5th National Communication of Romania

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ROMANIA
Ministry of Environment and Forests

Romania's Fifth National Communication on Climate Change under The United Nations Framework Convention on Climate Change

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Introduction

The submission of the fifth national communication to the secretariat of UNFCCC in January 2010, comes in a period of maximum debate about the future of climate change approach and for this reason, the presentations from the Annex I Parties of the elements required by the United Nation Framework Convention on Climate Change on the inventories, policies and measures and their effects, as well as the projections, all these aiming to reflect the implementation stage towards the ultimate objective of this Convention, are extremely important for the coming international commitments to be adopted soon.

Romania as a Member of the European Union will support the adoption and implementation of ambitious targets related to the reduction of the GHG emissions and adaptation to climate change in line with the European climate change policy. In this respect our country makes its best to participate with efficiency at the application of the European Trading Scheme and with less negative effects on the competitiveness of Romanian economic operators.

In terms of GHG emissions Romania has been taking advantage of the decline of the economy from 1989 and the modernization of industrial processes occurred thereafter. Therefore our country will concentrate its main efforts on the retrofit and development of environmental friendly technologies and put forward efficient and renewable energy.

Thus, as one can see in this document, our country did not need to adopt for the first commitment period supplementary policies and measure to reduce the GHG emissions and this attitude is supported by the fact that the projections are not alarming according the current Kyoto Protocol rules. However to consent the new climate change targets and rules, Romania will have to take into account the need of modernization and catching the gap of European living standards.

As it is mentioned in a specific chapter, our country has been encountering the negative effect of the extreme climate events and the modeling of future climate stresses the strong need to develop efficient strategies on adaptation in sectors like biodiversity, agriculture, water resources, forests, infrastructure, represented by buildings and constructions, tourism, energy, industry, transport and health.

One of the national priority in our climate change policy is related to the development of robust research in order to provide a good rationale for the policies and measures to be integrated in the development of sectoral strategies.

To facilitate the adoption and implementation of the national climate change policy in line with the new targets we need to strengthen education, training and public awareness.

Minister of environment and forests

László BORBÉLY

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I. EXECUTIVE SUMMARY

Romania is situated in the south-eastern part of the Central Europe inside and outside of the Carpathians Arch, on the Danube lower course.

It has a transitional temperate-continental climate, with oceanic influences from the West, Mediterranean from the South-West and excessive continental from the North-East. The 2005 convective season had a record of unusual severe weather events in Romania: flash floods, hail, intense cloud to ground strokes and many severe wind related events like tornadoes, downbursts, waterspouts and funnel clouds. 13 tornado events were reported across the country many of them being recorded and documented. The majority of these occurred in the southeastern part of Romania.

The hottest in 107 years in Romania was year 2007. The average temperature in January was 6°C higher than the average measured between 1961 and 1990. In July 2007, 53 meteo stations registered their record high temperature. In 2007 there was registered the highest temperature for July in Romania: 44.3 °C, in the city of Calafat. In terms of precipitation, year 2007 was a very dry year in the period April-July (the most important for agriculture) and excessively wet during August-November (time for cropping in agriculture).

Romania is a constitutional republic based on the separation and equilibrium of three powers: legislative, executive, justice.

The territory of Romania is divided into administrative units such as communes, towns and counties. Romania is divided into 41 counties and one municipality (Bucharest, the capital). The 41 counties are further structured into 2686 communes (for rural areas) and 265 cities and municipalities (for urban areas). Communes are divided into villages (which have no individual administration and hence not being an administrative division). There are 13,092 villages.

Main cities and towns in Romania account for more than half of the total population, 25 of them have over 100 thousands inhabitants each; this represent in total 57.6% of the urban population. Among the cities with the largest population, Bucharest ranks first (with as many as 2 million inhabitants), followed by Iaşi, Cluj-Napoca, Timişoara, Constanţa and Craiova (each with more than 300 thousand inhabitants). These 6 cities concentrate over 30% of the urban population.

The evolution of Romania's population shows a slight decrease of about 1% between 2003 and 2007

Table I_ 1 Evolution of Romania's population

Year	**2003**	**2004**	**2005**	**2006**	**2007**
Population (mil)	21.742	21.685	21.623	21.584	21.537

In terms of GDP, Romanian economy is on an upwards trend. According to Eurostat data (2009), the Romanian GDP was fast expanding as shown below:

Table I_ 2 Evolution of Romania's economy

Year	**2003**	**2004**	**2005**	**2006**	**2007**
GDP (bil €$_{2007}$)	53	61	80	98	121

GHG emissions per unit of GDP are continuing to decrease, due to the technical improvements, applications of different policies and due to the structural change of the GDP.

From the viewpoint of GDP formation, there is a positive contribution to total GDP growth of services and construction activities, these two branches holding together a share of 58.8% in GDP (in 2007). The gross value added in the services sector registered in 2007 a growth of 7.1% and the activity volume in the construction sector exceeded by 33.6% the level of 2006.The gross value added in industry registered a growth of 5.1%, and agriculture, forestry and fishery decreased their activity volume by 16.9%.

Table I_ 3 GPD formation in Romania

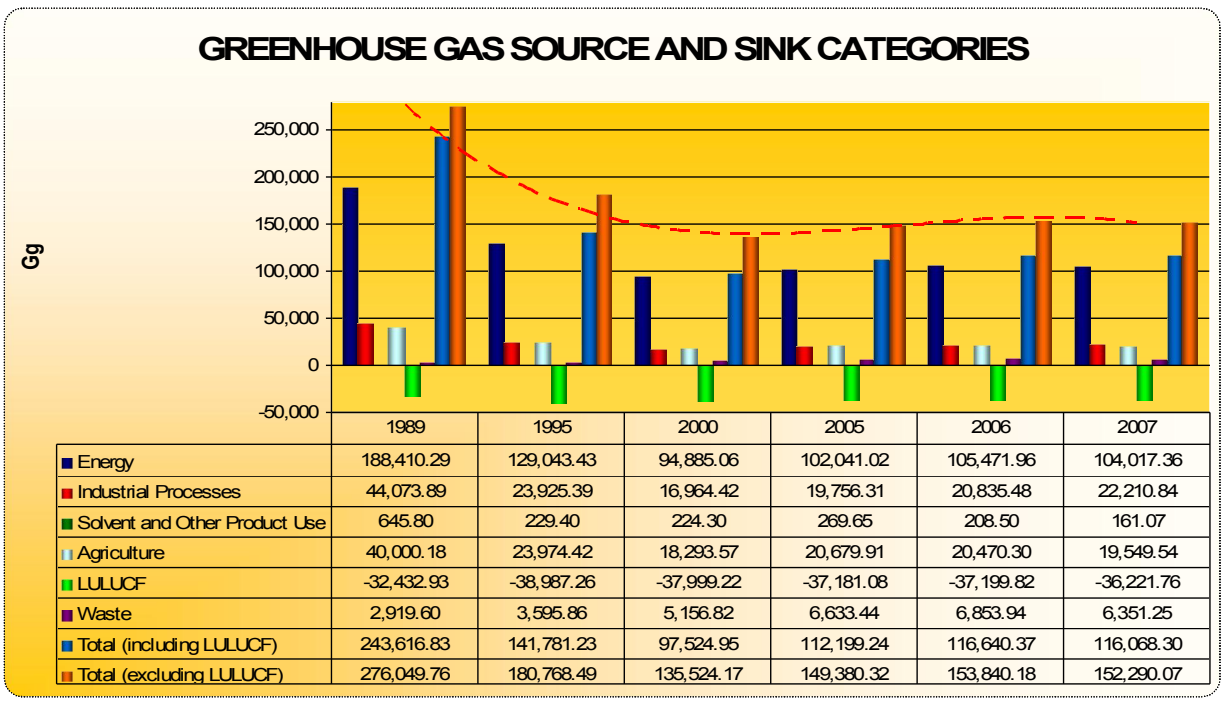
Field/base year	Services sector	Construction sector	Industry	Agriculture, forestry and fishery
2007/2006	7.1%	33.6%	5.1%	-16.9%
2006/2005	7.3%	19.4%	6.9%	3.3%

The main branches of the economy are the energy industry, metallurgy, car making industry, chemical and petrochemical industry, light industry, constructions, agriculture and the food industry.

In the latest reported year (2007) GHG emissions decreased by 1% against the emissions in 2006. Emissions in the Solvent Sector decreased with about 23%, while those in the Industrial processes increased by almost 7 % (this is actually the only sector in which GHG emissions increased in 2007, compared to 2006).

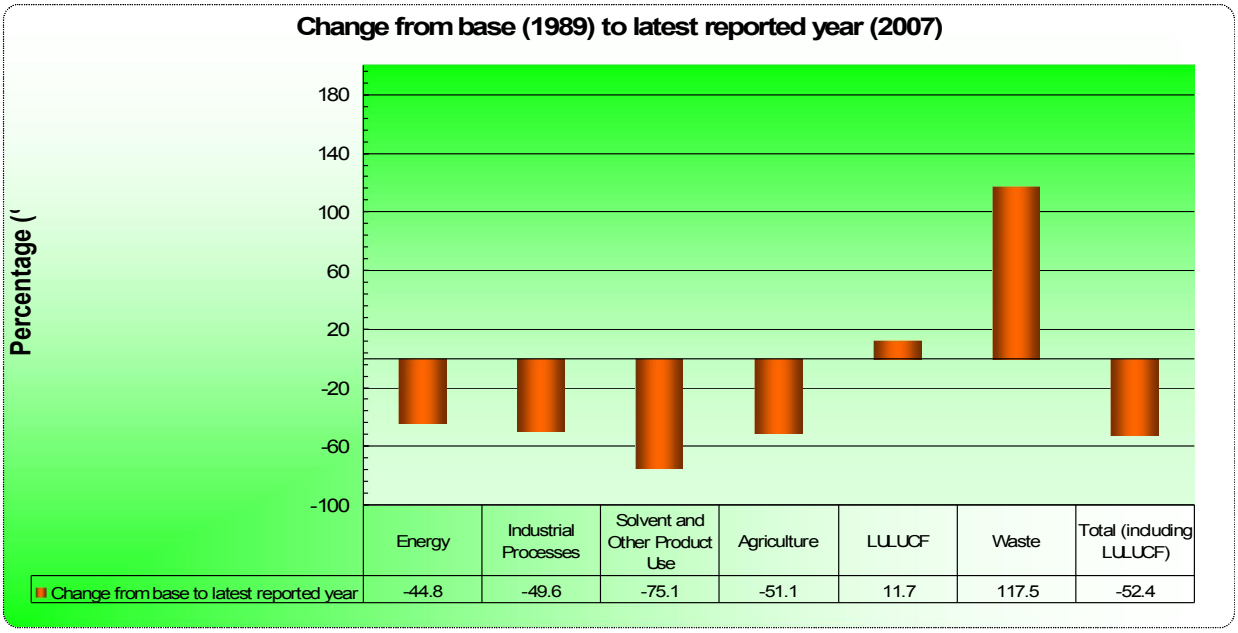
Emissions in one sector showed a systematically increasing trend since 1989; this is the waste sector; the reasons for systematic increase is on one hand the increase of waste production and on the other hand the improvements of the statistical data management regarding the field. All the mentioned trends are highlighted in the charts below.

Figure I_ 1 Greenhouse gas source and sink categories



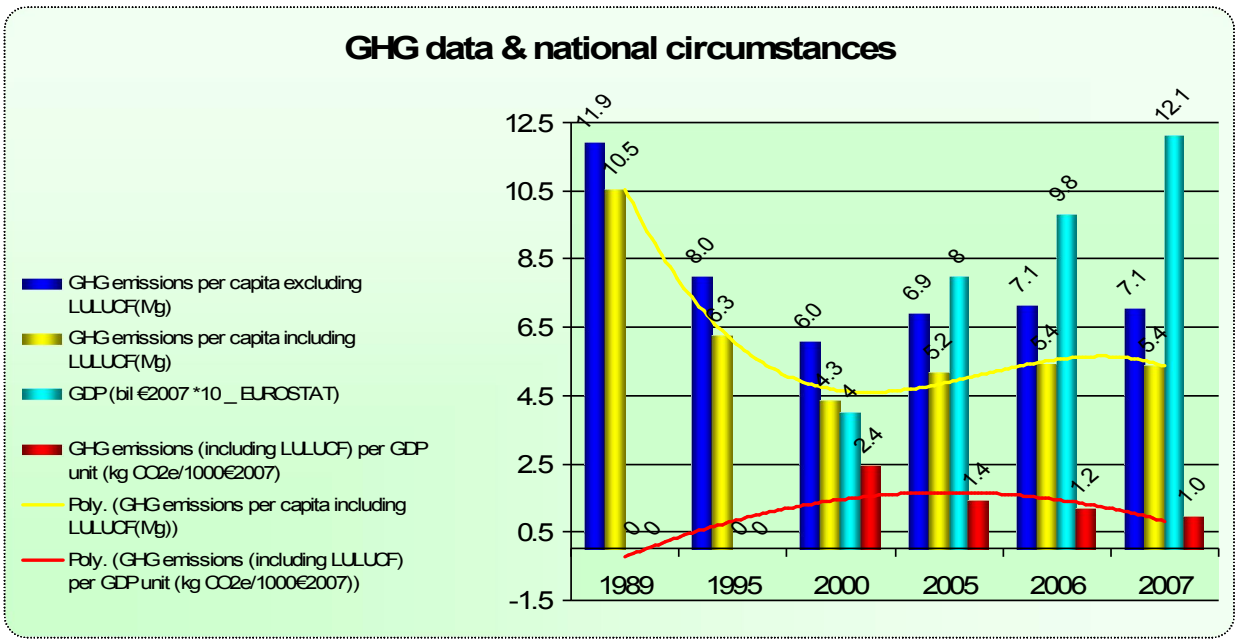
	1989	1995	2000	2005	2006	2007
Energy	188,410.29	129,043.43	94,885.06	102,041.02	105,471.96	104,017.36
Industrial Processes	44,073.89	23,925.39	16,964.42	19,756.31	20,835.48	22,210.84
Solvent and Other Product Use	645.80	229.40	224.30	269.65	208.50	161.07
Agriculture	40,000.18	23,974.42	18,293.57	20,679.91	20,470.30	19,549.54
LULUCF	-32,432.93	-38,987.26	-37,999.22	-37,181.08	-37,199.82	-36,221.76
Waste	2,919.60	3,595.86	5,156.82	6,633.44	6,853.94	6,351.25
Total (including LULUCF)	243,616.83	141,781.23	97,524.95	112,199.24	116,640.37	116,068.30
Total (excluding LULUCF)	276,049.76	180,768.49	135,524.17	149,380.32	153,840.18	152,290.07

Figure I_ 2 GHG emissions per capita between 1989 and 2007



A general decreasing trend for the GHG emissions per capita between 1989 and 2007 is to be noticed, though after year 2000 there was a small increase. In 2007 there was a decrease of less that 1% against 2006 in per capita emissions; on the other hand, it is obvious the trend of decoupling of the GDP and the GHG emissions per GDP unit; while GDP value grew three times between 2000 and 2007, the specific emissions decreased to 40% of the value. All trends may be noticed in the following charts:

Figure I_ 3 GHG data and national circumstances



The Ministry of Environment and Forests (ME) is the main responsible for policy making in the field of climate change through:

- developing national policy on climate change and coordination of the activities pertaining to the implementation of this policy at central, regional and local levels;

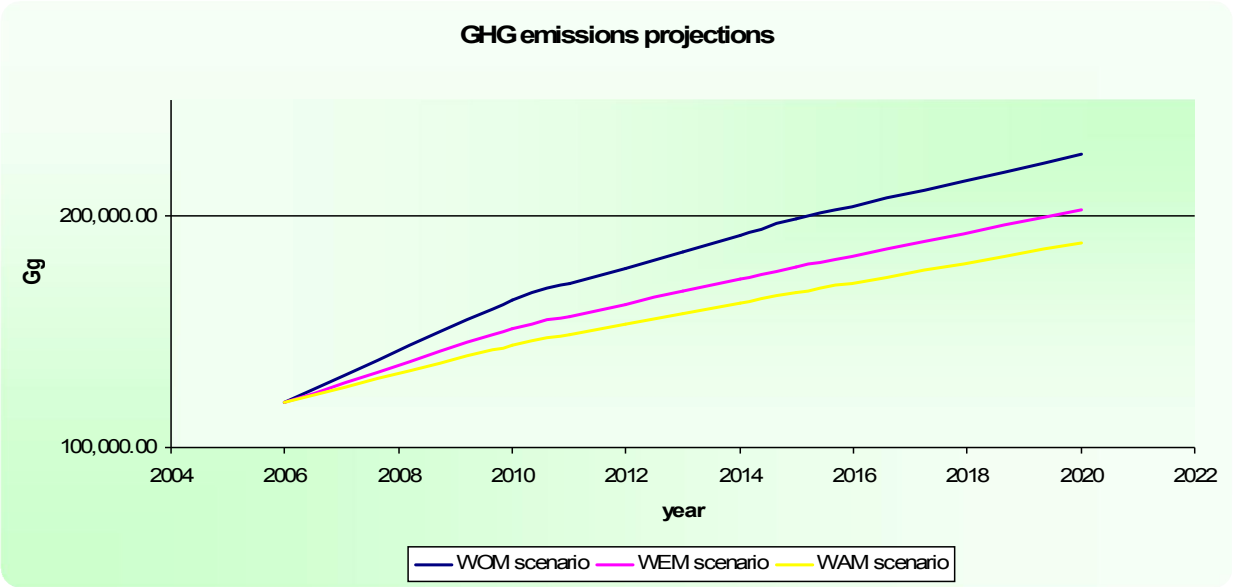
- coordinating the development, implementation and updating of the National Strategy on Climate Change and the National Action Plan on Climate Change;
- ensuring the integration of policies on greenhouse gas emission reductions into other sectorial policies;
- coordinating the national system for estimating emissions/removals;
- acting as UNFCCC focal point and representing the Romanian Government in UNFCCC negotiations and other international meetings on climate change;
- coordinating the implementation of the flexible mechanisms as required by the Kyoto Protocol;
- participating in the transposition and coordination of the implementation of EU emission trading legislation with its amendments; and
- chairing the National Commission on Climate Change

Adopted policies and measures which are influencing GHG emissions**:**

- National Strategy for Energy Efficiency for 2004-2015
- the strategy for heat supply in cities
- rules regarding the promotion of high efficiency cogeneration
- The Strategy for using renewable energy sources
- Strategy on the national research, development and innovation for 2007–2013
  - clean technologies for products and processes, with particular application in construction, transport and energy production, and economic and social mechanisms for implementing them
  - new eco-efficient technologies for waste management by using products life cycle analysis in the framework of environmental impact assessment;
  - scientific and technological support for the conservation, reconstruction and strengthening the biological and ecological diversity;
  - sustainable territorial development planning in order to provide an active support to a integrated and coherent economic-social development
- Strategies for the railway system, road infrastructure, naval transport and air transport aiming restructuring in accordance with EU standards
- National Strategic Plan for Agriculture and Rural Development for 2007-2013, which stimulates competitiveness in agriculture and forestry and provides support for the agriculture policy for the improvement of agriculture companies as follows:
  - setting up and upgrading of farms, assistance provided to farms entering the market, setting up of producer groups, improvement of primary processing and the marketing of agriculture and forestry products by efficient investment
  - improving the environment in rural areas - secures the sustainability of the environment and farming land used in areas of concern for the preservation of traditional landscapes
  - better life standards in rural areas and diversification of the rural economy - grants support for the agriculture policy and the development of rural areas, by improving conditions for rural life
  - LEADER - a combination of the previous 3 actions to identify local needs and to develop local development strategies
  - extend the forest areas from the present percentage of 27% to about 32% in 2013
- The National Strategy for Sustainable Development, horizons 2013 – 2020 – 2030
  - to improve the quality of, and access to infrastructure for wastewater treatment by providing sewerage services to the majority of urban areas by 2015 and establishing efficient regional structures for wastewater management
  - To develop integrated waste management systems by improving waste processing

GHG projections data are presented for "without measures" (WOM), "with measures" (WEM) and "with additional measures" (WAM) scenarios, on a sectoral basis (characterizing the Energy, Transport, Industrial Processes, Solvents and Other Products Use, Agriculture, Land Use, Land-Use Change and Forestry – LULUCF, and Waste categories).

Figure I_ 4 GHG Emissions projections



It is very probable that Romania achieves the target established through the Kyoto Protocol without making use of the provisions in Article 6, 12, or 17 of the previously mentioned Protocol; therefore, so far, the emissions reduction have happened only applying indirect domestic policies and measures.

The changes in the climate conditions in Romania are included into the global context, taking into account the regional conditions: the temperature increase shall be more obvious during the winter. According to the results of the modelling in AR4 of IPCC, in Romania it is expected an increase in the annual average temperature compared to the period 1980-1990 similar to the whole Europe. There are small differences to be noticed between the results of the models concerning the first decades of the 21st century and high differences to be noticed towards the end of the century:

- 0,5°C to 1,5°C for the period 2020-2029;
- 2,0°C to 5,0°C for 2090-2099, according to the scenario (e.g. between 2,0°C and 2,5°C in case of the scenario which provides the lowest increase of the global average temperature and between 4.0°C and 5.0°C in case of the scenario with the highest temperature increase)

Sectors identified to be directly affected by the temperature increase and the modification of the precipitations conditions as well as by the manifestation of the extreme weather include:

- biodiversity
- agriculture
- water resources
- forests
- infrastructure, represented by buildings and constructions
- tourism
- energy
- industry

- transport
- health & recreational activities.

Adaptation measures are proposed for all the identified sectors; among those sectors, agriculture is a priority as it regards the security of food supply.

Research and systematic observations are performed so that a better understanding of the effects of the climate change in Romania can be modeled, GHG mitigation measures proposed and adaptation measures can be adopted.

Between the institutions/groups of researchers with interests in the field of climate change, the National Meteorology Administration (NMA) is representative and carries on the most important number of projects, concerning the following main objectives:

a. Identifying changes observed in the climatic regime in Romania
b. Understanding those mechanisms controlling the regional climatic variability
c. Statistical and dynamical models
d. Validating global/regional climate models
e. Performing annual and seasonal estimations for Romania
f. A synthesis is further presented of the way these objectives are achieved.

In terms of education and training, the Ministry of Education is the representative of central public administration in charge of formulating the policy in the field. Several steps have been taken in order to stimulate the formal education on climate change in high school. Universities, especially the private universities have developed dedicated programs for postgraduate education in the field of climate change.

Informal education, capacity building and public awareness are promoted especially by NGOs; Terra Mileniul III Foundation and **Climate Action Network Romania**, worth being mentioned because of their pioneering projects dedicated to education and public awareness on climate change in schools and at local level (city and village).

II. NATIONAL CIRCUMSTANCES

II.A. GEOGRAPHICAL PROFILE

II.A.1 Geographical position

Romania is situated in the south-eastern part of the Central Europe inside and outside of the Carpathians Arch, on the Danube lower course.

The center of the country is placed at the crossing point of the parallel 46°N with the meridian 25°E (at 17 km north of town Făgăraş), and the Romanian territory is unfolding on 4°37'59" latitude (525 km) and 9°25'40" longitude (743 km). The exit to the sea enables water way connections with the countries in the Black Sea basin and the rest of the world. Romanian Black Sea seaside is lying on 245 km, between Musura stream (at the border with Ukraine) and Vama Veche (at the border with Bulgaria).

Size of Romania is about 240,000 km^2, being comparable with that of Great Britain and of Ghana, and ranking 80^{th} in the world and 13^{th} in Europe.

II.A.2 Relief

The main characteristics of Romania's relief are: proportionality (31% mountains, 36% hills and plateaus, 33% plains and meadows), concentric display in an amphitheatre of the relief major parts.

The great arch of the Carpathians is accompanied by an outer fringe known as the Sub Carpathians and extending from the Moldova River in the north to the Motru River in the southwest. The topography and the milder climate of this region favor different vegetation (including Mediterranean elements as the edible chestnut), resulting in the specialization of the region in cereals, fruits, and wine - notably Odobesti and Valea Calugareasca which have a European reputation.

The plains are situated mostly in the Southern part of the country and the most part are used for the cultivation of cereals.

II.A.3 Black Sea

The Black Sea exit gives Romania the possibility of developing the waterways transport. The seaside and the continental plateau area offer conditions for the capitalization of the undergrounds (oil, natural gases), water (fisheries, water sports), and land (tourism, recreation).

II.A.4 Danube and Danube Delta

The Danube is the longest river in the European Union, crossing the territory of ten countries and emptying itself in the Black Sea, through the Danube Delta; the last one is represented by a region with a medium-low altitude (31 cm), the biggest part of this area being under water.

II.A.5 Natural mineral resources

Romania's useful mineral resources are various. Among the main useful resources it can be mentioned: oil, natural gas, coal, ferrous and nonferrous ores, gold, silver and bauxite ore deposits, as well as vast reserves of salt. A special category of subsoil riches consist in more than 2000 mineral water springs, with consumption and medical treatments characteristics.

The mineral water is a renewable resource, but insufficiently capitalized, even though some of the mineral water springs received world appreciation for their quality. From the total mineral water reserve of 122 thousands m^3/day, which can be bottled, about 40% is capitalized.

II.A.6 Biodiversity

Vegetation is determined by the relief and by the pedo-climatic elements. Mountain regions are covered by coniferous forests (especially spruce fir), mixture forests (beech, fir-tree, spruce fir) and beech forests. Higher peaks are covered by alpine lawns and bushes of dwarf pine, juniper, bilberry, and red bilberry.

In the hills and plateaus there are broad-leaved forests, prevailing beech, common oak and durmast oak. The main forest species often met on low hills and high plains are Quercus cerris and Quercus frainetto.

The steppe and silvo-steppe vegetation, which covered the areas of low humidity in Dobrogea Plateau, Romanian Plain, Moldova Plateau, Banat and Crisana Plain, has been mostly replaced by agricultural crops.

The general ecosystem categories used in the preparation of specific policies are the following:

- Pastures
- Hay meadows
- Steppes
- Moors and heathlands
- Forest
- Freshwater and brackish aquatic ecosystems
- Marine and coastal ecosystems

Table II_ 1 Ecosystem categories used in the preparation of policies

Ecosystem Category	Biodiversity/Key Features
Pastures	High biodiversity. A highly anthropic ecosystem found primarily on lands that were once forested
Hay meadows	High biodiversity. An anthropic ecosystem
Steppes	Not well quantified
Moors and heathlands	Not well quantified
Forest	High biodiversity
Freshwater and brackish aquatic ecosystems	Very high ecosystem diversity. Danube Delta is a complex of ecosystems of world renown
Marine and coastal ecosystems	

II.A.7 Rivers

Romanian rivers are radial displayed, most of them having the springs in the Carpathians. Their main collector is the Danube River which borders the country in the south. The Romanian river network offers a significant hydro energy potential, most of it being already under use.

II.B. CLIMATE PROFILE

Romania's climate is a transitional temperate-continental with oceanic influences from the West, Mediterranean ones from the South-West and excessive continental ones from the North-East. The 2005 convective season had a record of unusual severe weather events in Romania: flash floods, hail, intense cloud to ground strokes and many severe wind related events like tornadoes, downbursts, waterspouts and funnel clouds. 13 tornado events were reported across the country many of them being recorded and documented. The majority of these occurred in the southeastern part of Romania.

The hottest was 2007 in 107 years in Romania. The average temperature in January was 6°C higher than the average measured between 1961 and 1990. In July 2007, 53 meteo stations registered their record high temperature. In 2007 there was registered the highest temperature for July in Romania: 44.3 °C, in the city of Calafat. In terms of precipitation, year 2007 was a very dry year in the period April-July (the most important for agriculture) and excessively wet during August-November (time for cropping in agriculture).

II.B.1 Temperature

Climatic variations are caused by geographical elements, the position of the main mountain ranges, elevation, etc. The average annual temperature varies with latitude, standing at 8°C in the North and 11°C in the South, with 2.6°C in the mountains and 11.7°C in the plains. In winter the Scandinavian (Arctic) anticyclone frequently affects the country, influencing the climate with the specific features of the sub-polar Scandinavian climate. An absolute minimum temperature of -38.5°C was registered at Bod in Brasov County and an absolute maximum temperature of 44.5°C at Ion Sion in the Baragan Plain.

Analysis performed on statistical data collected between 1961 and 2007 in 94 meteo stations, highlite significant changes in the temperature regimes in all seasons:

- About 2^{o}C increase of average temperature during summer, winter and spring; in the eastern side of Romania temperature increase exceeds 2 °C during winter.
- In autumn, there is a slight trend of decrease of the average temperature

II.B.2 Precipitations

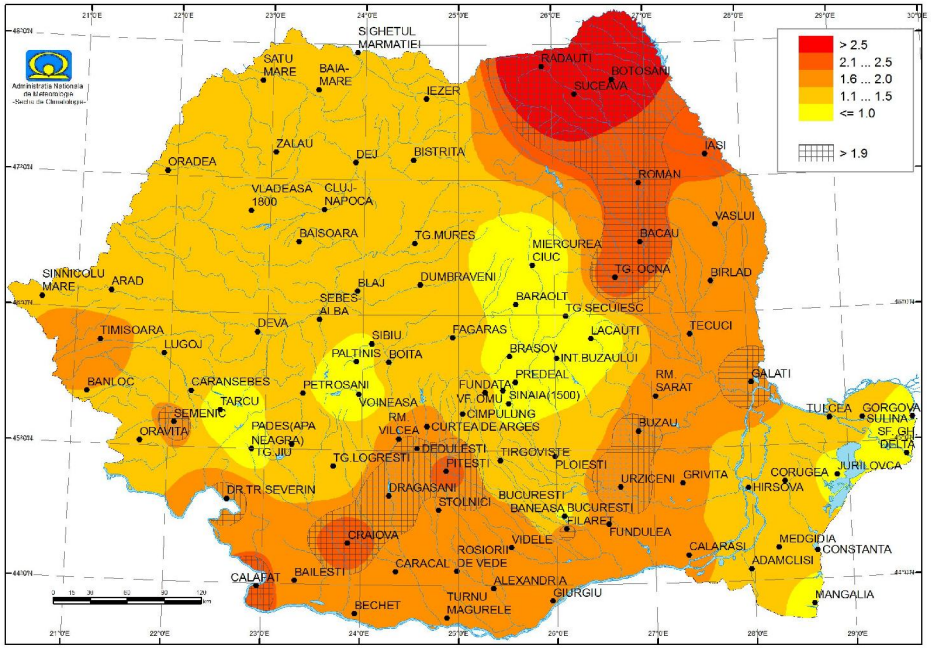
Annual average amount of precipitations vary between less than 300 mm/sqm*yr and 1200 mm/sqm*yr.

Based on statistics from 104 meteo stations between 1961 and 2007, there are a few conclusions that may be drawn:

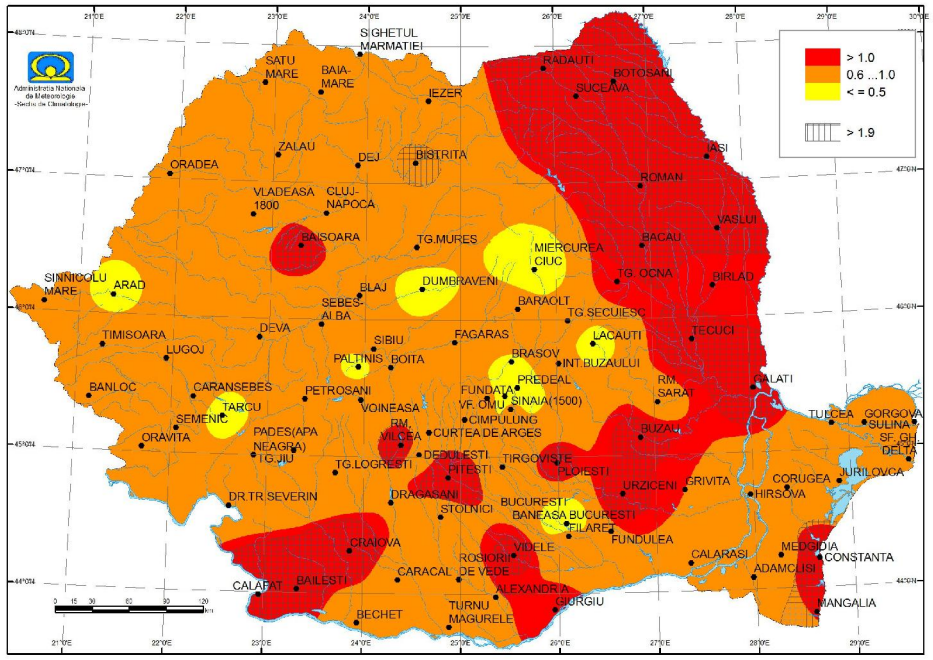
- There is a trend of decrease of the average amount of precipitations especially on summer and winter; this is confirmed with a certitude level of 90% only for a few small areas especially in the southern and eastern parts of Romania
- There is a trend of increase of the amount of precipitations on autumn

Figure II_ 1 Changes in the temperature regimes in all seasons

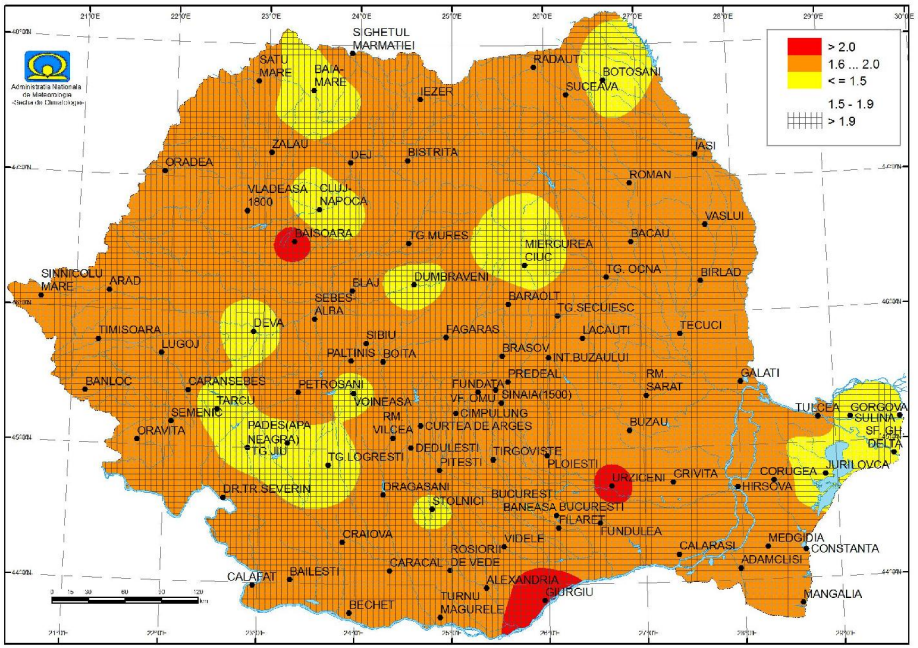
Winter



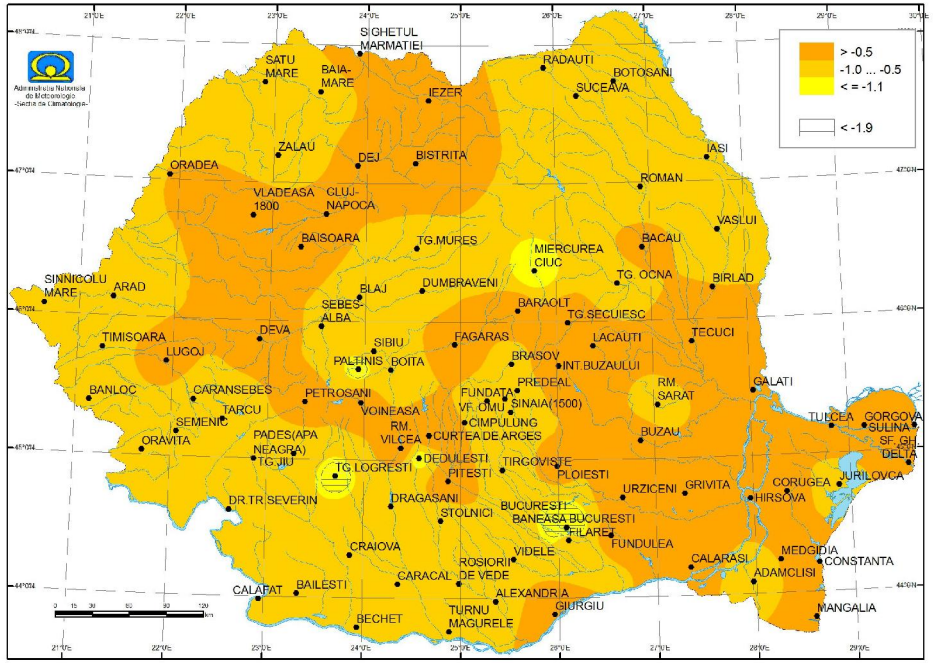
Spring



Summer



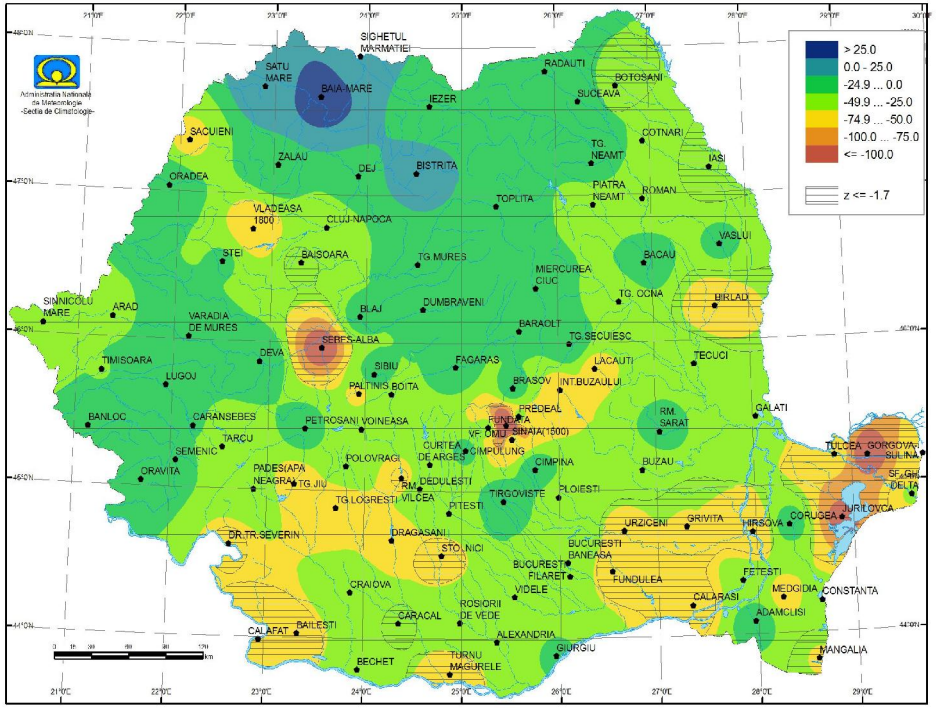
Autumn



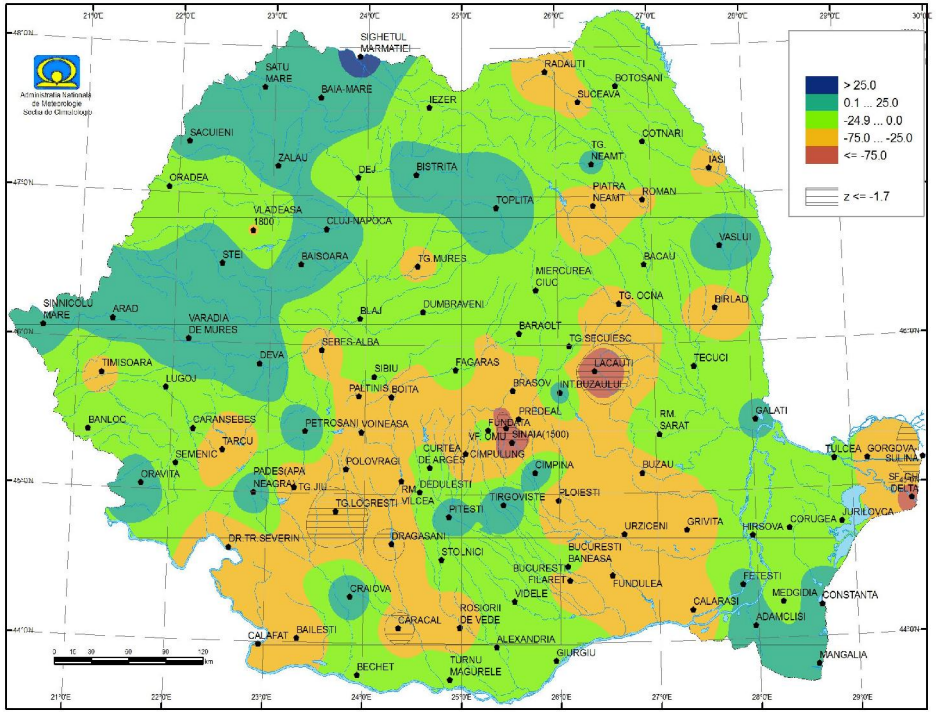
Trend of seasonal average temperature in Romania (^{o}C) during 1961-2007. Confidence level minimum 95% for hatch areas (Mann-Kendall Z>= 1.9)

Figure II_ 2 Trend of seasonal average amount of precipitations in Romania (mm) during 1961-2007.

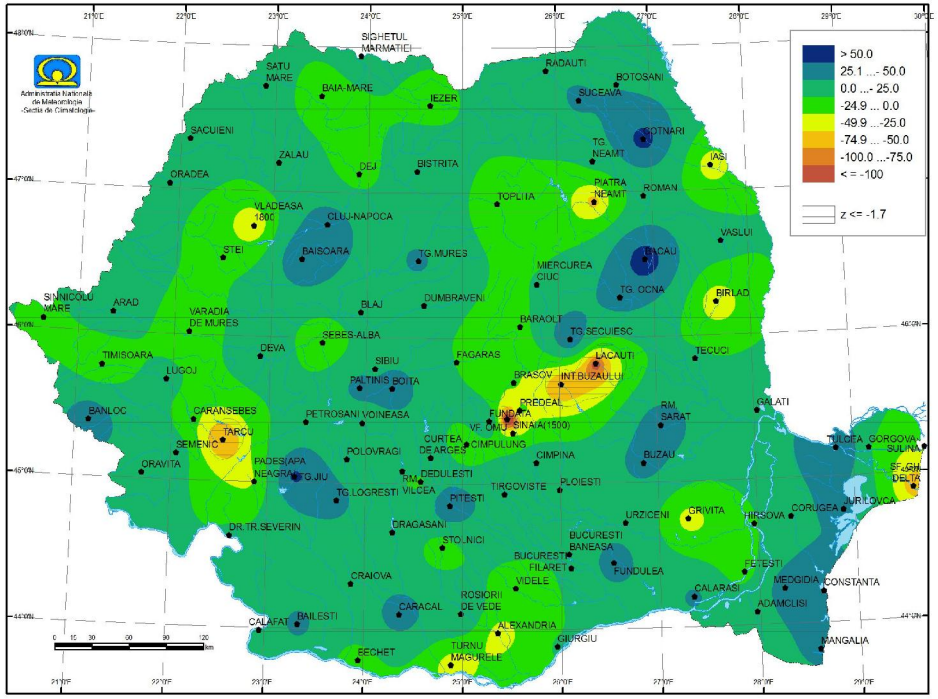
Winter

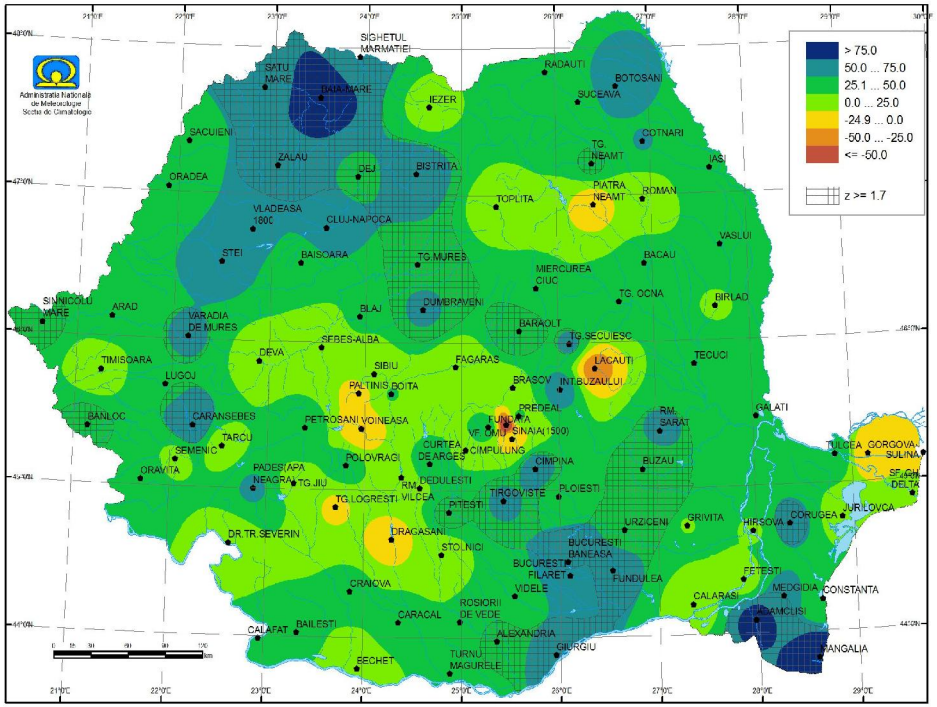


Spring



Summer **Autumn**





Confidence level minimum 90% for hatch areas (Mann-Kendall Z>= 1.9) (Mann-Kendall Z>= 1.7 for increase & Z<=-1.7 for decrease).

II.B.3 Other observed phenomena

- Decrease of the average wind speed both annually (entire country) and seasonally. The decrease trend is more important for the eastern side of the country and for the mountains.
- Increase of the maximum length of the periods without precipitations in the south of the country (on winter) and in the west (on summer);
- Increase of the number of days with more than 10 mm/day of precipitations (up to 4 days), extended areas in the northern side of the country, especially on autumn.
- Significant increase in the number of hoar frost days; tendency of moving of the last day towards spring

II.C. STATE ORGANIZATION

Romania is a constitutional republic based on the separation and equilibrium of three powers: legislative, executive, justice.

The Public Authorities, according to the Constitution, are:

- The Parliament (organized in two chambers) (senators and deputies elected for four years through popular vote)
- The Presidential Institution (president elected through popular vote for maximum two mandates of five years)
- The Government (proposed by the Prime Minister elected by the President; in order to operate must have the acceptance vote of the Parliament)
- The Public Administration:
  - Central level (Ministries) (Ministers proposed by the Prime Minister)
  - Local level (county, city, commune levels) (prefect, mayors and community councilors elected for four years through popular vote)
- The Justice Authority

II.D TERRITORIAL AND POPULATION PROFILE

II.D.1 Territorial profile

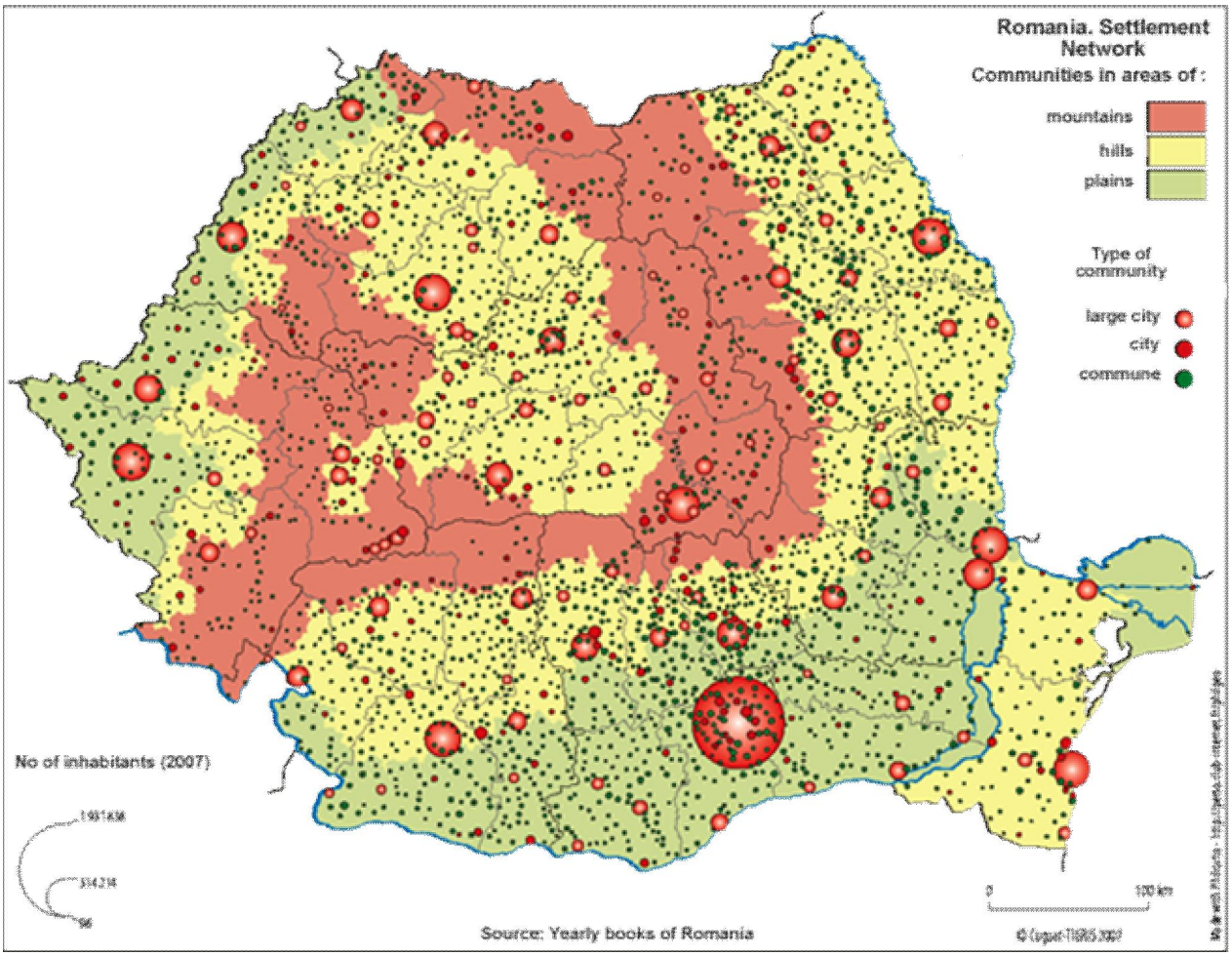
According to the Constitution, the territory of Romania is divided into administrative units such as communes, towns and counties. Romania's administration is relatively centralized and administrative subdivisions are therefore fairly simplified.

Romania is divided into 41 counties and one municipality (Bucharest, the capital). The 41 counties are further structured into 2686 communes (for rural areas) and 265 cities and municipalities (for urban areas).

Communes are divided into villages (which have no individual administration and hence not being an administrative division). There are 13092 villages.

Bucharest is an exception to this structure having a secondary official division into six sectors, each sector having a local government and council.

Figure II_ 3 Romania's localities



Source: Ministry of Development (http://www.mdlpl.ro/_documente/atlas/a_asezari.htm)

II.D.2 Population

Main cities and towns in Romania account for more than half of the total population, 25 of them have over 100 thousands inhabitants each; this represent in total 57.6% of the urban population. Among the cities with the largest population, Bucharest ranks first (with as many as 2 million inhabitants), followed by Iaşi, Cluj-Napoca, Timişoara, Constanţa and Craiova (each with more than 300 thousand inhabitants). These 6 cities concentrate over 30% of the urban population.

The evolution of Romania's population shows a slight decrease of about 1% between 2003 and 2007:

Table II_ 2 Evolution of Romania's population 2003-2007

Year	2003	**2004**	**2005**	**2006**	**2007**
Population (mil)	21.742	21.685	21.623	21.584	21.537

A major cause for population decrease is economic migration. The estimated number of Romanians that are working abroad is between 900000 and 1.8 millions (between 5 and 10 % from adult population). About 12% from Romanian families have at least one member that is working in a foreign country.

In terms of GHG emissions, changes in the quality of living (improvement of quality of living) will naturally drive towards higher emissions. On the other hand, population migration has a

negative influence on the development of economic activity in Romania itself as most part of the persons leaving abroad for a job are young and active persons.

II.D.3 Building stock

In recent years, the constructions field was fast growing; not only commercial and office buildings were built but houses as well; there was also a trend of increasing the number of dwellings in private ownership.

Houses were built both in the urban and rural areas; with a slight trend of accelerating the process in urban areas. In terms of utilities, almost all new houses benefit from all the required utilities.

Figure II_ 4 Number of dwelling

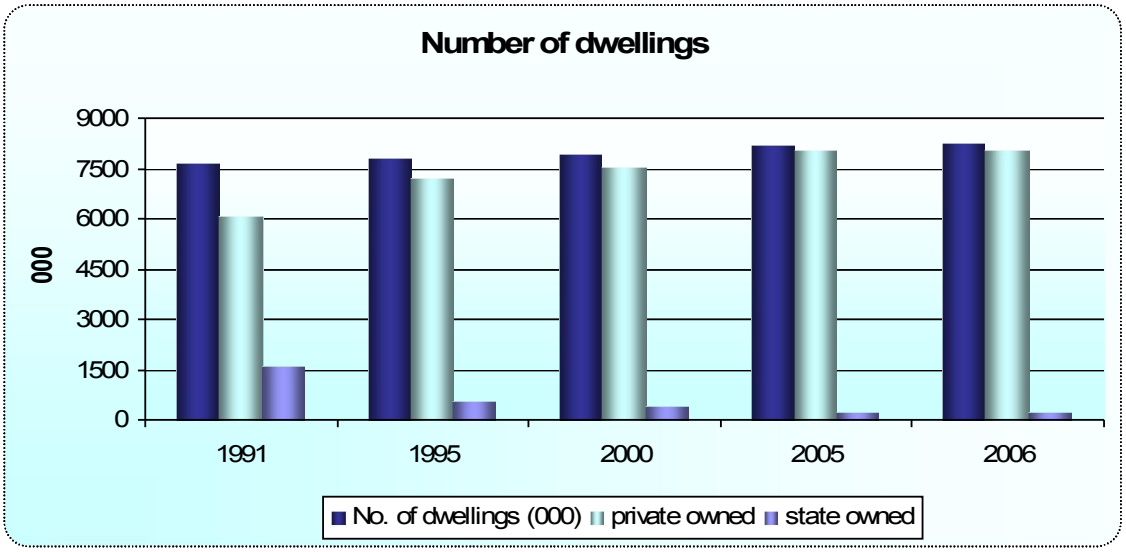
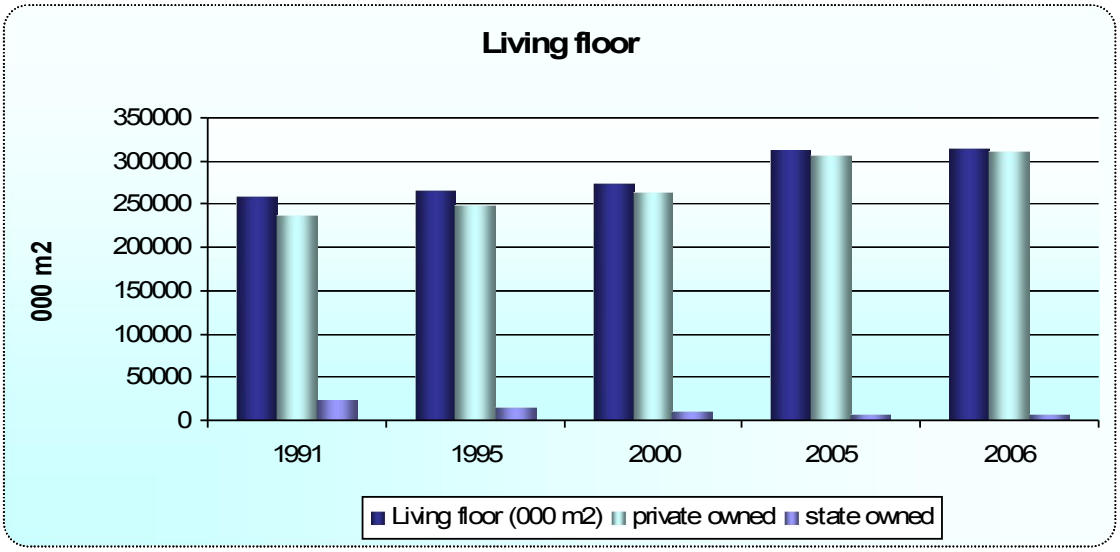


Figure II_ 5 Living floor in the dwellings



Regarding the public transportation systems, during the '90s, there was an accentuated trend of decreasing the number of cities organizing public transportation services. In the period 2000 – 2005, the number stabilized between 115 and 110, but in 2006 it decreased at 103.

Figure II_ 6 Number of cities with public transportation services

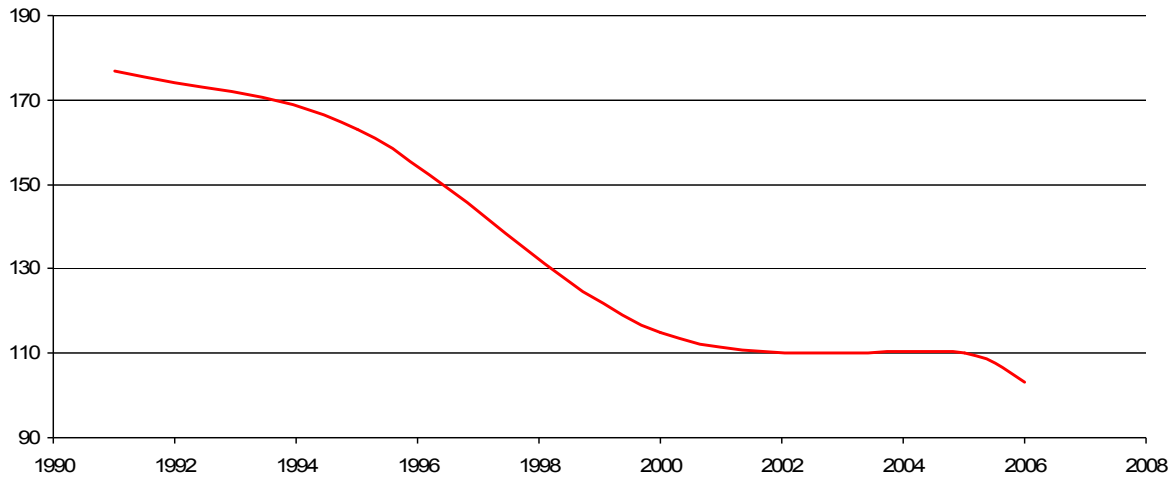


Figure II_ 7 Dwellings at the beginning of the year 2004

II.E ECONOMY

Romania joined the European Union in January 2007. Negotiations were driven by a long process of adjustments in Romania, finally resulting in economic growth. Catching-up process

has accelerated much after year 2000; though the real per capita GDP accounted only about 38.8 % in 2006 and 41 % in 2007 of the EU-27 level (Eurostat 2009).

The Romanian economy is a market based economy, promoting freedom of trade, protection against unfair competition, stimulation of domestic and foreign investments and protection of private property.

In terms of GDP, Romanian economy is on an upwards trend. According to Eurostat data (2009), the Romanian GDP was fast expanding as shown below:

Table II_ 3 Romanian GPD evolution

Year	**2003**	**2004**	**2005**	**2006**	**2007**
GDP (bil €$_{2007}$)	53	61	80	98	121

GHG emissions per unit of GDP are continuing to decrease, due to the technical improvements, applications of different policies and due to the structural change of the GDP.

From the viewpoint of GDP formation, we notice the positive contribution to total GDP growth of services and construction activities, these two branches holding together a share of 58.8% in GDP (in 2007). The gross value added in the services sector registered in 2007 a growth of 7.1% and the activity volume in the construction sector exceeded by 33.6% the level of 2006.The gross value added in industry registered a growth of 5.1%, and agriculture, forestry and fishery decreased their activity volume by 16.9%.

Table II_ 4 Contribution of different activities to GPD growth

Field/base year	**Services sector**	**Construction sector**	**Industry**	**Agriculture, forestry and fishery**
2007/2006	7.1%	33.6%	5.1%	-16.9%
2006/2005	7.3%	19.4%	6.9%	3.3%

The main branches of the economy are the energy industry, metallurgy, car making industry, chemical and petrochemical industry, light industry, constructions, agriculture and the food industry.

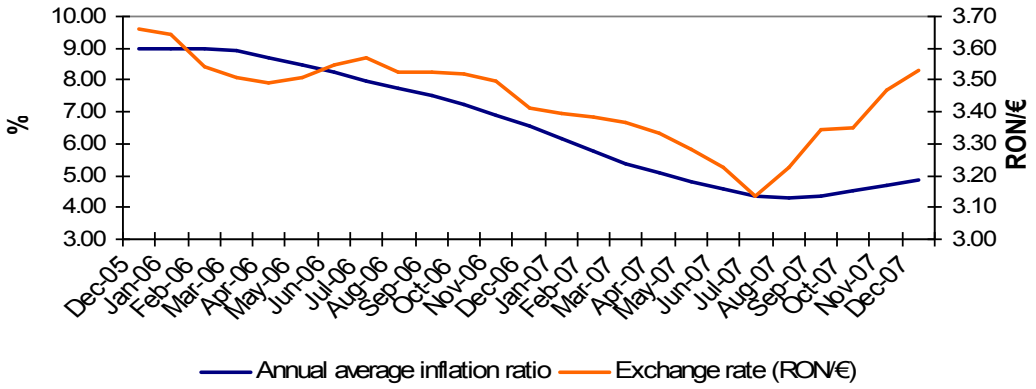
Exports rose as well with about 7.1 % in 2007 against 2006 figures. In the structure of exports, three sections of goods represent slightly more than 78 % of the total export: transport machinery and equipment (33.9%), manufactured products_raw materials (22.2%) and manufactured items (22.1%) (source: INS).

Romania's imports rose with 17.9% in 2007, compared to 2006. Sectors accounting for 82.4% in the total imports are: transport machinery and equipment (38.1%), manufactured products_raw material (23.2%), mineral fuel, lubricants and connected materials (10.8%) and chemicals and similar (10.3%) (source: INS).

Romania's currency is the "leu" (lei). 1 leu (RON) = 100 bani (ban).

Inflation rate decreased from about 9% in 2005 to about 4% in 2007, while the exchange rate against € offered the image of a constantly stronger RON in the same period; though the National Bank of Romania is continuously monitoring and adjusting it, through the market mechanisms.

Figure II_ 8 Romanian Inflation Ratio and Exchange Rate (dec 2005- dec 2007)



According to the data provided by the National Agency for Employment, the number of registered unemployed persons at the end of January 2008 was about 384000 compared to about 548000, in January 2006. High unemployment rates were registered in 2007 in the counties: Vaslui (9.4%), Mehedinţi (9.1%), Ialomiţa (7.9%), Teleorman (7.6%), Covasna (7.1%), Caras-Severin (6.7%). The lowest unemployment rates were registered in the counties: Timiş (1.3%), Ilfov (1.5%), and Bucharest (1.8%).

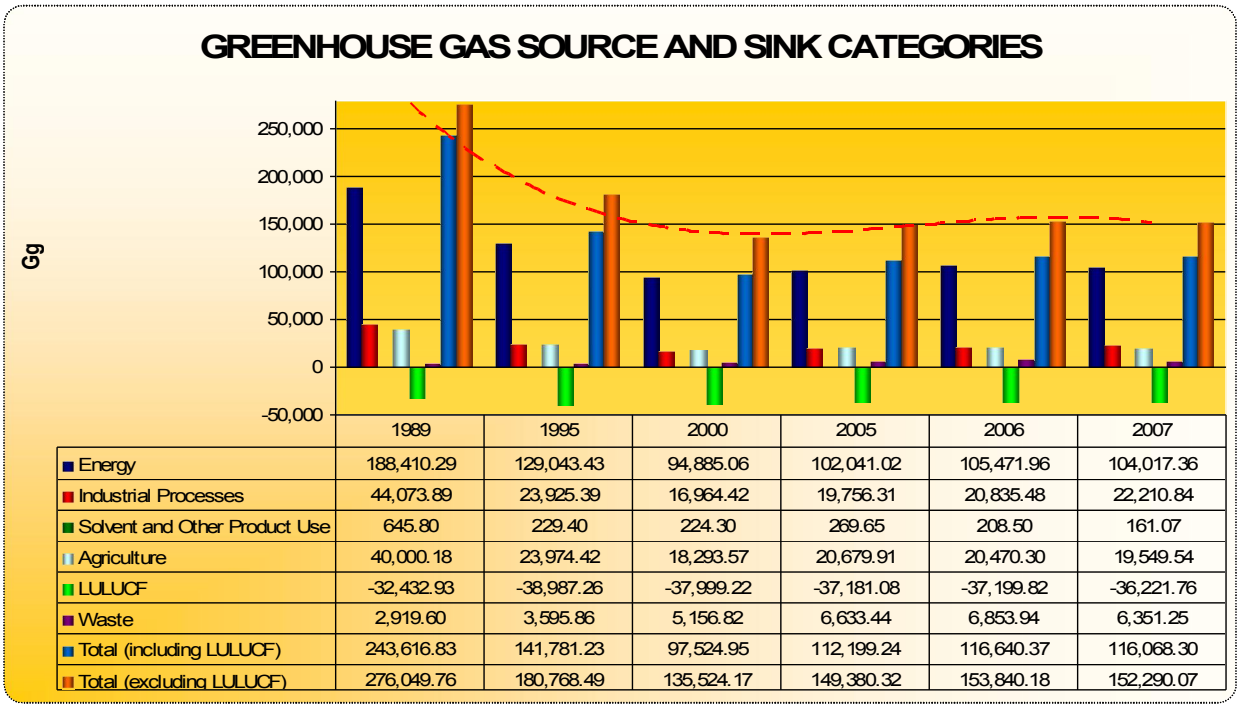
In terms of GHG emissions there was a strong decline in the '90s of previous century (60% - total, including LULUCF in 2000, against 1989), followed up by a small growth after year 2000 in all economic sectors (driving towards a decrease of 52.4% total, including LULUCF in 2007, against 1989). Figure II_ 9.

In the latest reported year (2007) GHG emissions decreased by 1% against the emissions in 2006. Emissions in the Solvent Sector decreased with about 23%, while those in the Industrial processes increased by almost 7 % (this is actually the only sector in which GHG emissions increased in 2007, compared to 2006).

Emissions in one sector showed a systematically increasing trend since 1989; this is the waste sector; the reasons for systematic increase is on one hand the increase of waste production and on the other hand the improvements of the statistical data management regarding the field.

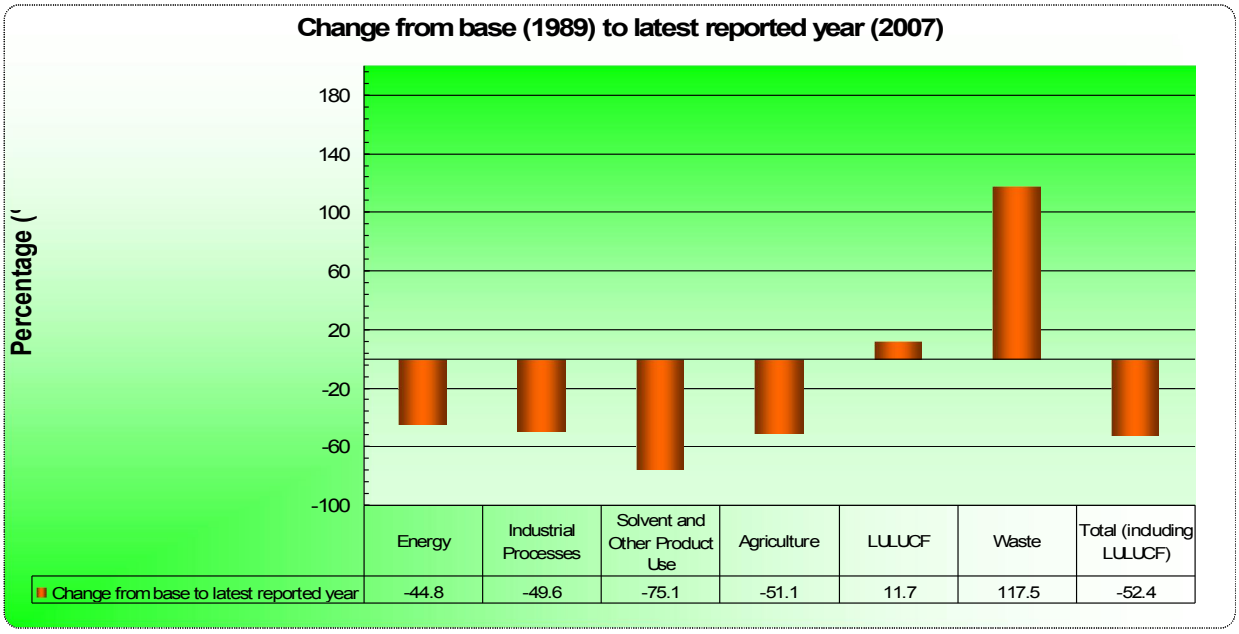
We notice a general decreasing trend for the GHG emissions per capita between 1989 and 2007, though after year 2000 there was a small increase. In 2007 there was a decrease of less that 1% against 2006 in per capita emissions; on the other hand, it is obvious the trend of decoupling of the GDP and the GHG emissions per GDP unit; while GDP value grew three times between 2000 and 2007, the specific emissions decreased to 40% of the value. All trends may be noticed in the following charts:

Figure II_ 9 Greenhouse gas source and sink categories



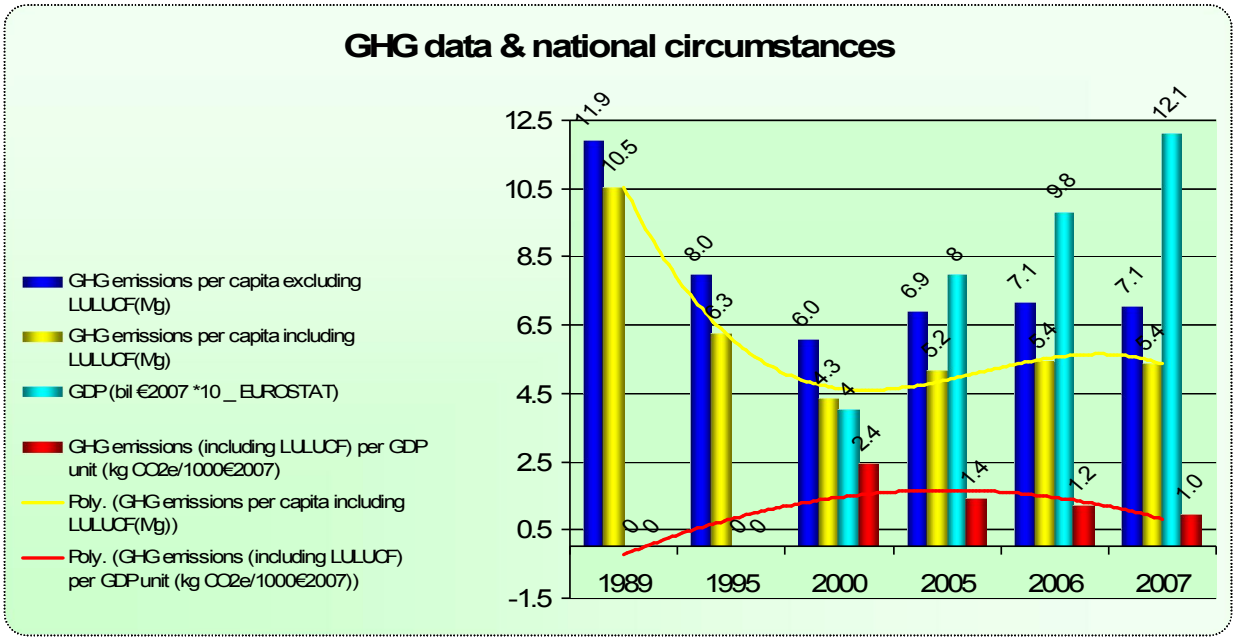
	1989	1995	2000	2005	2006	2007
Energy	188,410.29	129,043.43	94,885.06	102,041.02	105,471.96	104,017.36
Industrial Processes	44,073.89	23,925.39	16,964.42	19,756.31	20,835.48	22,210.84
Solvent and Other Product Use	645.80	229.40	224.30	269.65	208.50	161.07
Agriculture	40,000.18	23,974.42	18,293.57	20,679.91	20,470.30	19,549.54
LULUCF	-32,432.93	-38,987.26	-37,999.22	-37,181.08	-37,199.82	-36,221.76
Waste	2,919.60	3,595.86	5,156.82	6,633.44	6,853.94	6,351.25
Total (including LULUCF)	243,616.83	141,781.23	97,524.95	112,199.24	116,640.37	116,068.30
Total (excluding LULUCF)	276,049.76	180,768.49	135,524.17	149,380.32	153,840.18	152,290.07

Figure II_ 10 Change in GHG emissions from base (1989) to latest reported year (2007)



	Energy	Industrial Processes	Solvent and Other Product Use	Agriculture	LULUCF	Waste	Total (including LULUCF)
Change from base to latest reported year	-44.8	-49.6	-75.1	-51.1	11.7	117.5	-52.4

Figure II_ 11 GHC data and national circumstances



II.F ENERGY

In Romania, the State is the main owner in the energy industry. In early '90 of the previous century the entire industry was vertically integrated. The process of restructuring the sector started ten to fifteen years ago and was mainly driven by the EU integration requirements. Successive actions for reorganization and decentralization of the industry lead towards improving the competitiveness of some companies. The oil processing industry is almost entirely privately owned and in most cases the owners started to invest in new technology. On the contrary, the combined heat and power facilities delivering heat for district heating are owned by the municipalities; due to lack of investment and inappropriate price regulation and subsidy policy they are in a very bad condition.

The main characteristics of the sector are:

- excess installed capacity;
- poor management and prioritization of the sector development;
- absence of a competitive environment, and inadequate regulatory systems;
- low efficiency of energy use and energy conversion due to old and inefficient technologies;
- poor consideration of the economic criteria in planning and investment selection;
- high operation expenses;
- environmental pollution.

The government's most recent strategy in the sector highlights the need for enhancing the security of supply, utilization of locally available primary resources and enhancing the use of renewable energy. Reforms regarding the electricity market allowed a 100% opening of this market, both for industrial and for domestic users.

II.F.1 Energy resources

Table II_ 5 Domestic Primary Energy Production

Year	2002	2003	2004	2005	2006	2007
Total (thousand toe) of which (%)	27668	28192	28094	28050	20769	21005
• **Coal**	22.1	23.2	22.0	22.1	31.2	30.5
• **Crude oil**	21.5	20.5	19.9	18.0	23.6	22.4
• **Natural gas**	37.5	37.4	36.3	37.2	45.2	47.1

Table II_ 6 Domestic primary energy consumption

Year	2002	2003	2004	2005	2006
Total (thousand toe) of which (%)	36480	39032	39018	31725	33432
• **Coal and coke**	24.2	24.4	23.5	27.5	28.5
• **Crude oil and oil products**	25.7	23.3	25.9	28.9	28.1
• **Natural gas**	36.5	39.5	35.3	43.6	43.4

Oil

Romania is the top oil producer in Central and Eastern Europe; though the main characteristic of the onshore reserves is that they are in the second half of their life and require more energy and skills in order to be exploited. Romania operates offshore platforms in the Black Sea as well. In terms of oil production, in year 2006, the independence degree of the Romanian economy was of only 35.9% and it is declining.

In terms of refining capacity, 10 refineries provide Romania with the 5th largest refining capacity in Europe (14th in World).

Coal

Romania has important reserves of coal, although the coal quality is rather poor. The largest coal reserves are those of bituminous coal. Half of Romania's bulk coal production comes from the Petroşani Depression alone. A large lignite field in the Motru Valley (Gorj) supplies two of the largest power stations in the country Rovinari and Turceni.

Table II_ 7 Coal Production (thousand toe)

Year	2002	2003	2004	2005	2006	2007
Coal, out of which	6,117	6536	6192	5793	6477	6410
Lignite	4942	5499	5120	4698	5628	na

Nuclear

The Nuclear Power Plant in Cernavodă is the only nuclear power plant in Romania so far. It is equipped with two Candu reactors and two turbogenerators (about 700 MW each). The electricity production is about 17% of the country's electricity need.

Nuclear power is expected to reduce the increasing dependence of Romania on external supply of primary energy resources.

In confirmation with the Romanian Government's strategic objectives in relation to the energy sector, the Ministry of Economy has decided to pursue the development, construction, commissioning and operation of Units 3 and 4 of the Cernavodă Nuclear Power Plant ("Cernavodă NPP") with private sector investors.

Hydroelectric Power and Other Renewable Energy
The installed capacity of hydropower represents nearly 30 percent of Romania's total installed electricity generating capacity. The country's hydropower potential is extremely large, only about 6 GW being currently used. The estimated additional potential counts for more than 9 GW.

Wind Resources
Romania is considered to have the highest wind energy potential in the region. There is no current installed large scale capacity, but the Government has proposed an achievable target of 200 MW by 2010.

A few thousand (more than 14000) MW, in projects developed by private investors are currently being analyzed at different approval stages; the electricity transport capacity in Dobrogea area (having the best wind potential) does not exceed 3000 MW and no major investment is foreseen in short to medium term, meaning that the Grid development may turn into a barrier for developing this type of projects.

The Romanian wind atlas indicates wind speeds of 4.5 to 11.5 m/s at 50 m height in various areas of the country, notably off-shore. Highest measured wind speed is at Călimani at an altitude of 2022 m, with an annual average of 10.3 m/s at 10 m above ground.

Depending on the development rate of the projects and on the meteo conditions (the trend of decrease of wind speed in Romania), the wind farms may have a significant contribution to the decrease of GHG emissions from the electricity sector in the following decade.

Solar resources
The average solar radiation in Romania ranges from 1.100 to 1.300 kWh/m^2 per year for more than half of the country surface.

Some small photovoltaic farms (less than 1 MW) are announced and will be installed in the southern part of Romania on short to medium term.

Romania has exploited a significant amount of solar resources in the past especially in terms of solar thermal. This type of applications has started to be used again, after about 20 years of being blocked. The potential market for solar applications is very large; specific incentives will be needed in order for this potential to be realized.

The use of solar thermal may also contribute to the decrease of GHG emissions in the energy (heating and warm water production) sector. Depending on the provenience of the equipment, the emissions from industry may slightly increase as a consequence of the development of the branches producing the equipment.

Geothermal resources
The exploration and research for geothermal resources began in Romania in 1962, and over 200 wells have been drilled, proving the existence of low enthalpy geothermal resources with temperatures of 40-120 °C. At present about 137 MWt are used from about 60 active wells producing hot water in the temperature range of 55-115 °C.

Romania has the third highest geothermal potential of European nations, with major potential locations on the Western Plain, South Plains, Bucharest region, and in the Carpathian regions. Romania's highest enthalpy geothermal resource of 200 °C was identified at Tuşnad-Bai. Five sites have a temperature over 100 °C.

Biomass resources
Direct burning in the kilns, stoves for space heating, cooking and hot water preparation is about 95 percent of the biomass use. These furnaces have a nominal capacity between 0.8 kW to 4 kW and are hand stocked and with an average efficiency between 15 to 50 percent.

Burning in thermal plants to generate industrial steam and hot water in sawmills and in other industries equals about 5 percent of biomass usage. In sawmills, the average installed capacity is 3.3 MW and in other industries 4.7 MW.

The biomass sector in Romania is characterized by a twofold regional distribution about 90 percent of fuel wood and 55 percent of wood waste being found in the Carpathians and Sub-Carpathians. About 54 percent of agricultural wastes are found in the South Plain and Moldavia. About 52 percent of biogas is found in the South Plain and the Western Plains.

Large amounts of small-sized wood is obtained in wood industry, but utilization of this wood for energy purposes is insufficient due to difficulties related to gathering, processing and transportation. Studies show that these wood wastes are economically viable resources.

There are good opportunities for biomass development in Romania. Biomass applications can be grouped into the following main market segments:

- substitution of the fossil fuels in existing district heating schemes (wood chips)
- enhanced uses of biomass as industrial fuel (wood chips and logs as industrial fuel for steam or hot water boilers) instead of oil
- improved uses of biomass for new district heating schemes for small towns and villages near the resources, in the countryside, where the population has no access to central co-generation or gas supply
- uses of straw and other agricultural by-products in appropriate biomass boilers for heat supply of farms and small villages (in the medium term)
- The top priority is the use of biomass for thermal applications, substituting oil.

Assuming an available biomass energy supply, district heating systems represent the most immediate and low-cost biomass application in Romania especially CHP plants, industrial co-generation and co-firing.

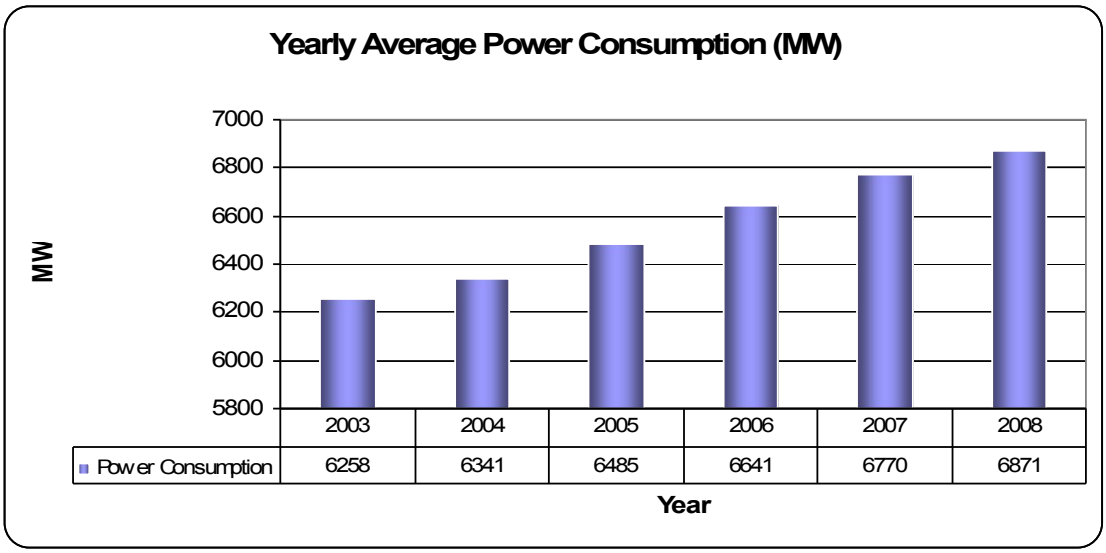
II.F.2 Energy transmission infrastructure

Oil & Gas Pipelines: Two state-owned companies control Romania's network of approximately 4,500 kilometers of petroleum pipelines. The first, Petrotrans, carries crude oil from the Black Sea port of Constanta to refineries inland and the second, owned by Conpet, carries crude oil from oil fields in the south and east to refineries in Campina, Darmanesti, Onesti, and Ploiesti. In addition, Romania has approximately 12,000 kilometers of natural gas pipelines, which bring gas into Romania from Bulgaria, Greece, and Russia (via Ukraine). In recent year, important rehabilitation programs were undertaken by the companies so that they minimize losses and risk of explosions/losses of gas.

II.F.3 Electricity, generation and consumption

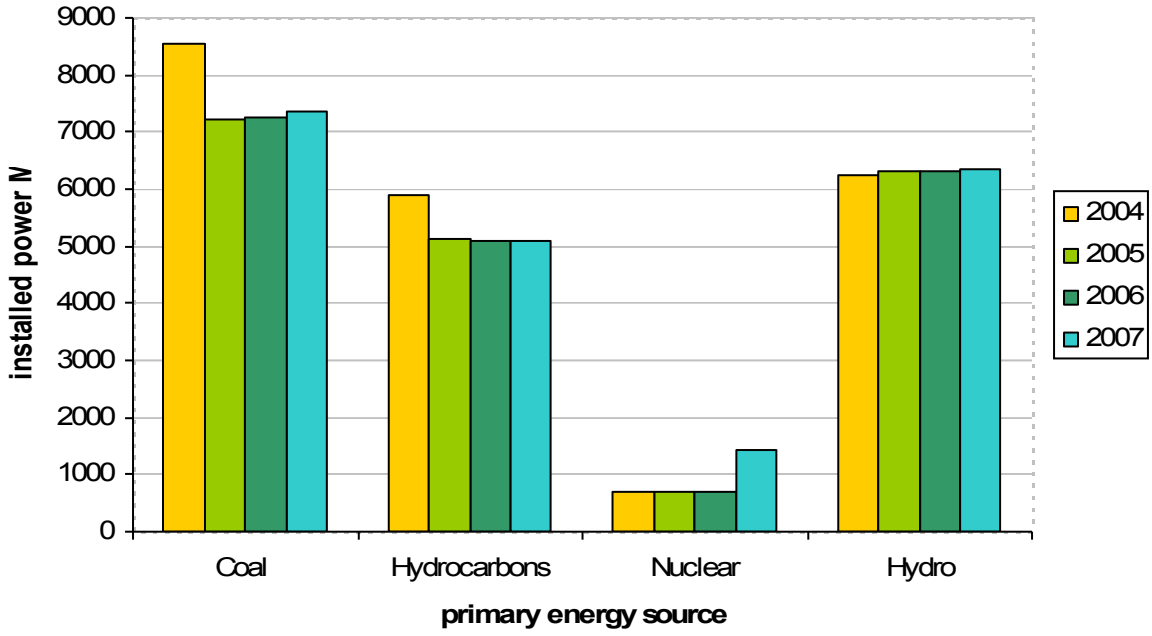
Power consumption in Romania is continuing to grow as the country develops. From 2003 to 2008, there was an increase in average power consumption of 9.8%. This is highlighted in the chart below.

Figure II_ 12 Yearly average power consumption (MW)



The installed power of the Romanian electricity generation system is based on a variety of primary resources, showing the importance offered to this sector; recent development shows an increase of interest towards nuclear power.

Figure II_ 13 Electricity installed power in Romania



Currently, electricity generation in Romania is based on fossil fuel thermal power plants, with important support from hydro power plants.

The entire economic and technical operation and development of the electricity sector is regulated, supervised and monitored by the National Electricity and Heat Regulatory Authority (ANRE), set up in October 1998 as a public institution, independent and autonomous.

The GHGs of resulting from the electricity sector may very broadly, depending on the intensity of use of hydro power, prices of fossil fuels, availability factors etc. From the data in the National GHG Inventory, it is obvious that in year 2005, there is a decrease of GHG emissions, due precipitations abundance and the possibility to use hydropower intensively.

II.G. TRANSPORTS

Located in the center of Europe, Romania is a turntable for international economic trades between the West and East, North and South of the continent and between Europe and the Middle East.

The main railway lines converge on the Capital, Bucharest being Romania's foremost railway node, with 8 main lines leaving from here, most of which are connected to international routes. There is more that 20000 km of railway installed in Romania though the amount is declining. There is a decline in the number of passengers and in quantities of merchandise transported as well.

River navigation is practiced along the Danube. Ships with draught exceeding 7 m can navigate on the maritime Danube downstream from Braila (from there only ships with a smaller deadweight and a draught of up to 2-2,5 m can navigate). The Danube-Black Sea Canal and the commissioning of the Danube-Main-Rhine Canal established a waterway of European importance that connects the North Sea to the Black Sea. The hydro-power and navigation systems Iron Gates I and II facilitate heavier traffic by operating a lock system.

Maritime navigation mostly involves big dead-weight ships. 60% of the country's imports and exports pass through the port of Constanta. The inland waterways and the Black Sea are served by 35 ports including 3 seaports, 6 river-sea ports and 26 river ports.

In addition to the railway and water transportation systems there is an important network of public roads that sum up almost 200000 km, including 281 km of highway. In June 2004, works began for the building of the Braşov-Borş highway that is going to connect Romania to the European Union the biggest infrastructure project in Europe. With a length of 415 km (in Romania), the highway starts from the center of Romania, reaching the border with Hungary. It passes by Braşov, Făgăraş, Sighişoara Tg-Mureş, Cluj-Napoca, Oradea.

Volumes of merchandises transported increased from 2006 to 2007 with about 4%, while the passenger transports increased insignificantly. The number of vehicles registered increased, the personal cars registering the highest growth (about 9%), accounting for slightly more than 3.5 million (2007).

Romania's main airport is the “Henri Coanda” Otopeni International Airport, 10 km away from Bucharest. Other airports are in Craiova, Timişoara, Arad, Oradea, Sibiu, Cluj-Napoca, Satu Mare, Baia Mare, Tg-Mureş, Bacău, Iaşi, Suceava, Tulcea, Caransebeş and Constanţa.

The number of passengers passing through the Romanian airports increased from 5497237, in 2006, to 7831258, in 2007 (42% higher in 2007 than 2006).

II.H. INDUSTRY

Between 1950 and 1990 the industrial sector was increasing its relative contribution to the national income and it underwent a radical structural change. Three branches became much more important: engineering and metalworking accounted for 25.8 percent of all industrial production in 1990, compared with 13.3 percent in 1950, while electricity and fuels increased their share from 13.2 to 19 percent and chemicals from 3.1 to 9.6 percent. The first year after revolution started directly with a sharp decline in output, which was not just due to a correction of misleading statistics during the communist era but real.

If in 1990 the GDP was formed from 21.8% agriculture, 40.5 %, industry (largely oversized), 5.4% by constructions and 32.3% by services. In 1999, 56.9% was services, 5%, constructions, 25% industry and 13.1% agriculture.

In the subsequent years, the trend was for the services to increase their share in the GDP and for industry and agriculture to decrease.

In 2007, compared with 2006, the industrial production was by 5.4% higher than in 2006, because of 6.4% growth for manufacturing production.

The highest growths was registered in the branches like: tobacco products (+26.9%), means of road transport (+18.8%), other means of transport not included in road transport (+17.3%), wood and wooden products manufacturing (+17,0%), construction materials manufacturing and other products of non-metallic minerals (+14.3%), rubber and plastics products (+14.0%), radio, TV and communication equipment (+13.6%), pulp, paper and paper products (+10.3%), food and beverages (+9.2%), chemical substances and products (+8.7%) and textile products manufacturing (+5.4%). The impact of significant growths over the increase of total manufacturing (+6.4%) was diminished by the falls registered in other sectors of manufacturing such as: clothing (-21.5%), electric machinery and apparatus (-6.1%), publishing houses, polygraphy, recording and copying (-4.4%), petroleum, coal coking and treatment of nuclear fuels (-3.5%) and leather goods and footwear (-3.0%).

II.I. AGRICULTURE

Although agriculture was collectivized by the government in 1949, a land reform program instituted in 1991 returned more than 80 percent of the country's agricultural land to nearly 5.5 million small farmers. The contribution of agriculture to the GDP remained stable in the first years of transition and even witnessed a slight growth in some years. This development does hardly reflect a productivity growth in the domain but is rather due to the massive decline in industrial output. The contribution of agriculture to GDP in the year when recovery was achieved (2000) is a better but still overestimating indicator for the performance of this sector (some 11 %), especially when the employment share of this sector (over 41 % in 2000) is taken into account. Another indicator for the low performance of the agricultural sector is its negative contribution to net exports.

Cereal grains, particularly corn (maize) and wheat, are the most important crops, followed by potatoes, sugar beets, and grapes. The region around Bucharest is noted for vegetable cultivation,

with tomatoes, onions, cabbages, and peppers among the crops grown. Romania is noted for its orchards and vineyards, and a variety of high-quality wines are produced and exported.

Table II_ 8 Dynamics of vegetal agricultural production (thou. tones)

	2002	2003	2004	2005	2007
Cereal grains	14357	12964	24713	19346	15759
Vegetables	2864	3358	3679	3625	4139
Oil plants	1195	1760	2160	1803	2050
Potatoes	4078	3947	4655	3739	4016
Fruits	952	2098	1444	1647	1486

Table II_ 9 Number of animals in farms in the period 2001-2004 (thou. heads)

	2002	2003	2004	2005	2006
Cattle	2878	2897	2812	2862	2934
Pigs	5058	5145	6589	6622	6815
Sheep	7312	7447	7466	7611	7678
Goats	633	678	662	687	727
Horses	879	897	840	834	805
Poultry	77379	76616	89455	86552	84990

The animal production recorded a positive evolution, as a direct consequence of the subsidies received by the farmers which revived the sector and assured the basis for its development.

Table II_ 10 Animal production

	M.U.	2003	2004	2005	2006
Meat - total	live weight	1699	1666	1508	1401
Milk - total	thou hl	57736	59837	60614	64607
Eggs	mill. pcs.	6641	6927	7310	7429
Wool	tonnes	16879	18049	18390	19378
Extracted honey	tonnes	17409	19464	17704	18195
Fish	tonnes	10050	10498	13352	12576

Since 1989, Romania's agriculture has undergone less spectacular changes than other sectors in point of structure and production volume. However, major alterations occurred in the structure of ownership and occupied population, as well as in the export-import relations.

Structure of ownership and agricultural holdings

The average size of the refunded land properties is 2.5 ha. Small land properties account for 66.5% of Romania's arable land.

The private sector accounts for 97.3% of the production value that is 97.4% of the vegetal production and 98.9% of the animal one. Organic agriculture represents, along with IT and the light and furniture industries, one of the main resources of Romanian exports.

Along with increased income, it may represent as well an important source of economic development with low GHG emissions.

II.J. LAND USE AND FORESTRY

II.J.1 Land use

According to the Romanian Government, in Romania, arable areas represent 39.2%, forests 28%, pastures and hayfields 20.5%, vineyards and orchards 2.3%, buildings, roads and railroads 4.5%, waters and ponds 3.7% and other areas 1.8%.

II.J.2 Forestry

The national forest stock, not uniformly divided in regards to geographic areas (65% mountain, 28% hill, 7% plain) occupies 26.7% of the total area, ~ 6.370 thousand ha. The main priority is to create forest covers which will fight against drought and desertification, and will also increase the absorption capacity for carbon dioxide thus providing greater climate stability.

II.K. WASTE MANAGEMENT

Waste management includes all the waste collection, transport, treatment, recovery and disposal, including monitoring. Responsibilities for waste management activities may be assigned to waste generators, according to the "polluter pays" principle or, as the case may be, to waste producers, according to the "producer responsibility" principle. Organizing the collection, transport and disposal of municipal waste is one of the obligations of local public administration.

Each type of waste generated on the country's territory shall be formally classified into one of the following categories:

- municipal and similar waste
- production waste
- medical activities waste

In year 2006, the amount of waste generated in Romania was predominantly production waste.

Table II_ 11 Waste generated in Romania in 2006

Type of waste	**Quantity** mil tons	**Share**
Waste generated in mining industry	199.25	62.15%
Waste generated in other industries	112.49	35.09%
Municipal waste	8.87	2.76%
TOTAL	**320.61**	**100%**

The management of municipal waste is performed in an organized system by specialized services belonging to the municipalities or leased from specialized companies. In 2006, collecting service covered 80 % of urban population and less than 12 % of rural population.

Household waste collection is still non-selective at the large scale; only 182 cities were collecting selectively by December 2007. Waste is disposed in landfills.

There is a decreasing trend of the biodegradable fraction in urban waste. It decreased significantly (from 72% in 1998 to 48% in 2005) in recent years.

The most important quantity of biodegradable waste is being produced in the rural area and individual composting is recommended and encouraged.

In Romania there is no waste incineration for the urban waste; though, there are four installations for the incineration of hazardous industrial wastes.

Hazardous waste producers hold the responsibility for hazardous waste management in a rational manner and for waste prevention and recycling, as additional to produced waste handle, storage, collection, transport, treatment and final disposal.

III. GREENHOUSE GAS INVENTORY INFORMATION, INCLUDING ON NATIONAL SYSTEMS AND THE NATIONAL REGISTRY

This chapter presents information on 2009 (last) submission of Romania's National GHG Inventory (NGHGI) of anthropogenic greenhouse gas emissions, submission to the UNFCCC Secretariat. The national greenhouse gas emissions/removals estimates were calculated for the period 1989-2007. The results are presented for every year of the analysed period and include also information on: trend analysis, data sources, key categories, uncertainties, and quality assurance and quality control (QA/QC) activities. The 2009 submission comprise the CRF Reporter database, CRF Tables and the National Inventory Report (NIR).

As a Party to the Convention, Romania is required to produce and regularly update the National GHG Inventory. The last NGHGI for the period 1989–2007 was compiled according to the recommendations for GHG inventories set out in the Updated UNFCCC reporting guidelines on annual inventories following incorporation of the provisions of Decision 14/CP. 11 (FCCC/SBSTA/2006/9), using the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 1996) as well as the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC GPG 2000) and Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC GPG 2003).

The last NGHGI submission covers the obligation of Romania under the UNFCCC. It also constitutes Romania's voluntary submission under the Kyoto Protocol. The inventories cover all sectors and the majority of the IPCC source categories. The direct GHG (including groups of gases) included in the national inventory are:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs);
- Sulphur hexafluoride (SF_6)

The report also contains data on calculations of emissions of the indirect GHGs: NO_x, NMVOC, CO and SO_2, which should be included according to the reporting guidelines. GHG emissions inventories have been reported since the 2005 submission using the CRF Reporter software, delivered by the UNFCCC Secretariat. The last NGHGI refers to figures generated using the 3.2.3 version of the CRF Reporter.

The GHG inventories submitted annually by Parties are subject to reviews by expert review teams (ERT), coordinated by the UNFCCC Secretariat. Up to now, the GHG inventories of Romania were reviewed as follows:

Table III_ 1 Information on reviews of the Romanian NGHGIs coordinated by the UNFCCC Secretariat

Year	Submission	Review process
2002	CRF tables and draft NIR submitted (late submission)	No Review
2003	CRF tables and NIR submitted	In - country Review
2004	CRF tables and NIR submitted	Desk Review
2005	CRF Reporter database, CRFs for LULUCF and NIR submitted	Centralized Review
2007	2006 2nd submission : CRF Reporter database, CRF Tables and NIR + Initial Report of Romania under the Kyoto Protocol	In - country Review
2008	2007 and 2008 submissions: CRF Reporter database, CRF tables and NIR	Centralized Review
2009	2009 submission: CRF Reporter database, CRF Tables and NIR	Centralized Review

The ERT's reports following these reviews can be found on the UNFCCC website.

III.A. SUMMARY TABLES

Summary tables on emission trends by gases and by sectors are presented, using the common reporting format, for 1989-2007, in the Annex A.I.

III.B. DESCRIPTIVE SUMMARY

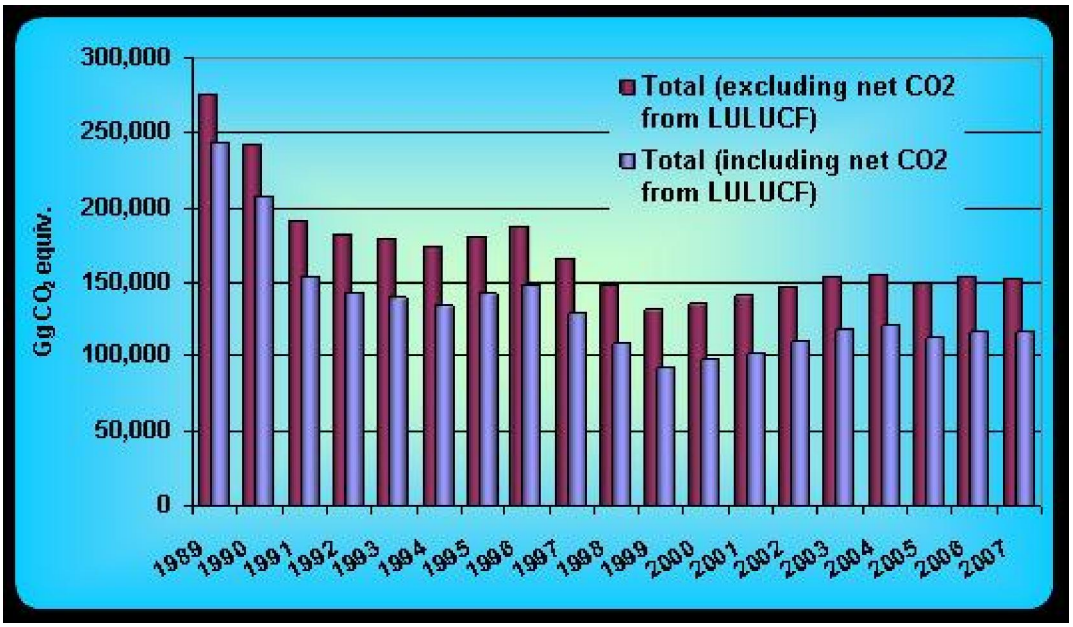
III.B.1 Trends of the aggregated GHG emissions

The total GHG emissions in 2007, excluding removals by sinks, amounted to 152,290.07 Gg CO_2 equivalent.

According to the provisions of the Kyoto Protocol, Romania has committed itself to reduce the GHG emissions by 8% in the period 2008-2012 comparing to the base year 1989. The total GHGs emissions (without considering sinks) decreased with 44.83% in the period 1989-2007, and the net GHG emissions (taking into account the CO_2 removals) decreased with 52.36% in the same period. Based on these observations, there is a great probability for Romania to meet the commitments to reduce the GHG emissions in the first commitment period 2008-2012.

The emissions trend reflects the changes in this period characterized by a process of transition to a market economy (Figure III_1).

Figure III_1 Trends of the aggregated GHG emissions



The emissions trend can be split in two parts: the period 1989-1996 and the period 1996-2007. The decline of economic activities and energy consumption in the period 1989-1992 had directly caused the decrease of the total emissions in that period. With the entire economy in transition, some energy intensive industries reduced their activities and this is reflected in the GHG

emissions reduction. Emissions have started to increase until 1996, because of the economy revitalization. Considering the starting of the operation at the first reactor at the Cernavoda nuclear power plant (1996), the emissions decreased again in 1997. The decrease continued until 1999. The increased trend after 1999 reflects the economic development in the period 1999-2004. The limited decrease of GHG emissions in 2005, compared with the 2004 and 2006 levels was caused by the record-breaking hydrological year positively influencing the energy produced in hydropower plants.

III.B.2 Trends by gases

All GHG emissions decreased comparing with the base year (Table III_2). The shares of GHG emissions have not significantly changed during the period. The largest contributor to total GHG emissions is CO_2, followed by CH_4 and N_2O. In the base year, the shares of GHG emissions were: 70.03% CO_2, 16.82% CH_4, 11.94% N_2O, 1.21% PFCs. In 2007, the shares of GHG emissions were: 72.81% CO_2, 16.89% CH_4, 9.88% N_2O, 0.41% PFCs. The F gases started to be use as substitutes for ODS in refrigerating and air conditioning systems since 1995. In 2007, the contribution of these gases to the total GHG emissions is negligible: 0.0105% HFCs and 0.00209% SF_6. Next table presents the trend of aggregated emissions, divided by gases.

Table III_2 Trends by gas [Gg CO_2 equivalent]

Year	CO_2 including LULUCF	CO_2 excluding LULUCF	CH_4 excluding LULUCF	N_2O excluding LULUCF	HFCs	PFCs	SF_6
1989	160,874.54	193,307.70	46,421.12	32,971.37	NO	3,349.56	NO
1990	136,546.05	172,130.45	40,568.86	28,223.36	NO	2,115.83	NO
1991	95,481.43	132,523.55	35,598.46	21,413.23	NO	1,942.09	NO
1992	89,928.36	127,776.00	32,181.39	20,415.77	NO	1,352.13	NO
1993	88,101.00	127,233.33	30,419.29	19,790.47	NO	1,409.43	NO
1994	84,324.02	124,059.20	29,413.14	18,824.07	NO	1,490.97	NO
1995	90,579.08	129,566.86	30,665.95	18,761.58	0.37	1,773.69	0.06
1996	97,509.52	135,512.77	31,238.82	18,339.56	0.73	1,769.07	0.06
1997	82,681.17	121,071.05	27,565.89	17,668.98	1.22	390.32	0.02
1998	66,852.28	107,333.43	25,209.29	15,773.36	2.65	416.55	0.01
1999	52,442.40	91,651.17	24,528.77	15,005.53	2.84	415.10	0.05
2000	57,298.28	95,306.52	25,092.87	14,708.19	3.41	413.17	0.00
2001	61,288.14	100,297.87	24,908.55	14,839.16	3.53	428.80	0.00
2002	69,791.08	106,336.13	25,671.04	14,205.07	4.22	444.64	0.01
2003	75,229.83	111,405.47	26,699.43	14,943.37	6.41	471.95	0.12
2004	76,682.00	112,174.29	26,132.90	16,562.85	8.92	513.45	0.08
2005	68,692.63	105,874.24	26,342.96	16,586.67	6.61	569.64	0.20
2006	73,915.81	111,117.99	26,569.24	15,520.64	22.57	609.65	0.09
2007	74,654.22	110,883.36	25,721.70	15,040.18	16.07	625.58	3.18

Carbon dioxide (CO_2) – the most significant anthropogenic greenhouse gas is the carbon dioxide. The decrease of CO_2 emissions (from 193,307.70 Gg in 1989 to 110,883.36 Gg in 2007) is caused by the decline of the amount of fossil fuels burnt in the energy sector (especially in the public electricity and heat production, and manufacturing industries and construction sectors) as a consequence of activity decline in this sector.

Methane (CH_4) – the methane emissions, related to the Fugitive emissions from fossil fuels extraction and distribution and to the livestock, declined in the same period. The CH_4 emissions estimated for the year 2007 decreased with 44.59% compared with the 1989.

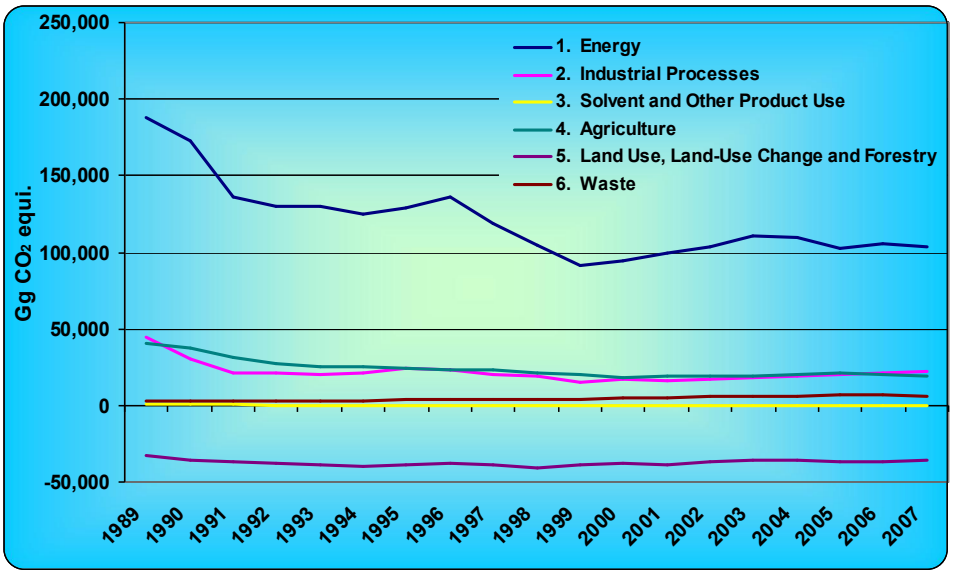
Nitrous oxide (N_2O) – the N_2O emissions are mainly provided by the Agricultural Soils in the Agriculture sector and the Chemical industry in the Industrial Processes sector. The decline of these activities is reflected in the N_2O emissions trend. The decrease in N_2O emissions in 2007 is 54.38% compared with the base year.

Fluorocarbons and SF_6 (HFCs, PFCs, SF_6) – the F-gases started to be used as substitutes for ODS in refrigerating and air conditioning systems since 1995; therefore the emissions resulted as a consequence of the use of these substances are estimated beginning with the same year. The PFCs emissions generated in the production of the primary aluminum are reported for the entire period since 1989 (and have decreased with 81.32% in 2007 comparing with 1989).

III.B.3 Trends by sectors

The figure below shows the GHG emissions trends by each sector. The GHG emissions are expressed in Gg CO_2 equivalent.

Figure III_ 2 Trends by sector



Energy: represents the most important sector in Romania. The Energy sector accounted for 68.3% (Figure III_3) of the total national GHG emissions in 2007. The GHG emissions resulted from the Energy sector decreased with 44.79% compared with the base year.

Industrial Processes contributes to total GHG emissions with 14.58%. A significant decrease of GHG emissions was registered in this sector (49.61% decrease from 1989 to 2007) due to the decline or the termination of certain production activities.

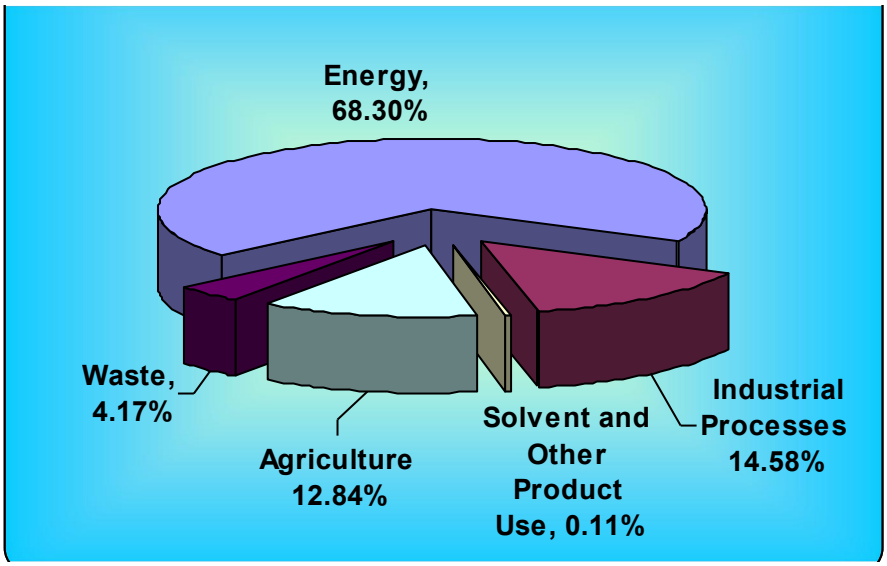
Agriculture GHG emissions have also decreased. The GHG emissions in 2007 are 51.13% lower in comparison with the 1989 emissions. In 2007, 12.84% of the total GHG emissions resulted from the agriculture sector.

LULUCF CO_2 removals by sinks are 11.68 % higher in comparison with the base year.

Waste sector emissions have increased in the period 1989-2007 (117.54%). Contribution of the waste sector to the total GHG emission is 4.17% in 2007.

Participation of sectors to GHG emissions (excluding LULUCF) is presented in the next figure.

Figure III_3 Sectoral GHG emissions in 2007 [%]

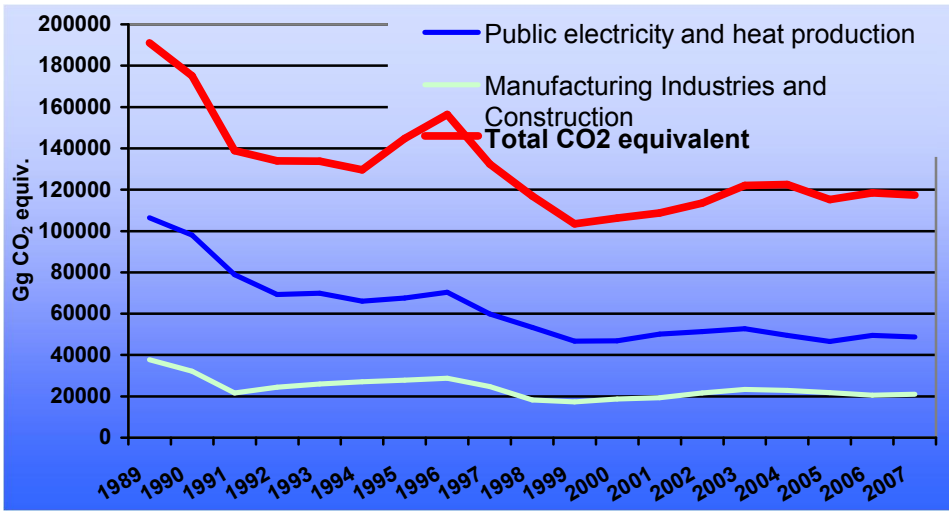


III.B.4 The description and interpretation of past emission trends

Energy (CRF sector 1)

The emissions trend reflects the changes in this period characterized by a process of transition to a market economy (Figure III_ 4 andFigure III_ 5). The emissions trend can be splitted in two parts: the period 1989-1996 and the period 1996-2007. The decline of economic activities and energy consumption in the period 1989-1992 had directly caused the decline in total emissions in that period. With the entire economy in transition, some energy intensive industries reduced their activities and this is reflected in the GHG emissions reduction.

Figure III_ 4 Overall GHG emissions trend in Energy

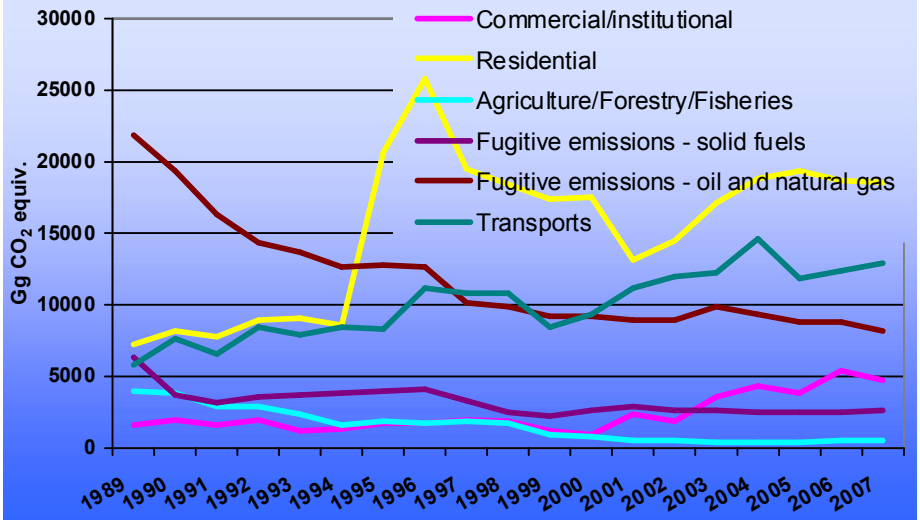


Emissions have started to increase until 1996, because of economy revitalization. Considering the starting of the operation of the first reactor at the Cernavoda nuclear power plant (1996), the emissions started to decrease again. The decrease continued until 1999. The increased trend after 1999 reflects the economic development in the period 1999-2007.

The 2005 decrease of the GHG emissions is due to the fact that it was a rainy year, therefore, the thermal power produced decreased, increasing the hydropower produced. In 2006, the situation changed (having a dry summer), with the decrease of the hydropower and the increase of the thermal power produced.

At the end of 2007, the second unit of the Cernavodă nuclear power plant was functioning, therefore the decrease in emission trend is not very noticeable.

Figure III_ 5 Sub-sectoral emissions trends in Energy



Transport (CRF sub-sector 1AA3)
The overall increasing emission trend of the transport sub-sector (Figure III_6) is given by the emissions trend of the road mean of transport and is increasing in 2006 from the base year with 212.41%, reflecting the increasing trend of the registered motor vehicles with 231.8 % in 2006 comparing with the base year. There are decline periods, for example the year 1999 characterized by the highest value for the fuels consumer price index.

Industrial Processes (CRF sector 2)
Due to the decrease of several productions levels, mainly within the chemical, mineral and metal industry, after 1989 the Industrial Processes overall emission has decreased (Figure III_7 and Figure III_ 8). This is the result of the restructuration and privatization in various activity sectors.

Metal production contributes to 42.80 % of the total GHG emissions from Industrial Processes in 2007. Mineral Product and Chemical Industry are the two other main contributing sectors with 35.32 % and 21.79 %, respectively, of the total GHG emissions in this sector. The contribution of Consumption of halocarbons and SF_6 to the overall sector is very low: 0.09 %.

In the base year, industrial processes sub-sectors contributions were: Mineral products 25.72%, Chemical industry 28.78%, Metal production 45.50%, Consumption of halocarbons and SF_6 0%.

Figure III_6 Sub-sectoral emissions trends in Transport sub-sector

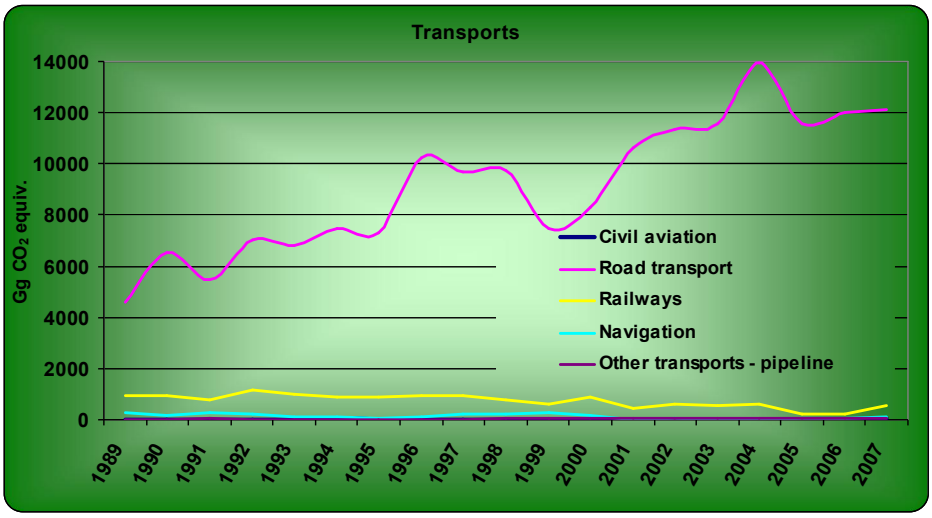


Figure III_7 Overall emissions trend in the Industrial Processes

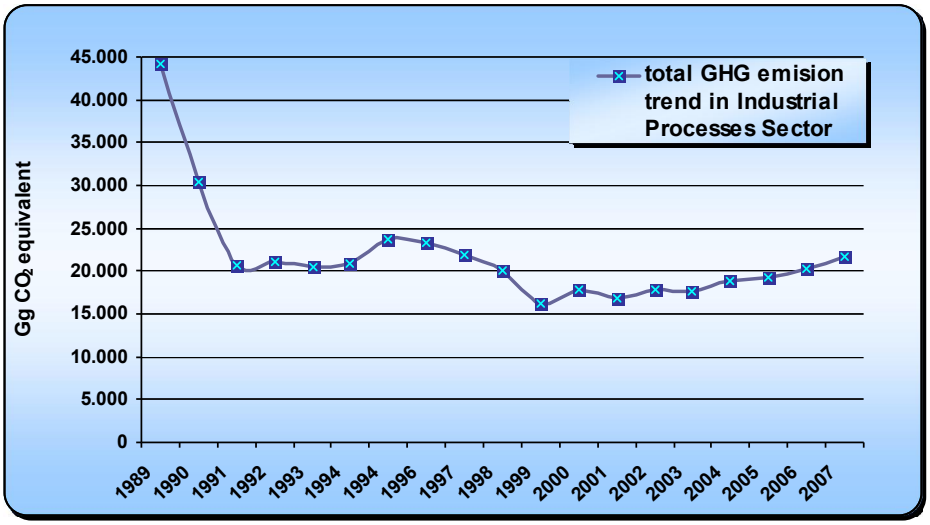
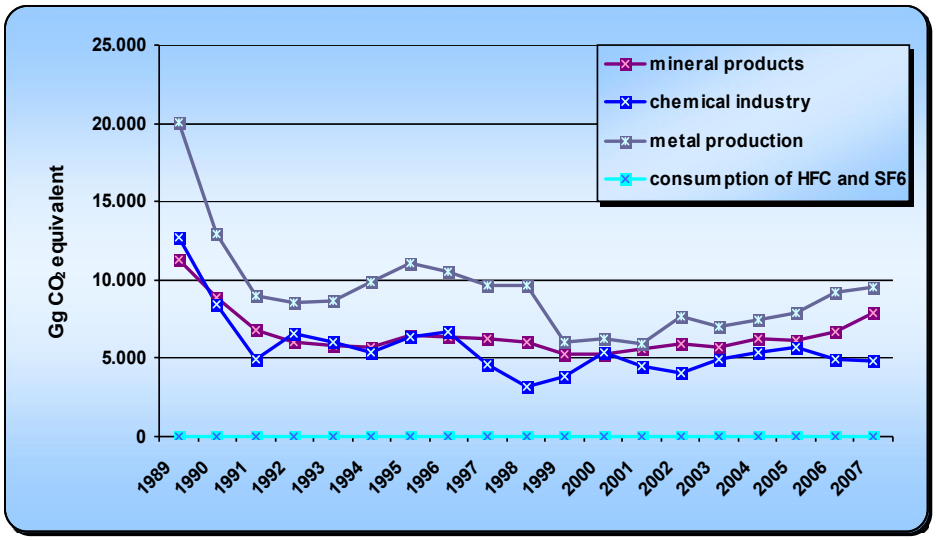
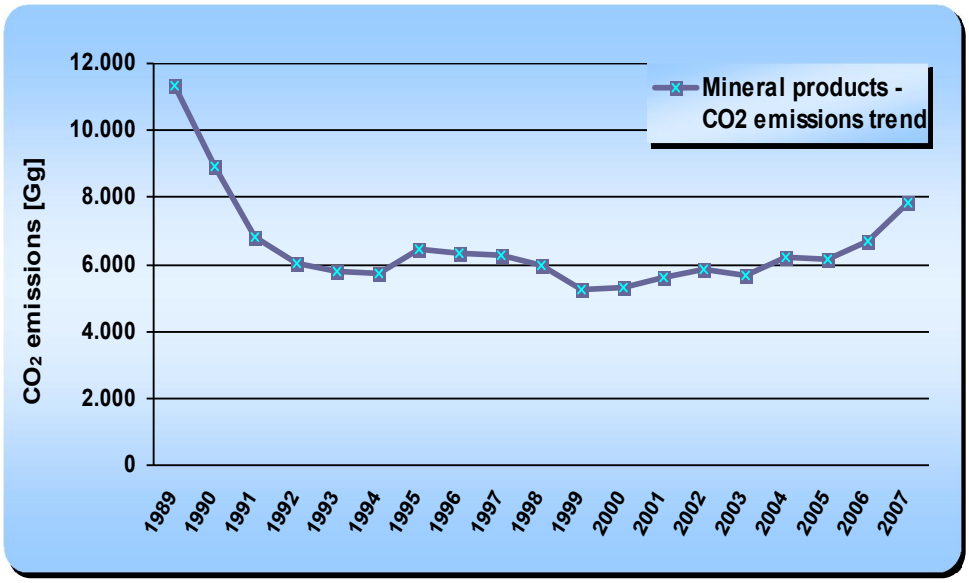


Figure III_ 8 GHG emissions trends in Industrial Processes, by sub-sectors, for 1989–2007 period



Mineral Products (CRF sub-sector 2A): GHG emissions of the Mineral Products sub-sector decreased during 1989-2007 due to the decrease recorded in cement production, lime production, limestone and dolomite consumption, soda ash production and use and glass production (Figure III_ 9); the emissions are relatively stable for 1993–2007. Starting with 2004 the cement production has recorded a minor increase.

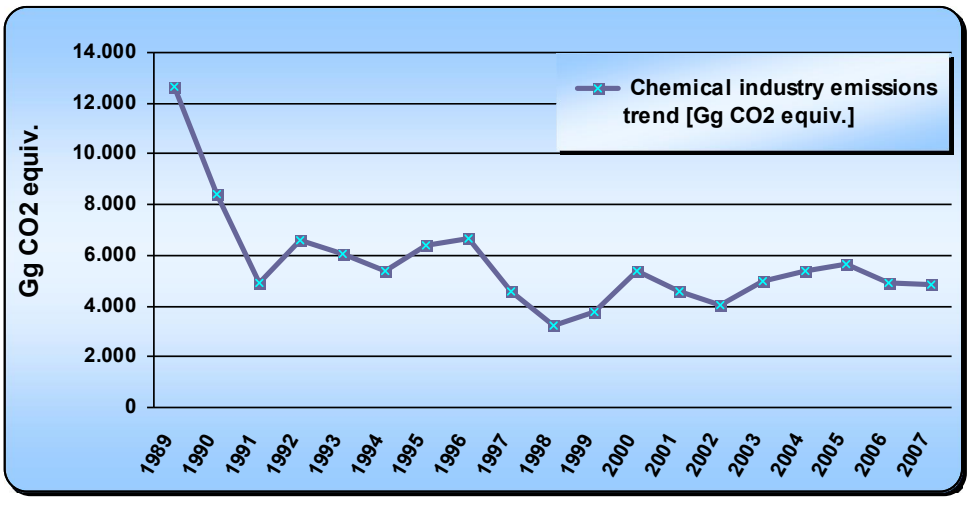
Figure III_ 9 Emissions trend in the Mineral Products sub-sector



Chemical Industry (CRF sub-sector 2B): The emissions from the Chemical Industry sub-sector decreased since 1989 (Figure III_ 10) due to the following:

- lowest level of emissions from the ammonia production was recorded in 1998 (production decreased by almost 50% compared to the previous and the next year) due to closing of a producing plant in 1998 and closing of another plant in 1998 and reopening it the next year;
- the nitric acid production recorded a decrease after 1989;
- the adipic acid production stopped at the end of 2001;
- the carbide production recorded a decrease after 1989

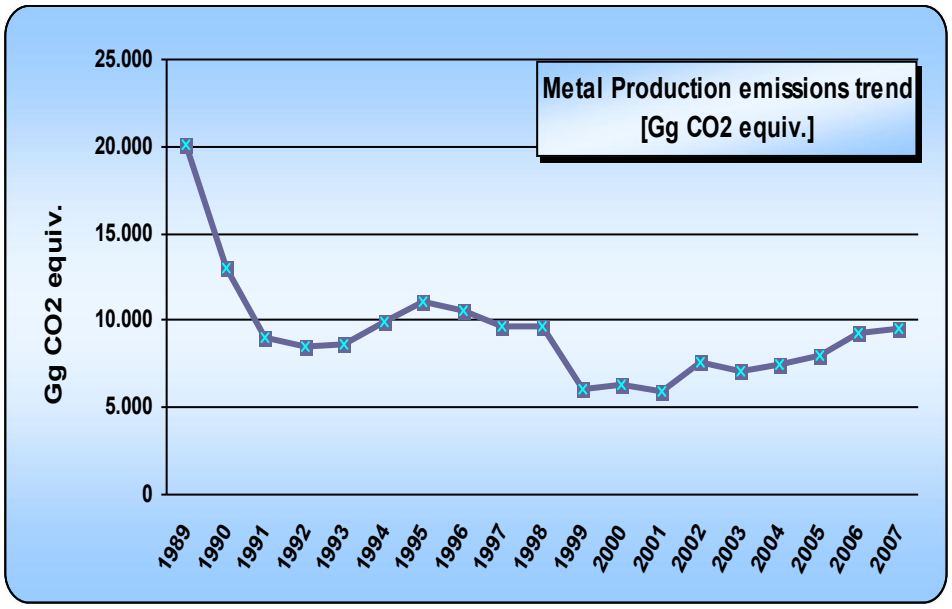
Figure III_ 10 Emissions trend in the Chemical Industry sub-sector



Metal Production (CRF sub-sector 2C): The GHG emissions from the Metal Production sub-sector decreased since 1989 (Figure III_ 11) due to:

- the iron and steel production recorded a decrease after 1989;
- ferroalloys production has recorded a decrease after 1989. The lowest level of emissions was recorded in 1999 due to the cease of production. In 2000 the production started again;
- the reduction of PFC emissions from production of aluminum due to changes in technologies starting with 2003

Figure III_ 11 Emissions trend in the Metal Production sub-sector



Other Production (CRF sub-sector 2D)

The IPCC 1996 Guidelines provides no default values for emission factors associated to the direct greenhouse gases. No national emission factors have been developed yet.

Production of Halocarbons and SF_6 (CRF sub-sector 2E), consumption of halocarbons and SF_6 (CRF sub-sector 2F) and consumption of halocarbons and SF_6 – Potential Emissions (CRF sub-sector 2F)

Romania is not producing any halocarbons and SF_6. The ascending trend of emissions (Figure III_ 12) in the consumption of halocarbons and SF_6 (CRF sub-sector 2F) and consumption of halocarbons and SF_6 – Potential Emissions (CRF sub-sector 2FP) is caused by the increasing production of the equipments using F-Gases.

In 2007 the SF_6 actual emissions increased significantly relative to 2006 because according to the questionnaires received from the operators a new economic agent started to use SF_6 in its activity (manufacture of other parts and accessories for vehicles and motor vehicle).

Solvents and Other Products Use (CRF sector 3)

The trend of emissions resulted from this sector follow the general trend (Figure III_ 13): emissions have decreased seriously after 1989, then the emissions were relatively stable from 1992 to 2002 and after 2002, emissions started to increase, due to the revitalization of the economic activities (automobile manufacture, construction and buildings).

Figure III_ 12 Emissions trends in the Consumption of Halocarbons and SF_6 and in the Consumption of Halocarbons and SF_6 – Potential Emissions sub-sectors

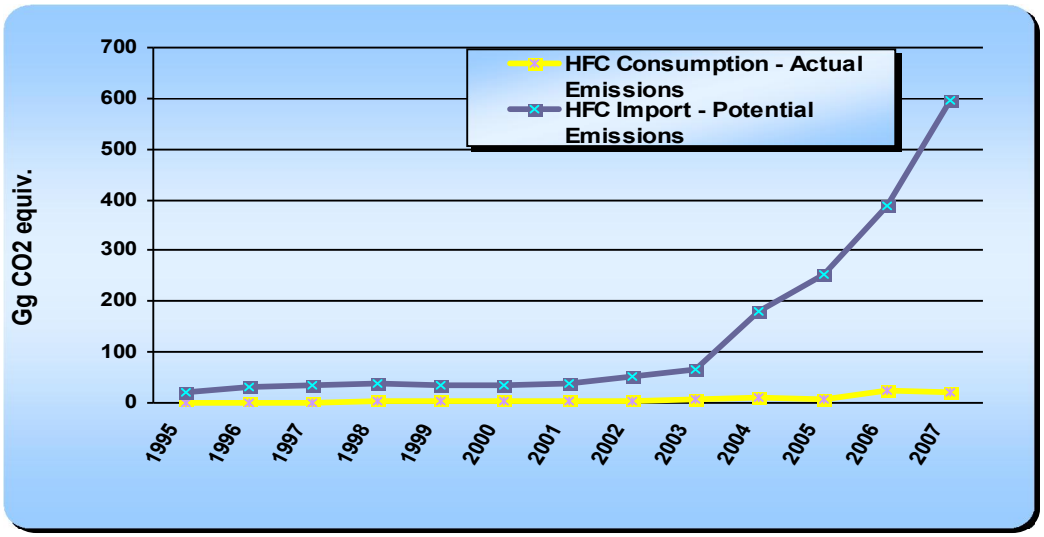
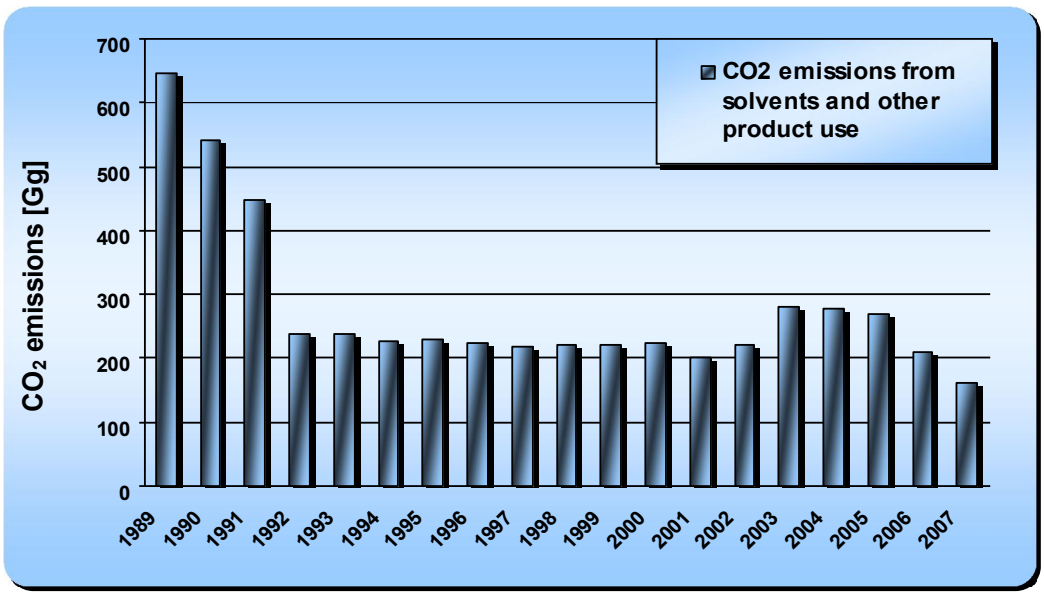


Figure III_ 13 Emissions trend in the Solvents and Other Products Use sector



Agriculture (CRF sector 4)

The Agriculture sector accounted for 12.84% of the total GHG emissions in 2007, reaching 19,549.54 Gg CO_2 equivalent. Within the GHG emissions from the agriculture sector, the N_2O emissions have the largest contribution (in 2007, N_2O emissions contribution is 59.17% to the total Agriculture sector's CO_2 equivalent emissions), followed by the CH4 emissions (that account for the remaining 40.83%).

Over the period 1989–2007, the GHG emissions resulted from agriculture sector decreased by 51.13%.

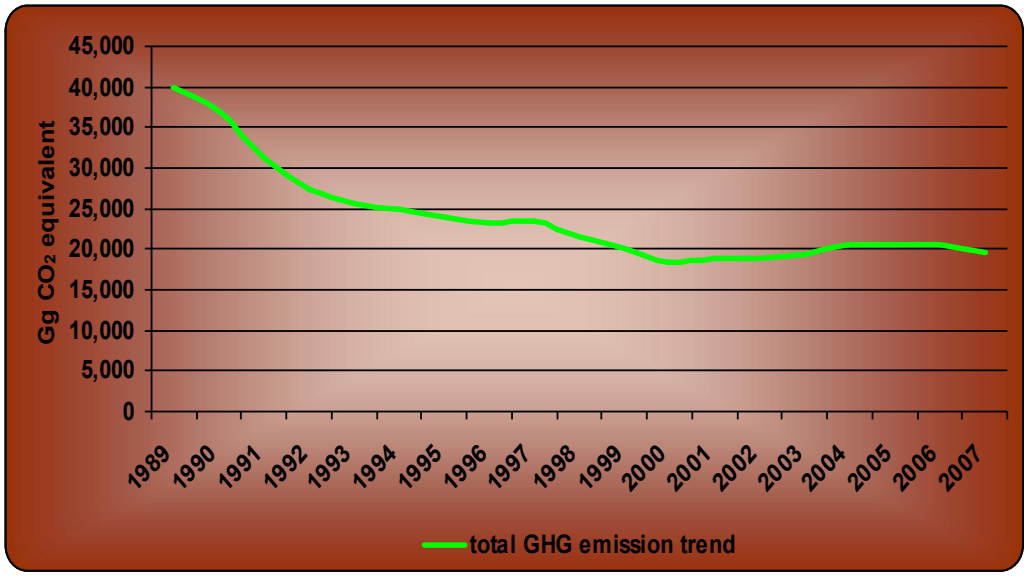
The Agriculture sector's CH_4 emissions decreased in 2007 with almost a half the level recorded in the base year (-46.92%). Because the methane emissions are mainly resulted in domestic livestock, the decrease of their level is due to the decline of the domestic livestock.

The N_2O emissions from the Agriculture sector decreased with 53.66% comparing with the base year. The reasons for this decrease are:

- the decrease of the amount of chemical fertilizers applied to soils;
- the decline of the domestic livestock

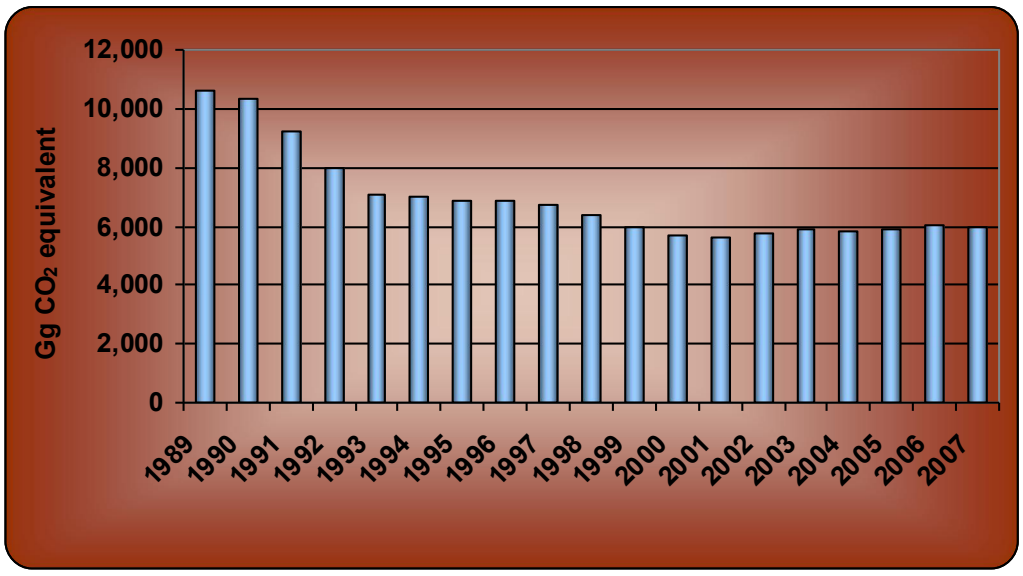
Over the period 1989–2007, the GHG emissions resulted from the agriculture sector decreased by 51% (Figure III_ 14).

Figure III_ 14 Total GHG emissions trend in Agriculture for 1989–2007



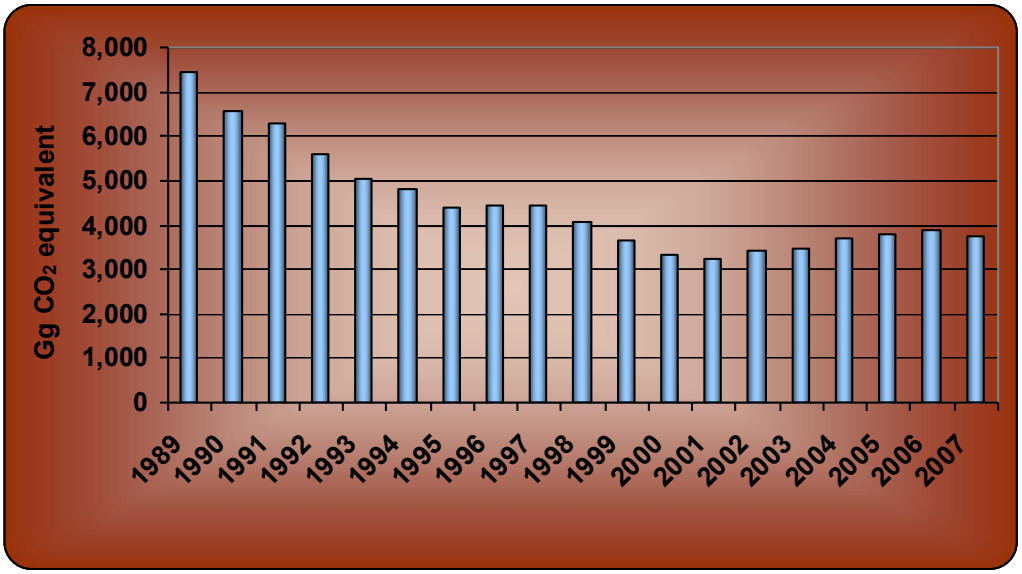
Enteric fermentation (CRF sub-sector 4A: The level of emissions decreased in 2007 by 44% comparing to the base year, reflecting the decrease in animal population over the same period (Figure III_ 15).

Figure III_ 15 Enteric fermentation emissions trend



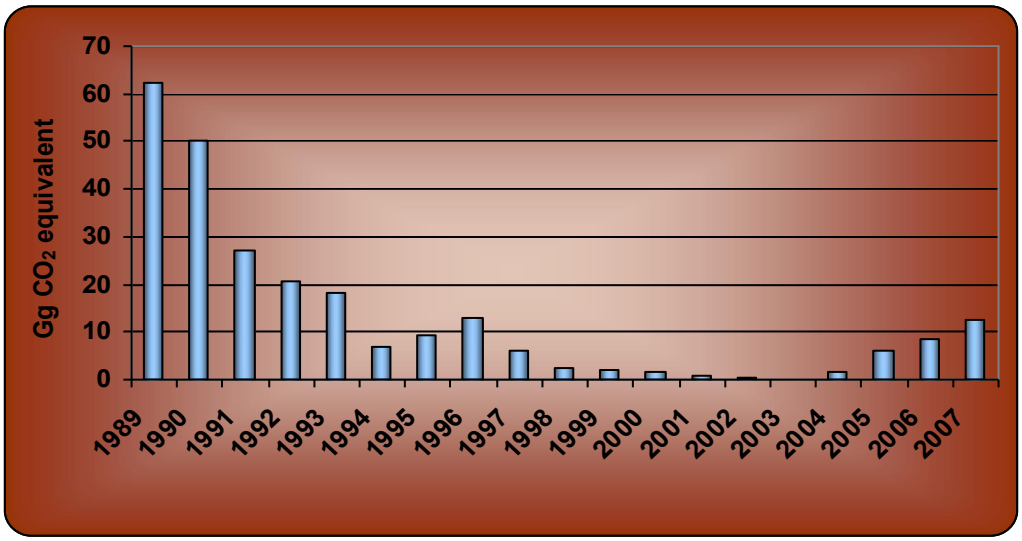
Manure management (CRF sub-sector 4B). The level of emissions decreased in 2007 by 50% comparing to the base year, reflecting the decrease in the livestock population over the period (Figure III_16).

Figure III_16 Manure management overall trend



Rice cultivation (CRF sub-sector 4C). Due to the decline of the rice cultivated area, emissions levels decreased by 80% in 2007 comparing to the base year (Figure III_ 17).

Figure III_ 17 Rice cultivation emissions trend



Agricultural soils (CRF sub-sector 4D). The decline of livestock population and the crop productions, and the decrease in the amount of synthetic fertilizer applied resulted in a 55% decrease of emissions in 2007 comparing to the 1989 (Figure III_ 18).

Field burning of agricultural residues (CRF sub-sector 4F): During the 1989-2001 the emission levels were directly proportional with the crop production levels. Due to the implementation of the legislation which forbidden the burning of the agricultural residues, from 2002 to 2007 emissions are considered as not occurring (Figure III_ 19).

Figure III_ 18 Agricultural soils emissions trend

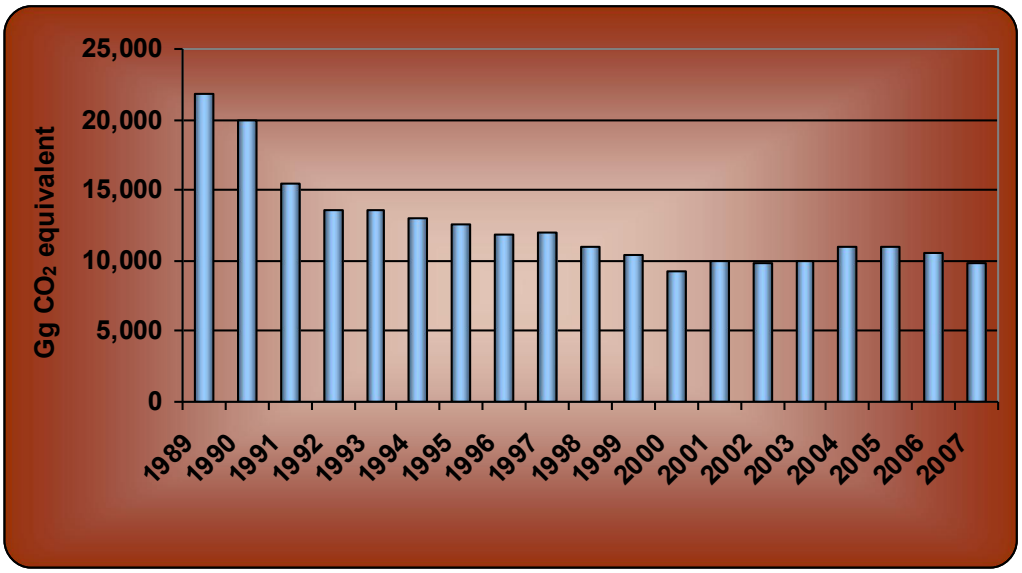
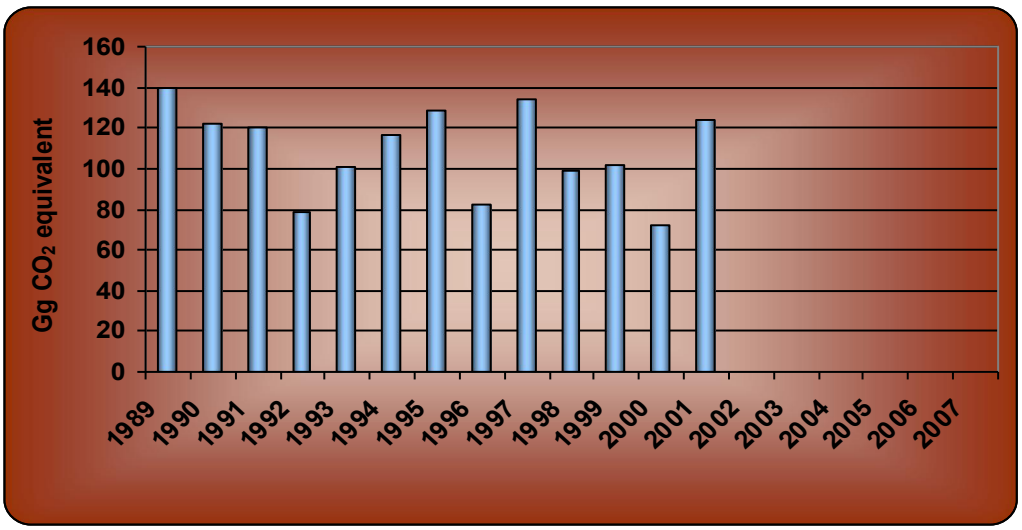


Figure III_ 19 Field burning of agricultural residues overall trend



Land-Use, Land-Use Change and Forestry (CRF sector 5)

There is no significant variation at the net removals/emissions or at the CO_2 removals trends over the period 1989 - 2007. The Romanian land use sector acts as a net sink, at an average uptake of 37,532 Gg/year, being relatively stable over the last 19 years (Figure III_ 20).

Emissions from LULUCF comprise CO_2, CH_4 and N_2O emissions from biomass burning. Due to the long drought in Romania, during 1999-2003 period, the area affected by wildfires increased and, as a direct consequence, levels of emissions increased (Figure III_ 21).

Due to the decrease trend of emissions from all other sectors, the percentage of net emissions/removals from LULUCF related to the total GHG emissions increased from 11.75% in 1989 to 23.78 in 2007.

Figure III_ 20 CO_2 removals trend and Net removals/emissions trend

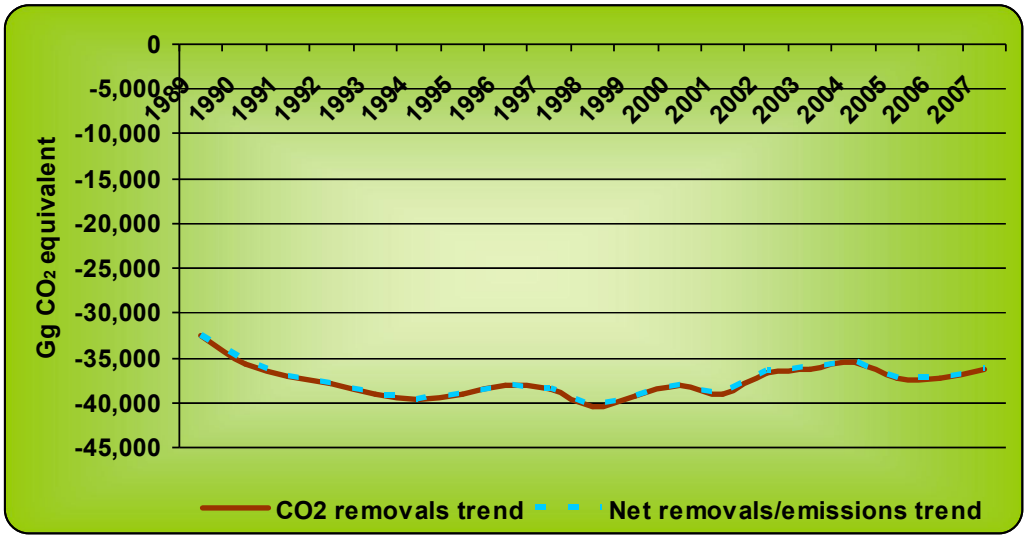
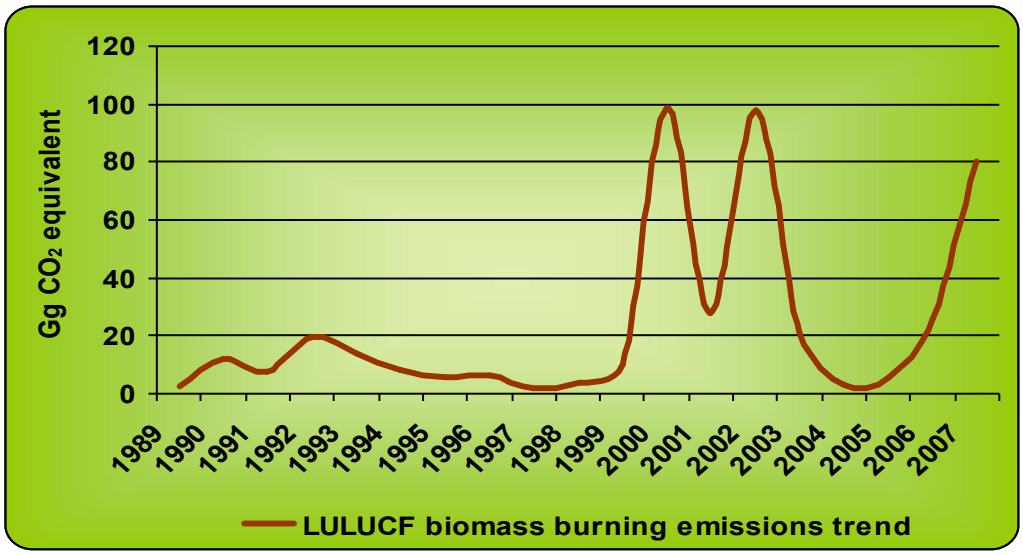


Figure III_ 21 Biomass burning emissions trend



Waste (CRF sector 6)

Over the period 1989 - 2007, GHG emissions resulted from Waste sector increased by 117.54 %, due to population consumption growth, to the increase of waste managed sites number and also to the increase of population connected to sewerage (Figure III_ 22).

Solid Waste Disposal on Land (CRF sub-sector 6A. The specific emissions trend is due to the increase of the managed waste disposed sites number and to the increase of the waste generation rate (Figure III_ 23). Since 2005 emissions have decreased due to the decline of the unmanaged sites number.

Figure III_ 22Total GHG emissions trend in Waste for 1989–2007 period

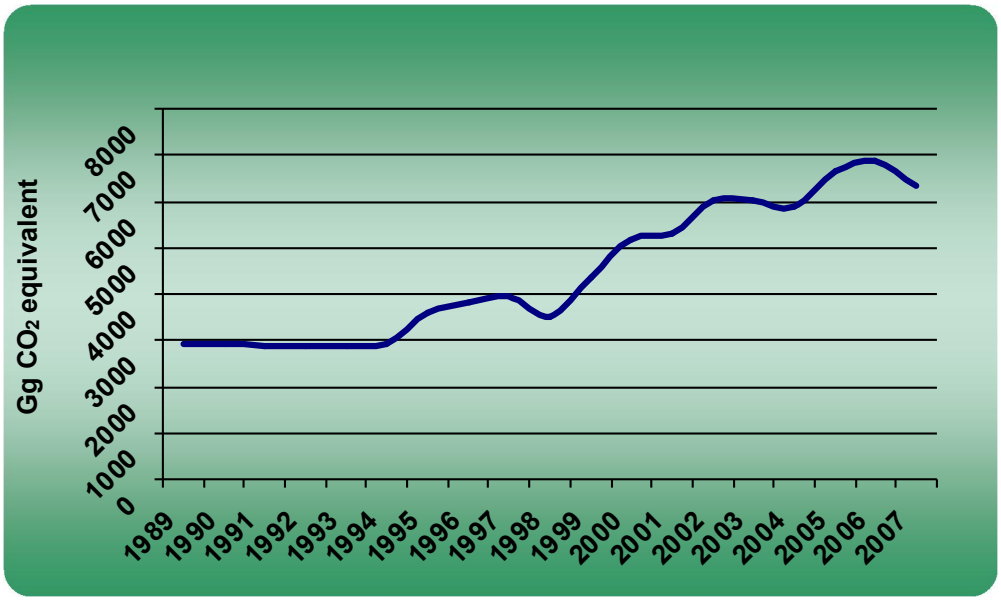
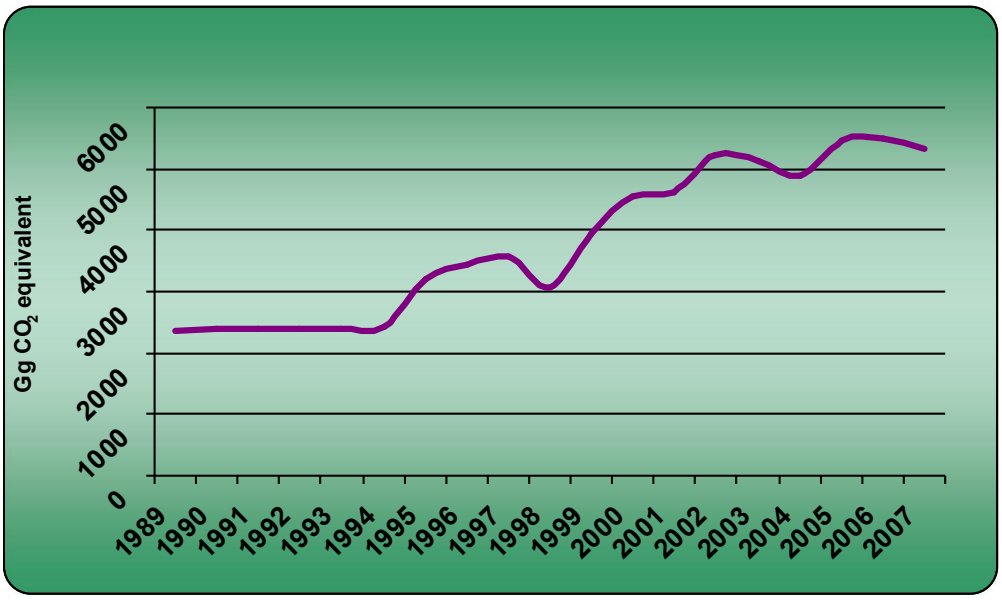


Figure III_ 23 Emissions trend in the Solid Waste Disposal on Land sub-sector



Wastewater Handling (CRF sub-sector 6B). Romania Wastewater handling sub-sector faced three periods as it can be observed (Figure III_ 24):

- 1990-1995 - the system failed because wastewater was not considered as a priority and also because of the lack of funds and organization;
- 1995-2000 - percentage of population connected to sewage and treated wastewater reached minimum values. European funds began to be attracted, organizational problems has been solved and local administrations have been decentralized by the end of period;
- 2000-2007 - wastewater became a priority, population connected to sewage and treated wastewater percentages significantly increased in both urban and rural areas

Waste Incineration (CRF sub-sector 6C). The specific emissions trend is due to the increase of the incinerators number over the period 1992-2006. The difference between 2006 and 2007 is

due to the fact that in 2006 a private operator ceased the activity of the incinerator (Figure III_ 25).

Figure III_ 24 Emissions trend in the Wastewater handling sub-sector

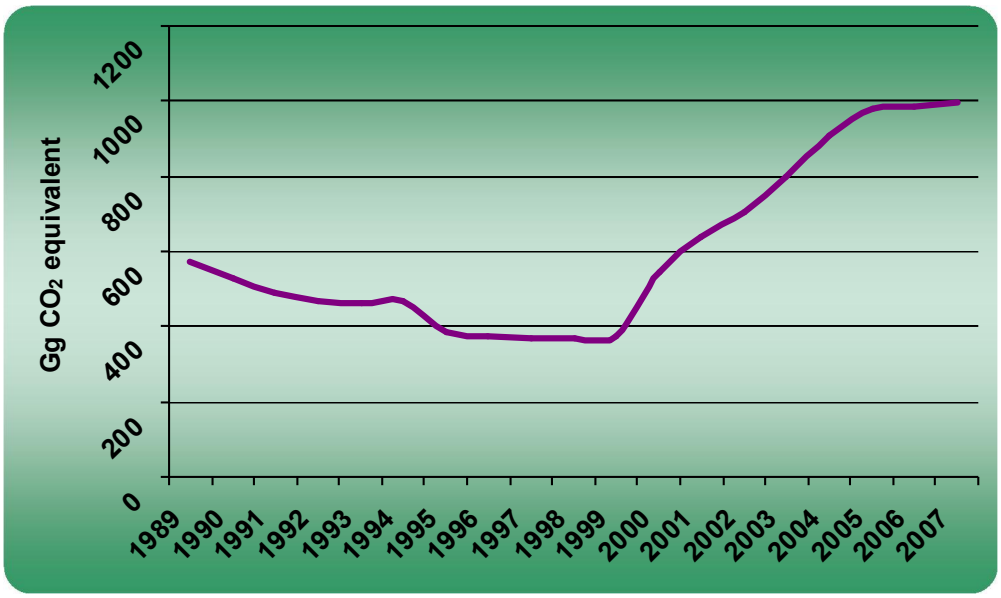
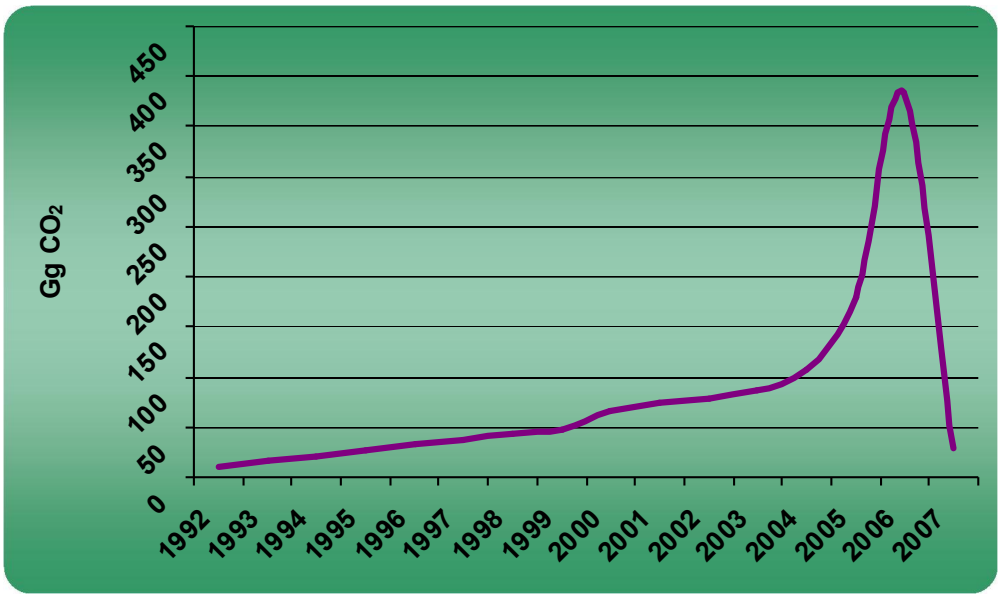


Figure III_ 25 Emissions trend in the Waste Incineration sub-sector



III.C. NATIONAL SYSTEMS IN ACCORDANCE WITH ARTICLE 5, PARAGRAPH 1, OF THE KYOTO PROTOCOL

(a) Name and contact information for the national entity and its designated representative with overall responsibility for the national inventory of the Party

The single national entity designated with overall responsibility for the Romanian GHG inventory is the National Environmental Protection Agency (NEPA).

NEPA's contact information are:
National Environmental Protection Agency
Address: Splaiul Independenţei no. 294, Sector 6, Bucharest
Phone: +40-21-207.11.55
Fax: +40-21-207.11.55
E-mail: schimbari_climatice@anpm.ro

The Romanian designated representative with overall responsibility for the national GHG inventory is Mr. Sorin Deaconu. Specific contact data are:

National Environmental Protection Agency
Address: Splaiul Independenţei no. 294, Sector 6, Bucharest
Phone: +40-21-207.11.55
Fax: +40-21-207.11.55
E-mail: sorin.deaconu@anpm.ro

(b) Roles and responsibilities of various agencies and entities in relation to the inventory development process, as well as the institutional, legal and procedural arrangements made to prepare the inventory

Based on Article 5 of the Kyoto Protocol, Romania established a National System for estimating the anthropogenic emissions for all greenhouse gases not covered by the Montreal Protocol. The system complies with the provisions of the subsequent decisions of the CMPs of the Kyoto Protocol and with provisions of the Decision 280/2004/EC of the European Parliament and of the Council and of the Decision 166/2005/EC of the European Commission concerning a mechanism for monitoring Community GHG emissions and for implementing the Kyoto Protocol.

The Governmental Decision no. 1570 for establishing the National System for the estimation of anthropogenic greenhouse gas emissions levels from sources and removals by sinks, adopted in 2007, and the subsequent relevant procedures are regulating all the institutional, legal and procedural aspects for supporting the Romanian authorities to estimate the greenhouse gas emissions levels, to report and to archive the National GHGI information.

The procedures subsequent to the Governmental Decision no. 1570/2007 comprise:

- Ministry of Environment and Forests Order no. 1376/2008 for approving the Procedure on NGHGI reporting and the modality for answering to the observations and questions raised following the NGHGI review;
- Ministry of Environment and Forests Order no. 1474/2008 for approving the Procedure on processing, archiving and storage of data specific to the NGHGI;
- NEPA's President Decision no. 23/2009 for approving the Procedure on selection of the estimation methods and of the emission factors needed for the estimation of the GHG levels;
- NEPA's President Decision no. 24/2009 for approving the QA/QC Procedure related to the NGHGI

The main objective of the Governmental Decision is to ensure the fulfillment of the obligations of Romania under the UNFCCC, the Kyoto Protocol and the European Community legislation.
The competent authority, which is responsible for administrating the National System, is the National Environmental Protection Agency (NEPA), under the subordination of the Ministry of Environment and Forests. NEPA has also the obligation of the preparation of the National GHGI; in this sense, the Governmental Decision no. 1570/2007 and the subsequent relevant

procedures supports NEPA by defining a legal, institutional and procedural framework to involve actively all the relevant responsible public authorities, different research institutes, economic operators, and professional associations.

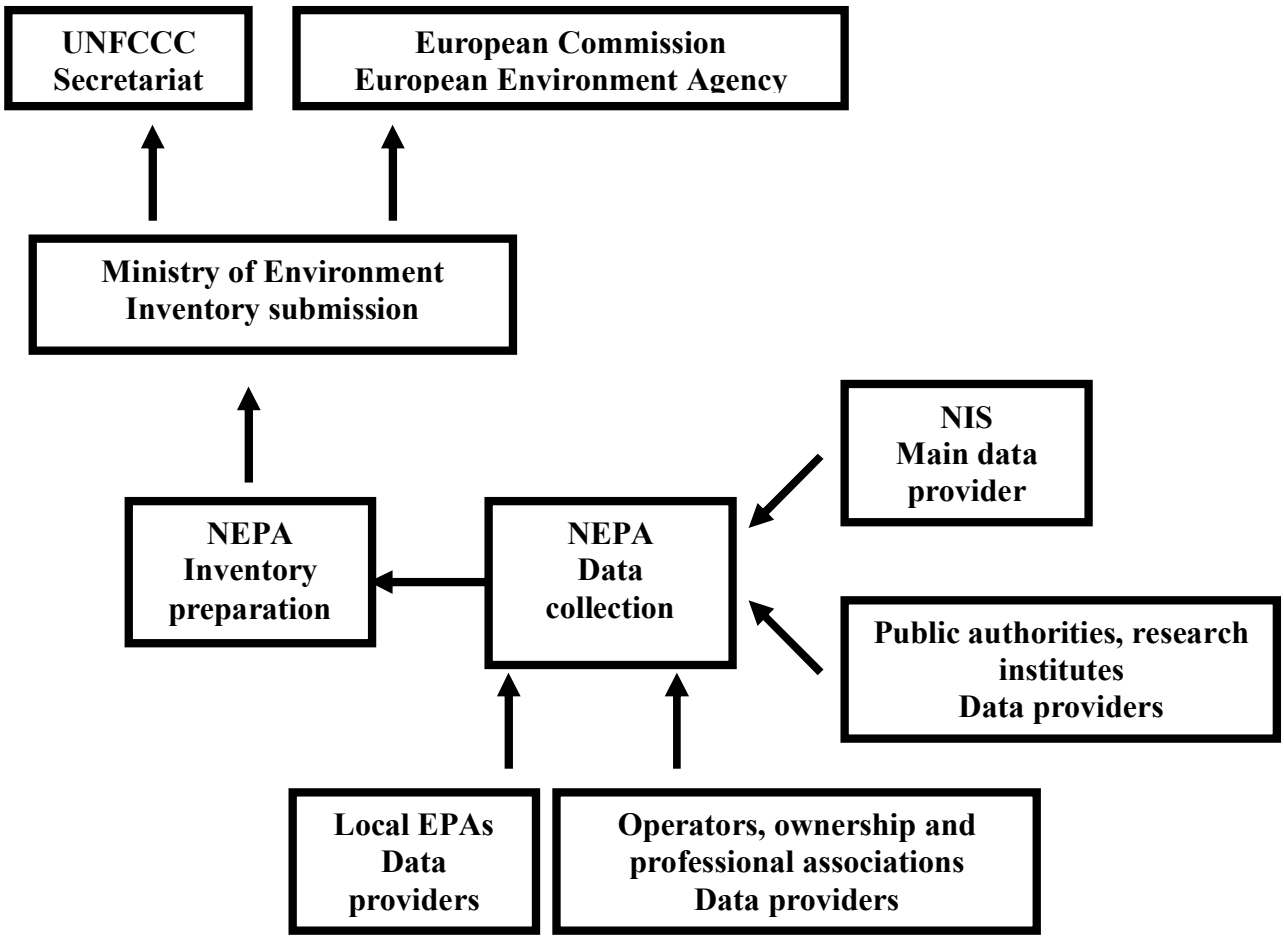
Central public authorities and the institutions under their authority, in their coordination or subordination, different research institutes, and the economic operators have the responsibility for submitting activity data needed for the GHG emissions calculation.
The main activity data supplier is the National Institute for Statistics (NIS) through the yearly-published documents like the National Statistical Yearbook and the Energy Balance. In 2002, the Ministry of Environment and Forests and NIS signed a protocol of co-operation. Under this protocol, NIS agreed to provide, besides its yearly publication, additional data, necessary for the inventory preparation.

The Ministry of Environment and Forests submits officially the National GHGI to the UNFCCC Secretariat, the European Commission and the European Environment Agency taking into account the specific deadlines.

Romania had regularly prepared and annually submitted the GHG inventory, based on a clear internal plan and structure.

The inventory system currently used in Romania is presented in the Figure III_ 26.

Figure III_ 26 Current national inventory system description



The following three stages are considered in the elaboration of the inventory: planning, preparation and management. In the first stage specific responsibilities are defined and allocated, the second stage refers to inventory preparation process (data collection, relevant information needed for estimating emissions, methodological choices) and the third stage refers to the inventory management that also includes quality management, as well as documentation on QA/QC activities.

(c) Description of the process for collecting activity data, for selecting emission factors and methods, and for the development of emission estimates

According to the Governmental Decision no. 1570/2007 establishing the National System for the estimation of the GHG emissions levels from sources and removals by sinks, the implementation of the National System ensures the NGHGI quality in three phases:

- planning;
- preparation and
- management of the NGHGI preparation activities
- Data collection

Data collection process comprises the following steps:

- identification of data requirements;
- identification of potential data suppliers;
- preparation of specific questionnaires;
- submitting the questionnaires to the potential suppliers of data;
- data collection;
- data verification: activity data received are examined (time series discrepancies, large changes in values from the previous to the current inventory year)

The following table presents the main activity data sources.

Table III_ 3 Activity data sources for the preparation of the GHGI

Sector	Data sources
Energy	• National Institute for Statistics - Energy Balance and other additional data • Romanian Civil Aviation Authority
Industrial Processes	• National Institute for Statistics- Statistical Yearbook and other additional data • 42 Local Environmental Protection Agencies • Direct information from industrial operators
Solvent and other product use	• National Institute for Statistics • 42 local Environmental Protection Agencies
Agriculture	• National Institute for Statistics
LULUCF	• National Institute for Statistics through Statistical Yearbook • National Forest Administration (RNP)
Waste	• National Institute for Statistics • National Environmental Protection Agency • Public Health Institute • National Administration “Romanian Waters” • Food and Agriculture Organization

Data processing and emission calculation

Data processing is done according to the provisions in the Ministry of Environment and Forests Order no. 1474/2008 for approving the Procedure on processing, archiving and storage of data specific to the NGHGI. Methods and emission factors selection is done according to the

provisions in the NEPA's President Decision no. 23/2009 for approving the Procedure on selection of the estimation methods and of the emission factors needed for the estimation of the GHG levels.

Activities are carried out at NEPA and comprise:

- primary data processing:
  - check the completeness of all data and information for all years and categories within the analyzed period;
  - complete the datasets, using also default IPCC interpolation/extrapolation and/or alternative techniques;
  - check the accuracy and consistency of datasets;
  - values transformation in order to reach the measurement unit adequate within the method used;
  - data aggregation/disaggregation considering the IPCC classification;
  - calculation and/or adjustment of different parameters considering the available data
- selection of the emission factors and of the methods according to the provisions of the decision trees in the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC GPG 2000) and IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC GPG 2003)

The sources of the emission factors used are: the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 1996), IPCC GPG 2000, IPCC GPG 2003 and plant specific in a very limited number.

The methods used to estimate emissions are mostly Tier 1, Tier 2 for some industrial processes and CORINAIR methods in case of Solvents and Other Product Use sector.

- application of methods;
- emission estimates, using the most recent data

The emissions are estimated using the IPCC 1996, as well as the IPCC GPG 2000. Emissions/removals by sinks in LULUCF sector are estimated using IPCC GPG 2003.

- internal review (errors are rectified);
- preparation of the national inventory report

The NIR adjacent to the 2009 submission of the GHGI was compiled according to the recommendations for inventories set out in the Updated UNFCCC reporting guidelines on annual inventories following incorporation of the provisions of Decision 14/CP. 11 (FCCC/SBSTA/2006/9) and includes detailed information on the inventories for all years from the base year to the year 2007, in order to ensure the transparency of the inventory.

Data archive

Data archiving is done according to the provisions of the Ministry of Environment and Forests Order no. 1474/2008 for approving the Procedure on processing, archiving and storage of data specific to the NGHGI.

NEPA team manages and maintains the NGHGI database and the documentation of specific inventory information. According to the provisions in IPCC GPG 2000, the NGHGI documentation includes:

- assumptions and criteria for selection of AD and EF;
- EF used, including references to the IPCC documents for default factors or to published references or other documentation for emission factors used in higher tier methods;

- AD or sufficient information to enable activity data to be traced to the referenced source;
- information on the uncertainty associated with AD and EF;
- rationale for choice of methods;
- methods used, including those used to estimate uncertainty;
- changes in data inputs or methods from previous years;
- identification of individuals providing expert judgment for uncertainty estimates and their qualifications to do so;
- details of electronic databases or software used in production of the inventory, including versions, operating manuals, hardware requirements and any other information required to enable their later use;
- worksheets and interim calculations for source category estimates and aggregated estimates and any recalculations of previous estimates;
- final inventory report and any analysis of trends from previous years;
- QA/QC plans and outcomes of QA/QC procedures

All inventory information, as far as needed to reconstruct and interpret inventory data and to describe the national system and its functions, is accessible at a single location at the NEPA's headquarters in Bucharest. While all information officially submitted according to the requirements of the Kyoto Protocol is translated into English, this may not be possible for background information made available during the review process as the official inventory documentation language is Romanian.

Specific NGHGI data are archived as follows:
- electronically – all available documents;
- on paper – the documents used for the NGHGI preparation unavailable in electronic format and the correspondence with different organizations

In order to ensure the security of databases and the confidentiality of the background data, both paper and electronic data are kept under strict access conditions. Furthermore, electronic data backup activities are undertaken on NEPA's server with daily frequency during the generation of the official submission and weekly in rest of cases.

Considering the provisions of relevant regulations, NEPA designated the manager of the archiving system.

(d) Description of the process and the results of key source identification and, where relevant, archiving of test data

The key category analysis has been performed according to the provisions of Chapter 7 of IPCC GPG 2000 and Chapter 5 of IPCC GPG 2003.
Separate key category analysis were conducted taking into account both the exclusion and inclusion of the LULUCF sector and also both level and trend criteria; all IPCC sectors and categories, sources and sinks (as suggested in Table 7.1 of IPCC GPG 2000 and in Table 5.4.1 of IPCC GPG 2003), and gases were analyzed. The key category analysis followed a Tier 1 approach.

The key categories are presented in Tables III_ 4 and III_ 5.

Table III_ 4 Summary of key categories in 2007, by level and trend, excluding LULUCF

A. IPCC Source Categories	B. Direct Greenhouse Gas	C. Key Source Category Flag	D. If Column C is Yes, Criteria for identification
Energy			
Agriculture/Forestry/Fisheries-liquid fuels	CO_2	Yes	Trend
Commercial/Institutional-gaseous fuels	CO_2	Yes	Level, Trend
Commercial/Institutional-liquid fuels	CO_2	Yes	Level, Trend
Energy Industries-gaseous fuels	CO_2	Yes	Level, Trend
Energy Industries-liquid fuels	CO_2	Yes	Level, Trend
Energy Industries-solid fuels	CO_2	Yes	Level, Trend
Energy Industries-solid fuels	N_2O	No	
Fugitive emissions-oil and natural gas	CH_4	Yes	Level, Trend
Fugitive emissions-solid fuels	CH_4	Yes	Level, Trend
Manufacturing Industries and Constructions-biomass	CO_2	Yes	Trend
Manufacturing Industries and Constructions-gaseous fuels	CO_2	Yes	Level, Trend
Manufacturing Industries and Constructions-liquid fuels	CO_2	Yes	Level
Manufacturing Industries and Constructions-solid fuels	CO_2	Yes	Level, Trend
Residential-biomass	CH_4	Yes	Trend
Residential-biomass	CO_2	Yes	Level, Trend
Residential-gaseous fuels	CO_2	Yes	Level, Trend
Residential-liquid fuels	CO_2	Yes	Level, Trend
Residential-solid fuels	CO_2	Yes	Trend
Road transport	CO_2	Yes	Level, Trend
Industrial Processes			
CO_2 emission from Ammonia production	CO_2	Yes	Level, Trend
CO_2 emission from Iron and steel production	CO_2	Yes	Level, Trend
CO_2 emissions from Cement production	CO_2	Yes	Level, Trend
CO_2 emissions from Lime production	CO_2	Yes	Level, Trend
N_2O emission from Nitric acid production	N_2O	Yes	Level, Trend
PFC emission from Aluminum production	PFC	Yes	Trend
Agriculture			
Agricultural soils: animal production	N_2O	Yes	Level
CH_4 from enteric fermentation	CH_4	Yes	Level
CH_4 from manure management	CH_4	Yes	Level, Trend
Direct N_2O emissions from agricultural soils	N_2O	Yes	Level, Trend
Indirect N_2O emissions from agricultural soils	N_2O	Yes	Level, Trend
N_2O from manure management	N_2O	Yes	Level
Waste			
CH_4 from solid waste disposal sites	CH_4	Yes	Level, Trend
CH_4 from waste water handling	CH_4	Yes	Trend

Table III_ 5 Summary of key categories in 2007, by level and trend, including LULUCF

A. IPCC Source Categories	B. Direct Greenhouse Gas	C. Key Source Category Flag	D. If Column C is Yes, Criteria for identification
Agriculture/Forestry/Fisheries-liquid fuels	CO_2	Yes	Trend
Commercial/Institutional-gaseous fuels	CO_2	Yes	Level, Trend
Commercial/Institutional-liquid fuels	CO_2	Yes	Trend
Energy Industries-gaseous fuels	CO_2	Yes	Level, Trend
Energy Industries-liquid fuels	CO_2	Yes	Level, Trend
Energy Industries-solid fuels	CO_2	Yes	Level, Trend
Manufacturing Industries and Constructions-gaseous fuels	CO_2	Yes	Level, Trend
Manufacturing Industries and Constructions-liquid fuels	CO_2	Yes	Level, Trend
Manufacturing Industries and Constructions-solid fuels	CO_2	Yes	Level, Trend
Residential-biomass	CH_4	Yes	Trend
Residential-biomass	CO_2	Yes	Level, Trend
Residential-gaseous fuels	CO_2	Yes	Level, Trend
Residential-liquid fuels	CO_2	Yes	Level, Trend
Residential-solid fuels	CO_2	Yes	Trend
Road transport	CO_2	Yes	Level, Trend
Industrial Processes			
CO_2 emission from Ammonia production	CO_2	Yes	Level, Trend
CO_2 emission from Iron and steel production	CO_2	Yes	Level, Trend
CO_2 emissions from Cement production	CO_2	Yes	Level
CO_2 emissions from Lime production	CO_2	Yes	Level
N_2O emission from Nitric acid production	N_2O	Yes	Level, Trend
PFC emission from Aluminium production	PFC	Yes	Trend
Agriculture			
Agricultural soils: animal production	N_2O	Yes	Level
CH_4 from enteric fermentation	CH_4	Yes	Level, Trend
CH_4 from manure management	CH_4	Yes	Level, Trend
A. IPCC Source Categories	**B. Direct Greenhouse Gas**	**C. Key Source Category Flag**	**D. If Column C is Yes, Criteria for identification**
Direct N_2O emissions from agricultural soils	N_2O	Yes	Level, Trend
Indirect N_2O emissions from agricultural soils	N_2O	Yes	Level, Trend
N_2O from manure management	N_2O	Yes	Level
LULUCF			
CO_2 from Forest Land remaining Forest Land	CO_2	Yes	Level, Trend
Waste			
CH_4 from solid waste disposal sites	CH_4	Yes	Level, Trend
Fugitive emissions-solid fuels	CH_4	Yes	Level, Trend
Fugitive emissions-oil and natural gas	CH_4	Yes	Level, Trend
Manufacturing Industries and Constructions-biomass	CO_2	Yes	Trend

Taking into account the exclusion of the LULUCF sector, in 2007:

- 22 categories are considered as key ones both by level and trend;
- 4 categories are considered as key ones, only by level;
- 6 categories are considered as key ones, only by trend

Taking into account the inclusion of the LULUCF sector, in 2007:

- 22 categories are considered as key ones, both by level and trend;
- 4 categories are considered as key ones, only by level;
- 6 categories are considered as key ones, only by trend

The most important key categories in 2007 are:

- CO_2 from Energy Industries - solid fuels;
- CO_2 from Road transport;
- CO_2 from Energy Industries - gaseous fuels;
- CO_2 from Residential - biomass;
- CO_2 from Iron and steel production;
- CO_2 from Forest Land remaining Forest Land

According to the UNFCCC reporting guidelines on annual inventories, the complete results of the key category analysis are presented, for the last year of the analyzed period, in the Annex 1 of the National Inventory Reports using the template provided by Tables 7A1-7A3 of IPCC GPG2000 and by Tables 5.4.5, 5.4.7 and 5.4.8 of IPCC GPG 2003.

(e) Description of the process for the recalculation of previously submitted inventory data

According to the relevant provisions in Chapter 7 of the IPCC GPG 2000 and to those in the Ministry of Environment and Forests Order no. 1376/2008 for approving the Procedure on NGHGI reporting and the modality for answering to the observations and questions raised following the NGHGI review, NEPA recalculates the emissions/removals estimates in the following cases:

- available data have changed;
- the previously used method is not consistent with good practice guidance for that source category;
- a category has become a key category;
- the previously used method is insufficient to reflect mitigation activities in a transparent manner;
- new methods become available;
- inclusion of new source/removal categories;
- changes in the activity data and emission factors acquisition and use;
- correction of identified errors;
- other cases in accordance with the relevant good practices

Regardless of their magnitude, NEPA recalculates the estimates for every year of the analyzed period, between the base year and the last reported year. Recalculations are done using a single method for all years, including, when needed, alternative techniques as interpolation, extrapolation and other relevant techniques.

The information on recalculations are reported within the CRF Tables and within the NIR, and comprise their rationale, information on procedures used, information on changes at methods, emission factors and activity data used level and information on source/removal categories not previously analyzed.

(f) Description of the quality assurance and quality control plan, its implementation and the quality objectives established, and information on internal and external evaluation and review processes and their results in accordance with the guidelines for national systems

Romania established the QA/QC Procedure based on the UNFCCC and Kyoto Protocol's provisions related to the GHG Inventory and the national system, the IPCC 1996 and IPCC GPG 2000 provisions, and to the Governmental Decision no. 1570/2007 establishing the National System for the estimation of the anthropogenic GHG emissions levels from sources and removals by sinks. QA/QC activities are both described within the QA/QC Programme and within the QA/QC Procedure related to the NGHGI, approved by the NEPA's President Decision no. 24/2009.

The documents comprise information on:

- the national authority responsible for the coordination of QA/QC activities;
- the objectives envisaged within the QA/QC framework;
- the QA/QC Plan;
- the QC procedures;
- the QA procedures

According to the provisions of the Governmental Decision no. 1570/2007 establishing the national system and to those in the NEPA's President Decision no. 24/2009, NEPA represents the competent authority responsible with the implementation of the QA/QC activities under the NGHGI. For this purpose, NEPA is performing the following activities:

- ensures that specific QA/QC objectives are established;
- develops and regularly updates a QA/QC plan;
- implements the QA/QC procedures

Considering the provisions of relevant regulations, NEPA designated a QA/QC coordinator.

The overall objective of the QA/QC programme/procedure is to develop the NGHGI in line with the requirements of the IPCC 1996, IPCC GPG 2000 and IPCC GPG 2003 and with the provisions of the UNFCCC and Kyoto Protocol COP decisions.

The specific quality objectives of the QA/QC programme/procedure and those application are an essential requirement in the GHG inventory development and submission processes in order to ensure and improve the implementation of the inventory principles: transparency, consistency, comparability, completeness and accuracy of the national emissions and removals estimates for the purposes of meeting Romania's reporting commitments under the UNFCCC, Kyoto Protocol and under the provisions of the Decision 280/2004/EC of the European Parliament and of the Council and of the Decision 166/2005/EC of the European Commission concerning a mechanism for monitoring Community GHG emissions and for implementing the Kyoto Protocol. They are required for providing concrete and measurable indicators regarding the standard that is aimed for the NGHGI preparation and reporting process. If necessary, they may be reviewed when revising the programme/procedure. The specific objectives comprise:

- Objectives for ensuring the transparency are referring to:
  - providing transparent information in the NIR;
  - providing sectoral background data tables of the CRF based on the aggregation allowed by methodologies and activity data;
  - providing documentation for the use of estimation algorithm on missing activity data;
  - using the notation keys as indicated in the UNFCCC guidelines;
  - addressing the recommendations related to transparency provided in the review reports,

during the preparation of the following inventory submission;
  - providing full documentation on quality checks used in the QA/QC procedures;
  - presenting in the NIR a summary of the improvement of transparency comparing with the previous submission.

- Objectives for ensuring the completeness are referring to:
  - reporting estimates for all sources and sinks and for all gases included in the IPCC guidelines as well as for other relevant source/sink categories;
  - reporting all emissions estimates by sources and removals by sinks from land use, land-use change and forestry (LULUCF) activities under Article 3.3 of the Kyoto Protocol and the elected activities under Article 3.4 of the Kyoto Protocol (forest management and revegetation);
  - reducing the use of the estimation algorithm for missing activity data annually, aiming to avoid its use completely;
  - addressing the recommendations related to completeness provided in the review reports, during the preparation of the following inventory submission;
  - providing all CRF tables/CRF Reporter including complete sectoral background data tables of the CRF, where similarities in methodologies or activity data used allow an aggregation;
  - providing information in the NIR on completeness of NGHGI;
  - providing a summary in the NIR regarding the changes related to completeness of NGHGI and the improvements of completeness from the previous submission.

- Objectives for ensuring the consistency are referring to:
  - maintaining a consistent time-series of emissions/removals;
  - undertaking the recalculations in a systematic and timely manner to account for any new knowledge and for the solutions of the problems identified;
  - addressing the recommendations related to consistency provided in the review reports, during the preparation of the following inventory submission;
  - providing information in the NIR on consistency and recalculations of NGHGI;
  - explaining the major trends and sharp increases/decreases of time series emissions in the NGHGI;
  - compiling and highlighting the issues related to time series consistency of NGHGI during the QC procedures and resolving the inconsistencies encountered;
  - eliminating all the inconsistencies between NIR and the CRF tables.

- Objectives for ensuring the comparability are referring to:
  - using the methodologies, procedures and formats agreed upon under the UNFCCC and the Kyoto Protocol for estimating and reporting the national GHG emissions and removals by sinks;
  - allocating the emissions and removals to source and sink categories in accordance with the aggregation level presented in the IPCC 1996, IPCC GPG 2000, IPCC GPG 2003 and in the UNFCCC and Kyoto Protocol COP decisions.

- Objectives for ensuring the accuracy are referring to:
  - providing the quantitative uncertainty estimates for the NGHGI;
  - using tier 2 or higher tier methods for estimating emissions from key categories as far as possible considering the availability of activity data;
  - providing information in the NIR on uncertainties of parameters under the NGHGI;
  - providing a summary of improvements concerning uncertainties performed from the previous submission;
  - providing a summary in the NIR regarding the changes in the uncertainty values of the

NGHGI and the improvement of uncertainty values from the previous submission.

Romania's QA/QC plan closely follows the definitions, guidelines and processes presented in Chapter 8 – Quality Assurance and Quality Control of the IPCC GPG 2000. The QA/QC plan constitutes the heart of the QA/QC procedures. It outlines the current and planned QA/QC activities. The specific QA/QC activities are performed during all stages of the inventory preparation.

The QA/QC plan is reviewed periodically, if needed, being modified as appropriate when changes in processes occur or based on the advice from independent reviewers.

QC activities

The following QC activities are conducted annually before and during the preparation of estimates (15 September-30 October):

- checking the specific requirements regarding the reporting deadlines;
- verification of the collection of data against the information needed;
- checking the correct transcription of input data from the format they were provided into the calculation sheets;
- checking the correctness of conversion factors to be used in calculation;
- checking the data structures integrity and the disaggregating of activity data at calculation sheets level;
- checking the concordance between the measurement units of data in the calculation sheets and the equivalent data in the CRF Reporter format;
- checking the consistency and the data values magnitude order used in the AD and EF series, at the calculation sheets level;
- identifying parameters common to multiple source categories or sinks and checking the values consistency between source categories or sinks;
- checking the emissions calculation into the calculation sheets by reproducing a representative sample calculation;
- checking the correctness of the aggregation of estimated emissions at the calculation sheets level

The following QC activities are conducted annually during and after the preparation of estimates (15 October -10 January-10 March):

- checking the emissions estimates existence for all sources and sinks and for the entire time series;
- checking the explanations existence when the emissions estimates are lacking;
- checking the correctness and consistency of choosing the AD, EF and methods used along the entire time series;
- checking the trends for identifying the outliers and re-analyze the values;
- checking the correctness of recalculations and the existence of explanations;
- checking the recording and archiving of AD, EF and methods used;
- checking the correctness and the completeness of the data transcription from the calculation sheets level to the CRF Reporter level;
- checking the correctness and the completeness of the data transcription from the CRF Reporter level to the CRF tables level;
- checking the data used in the NIR against the CRF tables and calculation sheets;
- checking the correctness of applied methods description, at the NIR's level;
- checking the references completeness at the NIR's level;
- checking the archiving of the CRF tables, NIR, „xml" database and of the CRF Reporter's specific databases, including the calculation sheets;
- checking the key sources persistency along the time series;

- checking the adequate qualification of individuals providing expert judgments on the uncertainty estimates and the archiving of documentation regarding the qualification and the expert judgments;
- checking the uncertainty calculation correctness by partially replying the Monte Carlo analysis;
- verification of the ERT recommendations implementation;
- checking the completeness of the QA/QC documentation archiving: QA/QC programme, checklists, ERT report, improvements lists;
- checking the QA/QC programme performance and propose improvements

The results of all checks outlined above are documented in the annual QC checklist for inventory preparation. For this purpose QC checklists are used consistently throughout the years by all experts involved in the inventory preparation.

Additionally to the above mentioned activities, according to the provisions in the IPCC 1996, IPCC GPG 2000, IPCC GPG 2003 and in the UNFCCC and Kyoto Protocol COP decisions, NEPA plans to conduct quality control specific activities, relevant to the key categories and to the categories affected by significant recalculations.

QA activities

By becoming an European Union Member State from the 1st of January 2007, Romania is obliged to prepare and submit the NGHGI according to the Decision 280/2004/EC of the European Parliament and of the Council and Decision 166/2005/EC of the European Commission, which provides for a QA activity after the first submission of data on 15th of January and a final QA of all 27 EU Member States after 15th of March for the preparation of the EC inventory. In this respect, starting with 2007, Romania has the possibility to verify the inventory twice before the official submission to the UNFCCC Secretariat.

In order to get an objective assessment of the inventory quality and for identifying areas where improvements can be made, NEPA involve third party reviewers at the QA activities level according to the provisions in IPCC GPG 2000, depending on the availability of resources. In this scope, NEPA is developing the specific procedural arrangements. ME through its international contacts and bilateral agreements supports NEPA in identifying the available processes for ensuring the implementation of QA activities.

Until now, NEPA was the beneficiary of technical support provided by the Austrian Environment Agency (as part of the twinning project RO/2006/IB/EN/09). One of the most important activities performed within this framework was the review of different sectors of the NGHGI. Austrian experts provided specific recommendations comprising:

- improvement of transparency at sectoral level considering the trend and recalculations description;
- improvement of transparency at sectoral level by providing a cumulative table on the status of emissions/removals estimation for every sub-sector;
- improvement on knowledge on practical ways of performing and documenting the QA/QC activities;
- improvement of the NGHGI archiving structure

For 18 month starting with March 2009, NGHGI team will be the beneficiary of a Netherlands Government to Government (G2G) project. One of its main aims is to develop the reporting capacity of the GHGI team also by assessing the possibility to use higher tier methods. Specific proposed activities comprise:

- Training courses/presentations on use of data specific to different reporting mechanisms at the GHG Inventory level; use of the IPCC 2006 methodology
  - use of ETS/LCP/EMEP-CORINAIR data;
  - use of COPERT model;
  - use of IPCC 2006 methodology/data versus IPCC 1996
- Peer review of every sector of the NGHGI. Detailed advices for improvement (including training courses/presentations of practical ways to move on higher tiers);
- Advices on moving on Tier 2 at the Enteric Fermentation, Manure Management and Agricultural Soils levels;
  - precise identification of activity data needs;
  - training courses/presentations on elaborating the specific requirements for a potential emission factors/other parameters study development;
  - presentations of other relevant advices
- Advices on moving on First Order Decay method at the Solid Waste Disposal Sites level;
- Assessment of the uncertainty analysis. Recommendations for improvement;
- Identification of the practical ways to complete the estimation of emissions/removals from Land converted to Forest Land (5A2), Cropland (5B), Grassland (5C), Wetlands (5D), Settlements (5E) and Other Land (5F)
  - precise identification of data and methodological needs for a Tier 1 approach;
  - training courses/presentations/technical assistance for completing the estimates
- Identification of the practical ways to complete the estimation of emissions/removals specific to Kyoto Protocol's Art. 3.3 and 3.4 activities: afforestation/reforestation/deforestation, forest management and revegetation
  - precise identification of data and methodological needs;
  - training courses/presentations/technical assistance for completing the estimates;
  - assessing the current system; make recommendations

National inventory submissions to the UNFCCC Secretariat are subject to the review procedures defined in the relevant COP/MOP decisions.

All recalculations planned and done (including those following the UNFCCC ERT review) are mentioned in the improvements list.

The results of QA checks (excepting the ERT report) are documented in the annual QA checklist for inventory preparation. For this purpose, QA checklists are used consistently throughout the years by all inventory experts involved in the inventory compilation.

(g) Description of the procedures for the official consideration and approval of the inventory

According to the provisions of the Ministry of Environment and Forests Order no. 1376/2008 for approving the Procedure on NGHGI reporting and the modality for answering to the observations and questions raised following the NGHGI review, after elaboration NEPA is sending the GHGI to the Ministry of Environment and Forests for evaluation and checking.

The potential observation/comments from ME made with the aim of improving the quality of the GHGI, are then analyzed by NEPA; as appropriate, NEPA is updating the GHGI and re-send it to the ME.

Considering the algorithm defined within the Governmental Decision no. 1570/2007 for establishing the National System for the estimation of anthropogenic greenhouse gas emissions levels from sources and removals by sinks, these activities are performed considering strict

deadlines, in order to allow for a timely official submission to the relevant international organizations.

III.D. NATIONAL REGISTRY

According to the Kyoto Protocol reporting guidelines (para 32), each Annex I Party shall provide a description of how its national registry performs functions defined in the annexes to decisions 13/CMP.11 and 5/CMP.12, and conformity with the requirements of the technical standards for data exchange (DES), including:

(a) The name and contact information of the registry administrator designated by the Party to maintain the national registry

Contact information on the registry administrator:

Romanian National Environmental Protection Agency
Atmosphere Protection and Climate Change Department
Address: Splaiul Independentei no. 294, Bucarest
Telephone: (+4) 021 207.11.28
Fax: 021 207.11.28
e-mail: romanian.registry@anpm.ro

Registry Manager - Mrs. Hortensia DUMITRIU:
Phone: (+ 4) 021 207 11 28
Fax: (+4) 021 207 11 28
Email: hortensia.dumitriu@anpm.ro

Registry Staff:

Adriana MARSOLEA:
Phone: (+4) 021 207 11 28
Fax: (+4) 021 207 11 28
Email: adriana.marsolea@anpm.ro

Valentina STERIAN :
Phone: (+4) 021 207 11 28
Fax: (+4) 021 207 11 28
Email: valentina.sterian@anpm.ro

Host - Innofactor Ltd
Tekniikantie 12, FIN – 02150 Espoo, Finland
Email: contact@innofactor.com
http://innofactor.com
Phone: (+3) 58 9 2517 2520
Fax: (+3) 58 9 2517 2521

(b) The names of the other Parties with which the Party cooperates by maintaining their national registries in a consolidated system

Romania does not cooperate with other countries concerning the administration or operation of the Romanian emissions trading registry.

(c) A description of the database structure and capacity of the national registry

The registry is implemented using a Microsoft SQL Server relational database management system with a dedicated data model for supporting registry operations.

(d) A description of how the national registry conforms to the DES between registry systems for the purpose of ensuring the accurate, transparent and efficient exchange of data between national registries, the clean development mechanism registry and the transaction log (decision 19/CP.7, para 1)

The Romanian registry system follows the UN Data Exchange Standards 7. Annex A.III.1 records the Interoperability Testing of the candidate Registry system with ITL, operated as part of the ITL Registry Initialization Process by LogicaCMG and Trasys on behalf of UNFCCC. The specifications for Registry Initialization Testing – encompassing Interoperability – are set out in DES Annex H.

The Incident and Problem Management processes are employed to record, track and progress resolution of failures identified during Interoperability evaluation and testing.

(e) A description of the procedures employed in the national registry to minimize discrepancies in the issuance, transfer, acquisition, cancellation and retirement of emission reduction units (ERUs), certified emission reductions (CERs), temporary certified emissions reductions (tCERs), long-term certified emission recutions (lCERs), assigned amount units (AAUs) and/or removal units (RMUs), and replacement of tCERS and lCERs, and of the steps taken to terminate transactions where a discrepancy is notified and to correct problems in the event of a failure to terminate the transactions

In order to prevent all discrepancies between the Romanian ETR and the central registries (CITL and ITL), the following activities have been adopted within the registry systems:

- all communication between the National Registry and the ITL is performed using the web-services utilizing the XML messages, as specified in the Data Exchange Standards; where possible, prior to data being sent from the registry to ITL, the registry validates the data
- against predefined conditions, in order to minimize sending incorrect information to the ITL;
- all units that are involved in a transaction are "earmarked" in the registry, thus preventing the units from being involved in another transaction until a response has been received from the ITL and the current transaction has been completed;
- the web-service that sends the messages to the ITL for processing ensure that an acknowledgment is received from the ITL before completing the tasks defined in the message. If an acknowledgment message has not been received after a number of retries, the web-service will terminate the submission and roll-back any changes made to the unit blocks that were involved within the transaction;
- when a 24 hour clean-up message is received, the existing web-service will roll back the pending transaction defined in the clean-up message and the units that were involved are set active again (instead of being unavailable, due to being reserved for the transaction), thus preventing any discrepancies in the unit blocks between the Registry and the central registries;
- finally, if an unforeseen failures were to occur, the data discrepancies between Romanian ETR and the CITL/ITL can be identified by running a reconciliation, and corrected using a

manual intervention function. Reconciliations and manual interventions will be performed until it is validated that the data is in compliance between the Romanian ETR and the CITL/ITL.

(f) An overview of security measures employed in the national registry to prevent unauthorized manipulations and to prevent operator error and of how these measures are kept up to date

The following security measures are adopted in the Romanian ETR registry in order to prevent unauthorized manipulations and minimize operator errors:

- access to the registry is restricted by a user name and a password;
- the actions that a user can perform are controlled by a permission system, thus it is possible to prevent unauthorized access to the chosen functionalities, such as national allocation plan modification. In the Romanian registry, the user rights are set so that the users will only have access to the functionalities they need;
- all activities in the registry are recorded and monitored regularly;
- validation of all user inputs are carried out in order to ensure that only valid details are submitted for further processing;
- database interventions are only carried out by validated procedures and professional personnel, over protected connections. Database is not accessible directly from an outside network, but only from the internal network of the hosting environment.

(g) A list of the information publicly accessible by means of the user interface to the national registry

As requested by the European Commission Regulation no. 2216/2004, Annex XVI, data publicly available (excluding confidential data) posted on the Romanian Registry site (rnges.anpm.ro) are the following:

- persons holding accounts: contact data;
- operators holding accounts: PAR/SAR contact data;
- national accounts administrator contact data;
- National Allocation Plan, and list with installations accessing the New-Entry Reserve;
- Number of units (ERUs, CERs and AAUs) cancelled and retired;
- Operators verified emissions for 2008.

(h) The Internet address of the interface to its national registry

The Internet address of the interface to its national registry is http://registry.anpm.ro .

(i) A description of measures taken to safeguard, maintain and recover data in order to ensure the integrity of data storage and the recovery of registry services in the event of a disaster

Network errors
LAN
All switches used in the production network have 24/7 warranty and support services with 4-hour response time. All critical switches have been duplicated and have a stand-by switch that can handle the critical network services in case of a hardware failure. Firewalls are duplicated in Innofactor's network, and hardware errors on them do not make the services unusable. Firewalls have 24/7 warranty and support services with 4-hour response in case of a hardware failure.

WAN

WAN services are provided by Elisa Plc. Innofactor has a service level agreement that guarantees two hours response time in network failures. In addition, there is a guarantee of fixing the service in 12 hours in any case. Both guarantees are given by Elisa Plc.

Hardware errors on the servers
The most probable hardware errors on server computers occur on hard drives and power supplies. Both are duplicated in production environment, and hardware errors on them should not result in server shutdown. All production servers have 24/7 warranty and support services with 4-hour response time.

This means that most of the hardware errors can be corrected in 6 to 8 hours (4 hour response time and 2 to 4 hours time for repairing the hardware). If hardware error has resulted in data loss, after correcting the hardware error, the Registry software and the necessary data has to be recovered according to software and data recovery plan.

Software errors
Common reasons for data corruption are failed software upgrade, security fix installation, hardware malfunction or unexpected server shutdown. Software recovery consists currently of three phases:

1. First phase is to recover the operating system and the other requirements of the registry. Operating system installation can be done in 1 to 3 hours per server. Installing the required software takes additional hour per server.
2. Next phase is reinstalling the registry, which takes about two hours per registry.
3. Final phase is importing the data from the backups to the servers and bringing them online. This phase is estimated to take 30 to 60 minutes, provided the backup system and on-site backups are available.

Server facilities
Recovery from a total destruction in server facilities takes days of weeks. If disaster is limited to server premises only, services can be rerouted to secondary server premises in the same building in the time required to reroute Internet connections, which takes 1 to 3 days. If the servers are unusable, the registry can be installed on workstation computers taken from the Innofactor network and reinstalled with server software. This can be done in the same timeframe than the rerouting of the Internet connections.

Recovery plan in the event of complete disruption of the host environment
Minimum hardware and software requirements to host registry on temporary basis

Temporary hosting of the registry software can be done with the following hardware and software:

- database server
  - modern, Intel-compatible processor
  - gigabyte of RAM (2 gigabytes recommended)
  - 80 gigabytes of hard disk
  - Windows Server 2003 Standard Edition (license and media available at the location)
  - SQL Server 2000 Standard Edition (license and media available at the location)
- application server
  - modern, Intel-compatible processor
  - 1 gigabyte of RAM
  - 80 gigabytes of hard disk installed
  - Windows Server 2003 Standard Edition (license and media available at the location)

- network connection
  - Services can be made visible to the public network (tcp ports 80 and 443 made visible)
  - Possibility to build a VPN ITL (Firewalls compatible with ITL VPN connection)

Recovery plan
The following procedure will be obeyed in the event of a complete disruption of the host environment:

1. Redirect registry's web site to the URL that indicates that the system is under maintenance;
2. Contact CITL/ ITL to disable national registry's processes at the CITL/ ITL;
3. Establish required server environment in alternative facility;
4. Install and configure Greta software (database, web-services and application) on the server environment;
5. Roll back latest available backup to the database;
6. Enable the registry's web site and the web services with access restricted to admin users;
7. Keep national registry's processes at the CITL/ITL disabled, run reconciliation to ensure data consistency of the national registry database. If reconciliation fails, perform needed manual interventions and repeat the phase as long as the reconciliation is completed;
8. When reconciliation is completed successfully, enable national registry's processes at the CITL/ ITL;
9. Test connectivity and transfer functionalities of the national registry;
10. When tests are successfully completed, allow access to the national registry to all users.

If the hosting customer of Innofactor Ltd has agreed on continuous consultancy service, part of the amount of work reserved monthly for the continuous consultancy service can be used for keeping the disaster recovery strategy up-to-date and training the disaster recovery on a regular basis.

(j) The results of any test procedures that might be available or developed with the aim of testing the performance, procedures and security measures of the national registry undertaken pursuant to the provisions of decision 19/CP.7 relating to the technical standards for data exchange between registry systems.

In Annex A.III_2 is presented the "Test Results and Evaluation Report" for ETS GoLive Plan MS Registry Testing - Registry of Romania, based on specific activities performed in 2008.
In Annex A.III_3 is presented the Report regarding Test Evaluation of the Greta software upgrade, the latest test performed by RO Registry, in 2009.

IV. POLICIES AND MEASURES TO MITIGATE GHG EMISSIONS

IV.A. POLICY MAKING PROCESS

On January 1st, 2007, Romania has joined the EU, finalizing a process that took more than 10 years (since 1995). The efforts of regulatory harmonization due by the date (and thereafter) concern all ranges of policies and measures, including those referring to the energy efficiency, pollution prevention and control, GHG emissions reduction.

Romania signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 at the Earth Summit in Rio de Janeiro, and ratified it by Law no. 24/1994, being included in the Annex I as a country with economy in transition. By ratifying this Convention, Romania presented clearly its concern for the global climate change process and its political will to fulfill the commitments under the Convention.

The Kyoto Protocol was approved in 1997, at the third Conference of the Parties to the Convention, in order to establish clear measures, targets and deadlines for developed countries to reduce GHG emissions. Romania signed the Kyoto Protocol in 1999 being the first Annex I Party to ratify it by Law no. 3/2001. The target adopted by Romania is 8% in the first commitment period 2008-2012, comparing to a different base year (1989). The Kyoto Protocol entered into force and became legally binding at international level on 16 February 2005.

The existing institutional framework in Romania in the field of climate change consists of institutions described below:

The Ministry of Environment and Forests (ME), which has the following responsibilities in the field of climate change:

- developing national policy on climate change and coordination of the activities pertaining to the implementation of this policy at central, regional and local levels;
- coordinating the development, implementation and updating of the National Strategy on Climate Change and the National Action Plan on Climate Change;
- ensuring the integration of policies on greenhouse gas emission reductions into other sectoral policies;
- coordinating the national system for estimating emissions/removals;
- acting as UNFCCC focal point and representing the Romanian Government in UNFCCC negotiations and other international meetings on climate change;
- coordinating the implementation of the flexible mechanisms as required by the Kyoto Protocol;
- participating in the transposition and coordination of the implementation of EU emission trading legislation with its amendments; and
- chairing the National Commission on Climate Change.

The ME is technically supported by the National Environmental Protection Agency (NEPA), which was established on the basis of Governmental Decision no. 459/2005. NEPA as a specialized body has legal status and it is subordinated to the ME. It is responsible for ensuring the implementation of the environmental protection related strategies, policies and legislation, including climate change. The main responsibilities related to climate change are:

- maintenance and updating of the greenhouse gas inventory;

- compliance with any other reporting requirements;
- improvement and operation of the National Registry on GHG emissions and its maintenance, which plays an important role in the implementation of the flexible mechanisms and EU Emissions Trading Scheme; and
- coordination of the relevant activities developed at regional and local level by regional and local environmental protection agencies.

For a better coordination between the ministries, the National Commission on Climate Change (NCCC*)* has been established by Governmental Decision no. 1275/1996, (amended in 2006), as a consultative body which aims to support the integration of climate change policy within other sectoral policies and to provide advisory services related to the approval of the National Communications and GHG inventories, as well as the approval of JI projects and emission trading activities. According to the current environmental regulation, almost all of the ministries have to implement environmental protection measures (including climate change) in their sectoral policies; therefore, those ministries are part of the institutional framework.

IV.B. DOMESTIC AND REGIONAL PROGRAMMES

Romania's current political outlook regarding environmental protection presents a pro-active approach that is mainly shaped by the approximation of national policy to EU standards. Chapter 19 of Romania's Governmental Programme 2009-2012 (adopted in December 2008) stipulates specific priorities for climate change mitigation and adoption of specific policies and measures in order to stabilize GHG emissions (promote the decrease of energy consumption through the use of efficient energy technologies, thermal insulation of residences and through sustaining the use of less polluting vehicles; promoting the cheap and clean energy production from renewable sources; identifying and implementing of feasible measures on carbon capture and storage).

Important parts of these commitments are already being implemented, such as the development of institutional capacity at the national level. Other provisions of the government's program concerning climate change were also developed, like the establishment of the legal procedure for the national system of assessing GHG emissions, the national registry and the adaptation measures.

The Governmental Decision no. 1570/2007 for establishing the National System for the estimation of anthropogenic GHG levels and the subsequent relevant procedures supports NEPA in the preparation of the National Greenhouse Gas Inventory by defining a legal, institutional and procedural framework to involve actively all the relevant responsible public authorities, different research institutes, economic operators, and professional associations.

The following three stages are considered in the elaboration of the inventory: planning, preparation and management. In the first stage specific responsibilities are defined and allocated, the second stage refers to inventory preparation process (data collection, relevant information needed for estimating emissions, methodological choices) and the third stage refers to the inventory management that also includes quality management, as well as documentation on QA/QC activities.

Romania's Governmental Programme stipulated before 2008 specific priorities for climate change mitigation and adoption of specific policies and measures in order to reduce GHG emissions.

Important parts of this commitment were implemented:

- elaboration of the National Strategy on Climate Change (NSCC) adopted in 2005
- elaboration of the National Action Plan on Climate Change (NAPCC)
- development of institutional capacity at the national level
- implementation of the National Registry
- updating of the GHG inventory
- establishment of the legal procedure for the national system of assessing GHG emissions
- elaboration of the guide for adaptation measures

The existing legal framework in Romania in the field of climate change allows for a coherent application of the UNFCCC and the Kyoto Protocol, consisting of:

- primary legislation, including specific acts on climate change;
- general environmental regulations, including climate change aspects;
- specific legislation related the sectors to energy, transport, agriculture and forestry, and waste management.

The primary legislation mainly contains multilateral environmental treaties in the field of climate change and the strategies and action plans developed for the implementation of these treaties. Ratification of the UNFCCC and the Kyoto Protocol are included in this category, as well as their related strategies and action plans.

As part of its commitments under the UNFCCC, Romania has submitted four national communications so far.

The general environmental regulation that includes climate change aspects refer to:

- environmental protection, containing special chapters regarding atmosphere protection, climate change, emissions trading, national registry, national inventory and the general requirements concerning the environmental permit, the control procedure, and others.
- atmosphere protection.
- integrated pollution prevention and control.

Some specific legal acts related to energy, transport, agriculture and waste include or refer to climate change aspects:

- Governmental Emergency Ordinance no. 124/2001 regarding the establishment, organization and operation of the Romanian Energy Efficiency Fund, as approved with amendments by Law no. 287/2002;
- Law no. 199/2000 regarding the efficient use of energy;
- Law no. 318/2003 regarding electric energy;
- Governmental Decision no. 443/2003 regarding the promotion of energy produced from renewable sources (transposing EU Directive 2001/77/EC);
- Governmental Decision no. 349/2005 on landfilling of waste (transposing EU Directive 1999/31/EC);
- Governmental Decision no. 541/2003 on the limitation of emissions from large combustion plants, as amended by Governmental Decision no. 322/2005 (transposing the EU Directive 2001/80/EC);
- Law no. 26/1996 – The Forest Management Code, as amended;
- All regulation regarding the EU ETS in Romania, adopted between 2006 and 2009
- ToRs regarding the application for financing under the EU integration funds.

Joint Implementation Mechanism in Romania

Article 6 of the Kyoto Protocol specifies that „for the purpose of meeting its commitments under Article 3, any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units (ERUs) resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy, provided that:

a. Any such project has the approval of the Parties involved;
b. Any such project provides a reduction in emissions by sources, or an enhancement of removals by sinks, that is additional to any that would otherwise occur;
c. It does not acquire any emission reduction units if it is not in compliance with its obligations under Articles 5 and 7;
d. The acquisition of emission reduction units shall be supplemental to domestic actions for the purposes of meeting commitments under Article 3."

In Romania, the JI projects may be developed on the clear procedures in accordance with those Track I and Track II.

JI is one of the two mechanisms so called "project based" mechanisms and involve investment in projects through which the (Investor) Parties may obtain emissions reductions at reduced costs; therefore achieving their own GHG emissions reduction commitments while developing JI (and CDM) projects in other countries.

International emissions trading allows countries included in Annex B of the Kyoto Protocol (similar to Annex I of Convention) to trade Assigned Amount Units (AAUs). This way a country that reduced GHGs emissions compared with its Annex B target has the possibility to sell the surplus achieved to another country witch hasn't met the emissions reduction target.

Romania successfully participates in the development of "Joint Implementation" projects based on the cooperation with different countries, for the reduction of greenhouse gas emissions. Romania has initiated and continues to develop bilateral cooperation with different states, for the development of this type of projects.

Romania signed 10 Memoranda of Understanding with different developed countries (Switzerland, the Netherlands, Norway, Denmark, Austria, Sweden, France, Italy and Finland), as well as with the World Bank's Prototype Carbon Fund, representing the legal framework for the development of JI projects.

Until now, 17 JI projects were approved and are in different stages of development. The total quantity of emission reductions to be generated by these projects is about 14 million tones of CO_2 equivalent (for the period 2008-2012, and in some cases before 2008), and the transfer is performed by the ME only based on the monitoring reports of the effective emissions reductions verified by accredited independent entities. The main projects approved are in the local authorities' area, such as: district heating systems (including the use of renewable energy sources – sawdust and geothermal energy), closing up of urban waste landfills. These investments have a positive impact not only by GHG emissions reductions, but also for the environment generally or from social point of view (providing of comfortable conditions at reasonable prices.

For Romania, the JI projects can be developed in areas as:

- co-generation installations
- fuel-switching in energy productive or industrial installations
- district heating systems;

- energy production installations creating clean energy (especially hydro-electric, geothermal, wind, solar, biogas or biomass)
- recovery of methane generated by urban waste landfills
- thermal rehabilitation of buildings
- reducing GHG emissions in the transport sector
- reducing GHG emissions in the agriculture sector
- afforestation and/or reforestation

The two Tracks of JI projects have following characteristics:

Track I allows the host country to use national guidelines for approving projects and for monitoring and verifying GHG's emission reductions. Track I allows host countries of JI projects to introduce national simplified procedures in comparison to JI Track II which must be in accordance with procedures establish by JISC. The eligibility criteria for using the Track I for participates countries (equal to those for IET), among which:

- Party to the Kyoto Protocol
- Assigned amount calculated
- National system in place for estimating emissions/removals
- National registry in place for tracking assigned amount
- Submission of most recent required emissions inventory
- Transmission of additional requested information

Since 2008, Romania can approve JI projects using its Track I procedures.

Track II applies if host country complies with only 3 conditions: is Party to the Kyoto Protocol, the assigned amount is calculated, and a national registry is in place. Under Track II, international oversight under a framework of very strict rules and guidelines has the key role in validation and verifying the emission reductions from a JI project.

ME is supported by the National Commission on Climate Change (NCCC) in the climate change related decision making process and for the approval of the JI projects.

NCCC acts as the main advisory body on JI approval advice to the ME. NCCC is an inter-ministerial consultative body consisting of representatives from the ministries relevant for the implementation of national policies on climate change.

The final decision about issuing a Letter of Endorsement or a Letter of Approval belongs to the Minister of Environment and Water Management, taking into account the NCCC advice.

European Union Emissions Trading Scheme

Romania participated in the EU ETS in the last year of Phase I of the scheme (2007); though several malfunctions at the level of GHG Registry prevented the companies to actively trade EUAs. Currently (second phase of the EU ETS) all malfunctions have been solved and companies included in the EU ETS may actively benefit from the rules of the ETS.

In drawing up the NAP for 2007 and 2008-2012 periods, Romania took into account the Guidance Document published by Commission for assisting Member States in the implementation of the criteria as listed in Annex III of Directive 2003/87/EC and the extended scope for the definition of "combustion installation" as it had been agreed by EC in the Climate

Change Committee on 31st of May 2006. The Romanian NAP was prepared through a working group coordinated by the Ministry of Environment and Forests.

After rounds of consultation with the Romanian authorities regarding the principles and the amount of allowances allocated for each installation falling under the provisions of Directive 2003/87/EC, in October 2007 the Commission decided on NAP 2007 and 2008-2012 as follows:

- the total amount of allowances for 2007 to be 10% less than the national cap proposed by the Romanian authorities (74,343,356 allowances) and
- the total amount of allowances for 2008–2012 to be 20.7% less than the national cap proposed by the Romanian authorities (349,671,593 allowances)

The Commission's decisions were implemented by the Romanian Government through GD no. 60/2008 approving the National Allocation Plan and establishing that:

- allocation of allowances is free of charge;
- New Entrants Reserve (NER) is established only for the second period of the scheme and not for 2007;
- project credits (ERUs and CERs) can be used up to 10% of the total quantity allocated to installation;
- auction is not used as allocation methodology for 2007 and 2008–2012; the Government will auction only the unused allowances from NER at the end of 2012;
- Early Action Reserve for 2008–2012 was established at 4.48% from the total amount of allowances;
- a JI set-aside for JI projects for 2008–2012 (as requested by Decision 2006/780/EC) was established at 1.91% from the total amount of allowances;
- a cogeneration Reserve for 2008-2012 for CHP installations with overall efficiency higher that 65% was established at 0.95% from the total amount of allowances;

The competent authorities with responsibilities in the ETS implementation chain are:

- Ministry of Environment and Forests - preparation of legislation related to the ETS, and overall coordination of ETS;
- National Environmental Protection Agency - implementation of the ETS;
- Regional Environmental Protection Agencies (REPAs)/Local Environmental Protection Agencies (LEPAs) - issuing GHG permits for IPPC installations/non-IPPC installations, checking GHG monitoring and reporting plans;
- National Environmental Guard – enforcement of penalties, site inspections;
- Ministry of Economy - accreditation of verifiers

Other projects

UNDP/GEF's Energy Efficiency Financing Team in Romania (2003 – 2006)

In 2003, UNDP/GEF set up an Energy Efficiency Financing Team in Romania, comprising experts in energy efficiency policy, engineering, banking, finance, communications and administration. The Team's mission was to persuade companies and municipalities to invest in energy efficiency, hence lowering GHG emissions, and to build local capacity for this type of GHG-friendly investment to continue in the future.

The Government of Romania, UNDP and GEF agreed a target for the Project - to help leverage 20 energy efficiency investments with a combined value of $12.5 million. This target was substantially exceeded. By the end of the project:

- 68 Romanian municipalities, pubic utilities and private companies had received substantive support from UNDP/GEF; and

- 34 investments with a combined value of almost 70 million USD were in progress or complete, with several more expected to follow.

The main economic benefits for companies and municipalities who participated in the project were lower electricity and fuel bills. The project yielded a number of social benefits such as warmer public buildings (typically schools), better-lit, safer streets, more efficient water utilities, better community heating and job creation. The main environmental benefit - as assessed by a team of independent evaluators - was that the 'successes' represented CO_2 savings of more that 120,000 tonnes per year.
www.energie.undp.ro

Stakeholders were the Government of Romania, which was represented by the Ministry of Economy, through the Romanian Agency for Energy Conservation (ARCE), who played an active role in the project. A Steering Committee featuring a wide range of ministries, organizations and NGOs met annually to provide guidance and advice. The GEF provided some $2 million to carry out this project, through UNDP/GEF in Bratislava, who oversaw the project.

UNDP Romania monitored the project locally, and, together with ARCE and others, sat on evaluation committees to award technical assistance contracts and to approve equipment grants using UNDP/UNOPS procurement and administrative rules. UNOPS executed the projects, controlling all financial expenditure and appointing a Chief Technical Adviser to manage the Project in Bucharest (www.energie.undp.ro).

Romanian Energy Efficiency Fund

The Romanian Energy Efficiency Fund is a financial institution providing commercial financing of investments projects aiming the rational use of energy. The Fund assists industrial companies and other energy consumers in adopting and use of modern technologies for efficient use of energy. Thus, the Romanian economy could be affected by the reduction of its final energy intensity and the mitigation of GHG and other pollutant emissions.

The main activities of the Romanian Energy Efficiency Fund are the management of the funds from GEF granted to Romania through the International Bank for Reconstruction and Development, and the financing of investment projects aiming the efficient use of energy. The activities of the Romanian Energy Efficiency Fund are in direct line with the national policy priorities in the field of energy efficiency.

The main competences and attributions of the Romanian Energy Efficiency Fund are:

- financing of investment projects fulfilling the requirements imposed by the selection and evaluation criteria;
- use of a set of evaluation criteria and some operational procedures in accordance with international standards, for selecting, identifying, evaluating, and financing of projects for increasing energy efficiency;
- technical assistance for companies and public institutions that submits to the Fund for analyses and approval of financing, energy efficiency project proposals that fulfil eligibility criteria;
- promoting and disseminating towards potential clients of information regarding Fund activities and project financing.

The Romanian Energy Efficiency Fund aims to promote a demonstrative effect, through the successful implementation of this GEF/IBRD energy efficiency project, and to increase the interest of the banking sector in supporting energy efficiency investments in Romania.

By March 2008, the Romanian Energy Efficiency Fund perfected a number of 20 financing contracts with a total value of $11.431 million and an estimated annual energy saving of 36,533 toe.

Green Investment Scheme Study

The green investment scheme (GIS) was proposed as an instrument for greening international emissions trading under Article 17 of the Kyoto Protocol. The main idea behind a GIS is that the revenues earned by countries through the sale of their assigned amount units (AAUs) — as defined under the Kyoto Protocol — are earmarked for projects that strive to reduce GHG emissions. This earmarking enhances the environmental integrity of the transfers of emission rights. Under a GIS, earmarked revenues will be spent on projects that lead to additional GHG emission reductions or support needed for capacity development, education or social programmes that would support future GHG reductions, depending on the scheme to be agreed between the AAU purchaser and the seller government.

The study was coordinated by the Regional Environmental Centre for Central and Eastern Europe (REC) and financed by the Japanese Special Fund. To ensure the success of the study and its future implementation, a close relationship was established with the Ministry of Environment and Forests as well as with the Environmental Fund Administration.

The study was organized in the following manner:

Chapter 1 provides the general setting for the GIS proposal. These issues are central for understanding the reasoning behind the proposal. They also provide the context of the next two chapters.

Chapter 2 proposes the institutional set-up for the GIS in the framework of the already existing institutional structure for environmental protection (Environmental Fund Administration), describes the functions of the GIS administration in Romania, and makes suggestions for the organization of a GIS management body and the synergies between different responsible organizations in the sector.

Chapter 3 describes the legal issues relevant for the establishment of a GIS and the important challenges related to the lack of awareness and knowledge in this area.

Chapter 4 examines the efficient use of GIS funding, providing a list of sectors and activities for potential projects on “hard” and “soft” greening.

Chapter 5 presents the conclusions related to the GIS potential to produce real environmental benefits and emissions reductions, as well as strengthened capacity in the climate change sector.

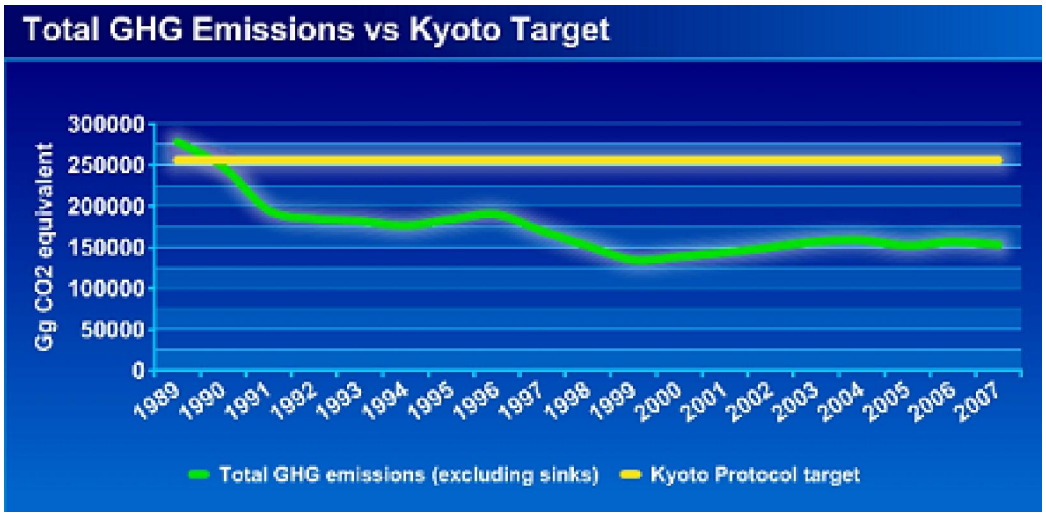
The study was prepared based on the National Action Plan on Climate Change – action on GIS background and hopefully will be followed by an implementation of a GIS in Romania.

IV.C. POLICIES AND MEASURES AND THEIR EFFECTS

The current level of GHG emissions is far below the Kyoto Protocol’s target adopted by Romania (8% less than emissions’ level in 1989). Assessing the economic growth scenarios and

the projected GHG emissions, it is obvious that Romania will fulfill its emissions reduction commitment under the Kyoto Protocol without additional measures.

Figure IV_ 1 Total GHG Emissions vs Kyoto Target



However, a significant potential exists to reduce the carbon intensity of the Romanian economy and to decouple the GHG emissions growth trend from the GDP growth trend. The options include, among others, further fuel switch and energy efficiency improvements in the power sector as well as an increased share of renewable electricity production and further efficiency improvement in the end-use sectors of the economy. In the non-energy sectors, methane emissions can be further reduced, while the sink capacity can be increased with afforestations and reforestations measures. Finally, N_2O emissions from the agriculture and industrial sectors can also be reduced, but consideration is necessary regarding the fact that in Romania agriculture if far from heaving reached its developing potential and that Romania is a net importer of food.

The goal of the Romanian Government is to reach the convergence with the economic development of the European Union member states, through adopting proper sectoral development strategies. The strategies and policies developed by the Romanian Government are focussed on the:

1. Consolidation of the rule of law and of democracy in Romania
2. Decreasing the state intervention in economy and strengthening its functions as guarantor of legality
3. Strengthening the individual liberties, increasing the citizen and family security
4. Guaranteeing and assuring the private property, restitution of properties abusively confiscated by the Communist regime, equal treatment of property
5. Stimulation of the entrepreneurship
6. Social and economic cohesion, reduction of poverty and social exclusion
7. Equality of chances
8. Respect of the minorities' rights
9. Environmental protection

Based on the provisions of the National Strategy and Action Plan on Climate Change several actions have been implemented in Romania in the period 2005-2008 aiming at:

- establishing the legal framework and improving the national system for the estimation of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol and the National GHG Inventory;

- creating the legal, institutional and procedural framework and implementing the EU Emission Trading Scheme (EU ETS);
- developing the National Allocation Plan for 2007 and 2008 - 2012 periods;
- setting up the legal and procedural framework for the National GHG Registry;
- commissioning the Registry and connecting it to CITL and ITL;
- setting up the national procedures for promoting JI projects under Track I and Track II allowing for a greater flexibility for project developers in preparing project's documentation and providing for a shorter approval process ;
- establishing the national Guidelines on Adaptation to Climate Change aiming at addressing the challenges of adapting to the effects of climate change

All policies and development strategies have been elaborated and implemented in compliance with the harmonization of the EU policies, plans and programmes in order to sustain the integration process.

Considering the decrease of GHG emissions in the period 1989-2007 and taking into account that no direct policies and measures have been prepared and implemented in Romania for reducing GHG emissions, it is impossible to provide detailed information regarding the instruments and the methodologies used for quantifying the results of the indirect policies and measures implemented for other purposes.

Policies and measures by sector

Energy

Since 2007, Romania has promoted a new "National Energy Strategy for the period 2007 - 2020" (GD 1069/2007). The strategy is built on three main pillars:

- Energy security:
  - increasing the energy security by ensuring the energy resources needed and limiting the dependence from the import of primary energy resources;
  - diversifying energy resources and transport routes;
  - increasing adequate level of national transport networks of electricity, natural gas and oil;
  - protecting critical infrastructure.
- Sustainable development:
  - increasing energy efficiency;
  - promoting energy production from renewable resources;
  - promoting power and heat production in cogeneration plants, especially in high efficiency cogeneration installations;
  - decreasing environmental impact of the energy sector;
  - efficient use of primary energy resources.
- Competitiveness:
  - developing competitive markets in electricity, natural gas, oil, green certificates, greenhouse gas emissions permits and energy services;
  - continuing the process of restructuring and privatization in the electricity, heating and natural gas sectors;
  - further restructuring of lignite sector, in order to increase profitability and access to capital markets.

In the context of EU integration, energy prices on the international market and climate change debates, the energy efficiency has turned into an important element of the national energy policy.

The energy efficiency policies and measures in Romania follow the National Strategy for Energy Efficiency for 2004-2015, approved by the Governmental Decision no. 163/2004.

The main objective of this document is to increase energy efficiency on each sector of the economy: energy consumption for extraction of natural resources, heat and electricity production, transport & distribution etc.

In 2005 Romania's consumption of primary energy resources was 40.5 million toe, while the GDP was 3665.3 Euro/inhabitant.

The energy sector is responsible for about 88% of the NOx and CO_2 emissions and 90% of the SO_2 emissions.

Following the World Bank methodology and the International Energy Agency statistics, the average final energy intensity (taking into account the final energy consumption) in Romania is higher than the EU member states average rate (4.28-8.73 for industry, 2.31-5.45 for transport, 1.13-9.00 for agriculture, 6.58-12.76 for residential area and 2.44-9.75 for the tertiary sector-public and commercial services).

The National Strategy for Energy Efficiency for 2004-2015, has considered the decrease of energy intensity by 40% (realistic scenario), 50% (optimistic scenario) and 30% (the pessimistic scenario) in comparison with 2001 level, in the context of adopting programmes for energy efficiency and achieving a 5.4% average GDP growth rate.

The decrease by 40% of the energy intensity means a reduction of primary energy of 2.122 millions toe/year or 25.4 million toe for 2004-2015 (industry 337 000 toe /year, residential area 823 000 toe/year, transport 303 000 toe/year, tertiary 47 000 toe/year, energy 612 000 toe/year).

The reduction of 25.4 million toe requires the promotion of high energy efficiency standards for new installations (estimated reduction of energy consumption of 9.5 million toe) and the development and implementation of energy efficiency programs (estimated reduction of energy consumption of 15.9 million toe.

The costs to reach this goal are estimated at 2.7 billion Euro (industry - 110 mil. Euro, residential area - 1 187 mil. Euro, transport - 216 mil. Euro, tertiary - 7 mil. Euro, energy - 1 137 mil. Euro). The reduction by 40% of the energy intensity leads to the decrease of primary energy supply, evaluated at minimum 3.4 billion Euro.

As in Romania the consumption of 1 toe releases about 2.38 tCO_2, the reduction of 25.4 million toe will save around 60.5 million tCO_2.

During the development of the energy policy, Romania must take into account both the environmental acquis communautaire in the areas of air control, industrial pollution control, pollution risk management, climate change, and the obligations assumed by ratifying the United Nations Framework Convention on Climate Change and its Kyoto Protocol, the Energy Charter Treaty, and the EURATOM Treaty.

The formal organization responsible for the implementation of the energy efficiency policy is the Romanian Agency for Energy Conservation (ARCE) that has come into existence by the Government Ordinance 78/2001. The main responsibilities of ARCE are:

- preparation, implementation and monitoring of programmes for the efficient use of energy;
- elaboration of technical regulations aimed to increase the energy efficiency;

- promotion of new energy sources;
- co-operation with domestic and international institutions in order to improve the energy efficiency and to reduce the negative environmental impact;
- consultancy services to the local public authorities in elaborating and applying energy efficiency programmes;
- approval of the energy efficiency programmes, according to the provisions of the Law 199/2000, amended by Government Ordinance 78/2001.

Since 2009, ARCE is part of ANRE (National Authority for Energy Regulation).

Security of supply
Law no 134/1995 on oil and Law no 82/1992 consolidated, on establishing the National Administration for State Reserves represents the legal framework in Romania in this sector. Romania will implement upon accession the Council Decision 68/416/EEC on the conclusion and implementation of individual agreements between Governments relating to the obligation of Member States to maintain minimum stocks of crude oil and/or petroleum products.

Romania will implement upon accession the Council Decisions 1999/280/EC and 1999/566/EC regarding the community procedure on the consultation on the prices of supply of crude oil and petroleum products to the consumers. The implementation will be made through the preparation of specialized statistical questionnaires, which have to be in accordance with the information requirements of the community regulations.

Also upon accession, Romania will implement the Council Regulation no 95/2964 introducing registration for crude oil imports and deliveries in the Community. Romania have transposed the Council Directive 73/238/EEC on measures in view to mitigate the effects of difficulties in the supply of crude oil and petroleum products and Decision 77/706/EEC on the setting of a Community target for a reduction in the consumption of primary sources of energy in the event of difficulties in the supply of crude oil and petroleum products.

For the implementation of the Council Directive 68/414/EEC, amended by Council Directive 98/93/EEC imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products stocks for a consumption period of 90 days, Romania obtained a five-year transition period, by 31 December 2011, for the creation of the minimum stocks. In 2011, on the basis of the forecasted increase of the indigenous consumption, Romania will have a storage capacity for 67.5 days.

Electricity. Starting with year 2007, the Romanian electricity market is 100% open; all consumers can choose their electricity supplier.

In Romania the electricity sector is in a continuous consolidation process. Regulation, authorization and control in the field of electricity are performed by the National Authority for Energy Regulation – ANRE. ANRE is an autonomous institution with the responsibility of issuing the secondary legislation in the field. Regarding the heat supplied centralized; the prices are also approved by National Authorities (ANRE and ANRSC _ the Authority regulating the field of communal services).

ANRE establishes prices and tariffs for electricity to captive consumers, based on developed methodologies. All methodologies refer to the following principles:
- consumers protection
- ensuring the economic and financial viability of the companies in the sector
- encouraging economic efficiency increase

- attracting investors

In Romania, the wholesale electricity market has two components:
- the regulated market, based on portfolio contracts or sell-buy contracts between producers and suppliers;
- competition market, agreements are closed on the spot market.

Though the electricity prices are high for the Romania population, they are among the lowest in Europe; therefore, the price is not yet an incentive for saving electricity.

Regarding the centralized heat supplied, in the ’90, there was a high trend of disconnection from this service, mainly due to the price and the fact that there was no monitoring and control systems installed at the user end. Another reason was the lack of control regarding the natural gas price for the domestic user.

The situation has changed in the early 2000 due to the implementation of some of the provisions of the Energy Efficiency Strategy; monitoring and control equipment was installed at the user and the rate of disconnections decreased. At the beginning of December 2004, there were 1190635 apartments connected to the DHSs all over the country; by the end of 2007, the number increased to 1661411, according to the data from ANRSC.

The district heating in Romania is mainly based on fossil fuel and cogeneration technologies. As concept, the system is good but the level of degradation, both, in production and transport/distribution equipment is high; in order not to lose the systems, huge amount of investment is needed and the Government has started to think about solutions.

In 2004, the Government has issued the strategy for heat supply in cities and in 2006, a financing program was started; finally, very few cities benefited from aid and invested in the rehabilitation of the systems (but this was never complete).

In 2007 the Government issued the rules regarding the promotion of high efficiency cogeneration; this GD was followed by the Procedure regarding the issuance of the guarantees of origin (GD 1461/2008) and GD 1215/2009 (regarding the criteria and conditions necessary for the implementation of the support scheme for the highly efficient cogeneration). This type of rules respect the EU regulation.

Improvements in the efficiency of the systems is expected and it can only be achieved through efficient support schemes.

Gas Sector. The natural gas field policy is implemented by the National Company for Natural Gas, ROMGAZ SA which was established by merging two production and storage companies (Government Decision no. 575/2001). The main activities of ROMGAZ are the geological research in order to discover new gas reserves, production, supplying and the underground storage of the natural gas, observing quality, safety, economic efficiency and environmental protection conditions.

The natural gas market in Romania is also regulated by ANRE, which ensures regulation, authorization and control. The Market Operator establishes monthly, in percentage quota, the quantity of natural gas from import and domestic production, for all the distributors licensed and authorized by the ANRE.

Romania has completed the legislative framework for the implementation of the Directive 98/30/EC concerning the common rules for the natural gas internal market. Romania shall implement the Directive 91/296/EEC and the Decision 95/49/EC on the transit of natural gas through grids, as regards the transit contract and the notification of the responsible transit entities in Member States, upon accession.

Romania follows closely the EU acquis communautaire concerning the natural gas market liberalization. The eligible consumers are free to import natural gas, without restrictions.

The governmental policy for 2004-2008 for this sector aims to reach the following main objectives:

- Intensification of geological activities, especially for deeper layers
- Clarification of the legal status of the natural gas pipeline transport. The current provisions are not sufficiently explicitly for:
  - Accessing private funds in rehabilitation and/or development of the national pipeline transport
  - Considering Romania a trustworthy partner in the oil transit from Baltic Sea to Western Europe
  - Granting the right to transport the natural gas through main pipeline system and storing capacity
- Bringing forward policies to provide continuity and security of gas supply. The following options are taken into account:
  - Diversification of import sources e.g. from Russian Federation
  - Interconnection of national transport system within the Western part of the country, for the purpose of assuring a second import source (North Sea);
  - Participation at achieving the transit project of natural gas from Caspic Sea and Near East region towards Western Europe;
  - Taking part in the construction of Turkey-Austria transit pipeline, on the route Bulgaria - Romania - Hungary (Nabucco project); pipeline transport;
- Increase of the gas storing capacities (in comparison with a ratio consumption/ deposit of 11%, assured today at a necessary minimum security share of 25% according with the negotiated commitments in order to cover 67,5 days in 2011).

Oil Sector. The National Agency for Mineral Resources – ANRM, which is co-ordinated by the Ministry of Economy and Trade, grants the authorizations for the prospecting, exploitation and production of hydrocarbons.

The main responsibilities of ANRM are:

- managing the mineral resources
- elaborating technical instructions for the application of Law on oil
- establishing the tariffs for the oil pipes transport

The Romanian legal framework for granting permits and laying down the conditions for oil prospect, exploitation and production of hydrocarbons, in compliance with the Directive 94/22/EC, is represented by:

- Law no 134/1995 on oil and Government Decision no 1265/1996 on the approval of the methodological norms for applying the Law on oil
- Orders and regulations issued by the authority responsible with oil areas - ANRM

Upon accession, Romania shall implement the Council Regulation 736/96/EC and Council Regulation 2386/96 regarding the European Commission notification on the investment projects

of community interest in the sectors of oil, natural gas and electricity. In this respect, the authorities responsible with the authorization will ensure the data collection on the investments projects, and will communicate them to the Ministry of Economy and Trade which will convey these data to the European Commission.

Solid Fuels. Taking into account the domestic natural reserves, coal will continue to be an important energy source, for which the existing infrastructure is an advantage. A priority objective of the National Strategy for Energy Development, prepared by the Ministry of Economy and Trade is to improve the efficiency of and to upgrade the coal industry. According to this Strategy, the restructuring process of the coal sector will continue, aiming at the following objectives:

- improving the economic and financial performances and also the environmental protection within the sector
- continuing the privatization process
- reducing the social impact in mining regions under restructuring (the National Agency for Development and Rehabilitation Programmes for Mining Areas, under the coordination of the Ministry of Economy and Trade, provides professional alternatives for jobless employees from the mining sector)
- strengthening the management of the mining companies

Considering the low economic performances of mining companies in the field of brown coal, hard coal and non-ferrous minerals, the existing capacities should be reconsidered to establish the conditions to cease activities, close non-viable mines and support mines with revival potential.

In the Strategy for the Mining Industry for 2004 – 2010 some measures have been identified to improve the efficiency in this sector. These measures are as follows:

- Reducing gradually the state's role by eliminating its involvement in non-mining, exploration and mining activities
- Revision and improvement of the legal framework
- Strengthening the administrative capacity of public institutions involved in the monitoring of the strategy, policies and actions for sector restructuring

The expected results of the enforcement of this strategy are estimated as follows:

- New commercial basis for the mining industry
- Elimination of subsidies and social allocation for the mineral and lignite sectors starting with 2007
- Control over the hard coal sector subsidies with respect to Directive 1407/2002/EC
- Focusing the state budget allocations on the best performing mines in the sector aiming at their privatization
- Privatization of the lignite open-pits in the form of commercial societies or as aggregate including heating plants
- Ensuring the social protection for the mining workers laid off
- Promoting a transparent closure process, informing and involving communities in the process
- Developing an attractive business environment
- Developing the private sector in the mining regions
- Ensuring an attractive environment for the extension of tourist activities

Nuclear Sector. Romania accepted the entire acquis in the field of nuclear energy, including the EURATOM Treaty, secondary legislation in the field of nuclear safeguarding and nuclear material and fuel supply, as well as international agreements in the field.

Romania fully accepts the recommendations of the European Union Report in the field of nuclear safety made during the negotiation process of this energy sector (CONF-RO 28/01). Romania will continue the dialogue in this field with the Council and will implement these recommendations before and after accession.

Romania observes the highest standards of nuclear safety and applies the Western Nuclear Regulatory Authority recommendations (WENRA), as well as the requirements of the International Atomic Energy Agency.
The first CANDU unit (700 MW) has been in operation in Romania at Cernavoda Nuclear Power Plant since 1996, and provides approx. 10% of the country energy supply. The commissioning of the second CANDU unit (700 MW), planned for 2005, has been postponed to 2007 due to the lack of finance at that moment. After the beginning of the commercial operation of Unit 2, Cernavoda Nuclear Power Plant will cover about 17% of the electricity at national level. Unit 3 and Unit 4 are planned for commissioning during the next decade.

Renewable Energy. The Strategy for using renewable energy sources has been approved in year 2003, transposing the European Directive 2001/77/EC. The document establishes targets up to 2015:

- In 2010 the renewable energy will be about 11% out of consumption of the primary energy. In 2015 the rate is estimated at 11.2%
- New renewable energy facilities in 2010 will have 441.5 MW installed electric energy, respectively 3 274 640 toe heat
- New renewable energy facilities in 2015 will have 789.0 MW installed electric energy, respectively 3 527 700 toe heat

Table IV_ 1 The expected use of renewable energy by type of source

Renewable energy sources	2010 (thousand toe)	2015 (thousand toe)
Solar energy	7.5	17.0
Wind energy	27.0	86.1
Hydro energy	1565.2	1608.2
Biomass energy	3347.3	3802.0
Geothermal energy	17.5	23.9
TOTAL	4946.0	5537.2
% total primary energy resources	11.0	11.2

In order to achieve these targets, the investment is estimated at 1.3 billion Euro for 2003-2010 and 1.4 billion Euro for 2011-2015.

Implementation of projects in the renewable energy sector is supported through a green certificates + mandatory quotas system, operational since autumn 2005; the system is functional, though the achievements are still waiting. Most part of the European countries use different other combinations of support systems and the Romanian system is often criticised by the private investors.

In 2008, a new law (220/2008) was issued in order to stimulate investment in the sector. It is also proposing targets up to 2020: consequently, the share of electricity produced from renewable energy sources in final consumption of electricity in the years 2010, 2015 and 2020 should be 33%, 35%, and 38%. The new Law proposes an upgraded version of the Green Certificates

system, accentuating the incentives offered for projects using a renewable energy source with a higher specific investment; though the law cannot be applied after more than one year since its publication.

It also creates the legal framework necessary for extending the use of renewable energy through:

a. defining rules relating to guarantees of origin, administrative procedures applicable to the grid connection in terms of energy produced from renewable sources;
b. establish criteria for environmental sustainability for biofuels and other bioliquids.

Investors may receive under this Act, the following facilities for strategic projects in the energy policy of Romania:

1. ensuring a maximum of 50% of loans over the medium or long term;
2. provision of transport infrastructure and utilities necessary for the investment initiation and development;
3. access roads and changes to the existing infrastructure necessary to initiate development and investment project;
4. exemptions or reductions of taxes on reinvested profit, for a period of 3 years after the service of investment;
5. the financial contributions from the state budget for new jobs created.

Industrial Processes

Romania follows closely the European Union policy in the industrial field, in order to develop a national competitive market, integrated in the European internal market. The first Industrial Policy Paper, approved through the Governmental Decision no. 657/2002 was developed for 2002-2004 and supported the negotiation process with the EU on the Chapter 15-Industrial Policy.

Presently the Government Programme presents new objectives for the industrial sector, related to the implementation of the EU concepts within the Lisbon Strategy related to the sustainable industrial development policy.

The main objectives of this strategy are:

- increase of competitiveness
- enhance research, development and innovation
- integration of sustainable management of natural resources and environment
- develop cooperation, industrial services, and public-private partnerships

In order to reach these objectives the Romanian Government industrial policy has to concentrate mainly on:

- Consolidating a stable and predictable business environment sustained by a proper institutional capacity
- Enhancing research-development and innovation
- Developing a competitive free market and sectoral assistance
- Promoting direct investments through a transparent, predictable and enabling economic atmosphere
- Sustaining the development of SMEs and the exports of Romanian high value added industrial products
- Sustaining and completing the privatization process and restructuring the economy
- Protecting the environment and natural resources
- Developing human resources policy and social cohesion

EU integration perspective has induced a new approach on the environment and the sustainable management of natural resources. This approach has defined medium (2010) and long term (2013) objectives, like:

- integrating environmental issues in elaborating development strategies and policies at sectoral, regional and national level;
- implementing Best Available Techniques and clean technologies in all industrial sectors;
- rehabilitating of historically affected areas;
- establishing a free market for waste and energy efficiency facilities.

The roadmap for implementing the Action Plan for Environmental Technologies 9 ETAP in Romania was approved in 2008.

Developed for 2008-2009, the action plan aims to promote environmental technologies to reduce pressure on natural resources and improve the quality of the environment and life considering also the promotion of economic growth. The plan contains priority actions to be undertaken by the Commission, national or regional governments, industry and other stakeholders, for the development and use on a large scale of the environmental technologies.

Based on expected results, the proposed objectives are grouped in three priority fields, as follows:

- transfer of environmental technologies from the research stage to market availability;
- improving market conditions to encourage the use of environmental technologies;
- globally promotion of environmental technologies

The Governmental Decision no. 217/2007 approving the Strategy on the national research, development and innovation for 2007–2013 promotes the necessity to include science, technology and innovation in the development of the knowledge on economic and social progress in Romania. Environmental protection is one of the priority areas of the strategy.

Research and development objectives for the period 2007 - 2013 aim to create and/or promote:

- clean technologies for products and processes, with particular application in construction, transport and energy production, and economic and social mechanisms for implementing them
- new eco-efficient technologies for waste management by using products life cycle analysis in the framework of environmental impact assessment;
- scientific and technological support for the conservation, reconstruction and strengthening the biological and ecological diversity;
- sustainable territorial development planning in order to provide an active support to a integrated and coherent economic-social development

The National Strategy for Sustainable Development, horizons 2013 – 2020 – 2030 adopted in 2008 provides that industrial development policies will follow the strategic directions and general objectives of the Romanian economy and fundamental elements of evolutions inside EU. Also, the eco-efficiency and the use of the best available technology will become essential criteria in investment decisions, not only in public acquisition, but also in other fields of the economic activity.

The main factors that will influence the evolution of various industries in the medium term are:

- maintaining and developing an attractive business environment, aiming to increase the investment flow, to stimulate technological modernization and permanent upgrade of the processes and products;

- considering the environmental impact of products along their entire life cycle (from project state, manufacture, assembly, marketing, distribution, sale and use, to recycling and disposal);
- supporting the research, development and innovation activities in conjunction with the real needs of industry and market requirements in order to obtain competitive advantages and to reduce technological and productivity delays comparing with the more advanced EU countries;
- promoting digital technologies at all stages, from design to production and marketing, including in the management of enterprises;
- improving sectoral assistance concomitant with the modernization of the role of public authorities in elaborating and implementing industrial policies and management of restructuring and development processes, according with EU practices;
- supporting the development of small and medium enterprises in manufacturing industry in order to achieve high quality products with lower costs, according to market requirements

Taking into account the existing natural resources exploitable at competitive costs, the main following industry capacities are estimated to increase during the next period:

- chemicals and oil industry (oil, fuels, plastics, rubber, etc)
- mineral industry (glass, ceramic, construction materials)
- biofuels production
- wood processing
- machinery for agriculture and food processing

The favorable geographic position of Romania, providing quick access to mineral resources, gives a good opportunity for the development of: iron and steel industry, aluminum and non-ferrous industry, varnishes and paintings industry.

Transports

The review of the current status of the Romanian transport system has highlighted a low developed highway system or insufficient fast routes towards neighboring countries or EU Member States, low naval infrastructure and a low quality of motor fleet.

The development of the transport infrastructure is a prerequisite to provide the development of Romania during 2007-2013. The Romanian Government has in view to develop the transport system taking into account the balanced development of local and regional economy as well as the integration of national transport network (and logistics) into the European network, namely the international network.

The 2001 EU White Paper on Transport specifically addresses the strong economic development, which is expected for the Candidate Member States (CMS) and the related increase of transport flows, in particular road haulage traffic. At the EU level and at the level of CMS actions should be taken to shift (or keep) the balance between modes in favour of rail transport, while at the same time negative repercussions on the economies of the CMS as a result of these policies should be avoided. The increase of transportation and related GHG emissions is for many EU Member States and probably on the longer term for CMS as well the main problem for achieving overall national emission reductions. Measures proposed by the EU are related to revitalizing railways, increasing competition by opening-up markets, supporting transport of good services and creating the Trans European Transport Network by solving bottlenecks, all striking a balance between growth in air transport and the environment, developing high-quality urban transport and R&D programs at the service of clean and efficient transport.

In the Romanian transport sector, the air quality problem is approached by imposing the use of less pollutant fuels, while providing information on fuel consumption and CO_2 emissions from the new vehicles as well as on the rehabilitation of the trans-European roads.

The following actions will be carried out in the upcoming period:

1. Reassessment of the transport strategy so that it includes climate change consideration into key decisions on transport infrastructure
2. Strengthen cooperation within institutions through the National Commission on Climate Change
3. Capacity building programme for the Authorities on policies and measures in managing GHG emissions from transport. This can be achieved in combination with starting up international cooperation in this field.
4. Improvement of the GHG inventories and emission scenarios for the transport sector

In order to perform efficiently these actions the Ministry of Transport has developed separate strategies for the railway system, road infrastructure, naval transport and air transport aiming restructuring in accordance with EU standards. These strategies aim to rehabilitate inland networks and to develop links with the European and international transport networks through:

- modernization of 5701 km of national roads at European standards
- modernization of 1 200 Km of railway
- increase of freight amount in the internal harbours (with 3.79 mil. tones compared with 2004) and maritime harbours (with 39.47 mil. tonnes compared with 2004)
- modernization of airport facilities

The cost estimated to develop a proper infrastructure in compliance with the EU standards is 14,584.53 million Euro.

The Law no 203/2003 established the development priorities of the transport infrastructure on medium and long term-time horizon 2015. Within the negotiation process, Romania has committed to complete the road infrastructure by 31 December 2016 and achieve the necessary modernization and adaptation of the inland waterways fleet in compliance with the EU standards by 31 December 2011.

As a new EU Member State, and taking into account the transition periods accepted during the negotiation process, Romania will adopt all EU measures and policies to reduce traffic emissions.

Agriculture

The total farmland in Romania in 2003 was about 14.8 million hectares representing around 61% of the total land (23.8 million hectares). Despite the good condition for development, the contribution of the agriculture sector to the GDP is relatively low.

In order to sustain the integration process and conclude the negotiation process with the EU the Ministry of Agriculture has elaborated different policies for the development of agriculture, food industry and forestry.

In 2006, the Government adopted a program for the stimulation of energy crops (including biofuel crops); as a consequence, In 2007, there was about 27000 ha, in 2007 and about 39000 ha, in 2008, cultivated with energy crops.

During the same year, 2006, the Ministry of Agriculture prepared the National Strategic Plan for Agriculture and Rural Development for 2007-2013. This document draws a review of the present

status and identifies the development priorities for agriculture, forestry and rural development, in the context of a new EU Member State.

The strategy for 2007-2013 is structured on 4 activities:

1. Increased competitiveness in agriculture and forestry - provides support for the agriculture policy for the improvement of agriculture companies as follows: the setting up and upgrading of farms, assistance provided to farms entering the market, setting up of producer groups, improvement of primary processing and the marketing of agriculture and forestry products by efficient investment
2. Improving the environment in rural areas - secures the sustainability of the environment and farming land used in areas of concern for the preservation of traditional landscapes
3. Better life standards in rural areas and diversification of the rural economy - grants support for the agriculture policy and the development of rural areas, by improving conditions for rural life
4. LEADER - a combination of the previous 3 actions to identify local needs and to develop local development strategies

Romania will have a complete and operational institutional capacity to implement the European agriculture policy by the accession date to the EU. During the last decade, the frequency and magnitude of draughts and floods caused potentially by climate change related effects have produced important damages to the crops of winter wheat and maize.

In 2008, there was adopted a law referring to the stimulation of renewal of tractors and other equipment in agriculture.

This program is part of larger support schemes, designed in the last decade to help the modernization of the activity in agriculture through farms improvement, improvement of irrigation systems, pasture improvement, promotion and support of ecological farms, rural development and promote best practices for the relationship agriculture - environment.

Forestry

In 2007, the forests covered 6,485 thousand hectares, of which 6,315 thousand hectares actually in full coverage, 30% coniferous and 70% foliage trees. The rest of 170 thousand hectares are plots of land prepared for reforestation, culture, production or forest administration land, non-productive lands included in the forestry management facilities. The ratio of forests in the national territory is 26.5%, with a ratio of 0.29 ha of forest/inhabitant.

Most of Romania's forests are in the mountain areas (58.5%). Hill areas are covered by 34.8% of the forests, and the plains only have 6.7% of the forests. The wood volume in the national forest fund is 1,341 million m^3. The average wood volume per hectare is 218 m^3. The annual total growth of forests is 34.6 million m^3. The average unit growth is 5.5 m^3 per year per hectare.

About 40% of the wood volumes cut every year goes to the population in rural areas (firewood, building, crafts etc.). As a result of the changes in ownership of the forests, the forested areas publicly owned by the state decreased from 94.7% in 1998 to 67.3% in 2004. By enforcing the Law 18/1991 and Law 1/2000 on restitution of the propriety, it has been brought to the public domain of local government units 806.1 thousand hectares of forests by the end of 2004, out of which 579.6 thousand hectares being owned by legal entities (associations, religious or educational facilities) and 693 thousand hectares by individuals.

The national objective included in the National Strategic Plan for Agriculture and Rural Development for 2007-2013 is to extend the forest areas from the present percentage of 27% to

about 32% in 2013. This policy of expanding forest areas is supported by environmental reasons and the need to improve the fertility of the existing degraded lands. This policy of expanding the forest surface is sustained from the environmental reason and soil amelioration and it will also contribute to a better absorption of GHG emissions.

The ratio of forests in the national territory is 26.7%, as against the European average of 35%. With a ratio of 0.25 ha of forest/inhabitant, Romania is under the European average of 0.35 hectares, occupying the 10th rank in Europe.

The possible impact of climate change on the Romanian forests might trigger a decrease of wood productivity after 2040, as a result of higher temperatures and shortage of precipitation.

Over the period 1989-2006 there is no significant variation at the LULUCF's removals/emissions levels. Actual submission of the inventory is based on a land use change matrix over the span. Consequently, Romanian land use sector act as a net sink, at an average uptake of 37,531.62 Gg/year, relatively stable over the last 19 years.

Waste

The Romanian regulation in the field of waste management is continuously improving in line with the European regulation. Major guidelines were issued in the field starting with year 2000 (Emergency Government Ordinance no. 78/2000 on the regime of waste, modified and approved by Law no. 426/2001). The National Waste Management Strategy (NWMS _ approved in 2004) which creates the necessary economically sound framework for developing and implementing an integrated waste management system was drafted for the interval 2003 – 2013.

The provisions of the NWMS apply to all categories of waste as defined in Government Emergency Ordinance no. 78/2000 on the regime of waste. This strategy has identified objectives for general and specific waste management as well as for hazardous waste management and calls for its achievement the involvement of the entire society, represented by: central and local public authorities; waste generators; professional associations and research institutes, the civil society.

Waste management activities are conducted based on the: principle of primary resources protection, principle of preliminary measures correlated with the use of BATNEEC, prevention principle, "polluter pays" principle correlated with the principle of producer responsibility and of user responsibility, principle of substitution, principle of proximity correlated with the principle of autonomy, principle of subsidiarity, principle of integration.

The NWMS involves as well the existence of:

- the National Waste Management Plan;
- the Regional Waste Management Plans;
- the County Waste Management Plans.

Some of the County and Regional Waste Management Plans are available in their updated version in the last five years.

In the Government's Programme for 2009–2012 the lines of action on waste management are:

- reviewing of the National Waste Management Strategy;
- development, approval and monitoring of implementation of the National Waste Management Plan for 2009–2013;
- financing correlation within the environmental infrastructure through the Operational Sectoral Programme Environment;

- recovery of municipal waste for the production of "green" energy

The National Strategy for Sustainable Development, horizons 2013 – 2020 – 2030 approved through Governmental Decision no. 1460/2008 highlights relevant issues specific to the waste management sector, such as:

- to improve the quality of, and access to infrastructure for wastewater treatment by providing sewerage services to the majority of urban areas by 2015 and establishing efficient regional structures for wastewater management
- To develop integrated waste management systems by improving waste processing

IV.D. POLICIES AND MEASURES NO LONGER IN PLACE

The first National Strategy on Climate Change of Romania (NSCC) was approved by the Governmental Decision no. 645/2005. The Strategy represented the general framework for implementing climate change policies and measures during the period 2005 - 2007. The policies implemented as objectives of the National Strategy are still in place.

By implementing this Strategy, Romania has taken its first steps towards a targeted and coordinated national effort to limit GHG emissions and to deal with the expected climate change impacts. The Strategy outlined Romania's policies in meeting the international obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol as well as Romania's national priorities in climate change.

The focus of Romania's approach to climate change is also represented by the requirements resulting from the EU integration (including participation in the EU Emissions Trading Scheme) as well as from international commitments under the UNFCCC and its Kyoto Protocol.

The underlying policies and activities as further defined in the National Action Plan on Climate Change (NAPCC) were carried out in the period 2005-2008. In the impact assessment of the NSCC, a longer term perspective was considered, in particular up to the end of the first commitment period of the Kyoto Protocol in 2012. This relatively short period was selected due to the rapid changes in the national economic situation and international climate change framework, particularly with Romania's accession to the European Union that determined an update of the NSCC.

NAPCC is the main instrument for the implementation of the NSCC and establishes how implementation progress is to be reported. NAPCC assigns tasks and responsibilities for every stakeholder institution and identifies the main actors for each specific action and relevant task. The NAPCC provides clear deadlines for the actions that need to be implemented and identifies potential funding sources for specific actions.

NAPCC is a dynamic instrument which must be regularly updated together with the NSCC in order to improve decision making in establishing the policies and measures in the field of climate change, so that these may be adapted to the economic developments in Romania.

The National Strategy on Climate Change of Romania had the following specific objectives:

1. To meet the Kyoto Protocol target on the level of national GHG emissions.
2. To limit the long-term economic, environmental and social costs of the impacts of climate change in Romania.

3. To establish an adequate policy, legal and institutional framework allowing for the development and implementation of policies and measures.
4. To implement a national GHG emissions and removals assessment system in compliance with UNFCCC and EU requirements.
5. To participate in flexible mechanisms under the Kyoto Protocol (JI and IET) to the maximum benefit of the Romanian environment and economy in compliance with UNFCCC and EU regulation, and in a stable and transparent domestic policy, institutional and regulatory framework.
6. To prepare the position of Romania regarding future international climate change policies and regulatory regimes post 2012.
7. To transpose and implement the directives on the EU Emissions Trading Scheme to allow the start of trading by 1.1.2007 (Chapter 8).
8. To continue implementing the existing domestic policies and measures to reduce the carbon intensity of the Romanian economy in full compliance with the EU acquis communautaire.
9. To incorporate climate change issues in education and research, and to increase the level of awareness and public participation of stakeholders in decision-making.
10. To elaborate the National Action Plan on Climate Change on the specific policies and measures to be implemented under the NSCC.

The National Strategy on Climate Change was prepared for the period 2005- 2007 and must be updated in the near future.

The National Action Plan on Climate Change (NAPCC) is the main instrument for the implementation of the NSCC and establishes how implementation progress is to be reported. NAPCC assigns tasks and responsibilities for every stakeholder institution and identifies the main actors for each specific Action and relevant task. The NAPCC provides clear deadlines for the Actions that need to be implemented and identifies potential funding sources for specific Actions.

Similar to the NSCC, the NAPCC was developed under the coordination of the Ministry of the Environment and Water Management (MEWM), by the Romanian and foreign consultants with inputs from the main stakeholders, such as: ministries, research institutes, agencies, the private sector, NGOs and experts in the field. The participation of all the stakeholders was of vital importance in drafting the NAPCC, as stakeholder commitment in the future implementation is essential.

The NAPCC consists of two parts: Part I – NAPCC Background and Part II – Description of the NAPCC Actions. The first part introduces general considerations underlying the drafting of the document; the working procedures and implementation schedule; and the procedure for monitoring and updating the NAPCC.

NAPCC is a dynamic instrument that must be regularly updated together with the NSCC in order to improve decision making in establishing the policies and measures in the field of climate change, so that these may be adapted to the economic developments in Romania.

The detailed Actions of the NAPCC were structured into 7 chapters, as follows:

Chapter 1 Cross-cutting issues
Action 1.1 Amend Government Decision no. 1275/1996 on the establishment of the NCCC
Action 1.2 Develop institutional capacity in public administration

Chapter 2 International reporting obligations

Action 2.1 Improve the National System for Estimating GHG Emissions
- Action 2.1.1 Develop and approve the specific procedure for the national GHG inventory
- Action 2.1.2 Annual preparation and timely submission of the national GHG Inventory
- Action 2.1.3 Prepare national emission factors and national methodologies for estimating the GHG emissions from various activities

Action 2.2 Establish the National Registry

Action 2.3 Develop the 4th National Communication to the UNFCCC Secretariat and submit to the UNFCCC Secretariat

Action 2.4 Prepare 2005 Report on Demonstrable Progress achieved in implementing the Kyoto Protocol and submits the Report to the UNFCCC Secretariat

Action 2.5 Prepare the Assigned Amount Report based on KP and submit to the UNFCCC Secretariat

Action 2.6 Prepare the post-2012 negotiations and actions

Chapter 3 Impacts and adaptation to climate change

Action 3.1 Strengthen cooperation between agencies, institutes and other stakeholders

Action 3.2 Build the foundation for adaptation: Scenario and scoping study

Action 3.3 Develop the National Action Plan for Adaptation (NAPA)

Action 3.4 Plan the Climate Adaptation Research Programme (CARP)

Action 3.5 Decision support tools for adaptation planning based on international experience

Chapter 4 Voluntary mechanisms under the Kyoto Protocol

Action 4.1 Develop project preparation and approval guidelines for JI projects under Track II

Action 4.2 Develop procedures for JI project approval under Track I

Action 4.3 Develop eligibility criteria and priority areas for JI projects

Action 4.4 Develop the basis and implementation framework for a Green Investment Scheme

Action 4.5 Implement Green Investment Scheme

Chapter 5 EU Emission Trading Scheme

Action 5.1 Assess institutional capacity needs and establish the institutional framework for the transposition of Directive 2003/87/CE as amended by Directive 2004/101/CE

Action 5.2 Approve primary legislation transposing Directive 2003/87/CE as amended by Directive 2004/101/CE

Action 5.3 Approve secondary legislation: Monitoring and reporting guidelines; Accreditation of verification bodies

Action 5.4 Develop methodology for the preparation of the National Allocation Plan (NAP)

Action 5.5 Prepare and approve the National Allocation Plan (NAP) for 2007-2012. Formally adopt the NAP. Issue GHG emission permits

Action 5.6 Communicate with future participants in the EU ETS

Chapter 6 Policies and Measures to reduce GHG emissions

Action 6.1 Increase Romania's participation in the "Intelligent Energy Europe" programme

Action 6.2 Promote energy production from renewable sources

Action 6.3 Promote energy efficiency among energy end users

Action 6.4 Promote cogeneration and energy efficiency in district heating

Action 6.5 Manage GHG emissions from transport

Action 6.6 Promote energy recovery from landfills

Action 6.7 Land use, Land-Use Change, and Forestry: Introduce integrated land-use systems

Chapter 7 Awareness, education and public participation
Action 7.1 Develop an Action Plan on Climate in Education (APCE)
Action 7.2 Increase Public Awareness of Climate Change
Action 7.3 Improve access to information and public participation

The general objectives of both mentioned documents are still valid, but the documents must be updated in the near future.

V. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES, AND SUPPLEMENTARITY RELATING TO KYOTO PROTOCOL MECHANISMS

V.A. PROJECTIONS

GHG projections data are presented in Tables V_1-V_13, for "without measures" (WOM), "with measures" (WEM) and "with additional measures" (WAM) scenarios, on a sectoral basis (characterizing the Energy, Transport, Industrial Processes, Solvents and Other Products Use, Agriculture, Land Use, Land-Use Change and Forestry – LULUCF, and Waste categories).

Additionally, projections are presented on a gas-by-gas basis for the following greenhouse gases: CO_2, CH_4, N_2O, HFCs, PFCs and SF_6; projections are also provided as a national total, using the agreed Global Warming Potential values.

Table V_ 1 CO_2 emissions trend for the WOM scenario

No.	Source of emissions	CO_2 emissions (Gg CO_2)											
		Historical		Estimated		Forecasted							
		1989	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020
1.	Energy	159,418.74	92,817	104,100	112,400	121,200	125,400	130,100	134,200	139,200	144,000	149,400	168,700
	A. Fuel combustion	159,418.74	92,817	104,100	112,400	121,200	125,400	130,100	134,200	139,200	144,000	149,400	168,700
	1. Energy industries	106,011.60	48,788	53,700	59,100	64,700	66,800	68,500	70,300	73,100	76,000	79,100	89,600
	of which:												
	under ETS		48,788	53,700	59,100	64,700	66,800	68,500	70,300	73,100	76,000	79,100	89,600
	2.Manufacturing Industries and Construction	37,425.45	19,303	21,800	22,500	23,900	24,400	25,900	26,500	27,100	27,700	28,300	31,900
	of which:												
	under ETS		5,550	6,200	6,600	6,700	6,900	7,400	7,900	8,200	8,400	8,800	9,700
	3. Transport	5,784.55	12,282	14,700	15,900	16,800	17,600	18,500	19,500	20,600	21,400	22,600	25,300
	4. Other Sources	10,197.13	12,444	13,900	14,900	15,800	16,600	17,200	17,900	18,400	18,900	19,400	21,900
	of which:												
	under ETS		4,120	4,600	5,100	5,700	6,200	6,700	7,100	7,300	7,700	8,400	8,700
2.	Industrial processes	33,053.63	17,646	18,900	20,100	21,800	23,600	24,400	25,300	26,200	27,100	28,000	31,100
	of which:												
	under ETS		11,440	12,900	15,700	16,700	17,800	18,600	19,400	20,100	20,900	21,300	24,100
3.	Solvent and other product use	645.80	210	250	270	280	290	290	300	300	310	310	350
4.	LULUCF	-32,641.42	-37,495	-37,600	-37,700	-37,735	-37,770	-37,805	-37,840	-37,875	-37,905	-37,940	-38,115
5.	Waste	-	338	400	400	400	400	400	400	400	400	400	500
Total CO_2 emissions without LULUCF		**193,118.17**	**111,011**	**123,650**	**133,170**	**143,680**	**149,690**	**155,190**	**160,200**	**166,100**	**171.810**	**178,110**	**200,650**
Total CO_2 emissions including LULUCF		**160,476.75**	**73,516**	**86,050**	**95,470**	**105,945**	**111,920**	**117,385**	**122,360**	**128,225**	**133,905**	**140,170**	**162,535**
Total CO_2 under ETS			**69,898**	**77,400**	**86,500**	**93,800**	**97,700**	**101,200**	**104,700**	**108,700**	**113,000**	**117,600**	**132,100**

Table V_ 2 CH_4 emissions trend for the WOM scenario

No.	Source of emissions	CH_4 emissions (Gg CO_2 equivalent)											
		Historical		Estimated		Forecasted							
		1989	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020
1.	Energy	28,593.0	12,215.1	12,467.7	12,726.0	13,125.0	13,477.8	13,830.6	14,179.2	14,502.6	14,811.3	15,134.7	16,388.4
	A. Fuel combustion	399.9	847.4	871.5	896.7	940.8	989.1	1,041.6	1,089.9	1,134.0	1,188.6	1,245.3	1,354.5
	1. Energy Industries	40.5	20.2	21.0	23.1	27.3	29.4	35.7	39.9	44.1	48.3	54.6	63.0
	2. Manufacturing Industries and Construction	54.3	33.8	35.7	37.8	42.0	44.1	48.3	54.6	58.8	63.0	69.3	79.8
	3. Transport	15.3	38.4	39.9	42.0	44.1	48.3	52.5	60.9	65.1	69.3	75.6	84.0
	4. Other Sources	289.7	755.0	774.9	793.8	827.4	867.3	905.1	934.5	966.0	1,008.0	1,045.8	1,127.7
	B. Fugitive Emissions from Fuels	28,193.1	11,367.7	11,596.2	11,829.3	12,184.2	12,488.7	12,789.0	13,089.3	13,368.6	13,622.7	13,889.4	15,033.9
2.	Industrial Processes	41.2	27.3	31.5	35.7	37.8	42.0	44.1	44.1	46.2	48.3	50.4	63.0
3.	Agriculture	15,643.9	7,837.2	7,994.7	8,145.9	8,309.7	8,511.3	8,681.4	8,857.8	9,053.1	9,250.5	9,424.8	9,912.0
4.	LULUCF	0.2	2.1	2.1	2.1	2.1	2.1	4.2	4.2	4.2	4.2	4.2	8.4
5.	Waste	7,749.9	8,979.6	9,248.4	9,479.4	9,678.9	9,901.5	10,128.3	10,355.1	10,560.9	10,775.1	11,006.1	12,117.0
TOTAL CH_4 emissions		**52,028.2**	**29,059.2**	**29,742.3**	**30,387.0**	**31,151.4**	**31,932.6**	**32,684.4**	**33,436.2**	**34,162.8**	**34,885.2**	**35,616.0**	**38,480.4**

Table V_ 3 N_2O emissions trend for the WOM scenario

No.	Source of emissions	N_2O emissions (Gg CO_2 equivalent)											
		Historical		Estimated		Forecasted							
		1989	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020
1.	Energy	398.5	399.9	421.6	434.0	458.8	471.2	477.4	483.6	489.8	496.0	505.3	523.9
	A. Fuel combustion	398.5	399.9	421.6	434.0	458.8	471.2	477.4	483.6	489.8	496.0	505.3	523.9
	1. Energy Industries	258.1	164.3	173.6	182.9	186.0	189.1	192.2	195.3	195.3	195.3	198.4	201.5
	2. Manufacturing, Industries and Construction	71.2	49.6	49.6	49.6	55.8	58.9	58.9	62.0	62.0	65.1	65.1	68.2
	3. Transport	15.2	31.0	31.0	34.1	37.2	40.3	40.3	40.3	43.4	46.5	46.5	49.6
	4. Other Sources	54.0	155.0	167.4	167.4	179.8	182.9	186.0	186.0	189.1	189.1	195.3	204.6
2.	Industrial Processes	7,440.0	2,507.9	3,165.1	3,348.0	3,689.0	3,937.0	4,185.0	4,371.0	4,588.0	4,774.0	4,929.0	5,332.0
3.	Agriculture	24,961.3	12,353.5	12,803.0	13,361.0	13,733.0	14,074.0	14,291.0	14,632.0	15,004.0	15,314.0	15,624.0	16,988.0
4.	Waste	599.4	719.2	722.3	728.5	728.5	731.6	734.7	740.9	747.1	756.4	765.7	812.2
TOTAL N_2O emissions		**33,399.3**	**15,980.5**	**17,112.0**	**17,871.5**	**18,609.3**	**19,213.8**	**19,688.1**	**20,227.5**	**20,828.9**	**21,340.4**	**21,824.0**	**23,656.1**

Table V_ 4 Total GHG emissions trend for the WOM scenario

No.	Source of emissions	Total GHG emissions (Gg CO_2 equivalent)											
		1989	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	188,410.3	105,432.0	116,989.3	125,560.0	134,783.8	139,349.0	144,408.0	148,862.8	154,192.4	159,307.3	165,040.0	185,612.3
	A. Fuel combustion	160,217.2	94,064.3	105,393.1	113,730.7	122,599.6	126,860.3	131,619.0	135,773.5	140,823.8	145,684.6	151,150.6	170,578.4
	1. Energy Industries	106,310.2	48,972.5	53,894.6	59,306.0	64,913.3	67,018.5	68,727.9	70,535.2	73,339.4	76,243.6	79,353.0	89,864.5
	2. Manufacturing, Industries and Construction	37,551.0	19,386.4	21,885.3	22,587.4	23,997.8	24,503.0	26,007.2	26,616.6	27,220.8	27,828.1	28,434.4	32,048.0
	3. Transport	5,815.1	12,351.4	14,770.9	15,976.1	16,881.3	17,688.6	18,592.8	19,601.2	20,708.5	21,515.8	22,722.1	25,433.6
	4. Other Sources	10,540.8	13,354.0	14,842.3	15,861.2	16,807.2	17,650.2	18,291.1	19,020.5	19,555.1	20,097.1	20,641.1	23,232.3
	B. Fugitive Emissions from Fuels	28,193.1	11,367.7	11,596.2	11,829.3	12,184.2	12,488.7	12,789.0	13,089.3	13,368.6	13,622.7	13,889.4	15,033.9
2.	Industrial Processes	40,534.8	20,181.2	22,096.6	23,483.7	25,526.8	27,579.0	28,629.1	29,715.1	30,834.2	31,922.3	32,979.4	36,495.0
3.	Solvent and Other Product Use	645.8	210.0	250.0	270.0	280.0	290.0	290.0	300.0	300.0	310.0	310.0	350.0
4.	Agriculture	40,605.3	20,190.7	20,797.7	21,506.9	22,042.7	22,585.3	22,972.4	23,489.8	24,057.1	24,564.5	25,048.8	26,900.0
5.	LULUCF	-32,641.2	-37,492.9	-37,597.9	-37,697.9	-37,732.9	-37,767.9	-37,800.8	-37,835.8	-37,870.8	-37,900.8	-37,935.8	-38,106.6
6.	Waste	8,349.3	10,036.8	10,370.7	10,607.9	10,807.4	11,033.1	11,263.0	11,496.0	11,708.0	11,931.5	12,171.8	13,429.2
HFCs, PFCs and SF_6 emissions - total		**3,349.5**	**631.4**	**694.5**	**757**	**817.5**	**891.1**	**962.4**	**1049**	**1132**	**1223.6**	**1321.5**	**1708**
Total GHG emissions without LULUCF		**281,894.9**	**156,682.1**	**171,198.8**	**182,185.5**	**194,258.2**	**201,727.5**	**208,524.9**	**214,912.7**	**222,223.7**	**229,259.2**	**236,871.5**	**264,494.5**
Total GHG emissions including LULUCF		**249,253.7**	**119,189.2**	**133,600.9**	**144,487.6**	**156,525.3**	**163,959.6**	**170,724.1**	**177,076.9**	**184,352.9**	**191,358.4**	**198,935.7**	**226,387.9**

Table V_ 5 CO_2 emissions trend for the WEM scenario

No.	Source of emissions	CO_2 emissions (Gg CO_2 equivalent)							
		2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	92,817.0	116,900.0	120,400.0	123,800.0	127,400.0	130,700.0	134,100.0	151,000.0
	A. Fuel combustion	92,817.0	116,900.0	120,400.0	123,800.0	127,400.0	130,700.0	134,100.0	151,000.0
	1. Energy industries	48,788.0	62,800.0	64,300.0	65,900.0	67,400.0	68,900.0	70,500.0	80,000.0
	2. Manufacturing Industries and Construction	19,303.0	23,500.0	24,300.0	25,000.0	25,800.0	26,500.0	27,200.0	29,800.0
	3. Transport	12,282.0	16,500.0	17,300.0	18,000.0	18,800.0	19,500.0	20,200.0	22,900.0
	4. Other Sources	12,444.0	14,100.0	14,500.0	14,900.0	15,400.0	15,800.0	16,200.0	18,300.0
2.	Industrial processes	17,646.0	22,200.0	23,100.0	23,900.0	24,700.0	25,600.0	26,500.0	29,900.0
3.	Solvent and Other Product use	210.0	270.0	280.0	280.0	290.0	290.0	300.0	340.0
4.	Land Use, Land Use Change and Forestry	-37,495.0	-37,780.0	-37,820.0	-37,860.0	-37,890.0	-37,940.0	-37,980.0	-38,180.0
5.	Waste	338.0	380.0	380.0	380.0	380.0	380.0	390.0	480.0
Total CO_2 emissions without LULUCF		**111,011.0**	**139,750.0**	**144,160.0**	**148,360.0**	**152,770.0**	**156,970.0**	**161,290.0**	**181,720.0**
Total CO_2 emissions including LULUCF		**73,516.0**	**101,970.0**	**106,340.0**	**110,500.0**	**114,880.0**	**119,030.0**	**123,310.0**	**143,540.0**
Total CO_2 under ETS		**69,898.0**	**91,500.0**	**94,500.0**	**97,610.0**	**100,260.0**	**103,130.0**	**106,150.0**	**119,530.0**

Table V_ 6 CH_4 emissions trend for the WEM scenario

No.	Source of emissions	CH_4 emissions (Gg CO_2 equivalent)							
		2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	12,215.1	12,948.6	13,230.0	13,511.4	13,792.8	14,078.4	14,357.7	15,120.0
	A. Fuel combustion	847.4	968.1	993.3	1,020.6	1,045.8	1,073.1	1,098.3	1,228.5
	1. Energy Industries	20.2	27.3	29.4	33.6	35.7	37.8	39.9	48.3
	2. Manufacturing Industries and Construction	33.8	42.0	44.1	48.3	50.4	52.5	54.6	63.0
	3. Transport	38.4	44.1	48.3	50.4	52.5	56.7	60.9	69.3
	4. Other Sources	755.0	854.7	871.5	888.3	907.2	926.1	942.9	1,047.9
	B. Fugitive Emissions from Fuels	11,367.7	11,980.5	12,236.7	12,490.8	12,747.0	13,005.3	13,259.4	13,891.5
2.	Industrial Processes	27.3	33.6	35.7	37.8	39.9	39.9	42.0	56.7
3.	Agriculture	7,837.2	8,085.0	8,169.0	8,253.0	8,337.0	8,421.0	8,505.0	9,156.0
4.	LULUCF	2.1	2.1	4.2	4.2	4.2	4.2	4.2	8.4
5.	Waste	8,979.6	9,481.5	9,559.2	9,678.9	9,798.6	9,918.3	10,080.0	10,825.5
TOTAL CH_4 emissions		**29,059.2**	**30,548.7**	**30,993.9**	**31,481.1**	**31,968.3**	**32,457.6**	**32,984.7**	**35,158.2**

Table V_ 7 N_2O emissions trend for the WEM scenario

No.	Source of emissions	N_2O emissions (Gg CO_2 equivalent)							
		2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	399.9	434.0	446.4	452.6	461.9	471.2	480.5	511.5
	A. Fuel combustion	399.9	434.0	446.4	452.6	461.9	471.2	480.5	511.5
	1. Energy Industries	164.3	182.9	186.0	189.1	195.3	198.4	201.5	210.8
	2. Manufacturing Industries and Construction	49.6	52.7	52.7	52.7	55.8	55.8	58.9	58.9
	3. Transport	31.0	34.1	34.1	37.2	37.2	40.3	40.3	43.4
	4. Other Sources	155.0	164.3	173.6	173.6	173.6	176.7	179.8	198.4
2.	Industrial Processes	2,507.9	3,441.0	3,658.0	3,906.0	4,123.0	4,340.0	4,588.0	4,975.5
3.	Agriculture	12,353.5	13,051.0	13,379.6	13,708.2	14,043.0	14,365.4	14,694.0	15,965.0
4.	Waste	719.2	728.5	731.6	734.7	737.8	740.9	744.0	787.4
TOTAL N_2O emissions		**15,980.5**	**17,654.5**	**18,215.6**	**18,801.5**	**19,365.7**	**19,917.5**	**20,506.5**	**22,239.4**

Table V_ 8 Total GHG emissions trend for the WEM scenario

No.	Source of emissions	Total GHG emissions (Gg CO_2 equivalent)							
		2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	105,432.0	130,282.6	134,076.4	137,764.0	141,654.7	145,249.6	148,938.2	166,631.5
	A. Fuel combustion	94,064.3	118,302.1	121,839.7	125,273.2	128,907.7	132,244.3	135,678.8	152,740.0
	1. Energy Industries	48,972.5	63,010.2	64,515.4	66,122.7	67,631.0	69,136.2	70,741.4	80,259.1
	2. Manufacturing Industries and Construction	19,386.4	23,594.7	24,396.8	25,101.0	25,906.2	26,608.3	27,313.5	29,921.9
	3. Transport	12,351.4	16,578.2	17,382.4	18,087.6	18,889.7	19,597.0	20,301.2	23,012.7
	4. Other Sources	13,354.0	15,119.0	15,545.1	15,961.9	16,480.8	16,902.8	17,322.7	19,546.3
	B. Fugitive Emissions from Fuels	11,367.7	11,980.5	12,236.7	12,490.8	12,747.0	13,005.3	13,259.4	13,891.5
2.	Industrial Processes	20,181.2	25,674.6	26,793.7	27,843.8	28,862.9	29,979.9	31,130.0	34,932.2
3.	Solvent and Other Product Use	210.0	270.0	280.0	280.0	290.0	290.0	300.0	340.0
4.	Agriculture	20,190.7	21,136.0	21,548.6	21,961.2	22,380.0	22,786.4	23,199.0	25,121.0
5.	LULUCF	-37,492.9	-37,777.9	-37,815.8	-37,855.8	-37,885.8	-37,935.8	-37,975.8	-38,171.6
6.	Waste	10,036.8	10,590.0	10,670.8	10,793.6	10,916.4	11,039.2	11,214.0	12,092.9
HFCs, PFCs and SF_6 emissions - total		**631.4**	**891.1**	**962.0**	**1,049.0**	**1,132.0**	**1,224.0**	**1,322.0**	**1,708.0**
Total GHG emissions without LULUCF		**156,682.1**	**188,844.3**	**194,331.9**	**199,691.6**	**205,236.0**	**210,568.7**	**216,102.7**	**240,825.6**
Total GHG emissions including LULUCF		**119,189.2**	**151,066.4**	**156,516.1**	**161,835.8**	**167,350.2**	**172,632.9**	**178,126.9**	**202,654.0**

Table V_ 9 CO_2 emissions trend for the WAM scenario

No.	Source of emissions	CO_2 emissions (Gg CO_2)							
		2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	92,817.0	112,300.0	115,300.0	118,450.0	121,550.0	124,500.0	127,500.0	141,900.0
	A. Fuel combustion	92,817.0	112,300.0	115,300.0	118,450.0	121,550.0	124,500.0	127,500.0	141,900.0
	1. Energy industries	48,788.0	60,800.0	61,900.0	63,100.0	64,200.0	65,400.0	66,500.0	75,000.0
	2. Manufacturing Industries and Construction	19,303.0	22,500.0	23,200.0	23,900.0	24,600.0	25,300.0	26,000.0	28,000.0
	3. Transport	12,282.0	15,500.0	16,250.0	17,000.0	17,750.0	18,400.0	19,200.0	21,900.0
	4. Other Sources	12,444.0	13,500.0	13,950.0	14,450.0	15,000.0	15,400.0	15,800.0	17,000.0
2.	Industrial processes	17,646.0	20,500.0	21,100.0	21,700.0	22,300.0	22,900.0	23,500.0	26,700.0
3.	Solvent and Other Product use	210.0	270.0	280.0	280.0	290.0	290.0	300.0	340.0
4.	LULUCF	-37,495.0	-37,788.0	-37,832.0	-37,876.0	-37,920.0	-37,964.0	-38,008.0	-38,228.0
5.	Waste	338.0	380.0	380.0	380.0	380.0	380.0	390.0	480.0
Total CO_2 emissions without LULUCF		**111,011.0**	**133,450.0**	**137,060.0**	**140,810.0**	**144,520.0**	**148,070.0**	**151,690.0**	**169,420.0**
Total CO_2 emissions including LULUCF		**73,516.0**	**95,662.0**	**99,228.0**	**102,934.0**	**106,600.0**	**110,106.0**	**113,682.0**	**131,192.0**
Total CO_2 emissions under ETS		**69,898.0**	**87,710.0**	**90,050.0**	**92,600.0**	**94,700.0**	**96,780.0**	**99,310.0**	**111,060.0**

Table V_ 10 CH_4 emissions trend for the WAM scenario

No.	Source of emissions	CH_4 emissions (Gg CO_2 equivalent)							
		2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	12,215.1	12,717.6	12,940.2	13,188.0	13,433.7	13,677.3	13,918.8	14,592.9
	A. Fuel combustion	847.4	947.1	959.7	976.5	991.2	1,003.8	1,014.3	1,123.5
	1. Energy Industries	20.2	25.2	27.3	29.4	31.5	33.6	35.7	35.7
	2. Manufacturing Industries and Construction	33.8	39.9	42.0	44.1	48.3	50.4	52.5	54.6
	3. Transport	38.4	42.0	46.2	48.3	50.4	52.5	54.6	56.7
	4. Other Sources	755.0	840.0	844.2	854.7	861.0	867.3	871.5	976.5
	B. Fugitive Emissions from Fuels	11,367.7	11,770.5	11,980.5	12,211.5	12,442.5	12,673.5	12,904.5	13,469.4
2.	Industrial Processes	27.3	31.5	33.6	35.7	37.8	39.9	42.0	52.5
3.	Agriculture	7,837.2	8,043.0	8,085.0	8,127.0	8,169.0	8,211.0	8,253.0	8,862.0
4.	LULUCF	2.1	2.1	4.2	4.2	4.2	4.2	4.2	8.4
5.	Waste	8,979.6	9,219.0	9,399.6	9,559.2	9,655.8	9,733.5	9,912.0	10,405.5
TOTAL CH_4 emissions		**29,059.2**	**30,011.1**	**30,458.4**	**30,909.9**	**31,296.3**	**31,661.7**	**32,125.8**	**33,912.9**

Table V_ 11 N_2O emissions trend for the WAM scenario

No.	Source of emissions	N_2O emissions (Gg CO_2 equivalent)							
		2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	399.9	427.8	437.1	443.3	449.5	455.7	461.9	502.2
	A. Fuel combustion	399.9	427.8	437.1	443.3	449.5	455.7	461.9	502.2
	1. Energy Industries	164.3	179.8	182.9	186.0	186.0	189.1	192.2	204.6
	2. Manufacturing Industries and Construction	49.6	52.7	52.7	52.7	55.8	55.8	58.9	58.9
	3. Transport	31.0	34.1	34.1	37.2	37.2	37.2	37.2	43.4
	4. Other Sources	155.0	161.2	167.4	167.4	170.5	173.6	173.6	195.3
2.	Industrial Processes	2,507.9	3,348.0	3,534.0	3,720.0	3,906.0	4,092.0	4,278.0	4,929.0
3.	Agriculture	12,353.5	12,958.0	13,237.0	13,516.0	13,795.0	14,074.0	14,353.0	15,252.0
4.	Waste	719.2	728.5	731.6	734.7	737.8	740.9	744.0	787.4
TOTAL N_2O emissions		**15,980.5**	**17,462.3**	**17,939.7**	**18,414.0**	**18,888.3**	**19,362.6**	**19,836.9**	**21,470.6**

Table V_ 12 Total GHG emissions trend for the WAM scenario

No.	Source of emissions	Total GHG emissions (Gg CO_2 equivalent)							
		2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
1.	Energy	105,432.0	125,445.4	128,677.3	132,081.3	135,433.2	138,633.0	141,880.7	156,995.1
	A. Fuel combustion	94,064.3	113,674.9	116,696.8	119,869.8	122,990.7	125,959.5	128,976.2	143,525.7
	1. Energy Industries	48,972.5	61,005.0	62,110.2	63,315.4	64,417.5	65,622.7	66,727.9	75,240.3
	2. Manufacturing Industries and Construction	19,386.4	22,592.6	23,294.7	23,996.8	24,704.1	25,406.2	26,111.4	28,113.5
	3. Transport	12,351.4	15,576.1	16,330.3	17,085.5	17,837.6	18,489.7	19,291.8	22,000.1
	4. Other Sources	13,354.0	14,501.2	14,961.6	15,472.1	16,031.5	16,440.9	16,845.1	18,171.8
	B. Fugitive Emissions from Fuels	11,367.7	11,770.5	11,980.5	12,211.5	12,442.5	12,673.5	12,904.5	13,469.4
2.	Industrial Processes	20,181.2	23,879.5	24,667.6	25,455.7	26,243.8	27,031.9	27,820.0	31,681.5
3.	Solvent and Other Product Use	210.0	270.0	280.0	280.0	290.0	290.0	300.0	340.0
4.	Agriculture	20,190.7	21,001.0	21,322.0	21,643.0	21,964.0	22,285.0	22,606.0	24,114.0
5.	LULUCF	-37,492.9	-37,785.9	-37,827.8	-37,871.8	-37,915.8	-37,959.8	-38,003.8	-38,219.6
6.	Waste	10,036.8	10,327.5	10,511.2	10,673.9	10,773.6	10,854.4	11,046.0	11,672.9
Total HFC, PFC and SF_6 emissions		**631.4**	**891.1**	**962.4**	**1049.0**	**1132.0**	**1223.6**	**1321.5**	**1708.0**
Total GHG emissions without LULUCF		**156,682.1**	**181,814.5**	**186,420.5**	**191,182.9**	**195,836.6**	**200,317.9**	**204,974.2**	**226,511.5**
Total GHG emissions including LULUCF		**119,189.2**	**144,028.6**	**148,592.7**	**153,311.1**	**157,920.8**	**162,358.1**	**166,970.4**	**188,291.9**

Table V_ 13Table V.13 HFCs, PFCs and SF_6 emissions trend

GHG/Year	Historical							Estimated		Forecasted							
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
HFCs emissions	2.93	2.78	3.25	5.12	6.94	4.00	21.70	23.87	26.01	28.09	30.62	33.07	36.05	38.90	42.05	45.41	58.70
PFCs emissions	413.14	428.75	444.59	471.90	513.34	569.63	609.65	670.53	730.88	789.29	860.35	929.19	1012.80	1092.94	1181.38	1275.90	1649.06
SF_6 emissions	0.00	0.00	0.01	0.00	0.08	0.11	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.19	0.24
HFCs, PFCs and SF_6 emissions - total	**416.07**	**431.53**	**447.85**	**477.02**	**520.36**	**573.74**	**631.44**	**694.50**	**757.00**	**817.50**	**891.10**	**962.40**	**1049.00**	**1132.00**	**1223.60**	**1321.50**	**1708.00**

Sensitivity analysis for projections
A sensitivity analysis has been conducted for a complete characterization of the solution for the development of the energy sector and the GHG emissions projections. The analysis evaluated the effects of variation of different key parameters (technical or economic) on the adopted solution.

The parameters subject to the sensitivity analysis were:
- electricity consumption:
- domestic consumption coverage (minimum, average, maximum);
- domestic consumption and export coverage (minimum, average, maximum)
- fuel prices;
- price of un-delivered energy;
- value of safety indicator;
- value of new groups investments

Trends in the consumption of electricity and heat are the main driver for the forecast in order to establish a program for the development of power plants in the sector for the period 2010-2020. The program takes into consideration as well the need for diversification of primary energy resources, the necessity to improve and modernize the sector, and the environmental requirements.

It can be noted that changing the consumption levels does not influence the structure of the development programme, but only the number of units that are installed in certain periods of time. Therefore, for ensuring electricity according to the "minimum consumption" it is necessary to install in the period 2010-2020 a new base load power unit (a 600 MW group on lignite) leading to the reduction of the GHG emissions adjacent to this group. For ensuring the energy export it is required an additional 600 MW lignite group in 2014-2020 leading to increasing GHG emissions adjacent to this group (Table V.14).

The CO_2 emissions trend in the period 2010-2020 for the 9 analyzed scenarios (a reference scenario and 8 alternative scenarios) are presented in Table V.14. It can be noted that CO_2 emissions will decrease due to changes of the production structure in 2006-2020. Thus, the CO_2 emissions in 2020 will represent 90% of 2006 emissions level, although the electricity production increases from 57.7 TWh to 78.2 TWh. In this case the CO_2, the average specific emissions decreases from 0.589 tonnes/MWh in 2006 to 0.396 tonnes/MWh in 2020.

Scenario A is the reference scenario and it is based on the assumption that all types of electricity generation units (nuclear, thermal, hydro, wind) are in open competition on the market, the selection order being the economic order in respect for the load curve at NPG level.

Alternative scenarios considering the efficient use of the domestic primary energy resources in hydro, wind and thermal power development programs are being considered as follows:
Scenario B is considering the use of hydroelectricity in new groups installed between 2010-2020 (217 MW, 472 MW, 1472 MW) all other candidate units being in open competition on the market;

Scenario C is considering the development of thermal power through the implementation of new fossil fired units during 2010-2013 by installing 3100 MW (1200 MW gas-fired, 700 MW on lignite, 1200 MW on brown coal), all the other units being in open competition on the market;

Scenario D considers the development of wind power plants during 2010-2017; the installed power is expected to reach 4000 MW; all other units being in open competition on the market;

Scenario E is based on the assumption that new thermal units will be installed in order to use domestic brown coal and lignite (more data presented in Table 5.8) and new hydro power units will be commissioned (472 MW) during 2010-2020;

Scenario F is based on the assumptions in scenario E + 4000 MW installed in wind farms

Table V_ 14 CO_2 emissions for the analyzed scenarios

	Scenario	CO_2 emissions (million tonnes/year)			
		2006	2010	2015	2020
A	-Reference economic order, with no restrictions	33.7	31.5	31.8	31.1
A	-Economic order, unrestricted maximum consumption hypothesis	33.7	32.6	34.1	33.2
B	- Hydro program required (Pi=217 MW)	33.7	31.5	31.8	31.3
B1	- Hydro program required (Pi=472 MW)	33.7	31.5	31.8	31.8
B2	- CHEAP-1000 MW in operation in 2016	33.7	31.5	31.8	32.9
B3	- Hydro program required (472MW) - Hydropower pumping station (CHEAP) -1000 MW in operation starting with 2016	33.7	31.5	31.8	32.3
C	- Thermal power program imposed (Pi = 3100 MW) during 2010-2013	33.7	30.7	31.8	32.3
D	- Wind program forced (Pi = 4000 MW) during 2010-2017	33.7	30.7	31.2	29.8
E	-Thermal power program required for lignite and coking coal consumption in the country according to the prognosis production -Hydro program required (472 MW)	33.71	30.7	31.5	32.0
F	- Thermal power program required for domestic lignite and coking coal consumption according to the prognosis production - Hydro program required (472 MW) - Wind program forced (Pi = 4000 MW) during 2010-2017	33.71	30.7	30.7	31.0

Sensitivity analysis on fuel prices variations shows that the solution for the development of electricity power plants remains virtually unchanged to this parameter, but it can be noted the variation of the objective cumulated function due to changes at the operational expenses level (fuel expenses).

Overall, the sensitivity analysis performed on the electricity power plants development options, established on economic and security of supply reasons, is stable for a wide scale of parameters variation, limits considered normal for key parameters in the optimization calculations.

Concluding, the CO_2 projected emissions depend on the electricity consumption trend which needs to be covered by the power plants development programme based on the energy strategy adopted by the Romanian Government.

The electricity price trend is influenced by the price of primary energy on international markets, the measures adopted in order to increase security of supply and measures adopted in order to reduce negative environmental impacts. It is also reflected in the updated cost of electricity and in the objective function (Tables V.15 and V.16).

For the economic criteria, in addition to the objective function value an updated cost of electricity is determined (Table V.15) which allows the scenarios ranking.

Table V_ 15 Updated electricity cost

Scenario	Objective function (billion Euro)	Updated cost (Euro/MWh)
A. Reference - economic order, with no restrictions	17.93	14.04
B. Hydro program required (Pi=217 MW)	18.11	14.18
B.1 Hydro program required (Pi=472 MW)	18.21	14.26
B.2 CHEAP-1000 MW in operation starting with 2016	18.14	14.20
B.3 Hydro program required (472MW) and CHEAP-1000 MW in operation starting with 2016	18.78	14.71
C. Thermal power program required (Pi = 3100 MW) during 2010-2013	18.74	14.67
D. Wind program required (Pi = 4000 MW) during 2010-2017	18.58	14.55
E. Thermal power program required for domestic lignite and coking coal consumption -Hydro program required (472 MW)	19.19	15.03
F. Thermal power program required for domestic lignite and coking coal consumption - Hydro program required (472 MW) - Wind program required (Pi = 4000 MW) during 2010-2017	20.20	15.80

Multi-criteria analysis of programs for the development of power plants presented above allows the selection of the program that takes into account the requirements of the "New EU Energy Policy".

Given that the costs required for environmental protection may be included in the operation costs that define the objective function, this criterion is excluded in the multi-criteria analysis and the programs will have to be ranked only considering two criteria: the economic criteria and security of supply criteria, both considered of equal importance.
Among the indicators defining security of supply, only the amount of imported fuel is being used in order to avoid double assessment.

Table V_ 16 presents the hierarchy of programmes based on grades obtained following their assessment using marks from 1 to 10, considering the degree on which they are complying with the presented criteria.

The development of national power system in the period 2010-2020 selected through the multicriteria analysis is taking into consideration the implementation of new units summing up to 4872 MW, as follows:

- 1320 MW - groups 3 and 4 from CNE Cernavoda;
- 600 MW - a group on domestic lignite;
- 1980 MW - cogeneration groups using gas turbines with various size recuperating boilers depending on the heating power requirements and the type of combined cycle gas turbines with 100 MW;
- 500 MW - 250 MW groups related to CHEAP Tarniţa;
- 442 MW – hydro plant groups.

This program is considered in the "with measures" case scenario. In the "with additional measures" scenario it is taken into consideration installing wind farms totaling 4000 MW. The

installation of wind groups is beneficial in contributing to increase the share of renewable energy used, thereby reducing use of fossil fuels and therefore the GHG emissions.

Table V_ 16 Evaluation of scenarios based on economic, electricity supplying security and environmental criteria

Scenario	Notation after criteria		Final mark	Scenarios prioritization
	Economic	Supplying security		
	Updated cost of electricity	The quantity of fuel imported		
A. Reference economic order, with no restrictions	10	1	5.5	3
B. - Hydro program required (Pi=217 MW)	9	2	5.5	3
B.1 - Hydro program required (Pi=472 MW)	9	2	5.5	3
B.2 - CHEAP-1000 MW in operation starting with 2016	9	2	5.5	3
B.3 - Hydro program required (472MW) and CHEAP-1000 MW in operation starting with 2016	8	3	5.5	3
C. - Thermal power program required (Pi = 3100 MW) during 2010-2013	8	4	6.0	2
D. Wind program required (Pi = 4000 MW) during 2010-2017	8	2	5.0	4
E. Thermal power program required for domestic lignite and coking coal consumption - Hydro program required (472 MW)	4	9	6.5	1
F. Thermal power program required for domestic lignite and coking coal consumption - Hydro program required (472 MW) - Wind program required (Pi = 4000 MW)	1	10	5.5	3

V.B. ASSESSMENT OF AGGREGATE EFFECTS OF POLICIES AND MEASURES

The total effect of policies and measures was calculated as the difference between the "with measures" and "without measures" scenarios emissions levels.

The effects are presented in terms of GHG emissions avoided/sequestered, by gas (on a CO_2 equivalent basis) and by sector, within the Tables V_17 - V_20.

Table V_ 17 CO_2 emissions avoided/sequestered

Emissions/removals category/Year	CO_2 emissions avoided/sequestered (Gg)						
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Energy	-8500	-9700	-10400	-11800	-13300	-15300	-17700
A. Fuel combustion	-8500	-9700	-10400	-11800	-1330	-15300	-17700
1. Energy industries	-4000	-4200	-4400	-5700	-7100	-8600	-9600
2. Manufacturing Industries and Construction	-900	-1600	-1500	-1300	-1200	-1100	-2100
3. Transport	-1100	-1200	-1500	-1800	-1900	-2400	-2400
4. Other Sources	-2500	-2700	-3000	-3000	-3100	-3200	-3600
Industrial processes	-1400	-1300	-1400	-1500	-1500	-1500	-1200
Solvent and Other Products Use	-20	-10	-20	-10	-20	-10	-10
LULUCF	-10	-15	-20	-15	-35	-40	-65
Waste	-20	-20	-20	-20	-20	-10	-20
Total CO_2 emissions without LULUCF	**-9940**	**-11030**	**-11840**	**-13330**	**-14840**	**-16820**	**-18930**
Total CO_2 emissions including LULUCF	**-9950**	**-11045**	**-11860**	**-13345**	**-14875**	**-16860**	**-18995**

Table V_ 18 CH_4 emissions avoided

Emissions category/Year	CH_4 emissions avoided (Gg CO_2 equivalent)						
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Energy	-529.2	-600.6	-667.8	-709.8	-732.9	-777.0	-1268.4
A. Fuel combustion	-21.0	-48.3	-69.3	-88.2	-115.5	-147.0	-126.0
1. Energy Industries	-2.1	-6.3	-6.3	-8.4	-10.5	-14.7	-14.7
2. Manufacturing Industries and Construction	-2.1	-4.2	-6.3	-8.4	-10.5	-14.7	-16.8
3. Transport	-4.2	-4.2	-10.5	-12.6	-12.6	-14.7	-14.7
4. Other Sources	-12.6	-33.6	-46.2	-58.8	-81.9	-102.9	-79.8
B. Fugitive Emissions from Fuels	-508.2	-552.3	-598.5	-621.6	-617.4	-630.0	-1142.4
Industrial Processes	-8.4	-8.4	-6.3	-6.3	-8.4	-8.4	-6.3
Agriculture	-426.3	-512.4	-604.8	-716.1	-829.5	-919.8	-756.0
LULUCF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste	-420.0	-569.1	-676.2	-762.3	-856.8	-926.1	-1291.5
TOTAL CH_4 emissions	**-1383.9**	**-1690.5**	**-1955.1**	**-2194.5**	**-2427.6**	**-2631.3**	**-3322.2**

Table V_ 19 N_2O emissions avoided

Emissions category/Year	N_2O emissions avoided (Gg CO_2 equivalent)						
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Energy	-37.2	-31.0	-31.0	-27.9	-24.8	-24.8	-12.4
A. Fuel combustion	-37.2	-31.0	-31.0	-27.9	-24.8	-24.8	-12.4
1. Energy Industries	-6.2	-6.2	-6.2	0.0	3.10	3.1	9.30
2. Manufacturing Industries and Construction	-6.2	-6.2	-9.3	-6.2	-9.3	-6.2	-9.3
3. Transport	-6.2	-6.2	-3.1	-6.2	-6.2	-6.2	-6.2
4. Other Sources	-18.6	-12.4	-12.4	-15.5	-12.4	-15.5	-6.2
Industrial Processes	-496.0	-527.0	-465.0	-465.0	-434.0	-341.0	-356.5
Agriculture	-1023.0	-911.4	-923.8	-961.0	-948.6	-930.0	-1023.0
Waste	-3.1	-3.1	-6.2	-9.3	-15.5	-21.7	-24.8
Total N_2O emissions	**-1559.3**	**-1472.5**	**-1426.0**	**-1463.2**	**-1422.9**	**-1317.5**	**-1416.7**

Table V_ 20 Total GHG emissions avoided/sequestered

Emissions/removals category/Year	Total GHG emissions/removals avoided/sequestered (Gg CO_2 equivalent)						
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Energy	-9066.4	-10331.6	-11098.8	-12537.7	-14057.7	-16101.8	-18980.8
A. Fuel combustion	-8558.2	-9779.3	-10500.3	-11916.1	-13440.3	-15471.8	-17838.4
1. Energy Industries	-4008.3	-4212.5	-4412.5	-5708.4	-7107.4	-8611.6	-9605.4
2. Manufacturing Industries and Construction	-908.3	-1610.4	-1515.6	-1314.6	-1219.8	-1120.9	-2126.1
3. Transport	-1110.4	-1210.4	-1513.6	-1818.8	-1918.8	-2420.9	-2420.9
4. Other Sources	-2531.2	-2746.0	-3058.6	-3074.3	-3194.3	-3318.4	-3686.0
B. Fugitive Emissions from Fuels	-508.2	-552.3	-598.5	-621.6	-617.4	-630.0	-1142.4
Industrial Processes	-1904.4	-1835.4	-1871.3	-1971.3	-1942.4	-1849.4	-1562.8
Solvent and Other Product Use	-20.0	-10.0	-20.0	-10.0	-20.0	-10.0	-10.0
Agriculture	-1449.3	-1423.8	-1528.6	-1677.1	-1778.1	-1849.8	-1779.0
LULUCF	10.0	15.0	20.0	15.0	35.0	40.0	65.0
Waste	-443.1	-592.2	-702.4	-791.6	-892.3	-957.8	-1336.3
Total HFC, PFC and SF_6 emissions	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total GHG emissions without LULUCF	**-12883.2**	**-14193.0**	**-15221.1**	**-16987.7**	**-18690.5**	**-20768.8**	**-23668.9**
Total GHG emissions including LULUCF	**-12893.2**	**-14208.0**	**-15241.10**	**-17002.70**	**-18725.50**	**-20808.80**	**-23733.9**

V.C. SUPPLEMENTARY RELATED TO MECHANISMS UNDER ARTICLE 6, 12 AND 17 OF THE KYOTO PROTOCOL

According to the most recent NIR, Romania is achieving the target established through the Kyoto Protocol without making use of the provisions in Article 6, 12, or 17 of the previously mentioned Protocol; therefore, so far, the emissions reduction have happened only applying domestic policies and measures.

On the other hand, Romania successfully participates in the development of "Joint Implementation" projects based on the cooperation with different countries, as host country.

Romania signed 10 Memoranda of Understanding with different developed countries (Switzerland, the Netherlands, Norway, Denmark, Austria, Sweden, France, Italy and Finland), as well as with the World Bank's Prototype Carbon Fund, representing the legal framework for the development of JI projects.

Until now, 17 JI projects were approved and are in different stages of development. The total quantity of emission reductions to be generated by these projects is about 14 million tones of CO_2 equivalent (for the period 2008-2012, and in some cases before 2008), and the transfer is performed by the ME only based on the monitoring reports of the effective emissions reductions verified by accredited independent entities. The projects are mainly developed in the local authorities' area, such as: district heating systems (including the use of renewable energy sources – sawdust and geothermal energy), closing up of urban waste landfills. These investments have a positive impact not only by GHG emissions reductions, but also for the environment generally or from social point of view (providing of comfortable conditions at reasonable prices.

Regarding the art 17 of the Kyoto Protocol, Romania intends to develop the mechanism for a Green Investment Scheme, in order to take benefit from the opportunity of "greening up" its economy while selling AAUs.

V.D. METHODOLOGY USED FOR THE PRESENTED GHG EMISSION PROJECTIONS

Gases and sectors covered

Projections are presented on a sectoral basis and on a gas-by-gas basis for the following GHGs: CO_2, CH_4, N_2O, HFCs, PFCs and SF_6. In addition, projections have been provided in an aggregated format for each sector as well as for a national total, using GWP values.

The sectors covered are:

1. Energy
   a. Fuel combustion
      Energy Industries
      Manufacturing Industries and Construction
      Transport
      Other Sources
   b. Fugitive Emissions from Fuels
2. Industrial processes
3. Solvent and Other Product

4. Agriculture
5. Land Use Land Use Change and Forestry
6. Waste

Description of methodologies, models, underlying assumptions and key input and output parameters

The methodology for GHG projections calculation is similar to the one used for establishing the National Allocation Plan under the EU ETS. It relies both on historical data provided by the National GHG Inventory, for the period 1989-2006, and on macroeconomic indicators forecasts, indicators considered in the Romanian Government's relevant strategies and for the socio-economic policies taking into consideration EU acquis communautaire.

The GHG projections were determined for Energy sector and non-energy sectors.

The GHG projections for the energy sector were established considering energy demand sub-sector (industry, transport, agriculture, household and commercial consumption) and energy supply sub-sector (primary energy resources extraction, their conversion in refineries, thermal and cogeneration power plants, transport and distribution of energy products to consumers).

The projections are based on calculations carried out using ENPEP (Energy and Power Evaluation Program) software, developed by Argonne National Laboratory of US Department of Energy (DOE) and distributed in Romania by the International Atomic Energy Agency (IAEA). The main modules used for the GHG projections are:

- MAED (Model for Analyses of Energy Demand) – forecasts the energy demand considering the information on the macroeconomic indicators trend;
- ELECTRIC – determines the power plants development program considering the specific policies on the use of renewable energy resources, on ensuring the energy security, on technological evolution and on international fuel prices
- BALANCE – determines the demand/supply balance for each analyzed year;
- IMPACTS – estimates, based on the data from the previous modules, the impact on atmosphere, water, soil, specific waste, materials and labour needed for the installations construction and exploitation, related employees risk and health, for the National Power Grid

In order to allow the use of the modules, a national energy balance has been prepared considering the available and imported energy resources. The main elements of the energy balance are:

- primary energy resources;
- primary energy resources conversion technologies;
- energy transport and distribution;
- energy consumers classified according to the IPCC Guidelines

Every sector is modeled in detail considering the technological processes and the IPCC emissions factors; based on that modeling, the GHG emissions are determined using the IMPACTS module.
The analyzed non-energy sectors comprise:

- the forestry – for evaluating the C sequestration options;
- the agriculture – for evaluating the CH_4 and N_2O emissions from livestock management and the N_2O emissions from the use of nitrous fertilizers;
- industry – for evaluating the emissions from industrial processes;
- solvents and other products use;
- waste management

The GHG emissions projections were prepared for three different scenarios:

- a reference scenario ”without measures” (WOM) , possible to be realized in the future, which does not include distinct activities for GHG emissions mitigation;
- a “with measures” scenario similar to the WOM scenario considering the evolution of the economic-social indicators, but comprising GHG emissions mitigation policies and programmes;
- a “with additional measures” scenario similar to the “with measures” scenario, which comprises additional GHG emissions mitigation policies and programmes

Technological source processes and their mitigation options were identified for every GHG sector.

The prioritization of options within each sector is based on a detailed analysis considering the following criteria:

- mitigation potential of the GHG emissions
- cost-benefit balance related to the GHG mitigation options
- indirect economic impact (creation of new jobs, import decrease)
- easy implementing options
- mitigation option long-term sustainability

Romania’s macroeconomic structure is different from the other EU countries. Over the past decades, Romania has undergone a long process of restructuring, resulting in a decreas of activity in primary and secondary processing sectors and an increase of activity of the services sector.
Over the next period new industrial activities with high added value and low material consumption are expected to be developed.

Assumptions on macroeconomic indicators and on Energy activities
The macroeconomic indicators trend is presented within Table V_ 21

Table V_ 21 Evolution of macroeconomic and energy indicators

Year	Meas. Unit. (MU)	Realized										Forecast								
		1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020
Population	106 inhabitant	23.2	22.5	21.9	21.84	21.79	21.73	21.67	21.62	21.55	21.47	21.38	21.32	21.26	21.20	21.14	21.08	21.02	20.96	20.3
Gross Domestic Product	109 Euro 2005	71.40	64.00	59.13	62.70	66.00	69.77	76.09	79.26	84.25	89.30	96.10	101.00	104.90	111.20	117.90	125.00	132.50	141.10	185.10
GDP/ inhabitant	Euro 2005/ inhabitant	3078	2845	2700	2871	3029	3211	3512	3666	3910	4160	4495	4738	4935	5300	5578	5930	6304	6732	9119
GDP growth	%	-	-	-	6.1	5.3	5.8	9.1	4.2	6.3	6.0	7.7	5.1	3.9	6.0	6.1	6.1	6.0	6.5	5.7
Primary energy intensity	toe/103 Euro 2005	0.86	0.74	0.63	0.60	0.55	0.56	0.51	0.48	0.47	0.44	0.42	0.40	0.39	0.36	0.35	0.34	0.33	0.32	0.26
Final energy intensity	toe/103 Euro 2005	0.51	0.41	0.38	0.36	0.35	0.36	0.36	0.32	0.31	0.29	0.28	0.26	0.25	0.24	0.23	0.22	0.21	0.21	0.17
Primary energy consumption	106 toe	61.49	47.10	37.07	37.97	36.48	39.03	39.02	37.93	39.57	39.3	40.4	40.4	40.9	41.1	41.2	42.5	43.7	45.2	48.1
Primary energy consumption per inhabitant	toe/ inhabitant	2.65	2.09	1.72	1.74	1.67	1.79	1.80	1.75	1.84	1.83	1.89	1.89	1.92	1.94	1.95	2.02	2.08	2.16	2.37
Gross consumption of electricity	TWh	63.40	59.26	51.94	53.86	54.94	56.65	56.48	59.41	62.69	62.7	65.5	67.7	70.6	72.2	74.5	79.5	84.5	89.5	100.0
Gross consumption of electricity per inhabitant	KWh/ inhabitant	2732	2634	2370	2466	2521	2606	2606	2748	2905	2920	3064	3175	3320	3405	3524	3771	4120	4270	4926

The macroeconomic policies envisaged in Romania are:

- selective restructuring of the economy;
- development of the industries with a competitive potential;
- modernization and development of the infrastructure;
- modernization of agriculture in line with the natural, human and economic potential of the country;
- implementation of supporting information technology based activities;
- development of tourism;
- diversification of activities in the services sector.

Industry adjustment and restructuring policies are aiming to increase the productivity, efficiency and quality of products and services. They also seek to assure compatibility between Romanian inter-sectoral structures with the existing and future EU structures, to progressively reach the same level of competitiveness with the EU Member States, including the promotion of better access for the Romanian products on the EU markets.
The modernization of industrial activities results in the reduction of energy intensity.

National Plan for Agriculture and Rural Development (PNARD) will contribute to strengthening of the rural development and to the improvement of the activity in agriculture, resulting in augmenting quantity and quality of food production.

The constructions sector will be developed in close correlation with the infrastructure modernization and development.

The electricity sector needs to be maintained at a rate that it can cover domestic needs and participate in the export (Table V_ 22).

Table V_ 22 Evolution of the electricity sector

Year		Electricity (TWh)									
		Realized			Forecast						
		2005	2006	2007	2008	2009	2010	2011	2012	2015	2020
Production of electricity to cover domestic consumption		56.48	58.99	60.7	62.5	64.2	66.3	67.7	69.5	74.5	85.0
Exporting electricity		2.93	3.41	2.00	3.00	3.50	4.50	4.50	5.00	15.00	15.00
Total production of electricity of which:		59.41	62.4	62.7	65.5	67.7	70.6	72.2	74.5	89.5	100.0
- in hydro power and renewable sources plants		20.21	17.75	16.00	18.00	19.50	21.70	22.30	23.00	26.00	32.50
- in nuclear power plant		5.54	5.55	7.0	10.80	10.80	10.80	10.80	10.80	21.60	21.60
- in thermal power plants		33.68	39.10	39.70	36.70	37.40	38.10	39.10	40.70	41.90	45.90
of which:	• on coal	21.66	27.10	28.70	25.70	26.40	27.10	28.10	29.70	30.90	34.90
	• on natural gas	10.00	10.00	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50
	• on residual fuel oil	2.00	2.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50

The forecasted evolution of the electricity sector, is based on the "Energy Strategy of Romania" for 2007-2020 and was established taking into account the following assumptions:

- increase of the national consumption of electricity with a constant rate of about 3% per year in the analyzed period;

- use of renewable energy sources to achieve the target of 33%, 35% and 38% of the gross domestic electricity consumption of 2010, respectively 2015 and 2020;
- the use of solid fuels through clean technologies;
- use of natural gas mainly in cogeneration groups in order to ensure the heat supply for the population.

During the period 2010-2017, 14 thermal power units with a total installed capacity of 4030 MW will be improved according to the Ministry of Administration and Interior Order no. 859/2005 approving the "National program to reduce sulfur dioxide, nitrogen oxides and dust emissions from large combustion plants" by implementing installations for flue gas desulphurization (FGD) and low NOx burners.

The installed power of the Romanian Power Grid was 18835 MW in 2006 (Table V_23). A reduction of installed capacity of 11% can be noted from the evolution of installed power during 2000-2007 due to the fact that only the group No.2 of the Cernavodă nuclear power plant (CNE Cernavoda) and hydropower groups totaling an installed capacity of about 240 MW were put into operation while some thermal power groups have been withdrawn at the end of their life span.

Table V_23 Evolution of installed electricity power

Year	2000	2001	2002	2003	2004	2005	2006	2007
Total installed power (MW), of which:	21905	20863	19659	19368	19626	19042	18835	19541
- nuclear power plants (MW)	706	706	706	706	706	706	706	1412
- hydro power plants (MW)	6120	6122	6242	6248	6279	6289	6363	6363
- thermal power plants (MW)	15079	14035	12529	12414	12641	12047	11766	11766

Electricity production is obtained at the rate of about 9% in CNE Cernavodă and about 30% in hydropower plants (Table V_ 24).

Table V_ 24 Evolution of electricity production by type of plants

Year	2000		2001		2002		2003		2004		2005		2006	
	TWh	%	TWh	%	TWh	%	TWh	%	TWh	%	TWh	%	TWh	%
Gross electricity production, of which:	51.93	100	53.86	100	54.90	100	56.64	100	56.48	100	59.41	100	62.69	100
- nuclear power plant	5.46	10.5	4.92	9.1	5.51	10.0	4.91	8.7	5.55	9.8	5.56	9.4	5.63	8.9
- hydro power plants	14.78	28.5	14.92	27.7	16.05	29.2	13.26	23.4	16.52	29.3	20.21	34.0	18.35	29.3
- thermal power plants, of which:	31.69	61.0	34.02	63.2	33.37	60.8	38.47	67.9	34.41	60.9	33.64	56.6	38.71	61.8
on coal	18.91	36.1	20.10	37.3	20.31	37.0	23.34	41.2	21.47	38.0	21.92	36.9	27.19	43.4
on natural gas	9.38	18.1	8.66	16.1	9.48	17.3	11.50	20.3	10.75	19.0	9.82	16.5	9.72	15.5
on residual fuel oil	3.40	6.5	5.26	9.8	3.58	6.5	3.63	6.4	2.20	3.9	1.90	3.2	1.80	2.9

Trends in the consumption of electricity and heat are the main driver for the forecast in order to establish a program for the development of power plants in the sector for the period 2009-2020.

The program takes into consideration as well the need for diversification of primary energy resources, the necessity to improve and modernize the sector, and the environmental requirements.

The evolutions in the sector are estimated based on six scenarios.

Scenario A is also the reference scenario and it is based on the hypothesis that all types of generation plant (nuclear, thermal, hydro, wind) are in free competition on the market, the selection order being the economic order in respect for the load curve at NPG level.

Alternative scenarios considering the efficient use of the domestic primary energy resources in hydropower, wind and thermal power development programs are being considered as follows:

Scenario B is considering the use of hydroelectricity in new groups installed between 2010-2020 (217 MW, 472 MW, 1472 MW) all other candidate units being in free competition on the market;

Scenario C is considering the development of thermal power through the implementation of new fossil fired units during 2010-2013 by installing 3100 MW (1200 MW gas-fired, 700 MW on lignite, 1200 MW on brown coal), all the other units being in free competition on the market;

Scenario D considers the development of wind power plants during 2010-2017; the installed power is expected to reach 4000 MW; all other units being in free competition on the market;

Scenario E is based on the assumption that new thermal units will be installed in order to use domestic brown coal and lignite (more data presented in Table 5.8) and new hydro power units will be commissioned (472 MW) during 2010-2020;

Scenario F is based on the assumptions in scenario E + 4000 MW installed in wind farms

According to the mentioned development scenarios, the structure of the primary energy consumed in Romania will be changed, while the overall efficiency of conversion of fossil fuels will rise from 35.6%, in 2010 to 44% in 2020.

Table V_ 25 Forecasted coal domestic production

Coal type	2008	2009	2010	2011	2012	2015	2020
Lignite (million tones/million toe)	32.0 5.94	33.0 6.17	34.3 6.3	35.0 6.39	36.0 6.48	37.8 6.80	35.8 6.44
Coking coal (million tones/million toe)	3.40 1.17	3.40 1.17	3.36 1.24	3.36 1.24	3.36 1.24	3.36 1.24	3.36 1.24

Price of energy is an important driver on the electricity market and it is largely depending on the fuel price; therefore, one of the assumptions considered for the analysis is referring to the variation of the fuel prices.

Table V_ 26 presents the forecasted fuel prices for 2010, 2015 and 2020.

Table V_ 26 Fuel prices forecast

Fuel type	MU	Scenario	Historic price	Forecasted price		
			2006	2010	2015	2020
Imported natural gas	Euro/GJ	minimum	5.34	4.92	5.20	5.48
		average		5.48	5.90	6.32
		maximum-optimal		5.76	6.32	6.88
		maximum -pessimist		6.32	7.21	8.06
Residual fuel oil	Euro/GJ	minimum	5.84	4.80	5.19	5.45
		average		5.97	6.49	7.01
		maximum- optimal		6.49	7.27	8.05
		maximum -pessimist		7.00	8.44	8.96
Lignite	Euro/GJ	minimum	1.71	1.78	1.87	1.96
		average		1.84	2.03	2.24
		maximum		1.92	2.16	2.30
Imported coking coal	Euro/GJ	-	3.29	3.50	3.68	3.81

Assumptions regarding the industrial processes

The assumptions in the industry sector are related to the evolution of the main industries considered: cast-iron, steel, aluminum, other non-ferrous metals, chemical fertilizers, other chemical products and cement.

Evolution of the main industrial processes is determined in accordance with the forecasted economic development of Romania.

Levels of production for various industrial products for 2010-2020 are established in line with the evolution during 2000-2006 and taking into account the forecasts for the various industries.

Table V_ 27 shows the evolution of different product industries envisaged for calculation of the reference scenario emissions.

The same production levels are considered for the alternative scenarios, but the focus is on improving the industry technology and replacing the inefficient technologies with modern ones.

It should be mentioned that the old technology is not expected to be replaced in the period 2009-2015. Thus, the production will be generated with the improved old technology. New capacities with modern technology are expected to be commissioned after 2015.

Emissions from Solvents and Other Products Use have been determined in correlation with the economic and technological evolution.

Table V_ 27 Industrial production trend

No.	Production (th. tonnes)	Realized				Forecast							
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2015	2020
1.	Steel	5578	5920	6175	6300	7960	8600	8800	9000	9000	9000	9300	9500
2.	Coke	1550	1573	1777	1900	2150	2250	2320	2360	2360	2360	2500	2800
3.	Iron	4101	4244	4098	4500	5800	6230	6400	6510	6510	6510	6700	6900
4.	Cement	5002	5624	6021	7280	8600	10000	11400	12900	14400	16000	16000	18000
5.	Lime	1936	1978	1978	2000	2100	2250	2400	2560	2730	2900	3000	3500
6.	Glass	314	315	320	350	480	500	520	540	570	600	620	700
7.	Ceramics	1503	1787	2112	2300	2400	2600	2750	2900	3000	3100	3300	4000
8.	Paper	444	454	371	435	552	640	670	680	795	800	850	950

Assumptions on non-energy activities in Agriculture

The agricultural area accounts for about 14800 thou ha out of which approximately 9400 thou ha are arable area, cultivated mainly with cereals and technical plants. Table V_ 28 presents the agricultural area trend for the "WOM" (reference) scenario, by land use, for the period 2010-2020.

Table V_ 28 Agricultural area trend

Year	Agricultural area (th. ha)								
	Historic						Forecast		
	2001	2002	2003	2004	2005	2006	2010	2015	2020
Total agricultural area, of which:	14852.3	14836.6	14717.4	14711.6	14741.2	14731.0	14900.0	15100.0	15400.0
- arable	9401.5	9398.5	9414.3	9421.9	9420.2	9434.6	9480.0	9610.0	9800.0
- pastures	3421.4	3424.0	3355.0	3346.9	3364.0	3334.4	3430.0	3470.0	3540.0
- hayfields	1510.0	1513.6	1490.4	1498.4	1514.7	1524.9	1540.0	1560.0	1590.0
-vineyards and vine nurseries	267.4	259.6	230.5	223.3	224.1	223.7	240.0	245.0	250.0
- orchards and tree nurseries	252.0	240.9	227.2	221.1	218.2	213.4	210.0	215.0	220.0

During the period 2000-2006, approximately 40 kg of chemical fertilizers per hectare were used as an average in Romania (Table V_ 29). This amount does not compensate the amount of the nutrient substances removed from soils and does not ensure a production level comparable to those in the European Community.

The nitrous fertilizers are the source of N_2O emissions. The N_2O emissions vary considering the application mode and the administration periods. Therefore, the improvement of the fertilizers use is envisaged in order to reduce the N_2O emissions.

Rice cultivation generates methane emissions due to the anaerobical fermentation of the organic matter in the flooding or irrigation period. In Romania, rice cultivation is performed on small areas. These areas have been continuously decreasing from 1989 (49.3 thou ha) to 2003 (0.1 thou ha); the areas increased in 2006 to 5.6 thou ha. Due to the small proportion of these emissions in the total level (0.1% in total methane emissions in 2006), mitigation measures are not envisaged.

Livestock methane emissions are generated by the enteric fermentation and manure management.

Table V_ 30 presents the livestock trend during 2000-2020. It can be noted that the livestock and the animal production are increasing together with the private property consolidation in agriculture.

The improvement of nutrition quality and the recovery and use of methane from manure management are envisaged in order to reduce the methane emissions.

Table V_ 29 Chemical and natural fertilizers amounts used in Agriculture trend

Year	Fertilizers (th. tonnes)								
	Used						Forecast		
	2001	2002	2003	2004	2005	2006	2010	2015	2020
Chemical fertilizers, of which:	369	326	362	380	461	363	460	492	525
- nitrogenous	268	239	252	270	299	252	300	320	340
- phosphatic	87	73	65	94	138	94	140	150	160
- potassic	14	14	15	16	24	17	20	22	25
Natural fertilizers	15327	15746	15762	17749	16510	14900	16000	16500	17000

Table V_ 30 Livestock trend

Year	Livestock (th. heads)									
	Historic							Forecast		
	2000	2001	2002	2003	2004	2005	2006	2010	2015	2020
Livestock, of which:	86803	87296	94139	93680	105243	105168	103949	109400	116405	124665
- bovines	2870	2800	2878	2897	2808	2862	2934	3060	3230	3400
- swine	4797	4447	5058	5145	6495	6622	6815	7675	8900	10325
- sheep	7657	7251	7312	7447	7425	7611	7678	7965	8340	8730
- goats	538	525	633	678	661	687	727	850	1035	1260
- horses	865	860	879	897	840	834	805	850	900	950
- poultry	70076	71413	77379	76616	87014	86552	84990	89000	94000	100000

Assumptions regarding the waste management

In order to estimate the GHG emissions from the waste management activities, both, solid and liquid waste were considered.

Key assumptions and differences in assumptions between the current NC and the previous NC

The same methodology for GHG projections calculation has been used in both current and previous National Communications on Climate Change.

In addition, the current NC includes the following:

- the national total includes hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6);
- projections in an aggregated format for each sector as well as for a national total, including all six direct greenhouse gases;
- information regarding imported natural gas and imported coking coal prices;
- information on the models/approaches used for the projections, on assumptions and the sensitivity analysis of the projections.

VI. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

VI.A. EXPECTED IMPACTS OF CLIMATE CHANGE

VI.A.1 Observed changes in the climate regime in Romania

During the period 1901-2007, the mean annual air temperature increased by 0.5°C.

In the last 20 years the warmest year is 2007 (average temperature 11.5°C) and the coldest 1985 (8.4°C) (Figure VI_ 1).

Figure VI_ 2 presents the evolution by decades of the mean monthly air temperatures at the level of surfaces of agricultural interest in Romania over the 1961-2008 period, in comparison with the referenced 1961-1990 period, for four months (January, March, July and August), considered to be the most representative as regards the increases of the thermal values (by over 1.3°C). Compared to the baseline, in January, in the 2001-2008 interval, the air temperature increased by 1.6°C, in March by 1.3°C, in July by 1.6°C and in August by 1.6°C. The increasing trend is obvious beginning with 1981.

Regarding the precipitation, the analysis over the data registered during 1901-2008 period highlighted a general decrease in the annual amount of precipitation (Figure VI_ 3) after the year 1960. A parallel enhance of the precipitation deficit, especially in the south and south-east of the country.

Though during the last 40-50 years important floods have occurred into most of the hydrographical basins, the floods have never reached such a long duration of time during the last 100 years (from February to September) and on such a wide area compared to 2005. Into the basin of the Trotus river, the flood occurred in July 2005 has reached exceptional values, the maximum outflow and the volume of the flood having the greatest values of the whole existing series of measurements. The greatest floods recorded in time occurred on the Putna and Ramnicu Sarat Rivers. The flood occurred on the Ialomita River is the second greatest flood produced since 1975; and that recorded on the Cricovul Sarat River is the greatest in the time series of recorded data.

In 2005, 76 human lives were lost in the floods.

The flood in April-May 2006 on the Danube represents the most important flood occurred during the observations period 1840-2006, the maximum outflow into the Baziaş section was of 15800 m^3/s compared to the greatest recorded until now in 1895 of 15082 m^3/s.

Year 2007 brought the most important droughts in the last 60 years.

Figure VI_ 1 Trend of annual mean air temperature in Romania (1901-2008)

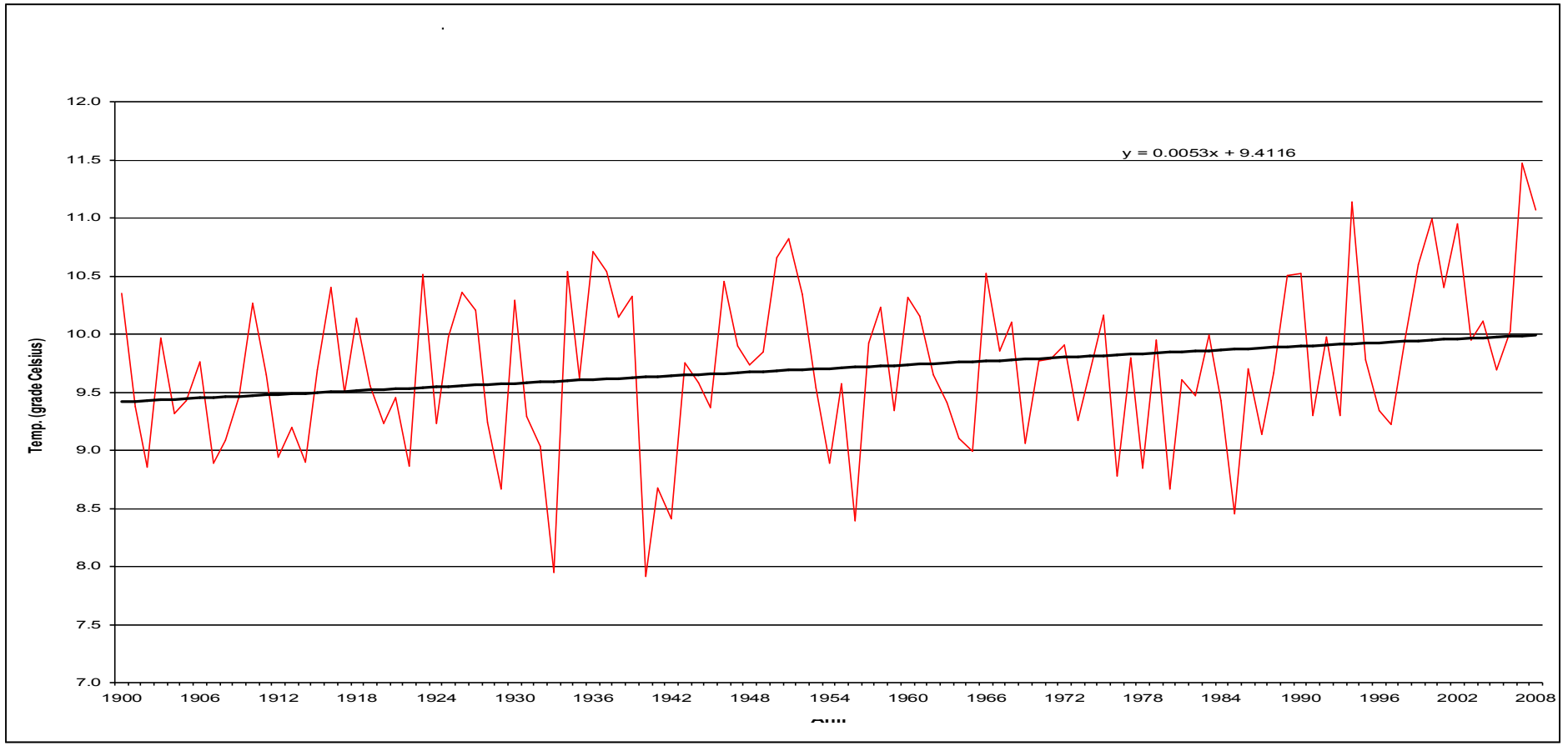
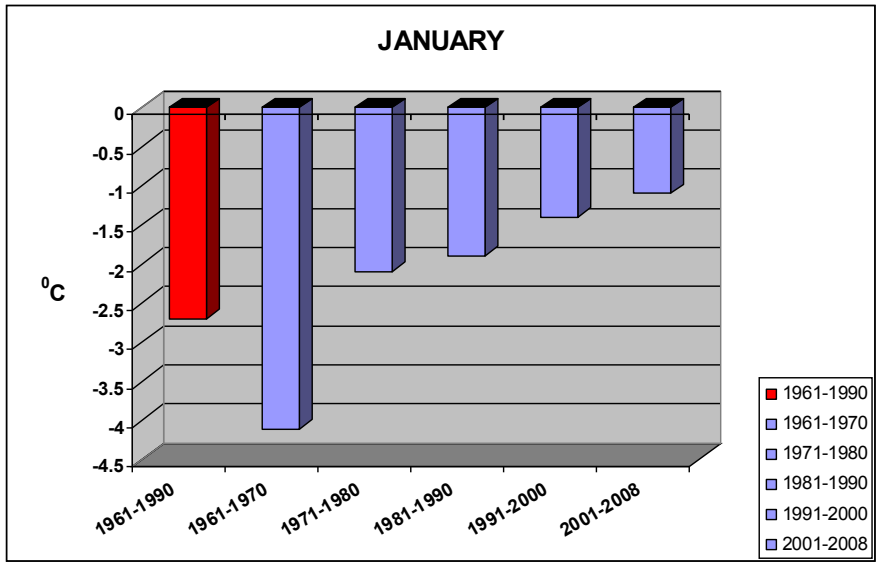
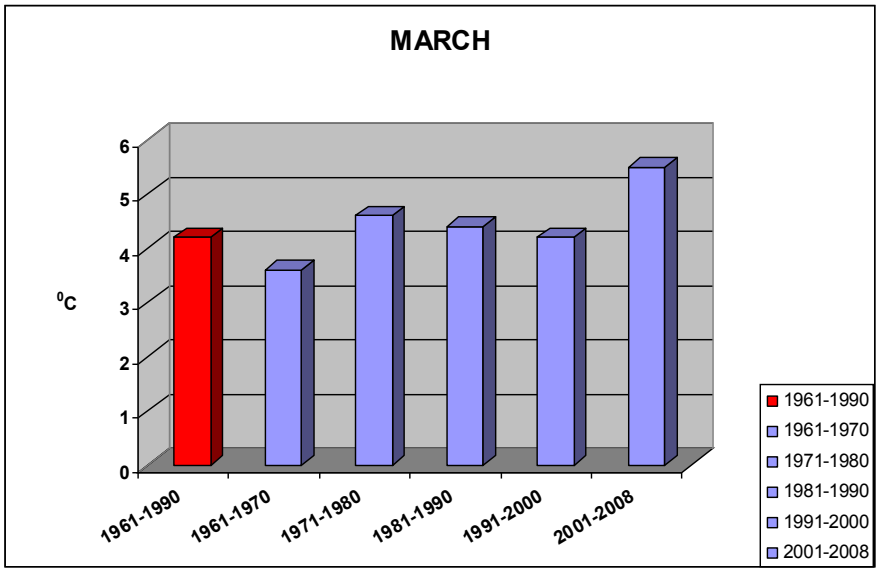
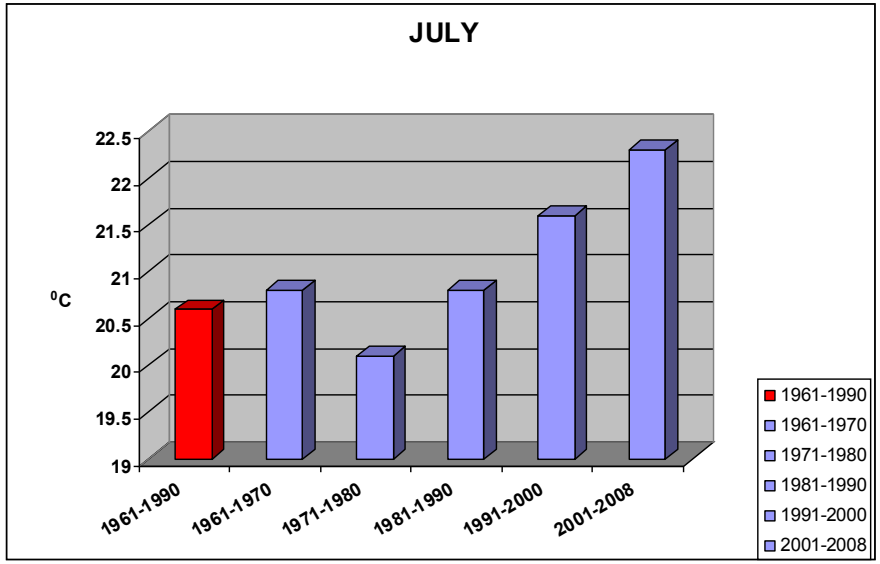


Figure VI_ 2 Decadal evolution of the mean annual air temperature recorded in Romania in 1961 - 2008, against 1961-1990







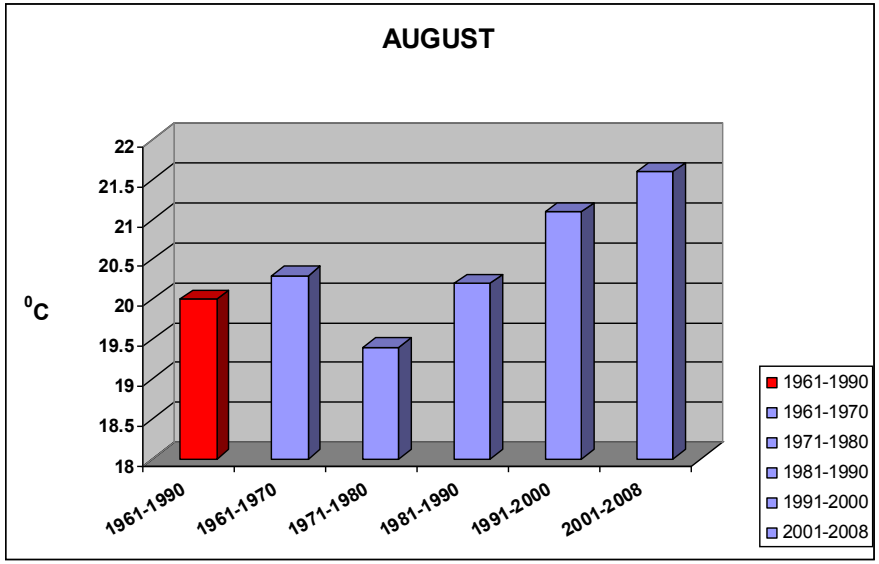
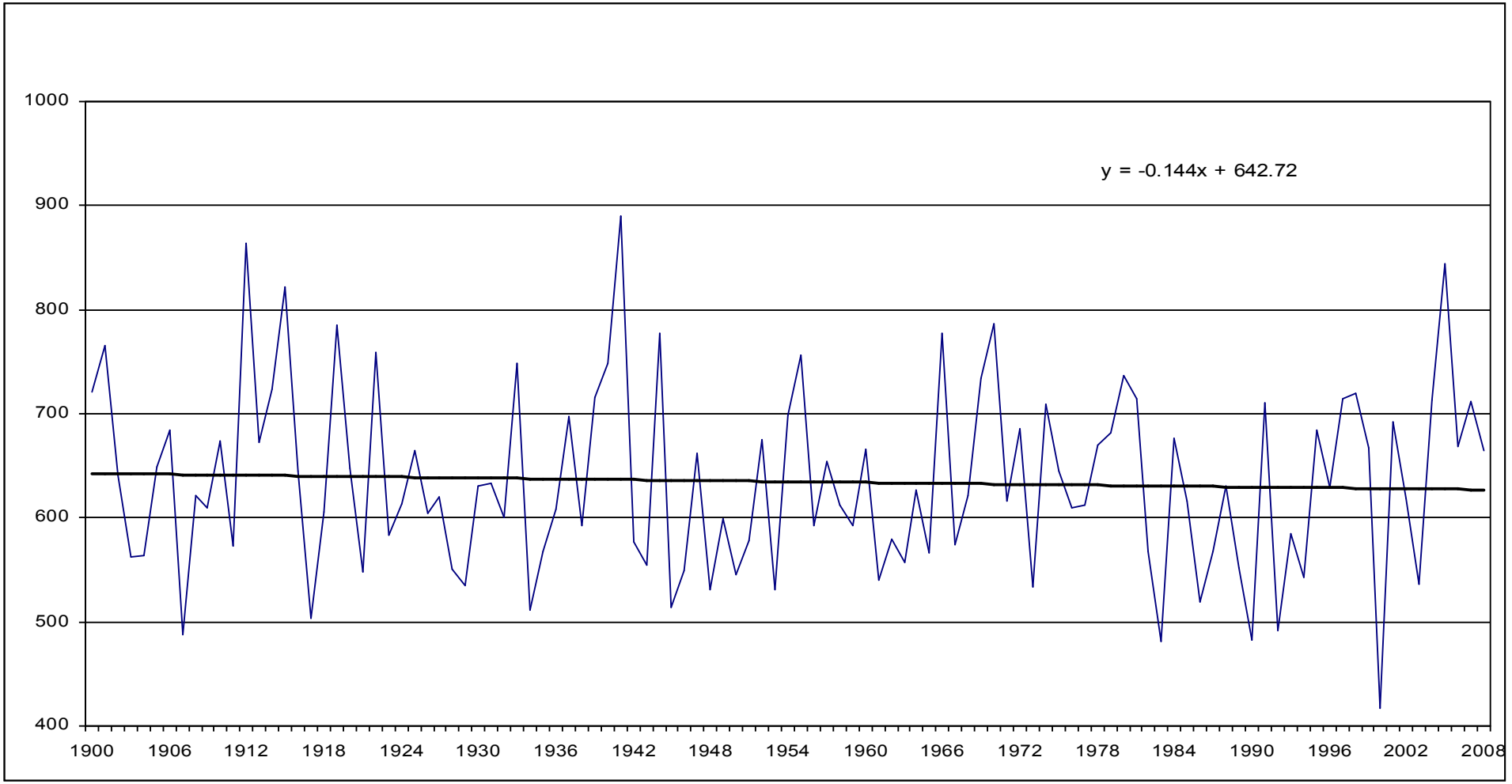


Figure VI_ 3 Trend of annual amounts of precipitations in Romania (1901 - 2008)



VI.A.2 Scenarios on the future climate change

The changes in the climate conditions in Romania are part of the global context, taking into account the regional conditions: the temperature increase is expected to be more obvious during the summer. According to the results of the modeling in AR4 of IPCC, in Romania it is expected an increase in the annual average temperature compared to the period 1980-1990 similar to the whole Europe. There are small differences to be noticed between the results of the models concerning the first decades of the 21st century and high differences to be noticed towards the end of the century:

- 0,5°C to 1,5°C for the period 2020-2029;
- 2,0°C to 5,0°C for 2090-2099, according to the scenario (e.g. between 2,0°C and 2,5°C in case of the scenario which provides the lowest increase of the global average temperature and between 4.0°C and 5.0°C in case of the scenario with the highest temperature increase).

From the precipitations point of view, over 90% of the climate models forecast for the period 2090-2099 serious droughts during the summer in Romania, especially in South and Southeast (with negative deviations compared to the period 1980-1990 higher than 20%).

Regarding the precipitations during the winter, the deviations are smaller, but the uncertainties are higher.

Participating in international cooperation programs and based on statistical models, the National Administration of Meteorology performed research even on a small scale (at the level of weather stations). Such results were subsequently compared to those generated by the regional climate models, achieving a better uncertainty assessment. Thus, results with a higher certainty were achieved on the increase of the winter precipitations in the Western and the North-Western Romania with 30-40 mm during the period 2070-2099 as opposed to the period 1961-1990 (Figure VI_ 4), in two scenarios of IPCC (A2 and B2).

Figure VI_ 4 Forecasted changes in the precipitation amounts during the summer in Romania
For the period 2070-2099 compared to the period 1961-199) achieved with the RegCM model, A2 scenario

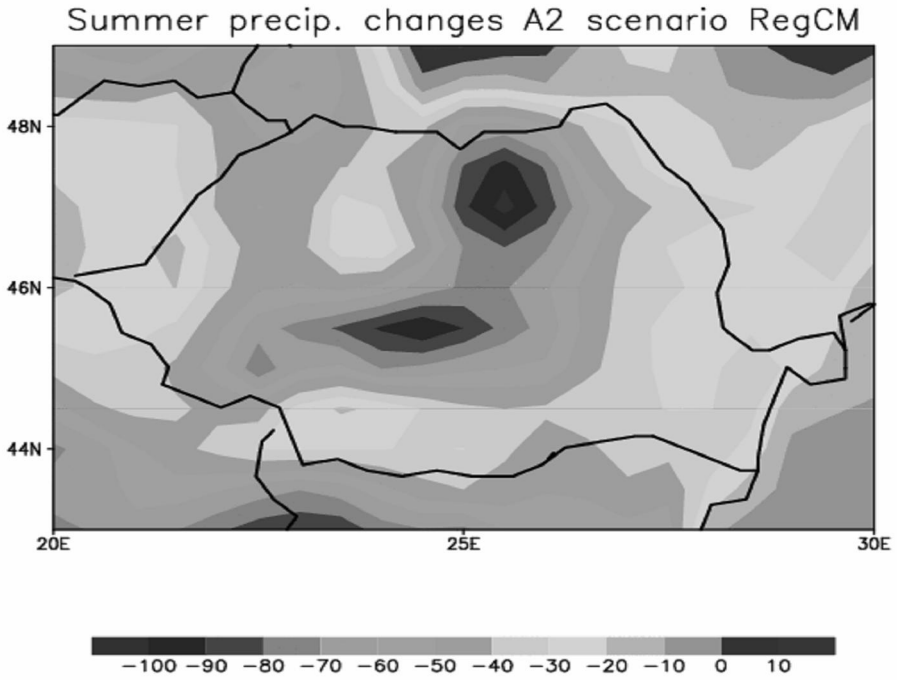
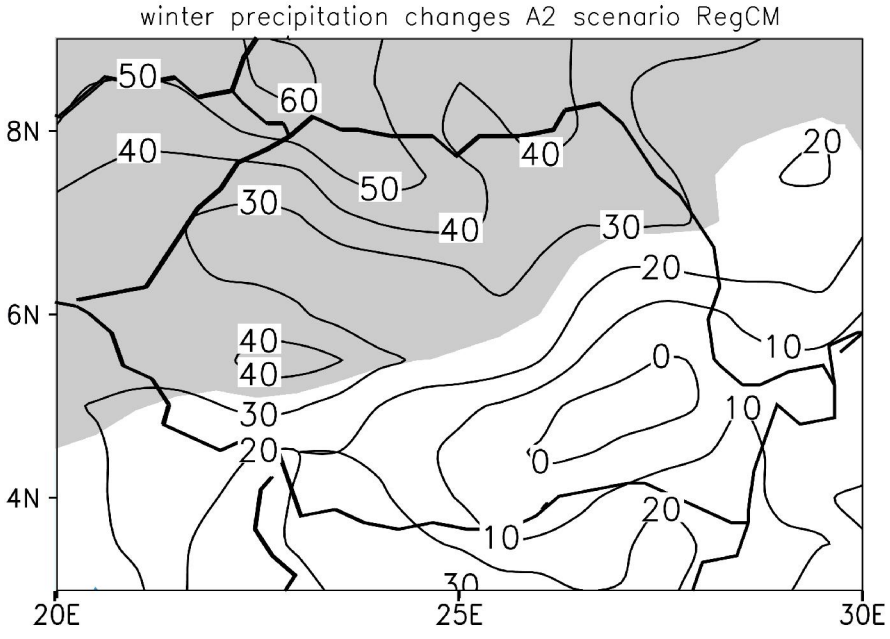
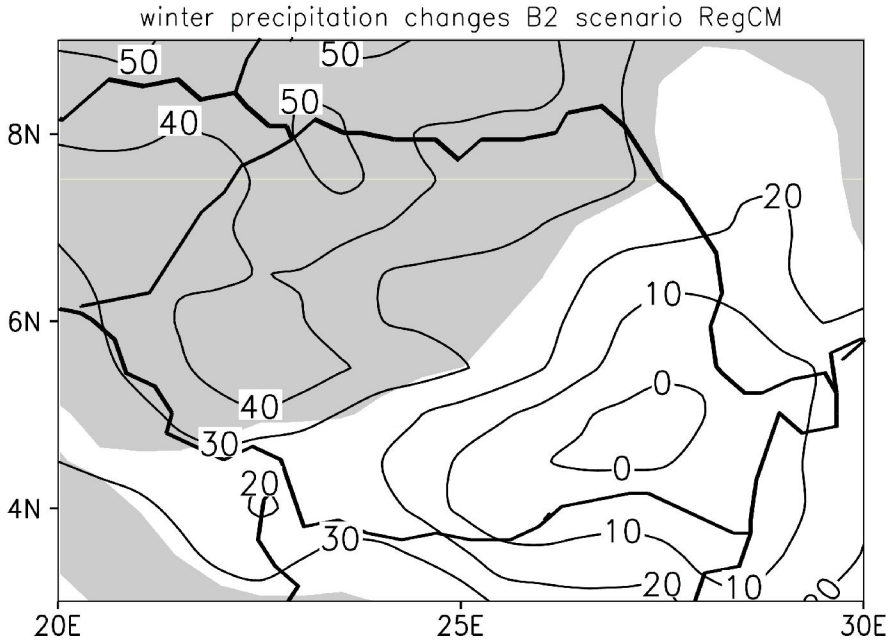


Figure VI_ 5 Forecasted changes in the precipitation amounts during the winter in Romania
Achieved from the simulations performed with the ICTP RegCM model, according to the scenarios IPCC A2 (a) and B2 (b) (Source: Busuioc and others, 2006)

(a)



(b)



In Year 2008, NMA has performed a study referring to the Climate Change in Romania. In order to understand the mechanisms influencing the Climate of Romania, the data series analyzed started 1960 and ended 2007. The analysis included the canonic correlation (CCA) between the climate anomalies in Romania and the anomalies of the air pressure at sea level (SLP), as well as the height of the geopotential at 500 mbar (H500). Other factors included in the analysis refer to the correlation of time series regarding the precipitations, temperatures, large scale climate variables, specific humidity, the correlation among the climate anomalies in Romania and the North Atlantic climate anomalies.

The analysis is performed at the most accurate possible scale.

Projections of the climate change in Romania (air temperature and precipitations) for 2001 - 2030 period are built applying the two downscaling methods (dynamic and static) recommended by the IPCC and applied to some global models (AOGCM) or regional models (RegCM) and applied to A1B IPCC Scenario (small increase of GHG concentrations in the atmosphere in the 21 century).

Results of the statistical downscaling modeling for the period 2001 – 2030, against 1960 – 1990, show the following:

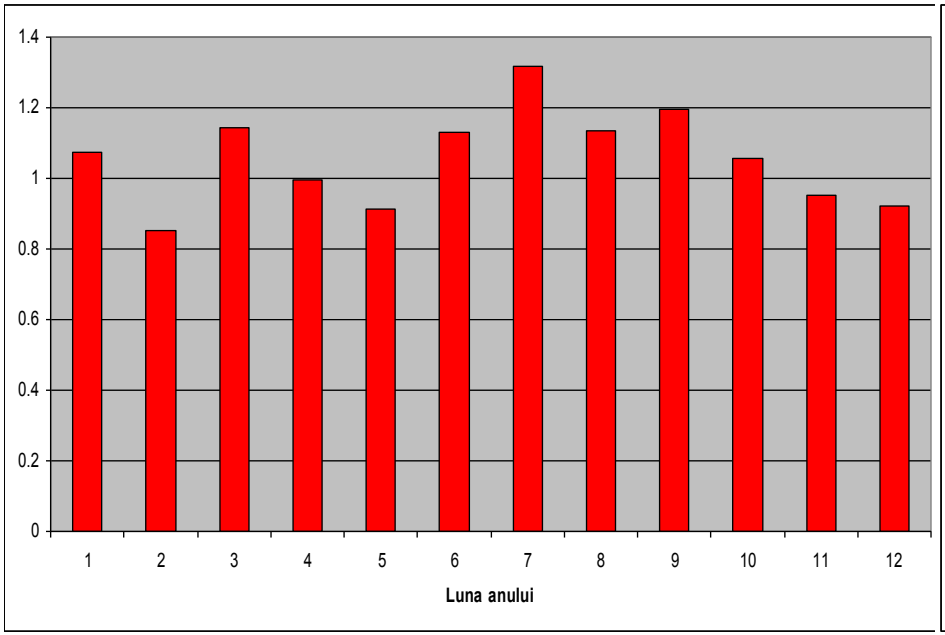
1. there will be an increase of average air temperature of 0.7 to 1.1 °C
2. there will be a decrease of average amount of precipitations during December and February, while in October and June there will be an increase of precipitations; for the other month, the amount is expected not to register important changes

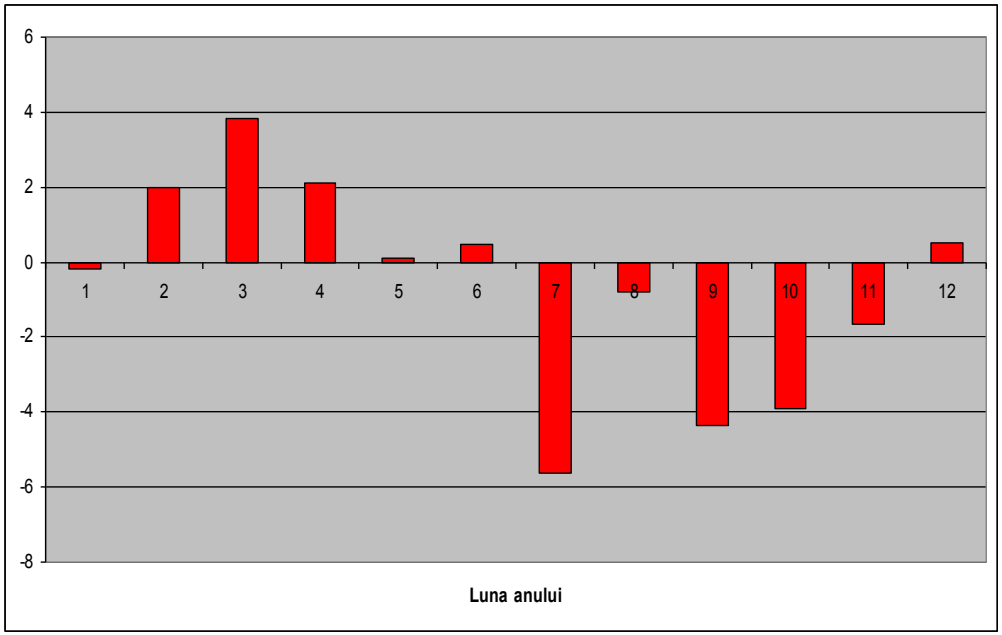
Results of the dynamic modeling for the period 2001 – 2030, against 1960 – 1990, show the following:

1. average temperature increases more in the Eastern side of Romania
2. air temperature is expected to decrease during winter, outside of the Carpathians (1.5°C) and to increase during summer (0.2°C)
3. during spring, the temperature will increase more (1.8°C)
4. during autumn, the temperature is expected to increase as well
5. increase of precipitations amount in the summer, especially in the Western side
6. increase of precipitations amount on autumn
7. decrease of precipitations during winter

The results of the 16 CMIP3 models (Lawrence Livermore National Laboratory, USA) are presented in Figure VI_ 6.

Figure VI_ 6 Changes of the monthly average temperature (^{o}C, left) and the daily ration of precipitations (%, right) for the period 2001-2030 (Scenario A1B) against 1961-1990, as average on Romania. (Values obtained as multimodel average)





Using the statistical downscaling models developed in the CECILIA project for monthly temperature at 94 Romanian weather stations, applied at 8 global climate models (ENSEMBLES GCMs, stream 1), the projections of temperature change for the future time slices 2021-2050 and 2070-2099 have been obtained as ensemble average over these projection. The results can be summarised as follows:

- Over the period 2021-2050, under the A1B scenario, it expected a temperature change ranging between 0.6^0C and 1.9^0C (mean 1.0^0C) for winter, 0.5^0C and 1.7^0C (mean 1.1^0C) for spring, 1.2^0C and 2.1^0C (mean 1.6^0C) for summer and 0.7^0C and 1.8^0C (mean 1.4) for autumn. This result is in agreement with those obtained from the ensemble mean of 7 ENSEMBLES GCMs, except for winter when the SDM signal is lower (Figure VI_ 7).
- For 2070-2099 time slice the warming is stronger for all seasons but highest for summer (up to 4 ^{o}C over the southern-soutwestern regions, see also Figure VIII_3).
- The spatial average over Romania of the climate signal obtained through the statistical downscaling models and directly from the RCMs is presented in Figure VI_ 8.

Figure VI_ 7 Change of the seasonal mean temperature (2021-2050 vs. 1961-1990) averaged over Romania Derived directly from various ENSEMBLES RCMs and indirectly through statistical downscaling model(SDM), driven by the ECHAM5-3 (left). On the right, the ensemble mean of the 8 SDM projections in comparison with the ensemble mean of 7 RCMs.

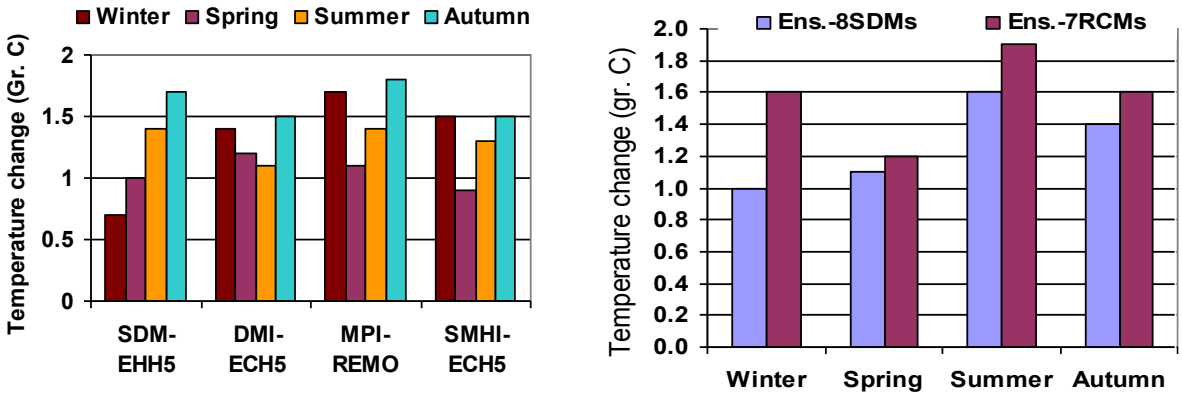
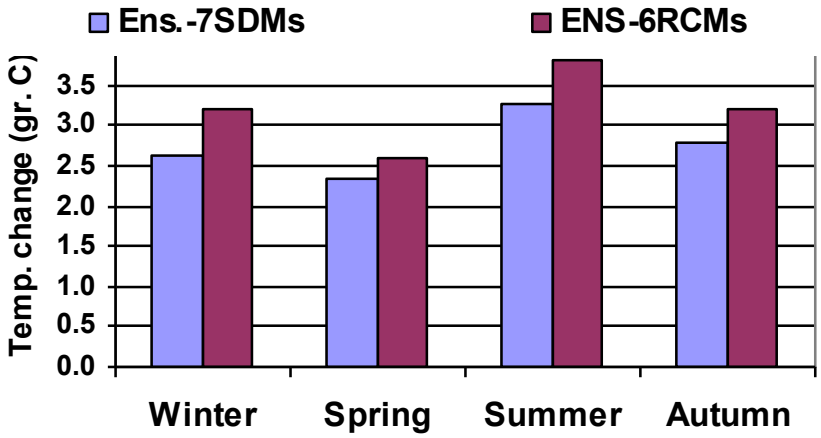


Figure VI_ 8 Change of the seasonal mean temperature (2070-2099 vs. 1961-1990), spatial averaged over Romania
Derived directly from 6 ENSEMBLES RCMs and indirectly through SDM driven by 7 GCMs.



VI.B. VULNERABILITY ASSESSMENT

Sectors identified to be directly affected by the temperature increase and the modification of the precipitations conditions as well as by the manifestation of the extreme weather include:

1. biodiversity
2. agriculture
3. water resources
4. forests
5. infrastructure, represented by buildings and constructions
6. tourism
7. energy
8. industry
9. transport
10. health
11. recreational activities

Other fields, like the food industry, the woodworking industry, textile industry, the production of biomass and renewable energy, are affected mostly indirectly.

VI.B.1 Biodiversity

The term "ecosystem" is a rather a supple or plastic term and it lacks a hard and fast definition that everyone can agree upon. But ecosystems are composed of the complex of interrelationships between plants animals and other life forms on the one side, and the non-living or inorganic components on their environment, on the other side.

Romania's first biodiversity strategy was formulated in 1996, two years after Romania's ratification of the Convention on Biological Diversity by Law (58/1994). This first Romanian Biodiversity Strategy (RBS) was updated in 2000 but neither of the two versions of the RBS was ever approved and adopted by Government as a legal document. For this reason, few resources were dedicated to their implementation, the RBS had little impact and few of the objectives and targets have been achieved. Both strategies were developed in an top-down manner and their main purpose was only to respond formally to the requirements of the Convention. There was very little stakeholder participation in the development of the first strategies, especially from civil society groups.

Currently, there were identified in Romania about 3.700 plant species, out of which 23 are declared natural monuments, 74 are extinct species, 39 are endangered species, 171 are vulnerable species and 1253 rare species. Regarding the animals, it was identified a number of 33.792 animal species, out of which 33.085 invertebrates and 707 vertebrates.

The climate change impact on a territory implies the analysis of the impact on the existing ecosystems on such territory and of the relationships among them, and this impact is overlapping the pressures already exerted concerning the habitat destruction and the pollution of the environment factors.

Disturbing environmental factors, in a drastic manner, has direct effect on the evolution of the living creatures, initially on their ability to adapt and subsequently on their ability to survive, being likely to act in extreme cases as extinction factors for certain species in the food chains, having drastic consequences on the local biodiversity and having a general impact. In order to

prevent this decline of the national biodiversity, as part of the global biologic diversity, it has to be taken into consideration the threats, the opportunities, the recommendations and the adaptation measures in this respect.

Activities such as the deforestation and overgrazing may lead to the exacerbation of the climate change effects. In certain countries, more and more people, especially those with low income, will have to live in marginalized regions (flood plains, slopes exposed to torrents, arid and semiarid regions) being therefore fully exposed to the climate change effects.

Therefore, the climate change effects may even generate the extinction of certain species which are represented by one single population or by very few populations and which live in ecological niches that are extremely narrow on the one hand, but also extremely vulnerable to these effects.

The realities mentioned above have serious consequences not only on the biodiversity preservation, but indirectly on the ability to survive of the human civilization; it is known that the services and products of the biologic diversity lie at the basis of its survival. The human civilization is part of the global ecological systems, and the loss of its functional balance affects directly the further development of the human civilization.

Identified threats of climate change on the biodiversity:

- modifications of the species behavior, as a result of the stress induced on their adaptation capacity (shorter hibernation period, the modification of the behavioral physiology of the animals as a result of the hydric and thermal stress or the stress determined by the solar radiations expressed even as erratic migrations; the impossibility to provide the transpiration conditions at normal physiological levels, negative irreversible influences on the migratory species, disturbance of plants evapo-transpiration, essential changes in the plants rhizosphere which may lead to their extinction);
- the modification of the habitats distribution and composition as a result of the change in the species structure;
- the increase of the exotic species at the level of the actual natural habitats and the increase of their potential to become invasive, as a result of either finding the favorable conditions, or of certain “ecological voids” by the extinction of certain indigenous species;
- the modification of the distribution of the ecosystems specific to wet areas, with the possible limitation up to their extinction;
- changes in the freshwater and marine aquatic ecosystems generated by water warming, and also by the possible rise of the sea level globally;
- the increase of the risk to reduce the biodiversity as a consequence of the extinction of certain flora and fauna species, caused by the decrease of the adaptation and survival abilities, as well as the possibilities of the species to turn into species more enduring to the new climate conditions.

A proposed set of criteria have been drafted for defining biodiversity conservation priorities in Romania. It is proposed that one assign higher priority for ecosystems:

a. With the highest species diversity
b. With the highest levels of endemism
c. That only exist in Romania
d. That find their greatest level of development in Romania
e. That are the least degraded
f. That are the most diminished compared to their original extent
g. That are the most threatened by present and foreseeable trends
h. That have the greatest economic value

Romania still lacks the data needed to apply these criteria systematically. However, they are applied below in a subjective way using the best available information:

1. Ecosystems with the highest species diversity:
   a. For terrestrial ecosystems, it is broad-leafed forests and hayfields that have the highest species diversity
   b. The wetlands of the Danube have the highest species diversity of all the wetlands. The Danube Delta is composed of a great complex of ecosystems.
   c. The shallow lakes "mares" have high diversity

2. Ecosystems with the highest levels of endemism:
   a. Caves
   b. High altitude ecosystems -- Rocky
   c. Hay meadows -- especially for plants and invertebrates
   d. Water courses

3. Ecosystems that only exist in Romania:
   a. Danube Delta
   b. Moville Cave

4. Ecosystems that find their greatest level of development in Romania:
   a. Stipa Steppes (they exist also in Hungry)
   b. Mountainous, rocky calcareous (limestone) ecosystems
   c. Glacial lake ecosystems

5. Ecosystems that are the least degraded:
   a. Glacial lakes
   b. Pristine forests (some of the most pristine in all of Europe)
   c. Sahaline Island – dune with grasses (ephedre)

6. Ecosystems that are the most diminished compared to their original extent:
   a. Oak forests on the Romania Plains of the south/southeast – only patches remain
   b. Several cities have relict forests around them (includes beech forests)
   c. Low altitude water courses (Tissa River is still in good shape)
   d. Pastures (being invaded by forest)
   e. Floodplain ecosystems of the Danube

7. Ecosystems that are the most threatened by present and foreseeable trends and that can realistically be conserved):
   a. All water courses
   b. Abandoned pastures
   c. Low altitude forests on the plains
   d. Wetlands on the river floodplains
   e. Coastal ecosystems of the Black Sea

8. Ecosystems that have the greatest economic value
   a. All forests
   b. Danube delta
   c. Ecosystems with considerable value for tourism – hay meadows,
   d. pastures, mountain ecosystems

The following are proposed as ecosystems that should benefit of the highest priority for conservation in Romania:

- The Danube Delta complex of ecosystems;
- Low attitude, broad-leaved forests on the plains
- Danube River floodplain ecosystems – especially the shallow lakes
- Brackish water lagoons

VI.B.2 Agriculture

The results of the most part of models used to forecast the international and local effects of climate change show precipitation decrease in the Central and Eastern Europe, especially during summer; therefore a precipitation deficit is expected to impact the agriculture and food production in Romania, which will also have as consequence a 10-30% decrease of the water resources, especially in the areas most affected by the decrease of precipitation.

Climate variability and climate extremes may increase as a result of global warming and will affect food supply in the country, particularly in regions with high present-day vulnerability and little potential for adaptation. Yields of grain and other crops could decrease across the southern and south eastern part of Romania due to increased frequency of drought. While losses may be partially offset by beneficial effects from carbon dioxide, crop production would be further threatened by increases in competition for water and the prevalence of pest and diseases and land losses through desertification. Generally, climate change effects on agricultural crops depend on local conditions of each site, the severity of changes in climate and the direct physiological effects of CO_2 concentration.

Agriculture is strongly influenced by the availability of water. Climate change will modify rainfall, evaporation, runoff, and soil moisture storage. Changes in total seasonal precipitation or in its pattern of variability are both important. The occurrence of moisture stress during flowering, pollination, and grain-filling is harmful to most crops and particularly so to maize, soybeans, and wheat. Increased evaporation from the soil and accelerated transpiration in the plants themselves will cause moisture stress; as a result there will be a need to develop crop varieties with greater drought tolerance. The demand for water for irrigation is projected to rise in a warmer climate.

Based on observations performed during the period 1961-2000, it was noticed that agricultural areas in the south and south-east of the country are the most vulnerable to rainfall deficit. In recent years (2000, 2001, 2002, 2003 and 2007), precipitations deficits was high and drought diminished the crops yield significantly (2007 being the peak year for drought severity, both for cereals and for annual crops). In south and south-eastern regions of Romania, the annual precipitation regime for the 1961-2000 period is characterized by a high variability in respect to the optimum water requirements of crops specific to each agricultural period, growing season, or agricultural year. Extremely low or insignificant quantities of rainfall lead to appearance and maintenance of rainfall regime with different intensity levels (extremely droughty, droughty and medium droughty) and also a highly attendance in summer months and during the vegetation season (April-October).

However, the combined effects of changes in temperature and precipitation regimes in different climate change scenarios are not yet well understood, thus additional work is required for impact assessment at regional level. Down-scaling the predictions of Global Circulation models (GCM) and taking into account the local conditions of the area of interest will improve the accuracy of crop yield estimations in the new conditions of climate change.

Soil water balance is directly affected by the crop water requirement through evapo-transpiration, which is dependent mainly on temperature and stage of vegetation. Crop water requirements depend on local weather conditions, soil and plants' characteristics and plant stage of growth.

The water balance of an agricultural field is an accounting of inputs (**precipitation**, **irrigation**, and capillary rise form **water table**), outputs (**evapo-transpiration**, **run-off**, **deep percolation**) and storage changes of water in the soil layer explored by roots. With a step of one day (or week or month), starting from water deficit rate at the end of previous period, water balance estimates the water deficit at the end of the current period.

In year 2000, especially in the South and South-East of the country, where the combined effect of thermal and water stress determined complete loss of the production during an extremely droughty year (Figure VI_ 9).

Year 2003 and 2007 brought high water stress for plants while the conditions were unfavorable for winter wheat in almost all agricultural regions of the country (Figures VI.9 & VI.10). Even in irrigated areas, crop yields were low in quantity and quality due to thermal stress that generally occurs in dry hot years.

Figure VI_ 9 Soil moisture reserve for winter wheat crop _ 2000

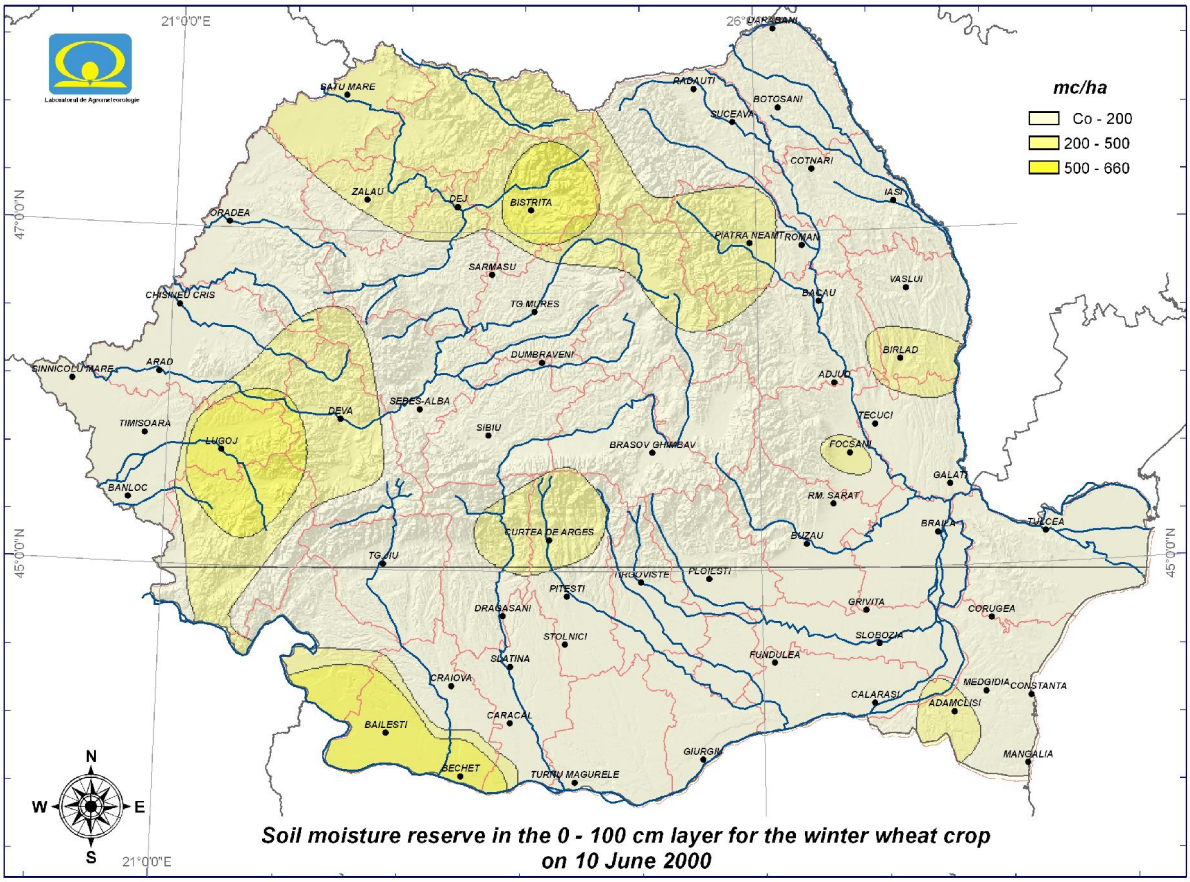


Figure VI_ 10 Soil moisture reserve for maize crop _ 2003

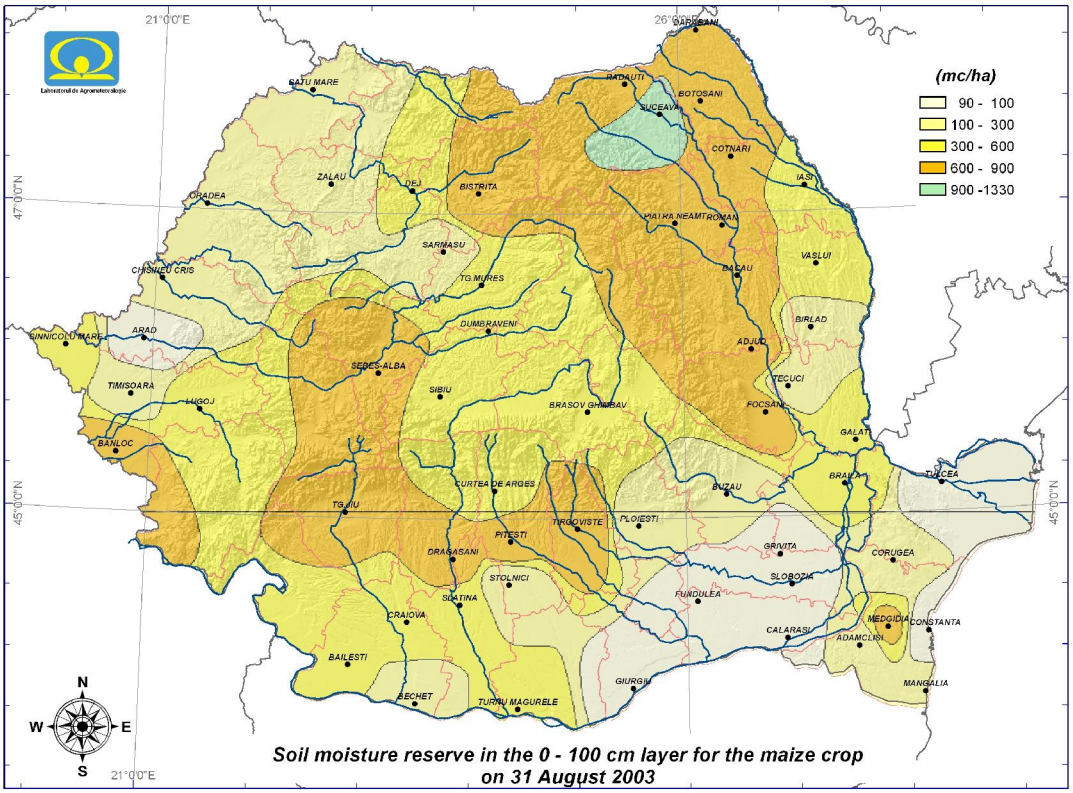
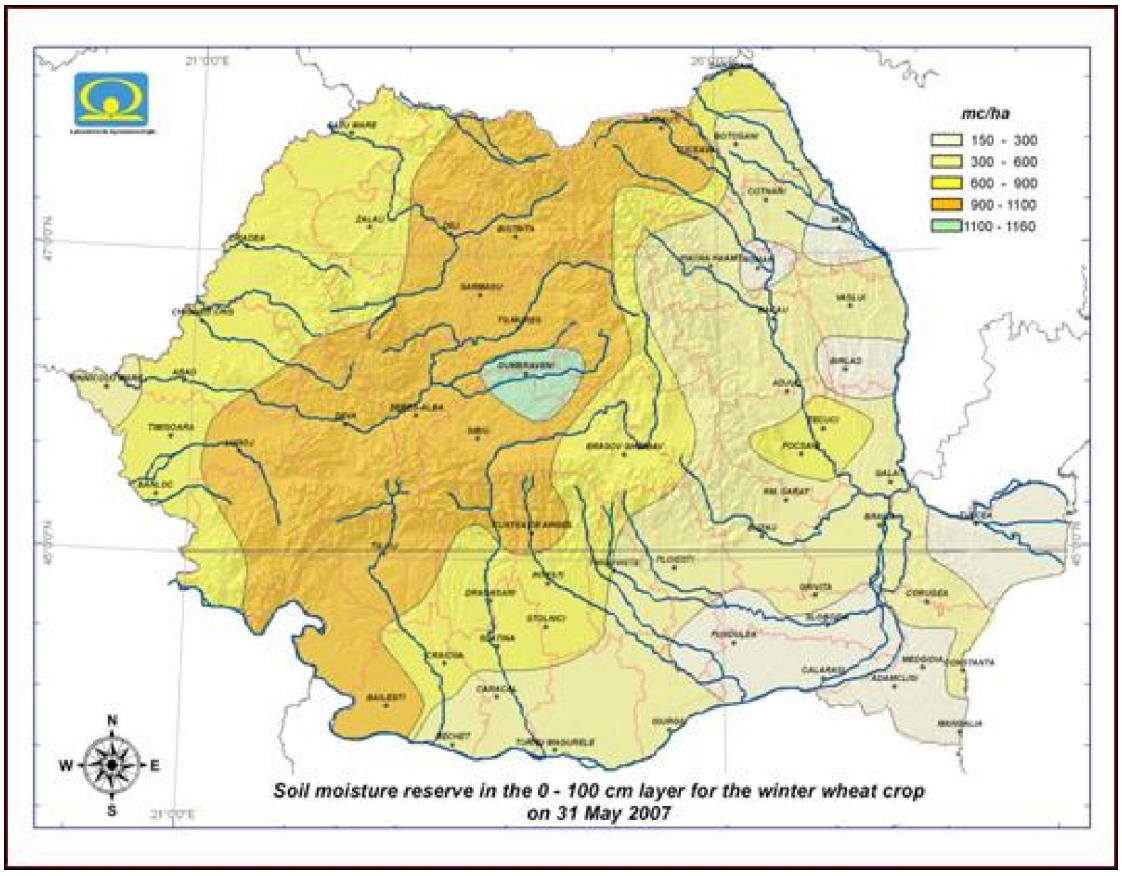


Figure VI_ 11 Soil moisture reserve for winter wheat _ 2007



The National Meteorological Administration is involved in several research projects , some of them regarding climate change and agriculture. In one of the projects there were analyzed possible climate change effects on winter wheat and maize growth, development and yielding, using the results and conclusions provided by six South-East Romania agrometeorological stations and applying the simulation models CERES-Wheat and CERES-Maize in combination with the RegCM3 climatic predictions (Georgi et al. 1993) at a very fine resolution (10 km) over 2020-2050.

According to the RegCM3 predictions over 2020-2050, SRES A1B scenario, climate predictions indicate lows higher by 2.4°C- 6.9°C, mostly in the warm season. Monthly mean highs are 2-5°C lower than in current climate conditions. Changes in monthly precipitation range from -33.8 mm to +29.7 mm. Precipitation amounts increase on the whole about 6-29.7 mm in the cold season (X-IV) and decrease during the warm season (V-IX) by 4-33.8 mm in comparison with the current climate conditions.

Analyzing the results simulated for 2020-2050 climate change estimations made by the regional climatic models highlighted that the future climate evolutions may he have important effects upon crops and they are conditioned by an interaction between the following factors: current climate changes on a local scale, severity of climate scenario-forecasted parameters, how the increased CO2 concentrations influence photosynthesis, and the genetic nature of plant types. Figure VI_ 12 show the changes occurred in the length of the vegetation season for winter wheat.

Under current climate conditions, the mean length of the vegetation season (from seeding time to ripeness) ranges between 269 and 284 days, decreasing by 11-17 days with climate change. The fastest growth occurs at Fundulea Station, where the winter wheat ripens 17 days earlier than under current clime conditions (Figure VI_ 12 and Table VI_ 1)

Figure VI_ 12 The winter wheat growing season duration under current conditions and RegCM3/2020-2050/SRES A1B predictions

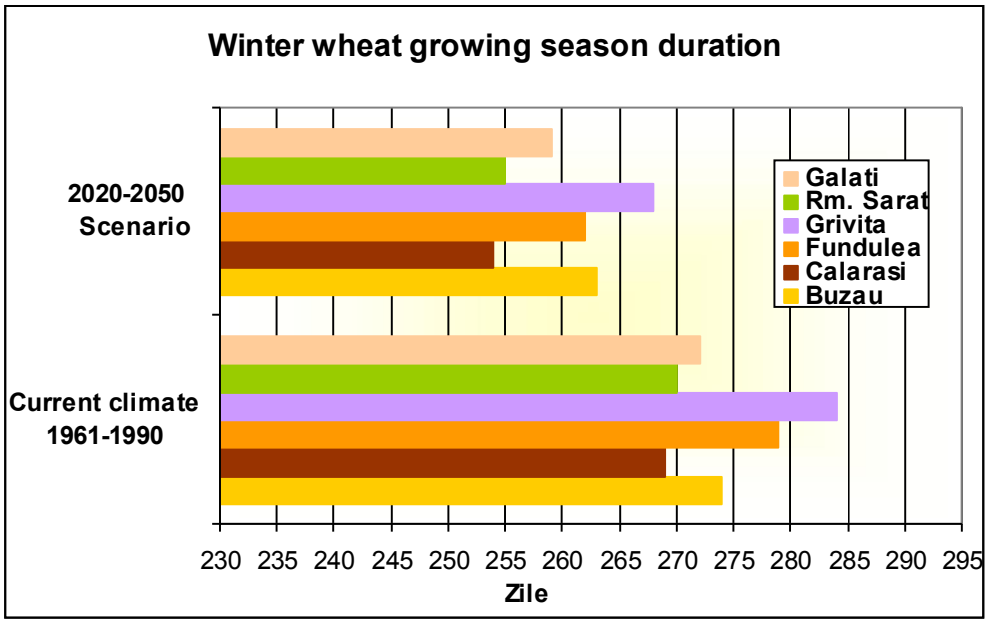
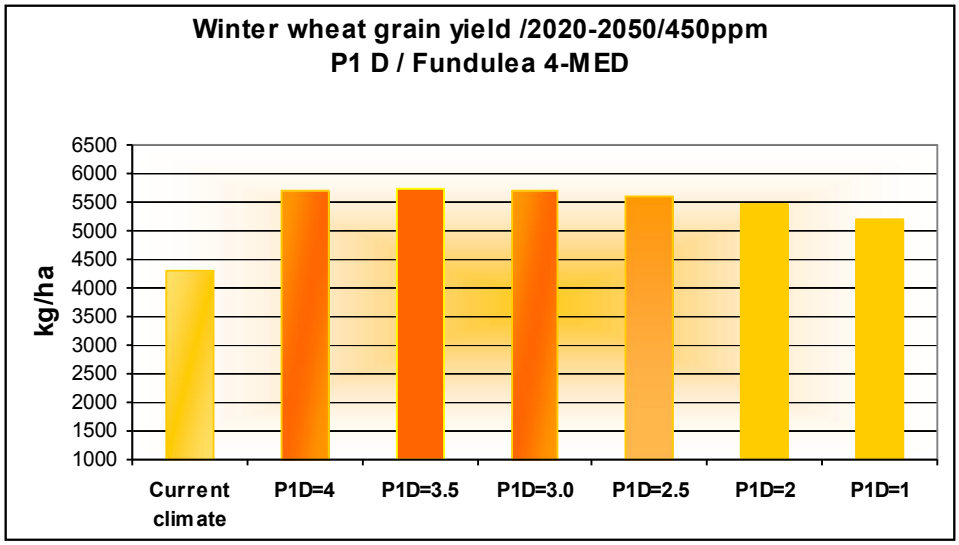


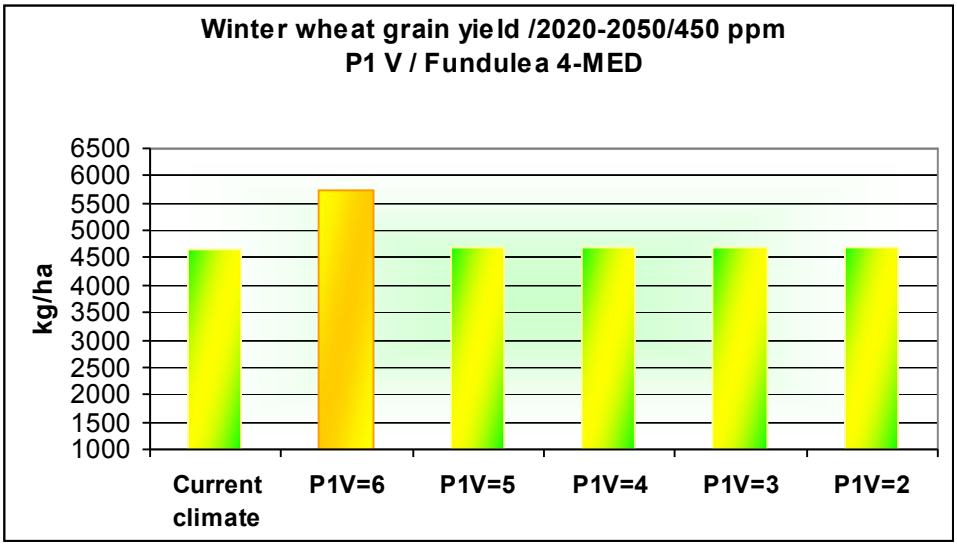
Table VI_ 1Duration of the winter wheat growing season

Site	Current climate / 1961-1990	Scenario / 2020-2050	Absolute differences (days)
Buzau	274 days	263 days	-11
Calarasi	269 days	254 days	-15
Fundulea	279 days	262 days	-17
Grivita	284 days	268 days	-16
Rm. Sarat	270 days	255 days	-15
Galati	272 days	259 days	-13

Under climate condition for the winter wheat crop the most suitable genotype are varieties with high vernalization (P1V=6.0) and with moderate photoperiod requirement (P1D=3.5), Figure VI_ 13

Figure VI_ 13 The selection of winter wheat genotype under climate scenario





A 30-year mean of winter wheat yields, simulated under current climate conditions, ranges between 3599 kg/ha at Galati and 5016 kg/ha at Calarasi. Given the probable climate conditions according to the RegCM3/2020-2050/SRES A1B scenario-predicted future evolution, the mean wheat yield is higher by 8.5% - 58.9% than the 1961-1990 one (Figure VI_ 14).

The climate change-related increase in wheat yields is connected to the positive effect of higher CO2 levels in the atmosphere upon photosynthesis (from 330 ppm under current conditions to 450 ppm according to the RegCM3/SRES/A1B scenario), which counterbalances the negative effect of shorter vegetation periods due to higher temperatures. Generally, increased CO2 concentrations result in a higher photosynthetic rate, reducing also water losses in crops.

Figure VI_ 14 The average winter wheat grain yield simulated under current conditions and RegCM3/2020-2050/SRES A1B scenario

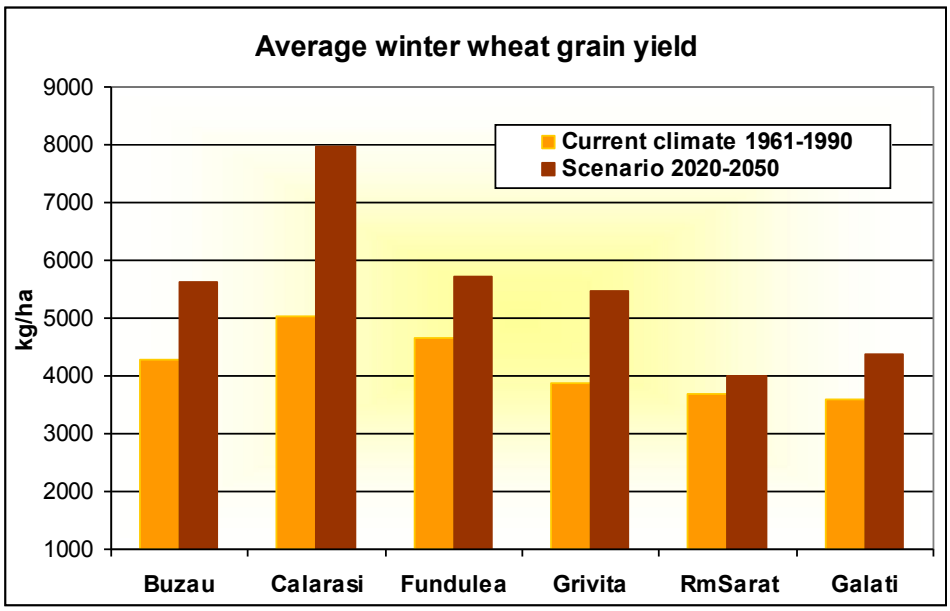


Table VI_ 2 Average winter wheat yield

Site	Current climate / 1961-1990	Scenario / 2020-2050	Relative differences (%)
Buzau	4285 kg/ha	5621 kg/ha	31.2
Calarasi	5016 kg/ha	7969 kg/ha	58.9
Fundulea	4650 kg/ha	5727 kg/ha	23.2
Grivita	3880 kg/ha	5470 kg/ha	41.0
Rm. Sarat	3700 kg/ha	4014 kg/ha	8.5
Galati	3599 kg/ha	4389 kg/ha	22.0

According to the modeling, the maize yields will decrease at every analyzed station due to higher temperatures that shorten the vegetation season, coupled with a water stress, mainly during the phenological phases of grain formation and filling.

Figure VI_ 15 and Figure VI_ 16 show the changes noticed of the length vegetation season and maize yields.

In current climate conditions, the average maize yield ranges between 4463 kg/ha at Buzau and 7005 kg/ha at Calarasi. Analyzing the simulated results highlighted a trend to decrease lightly on the whole by roughly 2-4% at Grivita, Rm. Sarat and Galati, and more abruptly, by 18-33% as against the current climate conditions at the other three stations. Maize yields get lower due to a shortening of the vegetation season by 20-29 days, following an increase in temperature, as well as due to water stress during grain filling, caused by diminished precipitation amounts. Being

also a C4 plant, maize benefits less from the effect of increased CO2 concentrations upon photosynthesis.

Figure VI_ 15 The changes of maize growing season duration under climate scenario

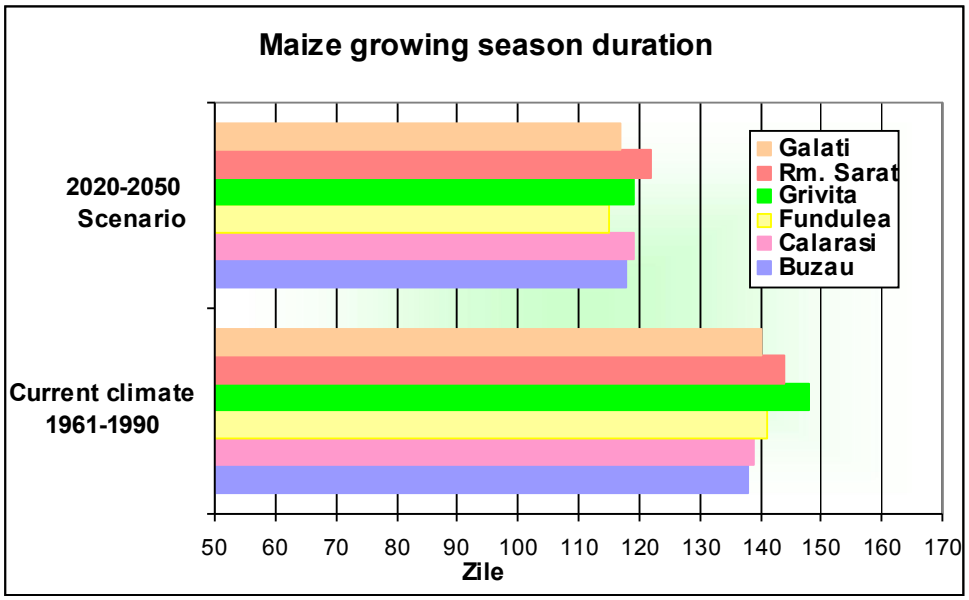


Table VI_ 3 Duration of maize growing seazon

Site	Current climate / 1961-1990	Scenario / 2020-2050	Absolute differences (days)
Buzau	138 days	118 days	-20
Calarasi	139 days	119 days	-20
Fundulea	141 days	115 days	-26
Grivita	148 days	119 days	-29
Rm. Sarat	144 days	122 days	-22
Galati	140 days	117 days	-23

Figure VI_ 16 The average maize yield simulated under current conditions and RegCM3/2020-2050/SRES A1B scenario

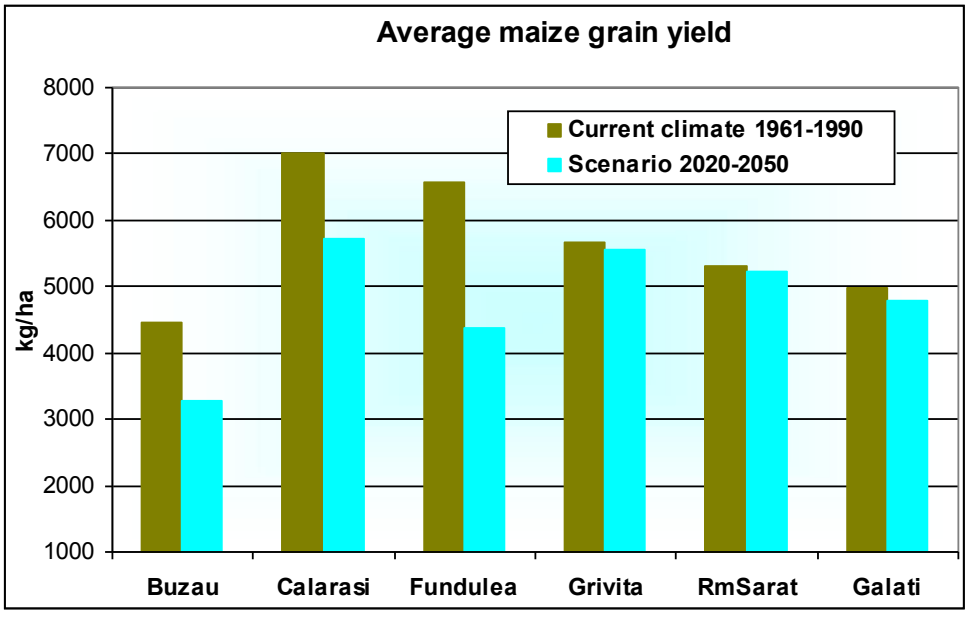


Table VI_ 4 Average maize yield

Site	Current climate / 1961-1990	Scenario / 2020-2050	Relative differences (%)
Buzau	4463 kg/ha	3290 kg/ha	-26.3
Calarasi	7005 kg/ha	5722 kg/ha	-18.3
Fundulea	6585 kg/ha	4383 kg/ha	-33.4
Grivita	5675 kg/ha	5569 kg/ha	-1.9
Rm. Sarat	5314 kg/ha	5224 kg/ha	-1.7
Galati	4970 kg/ha	4781 kg/ha	-3.8

A comparative analysis of the results obtained showed that future changes in regional scenario-based climate evolutions can have negative effects upon yield increase, development and formation. For both analyzed crops, the vegetation season gets shorter and there are fewer days available to reaching full ripeness. This shortening of the vegetation season is more marked in maize crops than in winter wheat. Such a forcing is mainly due to a probable increase in air temperature, estimated by the regional model.

As to the possible effects of climate change upon yields, they depend on the genetic type (C_3 or C_4), direct effects of increased CO2 concentrations on photosynthesis, local conditions and the severity of changes in climate evolution according to the two scenarios. So, maize yields decrease at every analyzed station in comparison with the current clime case, due to higher temperatures leading to shorter vegetation seasons associated with water stress, mainly during the phenological stage of grain formation and filling. In winter wheat, grain yields are higher than in current clime conditions at every station of the six analyzed, due to a positive effect of increased CO2 concentrations in the atmosphere (from 330 ppm to 450 ppm) upon photosynthesis and water use, which counterbalances the negative effect of a shorter vegetation period.

The results shown in this study are very important and they can contribute to laying the grounds of and developing management options to adapt to and mitigate climate change-related negative effects affecting crop systems.

VI.B.3 Water resources

At the national level, concrete actions were started to increase the ability to act, especially concerning the floods problem, but also generally, on the extreme weather phenomena. Therefore, the national meteorological system was updated and the hydrologic system is going to be updated (SIMIN, WATMAN and DESWAT).

As a result of the catastrophic floods recorded at the end of 2005, it was elaborated the National Strategy of Flood Risk Management, in which there are set the duties that fall on each structure involved in the flood risk management, structured on prevention actions and measures, of operational intervention as well as those for the rehabilitation and the return to the state of normality. It was thus proved that the old models are not suitable any longer under the new climate conditions, and a part of the existing protection works is no longer efficient, because the environment conditions changed dramatically. The strategy aims to reduce the impact of the floods on the population and on the goods by an appropriate planning and by a policy that should correspond to the standards and the expectations of the human communities, under the conditions of the environment protection.

In order to increase the efficiency on the floods management locally, it was elaborated the Prefect's Handbook for the management of the emergency situations in case of floods as well as the Mayor Handbook for the management of the emergency situations in case of floods. Also, there are set at the national, regional and local level, the procedures necessary for the management of the emergency situations generated by the hydrologic drought.

We enumerate the following:

- *Regulation on the management of emergencies situations arising from floods, hazardous weather phenomena, accidents at water constructional works and accidental pollution***,** in which the measures that have to be taken by all the owners are established in order for the irrigation systems to work at full capacity during the periods of extended drought, as well as the adaptation of the feed plants of the irrigation systems with supply from the Danube, in order to provide the service under the conditions of hydrologic drought
- *Basin plans and water use restrictions during the deficit periods,* elaborated for each of the 11 hydrographical basins on the Romanian territory, amended, completed and approved in 2006
- *Regulations for operating the dams and storage lakes at shallow water* elaborated by each owner and amended in 2006

The severe drought recorded in 2007 determined the provision of urgent measures for the management of the situations generated by the drought (the allotment of funds in order to perform deep drilling). In the same time it was elaborated the *National Strategy to Reduce Long-term Effects of Drought.*

In order to improve the intervention capacity in case of floods and drought whose frequency increased compared to the standard reference period for the analysis of the climate characteristics on the *Decrease of risks in the event of natural disasters and emergency preparedness*, with the support of World Bank, which follows:

- The rehabilitation and the increase in the safety level of the protection infrastructure against floods on 9 rivers seriously affected by the floods.
- The rehabilitation of the protections against floods at 3 enclosures on the Danube river.
- The increase of the safety level at 13 great dams.

These works have protection role that shall be made safe are designed according to the variability of the hydrologic parameters affected by the climate change.

It was also elaborated the study on "The Ecological and Economical Resizing of the Danube Floodplain in Romania". The complex study on the ecological and economical resizing into the Romanian sector of the Danube Floodplain represents an instrument for the strategic coordination at the level of the whole Romanian sector of the Danube, of the investment works for the prevention and fight against floods, as well as the future measures of economic development elaborated into the Programme of Ecologic and Economic Resizing for this area.

The new strategy of river improvement has an ecosystem approach, starting form the fact that the rivers are complex ecosystems, which depend of the watercourses conditions in which the outflows, the sediments transportation, the temperature of the water and other variables have a well defined role. In case certain modifications occur within these variables in relation to the values existing naturally, the ecologic balance is affected, fact that leads to the restructuring of the biocenoses, respectively the loss of species, the replacement of certain valuable species with less valuable ones.

As a consequence of this fact, the improvement of the rivers by hydro technical works must have as objective the preservation in time and space of the ecologic balance of the aquatic ecosystems, respectively of the watercourses. Instead of embedding the rivers between dams, solution applied usually up to now, the new concept "more space for the rivers" shows the dominant strategy in EU, by which it is sustained the necessity to recover the floodplains, in order for them to sew properly the floods.

The sustainable quantitative and qualitative administration of the water, the management of the natural disasters generated by the excessive presence or the lack of water, the preservation of the aquatic environment biodiversity by means of master plans performed at the level of the hydrographical basins.

The management guidance concerning the improvement and the management of the hydrographic basin is the planning instrument in the field of the water on the hydrographic basin and is made of two parts: The Improvement Plan of the Hydrographic Basin (PABH) and the Management Plan of the Hydrographic Basin (PMBH). This planning is proper to the new conditions implied by the climate change.

The management guidance set out in a general and balanced way the quality and quantity objectives of the waters, intending to provide:

- a good condition of the surface water or, for the artificial or strongly modified water bodies, a good ecologic potential and a good chemical condition of the surface water;
- a good chemical condition and a balance between the sampled quantity and the water recharge for all underground water resources;
- the performance of the objectives specially designed for the protected areas, in order to reduce the necessary treatment for the water production intended for the human consumption.

The climate change has led, together with other phenomena, to the increase with 34 cm of the level of the Black Sea during the period 1860-2004. The rehabilitation and the protection of coast area, at the actual moment is a priority problem for Romania. In this respect, the Ministry of Environment and Forests, the National Administration "Romanian Waters" with the support of the Japanese Agency of international Cooperation - JICA have initiated the project "Study on the protection and the rehabilitation of the Romanian Black Sea coast. The study had as objectives: the elaboration of a protection plan for the Southern part of the Romanian sea-coast, the performance of certain preliminary actions for the promotion of certain projects and the transfer of knowledge and technologies in the field of coast area protection and management to the Romanian party.

In order to achieve the objectives mentioned above, the studies included aspects related to the situation of field assessment, the division of the coast area in sub-sectors, the modifications of the shore and the causes for the beaches erosion, as well as a simulation of the future tendency of shore line modification. After the results assessment two prior Eforie North and Mamaia South areas were chosen, where rehabilitation works of the coast area were performed, as well as protection works against the erosion which also include sanding actions.

The coast protection plan was elaborated based on the results achieved and it includes the preliminary design of the necessary protection works, with target year 2015, the assessment of the protection measures, the selection of the protection measures with estimative costs, operation/maintenance/management plan, improvement plan within the institutional and legal framework, the strategies assessment of the coast protection plan.

The results of the study form a valuable documentary and technical support for the continuation of the rehabilitation and protection works of the coast area, as well as for the identification of the coast area vulnerable to the climate change effects.

Regarding the climate change impact on the water and sanitation supply systems, two major aspects were identified:

- warmer and shorter winters lead to the decrease of the seasonal snow volume and to the early and fast snow melting;
- The summers with extreme and dry temperatures generate the quantitative and qualitative decrease of the water resources and the increase of the water demand.

The water excess (floods) has as effect the rapid increase of the thickening, with consequences on the treatment process; also, problems occur because of the lack of the capacity to take over the sewage system as well as the damage of the cleaning process.

As mentioned in Chapter VI.A, there is a trend of increase of the Danube water flow at the entrance point in Romania, as well as an increase of the level of the Black Sea.

Figure VI_ 17. Trend of Danube water flow (1840 - 2005)

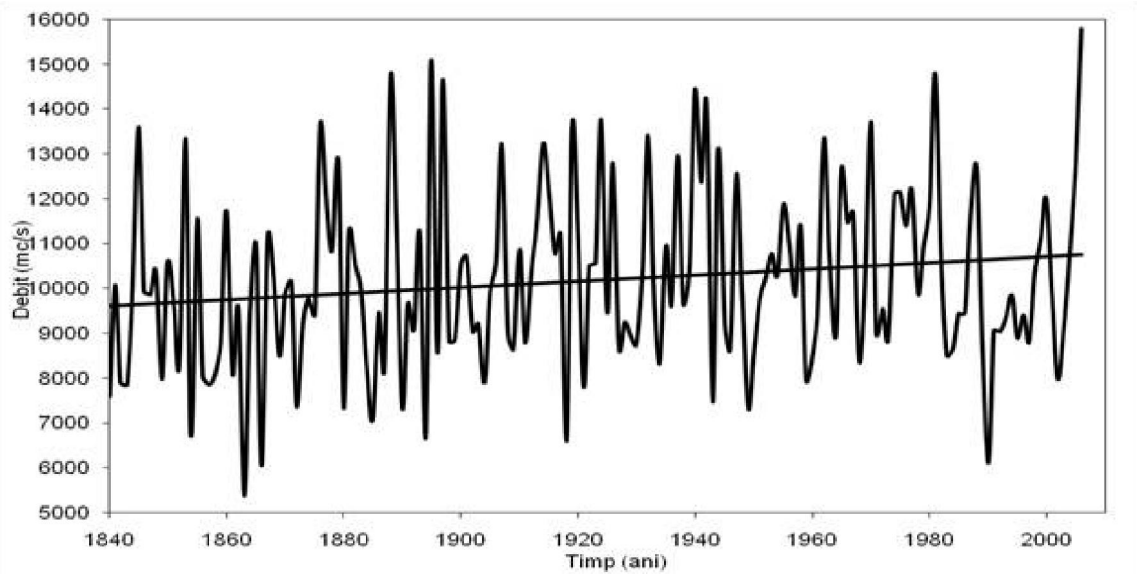
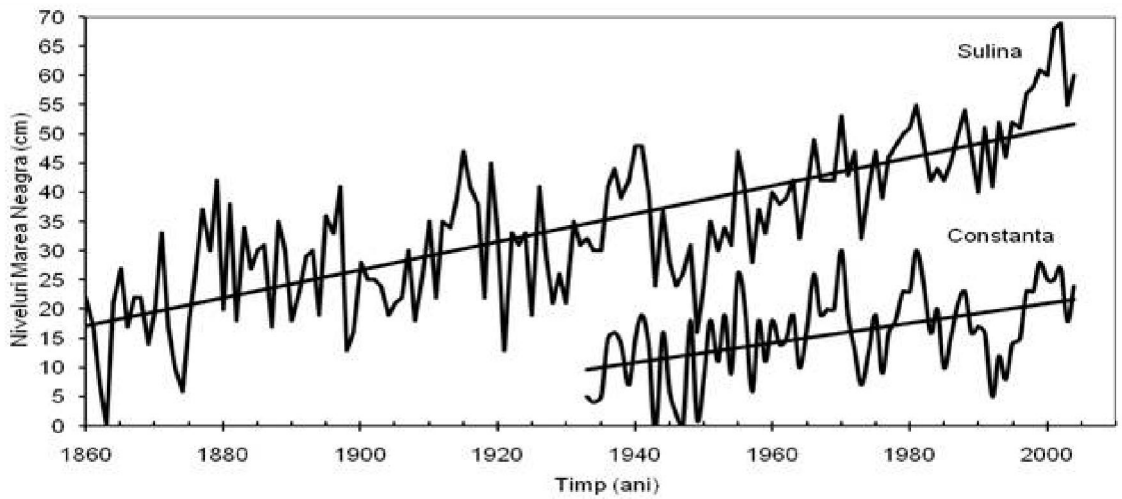


Figure VI_ 18. Trend of Black Sea level (1860 - 2005)



As a consequence to the climate change, the following vulnerabilities were identified:

- the increase of the evapo-transpiration, especially during the summer months due to the increase of the air temperature leading to the average decrease of the flowing conditions of the rivers with 10-20%;
- the decrease of the snow thickness and duration because of the air temperature increase during the winter, leading to a lower flow of the rivers and to a decrease of the capacity of soil moisture recovery;
- the decrease of the soil humidity leads to the decrease to minimum of the leakage (summer and autumn) contributing to the increase of the pollution frequency and of the water supply restrictions;
- increase stress on water as needs for irrigations in agriculture grow;
- the high temperatures may affect water quality in the rivers and storage lakes (the decrease of the dissolved oxygen and algae flourishing, eutrophication may affect the fish populations);
- the decrease of the river outflows may bring problems on the provision of utilities, the self-cleaning capacity of the rivers, the aquatic ecology and recreation;
- during the dry summers problems may occur related to the supply of the salubrious outflow;
- modifications on the underground water supply and the water-bearing layers;
- the increase of the diseases associated to water;
- the increase of the damages produced by floods and droughts.

VI.B.4 Forests

Important component of the ecosystems, forests will be submitted to significant stress:

- In Romania, the increase of the average annual temperatures with over 1-2 ºC, will have as first consequence the aridity of the southern and plain areas, but especially of the hill areas, which can determine the occurrence of unfavorable conditions for the forest vegetation. On medium term it is possible the destructuration of the brushes in the hill area, occupied now by mesophilic species (oak, beech). On long and very long term, it is estimated a migration of the forest area at altitude (the forest will migrate altitudinal starting from the plain area to the alpine vug);
- the climate change impact on the forests in Romania was analyzed by means of more global climate models. Thus, in the low and hilly forested areas it is estimated a significant decrease of the forest productivity after the years 2040, due to the increase of the temperatures and the decrease of the precipitations volume;
- the forest production and the ecosystem stability in the hills areas may be unbalanced in case of the occurrence of the climate changes effects, concerning the decrease of the precipitation amount and the increase of the temperatures. Though, on short term, the production capacity would be excellent, on medium term the scenarios suggest a drastic decrease of the productive capacity, by the decline of the species and the decrease of the tree populations.
- spruce forests will be affected by the climate changes by the decrease of the total accumulated biomass amounts, especially during the young and mature stages, at ages under 60 years. For these intervals, the losses of total biomass will be of about 50% though at superior ages they are recovered, therefore, at the ends of the production cycles it performs total productions compared to the brushes grown in normal conditions. It is noticed the reduced bio accumulative stability of these brush types under the circumstances of the occurrence of the climate changes. The fir tree is acting similar to the spruce tree and

does not represent major modifications concerning the total bioaccumulation during the production cycle;

- the increase of the insect attacks frequency, either known as forest pests, or as existing insect species which start to affect the forest (they existed in fauna, but were not harmful), either new species that came from the warmer areas, as a result of the climate change effects. A high share is owed by defoliating caterpillars within the groups of species which produce infestations, followed by the insects which attack between the rind and wood, the defoliating bugs, the sucking and galicol insects, the xylophagous insects, the insects which damage the root, the shoot and the seedlings strain and the seed insects.

VI.B.5 Infrastructure, constructions and urban planning

The major impact of the climate change on the urban areas, infrastructure and constructions is related, mainly, to the effects of the extreme weather events, such as the heat waves, abundant snowfalls, storms, floods, and the increase of the slopes instability and the modification of certain geophysical features. Therefore, urban planning and the design of an appropriate infrastructure play an important role in reducing the climate change impact and the decrease of the risk on the anthropic environment.
the panning of the territory may offer an integral framework that allows connections between vulnerability, the assessment of the adaptation risk, being able to lead to the identification of the most efficient action options.

Threats:

1. the increase of the risk of earth slide occurrence;
2. the modification of the characteristics of building materials and of the building foundations (e.g. setting time of concrete, field that is sensitive to humidity);
3. the damage of the buildings because of the increased storm intensity, of the earth slide and of the coast erosion;
4. the damage of the localities and of the infrastructure by the increase in the flood occurrence frequency;
5. the decrease of the population comfort degree
6. the loss of the existing construction stability in the uneven areas, on fields sensitive to humidity or in flooded areas
7. the increase of the unevenness of the comfort degree of the buildings due to the increased costs of the material and of the thermal isolation solutions

VI.B.6 Tourism

The seaside tourism: is strongly influenced by the climate change effects, by phenomena such as: coast erosion, the increase of the sea level, the increase of the temperature, extreme weather events (heavy rains, floods), the decrease of the water reserves.

Coastal erosion phenomena, noticed especially during the last decades, became almost a general phenomenon on the Romanian seaside, leading to the decrease of the beach surfaces. During the last decade, the balance between the contribution and the losses of sedimentary material is negative. For instance, the beach in Mamaia known formerly for its wide opening and stability, started to face accentuated erosion, especially in the southern part. According to the data of the National Institute of Marine Research and Development Grigore Antipa, the annual average modification rate of the shore line was of -2.3m/year, with oscillations between +7.8 m/year (Melody Hotel) and -10.4 m/year (Riviera Hotel).

Taking into account the fact that the beach of the seaside resorts represents one of the main attractions for the visitors, being the support of the tourist activity, its protection measures are more than imperious and require substantial investments. An appropriate conservation policy of the beaches and of decrease of the coast erosion will determine not only the protection of the tourism "raw material", but also the increase of the interest in the factors involved in tourism (tourists, operators, investors etc.) for this holiday destination.

The increase of the Black Sea level may generate not only the beach erosion, but also the destruction of the coast ecosystems or the flooding of the areas that have heritage monuments and other important tourist attractions.

Temperature increase in one tourist destination may determine the tourists to change their travel options. A warmer summer such as the one in year 2007 may encourage the Romanian tourists to make more frequent trips on the seaside. In the same time, global warming allow an extended summer season.

Extreme weather events, such as the floods and the storms in the last period, may affect not only the tourism infrastructure but may also jeopardize the tourists and local communities' safety and health. Most of the times, these extreme weather events are presented in media, and such tourist regions are damaged by the creation of a negative image among the visitors. The media in Romania presented the disastrous effects of flooding and storms which occurred on the seaside resorts, and the lack of reaction of the authorities and the tourism operators, as well as the absence of an action plan in emergency situations, determined the cancellation of certain stays of the foreign tourists in the resorts of the Romanian seaside.

Water reserves may be exposed to supplementary stress especially during the peak tourism season, as the increase of the demand corresponds to the dry periods and the decrease of the water reserves.

The mountain tourism: Resorts for winter sports are the most affected by the climate change effects. The increase of the temperatures will determine the decrease of the tourism season, and the opportunities for performing of winter sports and leisure activities will be diminished. As a result a greater pressure will be created on the areas at higher altitudes. In the same time, the summer season will record a higher demand, with negative effects on the environment and with the overflow of the tourist capacity of certain areas.

VI.B.7 Energy

Studies performed in Romania, highlighted a number of vulnerabilities in the energy field:

1. Electricity production and demand
   - Lack of water resources for electricity production; the electricity demand in Romania is covered by a mix of primary resources in which the hydropower covers more than 25% in a normal hydrologic year. As a result of the occurrence in the summer period of the long lasting droughts (2003, 2007), the electricity deficit in the system was covered by the energy produced from coal, which generated a special pressure concerning the coal production, but also on the electricity price
   - Low efficiency of investment projects in wind power, as a consequence of decreasing wind speed over time
   - Increase of electricity demand during summer, as a consequence of using air conditioning systems
   - Lack of cooling water for the Thermal/Nuclear power plants using a river as cold source

2. Energy infrastructure
   - Extreme weather conditions affect energy infrastructure and consumers may suffer situations where they are disconnected from the Grid
   - Decrease of the heat demand for winter heating as a result of the increase of the global average temperature is expected not to compensate for the increase of electricity demand for air conditioning and cooling devices during the hot summer days, leading to an imbalance of the development of energy production, transport and distribution infrastructure

VI.B.8 Industry

Leading to the increase of the production price and drop of competitiveness on international markets, the decrease of the water resource represents one of the main vulnerabilities of the industry in Romania. This is actually the main vulnerability related to the climate change, besides the regulation restrictions related to the cap and trade permitting in the GHG emissions field.

VI.B.9 Transport

The infrastructures of road, railway, marine and air transport are vulnerable especially to the manifestations of the extreme weather events. The direct impact of the climate change on the marine transport will be manifested, as a result of the fluctuations on the flowing conditions of the rivers and streams. Indirectly, the climate change impact will be felt at the level of the road and railway transport by the damage of the infrastructure and the lack of thermal comfort produced to the passengers.

The main identified threats are the following:

- the generation of important damages on the road transportation infrastructure because of the earth slide and of the floods (roads, bridges, railways);
- the damage of the harbour infrastructure and of the river-borne transportation conditions as a result of the Danube flowing conditions;
- the damage of the transportation conditions and regime as a result of the increased intensity of the extreme weather events;
- the temperature variations will damage the used materials and the technical solutions;
- the increase of the sea level will reduce the protection effects of the dams and of the quay walls;
- discomfort for the passengers as a result of temperature increase and under the circumstances of a high travel price as a result of the necessity to recover the damages produced to the infrastructure;
- the occurrence of disturbances in the goods transportation regime and in consequence on the afferent costs;
- the increase of the necessary investment volume to build and maintain the transport infrastructure.

VI.B.10 Health

The climate changes affect directly Romania and lead to the occurrence of the intense heat waves or of the extreme weather events. They will have as effect the short term increase of the deaths or the aggravation of certain chronic conditions (especially the cardiovascular and respiratory ones) or the occurrence of certain diseases induced by the vectors and water epidemics.

The less rich segments of the society as well as those biologically more fragile (children and old persons) will be more vulnerable to these effects. Therefore, it is necessary to pay a special attention to the social adaptation aspects, including the risks related to the employment and the effects on the living and housing conditions.

The extremely hot summers that affected Romania during the last years have drawn the attention on the problem of the thermic stress impact on the affected population. The heat waves in 2007 in Romania allowed the authorities to understand how the population health condition is affected and how should they act under these circumstances. The Romanian authorities received support from the French authorities in order to take appropriate measures, at the national level, during the periods in which Romania faced two heat waves during the summer of 2007.

The most affected areas by the heat waves are especially the urban areas, where the green spaces decreased, and the concrete urban constructions and the street asphalt lead to the intense absorption of solar radiation, which is accumulated and released during the night. In the same time, the urban transportation also contributes to these effects, under the circumstances in which the number of cars increased annually, significantly in Romania.

Longer summers lead to the increase of the exposure to the UV radiations, with direct effects on skin health (skin cancer), while the stress on agriculture may influence the nutritional status especially to children and poor population.

VI.C. ADAPTATION MEASURES

As mentioned in Chapter III, in 2008, the Romanian Government issued the "Adaptation Guide", providing the proposed measures for adaptation to the climate change.

VI.C.1 Biodiversity

Recommendations and adaptation measures:

- Creation of a national monitoring system for the endangered species; this must be performed with public and private support, through national programs and through the participation of the Civil Society, as a result of the research activities;
- Evaluation of the monitoring system in order to determine its efficiency in accordance with the evolution of the climate change effects and the identification of its modification opportunities.
- Extension regarding the use of data in the monitoring process, by adapting the results achieved using the mathematical simulation;
- Elaboration of the special management plans of the natural habitats in order to prevent and limit the degradation process of these habitats as a result of the climate change impact;
- Decrease of the additional pressures which affect vulnerable species;
- Decrease of the agricultural activities in the areas directly affected and the implementation of appropriate measures to protect the natural and semi-natural habitats existing close to the agricultural areas, including the identification of compensatory measures necessary for the survival of the affected population;
- Decrease of the impact generated by the industrial activities on the underground water and air quality, by isolation with forest belts;
- Increase of the forest areas by the rehabilitation of the waste areas and by the creation of other favorable areas;

- the performance of surveys on the assessment of different ecosystems/species vulnerability to the climate change effects

VI.C.2 Agriculture

By means of the European Project INTERREG IIIB CADSES: ACRETe – "Agriculture and Climate Change: how to Reduce Human Effects and Threats", co-financed by EU, to which Romania participated through the National Administration of Meteorology it was elaborated "The Code of Action for Reducing the Impact of Climate Change in Agriculture,, publication which can be considered "*The European Farmer Handbook"*. The document includes recommendations on the adaptation of the agricultural technologies and of all the activities specific to the agricultural production process to the climate change, as well as examples of best practices that lead to the decrease of the greenhouse gas emissions.

Specific measures for adaptation to climate change in agriculture could include:

- *improvement of the genotype varieties:* altered genetic coefficients, respectively for winter wheat the vernalization and photoperiod (P1V and P1D). For winter wheat the most suitable combinations can be the varieties with high or moderate vernalization and moderate or shorter photoperiod requirements.
- *Improvement of the effective use of water by crops:* use of cultivars resistant to abiotic stresses (i.e. drought, high temperature) and resistance to specific diseases; using different soil classes; changing the seeding date and selection of cultivars with shorter germination and shorter growing season; application of irrigation and choose the most suitable irrigation method considering type of crop, soil type, technology, costs and benefits; changing the agricultural practices and crop rotation systems; perform periodical soil analysis and tests, in order to assess and correct the limiting factors which hinder the normal growth and development of plants (acidity, nutrient excess or deficit, etc.); use of natural organic fertilizers, adapted to needs/demands.

Climate is the ensemble of meteorological processes and phenomena specific to a geographical region. The management decisions should aim to increase the agricultural production by growing in each region the appropriate crops that have the largest benefit from the natural potential for agriculture, which is evaluated through analysis of agropedoclimatic conditions

In year 2008, the Government adopted the "National Strategy for the decrease of effects of droughts, prevention and mitigation of soil degradation and desertification".

Among the measures proposed, the following may be reached:

- Selection of the cultivated species by correlation of the local environment conditions with the degree of genotypes resistance according to the limitative vegetation conditions (drought, humidity excess, high temperatures, cold / frost etc.).
- Crop management and the rational use of the field are compulsory measures for keeping the production potential, maintaining in the same time a low impact of the agricultural practices on the environment and climate;
- Cultivation of a greater number of species/genotypes, respectively varieties/hybrids, each agricultural year, with the different vegetation period, for a better exploitation of the climate conditions, especially the humidity conditions and the agricultural works lagging;
- Crop rotation and the determination of a crop structure that should include at least three groups of plants, respectively straw cereals 33%, hoe - technical plants 33% and legumes 33%. The following types of crop rotations can be used into the vegetable production: agricultural, fodder plants, special and mixed.

The basic principles in the application of the adaptation measures are based on:

- the use of varieties/hybrid plants well adapted to the pedoclimate conditions;
- the application of the field crop rotation into the great crop, in order to produce raw material in the foodstuffs, textile and chemical industry, etc;
- polyculture, in order to use efficiently the agricultural space and to increase biodiversity;
- The organization of crop rotations with green fertilizers, in order to improve the physical, chemical and biologic properties of the degraded soils.

The choice of the crop structure should be performed based on the adaptability of the varieties/hybrids to the pedo-climate conditions specific to the area correlated to the market requirements. Concerning the relief, knowing the depth of the underground water and of the surface water provides the prevention of the pollution risks as a consequence of the applied technologies. Also, it has to be taken into consideration the size of the slopes in order to perform soil works, especially the furrow, for the prevention of the soil degradation phenomena as a result of the erosion caused by the water.

- the use of certain varieties / hybrids adapted to the crop rotation system into the farm;
- the use of mixed crops, catch crops, permanent crops, double crops on the same fields or within the farm for increasing biodiversity.

The choice of the irrigation system according to the necessities and the local conditions concerning the surface, the type of the crop and the soil features represent the basic requirements in a sustainable agricultural management system, taking into account the following aspects:

- its own irrigation system has to be adapted to the cultivated surface and the financial resources, provided that there is a lake nearby or a river with permanent water, and especially that there is a permanent layer of phreatic water at the depth of 5 - 10 m, which can be brought to the surface by a pit and a small pumping station;
- knowing the soil properties and the soil capacity to keep water and the depth reached by the plants roots;
- monitoring all the aspects related to the organization before the application of the irrigations, during and after the management of the irrigation rate, respectively the choice of the application moment, the check of the water cycle by the measurement of the performance and the application regularity;
- the use of more monitoring mechanisms for the irrigation planning, the most used being the soil humidity measurement, observations on the plant condition and testing the drain tubes after the irrigations, in order to perform the necessary modifications for the next watering;
- the determination of an irrigation control programme, the actual technologies having the possibility to schedule automatically based on the analysis of certain samples or set of soil samples.

The main directions for the renewal of the irrigation sector as a first measure to reduce the drought effects, are the following:

- the elaboration of a complex study on prioritizing the rehabilitation of land improvement facilities and of the irrigation sector;
- the rehabilitation of the pump stations within the irrigation facilities declared of public utility, in order to reduce the energy consumption and to increase the hydraulic efficiency;
- the acceleration of putting into service or to into property of the infrastructure in the internal irrigation facilities to the federations or organizations of the users of irrigations water;
- carrying on the irrigations subsidy to support the operation of the irrigations facilities which provide a great economic potential;

- the completion of the implementation of "The Irrigation Sector Reform and Rehabilitation Project" financed by the World Bank.

The activities specific to the adaptation process in the zootechnical field refers to the fund of genes, specific measures to elaborate the diet, grazing and livestock housing, as well as storage techniques for the fertilizers. Thus, the greenhouse gases emissions in the livestock sector can be significantly reduced by genetic improvement, by the analysis of the genetic potential on selected livestock breeds, by a suitable balance between energy and proteins in the diet, by building appropriate shelters and suitable fertilizers warehouses. The introduction of certain suitable grazing systems into the farms may also contribute to the decrease of the greenhouse gases emissions.

The Code of Practice in agriculture recommends:

- huge, impervious and suitably fitted platforms to store the manure;
- to store the manure in cold and shady places;
- to cover the containers with liquid waste in order to reduce the ammonia emissions into the atmosphere by using waterproof canvases;
- to provide the suitable manure amounts within the farms specialized in its collection and processing;
- to build plants to capture the biogas, having as result the decrease of the methane emissions, and the achieved energy is used in order to reduce the fossil fuels;
- the grazing in the open air as opposed to the breeding in systems with shelters;
- to educate and to increase the awareness among the farmers on the consequences determined by the climate change effects;
- to revise continuously the agriculture strategies, in order to provide them flexibility in relation to the climate change effects and the adaptation measures.

Global warming and the prospect of the depletion of conventional energy sources imposed a new approach by introducing the bio fuels in order to reduce the pollutant emissions and the decrease of the carbon dioxide in the atmosphere. Therefore, the use on the largest scale of the alternative sources shall determine the gradual transition from the fossil fuels to the renewable sources of energy, in order to reduce the greenhouse gas emissions.
In order to manage efficiently the renewable energy sources it is recommended:

- to increase biodiversity within the farms by introducing new crops;
- to cultivate annual or perennial herbaceous with a high energetic value (cane, couch grass, sorghum, etc.);
- to collect, store and use the organic residual materials resulted from agriculture, food industry and farms with a high protein content (liquid manure, sewage and waste water, scrap fodder, crop residue, slaughterhouses waste);
- to increase the share of the crops intended for the biogas production, such as the maize, sugar beet, rape, etc., which can be cultivated as raw material for the biogas factories;
- to install solar heating panels for water and houses.

VI.C.3 Water resources

A number of national and international research projects were performed and they resulted also in proposing adaptation measures regarding the water resources. Among the proposed measures, the following may be highlighted:

- producing maps regarding the hazard and flood risk on the great hydrographic basins and particularization by the local administration of the flood risk maps at the level of the localities, with priority in the areas with high risk, identified on the maps performed at the level of the hydrographic basins;
- introducing the risk maps into the regional development plans, into the general city planning (PUG) and into the regional planning (PUZ);
- adopting regulation regarding the constructions on the high flood risk areas;
- development of studies necessary for the foundation of the adaptation measures in the field of water resources assessment;
- continuous assessment of the water resources on hydrographic basins and sub-basins under the circumstances of climate change;
- analyzing of the climate change influence on the watercourses maximum outflows;
- assessment of water needs for the main crops in Romania under the circumstances of climate change;
- assessment of water needs for the main utilities (drinking water supply, industrial water, water for zootechnics, fishing related activities, etc.) under the circumstances of the climate change;
- elaboration of studies for the determination of the water resources vulnerability to the climate change for each hydrographic basin with a surface wider than 1000 km^2, out of which the necessary adaptation measures should result.

Adaptation measures for the supply of the available water to the source:

- the performance of new infrastructures to turn the hydrological resources into socio-economic resources (new storage lakes, new inter-basin derivations, etc.);
- the modification of the existing infrastructures in order to be able to regularize the liquid outflows whose distribution in time is being modified as a result of the climate change (increased heights of certain dams, re-equipment with new works, etc.);
- the design and the implementation of certain solutions for the collection and the use of the rain water;
- the extension of the water recharge solutions of the phreatic layers;
- the construction of water basins without dams (the water level is below the ground level);
- the transition on a wide scale to the joint management by more countries of the water resources in the areas richer in water resources of the Europe.

Adaptation measures to the water utilities (users):

- the more efficient water use and conservation by the rehabilitation of the transportation and distribution installations and also through technological modifications (the promotion of the technologies with low water consumption, etc.);
- modifications in people's life style (the decrease of the water demand, the use of the recycled water for certain activities, etc.);
- the increase of the recycling degree of the water for industrial needs;
- the elaboration and the implementation of certain price and tariff systems for water according to the category of use, the season and the available resource;
- the use by certain utilities of the inferior quality water.

The improvement of the hydrographic basins:

- the inclusion into the management guidance (the improvement plans) of the hydrographic basins of a scenario in which the available resources of water are decreasing as a result of the climate change, and the demands of the utilities are increasing;

- the inclusion since the design phase into the storage lakes that will be performed of certain reserve volumes that should be used only in exceptional cases or the construction of certain storage lakes with special operation conditions in order to supplement the available water resources in critical situations;

Adaptation measures in the field of floods risk management:

- the performance of protection works with local aspect (the protection of human establishments, of the economical and social objectives) to the detriment of certain protections of great length;
- the improvement of the basins in the areas of leakage formation through ... wooded
- the use of certain solutions of expansion and temporary deflation of the flood waves into the specially improved areas, in the place of increased height of the existing dams or the performance of new dams;
- the elaboration of new design standards of the protection works against the floods (by the inclusion of the accepted risk);
- the correlation of the territorial development and improvement plans with the strategy and the risk management plans in case of floods;
- the promotion and the extension of the insurance system of the goods and persons against the floods;
- the implication and the education of the population in order to have a proper behaviour before, during and after the passage of the floods.

Measures for the risk decrease and the adaptation to the climate change effects for the water and sanitation supply systems:

- the creation of safety sources for extreme cases (into the deep layers 150-300m);
- the development of certain storage facilities for drinking water (the coverage of the demand for 1-2 days);
- making sectoral the distribution networks on common components;
- the decrease of the losses into the distribution networks (from 50% in the present to 20% in 2025);
- making users aware of the efforts to spare water by means of educational systems;
- the introduction of modern technologies into technologic processes in order to produce drinking water and to clean the waste water;
- the recycling of the purified water and its further processing into an important source for the coverage of the industrial and public demand, having a non-drinking quality;
- the computerization and automated management of the systems;
- the introduction of the risk management plans (the involvement of all the interested factors - users, operators, authorities);
- the introduction of certain inventive economic mechanisms for the water saving, as well as coercive measures for exceeding the specific water consumption, to all types of users;
- the elaboration of framework norms (handbooks, normative acts) based on which the risk management plans should be elaborated for each system;
- the insurance of the financing for the implementation of the safety plans to the major conurbations (over 100.000 inhabitants);
- the elaboration of studies and extensive research for the performance of the technologies necessary to the integral water recycling.
- the elaboration of the plans integrated on basins (the allotment of the resource, the use of water, return condition);
- the elaboration of certain alternative studies within the water and sanitation supply services (feeds, interlinking) and the reinforcement of the technological platform.

Within the investment programs it has to be provided:

- strategic sources of reserve;
- works that should diminish the risk of quantity and quality provision of the delivered water;
- systems and solutions that should reduce to the half the losses (technological and network losses);
- social, incentive and coercive rates.

VI.C.4 Forests

Recommendations and adaptation measures:

- the identification of the breeds, tolerant species, the testing of new species/more tolerant breeds to hydric stress in the air or soil and/or tolerant to high temperatures, long or temporary, early or autumn, tolerant to the late frosts;
- the encouragement of the development of demonstration activities of the research results by the users by the significant improvement of the capacity of public consultancy services and the support of the researches;
- the performance and the promotion of the guides of good practice in the forest field, which should provide the resilience of the forests to the climate change effects, adapted to the needs of the private property/state and the principles of sustainable administration;
- the increase of the standing wood surface, by the afforestation of certain degraded fields and of certain marginal fields, not proper for an efficient agriculture, as well as through the creation of forest shelter-belts for the agricultural fields, of the watercourses and of the communication ways, for the anti-erosion protection of slopes;
- the promotion of the energetic crops and the use of the waste forest biomass resources;
- the adoption of certain protection measures of the standing crop integrity, by forbidding the exchange of land use of the fields covered with forests and with other forms of forest vegetation;
- the proper improvement of the territory, taking into account the actual and possible effects of the climate change;
- the increase of the capacity of the forest institutions of management, control, assistance and regional coordination.

VI.C.5 Infrastructure, constructions and urban planning

Recommendations and adaptation measures:

The approach of the planning and the management practices of the urban space have to be approached on long term taking into account also the potential impact of the climate changes.
Among the main measures that are necessary, it can be enumerated:

- the promotion of specific prevention systems and fast efficient intervention in case of the occurrence of the extreme weather phenomena;
- the resizing of the sanitation system in order to take over the water excess got from the heavy rains fallen inside the city;
- the development of appropriate pavements, which should provide the infiltration of the rain water at the level of the footways, pedestrian platforms, for parking and for storage;
- the decrease of the risk produced by the excessive heat periods, by the increase of the patches and the provision of water for the patches;
- the development of the construction standards for green buildings, which should provide the storage and the cycling of the rain water, water saving by efficient installations and the development of patches at the terrace level

- the development of the standards and the constructive solutions for the improvement of the performances and the thermal isolation in order to make the energy consumption more efficient;
- the implementation of the modern architecture concepts for the performance of the constructions with a maximum potential of using the renewable energy sources;
- the promotion of materials and constructive solutions suitable for the potential effects of the climatic change;
- the extension of the application of the technologies and practices to use the renewable energy sources in order to provide the necessary utilities;
- the promotion of certain training the public awareness programmes required for the application of the identified adaptation measures and of certain training programmes for the architects having as subject the insurance of the buildings resilience to the climate change effects

VI.C.6 Tourism

Recommendations and adaptation measures:
Tourism is generally based on short term plans, without taking into consideration the long-term climate change effects.

Regarding the seaside area, it can be mentioned the following among the required measures:
- the rehabilitation of the beaches affected by the coast erosion;
- the increase of the protection measures against the natural disasters (the creation of certain barriers/natural or artificial dams against the floods);
- the adaptation to the new climate conditions by the construction of the tourist infrastructure and of the resorts far from the coast;
- the determination of stricter rules against the execution of buildings on the beach or nearby beaches, as well as on the areas exposed to natural risks;
- the diversification of the tourism forms which can be practiced on the seaside resorts (e.g. business tourism);
- the elaboration of a management plan for emergency situations which should be brought to the knowledge of the decision making factors and whose implementation to fall into the task of the local authority or/and of the tourism authorities etc.

In case of the mountain resorts a series of adaptation strategies may be applied to counterbalance the effects of the climate changes, such as:
- the endowment of the resorts with machines that generate artificial snow in order to help to the extension and the supplementation of the surfaces covered with natural snow;
- the creation of additional tourist attractions in the mountain resorts, alternatives to the winter sports in the cold season, not to be affected by the lack of snow;
- the diversification of the tourism forms that can be practiced in the mountain resorts (e.g. business resorts) in order to be able to address to other market segments;
- the extension of the summer tourism season and the creation of tourism packages for the people who can take holidays in the after season too, especially the old persons.

A part of the measures that have to be taken in order to reduce the climate change effects on the tourism are available on long term, such as: beaches rehabilitation, the building of a technical and material basis far from the beach or in the high mountain areas or of a tourism infrastructure which should address to other tourist segments too (business, health tourism, etc.)
In the field of tourism a series of studies and researches has to be performed regarding:

- the analysis of the possible climate change effects on the tourism activity and on the tourism regions in Romania (regression models between the main climate-temperature parameters, precipitations, the thickness of the snow layer and the tourism indicators-number of tourists, numbers of overnight stays);
- the analysis of the climate change influence on the tourism demand and of the tourist flows;
- the analysis of the climate change impact on the communities in which the tourism has an important economic and social role;
- sensitivity analysis on the tourism activity in the mountain and seaside resorts.

The tourism is not only affected by the climate changes, but it also contributes to them. Therefore, tourists transportations to the holiday destinations, the waste resulted from the stay in a resort etc. generate greenhouse gas emissions.

The climate change effects on the tourism should not be regarded as being isolated because the major changes in the tourism demand may have strong effects on the economic and social policy in such areas (for instance on the labor force demand, transportation infrastructure). Also, other activity sectors such as the agriculture, energetic industry, manufacture industry, the local network of small enterprises, which represent a raw materials resource and tourism materials, may be affected by the modification of the climate conditions. That is why it is necessary to have an action plan which should take into account all these aspects and the interferences between the economic sectors.
The climate conditions are changing rapidly, creating different problems to the tour operators. That is why, the tourism sector has to develop its ability to adapt in order to keep its viability and to continue generating economic and social benefits to the local communities and to enrich the tourists' life experience.
The education for tourists and operators regarding the climate effects is necessary to insure us that the implementation of certain adaptation measures will not be impaired and that the new opportunities will be maximized.

VI.C.7 Energy

Recommendations and adaptation measures:

- it is necessary to elaborate studies on the risk assessment concerning the climate change effects for the energy sector generally, and especially, in the risk assessment for the hydroelectric sector, but also taking into consideration these risks concerning the scheduled investment projects;
- it is necessary to take actions to determine the critical infrastructure in the energy system (hydroelectric dams, the transportation and distribution system, natural gas transportation system, oil and its derivatives) in order to determine the measures required in case of extreme weather phenomena (storms, tornadoes, floods, droughts, very low temperatures);
- researches and studies are necessary concerning the possible modifications in the increase of energy consumption because of the higher temperatures and of the extreme phenomena;
- the promotion of the energy production from renewable sources;

The elaboration of strategies by the local public administration authorities in order to use energy sources which should comply with the European environment and efficiency norms, in order to produce electric and thermic energy, in centralized systems

VI.C.8 Industry

In order to adapt to the climate change effects, all the industry sectors, as a matter of fact the whole economy, has to get oriented towards sustainable development, towards the use of energy efficient products, processes and technologies, the decrease of the greenhouse gas effects, the decrease of the carbon dioxide level and towards the use of the renewable energies.

The adaptation has to be reactive and proactive. It has to be identified the appropriate approach in order to transform all the challenges generated by the climate change into opportunities to encourage the research and the innovation, to identify new techniques, technologies and products.

VI.C.9 Transport

The Adaptation Guide suggests a few general recommendations and adaptation measures as well as performing a few detailed studies on the different transport possibilities n climate change in Romania. Among the proposed measures, the following are to be highlighted:

- the revision of the infrastructure regulations, such as: the drainage of the rain water, earth moving, roads, railways, bridges, tunnels;
- the identification of alternative transportation routes;
- the insurance of the proper collection of the rain water in the street network;
- the insurance of the communication ways protection in order to resist to the extreme weather conditions. For the road construction, there have to be provided enough bridges, ditches and channels in case of intense precipitations and floods;
- the protection of the railway infrastructure against erosion;
- the reinforcement of the harbor structure in order to face the heavier storms (e.g. the use of the concrete blocks);
- the replacement of the surface cables with underground cables;
- the construction, in the road and railway network, of an additional number of facilities for the insurance of the wild animal passage (green bridges, passages);
- the promotion of certain new technologies of street carpet (asphalt concrete or concrete cement) and execution of the runway, based on hydrocarbon pavement mixtures performed with modified asphalt in order to prevent the permanent deformations (because of high temperature) and to provide resistance to cracking (because of low temperature);
- the decrease of the road transportation, especially the goods transportation by mixing it with the other types of transportation (railway, marine, river-borne transportation). the promotion of the inter-modal transportation;
- the stimulation of the alternative transportations with an impact as low a possible on the environment;
- the improvement of the runways and the flow of traffic with effects on the decrease of the fuel consumption and implicitly the greenhouse gases emissions;
- the limitation of the masses of the means of transportation of goods on certain sectors with high population exposure;
- the afforestation of the areas affected by floods and earth slides close to the communication lines;

Required studies in the field in order to substantiate scientifically the future actions:

1. Study regarding the climate change impact on the different transportation sectors: railway, road, marine, air transport.
2. The identification of the way in which the climate changes affect different transportation sectors.

3. The assessment of the vulnerability of different transportation sectors to the climate change effects.
4. Risk studies for the areas with high vulnerability to the climate change effects.

VI.C.10 Health

The main proposed adaptation measures include:

- performing epidemiological studies concerning the influence of the climate change effects on health in Romania;
- the development of methodologies in order to forecast major health problems which may occur according to the severity of the climate change effects, taking also into account the social and economic circumstances;
- the development of certain surveillance methods and of early detection systems of the impact of the extreme heat waves on the health condition;
- the cooperation between the competent authorities in order to promote certain operative intervention programmes in case of the manifestation of certain extreme weather events;
- in this respect, the competent minister will propose within the national health programme, the public health sub programme, the following:
  - national methodologies of assessment and control of the climate change effects on the people's health.
  - intervention programme in case of extreme heat waves.
  - the control of the contagious diseases.

VII. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

Romania is not listed in Annex II of the Convention; therefore the provisions of UNFCCC Art. 4, para 3, 4, 5 are not applicable.

VII.A. PROVISION OF "NEW AND ADDITIONAL" RESOURCES

Not applicable to Romania.

VII.B. ASSISTANCE TO DEVELOPING COUNTRY PARTIES THAT ARE PARTICULARLY VULNERABLE TO CLIMATE CHANGE

Not applicable to Romania.

VII.C. PROVISION OF FINANCIAL RESOURCES

Not applicable to Romania.

VII.D. ACTIVITIES RELATED TO TRANSFER OF TECHNOLOGY

Not applicable to Romania.

VII.E. INFORMATION UNDER THE ARTICLE 10 OF THE KYOTO PROTOCOL

Not applicable to Romania.

VIII. RESEARCH AND SYSTEMATIC OBSERVATIONS

According to the requirements of the UNFCCC, research and systematic observations are performed so that a better understanding of the effects of the climate change in Romania can be modeled, GHG mitigation measures proposed and adaptation measures can be adopted.

VIII.A. GENERAL POLICY ON RESEARCH AND SYSTEMATIC OBSERVATION

In Romania, the Central Public Administration is regulating and coordinating the research field through the National Scientific Resedecompositionarch Authority (NSRA), financed through the State Budget.

According to the National Regulation, all entities performing research activities (private or public) are included into a National System.

NSRA ensures the strategic planning for defining, applying, monitoring and evaluating the national objectives on research and technology development.

National research and innovation programs are instruments for implementing the national strategy in the field. The research programs are part of:

a. national plans for research and innovation _ national plan
b. research plans of the central public authorities _ sectoral plans
c. other plans and programs

International programs refer to:

- experts training (China, Greece, South Corea, EU JRC etc.),
- research programs and technological platforms (FP7, EUREKA, NATO, COST, JRC etc.),
- bilateral programs (Moldova, Bulgaria, China, Germany, Finland, Japan, Switzerland, South Corea, UNESCO etc.),
- structural funds
- other research cooperation forms.

Most part of the mentioned plans and programs are open for financing projects and project components regarding climate change.

VIII.B. RESEARCH

In Romania, climate change becomes a subject of interest exceeding the limits of the obligations undertaken through the UNFCCC; scientists are interested by understanding the effects of climate change on the country and of the possible mitigation and adaptation measures. Between the institutions/groups of researchers with interests in the field, the National Meteorology Administration (NMA) is representative and carries on the most important number of projects, concerning the following main objectives:

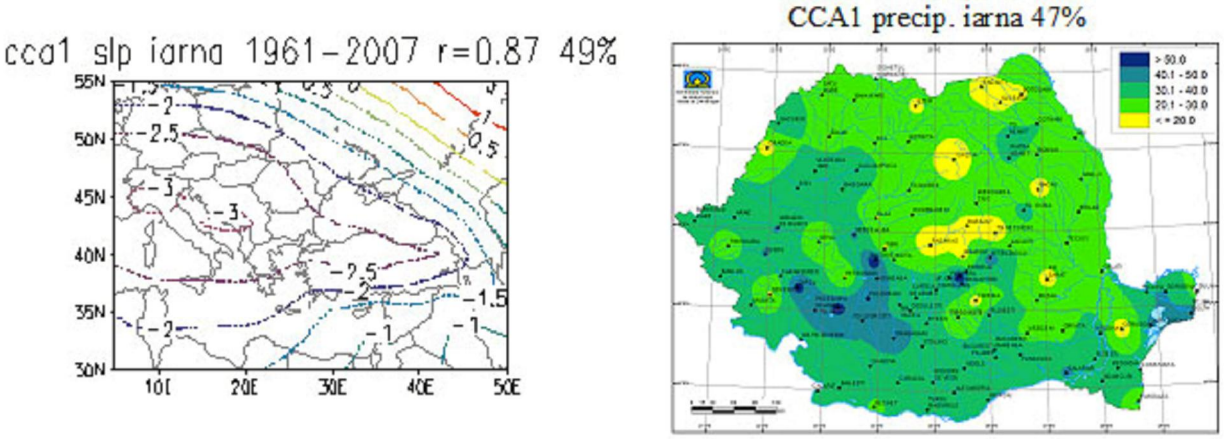
a. Identifying changes observed in the climatic regime in Romania
b. Understanding those mechanisms controlling the regional climatic variability
c. Statistical and dynamical models
d. Validating global/regional climatic models

e. Performing annual and seasonal estimations for Romania
f. A synthesis is further presented of the way these objectives are achieved.

Identifying changes observed in the climate regime in Romania
Using long series of observed data and adequate statistical methods (non-parametric tests), there are analyzed the long-term variation trends and the shifts in the mean for various climate parameters. For instance, the Pettit test is used for the identification of the shift points in the average and for testing their statistical significance, whereas the Mann-Kendall test is used to test the statistical significance of the linear trend. There were thus analyzed the annual and seasonal means of air temperature and precipitation from 14 weather stations with complete observation series over the 1901-2007 period and from a greater number of stations over the 1961-2007 period. Changes were also analyzed in the frequency of certain meteorological phenomena occurring in the cold season or in the regime of certain extreme phenomena.

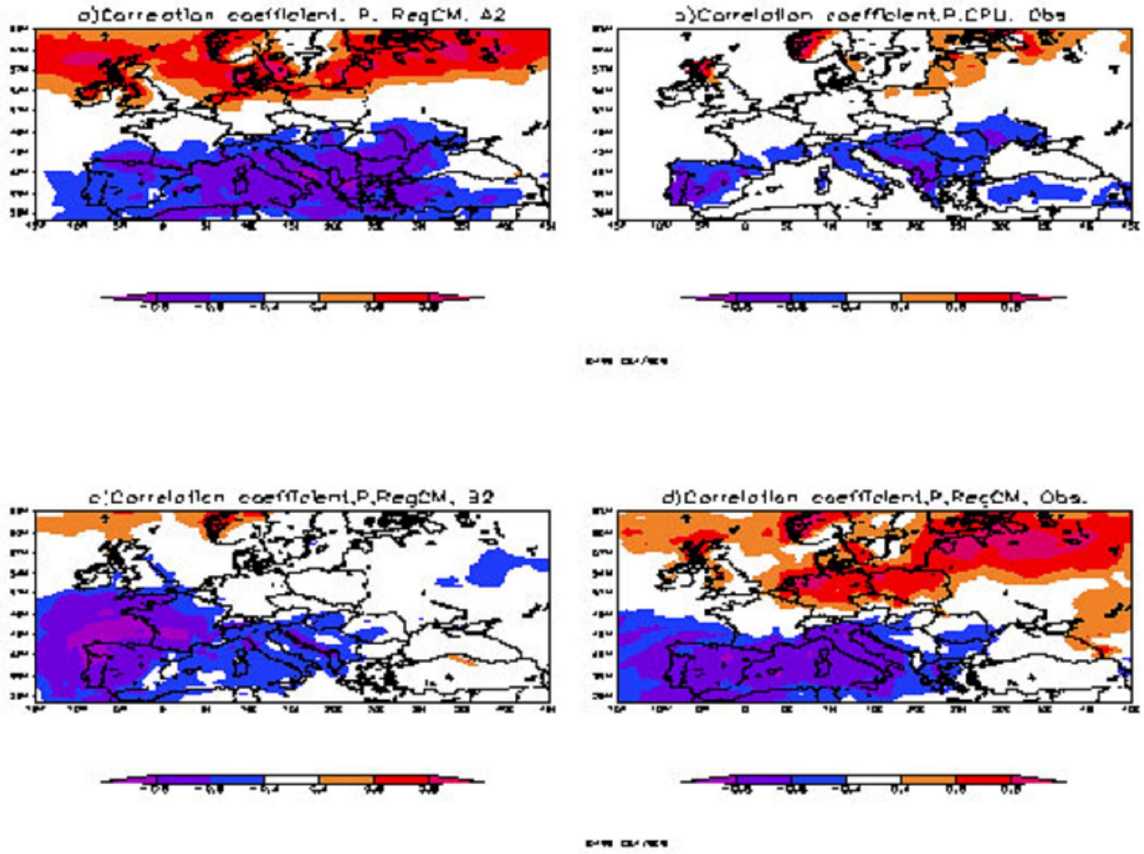
Understanding those mechanisms controlling the regional climate variability, with a special mention for Romania. Within this objective, there are carried-out studies on the spatiotemporal variability characteristics of the main climate parameters in Romania; the connections between those characteristics and the large scale processes' variability (atmospheric circulation, sea and ocean surface temperature, North Atlantic Oscillation), other circulation indices. Complex statistical methods were used as analysis procedures, such as: empirical orthogonal functions (EOF) and canonical correlation analysis (CCA). An exemplification of the results is rendered in Figure VIII_ 1

Figure VIII_ 1 Pair of surface atmospheric circulation patterns represented by the sea level pressure-SLP (left), optimum correlated with patterns of winter precipitation anomalies (right), Obtained through the canonical correlation analysis (CCA). Correlation coefficients between the time series associated to these patterns (r) and fraction of explained variance by each pattern are shown. First CCA pair showing the maximum correlation is presented



However, the effects of global warming overlap the natural fluctuations of the geosystem and it is still difficult to estimate the ratio between the anthropogenic and the natural factor, in configuring the climate variability of the North Atlantic Oscillation The way in which the configuration of the North Atlantic Oscillation modifies in climate change circumstances is very complex. An example are the numerical experiments performed with the RegCM regional climatic model, which discloses that the Icelandic and Azores centre respectively can modify their positions under the circumstances of the A2, B2 and B1 scenarios and that those modifications have a considerable local impact of the predictability of the winter precipitation (Figure VIII_ 2).

Figure VIII_ 2 Correlation coefficients between North Atlantic oscillations and winter precipitations in Europe and Romania
In Scenario A2 (a), and observations (b), Scenario B2 (c) and control simulation (1961-1990). Data was obtained based on experiments with the Regional model RegCM, forced to the lateral frontiers with the global model HadCM3. Scenarios were analyzed for the period 2071-2100



Statistical downscaling models
The ocean-atmosphere general circulation models (AOGCM) are the most plausible techniques for the simulation of the global climate system characteristics and also for projection the system's answer to scenarios of the influence of certain external factors (natural or anthropogenic).

Through the nature of their construction, these models directly supply information regarding the regional climate and the climate change at regional level. Given their complexity, the horizontal resolution of the atmospheric component of these global models is rather coarse (400 to 125 km), which is insufficient for the practical necessities regarding the study of the climate change impact on the various ecosystems. To obtain information at a finer scale (downscaling) two main methods are known: 1) the **dynamic method** represented by the regional climatic models (RegCM) coupled to the lateral conditions with the global climatic models, and b) the **statistical model** based on certain established statistical relations between observed climate variables and the large-scale atmospheric variables. In both cases, the quality of the products yielded through downscaling depends on the quality of the global models. Both methods display advantages and disadvantages, synthesized in the latest IPCC Report. For any given region it is ideal to use both methods, to better estimate the incertitude associated to the various climate change scenarios.

Several types of statistical downscaling models are known, **depending on** the type of the used statistical **relationship**. Until nou, the Climatological Department has developed two types of

statistical **"downscaling" models: linear models based on the CCA method** and conditioned and non-conditioned stochastic models. The models in the first category were applied to design scenarios referring to the mean monthly/seasonal air temperature (Figure VIII_ 3), the seasonal/monthly precipitation amount, whereas those in the second category were used to elaborate probabilistic scenarios regarding certain precipitation indices (including those referring to extreme events). Conditioned stochastic models are developed within the EU project **ENSEMBLES** (http://ensembles-eu.metoffice.com) (Figure VIII_ 4). Also studies referring to the comparison between the two downscaling models were performed.

Figure VIII_ 3 Change of the summer mean temperature (2070-2099 vs. 1961-1990) under the A1B emission scenario at 94 stations in Romania (^{o}C) , represented as ensemble mean over statistical downscaling projections from 8 ENSEMBLE GCM simulations (stream 1); results obtained in the FP6 CECILIA project

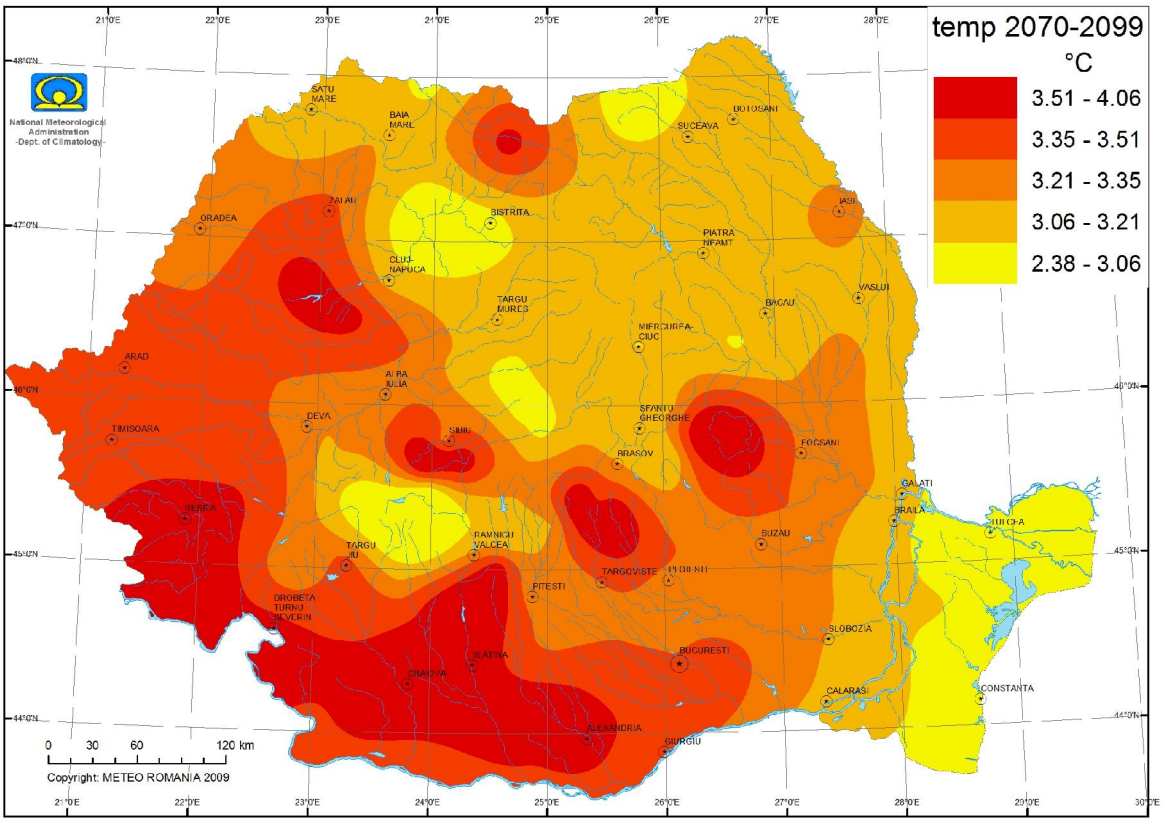
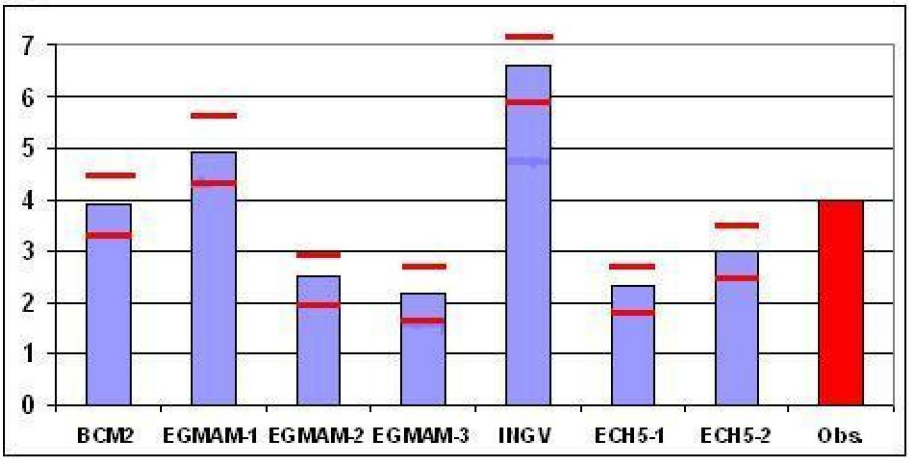


Figure VIII_ 4 Mean frequency (number of days) of summer daily precipitation exceeding 15 mm/day at the Calarasi station for the period 2070-2099 (A1B scenario)
Derived through a conditional weather generator applied to various ENSEMBLES GCMs (blue), compared to the current period 1961-1990 (red). These values are obtained as ensemble means over 1000 runs. The red bars indicate the 90% confidence intervals



Validation of the global and regional climate models regarding their capability to simulate regional climate characteristics, in particular those of Romania. Within this objective, ***the simulations of global and regional climatic models are analized*** as regards their accuracy in reproducing the climatic characteristics observed in Romania and the large scale / regional physical mechanisms governing their variability. Such studies are vital to determine the confidence level of the climate scenarios elaborated with those models. It is known that global models simulate correctly certain large scale climate processes and that they are less accurate in reproducing regional climate characteristics, the main reason being their coarse spatial resolution (several hundreds of km). Although the regional climate models are being improved with respect to reproducing certain regional climate characteristics, an increased spatial resolution does not contribute to eliminating all those models' imperfections, most of the problems being connected to the simulation of the precipitation characteristics.

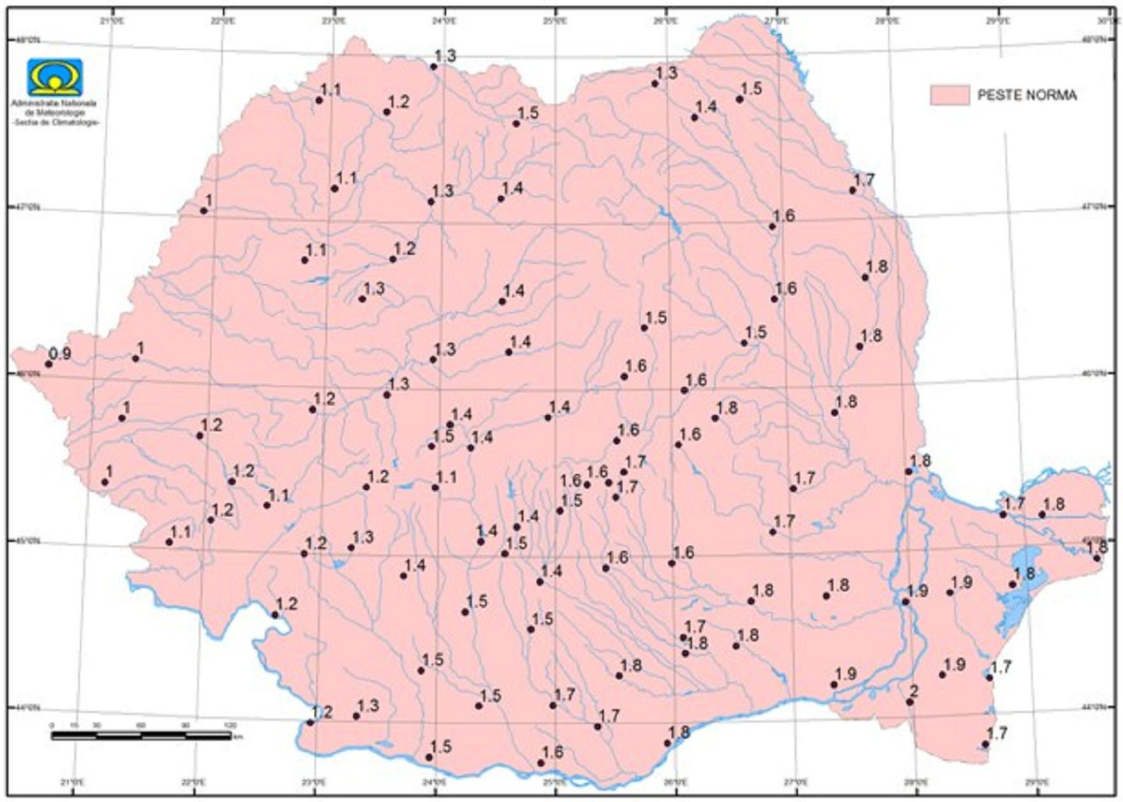
Annual and seasonal forecast estimations for Romania
Statistical studies are performed within this objective, so as to obtain for Romania forecast information. These studies are still in the research phase, the same as in the important European centers, where long-range forecast estimations are performed, based on deterministic models (e.g. at the European Centre for Medium-Range Weather Forecasts (ECMWF), based on deterministic models.

In the Climate Research Group (former Dynamic Climatology Group) within the Climate Department, studies are being developed based on statistical models (conditioned probabilities, autoregressive-AR models), with which there have been systematically elaborated, starting with 1992, forecast estimations of the temperature and precipitation seasonal anomalies, with a lead-time of 1 to 3 seasons. The analysis carried out over the 1992-2003 interval offered satisfactory results, at least as regards air temperature. In the latest years, those researches have been completed through the development of statistical models based on large scale predictors (multifield analogy, linear models based on the CCA method), that are being used at present. Having in view that, starting with the year 2003, Romania is an associate member to ECMWF, the statistical downscaling models based on the CCA method, routinely used for the local scale projection of the global climate change scenarios, are used for fine scale detailing (94 weather

stations in Romania) of ECMWF's forecast estimations, with a lead time of 1 to 6 months. An example for air temperature is rendered in Figure VIII_ 5.

Using the multicamp analogy method, adapted for the region of our country, prognostic estimation bulletins are made up, in a research, experimental regime, for the seasonal mean temperature and precipitation anomalies, at 28 weather stations in Romania. Multicamp analogy is based on the evolution of climatic state vectors in the hyperspace of phases, defined by the significant orthogonal empirical functions of the covariance matrix of the data. For the local components, spatial indices are used of the anomalies of temperature, precipitation and number of days with precipitation, for 28 weather stations that cover Romania's territory relatively uniformly. For the large-scale components of the climatic state vector, spatial indices were chosen of the sea surface temperature (SST) anomalies, of the geopotential anomalies at the level of 500 hPa, of the temperature anomalies at 850 hPa and of the zonal wind anomalies at 300 hPa.

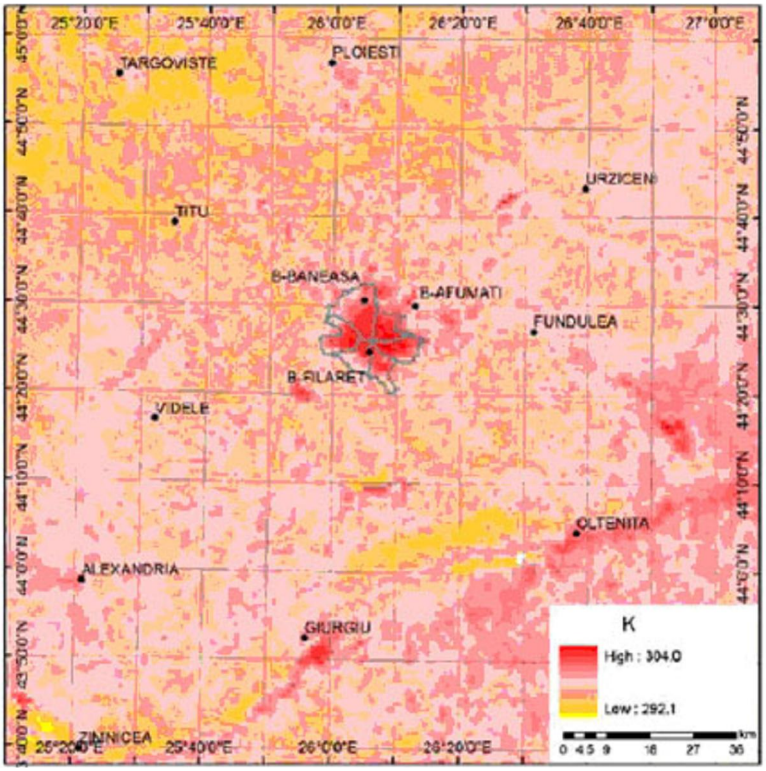
Figure VIII_ 5 Forecast estimation of temperature anomalies in August 2009
Derived through a statistical downscaling model applied to the temperature anomalies at 850 mb, estimated by the ECMWF in June 2009



Urban climatology

The recent evolution of the urban environment in Romania imposes peculiar attention as regards the climate research. Cities generate specific climate, characterized by significant deviations of every meteorological parameter against the characteristics of the extra-urban perimeter. Temperatures are higher during the summer days, the wind intensifies locally and the chemical composition of precipitation can pose serious problems. Technological development allows obtaining extremely useful information for the analysis of the urban climate. For instance, the use of satellite images contributes to a more precise identification of the urban heat island. The recent results in the field have been obtained within EUFAR project and were published during 2008 and 2009.

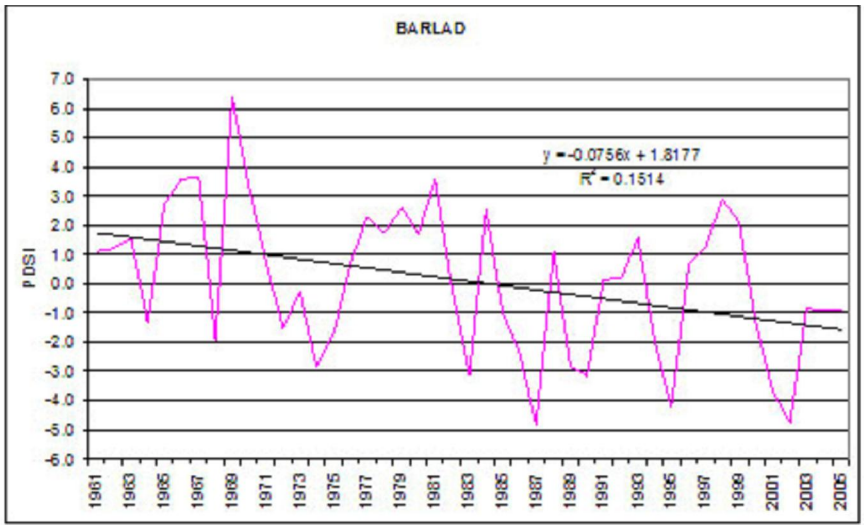
Figure VIII_ 6 Active surface temperature in the central part of the Romanian Plain On 23 July 2007 20.00 UTC, extracted from the MODIS MOD11_L2 product



Climate hazards

Extreme displays of the atmospheric phenomena can cause significant damage and life loss. In the latest years, specialized terminology is being using for such phenomena the term *atmospheric hazards*. The most frequent atmospheric hazards over the Romanian territory are: abundant precipitation, drought, snowstorm, extreme temperatures and heat waves. In turn, the high wind speeds, fog or electrical discharges can inflict negative consequences on the society and the environment. All these phenomena are the object of a number of studies achieved within the Climate Department and materialized in research projects **(CLIDOIN-link)** and publications. Thus, in the CLIDOIN project, the Palmer Drought Severity Index was computed at every station in Romania, for each month of the year and the analysis of its temporal and spatial variability (Figure VIII_ 7).

Figure VIII_ 7 Palmer Drought Severity Index April evolution at Barlad weather station (1961-2005)



Regarding the NMA's research projects, some of them are listed below:

Ongoing national projects

1. **Climatic archives in karst – an integrated approach for modeling and prediction of transient climate oscillations** (2009-2011); The project proposes an integrated approach aiming at analyzing the multi-proxy paleoclimate data from caves and karst deposits. The final objective of the project is to better understand the mechanisms controlling the transient climate oscillations (over hundreds of thousands of years) without anthropogenic influence, based on proxy indicators from karst deposits.

2. **Setting up a national multidisciplinary strategy for warning, monitoring and controlling the re-emergence of mosquito vector diseases(Diptera: Culicidae) in the European domain_VECBOLEM** (2008-2011); Through a multidisciplinary approach the project proposes a risk assessment of the re-emergence of malaria and West Nile virus infections by mosquito transmission. The environment conditions favorable to influencing the triggering, the spatial and temporal distribution and the dynamic of pathogen agents on host vertebrata and their vectors are investigated.

3. **Mapping the Hydropower Potential of Romania. Technical-economical approach (2008-2010);** METEO-ROMANIA investigates the spatial distribution of some climatic parameters significant for the national hydropower potential.

4. **Geological variety of the "Upper Paleozoic" in Romania and connection with the global climate change (PALEOCLIM);** investigations of the physical mechanisms responsible for climate and paleoclimate processes, highlighting the actual context of climate change.

Recently finished national projects

1. **Study on construction of national scenarios on future climate change in Romania (2008);** the results obtained refer to the estimation of observed changes in the climate regime in Romania, understanding of associated large-scale mechanisms and construction of scenarios related to a projection over the period 2001-2030 against 1961-1990.

2. **Using the LIDAR and remote sensing techniques for impact studies on relationships between atmospheric aerosols and regional climate variability**; monitoring of air mass trajectories for studying the meteorological conditions associated with aerosol loading in the troposphere. The aerosol parameterizations in the regional climatic model RegCM have been implemented in order to asses the direct and indirect effect of aerosol and its seasonal variability.

3. **Health-environment trans-disciplinary study of re-emerging West-Nile virus in the climate change conditions in Romania in order to setup appropriate strategies for monitoring and mitigation of such infections**; the METEO-ROMANIA research results mainly refer to the meteorological characteristics prior to and during the West Nile pests recorded in Romanian Plain, Danube Delta and Banat Plain. Also, the climatic conditions conducive to infections with the West Nile virus in different ecosystems in Romania were investigated.

4. **Climate change impact on the Holocene and present environment dynamics in the Romanian Carpathians** (MEDALP); aiming at observing and modeling of:
   - Spatial and temporal variability of the temperature and precipitation amounts in the Romanian Carpathians;
   - Investigations of the thermal vertical lapse based on satellite images;
   - Precipitation adjustment study based on geographic factors.

5. **Defining, assessment and zoning the forest risks in Romania (CLIDOIN)** (2006-2008);
   METEO-ROMANIA contributed to:
   - Assessing climatic indices significant for forest risks in Romania;
   - Geographically distributing the climate factors influencing the forest risks.

6. **Pledging the comfort and the energetic efficiency in buildings by using renewable sources (CEER),** (2006-2008)
   The output was the reference meteorological year for all the district capitals of Romania.

International collaborations

A. European FP6/FP7 projects

1. **ENSEMBLES (ENSEMBLE-based Prediction of Climate Changes and their Impacts (**2004-2009), FP6 project, coordinated by the Hadley Centre (UK); Main project objective: developing an ensemble prediction system based on the principal state-of-the-art, high resolution, global and regional Earth System models developed in Europe, to produce for the first time, an objective probabilistic estimate of uncertainty in the future climate at the seasonal to decadal and longer timescales. METEO-ROMANIA contribution refers to the developing of a conditional stochastic model for generation of daily precipitation time series used then for construction of probabilistic scenarios for various precipitation indices, including extreme precipitation events, at some stations in southern Romania.

2. **CECILIA - Climate Change Impacts in Central and Eastern Europe (2006-2009), FP6 project.** The main objective of the project is the assessment of impact and vulnerability to climate change at regional and local scales in central and Eastern Europe based on observations and high resolution (10 km) simulations for the periods 1961-2000, 2021-2050 and 2071-2100. The contributions of the Romanian team consist in numerical integration of a regional climatic model at 10 km over a domain centered over Romania, using the statistical downscaling modelling for the assessment of climate change on hydrologic cycle, water management in pilot areas, the Black Sea costal areas and the crop production. The extreme events (heavy precipitation, heatwaves, and droughts) in Romania based both on observations and high resolution simulations are also investigated.

3. ***DYNAMITE,*** FP6 project (2005-2008). Main objective: understanding the dynamics of the coupled climate system focusing on ENSO and NAO. Our institution tasks in the project were to substantiate the mechanisms involved in the linkage between NAO and the snow cover over Eurasia.

4. ***IPY-CARE (International Polar Year - Climate of the Arctic and its Role for Europe),*** FP6 project (2005-2007). The overall objective of IPY-CARE is to prepare a Pan-European science and implementation plan for the Arctic climate change and ecosystems research programme. The Romanian team participated at the elaboration of a Pan-European science

plan for the Arctic climate change and ecosystems research programme as contribution to the International Polar Year.

5. ***METAFOR (***2008-2011), FP7 project. The main objective of METAFOR is to develop a Common Information Model (CIM) to describe climate data and the models that produce it in a standard way, and to ensure the wide adoption of the CIM. METAFOR will address the fragmentation and gaps in availability of metadata (data describing) as well as duplication of information collection and problems of identifying, accessing or using climate data that are currently found in existing repositories. Our institution will test the CIM related products. Period: 2008-2011.

6. **The Integrated Remote Monitoring Techniques for Urban Heat Island (IRMOTUHI).** This project uses surface temperatures obtained from aircraft remote sensing in order to validate the land-surface temperature products retrieved by Moderate Resolution Imaging Spectroradiometer data (MODIS). Finally, IRMOTUHI aims at evaluating the UHI characteristics (Romania) in terms of its extension and magnitude. one flight campaign was performed over Rome (2007) and two over Naples, Italy (2007 and 2008). Period 2007-2008.

7. ***Action 725 - "Establishing an European Phenological Data Platform for Climatological Applications",* (2004-2009)**. The main objective of the Action is to establish a European reference data set of phenological observations, that can be used for climatological purposes, especially climate monitoring, and detection of changes. Secondary objectives address the harmonization of techniques for
   - defining the species and phases;
   - developing recommendations for monitoring and collection procedures (methodologies, sampling density and frequency, etc.);
   - selection criteria of data for further consideration;
   - quality control of observations;
   - commonly used formats of archiving and distribution of data;
   - mapping techniques of phenological information and other application methods;
   - increasing the knowledge on relations between climate and phenological phases.

8. ***Action 734 – "Impacts of CLImate change and Variability on European AGRIculture - CLIVAGRI"* (2006-2010***)***. The main objective of the Action is the evaluation of possible impacts from climate change and variability on agriculture and the assessment of critical thresholds for various European areas. Particular attention will be devoted to the quality of production, which represents the main goal of European agricultural policy, but also to the eco-environmental impacts. The results will be made readily available in order to significantly enhance the awareness in the agricultural sector of the current hazard level and the future perspectives related to the next few decades. The process of analyzing the impacts of climate change and variability on agriculture will address the following issues:
   - Determination of the possible change and variability of climate patterns in European regions with related uncertainties;
   - Collection and review of agro-climatic indices and simulation models used to assess the impacts of climate and hazards on agriculture processes;
   - Establishment of analysis methods (definition of frequency, intensity, trend, etc.);
   - Assessment of required resolution (spatial and temporal) for practical agro-climatological applications;
   - Analysis of trends of agro-climatic indices and simulation model outputs based on the application of past, present and future climatic conditions;
   - Evaluation of the impacts on agriculture;

- Addressing the specific needs of decision makers, extension services, farmers and the other end-users to define the hazard impacts on agriculture, by defining recommendations, suggestions and also early-warning systems.

9. **CC-Waters (Climate change impact on water supply) (2009-2012)-**under the Transnational Program in South East Europe (SEE): the contribution of National Meteorological Administration refers to construction of climate change scenarios for the Oltenia Plain and Banat Plain.

B. Bilateral collaborations

1. **Bilateral project Romania-Italy: Changes in the characteristics of extreme climate events in southern and southeastern Europe,** (2006-2008)
   Project objective: exchange of experience for developing of methods regarding the analysis of extreme events and statistical downscaling models. A cluster method applied for extreme precipitation events in Romania and statistical downscaling models applied for mean maximum temperature over northern Italy were developed.

2. **Bilateral project Romania-Bulgaria: Observed changes in precipitation regime in the Danube river lower basin in the context of climate change** (2008-2009)
   The main objective of the project is to complete the current research and knowledge about precipitation variability and change in the Danube river lower basin focusing on climate extremes in the context of global climate change. Emphasis is put on the understanding of the role of natural mechanisms and the anthropogenic influences on variability and changes in extreme precipitation both in Romania and Bulgaria along the Danube river.

3. **COST Actions**
   COST 733 «Harmonization and Applications of Weather Types Classifications for European Regions»
   COST 730 «Towards a universal thermal climate index UTCI for assessing the thermal environment of the human being»
   COST ES0601 "Advances in homogenization methods of climate series: an integrated approach (HOME)".

C. Other activities

- Evaluators for FP6 and INTAS projects (Aristita Busuioc, Constanta Boroneant);
- Associated Programme of the "Abdus Salam International Center for Theoretical Physics", Trieste, Italy;
- 2 Associated Seniors (Aristita Busuioc, Constanta Boroneant);
- 1 Associated Regular (Roxana Bojariu).

D. Publications

International peer-reviewed publications:
Books:
Balteanu, D.,Busuioc, A. Huba, M., Pomázi, I.,Sandulescu, M.,Witkowski, Z., Abrudan, J., Balint, G., Barka, I., Beták, Juraj - Bojariu, R.,Borcos, Mircea,Boroneant, C., Brožová, J., Cheval, S., Czernobaj,Y., Dumitrascu, M.,Enciu, P.Gardashuk,T., Geciu, A. et al., 2007,:*Carpathian Environment Outlook***,** Geneva: United Nations Environment Programme, 2007. - 236 s. ISBN 978-92-807-2870-5

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VIII.C. SYSTEMATIC OBSERVATION

The main organization performing systematic observations on climate (and climate change) is the National Meteorological Administration (NMA); the observations are performed through the National Meteorological Network (structure within the NMA) designed for carrying out

measurements and observations, primary validations and data transfer. It is managed by 7 Regional Meteorological Centers and by 2006 comprised 160 operational weather stations, 89 of them being automatic weather stations (MAWS). Measurements and observations at 281 rain-gauging stations are made on a voluntary basis. From the 160 weather stations, 120 are full-time operational and 40 are part-time operational. 55 weather stations perform a special agro-meteorological measurements program and radiometric measurements are performed at 8 stations.

The programme of meteorological upper-air measurements is carried out at the Aerologic Observatory of Bucharest, including two daily radio soundings (at 00^{00} and 12^{00} UTC) and at the aero-synoptic station in Cluj, including one daily radio sounding (at 00^{00} UTC). Daily wind soundings with PILOT balloon at 06^{00} UTC are also carried out at these two stations.

NMA participates in the international meteorological data exchange with a number of 23 stations in RBSN (Regional Basic Synoptic Network) and 14 stations in RBCN (Regional Basic Climatological Network).

In year 2003 it was established the operational National Meteorological Integrated System (SIMIN). Within this project the national radar network was finalized and modernized. In 2003 the national meteorological radar network became operational, exclusively composed of 7 modern Doppler equipments. The national radar network is one of the newest in Europe and it integrates three types of equipment produced by several companies (EEC, Gematronic and Metstar-Lockheed Martin). The radar information from all equipment is combined into a unique product – the national radar mosaic (available in 3 versions every 10 minutes). Given that most systems are placed very close to the Romanian borders, the radar information is also useful to the neighboring countries.

Observations from meteorological satellites refer to receiving and primarily processing in real time digital images and data from geostationary satellites METEOSAT-7 and MASG-1 in 3, and 12 spectral channels, respectively. The operative running of EUMETSAT/SAFNWC model started in February 2005, obtaining 8 of the 12 now-casting products, every 15 minutes, which are transmitted to the National Forecasting Centre.

Data on the electrical activity in the atmosphere are provided by the national detection network SAFIR-3000 at 7 sites, which are also used in now-casting.

IX. EDUCATION, TRAINING AND PUBLIC AWARENESS

IX.A. EDUCATION

Education is vital for the development of the society, as it can assure the assimilation of vital abilities by the future generations. In this context, climate change knowledge has a fundamental role to play in the learning process on the long run of reaching sustainable development.

In Romania, the central authority responsible for education is the ***Ministry of Education, Research, and Innovation.***

Climate change is increasingly present into the curricular activities in the high school. i.e. the IX class, Geography book contains elements like: weather and climate, evolution of climate indicators, Earth and Romania's climate, the global trends of climate evolution and, in addition, two articles on '*The role of ecosystems in the global climate change' and 'The climate change at a global scale and their causes'*. Other subjects treated are:

- Present changes of the terrestrial environment
- Natural and anthropic hazardous
- Afforestation, desertification and pollution
- Scenarios of the environmental evolution
- The environmental management

The Ministry of Education, Research and Innovation approved a schedule of the education activities, like contests, seminars and conferences that are related to the climate change subject (further information on the web site: www.edu.ro).

There are also many optional areas provided by the educational curricula that are targeting climate change subjects. We can mention in this context the one called '**Climate and pollution',** introduced in the National Economic College, Craiova. The main areas of studying are: *the present tendencies in climate changes, global warming, the potential impact of climate change, the identification and correlation of the agents that are influencing the ecological equilibrium and are determining the climate changes.*

Universities have started addressing the need for preparing specialists in the field of or related to climate change:

The "Ecological University of Bucharest" (EUB) has included in its Master of 2 years studying the climate change area, entitled: *Managing climate impacts* "on the Order of the the Ministry of Education, Research, and Innovation no. 4.666/01.09.2009. the main aspects are referring to supporting current theoretical climate evolution, correlation between its current trend of increasing global warming and intensify of the global meteorological phenomena with ecological risk and managing the economic and social effects of global climate change.

The university has also introductory courses for "Promotion of the theory of climate change and the management of their effects in other faculties of EUB: Economic Sciences, Law, Managerial Engineering, and Communication Sciences". The main thematical areas are subject to: theory of climate change and sustainable development, management of economic and social effects of climate change.

The Bucharest Academy of Economic Studies, The Faculty of Agrofood, and Environmental Economics has included in its curricula ecological subjects that are related to climate change.
The faculty offers guideliness for the diploma on the following topics: hazardous waste management, climate change affects natural capital, assessment of economic and environmental performance at the microeconomic level and runs scientific session for students in the following areas: environmental economics, environmental management, and environmental policies. The didactical activity is also dedicated to master or doctoral studies on ecology.

The faculty organized international conferences: "The environmental performance in a competitive economy" (2008, 2009) that has topics related also with climate change and the Scientific Session "the Economic and environmental dimension - a requirement for development in the IIIrd millennium ".

Furthermore, the faculty developed a project called „*Economic opportunities created for increasing the environmental performances on the oil market",* project code *nr. 2/08.01.2008.* In this project there were foreseen actions related to the convergences between the oil industry and the climate changes. Additional information about the activities of the university can be obtained on the web site: http://www.eam.ase.ro/

'Titu Maiorescu University' from Bucharest has included in its study plan disciplines from the I st cycle - graduation diploma and the II nd cycle - master the following topics: "The environmental law" and "The environment and the environmental protection", "The competition, competitively, innovation". Additional information about the activities of the university can be obtained on the web site: http://www.utm.ro/

IX.B. TRAINING

The subject of climate change was also subject of numerous seminars, workshops, conferences, fairs, projects. We have selected in this regard some actions developed by different institutions:

"Ecological University of Bucharest": "Opinions for and against the theory of global change", where the main topics were: supporting the current theoretical climate evolution, correlation between its current trend of global warming increasing and the meteorological phenomena with ecological risk, managing the economic and social global climate change.

"Politehnica University", The Faculty of the Biotechnical Systems Engineering had fruitful actions in interlinked areas related with sustainable development, energy and climate change.

- ***Climate change topics***: "The multidisciplinary character of the environmental engineering", „CIEM 2007"- The international conference on energy and environmental, „CIEM 2009"- The international conference on energy and environmental.
- ***Energy topics***: HERVEX 2007, section „Alternavite energies", HERVEX 2008, section „Alternavite energies", HERVEX 2009, section „Alternavite energies"
- ***Related subjects***: the energy independence for small installations based on renewable energy for agriculture, mountain areas and isolated power, use of energy crop corn for heat production and others, production of electricity through biomass gasification- 30 KW experimental instalation.

Additional information about the activities of the "POLITEHNICA UNIVERSITY can be obtained on the web site: http://www.upb.ro/; http://www.isb.pub.ro/

Institute of Education Sciences is involved, particularly in policy development and public education strategies, European and international projects, research projects, training projects, and dissemination projects. As it is concerning the environmental education, the institute is targeting the following areas: the environmental stimulus in the process of development, environmental quality, conservation, protection and improvement for development; education for the regeneration of the natural environment, education for recycling and reuse of materials.

The main actions related to environmental are:

- **"**L'école des traditions apprends des communautés locales manufacturières" trans border seminar organized by the Ialomita County School Inspectorate;
- The Guide: School in the IIIrd Millennium, Information and Education Council; course supports: Youth Project Management, Information and Education Council and Conflict management in the class of students;
- Guidance Innovation Relay Centres (GIRC);
- International forum seminar, Oradea, "*Distant world, closer life-Intercultural learning in local communities";*
- *The Ministry of Education, Research, and Innovation's National Report* on the implementation of the training sessions for trainers curriculum area advice and guidance at the national level;
- The non formal study/informal in relationship with the changes from the curricula, the reference framework for non-formal education/informal, methodological e-media and methodological guides.

The main partners of the institute are: the European Commission, the Council of Europe, UNESCO, the Ministry of SME and Environment Business, the Ministry of Foreign Affairs, the Ministry of Labor, Family and Social Protection, the Ministry of Education, Research and Innovation, the Ministry of Regional Development and Housing, the Ministry of Environment and Forests, the Ministry of Culture, Religious Affairs and National Heritage, the network of school inspectorates, the case of teachers, the public schools, Romanian Academy, network of universities and research institutes, TVR and other broadcasters, the national broadcasting and other radio stations, international and national magazines, publishing houses and journals etc.

The Institute of Education Sciences identifies as a priority the beginning of a national campaign on the theam: „*An integrated societal education program for sustainable development and climate changes*" (on-line, media and direct communication)

The activities of the **Romanian Association of Municipalities (AMR)** on climate change reflects the association's concern to find means to combat climate change and reduce carbon emissions at local level. That is why the association runs specific activities like:

- Seminar on „Actions of the public bodies for reducing the effects of climate change and the adaptation to them", held in Bucharest on 22-23 October 2008, with the support of the European Commission TAIEX Office. http://schimbariclimatice.amr.ro/seminar-2008/)
- Seminar on "Cities of the Future – towards local economy with low carbon" organized by AMR on October 14, 2009 in Brasov, with the support of the European Commission TAIEX Office, in partnership with Brasov City Hall and the Council of European Municipalities and Regions (CEMR). (http://www.eumayors.eu/articles/show_en.htm?id=65)
- The Association implemented during March 2009 - March 2010 with the TERRA Mileniul III NGO, the project called „ Romania's cities against climate change: before and after Copenhagen 2009", aimed at combating climate change and protecting the local environment. The project is funded through the financial mechanism of the European Economic Area (EEA), Fund for NGOs.

- The Association takes part in the initiative for reducing climate change called „The pact of Mayors" that was started by the European Commission. (www.eumayors.eu; http://www.managenergy.net)

The Romanian Association of Water (ARA) carry on specific actions that fold on water activity. We can mention the following:

- Quarterly meetings of the Committee Quality-Environmental where the topics of the presentations and discussions on environmental quality addressed also to climate change (hence: Challenges carbon footprint in the water)
- Open door days
- International day of the water quality monitoring

The Non- Governmental Organisation TRANSIRA carry on specific actions on transportation hence: participation in seminars / conferences for promoting green public systems of transportation, press releases for promoting electric transport, introduction, expansion or modernization of environmental transport trolleys or trams

The HOBBY CLUB JULES VERNE carry on measurements of radioactivity, microclimate parameters (thermal inversion), surface water pollution and genetic mutations in vegetable (2007 and 2008). The main activities were in the mining area of Grădiştea Muncelului – Cioclovina and Luncanii de Sus, and also in the areas of Nadrag and Avram Iancu.

Since its set-up, in 2007, the **Climate Action Network Romania** developed a number of interesting projects aiming at capacity building, policy influencing, increasing the education level and the public awareness (specific target groups and/or general):

1. The Climate is in our hands

The project was implemented during 3 years (2006-2009) and was meant to continue the activities of the Project "Green School - an investment in our children`s future".

Objectives:

1. Capacity building of the network;
2. Increasing the pupils' degree of education regarding climate change;
3. Influencing the environmental policies and the cross-cutting policies at a national level in order to mitigate climate change.

Target groups:

- NGO members of the network;
- Educational actors: teachers, pupils, representatives of School Inspectorates;
- Decision-makers at the central and local levels;
- Media representatives.

Activities:

- the elaboration of support materials ("Teacher's guide" focused on climate change - related issues in the energy, waste, transport and agriculture sectors, an applications kit, leaflets etc.);
- organizing training sessions with local project coordinators in nine counties of Romania and in Bucharest.
- The network website including a public virtual library and materials published by members of the network;
- training sessions with partners involved in the project;

- workshops on climate change issues with the teachers involved in the project.

Results:
- educational activities on climate change issues implemented in 106 schools all over Romania, with 2300 pupils (aged 10 to 18 years old) and 120 teachers involved;
- a complex and useful material meant to promote climate change education in schools (Environmental education in the context of climate change - The Teachers` Guide), supported by an application guide (Environmental education in the context of climate change - The Application Manual) and a Practical Toolkit, made to support mainly the energy chapter in the Manual;
- raising awareness on the project activities throughout a good media coverage and the updated website of the campaign;
- a representative number of teachers trained on climate change issues;
- increased capacity of the 10 network members to implement educational activities;
- improved communication and promotion tools of the network.

Implementation period: October 2006 - June 2009
Project coordinator: The Ecumenical Association of Churches in Romania (AIDRom)
Partners: Terra Mileniul III Foundation; ALMA-RO Association; Amoeba Eco Center; Pro Conventia Carpatica Association; "Floarea Reginei" Association; ONG Mare Nostrum; "Prietenii Pamantului" Association; "Rhododendron" Environmental Association; "Sighisoara Durabila" Association; TERRA Mileniul III Foundation.
Project supported by: Climate Action Network - Romania (CAN-RO) – the project partners are all members of CAN Romania
Project funded by: Kerk In Actie Foundation (the Netherlands) through AIDRom.

2. Young Ambassadors against Climate Change

Objectives:
The project aims to promote awareness of and action by youth groups (schools) about climate change, the key role of energy efficiency and the need to use renewable sources of energy. Thus it encourages partnerships with schools, inspectorates, key Romanian Ministries, relevant NGOs and the media.

Target groups:
- Secondary school teachers and pupils in 10 Romanian towns;
- Local and national mass media.

Activities:
- Training for at least ten teachers on climate change and communication methods in 10 Romanian towns - Bucuresti, Calarasi, Moreni, Constanta, Galati, Gheorgheni, Tg. Mures, Sinaia, Dej, Sighisoara;
- Publication of the Teacher's Guide to Climate Change and the Practical Applications' Manual on Climate Change (available in Romanian on the network's webpage).
- Education activities and a Toolkit designed and implemented by Climate Action Network - Romania. These contributed to educating pupils on climate change (on topics such as energy, transportation, waste, agriculture and forests) and attracted pupils through innovative methods;
- Organizing workshops on climate change delivered by the trained teachers;
- On January 15th a national awareness campaigns` competition for pupils was launched;
- Designing a webpage displaying the winning awareness campaigns and the other educational materials of the project (http://rac-ro.ngo.ro/concurs);

- Media events (media coverage of the project launch, the contest's awards events and the educational trip).

Results:
- 17 teachers trained during the project in 10 Romanian towns;
- 80 workshops delivered by the trained teachers based on the Teacher's Guide and Application Manual;
- Following the national competition for awareness campaigns held during Spring 2008, the jury formed by representatives of the British Embassy in Romania, British Council, Ministries of Education and of Environment, and the member NGOs selected 4 winning Young Ambassadors (one from each group of class). The 4 Ambassadors have been awarded a 1-week educational trip to the Carpathians;
- Raising awareness on climate change issues throughout a good media coverage on the project activities - from the launching event to the award ceremony;
- The competition webpage - www.rac-ro.ngo.ro/concurs, hosted by NGOs implementing the project. The website had The Teacher`s Guide available for download as well as the two winning advocacy campaigns.

Implementation period: October 2007 - April 2008
Project coordinator: TERRA Mileniul III Foundation, Bucharest
Partner: ALMA-RO Association, Bucharest
Project supported by: Climate Action Network - Romania (CAN-RO)
Media partner: Jurnalul National

3. Young Ambassadors against Climate Change – message for Copenhagen

The 2009 edition of the contest was also implemented by the two organizations, TERRA Mileniul III Foundation and ALMA-RO Association as a partner, being financed by the Danish Embassy.

The aim of the project was to raise public awareness in Romania regarding this year's UNFCCC COP 15 that will take place in Copenhagen, Denmark. Our target group was represented by the secondary-school pupils who created campaign instruments that tackled climate change in a competition at national level. The pupils had to design campaign instruments for the communities they live in, thus raising awareness regarding climate change and the stake of the COP 15 at local level.

The organizers received 233 applications for the contest, varying from presentations to videos, drawings, games, clothing, poems and different objects – all used to send pupils' messages to the communities they live in. The jury was composed of 9 people representing the Danish Embassy, the organizing NGOs, the Ministry of Education and the Ministry of Environment and Forests, Didactica Publishing House, the British Embassy and Green Report. Besides the four ambassadors that won the contest, 6 additional special prizes were offered to children that excelled in originality or had innovative campaign materials. One 14-year old girl received the special prize of the public, as she received over 2350 votes for her work from the readers of the online edition of Jurnalul National newspaper (her movie was viewed over 33 000 times).

Both the launch event of the contest and the award ceremony were hosted by the Danish Ambassador in Romania and gathered children, teachers, representatives of central public authorities and the media.

Implementation period: January 2009 - June 2009

Project coordinator: TERRA Mileniul III Foundation
Partners: ALMA-RO Association
Project supported by: Climate Action Network - Romania (CAN-RO), Didactica Publishing House
Media partner: Green Report, Jurnalul National

4. Increasing the capacity of Climate Action Network Romania

The general **objective** of this project is to consolidate the role and the actions developed by the national network against the effects of climate change - Climate Action Network Romania (CAN-RO).

Specific objectives:

1. Increasing the Climate Action Network (CAN) organizational capacity;
2. Training the network members as to gain the ability to be part of the elaboration, implementation and monitoring of public policies in the field of climate change and education (national and international level);
3. Raising the network`s participation level in other European organizations in the climate change sector.

Target groups:

- Climate Action Network Romania and the member NGOs;
- Central public administration representatives (Ministry of the Environment and Forestry, Ministry of Education, Ministry of Transport, Ministry of Agriculture and Ministry of Economy);
- Pupils and teachers form all over Romania (approximately 1500 children and teachers every year).

One important activity of the project was the International Conference on Climate Change held in Bucharest (10-11 September 2009). Over 100 participants took part at the event, representing national public authorities, three embassies (United Kindgom, Denmark, Sweden) local authorities, members of the National and European Parliament, NGOs, companies, international organization and the national media. Five foreign guests were invited to participate with speaches and presentations on climate change-related topics. The event included working groups dealing with sectoral approaches of climate change, starting from our position papers and proposed recommendations to improve the reduction of GHG emissions in Romania. The event also included a press conference, where 17 journalists participated.

Results:

- Elaboration of promotional materials of the network (website, banners, leaflets, annual report etc.);
- 2 general assemblies of the network;
- 1 training session on „Public policies on Climate Change issues" for the network members;
- CAN-RO membership to CAN Europe;
- Study visit with 5 participants to Brussels (including 7 official meetings with European organizations);
- 6 position papers sent to 132 national relevant institutions (Governement, National Agencies, research institutes, companies, NGOs and the media);
- 17 participants in the national round table on Education on Sustainable Development;
- 80 participants in the international conference on Climate Change;
- Local and national media coverage (8 press releases, 25 articles in the local and national media, 1 press conference)

Implementation period: December 2008 - October 2009
Project coordinator: ALMA-RO Association
Partner: TERRA Mileniul III Foundation and The Ecumenical Association of Churches in Romania (AIDRom)

5. "Move4Nature" Initiative

The "Move4Nature" Initiative came in support of the overall **UNEP** Long-term strategy on engagement and involvement of young people in environmental issues.

The "Move4Nature" Initiative aimed at:

- mainstreaming environmental education into schools curriculum in the Carpathian and Caucasus regions through transnational cooperation:
- Pilot project in the Carpathians is being developed in Romania,
- developing tools/educational materials which will be distributed in schools,
- establishing environmental awareness and encourage and facilitate cooperation and communication between schools in the region (Carpathian region).

Outputs:

- an Internet platform to facilitate communication,
- an informative and interactive training tour in 5 areas of Romania,
- a Carpathian and a Caucasus Education for Sustainable Development (ESD) toolkit.
- X teachers and students involved in educational activities based on the toolkit

Outcomes of the project:

- a strategy for an interactive Carpathian ESD program, better communication and coordination among the Carpathian countries on ESD,
- schools equipped with eco-educational materials and teachers trained in using them,
- better awareness of the mobility-related environmental issues,
- better awareness in the countries about the Carpathian environmental/mountain issues.

Implementation period: June 2007 - August 2009
Project coordinator: United Nations Environment Programme, Vienna
Partners: Carpathian Framework Convention, Mountain Partnership, ENSI, CASALEN, the Romanian Ministry of Education, Research and Innovation, HERO Association,
Supporters: Romanian Carpathian Society, Ecouri Verzi Association, Kogayon Association, ROMONTANA Association, CAN Romania, Amoeba Eco Center Association, Earthfriends Association, Romsilva, Carpathian Network of Protected Areas, the Northern Alliance for Sustainability, Global Resource Information Database, EURAC – European Academy of Bolzano.

6. Romanian small communities, schools and NGOs, promote climate friendly solutions

The project is the initiative of **Prietenii Pamantului – PP (Earth Friends) Association** (RO), **Norge Naturvernforbund – NCSN (National Society for Nature Conservation)** (NO), and **Reteaua de Actiune pentru Clima - RAC-RO (Climate Action Network Romania)** (RO).

The project is implemented in 6 different counties in Romania in cooperation with the Norwegian partner, during the next two years. The project continues and develops activities of the partners aimed to mitigate climate change and will contribute to the Romanian NGOs capacity building to address local energy issues in cooperation with local authorities and the public, particularly in rural areas and small communities. Pilot activities in a poor mountain area will demonstrate practical solutions and a new concept of participative decision-making to improve the energy planning and management will be replicated in other locations in Romania.

The general **objective** is increasing Romanian capacity to contribute to the mitigation of climate change through education and capacity building in the field of energy efficiency and renewable energy use.

The project **aims** to increase the Romanian NGOs' capacity through cooperation with Norwegian NGOs to initiate and support participatory initiatives in 6 Romanian villages and small towns from 6 different counties and to promote educational activities to increase energy efficiency and the use of renewable energy in public buildings and private homes.

The **main expected results** of the project are:

- A model of local energy planning committee and project management and the Rural Sustainable Development Centre in Brusturoasa, Bacau county, equiped and able to run training and practical demonstrative activities on bio-and solar energy for villagers, schools and local authorities;
- Local Energy Planning Committees and 3 pilot projects developed in other 3 locations in Romania;
- Development of educational manuals and teacher training sessions to assist schools in implemeting extracurricular activities and awareness activities on participatory processes and climate change issues. 10 pilot schools have been set up and at least 30 schools will become invoved by the end of the program;
- 10 NGOs increase their abilities to offer relevant contribution to local action plans and mitigating climate change policies.

Implementation period: June 2009 - April 2011
Project coordinator: Earthfriends Association
Partner: Climate Action Network Romania, National Society for Nature Conservation Norway

7. The World Wants a Real Deal!

On the 12th of December people from 18 communities in Romania took action on climate change. The one-hour candlelight vigils were meant to send a clear and strong message to the decision makers and the negociators taking part in the COP15 meeting in Copenhagen. As a response to the call made by AVAAZ.org, representatives of the NGO Coalition for Environment in Romania and supporters lit candles in Bucureşti, Miercurea Ciuc, Târgu Mureş, Braşov, Cluj Napoca, Bacău, Timişoara, Brăila, Arad, Paşcani, Oradea, Răşinari, Turda, Măureni, Iaşi, Odorheiul Secuiesc, Câmpina and Reşiţa. The event took place simultaneously with over 3000 of other similar events around the world.

8. Communication at the COP15 in Copenhagen

A representative of CAN Romania participated at the Conference of Parties under the UNFCCC and acted as a correspondent for the national media, environmental NGOs and citizens regarding the proceedings of the conference, the Eropean position and the outcomes of the negotiations. 5

press releases were sent to the national media during 8 days and live interviews were offered during this time to radios and TV channels.

Working closely with the Climate Action Network Romania, Terra Mileniul III Foundation is the most experienced and one of the very few NGOs acting in the climate change field in Romania. During 2006 and of 2007, they were involved in a number of projects aiming at the capacity building and increasing awareness regarding the use of renewable energy and the climate change:

a) Energy Resources for the Future

Period: October 2006 – September 2007
Promoting the electricity and thermal energy production from renewable energy sources (RES) in Romania has a very important role in environmental protection, in lowering dependency on oil and natural gas imports by diversifying energy supply, in the reduction of GHG emissions and consequently, climate change mitigation, the use of local energy sources and development of new business opportunities.

Romania was one of the first EU candidate countries to implement the provisions of Directive 2001/77/CE regarding the promotion of electricity production from RES. The national legislation establishes that the share of electricity produced from RES in the gross national electricity consumption should reach 33% by 2010. A framework promoting the use of RES has thus been established, a system of mandatory quotas combined with a green certificates scheme.

The „Energy Resources for the Future" project aimed to promote renewable energy sources. The project was implemented in partnership with the Romanian Agency for Energy Conservation (ARCE), Bucharest, the Earth Friends Association, Galati, and the Romanian Association for Energy Efficiency (SOCER), Craiova.

The objectives of the project were:
1. to increase expertise within NGOs and public authorities regarding the implementation the acquis communautaire in the field of renewable energy sources and the impact on environment policies;
2. to increase public awareness on the benefits of using renewable energy resources;
3. to improve environmental and energy policies with the support of civil society.

The activities of the project were:
- Promoting successful cases regarding the use of RES (leaflets and case studies report);
- The elaboration of an action plan proposal regarding the use of RES, in order to fulfill Romania's commitment to the European Union;
- Organising a round table and training session for representatives of various stakeholder groups: local public administration, NGOs, central authorities and research institutes;
- Organising an information caravan on the use of RES in 13 cities: Bucuresti, Brasov, Cluj, Deva, Iasi, Oradea, Sibiu, Suceava, Targu Mures, Timisoara, Constanta, Craiova, Galati and Rosia Montana.

The project was meant to continue 2 earlier projects that TERRA Mileniul III developed:

Increasing capacity for the implementation of the acquis communautaire in the energy sector at a local level, a project that was implemented in 2003, highly appreciated by both NGOs and

governmental representatives, as the first guide for the implementation of the acquis communautaire in the energy sector, that local authorities needed, was produced in the project.

Development of the Involvement of the Non-Governmental Sector in the Adoption and Implementation of the Environmental „Acquis Communautaire" in the Field of Air Quality and Climate Change, which has developed in 2004, and led to the elaboration of a national strategy on climate change and a national action plan.

b) Sustainable public transport in Bucharest

Period: December 2008 – October 2009

The project aimed to promote sustainable transport in Bucharest, as a solution to greenhouse gas emissions' reduction, having as main target group the users of surface public transport in Bucharest, as well as local public authorities.

The project's specific objectives were:

1. raising the population and local public authorities' awareness about greenhouse gas emissions reduction though the use of public transport;
2. increasing the level of promotion of the "Bucharest Transport Master plan", in the sense of a better promotion of the public transport and encouraging the population to use it.

The main activities envisaged were:

- conducting a public opinion survey on a sample of 1100 public transport users in Bucharest;
- elaboration of a report containing recommendations to the current Bucharest's transport master plan;
- an advocacy campaign at the level of local public administration in Bucharest in order to promote the measures of improving the current transport master plan;
- modernizing one pilot bus line; elaboration of promotional instruments which will promote public transport;
- organizing a bike march on September 22nd – the European Car Free Day (over 800 participants);
- organizing a national round table with representatives of central and local administrations, transporters' trade unions and NGos
- organizing a 5 day training on environmental management (specializing in climate change and transport) for local public administration, NGO and transport trade unions' representatives;
- dissemination of information in the national and local media, and on the partner organization's websites.

Implementing this project has generated a precedent and a role model for improving the quality of urban public transport in Romania, through precise recommendations and success stories in applying sustainable local public transport policies for the administrative structures in Bucharest and other towns, direct beneficiaries of the project.

By taking part in an environmental management training session (specialized on climate change and transport), the representatives of the Transporters Trade Unions and local public authorities from at least 4 towns in Romania and national NGOs contributed to an increase in the best sustainable transport practices, and replication of these types of activities becomes highly possible.

In Bucharest the project had only set one main activity regarding specific measures for improving the public transport – modernizing one bus line, but in the future this can be extended, even to bus lines going to the city's outskirts.

Also, this project has created a model of genuine collaboration among national environmental NGOs and the representatives of Trade Unions at a national level, which eventually leads to a stronger civil society.

Target groups: public transport users and local public administration.
Partner: Transporters' Trade Union in Bucharest

c) Romanian Cities fighting Climate Change: before and after Copenhagen 2009

Period: March 2009-March 2010

The project goal is to combat climate change locally.

Objectives:

1. to increase the awareness level of the municipality authorities regarding climate change;
2. to increase the information level of the public authorities of Romania's municipalities regarding the necessity to act locally for mitigation of climate change;
3. to enhance partnerships between the non-governmental sector and the public local authorities in order to protect the environment through local actions of climate change mitigation.

Activities:

1. Informative materials (including success stories of other municipalities' projects on climate change mitigation and a Guide for GHG emissions reduction at local level).
2. Eight regional meetings with the representatives of local authorities, environmental agencies, other key factors from 8 municipalities (drafting the local strategies for greenhouse gas emissions' reduction).
3. Designing two GHG emission inventories for 2 towns (together with a representative of Ministry of Environment and Forests and an expert).
4. Two local sustainable development strategies (based on an analysis of the communities' problems, made by the Project Team together with a working group – representatives of the local authorities, NGOs, local/regional governmental agencies, syndicates, enterprises etc)
5. National Conference (including a presentation of the project results).
6. Information dissemination.

Target group: the local authorities from the 8 regions in Romania
Partner: The Association of Municipalities in Romania.