy demand in transport met by renewable energy sources.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2011

Implemented in scenario: WEM

Implementation of the EU emissions Trading System

ETS stimulate use of biomass in fuel mix of energy producers and urge technology innovations. This policy is economic and regulatory measure with high positive impact on reduction of GHG emissions.

This PaM is the implementation of the ETS in Slovakia and the object is reduction of greenhouse gas emissions. National implementation in Slovakia is carried out with national act of emission trade (414/2012).

GHG affected: CO_2

Type of measure: economic and regulatory

Status: in force since 2013

Implemented in scenario: WEM

Optimization of a district heating

Optimisation of district heating (DH) will be performed by the installing cogeneration of heat and electricity to the district heating. Industrial cogeneration plants produce industrial steam which can be also used for district heating. Also other measures are taking into consideration (for example: improving of the efficiency of pipeline DH systems, installation of innovative technologies for DH, improving heat supply from the combined heat and power plants).

GHG affected: CO_2

Type of measure: regulatory

Status: in force since 2015

Implemented in scenario: WEM

Closing district heating plants from 2025
Phase out of solid-fired district heating plants from 2025 onwards.

GHG affected: CO_2

Type of measure: regulatory

Status: in force since 2015

Implemented in scenario: WEM

Increase of the ETS carbon prices
The ETS carbon prices affects the power sector, as well as the energy intensive industries and constitutes the main driver for the carbon emission reduction. Power generators will need to bid up the price of carbon allowances in order to facilitate their own transition from coal to gas.

GHG affected: CO_2

Type of measure: economic

Status: estimated after 2020

Implemented in scenario: WAM

Decommissioning fossil fuel power plants
Earlier decommissioning of solid-fired utility power plants: Vojany and Nováky power plants are assumed to decommission in 2025 and 2023 respectively.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: estimated after 2023

Implemented in scenario: WAM

Decarbonization of electricity generation
Decarbonization of electricity generation is achieved through renewables. Eligible RES technologies are Solar PV, wind onshore turbines and biomass.

GHG affected: CO_2

Type of measure: regulatory

Status: estimated after 2020

Implemented in scenario: WAM

Increase in the nuclear share of energy mix
Nuclear energy plays a crucial role in the electricity mix of Slovak Republic. In 2015, nuclear generation covered the 56% of total net electricity generation. Increase in the nuclear share in the medium term (2020 - 2025) due to the commissioning of two new nuclear reactors at Mochovce. Two new nuclear reactors in Mochovce will be commissioned until 2020 with a total net installed capacity of 818 MW, while the oldest nuclear plant, Bohunice with a net installed capacity of 940MW, will get an extension of its lifetime to 60 years, so as to stay operation until 2045.
Thus, nuclear generation remains stable in volume terms.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: estimated after 2035

Implemented in scenario: WAM

Continues to improve final energy efficiency in all sectors
Emphasis on policies supporting faster renovation of old buildings compared to historic trends and deep energy insulations in the renovated buildings. The energy efficiency policies also include strict building codes for new constructions, the promotion of heat recovery and best available techniques in industry, infrastructure and soft measures enabling higher efficiency in the transport sector.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: estimated after 2020

Implemented in scenario: WAM

4.3.2 Sectoral policies and measures – Transport

Environmental Design and Use of Products
Environmental Design and Use of Products - the aim of this measure is to reduce environmental impact at all stages of the life cycle of these products. The measure sets regulations for domestic appliances, motors and other electric equipment with the negative environmental impact throughout the product's lifecycle that use energy (for example: boilers, computers, cars, household appliances etc.). The automotive industry is forced to consider the entire life cycle of cars. Besides a reduction of fuel consumption and exhaust emissions, the production as well as the end-of-life phase have to be taken into account. Eco-Design includes an effective approach to integrate the aspects of resources availability, manufacturing technologies, in-use behaviour and recycling procedures. A challenge in the application of Eco-Design in automotive industry lies in the complex interactions of different, partially conflicting influencing factors. The use of vehicles produced in this way has the effect of reducing CO_2 emissions in the transport sector.

GHG affected: CO_2

Type of measure: regulatory

Status: in force since 2010

Implemented in scenario: WEM

CO_2 standards for cars and vans, efficiency standards for trucks along with the electrification of transport
Increase of cars efficiency and decrease of GHG emissions from passenger cars, vans and trucks. This covers the implementation of EU regulation 2009/443/EC and regulations 2011/510/EC and 2007/715/EC which set limits for CO_2 emissions from car and vans in Slovakia. Energy efficiency of vehicles is also promoted by support for buying fully electric cars or plug-in hybrid cars and alternative fuel cars (LNG, LPG, CNG or biogas) for a public charging point infrastructure for electric cars, for LNG, LNG distribution stations.

GHG affected: CO_2

Type of measure: regulatory

Status: in force since 2007

Implemented in scenario: WEM

Promotion of biofuels in road transport

Slovak Republic intend to accelerate the implementation of second-generation biofuels produced from non-food crops such as wood, organic waste, food crop waste and specific biomass crops. Operators have to blend biofuels in minimum energy contend as follows:

- 5.8% in 2017,
- 5.8% in 2018,
- 6.9% in 2019,
- 7.6% in 2020,
- 8.0% in 2021,
- 8.2% in 2022 - 2030.

Advanced biofuels energy content has to be at least:

- 0.1% in 2019,
- 0.5% in 2020 - 2024,
- 0.75% in 2025 - 2030.

GHG affected: CO_2, CH_4

Type of measure: regulatory and economic

Status: in force since 2010

Implemented in scenario: WEM

Electricity of transportation

Strong uptake of electric cars and fuel cell cars, replacing internal combustion engine cars.

GHG affected: CO_2

Type of measure: regulatory

Status: estimated after 2020

Implemented in scenario: WAM

4.3.3 Sectoral policies and measures – Industrial Processes and Product Use (IPPU)

Improvement of industrial sector

The IPPU sector will reduce the total energy by cogenerating industrial steam together with the self-produced electricity. Similarly, in the supply of industrial steam, cogeneration maintains its share but changes fuel in favor of biomass. Self-production of electricity in industry is less competitive in the long-term than under current conditions, since electricity generation, being subject to high ETS prices, transforms using RES and nuclear, putting downward pressure on prices for industrial electricity.

GHG affected: HFC; SF_6; CH_4

Type of measure: economic and regulatory

Status: in force since 2015

Implemented in scenario: WEM

Implementation of F-gas regulation in EU policy – cutting the F-gases emissions

Prohibition of some F-gasses placing on market according to regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases.

GHG affected: HFC; PFC; SF_6

Type of measure: regulatory

Status: in force since 2015

Implemented in scenario: WEM

Implementation of F-gas regulation in EU policy – placing on the market prohibitions referred to in Article 11(1)

Prohibition of F-gasses with GWP placing on market.

GHG affected: HFC; PFC

Type of measure: regulatory

Status: estimated after 2020

Implemented in scenario: WAM

4.3.4 Sectoral policies and measures – Agriculture

New manure management - Ordinance of the Gov. of the Slovak Republic No 342/2014 Coll. on Conditions for Granting Subsidies in Agriculture through Direct Payments

New measures in manure manipulation and processing and in addition new animal feeding policy implementation.

GHG affected: N_2O

Type of measure: economic and regulatory

Status: in force since 2015

Implemented in scenario: WEM

New animal feeding policy implementation - Ordinance of the Government of the Slovak Republic No 342/2014 Coll. on conditions for granting subsidies in agriculture through direct payments

Decreasing the number of dairy cattle, intensive feeding with active substances.

GHG affected: CH_4

Type of measure: regulatory and economic

Status: in force since 2015

Implemented in scenario: WEM

Agricultural soils - Ordinance of the Government of the Slovak Republic No 342/2014 Coll. on conditions for granting subsidies in agriculture through direct payments

Efficient use and appropriate timing of nitrogen inputs from mineral fertilizers.

GHG affected: N_2O

Type of measure: economic and regulatory

Status: in force since 2010

Implemented in scenario: WEM

Agricultural soils after the year 2015 - Ordinance of the Government of the Slovak Republic No 342/2014 Coll. on conditions for granting subsidies in agriculture through direct payments

Efficient use and appropriate timing of nitrogen inputs from mineral fertilizers after the year 2015

GHG affected: N_2O

Type of measure: economic and regulatory

Status: in force since 2015

Implemented in scenario: WEM

4.3.5 Sectoral policies and measures – Land Use, Land Use Change and Forestry (LULUCF)

The Rural Development Programme for the period of 2014 – 2020

The Rural Development Programme for 2014 – 2020 was prepared, where these issues was incorporated to the measures (for example organic farming). The program of financial support scheme for selected thematic priorities in rural development comprises 56 frame targets for specific policies and measures in this sector with positive environmental impacts. The programme is mainly focused on the increase of competitiveness of agriculture and forestry sectors (aiming to support investments on 1 250 farms and 400 food enterprises), whilst ensuring the appropriate management of natural resources and encouraging climate friendly farming practices, with around 20% of agricultural land managed to protect biodiversity, soil and/or water resources.

GHG affected: N_2O

Type of measure: regulatory and economic

Status: in force since 2015

Implemented in scenario: WEM

4.3.6 Sectoral policies and measures – Waste management

Waste Management Program of the SR 2016 – 2020

Strategy of waste management - set of measures. Evaluation specific targets from the programme for the period 2014 – 2018 and concludes that majority of them were not achieved. Programme sets national targets for:

- Reduction of residual municipal waste to 50% of 2016 level by 2025
- Reduction of biodegradable waste in residual municipal waste by 60% not later than 2025
- Reduction of landfilling to 10% of total municipal waste by 2035

GHG affected: CH_4

Type of measure: regulatory

Status: in force since 2016

Implemented in scenario: WEM

Waste Prevention Programme 2019 – 2025

Waste Prevention Programme of the Slovak Republic for 2019 – 2025 was approved by the Government of the Slovak Republic in January 2019. The programme will aim at minimizing the generation of waste and careful compliance with the waste management hierarchy. The new waste management information system will help improve the control over the waste flows.

GHG affected: CH_4

Type of measure: regulatory

Status: in force since 2018

Implemented in scenario: WAM

4.4 INFORMATION ON EFFECTS OF THE MITIGATION ACTIONS

Table 4.7: *Effects of the mitigation actions*

NAME OF PaM	POLICY IMPACTED	GHG EMISSIONS REDUCTIONS FOR YEAR 2020 (kt CO_2 eq. PER YEAR)			GHG EMISSIONS REDUCTIONS FOR YEAR 2025 (kt CO_2 eq. PER YEAR)		
		EU ETS	**ESD**	**Total**	**EU ETS**	**ESD**	**Total**
Environmental Design and Use of Products	ESD		21.99	**21.99**		47.33	**47.33**
Energy efficiency Improvements	EU ETS; ESD	257.36	109.16	**366.52**	489.32	207.54	**696.85**
Implementation of the EU Winter Package	EU ETS; ESD	225.80	51.97	**277.78**	238.83	54.97	**293.81**
Optimization of a district heating	EU ETS; ESD				337.40	56.10	
Decommissioning fossil fuel power plants	EU ETS; ESD				494.15	82.17	
Decarbonisation of electricity generation	EU ETS; ESD	277.71	63.92	**341.64**	286.38	65.92	**352.30**
Continues to improve final energy efficiency in all sectors	EU ETS; ESD	447.07	89.62	**636.68**	675.3	286.42	**961.72**

NAME OF PaM	POLICY IMPACTED	GHG EMISSIONS REDUCTIONS FOR YEAR 2030 (kt CO_2 eq. PER YEAR)			GHG EMISSIONS REDUCTIONS FOR YEAR 204 (kt CO_2 eq. PER YEAR)		
		EU ETS	**ESD**	**Total**	**EU ETS**	**ESD**	**Total**
Environmental Design and Use of Products	ESD		55.23	**55.23**		69.85	**69.85**
Energy efficiency Improvements	EU ETS; ESD	879.37	372.98	**1 252.35**	995.73	422.33	**1 418.07**
Implementation of the EU Winter Package	EU ETS; ESD	256.1	58.95	**315.05**	301.73	69.45	**371.18**
Optimization of a district heating	EU ETS; ESD	389.17	64.71	**453.88**	634.26	105.47	**739.72**
Decommissioning fossil fuel power plants	EU ETS; ESD	768.59	127.8	**896.39**	631.88	105.07	**736.95**
Decarbonisation of electricity generation	EUETS; ESD	559.13	128.69	**687.82**	611.79	140.81	**752.6**
Continues to improve final energy efficiency in all sectors	EU ETS; ESD	1 405.55	596.15	**2 001.70**	1 507.13	639.24	**2 146.36**

Table 4.8: *Indicators of policies and measures used in the GHG emission projections*

NAME OF PaM OR GROUP OF PaMs	INDICATORS USED TO MONITOR AND EVALUATE PROGRESS OVER TIME (EX-POST OR EX-ANTE)						COMMENTS
	INDICATORS USED	UNIT	2020	2025	2030	2035	
Environmental Design and Use of Products	White Appliances	GWh	14.095	15.009	15.983	16.269	GWh useful energy - Household thermal
	Black Appliances	number of appliances	20.783	25.143	27.724	30.534	in thousands appliances
Energy efficiency improvements	Energy Savings	GWh	365	606	925	966	CPS Energy Model
	Energy Efficiency Indicator - of Final energy demand (Unit: %)	in %	76.48	78.62	81.24	82.09	
Implementation of the EU Winter Package	Net Installed Capacity	GWhe	2.632	2.632	2.632	2.632	Nuclear energy
			2.138	2.139	2.255	2.521	Renewables
National Renewable Energy Action Plan. Government Resolution of the SR No 677/2010	Electricity Generation by Renewable plants	GWhe	5.015	5.109	5.291	5.687	CPS Energy Model
Implementation of the EU emissions Trading System	Gross Electricity Generation by Biomass plants	GWhe	498	391	314	550	CPS Energy Model
CO_2 standards for cars and vans, efficiency standards for trucks along with the electrification of transport	Stock of Vehicles	thousand vehicles	2.426	2.644	2.988	3.306	CPS Energy Model
	Final Energy Demand - By Mode and Fuel (Unit: GWh)	GWh	26.271	27.621	30.225	32.368	
Promotion of biofuels in road transport	Final Energy Demand	GWh	2.066	2.132	2.316	2.480	CPS Energy Model
Improvement of industrial sector	Direct Use of Fuels in Industry	GWh	50.767	51.738	50.969	50.516	Direct Use of Fuels in Industry - for all industry sector including steam and self - produced electricity by CHPs and boilers
	Steam Production by Industrial CHP	GWh	5.787	5.774	5.758	5.814	
	Gross Electricity Production by Industrial CHP	GWh	1.458	1.402	1.399	1.415	
Optimization of district heating	District Heating Losses	GWhth	1 147	989	865	746	CPS Energy Model
	Heat Plant Biomass	GWhth	715	666	757	684	
	Heat Plant Gas	GWhth	2.386	2.378	2.242	2.179	
Closing district heating plants since 2025	Fuel Consumption in Heat Solid Plants	GWh fuel	38	26	0	0	CPS Energy Model
Increase of the ETS carbon prices	Carbon price	$/tCO_2$	20.9	31.3	46.6	102.9	CPS Energy Model

NAME OF PaM OR GROUP OF PaMs	INDICATORS USED TO MONITOR AND EVALUATE PROGRESS OVER TIME (EX-POST OR EX-ANTE)						COMMENTS
	INDICATORS USED	UNIT	2020	2025	2030	2035	
Decommissioning fossil fuel power plants	Gross Electricity Generation by Coal plants	Gwhe	1 274	851	20	0	CPS Energy Model
Decarbonization of electricity generation	Net Electricity Generation by Solar PV plants	Gwhe	0.523	0.523	0.523	0.848	CPS Energy Model
	Net Electricity Generation by wind onshore turbines	Gwhe	0.028	0.132	0.259	0.344	
	Net Electricity Generation by Biomass plants	Gwhe	465	1 157	3 056	4432	
Increase in the nuclear share of energy mix	Net Installed Capacity (nuclear energy)	Gwhe	2.632	2.632	2.632	2.632	CPS Energy Model
	Net Installed Capacity by Nuclear plant	Gwhe	20.793	20.793	20.793	20.793	
Continues to improve final energy efficiency in all sectors	Energy Savings	GWh	365	650	2 440	2 836	Residential sector
	Energy Savings	GWh	275	510	1 484	1 802	Tertiary sector
Electricity for Transportation sector	Stock of Vehicles	vehicles	1.000	23.000	56.000	143.000	CPS Energy Model

4.5 INFORMATION ON CHANGES IN DOMESTIC INSTITUTIONAL ARRANGEMENTS FOR MITIGATION ACTIONS AND THEIR EFFECTS

The Slovak Republic has not made changes in the domestic institutional, legal, administrative and procedural arrangements for domestic compliance, monitoring, reporting and archiving of information and evaluation of the progress towards Slovakia's emission reduction obligations and targets since the last National Communication and Biennial Report (2018). The national inventory system of Slovakia and changes in national inventory arrangements are described in the Section 2.2 of this Report and can be found also in the National Inventory Report 2019.

In the comparison with the previous Biennial Report of Slovakia published in 2018, numbers of reported PaMs has been decreased. None of the PaMs with a significant effect on GHG emission reduction have been cancelled without replacement however PaMs without the measurable effect on mitigation were excluded from this report in the aim to increase transparency of reporting.

Methodology used for emission projections and PaMs reporting was aligned with the Low-Carbon Study prepared with the cooperation of the World Bank. Only selected PaMs on sectoral level were taken into consideration in this Study. These PaMs could also be quantified and their mitigation effect was modelled.

In this submission, the methodological details of the new approach applied in this area was explained. (described in the Sections 4, and 5) New model was used in energy and IPPU sector (CPS model, based on the LC Study of Slovakia). Other sectors (Transport, Waste, Agriculture, LULUCF) are slightly modified, but the principles are consistent with the previous submission.

4.6 ASSESSMENT OF THE ECONOMIC AND SOCIAL CONSEQUENCES OF RESPONSE MEASURES

Implementation of increasingly stringent environmental regulations and economic policies which penalize further use of environmentally harmful substances, technologies and so on might be associated with a range of side effects. It is not excluded that some of the possible adverse economic effects will affect some developing and less developed countries having fewer means for adequate remedial response measures. The magnitudes of these potential impacts are typically given by the stringency of the adopted measures, selection of the particular policy instrument, size and strength of the implementing economy relative to the world markets and also the actual macroeconomic set up of the affected developing countries.

In this Section potential channels of how domestically implemented environmental policies in the Slovak Republic might have exercised any impact on third countries are identified. Furthermore, any existing evidence about the potential magnitudes of these effects is highlighted. Similarly, the activities, in particular those related to the development aid of the Slovak Republic implemented in order to minimize the negative consequences caused by these policies, are described in this Section. The aim is to meet our commitments under the Kyoto Protocol in respect with transparent reporting on potential adverse social, environmental and economic impacts, particularly on developing countries.

4.6.1. Economic impacts

GDP follows the size of investment in energy efficiency, with higher investments in energy efficiency leading to lower consumption but higher GDP in total. This impact is driven by crowding out of private investment as a result of higher investments in energy efficiency. Lower private investment erodes the economy's capital stock, leading to lower output. The EU Reference 2016 Scenario (WEM) and Dcarb 2 scenario (WAM) involve a reduction of consumption (of three to six percent compared to the reference scenario during 2040 – 2050) ***(Figure 4.3)***. Household consumption is lower as households reduce consumption to pay for investments in efficiency, particularly building improvements. Investments in energy efficiency increase. Investment in power generation increases towards the end of the period as Slovakia builds a new nuclear generation plant. Exports contract both due to a loss in competitiveness as the cost of efficiency investments are passed on to consumers and due to lower productive capacity of the economy from the lower capital stock. Importantly, the macroeconomic impact on Slovakia is caused not only by its domestic policies but more than half of the consumption decline is caused by decarbonisation in the rest of the EU (which is modelled as a carbon tax in both ETS and non-ETS sectors). Policies in the rest of the EU lead to lower imports from Slovakia. For example, only about 50 to 60% of the drop-in consumption in Slovakia during 2040 to 2050 will becaused due to domestic policies (including ETS emissions pricing in Slovakia), while the rest will be caused due to lower demand from the rest of the EU driven by a deterioration in the terms-of-trade (***Figure 4.4***).

Figure 4.3: *Private consumption in WAM in % to change from WEM scenario in 2015 – 2050*

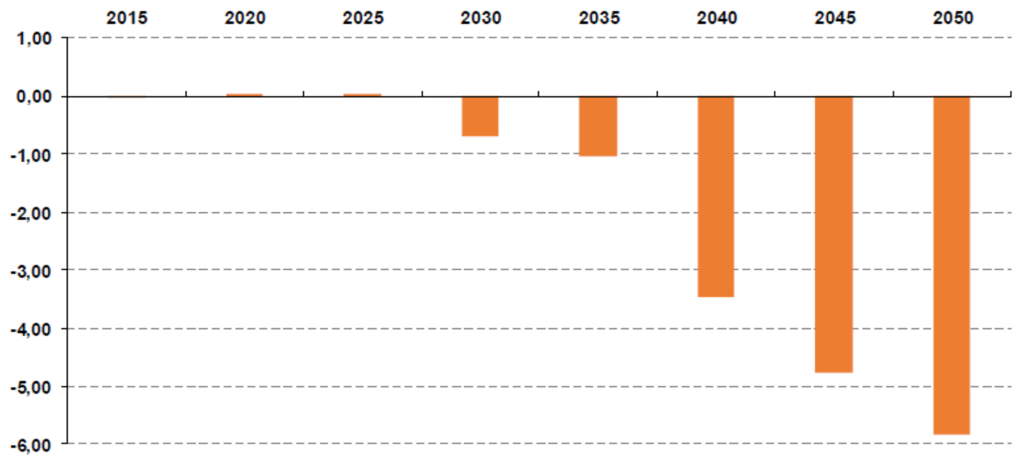
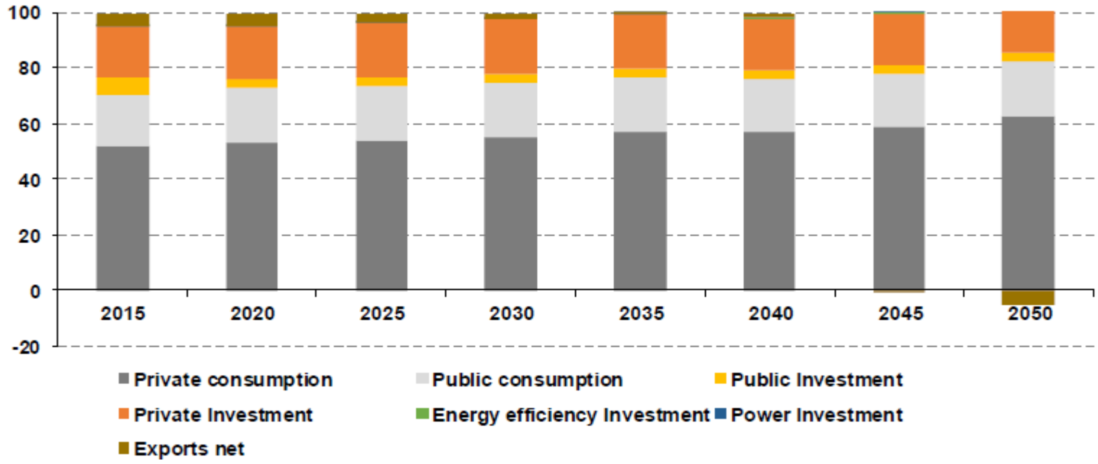


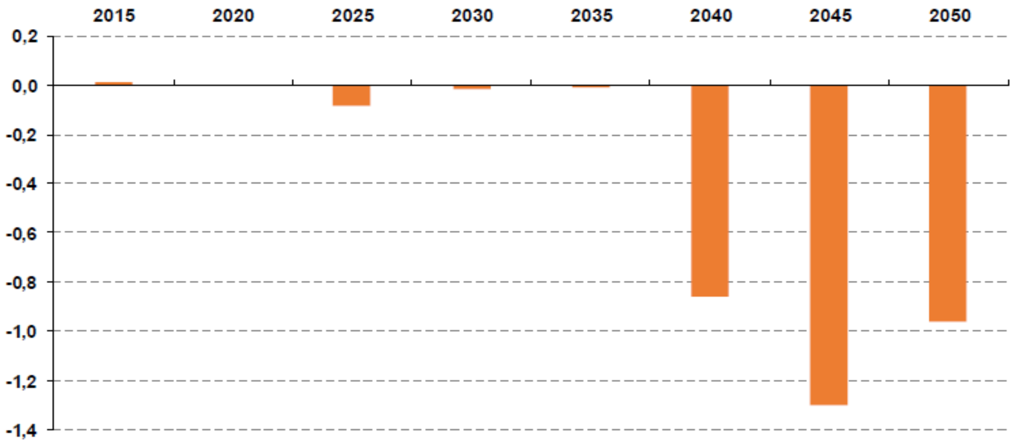
Figure 4.4: *Expenditure shares in GDP in %, by Dcarb2 scenario (WAM) in 2015 – 2050*



Source: E3-Modelling, CPS Technical Report

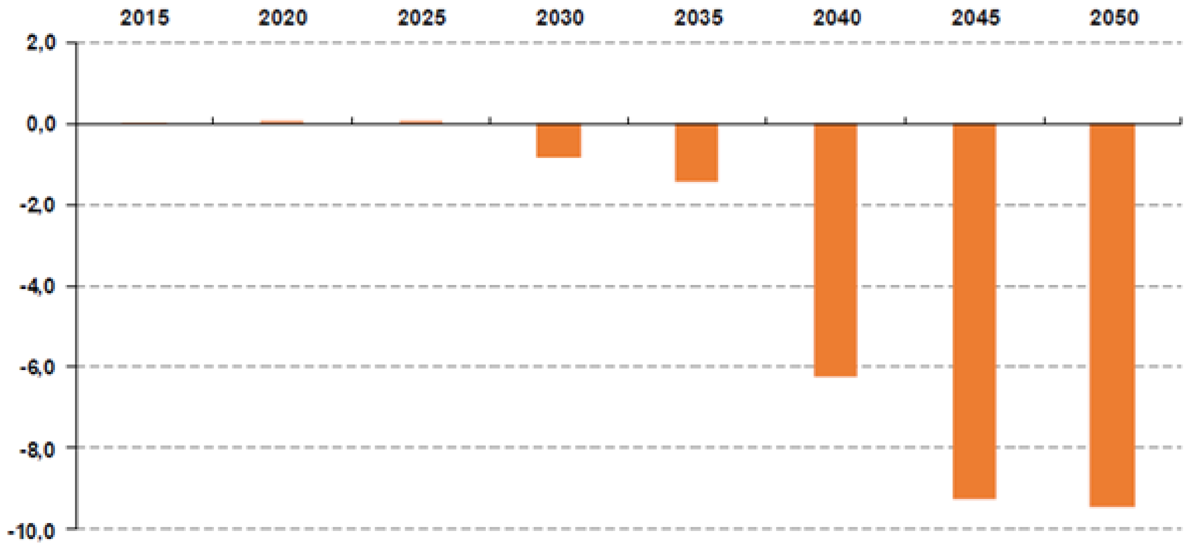
The changes in the industrial structure of the economy lead to a reallocation of labour across industries. As can be expected, sectors that expand (mainly export-oriented industries and industries supplying investment goods) attract additional labour, whilst those that contract (mainly industries producing consumption goods) release labour. However, not all workers who are made redundant from contracting sectors are able to find work in expanding sectors, leading to an increase in unemployment. Overall, structural change in the economy in response to decarbonisation policies seems to be negative for aggregate labour demand. In the short run (due to lagged wage adjustment), decreased labour demand translates mostly to lower employment. In the long run, by comparison, this translates mainly to decreased wages. The latter effects are substantial and dominate, especially towards the end of the projection period (***Figures 4.5*** and ***4.6***).

Figure 4.5: *Total employment in %, by Dcarb2 scenario (WAM) in relation to WEM in 2015 – 2050*



Source: E3-Modelling, CPS Technical Report

Figure 4.6: *Real wages - differences vs baseline (%)*

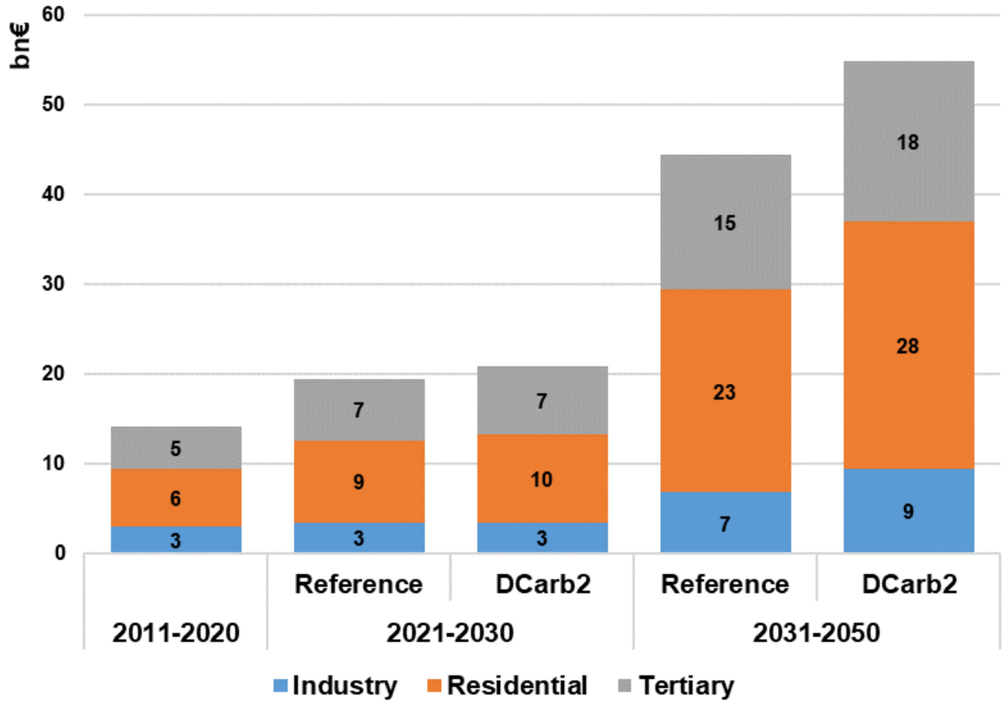


Source: E3-Modelling, CPS Technical Report

Investment Expenditures

The increase of energy efficiency and the wide development of RES lead to higher investment expenditures, as consumers shift towards buying more efficient energy products, equipment, appliances, vehicles etc., entailing higher capital costs. These additional costs are found to be small in the short and medium term (until 2030) and considerably higher in the long term. This is owing to the intensification of emission reduction and energy efficiency improvements after 2030.

Figure 4.7: *Investment expenditures across scenarios (bn EUR)*



Energy system costs

The cumulative total energy system costs in policy scenario are higher compared to reference scenario in the long term, while in the medium term (until 2030) a moderate increase of 1% is projected for the DCarb 2 (***Figure 4.8)***.

As presented in the ***Figure 4.9***, a general trend observed in Dcarb 2 scenario (WAM) (including reference) is the fact that the capital component of the energy system costs show an ascending trend over time and energy – related costs are shifting from Operative Expenditures to Capital Expenditures. For households and services, capital costs increase over time due to the investments in more efficient appliances. In industry, fuel costs cover the largest share of energy costs, increasing in the future due to the increasing price projection and higher ETS prices, while in the transport sector capital costs play an increasing role, higher investment expenditures as the mobility increases and investments in more efficient vehicles take place.

Figure 4.8: *Total energy system costs (in bn EUR)*

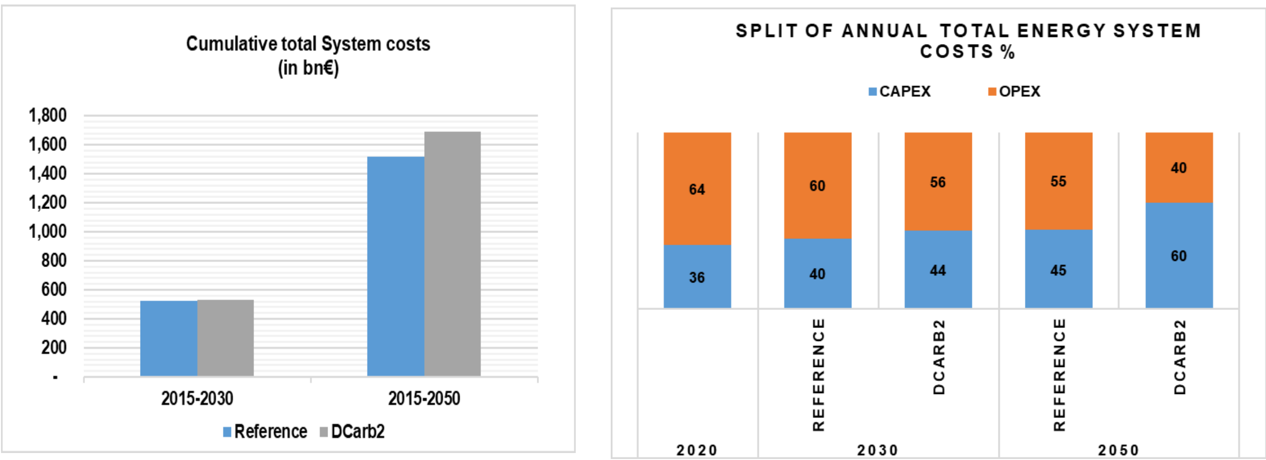


***Figure 4.9:** Disaggregation of system costs per sector*

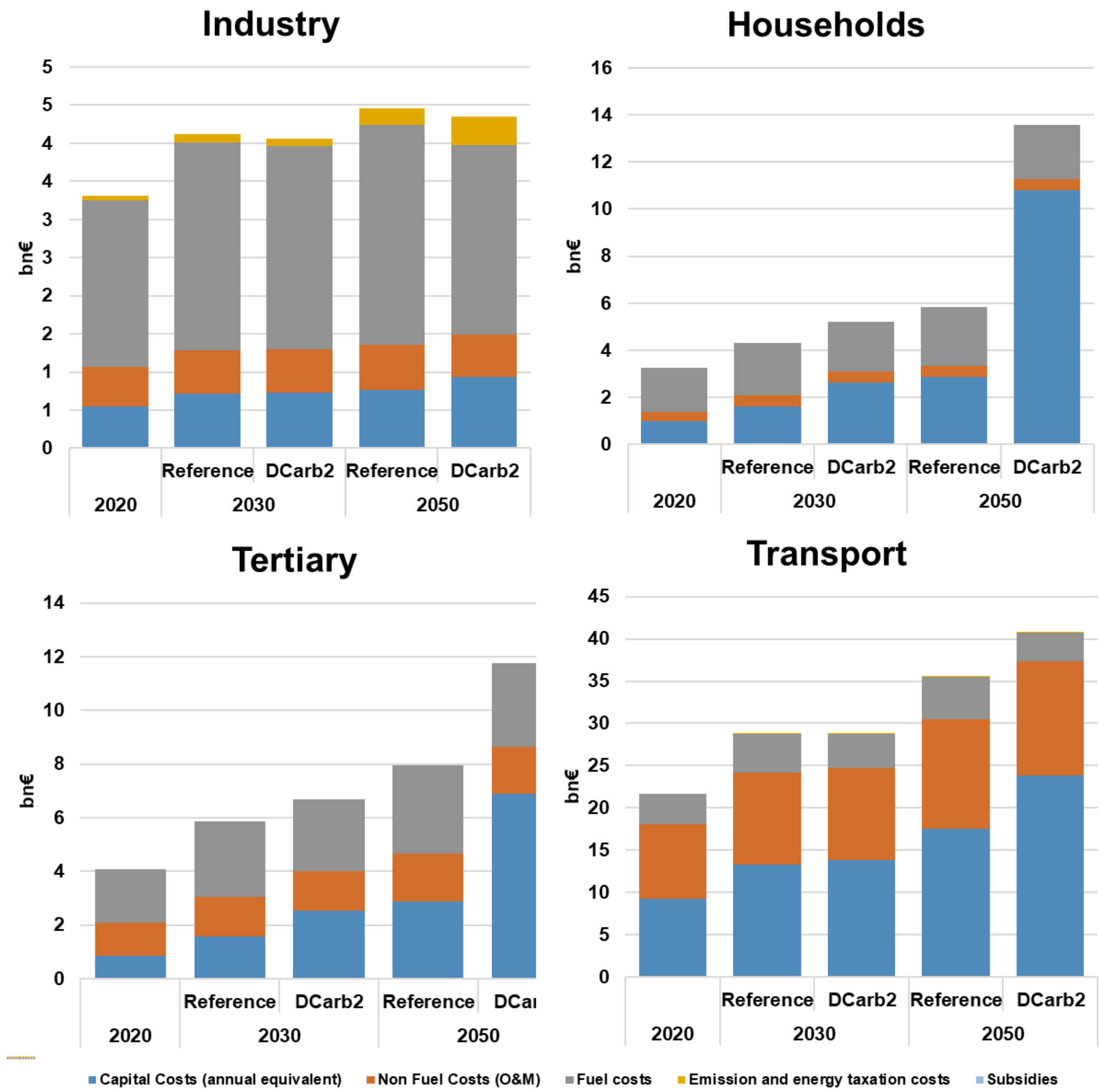


Table 4.9: *Investments by subsector or type, by scenario 2016 (real values), 2030 and 2050, in € millions and thousands of vehicles*

Investments (M €)	2016	2030		2050	
		Decarbonization scenario		Decarbonization scenario	
		Ref	Dcarb 2	Ref	Dcarb2
Heat recovery	-	115	292	126	984
Processing	970	1 555	1 470	1 957	2 197
Equipment & appliances	3 429	7 811	7 855	9 811	9 698
Building renovation by households	-	205	829	223	2 795
Building renovation in tertiary sector	-	257	832	285	1 511
Passenger cars (thousands of vehicles)					
Electric cars	-	37	56	211	1 646
Fuel cell cars	-	0	0	73	347
ICE plug in cars	-	69	99	263	370
ICE cars	1 754	2 409	2 357	2 561	1 211

Figure 4.10: *Total investment expenditures (in M € for 5-year period)*

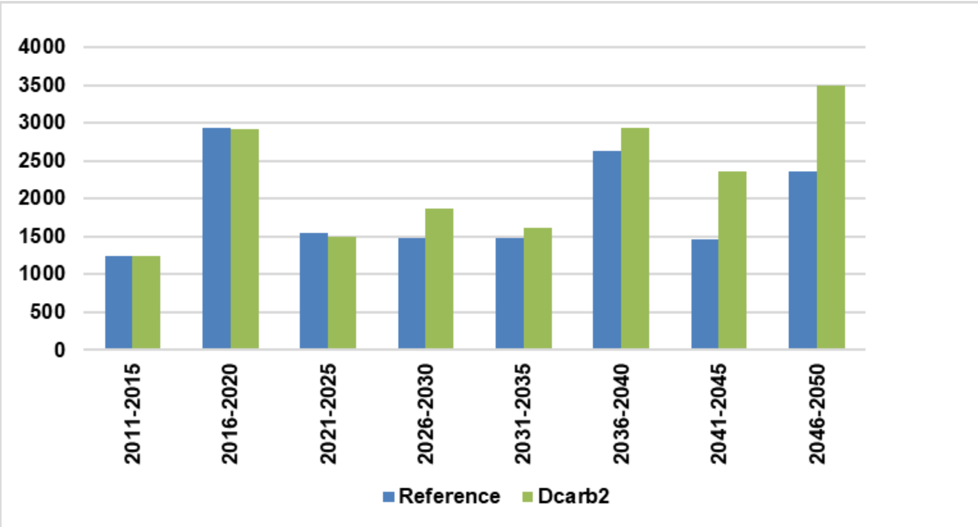


Table 4.10: *Some specific costs of policies and measures used in the GHG emission projections*

NAME OF PaM OR GROUP OF PaMs	PROJECTED COSTS (IN €)			DESCRIPTION OF COSTS
	ABSOLUTE COSTS PER YEAR IN EUR	YEAR(S) FOR WHICH COST HAS BEEN CALCULATED	PRICE REFERENCE YEAR	
Energy efficiency improvements	2 247 000 000	2020 – 2035	2015	Capital Costs (annual equivalent) and O&M
Implementation of the EU Winter Package	1 171 000 000	2035	2015	Total Cost of Electricity supply (in €)
National Renewable Energy Action Plan, Government Resolution of SR No 677/2010	1 483 000 000	2030	2015	Investment Expenditures in Electricity Only Plants (in € for 5-year period)
Implementation of the EU emissions Trading System	61 000 000	2035	2015	Investment Expenditures in Electricity Only Plants (in € for 5-year period)
CO_2 standards for cars and vans, efficiency standards for trucks along with the electrification of transport	34 561	2020 – 2035	2015	Capital Costs (annual equivalent) in Mil. EUR
Promotion of biofuels in road transport	3 456 100 000	2035	2015	Capital fuel Costs (annual equivalent) (in €)
Improvement of industrial sector	544 000 000	2035	2015	Capital Costs (annual equivalent)
Optimization of a district heating	103 000 000	2035	2015	Investment Expenditures in CHP & Heating Plants Gas (in € for 5-year period)
Increase of the ETS carbon prices	74.00	2035	2015	Carbon price ETS sectors (in €/$tnCO_2$)
Decarbonization of electricity generation	1 051 000 000	2035	2015	Investment Expenditures in Electricity Only Plants (in € for 5-year period)
Increase in the nuclear share of energy mix	5 190 000 000	2020	2015	Investment Expenditures in Electricity Only Plants (in € for 5-year period)

NAME OF PaM OR GROUP OF PaMs	PROJECTED COSTS (IN €)			DESCRIPTION OF COSTS
	ABSOLUTE COSTS PER YEAR IN EUR	YEAR(S) FOR WHICH COST HAS BEEN CALCULATED	PRICE REFERENCE YEAR	
Continues to improve final energy efficiency in all sectors	30 000 000	2035	2015	Income related (in tn CO_2/€)

4.7 ADOPTED LEGISLATIVE MEASURES

4.7.1 Fiscal policy instruments

Fiscal policy instruments are increasingly being referred to as an efficient instrument to correct existing environmentally related price distortions. The Slovak Republic maintains excise taxes on fossil fuels, electricity and mineral oils. The actual fiscal policy drivers, however, still remain much more linked to the current governmental budgetary situation rather than to provide fiscal incentives for environmentally sound behaviour. Since 2009 only minor changes occurred such as a decrease of the excise tax on diesel, removal of existing exemptions on coal tax payers and an increase of excise tax on LPG, CNG and electricity. No impact on any third countries is expected from already implemented fiscal policies and therefore no specific policies to offset any negative effects have been considered.

4.7.2 Biofuels policy

The biofuels policy has been put in place to meet the targets required by EU legislation. Increased demand and subsequently also production of biofuels might be reflected by rising commodity prices, respectively might cause land use changes resulting from the reduction of the supply of commodities in direct competition with those used for biofuels world-wide. Therefore, international trade represents the key channel through which the potential negative economic, social and environmental impacts might be transmitted towards developing countries. Taking into account the relatively low quantities of biofuels in use in the Slovak Republic and domestic production of raw materials for their production, we do not expect any negative effects either on forests destruction or contribution to rising world prices of agricultural commodities. Despite its rather low contribution to these developments, the Slovak Republic actively contributes to shaping the international sustainability standards either within its own (and internal EU) legislation process or within the framework of international institutions, such as the WTO, FAO, etc. Furthermore, the Slovak Republic has been actively engaged in strengthening the know-how on improving food security and agriculture, land and water management in Kenya. Moreover, scholarships for students from developing countries were offered with preference to those applying to pursue their studies in environmental sciences.

4.7.3 GHG reduction policies

The key policy option was development of the emerging carbon market with the resulting carbon price. Among the complementary policies, targets have been adopted to increase the share of renewable energy resources, increase energy efficiency as well as the new legislation which sets more stringent quality standards for fuels and personal cars.

Adopted policies could have had some implications for third countries either through the underlying carbon market price mechanisms or requirements to comply with new and tighter environmental regulations. CO_2 emission trading (either EU ETS or Kyoto Protocol emission trading) and increasingly stringent fuel quality standards might have some impact. The major example of its direct impact on third countries is the integration of the aviation sector into the trading scheme. Among indirect effects, the major example is the concern about possible carbon leakage. Most of the impacts of carbon leakage (shifts of industrial activity to countries without any GHG emission reduction commitments, potential downward pressure on oil prices, etc.) on third countries would in fact be rather positive for them.[26] Measures in place to minimize a potential carbon leakage include the provision to enlist economic sectors facing the immediate threat of carbon leakage, which will under the given conditions continue receiving their CO_2 allowances for free.

Furthermore, increasingly stringent fuel quality standards in Europe might in fact turn out to be a positive impact because it might trigger an increase of investments in the fuel processing industries in third countries. Rising fuel prices in Europe due to the carbon price (or tax) and quality increase might counter play the rising oil prices particularly due to increasing the scarcity of this commodity. Such effects might on the one hand negatively affect revenues of oil-exporting countries, which could on the other hand still be balanced by rising demand from the rest of the world. The final net impact will depend on the benefits derived from expansion of industrial production and costs needed to clean up higher levels of pollution including addressing its consequences.

Apart from emission trading, no other Kyoto Protocol flexible instruments have been used to meet the GHG emission reduction targets by the Slovak Republic, therefore no impact on third countries in this respect is reported.

Activities considered within the preparation of the adaptation strategy to climate change have a local character without any implications to third countries.

[26] In some specific cases where the polluting entity seeking a location in a developing country causes an increase of local pollution, increased environmental damage might outweigh economic benefits.

5 PROJECTIONS

In line with the complexity of greenhouse gas emission projections, focus on methodological and models improvements was essential in this Biennial Report of Slovakia. The new developed model for energy and large industry sectors substituted model MESSAGE used in a previous emission projections reporting. This approach is in line with the preparation of the Low Carbon Development Study of the Slovak Republic[27] *and following the methodology for preparation of the LCD Strategy of the Slovak Republic.*

Due to the methodological approach for the emission projections and the used scenarios, GHG emissions inventory submission of the ***May 15, 2018*** *and the base-year 2016 were applied. This caused differences between the Section 2 and Section 5 of this Fourth Biennial Report and in addition, differences in the CTF Tables 6(a) and (b) and the CTF Tables 1 and 4 (based on the submission April 30, 2019).*

5.1 SCENARIOS

The year 2016 was determined as the reference year for modelling of greenhouse gas emission projections for all scenarios, for which verified data sets were available from the national inventory of greenhouse gas emissions. Projections of GHG emissions were prepared for years 2015 – 2040 within the following scenarios:

With Measures Scenario (WEM) – is equivalent to the EU 2016 Reference Scenario (EU 2016 RS). Scenario follows the logic of the EC Reference 2016 Scenario. It includes the policies and measures adopted and implemented at the EU and national levels until the end of 2016 and the measures needed to achieve the renewables and energy efficiency targets in the year 2020. The EU policies included in the EU 2016 RS also comprise the amendments of the 3 Directives agreed in the beginning of 2015 (ILUC to the RES, FQD Directive and the Market Stability Reserve Decision to the EU ETS Directive).

The scope of the EU 2016 RS is to include the currently known policies and any additional measures – if needed - to achieve the binding climate-energy targets for 2020. Beyond 2020, further policy action is excluded from the EU 2016 RS, except of the EU ETS. The trajectory of prices for the EUA (EU ETS) allowances, used in the WEM, is compliant with the EU 2016 RS.

Despite the lack of new policies beyond 2020, the WEM scenario is not a frozen efficiency projection. The energy efficiency improvement in all sectors continue in the future, albeit at a slower pace than a dedicated policy would incite. The drivers of efficiency progress are the market forces. In industry, the energy efficiency progress is part of the quest for productivity growth, which is part of a sustained growth of value added. In the buildings and transport sectors, the energy efficiency improvement is due to the commercialisation of increasingly efficient equipment and vehicles as the industry considers the reduction of operation costs as a marketing factor able to attract increase in the sales. Therefore, the decoupling of energy consumption from economic growth continues in the future as a result of technology progress shown in the values of the corresponding parameters of the model chosen to reflect market forces, thus being below the values that would be reasonable for policy-related technology progress.

With additional measures scenario (WAM) – is equal to the Dcarb2 scenario (in energy and industry, partly also in transport). For the design of the WAM scenario, a policy package "Clean Energy for All European", launched by the European Commission in November 2016 was considered. PRIMES model

[27] https://www.minzp.sk/files/iep/2019_01_low-carbon-study.pdf

scenarios, named EUCO scenario, until 2030 and 2050 supported the impact assessment of the measures and objectives proposed by the EC.

WAM scenario includes ways of achieving various combinations of efficiency, renewables and emission reduction targets in 2040. The WAM scenarios also consider achievement of the EU's 2050 target for emission reductions. WAM scenario analysed for Slovakia have been designed as contrasting combinations of energy efficiency and renewables targets, representing the trade-offs between targets. Scenario include Slovakia's participation in the ETS and median targets for renewables and energy efficiency, scenario WAM involve the construction of new nuclear generation capacity for Slovakia, continuing the importance of nuclear energy in the generation mix.

The new governance process allows substantial freedom of the EU Member States regarding the adoption of national targets for renewables, energy efficiency and the overall GHG emissions reduction. There is not freedom regarding the non-ETS target, but the specification of this target by sub-sector is at the discretion of the country. As a substantial part of the non-ETS emissions are not related to energy combustion, it is also possible to arbitrate between energy and other sectors.

To shape a range of possible contributions by the Slovak Republic in the achievement of the EU targets for 2030 (described in the Section 4.2), the first, summary of possible ranges for the targets using several scenario-variants quantified for Slovak Republic using the PRIMES model were prepared. The Basic, Median and Ambitious categorisation refer to the possible intensiveness of the policy targets for the year 2030.

In brief, the contrasting scenarios, namely define a) a low energy efficiency and high RES scenario, versus b) a high target for energy efficiency and low-RES scenario, c) a middle case scenario and d) a scenario with very ambitious RES (mainly RES – E) and low energy efficiency. The four policy scenarios are presented in the ***Table 5.1***.

Table 5.1: *Policy assumptions used across policy scenarios*

SCENARIO NAME	RES POLICIES	EE POLICIES
DCarb1	Basic	Ambitious
DCarb2	Median	Median
DCarb3	Ambitious	Basic
DCarb4	Very ambitious (for RES - E)	Basic

For the WAM scenario policy median scenario DCarb2 has been chosen.

5.2 KEY PARAMETERS AND ASSUMPTIONS

Table 5.2 represents main projection parameters used for the emission projections in base the year 2016 and additional cross years.

Table 5.2: *Applied emission projections main parameters*

ITEM	UNITS	2016*	2020	2025	2030	2035	2040
Gross domestic product: Constant prices	EUR million	81 655	89 328	102 290	117 033	127 854	134 921
Population	1 000 heads	5 419	5 503	5 543	5 558	5 550	5 550
EU ETS carbon price WEM scenario	EUR/EUA	7.5	15	22.5	33.5	42	50
EU ETS carbon price WAM scenario	EUR/EUA	7.5	15	22.5	33.5	74	117
International coal import prices	EUR/GJ	2.97	2.64	3.16	3.79	4.01	4.18
International oil import prices	EUR/GJ	8.22	13.86	15.73	17.33	18.08	19.14
International gas import prices	EUR/GJ	5.78	8.91	9.64	10.49	11.2	11.58

** real values*

5.3 PROJECTIONS

5.3.1 Total aggregated GHG emissions projections

GHG emissions from international transport are not included in the national balance. However, GHG emission projections from international aviation and international navigation have been developed for the scenario with measures. From the data in ***Table 5.3*** it is obvious that projected GHG emissions from these categories are negligible in comparison with other sources.

Table 5.3: *Aggregated data on the projections of GHG emissions from international transport for scenario with existing measures (Gg CO_2 eq.)*

WEM	2016*	2020	2025	2030	2035	2040
International bunkers	174.21	183.49	183.49	183.49	183.49	183.49
International aviation	155.26	165.02	165.02	165.02	165.02	165.02
International navigation	18.95	18.47	18.47	18.47	18.47	18.47

** real values 2018 submission*

The projections of GHG emissions recalculated to equivalents of CO_2 according to valid values of GWP (Fourth AR of the IPCC) have been developed for all IPCC sectors, defined years and relevant scenarios. ***Table 5.4*** shows the results of modelling data in summary.

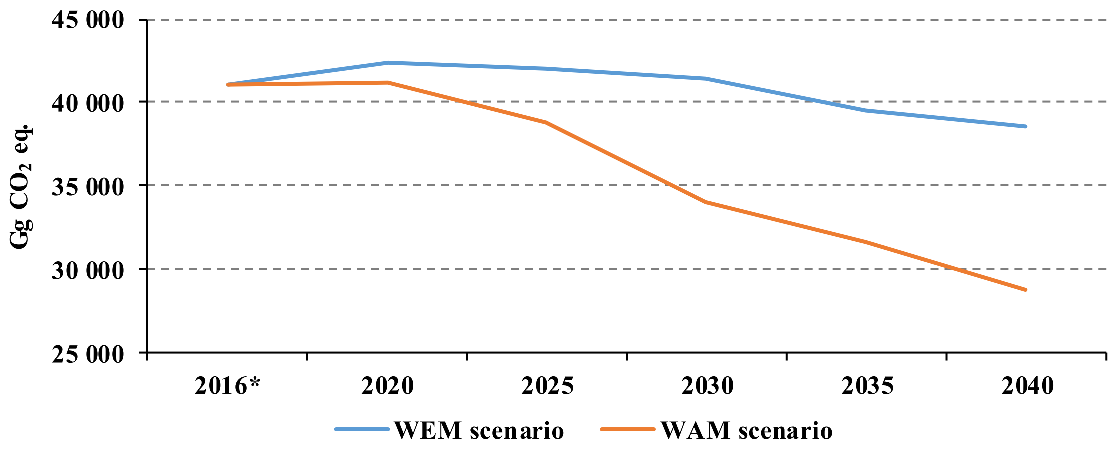
Table 5.4: *Total emission projections in the WEM and WAM scenarios with and without LULUCF in monitored sectors (Gg CO_2 eq.)*

WEM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	27 543.8	29 000.4	29 267.9	29 890.2	28 506.7	27 996.6
2. Industrial processes	9 338.2	9 414.1	9 063.4	8 097.6	7 663.0	7 193.9
3. Agriculture	2 671.3	2 376.2	2 390.7	2 419.8	2 497.1	2 570.2
4. LULUCF	-6 861.1	-6 145.1	-5 040.4	-4 434.0	-4 155.8	-4 231.2
5. Waste	1 483.8	1 564.0	1 324.3	991.5	858.9	760.4
Total CO_2 eq. (Gg) excl. LULUCF	41 086.5	42 354.8	42 046.3	41 399.0	39 525.7	38 521.2
Total CO_2 eq. (Gg) incl. LULUCF	34 225.4	36 209.7	37 005.8	36 965.0	35 369.9	34 290.0
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	27 543.8	27 845.2	25 801.6	23 151.8	21 320.0	19 260.8
2. Industrial processes	9 338.2	9 417.2	9 244.5	7 456.0	7 008.6	6 159.4
3. Agriculture	2 671.3	2 376.2	2 390.7	2 419.8	2 497.1	2 570.2
4. LULUCF	-6 861.1	-6 159.9	-5 072.2	-4 482.8	-4 221.6	-4 307.5
5. Waste	1 483.8	1 564.0	1 324.3	991.5	858.9	760.4
Total CO_2 eq. (Gg) excl. LULUCF	41 086.5	41 202.6	38 761.1	34 019.1	31 684.7	28 750.8
Total CO_2 eq. (Gg) incl. LULUCF	34 225.4	35 042.8	33 688.9	29 536.3	27 463.1	24 443.4

** real values 2018 submission*

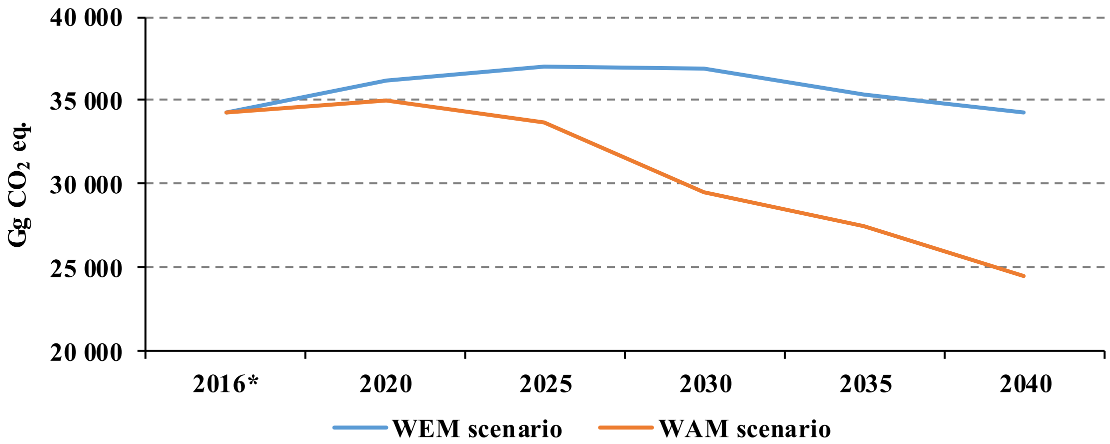
Table 5.4 shows trend in emission projections for the period 2017 – 2040 according to the WEM and WAM scenarios with and without LULUCF projections of sinks in Gg of CO_2 equivalents (***Figures 5.1*** and ***5.2***).

Figure 5.1: *Trend in emission projections in the WEM and WAM scenarios with LULUCF*



** real values 2018 submission*

Figure 5.2: *Trend in emission projections in the WEM and WAM scenarios without LULUCF*



** real values 2018 submission*

5.3.2 Emission projections from Energy sector including Transport

Energy sector produces GHG emissions form combustion and transformation of fossil fuels. Fugitive methane emissions are generated from fuel extraction, transport and processing.

The modelling of emission projections was based on results from new CPS model. CPS model is still not fully calibrated for CRF categorization of GHG emissions reporting, therefore adjustment of results from the model according to the GHG emission inventories was necessary.

The outputs from modelling were determined by reduction potential of measures to reduce greenhouse gas emissions. Detailed model results are available on the MŽP SR webpage, here. Relevant scenarios used in this submission are described in the Section 5.1 – EU Reference 2016 Scenario (WEM) and DCarb2 Scenario (WAM). Following parameters and PaMs were used in the projections of Energy sector:

The WEM scenario includes PaMs at EU level listed below:

- Eco-design Framework Directive (Directive 2005/32/EC);
- Energy Labelling Directive (Directive 2010/30/EU);
- Energy Performance of Buildings Directive, Energy Efficiency Directive (Directive 2012/27/EU);
- Completion of the internal energy market, including provisions of the 3rd package (Directive 2009/73/EC, Directive 2009/72/EC), Regulation (EC) No 715/2009, Regulation (EC) No 714/2009;
- Directive on the promotion of the use of energy from renewable sources - "RES Directive"- incl. amendment on ILUC (Directive 2009/28 EC as amended by Directive (EU) 2015/1513);
- EU ETS Directive 2003/87/EC as amended by Directive 2004/101/EC (international credits), Directive 2008/101/EC (aviation), Directive 2009/29/EC (revision for 2020 climate and energy package), Regulation (EU) No 176/2014 (back-loading), Decision (EU) 2015/1814 (Market Stability Reserve), and implementing Decisions, in particular 2010/384/EU, 2010/634/EU, 2011/389/EU, 2013/448/EU (cap), 2011/278/EU, 2011/638/EU (benchmarking and carbon leakage list);

- Regulation No 443/2009 on CO_2 from cars amended by Regulation No 333/2014, Regulations EURO 5 and 6;
- Regulation (EC) No 715/2007 and Regulation on CO_2 from vans - Regulation (EU) No 510/2011 amended by Regulation EU 253/2014;
- Industrial emissions (Recast of Integrated Pollution and Prevention Control Directive 2008/1/EC and Large Combustion Plant Directive 2001/80/EC) - Directive 2010/75/EU.

Apart from PaMs at the EU level and the national policies needed to implement 2030 obligations, the WEM scenario includes following specific national measures:

- Fuel switching of district heating solids-fired plants to biomass and gas;
- Phase out of solids-fired district heating plants from 2025 onwards;
- Subsidy on new sales of passenger cars, 5 000 euros for electric car and 3 000 euros for PHEV until 2020.

The specification of the WAM scenario relies on the logic of the design of the EU scenarios and in particular, the EUCO30 scenario, which sets the 2030 targets at EU level as follows:

- GHG emissions reduction: -40% in 2030 and -80 to -85% in 2050, compared to 1990;
- EU ETS CO_2 emissions reduction: -43% in 2030 and -90% in 2050, compared to 2005, but this is resulting from the EU ETS carbon price trajectories as an outcome of the EU ETS market regulations including the market stability reserve as adopted;
- Non-EU ETS GHG emissions reduction: -30% in 2030 compared to 2005, with specific obligations per country;
- RES share: 27% of gross final energy demand in 2030;
- Energy efficiency: reduction of primary energy by 30% (1 321 Mtoe – excluding non-energy consumption of energy products) in 2030 compared to 2007 baseline.

In addition to the national policies included in the WAM scenario, following national policies are also included:

- Earlier decommissioning of solid-fired utility power plants: Vojany and Nováky power plants are assumed to decommission in 2025 and 2023 respectively;
- RES support scheme in power generation: Eligible RES technologies are Solar PV, wind onshore turbines and biomass. The scenarios assume a support to 50MW in the period 2021 – 2025, followed by the support of another 500 MW based on auctions;
- Further development of nuclear energy is possible based on economic optimality;
- Carbon capture and storage is excluded.

5.3.2.1 Fugitive CH_4 and CO_2 emission projections from coal mining and post mining activities in the Slovak Republic

The fugitive CH_4 emission projections from underground coal mining and post-mining in the Slovak Republic have been estimated based on the following activity data:

- Coal production in 2016 from the underground mines have been obtained from the official sources among others mining company HBP, a.s. and the Statistical Office of the Slovak Republic;
- Coal production prediction from the Ministry of Economy of the Slovak Republic (MH SR) – Energy Policy of the Slovak Republic 2014 (WEM);

- Slovak Republic: CPS Energy Model, 01.08.2018 (WAM).

The fugitive CH_4 emission projections from underground coal mining and post-mining in the Slovak Republic have been estimated based on the following emission factors:

- methane and CO_2 emission factors from the IEA - CIAB Global Methane and the Coal Industry;
- specified by the mining company - HBP, a.s.

The fugitive CH_4 emission projections from underground coal mining and post-mining activities in the Slovak Republic have been estimated based on the following assumptions:

- Termination of state subsidies for coal mining in the mining company HBP a.s. is expected in 2023 (a realistic estimate in 2030);
- A gradual decline in coal mining is also recorded in connection with the closure of the Dolina Mine in 2015 and the closure of the Cígeľ mine (HBP as) in 2017;
- After 2023, due to the cessation of state coal subsidies, it is expected to fall faster with a sharp decline after 2030.

The ***Table 5.5*** and ***5.6*** provides expected values of coal production in the years 2016 – 2040.

Table 5.5: *Expected coal mining activity in the Slovak Republic until 2040 (WEM)*

MINES	UNIT	2016*	2020	2025	2030	2035	2040
HBP, a. s.	kt	1 652	1 350	1 300	1 300	0	0
Included mines *Cigeľ*	kt	234	0	0	0	0	0
Handlová	kt	300	0	0	0	0	0
Nováky	kt	1 118	1 350	1 300	1 300	0	0
BD, a. s.	kt	0	0	0	0	0	0
BČ, a. s.	kt	195	450	500	500	500	500
Total production	**kt**	**1 847**	**1 800**	**1 800**	**1 800**	**500**	**500**

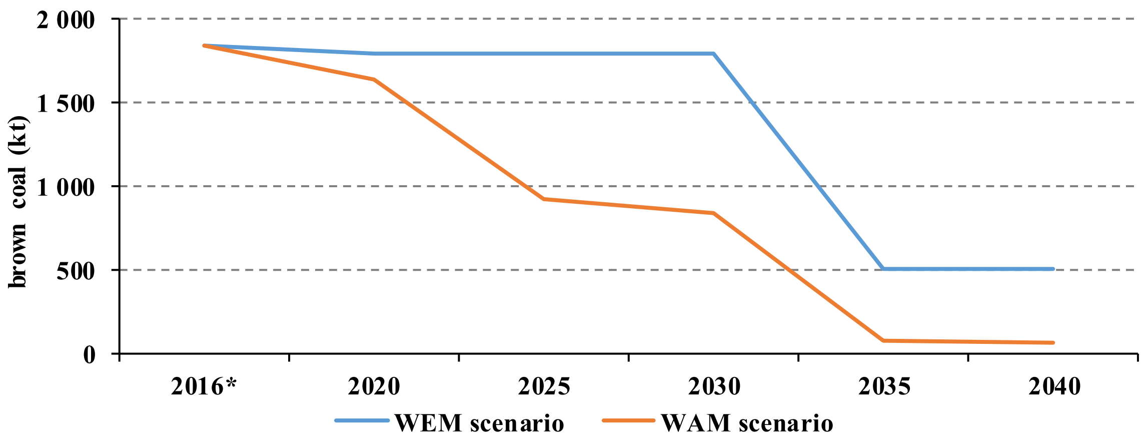
* *real values 2018 submission*; source: MH SR

Table 5.6: *Expected coal mining activity in the Slovak Republic until 2040 (WAM)*

MINES	UNIT	2016*	2020	2025	2030	2035	2040
HBP, a. s.	kt	1 652	1 189	424	341	0	0
Included mines *Cigeľ*	kt	234	0	0	0	0	0
Handlová	kt	300	0	0	0	0	0
Nováky	kt	1 118	1 189	424	341	0	0
BD, a. s.	kt	0	0	0	0	0	0
BČ, a. s.	kt	195	450	500	500	73	62
Total production	**kt**	**1 847**	**1 639**	**924**	**841**	**73**	**62**

* *real values 2018 submission*, source: Slovak Republic: Reference Scenario, CPS Energy Model, 01.08.2018

Figure 5.3: *Coal mining projected for the years 2016* – 2040 in the Slovak Republic*



** real values 2018 submission*

Table 5.7: *Fugitive methane and CO_2 emission projections from coal mining and post mining activities in the Slovak Republic for the years 2016* – 2040 (WEM)*

YEAR	BROWN COAL	CH_4	CO_2	CO_2
		tons		tons of CO_2 eq.
2016*	1 847 130	12 439	18 617	329 598
2020	1 800 000	11 502	22 421	309 971
2025	1 800 000	11 572	22 441	311 741
2030	1 800 000	11 457	22 441	308 866
2035	500 000	5 598	6 378	146 328
2040	500 000	5 510	6 378	144 128

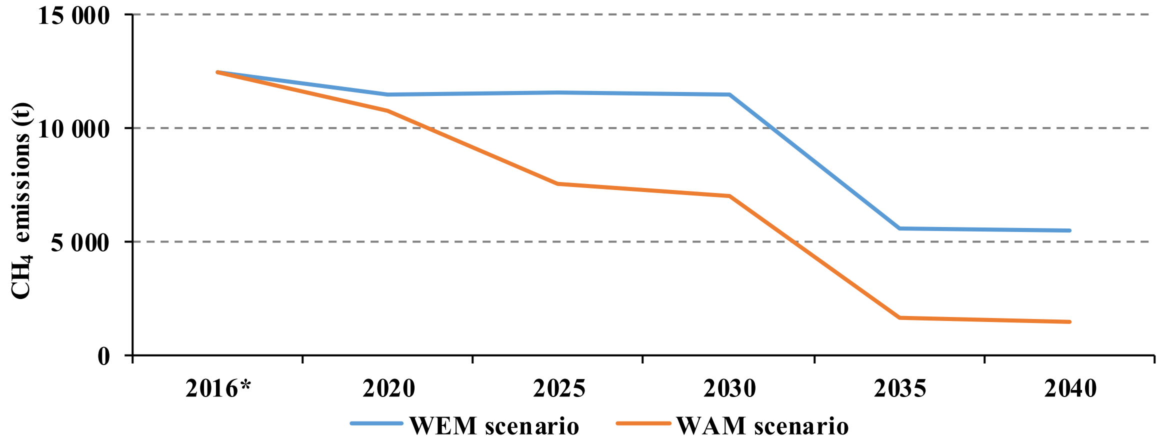
** real values 2018 submission*

Table 5.8: *Fugitive methane and CO_2 emission projections from coal mining and post mining activities in the Slovak Republic for the years 2016* – 2040 (WAM)*

YEAR	BROWN COAL	CH_4	CO_2	CO_2
		tons		tons of CO_2 eq.
2016*	1 847 130	12 439	18 617	329 598
2020	1 639 067	10 758	20 433	289 383
2025	924 341	7 524	11 622	199 722
2030	840 804	7 023	10 589	186 164
2035	73 258	1 624	935	41 535
2040	62 061	1 431	792	36 567

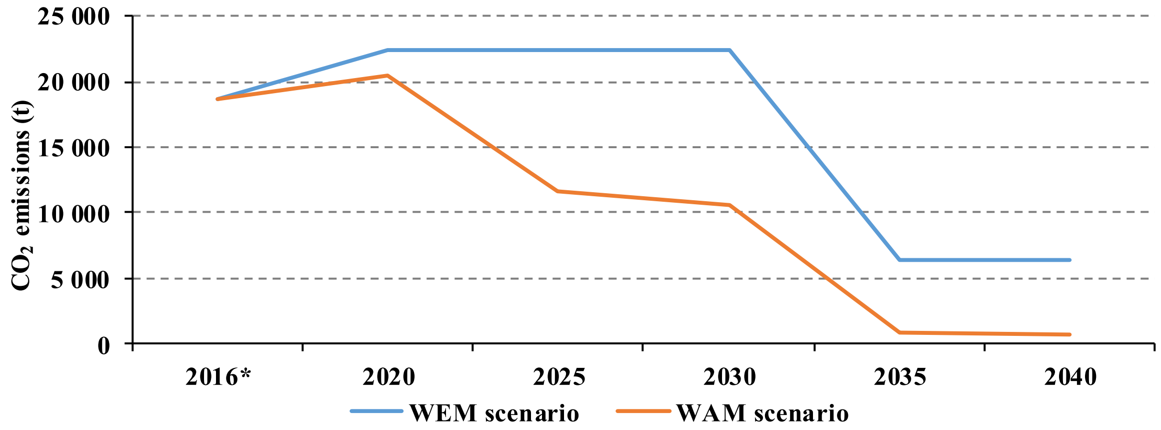
** real values 2018 submission*

Figure 5.4: *Trend of methane emission projections from coal mining and post mining activities in the Slovak Republic for the years 2016* – 2040 according to the IEA-CIAB methodology*



** real values 2018 submission*

Figure 5.5: *Trend of CO_2 emission projections from coal mining and post mining activities in the Slovak Republic for the years 2016* – 2040 according to the IEA-CIAB methodology*



** real values 2018 submission*

5.3.2.2 Fugitive CH_4 emission projections from transport and distribution of natural gas and oil in the Slovak Republic

The fugitive CH_4 emission projections from transport and distribution of natural gas and oil in the Slovak Republic have been estimated based on the following activity data:

- Statistical Office of the Slovak Republic (for the year 2016);
- Slovak Republic: CPS Energy Model 01.08.2018.

The fugitive CH_4 emission projections from transport and distribution of natural gas and oil in the Slovak Republic have been estimated based on the following emission factors:

- 2006 IPCC Guidelines for National GHG Inventories - Chapter 4: Fugitive Emissions;
- IPCC Good Practice Guidance and Uncertainty Management in National GHG Inventories - Fugitive Emissions from Oil and gas operation.

The fugitive CH_4 emission projections from transport and distribution of natural gas and oil in the Slovak Republic have been estimated based on the following assumptions:

- After 2020, oil production is expected to end in the Slovak Republic;
- Natural gas extraction will be only slowly decline. Without significant changes will be the consumption/distribution of NG and crude oil processing in Slovakia;
- Significant influence to reduce fugitive CH_4 emissions will reduce the amount of gas transported to other countries through gas pipelines in Slovakia, as a result of redirecting NG supplies via the North Stream pipeline;
- The values of the gradual reduction in gas supplies over the 2020 – 2040 period have been determined based on the trend over the last ten years (WAM).

Table 5.9: *Expected production, transmission and distribution of oil and NG in 2016* – 2040 (WEM)*

ACTIVITY	UNITS	2016*	2020	2025	2030	2035	2040
Oil production	t	10 000	10 254	0	0	0	0
Oil processing	t	5 738 018	5 749 078	5 664 604	5 621 146	5 458 604	5 282 346
Long-distance oil transmission	t	9 171 317	9 727 295	9 454 590	9 181 885	8 909 180	8 636 475
NG production	10^6 m^3	92.000	110.605	114.095	100.413	85.417	75.361
Long-distance NG transmission	10^6 m^3	60 600.00	69 069.62	67 882.19	67 036.01	66 102.13	68 622.51
NG distribution	10^6 m^3	4 716.000	4 871.149	5 556.479	5 466.016	5 267.342	5 355.552

** real values*

Table 5.10: *Expected production, transmission and distribution of oil and NG in 2016* – 2040 (WAM)*

ACTIVITY	UNITS	2016*	2020	2025	2030	2035	2040
Oil production	t	10 000	10 254	0	0	0	0
Oil processing	t	5 738 018	5 749 078	5 664 604	5 621 146	5 458 604	5 282 346
Long-distance oil transmission	t	9 171 317	9 727 295	9 454 590	9 181 885	8 909 180	8 636 475
NG production	10^6 m^3	92.000	110.605	114.095	100.413	85.417	75.361
Long-distance NG transmission	10^6 m^3	60 600.00	56 000.00	51 000.00	46 000.00	41 000.00	36 000.00
NG distribution	10^6 m^3	4 716.000	4 871.149	5 556.479	5 466.016	5 267.342	5 355.552

** real values 2018 submission*

Table 5.11: *Fugitive emission projections for the years 2016* – 2040, according to the IPCC 2006 GL, table 4.2.4 - Tier 1 emission factors (WEM)*

YEAR	CH_4	CO_2	NMVOC	N_2O
	tons			
2016*	54 309	1 213	8 747	0.0106
2020	61 355	1 330	9 043	0.0126
2025	61 088	946	8 868	0.0037
2030	60 262	892	8 771	0.0032
2035	59 239	827	8 771	0.0028
2040	61 310	807	8 292	0.0024

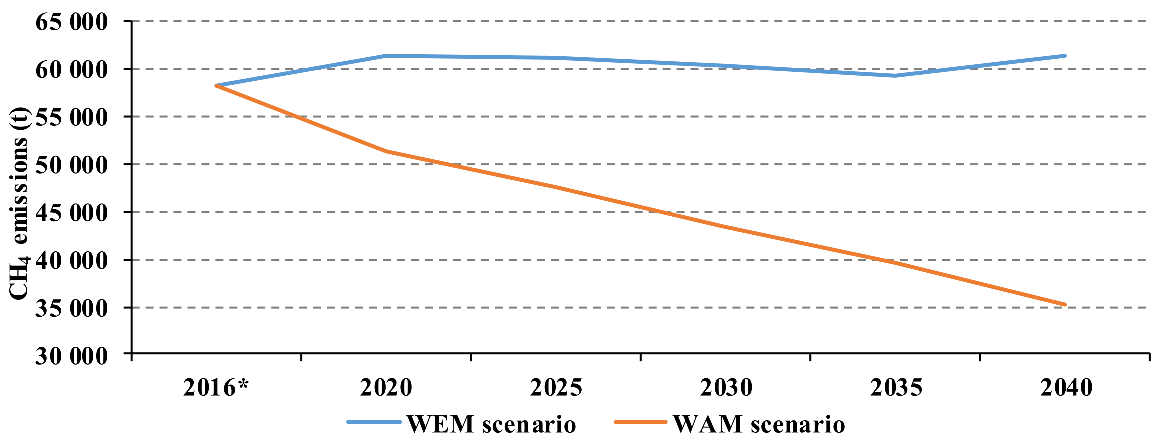
** real values 2018 submission*

Table 5.12: *Fugitive emission projections for the years 2016* – 2040, according to the IPCC 2006 GL, table 4.2.4 - Tier 1 emission factors (WAM)*

YEAR	CH_4	CO_2	NMVOC	N_2O
	tons			
2016*	54 309	1 213	8 747	0.0106
2020	51 280	1 296	8 896	0.0126
2025	47 582	879	8 672	0.0037
2030	43 434	808	8 527	0.0032
2035	39 606	727	8 527	0.0028
2040	35 212	677	7 914	0.0024

** real values 2018 submission*

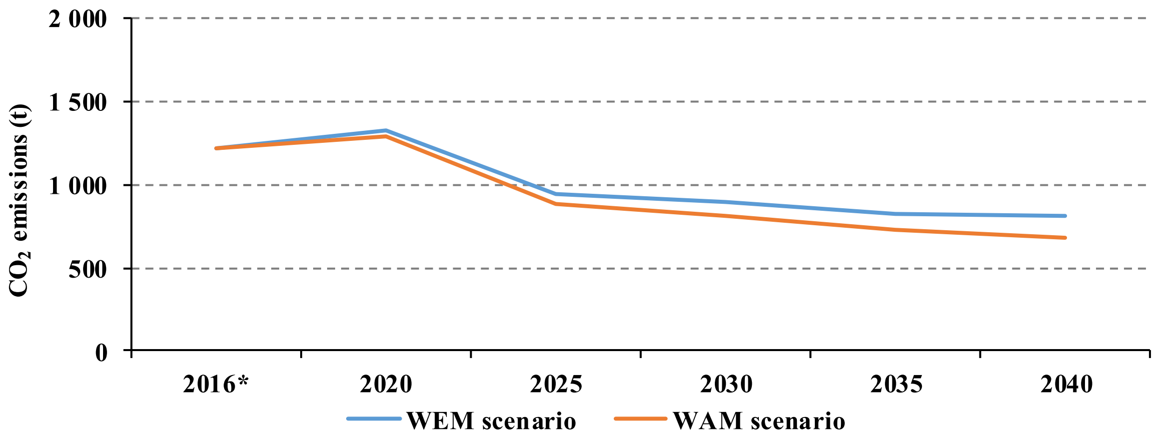
Figure 5.6: *The trend of developing CH_4 emission projections until 2040 in the Slovak Republic*



** real values 2018 submission*

In addition to CH_4 fugitive emission projections from transport and distribution of NG and oil in the Slovak Republic, CO_2, NMVOC, and N_2O emission projections were calculated, however their importance to the total GHG emission projections is negligible. The same conditions and methodology were applied.

Figure 5.7: *The trend of developing CO_2 emission projections until 2040 in the Slovak Republic*



** real values 2018 submission*

5.3.2.3 Transport sector

Emission projections from transport in the Slovak Republic are based on the energy model and its distribution described in the Sections above. Prediction of energy consumption in the Transport sub-sector was made as percentage ratio of fuels on total consumption in the Energy sector. Emission projections in road transport have been estimated based on the following activity data and procedures in the model:

- Aggregation of transferred data from COPERT 5 for the period 2000 – 2016 as the current version of COPERT uses totally 382 categories of road vehicles. The aggregation considered the mode of transport, the fuel used and the EURO emission standard;
- Updating data on new registrations and discarded vehicles;
- Allocation of new registrations to vehicle categories based on energy consumption forecasts;
- The distribution of scrapped vehicles into categories of older vehicles, so that their numbers gradually decrease to zero, because of the ongoing fleet renewal;
- Estimation of vehicle numbers for each year (2017 – 2040) based on the new registration and discarded vehicles;
- Aggregation of annual mileage, according to COPERT calculations, for the period 2000 – 2016 into defined vehicle categories and assumption of development of mileage for years 2017 – 2040;
- Export of "implied" emission factors from the COPERT program and their appropriate distribution for vehicle categorization in the projection model;
- Calculation of future traffic performance for the period 2017 – 2040 for given vehicle categories;
- Calculation of future emissions by multiplying the performance and emission factors.

Projections of CO_2 emissions in the category 1.A.3.b – Road Transportation were following trends referred to: EU Reference 2016 Scenario (WEM) and DCarb2 Scenario (WAM). Trends of CO_2 and N_2O emission is decreasing up to year 2040 but the trend of CH_4 is increasing compared to the WEM scenario. Most probable reason is the rising trend of natural gas and biogas consumption (***Table 5.15***). The emissions from biomass are not calculated separately in emissions projections, but the increase share of biofuels in gasoline and diesel oil influences CO_2 emission factors and consequently the CO_2 projections.

The Slovak Republic as well as other countries has been applying various Policies and Measures (PaMs) for the decrease of environmental burden from transport. All the Policies and Measures described in the Section 4.3.2 are in line with the Low Carbon Study of the Slovak Republic. From these measures, only those with calculable emission reductions were evaluated and used for "Decarbonisation" scenario (WAM).

***Table 5.13:** Overview of appropriate PaMs*

NAME	SHORT DESCRIPTION
Environmental Design and Use of Products	Environmental Design and Use of Products - the aim of this measure is to reduce environmental impact at all stages of the life cycle of these products. The measure sets regulations for domestic appliances, motors and other electric equipment with the negative environmental impact throughout the product's lifecycle that use energy (for example: boilers, computers, cars, household appliances etc.). The automotive industry is forced to consider the entire life cycle of cars. Besides a reduction of fuel consumption and exhaust emissions, the production as well as the end-of-life phase have to be taken into account. Eco-Design includes an effective approach to integrate the aspects of resources availability, manufacturing technologies, in-use behaviour and recycling procedures. A challenge in the application of Eco-Design in automotive industry lies in the complex interactions of different, partially conflicting influencing factors. The use of vehicles produced in this way has the effect of reducing CO_2 emissions in the transport sector.
CO_2 standards for cars and vans, efficiency standards for trucks along with the electrification of transport	Increase of cars efficiency and decrease of GHG emissions from passenger cars, vans and trucks. This covers the implementation of EU regulation 2009/443/EC and regulations 2011/510/EC and 2007/715/EC which set limits for CO_2 emissions from car and vans in Slovakia.
Promotion of biofuels in road transport	Slovak Republic intend to accelerate the implementation of second generation biofuels produced from non-food crops such as wood, organic waste, food crop waste and specific biomass crops. Operators have to blend biofuels in minimum energy contend as follows: a) 5.8 % in 2017, b) 5.8 % in 2018, c) 6.9 % in 2019, d) 7.6 % in 2020, e) 8.0 % in 2021, f) 8. 2% in 2022 – 2030. Advanced biofuels energy contend have to be at least: a) 0.1 % in 2019, b) 0.5 % in 2020 – 2024, c) 0.75% in 2025 – 2030.
Electricity for transportation sector	Strong uptake of electric cars and fuel cell cars, replacing internal combustion engine cars.

***Table 5.14:** Expected fuels consumption in transport sector in WEM scenario in 2016* – 2040*

FUEL	UNIT	2016*	2020	2025	2030	2035	2040
Gasoline	TJ	25 062.2	21 747.6	22 536.0	26 506.8	29 343.6	28 670.4
Diesel	TJ	58 811.6	56 314.8	59 245.2	62 582.4	65 685.6	64 396.8
LPG	TJ	1 759.7	3 506.4	3 297.6	3 283.2	2 988.0	2 894.4
Natural gas	TJ	234.5	752.4	792.0	1 076.4	1 339.2	1 587.6
Biogas	TJ	0.0	3.6	25.2	43.2	54.0	79.2
Biofuel conventional	TJ	5 318.6	7 437.6	7 675.2	8 337.6	8 928.0	8 794.8
Biofuel advanced	TJ	0.0	0.0	0.0	0.0	3.6	14.4
Kerosene	TJ	47.0	2 268.0	2 768.4	3 409.2	3 852.0	3 956.4
Hydrogen	TJ	0.0	0.0	0.0	7.2	151.2	464.4
Electricity	GWh	0.2	707.0	860.0	991.0	1 160.0	1 241.0

** real values*

Table 5.15: *Expected fuels consumption in transport sector in WAM scenario in 2016* – 2040*

FUEL	UNIT	2016*	2020	2025	2030	2035	2040
Gasoline	TJ	25 062.2	21 747.6	21 186.0	21 142.8	19 090.8	14 986.8
Diesel	TJ	58 811.6	56 314.8	57 020.4	56 844.0	50 464.8	35 082.0
LPG	TJ	1 759.7	3 506.4	3 204.0	3 358.8	3 168.0	3 834.0
Natural gas	TJ	234.5	752.4	784.8	1 080.0	1 400.4	1 638.0
Biogas	TJ	0.0	3.6	25.2	111.6	169.2	421.2
Biofuel conventional	TJ	5 318.6	7 437.6	7 326.0	7 938.0	3 214.8	2 836.8
Biofuel advanced	TJ	0.0	0.0	0.0	10.8	7 146.0	17 337.6
Kerosene	TJ	47.0	2 268.0	2 768.4	3 394.8	3 556.8	3 247.2
Hydrogen	TJ	0.0	0.0	0.0	10.8	327.6	2 365.2
Electricity	GWh	0.2	707.0	870.0	1 056.0	1 301.0	2 276.0

** real values*

Table 5.16: *Emission projections in road transport (WEM) for years 2016* – 2040*

YEAR	CO_2	CH_4	N_2O
	kilotons	tons	
2016*	6 271.94	342.44	208.24
2020	7 261.43	182.04	237.96
2025	8 093.57	150.04	272.55
2030	8 373.25	130.25	284.17
2035	8 365.98	112.91	285.87
2040	8 173.54	99.32	280.80

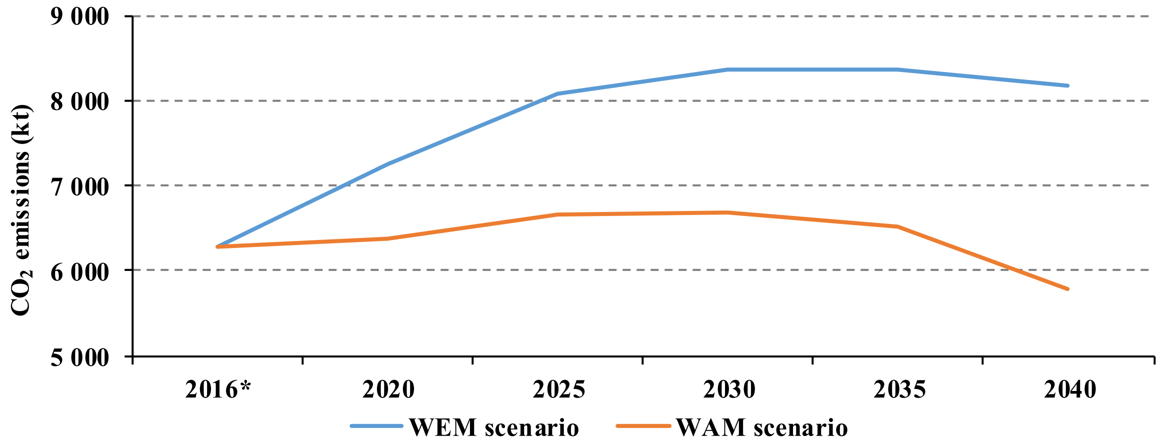
**real values*

Table 5.17: *Emission projections in road transport (WAM) for years 2016* – 2040*

YEAR	CO_2	CH_4	N_2O
	kilotons	tons	
2016*	6 271.94	342.44	208.24
2020	6 377.67	180.36	230.74
2025	6 657.64	148.84	263.71
2030	6 695.72	130.75	275.51
2035	6 523.17	119.64	272.11
2040	5 788.15	120.49	231.81

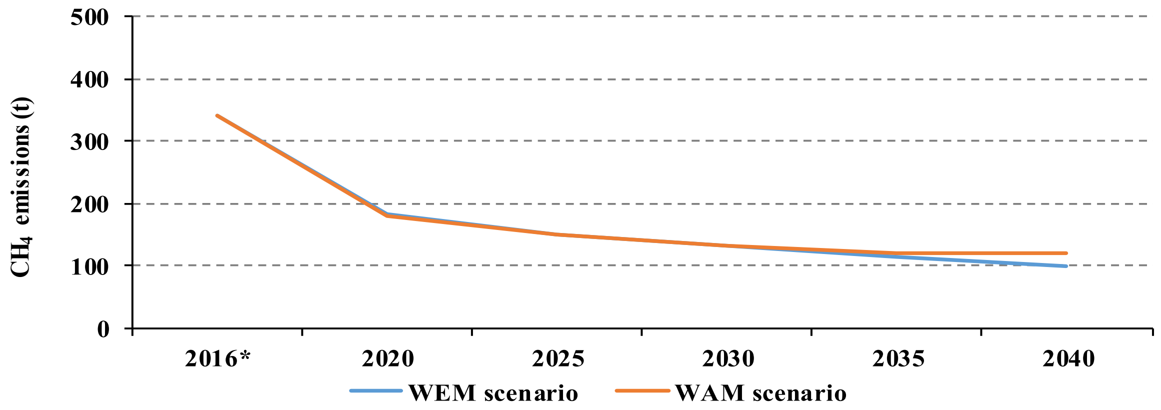
**real values*

Figure 5.8: *The trend of developing CO_2 emission projections until 2040 in road transport*



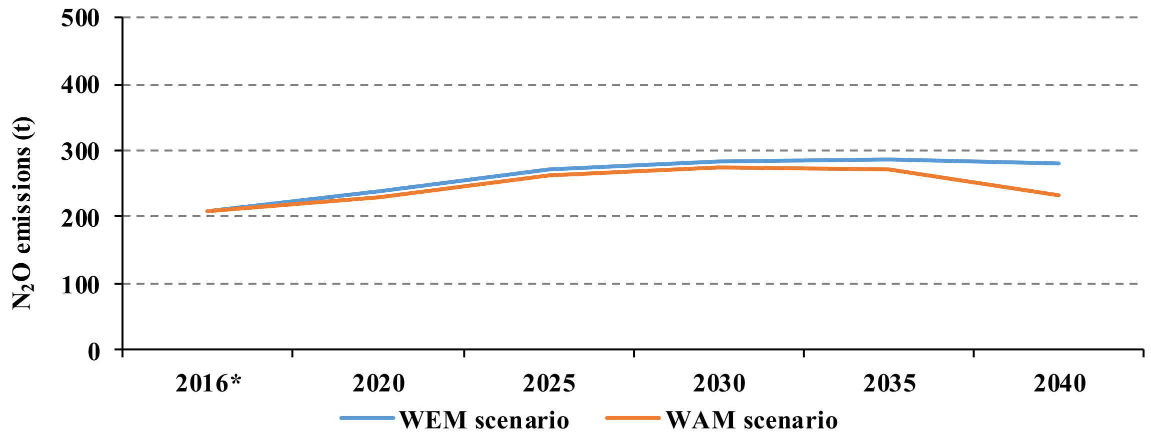
* *real values*

Figure 5.9: *The trend of developing CH_4 emission projections in road transport until 2040*



* *real values*

Figure 5.10: *The trend of developing N_2O emission projections in road transport until 2040*



* *real values*

In addition, the GHG emission projections from non-road transport in the Slovak Republic were calculated, however their importance to the total GHG emission projections is negligible. The non-road emissions projections were calculated by a simpler way, with the help of AutoRegressive Integrated Moving Average (ARIMA) modelling.

Table 5.18: *Emission projections in non-road transport (WEM and WAM) for years 2016* – 2040*

EMISSION	SECTOR	UNIT	2016*	2020	2025	2030	2035	2040
CO_2	Aviation	kt	3.56	4.55	4.88	4.87	4.87	4.87
	Railways		86.53	94.45	97.87	100.99	104.44	108.09
	Navigation		4.76	3.01	2.64	2.25	2.06	1.87
CH_4	Aviation	tons	0.06	0.07	0.07	0.07	0.07	0.07
	Railways		5.19	5.27	5.47	5.67	5.87	6.07
	Navigation		0.45	0.30	0.30	0.30	0.30	0.30
N_2O	Aviation		0.09	0.09	0.09	0.09	0.09	0.09
	Railways		35.77	36.57	37.87	39.07	40.47	41.88
	Navigation		0.13	0.06	0.06	0.06	0.06	0.06

** real values*

5.3.2.4 Emission projections in Energy sector presented by gases

Table 5.19: *Emission projections of CO_2 in the Energy sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
1. Energy	25 455.85	26 708.3	26 962.2	27 577.5	26 380.7	25 807.7
1.A Fuel combustion	25 436.02	26 684.6	26 938.8	27 554.2	26 373.5	25 800.5
1.A.1 Energy industries	7 499.09	7 065.1	6 781.9	7 008.7	6 208.5	6 417.6
1.A.2 Manufacturing industries and construction	6 660.33	6 763.1	6 586.7	6 726.5	6 483.5	6 079.1
1.A.3 Transport	6 665.20	7 685.6	8 428.2	8 697.4	8 677.6	8 483.8
1.A.4 Other sectors	4 546.63	5 106.2	5 078.7	5 055.8	4 940.7	4 758.2
1.A.5 Other	64.77	64.7	63.4	65.8	63.1	61.8
1.B Fugitive emissions from fuels	19.83	23.8	23.4	23.3	7.2	7.2
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	25 455.85	25 825.7	23 954.2	21 443.5	19 873.6	17 940.7
1.A Fuel combustion	25 436.02	25 804.0	23 941.7	21 432.1	19 872.0	17 939.2
1.A.1 Energy industries	7 499.09	7 070.2	5 599.9	4 419.1	3 964.2	4 183.9
1.A.2 Manufacturing industries and construction	6 660.33	6 769.3	6 287.3	5 385.9	4 684.0	3 684.4
1.A.3 Transport	6 665.20	6 793.5	6 976.0	6 999.6	6 810.6	6 067.0
1.A.4 Other sectors	4 546.63	5 106.2	5 018.7	4 576.7	4 364.7	3 956.7
1.A.5 Other	64.77	64.8	59.7	50.8	48.4	47.3
1.B Fugitive emissions from fuels	19.83	21.7	12.5	11.4	1.7	1.5

** real values*

***Table 5.20:** Emission projections of CH_4 in the Energy sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
1. Energy	75.56	82.7	82.8	82.2	75.1	77.1
1.A Fuel combustion	8.81	9.9	10.1	10.5	10.2	10.3
1.A.1 Energy industries	0.57	0.5	0.5	0.6	0.5	0.5
1.A.2 Manufacturing industries and construction	0.66	0.7	0.7	0.8	0.8	0.9
1.A.3 Transport	0.35	0.2	0.2	0.1	0.1	0.1
1.A.4 Other sectors	7.21	8.4	8.7	9.0	8.8	8.7
1.A.5 Other	0.02	0.0	0.0	0.0	0.0	0.0
1.B Fugitive emissions from fuels	66.75	72.9	72.7	71.7	64.8	66.8
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	75.56	71.9	65.0	59.7	49.6	44.8
1.A Fuel combustion	8.81	9.9	9.9	9.3	8.8	8.2
1.A.1 Energy industries	0.57	0.5	0.4	0.3	0.2	0.3
1.A.2 Manufacturing industries and construction	0.66	0.7	0.7	0.6	0.6	0.6
1.A.3 Transport	0.35	0.2	0.2	0.1	0.1	0.1
1.A.4 Other sectors	7.21	8.4	8.6	8.2	7.8	7.1
1.A.5 Other	0.02	0.0	0.0	0.0	0.0	0.0
1.B Fugitive emissions from fuels	66.75	62.0	55.1	50.5	40.8	36.6

** real values*

***Table 5.21:** Emission projections of N_2O in the Energy sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
1. Energy	0.668	0.751	0.790	0.861	0.837	0.877
1.A Fuel combustion	0.668	0.751	0.790	0.861	0.837	0.877
1.A.1 Energy industries	0.121	0.115	0.111	0.120	0.104	0.113
1.A.2 Manufacturing industries and construction	0.112	0.122	0.126	0.149	0.144	0.187
1.A.3 Transport	0.245	0.275	0.311	0.324	0.327	0.323
1.A.4 Other sectors	0.188	0.238	0.241	0.267	0.262	0.253
1.A.5 Other	0.002	0.001	0.001	0.001	0.001	0.001
1.B Fugitive emissions from fuels	0.000	0.000	0.000	0.000	0.000	0.000
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	0.668	0.744	0.748	0.722	0.696	0.668
1.A Fuel combustion	0.668	0.744	0.748	0.722	0.696	0.668
1.A.1 Energy industries	0.121	0.115	0.082	0.059	0.052	0.064
1.A.2 Manufacturing industries and construction	0.112	0.122	0.125	0.113	0.108	0.129
1.A.3 Transport	0.245	0.268	0.302	0.315	0.313	0.274
1.A.4 Other sectors	0.188	0.238	0.238	0.234	0.222	0.200
1.A.5 Other	0.002	0.001	0.001	0.001	0.001	0.001
1.B Fugitive emissions from fuels	0.000	0.000	0.000	0.000	0.000	0.000

** real values*

Table 5.22: *Emission projections of aggregated GHG in the Energy sector (Gg of CO_2 eq.)*

WEM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	27 543.77	29 000.4	29 267.9	29 890.2	28 506.7	27 996.6
1.A Fuel combustion	25 855.24	27 155.2	27 428.0	28 073.8	26 878.6	26 319.0
1.A.1 Energy industries	7 549.23	7 112.8	6 827.9	7 058.4	6 251.6	6 464.6
1.A.2 Manufacturing industries and construction	6 710.19	6 817.0	6 642.2	6 791.2	6 545.8	6 158.0
1.A.3 Transport	6 746.98	7 772.5	8 524.8	8 797.3	8 778.0	8 582.8
1.A.4 Other sectors	4 782.99	5 387.4	5 368.9	5 360.2	5 239.1	5 050.9
1.A.5 Other	65.84	65.6	64.3	66.8	64.0	62.7
1.B Fugitive emissions from fuels	1 688.53	1 845.2	1 839.9	1 816.3	1 628.1	1 677.7
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	27 543.77	27 845.2	25 801.6	23 151.8	21 320.0	19 260.8
1.A. Fuel combustion	25 855.24	26 272.5	24 411.4	21 878.9	20 298.9	18 343.3
1.A.1 Energy industries	7 549.23	7 118.0	5 634.0	4 443.7	3 985.9	4 210.6
1.A.2 Manufacturing industries and construction	6 710.19	6 823.3	6 342.5	5 435.3	4 731.2	3 738.9
1.A.3 Transport	6 746.98	6 878.2	7 069.9	7 096.9	6 907.1	6 151.9
1.A.4 Other sectors	4 782.99	5 387.3	5 304.5	4 851.5	4 625.5	4 193.9
1.A.5 Other	65.84	65.7	60.6	51.5	49.1	48.0
1.B Fugitive emissions from fuels	1 688.53	1 572.7	1 390.1	1 272.8	1 021.2	917.6

** real values*

5.3.3 Emission projections from the sector Industrial Processes and Product Use

Projections of the non-EU ETS CO_2 emissions in the category 2.A.2 – Lime Production were following trends referred to: EU Reference 2016 Scenario (WEM) and DCarb2 Scenario (WAM). Trend of CO_2 emissions in the category „Food, Drink & Tobacco“ was taken into consideration, mostly due to utilisation of CO_2 emissions produced by sugar industry.

Projections of the non-EU ETS N_2O and CH_4 emissions in the category 2.B – Ammonia and Hydrogen Production and EU ETS N_2O emissions from the category 2.B.2 – Nitric Acid Production were following trends referred to: EU Reference 2016 Scenario (WEM) and DCarb2 Scenario (WAM). Trend of natural gas consumption in the category „Chemicals“ was taken into consideration for emission projections in ammonia and hydrogen production and trend of productivity in the category “Chemicals, Fertilisers and Petrochemicals” was taken into consideration for emission projections in nitric acid.

Projections of the non-EU ETS CH_4 emissions in the category 2.C.2 – Ferroalloys and non-EU ETS CO_2 emissions from the category 2.C.5 – Lead Production were following trends referred to: EU Reference 2016 Scenario (WEM) and DCarb2 Scenario (WAM). Trend of productivity in the category “Non-Ferrous Metals Primary Processing” was taken into consideration for emission projections.

Projections of the non-EU ETS CO_2 emissions in the category 2.D – Lubricants, Paraffin and Solvents Ferroalloys were following trends referred to: EU Reference 2016 Scenario (WEM) and DCarb2 Scenario (WAM). Trend of productivity in the category “Non-Energy Use of Liquid Fuels” was taken into consideration for emission projections in the category CO_2 emissions from lubricants. Trend of CO_2 emissions from paraffin was constant in the last 10 years and this was also used in projections. Trend of productivity in the category “Textiles” was taken into consideration for emission projections in the category CO_2 emissions from solvents.

Numbers and trends of WEM and WAM scenarios are presented in the tabular format accompanied this submission.

5.3.3.1 F-Gases sector

Projections of F-Gases were calculated based on the approved EU legislative - Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006, Annex III as follow:

Table 5.23: *Placing on the market prohibitions referred to in Article 11(1)*

PRODUCTS AND EQUIPMENT WHERE RELEVANT, THE GWP OF MIXTURES CONTAINING FLUORINATED GREENHOUSE GASES SHALL BE CALCULATED IN ACCORDANCE WITH ANNEX IV, AS PROVIDED FOR IN POINT 6 OF ARTICLE 2		DATE OF PROHIBITION
1. Non-refillable containers for fluorinated greenhouse gases used to service, maintain or fill refrigeration, air-conditioning or heat-pump equipment, fire protection systems or switchgear, or for use as solvents		4. July 2007
2. Non-confined direct evaporation systems that contain HFCs and PFCs as refrigerant		4. July 2007
3. Fire protection equipment	that contain PFCs	4. July 2007
	that contain HFC-23	1. January 2016
4. Windows for domestic use that contain fluorinated greenhouse gases		4. July 2007
5. Other windows that contain fluorinated greenhouse gases		4. July 2008
6. Footwear that contains fluorinated greenhouse gases		4. July 2006
7. Tyres that contain fluorinated greenhouse gases		4. July 2007
8. One-component foams, except when required to meet national safety standards, that contain fluorinated greenhouse gases with GWP of 150 or more		4. July 2008
9. Aerosol generators marketed and intended for sale to the general public for entertainment and decorative purposes, as listed in point 40 of Annex XVII to Regulation (EC) No 1907/2006, and signal horns, that contain HFCs with GWP of 150 or more		4. July 2009
10. Domestic refrigerators and freezers that contain HFCs with GWP of 150 or more		1. January 2015
11. Refrigerators and freezers for commercial use (hermetically sealed equipment)	that contain HFCs with GWP of 2 500 or more	1. January 2020
	that contain HFCs with GWP of 150 or more	1. January 2022
12. Stationary refrigeration equipment, that contains, or whose functioning relies upon, HFCs with GWP of 2 500 or more except equipment intended for application designed to cool products to temperatures below – 50°C		1. January 2020
13. Multipack centralised refrigeration systems for commercial use with a rated capacity of 40 kW or more that contain, or whose functioning relies upon, fluorinated greenhouse gases with GWP of 150 or more, except in the primary refrigerant circuit of cascade systems where fluorinated greenhouse gases with a GWP of less than 1 500 may be used		1. January 2022

<table>
<tr><th colspan="2">PRODUCTS AND EQUIPMENT WHERE RELEVANT, THE GWP OF MIXTURES CONTAINING FLUORINATED GREENHOUSE GASES SHALL BE CALCULATED IN ACCORDANCE WITH ANNEX IV, AS PROVIDED FOR IN POINT 6 OF ARTICLE 2</th><th>DATE OF PROHIBITION</th></tr>
<tr><td colspan="2">14. Movable room air-conditioning equipment (hermetically sealed equipment which is movable between rooms by the end user) that contain HFCs with GWP of 150 or more</td><td>1. January 2020</td></tr>
<tr><td colspan="2">15. Single split air-conditioning systems containing less than 3 kg of fluorinated greenhouse gases, that contain, or whose functioning relies upon, fluorinated greenhouse gases with GWP of 750 or more</td><td>1. January 2025</td></tr>
<tr><td rowspan="2">16. Foams that contain HFCs with GWP of 150 or more except when required to meet national safety standard</td><td>Extruded polystyrene (XPS)</td><td>1. January 2020</td></tr>
<tr><td>Other foams</td><td>1. January 2023</td></tr>
<tr><td colspan="2">17. Technical aerosols that contain HFCs with GWP of 150 or more, except when required to meet national safety standards or when used for medical applications</td><td>1. January 2018</td></tr>
</table>

F-Gases emission projections in the category 2.F were prepared using two scenarios – WEM and WAM. Projections by the WEM scenario were following directly the above-mentioned EU Regulation, Annex III. Projections by the WAM scenario were following the above-mentioned EU Regulation in addition with the condition that all refrigerants shall be supplied by the gases with low GWP (or by the supplementary gases).

F-Gases (SF_6) and N_2O emission projections in the category 2.G were prepared using two scenarios – WEM and WAM.

Projections of the SF_6 by the WEM scenario were following by extrapolation tool of the base year (and considering time series consistency) with the assumption of phase-out of obsolete equipment. Projections by the WAM scenario were following the restrictions about the utilisation of SF_6 gas in the new equipment.

Projections of N_2O emissions were following trends referred to: EU Reference 2016 Scenario (WEM) and DCarb2 Scenario (WAM). Trend of CO_2 emissions in the category „Food, Drink & Tobacco“ was taken into consideration, mostly due to utilisation of N_2O in aerosol cans.

5.3.3.2 Emission projections in the Industry sector presented by gases

Table 5.24: *Emission projections of CO_2 in the IPPU sector (Gg)*

WEM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	8 459.7	8 442.6	8 161.5	7 752.6	7 443.7	6 984.4
2.A Mineral Industry	2 183.4	2 022.6	1 971.6	1 816.5	1 747.8	1 669.7
2.B Chemical industry	1 348.3	1 404.5	1 378.6	1 342.7	1 279.2	1 182.8
2.C Metal industry	4 843.5	4 901.6	4 699.3	4 482.7	4 311.2	4 032.5
2.D Non-energy products from fuels and solvent use	84.4	114.0	111.9	110.7	105.4	99.4
2.F Product uses as substitutes for ODS	NO	NO	NO	NO	NO	NO
2.G Other product manufacture and use	NO	NO	NO	NO	NO	NO
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	8 459.7	8 445.8	8 355.4	7 175.1	6 831.4	5 993.8
2.A Mineral Industry	2 183.4	2 022.9	1 991.7	1 635.9	1 543.6	1 343.0
2.B Chemical industry	1 348.3	1 404.9	1 412.6	1 254.4	1 241.1	1 192.0

2.C Metal industry	4 843.5	4 904.1	4 838.5	4 174.2	3 938.6	3 355.8
2.D Non-energy products from fuels and solvent use	84.4	114.0	112.5	110.6	108.1	103.0
2.F Product uses as substitutes for ODS	NO	NO	NO	NO	NO	NO
2.G Other product manufacture and use	NO	NO	NO	NO	NO	NO

** real values 2018 submission*

Table 5.25: *Emission projections of CH_4 in the IPPU sector (Gg)*

WEM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	0.060	0.080	0.077	0.073	0.070	0.065
2.A Mineral Industry	NO	NO	NO	NO	NO	NO
2.B Chemical industry	0.021	0.022	0.022	0.021	0.020	0.019
2.C Metal industry	0.039	0.058	0.055	0.052	0.050	0.047
2.D Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO
2.F Product uses as substitutes for ODS	NO	NO	NO	NO	NO	NO
2.G Other product manufacture and use	NO	NO	NO	NO	NO	NO
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	0.060	0.08	0.08	0.07	0.07	0.06
2.A Mineral Industry	NO	NO	NO	NO	NO	NO
2.B Chemical industry	0.021	0.02	0.02	0.02	0.02	0.02
2.C Metal industry	0.039	0.06	0.06	0.05	0.05	0.04
2.D Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO
2.F Product uses as substitutes for ODS	NO	NO	NO	NO	NO	NO
2.G Other product manufacture and use	NO	NO	NO	NO	NO	NO

** real values 2018 submission*

Table 5.26: *Emission projections of N_2O in the IPPU sector (Gg)*

WEM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	0.642	0.571	0.556	0.539	0.514	0.481
2.A Mineral Industry	NO	NO	NO	NO	NO	NO
2.B Chemical industry	0.409	0.349	0.342	0.333	0.317	0.294
2.C Metal industry	NO	NO	NO	NO	NO	NO
2.D Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO
2.F Product uses as substitutes for ODS	NO	NO	NO	NO	NO	NO
2.G Other product manufacture and use	0.233	0.223	0.214	0.205	0.196	0.187
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	0.642	0.572	0.565	0.499	0.470	0.431
2.A Mineral Industry	NO	NO	NO	NO	NO	NO
2.B Chemical industry	0.409	0.349	0.351	0.311	0.308	0.296
2.C Metal industry	NO	NO	NO	NO	NO	NO
2.D Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO
2.F Product uses as substitutes for ODS	NO	NO	NO	NO	NO	NO
2.G Other product manufacture and use	0.233	0.223	0.214	0.188	0.162	0.136

** real values 2018 submission*

***Table 5.27:** Emission projections of HFC in the IPPU sector (Gg of CO_2 eq.)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
2. Industrial processes	673.37	785.1	719.4	167.6	49.3	49.3
2.F Product uses as substitutes for ODS	673.37	785.1	719.4	167.6	49.3	49.3
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	673.37	785.1	704.5	115.8	21.1	21.1
2.F Product uses as substitutes for ODS	673.37	785.1	704.5	115.8	21.1	21.1

** real values 2018 submission*

***Table 5.28:** Emission projections of PFC in the IPPU sector (Gg of CO_2 eq.)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
2. Industrial processes	6.49	8.98	9.43	9.60	9.79	9.82
2.C Metal industry	6.49	8.98	9.43	9.60	9.79	9.82
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	6.49	8.98	9.43	9.60	9.79	9.82
2.C Metal industry	6.49	8.98	9.43	9.60	9.79	9.82

** real values 2018 submission*

***Table 5.29:** Emission projections of SF_6 in the IPPU sector (Gg of CO_2 eq.)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
2. Industrial processes	5.82	5.16	5.37	5.45	5.33	5.33
2.G Other product manufacture and use	5.82	5.16	5.37	5.45	5.33	5.33
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	5.82	4.99	5.01	4.93	4.64	4.63
2.G Other product manufacture and use	5.82	4.99	5.01	4.93	4.64	4.63

** real values 2018 submission*

***Table 5.30:** Emission projections of aggregated GHG in the IPPU sector (Gg of CO_2 eq.)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
2. Industrial processes	9 338.2	9 414.1	9 063.4	8 097.6	7 663.0	7 193.9
2.A Mineral Industry	2 183.4	2 022.6	1 971.6	1 816.5	1 747.8	1 669.7
2.B Chemical industry	1 470.8	1 508.9	1 481.1	1 442.6	1 374.3	1 270.7
2.C Metal industry	4 851.0	4 912.0	4 710.1	4 493.6	4 322.3	4 043.4
2.D Non-energy products from fuels and solvent use	84.4	114.0	111.9	110.7	105.4	99.4
2.F Product uses as substitutes for ODS	673.4	785.1	719.4	167.6	49.3	49.3
2.G Other product manufacture and use	75.3	71.6	69.2	66.6	63.9	61.2
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial processes	9 338.2	9 417.2	9 244.5	7 456.0	7 008.6	6 159.4
2.A Mineral Industry	2 183.4	2 022.9	1 991.7	1 635.9	1 543.6	1 343.0
2.B Chemical industry	1 470.8	1 509.3	1 517.7	1 347.7	1 333.4	1 280.6
2.C Metal industry	4 851.0	4 914.5	4 849.4	4 185.0	3 949.5	3 366.6
2.D Non-energy products from fuels and solvent use	84.4	114.0	112.5	110.6	108.1	103.0
2.F Product uses as substitutes for ODS	673.4	785.1	704.5	115.8	21.1	21.1
2.G Other product manufacture and use	75.3	71.4	68.8	61.0	52.9	45.0

** real values 2018 submission*

5.3.4 Emission projections from Agriculture sector

The mitigation potential in agriculture is connected with the manure management, especially storage of manure and animal feeding policy. The mitigation measures were incorporated in the Rural Development Program for 2014 – 2020. Current legislation is consistent with the Good Agricultural Practice for farmers and the Common Agricultural Policy (CAP) on the State level. The CAP is dividing into two pillars: the first pillar comprises direct subsidies per hectare of the harvested area and per cattle. The second pillar of the CAP is designed as the Rural Development Program to support rural areas and farmers. Promoting resource efficiency and supporting the shift toward a low-carbon and resilient climate economy in agriculture and food production. The Slovak Republic uses finance from the Rural Development Policy to modernize manure storage capacity, to improve the welfare of animals and to modernize housing of animals. Some measures have also impact on reduction of ammonia and GHG emissions. The mentioned measures have a significant impact on emissions from cattle and pigs breeding. To minimised nitrogen losses, effective control of nitrogen pathways in the agricultural nitrogen cycle is essential. Storage manure and slurries are performed in intensive and semi-intensive farms. Small farmers are not targeted now, due to a limited number of livestock.

Activity data: Emission projections of the livestock numbers up to the year 2040 assumed additional significant decreasing, which is not in compliance with the Conception of the Agricultural Development of the Slovak Republic. Time series of inputs were different in length (the longest for the period 1970 – 2016, the shortest for the period 2003 – 2016) and were obtained from the different sources:

- Statistical Office of the Slovak Republic (ŠÚ SR) – statistical database, number of livestock

The number of livestock is the most important parameter and it is used in estimation CH_4 from enteric fermentation and emission projections from manure management (CH_4 and N_2O). The results were used in the WEM scenario.

- National Agriculture and Food Centre - Research Institute of Agriculture and food economics centre - (NPPC - VÚEPP) - status and forecasting reports

The status and forecasting reports analysed the new available legislation and national strategies for future animal developing. It shows, that no legislation or strategies were taken into account.

- National Agriculture and Food Centre – Research Institute of Animal Production (NPPC - VÚŽV) – animal feeding information

Animal feeding information is important in CH_4 estimation from the enteric fermentation used in the WEM scenario.

- Central Control and Testing Institute in Agriculture (ÚKSÚP) – statistical database of inorganic nitrogen fertilizers, liming use and urea consumption

Consumption of nitrogen fertilizers, limestone and urea were implemented in WEM scenario. Activity data on projected parameter are shown in the ***Table 5.31***.

Table 5.31: *Projections parameters used in WEM scenario until 2040*

SOURCES/ YEARS	2016*	2020	2025	2030	2035	2040
1 000 heads						
Cattle	446.11	420.26	409.24	406.00	405.04	404.76
Sheep	368.9	349.25	344.12	354.48	372.33	394.32
Swine	585.84	524.34	475.22	445.51	427.54	416.66
Goat	36.35	37.25	37.60	37.71	37.75	37.76
Horses	6.41	6.06	5.40	4.75	4.11	3.46
Poultry	12 130.5	12 112.59	11 921.31	11 733.78	11 549.95	11 369.73
tons						
Inorganic N-fertilizers	126 235.77	124 614.67	134 062.06	143 509.45	152 956.83	162 404.22
Urea application	86 006.26	50 203.48	57 178.88	61 676.1	64 575.71	66 445.10
Liming application	37 152.33	20 931.13	22 543.14	24 362.83	26 420.44	28 751.38

** real values 2018 submission*

Methodology: Research Institute of Agriculture and Food Economics in Bratislava prepared parameters for emission projections in the exponential balancing model - **SAS 9.3** for the period 2017 – 2040. The model used adaptive methods for time series parameters projections. The Projections of parameters is based on exponential smoothing. Exponential smoothing is the weighted average of the past data, with the recent data points given more weight than earlier data points. The weights decay exponentially towards the earlier data points.

The calculations were based on the analysis of historical time series of the individual forecasted indicators, assuming that the current status of other external factors is maintained. The external factors influence the forecast parameters in different intensity and direction, but future development is often unpredictable. For example, the CAP measures have a significant impact on both animal and plant production. However, negotiations on its direction beyond 2020 are still ongoing, and the final reform for 2021 – 2028 will be known in a coming years. In addition to the CAP, several other factors can influence the indicators - whether economic (supply, demand, agricultural input and output prices, etc.), political or accidental (natural disasters, climate change, etc.).

Even though the current projections may differ from the actual values achieved in the future due to several external factors, the forecasts reflect reasonably well the current trends and expectations for the future. In particular, there is a continuing decline in livestock production in the Slovak Republic (cattle, pigs, poultry, horses and partly sheep). The consumption of inorganic N-fertilizers also increases, which will need to replace the lack of organic nitrogen into soils. The agricultural production will increase as a result of the reduction in livestock numbers.

The emission projections were estimated according to the IPCC 2006 Guidelines methodologies, the Slovak Republic not used the specific model for forecasting emissions. Calculation of methane is based on estimation specific parameters from feeding situation. Estimation of methane from manure management and methane from enteric fermentation is done in conjunction, due to common used parameters, especially gross energy intakes.

The basis for the accurate calculation of the nitrogen emissions is the nitrogen flow. The nitrogen flow as available national parameter was taken into account for more accurate emissions estimations.

Scenarios: The Slovak Republic has only the WEM scenario for emission projections in agriculture. WEM scenario includes measures from the strict implementation of CAP recommendations mostly in manure management and agricultural soils, as was implemented in the Governmental Act No 488/2010 Coll.

Table 5.32: *Emission projections in the Agricultural sector until 2040, WEM scenario*

YEAR	ENTERIC FERMENTATION	MANURE MANAGEMENT	AGRICULTURAL SOILS**	AGRICULTURE TOTAL
	Gg CO_2 eq.			
2016*	976	315	1 381	2 671
2020	893	267	1 217	2 376
2025	851	255	1 285	2 391
2030	842	251	1 327	2 420
2035	821	248	1 429	2 497
2040	821	247	1 501	2 570

** real values 2018 submission; ** including categories 3.D, 3.G and 3.H*

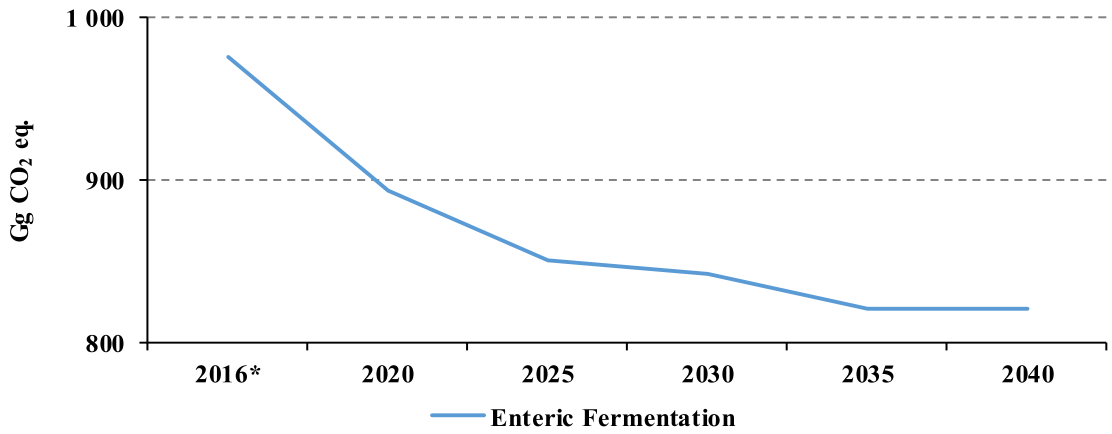
Methane emission projections from Enteric Fermentation were prepared using WEM scenario. The emission projections decreased mainly due to a decrease in the projected number of livestock and intensive feeding with active substances in dairy cattle category. Predictions by the WEM scenario were following Ordinance of the Government of the Slovak Republic No 342/2014 Coll. **(*Figure 5.11*)**.

Scenario with existing measures (WEM) in Manure Management emission projections includes new measures in manure storage and processing manure management, especially in the storage of liquid and solid manure. Projections by the WEM scenario were following the Ordinance of the Government of the Slovak Republic No 342/2014 Coll. as demonstrated in the ***Figure 5.12***.

Agricultural soils emission projections were prepared using WEM scenario. The emission projections increased due to the increasing consumption of urea and limestone. The limestone is used due to increasing of soil fertility. It is assumed that urea consumption also increases, which will be needed to replace the lack of organic nitrogen into soils due to livestock decreasing. The emission projections increase due to the increase of applied nitrogen fertilizers into soils (***Figure 5.13***).

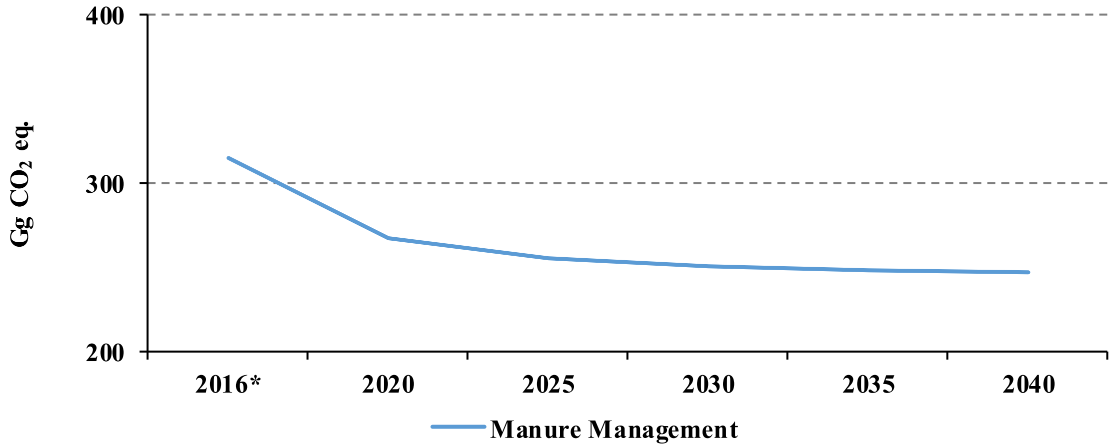
The Slovak Republic, as well as other countries, have been applying various measures for the decrease of the environmental impact of agriculture. ***Table 5.33*** describes emission reductions, which were evaluated from these measures.

***Figure 5.11**: Trend of Enteric Fermentation emission projections (in Gg of CO_2 eq.) in the Slovak Republic until 2040*



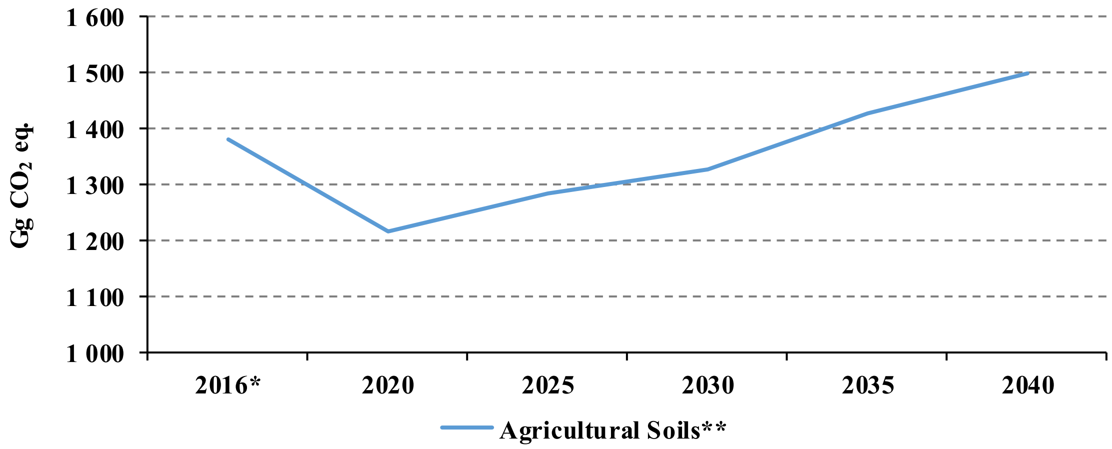
** real values 2018 submission*

***Figure 5.12:** Trend of Manure Management emission projections (in Gg of CO_2 eq.) in the Slovak Republic until 2040*



** real values 2018 submission*

***Figure 5.13:** Trend of Agricultural Soils emission projections (in Gg of CO_2 eq.) in the Slovak Republic until 2040*



** real values 2018 submission, ** includes categories 3.D, 3.G and 3.H*

Table 5.33: *Potential of possible mitigation measures*

MITIGATION MEASURES	POLLUTION	REDUCTION POTENTIAL	DESCRIPTION
Storage of liquid, covered tanks isolated by surroundings	N_2O	100%	Slurries are stored as excreted to facilitate handling and are stored in tanks with oxygen access.
Storage of manure	N_2O	100%	Manure is stored as excreted or with some minimal addition of water to facilitate handling and is stored pod roof with concrete floor.
Intervention in animals feeding	CH_4	NA	Decreasing the number of dairy cattle, intensive feeding with active substances mainly with cereals.

5.3.4.1 Emission projections in the Agriculture sector presented by gases

Table 5.34: *Emission projections of CO_2 in the Agriculture sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
3. Agriculture	79.42	46.03	51.85	55.95	58.98	61.38
3.A Enteric fermentation	NO	NO	NO	NO	NO	NO
3.B Manure management	NO	NO	NO	NO	NO	NO
3.D Agricultural soils	NO	NO	NO	NO	NO	NO
3.G Liming	16.35	9.21	9.92	10.72	11.62	12.65
3.H Urea application	63.07	36.82	41.93	45.23	47.36	48.73

** real values 2018 submission*

Table 5.35: *Emission projections of CH_4 in the Agriculture sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
3. Agriculture	45.09	40.07	38.15	37.73	36.76	36.77
3.A Enteric fermentation	39.04	35.71	34.02	33.66	32.82	32.85
3.B Manure management	6.05	4.36	4.13	4.06	3.94	3.92
3.D Agricultural soils	NO	NO	NO	NO	NO	NO
3.G Liming	NO	NO	NO	NO	NO	NO
3.H Urea application	NO	NO	NO	NO	NO	NO

** real values 2018 submission*

Table 5.36: *Emission projections of N_2O in the Agriculture sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
3. Agriculture	4.91	4.46	4.65	4.77	5.10	5.33
3.A Enteric fermentation	NO	NO	NO	NO	NO	NO
3.B Manure management	0.55	0.53	0.51	0.50	0.50	0.50
3.D Agricultural soils	4.37	3.93	4.14	4.26	4.60	4.83
3.G Liming	NO	NO	NO	NO	NO	NO
3.H Urea application	NO	NO	NO	NO	NO	NO

** real values 2018 submission*

Table 5.37: *Emission projections of aggregated GHG in the Agriculture sector (Gg of CO_2 eq.)*

WEM scenario	2016*	2020	2025	2030	2035	2040
3. Agriculture	2 671.3	2 376.2	2 390.7	2 419.8	2 497.1	2 570.2
3.A Enteric fermentation	976.0	892.6	850.5	841.6	820.6	821.3
3.B Manure management	314.7	266.9	255.3	251.4	247.7	247.4
3.D Agricultural soils	1 301.1	1 170.6	1 233.0	1 270.8	1 369.8	1 440.1
3.G Liming	16.4	9.2	9.9	10.7	11.6	12.7
3.H Urea application	63.1	36.8	41.9	45.2	47.4	48.7

** real values 2018 submission*

5.3.5 Emission projections from the Land Use, Land Use Change and Forestry sector

The emission and removal projections in the LULUCF sector were based on the sectoral strategy document Rural Development Programmes of the Slovak Republic for 2007 – 2013 and 2014 – 2020, taking into account adopted National Forest Program (NFP) of the Slovak Republic as well as the Action Plans of the NFP for 2009 – 2013 and 2015 – 2020. Emission and removal projections consider all three scenarios (WOM, WEM, WAM) and projection parameters (area of managed forest). The base year for projection was the year 2016.

Projections of GHG emissions/removals in the LULUCF sector were prepared based upon following input data:

- Afforestation of non-forested areas,
- Grassing of arable soil,
- Increasing protection against forest fires.

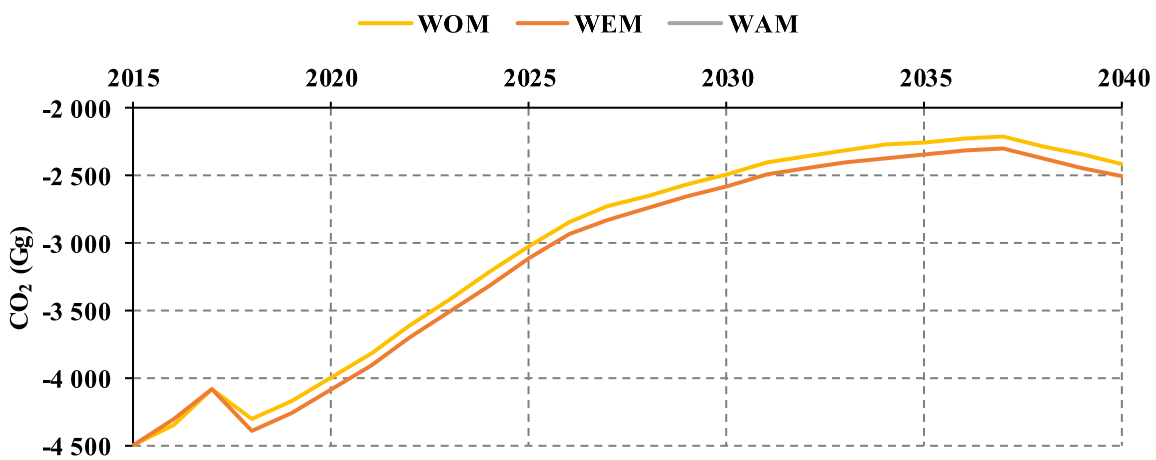
Scenario without measures (WOM) – corresponds to the status of forest management and land use without the measures realised until 2016 as well as measures planned for the following decades. The development of forests is estimated according to effective forest management plans without an introduction of any specific measure.

Scenario with existing measures (WEM) – represents the effect of considered measures realized by the year 2016. In the period 2004 – 2006, only minimal specific mitigation measures were implemented in the forest management and land use. In this period, the afforestation of agricultural land was supported by the Rural Development Programme (RDP) and the Sector Operational Programme for Agriculture and Rural Development. The conversion of agricultural land to forest land (afforestation) was approved within these programmes for 15 projects covering 100 ha in total. In the period 2007 – 2016, afforestation of non-forested areas and grassing of arable soil continued according to the RDPs for the period 2007 – 2013 and 2014 – 2020. The following mitigation measures were considered in the WEM scenario:

- Afforestation of 800 ha of low productive soil by fast growing tree species and the first afforestation of 600 ha of agricultural land by 2016;
- Grassing of 50 000 ha of arable land by 2016;
- Effect of the Regulation No 2152/2003/EC on Forest Focus in relation to forest fires estimates the reduction of risk of forest fires to 90% compared to the period of 2000 – 2003.

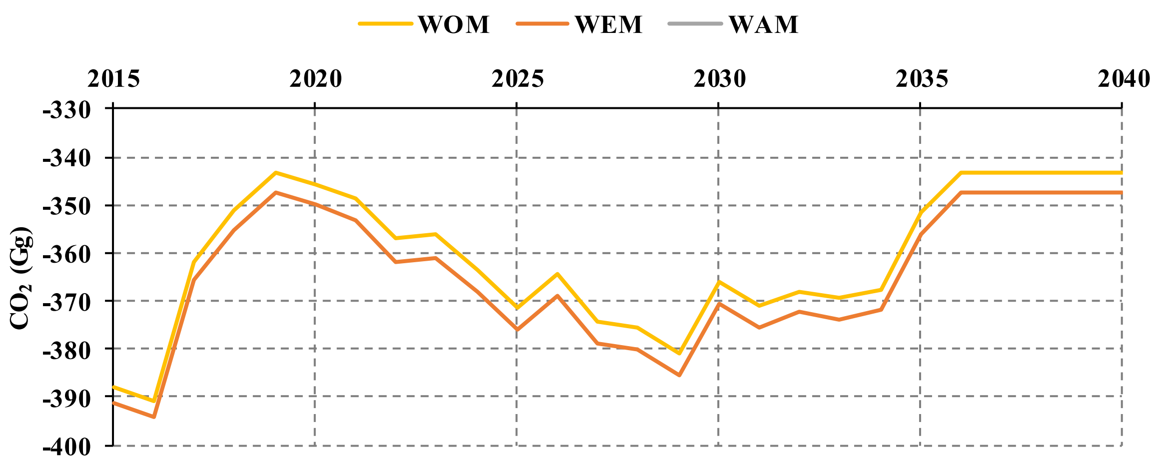
Scenario with additional measures (WAM) – corresponds to the measures foreseen after the year 2016. The RDP (2014 – 2020) was adopted as a continuation of the previous document, with no newly introduced specific measures. Afforestation of 23 000 ha of agricultural land by 2020 – 2040 was taken into account in WAM scenario. Methodical procedure used for calculations has been based on mathematical relations as defined in the basic instrument for greenhouse gas emissions estimation – The 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other Land Use (IPCC 2006 GL). The procedures referred to in the Chapter 4 Forest Land, Chapter 5 Cropland, Chapter 6 Grassland, Chapter 8 Settlements and Chapter 9 Other Land according to the IPCC 2006 GL were used. The values of the emission factors and conversion/expansion factors used for the projections are identical with the values applied in the emission inventory for the LULUCF sector used in 2016 and published in the National Inventory Report of the Slovak Republic 2018.

Figure 5.14: *Projections of CO_2 (in Gg) emissions/removals from the category 4.A.1 Forest Land remaining Forest Land (WEM and WAM are identical)*



** real values 2018 submission*

Figure 5.15: *Projections of CO_2 (in Gg) emissions/removals from the category 4.A.2 Land converted to Forest Land (afforestation) (WEM and WAM are identical)*



** real values 2018 submission*

Table 5.38 shows results of modelling CO_2 emission/removal projections in the LULUCF sector. The scenarios WOM and WEM mostly do not differ as there are not considered any significant measures applied so far and the evolution of emissions and removals by sinks of CO_2 has almost the same course as the LULUCF sector reports in the period from 1990 to 2014, when the whole period shows a sink of CO_2 in the range 4 600-9 000 Gg (kt) of CO_2. Projections of CO_2 removals in the period 2030 – 2037 show decreasing trend. The main driver is the decrease of biomass increments in managed forest due to the lower relative share of forest age classes with the highest increments of wood biomass. After 2037 a change of the trend is expected according to the model results. Scenario WAM reflects the development of emissions with the afforestation of 23 000 ha of grassland until 2040 and grassing 50 000 ha of cropland after 2016. Based on such assumption, the scenario shows a rise of CO_2 removals in forests and in cropland and slight decrease in meadows and pastures and likewise an increase of emissions from Settlements and Other land categories.

Table 5.38: *Emission/removal projections of CO_2 in the LULUCF sector (Gg)*

WEM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
4. LULUCF	-6 915.53	-6 193.7	-5 090.3	-4 484.9	-4 206.6	-4 283.8
4.A Forest land	-4 696.03	-4 437.8	-3 492.3	-2 947.7	-2 697.8	-2 857.0
4.B Cropland	-1 154.70	-1 056.6	-1 050.7	-1 027.8	-1 005.6	-985.3
4.C Grassland	-178.81	-108.8	-68.4	-92.8	-126.0	-132.7
4.E Settlements	79.88	102.7	111.1	103.9	101.8	102.3
4.F Other Land	97.75	132.7	143.0	146.5	132.4	133.2
4.G HWP	-1 063.63	-825.9	-733.0	-666.9	-611.5	-544.2
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
4. LULUCF	-6 915.53	-6 208.5	-5 122.0	-4 533.6	-4 272.3	-4 360.1
4.A Forest land	-4 696.03	-4 444.0	-3 508.7	-2 974.3	-2 734.5	-2 903.0
4.B Cropland	-1 154.70	-1 056.5	-1 050.5	-1 027.5	-1 005.2	-984.8
4.C Grassland	-178.81	-117.5	-84.0	-115.3	-155.4	-163.5
4.E Settlements	79.88	102.7	111.1	103.9	101.8	102.3
4.F Other Land	97.75	132.7	143.0	146.5	132.4	133.2
4.G HWP	-1 063.63	-825.9	-733.0	-666.9	-611.5	-544.2

** real values 2018 submission*

Projections of CH_4 emissions from forest fires: The same procedure was used in modelling CH_4 emissions as it was used in the projections of CO_2 sinks. The projections of CH_4 emissions from forest fires are shown in the following table.

Table 5.39: *Emission projections of CH_4 in the LULUCF sector from forest fires (Gg)*

WEM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
4. LULUCF	0.76	0.70	0.73	0.75	0.76	0.80
4.A Forest land	0.76	0.70	0.73	0.75	0.76	0.80
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
4. LULUCF	0.76	0.70	0.73	0.75	0.76	0.80
4.A Forest land	0.76	0.70	0.73	0.75	0.76	0.80

** real values 2018 submission*

Projections of N_2O emissions for LULUCF sector: Projections of N_2O emissions have been modelled similarly to the projections of CO_2 emission/removal, results are in next table.

Table 5.40: *Emission projections of N_2O in the LULUCF sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
4. LULUCF	0.119	0.104	0.106	0.108	0.106	0.110
4.A Forest land	0.042	0.039	0.040	0.041	0.042	0.044
4.B Cropland	0.029	0.029	0.025	0.027	0.029	0.031
4.C Grassland	0.001	0.001	0.001	0.001	0.001	0.001
4.E Settlements	0.014	0.016	0.018	0.016	0.016	0.016
4.F Other Land	0.017	0.019	0.021	0.022	0.018	0.018
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
4. LULUCF	0.119	0.104	0.106	0.108	0.106	0.110
4.A Forest land	0.042	0.039	0.040	0.041	0.042	0.044
4.B Cropland	0.029	0.029	0.025	0.027	0.029	0.031
4.C Grassland	0.001	0.001	0.001	0.001	0.001	0.001
4.E Settlements	0.014	0.016	0.018	0.016	0.016	0.016
4.F Other Land	0.017	0.019	0.021	0.022	0.018	0.018

** real values 2018 submission*

Projections for CH_4 and N_2O emissions, which are caused mostly by biomass burning after logging show decreasing trend in the WAM scenario, especially as a result of increasing share of shelterwood system in forestry.

Table 5.41: *Emission projections of aggregated GHG in the LULUCF sector (Gg of CO_2 eq.)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
4. LULUCF	-6 861.09	-6 145.1	-5 040.4	-4 434.0	-4 155.8	-4 231.2
4.A Forest land	-4 664.40	-4 408.6	-3 462.1	-2 916.8	-2 666.1	-2 823.9
4.B Cropland	-1 146.19	-1 047.9	-1 043.3	-1 019.7	-996.9	-976.2
4.C Grassland	-178.40	-108.5	-68.1	-92.6	-125.7	-132.3
4.E Settlements	83.95	107.5	116.6	108.7	106.5	106.9
4.F Other Land	102.68	138.3	149.4	153.2	137.8	138.6
4.G Harvested Wood Products	-1 063.63	-825.9	-733.0	-666.9	-611.5	-544.2
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
4. LULUCF	-6 861.09	-6 159.9	-5 072.2	-4 482.8	-4 221.6	-4 307.5
4.A Forest land	-4 664.40	-4 414.8	-3 478.5	-2 943.3	-2 702.9	-2 869.9
4.B Cropland	-1 146.19	-1 047.8	-1 043.1	-1 019.4	-996.5	-975.7
4.C Grassland	-178.40	-117.2	-83.7	-115.1	-155.1	-163.1
4.E Settlements	83.95	107.5	116.6	108.7	106.5	106.9
4.F Other Land	102.68	138.3	149.4	153.2	137.8	138.6
4.G Harvested Wood Products	-1 063.63	-825.9	-733.0	-666.9	-611.5	-544.2

** real values 2018 submission*

Slovakia has not so far estimated emissions and removals from the category 4.D Wetland, there is a lack of information on which the projections of emissions and removals for the accounting period could be modelled.

5.3.6 Emission projections from the Waste sector

Projection of emissions from the Waste Sector to the year 2040 is focusing on disposal of municipal waste and municipal wastewater treatment. These two major sources of emissions represent more than 80% of emissions estimated in the sector. Emissions from composting, incineration of waste, disposal of industrial waste and treatment of industrial wastewater are estimated as 10 years average (2007 – 2017), only for composting of municipal waste the 2017 value is used, for the entire period 2018 – 2040.

5.3.6.1 Municipal Waste Disposal

Emissions from municipal waste disposal are influenced by amount of disposed waste, which is regulated by the Act on Waste Management and incineration of landfill gas, which is regulated by the Act on Air Pollution Control. Thus, projections of emissions from municipal waste disposal are divided to modelling of waste amounts and modelling of landfill gas recovery.

Total generated waste projection is based on projection of waste per capita and population growth. It is in line with Eunomia[28] prediction prepared in 2016. This waste generation prediction is used for all prepared scenarios. Amounts of separated recyclables (paper, plastics, glass, food waste, garden waste) are used as variables for preparation of individual scenarios.

After estimation of gross emissions from landfilling, net emissions are estimated by subtracting recovered methane.

WEM scenario: Scenario with measures is based on expectation that the development in municipal waste management will continue as observed in the last decade. This development is characterized by organization of waste collection on municipal level and increasing separation of recyclables, maintaining landfilling as the main waste disposal method. It is assumed, that the two incinerators (Košice and Bratislava) will continue operation at current throughput (200 kt/yr) under this scenario.

Landfill gas is recovered only for profit from electricity generation and electrical companies are reluctant in connecting new electricity generators. Thus, the increase of methane recovery from landfill gas follows the trends from previous decade.

The main document defining strategy of waste management is the Waste Management Program of the Slovak Republic 2016 – 2020[29]. This document states that the previous plan for 2011 – 2015 did not achieved planned objectives and states that the objective for 2013 to reduce disposal of biodegradable waste to 50% of 1995 level was not achieved, neither the objective to recycle 35% of municipal waste by 2015. The plan for the period 2021 – 2025 is not yet available.

WAM scenario: The Waste Prevention Programme 2019 – 2025[30] evaluates specific targets from the programme for the period 2014 – 2018 and concludes that majority of them were not achieved. This new WPP 2019 – 2025 defines the following quantified targets for municipal waste:

- Reduction of residual municipal waste to 50% of 2016 level by 2025;
- Reduction of biodegradable waste in residual municipal waste by 60% not later than 2025;
- Reduction of landfilling to 10% of total municipal waste by 2035.

[28] Support to Waste Targets Review – final report, Eunomia 2016, Appendix 2, Country Summary Report Slovakia http://ec.europa.eu/environment/waste/pdf/target_review/Eunomia_appendixes.zip

[29] http://www.minzp.sk/files/sekcia-enviromentalneho-hodnotenia-riadenia/odpady-a-obaly/registre-a-zoznamy/poh-sr-2016-2020_vestnik.pdf

[30] In approval process https://www.slov-lex.sk/legislativne-procesy/SK/LP/2018/880

It is assumed, that to achieve the targets above, the two incinerators will continually increase operation to their full capacity of 285 kt/yr (Košice 70+80kt/yr and Bratislava 135 kt/tr). Also, additional incinerators and MBT capacity of 560 kt/yr needs to be developed.

In this scenario the recovery of landfill gas is assumed from all landfills developed after 1993, because these had to establish landfill gas collection systems.

5.3.6.2 Municipal wastewater treatment

Emissions from wastewater treatment are influenced by population using defined pathways. The main source of emissions is holding tanks (septic without effluent). Predictions of wastewater emissions are based on changing number of people using public sewers and domestic wastewater treatment plants to estimate reduction in population using holding tanks for modelling methane emissions. Nitrogen oxide emissions are based on estimation of protein consumption while characterisation of WWT plants is considered without change.

Recovery of biogas from anaerobic digestion of sludge is not a factor influencing emissions, as the wastewater legislation requires all anaerobic treatment installations to have flaring or burning systems for biogas. Moreover, in climatic conditions of Slovakia heat generated from biogas is an important element of energy balance of a wastewater treatment plant.

Only one scenario is prepared for wastewater sector. No quantified targets are available for the period 2018 – 2040 which would allow alternative scenarios.

WEM scenario: Scenario with measures is based on expectation that the development in wastewater management will continue as observed in the last decade. This development can be characterised by gradual development of sewer systems and modernisation of wastewater treatment plants to comply with requirements of EU strategies in water sector. The scenario assumes that the number of holding tanks will decrease due to extension of sewer systems from current 68% to 75% and growing domestic wastewater treatment plants from current 2% to 5%.

5.3.6.3 Emission projections in the Waste sector presented by gases

Table 5.42: *Emission projections of CO_2 in the Waste sector (Gg)*

WEM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
5. Waste	1.83	1.85	1.85	1.85	1.85	1.85
5.A Solid Waste Disposal	NO	NO	NO	NO	NO	NO
5.B Biological treatment of solid waste	NO	NO	NO	NO	NO	NO
5.C Incineration and open burning of waste	1.83	1.85	1.85	1.85	1.85	1.85
5.D Wastewater treatment and discharge	NO	NO	NO	NO	NO	NO
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
5. Waste	1.83	1.85	1.85	1.85	1.85	1.85
5.A Solid Waste Disposal	NO	NO	NO	NO	NO	NO
5.B Biological treatment of solid waste	NO	NO	NO	NO	NO	NO
5.C Incineration and open burning of waste	1.83	1.85	1.85	1.85	1.85	1.85
5.D Wastewater treatment and discharge	NO	NO	NO	NO	NO	NO

** real values 2018 submission*

Table 5.43: *Emission projections of CH_4 in the Waste sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
5. Waste	54.63	57.49	47.88	34.55	29.23	25.27
5.A Solid Waste Disposal	38.89	42.09	33.23	20.71	16.22	13.02
5.B Biological treatment of solid waste	3.70	3.97	3.97	3.97	3.97	3.97
5.C Incineration and open burning of waste	0.02	0.01	0.01	0.01	0.01	0.01
5.D Wastewater treatment and discharge	12.02	11.43	10.66	9.86	9.03	8.26
WAM SCENARIO	2016*	2020	2025	2030	2035	2040
5. Waste	54.63	57.49	47.88	34.55	29.23	25.27
5.A Solid Waste Disposal	38.89	42.09	33.23	20.71	16.22	13.02
5.B Biological treatment of solid waste	3.70	3.97	3.97	3.97	3.97	3.97
5.C Incineration and open burning of waste	0.02	0.01	0.01	0.01	0.01	0.01
5.D Wastewater treatment and discharge	12.02	11.43	10.66	9.86	9.03	8.26

** real values 2018 submission*

Table 5.44: *Emission projections of N_2O in the Waste sector (Gg)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
5. Waste	0.39	0.42	0.42	0.42	0.42	0.43
5.A Solid Waste Disposal	NO	NO	NO	NO	NO	NO
5.B Biological treatment of solid waste	0.22	0.24	0.24	0.24	0.24	0.24
5.C Incineration and open burning of waste	0.01	0.01	0.01	0.01	0.01	0.01
5.D Wastewater treatment and discharge	0.16	0.17	0.17	0.18	0.18	0.18
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
5. Waste	0.39	0.42	0.42	0.42	0.42	0.43
5.A Solid Waste Disposal	NO	NO	NO	NO	NO	NO
5.B Biological treatment of solid waste	0.22	0.24	0.24	0.24	0.24	0.24
5.C Incineration and open burning of waste	0.01	0.01	0.01	0.01	0.01	0.01
5.D Wastewater treatment and discharge	0.16	0.17	0.17	0.18	0.18	0.18

** real values 2018 submission*

Table 5.45: *Emission projections of aggregated GHG in the Waste sector (Gg of CO_2 eq.)*

WEM SCENARIO	2016*	2020	2025	2030	2035	2040
5. Waste	1 483.8	1 564.0	1 324.3	991.5	858.9	760.4
5.A Solid Waste Disposal	972.2	1 052.1	830.9	517.7	405.5	325.4
5.B Biological treatment of solid waste	158.8	170.2	170.2	170.2	170.2	170.2
5.C Incineration and open burning of waste	3.5	4.6	4.6	4.6	4.6	4.6
5.D Wastewater treatment and discharge	349.4	337.1	318.7	299.0	278.6	260.2
WAM SCENARIO	**2016***	**2020**	**2025**	**2030**	**2035**	**2040**
5. Waste	1 483.8	1 564.0	1 324.3	991.5	858.9	760.4
5.A Solid Waste Disposal	972.2	1 052.1	830.9	517.7	405.5	325.4
5.B Biological treatment of solid waste	158.8	170.2	170.2	170.2	170.2	170.2
5.C Incineration and open burning of waste	3.5	4.6	4.6	4.6	4.6	4.6
5.D Wastewater treatment and discharge	349.4	337.1	318.7	299.0	278.6	260.2

** real values 2018 submission*

5.4 SPECIFIED APPROACHES AND SOFTWARE MODELS FOR PARTICULAR SECTORS (METHODOLOGY)

Various procedures and software modules for particular sectors were used in the projections of GHG emissions:

- Energy and industry – **Compact Primes for Slovakia**
- Transport –TREMOVE and COPERT IV models and expert estimation
- Solvents – expert approach
- Agriculture – expert approach
- LULUCF – expert approach
- Waste – expert approach

5.4.1 Energy and energy industry – Model CPS

CPS – Compact Primes for Slovakia is a mathematical system implemented in the General Algebraic Modelling System (GAMS), a high-level modelling tool for mathematical programming. CPS is designed to support energy strategy making including assessment of policy instruments, energy demand and supply planning and evaluation of climate change mitigation policies. The model includes key energy sector metrics at a detailed level: demand for energy by sector and fuel, modelling of energy efficiency possibilities, capacities of technologies, power generation mix, cogeneration and other energy supply technologies, fuel prices and system costs, investment by sector and energy-related CO2 emissions.

An energy model for Slovakia captures the details of energy supply and demand that are critical to designing a low carbon path. A country-level energy model, named the Compact-PRIMES for Slovakia (CPS), provides a bottom-up technology-rich analysis of the key elements of the energy sector and has been designed to evaluate low carbon options for the energy sector. The CPS model is a single-country partial equilibrium model of the energy sector, which balances energy supply and demand. As a hybrid model with technology and engineering detail together with micro- and macroeconomic interactions and dynamics, the CPS' sectoral decisions consider technology and costs. Electricity and heat supply and biomass supply are captured on the supply side while energy demand modelling includes separate treatment of the industrial sector (and 10 subsectors), transport, and other demand. The design of the CPS model is appropriate for the quantification of long-term energy planning and policies reducing energy-related greenhouse gas emissions.

In addition, the macroeconomic model, named the ENVISAGE-Slovakia applied general equilibrium (Slovak-CGE) model, has been customized to reflect the particular features of the Slovak economy. A macroeconomic model for Slovakia complements the energy model, using the detailed energy system results from the CPS model and assessing economy wide impacts. Importantly, demand for energy commodities across households and firms is price sensitive, and various electricity generation options are captured. Emissions are explicitly modelled. A variety of mitigation policies can be analysed using the Slovak-CGE model. By comparison with the CPS energy model, the aim of the Slovak-CGE model is to simulate the broader economic effects of moving towards a low carbon economy

Detailed description is provided in the Final Project Report here[31].

[31] https://www.minzp.sk/files/oblasti/politika-zmeny-klimy/2019_01_low-carbon-study.pdf

5.4.2 Slovakia road transportation model and Arima model for non-road transportation

GHG emissions from road transport in annual inventory are calculated by method of EMEP/CORINAIR which is included in the program product for the calculation of emissions from road transport - COPERT 5. Therefore, the name of the method is the same as the name of the COPERT model. Besides GHG emissions, the COPERT 5 model calculates emissions of all current pollutants including limited pollutants (CO, NO_2, NOx, PM, HFCs), heavy metals and persistent organic pollutants, as well as exhaust and non-exhaust emissions. Determination of CO_2 emissions is in principle identical with the method applied in the emission inventories.

CH_4 and N_2O emissions are calculated for individual categories of vehicles and then they are summarised in order to calculate the total amount. Emission factors for CH_4 and N_2O according to the COPERT 5 model are different for different fuels, different vehicles and different levels of technology. In the case of CH_4 emissions, they also depend on average speed. In COPERT 5, the vehicle fleet is divided into five basic categories and 382 sub-categories according to the scale of city/town road and motorway operation. The calculation method makes use of technical data on individual categories and sub-categories of vehicles in combination with several parameters specific for the particular country which makes use of this method.

These characteristics are as follows: vehicle park structure, age of vehicles, prevailing character of the operation, fuel parameters and climate conditions. The calculation of emissions is based on five basic parameters: total fuel consumption, vehicle park, driving conditions, emission factors and average mileage for every sub-category. Exhaust emissions from road transport are divided in two types, which are hot emissions produced by the engine of vehicles heated to the operational temperature and cold emissions from starting a cold engine. The calculation of the emissions including CO_2 and also partially N_2O is based on fuel consumption.

Emission projections from transport in the Slovak Republic are based on the energy model (CPS) and its distribution described in the Energy (Section 5.4.1). Prediction of energy consumption in the transport sector was made as percentage ratio of fuels on total consumption in the energy sector. Road transport projections has been estimated based on the following activity data and procedure in the national model:

- Aggregation of transferred data from COPERT 5 for the period 2000 – 2017 as the current version of COPERT uses totally 382 categories of road vehicles. The aggregation took into account the mode of transport, the fuel used and the EURO emission standard,
- Updating data on new registrations and discarded vehicles,
- Allocation of new registrations to vehicle categories based on energy consumption forecasts,
- The distribution of scrapped vehicles into categories of older vehicles so that their numbers gradually decrease to zero, because of the ongoing fleet renewal.
- Estimation of vehicle numbers for each year (2018-2040), based on the new registration and discarded vehicles,
- Aggregation of annual mileage, according to COPERT calculations, for the period 2000 – 2017 into defined vehicle categories and assumption of development of mileage for years 2018 – 2040
- Export of “implied” emission factors from the COPERT program and their appropriate distribution for vehicle categorization in the projection model
- Calculation of future traffic performance for the period 2018-2040 for given vehicle categories,

- Calculation of future emissions by multiplying the performance and emission factors.

All these data were transferred to the excel calculation sheet with the outcomes of the energy model (CPS) and calculated GHG emissions for every year.

The non-road emissions projections were calculated by a simpler way, with the help of AutoRegressive Integrated Moving Average (ARIMA) modelling. ARIMA model is a statistical analysis model that uses time series data to better understand the data set and to predict future trends. It also gauges the strength of one dependent variable relative to other changing variables.

5.4.3 Industry products and other product use – Expert software tool

The basic approach for both scenarios is following the value added growth in industrial categories. The maximal production capacity and stoichiometry is the limitation of emission projections and in general follows the reference scenario.

Software is based on the MS Excel platform and was developed for automatic emission projections generation. The basic input data of value added growth and maximal production capacity were included in the WEM scenario. In the following steps additional specific parameters were included step by step into the model and emission projections were calculated for WAM scenarios.

5.4.4 Agriculture – Expert software tool

Calculation of emission projections were based on the mathematical formulas and definitions described in the IPCC Guidelines for the agriculture categories. Emission factors and conversion factors are consistent with the factors used in the emission inventory. The calculation tool is based on the MS Excel platform and the calculation includes different PaMs (in numerical formulation) according to the projections scenario.

5.4.5 LULUCF – Expert software tool

Calculation of emission projections were based on the mathematical formulas and definitions described in the IPCC Guidelines for the land use and land use change categories. Emission factors and conversion factors are consistent with the factors used in the emission inventory. Projections of the expected future development of forest stands in Slovakia are based on simulation of changes in their age structure, tree species composition, growing stock and biomass available for harvesting. The modelling approach (programmed in Python language - http://www.nlcsk.sk/cafmocc/fcarbon.html#lang-en) includes different PaMs (in numerical formulation) according to the WEM and WAM scenarios. Results of the modelling (expected biomass increments and harvests, forest characteristics) were utilised for the quantification of GHG emissions. The calculation tool for quantifying emissions is based on the MS Excel platform.

5.4.6 Waste – Expert software tool

The waste amounts model is derived from statistical data on municipal waste published by the ŠÚ SR[32] and waste composition analysis published by Benešová[33]. Total generated waste is estimated from demographic projections and waste per capita. Generated waste is divided to mixed municipal waste, group of separately collected fractions covered by waste composition analysis and group of other

[32] Množstvo komunálneho odpadu podľa spôsobu nakladania, Datacube, Statistical Office of the Slovak Republic http://datacube.statistics.sk/#!/view/sk/VBD_SK_WIN/zp1005rs/Mno%C5%BEstvo%20komun%C3%A1lneho%20odpadu%20pod%C4%BEa%20sp%C3%B4sobu%20nakladania%20%28v%20ton%C3%A1ch%29%20%5Bzp1005rs%5D

[33] Benešová, Kotoulova, Černík: Základní charakteristiky komunálních odpadů http://www.mnisek.cz/e_download.php?file=data/editor/234cs_2.pdf&original=STANOVEN%C3%8D+PRODUKCE+ODPAD%C5%AE-P%C5%98%C3%8DLOHA.pdf

separately collected fractions not covered by waste composition analysis. The same division is applied for landfilled waste. Total landfilled waste is estimated as difference between total generated waste and sum of recovered waste as material and incinerated. The model uses amounts of separated fractions as input variables, from which is estimated the amount of mixed/residual waste and also changes in waste composition. Overview of model parameters and their interdependencies is shown in the table below.

Table 5.46: *Overview of model parameters*

PARAMETER	GENERATED WASTE	LANDFILLED/INCINERATED WASTE
Total	Waste/cap population	Total generated – recovered – (incinerated or MBT)
Separated waste analysed	Sum of separated fractions	Sum of separated fractions landfilled (rejects)
Separated waste not analysed	Total generated waste 0.2	Generated separated waste not analysed 0.5
Residual waste	Total waste - Separated waste analysed - Separated waste not analysed	Total waste - Separated waste analysed - Separated waste not analysed

5.5 DIFFERENCES BETWEEN BR3 AND BR4 EMISSION PROJECTIONS

Several differences occurred in comparison of 3. and 4. Biennial Report of the Slovak Republic. Differences are caused by small changes in input inventory data and more significant differences by methodology changes. This new Section provides brief overview of the differences as it was encouragement provided in the review report of Third Biennial Report of Slovakia.

The biggest influence has using of the new energy and industry model CPS. This has impact on emission projections of energy sector, including transport and industry sector.

In addition, reflection of the recommendations/encouragements made in the latest UNFCCC review of the Third Biennial Report of the Slovak Republic in a part of emission projections were considered. Mainly regarding the improvements in completeness of the emission projections including indirect emission projections (***Table 5.12*** for example). However, system of emission projections in Slovakia integrates projections of GHG emission and also projection of air pollutants. All assumptions and input parameters are consistently introducing into the models.

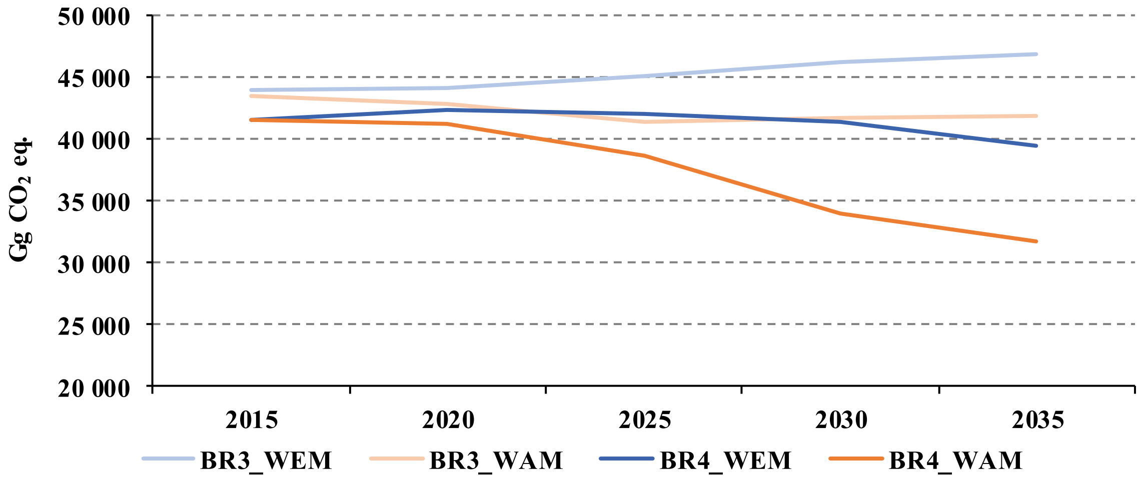
Information on models and assumptions was improved and strengthen in this Biennial report, this was due to using a new energy model and addition information can be find also in the Low-Carbon Study of Slovakia referred here.

Slovakia is continuously improving also sensitivity analyses to discover synergies and antagonistic factors of the several PaMs, for example utilisation of biomass in line with the renewables target in the GHG mitigation policy and negative effect on the air quality.

5.5.1 Comparison of total aggregated GHG emission projections

Figure 5.16 below shows relative significant differences between previous and new emission projections. More information can be find in sectoral view.

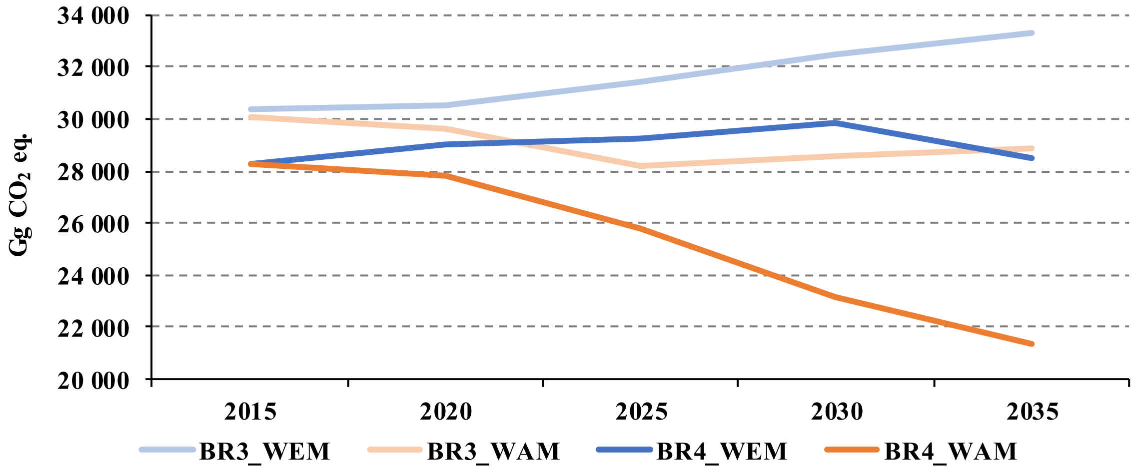
Figure 5.16: *Comparison of BR3 and BR4 aggregated GHG emission projections (Gg CO_2 eq.)*



5.5.2 Comparison of aggregated GHG emission projections in the Energy sector

Changes in the Energy sector have the biggest impact on total changes between BR3 and BR4. It caused mainly by expectation that more effective measures will be implemented after 2020.

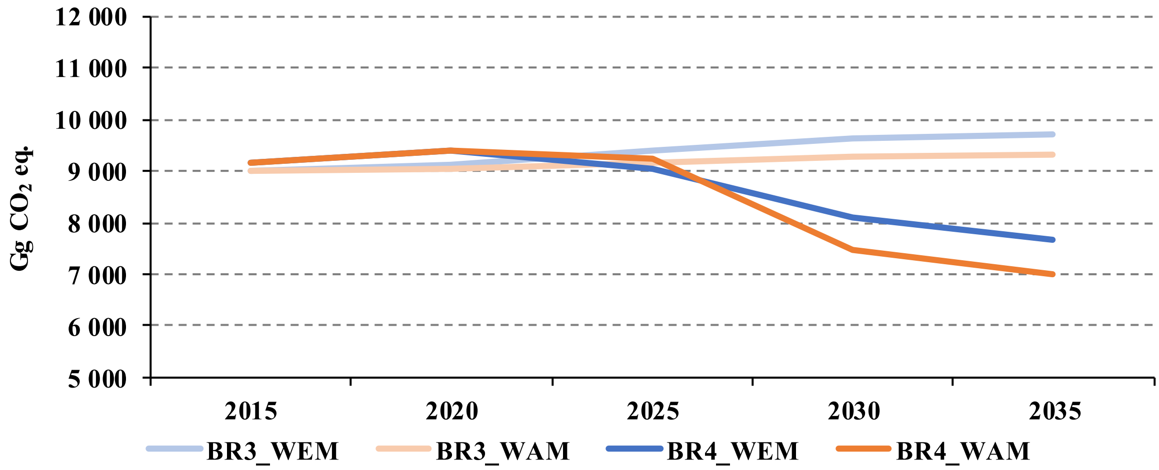
Figure 5.17: *Comparison of BR3 and BR4 GHG emission projections in the Energy sector (Gg CO_2 eq.)*



5.5.3 Comparison of aggregated GHG emission projections in the IPPU sector

Changes in the IPPU sector have also significant impact on total changes of the emission projections between BR3 and BR4. Implementing of more effective measures are expected after 2025. In BR4 occurred situation when emission projected in WAM scenario are higher, then in the WEM scenario. This is based on decision process of the new CPS model. Mentioned situation could appear when CPS model in different scenarios run with the set of determined assumptions. Model itself decides how to reach the target. This can caused temporary increases emission projections in WAM scenario in comparison with WEM in few categories. But at the end, in a complex, it´s resulting to overall decreasing of emissions.

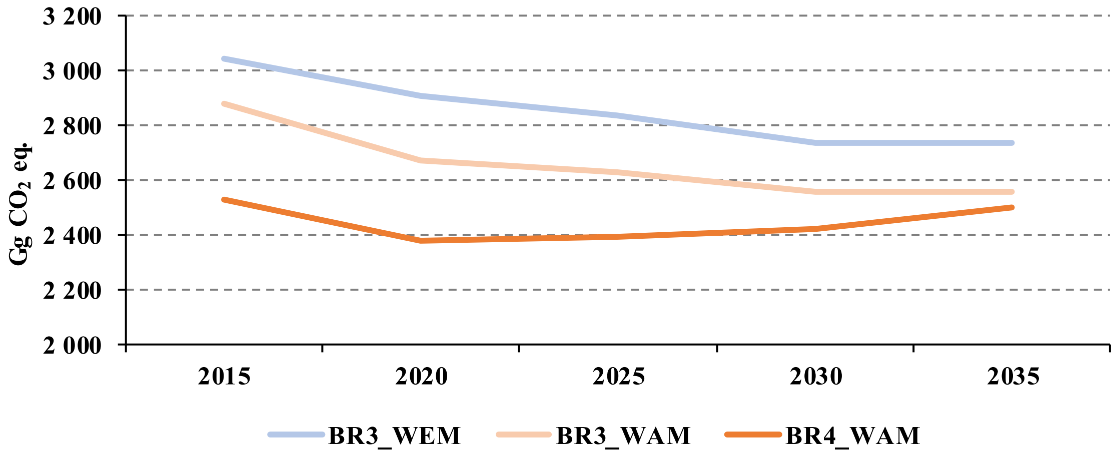
Figure 5.18: *Comparison of BR3 and BR4 GHG emission projections in the IPPU sector (Gg CO_2 eq.)*



5.5.4 Comparison of aggregated GHG emission projections in the Agriculture sector

Changes in the Agriculture sector has only small impact on overall emission projections. In comparison with the BR3, BR4 emission projections are lower, but they have slightly increasing trend after 2020. Differences are caused by new input data and innovative methodological approach with shifting to the higher tier methods.

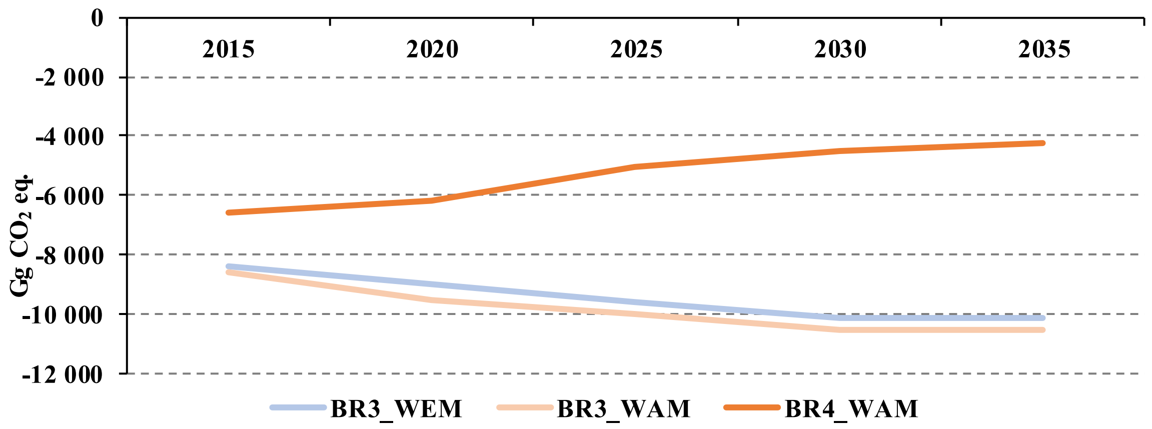
Figure 5.19: *Comparison of BR3 and BR4 GHG emissions projection in the Agriculture sector (Gg CO_2 eq.) (BR4_WEM = BR4_WAM)*



5.5.5 Comparison of aggregated GHG emission projections in the LULUCF sector

Very significant changes occurred in the LULUCF sector. Differences are visible in the figures and also in the emission trend. It was caused by new information on expected future development in the managed forest stands (the growing stock, volumes of harvested wood, biomass increments, etc.) and also by more detailed methodological approach to construction of the projections for this sector (see Section 5.4.5).

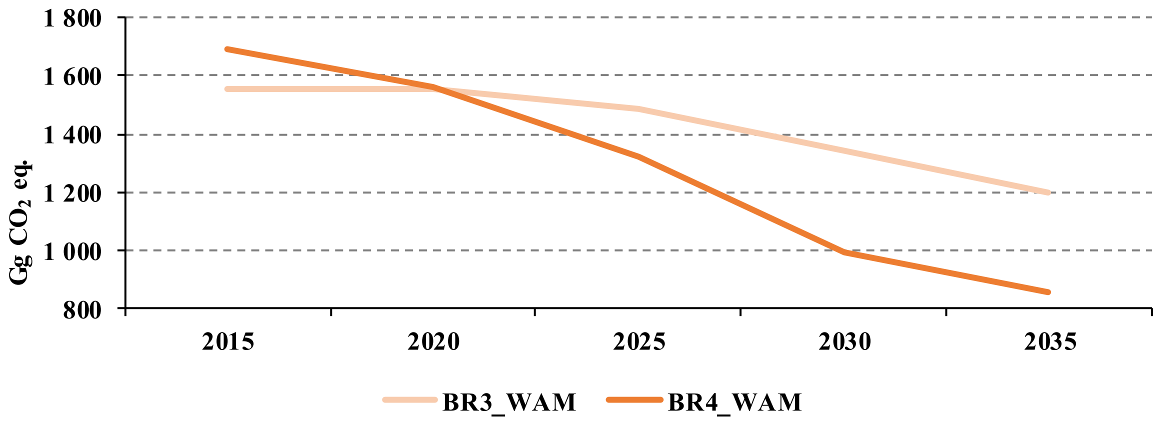
Figure 5.20: *Comparison of BR3 and BR4 GHG emission projections in the LULUCF sector (Gg CO_2 eq.) (BR4_WEM = BR4_WAM)*



5.5.6 Comparison of aggregated GHG emission projections in the Waste sector

Figure 5.21 shows visible differences between BR3 and BR4 emission projections, but they have very small impact on overall comparison. They were caused also by new information about expected future development in this sector and more strength policy.

Figure 5.21: *Comparison of BR3 and BR4 GHG emission projections in the Waste sector (Gg CO_2 eq.) (BR3_WEM = BR3_WAM; BR4_WEM = BR4_WAM)*



6 PROVISION ON FINANCIAL, TECHNOLOGICAL AND CAPACITY BUILDING SUPPORT TO DEVELOPING COUNTRIES

The Section provides information on the provision of financial, technological and capacity-building support to developing countries. It embraces information on climate related financial support which Slovakia provided to developing countries during the years 2017 and 2018. It also gives the overview of relevant climate related projects specifically aimed at addressing climate change or related activities that were primarily designed for other purposes, but are also contributing to the area of mitigation or adaptation process. Of the total portfolio, following activities were selected: activities in the field of climate change adaptation, mitigation projects, technology transfer support and capacity building projects for water, waste management, ecological agriculture, food security, afforestation and renewable energy sources development. Slovakia used the UNFCCC Common Tabular Formats (CTF) as the template for provision of public financial support attached to this submission.

6.1 APPROACH OF SLOVAKIA TO PROVISION OF CLIMATE FINANCE, INCLUDING THE PROVISION OF NEW AND ADDITIONAL RESOURCES

Slovakia became a member of the community of donors providing assistance to developing countries with its accession to the OECD (2000), European Union (2004) and the OECD Development Assistance Committee – DAC (2013). Preparatory process and the Membership in these organizations have made a significant contribution to the creation of the mechanism for the Slovak Official Development Assistance (ODA). The policy of development assistance is in legislation governed by Act No 617/2007 Coll., on ODA and amendment of Act No 575/2001 Coll., on the Organization of Activities of the Government and Central State Administration, as amended. Official development assistance has become an integral component of the foreign policy of the Slovak Republic. More than 400 projects in nearly twenty countries in Africa, Asia and Europe have been implemented over the past decade under the SlovakAid logo.

For the period 2014 - 2018 there have been set 10 territorial priorities of the Slovak ODA within eight main SlovakAid programmes:

1. Development Interventions Programme;
2. Transformation Experience Sharing Programme;
3. Business Partnership Programme;
4. Humanitarian Aid Programme;
5. Governmental Scholarships Programme;
6. Programme for Sending Development Workers and Civil Experts to Developing Countries;
7. Development Education and Public Awareness Programme;
8. Capacity Building Programme.

The Slovak Republic cooperates with the following partner countries:

1. programme countries: Afghanistan, Kenya, Moldova;
2. project countries: Albania, Belarus, Bosnia and Herzegovina, Georgia, Kosovo, Ukraine;
3. country with exceptional humanitarian and development needs: South Sudan.

Slovak development cooperation will generally focus on the following seven areas:

- education – training focusing on access to the labour market and self-employment, education of teachers and equipment of educational facilities;
- healthcare - basic healthcare, nutrition programmes, education of the population and public awareness of prevention and healthcare, education of healthcare personnel;
- good governance and building of civil society - public finance management, public sector reform, enhancement of rule of law and public participation in democratic processes, security sector reform, activities of civil experts within international crisis management;
- agriculture and forestry - implementation of new techniques and methods, processing of agricultural products with focus on their marketing and sales, food security, soil protection;
- water and sanitation - drinking water supply, water and waste management;
- energy – with focus on energy security and alternative resources;
- support of market development of the environment, small and medium enterprises.

Development cooperation of the Slovak Republic during the period 2014 - 2018 is based on eight main programmes:

- Development Interventions Programme;
- Transformation Experience Sharing Programme;
- Business Partnership Programme;
- Humanitarian Aid Programme;
- Governmental Scholarships Programme;
- Programme for Sending Development Workers and Civil Experts to Developing Countries;
- Development Education and Public Awareness Programme;
- Capacity Building Programme.

Cooperation instruments for main programmes are:

- block grants;
- small grant scheme;
- financial contributions (micro-grants);
- supply of goods and services;
- CETIR;
- start up;
- trilateral cooperation;
- earmarked contributions to international organisations;
- Slovak Republic - UNDP cooperation;
- Slovak Republic - EBRD Technical Cooperation Fund;
- loans with a grant element;
- financial contributions;
- financing scholarships.

The Slovak Republic also participates in development activities of the international community through the EU and international organisations and institutions. Multilateral development cooperation can be perceived as an instrument for support of those developing countries and sectors in which it is not effective for the Slovak Republic to act on a bilateral basis. Assistance in the form of multilateral contributions has made up approximately 75% of the total Slovak ODA. Priority of the Slovak Republic in multilateral development assistance is to increase the engagement of Slovak entities in the programmes and projects of the EU, UN and other international organisations and international financial institutions. The goal of the Slovak Republic is to actively participate in the decision-making process of the EU, multilateral organisations and institutions to which it contributes, and which reflect Slovak attitudes, values and priorities of foreign policy and development cooperation in specific activities of these international organisations.[34]

6.2 FINANCIAL RESOURCES

All the Slovak bilateral and multilateral climate financial support provided to developing countries in 2017 and 2018 was channelled through the Official Development Assistance (ODA) in accordance with the OECD DAC methodology.

6.2.1 Provision of financial support through multilateral channels

Slovakia defines those financial contributions as being climate specific which funded climate relative activity defined as mitigation, adaptation, cross-cutting or other climate specific activity. If there are climate specific contributions reported in Third Biennial Report, core/general and climate specific data should be mutually exclusive – funds should only be reported in one of the categories. Slovakia concerns some of the multilateral as well as bilateral contributions as climate specific. Climate specific category concerns contributions to multilateral climate funds and dedicated projects managed by multilateral institutions, for instance in 2017 and 2018 Slovakia contributed to the Montreal Protocol Multilateral Fund, the Montreal Protocol Trust Fund, the International Finance Corporation, the World Meteorological Organisation (WMO), International Investment Bank and funded projects through the European Bank for Reconstruction and Development (EBRD).

The total climate specific financial contribution provided by the Slovak republic to developing countries through multilateral channels in the years 2017 - 2018 was 2 655 244,54€ (2 945 728,29 USD). Of this support, 1 691 874,33€ (1 876 965,38 USD) was directed to mitigation and 193 757,92€ (214 955,03 USD) to adaptation. In 2017 - 2018 Slovakia provided 769 612,29€ (853 807,87 USD) core/general finance contributions to multilateral organizations. Detailed financial support provided through multilateral channels is included in the CTF Table 7a attached to this submission.

6.2.2 Provision of financial support through bilateral channels

With respect to bilateral contribution, Slovakia funded climate related study programmes for foreign students and capacity building projects in different developing countries. The total support by the Slovak Republic to developing country Parties to the UNFCCC through bilateral channels in 2017 and 2018 was 4 001 358,96€ (4 439 107,5 USD). Of this support, 1 743 041,95€ (1 933 730,6 USD) was directed to mitigation, 2 129 949,1€ (2 362 965,5 USD) to adaptation and 128 368€ (142 411,45 USD) to cross-cutting activities. Detailed financial support provided through bilateral channels is included in the CTF Table 7b attached to this submission.

6.3 TECHNOLOGY DEVELOPMENT AND TRANSFER

In 2017 and 2018 the Slovak Republic did not financially support any technology transfer project.

6.4 CAPACITY BUILDING

In the years 2017 - 2018, the Slovak Republic supported 27 capacity building projects, mainly in the form of bilateral cooperation - see the SVK CTF Table 7a and 9 attached to this submission. All of them

[34] https://www.mzv.sk/web/en/foreign_policy/slovak_aid

have been realized under the Official Development Assistance on the basis of open calls of the Slovak Agency for International Development Cooperation. Another form of support is scholarships that Ministry of Education, Science, Research and Sport of the Slovak Republic provided to students from developing countries, which represent territorial priorities for ODA. All of the scholarships were provided to students whose study programme was environmental oriented, for example processing of agricultural products, environmental science, geodesy and cartography, land protection and land use, environmental planning and other. In addition, there were also projects implemented through multilateral channels, in particular through the European Bank for Reconstruction and Development. Their reports are presented in the CTF Table 7a attached to this submission.

At the moment Slovakia does not possess any information on climate related private finance mobilization, therefore this Biennial Report embraces only the financial support from the public sector.

ANNEX 1: CTF TABLES FOR THE FOURTH BIENNIAL REPORT OF THE SLOVAK REPUBLIC

Overview on CTF tables provided with the Fourth Biennial Report:

CTF Table 1:	Emission trends
CTF Table 2:	Description of quantified economy-wide emission reduction target
CTF Table 3:	Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects
CTF Table 4:	Reporting on progress
CTF Table 4(a)I:	Progress in achieving of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector
CTF Table 4(a)II:	Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
CTF Table 4(b):	Reporting on progress
CTF Table 5:	Summary of key variables and assumptions used in the projections analysis
CTF Table 6(a), (b), (c):	Information on updated greenhouse gas projections under a 'with measures' scenario, under a 'without measures' scenario and under a 'with additional measures' scenario
CTF Table 7:	Provision of public financial support: summary information
CTF Table 7(a):	Provision of public financial support: contribution through multilateral channels
CTF Table 7(b):	Provision of public financial support: contribution through bilateral, regional and other channels
CTF Table 8:	Provision of public financial support: provision of technology development and transfer support
CTF Table 9:	Provision of public financial support: capacity – building support