THIRD 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, 15 December 2017

PREFACE

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CONTENTS

1 INTRODUCTION

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 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 Third Biennial Report of the Slovak Republic (3BR SVK) was prepared under the decision 2/CP.17 of the Conference of the Parties under the UNFCCC.

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 GHG emissions and trends, and the GHG inventory including information on national inventory system (section 2);
- Quantified economy-wide emission reduction target (section 3);
- Progress in achievement of quantified economy-wide emission reduction targets and relevant information (section 4);
- Projections (section 5);
- Provision of financial, technological and capacity-building support to developing country Parties (section 6).

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) were submitted separately in the CTF Tables 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.

Tabular information and list of tables can be found in the Annex 1 of the 3BR of the Slovak Republic.

2 INFORMATION ON GHG EMISSIONS AND TRENDS, GHG INVENTORY INCLUDING INFORMATION ON NATIONAL INVENTORY SYSTEM

The legal basis for the compilation of the GHG inventory and the GHG inventory methodology as well as data availability is described in the National Inventory Report of the Slovak Republic 2017, chapter 1, submitted to the UNFCCC on 11 April 2017. The greenhouse gas data presented in this chapter are consistent with the 2017 GHG inventory submission of the Slovak Republic to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat submitted on 11 April 2017 in the CRF Tables.

Summary tables of GHG emissions of the Slovak Republic for emission trends by gas and by sector in the common tabular format are presented in the CRF Tables 1(a) and 1(b) in the CTF Tables attached to this submission. These data and the complete submissions of the Slovak Republic under the Regulation (EU) No. 525/2013 of the European Parliament and of the Council are also available on the website of the European Environmental Agency.[1]

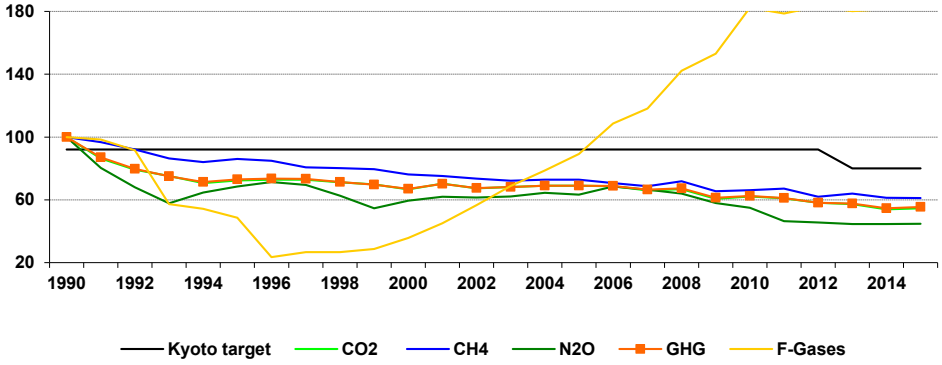
2.1 SUMMARY INFORMATION ON GHG EMISSIONS TRENDS

2.1.1 Overall GHG emissions trends

Total GHG emissions were 41,269.49 Gg of CO_2 eq. in 2015 (without LULUCF). This represents a reduction by 44.6% against the base year 1990. In comparison with 2014, the emissions increased by 1.45%. The increase in total emissions of 2015 compared to 2014 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 interannual increase of removals in the LULUCF sector.

The emissions without LULUCF in 2015 slightly increased compared with 2014. During the whole period 1991 - 2015, the total greenhouse gas emissions in the Slovak Republic did not exceed the level of 1990. 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 the Slovak Republic*



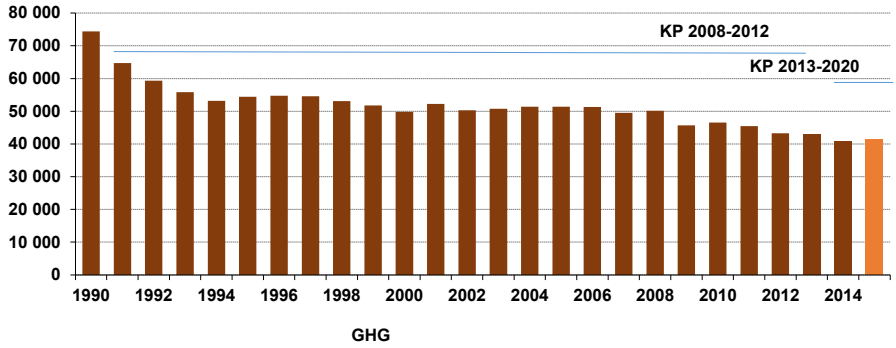
Slovakia has decreased its emissions by around 18% between 2008 and 2015. According to 2015 projections, Slovakia is on track to overachieve 2020 target, with a 17% margin between the projected emissions and its target, as compared to 2005.

Reduction of emissions in Slovakia is conjunction of different impacts starting from impressive industrial and technological restructuring connected with the fuel switching of fossil fuels from coal

[1] http://cdr.eionet.europa.eu/sk/eu/mmr/art07_inventory/ghg_inventory/

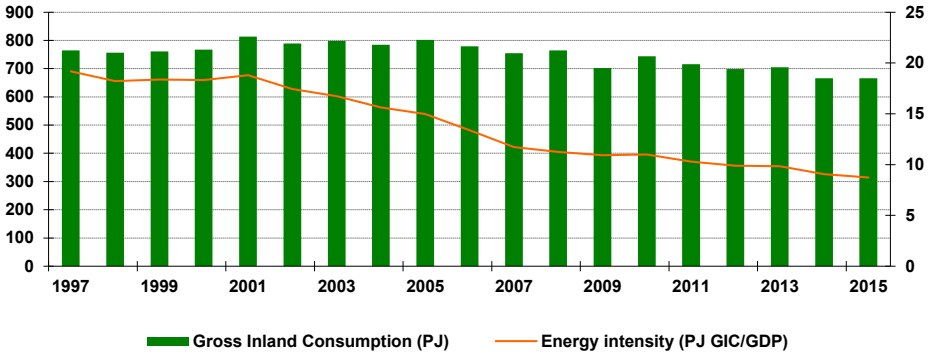
and oil to the natural gas (air pollution legislation since 1991 was the main driving force), economy restructuring towards the less energy intensive production (mostly in recent years) and also by temporary changes in production intensity (driven by global and EU markets). Transport (mostly the road 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 trends observed in primary energy intensity could be partly explained by the economic crisis. In addition, 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.

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



This important reduction of emissions 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. Transport (mostly the road transport), with increasing emissions is an important exception.
Structural changes in energy sector and the implementation of economic instruments have played an important role in achieving the current status, when the trend of GHG emissions does not copy the fast 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 (production and distribution of electricity, natural gas and water) reached 12% share in total GDP of the Slovak Republic in 2013. Energy intensity is still higher than the average in the EU-15 (member states before 2004 enlargement), in spite of its continual decrease. Reason for that is the adversely high share of energy intensive industry in GDP. This trend can be illustrated also by the indicator comparing the gross inland consumption (GIC) of energy resources with the GDP growth. Energy intensity is expressed in PJ/Bio Euro. The significant decrease in gross inland consumption was the result of gas crises from the beginning of 2009 and followed by the lack of resources in energy and iron and steel industry (coke production).

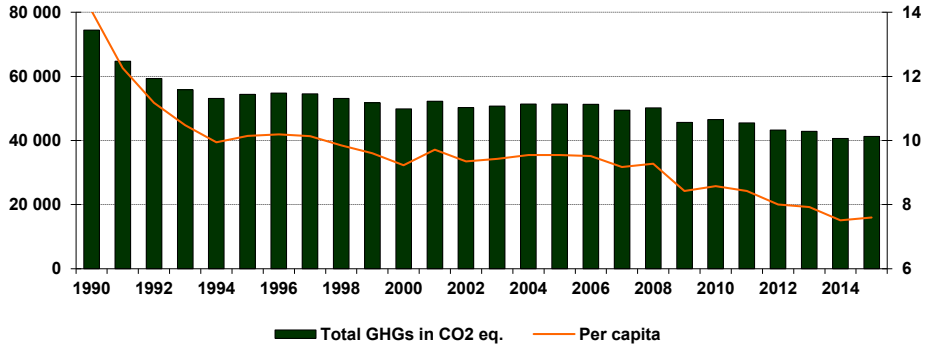
Figure 2.3: *The trend of energy intensity (right y axis) in the period 1997 - 2015 (estimated by the revised statistical approach NACErev.2)*



Beside the basic macroeconomic indicators as GDP, GDP per capita, foreign and domestic trade development, inflation, 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 that 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.

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. But 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 - 2015*



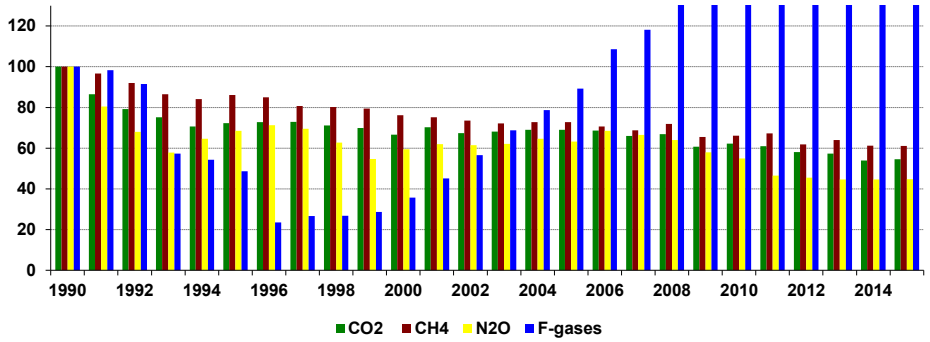
2.1.2 Emissions trends by gases

Total anthropogenic emissions of carbon dioxide excluding LULUCF have decreased by 45.4% in 2015 compared to the base year (1990). Nowadays the amount is 33,816.79 Gg of CO_2. Compared to the previous inventory year 2014, the increase is 1%. The reason for the increase in CO_2 emissions in 2015 is caused mainly by increasing CO_2 emissions in energy, industrial processes and waste sectors due to increase in economy and productivity in Slovakia. In 2015, CO_2 emissions including LULUCF sector are almost at the same level compared to the previous year and decreased by 48% compared to the base year.

Total anthropogenic emissions of methane without LULUCF decreased compared to the base year (1990) by 39.5% and currently the emissions are 4,352.44 Gg of CO_2 eq. In absolute value, CH_4 emissions were 174.10 Gg without LULUCF. Methane emissions from LULUCF sector are 0.67 Gg of CH_4 caused by forest fires. The trend has been relatively stable during the last years with a slight

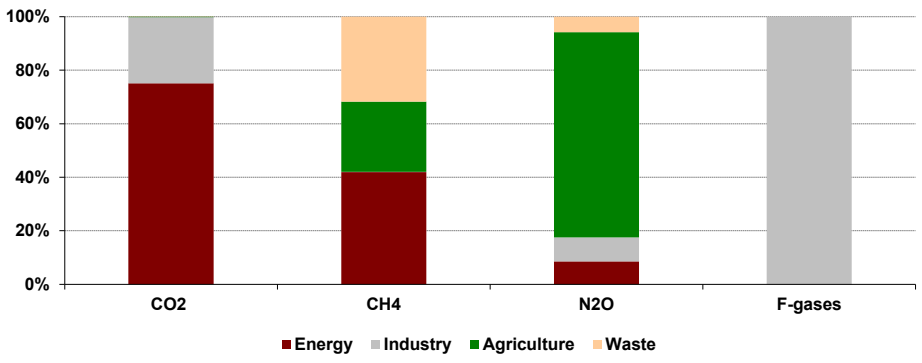
increase in the year 2014 due to the emission increase from agriculture. Methane emissions peaked in 2002 due to the implementation of new waste legislation and increasing emissions from solid waste disposal sites in the Slovak Republic.
Total anthropogenic emissions of N_2O without LULUCF decreased compared to the base year (1990) by 53.3% and currently the emissions are 2,342.56 Gg of CO_2 eq. Emissions of N_2O in absolute value were 7.86 Gg without LULUCF. Emissions of N_2O from LULUCF sector are 0.1 Gg. Emissions decreased compared to the previous year 2014 by less than 1% due to the decrease in energy and industrial processes sectors. 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 734.88 Gg of HFCs, 8.5 Gg of PFCs and 14.31 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. Emission trend of PFCs is decreasing and emissions of SF_6 are slightly increasing due to the increasing consumption in industry.

Figure 2.5: *Emission trends by gas for the years 2000 - 2015 relative to the 1990 level (in %)*



The major share of CO_2 emissions comes from the energy sector (fuel combustion, transport) with the 75% share from the total carbon dioxide emissions in 2015 inventory, 25% of CO_2 is produced in industrial processes and product use sector and negligible amount is produced in agriculture (0.22%) and waste (0.02%) sectors. The energy related CO_2 emissions from waste incineration are included in energy sector. The 32% of CH_4 emissions is produced in waste sector (SWDS), 42% of methane emissions is produced in energy sector and 26% in agriculture sector. More than 75% of N_2O emissions are produced in agriculture sector (nitrogen from soils), 9% in industrial processes sector (nitric acid production), 6% in waste sector and 9% 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 2015*



2.1.3 Emissions trends by main source and sink categories

Aggregated GHG emissions from energy sector based on sectoral approach data in 2015 were estimated to be 27,445.21 Gg of CO_2 eq. including transport emissions (6,704.75 Gg of CO_2 eq.), which represent the decrease by 52% compared to the base year and 1% increase in comparison with 2014. Transport sub-sector increased by 3% compared to 2014 and in comparison with the base year it declined by 2%.

Total emissions from industrial processes and product use sector were 9,285.16 Gg of CO_2 eq. in 2015, which was decreased by 5% compared to the base year and the increased by 2% compared to the previous year. This sector covers also emissions from solvents use.

Emissions from agriculture sector were estimated to be 3,014.46 Gg of CO_2 eq. It is 54% decrease in comparison with the base year and 1% 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.

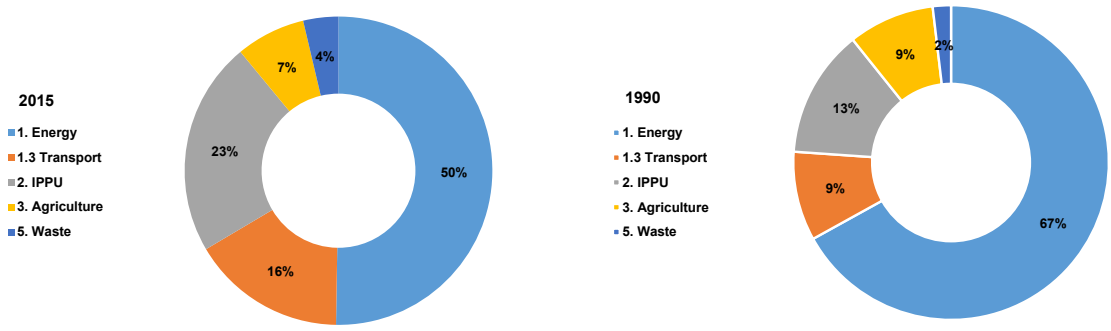
Emissions from waste sector were estimated to be 1,524.67 Gg of CO_2 eq. The increase is 3% compared to the previous inventory year and the time series are stable for last years. Compared to the base year, the increase was more than 9%, because of increased methane emissions from solid waste disposal sites. The emissions from waste incineration with energy use are included into energy sector, category 1.A.1.a – energy industries, other fuels.

Structural changes in energy sector and the implementation of economic instruments have played an important role in achieving the current status, when the trend of GHG emissions does not copy the fast 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.

The comparison of the 2015 sectors share with the base year is shown on the following Figure 2.7. The significant decrease is visible in energy sector (without transport) and increase in waste, IPPU and transport sectors. Emissions from international aviation and shipping are excluded from the national totals and therefore not presented here.

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 167.72 Gg of CO_2 eq. in 2015. Emissions from international aviation have more than 95% share.

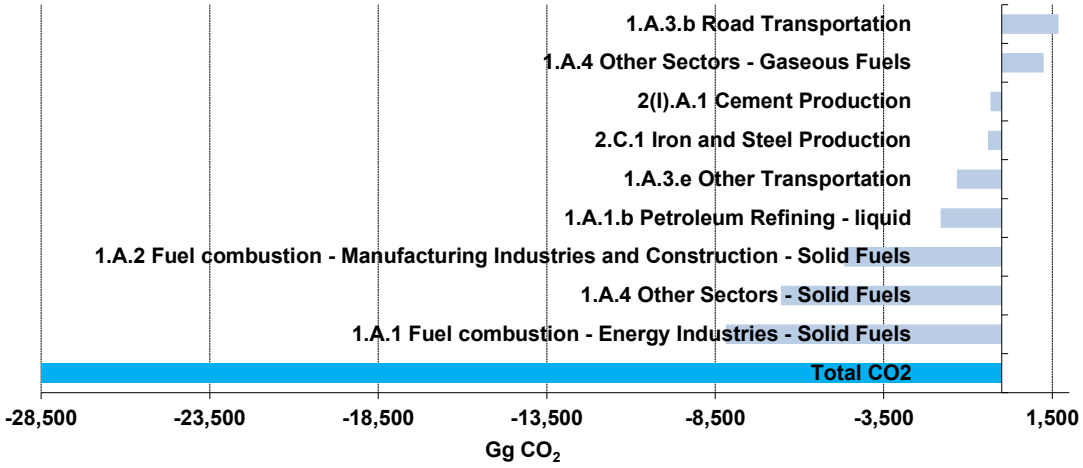
Figure 2.7: *The share of individual sectors in total GHG emissions in 1990 and 2015*



CO_2 emissions from the category 1.A.3.b - Road Transportation – diesel fuel are the largest key source accounting for 19% of total CO_2 emissions without LULUCF in 2015. Between 1990 and 2015, CO_2 emissions in road transportation increased by 1.8 Mt of CO_2, which is 19% 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. Figure 2.5 below shows that, solid fuels from the category 1.A.1 Fuel combustion - Energy Industries is the second largest key category without LULUCF (14%) and the decrease (64%) is between 1990 and 2015. The main explanatory factors of

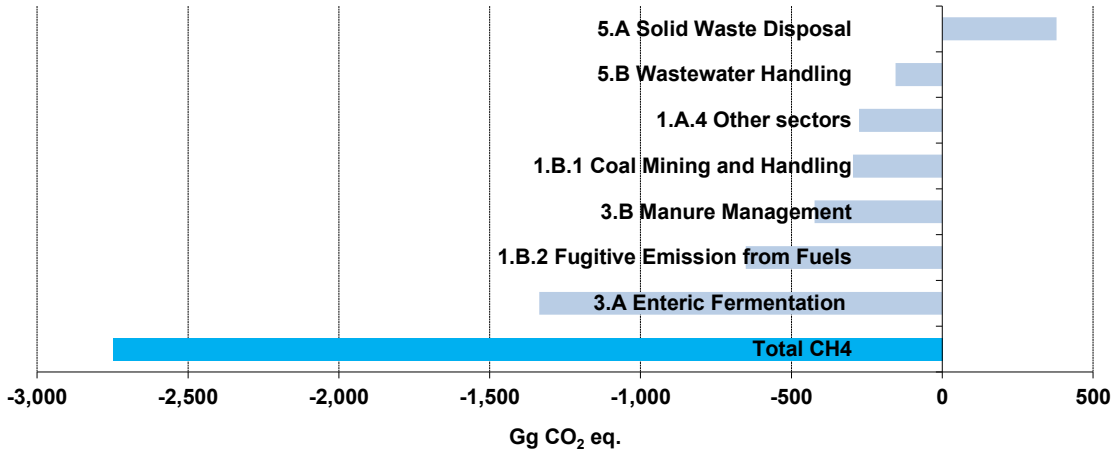
emissions decrease is in improvements in energy efficiency and (fossil) fuel switching from coal to gas. A shift from solid and liquid fuels to mainly natural gas took place and an increase of biomass and other fuels has been recorded.
CO_2 emissions from fuels in the category 2.C.1 - Iron and Steel Production are the largest key category without LULUCF in the IPPU sector, accounting for 12% of total CO_2 emissions in 2015. CO_2 emissions from the category 1.A.2 in energy sector are the third largest key source in the Slovak Republic, accounting for 12.3% of total GHG emissions in 2015. Between 1990 and 2015, emissions from this category showed the decrease by 54%.

Figure 2.8: *Absolute change of CO_2 emissions by large key categories 1990 to 2015*



Methane emissions account for 11% of total GHG emissions in 2015 and decreased by 40% since 1990 to 174.10 Gg CH_4 in 2015. The two largest key sources (5.A Solid Waste Disposal at 23% and 3.A Enteric Fermentation at 22% of total CH4 emissions in 2015) account for 50% of CH_4 emissions in 2015. Figure 2.6 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.

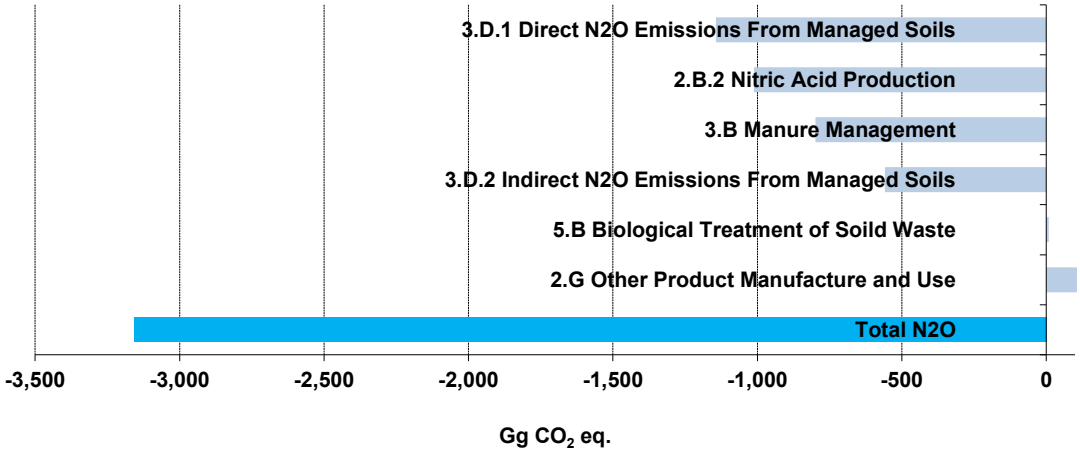
Figure 2.9: *Absolute change of CH_4 emissions by large key categories 1990 to 2015*



N_2O emissions are responsible for 5.7% of total GHG emissions and decreased by 53% to 7.86 Gg of N_2O in 2015 (Figure 2.10). The two largest key sources causing this trend – 3.D.1 Direct N_2O Emissions from Managed Soils 53% and 3.D.2 Indirect N_2O Emissions from Managed Soils at 16% of total N_2O emissions in 2015. The main reason for large N_2O emission cuts were reduction measures in

the "nitric acid production" and decreasing agricultural activities (Figure 2.9). 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 1.84% of total GHG emissions. In 2015, emissions were 757.69 Gg CO_2 eq., which was 141% above 1990 levels. The largest key source is 2.F.1 Refrigeration and Air Conditioning and accounts for 93% of fluorinated gas emissions in 2015. HFC emissions from the consumption of halocarbons showed large increases between 1990 and 2015. 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 decreased substantially. The decrease has started in 1996 and was the strongest in 1999 and 2000.

Figure 2.10: *Absolute change of N_2O emissions by large key categories 1990 to 2015*



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. The estimated removals from afforestation/reforestation activities represented -443.09 Gg CO_2 eq. in 2013, -441.82 Gg CO_2 eq. in 2014 and -465.13 Gg CO_2 eq. in

2015. Emissions from deforestation were 43.04 Gg CO_2 in the year 2013, 62.80 Gg CO_2 in 2014 and 64.45 Gg in 2015. The activities under Article 3.3 of Kyoto Protocol represent the net removal of -400.03 Gg CO_2 eq. in 2013, -379.01 Gg CO_2 eq. in 2014 and -400.66 Gg CO_2 eq. in 2015.
The CO_2 removals from forest management were related to the changes in living biomass. The net removals in this activity were 5,186.48 Gg CO_2 eq. in 2015. The emissions from biomass burning are associated with FM as well. The emissions of CH_4 and N_2O in 2015 were 0.67 Gg CH_4 and 0.04 Gg N_2O in 2015. The net CO_2 eq. removals were 5,158.64 Gg in 2015.

Table 2.2: *Emissions and removals (Gg of CO_2 eq.) in 2013, 2014 and 2015 resulting from activities under the Articles 3.3 and 3.4 of the Kyoto Protocol*

Activities	2013	2014	2015	Total
Total 3.3 and 3.4	**-7,189.47**	**-5,224.27**	**-5,559.29**	**-17,973.04**
A. Article 3.3 activities	-400.03	-379.01	-400.66	-1,179.7
A.1 Afforestation/ Reforestation	-443.09	-441.82	-465.13	-1,350.04
A.2 Deforestation	43.04	62.80	64.45	170.29
B. Article 3.4 activities	-6,789.44	-4,845.26	-5,158.64	-16,793.34
B.1 Forest Management	-6,789.44	-4,845.26	-5,158.64	-16,793.34

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 2017, Chapter 1 and in the Chapter 3.3 of the 7th National Communication of the Slovak Republic.
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 is 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, the Ministry of Interior, Ministry of Finance, Ministry of Foreign and European 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[2], another in April 2013[3], in April 2014[4], in April 2015[5], in April 2016[6] and in April 2017[7].

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, 2007.21 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 was also provided in the Seventh National Communication of the SR on Climate Change, published in December 2017.

[2] http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=21144
[3] http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=22264
[4] http://www.rokovanie.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=23392
[5] http://www.rokovanie.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=24429
[6] http://www.rokovanie.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=25426
[7] http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=26360 (No.151/2017)

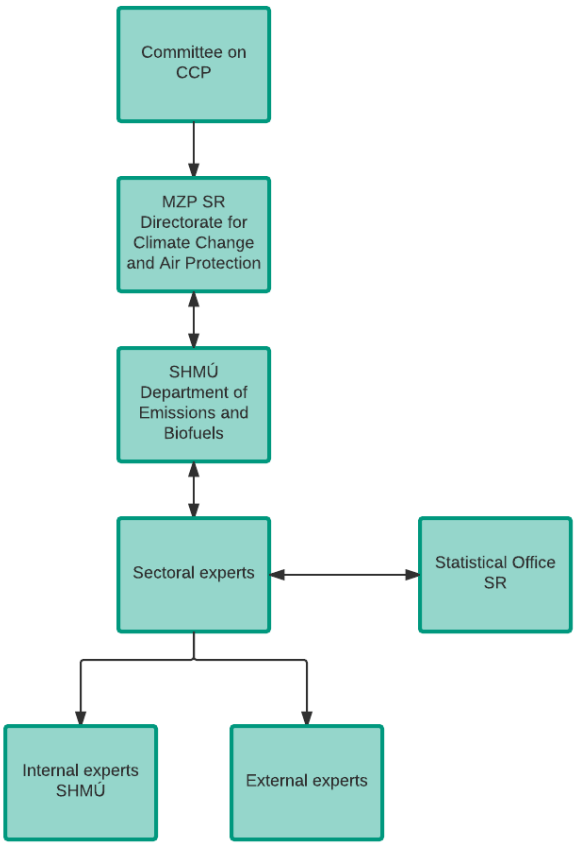
2.2.1 Information on changes in National Inventory System

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

- Structural changes in the MŽP SR, establishment of the Directorate for Climate Change and Air Protection - in force since 1 June 2016;
- Structural changes in the Slovak Hydrometeorological Institute (SHMÚ), establishment of the Department of Emissions and Biofuels (OEaB) – in force since 1 January 2017. The OEaB has two main tasks: emission inventories (GHG, NECD, and CRLTAP) and the National System of Biofuels. The OEaB is also responsible for developing and maintaining the National Emission Information System (the NEIS) – the database of stationary sources to monitor the development of SO_2, NO_x and CO emissions at the regional level and to fulfil reporting commitments under national regulations and EU Directives (https://www.air.sk). The NEIS software product is constructed as a multi-module system corresponding fully to the requirements of current legislation. The NEIS database also contains some technical information about sources like fuel consumption and use for the estimation of sectoral approach.
- Enhancement of the Single National Entity by new experts focusing on agricultural sector and transport. This new positions are permanent – in force since spring 2016.

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

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



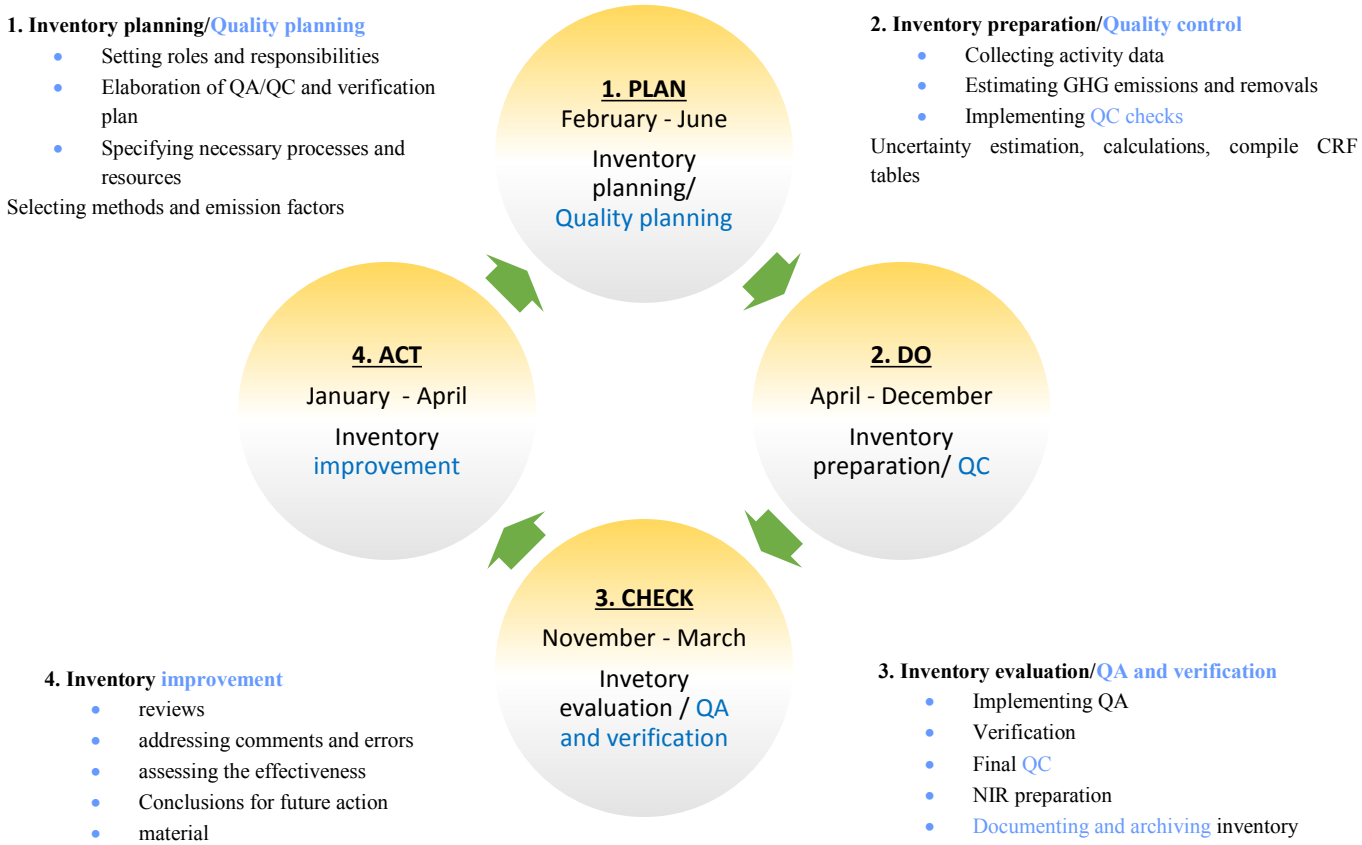
2.2.2 Quality management

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 SHMU as a global standard, the certification itself proceeds according to the partial processes inside of the SHMU 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. 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 emission reduction target under the UNFCCC and the compliance architecture set up within the EU in order to meet that target, and gives an overview of other EU emission reduction targets. The Slovak republic also inform about national circumstances and the progress in the fulfilment of the national emission reduction target.

3.1 QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

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.[8]

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.
- 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.[9]

[8] 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

[9] 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.

- 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.

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.

Table 3.1: *Key facts of the Convention target 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.

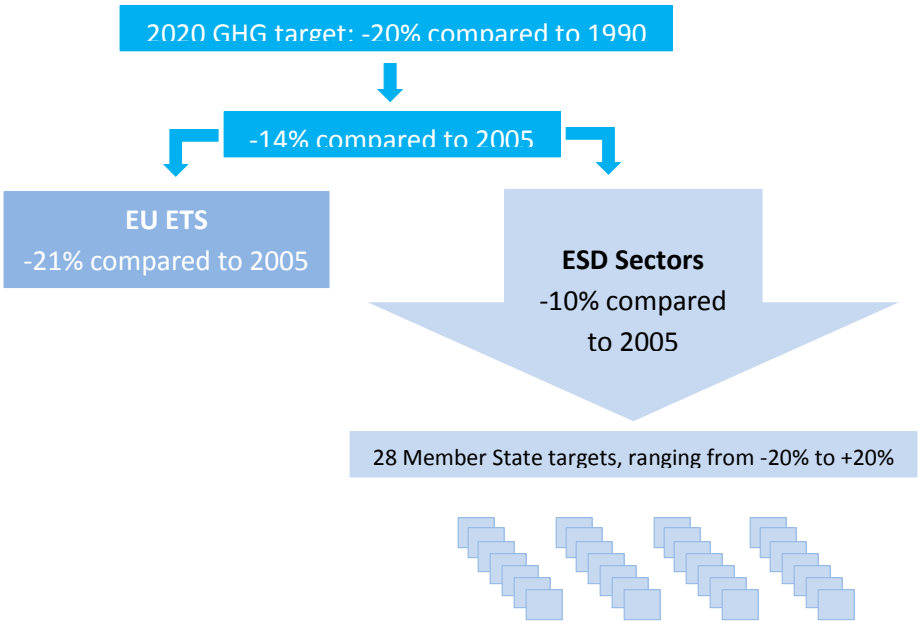
As this target under the Convention has only been submitted by EU-28 and not by each of its Member States (MS), there are no specified Convention targets for single MS. Due to this, Slovakia as part of the EU-28, takes on a quantified economy-wide emission reduction target jointly with all Member States.

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:

- a 21% reduction target compared to 2005 for emissions covered by the ETS (including domestic and international aviation);

- a 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[10], 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 decrease 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) and EU-BR2 (Chapter 3.1).

Non-ETS emissions are addressed under the Effort Sharing Decision (ESD).[11] 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.[12]

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

[10] 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

[11] Decision No 406/2009/EC

[12] 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

transferred into binding quantified annual reduction targets for the period from 2013 to 2020 (EC 2013),[13,14] 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 2015 verified emission of stationary installations covered under the EU-ETS in Slovakia summed up to 21.2 Mt CO_2 eq. With total GHG emissions of 41.3 Mt CO_2 eq. (without LULUCF) the share of EU ETS emissions is around 51%.

The monitoring process is harmonized for all European MS, especially laid down in the Monitoring Mechanism Regulation.[15] 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 Third Biennial Report of the European Union.

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 and 2014 ESD emissions the Slovak Republic carried-over its surplus AEAs to the subsequent years of the compliance period 2013 - 2020 (2013 surplus AEAs was carried-over to 2020 and 2014 surplus AEAs was carried-over to 2016).

3.2 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).

3.2.1 Monitoring Mechanism Regulation

The Monitoring Mechanism Regulation No. 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

[13] 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).

[14] 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).

[15] 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.

- 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) No. 749/2014 and Delegated Regulation (EU) No. 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.

3.2.2 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). 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 OTHER EMISSIONS REDUCTION TARGET

In addition to the EU target under the Convention, the EU also committed to a legally binding quantified emission limitation 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. On the left, the table includes the international commitments under the Kyoto Protocol and the UNFCCC. On the right, the Slovak Republic commitments under the EU Climate and Energy Package and the proposed framework on climate and energy policies until 2030 are included.

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

	INTERNATIONAL COMMITMENTS			EU DOMESTIC LEGISLATION	
	KYOTO PROTOCOL		**UNFCCC**	**CLIMATE AND ENERGY PACKAGE**	
				EU ETS	**ESD**
Target year or period	First Commitment Period (2008-2012)	Second Commitment Period (2013-2020)	2020	2013-2020	2013-2020
Emission reduction target	-8%	-20%	-20%	-21% compared to 2005 on the EU level	Annual targets trajectory with the +13% target in 2020
Further targets	-	-	Conditional target of -30% if other Parties take on adequate commitments	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	

	INTERNATIONAL COMMITMENTS			EU DOMESTIC LEGISLATION	
	KYOTO PROTOCOL		**UNFCCC**	**CLIMATE AND ENERGY PACKAGE**	
				EU ETS	**ESD**
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 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	
LULUCF	Included ARD and other activities not elected	Includes ARD and forest management, other activities if elected (new accounting rules)	Excluded	Excluded	
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.	Domestic and international aviation, as in the scope of EU ETS	Aviation generally excluded, some domestic aviation included (operators below ETS de Minimis thresholds)
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	Subject to quantitative and qualitative limits, as set in EU Regulation 1123/2013.	The annual use of credits by Slovakia shall not exceed a quantity equal to 3 % from 2005 levels.
Carry-over of units from preceding periods	Not applicable	Subject to KP rules including those agreed in the Doha Amendment	Not applicable	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, NF_3	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	
Sectors included	Annex A of KP (Energy, IPPU, agriculture, waste), LULUCF according to KP accounting rules for CP1	Annex A of KP (Energy, IPPU, agriculture, waste), LULUCF according to accounting rules for CP2	Energy, IPPU, agriculture, waste, aviation in the scope of the EU ETS	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
GWPs used	IPCC SAR	IPCC AR4	IPCC AR4	IPCC AR4	

3.4 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 0.96% in the year 2015.

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 Third Biennial Report of the European Union (section 3.2.2.1). 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 2015 anthropogenic GHG emissions decreased by 44.6% 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 2015 by 16.05% compared to 2005 and ESD emissions, even Slovakia has positive target of 13% up to 2020, decreased in 2015 by 23.24% compared to 2005.

Table 3.3: *Evaluation of ETS and ESD GHG emissions in 2013 - 2015*

	2013	2014	2015
Total GHG emissions (Gg CO_2 eq.)	42,885.65	40,677.79	41,269.49
ETS emissions (Gg CO_2 eq.)	21,831.83	20,918.07	21,181.22
ESD emissions (Gg CO_2 eq.)	21,080.25	19,782.14	20,084.62
Ratio ETS/ESD in %	50.91/49.15	51.42/48.63	51.32/48.67

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 2015 was 12.9%, 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 (15.4 Mtoe in 2015) was already under the 2020 target of 16.4 Mtoe. The final energy consumption (10.1 Mtoe in 2015) still shows a remaining gap to the 2020 target of 9 Mtoe. Both numbers marked a slight increase in 2015 compared to the previous year (with 0.8% and 3% 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 11 April 2017, the Slovak Republic total anthropogenic emissions of greenhouse gasses expressed as CO_2 eq. decreased by 44.6% 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.

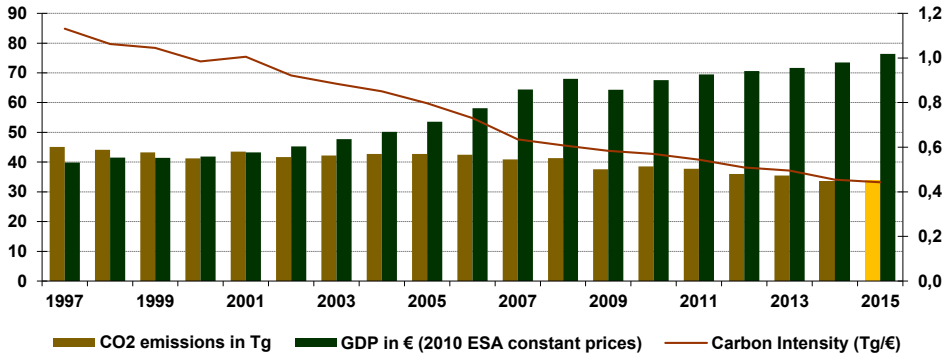
- Global economic and financial crises started in 2009 and the short term crises in oil and natural gas supply from Ukraine at the beginning of 2009 (January - February).
- Increase of energy efficiency and share of the renewable energy sources on final consumption.
- Implementation of strict policies 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 (2015) 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	2000	2001	2002	2003	2004	2005	2006	2007
CO_2 emission in Tg	41.24	43.55	41.71	42.19	42.71	42.74	42.47	40.87
GDP in Bio € at ESA 2010 prices	41.89	43.28	45.24	47.69	50.20	53.59	58.12	64.40
Carbon Intensity (Tg/GDP)	0.98	1.01	0.92	0.88	0.85	0.80	0.73	0.63
YEAR	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
CO_2 emission in Tg	41.38	37.59	38.51	37.80	36.00	35.53	33.42	33.79
GDP in Bio € at ESA 2010 prices	68.02	64.33	67.58	69.48	70.63	71.69	73.53	76.35
Carbon Intensity (Tg/GDP)	0.61	0.58	0.57	0.54	0.51	0.50	0.45	0.44

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



4 POLICIES AND MEASURES

In the European Union and their Member States, there are two distinct levels of policies and measures (PAMs) that have an impact on greenhouse gas emissions:

- European Union policies, which are proposed by the Commission and subsequently approved, amended or rejected by the Council of the European Union and the European Parliament. These common and coordinated policies and measures are applicable to all Member States, though Member States may implement Directives at different points in time. The EU's National Communication concentrates on these common and coordinated policies and measures.
- National policies developed and implemented by the Member States themselves. Therefore we are submitting in the Third Biennial Report of the Slovak Republic brief overview of the most significant climate related PAMs on the EU level together with information on specific national PAMs implemented, adopted or planned to reduce emissions.

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 1 May 2004. The European Commission's Decision on the Phase I National Allocation Plan of the Slovak Republic was adopted on 20 October 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*

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: Ministry of the Environment

The second phase of the EU ETS was the five year 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 29 November 2006 and amended with a decision from 7 December 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*

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: Ministry of the Environment

The third phase of the EU ETS began from 1 January 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 Commission with a list of installations covered by the Directive in its territory to Commission on 17 August 2012.

Table 4.3: *Statistics from the Phase III of the National Allocation Plan*

Year	2013	2014	2015	2016
Allocation	16,466,336	15,821,315	15,029,434	14,522,533
Verified emissions	21,829,374	20,918,069	21,181,280	21,264,045

Source: Ministry of the Environment

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 28 February 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 is currently being discussed in the so called "trilogues process" with the goal of reaching a common position between the European Parliament and the Council before it can be adopted.

- 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 three 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.

Table 4.4: *The Slovak Republic's revenue from auctions during the period 2012 - 2016*

Period	2012	2013	2014	2015	2016
	EUR				
Slovak Republic Revenue (EUAs)	12,193,290	61,702,620	57,590,625	84,312,060	64,991,430
Slovak Republic Revenue (EUAAs)	-	-	44,590	197,300	55,815
Total SVK Revenue	12,193,290	61,702,620	57,635,215	84,509,360	65,047,245

- 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.

- 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. Currently negotiations related to linking are on-going between the EU and Switzerland.

- MSR

Market stability reserve (MSR) was introduced as a long term solution to fight the existing surplus of allowances within the EU ETS. It is an automated mechanism that will automatically 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 will be operational from 2019 and all backloaded allowances will become 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.

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 ETS and ESD GHG emissions in 2015*

Category	Unit	Total GHG emissions	ETS emissions	ESD emissions	Ratio ETS/ESD in %
GHG emissions	Gg of CO_2 eq.	41,269.49	21,181.22	20,084.62	51.32/48.67
Emissions of CO_2	Gg	33,816.79	21,032.71	12,784.08	62.20/37.80
Emissions of N_2O	Gg of CO_2 eq.	2,342.56	139.78	2,202.78	5.97/94.03
Emissions of PFCs	Gg of CO_2 eq.	8.50	8.50	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 and 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).

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

2020 ESD target (% vs 2005)	+13%
2015 ESD emissions (% vs 2005)	-23.2%
2020 ESD projections WEM (% vs 2005)	-23%
2020 ESD projections WAM (% vs 2005)	-26%

In accordance with 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 results of the evaluation were used by the Commission when preparing its legislative proposal, the "Effort Sharing Regulation", setting out binding annual greenhouse gas emission targets for Member States for the period 2021 - 2030. The proposal was presented on 20 July 2016. The proposed Regulation maintains the main elements of the ESD architecture, including the binding annual greenhouse gas emission targets 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 year 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

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 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.

Concerning the sustainability criteria, 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. The Act No. 181/2017 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 the 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 6 September 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 Ministry of Environment of the Slovak Republic.

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

4.2.3 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 CO_2 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 CO_2 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.

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

Figure 4.1: *Tax revenues from energy product taxation*[16]

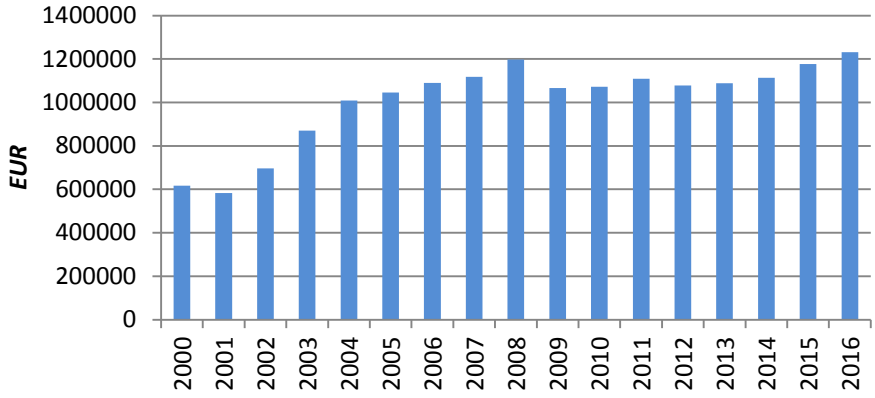
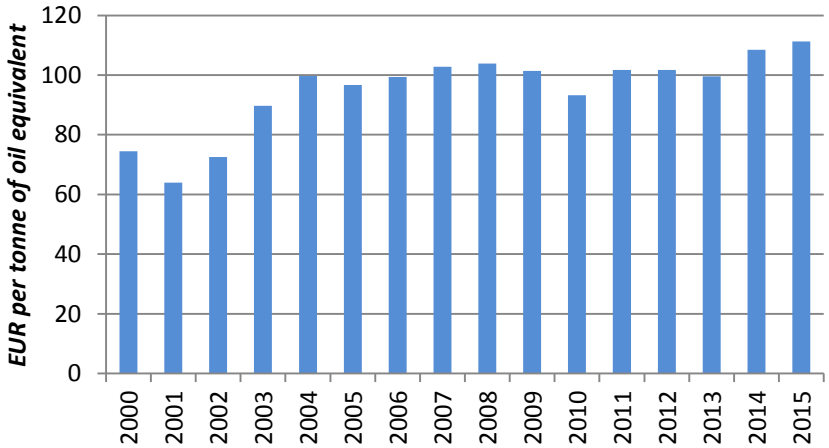


Figure 4.2: *Development in implicit tax rate on energy product in Slovakia in 2000 - 2015*



4.2.4 Carbon capture and storage

Directive 2009/31/EC on the geological storage of carbon dioxide was transposed into national legislation through Act No. 258/2001 Coll. in 2011. Suitable geological locations were identified in Slovak Republic.

GHG affected: CO_2
Type of measure: regulatory

4.2.5 National Emission Ceilings

Existing NEC Directive 2001/81/EC will be 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

[16] http://ec.europa.eu/taxation_customs/tedb/taxDetails.html?id=4148/1496928576#tax_revenueTitle1

4.3 SECTORAL POLICIES AND MEASURES – ENERGY AND TRANSPORT

The majority of policies within this sector presented in the Sixth National Communication of the Slovak Republic on Climate Change (2013) are still relevant. In addition to legislative instruments on emission trading, Act No. 137/2010 Coll. on air protection as amended plays an important role. This act is complemented with Act No. 401/1998 Coll. on charges for air pollution as amended, which serves for the control and regulation of emission limits for basic air pollutants. Monitoring and keeping records on emissions from stationary air polluting sources, as well as the system of fees and charges that is mandatory for the operators of medium and large scale sources of air pollution, have positively affected greenhouse gas emissions reduction and contributed to the decoupling (greenhouse gas emissions do not follow the growth of GDP) of the emission trajectory in the Slovak Republic since 1997.

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 section 4.2.1.

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

Impact renewable energy sources in heat and electricity generation. Increase the share of electricity production from RES in the power system. Increase consumption of biomass for the production of electricity and heat.

GHG affected: N_2O

Type of measure: regulatory and economic

Status: in force since 2013

Implemented in scenario: WEM

4.3.2 Improving the thermal performance of family houses buildings - Energy Efficiency Action Plan for the period 2014 - 2016 with the outlook for 2020 (adopted in July 2014)

Improving the thermal performance of buildings - family houses. Renovation of family houses with energy savings of at least 20%. Measures financed from owners' resources and through the banking sector.

GHG affected: CO_2, N_2O, CH_4

Type of measure: regulatory and economic

Status: in force since 2014

Implemented in scenario: WEM

4.3.3 Improving the thermal performance of public sector buildings - Energy Efficiency Action Plan for the period 2014 - 2016 with the outlook for 2020 (adopted in July 2014)

Improving the thermal performance of buildings - office buildings, hotels and restaurants, wholesale and retail trade, schools, school facilities, hospital. Renewal of the selected type of buildings saving energy by at least 20%. Measures financed from own resources.

GHG affected: CO_2, N_2O, CH_4

Type of measure: regulatory and economic
Status: in force since 2014
Implemented in scenario: WEM

4.3.4 Improving the thermal performance of residential buildings - Energy Efficiency Action Plan for the period 2014 - 2016 with the outlook for 2020 (adopted in July 2014)

Improving the thermal performance of buildings - residential buildings and renovation of residential buildings. The State Housing Development Fund was established in 1997 under the Act No. 124/1996 Coll. the State Housing Development Fund, providing support for the expansion and modernization of the housing stock, particularly in the form of favourable long-term loans.
GHG affected: CO_2, N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2014
Implemented in scenario: WEM

4.3.5 Energy efficiency improvement in industry - Energy Efficiency Action Plan for the period 2017 - 2019 with the outlook for 2020

Energy efficiency improvement and reducing the energy consumption of the industry sector.
GHG affected: CO_2, N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2017
Implemented in scenario: WAM

4.3.6 Improving the thermal performance of family houses buildings - 4th Energy Efficiency Action Plan for the period 2017 - 2019 with the outlook for 2020 (adopted in April 2017)

Improving the thermal performance of buildings - family houses. Renovation of family houses with energy savings of at least 20%. Measures financed from owners' resources and through the banking sector.
GHG affected: CO_2, N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2017
Implemented in scenario: WAM

4.3.7 Improving the thermal performance of public sector buildings - 4th Energy Efficiency Action Plan for the period 2017 - 2019 with the outlook for 2020 (adopted in April 2017)

Improving the thermal performance of buildings - office buildings, hotels and restaurants; wholesale and retail trade, schools, school facilities, hospitals. Renewal of the selected type of buildings saving energy by at least 20%. Measures financed from own resources.
GHG affected: CO_2, N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2017
Implemented in scenario: WAM

4.3.8 Improving the thermal performance of residential buildings - 4th Energy Efficiency Action Plan for the period 2017 - 2019 with the outlook for 2020 (adopted in April 2017)

Improving the thermal performance of buildings - residential buildings and renovation of residential buildings. The State Housing Development Fund was established in 1997 under the Act No. 124/1996 Coll. the State Housing Development Fund, providing support for the expansion and modernization of the housing stock, particularly in the form of favourable long-term loans.

GHG affected: CO_2, N_2O, CH_4

Type of measure: regulatory and economic

Status: in force since 2017

Implemented in scenario: WAM

4.3.9 Emissions trading, the new allocation - Act No. 414/2012 Coll. on Emission Trading in amendments

The ETS stimulates the use of biomass in the fuel mix of energy units. Economic and regulatory measure primarily focused on air protection with high positive impact on the reduction of GHG emissions.

GHG affected: CO_2, CH_4

Type of measure: regulatory and economic

Status: in force since 2012

Implemented in scenario: WEM

4.3.10 Hybrid transports in cities - Action Plan for Energy Efficiency 2011 - 2013, Government Resolution of the Slovak Republic No. 301/2011 Coll.

Buying low floor hybrid buses in selected cities (Žilina, Bratislava, Košice).

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2011

Implemented in scenario: WEM

4.3.11 Modal shift to public transport - Action Plan for Energy Efficiency 2011 - 2013, Government Resolution of the Slovak Republic No. 301/2011 Coll.

The measure consists of the implementation of these specific projects: "The support system of urban public transport operating segment Janíkov Dvor - Šafárikovo sq., Part 1 Šafárikovo sq. - Bosákova street", "Tramway Dúbravka in section Hanulova - At the Cross", "NS MHD Phase 1 Central Station - Janíkov Dvor operating segment Bosákova street - Janíkov Dvor, Part 2 Bosákova - Janíkov Dvor", "The modernization of tram tracks - Karloveská, Vajnorská and Račianska Radial", "railway station, integrated passenger transport terminals (TIOP) in Bratislava, Bratislava section of the main station - Podunajské Biskupice (implementation)", "ZSR integrated passenger transport terminals (TIOP) in Bratislava, Bratislava section of the main station - Devínska Nová Ves (implementation)", "NS MHD Phase 1 Central Station - Janíkov Dvor, Operations Department Central Station - Šafárikovo sq.", "ZSR integrated passenger transport terminals (TIOP) in Košice Region Phase I (PD implementation)", "Modernisation of tram tracks in Košice - second stage".

GHG affected: CO_2, N_2O

Type of measure: regulatory and economic

Status: in force since 2011

Implemented in scenario: WEM

4.3.12 Modal shift to public transport - Transport Policy of the Slovak Republic into 2015

Free travel for students and citizens of retirement age. Discount fares for rail for working people. The modernization of the railway corridor Žilina - Košice - Čierna nad Tisou.

GHG affected: CO_2, N_2O

Type of measure: regulatory and economic

Status: in force since 2005

Implemented in scenario: WEM

4.3.13 Improved transport behaviour and the road infrastructure - Transport Policy of the Slovak Republic into 2015

Energy savings are achieved by reducing fuel consumption by users of the road infrastructure in the new technically superior infrastructure in comparison with the original technically outdated road infrastructure. Ensure speedy completion of the motorway network included in the TEN-T routes Bratislava - Žilina - Košice - Vyšné Nemecke - state border SR / Ukraine (Va corridor; D1 motorway section) Priority of Bratislava - Košice as the main transport and urban connection for the SR, Construction of new high-capacity road infrastructure segments, troubleshooting first-class roads and modernizing rail infrastructure.

GHG affected: CO_2, N_2O

Type of measure: regulatory and economic

Status: in force since 2005

Implemented in scenario: WEM

4.3.14 Introduction of Euro 6 emission standards - Transport Policy of the Slovak Republic into 2015

The introduction of more stringent Euro 6 emission standards for new vehicles set significantly stricter emission limits for basic pollutants and particulates from traffic. There are anticipated reductions in fuel consumption due to the improved efficiency of engines and reductions in greenhouse gas emissions are anticipated.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2005

Implemented in scenario: WEM

4.3.15 Government Regulation of the Slovak Republic No. 246/2006 Coll. on the minimum quantity of fuels produced from renewable sources in the petrol and diesel fuels placed on the market in the Slovak Republic

Continuously increasing the share of bioethanol and biodiesel blended with gasoline and diesel. It is planned to increase the use of CNG - filling station infrastructure support.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2010

Implemented in scenario: WEM

4.3.16 Decree No. 362/2010 Coll. determining the requirements for quality of fuels and maintaining the operational evidence on fuels

Defines rules for fuel suppliers, i.e. requirements for higher share of biofuel in gasoline and mineral oil, and the duty of providing information of the share of biofuels in transport petrol and diesel consumption.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2010

Implemented in scenario: WEM

4.3.17 Regulation No. 655/2007 Coll. on technical conditions to reduce emissions from air conditioning systems in motor vehicles

Reduction of emissions from air conditions.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2007

Implemented in scenario: WEM

4.3.18 Effect of European legislative - Regulation No. 2009/443/EC and Regulation No. 2011/510/EC which sets limits for CO_2 emissions from car and vans

Increase car efficiency and decrease GHG emission production from cars and vans. Effect of European legislative - Regulation No. 2009/443/EC and Regulation No. 2011/510/EC which set limits for CO_2 emissions from cars and vans.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2010

Implemented in scenario: WEM

4.3.19 Emissions trading, allocation for civil aviation - Act No. 414/2012 Coll. on Emission Trading in amendments

The measure sets the decrease of GHG emissions from civil aviation through the EU ETS cap-and-trade system.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2012

Implemented in scenario: WEM

4.3.20 Strategy of Development of Electromobility

Electromobility brings a significant improvement of driving parameters from the point of view of its impact on the environment. The Strategy of Development of Electromobility in Slovakia deals with its support for electric vehicles.

GHG affected: CO_2

Type of measure: regulatory and economic

Status: in force since 2015

Implemented in scenario: WEM

4.3.21 Effect of European legislative - EU White Paper on Transport

Commitment from EU White Paper on the long-distance transportation of goods by trucks to rail: in total it should be 30% of goods currently transported by road over a distance longer than 300 km. According to this measure goods should be transported by rail transport.

GHG affected: CO_2
Type of measure: regulatory and economic
Status: in force since 2011
Implemented in scenario: WEM

4.4 SECTORAL POLICIES AND MEASURES – INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)

4.4.1 Nitric acid production - Act No. 414/2012 Coll. on Emission Trading in amendments

The act gives provisions for the implementation of a secondary catalyst at nitric acid production. Nitric acid production is the major source of N_2O emissions. Nitric acid is produced in two plants. In 2014, improved technology with a secondary catalyst was used in both plants. This led to a reduction of N_2O emissions.

GHG affected: N_2O
Type of measure: regulatory and economic
Status: in force since 2013
Implemented in scenario: WEM, WAM

4.4.2 Aluminium production - Act No. 414/2012 Coll. on Emission Trading in amendments

Its implementation enables the control of efficiency on aluminium production. The technology was changed from Söderberg to prebaked technology in 1996. It resulted in a significant decrease of CO_2 and PFC emissions. The improvements in production also resulted in a decrease of PFC emissions after 2009. Further improvement in a better performance controlling process of electrolysis cells was achieved in 2013. The CO_2 emissions from pitch volatiles combustion and from bake furnace packing material were calculated in 2013 for the first time (according to the IPCC 2006 GL) and the resulting implied emission factor per aluminium produced was estimated.

GHG affected: PFCs
Type of measure: regulatory and economic
Status: in force since 2013
Implemented in scenario: WEM, WAM

4.4.3 Cement production - Act No. 414/2012 Coll. on Emission Trading in amendments

Its implementation may cause a partial change in raw materials used. The utilisation of non-carbon raw materials for cement production will start after 2020 (such as ground granulated blast-furnace slag). It is assumed 5% input into kiln load.

GHG affected: CO_2
Type of measure: regulatory and economic
Status: estimated after 2020
Implemented in scenario: WAM

4.4.4 Lime production - Act No. 414/2012 Coll. on Emission Trading in amendments

Its implementation may cause the reduction of dolomite lime production and its replacing with quicklime production. The reduction or closure of dolomite lime mines after 2020 can occur.
GHG affected: CO_2
Type of measure: regulatory and economic
Status: estimated after 2020
Implemented in scenario: WAM

4.4.5 HFCs gases with lower GWP

The HFC emission increase will be less dynamic due to the significant increase of coolants with new HFC gases (with lower GWP) after 2020 and continual replacement of recycling HCFC coolants with "natural coolants".
GHG affected: HFC
Type of measure: regulatory and economic
Status: in force since 2015
Implemented in scenario: WEM

4.4.6 New mandatory parameters of F-Gases

In addition to the parameters described in the WEM scenario for F-gases, foams containing HFCs will be forbidden; coolants with high GWP will also be restricted. Increased use of F-gases that are not covered by IPCC (such as hydrofluoroolefins) will start in a significant manner after 2025. The utilisation of F-gases with lower GWP in aerosols and fire extinguishers will be mandatory.
GHG affected: HFC
Type of measure: regulatory and economic
Status: in force since 2017
Implemented in scenario: WAM

4.4.7 Lower content of N_2O in aerosol cans

Decrease the content of N_2O in aerosol cans after 2020.
GHG affected: N_2O
Type of measure: regulatory and economic
Status: in force since 2010
Implemented in scenario: WEM

4.4.8 Additional decrease content of N_2O in aerosol cans

Additional decrease in the content of N_2O in aerosol cans after 2025.
GHG affected: N_2O
Type of measure: regulatory and economic
Status: in force since 2017
Implemented in scenario: WAM

4.4.9 BAT at servicing of the electrical equipment

Stable SF_6 emission factors from electrical equipment due the use of "best available technology" (BAT) for the servicing of units.
GHG affected: SF_6
Type of measure: regulatory and economic

Status: in force since 2015
Implemented in scenario: WEM

4.4.10 Service of electric equipment only on BAT level technology

Service of electric equipment will be possible only on BAT level technology and only in "sealed for life" systems.
GHG affected: SF_6
Type of measure: regulatory and economic
Status: in force since 2017
Implemented in scenario: WAM

4.5 SECTORAL POLICIES AND MEASURES – AGRICULTURE

- Decree of the Ministry of Agriculture and Rural Development of the Slovak Republic No. 362/2010 Coll.;

4.5.1 Common Agricultural Policy

The Common Agricultural Policy (CAP) is the agricultural policy of the European Union. It implements a system of agricultural subsidies and other programmes. It was introduced in 1962 and has undergone several changes since then to reduce the cost (from 71% of the EU budget in 1984 to 39% in 2013) and also to consider rural development in its aims.
GHG affected: CO_2, N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2010
Implemented in scenario: WEM

4.5.2 Nitrates Directive

The Nitrates Directive (1991) aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. The Nitrates Directive forms an integral part of the Water Framework Directive and is one of the key instruments in the protection of waters against agricultural pressures.
GHG affected: CO_2, N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2010
Implemented in scenario: WEM

4.5.3 The Rural Development Programme for the period of 2014 - 2020

The programme will increase the competitiveness of agriculture and forestry (by supporting investments on 1,250 farms and 400 food enterprises). It will ensure appropriate management of natural resources and encourage farming practices which are climate-friendly. Around 20% of farmland will be farmed in a manner that protects biodiversity, soil and/or water resources. The program of financial support scheme for select thematic priorities in rural development comprises 56 frame targets for specific policies and measures in this sector with positive environmental impacts. Contribution of supported PaMs to the sustainable development will serve as horizontal criteria for support.
GHG affected: CH_4, N_2O, CO_2
Type of measure: regulatory and economic
Status: in force since 2015

Implemented in scenario: WEM

4.5.4 Conception of the Agricultural Development of the Slovak Republic for years 2013 - 2020

The concept of agricultural development plans an increase in animal numbers for the years 2013 - 2020. Pursuant to the Conception, the endeavour of the Slovak Republic is to ensure self-sufficiency for important agricultural commodities with the aim to achieve the level of 80% up to 2020. That leads to the support of livestock primary production in the Slovak Republic, which is also closely linked to the employment policy in the agricultural sector.

GHG affected: CH_4, N_2O

Type of measure: regulatory and economic

Status: in force since 2013

Implemented in scenario: WEM

4.5.5 Manure management - Ordinance of the Government of the Slovak Republic No. 342/2014 Coll. laying down the rules for the granting of agricultural aid in respect to the direct payments schemes

Measures in manure manipulation and processing in enteric fermentation. Measures to implement better technologies of manure manipulation and processing in enteric fermentation.

GHG affected: CH_4, N_2O

Type of measure: regulatory and economic

Status: in force since 2014

Implemented in scenario: WEM

4.5.6 New manure management - Ordinance of the Government of the Slovak Republic No. 342/2014 Coll. laying down the rules for the granting of agricultural aid in respect to the direct payments schemes

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

GHG affected: CH_4, N_2O

Type of measure: regulatory and economic

Status: in force since 2015

Implemented in scenario: WAM

4.5.7 Agricultural soils - Ordinance of the Government of the Slovak Republic No. 342/2014 Coll. laying down the rules for the granting of agricultural aid in respect to the direct payments schemes

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

GHG affected: N_2O

Type of measure: regulatory and economic

Status: in force since 2014

Implemented in scenario: WEM

4.5.8 Agricultural soils after the year 2015 - Ordinance of the Government of the Slovak Republic No. 342/2014 Coll. laying down the rules for the granting of agricultural aid in respect to the direct payments schemes

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

GHG affected: N_2O
Type of measure: regulatory and economic
Status: in force since 2016
Implemented in scenario: WAM

4.5.9 Reduced number of dairy cattle - Ordinance of the Government of the Slovak Republic No. 342/2014 Coll. laying down the rules for the granting of agricultural aid in respect to the direct payments schemes

Decreasing the number of dairy cattle.
GHG affected: CH_4
Type of measure: regulatory and economic
Status: in force since 2014
Implemented in scenario: WEM

4.5.10 New animal feeding policy implementation - Ordinance of the Government of the Slovak Republic No. 342/2014 Coll. laying down the rules for the granting of agricultural aid in respect to the direct payments schemes

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 2016
Implemented in scenario: WAM

4.6 SECTORAL POLICIES AND MEASURES – LAND USE, LAND USE CHANGE AND FORESTRY (LULUCF)

- The Rural Development Programme for the period of 2014 - 2020 (as referred to in section 4.5.3)
- Conception of the Agricultural Development of the Slovak Republic for the years 2013 -2020 (as referred to in section 4.5.4)

4.6.1 Forest Strategy/Forest Action Plan

The Forest Action Plan includes several key actions referring to climate change mitigation: the promotion of forest biomass for energy generation, EU compliance with UNFCCC and Kyoto obligations and protection of EU forests.
GHG affected: CO_2
Type of measure: regulatory with direct impact on emissions
Status: in force from 2006
Implemented in scenario: WEM

4.6.2 Forest measures within the Rural Development Policy

Forestry is an integral part of rural development; support for sustainable and climate-friendly land use should encompass forest area development and the sustainable management of forests.
GHG affected: CO_2
Type of measure: regulatory, economic
Status: in force from 2015

Implemented in scenario: WEM

4.6.3 LULUCF accounting

Provides the basis for the formal inclusion of the LULUCF sector and ensures a harmonized legal framework allowing the collection of reliable data by robust accounting and reporting in a standardized way.
GHG affected: CO_2
Type of measure: economic
Status: in force from 2002
Implemented in scenario: WAM

4.7 SECTORAL POLICIES AND MEASURES – WASTE MANAGEMENT

4.7.1 Act No. 79/2015 Coll. on Waste and amendments to certain acts as amended

This act introduces emphasis on the separation of packagings and recyclables. It also changes the financing scheme for separate collection from the State Recycling Fund to Organisation of Waste Producers. The impact of this change is not known. Disposal of waste is allowed only in permitted managed sites (Art. 13). This Act bans the disposal of garden waste and requires separate collection of kitchen waste but these regulations are not yet fully implemented (Art. 80).
GHG affected: CO_2, CH_4, and N_2O
Type of measure: regulatory and economic
Status: in force since 2015
Implemented in scenario: WEM

4.7.2 Waste Management Program of the Slovak Republic for 2011 - 2015

The Waste Management Plan for 2011 - 2015 includes several key targets referring to climate change mitigation: increase of waste recycling to 35% by 2015, reduction of biodegradable waste disposal in line with the Landfilling Directive (reduction to 50% by 2013, reduction to 45% by 2015 and reduction to 35% by 2020, compared with the 1995 level) requirement to introduce the separate collection of biodegradable waste and increase of land application of stabilized waste water sludge.
GHG affected: CO_2, CH_4, and N_2O
Type of measure: regulatory and economic
Status: in force since 2015
Implemented in scenario: WEM, WAM

4.7.3 Strategy on the Reduction of the Biodegradable Waste Deposition to Landfills 2010

The Strategy was prepared to enable implementation of the Landfilling Directive. Measures are aimed on increasing separation of recyclables, composting and preparation of RDF.
GHG affected: CH_4 and N_2O
Type of measure: regulatory
Status: in force since 2015
Implemented in scenario: WEM, WAM

4.7.4 Water Plan 2009 - 2015

The Water Plan for 2009 - 2015 identified the need for the reduction of organic pollution of surface water and calls for the reconstruction of 157 WWT plants, the development of 54 new WWT plants and the development of sewer systems in 277 municipalities.
GHG affected: CH_4 and N_2O

Type of measure: regulatory
Status: in force since 2009
Implemented in scenario: WEM, WAM

4.7.5 Regulation No. 372/2015 on dumping waste and temporary dumping of iron mercury

Energy efficiency improvement and reducing the energy consumption of the Industry sector.
GHG affected: N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2015
Implemented in scenario: WEM, WAM

4.7.6 Act. No. 309/2009 Coll. on support of renewable sources of energy and highly effective co-generation in amendments

The Regulatory Office for Network Industries defined the price for energy generated from landfill gas as €70/MWh and for energy generated from WWT biogas from €100 to €120/MWh (depending on capacity).
GHG affected: N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2009
Implemented in scenario: WEM, WAM

4.7.7 Act No. 364/2004 on water management last amended by Act No. 303/2016

The measure regulating waste water management through the Maximum concentrations of waste water parameters allowed for discharge are defined in Governmental Regulation No. 269/2010.
GHG affected: N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2004
Implemented in scenario: WEM, WAM

4.7.8 Plan for Development of Public Sewers for the period 2010 - 2015

The measure implements legislation on waste management. This plan was updated to cover the period up to 2021, but lacks information which would allow quantification of waste water sector development on emissions.
GHG affected: N_2O, CH_4
Type of measure: regulatory and economic
Status: in force since 2010
Implemented in scenario: WEM, WAM

4.8 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 6NC and 2BR. The national inventory system of Slovakia and changes in national inventory arrangements since 6NC and 2BR are described in Chapter 2.

None of the PaMs with a significant effect on GHG emission reduction have been cancelled without replacement. Act no. 572/2004 Coll. on Emission Trading and its previous amendments has been fully replaced by Act No. 414/2012 Coll. on Emission Trading in amendments.
Ordinance of the Government of the Slovak Republic No. 488/2010 Coll. has been fully replaced by Ordinance of the Government of the Slovak Republic No. 342/2014 Coll. laying down the rules for the granting of agricultural aid in respect to the direct payments schemes.

4.9 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 chapter 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 chapter. 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.

4.9.1 ADOPTED LEGISLATIVE MEASURES

4.9.1.1 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.

4.9.1.2 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.

4.9.1.3 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.[17] 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.

[17] 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

5.1 CONTEXT

The year 2014 was determined as the reference year for greenhouse gas emission projections for all three scenarios and verified data sets from the national inventory of greenhouse gas emissions were used for modelling. The gases covered are: CH_4, CO_2, N_2O and F-gases. The sectors covered are: Energy (including transport), Industrial processes and product use, Agriculture, LULUCF and Waste.

5.2 SCENARIOS

Projections of GHG emissions were prepared for years 2015 - 2040 within the following scenarios:
Without measures scenario (WOM) – projections exclude reductions achieved or expected from all measures adopted after 1 January 2015 and exclude all planned measures. The without measures scenario represents the reference scenario to define emission levels and represents a business as usual scenario type - BAU.
With measures scenario (WEM) – projections reflect all measures implemented or adopted before the date of preparation of the projections (31 December 2016).
With additional measures scenario (WAM) – projections include WEM policies and measures and all other measures still planned (not yet adopted by the date of preparation of the projections).

5.3 KEY PARAMETERS AND ASSUMPTIONS

Table 5.1 represents main projection parameters for the projection in base the year 2014 and additional cross years.

Table 5.1: *Applied projection main parameters*

Item	Units	2014	2015	2020	2025	2030	2035	2040
Gross domestic product: Constant prices	EUR million	73,530	76,347	88,878	101,774	116,443	127,210	127,210
Population	1000 People	5,419	5,424	5,503	5,543	5,558	5,550	5,550
EU ETS carbon price	EUR/EUA	4.5	4.5	15	22.5	33.5	42	42
International coal import prices	EUR/GJ	1.8	1.9	2.2	2.6	3.2	3.4	3.4
International oil import prices	EUR/GJ	9.5	9.8	11.6	13.2	14.5	15.1	15.1
International gas import prices	EUR/GJ	6.1	6.3	7.5	8.1	8.8	9.4	9.4

5.4 PROJECTIONS

5.4.1 Total aggregate GHG emission projections

GHG emissions from international transport are not included in the national balance. GHG emission projections from international aviation and international navigation have been developed for the scenario with measures. From the data in Table 5.2, it is obvious that projected GHG emissions from these categories are negligible in comparison with other sources.

Table 5.2: *Aggregated data on the projections of GHG emissions from international transport for scenario with existing measures (Gg CO_2 eq.)*

WEM	2014	2015	2020	2025	2030	2035	2040
M.International bunkers	133.84	134.38	137.11	138.15	139.66	139.66	139.66
M.IB.Aviation	119.43	119.97	122.71	123.74	125.26	125.26	125.26
M.IB.Navigation	14.40	14.40	14.40	14.40	14.40	14.40	14.40

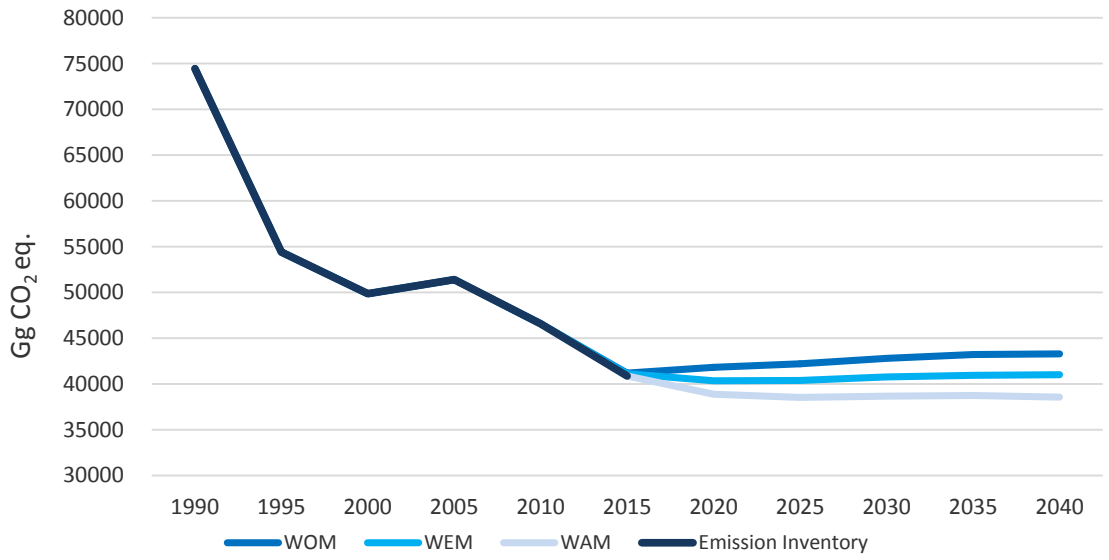
The projections of GHG emissions recalculated to equivalents of CO_2 according to valid values of GWP have been developed for all IPCC sectors, defined years and relevant scenarios. Table 5.3 shows the results of modelling data in summary.

Table 5.3: *Projection of aggregated GHG emissions in monitored sectors (Gg CO_2 eq.)*

WOM	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Total excluding LULUCF	74,460	54,412	49,863	51,396	46,560	41,188	41,819	42,179	42,790	43,194	43,269
Total including LULUCF	65,469	45,127	40,144	45,791	40,547	35,984	36,567	37,399	38,272	38,524	38,600
1. Energy	56,668	39,568	36,540	36,759	32,741	27,627	28,093	28,563	28,952	28,957	28,640
2. Industrial processes	9,813	9,383	8,594	10,258	9,610	9,080	9,262	9,355	9,700	10,157	10,542
3. Agriculture	6,587	4,122	3,379	3,022	2,813	3,020	2,977	2,758	2,673	2,670	2,676
4. LULUCF	-8,991	-9,284	-9,719	-5,605	-6,013	-5,204	-5,253	-4,780	-4,518	-4,670	-4,670
5. Waste	1,393	1,339	1,351	1,357	1,395	1,461	1,488	1,503	1,465	1,411	1,411
WEM	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Total excluding LULUCF	74,460	54,412	49,863	51,396	46,560	41,099	40,336	40,374	40,744	40,940	41,014
Total including LULUCF	65,469	45,127	40,144	45,791	40,547	35,870	35,070	35,582	36,214	36,258	36,332
1. Energy	56,668	39,568	36,540	36,759	32,741	27,546	26,959	27,168	27,372	27,248	26,936
2. Industrial processes	9,813	9,383	8,594	10,258	9,610	9,073	8,912	8,945	9,234	9,611	9,991
3. Agriculture	6,587	4,122	3,379	3,022	2,813	3,020	2,977	2,758	2,673	2,670	2,676
4. LULUCF	-8,991	-9,284	-9,719	-5,605	-6,013	-5,230	-5,265	-4,793	-4,530	-4,682	-4,682
5. Waste	1,393	1,339	1,351	1,357	1,395	1,461	1,488	1,503	1,465	1,411	1,411
WAM	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Total excluding LULUCF	74,460	54,412	49,863	51,396	46,560	40,877	38,880	38,514	38,647	38,721	38,570
Total including LULUCF	65,469	45,127	40,144	45,791	40,547	35,647	33,603	33,710	34,106	34,028	33,877
1. Energy	56,668	39,568	36,540	36,759	32,741	27,364	25,801	25,699	25,693	25,494	25,191
2. Industrial processes	9,813	9,383	8,594	10,258	9,610	9,073	8,823	8,751	8,988	9,313	9,460
3. Agriculture	6,587	4,122	3,379	3,022	2,813	2,979	2,768	2,561	2,502	2,502	2,509
4. LULUCF	-8,991	-9,284	-9,719	-5,605	-6,013	-5,230	-5,276	-4,804	-4,542	-4,693	-4,693
5. Waste	1,393	1,339	1,351	1,357	1,395	1,461	1,488	1,503	1,465	1,411	1,411

Aggregated data on projections of GHG emissions according to the three modelled scenarios in the period of 1990 - 2040 are summarised in Figure 5.1. Their trends show that the reduction target under the Kyoto Protocol can also be achieved by the scenario without measures during the first binding period with the prospective until 2030.

Figure 5.1: *Projections of aggregated GHG emissions according to defined scenarios in the monitored sectors*



5.4.2 Emission projections from energy sector including transport

The energy sector produces GHG emissions from the 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 updated predictions of the sectoral value added (VA) growth, fuel prices and energy carriers' prices, sectoral energy demand as well as the predictions of population development in the Slovak Republic from the Slovak Demographic Research Centre and the Energy Efficiency Action Plan for the period 2014 - 2016 with the outlook for 2020.

The outputs from modelling were determined by reduction potential of measures to reduce greenhouse gas emissions. Updated figures from macroeconomic and demographic data forecasts were applied for the period of 2015 - 2040 and an increase in the VA growth rate and sectoral energy demand has been reflected in final energy demand for several industrial sectors (Table 5.2) according to the EU Reference Scenario 2016.

The MESSAGE model was used for stationary sources i.e. CRF categories 1.A.1, 1.A.2, 1.A.4 and 1.A.5 while the TREMOVE model was used for transportation category 1.A.3.

Table 5.4: *Parameters applied for energy consumption projection in relevant economical branches*

Item	Units	2014	2015	2020	2025	2030	2035	2040
Final energy demand:-Total	TJ	364,705	382,904	397,295	389,636	384,929	378,169	368,164
Final energy demand:-Industry	TJ	134,830	138,781	142,804	139,060	134,950	127,889	118,995
Final energy demand:-Transport	TJ	90,765	90,828	96,788	99,370	104,337	108,324	109,846
Final energy demand:-Residential	TJ	81,723	83,219	84,436	85,050	85,278	85,161	85,045
Final energy demand:-Agriculture/Forestry	TJ	5,754	6,297	6,670	6,483	6,357	6,158	5,872
Final energy demand:-Services	TJ	51,633	63,779	66,598	59,671	54,008	50,637	48,406
Transport parameters								
Number of passenger-kilometres	million pkm	37,631	37,979	45,075	51,338	57,597	62,133	62,133
Freight transport tonnes-kilometres	million tkm	22,713	22,938	26,055	28,985	32,067	34,289	34,289
Final energy demand for road transport	TJ	86,851	86,911	92,184	94,099	98,391	101,904	101,904

In the *WOM* scenario all implemented measures are included in the emission level for the scenario base year 2014. Emission levels in the following years are determined by the final energy growth rate only.

Parameters and PAMs used in the energy sector:
Modelling emission projections in the energy sector are based on the following input data and information:

- Updated forecasts of the VA growth, based on the annual growth rate used in Reference Scenario 2016 (PRIMES Model).
- Updated forecasts of final energy consumption of industrial branches, residential heat generation and other energy consumption in residential, and other non/industrial sectors from Reference Scenario 2016 (PRIMES Model).
- The impact of energy savings in family house buildings has been modelled by implementing the Energy Efficiency Action Plan for the period of 2014 - 2016 with the outlook for 2020 adopted in July 2014 (as referred to in section 4.3.2).
- The impact of energy savings in the public sector has been modelled by implementing the Energy Efficiency Action Plan for the period of 2014 - 2016 with the outlook for 2020 adopted in July 2014 (as referred to in section 4.3.3).
- The impact of energy savings in the residential sector, e.g. individual and apartment houses, has been modelled by implementing the Energy Efficiency Action Plan for the period of 2014 - 2016 with the outlook for 2020 adopted in July 2014 (as referred to in section 4.3.4).
- The impact of RES in heat and electricity generation has also been implemented in the WEM scenario, considering the National Renewable Energy Action Plan (Government Resolution of the SR No. 677/2010) (as referred to in section 4.3.1).
- The input data from this plan in the period of 2014 - 2020 has been implemented in the WEM scenario.
- The 4th Energy Efficiency Action Plan for the period of 2017 - 2019 with the outlook for 2020 has been used for the WAM scenario; (as referred to in section 4.3.6; 4.3.7; 4.3.8).
- The population growth forecast from the Demographic Research Centre.
- The fuel mix and emission data from individual ETS sources as well as data from energy statistics were used as input data in the MESSAGE model.
- Fuel prices from the Regulatory Office have been used for the base year 2014 and the year 2015. The trend was modelled using EU recommended data. The CO_2 marker prices for ETS have been used from this source as well.

Outcomes from modelling were determined by the reduction potential of measures, their synergies and also by the costs of implementation. Updated figures from macroeconomic and demographic data forecasts were applied for the period of 2010 - 2040 and the trend of gross value added, or final energy demand has been reflected in figures for several industrial sectors.

Parameters and PAMs used in the energy sector – Transport:
The existing measures in transport and the other sectoral information from the Ministry of Transport, Construction and Regional Development of the Slovak Republic were taken into consideration for WOM, WEM and WAM scenarios. Projections in transport were prepared by the TREMOVE model, which is based on data from the COPERT model, used for emission inventory in road transport. Data for transport projected parameters have been obtained from the Reference Scenario 2016.
Emission projections from transport were prepared with the following assumptions:

- Biofuels support: additional increase of biofuel share in fuel. The biofuel share in fuels should be in accordance with Act No. 309/2009 Coll. on the promotion of renewable energy sources and highly efficient cogeneration:

Table 5.5: *Expected biofuels share in fuels*

Item	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
biodiesel	5.2%	5.3%	5.4%	6.8%	6.8%	6.9%	6.9%	6.9%	6.9%	6.9%
bioethanol	3.1%	3.2%	3.3%	4.1%	4.5%	4.6%	4.7%	5.9%	6.2%	7.4%
Item	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
biodiesel	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
bioethanol	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%

- Effect of European legislative – Regulation No. 2009/443/EC and Regulation No. 2011/510/EC which set limits for CO_2 emissions from car and vans (as referred to in section 4.3.18).
- Effect of EU White Paper on the transportation of goods over long distances from trucks to rail (as referred to in section 4.3.21).
- Support of rail transport use by passengers: free tickets for students and seniors and other discounts (as referred to in section 4.3.12).
- Civil aviation under the ETS scheme (as referred to in section 4.3.19).
- Hybrid transport in cities - Action Plan for Energy Efficiency 2011 - 2013, Government Resolution of the SR No. 301/2011 Coll. (as referred to in section 4.3.10).
- Modal shift to public transport - Action Plan For Energy Efficiency 2011 - 2013, Government Resolution of the SR No. 301/2011 Coll. (as referred to in section 4.3.11).
- Modal shift to public transport - Transport Policy of the Slovak Republic into 2015 (as referred to in section 4.3.12).
- Improved transport behaviour and road infrastructure - Transport Policy of the Slovak Republic into 2015 (as referred to in section 4.3.13);
- Introduction of Euro 6 emission standards - Transport Policy of the Slovak Republic into 2015 (as referred to in section 4.3.14).
- Government Regulation No. 246/2006 Coll. on the minimum quantity of fuels produced from renewable sources in the petrol and diesel fuels placed on the market in the Slovak Republic (as referred to in section 4.3.15).
- Decree No. 362/2010 Coll. determining the requirements for the quality of fuels and maintaining operational evidence on fuels (as referred to in section 4.3.16).
- Regulation No. 655/2007 Coll. on technical conditions to reduce emissions from air conditioning systems in motor vehicles (as referred to in section 4.3.17).
- Electromobility Development Strategy – sales support for electric vehicles (as referred to in section 4.3.20).

Parameters and PAMs used in the energy sector – fugitive emissions:

The fugitive emissions of CH_4 from transport and the distribution of natural gas and oil in the SR have been calculated from the following data:

- Data of NG and oil have been obtained from the sources:
  - the Statistical Office of the SR (for the years 2014 and 2015);
  - the „Reference Scenario 2016“ (for the years 2015 - 2035).

- For the calculation of fugitive methane emissions, emission factors from the following sources were used:
  - 2006 IPCC Guidelines for National GHG Inventories - Chapter 4: Fugitive Emissions.

Table 5.6: *Expected production, transmission and distribution of oil and NG in the SR in the years 2015 - 2035*

Activity	unit	2014	2015	2020	2025	2030	2035
Oil production	t	12,000	12,000	0	0	0	0
Oil processing	t	5,220,000	5,954,527	5,272,940	5,123,536	5,018,020	5,011,865
NG production	mil. m^3	100	93	93.078	92.754	91.735	87.372
Long-distance NG transmission	mil. m^3	46,500	55,800	68,454.601	67,601.291	66,659.537	69,201.164
NG distribution	mil. m^3	4,014	4,639	5,601.683	5,579.961	5,523,536	5,287.752

The fugitive methane emissions from underground coal mining and post-mining activities in the Slovak Republic have been calculated from the following data:

- Data of coal production in the years 2014 and 2015 from single underground mines, have been obtained from official sources – the companies: HBP, a.s., Baňa Dolina, a.s. and Baňa Čáry, a.s.;
- Data of expected coal production for the years 2015 - 2035, have been obtained from sources of the Ministry of Economy of the SR – "The Energy Policy of the Slovak Republic 2014". Table 1 provides expected values of coal production in the years 2015 - 2035;
- For the calculation of fugitive methane and CO2 emissions, emission factors from "IEA – CIAB Global Methane and the Coal Industry" and specifications of mine operator HBP, a.s. were used.

Table 5.7: *Production of coal and expected development up to 2035*

Mine	Unit	2014	2015	2020	2025	2030	2035
Cigeľ	kt	606	401	0	0	0	0
Handlová	kt	253	233	0	0	0	0
Nováky	kt	1,093	1,187	1,350	1,300	1,300	1,300
HBP, a. s. total	kt	1,952	1,820	1,350	1,300	1,300	1,300
BD, a. s.	kt	70	22	0	0	0	0
BČ, a. s.	kt	166	97	450	500	500	500
Slovakia total	kt	2,188	1,939	1,800	1,800	1,800	1,800

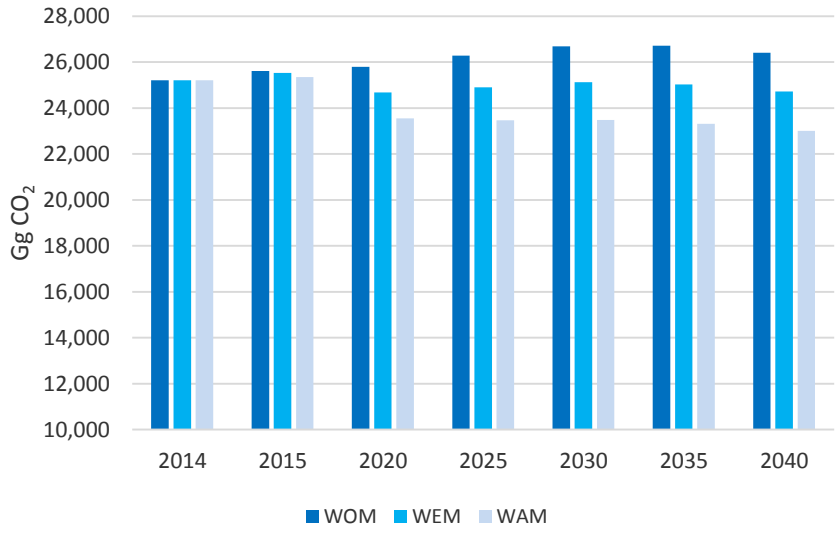
5.4.2.1 Projections of CO_2 emissions

Figure 5.8 shows the results of modelling projections of CO_2 emissions according to the particular scenarios. Anticipated dynamics of economic growth will lead to an increase in CO_2 emissions. The effect of the included measures caused a decrease of emissions in the WEM and WAM scenarios.

Table 5.8: *Projections of CO_2 emissions in sector energy (Gg)*

WOM	2014	2015	2020	2025	2030	2035	2040
1. Energy	**25,202.3**	**25,609.4**	**25,792.2**	**26,279.5**	**26,684.7**	**26,717.1**	**26,401.5**
1.A Fuel Combustion Activities	25,174.6	25,588.6	25,773.8	26,261.5	26,666.7	26,699.2	26,383.5
1.A.1 Energy Industries	7,072.7	7,272.6	6,627.6	6,615.1	6,501.2	6,341.9	6,125.8
1.A.2 Manufacturing Industries and Construction	7,235.4	7,196.9	7,362.7	7,352.7	7,381.9	7,363.7	7,342.7
1.A.3 Transport	6,415.7	6,665.3	7,205.6	7,863.1	8,479.3	8,780.2	8,772.0
1.A.4 Other Sectors	4,398.8	4,402.7	4,523.1	4,375.1	4,246.6	4,156.5	4,088.6
1.A.5 Other	52.0	51.1	54.7	55.4	57.8	56.9	54.5
1.B Fugitive Emissions from Fuels	27.7	20.8	18.4	18.0	18.0	17.9	17.9
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**25,202.3**	**25,529.9**	**24,674.0**	**24,903.2**	**25,126.3**	**25,031.6**	**24,720.3**
1.A Fuel Combustion Activities	25,174.6	25,509.1	24,655.7	24,885.2	25,108.3	25,013.7	24,702.4
1.A.1 Energy Industries	7,072.7	7,218.0	6,128.1	6,040.3	5,864.5	5,638.4	5,414.6
1.A.2 Manufacturing Industries and Construction	7,235.4	7,196.9	7,183.7	7,173.6	7,202.6	7,184.2	7,175.1
1.A.3 Transport	6,415.7	6,665.3	6,917.5	7,392.2	7,888.3	8,129.2	8,120.9
1.A.4 Other Sectors	4,398.8	4,377.8	4,371.7	4,223.7	4,095.2	4,005.1	3,937.2
1.A.5 Other	52.0	51.1	54.7	55.4	57.8	56.9	54.5
1.B Fugitive Emissions from Fuels	27.7	20.8	18.4	18.0	18.0	17.9	17.9
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**25,202.3**	**25,352.7**	**23,542.1**	**23,461.1**	**23,473.6**	**23,308.2**	**23,006.2**
1.A Fuel Combustion Activities	25,174.6	25,331.9	23,523.8	23,443.1	23,455.6	23,290.2	22,988.2
1.A.1 Energy Industries	7,072.7	7,137.8	5,568.5	5,489.9	5,371.3	5,208.3	4,993.8
1.A.2 Manufacturing Industries and Construction	7,235.4	7,169.4	7,097.9	7,087.8	7,116.8	7,098.4	7,089.3
1.A.3 Transport	6,415.7	6,665.3	6,754.0	6,909.3	7,137.6	7,244.6	7,236.4
1.A.4 Other Sectors	4,398.8	4,308.4	4,048.7	3,900.7	3,772.2	3,682.1	3,614.2
1.A.5 Other	52.0	51.1	54.7	55.4	57.8	56.9	54.5
1.B Fugitive Emissions from Fuels	27.7	20.8	18.4	18.0	18.0	17.9	17.9

Figure 5.2: *Projections of CO_2 emissions according to defined scenarios in sector energy.*



5.4.2.2 Projections of CH_4 emissions

The energy-related CH_4 emissions arise from the combustion and transformation of fossil fuel. Fugitive methane emissions arise from the extraction, transport and processing of fuels. The projections of CH_4 emissions from the combustion and transformation of fossil fuels have been modelled by means of the fuel consumption in individual scenarios according to the IPCC method and recommended IPCC aggregated emission factors. In the case of CH_4 emissions in transport, emission factors from the COPERT IV model were applied for individual types of vehicles. Modelling made use of the same scenarios as in the case of CO_2 emissions from the combustion and transformation of fuels (chapter 6.4.2.1). This approach allows for finding out the effect of measures aimed at the reduction of CO_2 emissions to the level of CH_4 emissions. Annual fugitive emissions of CH_4 have been calculated for the following activities (Table 5.9):

- underground mining and post-mining activities;
- transport and processing of oil and oil products;
- extraction and transport of natural gas;
- venting and flaring.

Table 5.9: *Projections of CH_4 emissions in the energy sector (Gg)*

WOM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**67.8**	**72.8**	**83.7**	**82.7**	**81.7**	**80.6**	**80.5**
1.A Fuel Combustion Activities	9.6	9.6	9.7	9.6	9.6	9.5	9.5
1.B Fugitive Emissions from Fuels	58.2	63.2	74.0	73.0	72.2	71.1	71.1
1.B.1 Solid fuels	15.3	12.8	11.5	11.6	11.5	11.4	11.4
1.B.2 Oil and natural gas	42.8	50.4	62.5	61.5	60.7	59.7	59.7
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**67.8**	**72.7**	**83.4**	**82.3**	**81.3**	**80.1**	**80.0**
1.A Fuel Combustion Activities	9.6	9.6	9.4	9.2	9.1	9.0	9.0
1.B Fugitive Emissions from Fuels	58.2	63.2	74.0	73.0	72.2	71.1	71.1
1.B.1 Solid fuels	15.3	12.8	11.5	11.6	11.5	11.4	11.4
1.B.2 Oil and natural gas	42.8	50.4	62.5	61.5	60.7	59.7	59.7
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**67.8**	**72.6**	**82.8**	**81.7**	**80.7**	**79.5**	**79.5**
1.A Fuel Combustion Activities	9.6	9.5	8.8	8.7	8.5	8.4	8.4
1.B Fugitive Emissions from Fuels	58.2	63.2	74.0	73.0	72.2	71.1	71.1
1.B.1 Solid fuels	15.3	12.8	11.5	11.6	11.5	11.4	11.4
1.B.2 Oil and natural gas	42.8	50.4	62.5	61.5	60.7	59.7	59.7

5.4.2.3 Projections of N_2O emissions

The energy-related N_2O emissions arise from the combustion and transformation of fossil fuel. The production of N_2O emissions from transport has also been calculated within this sector. Similarly to methane, the projections of N_2O emissions are calculated by means of the IPCC method, which makes use of recommended emission factors. In transport the emission factors for individual types of vehicles from the COPERT IV model are used. Scenarios for the calculation of emissions from the combustion and transformation of fuels are the same as the scenarios for CO_2 and CH_4 emissions and it allows for analysing the effect of measures focused on the reduction of CO_2 emissions and the production of N_2O.

Table 5.10: *Projections of N_2O emissions in sector energy (Gg)*

WOM	2014	2015	2020	2025	2030	2035	2040
1. Energy	**0.641**	**0.666**	**0.701**	**0.727**	**0.751**	**0.757**	**0.754**
1.A Fuel Combustion Activities	0.641	0.666	0.701	0.727	0.751	0.757	0.754
1.A.1 Energy Industries	0.148	0.156	0.142	0.144	0.141	0.139	0.137
1.A.2 Manufacturing Industries and Construction	0.124	0.124	0.126	0.124	0.123	0.119	0.122
1.A.3 Transport	0.207	0.223	0.264	0.292	0.322	0.336	0.336
1.A.4 Other Sectors	0.162	0.163	0.169	0.166	0.164	0.162	0.158
1.A.5 Other	0.001	0.001	0.001	0.001	0.001	0.001	0.001
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**0.641**	**0.662**	**0.673**	**0.696**	**0.718**	**0.722**	**0.720**
1.A Fuel Combustion Activities	0.641	0.662	0.673	0.696	0.718	0.722	0.720
1.A.1 Energy Industries	0.148	0.152	0.118	0.119	0.117	0.113	0.111
1.A.2 Manufacturing Industries and Construction	0.124	0.124	0.125	0.124	0.123	0.119	0.122
1.A.3 Transport	0.207	0.223	0.261	0.287	0.315	0.329	0.329
1.A.4 Other Sectors	0.162	0.163	0.167	0.165	0.163	0.160	0.157
1.A.5 Other	0.001	0.001	0.001	0.001	0.001	0.001	0.001
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**0.641**	**0.656**	**0.633**	**0.655**	**0.675**	**0.668**	**0.666**
1.A Fuel Combustion Activities	0.641	0.656	0.633	0.655	0.675	0.668	0.666
1.A.1 Energy Industries	0.148	0.147	0.085	0.085	0.082	0.080	0.078
1.A.2 Manufacturing Industries and Construction	0.124	0.124	0.125	0.123	0.122	0.118	0.121
1.A.3 Transport	0.207	0.223	0.261	0.286	0.313	0.314	0.314
1.A.4 Other Sectors	0.162	0.162	0.162	0.160	0.158	0.155	0.152
1.A.5 Other	0.001	0.001	0.001	0.001	0.001	0.001	0.001

5.4.2.4 Projections of aggregated GHG emissions

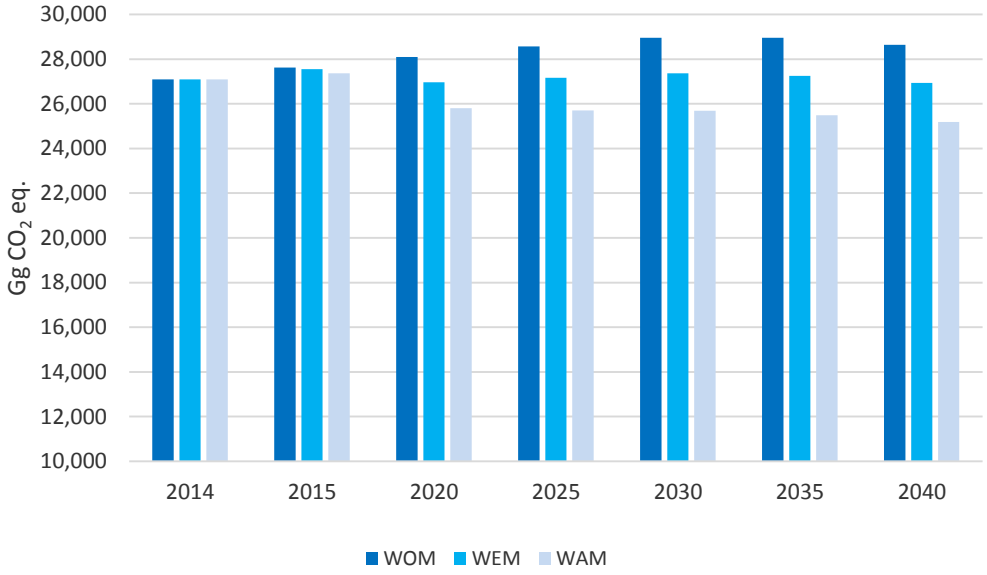
Table 5.11 shows aggregate projections of GHG emissions in the energy sector. Figure 5.3 shows the comparison of projected emissions in the energy sector in CO_2 eq. by 2020 for all scenarios as well as their index of emission level toward the UNFCCC base year (1990).

Table 5.11: *Aggregated projections of GHG emissions in the energy sector (Gg CO_2 eq.)*

WOM	2014	2015	2020	2025	2030	2035	2040
1. Energy	**27,088**	**27,627**	**28,093**	**28,563**	**28,952**	**28,957**	**28,640**
1.AFuel Combustion Activities	25,605	26,027	26,225	26,719	27,129	27,162	26,845
1.A.1 Energy Industries	7,135	7,338	6,689	6,677	6,562	6,402	6,185
1.A.2 Manufacturing Industries and Construction	7,290	7,251	7,418	7,407	7,436	7,417	7,397
1.A.3 Transport	6,493	6,748	7,299	7,963	8,587	8,892	8,883
1.A.4 Other Sectors	4,634	4,639	4,764	4,615	4,486	4,394	4,324
1.A.5 Other	53	52	55	56	59	58	55
1.B Fugitive Emissions from Fuels	**1,482**	**1,600**	**1,868**	**1,844**	**1,822**	**1,795**	**1,795**
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**27,088**	**27,546**	**26,959**	**27,168**	**27,372**	**27,248**	**26,936**
1.A Fuel Combustion Activities	25,605	25,946	25,092	25,324	25,550	25,454	25,141
1.A.1 Energy Industries	7,135	7,281	6,178	6,091	5,914	5,687	5,462
1.A.2 Manufacturing Industries and Construction	7,290	7,251	7,238	7,228	7,257	7,237	7,229

1.A.3 Transport	6,493	6,748	7,009	7,487	7,988	8,232	8,223
1.A.4 Other Sectors	4,634	4,613	4,611	4,462	4,332	4,241	4,171
1.A.5 Other	53	52	55	56	59	58	55
1.B Fugitive Emissions from Fuels	**1,482**	**1,600**	**1,868**	**1,844**	**1,822**	**1,795**	**1,795**
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1. Energy	**27,088**	**27,364**	**25,801**	**25,699**	**25,693**	**25,494**	**25,191**
1.A Fuel Combustion Activities	25,605	25,764	23,934	23,855	23,870	23,700	23,396
1.A.1 Energy Industries	7,135	7,199	5,603	5,525	5,405	5,241	5,026
1.A.2 Manufacturing Industries and Construction	7,290	7,224	7,152	7,142	7,170	7,151	7,143
1.A.3 Transport	6,493	6,748	6,845	7,003	7,237	7,343	7,334
1.A.4 Other Sectors	4,634	4,542	4,277	4,129	3,999	3,907	3,838
1.A.5 Other	53	52	55	56	59	58	55
1.B Fugitive Emissions from Fuels	1,482	1,600	1,868	1,844	1,822	1,795	1,795

Figure 5.3: *Projections of aggregated GHG emissions*



5.4.3 Emission projection from sector industrial processes and product use

The industrial processes and products use sector is not in general as sensitive to different PaMs implementation as the energy sector due to the principle of emission production following stoichiometry. One of the most important measures in this sector is using BAT technologies. Therefore the basis for both scenarios is the value added growth following the reference scenario with only limitation being maximal technological capacity of production. The following measures were included in all scenarios.

In the ***WOM*** scenario all implemented measures are included in emission levels in the scenario base year 2014. Emission levels in the following years are determined by the value added growth rate only.

*Parameters and other key information for trend development in industry for the **WEM** scenario:*

- Improved technology was installed in 2 ammonia plants in 2014 and outcomes were used in the scenario.

- Modernization of the production unit of ethylene with lower emissions by -16% will be put in operation in 2016.
- Stable N_2O emission factors from nitric acid production due to the precise control of the technological process (as referred to in section 4.4.1).
- Stable PFCs emissions from aluminium production due to the precise control of the technological process (as referred to in section 4.4.2).
- The increase of HFC emissions will be less dynamic due to the significant increase of coolants with new HFC gases (with lower GWP) after 2020 and continual replacement of recycling HCFC coolants with "natural coolants" (as referred to in section 4.4.5).
- Stable SF_6 emission factors from electrical equipment due to the use of BAT when servicing units (as referred to in section 4.4.9).
- Lower content of N_2O in aerosol cans after 2020 (as referred to in section 4.4.7).

*Parameters and other key information for trend development in industry for the **WAM** scenario:*

- Improved technology was installed in 2 ammonia plants in 2014 and outcomes were used in the scenario.
- The utilisation of non-carbonates raw materials for cement production will start after 2020 (such as ground granulated blast-furnace slag) with an assumed 5% input into kiln load (as referred to in section 4.4.3).
- The reduction or closure of dolomite lime mining operations after 2020 can occur (as referred to in section 4.4.4).
- In addition to the parameters described in the WEM scenario for F-gases, foams containing HFCs will be forbidden; coolants with high GWP will also be restricted. Increased use of F-gases that are not covered by IPCC (such as HFO) will start in a significant manner after 2025. The utilisation of F-gases with lower GWP in aerosols and fire extinguishers will be mandatory (as referred to in section 4.4.6).
- Service of electric equipment will be possible only on BAT level technology and only in "sealed for life" systems (as referred to in section 4.4.10).

5.4.3.1 Projections of CO_2 emissions

The drivers in the mineral, chemical, metallurgy and other industries were value added growth. This driver estimates non-energy CO_2 projections. Emission generation is influenced only by stoichiometry. Production of CO_2 emissions in scenarios depends directly on the production of construction materials and the use of mineral raw materials. Projections of emissions reflect the influence of applied measures with a gradual increase in production by 2040. Measures connected with fuel consumption and the increasing share of renewable energy sources was already included in projections of the energy sector (category 1.A.2). Table 5.12 shows CO_2 emission projections of the *industrial processes and product use sector*.

***Table 5.12:** Projections of CO_2 emissions in the industrial processes and product use sector (Gg)*

WOM	2014	2015	2020	2025	2030	2035	2040
2. Industrial Processes	**8,134.3**	**8,119.8**	**8,344.5**	**8,550.8**	**8,911.3**	**9,355.7**	**9,738.0**
2.A Mineral Products	2,277.1	2,268.8	2,199.6	2,329.5	2,701.5	3,305.2	4,056.3
2.B Chemical Industry	1,219.1	1,232.1	1,299.2	1,401.4	1,517.8	1,588.7	1,662.8
2.C Metal Production	4,540.4	4,523.2	4,754.9	4,721.0	4,583.6	4,347.7	3,904.8
2.D Non-energy products	97.8	95.8	90.9	98.8	108.4	114.1	114.1

WEM	2014	2015	2020	2025	2030	2035	2040
2. Industrial Processes	**81,34.3**	**8,112.9**	**8,054.4**	**8,285.8**	**8,673.2**	**9,117.3**	**9,499.2**
2.A Mineral Products	2,277.1	2,268.8	2,199.6	2,329.5	2,701.5	3,305.2	4,056.3
2.B Chemical Industry	1,219.1	1,232.1	1,230.2	1,367.6	1,511.1	1,581.8	1,655.6
2.C Metal Production	4,540.4	4,516.3	4,533.8	4,489.8	4,352.2	4,116.2	3,673.2
2.D Non-energy products	97.8	95.8	90.9	98.8	108.4	114.1	114.1
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial Processes	**8,134.3**	**8,112.9**	**7,965.4**	**8,117.4**	**8,495.8**	**8,936.2**	**9,317.5**
2.A Mineral Products	2,277.1	2,268.8	2,158.9	2,213.5	2,578.4	3,179.8	3,930.9
2.B Chemical Industry	1,219.1	1,232.1	1,219.6	1,355.9	1,498.2	1,568.4	1,641.6
2.C Metal Production	4,540.4	4,516.3	4,496.0	4,449.1	4,310.8	4,073.9	3,630.9
2.D Non-energy products	97.8	95.8	90.9	98.8	108.4	114.1	114.1

5.4.3.2 Projections of CH_4 emissions

The production of ammonia and ferroalloys is the main sources of methane emissions in the industrial processes sector in the Slovak Republic. The projections are shown in Table 5.13. Methane emissions are directly connected with the consumption of natural gas (and thus with the production of ammonia) and with the production of ferrosilicium alloys. Thus only one scenario was assumed, based on value added growth.

Table 5.13: *Projections of CH_4 emissions from ammonia and ferroalloys production (Gg)*

WEM	2014	2015	2020	2025	2030	2035	2040
2. Industrial Processes	0.0622	0.0706	0.0673	0.0723	0.0770	0.0805	0.0805
2.B Chemical Industry	0.0119	0.0222	0.0209	0.0226	0.0245	0.0256	0.0256
2.C Metal Production	0.0504	0.0484	0.0463	0.0497	0.0526	0.0549	0.0549

5.4.3.3 Projections of N_2O emissions

Nitric acid production is the major source of N_2O emissions. Nitric acid is produced in two plants. In 2014, improved technology with a secondary catalyst was used in both plants. This led to a reduction of N_2O emissions. The inclusion of this activity into the EU ETS was an impulse to further steps leading to a reduction of emissions. The other source of N_2O emissions (use of natural gas for the production of ammonia) is negligible. Modelling results are presented in Table 5.14.

Table 5.14: *Projections of N_2O emissions from ammonia and nitric acid production (Gg)*

WEM	2014	2015	2020	2025	2030	2035	2040
2. Industrial Processes	0.756	0.672	0.649	0.674	0.703	0.718	0.709
2.B Chemical Industry	0.487	0.471	0.426	0.460	0.498	0.521	0.521
2.G Other product manufacture and use	0.269	0.201	0.223	0.214	0.205	0.196	0.187

5.4.3.4 Projections of PFCs HFCs and SF_6 emissions

PFC emissions

During aluminium production, the perfluorocarbons CF_4 a C_2F_6 emissions are produced. These emissions are produced by the technological perturbation of the so called “anode effect”. This effect is connected with the quality of technological process. This quality is very high in the Slovak Republic, therefore these emissions are on a low level. The inclusion of this activity into the EU ETS was an

impulse to further steps leading to reducing emissions. The projected emissions of PFC from aluminium production are presented in Table 5.15.

Table 5.15: *Projections of PFCs emissions in the industrial processes and product use sector (Gg CO_2 eq.)*

WOM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2.C.3 Aluminium Production	11.1	8.5	10.7	11.4	12.1	12.6	12.6
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2.C.3 Aluminium Production	11.1	8.5	8.1	8.7	9.2	9.6	9.6

HFC and SF_6 emissions

Fluorinated gases (F-gases) are among three basic groups of greenhouse gases defined in Annex A to the Kyoto Protocol (HFCs PFCs and SF_6). These substances have replaced the ozone depleting Freon and are monitored under the Montreal Protocol. Projections of F-gas emissions are complicated due to the relatively high number of various mixtures of gases. Some mixtures can contain 12 different gases in different proportions. The last implementation policies and measures in the F-gas agenda were taken into consideration in the WEM scenario for the sector of industrial processes. The application of new natural cooling agents (such as ammonia or CO_2) influenced emission projection trends. No trend can be predicted in fire extinguisher emissions. The F gas emissions with high GWP have a significant impact on emission level. The measures for reduction in this sector are based on the selection of appropriate equipment, filling media and services. This also allows for a supply of several gases or excluding it from use. Projected emissions of HFCs and SF_6 are summarized in Tables 5.16 and 5.17, respectively.

Table 5.16: *Projections of HFCs emissions in the industrial processes and product use sector (Gg CO_2 eq.)*

WOM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2.F Product uses as substitutes for ODS	653.8	734.9	662.5	533.6	500.4	500.4	500.4
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2.F Product uses as substitutes for ODS	653.8	734.9	637.7	430.9	322.5	250.2	250.2
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2.F Product uses as substitutes for ODS	653.8	734.9	637.7	406.1	264.4	153.5	58.7

Table 5.17: *Projections of SF_6 emissions in the industrial processes and product use sector (Gg CO_2 eq.)*

WOM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2.G Other product manufacture and use	14.2	14.3	25.6	26.4	27.1	27.8	28.6
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2.G Other product manufacture and use	14.2	14.3	16.8	17.2	17.6	18.1	18.5
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2.G Other product manufacture and use	14.2	14.3	16.8	16.3	12.3	8.3	4.3

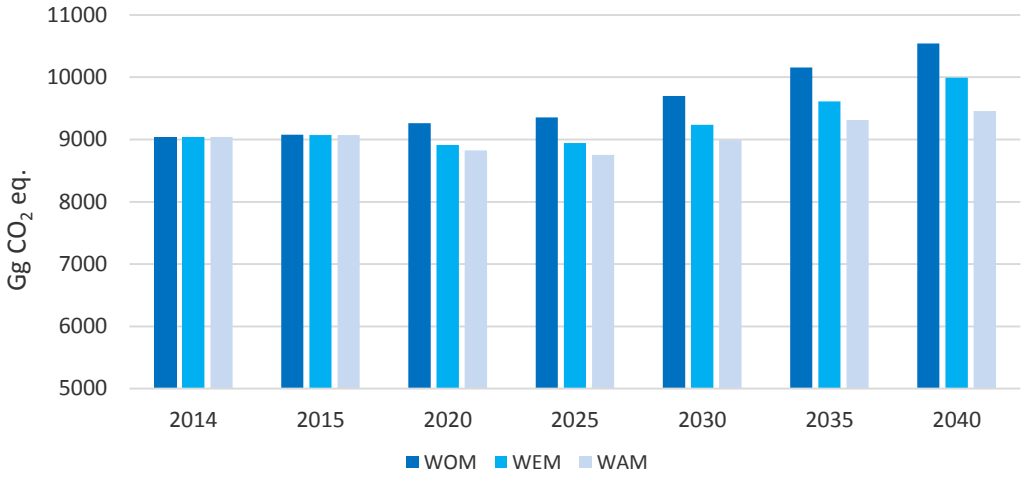
5.4.3.5 Projections of aggregated GHG emissions

Table 5.18 and figure 5.4 show aggregated data on the projections of technological GHG emissions in the industrial processes and product use processes sector including F-gasses.

Table 5.18: *Projections of aggregated GHG emissions in the industrial processes and product use sector including F-gasses (Gg CO_2 eq.)*

WOM	2014	2015	2020	2025	2030	2035	2040
2. Industrial Processes and Product Use	**9,040**	**9,080**	**9,262**	**9,355**	**9,700**	**10,157**	**10,542**
2.A Mineral Products	2,277	2,269	2,200	2,330	2,702	3,305	4,056
2.B Chemical Industry	1,365	1,373	1,449	1,563	1,693	1,772	1,846
2.C Metal Production	4,553	4,533	4,767	4,734	4,597	4,362	3,919
2.D Non-energy products	98	96	91	99	108	114	114
2.F Product uses as substitutes for ODS	654	735	663	534	500	500	500
2.G Other product manufacture and use	94	74	93	96	100	103	106
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial Processes and Product Use	**9,040**	**9,073**	**8,912**	**8,945**	**9,234**	**9,611**	**9,991**
2.A Mineral Products	2,277	2,269	2,200	2,330	2,702	3,305	4,056
2.B Chemical Industry	1,365	1,373	1,358	1,505	1,660	1,738	1,812
2.C Metal Production	4,553	4,526	4,543	4,500	4,363	4,127	3,684
2.D Non-energy products	98	96	91	99	108	114	114
2.F Product uses as substitutes for ODS	654	735	638	431	322	250	250
2.G Other product manufacture and use	94	74	83	81	79	77	74
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
2. Industrial Processes and Product Use	**9,040**	**9,073**	**8,823**	**8,751**	**8,988**	**9,313**	**9,460**
2.A Mineral Products	2,277	2,269	2,159	2,213	2,578	3,180	3,931
2.B Chemical Industry	1,365	1,373	1,347	1,493	1,647	1,724	1,669
2.C Metal Production	4,553	4,526	4,505	4,459	4,321	4,085	3,642
2.D Non-energy products	98	96	91	99	108	114	114
2.F Product uses as substitutes for ODS	654	735	638	406	264	154	59
2.G Other product manufacture and use	94	74	83	80	68	57	45

Figure 5.4: *Projections of aggregated GHG emissions according to defined scenarios in the industrial processes and product use sector including F-gasses (Gg CO_2 eq.)*



5.4.4 Emission projections from agriculture sector

The mitigation potential in agriculture is mostly connected with manure management (storage, application on soil) and animal feeding policy. Since 2011, there have been no policy papers approved

on climate change in the field of plant production or animal management. The Rural Development Programme for 2014 - 2020 was prepared where these issues were incorporated into the measures (for example, organic farming). The older policy, Act No. 220/2004 Coll. on the Protection and Use of Agricultural Land as amended, partly address the issue of poorer quality land use for the establishment of plantations of fast growing trees. It is land of a lower quality and the biomass production from it will increase renewable energy use, thereby reducing the need for fossil fuels. Current legislation and recommended good agricultural practice with measures taken are mainly manifested in the storage of waste from animal production and the integration of waste into agricultural land. Although detailed mapping of storage space is lacking, it can be assumed that in 2015 in the Slovak Republic, all liquid waste was stored in a covered area for more than 120 days. This also allows the use of effective measures in the field of the incorporation of waste into agricultural land. This assumption will be fulfilled for the new construction of storage space. This measure has the greatest impact on pig breeding. Part of the liquid waste is then absorbed by straw and is stored in solid form. After 2015, therefore, a further scope for the reduction of emissions from manure storage is not expected. Effective control of nitrogen paths in the cycle of agricultural production changes the loss of nitrogen emissions into valuable fertilizer. The storage of waste is possible only in intensive farms for grazing animals (sheep, goats, horses, some categories of cattle) and has only limited application for housing.
The most relevant climate change mitigation activities in the agriculture sector are part of the EU Common Agricultural Policy, Agricultural Market and Income Support (1st pillar of the EU Common Agricultural Policy) and in the Rural Development Policy (2nd pillar of the EU Common Agricultural Policy).
Previous emission projections up to the year 2030 assumed additional significant decreases in the number of animals, which is not in compliance with the Conception of Agricultural Development of the Slovak Republic.
An increase in animal numbers was planned in the recent internal document Conception of Agricultural Development of the Slovak Republic for the years 2013 - 2020 prepared by the Ministry of Agriculture and Rural Development of the Slovak Republic (Table 5.19). Pursuant to the Conception, the endeavour of the Slovak Republic is to ensure self-sufficiency for important agricultural commodities with the aim to achieve the level of 80% up to 2020. That leads to the support of primary livestock production in the Slovak Republic, which is also closely linked to the employment policy in the agricultural sector.
Input data on the number of livestock used for the projections of GHG emissions in the agriculture sector are shown in Table 5.19.

Table 5.19: *Projections of livestock numbers in the Slovak Republic by 2020 (thousands of animals)*

Animal	2014*	2015*	2016	2017	2018	2019	2020	2025	2030
	Animal numbers (in thousands)								
	Conception of Agricultural Development of the Slovak Republic for the years 2013 - 2020								
cattle	465.5	457.6	470.3	471.9	473.0	473.8	474.4	437.6	427.2
pigs	641.8	633.1	677.4	724.9	775.6	829.9	888.0	963.3	949.5
poultry	12,494.1	12,836.2	13,415.2	13,817.6	14,093.9	14,729.5	14,994.5	13,235.1	13,235.1

**Real data*

Parameters and other key information for trend development in the agriculture sector:
The **WOM** (BAU) scenario is identical with the scenario with measures. The scenario with additional measures includes the strict implementation of CAP recommendations mostly in manure management

and agricultural soils as was implemented in Ordinance of the Government of the Slovak Republic No. 342/2014 Coll. laying down the rules for the granting of agricultural aid in respect to the direct payments schemes.

- The scenario with existing measures (**WEM**):
  - Scenario includes new measures in manure manipulation and processing in the enteric fermentation and manure management categories (as referred to in section 4.5.3).
  - Efficient use and appropriate timing of nitrogen inputs from mineral fertilizers (as referred to in section 4.5.5).
  - Decreasing the number of dairy cattle (as referred to in section 4.5.7).
  - Increasing self-sufficiency of important agricultural commodities with the aim to achieve a level of 80% up to 2020 (as referred to in section 4.5.2).
- Scenario with additional measures (**WAM**):
  - The scenario includes new measures in manure manipulation and processing and in addition new implementation of the animal feeding policy in the enteric fermentation and manure management categories (as referred to in section 4.5.4).
  - More efficient use and appropriate timing of nitrogen inputs from mineral fertilizers (as referred to in section 4.5.6).
  - Decreasing the number of dairy cattle, intensive feeding with active substances (as referred to in section 4.5.8).

5.4.4.1 Projections of CH_4 emissions

Table 5.20 shows projections of methane emissions from enteric fermentation and manure management.

Table 5.20: *Projections of CH_4 emissions according livestock species in category manure management (Gg)*

WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
3. Agriculture	**46.93**	**45.98**	**41.30**	**39.06**	**34.80**	**34.80**	**34.80**
3.A Enteric fermentation	40.40	39.56	35.41	33.63	30.01	30.01	30.01
3.B Manure management	6.53	6.42	5.89	5.44	4.79	4.79	4.79
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
3. Agriculture	**46.93**	**45.98**	**35.55**	**33.37**	**29.82**	**29.97**	**29.97**
3.A Enteric fermentation	40.40	39.56	29.66	27.93	25.03	25.18	25.18
3.B Manure management	6.53	6.42	5.89	5.44	4.79	4.79	4.79

5.4.4.2 Projections of N_2O emissions

Scenarios for modelling projections of N_2O emissions are defined in the same way as the projections for methane emissions and according to the description of measures above (in chapter 5.4.4).

Table 5.21 shows all three scenarios prepared for the projections of N_2O emissions in the agriculture sector.

Table 5.21: *Projections of N_2O emissions in the agriculture sector (Gg)*

WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
3. Agriculture	**6.06**	**6.03**	**6.28**	**5.73**	**5.80**	**5.79**	**5.81**
3.B Manure management	0.58	0.57	0.64	0.62	0.61	0.61	0.62
3.D Agricultural soils	5.47	5.46	5.64	5.11	5.20	5.19	5.20

WAM	2014	2015	2020	2025	2030	2035	2040
3. Agriculture	**6.06**	**5.89**	**6.06**	**5.55**	**5.65**	**5.64**	**5.66**
3.B Manure management	0.58	0.53	0.57	0.56	0.56	0.55	0.56
3.D Agricultural soils	5.47	5.36	5.49	4.99	5.09	5.08	5.09

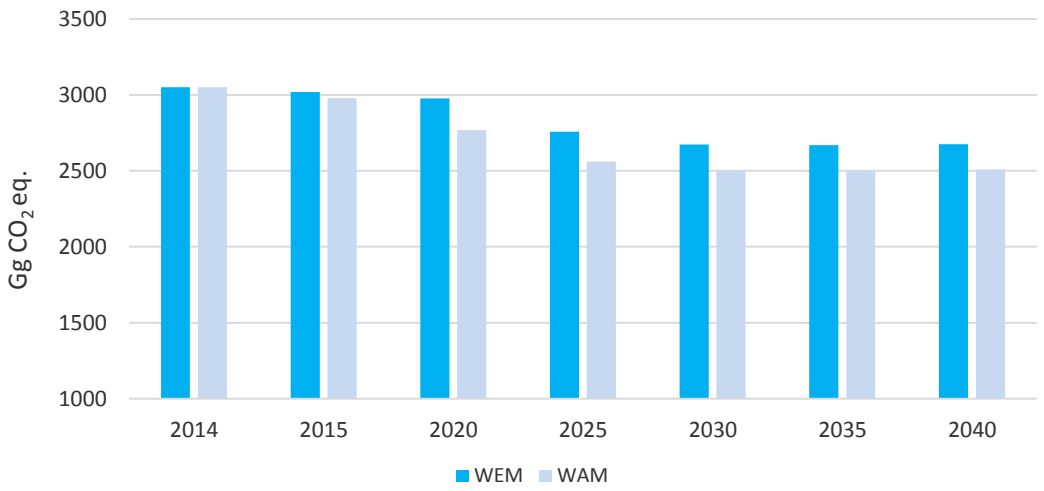
5.4.4.3 Projections of aggregated emissions

Table 5.22 and figure 5.5 show aggregated data on the projections of GHG emissions in the agriculture sector.

Table 5.22: *Projections of aggregated emissions in the agriculture sector (Gg CO_2 eq.)*

WEM	2014	2015	2020	2025	2030	2035	2040
3. Agriculture	**3,051**	**3,020**	**2,977**	**2,758**	**2,673**	**2,670**	**2,676**
3.A Enteric fermentation	1,010	989	885	841	750	750	750
3.B Manure management	336	331	338	320	301	300	303
3.D Agricultural soils	1,632	1,626	1,680	1,524	1,548	1,546	1,549
3.G Liming	16	16	16	16	16	16	16
3.H Urea application	58	58	58	58	58	58	58
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
3. Agriculture	**3,051**	**2,979**	**2,768**	**2,561**	**2,502**	**2,502**	**2,509**
3.A Enteric fermentation	1,010	989	741	698	626	629	629
3.B Manure management	336	318	318	302	285	285	288
3.D Agricultural soils	1,632	1,598	1,635	1,487	1,517	1,514	1,518
3.G Liming	16	16	16	16	16	16	16
3.H Urea application	58	58	58	58	58	58	58

Figure 5.5: *Projections of aggregated GHG emissions according to defined scenarios in sector agriculture (Gg CO_2 eq.)*



5.4.5 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 included in the Rural Development Programmes of the Slovak Republic for 2007 - 2013 and 2014 - 2020, taking into account the adopted National Forest Program (NFP) of the SR as well as the Action Plans of the NFP for 2009 - 2013 and 2015 - 2020. Emission and sink projections consider all

scenarios (without measures, with existing measures and with additional measures) and projection parameters (area of managed forest). The base year for the projection was the year 2015.

Parameters and other key information for trend development in the Land Use, Land Use Change and Forestry (LULUCF) sector:

Projections of GHG emissions/removals in sector LULUCF were prepared based upon following measures:

- 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 till 2015 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 2015. In 2004 - 2006, only minimal specific mitigating measures were implemented in 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 Agriculture and Rural Development (as referred to in section 4.7.1). 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 - 2015, afforestation of non-forested areas and grassing of arable soil continued according to the RDPs for 2007 - 2013 and 2014 - 2020. The following mitigation measures were considered in the 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 2015;
- Grassing of 50,000 ha of arable land by 2015;
- The effect of Regulation No. 2152/2003/EC 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 2015. 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 - 2030 was taken into account in the WAM scenario (as referred to in section 4.5.3).

The methodical procedure used for calculations was based on mathematical relations as defined in the IPCC 2006 GL, the basic instrument for the balance of greenhouse gas emissions and sinks. The values of the emission factors and conversion/expansion factors used for the projections are identical to the values applied in the emission inventories for the LULUCF sector in 2017.

5.4.5.1 Projections of CO_2 sinks

Table 5.23 shows the results of modelling CO_2 sinks in the land use land use change and forestry sector. The scenarios without measures and with existing measures mostly do not differ as no significant measures applied so far are being considered 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 1990 - 2014, when the whole period shows a sink of CO_2 in the range of 4,600 - 9,000 Gg of CO_2. The increase of CO_2 removal in 2020 compared to 2015 is due to the decrease in the harvest volume. Projections of CO_2 removals in the period 2020 - 2035 show a 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. The scenario with additional measures reflects the development

of emissions with the afforestation of 23,000 ha of grassland by 2030 and grassing of 50,000 ha of cropland by 2015. Based on such an assumption, the scenario shows a rise of CO_2 removals in forests and in cropland and a slight decrease in meadows and pastures and likewise an increase in emissions from settlements and other land categories.

Table 5.23: *Projections of CO_2 sinks in the LULUCF sector (Gg)*

WOM	2014	2015	2020	2025	2030	2035	2040
4. Land Use, Land-Use Change and Forestry	**-6,166**	**-5,248**	**-5,297**	**-4,825**	**-4,563**	**-4,714**	**-4,714**
4.A Forest land	-4,633	-3,876	-3,881	-3,443	-3,173	-3,327	-3,327
4.B Cropland	-803	-736	-768	-722	-722	-722	-722
4.C Grassland	-185	-192	-215	-215	-215	-215	-215
4.E Settlements	81	88	110	110	110	110	110
4.F Other Land	104	188	132	132	132	132	132
4.G Harvested wood products	-731	-721	-675	-687	-695	-693	-693
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
4. Land Use, Land-Use Change and Forestry	**-6,166**	**-5,274**	**-5,310**	**-4,837**	**-4,575**	**-4,727**	**-4,727**
4.A Forest land	-4,633	-3,902	-3,894	-3,456	-3,185	-3,339	-3,339
4.B Cropland	-803	-736	-768	-722	-722	-722	-722
4.C Grassland	-185	-192	-215	-215	-215	-215	-215
4.E Settlements	81	88	110	110	110	110	110
4.F Other Land	104	188	132	132	132	132	132
4.G Harvested wood products	-731	-721	-675	-687	-695	-693	-693
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
4. Land Use, Land-Use Change and Forestry	**-6,166**	**-5,274**	**-5,321**	**-4,848**	**-4,586**	**-4,738**	**-4,738**
4.A Forest land	-4,633	-3,902	-3,905	-3,467	-3,196	-3,350	-3,350
4.B Cropland	-803	-736	-768	-722	-722	-722	-722
4.C Grassland	-185	-192	-215	-215	-215	-215	-215
4.E Settlements	81	88	110	110	110	110	110
4.F Other Land	104	188	132	132	132	132	132
4.G Harvested wood products	-731	-721	-675	-687	-695	-693	-693

5.4.5.2 Projections of CH_4 emissions from forest fires

The projections of CH_4 emissions from forest fires are shown in table 5.24.

Table 5.24: *Projections of CH_4 emissions in the LULUCF sector from forest fires (Gg)*

WEM	2014	2015	2020	2025	2030	2035	2040
4. Land Use, Land-Use Change and Forestry	**0.69**	**0.69**	**0.69**	**0.69**	**0.69**	**0.69**	**0.69**
4.A Forest land	0.69	0.69	0.69	0.69	0.69	0.69	0.69

5.4.5.3 Projections of N_2O emissions from forest fires

Projections of N_2O emissions from forest fires are shown in table 5.25.

Table 5.25: *Projections of N_2O emissions in the LULUCF sector from forest fires (Gg)*

WEM	2014	2015	2020	2025	2030	2035	2040
4. Land Use, Land-Use Change and Forestry	**0.092**	**0.092**	**0.092**	**0.092**	**0.092**	**0.092**	**0.092**
4.A Forest land	0.038	0.038	0.038	0.038	0.038	0.038	0.038
4.B Cropland	0.028	0.028	0.028	0.028	0.028	0.028	0.028
4.C Grassland	0.002	0.002	0.002	0.002	0.002	0.002	0.002
4.E Settlements	0.013	0.013	0.013	0.013	0.013	0.013	0.013
4.F Other Land	0.012	0.012	0.012	0.012	0.012	0.012	0.012

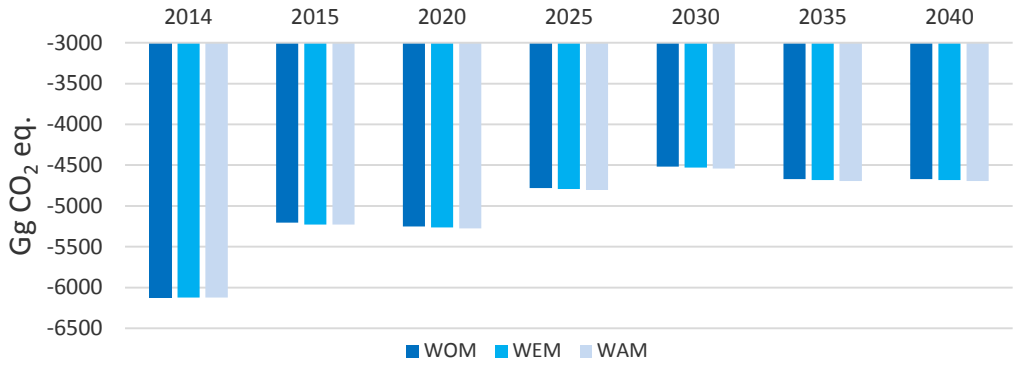
5.4.5.4 Projections of aggregated sinks

Table 5.26 and figure 5.7 show aggregated projections of GHG emissions and sinks in the LULUCF sector.

Table 5.26: *Projection of aggregated emissions and sinks in the LULUCF sector (Gg CO_2 eq.)*

WOM	2014	2015	2020	2025	2030	2035	2040
4. Land Use, Land-Use Change and Forestry	**-6,122**	**-5,204**	**-5,253**	**-4,780**	**-4,518**	**-4,670**	**-4,670**
4.A Forest land	-4,605	-3,848	-3,853	-3,415	-3,144	-3,298	-3,298
4.B Cropland	-795	-728	-760	-713	-713	-713	-713
4.C Grassland	-184	-191	-215	-215	-215	-215	-215
4.E Settlements	84	92	114	114	114	114	114
4.F Other Land	108	192	136	136	136	136	136
4.G Harvested wood products	-731	-721	-675	-687	-695	-693	-693
WEM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
4. Land Use, Land-Use Change and Forestry	**-6,122**	**-5,230**	**-5,265**	**-4,793**	**-4,530**	**-4,682**	**-4,682**
4.A Forest land	-4,605	-3,873	-3,865	-3,428	-3,157	-3,311	-3,311
4.B Cropland	-795	-728	-760	-713	-713	-713	-713
4.C Grassland	-184	-191	-215	-215	-215	-215	-215
4.E Settlements	84	92	114	114	114	114	114
4.F.Other Land	108	192	136	136	136	136	136
4.G Harvested wood products	-731	-721	-675	-687	-695	-693	-693
WAM	**2014**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
4. Land Use, Land-Use Change and Forestry	**-6,122**	**-5,230**	**-5,276**	**-4,804**	**-4,542**	**-4,693**	**-4,693**
4.A Forest land	-4,605	-3,873	-3,876	-3,439	-3,168	-3,322	-3,322
4.B Cropland	-795	-728	-760	-713	-713	-713	-713
4.C Grassland	-184	-191	-215	-215	-215	-215	-215
4.E Settlements	84	92	114	114	114	114	114
4.F Other Land	108	192	136	136	136	136	136
4.G Harvested wood products	-731	-721	-675	-687	-695	-693	-693

Figure 5.6 *Projections of aggregated GHG emissions and sinks according to defined scenarios in the LULUCF sector (Gg CO_2 eq.)*



5.4.6 Emission projections from the waste sector

Policies and strategies in the waste sector influencing the prediction of emissions in the Slovak Republic are prepared and implemented by the Ministry of Environment, the Ministry of Economy and the Regulatory Office for Network Industries.

Solid waste

The Ministry of Environment is regulating waste management through the Act on Waste Management in the latest wording in No. 79/2015 as amended, which is introducing emphasis on the separation of packagings and recyclables. It is also changing the financing scheme for separate collection from the State Recycling Fund to the Organisation of Waste Producers. The impact of this change is not known. Disposal of waste is only possible on authorized landfill sites (§ 97). The Act on waste management prohibits not only the disposal of biodegradable garden waste, but also the disposal of sorted biodegradable kitchen and restaurant waste (§ 13), and the Act establishes the obligation for municipalities to ensure the implementation of sorted collection for biodegradable kitchen waste from households, foot oils and fats and so-called biodegradable green waste (§ 81). The Act on Waste, as well as Decree of the Ministry of Environment of the Slovak Republic No. 371/2015 Coll., which implements certain provisions of the Act on Waste, came into force from 1 January 2016, the collection standards for biodegradable municipal waste set out in this Decree, whose efficiency was shifted to 1 January 2017, is currently in force.

The Waste Management Plan of the Slovak Republic defines the approach to waste management in the period of 2016 - 2020. It sets the following targets for separate collection (or diversion from disposal):

Fraction (tons)	Target 2020	Real 2015	Base 2013
Glass	90,000	53,518	48,890
Plastics	110,000	34,658	29,010
Paper	120,000	65,158	64,022
Kitchen waste		4,755	2,838
Garden waste		133,582	98,168
Biodegradable waste (see Note)	717,185	212,263	169,523

Note: The target for biodegradable waste (paper + kitchen + garden + other biodegradable fractions) was estimated as the difference between the modelled amount of generated biodegradable waste (1,047,585 t) and the amount which can be disposed in accordance with the targets of the Landfilling Directive (35%, which equals 330,400 t).

Landfill gas must be collected and burned if a landfill generates it in amounts sufficient for burning and the site operator is required to monitor its occurrence, amounts and composition. (Regulation of the Ministry of Environment No. 372/2015, Art. 5).

There is no specific strategy supporting the utilization of landfill gas by the Ministry of Environment in the Slovak Republic.
The Ministry of Economy regulates the use of landfill gas and biogas from waste water treatment through the Act on the Support of Renewable Sources of Energy and Highly Effective Co-generation No. 309/2009 last amended by Act No. 173/2015 and by the Act on Energy No. 656/2004 Coll. last amended by Act No. 251/2012.
The Regulatory Office for Network Industries defined the price for energy generated from landfill gas as €70/MWh and for energy generated from WWT biogas from €100 to €120/MWh (depending on capacity).
All these efforts to increase the share of renewable sources of energy were halted by energy distributing companies, which do not accept the connection of new renewable sources of energy bigger than 10 kW from December 2013, arguing that these sources endanger the safety and reliability of the distribution network. The Regulatory Office for Network Industries published information stating that the share of energy produced by renewable sources dropped in 2015 to 17%, compared to 21% in 2014. It is not clear how the situation will develop in the future.
The Ministry of Environment started supporting the clean-up of illegal dump sites in 2015. For the first round, 10 million Euros was provided by the Environmental Fund in 2015 and 9 million Euros was allocated to 211 municipalities. The Ministry of Environment continued this activity in 2016, providing 7 million Euros to 165 municipalities.

Waste water treatment

The Ministry of Environment regulates waste water management through the Act on Water Management No. 364/2004 last amended by Act No. 303/2016. The maximum concentrations of waste water parameters allowed for discharge are defined in Governmental Regulation No. 269/2010.
The strategy which implements this legislation is formulated in the Plan for the Development of Public Sewers for the period of 2010 - 2015. This plan was updated to cover the period up to 2021, but lacks information which would allow the quantification of waste water sector developments on emissions.

Approach to projections

The waste sector is represented by a scenario with existing measures only. The input data for the scenario with existing measures are only partially available, measures supporting renewable sources are in contradiction with steps taken by distribution companies and targets defined in the Waste Management Plan do not seem to be achievable. There are no additional measures in the waste sector used in the Slovak Republic.

WEM scenario

The projections of waste sector emissions are based on the emissions from municipal solid waste and from municipal waste water. These emissions represent 65% of total emissions of the waste sector expressed in CO_2 eq. The remaining 35% of emissions are considered to remain constant over the projecting period.

MSW disposal projections

Emissions from disposal of MSW depend on population, waste generation per capita and share of landfilled waste. Information on the future development of the population of the Slovak Republic was obtained from the Ageing Report 2015 (AR2015) and from the INFOSTAT Demographic Research Centre (DRC). AR2015 expects a decrease of population of the Slovak Republic by 4% in 2035 and the DRC expects an increase by 2%.

Because waste generation per capita shows strong correlation with the index of real wage, the prediction of the Institute of Financial Policy on the development of real wage until 2020 was used. The IFP expects that in the long term (2020), the real wage index will grow 2.9% annually. The share of MSW disposal in the Slovak Republic in high, reaching 65% - 70%. The observed long-term trend in the share of MSW disposal shows a decrease by 10% in a decade. It is assumed that this trend will also continue in the future and the share of disposal will decrease to 50% in 2035.

Waste water projections

Emissions from municipal waste water depend on population, protein consumption and distribution of waste water according to the type of treatment. Projections of waste water emissions are based on the same demographic projections as for MSW disposal.

Although the data indicate a downward trend of protein consumption, the FAO expects that it will increase by 20% by 2035. This expectation was included as a target value for 2035 for the nitrogen balance.

The key question in the distribution of waste water according to the type of treatment is the share of septic tanks, as they are the main source of waste water emissions. First, the share of population using centralised WWT plants and household WWT plants was estimated and the remaining population is expected to use septic tanks. Due to the mountainous character of the Slovak Republic, it is expected that the share of the population connected to centralised WWT plants will increase from 65% to 70% and for household WWT plants from 2% to 5%. This development will result in a decrease of the share of septic tanks from 30% to 22%. It is also assumed that the share of waste water treated in advanced WWT plants will increase from 60% to 70%. This will lead to an increase of direct emissions from waste water treatment.

Sources with constant emissions

Waste sector sources for which it is assumed that their emissions will remain constant include industrial waste disposal, biological treatment, incineration and industrial waste water. There is a lack of information on their development in the next 20 years. The probability of increase or decrease of these emissions cannot be quantified.

There are no plans for the development of new waste incineration plants, it is therefore expected that the existing ones will continue operation without change. Generation of industrial waste may increase if industrial production goes up, but it may decrease if modern low-waste technologies are introduced.

Results

The WEM scenario indicates that total emissions from the waste sector will decrease by 4.4% if demography develops according to the AR2015, or decrease 1.5% if demography follows the DRC predictions. The main driver for this decrease would be the reduction of septic tank use.

MSW disposal, as the main source of emissions in the waste sector, will remain without change. The increase in MSW generation will be compensated by the increase of MSW separation. Also, the utilization of landfill gas has an important effect on emissions from MSW disposal.

5.4.6.1 Projections of CO_2 emissions

CO_2 emissions are only generated from the waste incineration category. Results of modelling are shown in table 5.27. The scenario with measures is identical with the WAM scenario.

Table 5.27: *Projections of CO_2 emissions from waste incinerations (Gg)*

WEM	2014	2015	2020	2025	2030	2035	2040
5. Waste	**6.85**	**6.41**	**6.41**	**6.41**	**6.41**	**6.41**	**6.41**
5.C Incineration and open burning of waste	6.85	6.41	6.41	6.41	6.41	6.41	6.41

5.4.6.2 Projections of CH_4 emissions

CH_4 emissions are generated from the landfilling of solid waste and waste water treatment. The scenario with measures is identical with the scenario with additional measures.

Table 5.28: *Projections of CH_4 emissions in sector waste (Gg)*

WEM	2014	2015	2020	2025	2030	2035	2040
5. Waste	**54.4**	**53.4**	**54.3**	**54.8**	**53.1**	**50.9**	**50.9**
5.A Solid Waste Disposal	38.5	38.3	39.7	40.9	40.0	38.6	38.6
5.B Biological treatment of solid waste	3.5	2.8	2.8	2.8	2.8	2.8	2.8
5.C Incineration and open burning of waste	0.03	0.03	0.03	0.03	0.03	0.03	0.03
5.D Wastewater treatment and discharge	12.4	12.2	11.7	11.0	10.3	9.5	9.5

5.4.6.3 Projections of N_2O emissions

N_2O emissions are generated from waste water treatment, waste incineration and other waste and waste composting. The scenario with measures is identical with the scenario with additional measures.

Table 5.29: *Projections of N_2O emissions in the waste sector (Gg)*

WEM	2014	2015	2020	2025	2030	2035	2040
5. Waste	**0.42**	**0.40**	**0.42**	**0.43**	**0.44**	**0.45**	**0.45**
5.B Biological treatment of solid waste	0.21	0.21	0.21	0.21	0.21	0.21	0.21
5.C Incineration and open burning of waste	0.02	0.02	0.02	0.02	0.02	0.02	0.02
5.D Wastewater treatment and discharge	0.19	0.17	0.19	0.20	0.21	0.22	0.22

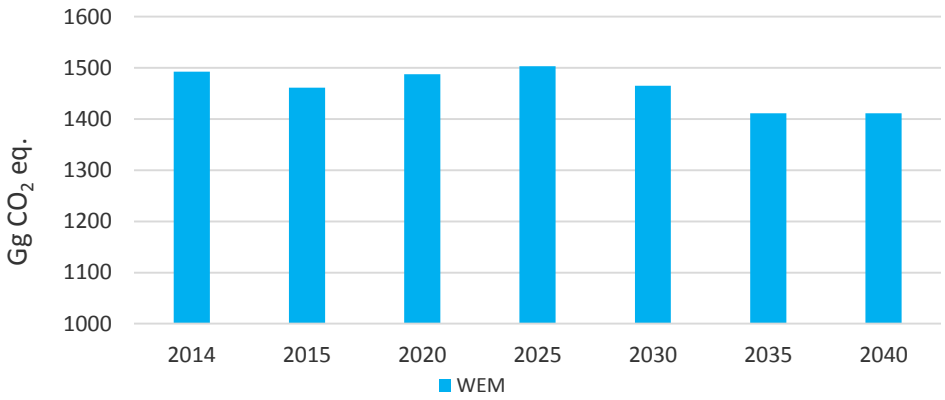
5.4.6.4 Projections of aggregated GHG emissions

Table 5.30 and figure 5.7 show aggregated data on projections of GHG emissions in the waste management sector.

Table 5.30: *Projection of aggregated GHG emissions in the waste sector (Gg CO_2 eq.)*

WEM	2014	2015	2020	2025	2030	2035	2040
5. Waste	**1,492.58**	**1,461.26**	**1,487.72**	**1,502.98**	**1,465.09**	**1,411.17**	**1,411.17**
5.A. Solid Waste Disposal	962.20	958.32	992.42	1021.80	1000.01	963.81	963.81
5.B. Biological treatment of solid waste	149.73	132.80	132.80	132.80	132.80	132.80	132.80
5.C. Incineration and open burning of waste	13.20	12.86	12.86	12.86	12.86	12.86	12.86
5.D. Wastewater treatment and discharge	367.45	357.29	349.64	335.52	319.42	301.70	301.70

Figure 5.7: *Projections of aggregated GHG emissions according to defined scenarios in the waste sector (Gg CO_2 eq.)*



5.4.7 Sensitivity analysis (SA)

A decomposition analysis tool has been used for the sensitivity analysis. Change of the GDP parameter has been used. The following Table 5.31 shows the value of GDP for WEM scenario, low and high GDP value.

Table 5.31: *Overview of GDP values used in SA*

(Mio Euro (2010))	2014	2015	2020	2025	2030	2035
WEM GDP	73,530	76,347	88,878	101,774	116,443	127,210
High GDP	73,530	76,347	93,322	106,863	122,265	133,570
Low GDP	73,530	76,347	84,434	96,685	110,621	120,849

The level of GHG emissions under the different GDP assumptions are comprised in the Table 5.32.

Table 5.32: *Total GHG emissions excluding LULUCF using different GDP assumptions*

Scenario GHG emissions (Mt CO_2 eq.)	2014	2015	2020	2025	2030	2035
Reference	40.40	40.78	40.02	40.07	40.46	40.67
Higher GDP	40.40	40.78	42.02	42.07	42.49	42.71
Lower GDP	40.40	40.78	38.02	38.06	38.44	38.64

5.5 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 (except of transport) and industry – MESSAGE model[18]
- Transport –TREMOVE and COPERT IV models and expert estimation
- Solvents – expert approach
- Agriculture – expert approach

[18] Detailed description of the MESSAGE model was presented in the Fourth National Communication of the Slovak Republic on Climate Change and the Report on Progress in achieving the Kyoto Protocol, MŽP SR, Bratislava 2005 (http://www.minzp.sk/sekcie/temy-oblasti/ovzdusie/politika-zmeny-klimy/dokumenty/).

- LULUCF – expert approach
- Waste – expert approach

5.5.1 Energy (except of transport) and industry – model MESSAGE

Message is an optimization model with linear programming. The program seeks an optimal solution for a selected period. The model is flexible and allows seeking a minimum optimal function for whatever parameters (not only energy systems). The mathematical description is complex. The optimization function seeks minimum costs to meet demands for the final consumption supply from primary and imported energy sources. The model also allows inserting certain constraints that simulate regulation of the system based upon the source limits, price regulation, and emission impact. The electricity network creates an integrated part and curves of load could be adjusted for individual periods. It also supports modelling of combined electricity and heat production.

5.5.2 Transport –TREMOVE and COPERT IV models and expert's judgment

TREMOVE is a transport and emission simulation model developed for the European Commission. It is designed to study the effects of different transport and environment policies on the emissions of the transport sector. The model estimates transport demand, the modal split, vehicle fleets, vehicle stock renewal, the emission of air pollutants and the welfare level under different policy scenarios. All relevant transport modes are modelled, including aviation. Maritime transport is treated in a separate model. TREMOVE covers the period of 1995 - 2035, with yearly intervals.

TREMOVE is a policy assessment model to study the effects of different transport and environment policies on the emissions of the transport sector. The model can be applied for environmental and economic analysis of different policies, such as road pricing, public transport pricing, emission standards, subsidies for cleaner cars, etc.

The broad scope of the TREMOVE model makes it possible to assess integrated environmental policy packages covering the whole of Europe and all modes. On the other hand, the level of detail is sufficient to simulate effects of country- or mode-specific measures. Welfare costs of policies are calculated taking into account costs to transport users, transport suppliers, governments as well as the general public.

The strength of TREMOVE is that it is an integrated simulation model. The model simulates, in a coherent way for passenger and freight transport, the changes in volume of transport, modal choice and vehicle choice (size & technology) relative to transport and emissions baseline.

The transport demand module describes transport flows and the users' decision-making process when it comes to making their modal choice. Starting from the baseline level of demand for passenger and freight transport per mode, period, region, etc., the module describes how the implementation of a policy measure will affect the users' and company's choice between these 388 different transport types. The key assumption here is that the transport users will select the volume of transport and their preferred mode, period, region, etc., based on the generalized price for each mode, such as cost, tax or subsidy and time cost per kilometres travelled. The output of the demand module consists of passenger kilometres (pkm) and ton kilometres (tkm) that are demanded per transport type for a given policy environment. The pkm and tkm are then converted into vehicle kilometres.

The vehicle stock turnover module describes how changes in demand for transport or changes in vehicle price structure influence the share of age and type of vehicles in the stock. The output of the vehicle stock module is twofold; we split both the total fleet and the number of km for each year according to vehicle type and age.

The fuel consumption and emissions module is used to calculate fuel consumption and emissions based on the structure of the vehicle stock, number of kilometres driven by each vehicle type and driving conditions.

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 IV. Therefore the name of the method is the same as the name of the COPERT model. Besides GHG emissions, the COPERT IV 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 IV 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 version 9.0, the vehicle fleet is divided into six basic categories and 241 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 other parameters. 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. These emissions are additional. The calculation of the emissions including CO_2 and also partially N_2O is based on fuel consumption.

5.5.3 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 WOM scenario. In the following steps additional specific parameters were included step by step into the model and emission projections were calculated for WEM and WAM scenarios.

5.5.4 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 WEM and WAM scenarios.

5.5.5 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. The calculation

tool is based on the MS Excel platform and the calculation includes different PAMs (in numerical formulation) according to the WEM and WAM scenarios.

5.5.6 Waste – expert software tool

Calculation of emission projections were based on the mathematical formulas and definitions described in the IPCC Guidelines for waste 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 WEM and WAM scenarios.

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

The chapter 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 2015 and 2016. 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.

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.[19]

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

6.2 FINANCIAL RESOURCES

All the Slovak bilateral and multilateral climate financial support provided to developing countries in 2015 and 2016 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 Second Biennial Update 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 2015 and 2016 Slovakia contributed to the Montreal Protocol Multilateral Fund, the Montreal Protocol Trust Fund, the International Finance Corporation, the World Meteorological Organisation (WMO) 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 Parties to the UNFCCC through multilateral channels in the years 2015 - 2016 was 3,512,733.51 € (4,147,133.18 $). Of this support, 1,950,992.5 € (2,303,341.75 $) was directed to mitigation and 408,875.36 € (482,718.25 $) to adaptation. In 2015 - 2016 Slovakia provided 1,152,865.65 € (1,361,073.18 $) core contributions to multilateral organizations, including to the operating entities of the financial mechanism of the UNFCCC. 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 2015 and 2016 was 2,822,783.45 € (3,332,578.09 $). Of this support, 188,532.50 € (222,581.47 $) was directed to mitigation, 2,201,860.23 € (2,599,516.15 $) to adaptation and 432,390.72 € (510,480.47 $) to cross-cutting. 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 2015 and 2016 Slovak Republic did not financially support any technology transfer project.

6.4 CAPACITY BUILDING

In the years 2015 - 2016, the Slovak Republic has implemented more than 35 capacity building projects, mainly in the form of bilateral cooperation - see CTF Table 7a and 9 attached to this submission. All of them 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.

All the provided bilateral and multilateral climate finance implicated in the Second Biennial Update Report has the status provided, as all of the Slovak financial contribution has been already paid up.

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

7 IMPROVEMENTS AND IMPLEMENTATION OF THE RECOMMENDATIONS

The ERT recommends that Slovakia include in its next biennial report (BR) the information on changes in its domestic institutional arrangements, including institutional, legal, administrative and procedural arrangements used for domestic compliance towards its economy-wide emission reduction target.

- The information on changes to the domestic institutional arrangements can be found in the chapter 4.8.

The ERT recommends that Slovakia improve the transparency of its reporting in its next BR and/or CTF tables by providing, in the case that the estimated mitigation impacts of some PaMs are not reported in CTF table 3, explanations for the reasons why such information is not reported. This information could be provided either in the BR or in the footnotes to CTF table 3.

- The explanation can be found in the footnotes to CTF table 3.

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

Overview on CTF tables provided with the third 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