

REPUBLIC OF POLAND

**NATIONAL REPORT
TO THE FIRST CONFERENCE OF THE PARTIES
TO THE UNITED NATIONS
FRAMEWORK CONVENTION
ON CLIMATE CHANGE**

Warszawa

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**Additional information:
Ministry of Environmental Protection,
Natural Resources and Forestry**

Department of Air and Land Protection

**Warszawa
Wawelska 52/54
tel +48 22 25 89 73
fax +48 22 25 20 03**

Preface

Poland together with over 150 other countries signed the United Nations Framework Convention on Climate Change during the UN "Environment and Development" Conference in Rio de Janeiro in 1992. By this, the Government of Poland expressed its will to participate in the action undertaken by the world's society to save the Earth's globe climate.

On 26 October 1994 Poland became the Party to the UN Framework Convention on Climate Change, by this obliged itself to implement the commitments to the Convention. To undertake the decision to ratify the Convention, required the particular courage, that since Poland is in phase of system and economy transformation. The Government of Poland shall make all necessary efforts to assure that modernisation of national economy will bring full success.

The failure would also mean that commitments we adopted by the ratification of the Convention would not be implemented. We believe however, that with the nation's effort and with the friendly co-operation and help of the international community, we will direct our economy to the path of sustainable development and will implement the commitments.

Stanislaw ZELICHOWSKI

Minister of Environmental Protection,
Natural Resources and Forestry

Warszawa

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Summary

The aim of the Report

The aim of this Report is to present to the Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC), accordingly to Article 12 item 1 and 2 - the policy of the Polish Government implemented in actions leading to the fulfilment of obligations ensued by the Convention.

The Report covers the inventory of the greenhouse gases emission sources and sinks in Poland, in the base year 1988, the assessed emission on the greenhouses gases for the year 2000, information on the undertaken and planned actions aimed to limit the emission and to increase sinks and on the possibilities to adapt Polish economy to changed climatic conditions.

Poland's commitments of the Convention

The ratification of the Convention put upon the Annex I Parties commitments to stabilise the greenhouse gases emission by the year 2000 on the level of 1990. The consequence of this obligation is the preparation and then implementation of the national programme of actions aimed to achieve this goal.

The Article 4 paragraph 6 of the Convention, allows countries with economies in transition a certain flexibility in the implementation of the commitments of the Convention. Taking into account the above, the Polish Government acknowledges the right of Poland to accept the year 1988 as reference year for the implementation of the commitments to the UN Framework Convention on Climate Change instead of the year 1990 provided by the Convention, moreover to the partial implementation of the commitments concerning the greenhouse gases emission stabilisation.

The Polish economy specific features

In the Polish economy the main primary energy source is coal, and its consumption in the base year was 76.5%. In 1992 this participation decreased to 75.3%, with the increased use oil and natural gas.

Polish industry is dominated by the raw material industries with relatively high participation of low processed products, with high energy and raw materials consumption, and the low rate of production renewal. The industry has a decisive role in the generation of the Gross National Product, but the data for 1992 shows that there is a tendency for its reduction.

In 1989 Poland entered the path of thorough structural and economic changes. The Government priorities are mainly focused on the country's economy modernisation and restructuring with the proper account given to such problems as privatisation, unemployment, social protection for the impoverished groups of the society, etc.

The main aim of the Polish economy for the nearest decades is to realise complex reforms in all sectors to lower the energy and raw materials consumption, which should help in the implementation of the sustainable development principles. In the economy it is expressed in the tendency for such

a conduct of economic activities, that with a possibly small use of the non-renewable resources (energy and raw materials) and with the possibly small environmental impact, the products achieved would be of a proper value, with a substantial role of the know-how and technologically improved.

The efficiency of further actions is highly dependant on the success of social and economic reforms' programme initiated in 1989. Due to the direct impact of the greenhouse gases' reduction actions on the state of the economy, the implementation of the commitments of the Convention will depend on the reforms' programme success.

The ecological policy goals in the field of greenhouse gases

Taking under account the above mentioned social and economic priorities of Poland it is understandable that the problem of greenhouse gases emission reduction taken separately is not a priority goal. However the need to ensure the economy competitiveness and for the efficient use of fossil fuels bring about the situation when realised actions allow to reduce the greenhouse gases emission (particularly the carbon dioxide).

This goal should be achieved with the market economy mechanisms, such as prices change to world's market prices' levels, cessation of the subsidies for the majority of the economy sectors, financial support for the industrial plants' modernisation, etc.

The limitation of the carbon dioxide emission to the level agreed in the international forum is one of long term goals of the State Environment Policy approved by the Parliament (Sejm) of the Republic of Poland in 1991.

The greenhouse gases inventory for the year 1988

The inventory of greenhouse gases of anthropogenic emissions and sinks in Poland shown, that emission (in Gg) of these gases in 1988 was:

carbon dioxide	483 700
methane	6 060
nitrous oxide	73
nitrogen oxide	600
carbon oxide	2 730
NMVOC	over 352

The values given above, as valid for the base year and being the reference level for the assessment of Poland's implementation of the Convention commitments fulfilment.

The carbon dioxide retention in agriculture amounted to 11 750 Gg, and in forests 18 280 of this gases was captured.

The actions aimed at the greenhouse gases emissions reduction undertaken since 1988

The comparison of the 1988, 1990 and 1992 inventories indicates that the emission of the most

important greenhouse gases has a decreasing tendency. The permanence of tendency for the carbon dioxide emission decrease is proved by the fact, that in spite of the GNP growth in 1992 the further emission decrease is noted. This is due to the energy consumption lowering in the whole economy. The greenhouse gases emission reduction is caused not only by the economic recession resulting in the reduced production and the decrease of the primary energy demand, but also by the economic reform forcing the actions, propitious for the greenhouse gases emission limitation.

An example of such action are the large-scale activities aimed to eliminate the use of coal in small boiler-houses, in households and small production plants and to replace it with another energy carrier like gases or fuel oil. The inventories of such actions made in several areas of the country show that they resulted in the reduction of the carbon dioxide of about 6 500 Gg during the years 1989 - 1993.

The actions are also undertaken to increase the carbon dioxide absorption by forests, by the increase of forestation. Since 1988 till 1993 the forested area increased for about 60 000 hectares.

Strategies and directions of the actions adopted by the Government in the field of the greenhouse gases emissions reduction

The main goals of the Polish economy are set by the document "Strategy for Poland 1995-1997" approved by the Government and by the Parliament of the Republic of Poland.

The document assumes:

- * the increase of the Gross National Product for 22%,
- * the inflation decrease to less than 10% per year,
- * the unemployment decrease,

The existing strategies and project prepared by the Ministries assume:

- * the changes leading the industrial production efficiency increase,
- * the implementation of the programme for the increase of the efficiency of the energy use,
- * the rationalisation of transportation's and carriage system,
- * the directing of the agriculture to the improvement of products quality and the forestry to forest husbandry rationalisation,
- * the implementation of waters protection and use rationalisation programme
- * the implementation of the waste re-use programme.

The expected results of the assumed economic strategies in greenhouse gases emissions and sinks assessment in 2000

The forecast concerning the greenhouse gases emission, particularly the carbon dioxide emission, the most important one because of its volume, indicate that in the year 2000 the emission of these gases should not exceed the 1988 level.

1. Introduction

In June 1992, during the "Environment and Development" Conference in Rio de Janeiro, The Polish Government signed the UN Framework Convention on Climate Change. On 16 June 1994 the Convention was ratified by Poland, and in 28 July the ratification document was deposited at the Depository. Accordingly to the Convention, Poland become the Party to the Convention on October 26, 1994. Thus Poland joined the group of countries aiming to reduce the emission of the gases that cause the greenhouse effect and intending to undertake actions to stabilise the concentration of this gases in the atmosphere. It is to be mentioned, that our country is heading the countries with group of the countries with the biggest carbon dioxide emission into atmosphere (accordingly to IEA, the 13-th position in the world). Poland's emission makes only 1.5% of the global emission.

As a result of the Convention signing by Poland, there was called into being the Secretariat of the Convention, with the main goal to prepare by Poland the Convention's ratification process and to co-ordinate and manage the activities to implement the commitments to the Convention.

1.1 The aim of the Report

The main purpose of the Report is to submit to the Conference of the Parties - accordingly to Article 12 paragraphs 1 and 2 of the Convention - the Polish Government policy in mitigation of greenhouse effect growth and the specification of actions aimed to implement the commitments. The scope of report was defined by the International Negotiating Committee for the Framework Convention on Climate Change.

The main part of the report covers the specification of the results of the greenhouse gases emission sources and sinks inventory for the reference year, the expected greenhouse gases emission volume in the year of destination, information of the undertaken and planned actions to reduce the emissions and to increase the absorption and the capacity of the Polish economy to adapt to the changed climatic conditions.

1.2 Poland's commitments to the Convention

The ratification of the Convention puts upon Poland the same obligations as for the other countries listed in Annex I. The most important of them is " *the return by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol*" (Article 4, paragraph 2, subparagraph (a) of the Convention). For this group of countries it means the return to the 1990 emission level. For Poland it means the stabilisation of emissions in 2000 on the level of 1988. The consequence of this commitment is the preparation and than the implementation of the actions programmes aimed to achieve this goal.

1.3 The attitude toward the term "flexibility" in Poland's implementation of the commitments of the UN Framework Convention on Climate Change

In accordance to Article 4 paragraph 6 of the Convention, Poland has the right for a flexible

approach to the implementation of the commitments of the Convention. As "flexibility" the Polish Government understands the acceptance of 1988 levels, instead of the 1990 levels foreseen by the Convention, and also only the partial fulfilment of the obligation concerning the presentation of the social and economic strategy aimed to implement the Convention's resolutions in the greenhouse gases emission stabilisation.

The reason of taking this assumption was the fact, that 1990 was in Poland the first year after the substantial political and economical changes, that resulting in the change of the political system, which had an impact on the economy stability. In this year there happened a partial collapse of the economy. For this reason the greenhouse gases emissions' volume in 1990 did not correspond to the normal level that results from the needs of the country's development and the real economic potential of the country. The choice of this year would not be authoritative for the Polish economy. The process is illustrated by the dynamics of the added value changes in industry (Fig. 1.1) and the Gross National Product changes (Table 1.1.)

Fig. 1.1 Dynamics of the added value in industry (fixed prices) in 1981- 1992 years (*not available electronically*)

Table 1.1. Changes of the Gross National Product in constant prices in 1990

year	1988	1989	1990	1991	1992
GNP (billions ¹ zlotys)	648 200	649 500	560 300	521 200	534 900

The 1988 is the last year of a relatively undisturbed economical development. The changes of production volumes of some goods are give in table 1.2.

Table 1.2 Production of the selected items in Poland in 1970 - 1992

Type of production or item	production volume in years					
	1970	1980	1985	1988	1990	1992
Pig iron(mln t.)	7.3	12.0	9.8	10.3	8.7	6.4
Raw steel (mln t.)	11.8	19.5	16.1	16.9	13.6	9.9
Electric power (TWh)	64.5	122.0	138.0	144.0	136.0	133.0
Cement(mln t.)	12.2	18.4	15.0	17.0	12.5	11.9

Accordingly to the experts' assessment, the production volume of 1988 will not be achieve before 2000. Since the beginning of 1990-ties the economy is being gradually rebuilt. Considering the period needed for the system and economical transformation, the full and uniform economic strategy for the period till the end of the century, does not exist yet. This does not allow to characterise the quantity of actions planned for specific sectors in the future.

Taking under account the above, the Polish Government applies, according to Article 4 paragraph 6 of the Convention, to the Conference of the Parties to the Convention, for the acceptance of particular situation of Poland and for the acceptance of the 1988 levels in the

¹ means 10⁹

implementation of the commitments for the stabilisation of the greenhouse gases emission moreover for the recognition the partial implementation of the commitment to communicate the detailed description of policies of the emissions' limitation resulting from Article 12, paragraph 2, subparagraphs (a) and (b) of the Convention.

1.4. The geography of Poland and the main social and economic data

Poland is situated at the European Lowland in the Vistula and Odra rivers-basins, between the Baltic Sea and the Carpatian Arc. Its surface is 312.7 thousand square kilometres.

The Poland's geographical position results in both marine and continental climates' influence. That causes the big daily and interannual variations. The annual mean surface air temperature in Poland, is 7.7 centigrade (1951 - 1990). The spatial distribution of this climate is diversified and depends on the altitude above the sea level and the distance from the Baltic Sea and the Atlantic Ocean. The coldest areas are the north-eastern part of Poland and mountains placed in the South of the country, with the mean yearly air temperature of 6.5 centigrade. The warmest is the western part with the mean yearly temperature of about 8.5 centigrade. The mean annual sum precipitation in Poland is about 600 mm, and the distribution depends on the ground shaping and exposition. Thus the biggest precipitation is observed in the mountains and highlands (above 800 meters) in the southern part of the country, while in the lowland areas, in the central part of the countries the volumes are lowest (450 - 500 mm).

The population of Poland was 37.9 million in 1988 (25-th position in the world) and increased to 38.4 million in 1992. It is assessed that in 2000 the population will reach 39.5 million and in 2010 - 41 million. The selected demographic data is presented in Table 1.3.

Table 1.3. The selected demographic data for Poland

Year	Population			
	millions	Population per sq. km	Birth-rate ‰	Population in urban areas %
1950	25.0	80	19.1	36.9
1960	29.8	95	15.0	48.3
1970	32.7	104	8.5	52.3
1980	37.5	114	9.6	58.7
1988	37.9	121	5.7	62.2
1992	38.4	123	3.2	61.7

The Table shows that since 1988 the population has stabilised, and the lowering birth-rate indicates that these changes are of a permanent character at least by the end of the century. The percentage of population in urban areas nears the level observed in the developed countries (about 80% of the population).

Since 1975 Poland has maintained the two-level administrative system: the country is divided into 49 Voyvodships and 2 459 Communities.

The Polish economy can be described by the following selected parameters:

- **the Gross National Product (GNP)**, changes of which are given in Table 1.1,
- **the unemployment** (not registered in 1988) amounted in 1993 to 15.7% of the professionally active population and in the midst of 1994 rose to 16.8%,
- **the foreign debt** (about 30 billion USD in 1988), in 1993 it amounted to about 48 billion USD,
- **inflation**, which in 1989 was 351.1%, shows the lowering tendency and in 1994 would not exceed 27%,

In the same time:

- **the cars per household factor** rose from 0.3 in 1988 to 0.4 in 1992,
- **the energy consumption per capita** in 1988 was 4.8 tons of carbon equivalent (tce), in 1992 - 3.6 tce (1tce = 29.3 GJ).

The above tendencies on one hand show the growing welfare of some society groups (cars), on the other the decrease of the energy consumption caused by the production reduction, industry modernisation and the limitation of the energy use by society caused by the rise of prices.

1.5. Specific features of the Polish economy

Coal is the main energy carrier in the Polish economy. The characteristics of the primary energy use in Poland in the period since 1962 till 1992 are presented in Table 1.5.-1.

Table 1.4 The structure of the primary energy use in Poland

	% of primary energy use in years							
Energy carriers	1960	1970	1980	1988	1989	1990	1991	1992
Coal	92.8	81.8	76.9	76.5	76.4	74.9	76.3	75.3
Petroleum	4.3	10.5	14.8	14.3	14.4	14.9	14.3	15.3
Natural gas	1.2	6.1	7.1	7.8	7.7	8.8	8.1	8.0
Hydro energy	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other fuels	1.6	1.5	1.1	1.3	1.4	1.3	1.2	1.3
Total (PJ)	2353	3507	5153	5386	5117	4222	4130	4090

The direct use of energy in specific sectors was substantially changed in 1988 - 1992, as shown in Table 1.5.

Table 1.5. The direct energy use by sectors in 1988 and 1992
energy use (PJ)

Sector	1988	1992
Total	3953.4	2931.6
Industry	1653.0	1113.3
Constructing	58.3	24.4
Agriculture	79.8	39.8
Transportation	208.9	114.5
Municipal	39.5	36.8
Other sectors	1913.9	1602.8

After 1988 there was noted the tendency for production and energy consumption fall caused mainly by the economic recession.

The Polish industry is characterised by the predominance of raw material production, relatively high contribution of low-processed products of high energy and raw materials consumption, low rate of production renewal. The industry's participation in the Gross National Product is shown on Figure 1.2.

Figure 1.2 The structure of the Gross National Product in 1988, 1990 and 1992 by sectors (*not available electronically*)

As shown the industry has a main role in the creation of the Gross National Product, although considering the data of 1992 there is tendency for its contribution decrease.

In 1989, Poland has entered a path of thorough reforms of the political system and economy. One of the main tasks is to create the market economy, in that to privatise the state owned enterprises. The occurring social and economic changes create the chance to disseminate the environment friendly actions, for this factor begins to play a role in the assessment of every economic venture.

The main aim of the Polish economy for the nearest decades is to realise complex reforms in all sectors to lower the energy and raw materials consumption, which should help in the implementation of the sustainable development principles. In the economy it is expressed in the tendency for such a conduct of economic activities, that with a possibly small use of the non-renewable resources (energy and raw materials) and with the possibly small environmental impact, the products achieved would be of a proper value, with a substantial role of the creative ideas and technologically improved - to fulfill human needs.

The efficiency of further actions is highly dependent on the success of social and economic reforms' programme initiated in 1989. Due to the strict impact of the greenhouse gases'emission reduction actions on the state of the economy, the implementation of the commitments of the Convention will depend on the reforms' programme success. It is assumed the economy transformation process will last for more than a decade or even several decades.

1.6. The state and protection of the environment in Poland

Poland is a country of environmental contrasts. On one hand there is a beautiful, quite well preserved nature, sometimes unique in the European scale. There are 19 National Parks places all over the country, from the Baltic sea shore to the mountains, where are the most valuable, because of their biodiversity, nature's resources. The north-eastern part of Poland with its comparatively lightly changed nature makes the "Green Lungs of Europe".

On the other hand there are areas with a highly degraded environment. They are mainly the highly urbanized and industrialized areas and nature areas affected by the direct impact of gases and dust emissions and other hazards like sewages and wastes. These regions are inhabited by approximately 35% of Polish population.

In this situation the most important actions for nature preservation are conducted in two strategic

directions: creation of an ecologically consistent system of protected areas, which is aimed to cover the 30% of the country's area and preservation of ecosystems functioning by the ensurance of the ecological processes' continuity and a particular protection of valuable nature complexes eminent for their biodiversity.

The growing hazards for the environment forced the Polish Government to undertake actions for its protection and to prepare the programme for sustainable development for our country. The main assumptions of this programme are included in the "State Environmental Policy", approved by the Parliament (Sejm) in 1991 and made internationally known by means of the report during UNCED in Rio de Janeiro in 1992. The programme for this policy implementation is systematically updated and supplemented by the sectoral strategies of the economy restructuring and modernisation. The implementation process is supported by the regional state and community authorities. A very important is public awareness based on reliable and well-distributed information.

In spite of a very complex economical situation the Polish Government undertakes substantial efforts to protect the environment. These efforts are shown in Table 1.6-1, covering expenses for the environmental protection investments (without expenses for water engineering ventures), in current prices, in 1988 - 1992.

Table 1.6. Expenditures for the environmental protection in Poland in 1988 - 1992.

Years	1988	1989	1990	1991	1992
Billions zloty	5 100	4 800	5 500	8 800	11 700
% of GNP	0.6	0.5	0.8	1.1	1.3

The assessed expenses for the environmental protection in Poland are shown in Figure 1.3.

Figure 1.3. The structure of the expenses for the environmental protection in Poland (*not available electronically*)

1.7. The ecological policy goals in the field of greenhouse gases

The Government priorities are focused mainly on the modernisation restructuring of the economy with a simultaneous account of such problems as privatisation, unemployment, social protection of the impoverished groups of the society and others. For this reason it is understandable that the problem of greenhouse gases emission reduction taken separately is not a priority goal. However the need to ensure the economy competitiveness and for the efficient use of raw material for energy production bring about the situation when realised actions allow to reduce the greenhouse gases emission (particularly the carbon dioxide and methane).

This goal should be achieved with the market economy mechanisms, such as prices change to world's market prices' levels, cessation of the subsidies for the majority of the economy sectors, implementation of mechanisms such as Integrated Resources Planning, financial support for the industrial plants' technological modernisation, etc.

These actions heading for the rationalisation of the energy management, industry and transportation were assigned a priority in the "State Environmental Policy" that is a guideline for the direction of

the sustainable development of Poland. In the document one of the long-term goals is "*...the limitation of the carbon dioxide emission to the level agreed in the international forum*".

1.8. Completeness of the data used in this report

The social and economic information is collected within the State system of statistical information managed by the Central Office for Statistics. This system is highly reliable especially when the year 1988 is concerned - the last year centrally planned economy. The data on environment and emissions in the scope required by the Convention may have certain gaps. It is due to the fact, that the environmental information system is currently created and does not cover all the elements required by the Convention.

Along with the political system transformation and a spontaneous development of economic occurrences the fullness of the economic data in the next several years may worse for there be a need to adjust the statistic system to new conditions, among them to new ownership conditions. Nevertheless the accuracy of this information is on the level of such information presented by the developed countries.

2. The greenhouse gases emission inventory for the base year 1988

The inventory of anthropogenic emissions greenhouse gases and sinks is the base for the assessment the efficiency of the fulfilment of the obligations ensued by the Convention on the countries listed in Annex I, and Poland as one of them.

The important problem in emissions and sinks assessment is the need for the use of the unifies methodology, which would enable the comparison of the results.

Poland prepared two versions of inventories for the year 1988, which is the reference year. The first one was prepared in 1992 by an order of the Ministry of Environmental Protection, Natural Resources and Forestry, and covered the following sectors of the economy:

- * energy
- * agriculture
- * forestry
- * transportation
- * municipal landfills and sewage treatment plants

The main aim of the pilot inventory was the primary assessment of the emissions in the main sectors of the economy. It was prepared with the use of methodology and classification used in Poland. It enables to determine the set of data necessary for the OECD procedure use, determination of insufficiently recognised areas, where inventory could not be prepared, and also the assessment of the usefulness of the employed emission and sinks factors, under Polish conditions.

The second evaluation of emissions and sinks for 1988 was made with the use of the emission factors given in Annex 4, and in case of the lack of the emission factors, with the employment of the methodology agreed by OECD in the document "Estimation of Greenhouse Gases Emissions and Sinks. Final Report from the OECD Experts Meeting" of February 1991. It covered the greenhouse gases like: CO₂, CO, NO_x, CH₄, Non-Methane Volatile Organic Compounds (NMVOC) and Hydrocarbons.

As shown by the experience, the factors recommended by OECD/IPCC are not always proper for the transportation technologies employed in Poland. For this reason along with the emission evaluation made with the recommended methodology, the emission was also calculated by the methods used in Poland. The values of these factors are given in Annex 4 paragraph B.

The balance of emissions and sinks in agriculture was prepared with the employment of the methodology taken from the literature by Polish experts' teams.

In cases when the values obtained with the use of one factor were doubted, or when the methodology contained a number of calculations' variants and also where the OECD and Polish (transportation) factors were used, the emission was calculated for the extremum factors' value and the range of emissions were given in the table.

The report including the inventory results was supplied to the Intergovernmental Panel for Climate Change and IEA.

2.1. The evaluation of the basic data use for the inventory preparation

The data on the greenhouse gases emissions are of a various precision. The most reliable is information on the carbon dioxide emissions from energy production and transportation sectors. The data from other sectors is given with the lower precision, and mainly from the municipal sector because of the lack of reliable assessments of emissions' volume and the proper coefficients necessary for such assessments.

The data concerning methane and nitrous oxide emissions is given with a more substantial error. The main reason for assessment's inaccuracy is that the data on greenhouse gases emissions and sinks were not included in national statistical data collection system. There is also a lack of emission coefficients for many emission sources, mainly for technologies incompatible with standards of OECD member countries.

The lack of the detailed data on the economic activities and emission coefficients or its low reliability, made it impossible to fully evaluate the emissions from combustion processes of all gases with the "bottom-up" method with the division into sectors, including wood combustion for energetic purposes, emissions related to the extraction, transportation, storage and distribution of liquid fuels, emission from technological processes (excluding the cement production) and emissions resulting of the land use changes.

The range of the data and emission coefficients' availability was given Table 2.1.

Table 2.1. Range of the data and coefficient availability

Source of emission	CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOC	Rel
Fuels combustion	Cal	Cal	Cal	Cal	Cal	Cal	H
Fugitive fuel	Cal	Cal	-	-	-	-	M
Cement production	Cal	-	-	-	-	-	M
Solvents' use	0	0	0	0	0	0	
Enteric fermentation	0	Cal	0	0	0	0	M
Animal wastes	0	Cal	0	0	0	0	M
Agricultural soils	0	-	Cal	0	0	0	M
Agricultural waste burning	0	Cal	Cal	Cal	Cal	-	M
Land use change/ forestry	0	Cal	0	0	0	0	L
Waste	Cal	Cal	-	-	-	-	M

Cal - calculated value, - - does not occur, 0 - lack of data,
Rel - data reliability: H - high, M - medium, L - low

In the **fuels' combustion** there was a lack of data of fuels use in various combustion technologies in various sectors. There was also a deficiency of some emission's indicators so the coefficients set was not complete.

In the **mining, transportation and fuel storage** sector there was a shortage of the complete data for the evaluation of emissions from fuel oil and natural gas.

In the **surface emissions (solvents use)** there were no emission coefficients and the proper data on production and use.

In the **community waste** sector the whole necessary data was missing, moreover the methodology did not include the methane emission coefficients for the sewage treatment plants.

In the **enteric fermentation and animal wastes** the whole range of data on the animals' age structure and food was not available. There also were no emission coefficients from the agricultural sewage processing plants.

For the emission of **nitrous oxide from the nitrogen fertilisers** there was no necessary data on the spatial and time distribution and the types of fertilisers used and moreover the emission's coefficients.

In the evaluation of emissions resulting from the **land use changes** there was a lack of a basic information on such activities, and for the evaluation of emissions from the agricultural waste burning there were no coefficients suitable for Polish conditions.

In the sector of fuels mining, transportation, storage and combustion, due to the data shortages the emission was assessed taking under account the fuels' balance. In the other sectors, in case of data shortage the assessment of the emissions was not done.

For the above mentioned reasons the results of the 1988 inventory are to be treated cautiously. Doubtless the data on the carbon dioxide emission, especially from the fuel combustion sector is highly reliable. The other gases, particularly the nitrous oxide, have much less reliable evaluation. The errors' range is shown by the range of assessment changes in Table 2.2.

2.2. The greenhouse gases emissions inventory for sectors and gases

The results of the greenhouse gases emissions (in Gg) in 1988 are given in Table 2.2.

Table 2.2 Emission of greenhouse gases in Poland in 1988

Greenhouse gases emission sources and sinks	Emission in Gg					
	CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVO C
Total	483 700	6 060	73	600	2 730	>352
1. All energy¹	473 470	3 880	>0,3	580	1 260	>352
1.A. fuel combustion activity	462 820	9	>0,3	508	1 260	>352
1.A.1. Energy and transformation industry	-	-	-	-	-	-
1.A.2. Industry	-	-	-	-	-	-
1.A.3. Transport in that:	34100	9	>0,3	580	1 260	>352
range				543 - 605	1 216 - 1 304	
Bunker	530	0,1	0,001	10	25	0,6
1.A.4. Commercial/ Industrial	-	-	-	-	-	-
1.A.5. Residential	-	-	-	-	-	-
1.A.6. Agriculture/ forestry	-	-	-	-	-	-

1.A.7. Other	-	-	-	-	-	-
1.A.8. Biomass burned for energy	1 640					
1. B. Fugitive fuel	10 650	3 870	-	-	-	-
range	10 450 - 10 850	3 800 - 3 940				n.a.
1.B.1. Crude oil and natural gas	-	-	-	-	-	-
1.B.2. Coal mining	10 650	3 870	-	-	-	n.a.
range	10 450 - 10 850	3 800 - 3940				
2. Other industrial production processes	8 480	n.a.	n.a.	n.a.	n.a.	n.a.
2.A. Chemicals	n.a.	-	-	n.a.	n.a.	-
2.E.1. Non-metallic mineral products	8 480	n.a.	n.a.	n.a.	n.a.	n.a.
C. Other	n.a.	-	n.a.	n.a.	n.a.	-
3. Solvents use	-	-	-	-	-	-
4. Agriculture	n.a.	1 540	73	20	1 470	-
range		1 500 - 1580	1 - 145	15 - 33	774 - 2 163	
4.A. Enteric fermentation	n.a.	950	n.a.	n.a.	n.a.	n.a.
4.B. Animal wastes	n.a.	500	n.a.	n.a.	n.a.	n.a.
4.D. Agricultural soils	n.a.	-	72	n.a.	n.a.	n.a.
range			0 - 144			
4.E. Agricultural waste burning	n.a.	90	1	24	1 470	-
range		40 - 130	0.6 - 1.7	15 - 33	774 - 2 163	
5. Land use change/ forestry	-	-	-	-	-	-
5.A. Forest clearing	-	-	-	-	-	n.a.

5.B. Conversion of grasslands to cultivated lands	-	n.a.	n.a.	-	n.a.	n.a.
5.C. Logging/ managed forests	-	n.a.	n.a.	-	n.a.	n.a.
5.D. Abandonment of managed lands	-	n.a.	n.a.	-	n.a.	n.a.
6. Waste	1 750	640	-	-	-	-
6. A. Landfills	1 750	640	n.a.	n.a.	n.a.	n.a.
range	1 200 - 2 300	436 - 835				
6. B. Sewage treatment	n.a.	-	n.a.	n.a.	n.a.	n.a.
6. C. Other	-	-	-	-	-	-

n.a. - not available

- no emission

¹ combustion, production, transportation, storage and distribution of fuels.

Notice. The value in particular columns may not add up, because of the degree of aggregation and not taking under account the whole spectre of sources especially small ones.

The Polish Government takes the country's emission values given above, as valid for the base year and being the reference level for the assessment of the Convention obligations' fulfilment.

2.3. Emissions and sinks balance of CO₂ in agriculture and forest ecosystems

In 1991 there was prepared the supplementary inventory for the reference year covering two sectors: agriculture and forestry. The prepared inventory showed that agriculture, during the metabolic processes in the plant and animal organisms, actively participates in the exchange of carbon dioxide between the agrocenosis and atmosphere. As a result of this circulation, crop plants during the vegetation period absorbed **222 630 Gg** of CO₂, which makes 50 % of the total carbon dioxide emitted during the combustion of coal, oil and gases. In the same year, as result of the biological oxidation the agriculture emitted into atmosphere **208 300 Gg** of CO₂, with the partial retention of **11 750 Gg** of this gases, however the cyclic circulation of the carbon dioxide between atmosphere. and crop plant makes an important factor buffering the rapid changes of CO₂ concentration in the atmosphere. There is always a possibility to increase the CO₂ retention by the proper agrotechnical methods and plant changing systems.

The source of the CO₂ emission and sink is also the forest ecosystems' biomass. In 1988 the absorption of CO₂ was **33 200 Gg**. In the same year the emission from this sector caused the biomass destruction: while timber harvesting, during forests' fires, firewood and matches wood use and by the leafage pests' gradation was **14 920 Gg**. Thus in 1988 **188280 Gg** of CO₂ was permanently absorbed in the forest ecosystems' biomass.

Thus the real net emission of CO₂ in the whole country in the reference year was smaller than that given in Table 2.2 for about **30 000 Gg**.

Results of inventory of the greenhouse gases emission for year 1988 will create a base for comparison of emissions and sinks in the following years.

3. The evaluation of greenhouse gases emissions in 1990 and 1992

Accordingly to the standpoint of the UNFCCC Intergovernmental Negotiating Committee, that the countries listed in Annex I (regardless of the reference period taken) should prepare the inventory for the 1990, to enable to evaluate the global emission in this year, the Polish Government presents the evaluation of greenhouse gases emission in 1990 (Annex 2). The inventory was prepared with the employment of the CORINAIR methodology and also its coefficients. Due to the implemented "bottom-up" method the results for some gases are substantially different (e.g. NO_x, CO and NMVOC). It is to be remembered, that -as estimated- the evaluation errors in these methods may be up to 40 % and for the nitours oxide even up to 200%.

The Polish Government distinctly understands that the given emission volumes in 1990 cannot be taken for the reference levels, which will be valid in the greenhouse gases emission stabilization period accordingly to the commitments to the Convention.

Polish standpoint in this matter has already been presented in Chapter 1.3.

The spatial distribution of some greenhouse gases emission in Poland in 1990 s presented in Figure 3.1, 3.2 and 3.3. The distribution of the carbon dioxide is trictly related to the industrialized areas or the positioning of big power and heating plants, thus the biggest emission is observe in Katowickie and Piotrkowskie Voyvodships. The distribution of the other gases emission (methane and nitrous oxide) is more regular, but Katowickie Voyvodship also dominates.

To evaluate the degree of efficiency of the actions undertaken by Poland or for the comparison, the inventory of greenhouse gases emissions in 1992 is also presented. This inventory (Annex 3) was prepared with an employment of the OECD/IPCC methodology recommended by the Intergovernmental Negotiating Committee (INC FCCC) and published in 1994, in the "Greenhouse Gas Inventory Workbook. IPCC Draft Guidelines for National Greenhouse Gas Inventories" volumes 1-3.

Table 3.1. Comparison of the results of the three inventories of greenhouse gases emissions in Poland

Years of preparation	Greenhouse gases emission (Gg)					
	CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOC
1988 (IPCC)	483 700	6 060	73	600	2 730	352
1990 (CORINAIR)	414 930	6 107	156	1 445	7 338	1 294
1992 (IPCC)	359 439	2 474	50	1 283	1 610	460

Figure 3.1. (The distribution of CO₂ (in Tg) emission in Poland in 1990) is not available electronically .

Figure 3.2. (The distribution of CH₄ (in Gg) emission in Poland in 1990) is not available electronically.

Figure 3.3. (The distribution of N₂O (in Gg) emission in Poland in 1990) is not available electronically.

The results of this comparison show that the emission of the most important greenhouse gases has a reduction tendency. The growth of the N₂O, NO_x, CO and NMVOC in 1990 is rather a result of the implementation of different methodologies than a real emission increase. The experience gathered during the 1992 inventory, the methane emission in the reference year may be evaluated too high. The comparison shows also the CORINAIR methodology in case of the greenhouse gases gives overestimated results.

4. The actions for the greenhouse gases emission reduction undertaken since 1988

Together with the economic recession, which results in the decreasing production and smaller primary energy consumption, the economical reform forces the actions propitious for the greenhouse gases emission reduction. The examples of such actions are the large scale actions heading for the exchange of the coal as the fuel in small boiler houses, in households and small industrial plants, for other energy carriers like gas or fuel oil. These actions are taken mainly by the state-owned and private enterprises and local authorities with the financial support of ecological funds, governmental and non-governmental agencies (banks, foundations). The introductory inventory shows that these actions are of the mass character. It concerns mainly the elimination of the coal fired stoves and conversion into gas or oil heating and connection into district heating system.

The actions are also undertaken to increase the carbon dioxide absorption by forests during the forestation growth. Between 1988 and 1993 the area of forests increased for about 60 000 hectares.

4.1 Examples of the implemented technologies limiting the greenhouse gases emission

For the economical reasons, regardless the recession in 1990-1993 the process of the energy efficiency use was intensified. It mainly concerns the change of the heating system in the municipal sector and farming, exchange of the energy carriers for the more economical ones and the production technology changes. Because of the substantial dispersion of such actions and their mass character, and also for the mentioned above period of the state statistical data collection system adaptation to the new economical conditions, these actions are not covered by the national statistical system. For needs of this report the partial inventory of such actions was prepared. It includes about 900 projects implemented in 1989-1993. The results, that being the carbon dioxide emission reduction resulting of the 360 realized investment ventures, where the emission evaluation was possible are presented in Table 4.1.

As shown in Table 4.1, presenting only the fragmentary data, the actions undertaken in the local scale intended to increase the efficiency of fuel and energy use, result in a substantial carbon dioxide emission reduction. The directions of such actions are given in Annex 1. The decreasing tendency for the carbon dioxide emissions is verified by the data published by the Central Office of Statistics, presented in Table 4.2, presenting this gas emission changes (in Gg). Regardless the Gross National Product growth in 1992 (Table 1.1), the further emission decrease is observed showing the improved efficiency of the energy management.

Table 4.1. The greenhouse gases emission reduction value resulting from the local actions

Investment type	Number of investments	CO ₂ emission reduction in Mg/year
Coal heating into electricity conversion	196	6 040
Coal heating into gas conversion	10	4 104 620
Coal heating into oil conversion	4	41 520
Connection to municipal heating systems with elimination boiler houses and individual heating stoves	114	1 056 600
Manufacturing technology changes	77	507 390
Boilers modernization	27	797 520
Renewable energy sources use	2	52 900
Total	360	6 566 590

Table 4.2. Carbon dioxide emission changes in Poland in 1988-1992

Years	1988	1989	1990	1991	1992
Emission CO ₂ in Gg	509 400	488 000	406 900	396 900	393 100

The values given in Table 4.2 were evaluated using the OECD/IEA methodology published in the "Greenhouse gases emissions in 1991". The differences in the absolute value between inventory results given in Chapter 2 and Table 4.2 result from the different coefficients use. The values evaluated with the OECD/IPCC methodology are lower than that given in Table 4.2 for about 5% (1988) and for about 3% (1992), moreover the CORINAIR methodology gives the results bigger for about 2%. These differences under the adopted assumptions and evaluations' methodologies are to be considered as insignificant.

5. Strategies and directions of the actions adopted by the Government of Poland in the field of the greenhouse gases emissions reduction

5.1 Situation in the strategy implementation

Until now the Government and the Parliament (Sejm) adopted the "Strategy for Poland 1995-1997" the document having the character of the framework economic plan, and also the already mentioned "State Environmental Policy". The sectoral strategies are in various stages of development and : the "Industrial Policy" was accepted by the Council of Ministers, the "Poland's Energy Policy" is approved by the Ministry of Industry and Trade, the "Transportation' Policies in the stage of inter-ministerial discussion, and the "Agricultural Policy" and the "Policy for the Housing and Municipal Sector" are in the phase of assumptions' approval.

The tasks defined in the above strategies are implemented by the interested entities, even in case when they have not been formally approved.

5.2. Co-ordination of the strategies

Regardless the lack of the formal approval of the majority of sectoral strategies, every prepared project considers the assumptions of the already existing strategies, and also every new strategy project is harmonized with the interested sectors and supplied for the opinion preparation by the non-governmental organizations.

5.3. The directions of the Polish economy restructuring

The directions of the Polish restructuring defined in the "Strategy for Poland" approved by the Government in 1994 assume in the next four years:

- * the increase of the GNP for 22%,
- * the inflation decrease to less than 10% per year,
- * the unemployment decrease.

The existing strategies and projects prepared by the Ministries assume:

- * the changes leading the industrial production efficiency increase, including also adaptation to the environmental standards by implementation environmentally sound technologies,
- * the implementation of the programme for the increase of the efficiency of the energy use,
- * the rationalization of the transportation's and carriage system in local and national scale,
- * the directing of the agriculture to the improvement of products quality and the forestry to forest husbandry rationalisation,
- * the implementation of waters protection and use rationalisation programme,
- * the implementation of the waste re-use programme.

The tasks in the environmental protection defined in the "State Environmental Policy" document, are taken into account in all the prepared sectoral strategies.

Industry. The reforms in the industry cover:

- change of the sectoral structure in the whole industry (the withdrawal from the dominating excavating, metal, large-scale chemical synthesis and smelting industries to electronic, automotive, food processing, chemical, light and some types of metal industries like environmental protection equipment facilities production),
- the change of production lines in the specific industries
- the change of production technology (increase of the productivity, energy use efficiency and the limitation of the harmful environmental impact will result in the gas emission reduction, in that the greenhouse gases),
- the change of the management and organisational system in the particular industrial plants caused by the ownership change (privatisation), the foreign capital input and by the market economy.

The described process of restructuring has a positive impact on the environment state, also by the reduction of the greenhouse gases emission. The majority of the modern technologies is based on the economical water, raw materials and energy use forced by the need to optimise the production costs. One of the tasks of the Polish economy is the adoption of such modern and clean technologies, and the State Administration task is to make preferences for the enterprises using them.

Energy sector. The energy production sector is also restructured. This sector is one of the biggest in the Polish economy. In 1988 it's added value part to the Gross National Product was 4% and is diminishing since this year (in 1992 it reached 1.3%).

The Polish power system is supplied by the net of industrial and municipal electric power heat and electric power and heat producing plants using mainly coal, which results in a substantial carbon dioxide emission into the atmosphere. For the economical and ecological reasons there is a need to abandon the coal monoculture in the future years in favour of the bigger use of the other, less harmful for the environment, hydrocarbon fuels. For example, the use of the natural gas instead of the coal will distinctly raise the energy production efficiency and will reduce the pollutants' emission into the atmosphere. It is expected that the country's production of the natural gas will raise to 6.4 million tons of carbon equivalent units, 0.7 million tons of tce units will be utilised while mines' de-methanation and there will be a further increase of the gas import.

The reform of the whole system of energy's production, distribution and consumption is necessary to use and save fuel more efficiently. The factor of the primary energy consumption for the creation of the Gross National Product unit is 2 - 3 times bigger than in highly developed countries. The reasons for that are:

- the primary energy structure with a big participation of hard and brown coal,
- outdated technologies of the processing to the consumer energy carriers,
- the structure of the Gross National Product with the supremacy the industries with high energy and raw materials consumption'
- the inefficient energy use in the national economy, particularly in the industry and housings' (low buildings insulation's).

The three sectors of the energy system are reformed:

- energy production and distribution,
- fuels acquisition and production,

- energy consumption by users.

The following changes in the primary energy consumption are expected till 2000 in Poland, as specified in Table 5.1.

Table 5.1. The primary energy demand in 2000

energy carriers	energy demand (million tons of carbon equivalent units)	
	1988	2000 ^x
Hard coal	121.0	92.7 - 107.8
Brown coal	20.2	17.5
Natural gas	13.9	17.9 - 21.9
Liquid fuels	25.3	30.3 - 29.3
Nuclear fuels	0	0
Other fuels	3.4	4.9 - 5.1

^x) - It is dependant on the adopted plan of country's macroeconomics development (see Chapter 6)

The solid fuels will still be the main energy source, but their participation in the fuel balance will diminish in favour of the hydrocarbon fuels. After 2000 the biofuels (e.g. biogas, wood, vegetable oils) will gain in importance. The gradual conversion into gas fuels will have a positive consequences both for the economy and environment. That is why the Government policy will stimulate the development of technologies for the chemical coal processing and the biofuels, and the environmentally sound technologies of fuels acquisition.

Another important factor for the energy efficiency improvement in Poland is the modernisation of the electric power production and distribution. For this reason the coal fired power plants are being modernised. It will result in the power production increase for about 5 - 10%, that due to the processing efficiency increase and will result in the dust and gases emission decrease. The gas fired power and heating plants are scheduled. They are more efficient in the fuel to power conversion than the conventional coal fired power and heating plants. The growth of the use of the renewable environmentally clean energy sources is planned, that by the construction of the new hydro power plants, wind power stations and sun energy collectors (rather a local scale ones). The possibility for the nuclear energy use depends on the need for the use of new-generation reactors (with a passive security system) and a satisfactory solution of the nuclear waste storage.

A very important element of the energetic system is the energy consumption, where are the big possibilities for its use efficiency improvement.

The problem of energy saving concerns mainly the industry and the municipal sector's heating system or the unnecessary consumption in the households. The mechanism leading to this goal is the policy of the abandonment of the energy production subsidies and the prices nearing to the international level. The changes of the electric power prices are presented on Figure 5.1. In a similar degree the prices of the energy carriers are changed.

Figure 5.1 Electric power price changes in 1989 - 2000 (*not available electronically*)

The heating energy sector is also restructured, mainly the widening of heating nets supplied by the heat and power plants and heat plants and the conversion to gas together with the liquidation of small, local boiler houses and individual stoves.

The above principles of the energy saving policy are included in the document "Assumptions for the Energy Saving Policy in Dwelling Houses". The programme schedules the actions for the buildings' thermal insulation's improvement, the improvement of the energy use in public buildings, modernisation of the local heat sources and the heating sector.

The energy consumption for the heating purposes amounts to 42 % of the total primary energy use, while the energy use efficiency is only 50%. The programme plans the implementation of the new standard for the insulating power partitions imperviousness, which will result in the reduction of the energy use for an apartment from 3.2 ton of coal equivalent units to 2.75 ton. As a result of thermal insulation's improvement the demand for heat may be reduced for about 15 - 30% compared to the current situation. In the public use buildings as the result of the automatic regulation systems and energy management implementation, in 2000, the loss will be reduce by about 30%. The heating system restructuring, based on the heat potential use improvement, heat supplies reliability increase and exploitation costs' minimisation will cause the saving of 1.7 million tons of coal equivalent units. To support these actions, in 1994 three Ministers (Minister of Environmental Protection, Natural Resources and Forestry, Minister of Industry and Trade and Minister of Spatial Planning and Constructing) the National Agency for the Energy Conservation was called into being.

Transportation. The transportation policy assumptions plan the goods carriage increase, in 1993 - 2005, for about 85% and people transport for 96%. In the same time the automotive transportation costs' rise is expected, that by the imposition of infrastructural and ecological fees to raise the competitiveness of the means of transportation. The Polish Government will create the mechanisms favouring the introduction of modern technologies resulting in the pollution reduction in this sector of the economy.

The passengers' carriage (current situation and prognosis) of the specified kinds is given in Table 5.2. The forecast was prepared in 1992 and is to be corrected for the estimated state for private motoring in 1995 is over fulfilled now.

Table 5.2. Current and expected passengers' carriage

Transportation means	passenger's carriage (in percentage of passenger by kilometres)			
	1988	1990	1995	2000
Individual cars	33.7	40.9	47.7	49.9
Railways	30.7	29.5	19.7	17.5
Buses	33.3	27.0	27.9	26.8
Aviation	2.3	2.6	4.7	5.8

The structure of the goods carriage is given in Table 5.3.

Table 5.3. The current and expected structure of goods transportation

	goods transportation (in percentage of tons by kilometres)			
Transportation means	1988	1990	1995	2000
Roads	21.6	29.0	51.7	63.1
Railways	67.4	60.2	37.8	29.3
Water inland	0.8	0.8	0.6	0.6
Pipelines	10.2	10.0	9.9	7.0

In the road transportation the State Strategy project plans the adaptation of the roads' system in Poland to the European Union standards, in that the construction of 2600 kilometres of highways and 3600 kilometres of express ways. The cost of this ventures is estimated for about 6 billion USD in 1995 - 2010.

The change in the liquid fuels demand in transportation sector in 1992 and 2000 year are presented in Table 5.4. The forecast includes the following means of transportation: passenger cars, delivery vans, lorries with carrying capacity bigger than 3,5 ton, buses, farm tractors, locomotives, one-track vehicles, ships.

Table 5.4 The forecast of the liquid fuel demand for transportation for 2000

	liquid fuel demand (thousands of ton) in years	
Fuel type	1992	2000
Fuel oil	5150	6150
Petrol in that:	4330	5330
non-lead petrol	630	2650
Sea bunker	720	900

The general fuel demand increase for about 50% in 2000, shown in the forecast, is cause mainly by the non-lead fuel demand increase. It is to be expected, that the total emission from this sector will raise for about 7 000 Gg in 2000.

Agriculture. The project for the Polish agricultural policy strategy assumes, that the agricultural production will rise at the rate of 1.7 - 1.8% per year and in 2000 will rise to the level 12.5 - 13.4% bigger than in 1993. The volume of the agricultural production of the main crops is presented in Table 5.5.

Table 5.5. The plant production volume in 1988 and 1993

	Production (million tons)	
type Crop	1988	1993
Cereals in that:	24.5	23.4
wheat	7.6	8.2
rye	5.5	5.0
Potatoes	34.7	36.3
Sugar beets	14.1	15.6

The agricultural policy assumes the limitation pollutants' emission by the agriculture (in that

nitrogen oxides' emission) and supply for forestation of 230 thousand hectares of the agricultural land till 2000.

The use of the nitrogen fertilisers in the Polish agriculture will be about 900 - 1050 thousand tons in 2000 (of the pure nitrogen). The former use of these fertilisers is presented in Table 5.6.

Table 5.6 The use of the nitrogen fertilisers

years	1988/1989	1989/1990	1990/1991	1991/1992
use of fertilizers (thousand of tons of pure nitrogen)	1520	1274	735	619

The forecast for the animal production is very unreliable because of the situation changing in the agricultural policy. It is expected that the cattle population will rise to 10 - 11 million and pigs' population will rise to 22.5 million in 2000.

The tendency for the population change in the recent period is presented in Table 5.7.

Table 5.7 The changes of animal stock since 1980

livestock (thousands) in year							
Animal type	1980	1985	1988	1989	1990	1991	1992
Cattle	12 649	11 055	10322	10 733	10 049	8 844	8 8221
Pigs	21 326	17 614	19 605	18 835	19 464	21 868	22 086
Sheep	4 207	4 837	4 377	4 409	4 159	3 234	1 870

Forestry. The forestry policy assumes the growth of the forestation and the forests health-state improvement.

In 1988 the forest in Poland covered the area of 8 672 thousand hectares, that being the 27.7 of the country's area (the average forestation in Europe is 32%). The characteristic feature of the forests is the coniferous trees domination - 78.7%. The forest resources of the country were in 1988, 1 404.5 million cubic metres of wood and in 1992 raised to 1 495.5 million cubic metres. It is expected that in 2000 the forestation will grow to 29%, and the wood resources will reach 1 540 million cubic metres. It is also estimated that the mass growth rate will result in the carbon dioxide sinking increase for about 0.5 Gg.

Polish forests are in the state of the health harm danger, which in some regions is of the disaster character. The reasons for this unfavourable health situation are both the natural conditions (the numerous occurrences of insectal and fungus pathogens, extremum weather conditions: windbreaks and droughts) and anthropogenic (the bad forests' management, deforestation and air pollution).

The forests' management in the state owned forests enables the forested area growth (logging areas smaller than forested areas). The wood harvesting in 1993 - 1997 will amount to 17.6 million cubic metres of large timber in the State Forests, while in 1988 the tree felling was 20.5 million cubic metres. The decrease of the forests' area is - beyond the deforestation and timber vermin's' attacks. - mainly caused by the woods fires, which in some case have a serious range (Table 5.8).

Table 5.8. The forests area affected by fires

years			1988	1985	1988	1989	1990	1991	1992
forests area (hectares)			1 735	1 825	3 801	4 997	7 341	2 567	43 755

In spite of the presented losses in the forests resources, the forestation successively grows. In 1993 it grew to 27.9% (Figure 5.2).

Figure 5.2 Changes of forestation in Poland (*not available electronically*)

The forests being an important sink in the CO₂ circulation, play protective and social role. This importance of the forest ecosystems calls for the forestation increase to at least 30% in the next 20 - 25 years, mainly by the conversion of the grounds with a low agricultural efficiency and the areas contaminated and transformed by the industry. It is also necessary to rebuilt forest stands damaged by pollution, by their renewal or species change. The one-specie forests, damaged in the biggest degree, will be replaced by the multi-species forests' crops with a big participation of deciduous plants. The concept for the forestry development and National Parks' ecosystems' protection is one of the most important elements of the strategy of the sustainable development and will be implemented in a composite way, covering the legal aspects (The Act on Forests and Forests' Management), technological aspects (use of the environmentally friendly technologies in the economy), financial aspects (resources from the State Budget) and regional aspects (the agro-forensic spatial planning in particular regions of the country).

Municipal. In the municipal management the main problem is the management of gas from the municipal landfills. It is estimated that the municipal landfills, which in 1988 were of the volume 46 m³ of solid waste, contain 11 milliard m³ of gas, that being the equivalent of 5.2 million tons of carbon equivalent units per year (40% - 60% of the gas is methane, and the remaining part is carbon dioxide). The strategy is currently prepared, for the actions in the waste processing intensification with the simultaneous neutralisation of the dump gas by its utilisation or burning.

The above directions of the management restructuring are to a big degree based on the assumption of the political reform directions' durability, that dependant on the domestic and international political and economic situation. Taking regard of the transformation period and the transitional character of the Polish economic system they may change in the future.

5.4. The legal and economic regulations in the environmental protection

The environmental protection is one of the constitutional obligations of the State and the right and obligation of its citizens. In the main Act (the Constitution) it is stated that "Polish citizens have the right to use the values of the natural environment and bear an obligation of its protection" (Article 71).

The legal protection of the environment is subject to a number of regulations. These matters are regulated in the regulations on spatial management, agricultural and forest lands' management, land surface and mineral resources management, water management, forests' management, landscape, objects of the nature, historical buildings, health-resorts.

It is also covered by the mining law and the regulations for constructing and investments.

The problem of the composite environmental protection was considered by the Act on Environment Protection and Shaping of 31 January 1980. The purpose of this Act is to regulate, as fully as it is possible, the environmental protection issues and to ensure the consistent policy, particularly the State policy, in the complex interdisciplinary problems.

The Act on Environment Protection and Shaping puts the commitment on the State and local authorities, entities and their employees, to enforce the environmental protection requirements and to execute the liability for the environment state violation. The exploitation of the natural resources is allowed within the limits set by the law. The Act imposes the obligation for the permit for natural resources use obtaining, by all the entities, that based on the prepared environmental impact assessment.

The legal mean to execute this provisions is an obligation to:

- a) use the methods, technologies and facilities protecting the environment,
- b) obtain permits and concessions for the use of the environment,
- c) monitor the type and volume of substances discharged into environment.

For the non-observance of these regulations, the administrative sanctions and penal responsibility is provided.

The achievement of the planned goal can be done only with an employment of the proper legal, organisational and economic instruments, which are:

- act on forests,
- act on spatial management,
- geological law,
- energy law,
- water law,
- environmental management agencies structure,
- law enforcement system,
- economic mechanisms stimulating investments in the environmental protection.

The environmental protection legal system is permanently modernised, that is the existing acts are adapted to the changing social, economic and ecological conditions.

Until now the following acts are approved or are in the last stage of the legislative process:

- on Environment Protection and Shaping,
- on Spatial Management,

- on the State Inspectorate of Environmental Protection,
- on Forests,
- on Nature Conservation,
- Water Law,
- Hunting Law.

The updated act on the environmental protection will take under account the situation resulting the economic and social changes in the country and will enable the more efficient enforcement of the environmental protection principles' compliance by all the entities.

In the market economy conditions, in the environmental quality management system very important role is played by economic instruments. In this instruments' group the main enforcement mechanism is created by financial incentive, such as:

- fees for the commercial use of environment and making changes in it,
- administrative fines for the incompliance with standards,
- administrative fines for the removal without permission of trees and bushes and devastation of greens,
- additional nuisance related the over date payment of fees and fines and classification of fines as expenses not included in the cost of income achievement,
- discontinuance of fees and fines execution in case of the beginning of investments resulting in environment improvement,
- subsidy in the form of donations, preferential credits, the income tax relieves, the turnover tax exempt, relieves in farming tax, tax exempts for the real-estate stimulating the actions for the environmental protection.

The acceptable conditions and volumes of the emissions, pollutants discharge and waste storage are determined by Voyevods. The fees for the environment use are determined in the administrative decision taken by the Voyevodship Authorities.

The obligation to pay fees concerns: water intake, sewage discharge into water and ground, pollutants' emission into air, waste storage and trees and bushes removal.

The costs of environment pollution, accordingly to the "polluter pays" principle, are charged to the polluting entities thus forcing their pro-ecological behaviour. In case of the incompliance with the acceptable pollutants' emission into environment standards the financial penalties are fined.

The fees and fines in pollutants' emission into environment and trees and bushes removal are determined in the Order of the Council of Ministers, and the fees for water intake and sewage discharge are determined by Voyevoda.

The currently valid regulations provide for the penal responsibility in case of offences and malfeasances against the environmental protection. One of the essential sanctions in case of the serious incompliance with the environmental protection principles is the stoppage of the production in the facility.

Financial resources are obtained from fees and fines supply Voyvodship's Funds for Environmental Protection as well as the National Fund for Environmental Protection and Water

Management and since 1993 also local communities funds for environmental protection. Above mentioned resources are directed on environmental investments with the higher priority for given region.

To supervise the environmental law observance, the State Inspectorate of Environmental Protection (SIEP) was called into being, with the tasks which amongst others are control of the compliance with the valid regulations, the issuing of orders for the removal of the harmful impact causes, imposing of the penalties for the incompliance with valid pollutants' discharge limits with the stoppage of the activities harmful for the environment. This institution also monitors the environment state and registers the changes in it, that being the environment monitoring (organisation and supervision of measuring stations, both on the country level operating in international system and regional and local ones. The SIEP organs are the Chief Inspector of Environmental Protection and Voyevodships' inspectors of environmental protection.

5.4.1. The structure of agencies for environmental protection management

The main state administration organ which controls and co-ordinates the activities in the environmental protection is the Ministry of Environmental Protection, Natural Resources and Forestry. To perform his actions the Minister has the state executive apparatus including the Ministry and Voyevodship Departments of Environmental Protection, and to control the execution of the decisions the State Inspectorate of Environmental Protection and Voyevodship Inspectorates of Environmental Protection. The financing of pro-ecological ventures is ensured and supported by the Regional Boards of Water Management (in the field of water engineering), the National Fund for Environmental Protection and Water Management and Voyevodship Funds for Environmental Protection and Water Management. The research background consists of the scientific and research institutes subordinate to the Minister and the opinion making and counselling is in the hands of the State Council of Environmental Protection. The Council tasks are to opinion the matters related to the environment protection and to present proposals and conclusions aimed at the environmental protection conditions' creation, its preservation and improvement.

In the regional administration for the environment conditions, the Voyevodship Departments of Environmental Protection are responsible. The main responsibility and decisions in the actual actions for the environmental protection are assigned to the entities and local authorities, with a decisive voice and assigning the resources both from their own funds and transferred by the ecological funds. The duty to create the conditions necessary to implement the environmental protection regulations is impose on Ministers supervising the particular sectors.

The structure of environmental protection managing organs in Poland, is presented on Figure 5.3.

Figure 5.3 The environmental protection management organisation chart (*not available electronically*)

5.4.2. The legal mechanisms stimulating the greenhouse gases emission reduction

The Act on Environment Protection and Shaping in the term of the air pollution includes also the emission of the gases that can have and adverse impact on the climate.

The executing act regulating the air protection from pollution, is the Order of the Minister of Environmental Protection, Natural Resources and Forestry on 12 February 1990. This order determines, among others the limits for the discharge into atmosphere of the nitrogen oxides from the fuel combustion in energy generation and determines the limits for the concentration of nitrogen oxides, carbon oxides, non methane volatile organic compounds in the air, thus creating the base for the execution of the commitment of this gas emission reduction.

The problem of the solutions used in the environmental protection for the climate protection lies in the fact that the emission of some of the greenhouse gases, mainly the carbon dioxide is not subjected to administrative regulations yet.

The other legal acts regulating in an indirect way the climate protection are: the Act on Nature Conservation of 16 October 1991 and the Act on Forests of 28 September 1991.

5.4.3. The economical mechanisms stimulating the greenhouse gases emission reduction

The economical mechanisms valid in Poland allow to limit the greenhouse gases emission. They are:

a) the fees for the greenhouse gases emission. Since 1993 such fees have been charged to the industrial plants and municipal enterprises, among others for the emission of all kinds of the greenhouse gases, carbon dioxide and nitrogen oxides.

The level of the fees' for the gaseous substances and dusts emission into the atmosphere, in that CO₂, are updated every year by the Order of the Council of Ministers.

b) the fee for the trees and bushes removal,

c) subsidies for the realisation of the ventures enabling, among others, the greenhouse gases emission reduction, in the form of:

- donations from the National Fund for Environmental Protection and Water Management and the respective Voyvodship, Commune and municipalities' funds,
- low interest rate loans assigned by these funds,
- preferential credits assigned by the Bank of Environmental Protection.

The analysis proved that the one of the main instruments stimulating the greenhouse gases emission reduction in Poland, in future, will be the fees for this gas emission. The fees' level should depend on the energy use, and the resources created by these fees should be assigned for the energy saving ventures subsidising and the increase of the sink capacity of the biosphere. The criteria and mechanisms of resources acquisition and use are currently prepared. Another discussed mechanism is the ecological fee imposed on fuels.

6. The expected results of the realisation of the adopted economic strategies, in the field of greenhouse gases emission and sink in 2000

The assessment of the future greenhouse gases emission, mainly the carbon dioxide as a gas of the greatest importance in the Polish input to the global emission, is facilitated by the sectoral strategies that are now prepared.

Below, there are presented results of two works concerning the greenhouse gases emission reduction in the future. They are based on the several versions of the national energy system strategies prepared with the means of the macroeconomic models for medium and long time range.

In the first work for the assessment of the future greenhouse gases emission, the set of models for medium-term (20 - 25 years) programming of the energy system, was used. The set consists of the three complementary models: the economy structure, the direct demand for energy and the optimisation of fuels and energy acquisition and processing. Only these objects were separated, which have a substantial impact on the economy as the whole, such as: coal mining, coke production, crude oil refineries, electric power production, heating, foreign trade in fuels and energy. The final consumption of fuels and energy and the environmental protection requirements were also taken under account.

The main input data for the model concern: the population, national product growth rate, directions for the economy structure change, national product distribution and consumption structure. The data on the foreign trade in fuels and energy, on the environment, e.g. the pollutant emissions' limits and also the data on technologies were also taken under account.

There also included the scenarios for the energy consumption changes in such sectors as iron industry, non-ferrous metal industry, food processing industry, light industry, pulp and paper industry, constructing, transportation, agriculture and services. Several scenarios are assumed in the energy consumption development. The evaluation of two of such scenarios was done: LOW and HIGH, based on different Gross National Product in particular years. The assumed GNP changes (percentage) for both scenarios are shown in Table 6.1.

Table 6.1. The expected changes of the Gross National Product till 2000

Scenarios	% of GNP		
	1990	1995	2000
LOW	100	95	112.5
HIGH	100	117	152.9

The assumed GNP's growth average rate is 2.3% and 4.2% respectively.

For each of the scenarios three variants of ecological limitations were prepared:

REFERENCE - do not include any particular limitations,

BASE - includes the valid limits for the emission of sulphur oxides, nitrogen oxides and dust from

the combustion of fuels,

EKO - including the emission limitations accordingly to the State Ecological Policy priorities.

All three variants assume the rise of oil and gas prices for 50%, till 2010.

The forecast of carbon dioxide emission change till 2000, in the power sector is presented in Table 6.-2.

Table 6.2. The forecast of the carbon dioxide emission for the selected scenarios of energy sector development

Variant	Carbon dioxide emission (Gg)		
	1988	HIGH	LOW
REFERENCE	458 000	405 000	455 000
BASE	458 000	404 000	454 000
EKO	458 000	394 000	448 000

The carbon dioxide emission value in 1988 given in Table 6.-2 for the energy sector, differ from the value given in Table 2.2 covering the emission inventory for 1988, but the difference of about 1% can be neglected.

In the second work of 1992, the analysis was made of the greenhouse gases emission changes, that prepared on the long term macroeconomic scenarios based on three models: The Dynamic Simulation Model of the National Economy, the Energy Demand Model and the Energy Supply Model. In these models the national economy is divided in 25 branches and sectors. The differences and balance equations used give the models, the dynamic character by taking account of the variable growth's rate.

The model employs the following variable for each branch for the historical period and estimates for the prognosed period:

global value, indirect use, added value, investments, employment, exportations, importations, population.

It is assumed, that the transformation process will be realised till 2000 and in this period the economy will be intensively changed and developed, and simultaneously the economic structures and the national product will not change too rapidly. It was assumed that the potential for the CO2 emission's changes depends on the investments' structure. The Poland's foreign debt and foreign credits and investments were neglected. It was also assumed that the export growth rate will be bigger than the import growth rate.

Several scenarios were analysed. For the detailed analysis the variant was chosen, which assumes the big participation of the trade, services and transportation sectors in GNP and the decrease of the participation of the power consuming industries.

Moreover the scenario assumes the development of services and industry with the exclusion of the following industries: metallurgy, machine and electrical, chemical and mineral. The investments decrease is also assumed in agriculture, and the growth in the transportation and power sectors. The scenario takes the following structure of the use of the primary energy carriers in 2030: 90% - coal and 10% - gas. The results obtained within this scenario show that in 2000 the carbon dioxide emission will be about 338 000 Gg.

The expected run of the carbon dioxide emission change for the above variant by the year 2000 is presented in Figure 6.1.

Figure 6.1. The carbon dioxide emission changes in the power sector accordingly to the macroeconomic scenario by 2000 year. (*Not available electronically*)

The methane emission forecast depends on the assumed hydrocarbon fuels consumption growth and the transportation development, and the nitrous oxide emission depends on the agriculture's efficiency with the reduced crop area. The estimation made shows that the methane emission can reach 1 780 Gg and nitrous oxide 61.8 Gg in 2000.

The presented assessments of the future greenhouse gases emission do not take account of the currently undertaken actions, which are presented in Chapter 3 and ventures which are realised now, and which lead to the further emission reduction

The examples of such actions are the actions in constructing presented in Chapter 4 and in Annex 1, where the introduction energy saving technologies will substantially diminish the power and fuels use till 2000, or the undertaken actions for the increase of mining methane use.

As it is seen in the results of the analysis of the scenarios prepared by two independent centres, both of them show that the emission of carbon dioxide in 2000 will not be bigger than in 1988. Nevertheless in case if the GNP growth rate will remain on high level (about 4%/ year) fulfillment of the Convention commitments may be endangered.

7. International co-operation

7.1 Foreign aid for environmental protection

The volume of the foreign aid in 1990 - 1993 totalled 230.428 million USD and was assigned to support the realisation of 236 projects related to the environmental protection. Till the end of 1993 the realisation of 109 was ended. In the reduction of the greenhouse gases emission the aid covered the following field of the environmental protection: atmosphere, nature, land surface and waters' protection. It covered among others the investments in:

- processing into biogas and utilisation of solid waste and sewage,
- renewable energy sources (wind and geothermal energy),
- fuels conversion in heating and heating systems' modernisation,
- thermoinsulation of heating pipes,
- power systems modernisation,
- coal enrichment.

The volume of this aid is presented in Table 7.1.

Table 7.1. Sources and volume of the foreign aid in environmental protection in Poland in 1990 - 1993

Source of aid	Number of projects	Donations sum in millions USD (30.06.93 exchange rate)
World Bank	2	4.500
Belgium	4	1.757
Denmark	93	30.613
EEC	36	84.083
Finland	17	6.727
Holland	28	8.793
Japan	3	5.727
Norway	20	3.336
Germany	2	26.341
Switzerland	4	2.736
Sweden	14	19.181
United States	9	36.300
Great Britain	4	0.334
Total	236	230.428

In the atmosphere protection the biggest aid was granted by: United States, Germany, EEC, Sweden and Denmark, and for the nature conservation (with forests) by the World Bank and EEC.

The biggest financial share was granted by the Commission of European Communities. This aid is realised by PHARE Programme and in the particular years it amounted to (in millions ECU):

1990	22.0
1991	35.0
1992	18.0
1993	0.0
1994	12.0

7.2 The Global Environmental Fund

The GEF gave Poland the aid, beyond the financial mechanism of the Convention, the sum of 25 million USD for the coal to gas conversion of the heating system. The aim of this programme is the limitation of the carbon dioxide emission.

7.3 The other sources of the aid

Poland obtained the UNEP financial aid of 340 000 USD for the preparation of the inventory of the greenhouse gases emissions for the year 1992 and the US Government aid of 584 000 USD to prepare the Country Study on Strategies for the Greenhouse Gases Emissions' Reduction and Adaptation of the Polish Economy to the Climate Change.

The results of this inventory are presented in this Report, but the results of the national study will be available at the end of 1995.

7.4 Multilateral co-operation

In 1992 the new form financing of the environmental protection actions was created. The Government called into being the "ECOFUND" foundation, with the task of the efficient management of the financial resources originating from the conversion of the Polish foreign debt to the support of ventures in the environmental protection. Some countries, the Paris Club members (the United States, France, Switzerland) agreed to assign the part of the Polish foreign debt to investments in the environmental protection.

The ECOFUND statute states that these resources may be used for co-financing of the projects in environmental protection not only of a local and national scale, but also in the global scale. One of the main directions of the investments' financing from this source is the greenhouse gases emission reduction. In 1993 - 1994, about 88 billion zloty, were assigned to the investments in this field. These investments cover, among others, coal to gas heating conversion, apartment buildings connection to the district heating system, use of the renewable energy sources (geothermal).

Polish experts participate in the works of various international scientific organisations, among which the Intergovernmental Panel for Climate Change(IPCC) is to be mentioned. Polish scientists are co-authors of two chapters of the IPCC Special Report (water resources and forests) and participate in the opinioning of other chapters: ecosystems, radiational extortion, strategies for emission reduction and others.

Polish experts' groups participate in the realisation of project covering the National Study for Latvia in the inventory of the greenhouse gases emission, financed by the Dutch Government and also participate in the evaluation of the sea level influence on the Vietnamese economy.

7.5 The Joint Implementation of the commitments to the UN Framework Convention on Climate Change (JI)

Accordingly to the Decision of the Minister of Environmental Protection, Natural Resources and Forestry, Poland will join the implementation of the pilot phase of this mechanism. The work group was called into being with the task of preparation of the detailed criteria for the start-up and implementation of such projects and the JI Secretariat with the task of supervising of the pilot phase implementation.

Actually, the joint project with Norway is prepared for implementation. It is related to the fuels use conversion in the heating system. The Norwegian participation is 1 million USD. The principles of co-operation were settled in the agreement between Governments of Poland and Norway.

In the preparatory phase there are also other projects, that will be proposed to the interested countries.

8. The preparation of the economy and society for the climate change effects. Strategies of adaptation

In Poland, the evaluation of the climate change effects was made for two sectors: water management and sea shore protection.

In the **water management** such evaluation covers the results in the Nature and does not include the adaptation costs. It was prepared with the employment of the CLIRUN3 model prepared in Poland. The results obtained are substantially different, dependant on the results of general atmospheric circulation models. Regardless of the fact climatic scenario is employed, the future climate changes will cause the runoff and soil humidity decrease in Summer time and the flood period move from Spring time (March, April) to Winter time (January, February). These changes will have a substantial impact on the water management, especially in agriculture. If this scenario becomes true the water demand in this sector will substantially grow.

Considering the low reliability of the results and economic situation in Poland, the "minimum regret" strategy is proposed, which solves the current problems in a maximum optimal way, and prepares the water systems for the potential loads and shocks, among others, by the of the actual yearly variability reduction by the construction of water reservoirs' system , the waters' quality improvement and the increasement of water consumption efficiency. It require the institutional adaptation of the state administration to the new conditions to overrun the water defficiency barrier, to agree the new Water Law and to prepare the strategy of draughts prevention.

In the area of **the coast protection** the prepared report determines the areas most vulnerable for the sea surface level changes and hazards for the population, economy and ecosystems in the coastal area. With an assumed scenarios of the change of the sea surface level for a 30 and 100 cm, in case no actions will be taken, we will loose respectively 672 or 948 sq. kilometres of land, 400 or 564 km of roads, 35 or 126 km of railways, 300 or 415 km of power distributing lines and 26 bridges.

The prevention coast for various scenarios were evaluated. This cost are ten times bigger than the value of the protected areas. Under these circumstances it is highly improbable that the resources for the sea shore protections will be found.

9. The greenhouse gases monitoring, research and observations of climate made in Poland

The existing in Poland, atmospheric monitoring network does not include the greenhouse gases. Currently the programme is prepared for the carbon dioxide and methane monitoring.

The research in the field of climate change and protection is actually financed from the state resources, and is done by many governmental and non-governmental organisations. The funds are divided amongst several decentralised groups so the full inventory of the research is not possible. Nevertheless the main part of the research is financed by the Scientific Research Committee - the state agency managing the scientific research, in the form of individual, ordered and target projects.

The information on this group of research is presented below.

In 1991 - 1994 the majority of resources was assigned to the studies of the efficient energy use and consumption - about 207 billion zloty and to the studies on transportation systems - about 110 billion zloty. The substantial resources (about 40 billion zloty) were designated for the research in the reduction of power and materials consumption in production. Moreover the studies were made of:

- climate change (mainly the evaluation of the future changes and methodology of the scenarios of the future changes),
- protection of the living nature resources (in that the nature resources management, improve forests sanitary conditions, reconstruction of biodiversity structures),
- soils protection from erosion,
- global changes,
- oceanology,
- polar regions.

The Polish Government assigned for this kind of studies about 700 billion zloty from this singular source.

Poland has not as yet officially called into being the National Climate Programme (WCP) and the Global Change Programme (IGBP), but the research are made in this field by both governmental and non-governmental organisations.

Moreover the studies are prepared in Poland on the climate change consequences and their influence on water management, forestry and agriculture. The detailed data on the problems studied within WCP scope is presented in Annex 5.

The IGBP Programme is realised in the following subject groups:

- Mechanisms of the future global changes,
- Global changes influence on agriculture and forests ecosystems,
- Global changes influence on the heavily polluted and degraded areas (industrial areas),
- Global changes influence on the maritime environment and sea shore zone,
- Global changes evaluation in other climatic regions (polar, dry, tropical damp).

The study is being made, with the task to prepare the regional scenarios of climate change in Poland based on the results of the models for the general circulation of atmosphere.

In the field of the emissions' evaluation it is necessary to begin studies in energy production and consumption, emission while processing and from the surface sources, waste dumps emission, emission from agriculture, forests and land use.

Within the strategy for the emission stabilisation and reduction there is a need to create the systems of data acquisition, technologies favouring the reduction with costs' evaluation, preparation emission reduction strategy in all sectors (power, transportation, industry, agriculture, municipal and residential, forestry) till 2030, and the creation of the greenhouse gases emission and concentration, monitoring system in Poland.

10. The ecological education and public awareness. The role of non-governmental organisations

10.1. The development of the public awareness of the causes and impacts of the climate change

The increase of the public awareness of the climate change is made in two ways: by the formal and informal education.

The formal education includes children and youth teaching at schools, where in the scope of the particular subjects, especially chemistry, physics, geography and biology the essential information on climate system and dangers to it, is given.

Moreover, in 800 secondary schools of the ecological profile, these problems taught in a much wider scope. In the majority of the university type schools, regardless their profile, the problems of environmental protection and engineering are covered by special studies' programmes. At such studies the climate change problems are also presented.

The research institutes subordinate to the MEPNRF and some of the NGOs conduct the teachers' training in environmental protection.

The widespread informal education includes lectures and lessons available for everybody interested, and also press articles and radio and television programmes.

10.2 Popularization activities

The popularization of the environmental protection issues is made by periodicals of the various levels of specialisation and by publications like IUCN Dossier "Climate changes" 1000 copies' edition with the financial support of UNEP, books "Greenhouse Effect and Climate Change", "Rio the Beginning of Ecological Era - Earth Summit), translations of foreign publications like J. Vernier's "Environment", "Earth Summit. Global Actions Programme" published by The Centre for Our Common Future and others.

This task is also achieved by numerous conferences and symposiums, where Polish and international achievements in this area are presented.

10.3. The non-governmental organisations' role

The one of the main rules of the Polish ecological policy is the environmental protection management socialisation. It means, that the society can decide in the matters of the aims' realisation and ecological policy priorities in that the commitments to the UN Framework Convention on Climate Change. The natural ally of the agencies responsible for the commitments' implementation, are non-governmental ecological organisations (NGOs). In Poland there are 200 such organisations, some of them big like the Polish Ecological Club, League for the Preservation of Nature, or Green Federation operating all over the country, with more than ten thousand members and lobbied in the Parliament Senate and in Gminas' Councils, some small with several or more persons active in local communities.

The most important actions realised in the country level are:

- * the impact on the representative organs (Parliament), executive organs (Government) to create the legal regulations respecting the ecological policy goals, particularly the energy, transportation and industrial policy,
- * informal ecological education playing an important role in this field,
- * participation in the environmental impact assessments for new investment projects financed by GEF and realized in JI formula.

On the local level the actions are made in the nature conservation, efficient energy use, decrease of transportation nuisances and ecologisation of agriculture.

Bibliography

Bilans energetyczny Polski w uk³adzie statystyki OECD, Eurostat i ONZ Centrum Informatyki Energetyki 1992 (Energy Balance of Poland in OECD, Eurostat and UN Statistical Standards).

Bojarski W. and others, 1994 Ochrona rodowiska w państwowej polityce energetycznej IPPT PAN Warszawa (Environmental Protection in the State Power Policy)

Case Study of Greenhouse Gases Emission in Poland, 1993. FEWE, Warsaw.

Cofa³a J., Klimont Z., 1991, Poland's Emission of Greenhouse Gases from Energy-Related Activities; IPPT PAN - not published.

Fotyma M. and others 1993 Zapotrzebowanie polskiego rolnictwa na nawozy mineralne do roku 2010. Przemys³ Chemiczny nr 6 (Polish Agriculture Demand for Mineral Fertilisers Until 2010).

Gaz z wysypisk sta³ych odpadów komunalnych MGPIB 1993 - nie publikowany (Gas emission from the Municipal Landfills, not published).

Gospodarka paliwowo-energetyczna w latach 1991-1992, GUS 1993 Warszawa (Fuel and Energy Management in 1991 - 1992).

Informacja o projektach ochrony rodowiska realizowanych z udzia³em pomocy zagranicznej MO ZNiL 1993 Warszawa -nie publikowany (Information on Environmental Protection Projects Realised with the Foreign Aid -not published).

Kaczmarek Z., Sensitivity of Water Systems to Climate Change (in print).

Karaczun Z. 1994 Rola ekologicznych organizacji pozarz¹ dowych we wprowadzaniu wymagań Ramowej Konwencji o Zmianach Klimatu w Polsce Warszawa - nie publikowane, (Role of the Ecological Non-Governmental Organisations in the Implementation of Commitments to the Framework Convention on Climate Change in Poland- not published).

Metodyka oszacowania emisji i wychwytu gazów cieplarnianych FEWE 1991 Warszawa (Methodology of Greenhouse Gases Emission and Sink evaluation).

Michu³ka M., Kachniarz M., 1994 Charakterystyka kluczowych róde³ emisji gazów cieplarnianych w Polsce (Przemys³). IO . Warszawa- nie publikowane (Characteristics of Key Greenhouse Gases Emission Sources in Poland (Industry) - not published).

Nalborczyk E. i in., 1991 Absorbcja, emisja i retencja gazów cieplarnianych przez polskie rolnictwo w latach 1970-1989 Warszawa - nie publikowany (Greenhouse Gases Absorption, Emission and Retention in the Polish Agriculture in years 1970-1989; not published.)

Nowicki M., 1993 Strategia ekorozwoju Polski MO ZNiL Warszawa (Strategy of Sustainable Development of Poland).

Ochrona rodowiska 1993 GUS Warszawa (Environmental Protection 1993)

Polish National Report for UN Conference "Environment and Development" UNCED-Brasil 1992. MOSZNiL, Warszawa.

Polityka Ekologiczna Państwa 1993 MOSZNiL, Warszawa (State Environmental Policy).

Polityka Energetyczna Polski i Zarys Programu do roku 2010. 1993 MPiH Warszawa - nie publikowane (Poland's Energy Policy and Outline of Programme Until 2010 - not published).

Polityka Przemys³owa. Za³ożenia, program realizacji w latach 1993-1995 MPiH 1993

nie publikowany (Industrial Policy. Assumptions, Implementation Programme for 1993 - 1995, not published).

Polityka Transportowa. Projekt 1994 MTiGM, Warszawa - nie publikowany (Transportations Policy. Draft- not published).

Poskrobko i in. 1994 Ocena możliwości stosowania mechanizmów ekonomiczno-prawnych do ograniczenia emisji gazów cieplarnianych,- nie publikowane (Assessment of Possibilities of Economic and Legal Mechanisms Use in Greenhouse Gases Emission Limitation. not published.)

Program rozwoju hodowli bydła mięsnego w Polsce 1994 MRiG⁻ Warszawa nie publikowany (Programme for the Development of Slaughter Cattle Breeding in Poland, not published).

Program rozwoju wybranych dziedzin leśnictwa i ochrony ekosystemów w Parkach Narodowych na lata 1993-1997 1993 MO ZNiL, Warszawa (Programme for the Development of Selected Fields in Forestry and Ecosystems Protection in National Parks in 1993 - 1997- not published).

Radwanski E. and others, The Greenhouse Gases Emission Inventory for 1988 in Poland, 1992. FEWE, Warszawa.

Radwanski E.,1992 Zarys problemów badawczych i działań wspomagających na rzecz udziału Polski w stabilizacji i redukcji wpływu gazów cieplarnianych na zmiany klimatu FEWE. Warszawa - nie publikowane (Outline of Research Problems and Assisting Actions for Polish Participation in Stabilisation and Reduction of Greenhouse Gases on Climate Change,not published).

Radzimirski S.,1991, Inwentaryzacja źródeł produkcji i emisji gazów cieplarnianych w roku bazowym 1988 - transport. Warszawa - nie publikowane (Inventory of Greenhouse Gases Production Sources and Emission for base year 1988 in Transport Sector- not published).

Roczniki statystyczne GUS (kilka lat) Warszawa (Statistical Yearbooks GUS).

Rydziński Z. i in.1991, Inwentaryzacja źródeł produkcji i emisji gazów cieplarnianych w roku bazowym 1988. Wysypiska komunalne i miejskie oczyszczalnie ścieków - nie publikowane. (Inventory of the Greenhouse Gases Sources and Emissions for base year 1988 from Landfills and Sewage Treatment Plants-; not published.)

Rykowski K.,1993, Lasy w: Stan środowiska w Polsce GRID Warszawa (Forests in: State of Environment in Poland).

Rykowski K., Galinski W.,1991 Absorpcja i emisja gazów cieplarnianych w lasach Warszawa - nie publikowane (Greenhouse Gases Absorption and Emission in Forestry; not published).

Seminarium: Inwentaryzacja emisji CORINAIR 1990 Atmoterm 1994 Opole (CORINAIR Emission Inventory 1990, Seminar materials. Atmoterm)

Strategia dla Polski (1995 - 1997). Dokument rządowy. 1994 (Strategy for Poland (1995 - 1997), Government document.)

Synteza koncepcji programu utylizacji odpadów komunalnych do 2000 roku. Projekt. 1990 MGPIB ,Warszawa, nie publikowany (Synthesis of Concept for the Programme of Municipal Waste Utilisation Until 2000. Draft- not published).

Wojtulewicz J. i in. 1994, Wyznaczanie współczynników emisji dla zbioru paliw kopalnych i ich pochodnych wg klasyfikacji OECD/IEA dostosowanych do metodyki

OECD/IPCC przy uwzględnieniu technologii spalania. Fewe, Warszawa- nie publikowany (Determination of Emission Coefficients for the Set of Fossil Fuels and Derivates Accordingly to OECD/IEA Classification Adapted to OECD/IPCC Methodology with Account of Combustion Technologies - not published).

Założenia polityki energooszczędności w budownictwie MGPIB, 1993a - nie publikowane (Assumptions for Energy Saving Policy in Constructing. Draft, not published).

Założenia polityki społeczno-gospodarczej dla wsi, rolnictwa i gospodarki żywnościowej do roku 2000 1994 MRiG⁻ Warszawa - nie publikowany (Social and Economic Policy Assumptions for Countryside, Agriculture and Food Management Untill 2000, - not published).

Zbiór technologii ograniczających emisję gazów cieplarnianych wdrożonych w latach 1989-1990 1994 IO (Collection of Technologies for Greenhouse Gases Emission Limitation Implemented in 1989 - 1993).

Zeidler R., 1992, Assessment of the Vulnerability of Poland's Coastal Areas to Sea Level Rise.

Index of abbreviations

CORINAIR	the COoRdination d'INformation Envirnementale AIR emissions inventory
GEF	Global Environmental Fund
GNP	Gross National Product
GRID	Global Resouces Information Database
IEA	International Energy Agency
IEP	Institute of Environmental Protection
IGBP	International Geosphere-Biosphere Programme
INC/FCCC	Intergovernmental Negotiating Committee for a Framework Convention on Climate Change
IPCC	Intergovernmental Panel on Climate Change
IUCC	Information Unit on Climate Change
MAFM	Ministry of Agriculture and Food Management
MEPNRF	Ministry of Environmental Protection, Natural Resources and Forestry
MIT	Ministry of Industry and Trade
MSPC	Ministry of Spatial Planning and Constructing
MTME	Ministry of Transportation and Maritime Economy
NGOs	Non-Governmental Organisations
NMVOC	Non Methane Volatile Organic Compounds
OECD	Organisation for Economic Co-operation and Development
UNEP	United Nations Environmental Programme
WCP	World Climate Programme

Annex 1. The list of the more important actions aimed at the emission reduction and sink growth of the greenhouse gases

Gas	Sector	Action	Aim	Instrument type	Implementations situation
CO ₂	energy	fuel conversion	energy saving	technical	numerous
		elimination of individual heating	fuel saving	technical	numerous
		renewable energy sources	fuel saving	technical	in the wind and geothermal energy
		pipes insulation	energy saving	technical	common
CO ₂	constructing	power price growth	energy saving	economical	systematic donations liquidation
		thermoinsulation of buildings	energy saving	technical	common in new buildings
N ₂ O, CO ₂	transportation	catalytic converters installation	fuel saving	technical	in new cars
		propane-butane fuel	fuel saving	technical and economical	rare
		vehicles with improved technical parameters	fuel saving	economical (custom fees)	common
		oilseed rape oil fuel	fuel saving	technical	experimental
CH ₄ , CO ₂	municipal	dumps gas utilisation	fuel saving	technical	experimental
CH ₄	mining	mining methane utilisation	energy saving	technical	rare
CO ₂	forestry	renewal and forestation	sink increase	technical	common
NMVOC	liquid fuels	tanks, lines and distributors tightening	fuel saving	administrative, economical, technical	realised in big refineries and fuel depots

Annex 2. The Greenhouse Gases Emission Inventory in 1990 Accordingly with CORINAIR

Greenhouse gases emission (Gg)						
Sector	C ₀₂	CH ₄	N ₂ O	NO _x	CO	NMVOC
TOTAL	414 930	6 100	156	1 450	7 400	1 290
commercial, local and community power, heating and power and heating plants	217 080	100	19	540	1 410	100
industrial combustion and processes	151 230	25	19	423	3 150	100
fuels excavation and distribution	-	2 910	-	-	-	50
solvents use	-	-	-	-	-	230
road transportation	19 580	4	0.7	243	2 140	250
other vehicles and facilities	11 670	1	0.3	160	90	70
waste management and utilisation	2 080	820	2	83	230	170
agriculture	0	1 860	94	-	-	30
biomass	13 290	390	21	1	20	290

n.a. - not available

-- does not occur

Annex 3 The greenhouse gases emissions in Poland in 1992 (Gg)

Categories of greenhouse gases emissions sources and sinks	CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOC
TOTAL 1	359 439	2 474	50	1 283	1 610	640
1.all energy	360 988	821	5.8	1 242	1 495	416
1.A. Fuel combustion activities	360 927	28	5.8	1 242	1 495	416
1.A.1. Energy and transformation industries	223 009	8	3,06	605	108	10
1.A.2. Industry	37 259	10	0.29	135	41	23
1.A.3.1. Transport - mobile sources	29 473	8	1.39	417	1 283	334
1.A.3.2. Transport - stationary sources	1 002	0.03	0.01	0.4	0.4	0.23
1.A.4. Commercial/institutional	18	v.a.	v.a.	0.02	0.002	v.a.
1.A.5. Residential	64 933	1.6	0.87	39	25	3
1.A.6. Agriculture /forestry	5 233	0.2	0.17	46	38	7
1.A.7. Others	-	-	-	-	-	-
1.A.8. Biomass burning for energy	4 038	0.15	0.08	5	14	1.02
1.B. Volatile fuel emission	61	793	n.a.	n.a.	n.a.	39
1.B.1.a. Liquid fuels system	53	0.5	-	-	-	34
1.B.1.b. Gaseous fuels system	8	164	-	-	-	5
1.B.2. Coal system	-	628	-	-	-	-
2. Industrial processes	10 603	8	12.9	40	75	59
2.A. Iron and steel	302	0.6	n.a.	9	42	11
2.B. Non-ferrous metals	35	0	n.a.	0.13	33	0.04
2.C. Inorganic chemical	1 493	7.6	12.9	31	n.a.	8
2.D. Organic chemical	0.09	n.a.	n.a.	n.a.	n.a.	13
2.E.1. Cement production	7 971	n.a.	n.a.	n.a.	n.a.	16
2.F. Others	802	n.a.	n.a.	n.a.	n.a.	11
3. Solvents' use	n.a.	n.a.	n.a.	n.a.	n.a.	165
3.A. Paints use	n.a.	n.a.	n.a.	n.a.	n.a.	62
3.B. Chemical degreasing and cleaning	n.a.	n.a.	n.a.	n.a.	n.a.	22
3.C. Chemical products	n.a.	n.a.	n.a.	n.a.	n.a.	4
3.D. Others	n.a.	n.a.	n.a.	n.a.	n.a.	77
4. Agriculture	-	704	31.49	1.34	40	-
4.A. Enteric fermentation	-	647	-	-	-	-

Categories of greenhouse gases emissions sources and sinks	CO₂	CH₄	N₂O	NO_x	CO	NMVOC
4.B. Animal wastes	-	56	-	-	-	-
4.D. Agricultural soils	-	-	31.43	-	-	-
4.E. Agricultural waste burning	-	1.1	0.06	1.34	40	-
5. Land use change/forestry	-12 152	0.004	v.a.	0.001	0.06	-
5.A. Forest clearing	244	0.004	v.a.	0.001	0.06	-
5.B. Conversion of grassland to cultivated lands	5 239	-	-	-	-	-
5.C. Logging/management forest	-17 632	-	-	-	-	-
6. Waste	-	941	-	-	-	-
6.A. Landfills	-	844	-	-	-	-
6.B. Sewage treatment	-	97	-	-	-	-
6.C. others	-	-	-	-	-	-

v.a. vestigial amounts

- does not occur

n.a. not available

1 - without item 1.A.8

Notice: negative values mean sinking amount of gas.

Annex 4. THE GREENHOUSE GASES EMISSION COEFFICIENT USED IN THE INVENTORY FOR THE REFERENCE YEAR

A. The carbon dioxide emission coefficients for the fossil fuels and its derivatives' combustion in the stationary objects (kgC/GJ)

Emission source	Emission factor values in kg C/GJ
crude oil	20.0
petrols	18.9
fuel oils	20.2
heating oil	21.1
hard coal	25.8
brown coal	27.6
peat	28.9
coke and semi-coke	25.8
town gas	17.1
highly methanated natural gas	15.2
natural gas with nitrogen	15.4

B. The emission coefficients in transportation sector (kg/GJ)

	CO ₂	NO _x	CO
Passenger cars:			
petrol	72.49	0.632 - 0.759	5.563 - 5.589
diesel	73.85	0.272	0.508
Light trucks:			
petrol	72.49	0.966	7.471
diesel	73.85	0.550	0.984
Trucks:			
two-stroke	72.49	0.161	7.586
petrol	72.49	0.908	8.322
diesel	73.85	1.770	0.843
Tractors and farming machines:	73.85	1.358	1.663
Diesel locomotives	73.85	1.265	0.691
Ships	73.85	1.171	0.186
Passenger aircrafts	73.85	0.766	2.483

C. The methane emission coefficients in coal mining ($\text{m}^3\text{CH}_4/\text{Mg}$ of coal)

Emission source	CH_4
Ventilation systems:	
underground mines	27.1
strip mines	2.5
After mining processes	2.32

D. The emission coefficient for the cement production is $0.4985 \text{ Mg CO}_2/\text{Mg}$ of cement

E. The methane emission from landfills was calculated with the Bingemer and Crutzen method.

F. The methane emission from the enteric fermentation of the animal stock was calculate with the OECD methodology with the employment of the equation:
Yearly CH_4 emission [kg/animal/year] = $0.8 \times (\text{weight in kg})^{0.75}$,
and for the emission from the animal wastes the OECD methodology was used.

G. The evaluation nitrous oxide emission from the nitrogen fertilisers was done with the following coefficients (in % of Nitrogen)

for nitrates - 0.001 and 0.5
for ammonia - 0.86 and 6.84

Annex 5. ACTUAL SITUATION IN THE CLIMATIC RESEARCH IN POLAND AND ACTIONS PLANNED IN RELATION TO THE WORLD CLIMATE PROGRAMME

Introduction

Poland is one of the countries, which have not an official National Climate Committee and a National Climate Programme. In spite of that attempts were made to co-ordinate the climate studies more closely. The main assumptions for the National Climate Programme organisation were formulate in 1986 - 1989. The financial problems and the reorganisation of the state administration caused that this programme was not officially organised. In spite of this, Polish scientific circles got deeply engaged in the studies notably compliant to the assumptions of the National and World Climate Programmes.

Poland participates in all major international works and programmes concerning the results of the eventual global climate changes, like: Global Change - IGBP (International Geosphere-Biosphere Programme), IPCC (intergovernmental Panel on Climate Change (WMO/UNEP), WOCE (World Ocean Circulation Experiment), WCP - WATER and others.

The types of undertaken actions

The climate research related to the World Climate Programme are conducted in several scientific institutes. For some time, the co-ordination and evaluation of these studies were done by the Committee of Meteorology and Atmospheric Physics of the Polish Academy of Sciences. Regardless of that, every institution made its own independent studies. The Meteorological Service has a substantial background of the national meteorological network and is in charge of the main archive materials on climate. This Service has the technical and personnel capacity to develop the existing climate data bases and to make studies, especially in applications (applied meteorology) and forecasts (long-time forecasts). Universities and other institutions have a considerable potential in theoretical, regional and some highly specialised research.

Connections with the World Climate Programme and actions related to it

The past climate studies were somewhat dispersed, but a part of them was complementary with the main sub-programmes if the World Climate Programme.

The biggest part of the studies made by the Meteorological Service was in the climate Data and Monitoring Programme. In several stations the data the data was collected for the periods longer than 200 years.

The first instrumental measurements of pressure and temperature were done in Warsaw in 1648 in the so called Florentine network. In 1692 the meteorological station was organised in Wroclaw. In Warsaw, the regular meteorological observations began in 1779. Since 1792 the measurements in the Cracov Astronomical Observatory have been made, and the permanent observations have been done since 1826.

The central data base contains the daily and limited time observations with the 3 hours step for 63 meteorological stations since 1966. In about 130 climatic stations the daily reports were

have been collected since 1951. The notice is to be taken of the creation, in various institutions, of the historical data basis to study the long time climate changes, in that the traditional data and the proxy data. The information on the existing data was supplied to WMO, for the INFOCLIMA information system.

In December 1990 the Polish Hydro-Meteorological Service installed the CLICOM international system for data analysis. This system acquires data from synoptic and climatic stations.

In the past years the bigger notice was taken of the **climate monitoring**. The main results of the actual state of the climate elements in Poland evaluation, have been published in the Hydro-Meteorological Monthly Bulletin since 1977. It includes the atmospheric circulation characteristics and the hydrologic and weather conditions in Poland compared to the long time data. Recently the specialised bulletins are published e.g. in Baltic Sea monitoring, atmospheric pollution. For the monitoring purposes the satellite data is also used.

The Hydro-Meteorological Service ensures meteorological service for the animal and plant production, that related to the sub-programme of **applications and services in agriculture and food management**. There exists the network of agro-meteorologic posts and agro-experimental posts and phenological posts. The decade and monthly agro-meteorological bulletins are published, delivering information on the crop plants' vegetation conditions. In case of the extremal conditions' occurrence, special work teams are organised e.g. in case of the 1992 drought. The agro-meteorological research is also done by agricultural universities and agricultural research institutes.

In **water management** the stress is put on the water resources studies, that resulting from the water deficiency in some regions of Poland in the previous years. That is why it is so important to study the water conditions in relation to the climate change.

In the **energy** sector the climate base was created for the use of renewable energy sources (wind, sun energy).

For the **heating** purposes the climatic standards were prepared and the system for the municipal heating control related to the meteorological conditions change.

For the **town and spatial planning** the help was rendered in the climatic standards preparation. The top-climatic and soil quality and climatic maps were prepared. The probabilistic characteristics of intensive precipitation for the town drainage system projects were also prepared.

In the subject of the climate influence on **human health** the bio-climatic programmes were developed in several centres. The bio-climatic situation was evaluated and bioclimatic regions were determined, also for the **tourism and recreation** purposes. The vast bio-climatic monograph of Polish resorts was published. There was also prepared a bio-meteorological shield prepared for road **transportation**.

The **atmospheric pollution monitoring** has been done for several years in BAPMoN, EMEP

and Integrated Monitoring network.

The climatological support for agriculture, water resources and energy sector will be kept on the actual level with the aim of the more detailed time scale and regionalisation of the climatologic guard and forecasts. For the reason of commercialisation of the economic activities, it is expected that the new market economy systems will stimulate the climatic actions for the economy. In particular, it will concern the agriculture, forestry, horticulture and fruit-culture.

In the **human impact on climate** sub-programmes the majority of studies is devoted to the urban and industrial agglomerations' impact on local climate. These studies are parallel to the antropogenic changes of atmosphere composition research.

The evaluation of the antropogenic influence deformation of the natural climate variability is of also of a particular importance. This task is realised by the comparative studies in the big antropopression areas and the areas free from the direct human impact (mountain and rural areas).

The next group of subjects includes the already mentioned studies on the eventual climate changes caused by the greenhouse effect impact. The most of changes' scenarios is based on the assumption of the CO₂ concentration doubling. In Poland there are no conditions to model these processes in the global scale, so all the effort is directed to adopt the results from the Global Atmospheric Circulation Models to the regional scale, in order to assess the expected temperature and precipitation territorial differentiation. The results of these studies are use to predict the water resources in Poland.

Some of the studies aim to evaluate the eventual climate changes' impact on the crops' structure, forest resources and on the sea surface level. The studies of particular importance are that of climate change scenarios and their relation to energy sources and economy.

The most diversified group are the research programmes. The majority of the is aimed to diagnose (detect) the climate changes.

The most important subjects complementary with World Climate Programme aims, are:

- studies of the chose climate elements in Poland in the area of instrumental observations (air temperature, atmospheric pressure, exposition to sun) compared to changes occurring in Europe.
- reconstruction of the climatic conditions since the end of glaciation until present time (paleoclimatic studies, dendroclimatic studies, historical sources' analysis)
- climate modelling with the aim to prepare climatic scenarios in the regional scale
- circulation factors influence on the spatial and time climate changeability shaping
- sun radiation balance structure characteristics
- regional studies of the climate diversification, especially the Baltic Sea and mountain areas climatic conditions. In international co-operation the **climatic monograph of the Baltic Sea** is being prepared.

Poland is SCAR member and conducts the vast studies on polar ecosystem's changes related to

the climate changes. Polish Academy of Sciences keeps two polar stations ("Arctowski" in Antarctic and "Hornsund" in Arctic) and many teams joined the studies on climate in these areas. The team of oceanologists studies the climate changes in the WRCP "Greenland Sea Project". In co-operation with Norway the studies are made of mass and temperature balance changes in the Svalbard glaciers related to the global warming.

The research work will concentrate on the climate change detection, preparation of the regional climate scenarios and on the use of the results of the studies, for the evaluation of the changed climatic conditions' impact on economy, mainly on water resources and agriculture, the sectors that under Polish conditions are the most exposed ones to climate change. The success of these actions depends on the formal creation of the national climatic programme in Poland.

To facilitate the future Reports to the Conference of the Parties to the Convention it is necessary to make scientific studies, which will learn the problems, not answered as yet. They are aimed to create the base for the political and economic decisions' making, enabling the shaping of the society and economy development with the implementation of the commitments to the Convention in the greenhouse gases emission reduction and sink growth.

The results of these studies will be used for the reliable evaluation greenhouse gases emission and sink in the next years, for the creation of the emission stabilisation and reduction scenarios, and the forecasting of the future emission.