3. GREENHOUSE GAS INVENTORY BY SOURCES AND REMOVALS BY SINKS

As a Party to the United Nations Framework Convention on Climate Change, in its National Communication the Kyrgyz Republic should provide information on results of its greenhouse gas inventory of emissions by sources and removals by sinks. In order to achieve international comparability of inventory results, IPCC requirements apply. In preparing a GHG inventory calculation methodologies approved and agreed upon by the Conference of Parties must be used. The methodological basis for calculations of GHG emissions and removals by sinks agrees with the IPCC Guidelines (Revised 1996 IPCC Guidelines, IPCC/UNEP/OECD/IEA, 1997) and the IPCC Good Practice and Uncertainty Management in National Greenhouse Gas Inventories, 2000. The default factors applied in our calculations were taken from the IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual, Revised 1996. In the absence of default approaches, it was permitted to apply national calculation methods and coefficients.

According to the Guidelines, the inventory was designed by sectors: energy, industries, solvents, agriculture, land-use changes and forestry, and waste. Emissions of the following GHGs were taken into consideration: carbon dioxide, methane, nitrous oxide, nitrogen oxides, carbon monoxide, non-methane volatile organic compounds (NMVOCs), sulphur dioxide, and halogens. Greenhouse gas inventory was implemented during the period of 1990-2000 in the Republic as a whole and, where appropriate, in the context of the 7 oblasts (provinces) and Bishkek city. In concordance with IPCC Guidelines, the year 1990 was taken as a base year.

Inventory results, according to Guidelines statements, are expressed both in mass units for certain GHGs and in relative units of CO_2 equivalent. The latter are applied to compare the contribution of various gases to total GHG emissions and depend on the value of their global warming potentials (GWP).

Carbon dioxide's GWP was assumed as the unit; potentials of other gases were defined in relation to that. Though any period may be chosen for comparison, 100 years (as recommended by IPCC) was applied as a period for GWP calculating in the national inventory (see Table 3.1).

Table 3.1. Global warming potentials of the main greenhouse gases

Greenhouse gas	Chemical formula	Period of existence, years	GWP for the period of:		
			20 years	100 years	500 years
Carbon dioxide	CO_2	Changeable	1	1	1
Methane	CH_4	12	63	23	7
Nitrous oxide	N_2O	114	275	296	156

Note: in addition, GWP for halogens not controlled by the Montreal Protocol were defined
Source: Climate Change 2001. The Scientific Basis, IPCC, 2001.

3.1. Methodologies and data sources

The information base for GHG emission assessment is information on fuel and energy resources use, the existence of GHG sources, volumes of production giving GHG emissions. The following information sources were used:

- Official publications by the National Statistics Committee;
- Internal information of ministries, state institutions and organisations;
- Information provided by national experts.
- Data in mass media.

Information on similar items sometimes varies by different sources. Therefore, all information sources were ranged by level of reliability. The highest degree of information reliability was given to official publications by state statistics bodies, and further in descending order:

- Internal information of ministries, state institutions and organisations;
- Information provided by national experts;
- Data obtained through calculations;
- Data in mass media.

3.1.1. Energy sector

In the overall economy, the energy sector is the largest GHG emission source in all countries around the world. The Kyrgyz Republic is no exception. The following items were included in the energy sector:

1. Coal consumption in the following areas of the economy:

   - in energy sector – energy production in the fuel and energy sector;
   - in industry and construction – heat power production for technological needs and heat supply;
   - in commercial and housing sectors – heat supply for municipal and public buildings, state housing and private sector.

2. Use of cokes in foundries and blacksmith manufacturing.

3. Consumption of natural and liquefied gas in the following areas:

   - in energy sector – energy production in the fuel and energy sector;
   - in industry – heat power production for technological needs;
   - by motor vehicles;
   - in the housing sector.

4. Liquid fuel consumption:

   - black oil fuel as additive to bituminous coals in power engineering;
   - aviation kerosene in civil aviation;
   - petrol, diesel oil and lubricants for motor vehicles, marine transport, construction and agriculture machines and mechanisms.

Most combustive-lubricating materials (CLM) are imported. Permanent domestic demand and differences in prices for CLM (compared to prices in neighbouring countries) make them very attractive in terms of smuggling, the volume of which, by estimation, exceeds legal imports 2 to 3 times. Therefore, official statistical data cannot serve as information base for the assessment of GHG emissions from CLM. Instead, CLM consumption was estimated on the basis of amount of technically operable MV units, taking into consideration the average annual run and/or average annual period of functioning, as well as normal CLM consumption per 100 km of run and/or per one hour of functioning. Average values of run or period of functioning were assumed taking into consideration types and categories of MVs, machines and mechanisms. CLM consumption standards are estimated by basic norms adopted in the Republic, with modifications depending on conditions of primary service.

Dry bio-mass in the form of wood and dry manure is conventionally used in domestic conditions as fuel. GHG emission from dry bio-mass is not included into the total amount; data on this are mentioned only as supplementary information.

3.1.2. Industrial processes

Industry in Kyrgyzstan includes the following GHG sources:

- Mineral products – production of cement, construction lime, glass, bitumen, and pitch mineral;
- Chemical industry – manufacture of polyethylene film and plastic wares;
- Metal production – stibium, mercury, re-fusion of ferrous and non-ferrous metals;
- Food industry.

The following GHGs emerge due to industrial processes: CO_2, NO_X, CO, NMVOC, SO_2.

For GHG emission assessment in the Kyrgyz Republic, default factors and methodologies recommended by the Guidelines were mainly used. For technological processes not reflected in the Guidelines, additional research was conducted to calculate GHG emissions. Those processes were as follows: production of stibium and mercury; core-mould casting, re-fusion of cast iron and non-ferrous metals; glass production; blasting operations.

A rather great variety of food products and absence of standard factors for all types of products required aggregation of food products into groups of produce with similar gas composition and similar specific emission factors.

3.1.3. Solvents

Chloride-derived carbohydrates are used in the Republic as solvents; those are trichloroethylene, perchloroethylene, dichloroethane and other. In accordance with national methodologies, it is assumed in the assessment of emissions from solvents that all of their volume passes to atmosphere when used, i.e. emission from solvents is equal to their use. Calculations were conducted only for 1995-2000, since official registration of imported halogenated derived carbohydrates had not been carried out earlier.

3.1.4. Agriculture

GHG emissions were estimated for the following main sources:

- Animal husbandry and poultry farming, which includes emissions due to enteric fermentation of farm animals and cattle (or livestock), as well as emissions resulting from gathering, storing and using animal and poultry waste (manure and guano);
- Rice cultivation (in inundated rice fields);
- Agricultural lands (emissions due to using fertilisers and growing certain crops);
- Field burning of agricultural residues;
- Natural fires in the mountains.

The following GHG emissions were defined: CO_2, CH_4, N_2O, NO_X, and CO.

Calculations for all sources, except natural fires in mountains, are implemented with methodologies recommended by IPCC using national factors. A specific approach was used in calculating emission in the case of natural fires in mountains.

3.1.5. Land-use change and forestry

Land-use change and forestry encompasses three types of activities leading to GHG emissions and removals by sinks; changes in forest and other woody bio-mass stocks; forest and grassland conversion; abandonment of managed lands.

At present there is no forest and grassland conversion into ploughed fields, as most of lands suitable for this purpose are already being used.

3.1.6. Waste

The waste sector comprises GHG emissions emerging from solid waste disposal, domestic and industrial wastewater purification.

In the Kyrgyz Republic, solid waste is disposed only in non-controlled dumps. According to expert estimations, waste produced by the population living in cities is disposed in non-controlled deep dumps. The population living in urban-type communities disposes wastes in non-controlled shallow dumps. Waste produced by the village population was not taken into consideration when emission volume was being estimated. The displacement rate method was applied to define the value of methane emissions.

Calculations of the value of methane emissions from domestic, communal sewage and sludgy waste, as well as emissions of nitrous oxide from anthropogenic sewage were performed according to standard methodologies.

3.2. Greenhouse gas emissions

3.2.1. Total greenhouse gas emissions

A brief description of GHG inventory results in the Kyrgyz Republic for 1990-2000 by sectors and categories of sources is presented in the Annex. Total emissions of all greenhouse gases in Kyrgyzstan in the base year 1990 amounted to 36,647 Gg in CO_2 equivalent, including 29,105.5 Gg of CO_2 emissions. Net emissions taking CO_2 absorption into account were 35,817 Gg. In 1990, specific GHG emissions were 8.28 tons per capita, 6.58 tons out of which was CO_2. The dynamics of total emission of main greenhouse gases (Figure 3.1) to a certain extent reflect the economic circumstances of Kyrgyzstan. The largest contribution to total GHG emissions is from energy sector, which makes up about 80% of 1990 emissions of all main GHGs in CO_2 equivalent, and 74% in 2000. The structure of main GHG emissions in CO_2 equivalent by sectors for 1990 and 2000 is demonstrated in Figures 3.2 and 3.3.

Figure 3.1. Dynamics of total emissions of main greenhouse gases in Gg of CO_2 equivalent

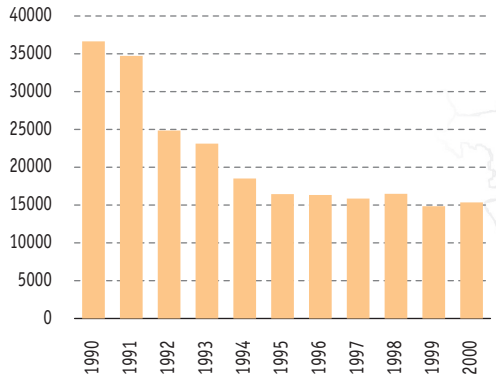
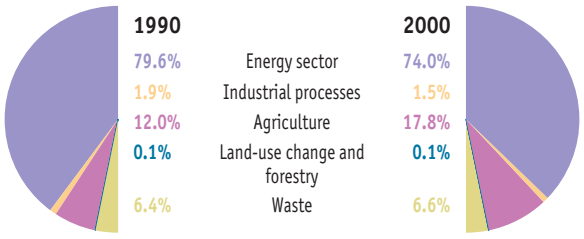
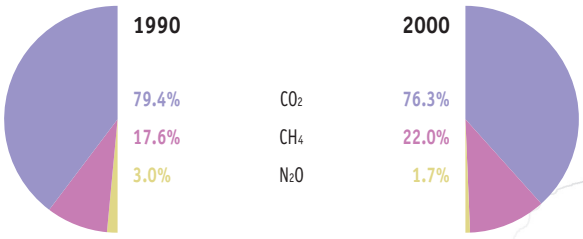


Figure 3.2. Distribution of total greenhouse gas emissions by sectors



Solvent sector is not shown here and further, as its contribution to total GHG emissions is insignificant.

Figure 3.3. Share of the main GHGs in total emission in 1990 and 2000



3.2.2. Emissions of greenhouse gases by oblasts

For industrial processes, proportion of GHG emission volumes by oblasts and Bishkek city in 1990 and 2000 is shown in Figures 3.4 to 3.8.

Figure 3.4. Distribution of CO_2 emissions by oblasts and Bishkek city

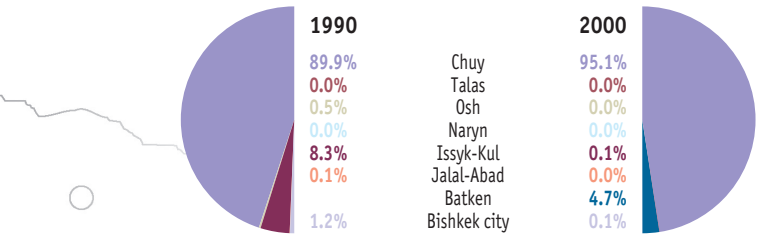


Figure 3.5. Distribution of NO_x emissions by oblasts and Bishkek city

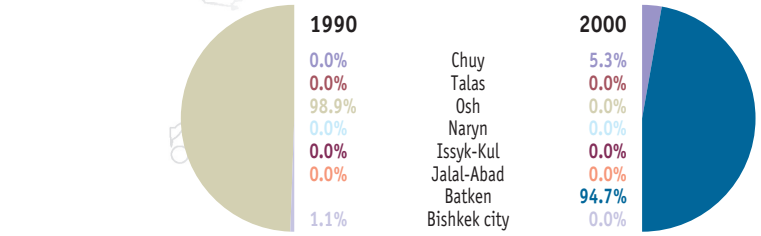


Figure 3.6. Distribution of CO emissions by oblasts and Bishkek city

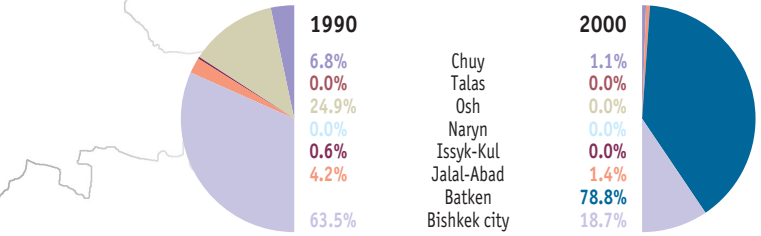


Figure 3.7. Distribution of NMVOC emissions by oblasts and Bishkek city

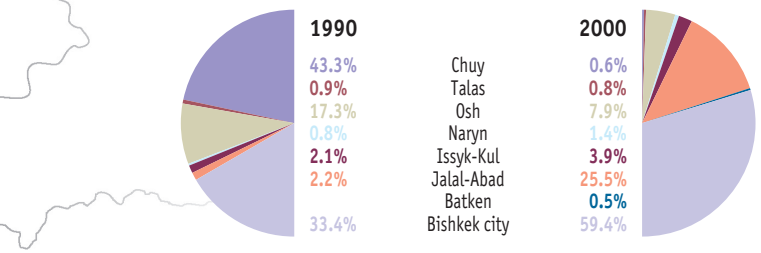
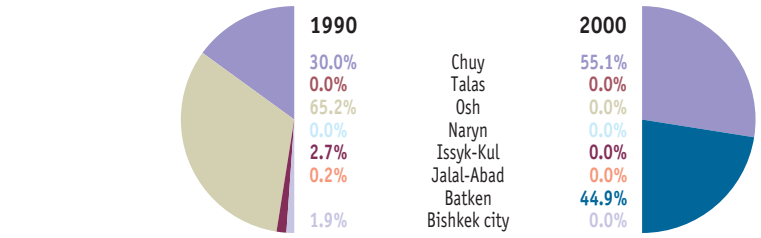


Figure 3.8. Distribution of SO_2 emissions by oblasts and Bishkek city



Changes in the proportions of NO_x and SO_2 emissions by oblasts – more precisely, the share of Osh oblast – between 1990 and 2002 are conditioned by the fact that, in 2000, the new Batken oblast (hosting the Haidarkan mercury metallurgical complex, a large GHG emission source) was split off from Osh oblast.

Changes in the distribution of CO_2 and, to some extent, NO_x, are related to a dramatic fall in industrial production in Bishkek, especially in machine building, in the early 1990s. This led to reduction of emissions from re-melting of ferrous and non-ferrous metals in Bishkek.

The main source of NMVOC emissions (up to 98%), both in 1990 and 2000, was the production of paving asphalt. In 1990, the main contribution to total NMVOC emission volume was made by Bishkek city, Chuy and Osh oblasts. The reason for this was road rehabilitation of the Bishkek, and Jalal-Abad sections of the Bishkek – Osh road.

Figure 3.9. Distribution of GHG emissions in agriculture by oblasts and Bishkek city in CO_2 equivalent

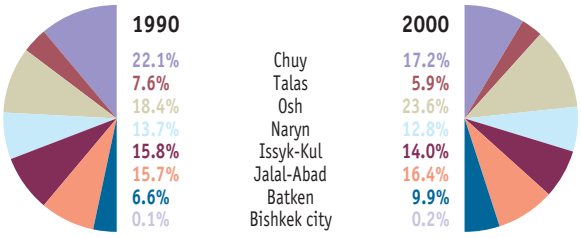


Figure 3.10. Distribution of methane emissions by oblasts and Bishkek city