4. POLICY AND MEASURES TO MITIGATE GREENHOUSE GAS EMISSIONS

Chapter 4 outlines the existing strategy, legislative framework and decisive measures which were adopted in the Slovak Republic in connection with environmental protection as a whole or with a focus on the mitigation of greenhouse gas emissions. Considering the character of economic development and the structure of industrial production in the Slovak Republic, in this chapter we pay special attention to the possibilities of energy efficiency enhancement under the conditions of sustainable development. In addition to characteristics of recently adopted or prepared measures and activities in the area of mitigation of GHG emissions and sinks, this chapter evaluates the actual situation of policy and decisive measures which were already outlined in the Second National Communication on Climate Change.

The existing strategy in the area of environmental protection can be simply characterised as a move from the removal of consequences of environmental degradation or pollution to elimination of the reasons for this pollution, through the observance of the principle of subsidiarity and the "polluter pays" principle.

4.1 ENVIRONMENTAL PROTECTION STRATEGY

In this section we provide brief characteristics of decisive conceptual documents, a part of which is the policy of mitigating negative effects of climate change, whether directly by reducing GHG emissions, or indirectly by limiting negative impacts of energy sector, agriculture and other economic activities.

- **Strategy, Principles and Priorities of Governmental Environmental Policy**
  The document was approved by decision of the Slovak Government No. 619 of September 7, 1993 and decision of the National Council of the Slovak Republic No. 339 of November 18, 1993. This material determined the priorities of the state environmental policy and formulated the long-term, medium-term and short-term strategies for its implementation. Material and time limits indicated in individual objectives were in reference to international conventions, EU directives and recommendations of UN units. The short-term strategy explicitly comprised the development of a national program to mitigate greenhouse gas emissions and its implementation in the period of years 2000 to 2010. The measures for attainment of objectives of the Strategy in all ten sectors of environmental protection and development were also included in the first National Environmental Action Program (NEAP), adopted by Resolution of the Government No. 350/1996 and specified in 9 regional (KEAP) and 79 district environmental action programs (OEAP).

- **National Environmental Action Program of SR II**
  The document approved in December 1999 lays down priorities, principles and objectives of the environmental policy of the Slovak Republic. The priorities of the state environmental policy include the area of air protection from pollutants, particularly greenhouse gases, and global environmental safety, as well as the issues of generation, utilisation and correct disposal of different types of waste.

- **Strategy of the Slovak Republic in relation to global climate change**
  The document under preparation should comprise a comprehensive strategy of the Slovak Republic, focused exclusively on climate change issues and reduction of GHG emissions. The global objective of the international community in the framework of the UN Framework Convention is to stabilise concentrations of greenhouse gases in the atmosphere at a level, which has no dangerous effects on the climate system. The Slovak Republic shall participate in these efforts in line with the worldwide division of responsibility, and meet its accepted commitments. For attainment of the global objective from the view of the Slovak Republic, the main goals were defined for short-term, medium-term and long-term periods. In the framework
of the medium-term strategy (2003 to 2008) the objective is to achieve such a development of greenhouse gas emissions until 2005 which shall provably allow meeting the commitment of the Kyoto Protocol. This Strategy is directly followed by the Action Plan of Fulfillment of the Kyoto Protocol. Commitments to the UN FCCC are tied in which bring an overview of measures, quantification of their impacts on reduction of GHG emissions, together with an estimate of the costs of their implementation, as well as a proposal for competences and a time schedule of their implementation.

- **Energy Policy of the Slovak Republic**
  The Government took into consideration the project of a new energy policy of the Slovak Republic by its Resolution No. 5/2000. The decisive objectives defined in this document can be summarily defined as follows: the preparation for integration in the EU internal market, the safety of energy supplies and the sustainable development. Accession to the European Union involves the adoption of several measures, particularly the restructuring of the energy sector, new principle of regulation of the energy sector, adjustment of prices, liberalisation and opening the free electricity market. Environmental protection was one of determining factors of the formulation of energy policy. Based on analyses, basic assumptions for the attainment of the commitment under the Kyoto Protocol in the energy sector were formulated as follows: to maintain the share of power generation from sources producing minimum amounts of CO₂, more significant decrease in energy intensity of production, energy savings and better utilisation of the renewable energy sources (RES) potential. Together with the objectives, potential tools for their achievement were indicated. The document, both in Slovak and English versions, is available on web site: www.economy.gov.sk.

- **Waste Management Program of the Slovak Republic for the period of years 2000 to 2005**
  A system conceptual document approved by Resolution of the Slovak Government No. 799/1996, which was elaborated following the evaluation of the first WMP SR started in the year 1993. On the basis of results of the first stage (1993 to 1996), this document modifies objectives until the years 2000 and 2005, taking into account real economic potential and a new territorial and administrative structure. In addition to further development of the whole infrastructure of waste management, main objectives of the Program can be qualified as the limitation of waste generation and enhancement of the recyclable waste utilisation.

- **Conception to Reduce Greenhouse Gas Emissions in Construction and Public Sector of the Slovak Republic until 2005**
  According to data of the Second National Communication on Climate Change, Slovak Republic, the share of the construction industry in total CO₂ emissions ranged from 5.9 to 7.9 %. After a general decline in building production and limitation of demand for building materials in the period since 1990, recovery of the industry was observed in 1995, which has led to higher generation of CO₂ emissions. This document brings an analysis of potential measures to compensate this negative tendency. Measures representing direct intervention in production technology, measures in the combustion process or changes in the fuel base, as well as measures in the area of heat insulation of buildings, which lead to reduction of CO₂ emissions through energy savings, come into consideration.

- **Proposal for long-term measures regarding the adaptation of the Slovak Republic to climate changes**
  This document was negotiated and approved by management of the Ministry of Agriculture of the Slovak Republic in November 2000. It comprises a proposal for a comprehensive set of reduction measures in agriculture and management of water supplies and forestry, which is analysed in more detail in subsection 4.3.

- **Projects and research programs aimed to the climate change strategy and policy**
  In connection with acceptance of quantified reduction objectives in line with requirements of the Kyoto Protocol by the Slovak Government, projects and research programs related to issues of climate changes were solved in a larger extent. Proposals for mitigating and adapting
measures, as well as a comprehensive analysis of the potential of the Slovak Republic in the area of reduction of GHG emissions are the result of following research programs and projects (we indicate only those of highest importance):

- The National Climate Program of the Slovak Republic
- The National Program of GHGs Inventory, SHMÚ
- The National Program to Stabilise and Reduce CO₂ Emissions in Transportation in the Slovak Republic, November 1994 (VÚD Žilina)
4.2 OVERVIEW OF POLICY AND MEASURES TO REDUCE GREENHOUSE GAS EMISSIONS

The following text outlines an evaluation of the actual situation of decisive reduction activities specified in the Second Slovak National Communication, as well as an overview of new measures in the area of GHG emissions reduction. Subject to analysis were measures applied directly with the view of reducing GHG emissions, as well as those for which the mitigating effect is achieved indirectly, through energy savings and by mitigating the negative effects of economic activities on climate change. The measures are evaluated with a view of the current stage of implementation and, where relevant information is available, the impact of measures and supporting programs is quantified. It is clear that the comprehensive framework for the application of the policy to mitigate the negative consequences of climate change in Slovakia consists of a group of measures from the Second National Communication still in force, together with actual measures and activities indicated in the following text.

4.2.1 Cross sectorial measures

These measures represent activities and measures, the effect of which shows in several categories of greenhouse gases or in several sectors at the same time.

4.2.1.1 Policy and mitigating measures from the Second National Communication

- Act No. 309/1991 Coll. on Protection of the Air against Pollutants
  
  **Type of measure – regulatory and economic**
  
  **Status of implementation – implemented measure, the last amendment – Act No. 459/2000 Coll.**
  
  Initially a strictly regulatory instrument. Though it was aimed at basic pollutants, it represented one of the most efficient instruments for reduction of CO₂ emissions. By amendment it was replaced by a combined regulatory and economic measure. The amendment introduces, for existing sources not meeting the concentration emission limits of the basic pollutants in the initial time limit (before 31 December 1998), the possibility of their further operation until 31 December 2006, after classification to so-called class "B". The classification of a source of pollutants to the class "B" means, in addition to higher basic charges for pollutants, their further current increase through coefficients determined until 2006. Under the stated amendment, a mechanism of declaring so-called "emission quotas ", i.e. maximum allowed amounts of pollutants which may be emitted by a group of sources in the country, district, or individual source, was introduced to the environmental protection legislation frame.

- Act No. 286/1992 Coll. on Income Taxes
  
  **Type of measure – economic**
  
  **Status of implementation – implemented measure, the last amendment – Act No. 366/1999 Coll.**
  
  The Act constitutes an economic instrument which also in the adopted amendment (§ 19, letter c) declares the possibility, in the calendar year when the equipment was put into service, and in the following five years, to obtain income tax allowance for the operation of small hydro-electric power plants with installed output up to 1 MW, equipment with combined power and heat generation with installed output up to 1 MW, heat pumps, solar equipment for the utilisation of geothermal energy, equipment for biogas production, equipment for production of biologically degradable substances etc.,...
Liberalisation of energy and fuel prices

Type of measure – economic
Status of implementation – prices are still regulated (partial liberalisation), gradual elimination of subsidies

Although the energy sector in its existing structure has the character of a natural monopoly, resulting in the need for state regulation of fuel and energy prices, it has observed positive changes, motivated by the effort towards full price liberalisation, against the situation of the year 1997. In addition to ambitions for integration, the reason for elimination of all types of subsidies to energy prices - including cross sectorial - is the prepared restructuring and privatisation in the electrical and gas industries and the endeavour towards rational function of the market. Regulation of the Ministry of Finance No. 87/1996 Coll., by which Act No. 18/1996 Coll. on prices is executed, remains in force. Several measures were issued - e.g. Measure of the Ministry of Finance of the Slovak Republic No. 94/1999, by which the difference between maximum production price of heat and the price for households was removed. At the same time, a so-called "Schedule of Adjustments of Regulated Prices, Including Energy" for the period until 2002 was elaborated.

Program Supporting Economic Activities Resulting in Savings of Energy and Imported Raw Materials

Type of measure – economic
Status of implementation – program completed by 31 December 1999

The Program was declared by the Ministry of Economy of the Slovak Republic in collaboration with the Ministry of Finance of the Slovak Republic and the Slovak Guarantee and Development Bank. It was aimed at the support of the implementation of projects to decrease energy intensity, better utilisation of renewable energy sources and reduction of imported materials and raw materials in industrial and tertiary areas - the government still covers a part of interest rates and grants advantageous credits. State support for this program was provided only in the years 1992, 1993 and 1995, whereby the provided sum in an amount of 158.1 mil. SKK represented about 11 % of total budget costs of the implementation of 64 projects. From the evaluation of the program it results that total heat savings for implemented projects represents 2331.6 TJ/year, electricity savings 56 571 MWh/year, fuel savings 66.8 TJ/year and total savings in imported raw materials was quantified to 4.087 mil. USD. On the basis of the calculations we can state that 1 GJ of saved energy burdens the state budget in the amount of 120 SKK/GJ. In the years 1996 to 1998 no financial resources from state budget were allocated for this program and it was completed in 1999.

Act No. 238/1991 Coll. on Waste

Type of measure – regulatory
Status of implementation – implemented measure, the last amendment – Act No. 255/1993 Z. z., in November 2000 the Slovak Government approved a comprehensive amendment of this Act

The Waste Act remains the basic legal norm in the area of waste management. Under this Act, an entity generating waste is obliged inter alia to use generated waste as a source of secondary raw materials or energy. Waste storing in landfills is the last stage of waste disposal, which cannot be otherwise used. In June 2000 the Ministry of Environment of the Slovak Republic presented a project of a new act on waste, together with projects of ten implementory regulations. According to this amendment, the whole legal framework for the area of waste management will change and only Act of the National Council of the Slovak Republic No. 327/1996 Coll. on charges for waste disposal will remain in force.

1 Replaced by the Program supporting energy savings and the utilisation of alternative energy sources (since 1. 1. 2000).
4.2.1.2 Actual policy and measures to reduce GHG emissions

- **Act No. 211/2000 Coll. on Free Access to Information (Act on Information Freedom)**
  Type of measure – regulatory
  Status of implementation – implemented measure, replacing the Act No. 171/1998 Coll. on access to environmental information
  The new legal norm stipulates the conditions, procedure and extent of free access to information. For the area of the environment, a special provision was adopted therein, according to which natural or legal persons were obliged, in compliance with special regulations or decisions, to measure the volume of pollutants released into the atmosphere or water, and under which the obligation to publish results of such measurements arises.

- **Act No. 127/1994 Coll. on Environmental Impact Assessment (EIA)**
  Type of measure – regulatory
  Status of implementation – implemented measure
  The system of comprehensive professional and public assessment of environmental impacts of a prepared building, facility or activity.

- **Act No. 237/2000 Coll. on the State Fund of the Environment**
  Type of measure – economic
  Status of implementation – implemented measure, replacing the Act No. 128/1992 Coll.
  Charges, penalties, sanctions for air pollution, subsidies from state budget and other revenues form the environmental protection and development fund. The amendment extends the existing function of the Fund from purely subsidy-related to a credit function. The Fund should be focused on granting so-called cheap credits (more advantageous conditions than in case of credits granted by commercial banks) and on investments in environmental protection and development.

- **Act No. 401/1998 Coll. on Charges for Air Pollution**
  Type of measure – economic
  Status of implementation – implemented measure
  According to Act No. 401/1998 Coll., each operator of a pollution source is obliged to pay progressively increasing charges (using coefficients defined for each year), depending on the amount and the type of pollutants emitted into the atmosphere. For example, basic charge for emissions of solid particles is 5 000 SKK/t, for SO\textsubscript{2} emissions 2 000 SKK/t, for NO\textsubscript{x} emissions 1 500 SKK/t, for CO emissions 1 000 SKK/t, for total organic carbon emissions 4 000 SKK/t and for other pollutants from 2 000 to 40 000 SKK/t. Although charges for CO\textsubscript{2} emissions were not fixed, their level is indirectly affected by this measure.

  Type of measure – regulatory
  Status of implementation – implemented measure
  This measure determines emission quotas of sulphur dioxide for individual districts for the period of years 2002 to 2004.

- **The National Program of Environmental Evaluation and Identification of Products**
  Type of measure – regulatory with indirect economic effect
  Status of implementation – implemented measure
  Since 1996 infrastructure and conditions for the implementation of the Program were created, which allows evaluation and identification of environmentally friendly products (EVV); in the years 1997 and 1998, this marking was granted to 10 products.
4.2.2 Energy sector

4.2.2.1 CO₂ emissions

4.2.2.1.1 Policy and mitigating measures from the Second National Communication

- Measures resulting from the Energy Strategy and Policy of the Slovak Republic until 2005

A more specific analysis of some measures from the Energy Conception of the Slovak Republic, from the view of their CO₂ reduction potential, investment intensity and period for the implementation, was executed in the framework of elaboration of the document Action Plan of the Fulfilment of the Kyoto Protocol Commitments to the UN FCCC, the Ministry of Environment of the Slovak Republic, 2000 [13]. Table 4.8 (section 4.4) provides an overview of measures and quantified parameters, which allow a preliminary evaluation of their reduction potential. Other measures indicated in the Second National Communication, such as the completion of desulphurization equipment for two units 110 MW in ENO B, construction of a new fluid boiler in ENO A and installation of a new complex and continual emission monitoring system (checking emissions of CO₂, CO, SO₂, NOₓ and solid particles) have already been executed. In addition to creation of conditions for maintenance of inland brown coal extraction (indirectly declared in the Resolution of the Slovak Government No. 559 of July 12, 2000), the purpose of their introduction was to meet environmental criteria, particularly those of Regulation of the Government No. 92/1996 Coll.

4.2.2.1.2 Present policy and measures for reduction of CO₂ emissions

- Program Supporting Energy Savings and Utilisation of Alternative Energy Sources

**Type of measure – economic**

**Status of implementation – implemented measure**

The Program was declared by the Ministry of Economy of the Slovak Republic and the Ministry of Finance of the Slovak Republic, based on the Resolution of the Government No. 1055/1999, with effect as from January 1, 2000. The guarantor and coordinator of the Program is the Slovak Ministry of Economy. Under this Program subsidies or return financial assistance are provided to projects classified in one of the following groups:

**Support of energy savings in apartment houses and apartments**

- purchase and installation of control equipment to ensure energy-saving operation of apartment houses and apartments,
- reconstruction of heat sources supplying apartment houses,
- optimisation of the extent of centralised district heating (CZT) systems and their extension.

**Support of the alternative energy sources utilisation**

- stimulates projects of building facilities which use mainly renewable sources of energy (construction of small hydro-electric power plants, energetic utilisation of biomass, utilisation of heat pumps, installation of solar collectors, utilisation of geothermal and wind energy).

**Support of activities resulting in energy savings**

- introduction of advanced equipment and technologies production,
- rationalisation of fuel and energy consumption (reconstruction of heat sources, heating systems of technological processes),
- replacement of fossil fuels, support of production of facilities for treatment and utilisation of biomass.

The support is provided in two forms - by covering a part of credit interest up to 70% of basic interest, but no more than 4 mil. SKK/project, or by providing return financial assistance at a
maximum amount of 3 mil. SKK/project, with term of payment 3 years. Presently the program is
subsidised by the lump sum of 30 mil. SKK/year.

- **Regulation of the Ministry of Environment of the Slovak Republic No. 144/2000 Coll.**
on requirements for fuel quality, keeping operating records.
*Type of measure – regulatory*
*Status of implementation – implemented measure*
This measure stipulates requirements for the quality of solid fossil fuels, liquid oil fuels, gasoline
and diesel fuel and defines conditions for keeping operating records (type, extent and way of
providing data to air protection authorities) for fuel producers, importers and distributors.

- **Act No. 70/1998 on Energy and on a Change of the Act No. 455/1991 Coll. on Trade**
*Type of measure – regulatory*
*Status of implementation – implemented measure*
The Act stipulates conditions for trade in electrical engineering, gas industry and heat supplies,
rights and obligations of electricity, gas and heat consumers, and rules of state regulation in the
energy sector. It takes into account the contemporary state of trade legislation in EU countries
and comprises recommendations of the EC Commission relating to transparency, licensing,
observance of rules of competition and customer protection. It declares the obligation of
electricity buyers and heat distributors to buy electricity and heat from renewable resources of
energy or from combined electricity and heat production where it is justified by environmental
reasons or allowed by technical conditions.

- **Proposal of the Act on Energy Efficiency**
*Type of measure – regulatory*
*Status of implementation – measure under preparation*
The Act under preparation directly stipulates economic utilisation of energy in all branches of the
economy and introduces new institutions for enhancement of energy efficiency and better
utilisation of renewable energy sources (RES). The decisive measures under the projected Act
can be briefly characterised as follows:
- economic operation of buildings and energy facilities, as well as their need, are assessed
during the process of building approbation;
- for licence holders and large consumers of energy the proposed legal norm imposes the
  obligation to ensure a regular energy audit, appoint an energy manager and elaborate a
  program of energy efficiency,
- obligatory labelling of chosen energy equipment and appliances, determination of minimum
  limit of efficiency for operated heat equipment,
- for consumers of liquid fuels the norm imposes the obligation to apply preferentially
  equipment with combined electricity and heat generation when executing reconstruction or
  building new heat sources.

An integral part of the projected act is the elaboration of the *National Program of Energy
Efficiency*, which should represent a wide range of measures (monitoring trends of energy
consumption, data base of projects, demonstration projects, information on potential financial
support etc.), to ensure awareness and promote reduction of energy intensity.

- **Protocol of Energy Charter on Energy Efficiency and Related Environmental Aspects**
The Protocol, which was signed on January 17, 1994 in Lisbon and which entered into force in
April 1998, was ratified by the Slovak Republic in October 1995 as the first of the member
countries of the Energy Charter. In the international context, this is the most important tool to
support an energy efficiency policy in the creation of conditions for rational production,
distribution and utilisation of energy, and for the support of international collaboration in these
areas.

- **Act on Regulation in Network Branches**
*Type of measure – regulatory*
*Status of implementation – measure under preparation*
The prepared Act should stipulate legal, economic and organisational conditions in those
business activities in energy branches which are characterised as a lacking or underdeveloped
competition environment due to the existence of a natural monopoly. Several legal norms are
amended by this act, such as Act No. 70/98 Coll. on Energy.
4.2.2.2 Fugitive emissions of CH$_4$

The development and level of fugitive CH$_4$ emissions will be affected by the level of underground coal extraction, requirements for oil and gas treatment and the level of natural gas transport and distribution through our territory.

4.2.2.2.1 Policy and mitigating measures from the Second National Communication

- **General gas distribution system**

  Presently the reported losses in transportation of natural gas, which may be a source of fugitive CH$_4$ emissions represent about 2% of the total volume of consumed gas. According to actual data for the year 2000, this would correspond to the volume of 150 mil. m$^3$ or 100 thousand tonnes of CH$_4$ emissions per year.

  However these are only fictive amounts reported on the basis of the actual state of measuring and control equipment, where equipment for temperature and heat compensation are not installed in all cases, due to which uncertainty of measurements amounts to 1.5%. Actual fugitive emissions determined according to the qualified analysis and evaluation of effects of the measures specified in the Second National Communication (whether partially or fully implemented) will probably represent only 10% of the stated volume, i.e. approximately 15 mil. m$^3$ or 10 thousand tonnes of CH$_4$ per year.

- **Transit system**

  The measures specified in the Second National Communication have been fully implemented. Also thanks to these measures, actual emissions of natural gas in transit range from 10 to 14 mil. m$^3$, i.e. 6.8 to 9.5 thousand tonnes of CH$_4$ per year. However the source of these emissions is not uncontrollable leakage from transit transport, but so-called technological consumption of natural gas occurring by start-ups of gas turbines and their depressurisation, as well as by depressurisation of line sections of the transit system and different technological units of compressor stations. This depressurisation inevitably precedes repairs on this equipment.

  The overview of several executed technical measures for mitigating activities to reduce CH$_4$ emissions in the area of transit system:
  - adaptation of combustion chambers and replacement of regeneration exchangers in operation of turbines GT-750 with total costs of 70 mil. SKK (compressor plant in Jablonov nad Turnou and in Ivánka pri Nitre),
  - installation of a Cooper Rolls low-emission turbine unit in Jablonov nad Turnou,
  - installation and successful testing of technical solution for reduction of methane leakage into the atmosphere during the start-up of three GT-750 turbines at the compressor plant in Ivánka pri Nitre,
  - in Ivánka pri Nitre a continual emission monitoring system was installed on 12 turbine units GT-750 at total costs of 10.5 mil. SKK,
  - in 2000 investments in replacement of gas expanders of start-up equipment with electric drive in an amount of 12.5 mil. SKK are planned – this equipment solves the problem of gas leakage during the start-up of gas turbines.

4.2.2.2.2 Actual policy and measures to reduce fugitive CH$_4$ emissions

- **General gas distribution system**

  **Type of measure – technical**

  **Status of implementation – implemented measure**

  Inspection of networks within the national gas pipeline.

- **Transit system**
Type of measure – technical
Status of implementation – measure under preparation

- Depending on economic possibilities, continuous replacement of gas expanders at the start-up of gas turbines with electric starters.
- Replacement of installed output of turbine units with more efficient and effective equipment (23 and 28.3 MW, efficiency 37%).
- Permanent monitoring of technological need for natural gas.

It is supposed that total potential of indicated technical measures means annual reduction of fugitive CH\(_4\) emissions from the transit system by 3000 tonnes. It is also expected that the measure for enhancement of turbine unit output could result in reduction of CO\(_2\) emissions by 10 to 15 % (the present level is 2 mil. tonnes).

4.2.2.3 Other gases

The greenhouse effect of the atmosphere is indirectly affected by non methane fugitive organic substances (NVOC), NO\(_x\) and CO (ozone precursors) and SO\(_2\) (sulphate precursor). The Slovak Republic is progressively limiting emissions of these gases under legislation in force and accepted international commitments. In the area of energy and fuel transformation the following protocols are in place:

- **Convention on Long-Range Transboundary Air Pollution**
  
  The following executing protocols to the Convention signed in Geneva in 1979 were gradually adopted:

  - **Protocol on Reduction of Sulphur Emissions or their Transboundary Fluxes by 30% (Helsinki, 1985)** – The Slovak Republic is the successor of this Protocol. The commitment was met, SO\(_2\) emissions were reduced from the volume of 780 thousand tonnes in 1980 to 380 thousand tonnes in 1992, which represents a decrease of 48 % (the protocol requirement is a decrease of 30% by 1993 against the level of the year 1980).

  - **Protocol on Further Reduction of Sulphur Emissions (Oslo, 1994)** – The Slovak Republic ratified the Protocol on March 2, 1998. The commitments of the Slovak Republic to reduce SO\(_2\) emissions under this protocol are as follows:

    | Year | 2000 | 2005 | 2010 |
    |------|------|------|------|
    | Emissions of SO\(_2\) [thous. t] | 337  | 295  | 240  |

    The protocol requirement for acceptance of emission limits was executed by Regulation of the Slovak Government No. 92/1996 Coll., by which the Act on Air is executed. In the years 1994 and 1995 the volume of SO\(_2\) emissions decreased to 238 thousand tonnes and 223 thousand tonnes, respectively. To meet the commitment under the Protocol, it is necessary to maintain the reached level and prevent any excess of the stated emission volumes.

  - **Protocol on Reduction of Nitrogen Oxide Emissions or their Transboundary Fluxes (Sophia, 1988)** – Slovakia is a successor of the Protocol and it has adhered to its commitments, i.e. to reduce NO\(_x\) emissions by 1994 to the level of the year 1987, to introduce emission limits for NO\(_x\) and ensure availability of leadless gasoline. Since 1998 exclusive utilisation of leadless gasoline was introduced by legislative means.

  - **Protocol on Limitation of Volatile Organic Compounds (VOC) Emissions or their Cross-Border Transfers (Geneva, 1991)** – Slovakia ratified the Protocol in 1999. Upon a resolution of the Government, the National Program of VOC (NP VOC) was prepared, which has defined the way in which the set objective, i.e. to reduce VOC emissions by 30 % by 2000, as compared with the year 1990, would be met.

  - **Protocol on Reduction of Acidification, Eutrophication and Ground Ozone** – The protocol tightens up commitments for the generation of SO\(_2\) and NO\(_x\) emissions for the year 2010, including a gradual increase of charges as a stimulating factor. Commitments for the Slovak Republic under this Protocol represent a volume of SO\(_2\) emissions in 2010 of 110 thousand tonnes; the reduction target for NO\(_x\) is 130 thousand tonnes and for volatile organic compounds VOC, 140 thousand tonnes.

- **The National Program of Reduction of VOC Emissions (NP VOC)**
The attainment of objectives of this program was divided into two stages: stage 1 covered the period 1995 – 1997 and stage 2 the period 1997 – 2000. The results of evaluation of stage 1 show that in 1996 VOC emissions were reduced by 30% against the level of the year 1990, whereby the following measures contributed to this reduction:

- reduction of total volume of used paints at an increased share of low-solvent/solvent-free paints,
- intensive gasification of combustion units, particularly in municipal power plants (small and medium-sized sources),
- successful application of the reduction plan for VOC emissions in the sector of industrial crude oil treatment,
- replacement of vehicle fleet in favour of vehicles controlled by catalysers,
- application of the waste management program.

Stage 2 of the National Program of Reduction of VOC Emissions was completed in 2000. From evaluation of the course of the stages 1 and 2 of the Program it results that at both stages a total reduction of VOC emissions by 47% was reached, which was expressed as the average value of reduction for all examined sectors, compared with the level of the year 1990. In individual sectors the level of reduction is different; the most significant reduction of VOC emissions against the year 1990 was reached in the sector of waste management (97%) and in the industrial organic chemistry (88%).

Table 4.1 shows brief characteristics of mitigating measures to reduce CO₂ emissions in the energy sector and quantification of their reduction potential for cross sectorial years.
Table 4.1 Characteristics and reduction potential of some mitigating measures in the energy sector²

<table>
<thead>
<tr>
<th>Name of policy/measure</th>
<th>Objective and/or Activity affected</th>
<th>GHG affected</th>
<th>Type of instrument</th>
<th>Status</th>
<th>Implementing entity/entities</th>
<th>Mitigation</th>
<th>Impact</th>
<th>?GHG</th>
<th>?GgCO₂ equiv./year</th>
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<tbody>
<tr>
<td>Act No. 309/1991 Coll. on Protection of the Air</td>
<td>Reduction of emissions of the basic pollutants</td>
<td>CO₂, CH₄, N₂O</td>
<td>Regulatory and economic</td>
<td>I</td>
<td>Slovak Ministry of Environment and Economic authorities</td>
<td>258</td>
<td>1 365</td>
<td>1 372</td>
<td>1 342</td>
</tr>
<tr>
<td>Implementation of combined cycles</td>
<td>Increase in energy efficiency</td>
<td>CO₂</td>
<td>Regulatory and economic</td>
<td>I</td>
<td>Slovak Ministry of Economy</td>
<td>0</td>
<td>972</td>
<td>814</td>
<td>911</td>
</tr>
<tr>
<td>Thermal insulation of buildings</td>
<td>Reduction of final energy consumption in sectors MVV &amp; RR</td>
<td>CO₂</td>
<td>Regulatory and technical</td>
<td>I</td>
<td>MVV &amp; RR SR</td>
<td>0</td>
<td>78</td>
<td>803</td>
<td>634</td>
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<tr>
<td>Utilisation of renewable energy sources</td>
<td>Decrease in fossil fuel consumption</td>
<td>CO₂</td>
<td>Regulatory and technical</td>
<td>I</td>
<td>Slovak Ministry of Economy</td>
<td>159</td>
<td>1 138</td>
<td>1 857</td>
<td>2 334</td>
</tr>
<tr>
<td>Shifting of services from individual to public transport</td>
<td>Decrease in hydrocarbon fuel consumption</td>
<td>CO₂, CH₄</td>
<td>Regulatory and technical</td>
<td>S</td>
<td>Slovak Ministry of Transport, Posts and Telecommun.</td>
<td>0</td>
<td>132</td>
<td>269</td>
<td>405</td>
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<td>Environmental protection</td>
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<td></td>
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<td>6</td>
<td>19</td>
<td>34</td>
</tr>
</tbody>
</table>

Note – The positive values of ΔGHG correspond to reduction of greenhouse gas generation at the introduction of the respective measure.

Legend to table:
I – policy and measure have been already implemented (using criteria of updated IPCC Guidelines 1999/7)
S – adopted, approved policy or measure
P – planned, prepared policy/measure

² Table 4.1 shows aggregated emissions of CH₄ and N₂O converted using GWP [Gg equiv. CO₂].
4.2.3 Transportation

From the GHG emission point of view, transport management, the full utilisation of the transport system, as well as the use of proper type of transport play an increasingly important role. In general, the amount of emitted pollutants is in direct proportion to the total output (or the amount of consumed fuel) of the examined type of transport. For road vehicles, railway wagons, vessels and aeroplanes, the calculation of emissions is based on the amount of consumed fuel.

4.2.3.1 CO₂ emissions

4.2.3.1.1 Policy and mitigating measures from the Second National Communication

- **Act No. 316/1993 Coll. on Consumption Tax on Hydrocarbon Fuels and Oils**
  *Type of measure – economic*
  The Act stipulates the rates of consumption tax on fuels used in transportation, giving preferential tax treatment to those using gaseous hydrocarbon fuels and so-called environmental fuels of domestic origin. Rates of consumption tax under the last amendment are as follows:
  - the level of 15 400 SKK/t for gasoline (special types of gasoline not used as fuel 2 800 SKK/t),
  - the lower value of consumption tax at the level of 14 600 SKK/t is applied for diesel fuel,
  - the consumption tax for LPG is 2 370 SKK/t,
  - the consumption tax for natural gas is 2 SKK/m³,
  - the consumption tax for environmental fuel produced in the country is 3 000 SKK/t.

- **Act No. 87/1994 Coll. on Road Tax, as amended**
  *Type of measure – economic*
  *Status of implementation – implemented measure, latest amendment – Act No. 335/1999 Coll.*
  The Act determines road tax for the utilisation of roads by motor vehicles and their attached vehicles used for business or in connection with business. For exclusive utilisation of combined transport for shipment of goods under this Act full or partial tax allowance (from 25 to 75% of tax) may be provided, depending on the range of vehicles participating in combined transport.

- **Control of vehicles in operation**
  *Type of measure – regulatory*
  *Status of implementation – implemented measure³*
  Regulation of the Ministry of Transport, Posts and Telecommunications of the Slovak Republic (MTPT SR) No. 265/1996 Coll. on emission controls of motor vehicles used in road transport (implementary regulation to Act No. 309/91 Coll. on Air) stipulates the means of determination of the amount of emitted pollutants from motor vehicles used in road transport, conditions of granting a licence for execution of emission controls and conditions of granting a certificate of professional competence for execution of emission controls. Regulation of the MTPT SR No. 307/1999 Coll., by which Regulation of the MTPT SR No. 265/1996 Coll. on emission controls of motor vehicles used in road transport is modified and amended, determines emission limits for a vehicle in traffic and time limits of emission control of a vehicle in traffic. Regulation of the MTPT SR No. 327/1997 on controls of technical condition of vehicles comprises general provisions for controls of technical condition of vehicles, time limits of controls, extent of control, result and evaluation of technical condition of vehicle and other provisions directly relating to the execution of control of technical condition of a vehicle.

³ measure implemented through amended decrees.
Formation and development of combined transport system

In spite of adopted legislative measures which economically motivate this form of transport using allowances or reductions of road tax (Act No. 87/1994 Coll.), the range of combined transport in Slovakia is small in comparison with the European level. For further development of combined transport it is necessary to legislate, based on practical experiences of operators, some other areas, e.g. to define this form of transport in the Commercial and Trade Codes as an independent area of transport and licensed activity, to support economically the import of technology for combined transport, to exempt it from VAT, or to introduce restrictive measures in international truck transport at border crossing (e.g. weighing) etc. Presently in the territory of the Slovak Republic there are combined transport terminals in Cierna nad Tisou, Dobrá in neighbourhood of Cierna nad Tisou, Košice, Ružomberok, Bratislava - ÚNS, Bratislava - Pálenisko (port), Nové Zámky, Dunajská Streda and Štúrovo. Among them only the terminal located in Dobrá in neighbourhood of Cierna nad Tisou represents a modern combined transport terminal (CTT) meeting the European standard.

Utilisation of alternative fuels

Type of measure – regulatory and economic
Status of implementation – implemented measure, changes in tax rates (amendment of the Act No. 316/1993 Coll.)

The share of utilisation of alternative fuels in transport is stipulated by Act No. 87/1994 Coll. on road tax, which allows tax exemption for vehicles using electric or solar energy for a 5 year period from allocation of registration number, and reduces by 50% road tax for vehicles powered by liquified petroleum gas (LPG) or compressed natural gas for the first two years from the origin of tax liability. Also Act No. 316/1993 Coll. on consumption tax on hydrocarbon fuels and oils determines lower tax rates for gaseous fuels. In 1999 more than 21 thousand passenger cars powered by LPG and several buses for local transport using natural gas were in operation in the Slovak Republic. More than 30 public LPG filing stations are in operation. Currently, 7 metylester colza oil plants (MERO) with a total production capacity of 17 500 tonnes are located in Slovakia. In 1999, they produced approximately 7 500 tonnes of MERO, which was used for production of mixed fuel [14].

Acceleration of the vehicle fleet replacement

The vehicle fleet replacement continues at a rate corresponding to the economic potential of the country, its enterprises and population. In spite of the unfavourable economic situation, in 1999 of a total operated fleet of 1 246 959 passenger cars, 343 615 vehicles were equipped with a three-way controlled catalyser, i.e. 27.5% of the fleet consists of vehicles which are from the technical and technological point of view new and more friendly to the environment. Some space (though limited in time) for the acceleration of vehicle fleet replacement was created by the provisional cancellation of the import surcharge in 1997 and in the following period it was affected by incentive measures adopted for the purchase of new vehicles on the part of sellers, insurance companies etc.

To solve the unfavourable situation in the area of obsolescence, wear and tear of the vehicle fleet in public bus transport - enterprises associated in the Slovak Bus Transport, in 1998, by Resolution of the Government No. 453/1998, the Program of Replacement of the Bus Fleet SAD was adopted, which allocated 47.5 mil. SKK from funds of the MTPT SR for the purchase of new vehicles. By Act No. 372/1999 Coll. on the state budget of the Slovak Republic for the year 2000, an amount of 200 mil. SKK was allocated in the section of the MTPT SR for bus fleet replacement in 2000, by which the Government contributes up to one third to the purchase of 170 new vehicles. Resolution of the Government No. 544/1999 to the Project of Economic Stabilisation and Transformation of the Slovak Railways should help to solve the unfavourable situation in the area of modernisation of the rolling stock.

4.2.3.1.2 Actual policy and measures to reduce CO₂ emissions

Program supporting rationalisation of fuel and energy consumption in transport

Type of measure – regulatory and technical
Status of implementation – approved measure
The Program, which represents a group of measures and technical solutions aimed to reduce specific consumption and enhance efficiency in transport, was elaborated in compliance with Resolution of the Slovak Government No. 5/2000 to the project of Energy Policy of the Slovak Republic. From the presented group of 27 short-term and medium-term measures until 2007 we chose only those, the introduction of which results in mitigation of negative impacts of transport on the environment.

**Acceleration of public transport by**
- the utilisation of an analysis of drive course and idle time,
- the introduction of integrated transport systems for railway transport, streetcars and trolley coaches,
- the improvement of the condition and equipment of stops and stations,
- drawing up conceptions of the development of public network in relation to direct, fast and fluent connection of the city centre with suburban areas
- own lines for the elevated railroad (L-train),
- the introduction of an active tariff policy in mass city transport,
- wider utilisation of small-capacity buses in city transport.

**Reduction of specific consumption in individual transport**
- voluntary agreements between the Government and producers or importers of vehicles (agreements on investments in energy efficiency in exchange for reduction of tax load),
- adjustments of emission limits (systematic application of regulations of UN EEC and EU directives),
- extended use of LPG and natural gas as fuel in passenger and public transport,
- application of fuel systems based on alternative sources,
- development of local energy control systems MERS (autonomous regulation of power consumption with remote control and data collection).

**Projection of energy saving objectives in acts, standards and administrative regulations**
- charges for authorisation of operation depending on consumption (lower tax rate for vehicles equipped with a catalyser),
- customs duty dependent on consumption – import prices linked to regulated consumption,
- provisions of tax law for investments in enhancement of energy efficiency of the fuel base

**Technical measures for improvement of infrastructure and vehicle fleet in public transport**
- acceleration of railway transport – integrated transport systems for suburban and local transport,
- support of the development of public transport,
- improvement of road transport continuity – construction of capacity roads (highways),
- development of combined transport – the development of infrastructure and the technical base, more intensive utilisation of CT in main transport directions.

**Support of cycling and pedestrian traffic**
- planning and construction of a cycling network, combined automobile and cycling transport on subsidiary roads, cycling tracks in pedestrian zones etc.,
- the development of attractive infrastructure for pedestrians.

**Development of awareness and information activity**
- transport education at schools, aimed in addition to safety problems to issues of energy savings and environmental protection, transport education at driving schools - economic style of driving,
- campaign in media (radio, television, conferences, fairs).

**4.2.3.2 Other gases**
Many of the measures indicated in the *Program Supporting Rationalisation of Fuel and Energy Consumption in Transport also* apply to the category of other gases.
4.2.4 Industry

After a many-year transformation process, metallurgy, chemical, engineering and foodstuff industries remain bearing branches of Slovak industry, i.e. there still prevail branches with high demands on raw materials, energy and transport and with a low degree of processing. Although the shutdown of some less-effective production units and reduction of the volume of production in the elapsed period were followed by reduction of CO\textsubscript{2} emissions in industry, in case of economic growth other reserves of reduction of fossil fuel consumption should be found for the modernisation and restructuring of industrial production. In reduction of CO\textsubscript{2} emissions in industry, cross sectoral measures play an important role, especially the synergetic effect of the Act on Protection of the Air, measures for energy savings and the prepared liberalisation of raw material and energy prices.

4.2.4.1 CO\textsubscript{2} emissions

4.2.4.1.1 Policy and reduction measures from the Second National Communication on Climate Change, Slovak Republic

- **Iron and steel production in VSŽ**
  In VSŽ, a. s., one of the most important industrial enterprises contributing to the creation of CO\textsubscript{2}, a decline in production was observed in the recent period due to changes in property relations. To meet adopted environmental legislation, in the internal heating plant, low-sulphur coal with a content of 0.6% of sulphur is now burnt in five boilers and the sixth boiler is gasified and serves only for combustion of waste gases from technology. The analysis of CO\textsubscript{2} creation in technology itself shows that its level will only depend on the volume of production.

- **Innovation of aluminium technology in ZSNP Žiar nad Hronom**
  One condition of the entry of foreign capital in the project of modernisation of aluminium production in ZSNP, a. s. (the utilisation of pre-burnt anodes and dry absorption of exhalation) was adaptation of all productions to environmental requirements. From 25 environmental projects under this program 18 projects have by now been implemented.

- **Cement production**
  In cement production CO\textsubscript{2} emissions occur by decomposition of limestone in cement clinker and lime calcinators and by combustion of fuels in technological and auxiliary equipment (furnaces, dryers, combustion chambers).
  It is clear that these areas also represent potential room for the implementation of measures to reduce CO\textsubscript{2} emissions [8], [9].
  In the area of production technology particularly the following measures come into consideration:
  - concentration of cement clinker production in larger production units with planned utilisation of most advanced technologies,
  - limitation of wet cement clinker production,
  - limitation of cement clinker production in shaft furnaces,
  - production of mixed cements with a lower content of cement clinker,
  - production of special cements with lower saturation by calcium monoxide,
  - production of cements with adjusted chemical composition of raw-material mixture, which are calcinated at lower temperature.
In fuel combustion processes the following measures leading to reduction of CO₂ emissions can be considered:
- the utilisation of waste heat from the technological process (particularly heat from rotary kilns),
- optimisation of the combustion process with a view to fuel saving,
- the utilisation of alternative fuels (used tyres, some types of waste) – actually in very limited amount due to high prices.

Clinker production was closed in ZEOCEM, a. s., Bystré (1997), in Cementáren Lietavská Lúcka, a. s.,(1998) and in two rotary kilns in Stredoslovenská cementáren Banská Bystrica, a. s.

4.2.4.1.2 Present policy and measures to reduce CO₂ emissions

- Cement production
  Type of measure – technical
  Status of implementation – approved measure
  A specific description of potential areas for the introduction of measures to mitigate CO₂ emissions in cement production, both in production technology and in fuel combustion processes, is provided in subsection 4.2.4.1.1. A brief overview of planned measures together with time schedule and supposed volume of reduction is provided below:

  Measures in the area of production technology
  Reduction of lime production
  - The planned decrease of production in the lime works of Nové Mesto nad Váhom, Žirany, Margecany and Tisovec on one hand and the increase of production in the lime works of Gombasek and Rohožník on the other hand should result in total reduction of CO₂ emissions by 92.4 thousand tonnes per year.

  Measures in fuel combustion processes
  Reduction of fuel consumption in clinker calcination
  - Construction of rotary kiln in the joint-stock company CEMMAC Horné Srnie. The new rotary kiln will replace 5 shaft furnaces, whereby planned reduction of specific fuel consumption from 4300 kJ/kg to 3100 kJ/kg will show in reduction of CO₂ emissions by about 42 thousand tonnes per year.
  - Reconstruction of disperse raw material preheater until 2005 in the joint-stock company Cementáren Turna nad Bodvou. The purpose of this reconstruction is to enhance thermal efficiency of the preheater and reduce fuel consumption; expected reduction of CO₂ emissions is approximately 13.3 thousand tonnes per year.
  - Reconstruction of thickening cyclones in the joint-stock company Považská cementáren Ladce. Planned reduction of CO₂ emissions after reconstruction represents 7.2 thousand tonnes per year.

  Combustion of alternative fuels
  - In the joint-stock company HIROCEM, the rotary kiln PC2 was adapted so as to allow regular combustion of adequately conditioned waste, including tyres. The target value for reduction of CO₂ emissions through the utilisation of alternative fuels was determined at 8.1 thousand tonnes.

4.2.4.2 Other gases
The legislative framework, developed activities and description of their effects, which were specified for the category of other gases in the energy sector (subsection 4.2.2.3), also apply to the industrial sector in the cross sectorial areas.
4.2.4.3 Emissions of HFCs, PFCs and SF$_6$ – New gases

Under the term **New gases** emissions are analysed of substances which may be classified as greenhouse gases from the aspect of their effects, but before COP3 in Kyoto they were not taken into account in the inventory and projection of greenhouse gases. Their first inventory was executed in 1995. HFCs, PFCs and SF$_6$ are not produced in Slovakia, only data on their consumption are available. A more specific description of individual gases and the way of their utilisation is provided in Appendix P2 (section P2.1). Considering the nature of these substances the choice of mitigating measures is very limited.

4.2.5 Residential, commercial and institutional sectors

4.2.5.1 CO$_2$ emissions

4.2.5.1.1 Policy and mitigating measures from the Second National Communication

- **Program of Energy Consumption Reduction in Apartment and Family Houses**
  - Type of measure – economic

The Program was designed for owners of apartment houses, family houses and thermal sources for district heating.

- **Part A – Additional provision with thermal insulation of apartment houses in collective forms of construction** [10]
  
From 1992 until the end of the year 1997, 271 projects with a total budget expenditure of 960 mil. SKK were implemented, whereby the participation of the Government represented the amount of 540.8 mil. SKK for the total number of 10 937 apartments. The achieved heat savings for the examined period represented a volume of 196 866 GJ/year and expenditures of state budget per GJ of saved energy were in average 2 747 SKK/GJ.

- **Part B – Installation of measuring and control equipment and modernisation of heating systems in apartment houses and apartments** [9]

The total volume of funds provided under the Program from state budget until the end of the year 1998 amounted to 186.1 mil. SKK.

4.2.5.1.2 Present policy and measures to mitigate CO$_2$ emissions

- **Proposed conception of building reconstruction with special accent upon housing fund**
  - Type of measure – regulatory and technical
  - Status of implementation – approved measure (Resolution of the Slovak Government No. 1088/1999)

This measure comprises a group of measures for reconstruction of the housing fund with a view to preserving the existing fund, extending its useful life and creating conditions for energy savings:

- More intensive procedure in providing the existing housing fund with thermal insulation using the state programs of energy savings.
- Systematic introduction of measuring and control equipment in the housing fund and in the respective energy system.
- Additional improvement of physical parameters of windows and doors built in the existing housing fund.

$^4$ This Program was replaced by the Program supporting energy savings and utilisation of alternative energy sources and presently it is supported through the State Fund of Housing Development at the Ministry of Construction and Regional Development of the Slovak Republic.
4.2.6 Agriculture

As was said in subsection 4.1, the elaborated document Proposal for Measures to Adapt Agriculture of the Slovak Republic to Climate Change[11] includes a specific overview of activities and projects to solve negative impacts of climate change in chosen areas with effect on emissions of CO\textsubscript{2}, CH\textsubscript{4} and N\textsubscript{2}O\textsuperscript{5}.

In agriculture:
- the application of protective and economic cultivation technologies,
- changes in growing technologies,
- changes in agroclimatic classification and structure of grown crops and varieties,
- changes in cultivation programs,
- changes in the integrated protection of crops,
- changes in water management of soil regulation,
- changes in nutrition of plants,
- reduction of greenhouse gas emissions, treatment of excrements and wastes in animal production,
- changes in agricultural production management,
- revitalisation of the existing and construction of new irrigation systems.

In management of water supplies:
- solution of potential consequences of climate change on water supplies,
- slowdown of runoff by construction of purpose reservoirs,
- construction of new hydro-energy sources leading to the utilisation of naturally renewable natural sources in order to reduce consumption of fossil energy sources.

In forestry:
- changes of tree species composition of forests,
- afforestation of non-forest areas,
- the area of forestry bioclimatology, eco-physiology, forest protection, genetics and cultivation of tree species,
- measures to improve vegetation condition in forests affected by emissions,
- adaptation of extraction and production technologies to environmental requirements,
- preservation and reproduction of the genofund of tree species in forests
- changes of hydric influence of forests.

In the area of breeding, cultivation and nutrition of animals:
- modelling of breeding systems with the possibility to reduce the influence of extreme microclimate on utility and health condition of animals,
- the protection of livestock from high temperatures,
- modelling the influence of the amount of annual genetic gain on milk and beef production and on population of cattle in relation to the required milk and meat production in the Slovak Republic,
- the application of livestock breeding systems which will allow the reduction of the influence of extreme climatic parameters on production and health condition of animals and the influence of breeding on air quality and water management systems,
- the completion of storage capacities of stable manure and liquid manure in compliance with EU legislation in force,
- the utilisation of manure application systems with reduced influence on air quality and water management systems.

\textsuperscript{5} The overview of measures also includes reduction measures – in italics.
4.2.6.1 CO₂ emissions

As regards the share of the sector in total emissions, measures to reduce formation of CO₂ emissions in agriculture only focus on the area of fuel and energy consumption, i.e. cross-sectorial measures. The analysis of data from the years 1998 and 1999 clearly shows that for total year-on-year savings of fuels and energies in agriculture, consumption of "environmental-friendly" types (natural gas and heavy heating oil) increased. The CO₂ sinks are evaluated in Chapter 3.

- Regulation of the Ministry of Agriculture of the Slovak Republic No. 928/1992 – 100 on the support of enterprise in agriculture
  Type of measure – regulatory and economic
  Status of implementation – implemented measure
  State support to rationalisation of the energy system in agriculture and foodstuff industry, utilisation of renewable sources, wastes and waste heat, purchase of new technologies, production and consumption of biofuel.

- Conception of Agrarian and Food Policy until 2005
  The document aims to create conditions for the implementation of the European model of multi-functional agriculture. It will include measures of sustainable management.

- Agro-environmental Program of the Slovak Republic
  The basic document of adaptation of agriculture to environmental requirements, which is the result of the effort towards mutual integration of agrarian and environmental policy.

4.2.6.2 CH₄ emissions

Agriculture, solid waste storage and wastewater treatment are the major sources of methane production. While the share of anthropogenic methane emitted in the atmosphere from waste dumps accounts, by estimate, for 5 to 20 % of total production, the share of agriculture on total methane production in 1996 was approximately 35% (109 thousand tonnes) [7].

The sources of methane production in agriculture are concentrated in the area of animal production. They are mostly represented by:
- CH₄ emissions from enteric fermentation of livestock,
- CH₄ emissions from animal waste management.

Based on characteristics of the major sources of methane production in agriculture, we can define as real possibilities of reduction of methane emissions the following measures:
- reduction of livestock or change in representation of livestock in individual categories (cattle, pigs, poultry, horses, sheep, goats),
- treatment of waste from animal production to biogas.

As cattle are the largest methane producer among all animal categories (large weight, digestive system, large number of animals), trends of total CH₄ emissions also reflect the number of animals in this category. In the years 1990 to 1998, the number of cattle decreased by almost one half, which corresponds to a total reduction of CH₄ emissions from more than 133 thousand tonnes in 1990 to 65 thousand tonnes in 1998. Methane production from animal production may be effectively used for biogas production. The estimate of biogas production from organic substance of excrements of individual categories of livestock can be based on the following data [12]:
- dairy cattle 1.26 m³ of biogas/unit/day
- beef cattle 0.93 m³ of biogas/unit/day
- pig 0.15 m³ of biogas/unit/day
- layer 0.020 m³ of biogas/unit/day

In Slovakia this technology is applied in Bátka near Rimavská Sobota. Theoretically this method can eliminate methane from dry or wet excrement storage of big farms, which means a potential reduction of methane from this source by up to 80%.

4.2.6.2.1 Policy and mitigating measures from the Second National Communication
Code of Good Agricultural Practice in the Slovak Republic – soil protection
The document which was approved and published in 1996 remains in force. In the framework of this amendment Part II was elaborated, which includes rules for correct utilisation of fertilisers.

4.2.6.2.2 Present policy and measures to reduce CH₄ emissions

  Type of measure – regulatory
  Status of implementation – implemented measure
  The amendment of Act No. 307/1992 Coll. stipulates inter alia the definition of agricultural soil stock and obligations of the owner or the lessee of land being a part of the agricultural soil stock to execute agrotechnical measures which guarantee protection, preservation and restoration of natural properties of agricultural soil. Subsection 5 of the Act specifies measures to repair damage to natural properties of agricultural soil.

- Act No. 136/2000 Coll. on Fertilisers
  Type of measure – regulatory
  Status of implementation – implemented measure
  The Act, which was adopted in March 2000, lays down conditions for putting into circulation fertilisers, farming substrates and soil additives, conditions of registration of fertilisers, their storage and utilisation, conditions of agrochemical testing of agricultural soil and determination of soil properties of forest land.

- Conception of Cattle Breeding for the period 2000 – 2005
  Type of measure – regulatory
  Status of implementation – implemented measure
  The strategy of further development of cattle breeding in Slovakia [14] is based on two basic requirements:
  1/ production of sufficient amount of quality products for domestic market - after revival of the economy, a gradual increase of meat and milk consumption is expected for breeding of such number of cattle which shall allow to improve permanently the cultural character of the country and partially solve the social problem;
  2/ the viewpoint of world trade globalisation and the accession of Slovakia to EU – since January 1, 2000, Regulation of the EU Council No. 1254/1999 on common organisation of beef and calf market has been in force, according to which subsidies for prices shall be successively reduced with a view to enhancing competitiveness on international markets. More details and an overview of conceptual documents from the affected area are available on the web site: www.mpsr.sk.

4.2.6.3 N₂O emissions

Unlike other greenhouse gases, the mechanism of formation of N₂O emissions and sinks has not been thoroughly examined, and presented data have a high degree of uncertainty. Agriculture has the largest share on total N₂O production (approximately 75%), which represents the only sector in Slovakia where measures to reduce N₂O emissions can be applied. The process of formation of N₂O emissions by combustion or transformation of fossil fuels is similar as with carbon dioxide and methane, i.e. reduction of its formation is positively affected by all measures, which result in a reduction of fossil fuel consumption. On the contrary, in the case of wastewaters, measures to reduce CH₄ emissions result in an increase of N₂O emissions.

The major sources of N₂O emissions are:
- N₂O emissions from for soil enterprising for agricultural purposes,
- N₂O emissions from animal waste enterprising,
- indirect N₂O emissions.

The release of N₂O emissions also occurs during storage of stable manure. The amount of N₂O depends especially on the way and the period of animal waste storage.
- indirect N₂O emissions.
They occur by atmospheric deposit of ammonium and NO₃, as well as by transformation from washed-up nitrogen and from nitrogen losses caused by runoff.

The real potential for reduction of N₂O emissions from agricultural production on the basis of provided characteristics of sources is represented by the following measures:
- reduction of areas used for agriculture (particularly those which are unfit for purposes of agricultural production),
- reduction of the application of fertilisers,
- decrease of the number of livestock or change of its representation in individual categories,
- suitable storage and treatment of wastes from vegetable and animal production, transformation of liquid manure to biogas,
- treatment of post-harvest remainders from vegetable production.

- Act No. 307/1992 Coll. on Agricultural Soil Protection (section 3, § 4, 5 and 6)
  Type of measure – regulatory
  Though amended, the Act remains the basic legal norm which ensures the fulfilment of environmental criteria in the area of agriculture. According to this Act users of agricultural soil are obliged to use it in such a way that will minimise the negative effects of their activity on the environment (water, atmosphere). All changes in the use of agricultural soil may be executed only after approval by the agricultural soil stock protection body. Another amendment of the Act under preparation (2003) should include definitions of soil functions and comprehensive ensurance of their sustainable development.

- Directive of the Ministry of Agriculture of the SR No. 5000/1982 on the Water Protection against Agricultural Contamination
  Type of measure – regulatory
  Status of implementation – implemented measure

- Directive of the Ministry of Agriculture of the SR No. 5001/1982 on Manipulation with and Utilisation of Liquid Manure and Liquidation of Ensilage Juices
  Type of measure – regulatory
  Status of implementation – implemented measure, amended by Regulation of the Ministry of Agriculture No. 33/1999 Coll. on preparations for plant protection
  The regulation stipulates details on keeping records of consumption and application of preparations for plant protection and on conditions of testing and assessment of the preparations.

- Code of Good Agricultural Practice – soil protection
  The document, which was approved and published in 1996, deals with protection of soil fertility, protection from physical degradation of soil, soil contamination and its consequences, as well as with management of water and air soil regimes. In the framework of its amendment Section II - Principles of correct application of fertilisers - was elaborated. The prepared Section III of the Code of Good Agricultural Practice will deal with water protection.

Table 4.2 shows brief characteristics of major mitigating measures to reduce CH₄ emissions in agriculture and quantification of their reduction potential for the cross-sectorial years.
Table 4.2 Characteristics and potential of some measures in agriculture

<table>
<thead>
<tr>
<th>Name of policy/measure</th>
<th>Objective and/or Activity affected</th>
<th>GHG affected</th>
<th>Type of instrument</th>
<th>Status</th>
<th>Implementing entity/entities</th>
<th>Mitigation</th>
<th>Impact</th>
<th>ΔGHG [GgCO₂ equiv./year]</th>
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</thead>
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<tr>
<td>Reduction of the livestock number</td>
<td>Intensification of agricultural production</td>
<td>CH₄</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Harmonisation with EU legislation⁷</td>
<td>N₂O</td>
<td>Regulatory</td>
<td>I</td>
<td>The Ministry of Agriculture SR</td>
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<tr>
<td>Total</td>
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<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>-524</td>
</tr>
<tr>
<td>Treatment of animal excrements to biogas</td>
<td>Application of RES</td>
<td>CH₄</td>
<td>Technical</td>
<td>I</td>
<td>The Ministry of Agriculture SR</td>
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</tr>
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<td></td>
<td>Reduction of GHG emissions</td>
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<td></td>
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</tbody>
</table>

Note – The positive values of ΔGHG correspond to reduction of GHG emissions upon introduction of the respective measure.

Legend:
I – policy and measure have already been implemented (using criteria of the updated IPCC Guidelines 1999/7)
S – adopted, approved policy or measure
P – planned, prepared policy/measure

⁶ Table 4.2 shows aggregated emissions of CH₄ and N₂O converted using GWP [Gg equiv. CO₂].
⁷ The measures arising under the EU Directive lead to reduction of CH₄ emissions. On the other hand, formation of N₂O emissions increases upon their introduction.
4.2.7 Land usage change and forestry

4.2.7.1 CO₂ emissions
In general, in forestry we can define the following mitigating measures which develop from basic balance categories and individual related processes:
- reduction of permanently deforested areas,
- afforestation of non-forest areas,
- increase of carbon stock in the existing forests,
- increase of utilisation of wood and its better valorization,
- utilisation of wood as biomass – replacement of fossil fuels.

In the Second National Communication, the following potential mitigating measures were identified for the area of forestry:
- tree species composition change,
- afforestation of non-forest areas,
- protection of the existing carbon stock in forests affected by emissions

➢ Tree species composition change
In the framework of the economical planning (Decree of Ministry of Agriculture No. 5/1995 Coll. on economic forests adjustment), the share of leafy forests will be increased in the area with conifer forests (replacement of spruce by beech, which has higher specific content of carbon per 1 ha). Considering the longevity of the reproduction process in forests, the tree species composition change can be reached only very slowly. At this stage we cannot therefore evaluate the actual effect of this measure on the carbon balance.

➢ Afforestation of non-forest areas
Afforestation of non-forest areas represents the most effective way of carbon sequestration because it is accompanied by formation of new stock as well as carbon accumulation in soil humus. The potential of areas suitable for afforestation in Slovakia is quite large. By repeal of Decree of the Slovak Government No. 550/1994, by which the Program of Afforestation of Non-Forest Areas Unfit for Agricultural Use in the period 1994 – 1996, with outlook until 2000, was implemented, this Program was suspended, including cancellation of its institutional assurance. The result of program implementation is total afforestation of 877 ha of soil during the period 1995 – 1999 (against the planned afforestation of 50 000 ha of non-forest areas until 2000). The practical implementation of the program was impeded by several factors, the most important of which were unsettled property relations to land (difficult identification of owners) and unclear financial and subsidy policy in relation to land owners.

➢ Protection of carbon stock in forests affected by emissions
The solution of problems related to improvement of vegetation conditions in forests, i. e. slowdown or stoppage of the decrease of increment in forests affected by emissions, with subsequent positive effect on the carbon balance, has a long tradition in Slovakia, but it obtained a legal framework only in 1994, when the Implementation Program for Elimination of Damages Caused by Anthropogenic Activity, especially by emissions in forest ecosystems, was approved by Resolution of the Slovak Government No. 594/1994. Under this Program implementation projects were developed for individual areas (Low Tatra, Stredné Považie, Belianske Tatry, Žiar nad Hronom, Polana, Orava-Kysuce, Spiš, Horná Nitra, Jelšava-Lubeník) the implementation of which was however impeded by the lack of funds. During the period 1995 – 1997, measures for improvement of vegetation conditions were executed on a total area of 3 822 ha, with costs of 48 mil. SKK. In spite of enormous effort, the Program was not implemented in the planned extent of preventive and corrective measures because of the lack of funds.
Table 4.3 Characteristics and reduction potential of some mitigating measures in forestry

<table>
<thead>
<tr>
<th>Name of measure</th>
<th>Policy/Activity affected</th>
<th>GHG affected</th>
<th>Type of instrument</th>
<th>Status</th>
<th>Implementing entity/entities</th>
<th>Mitigation</th>
<th>Impact</th>
<th>ΔGHG [GgCO₂ equiv./year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil stock stock protection</td>
<td>Increase of soil carbon stock – lower effect*</td>
<td>CO₂</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Agriculture</td>
<td>0</td>
<td>73</td>
<td>51</td>
</tr>
<tr>
<td>Protection</td>
<td>Increase of soil carbon stock – higher effect*</td>
<td>CO₂</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Agriculture</td>
<td>0</td>
<td>88</td>
<td>80</td>
</tr>
<tr>
<td>Regulation of timber extraction</td>
<td>Reduction of permanently deforested area – lower effect</td>
<td>CO₂</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Agriculture</td>
<td>0</td>
<td>330</td>
<td>660</td>
</tr>
<tr>
<td></td>
<td>Reduction of permanently deforested area – higher effect</td>
<td>CO₂</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Agriculture</td>
<td>0</td>
<td>660</td>
<td>990</td>
</tr>
<tr>
<td>Afforestation of non-forest areas</td>
<td>Increase of GHG sinks - lower effect</td>
<td>CO₂</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Agriculture</td>
<td>0</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Increase of GHG sinks - higher effect</td>
<td>CO₂</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Agriculture</td>
<td>0</td>
<td>2</td>
<td>13</td>
</tr>
</tbody>
</table>

*The lower effect corresponds to the scenario with measures, the higher effect to the scenario with additional measures (see Chapter 5).

Note – The positive values of ΔGHG correspond to reduction of GHG emissions upon introduction of the respective measure.

Legend to table:
I – policy and measure have already been implemented (using criteria of the updated IPCC Guidelines 1999/7)
S – adopted, approved policy or measure
P – planned, prepared policy/measure
4.2.8 Waste management

4.2.8.1 CH₄ emissions

The major sources of methane production are: agriculture, solid waste storage and waste water treatment. The share of anthropogenic methane emission in the atmosphere from waste dumps represents, according to estimates, 5 to 20 % of total production [7].

- **Act No. 238/1991 Coll. on Waste**
  - **Type of measure** – regulatory
  - **Status of implementation** – implemented measure, the last amendment approved by the Slovak Government in November 2000

The Act on Waste remains the basic legal norm in the area of waste management. Among others, according to this Act, the waste producer is obliged to use produced waste as a source of secondary raw materials or energy. Disposal of waste in landfills should be the last step of waste treatment which cannot be used otherwise. In June 2000 the Ministry of Environment of the Slovak Republic submitted a proposal of a new Act on Waste, together with proposals for ten implementation regulations. Under this amendment, the whole legal framework for the area of waste management changes and only Act of the National Council of the Slovak Republic No. 327/1996 Coll. on charges for waste disposal remains in force.

- **Decree of Slovak Government No. 606/1992 Coll. on Waste Treatment**
  - **Type of measure** – regulatory
  - **Status of implementation** – implemented measure, latest amendment - Decree of the Slovak Government No. 190/1996 Coll.

The Decree stipulates general conditions for waste treatment, special conditions for hazardous waste treatment and rules for landfill management. Waste treatment should be executed so that separable and utilisable substances could be used to a maximum extent in the production process. The amount of subsequently produced waste should be as small as possible, with minimum negative impacts on environment. Vegetable waste, animal excrements, sludge from sewage treatment plants and other similar waste should be preferentially treated in a biological way. The building of new landfills where gas generation is anticipated must contain a gas drainage system. In the framework of the amendment of the Act on Waste, a new form of the stated Decree is being prepared.

- **Waste Management Program of the SR until 2000**
  - **Type of measure** – regulatory and economic
  - **Status of implementation** – implemented measure

The Waste Management Program of the Slovak Republic, approved by Resolution of the Slovak Government No. 500/1993, determined the conception for solution of issues of waste management and the means of waste treatment in the Slovak Republic. For the attainment of the Program objectives, funds in a total amount of 2 918 mil. SKK were used until the year 1995. The total amount of funds allocated to the support of waste management projects from the State Environment Fund in the period 1993 – 1997 represented a sum of 1 475 mil. SKK. The evaluation of the progress of implementation of some WMP measures from the Second National Communication, in relation to methane emissions, for the period 1993 –1996, is provided in Table 4.4.

---


<table>
<thead>
<tr>
<th>Objective</th>
<th>Status of implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>To extend collection and utilisation of secondary raw materials by introduction of separated waste collection to reduce the amount of communal waste determined for disposal by 20% against the level of year 1992.</td>
<td>The separated waste collection is introduced in 500 communities and cities of Slovakia. In this way 350 000 tonnes of recyclable materials are obtained every year, which represents 22% of the total communal waste production.</td>
</tr>
<tr>
<td>To refine at least 20% of the volume of biological waste to organic fertilisers.</td>
<td>According to available data, 1.9 mil. tonnes of different agricultural wastes are subject to biological treatment. In addition, 5.9 mil. tonnes of stable manure and straw and 5.6 mil. tonnes of liquid manure are used for fertilisation.</td>
</tr>
<tr>
<td>To dispose in the prescribed way 50% of all communal wastes in landfills, which meet technical requirements.</td>
<td>In the examined period, new landfills were built and others were subject to special conditions. Currently more than 95% of communal waste is disposed in approved landfills.</td>
</tr>
<tr>
<td>To build a new, or adapt existing communal waste incinerators in Bratislava and Košice.</td>
<td>This measure has not been implemented because of lack of funds.</td>
</tr>
<tr>
<td>To build 10 waste composting facilities.</td>
<td>Industrial compost production has decreased by about 85% since 1992, especially due to cancellation of state subsidies and the low interest in these products. The existing facilities are now used particularly for biological decontamination of soils.</td>
</tr>
<tr>
<td>To build 9 high-capacity regional landfills for communal waste.</td>
<td>Since 1992, 31 new landfills have been built and 27 are under construction. Most of them have a regional character. The system of transfer stations used for waste transport to more distant landfills is very demanding from the technical aspect and has not been introduced yet.</td>
</tr>
</tbody>
</table>

> Act No. 128/1992 Coll. on the State Environment Fund
*Type of measure – economic*
*Status of implementation – not in force, it was replaced by the Act No. 237/2000 Coll.*

In the years 1993 to 1997, from the State Environment Fund of the SR, funds for the support of waste management projects in a total amount of 1 475 mil. SKK were allocated. The contributions were used mostly for the development of separated waste collection, construction of regional landfills, reconstruction of old landfills, waste recycling and proper treatment of hazardous waste.

> Waste Information System
The Regional Waste Information System (RISO) is designed for all levels of state government in waste management. The first version of the information system was developed in the period of validity of the initial waste catalogue (709 types of waste in 1991), while the existing system was adjusted in terms of the Decree of the MOE SR No. 19/1996 Coll., stipulating waste categorisation and issuing an extended Waste Catalogue (749 types of waste in 1996). RISO is designed so that all waste can be traced to the place of its origin, its quantity and the way of its treatment, including transport and place of neutralisation.

> Decree of the Slovak Government No. 605/1992 Coll. on Keeping Waste Records
*Type of measure – regulatory*
*Status of implementation – implemented measure*

The Decree defines basic conditions for keeping waste records. In the period since the Second National Communication on Climate Change, it has not been amended.

> Act No. 327/1996 Coll. on Charges for Waste Disposal
*Type of measure – economic*
*Status of implementation – implemented measure*

The Act determines charges for waste disposal in landfills and sludge beds. It imposes higher charges for waste disposal in landfills, which do not meet legislative requirements, making them
disadvantageous. In the period since the Second National Communication on Climate Change, it has not been amended. The anticipated term of its amendment is the year 2001.

Table 4.5 shows brief characteristics and reduction potential of measures in the sector of waste management.
### Table 4.5 Characteristics and potential of some measures in the sector of waste management

<table>
<thead>
<tr>
<th>Name of policy/measure</th>
<th>Objective and/or Activity affected</th>
<th>GHG affected</th>
<th>Type of instrument</th>
<th>Status</th>
<th>Implementing entity/entities</th>
<th>2000</th>
<th>2005</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support of separated waste collection and utilisation of biologically active waste Biogas combustion</td>
<td>Reduction of emissions and the amount of biologically active waste disposed in landfills – lower effect</td>
<td>CH₄</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Environment</td>
<td>0</td>
<td>90</td>
<td>260</td>
<td>428</td>
</tr>
<tr>
<td></td>
<td>– higher effect</td>
<td>CH₄</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>181</td>
<td>428</td>
<td>689</td>
</tr>
<tr>
<td>Waste water treatment</td>
<td>Reduction of CH₄ emissions and harmonisation with EU - effluents</td>
<td>CH₄</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Environment</td>
<td>0</td>
<td>11</td>
<td>34</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>– lower effect</td>
<td>CH₄</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>21</td>
<td>55</td>
<td>84</td>
</tr>
<tr>
<td>Waste water treatment</td>
<td>Reduction of CH₄ emissions and harmonisation with EU – industrial waters</td>
<td>CH₄</td>
<td>Regulatory</td>
<td>I</td>
<td>Slovak Ministry of Environment</td>
<td>0</td>
<td>11</td>
<td>34</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>– lower effect</td>
<td>CH₄</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>22</td>
<td>57</td>
<td>95</td>
</tr>
</tbody>
</table>
| Waste water treatment  | Harmonisation with EU              | N₂O          | Regulatory | P | Slovak Ministry of Environment | 0     | -3**  | -6    | -8    |*

*The lower effect corresponds to the scenario with measures, the higher effect to the scenario with additional measures (see Chapter 5).

**Note – The positive values of ΔGHG correspond to reduction of GHG emissions upon introduction of the respective measure.**

**Legend to table:**
I – policy and measure have already been implemented (using criteria of the updated IPCC Guidelines 1999/7)
S – adopted, approved policy or measure
P – planned, prepared policy/measure

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9 Table 4.5 shows aggregated emissions of CH₄ and N₂O converted using GWP [Gg equiv. CO₂].

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4.3 OTHER INSTRUMENTS AND MECHANISMS TO REDUCE GHG EMISSIONS

The Kyoto Protocol has generally extended the possibilities of countries to choose the means and instruments which are the most suitable for the attainment of reduction objectives with regard to specific circumstances of the respective country. The common feature of the new mechanisms is the effort to achieve maximum reduction potential in the most efficient way. In addition to the bubble concept (the European Union) the protocol defines in the framework of international collaboration the following flexible mechanisms:

a) Joint Implementation (Art. 6).
b) Clean Development Mechanism (Art. 12).
c) Emission Trading (Art. 17).

The Joint Implementation (JI) and the Clean Development Mechanism (CDM) consist in acquisition of emission reduction credits on the basis of investments (including transfers of technologies) in countries with a transforming economy or in developing countries, while emission trading allows purchasing and selling emission reduction credits according to the agreed scheme in the framework of countries specified in ANNEX I of UN FCCC.

In spite of the evident economic efficiency, the practical utilisation of these mechanisms is connected with a number of institutional and political problems, as well as difficult practical issues linked to the transfer of technologies, monitoring, verification and – last but not least – mutual confidence of the concerned parties. Recent development shows that the implementation of new mechanisms of reduction is subject to achievement of consensus in the international context.

In the framework of the prepared strategy, the Slovak Republic would preferentially participate in international emission trading at two levels - intergovernmental and individual enterprises – according to exactly defined international and domestic rules. In addition to foreign investments, this activity should result in the more distinct implementation of efficient technologies. Considering the high transaction costs related to preparation and implementation of projects, the amount of administrative work and lower effectiveness, the utilisation of the JI mechanism in the Slovak Republic will be probably lower. Based on the actual inventory of GHG emissions and projections of future emission development, it can be anticipated that the Slovak Republic will meet the Kyoto reduction target through internal activities, so the application of CDM is not supposed. Within the stage of so-called AIJ (Activities Implemented Jointly), four projects aimed at the utilisation of biomass are now being prepared or implemented in Slovakia.

Other possibilities for gaining financial resources for investments in environmental projects, restructuring of industry, enhancement of energy efficiency, transport and agriculture are represented by pre-accession financial instruments of the European Union for assistance to the associated countries - ISPA (Instrument for Structural Policies for pre-Accession), PHARE II, SAPARD, SAVE II, ALTENER II and JOULE-THERMIE.

4.4 SUMMARY OF MEASURES AND RECOMMENDATIONS UNDER THE ACTION PLAN OF FULFILMENT OF KYOTO PROTOCOL COMMITMENTS

As was stated above, the Action Plan of Fulfilment of the Kyoto Protocol Commitments of the UN FCCC, the Ministry of Environment of the Slovak Republic, 2000 [13] has thoroughly analysed direct and indirect reduction measures from the viewpoint of their GHG reduction potential, investment intensity and the time horizon for their implementation. The analysis has focused on the energy sector, namely on the fossil fuel combustion and transformation, which significantly contributes to the total CO\(_2\) emissions, but which also represents the largest potential for implementing the CO\(_2\) mitigation measures. Based on the projections of CO\(_2\) emissions from combustion and transformation of fossil fuels using scenarios in chapter 5, we can state that in the case of relatively balanced economic
development Slovakia has a real chance to meet the reduction commitment under the Kyoto Protocol. The purpose of the analysis in the Action Plan was however to find other reduction potential which would allow meeting the more severe commitments in the following target period (Post-Kyoto period), as well as using the potential emission reduction reserve in the framework of flexible mechanisms (described in section 4.3) for acquisition of investments or innovation of technologies.

The following measures were evaluated:

**Measures on the energy demand side**
- Improvement of thermal characteristics of building in housing communal sector.
- Shifting from individual road transport to public mode.

**Measures on the energy supply side**
- Utilisation of combined cycles (CC) with electricity and heat cogeneration in public power plants (public PP).
- Utilisation of combined cycles (CC) with electricity and heat cogeneration in industrial power plants (industrial PP).
- Utilisation of biomass in industrial PP.
- Utilisation of biomass in the central district heating system (DHS).
- Utilisation of geothermal energy in the central heating system.
- Utilisation of biomass for individual heating.
- Utilisation of solar energy for heating and conditioning of hot supply water.

Some of the previous measures interact so that the total reduction effect may be reduced. For example, thermal insulation of buildings reduces the effect of measures implemented in heat production in district heating systems. On the other hand, the introduction of combined cycles in industrial PP reduces the potential for the utilisation of biomass etc.

Quantified parameters of comprehensive evaluation of the reduction potential of individual measures are summarised in Table 4.8.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CC in industrial PP</td>
<td>469045</td>
<td>1030</td>
<td>23.1</td>
<td>230</td>
<td>0.45</td>
<td>126 MWₑ</td>
<td>283 MWₑ</td>
<td>440 MWₑ</td>
</tr>
<tr>
<td>CC in public PP</td>
<td>242300</td>
<td>1200</td>
<td>27.0</td>
<td>585</td>
<td>1.15</td>
<td>year 2004</td>
<td>242 MWₑ</td>
<td></td>
</tr>
<tr>
<td>CC in public PP with thermal insulation</td>
<td>242300</td>
<td>1198</td>
<td>26.9</td>
<td>541</td>
<td>1.06</td>
<td>year 2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass in industrial PP with parallel implementation of CC</td>
<td>55337</td>
<td>-1884</td>
<td>-42.3</td>
<td>328</td>
<td>0.64</td>
<td>9 %</td>
<td>18 %</td>
<td>24 %</td>
</tr>
<tr>
<td>Biomass in DHS without effect of thermal insulation of apartments</td>
<td>98118</td>
<td>-1835</td>
<td>-41.2</td>
<td>386</td>
<td>0.76</td>
<td>year 2002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass in DHS with effect of Thermal insulation of apartments</td>
<td>73627</td>
<td>-2035</td>
<td>-45.7</td>
<td>307</td>
<td>0.60</td>
<td>9 %</td>
<td>14 %</td>
<td>21 %</td>
</tr>
<tr>
<td>Biomass in individual heating Of houses</td>
<td>13525</td>
<td>-1008</td>
<td>-22.7</td>
<td>685</td>
<td>1.34</td>
<td>year 2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geothermal energy in DHS Without effect of thermal insulation of apartments</td>
<td>159959</td>
<td>-1749</td>
<td>-39.3</td>
<td>217</td>
<td>0.43</td>
<td>102 MWₑ</td>
<td>229 MWₑ</td>
<td>355 MWₑ</td>
</tr>
<tr>
<td>Geothermal energy in DHS with Effect of thermal insulation of apartments</td>
<td>209091</td>
<td>-1253</td>
<td>-28.2</td>
<td>165</td>
<td>0.32</td>
<td>102 MWₑ</td>
<td>229 MWₑ</td>
<td>355 MWₑ</td>
</tr>
<tr>
<td>Solar heating in individual heating of Houses</td>
<td>459222</td>
<td>381</td>
<td>8.6</td>
<td>174</td>
<td>0.34</td>
<td>163 TJ</td>
<td>326 TJ</td>
<td>490 TJ</td>
</tr>
<tr>
<td>Biomass in heat monoproduction In industrial PP</td>
<td>56978</td>
<td>-494</td>
<td>-11.1</td>
<td>267</td>
<td>0.52</td>
<td>10 %</td>
<td>20 %</td>
<td>30 %</td>
</tr>
<tr>
<td>Biomass in cogener. In industrial PP</td>
<td>15657</td>
<td>-1830</td>
<td>-41.1</td>
<td>77</td>
<td>0.15</td>
<td>year 2000</td>
<td>1172 TJ</td>
<td>1128 TJ</td>
</tr>
</tbody>
</table>
## 4.5 LITERATURE


