Chapter 1. Executive Summary

1. National Circumstances

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 (1075 km) and has exit to the Black Sea, being placed at a distance ranging between 1050 km and 2800 km against the continent extremities.

Relief

Romania's relief consists of three major levels: the highest one in the Carpathians (the highest peak Moldoveanu 2544 m), the middle one which corresponds to the Sub-Carpathians, to the hills and plateaus and the lowest one in plains, meadows and Danube Delta (the youngest relief unit under permanent formation with an average height of 0.52 m). 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.

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.

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.

Precipitation

Annual precipitation decreases in intensity from west to east, from 600 mm in the Romanian Plain to less than 400 mm in Dobrogea but can reach 1000-1400 mm in the mountain areas.

Population

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

Year	**2003**	**2004**
Population	21,742	21,685

Economy
The Romanian economy is a market economy, promoting freedom of trade, protection against unfair competition, stimulation of domestic and foreign investments and protection of private property. The transition at the beginning of 1990, from a centralized, state-controlled economy to an unguided free market economy, resulted in significant economic and social difficulties. During this transition to capitalism, Romania has displayed symptoms of considerable economic recession.

2. Inventories of Anthropogenic Greenhouse Gas Emissions and Sinks

This chapter presents Romania's National GHG Inventory based on the last submission (2006) of anthropogenic GHG emissions inventories to the UNFCCC Secretariat. The national GHG emissions estimates were calculated for the period 1989-2004 and this results are presented for all years from 1989 to 2004 including also trend analysis, data sources, key sources, uncertainties, and quality assurance and quality control (QA/QC) activities. Romania prepared the CFR Reporter database containing emission estimates for the period 1989-2004 and the National Inventory Report.

The last GHG emissions inventory for the period 1989 – 2004 was compiled according to the recommendations for GHG inventories set out in the UNFCCC Guidelines on Reporting and Review, (FCCC/CP/2002/8 and FCCC/SBSTA/2004/8), using the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines, 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 for LULUCF, 2003). The GHG emissions inventory has been reported since the 2005 submission by using the software programme CRF Reporter, delivered by the UNFCCC Secretariat.

The GHG inventory covers all sectors and the majority of the IPCC source categories. The GHGs emissions estimated in the national inventory are:

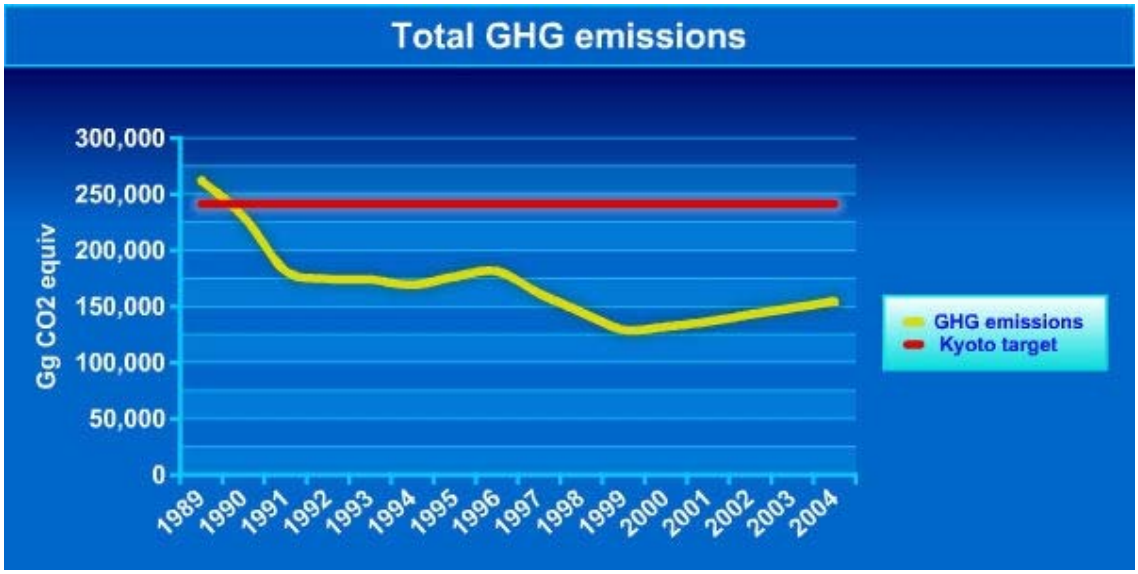
- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs);
- Sulphur hexafluoride (SF_6).

The chapter also contains estimation of precursors and indirect GHG emissions: NOx, NMVOC, CO and SO_2, which need to be included according to the reporting guidelines. The main remaining gap in the inventory is related to the disaggregated estimate of the international bunker fuels. Some minor IPCC source categories were not estimated, such as the emissions from asphalt roofing, from road paving with asphalt, and from histosols due to the lack of activity data.

MEWM, together with NEPA and ICIM are working together for improving the national system for the estimation of GHG emissions based on the provisions of the National Action Plan on Climate Change (NAPCC), adopted in December 2005 as the Governmental Decision no. 1877/2005. This will be done within the framework of the national system for integrated air quality assessment and management, set up by the Governmental Decision no. 586/2004. The system ensures the organizational, institutional and legal framework for cooperation between authorities and public institutions that have competences in atmosphere protection and air quality assessment and management in Romania.

The following three stages will be considered in the elaboration of the inventory: planning, preparation and management. In the first stage specific responsibilities will be 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.

Figure 1 The total GHG emissions in CO_2 equivalent in the period 1989-2004



3. Policies and Measures to Mitigate GHG Emissions

Since 22 June 1995, when Romania submitted formally the application for the accession to the European Union, the European integration has been representing the political objective of all the following Governments and political parties. In 2004 Romania completed the negotiation process followed by the signing of the Accession Treaty on 25 April 2005, establishing the official accession of Romania to the European Union on 1 January 2007.

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 current level of GHG emissions is far below the Kyoto Protocol's target taken by Romania. 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 any additional measures even in case of the less conservative one.

However, a substantive potential exists to further reduce the carbon intensity of the Romanian economy and to decouple and lower the GHG emissions growth trend from the GDP growth trend.

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

With this Strategy, Romania has taken its first steps towards a targeted and coordinated national effort to limit GHG emissions and to deal with the climate change impacts that are to be expected. The Strategy outlines 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 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.

Although the Kyoto Protocol's flexible mechanisms are "voluntary", Romania got involved successfully in the development of "Joint Implementation" projects based on the cooperation with different countries, for the reduction of greenhouse gas emissions, being at this moment the most attractive country on JI, according to the Point Carbon Agency. Romania has initiated and continues to develop bilateral cooperation with different states, for the development of this type of projects.

Romania signed 8 Memoranda of Understanding with different developed countries (Switzerland, the Netherlands, Norway, Denmark, Austria, Sweden and France), as well as with the World Bank's Prototype Carbon Fund, representing the legal framework for the development of JI projects and is negotiating other 5 similar agreements.

Until now, 15 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 8.8 million tones of CO_2 equivalent.

EU Emission Trading Scheme (EU ETS) is a Community wide "cap & trade" scheme for the GHG emissions established by Directive 2003/87/EC. The emission trading scheme is one of the key instruments for implementing EU commitments under the Kyoto Protocol (8% reduction in GHG emissions compared to 1990 levels) The first phase of this scheme commenced on January 1st 2005 and will end on 31st December 2007. The second phase will run from 2008 to 2012 as the first commitment period of the Kyoto Protocol

4. Projections and Assessment of Measures Effects to Mitigate GHG Emissions

This chapter was prepared by the Institute for Studies and Power Engineering (ISPE) based on a contract with the Ministry of Environment and Water Management for the

preparation of a research study on the GHG emissions projections related to the implementation of the EU Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community (EU ETS) that covered also the sectors not included in EU ETS.

Projections and assessment of measures effects to mitigate GHG emissions were prepared taking into consideration the strategic objective of reducing the economic discrepancy between Romania and the European Union member state countries, based on the upcoming accession to the EU on 1st January 2007.

The Romanian Government's policy after the year 2000 was mainly based on the need to sustain an accelerated growth of GDP.

The projected CO_2 emissions in 2020 will exceed the CO_2 emissions level estimated for the base year, 1989 considering only the "without measures" scenario. For the other two scenarios projections for the CO_2 emissions show that the difference in the year 2020 comparing with 1989 is 6% below in the "with measures" scenario and 11% below in the "with additional measures" scenario. Thus, the emissions reduction target taken by Romania under the Kyoto Protocol in the period 2008-2012 will be observed taking into account the CO_2 emissions level in 2010, which were projected to be around 70-80% of the base year level.

It should be also highlighted the important projected increase of the energy sector emissions after 2005 mostly due to the fossil fuels combustion and the use of domestic energy resources as lignite and hard coal.

It is worth mentioning the projected increase of CH_4 emissions from all sectors. The most important sources of CH_4 emissions remain oil and natural gas and agriculture sectors. The most important projected N_2O emissions source remains the agriculture sector.

It is obvious that the total GHG emissions level in 2020 for all scenarios will not exceed the aggregated emissions level in the Kyoto Protocol's base year 1989, 262,282 Gg CO_2 eq., Romania being able to meet its emissions reduction target under the Kyoto Protocol although all the scenarios show an increasing trend taking into consideration the Romanian Government's efforts regarding the economic growth and also the harmonization with the EU acquis communautaire in the social and economic fields.

5. Climate Change Impacts Vulnerability Assessment and Adaptation Measures

Climate variability and change, drought, flooding episodes and other extreme climatic events are able to induce significant effects on all economic sectors, but mostly on agriculture, which is the most dependent on the weather. Every physical, chemical and biological process that determine the growth and development of crops is regulated by specific climatic demands and any deviation from those demands can determine large variability as regards the yields and, implicitly major negative consequences on the nourishment security.

Romania is one of the most rural countries in Europe, with its rural area including 64% of the country's territory, more then 12.000 localities and over 48% of the total population. Agriculture is a major component of the Romanian economy representing almost 20% of its Gross Domestic Product.

The main crops cultivated are winter wheat and grain maize, followed by sunflower, potatoes, sugar-beat and soybeans. In Romania, the wheat crops represent 23% of the arable surface covered by the field crops, 36% of the cereals and 30% of the total cereal production. The maize crop puts Romania on the 9th place in the world as cultivated surface, the mean production/ha representing 59.6% of worldwide mean production (2004).

Figure 2 The annual mean air temperature trend in Romania over the period 1900-2000

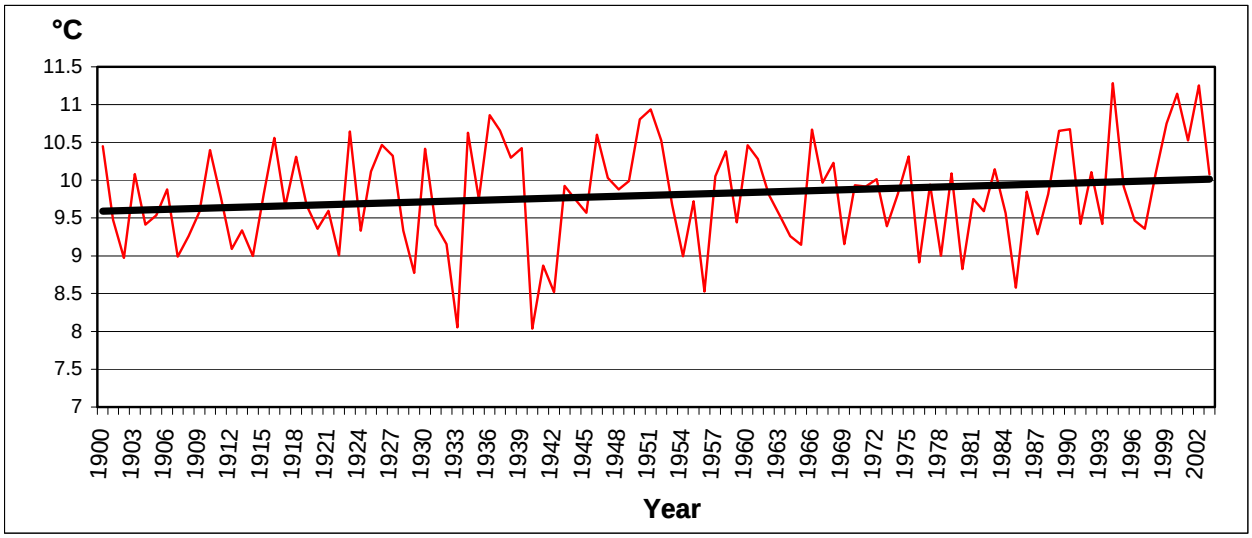
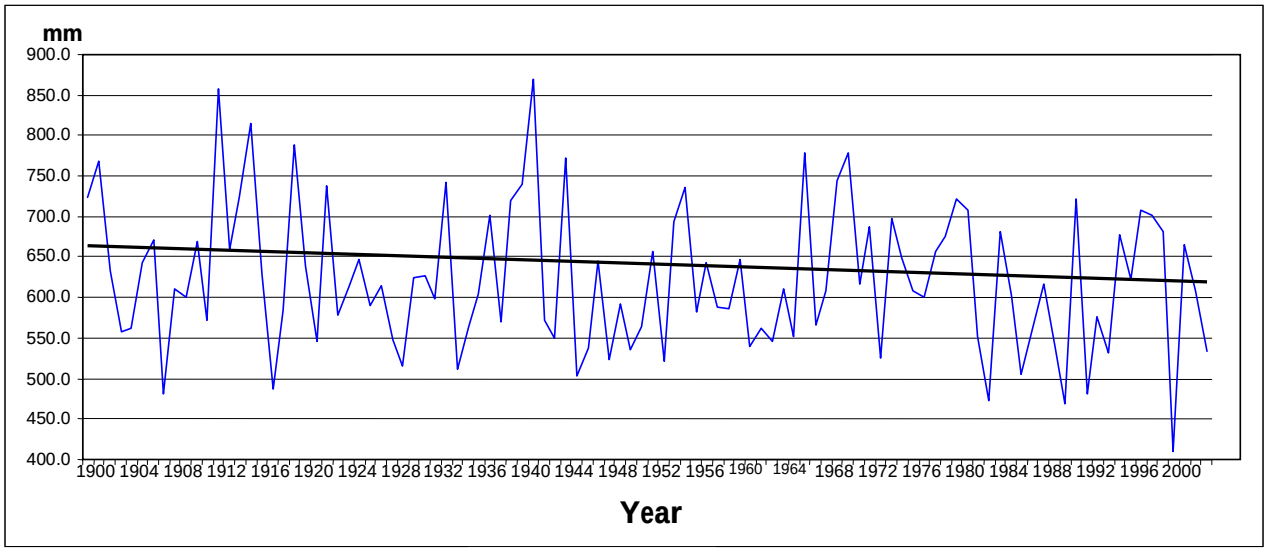


Figure 3 The annual precipitation amount trend in Romania over the period 1900-2000



Drought is one of the major natural processes affecting Romanian agriculture. 48% of the agricultural area (14,717.4 thousand ha) is affected by drought, the south-eastern and eastern parts of the country being the most affected areas. The drought phenomenon, although without a strict cyclical character, generally shows repeatability at 15-25 years intervals. Within such cycles are extremely dry years, but also short-term interruptions of about 1-3 years with rainfalls above the normal amounts.

In Romania, the year 2005 was by 0.1º C colder than the climatologically norm (1961-1990). The closeness to the normal values was due to the fact that throughout the year, the all-country thermal pattern was characterized by positive deviations ranging within 0.2 - 2.4º C in six of the year's months (January, May, July through September, December) and by values lower by 0.3 – 2.6º C in the other six months of the year: February through April, June, October, November.

At the country level, the mean precipitation amount in 2005 was 866.5 mm (against a climatologically norm of 647.0 mm). Precipitation amounts, in excess of the average in January through May, July through September and December and the scarce ones in June, October and November, shaped an annual precipitation pattern in excess of the average by 33.9% against the reference period. In August, following large precipitation amounts, the positive deviation against the normal was 124.2%.

6. Research and Systematic Observations

During the last period, the main research objective areas on climate change issue referred to:

- Identification of changes (trends and shifts) in the observed long term climatological time series and linkage with changes in the large-scale circulation; special attention was given to the frequency and intensity of extreme climate events (extreme precipitation and extreme temperature) and frequency of certain meteorological phenomena during the cold season (rime, snowstorm, hoarfrost and glazed frost);
- Development of statistical downscaling modeling in order to project global climate change scenarios on regional/local scale;
- Validation of the global/regional climate models in reproducing the regional features and large-scale mechanisms controlling the regional climate variability;
- Construction of climate change scenarios for the Romanian region by applying the statistical downscaling models to the changes in the large-scale parameters derived from global climate change scenarios achieved with various general circulation models (GCM);
- Comparison between statistical and dynamical downscaling results

The National Meteorological Network is a structure within the National Meteorological Administration (NMA) designed for carrying out measurements and observations, primary validations and data transfer. It is managed by 7 Regional Meteorological Centers and at the end of the year 2005 it was composed by 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.

7. Education Training and Public Awareness

In Romania the climate change related activities are under the responsibility of the Ministry of Environment and Water Management which has undertaken a series of activities regarding education, training and public awareness in the last years in close co-operation with foreign partners like the Netherlands, Denmark and Switzerland and also with some NGOs. Some of the activities developed in this regard were related to distributing the Third National Communication to the UNFCCC, preparing the National GHG Inventory in the specified format (CRF and NIR), re-organizing the National Commission on Climate Change, publishing media articles on climate change issues, and

raising awareness through the ministry web page. Awareness of the causes and effects of climate change is not yet so widespread in Romania due to a lack of capacity and financial resources.

In Romania, the access to information and the public participation in environmental decision-making is well regulated through a set of national laws and ratified international conventions.

The highest authority involved in education in Romania is the Ministry of Education and Research. The climate change process is not specifically addressed in the curricula, but it is presented in the broad framework of environmental protection and sustainable development education. Climate change activities are addressed at the environmental departments or faculties in the state owned or private universities. In the period 1995-2002, several universities in Bucharest and in other important university centers like Timisoara, Brasov, Cluj, Iasi established faculties or departments studying environmental sciences and in this respect climate change issues were addressed.

The Ministry of Environment and Water Management uses different channels for providing information to relevant target groups: mass media, NGOs, business sector. One of the instruments is the ministry's website - www.mmediu.ro.

Several training programmes and activities were developed in Romania based on direct co-operation between the government and NGOs and also on the international cooperation.

Romania has great potential to attract foreign investments through the Joint Implementation mechanism aimed to bring more energy efficiency and cost-effective technologies in the power, industrial and transport sectors.

Chapter 2. National Circumstances

1. Geographical profile

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 (1075 km) and has exit to the Black Sea, being placed at a distance ranging between 1050 km and 2800 km against the continent extremities.

The center of the country is placed at the crossing of the parallel 46°N with the meridian 25°E (at 17 km north of town FŁgŁraк), 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 connections with the countries in the Black Sea basin, in the Mediterranean Sea basin and by means of this with all the countries in the world. Romanian Black Sea seaside is lying on 245 km, between Musura stream (at the border with Ukraine) and Vama Veche locality (at the border with Bulgaria).

The total surface area of Romania is 238,391 km^2, being comparable with Great Britain and Ghana, and ranking 80^{th} in the world and 13^{th} in Europe. Romania's borders total 3,149.9 km. Two thirds of them (2,064.4 km) are marked by rivers -- the Danube, the Prut, and the Tisza -- or follow the Black Sea shoreline, while the remaining one third (1,085.5 km) is on the land. Romania's territorial waters extend 12 nautical miles into the Black Sea.

Romania borders on five countries, its sixth neighbor being the Black Sea. It borders on the Republic of Moldavia to the NE and E, on Ukraine to the N and E, on the Black Sea to the SE, on Bulgaria to the S, on Serbia to the SW and on Hungary to the W.

Relief

Romania's relief consists of three major levels: the highest one in the Carpathians (the highest peak Moldoveanu 2544 m), the middle one which corresponds to the Sub-Carpathians, to the hills and plateaus and the lowest one in plains, meadows and Danube Delta (the youngest relief unit under permanent formation with an average height of 0.52 m). 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 Eastern Carpathians extend from the Ukrainian border to the Prahova River valley and reach their maximum height in the Rodna Mountains, with Pietrosu rising to 2,303 m. They are made up of a series of parallel crests that are oriented in a more or less north-south direction. Rivers have cut narrow gorges e.g. Cheile Bistriţei and Bicazului, offering magnificent scenery. The volcanic ranges Oaк and Harghita cover the western fringe for about 400 km lending character to the landscape. Sfânta Ana Lake - the only crater lake in Romania - can also be found here. The volcanic crescent provides rich resources (notably copper, lead, and zinc) as well as mineral-water springs being the basis for establishment of the health resorts. Eastern Carpathians are made of mostly by easily weathered limestone and conglomerates, which again provide some striking scenery. The Maramureк, Gurghiu, Ciuc, and Bârsei depressions further break up the mountainous relief.

The Southern Carpathians (Transylvanian Alps) lie between the Prahova River valley on the east and the structurally formed Timiк and Cerna river valleys to the west. They are composed mainly of hard crystalline and volcanic rocks, which give the region a massive character that differentiates it from the other divisions of the Carpathians. The highest points in Romania are reached in the peaks of Moldoveanu (2,544 m) and Negoiu (2,535 m), both in the FŁgŁraк Massif, which, together with the Bucegi, Parâng, and Retezat-Godeanu massifs, form the major subdivision of the region. The lasts contain Romania's oldest national park, which, covers more than 140,000 acres (56,000 hectares), offering spectacular mountain scenery and providing an important refuge for the chamois (*Rupicapra rupicapra*) and other animals. As in the Eastern Carpathians, there are important lowland depressions (notably Brezoi, Haşeg, and Petroкani), and agriculture and industrial activities are concentrated within.

The Western Carpathians extend between the Danube and Someк rivers. Unlike the other divisions of the Carpathians, these mountains do not form a continuous range but rather a cluster of massifs around a north-south axis. Impressive deeply penetrating structural depressions are separating the massifs. Historically, these depressions have functioned as easily defended “gates,” as it is reflected in their names: the Iron Gate of Transylvania at Bistra and the Eastern Gate at Timiк-Cerna.

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 Calugareasca Valley which have a European reputation.

The Romanian Plain, the principal “producer” of grains in the country lies between the Carpathians range and the Danube.

Black Sea

The Black Sea represents Romania’s gate for the seas and oceans of the world. 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).

Danube Delta

Danube Delta is represented by a region with a medium-low altitude (31 cm), the biggest part of this area being under water. It lies where the Danube flows into the Black Sea.

The Danube Delta territory formed in quaternary age, in deep relation with the level variation of Black Sea and the deposits of mud brought by the Danube river, has the shape of a big equilateral triangle, with about 80 kilometers on each side.

The Danube is divided in three branches: Chilia, Sulina and Sf. Gheorghe. The mysterious lands of the Danube Delta lies between those three branches: sand banks (river sand banks like Chilia, Caraorman, Pardina, Stipoc; maritime sand banks like Letea, SŁrŁturile, Crasnicol); streams (Sontea, PŁpŁdia, Litcov, Lopatna); lakes (Merhei, Mataita, Fortuna, Gorgova, Trei Ozere, Roku, Rokulet, Puiu); swamps.

Vegetation is very rich and it is mostly made by reed thicket, sedges, and aquatic plants (water lily). Sands and salty-pasture vegetation and also oak, ash, elm and poplar grow

on maritime sand banks. Danube Delta is a very attractive region for its various species of fish and birds, including also endemic ones. There are more than 300 species of birds: storks, wild ducks and gooses, woodcocks, cormorants, egrets, swans, and eagles, some of them being protected by law.

Danube Delta, as a special unity of relief, has some particular characteristics:

- ∉ the most recent land of Romania
- ∉ the most compact zone of reeds (about 240,000 ha)
- ∉ the largest dunes of sand in Romania (about 20,000 ha)
- ∉ the largest beach at the Romanian seaside of the Black Sea (about 30 km length; 1-2 km large)
- ∉ the biggest lake in Romania (Razim 415 km^2)
- ∉ the biggest maritime sand bank (Letea-17,000 ha)
- ∉ the lower altitude in Romania (Sulina)
- ∉ the richest and the most various fauna in Europe (over 300 species).

Natural resources

Romania's useful mineral resources are various. Among the main useful resources it can be mentioned: crude oil (with old exploitation traditions), natural gas, coal, (especially coking pit coal, brown coal and lignite), ferrous and nonferrous ores, gold, silver and bauxite ore deposits, as well as vast reserves of salt. A special category of subsoil riches is constituted by 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.

Vegetation

Vegetation is determined by the relief and by the pedo-climatic elements, being displayed in floors. 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.

Fauna

Romania's fauna is grouped by different areas according to each species biotype. Relict elements as black goat (chamois) and mountain eagle live in the alpine areas. Various animals live in the Carpathians forests: bear, buck, lynx, wolf, wild boar, roebuck, squirrel and several species of birds. In a few mountain areas both mountain cock and birch cock can still be met. In the hill and plain areas different animals can be seen: hares, moles, hedgehogs, various birds, lizards, batrachians. Rodent animals as gopher and hamster are characteristic for the steppe areas. Water fauna is represented especially by trout in the mountain rivers (huck which was mostly spread in the past has

become quite rare); dace and barbell in the hill regions; carp, perch, pike, sheat fish, crucian in the field region and Danube Delta; sturgeon species can also be met in the marine territorial waters and on the downstream Danube.

Lakes

In Romania there are numerous natural lakes (genetic types) spread in all major units of relief, from glacial ones in the mountain areas (Lake Mioarelor - Fagaras 2282 m) to river-maritime banks (Lake Techirghiol at 1.5 m) and anthropogenic lakes established in all relief units for benefiting of the hydro-energy potential, for irrigations, for water supply, and for fish breeding.

There are around 3,500 lakes, but only 0.9% of them have an area exceeding 1 km^2. The most important ones are the lagoons and the Black sea coast lakes (Razim 425 km^2, Sinoe 171 km^2) and the lakes along the Danube bank (Oltenia 22 km^2, Brates 21 km^2). Glacial lakes are mostly spread in the Carpathian Mountains (Lake Bucura is the largest). The most important anthropogenic lakes are the storage reservoirs for power generation on the Danube, at the hydro-power plants of Iron Gates II (40,000 ha) and Iron Gates I (10,000 ha although the water volume - 2,400 million cubic meters - being three times bigger than Iron Gates II), and also the storage reservoirs of Stânca-Costesti (5,900 ha) on the Prut and Izvorul Muntelui on the Bicaz river (3,100 ha).

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 on 1075 km and flows into the Black Sea.

Length of major rivers on Romanian territory

River name	Length of the river (km)	Basin area (km^2)
Danube	1075	33250
Mures	761	27890
Prut	742	10990
Olt	615	24050
Siret	559	42890
Ialomita	417	10350
Somes	376	15740
Arges	350	12550
Jiu	339	10080

2. Climate profile

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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.

Precipitation
Annual precipitation decreases in intensity from west to east, from 600 mm in the Romanian Plain to less than 400 mm in Dobrogea but can reach 1000-1400 mm in the mountain areas.

3. State organization

The Constitution
The 1991 constitution proclaims Romania as a democracy and market economy, in which human dignity, civic rights and freedom, the unhindered development of human person, justice, and political pluralism are supreme and guaranteed values. The constitution directs the state to implement free trade, protect the principle of competition, and provide a favorable framework for economical development. The constitution provides for a president, a Parliament, a Constitutional Court and a separate system of lower courts that includes the Supreme Court.

The two-chamber Parliament
The two-chamber Parliament, consisting of the Chamber of Deputies and the Senate represents the law-making authority. Deputies and senators are elected for 4-year terms by universal suffrage. Elected officials at all levels of government, with the exception of the president and mayors, are selected on the basis of party lists, with parliamentary seats, city and county council representation, all allocated in proportion to party choices made by the electorate.

The president
The president is elected by popular vote for a maximum of two terms. The length of the term was extended from four to five years in an October 2003 constitutional referendum. He is the Chief of State, charged with safeguarding the constitution, foreign affairs, and the proper functioning of public authorities. He is the supreme commander of the armed forces and chairman of the Supreme Defense Council. According to the constitution, he acts as mediator among the power centers within the state, as well as between the state and society. The president nominates the Prime-Minister, who in turn appoints the Government, which must be approved by a vote of confidence in the Parliament.

Local councils and mayors
Local councils and elected mayors are the public administration authorities at the local level (villages and towns). The county council is the public administration authority that coordinates the activities of all village and town councils in a county. The central government appoints a prefect for each county and the Bucharest municipality. The prefect is the representative of the central government at the local level and directs any public services of the ministries and other central agencies at the county level. A prefect may block the action of a local authority if he deems it unlawful or unconstitutional. The matter is then decided by an administrative court.

Under legislation in force since January 1999, local councils have control over spending of their allocations from the central government budget, as well as authority to raise additional revenue locally.

4. Territorial and population profile

Territorial profile

According to Article 3 of 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 eight development regions, which are not administrative divisions per se but rather exist to co-ordinate regional development. These regions are divided into 41 counties and one municipality (Bucharest, the national capital). The 41 counties are divided into 2686 communes (for rural areas) and 265 cities and municipalities (for urban areas). Municipality status is given to larger cities having more decentralized administration than towns.

Beyond the commune, city or municipal level, there are no further administrative subdivisions. However, communes are divided into villages (villages having no individual administration and hence not being an administrative division). There are 13,092 villages.

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

Population

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

Year	2003	2004
Population	21,742	21,685

Demographic rates	2003	2004
Natural growth rate: crude rate of natural increase (births - deaths)	-2.5	-1.9
Infant mortality rate: number of deaths of children under one year of age relative to 1000 live births	16.7	16.1
Life expectancy at birth: male	67.4	67.9
Life expectancy at birth: female	74.8	75.3

A major cause for population decrease after 1989 was emigration. The estimated number of Romanians that are working abroad is between 900,000 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.

5. Economy

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

The transition at the beginning of 1990, from a centralized, state-controlled economy to an unguided free market economy, resulted in significant economic and social difficulties. During this transition to capitalism, Romania has displayed symptoms of considerable economic recession.

Thus, Romania has been forced to face, devaluation of the national currency, increase in the unemployment rate, decrease of the internal production in conjunction with an increase in inflation and foreign imports, accumulation of external debt and inconsistency of the policies for economic recovery during its economic restructuring process for implementing the principles of a free market economy.

Given continued difficulties inherent with this transition, over the last three years Romania has embarked on a set of measures for economic improvement, resulting in better coordination of the general economic policy and acceleration of reforms in the economic sector, steps that have been welcomed abroad by both international bodies and private investors and recognized in the accession process to the European Union.

The National Bank of Romania plays an important role by consistently monitoring the implementation of an effective monetary policy to secure stability for the national currency and to safeguard and ensure the money flows throughout the economy.

The Romanian economy has been focused on stricter monetary control, especially because business executives recognize the need for monetary stability to encourage the development of the private sector, including through governmental programs creating a legal and economical environment that promotes private business and economic productivity.

Romania is a signatory to, or adhered to, important international or regional treaties to secure a healthy business environment based on fair competition among the market participants and the coordination of inter-country economic policies with the aim of synchronizing measures taken to increase the quality of products and services launched on the market. Romania is a party to numerous bilateral treaties on investments and it is also a signatory to an impressive number of double taxation treaties. The integration of the Romanian economy into the European market is one of the major objectives of Romania. Recently, the influence of this priority on the organization and implementation of the national economic strategy have become increasingly visible. This has resulted in Romania being accepted as a participant in the negotiations for potential entry into the European Union, negotiations that were completed in 2004 and shall be followed by the actual accession, which is to take place on January 1, 2007.

In 2004, Romania’s GDP was 46.7 billion euros, 4.9% higher than the previous year. GDP per capita increased at around 2,113 euros. The main branches of the economy are the energy industry, metallurgy, the car industry, the chemical and petrochemical industry, light industry, constructions, agriculture and the food industry.

According to figures released by the National Statistics Institute, Romania's exports in 2004 totaled 18.934 billion euros, 21.3% higher than in the previous year. Clothing and textiles held the highest position, accounting for 22.3% of exports, followed by automobiles and mechanical devices, electrical machines and equipment, image and sound recording and reproduction (17.6%), metallurgical products (15.4%), mineral products - oil products, ore, coal, cement, salt (7.2%), footwear (6.5%), and means of transport and transport materials (6.3%).These goods made up 75.3% of total exports.

As compared to 2003, the value of EU-bound exports has risen by 20.1%, making up 72.9% of Romania's total exports. In 2004, the 10 most important export partners (representing 74.1% of the total value) were Italy (21.3% of the total value), Germany (15%), France (8.5%), Turkey (6.9%), Great Britain (6.7%), Hungary (3.8%), the Netherlands (3.2%), Austria (3.1%), the United States (2.9%) and Greece (2.7%).

Also in 2004, Romania's imports reached a total of 26.28 billion euros, 24% higher than in the previous year. As for the import structure, car and mechanical devices, electrical machines and equipment, image and sound recording and reproduction (23.8% of the total value), mineral products (13.4%), clothing, textiles (12.6%), means of transport (9.3%), metallurgical products (8.4%), and chemical industry products (7.9%) filled up the 6 most frequently imported categories of goods (that is 75.4% of total imports).

As compared to the year 2003, the value of imports from EU countries has risen by 19.8%, representing 64.9% of total imports. The 10 most important import partners (representing 66.4% of total imports) were Italy (17.2% of total imports), Germany (14.9%), France (7.1%), the Russian Federation (6.8%), Turkey (4.2%), Austria (3.5%), Great Britain (3.3%), China (3.3%), Hungary (3.2%), and the United States of America (2.8%).

Romania's currency is the "leu" (pl., lei) – ROL. 100 bani (sing., ban) equal one "leu". On July 1, 2005, Romania redenominated the currency and a new (or heavy) "leu" (RON) is valued at 10,000 old "lei" (ROL). New notes (RON) have the same dimensions as Euro notes of similar value, and they have the same colors and design as their corresponding ROL equivalents (for example, the 100 RON banknote looks similar to the 1,000,000 ROL banknote).

Inflation rate was 9.3% in December 2004 as compared to December 2003. Exchange rate against the Euro was 39,663 ROL on December 31st, 2004 (+3.66% compared to December 31st, 2003). The exchange rate against the USD was 29,067 ROL on the same day (+12.13% compared to December 31st, 2003).

In January and February 2005, the ROL saw speedy appreciation against the Euro and the USD and, at the same time, an unusually high fluctuation for Romania (which reached about 35,500 ROL for 1 Euro and about 27,500 ROL for 1 USD). This came against the backdrop of the National Bank of Romania's non-intervention policy and large entries of foreign capital, as the capital account liberalization date draws closer. The measure will allow non-residents to open ROL short-term bank deposits in Romania.

According to the data provided by the National Agency for Employment, the number of registered unemployed persons at the end of August 2006 was 446.5 thousands. High unemployment rates were registered in the counties: Vaslui (9.8%), Mehedinţi (8.9%), Gorj (8.8%), Harghita (8.5%),Ialomiţa (8.5%). The lowest unemployment rates were registered in the counties: Timiк (2.0%), Ilfov (2.2%), Bihor (2.5%), Satu Mare (2.9%) and Bucharest Municipality (2.6%).

6. ENERGY

The most important problems in the energy sector were:

- successive vertical integration of enterprises, an absence of a competitive environment, and inadequate regulatory systems;
- low efficiency of energy use due to old and inefficient technologies and the dilapidated state of assets, compounded by poor operations and maintenance;
- lack of economic criteria in planning and investment selection;
- over employment and operational inefficiencies;
- weak financial position of sector entities and the accumulation of inter-enterprise arrears; and
- environmental pollution.

The government strategy to address those issues has provided for:

- introducing a sector reorganization to separate policy and strategy operational functions, followed by plans to allow for the participation of public and private independent operators in a competitive environment;
- implementing energy price reforms to align process with economic costs;
- critically screening the energy sector investment program limiting it to the highest priority investments; and
- developing a program for the rehabilitation of the existing energy supply infrastructure.

Institutional aspects

Termoelectrica is a state-owned power and heat generation company with 9,970MW of capacity, covering approximately 45% of the electric power market. Termoelectrica plants use fossil fuels and hydro power to generate electricity. A lot of plants need rehabilitation activities and modernization, and more than 80% of the plants are 20-30 years old. Estimated total investment needed to complete the necessary work is US$2.5 billion.

Electrica sold over 40 terawatt hours of electricity last year. Currently, a central goal of the company is to modernize and retrofit existing units. Electrica is pursuing privatization following a company wide re-organization.

Hidroelectrica supplies 30% of Romanian electricity (6,250MW) from hydro power plants. A short term goal is to modernize existing equipment, which is rapidly deteriorating. Hidroelectrica estimates US$450 million will be needed to make the necessary upgrades.

Petrom is an integrated oil and gas company, with operations from exploration to production, refining and selling directly to customer through commercial outlets. Petrom is the largest oil producer and second largest natural gas producer in Romania. A short-term goal of the company is to invest larger amounts of capital in refining. Petrom has been privatized this year by the Romanian Government. Petrom has begun production of crude oil in Kazakstan and is anticipating increasing its output substantially by 2010.

RomGaz covers 45% of the Romanian gas sector supply needs, with 7.5 billion cubic meters (bcm) annually and 3,600 wells. Activities include geologic surveying, production, depositing and storage. RomGaz is pursuing a feasability study of a gas transit corridor between Romania, Turkey, Bulgaria, Hungary and Austria.

Transgaz is a state-owned natural gas transportation and gas transit network company operating more than 11,000 km of pipeline. Rehabilitation and modernization of pipelines, compressor units and metering installations remain the most important objectives. Additionally, plans include a connection to the European gas grid and an increase in connections with the former Soviet states and south-eastern European states.

Distrigaz Sud is a distributor and seller of gas in the southern half of Romania, including the capital Bucharest. Distrigaz Sud operates more than 13,500 km of pipeline, distributes 5 bcm gas annually, and has over 800,000 customers.

Distrigaz Nord is a distributor and seller of gas in the northern half of Romania with greater than 17,000 km of pipeline, 40% of the Romanian gas market and 9,100 employees. Both Distrigaz Sud and Distrigaz Nord have begun the privatization process.

Resources

Domestic Primary Energy Production

Year	2000	2001	2002	2003	2004	2005
Total (mil. tep) of which (%)	28,190	29,021	27,668	28,192	28,094	28,050
∉ **Coal**	19.9	21.5	22.1	23.2	22.0	22.1
∉ **Crude oil**	21.8	21.0	21.5	20.5	19.9	18.0
∉ **Natural gas**	38.9	37.3	37.5	37.4	36.3	37.2

Domestic primary energy consumption

Year	2000	2001	2002	2003	2004	2005
Total (mil. tep) of which (%)	36,374	37,971	36,480	39,032	39,018	40,500
∉ **Coal and coke**	20.6	21.5	24.2	24.4	23.5	22.4
∉ **Crude oil and oil products**	27.0	28.5	25.7	23.3	25.9	25.1
∉ **Natural gas**	37.6	35.1	36.5	39.5	35.3	36.4

Final energy consumption

Year	2000	2001	2002	2003	2004	2005
Total (mil. tep) of which (%)	22,163	22,438	23,370	25,153	27,331	29,179
∉ **Industry**	40.7	41.7	45.4	43.3	41.3	42.5
∉ **Transports**	15.8	17.7	18.4	17.2	21.6	19.9
∉ **Households**	38.1	32.1	31.2	31.3	28.9	30.3

Oil

Romania is the number one oil producer in central and eastern Europe producing 6.3 million tons of petroleum last year. At present, there are 4 Black Sea oil platforms, which are yielding 1.5 million tons of crude oil annually, which is more than 12% of the

country's total crude output. 10 refineries provide Romania with the 5th largest refining capacity in Europe (14th in World).

Coal

The largest coal reserves are those of bituminous coal. Half of Romania's bulk coal production comes from the Petrokani Depression alone. Reserves of poorer-quality lignite are being tapped to meet energy requirements. Except for the Baraolt-Vârghis Basin, which lies within the Carpathians, most deposits are found along the fringe of the mountain areas. A large lignite field in the Motru Valley (Gorj) supplies two of the largest power stations in the country Rovinari and Turceni.

Coal Production (in millions tons)

Year	2000	2001	2002	2003	2004	2005
Coal	3.2	3.5	3.3	3.0	2.9	2.9
Lignite	25.8	29.4	26.8	29.8	28.6	28.0
Brown coal	0.3	0.3	0.2	0.2	0.2	0.1

Nuclear

The Nuclear Power Plant in CernavodŁ is the only nuclear power plant in Romania. It produces between 10% and 12% of the country's electricity. It uses CANDU reactor technology, using heavy water produced at Drobeta-Turnu Severin as its neutron moderator and water from the Danube for cooling.

The power plant was designed in Canada by Atomic Energy of Canada Limited in the 1980, during the Communist era. The initial plan was to build five units, of which Unit One was finished in 1996 and produces 705,6 MW of electricity, while Unit Two is under construction and will be operational in the first trimester of 2007. When Unit Two will be operational, the plant is expected to provide 18% of the country's electrical needs. Units 3 and 4 are also in their planning stages, being expected to be built in six years after the contracts will be signed. When completed, the four units combined are expected to provide up to 35-40% of Romania's total electricity needs, reducing its dependence on fossil fuels for electricity generation.

CernavodŁ Nuclear Power Plant represents a safe, efficient and clean source of electricity, included in the national strategy of social and economic development of Romania.

Nuclear power will reduce the dependence of Romania on external suppliers of primary resources, geographically sited outside of Europe, in line with the EU policy to increase the "Security of Energy Supply".

The CernavodŁ nuclear power plant is owned and operated by Nuclearoelectrica (SNN S.A.), SNN has three sub companies:

- CNE-PROD, responsible for the safe and efficient operation of Unit 1;
- CNE-INVEST, responsible for the completion of Unit 2 and the preservation of Units 3-5;
- Nuclear Fuel Plant Pitekti, responsible for fabrication of nuclear fuel.

In confirmation with the Romanian Government's strategic objectives in relation to the energy sector, the Ministry of Economy and Commerce has decided to pursue the

development, construction, commissioning and operation of Units 3 and 4 of the CernavodŁ Nuclear Power Plant (“CernavodŁ NPP") with private sector investors.

Hydroelectric Power and Other Renewable Energy

The installed capacity of hydropower is 6,120 MW, representing nearly 30 percent of Romania’s total installed electricity generating capacity. The country’s hydropower potential is extremely large, with an estimated additional potential of over 9 GW. Lack of funding is the greatest barrier to increasing current capacity.

The total theoretical hydroelectric potential of Romania, given optimum technological conditions, has been calculated at some 70 billion kilowatt-hours in an average year, but for technical and economic reasons only a fraction of this potential has been developed. Geographically, the hydroelectric reserves of Romania are concentrated along the Danube and in the valleys of rivers emerging from the mountain ranges of the country. Other hydrographic resources include more than 2,500 lakes, ranging from the glacial lakes of the mountains to those of the plains and the marshes of the Danube delta region. The main effort since the 1940s, however, has been on the Argeк, Bistrița, Lotru, Olt, Sebeк, and Someк rivers as well as on the Danube at the Iron Gates.

The Romanian Government has encouraged foreign investment in hydropower through Hydroelectrica, the state-owned hydropower producer. There are 362 Hydroelectric Power Plants (HPP) with an overall installed capacity of 6,120 MW.

Out of these 362 hydroelectric power plants there are:

- 317 HPPs with capacities between 0 and 30 MW, totalizing 1069 MW installed
- 32 HPPs with capacities between 30 and 100 MW, totalizing 1529 MW installed
- 13 HPPs with capacities over 100MW, totalizing 3552 MW installed

Wind Resources

Romania is considered to have the highest wind energy potential in the region. Its wind resources are well-documented, and there are a broad range of existing applications from small autonomous units for rural areas to large off-shore potential. There is no current installed large scale capacity, but the government has a target of 200 MW by 2010.

The country wide wind-atlas, prepared by the Energy Research and Modernizing Institute (ICEMENERG SA) in 1993, is based on WASP software and meteorological data deserved during the period 1980-1990. 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 CŁlimani at an altitude of 2022 m, with an annual average of 10.3 m/s at 10 m above ground.

A 24.5 MW project, consisting of 22 each 750 kW and 4 each 2 MW turbines, was identified at Constanța (Black Sea coast) and it is developed by ABB being in the stage of "investment approval". The average wind speed at hub-height is 6.2 m/s.

Solar resources

Romania has exploited a significant amount of solar resources in the past, but since 1990, the manufacturing, installation, research and development has virtually ceased. The potential market for solar applications is very large but specific incentives will be needed in order for this potential to be realized. A large scale program for various solar applications was implemented starting from 1979 (solar domestic hot water systems for hotels at the Black Sea seaside and for apartment blocks, greenhouses near Bucharest,

solar drying for agricultural products in the South Plain, solar cooling for fish preservation in Dobrogea region, industrial applications). A lot of efforts have been made in research and development activities and an important human potential and infrastructure was available. The peak of installations occurred in 1984-85.

The poor quality of the equipment and installation made in Romania and the lack of maintenance in many of the early installations resulted in a deep dissatisfaction, creating an additional barrier to further solar energy utilization. The manufacturing, installation and R&D activities have practically stopped since 1990 because of the market reforming and the resulting difficult economic situation.

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.

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 Tuknad-Bai. Five sites have a temperature over 100 °C.

The main technical potential areas include:

- Western Plain with 4,300 TJ/year potential energy production
- Southern Carpathians (at the contact with the Getical Subcarpathians) with 270 TJ/year potential energy production
- South Plains with 720 TJ/year potential energy production

Biomass resources

Biomass is currently used only for heating purposes. In the year 1998 the production of biomass reached 126 PJ and contributed 11 percent to the total energy of the country. In 1999, the biomass production was of 118 PJ. The potential market for biomass applications is very large but specific incentives will be needed in order for this potential to be realized.

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 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.

Energy Transmission Infrastructure

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).

Electricity

Generation and Consumption

Electricity generation in Romania is primarily from thermal power plants (coal, natural gas, and oil), with the balance of production from hydroelectric facilities and the nuclear power plant.

Romania's economy was for a long period in transition from a "commanded" economy to a market driven economy. At present, the energy sector is characterized by:

- Co-generation plants for urban heating
- Extensive use of coal-fired installations for power and heating systems
- Use of hydroelectric power plants and potential for strong development
- Nuclear energy from the CernavodŁ nuclear power plant

The whole 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.

7. 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. Romania manufactures all kinds of railway cars as well as electric and Diesel-electric engines.

In addition to the railway and water transportation systems there is an important network of public roads in Romania that sum up 198,589 km, including 214 km of highway, 14,696 km of national roads, 36,010 km of county roads, 27,781 km of communal roads, 22,328 km of streets in towns and 97,660 km of streets in rural localities. Like in the railway system, the capital of Romania remains the major road juncture, from where the routes start towards the four cardinal points, being connected to important European motorways.

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 Constanţa. The inland waterways and the Black Sea are served by 35 ports including 3 seaports, 6 river-sea ports and 26 river ports.

Romania's main airport is the “Henri Coanda” Otopeni International Airport, 10 km away from Bucharest, which handles 75% of the passenger and goods traffic. At the northern end of Bucharest lies the BĿneasa Airport, which handles international and domestic flights.

The internal airlines connect the capital to Craiova, Timiкoara, Arad, Oradea, Sibiu, Cluj-Napoca, Satu Mare, Baia Mare, Tg-Mureк, BacĿu, Iaкi, Suceava, Tulcea, Caransebeк and Constanţa. Several international lines connect Bucharest to the other important cities in Europe and worldwide.

Works are underway to modernize the national roads open to international traffic, with a total length of about 2,150 km. The Bucharest-Fetecti highway segment (134 km) is being extended from Cernavoda to Constanţa. Bridges are going to be built across the Danube and the Prut, as well as four new airports in Braкov, Galaţi, Alba Iulia and Bistriţa.

In June 2004, works began for the building of the Braкov-Borк highway that is going to connect Romania to the European Union the biggest infrastructure project in Europe. With a length of 415 km, the highway starts from the center of Romania, reaching the border with Hungary. It passes by Braкov, FĿgĿraк, Sighiкoara Tg-Mureк, Cluj-Napoca, Oradea.

8. Industry

While the industrial sector was increasing its relative contribution to the national income, 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. Two other

branches, metallurgy and construction materials, showed an important advance. The main sectors showing declining trends were wood processing and paper, textiles and clothing, and food processing.

9. 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. In 1998, almost 20 percent of the workforce was engaged in agriculture. 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.

Dynamics of vegetal agricultural production (thou. tones)

	2001	2002	2003	2004
Cereal grains	18,871	14,357	12,964	24,713
Vegetables	2,877	2,864	3,358	3,679
Oil plants	1,006	1,195	1,760	2,160
Potatoes	3,997	4,078	3,947	4,655
Fruits	1,353	952	2,098	1,444

Number of animals in the period 2001-2004 (thou. heads)

	2001	2002	2003	2004
Cattle	2,800	2,878	2,897	2,812
Pigs	4,447	5,058	5,145	6,589
Sheep	7,251	7,312	7,447	7,466
Goats	525	633	678	662
Horses	860	879	897	840
Poultry	71,413	77,379	76,616	89,455

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. It can be mentioned the increasing trend of the pig population (9.2% in 2004 compared to 2001), sheep and goats (7.9%) and cattle (4.2% in the year 2003). Production of meat (17.7%), eggs (15.4%) and milk (12.5%) increased in 2004, compared with 2001 in direct correlation with the increase in livestock.

Animal production

	M.U.	2001	2002	2003	2004
Meat - total	live weight	1,415	1,604	1,699	1,666
Milk - total	thou hl	53,169	55,146	57,736	59,837
Eggs	mill. pcs.	6,001	6,432	6,641	6,927
Wool	tonnes	16,880	16,659	16,879	18,049
Extracted honey	tonnes	12,598	13,434	17,409	19,464
Fish	tonnes	13,417	16,232	10,050	10,498

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

Whereas in 1990, for instance, the whole farming land was still collective property (agricultural co-operatives or state farms), starting with 1991 (under Law no. 18), a large number of former owners got their land back, within the limits of 10 hectares per family. Thus, 9340 thousand hectares of arable land were turned into 3.9 million small private farms.

Under Law no. 169/1997 on the privatization of state farms, upon request, former owners could get back up to 50 hectares per family from the land of these farms. According to EU standards, this type of reform required the limitation of the plots returned to their former owners, and selling the land in point was forbidden (for a certain number of years).

Small landed properties account for 66.5% of this country's arable land. These small farms lack the capacity to make investments, fertilize the soil, use irrigation systems and apply modern technologies. Consequently, productivity did not increase and profitable market relations are yet to be established. The optimum type of land concentration is to be achieved soon both by the sale of small properties and by association.

The farming population features a good professional structure: 50 000 highly trained specialists, while 35.4% of the persons occupied in agriculture have secondary studies.

Privatization in agriculture has been concluded. 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. The agricultural companies that could not be privatized will undergo reorganization or bankruptcy procedures and will be sold piece by piece.

Of the 2387.6 thousand hectares held in property by the Agency of the State Domain, 1704.2 hectares were given back to their former owners under Law no. 18/1991; 574.6 hectares were granted for concession, lease or association, and 108.8 thousand hectares are going to be leased.

It is estimated that the ecologically cultivated areas have grown up to 75 thousand hectares including grain crops, fodder crops, pastures, oil-bearing and protein-rich plant cultures, vegetable fields and fruit orchards (cherry, sour cherry), berries, etc. In the ecological animal-breeding sector, estimates indicate a growth of about 10,000 in milk cows and 70,000 in milk sheep, 6000 in poultry.

Organic agriculture represents, along with IT and the light and furniture industries, one of the main resources of Romanian exports.

Romania and the EU have established quotas for the trade in farming products. The negotiations with the EU on bilateral trade in basic farming products have been concluded, and customs duties-exempt quotas have been established. Romania will benefit by export tariff quotas exempt from customs duties for chicken, pork, beef and meat products. As to the dairy sector, beside the existing quota for cheeses and green cheese, quotas have been established for powdered milk and yogurt.

Romania also has quotas established for all categories of grains, as well as for flour. As regards fruit, a non-tariff barrier applied in certain cases has been waived. The concessions agreed upon with the EU in relation to imports of all categories of meat and

meat products, grain, cheeses, and tomatoes are to be applied provided the Community eliminates all export restrictions.

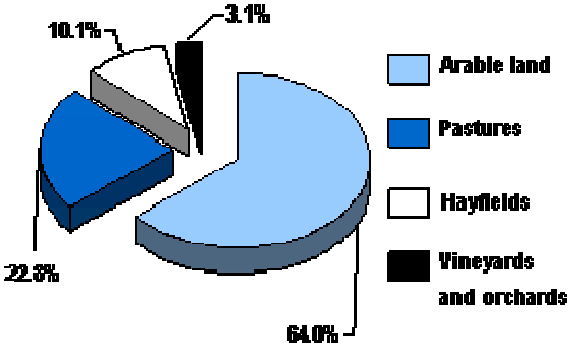
Over the period 2007-2009, Romania will receive from the EU almost 4 billion Euro for sustaining the agriculture sector. The funds will be distributed towards three main directions: direct payments, rural development (which will also include the re-conversion of the labor force), and market interventions. Romania will have to show within three years that it can raise its production to the levels agreed upon with the European Commission.

The 2004 yields are above all expectations. According to the official statistics, the wheat harvest had reached an all-time high: over 5000 kg per hectare. Significant growths have been recorded in other crops as well: 4118 kg/hectare in autumn barley, 4040 kg/hectare in autumn two-row barley. Figures show that the highest crops since 1989 were recorded in two-row barley and rape.

10. Land use and forestry

Land use

According to the Romanian Government, 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%.



Land stock represents the most important natural resource, including the land plots (and the areas covered with water) regardless of there use. Agricultural land represents more then 62% of the territory followed by forests and other land with forest vegetation. Waters, ponds, lakes, yards and infrastrucutre occupies 11% of the total area of the country.

Arable land occupies about 63% of the total agricultural area followed by pastures (about 23%). The rests consists of hay fields (~10%), vineyards (2%) and orchards (2%). Natural disasters (floods and the desertification tendency) have affected agriculture and infrastructure.

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.

11. Waste management

The increasing consumption in the last period, the old technology of the installations used generate millions of tones of waste every year that represent a huge threat for the environment, also affected by the waste deposited in urban and industrial waste landfills. Still at the beginning, separation of households waste (~ 30% of urban waste) in urban areas will hopefully become one of the main methods of recycling materials.

Waste management includes all the waste collection, transport, treatment, recovery and disposal. Responsibilities for waste management activities shall 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 urban areas, the management of municipal waste is performed in an organized system by specialized services belonging to the municipalities or to sanitation operators. Waste management services are provided based on contracts concluded with individual generators, but this system only covers 95% of all municipal waste generators in the urban areas.

In rural areas, there are in general no organized waste management services, transport to disposal sites being performed individually by the waste generators. Only a limited number of rural settlements are covered by organized waste management services, particularly those located in the immediate vicinity of urban centers.

The total quantity of municipal and similar waste (along with construction and demolition waste, and sewage sludge from urban water purification plants) generated in 2004 was estimated at 9.58 million tons, the share of household waste in the total quantity being estimated taking into account the values of the average generation index (1.04 kg/inhabitant/day in the urban area and 0.15 kg/inhabitant/day in the rural area). The total value of household and similar waste generated in 2004 was therefore estimated to 7.66 million tons (out of which only 5.72 million tons were collected by the sanitation services).

Household waste collection is still non-selective at the large scale (there are only a small number of pilot projects doing that) and is disposed by land filling (in urban waste disposal sites). According to estimates, about 5% of the total quantity of household waste is collected with a view to recovery.

In 2004, the total quantity of waste resulting from productive activities reported was 372.4 million tons that is 24.5 millions tons of hazardous and non-hazardous production waste and 347.9 million tons of other types of waste mostly represented by mining activities waste.

The highest shares of production wastes were accounted for by the power generation sector (11.7 million tons), the metallurgical industry (4.8 million tons), the food industry (1.2 million tons) and the chemical/petrochemical industry (1.1 million tons).

About 33% of the total quantity of production waste was recovered, while the remaining 67% was disposed of (by land filling or incineration). Approximately 600,000 tons of hazardous waste was generated in the year 2004, which accounts for 2.5% of all production waste. Out of the total hazardous waste generated, 43% was recovered and 57% was disposed.

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.

Chapter 3. Inventories of Anthropogenic Greenhouse Gas Emissions and Sinks

1. Introduction

This chapter presents Romania's National GHG Inventory based on the last submission (2006) of anthropogenic greenhouse gas emissions inventories to the UNFCCC Secretariat. The national greenhouse gas emissions estimates were calculated for the period 1989-2004 and this results are presented for all years from 1989 to 2004 including also trend analysis, data sources, key sources, uncertainties, and quality assurance and quality control (QA/QC) activities. Romania prepared the CFR Reporter database containing emission estimates for the period 1989-2004 and the National Inventory Report.

As a Party to the Convention, Romania is required to produce and regularly update the national GHG inventory. According to the COP decision to implement the UNFCCC guidelines on reporting and reviewing (FCCC/CP/1999/7), Parties shall also submit a National Inventory Report (NIR) containing detailed and complete information on their inventories, in order to ensure the transparency of the inventory.

The last GHG emissions inventory for the period 1989 – 2004 was compiled according to the recommendations for GHG inventories set out in the UNFCCC Guidelines on Reporting and Review, (FCCC/CP/2002/8 and FCCC/SBSTA/2004/8), using the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines, 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 for LULUCF, 2003). The GHG emissions inventory has been reported since the 2005 submission by using the software programme CRF Reporter, delivered by the UNFCCC Secretariat.

The GHG inventory covers all sectors and the majority of the IPCC source categories. The GHGs emissions estimated 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 estimation of precursors and indirect GHG emissions: NOx, NMVOC, CO and SO_2, which need to be included according to the reporting guidelines. The main remaining gap in the inventory is related to the disaggregated estimate of the international bunker fuels. Some minor IPCC source categories are not estimated, such as the emissions from asphalt roofing, from road paving with asphalt, and from histosols due to the lack of activity data.

The greatest attention during the preparation was focused on direct GHGs regulated by the Kyoto Protocol - CO_2, CH_4, N_2O, HFCs, PFCs and SF_6. In addition, the indirect GHGs (NO_X, CO, NMVOCs, SO_2) were also taken into account.

The GHG inventories submitted annually by Parties are subject to reviews by expert

review teams, coordinated by the UNFCCC Secretariat. Up to now, the GHG inventories of Romania were reviewed as follows (Table 1):

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
2006	CRF Reporter database, CRFs for LULUCF and NIR submitted	No Review

The expert review team's reports following these reviews can be found on the UNFCCC website.

2. Inventory preparation process

2.1 Institutional arrangements

The Ministry of Environment and Water Management (MEWM) has the overall responsibility on the national GHG inventories and submits them to the UNFCCC Secretariat.

The National Environmental Protection Agency (NEPA) is the designated responsible institution for the preparation of the GHG emissions inventories. The National Institute for Environmental Protection (ICIM) was responsible for the GHG emissions estimates in the period 1995-2005 based on annual contracts with the Ministry of Environment and Water Management and the first complete national was submitted to the Secretariat in 2002. A lot of efforts have been made since then in order to improve the quality of the inventory and increase the knowledge of experts participating in its preparation.

The National Environmental Protection Agency (NEPA) started to be involved in the inventory development from 2005, mostly on the activities related to data collection. The NEPA also coordinates the local Environmental Protection Agencies that have been used as a source of bottom-up data for the inventory (ex: in case of HFCs, PFCs and SF_6 consumption, iron and steel production).

The main activity data supplier is the National Institute for Statistics (NIS) through the annualy-published documents like National Statistical Yearbook and the Energy Balance. In 2002, the Ministry of Environment and Water Management and the National Institute for Statistics signed a protocol of co-operation. Under this protocol, NIS agreed to provide, besides its yearly publication, additional data, necessary for the inventory preparation. There are still some timing problems related to the NIS relevant publications like the Energy Balance and the Statistical Yearbook data that are made available to the inventory team. The Energy Balance is not presented until November next year and the Statistical Yearbook is usually published in February-March two years after. Therefore it was difficult for ICIM and NEPA during the last years to meet the inventory submission

deadlines because of the late publishing of the activity data publications.

Continuing the previous year experience, the LULUCF sector has been prepared by the Forest Research Institute (ICAS), under a contract with the National Research and Development Institute for Environmental Protection (ICIM Bucharest). Moreover, contacts were established with ministries, research institutes, organizations and companies that were requested to provide data for the inventory preparation.

2.2 National System

Based on art. 5 of the Kyoto Protocol, Romania is establishing a national system to estimate anthropogenic emissions for all GHGs not covered by the Montreal Protocol. The system should comply with the subsequent decisions of the COP/MOPs of the Kyoto Protocol and the EU Decision 280/2004/EC on a mechanism for monitoring GHG emissions. Romania has regularly prepared and submitted annually the GHG inventory, based on a clear internal plan and structure but the national system still needs to be improved.

MEWM, together with NEPA and ICIM are working together for improving the national system for the estimation of GHG emissions based on the provisions of the National Action Plan on Climate Change (NAPCC), adopted in December 2005 as the Governmental Decision no. 1877/2005. This will be done within the framework of the national system for integrated air quality assessment and management, set up by the Governmental Decision no. 586/2004. The system ensures the organizational, institutional and legal framework for cooperation between authorities and public institutions that have competences in atmosphere protection and air quality assessment and management in Romania.

The following three stages will be considered in the elaboration of the inventory: planning, preparation and management. In the first stage specific responsibilities will be 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.

Establishment of the national system for estimating anthropogenic GHG emissions represents one of the eligibility criteria for the Romanian participation in the flexible mechanism (JI Track 1 and IET) under the Kyoto Protocol. As provided by the NAPCC, the national system will be fully operational by December 2006 based on a capacity building support programme financed by the Danish Environmental Protection Agency.

Though in Romania a system has been used in the last five years for preparation of the national inventories, a specific legal procedure has not been approved yet. Based on the NAPCC, further clarification in terms of division of competences and designation of responsible institutions needs to take place. Until December 2006, Romania will establish a specific legal procedure for the national system, thus setting up the framework for formatting, collecting, processing and presentation of data on the activities and information necessary for the preparation of the national inventory.

2.3 Activity data collection

The last GHG inventory for the period 1989-2004 was compiled according to the recommendations for inventories set out in the UNFCCC Guidelines on Reporting and

Review (FCCC/CP/2002/8 and FCCC/SBSTA/2004/8) and the report includes detailed information on the inventories for all years from the base year to the year 2004, in order to ensure the transparency of the inventory. The emissions are estimated 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 "IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry" (IPCC GPG LULUCF 2003).

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, via MEWM or NEPA
- Data collection
- Data verification: activity data received are examined (time series discrepancies, large changes in values from the previous to the current inventory year)

All these activities are performed by NEPA / ICIM, which is responsible for all sector estimates, except for LULUCF. In the case of LULUCF, the Forest Research Institute, which was responsible for the emissions/removals estimates and the preparation of the LULUCF report, carried out all the activity data related actions.

Data processing and emission calculation
Activities carried out at NEPA / ICIM:

- primary data processing (aggregation, disaggregation)
- application of methods
- emission estimates, using the most recent data
- internal review (errors are rectified)
- preparation of the national inventory report

Data archive
The input data used to estimate emissions; the outputs and all other relevant information including procedures followed are archived at NEPA headquarters.

2.4 Methodology

The emissions are estimated using "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). Emissions in LULUCF sector are estimated using the new methodology "IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry" (IPCC GPG LULUCF 2003).

The following table (Table 2) presents the main data sources used for activity data:

Sector	Data sources
Energy	National Institute for Statistics - Energy Balance and other additional data Ministry of Public Administration Ministry of Transports
Industrial Processes	National Institute for Statistics-Statistical yearbook and other additional data 42 local Environmental Protection Agencies Industrial companies

Solvent and other product use	∉ National Institute for Statistics ∉ 42 local Environmental Protection Agencies
Agriculture	∉ National Institute for Statistics ∉ Ministry of Agriculture, Forests and Rural Development
LULUCF	∉ Forest Research Institute ∉ Ministry of Agriculture, Forests and Rural Development
Waste	∉ National Institute for Statistics ∉ National Environmental Protection Agency ∉ Public Health Institute

The sources of the emission factors used are: IPCC 1996, IPCC GPG 2000 and very limited country specific and plant specific. The methods used to estimate emissions and the sources of EF are described in Summary 3 of the CRF Reporter (mostly Tier 1, Tier 2 for some industrial processes and CORINAIR methodology in case of solvents and other product use).

2.5 Key source categories

Key sources are defined as the sources of emissions that have a significant influence on the inventory as a whole, in terms of the absolute level of the emissions, the trend, or both. Based on the guidance provided by the "IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories", the key source categories have been determined with the application of Tier 1 method.

Table 3 shows that the most important emissions sources are the stationary combustion of fossil fuels, mobile combustion-road, fugitive emissions-oil and natural gas. Iron and steel, nitric acid and cement production within the industrial processes sector has also significant contribution to the total GHG emissions.

Table 3 Summarized key sources categories in 2004 (both level and trend assessment)

SECTOR	SOURCE CATEGORIES	GHG	KS
1. Energy	Stationary combustion solid fuels	CO_2	L, T
1. Energy	Stationary combustion gaseous fuels	CO_2	L, T
1. Energy	Stationary combustion liquid fuels	CO_2	L, T
1. Energy	Mobile combustion - road	CO_2	L, T
1. Energy	Fugitive emissions - oil and natural gas	CH_4	L, T
2. Industrial Processes	CO_2 from iron and steel production	CO_2	L, T
6. Waste	CH_4 from solid waste disposal sites	CH_4	L, T
4. Agriculture	CH_4 from enteric fermentation	CH_4	L, T
4. Agriculture	Direct N_2O emissions from agricultural soils	N_2O	L, T
2. Industrial Processes	N_2O from nitric acid production	N_2O	L, T
2. Industrial Processes	CO_2 emissions from cement production	CO_2	L
1. Energy	Fugitive emissions - solid fuels	CH_4	L, T
2. Industrial Processes	CO_2 emissions from lime production	CO_2	L
2. Industrial Processes	Ammonia production	CO_2	L, T
4. Agriculture	CH_4 from manure management	CH_4	L, T
2. Industrial Processes	PFC from aluminium production	PFCs	T
6. Waste	CH_4 from waste water handling	CH_4	T
1. Energy	Stationary combustion - biomass	CH_4	T
1. Energy	Mobile combustion - navigation	CO_2	T

2.6 QA/QC information

There is no formal quality assurance/quality control (QA/QC) plan in place. The national system for the estimation of GHG emissions will outline a draft for implementing a QA/QC plan. In the preparation of every annual GHG emission inventory several quality control (QC) procedures were carried out already by the inventory experts from NEPA and ICIM.

QC activities

The expert team involved in the inventory preparation process, performed some general QC activities related to the processing, archiving and reporting of data. Some basic QC activities made were: checking for transcription errors in data input, checking whether the parameters and emission units are correctly recorded, comparing within the time series, in order to obtain consistent trends. The GHG emissions inventories for the whole period 1989-2004 have been archived in the NEPA database and at the Ministry of Environment and Water Management.

QA activities

No QA activities were performed beyond the UNFCCC annual reviews (in-country review in 2003, desk review in 2004 and centralized review in 2005). In some cases, the 42 local environmental protection agencies were used as a source of bottom-up data for some source categories and data were checked against the data provided in national statistics. Reports from IEA, EUROSTAT and FAO were also consulted in the inventory preparation.

2.7 Uncertainty analysis

Romania has not estimated quantitative uncertainty as described in the "IPCC Good Practice Guidance". IPCC GPG reports some uncertainty estimates associated with emission factors for some industrial processes, but those associated with activity data are not estimated since the official statistics have not provided the uncertainty values. This activity is planned to start at the 2007 submission based on the legal procedure developed for the implementation of the national system.

2.8 Completeness

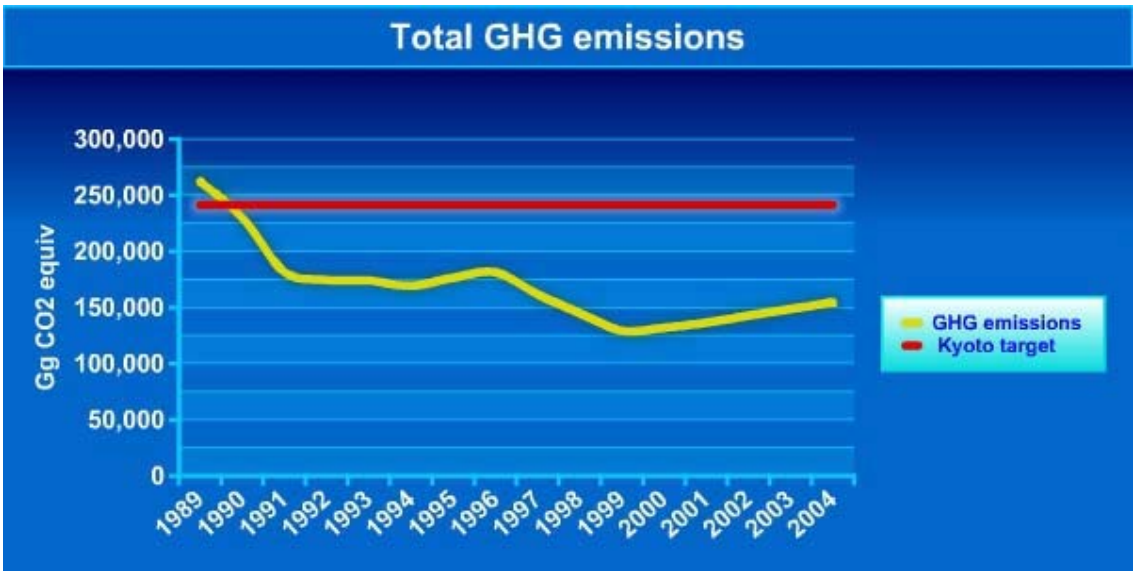
The inventory covers all sectors and all gases for the period 1989-2004 and it is complete in terms of geographical coverage. Emissions are presented by sector, by sub-sector and by gas. There are still some gaps in the inventory, such as: a separate estimate of international bunker fuels, asphalt roofing, and road paving with asphalt estimates. Comparing with the 2005 submission, the completeness of the inventory has been improved by adding the emissions from waste incineration.

3. Trends in Greenhouse Gas Emissions

For the trend analysis, the GHG emissions resulted from each sector were converted into CO_2 equivalent according to the IPCC's Global Warming Potential.

According to the figure below, there is a great probability for Romania to meet its Kyoto Protocol commitments regarding the limitation of the GHG emissions in the first commitment period (2008-2012).

Figure 1 The total GHG emissions in CO_2 equivalent in the period 1989-2004



3.1 Trends of the aggregated GHG emissions

The total GHG emissions in 2004, excluding removals by sinks, amounted to 154,627 Gg CO_2 equivalent, which is still below the base year emissions level: 262,281.5 Gg CO_2 equivalent. In accordance with 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 41% in the period 1989-2004, and the net GHG emissions (taking into account the CO_2 removals) decreased with 47% in the same period.

The GHG emissions trend reflects the main trends in the economic development of the country and also the changes in this period characterized by a process of transition to a market economy. The GHG emissions trend can be split in two parts: the period 1989-1996 and the period 1996-2004. 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. Emissions have started to increase until 1996, because of economy revitalization. Considering the starting of the operation at 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 and the economy revitalization in the period 1999-2004.

3.2 Trends by gas

All GHG emissions decreased comparing with the reference year. 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: 71.86% CO_2, 19.4% CH_4, and 7.47% N_2O. In 2004, the shares of GHG emissions were: 75.25% CO_2, 17.42% CH_4, 6.98% N_2O, and 0.33% PFCs. The F-gases started to be used as substitutes for ODS in refrigerating and air conditioning systems since 1995. In 2004, the contribution of these gases to the total GHG emissions is negligible. Table 4 presents the trend of aggregated emissions, divided by gases.

Table 4 Trends by gas (Gg CO_2 equivalent)

	1989	1990	1991	1992	1993	1994	1995	1996
CO_2 including LULUCF	152,544.15	132,129.72	94,598.63	92,657.12	92,471.16	88,623.89	95,371.44	101,689.51
CO_2 excluding LULUCF	188,488.10	167,122.29	130,646.73	129,463.04	130,157.25	126,782.35	132,826.24	138,256.28
CH_4	50,852.89	44,439.61	38,832.20	33,457.82	31,361.13	30,344.61	30,689.73	31,071.99
N_2O	19,591.04	16,389.63	10,246.54	10,250.29	11,036.34	10,651.82	11,380.31	10,272.16
HFCs	NO	NO	NO	NO	NO	NO	0.22	0.44
PFCs	3,349.52	2,115.77	1,942.01	1,352.05	1,409.32	1,490.97	1,773.67	1,768.98
SF_6	NO	NO	NO	NO	NO	NO	0.06	0.06

	1997	1998	1999	2000	2001	2002	2003	2004
CO_2 including LULUCF	86,601.82	71,123.11	55,393.71	58,786.53	62,711.37	72,486	78,247.2	81,692.6
CO_2 excluding LULUCF	123,435.46	109,622.29	92,810.54	95,621.36	100,380.4	107,626	113,050	116,361
CH_4	27,623.08	26,143.94	26,111.11	26,782	26,064.76	26,384.1	26,570.4	26,939.9
N_2O	10,435.16	8,926.55	9,988.161	9,032.453	9,694.654	8,224.15	8,527.33	10,805.9
HFCs	0.73	1.97	2.42	2.93	2.78	3.25	5.12	7.13
PFCs	390.19	416.47	415.04	413.14	428.75	444.59	471.90	513.34
SF_6	0.02	0.01	0.048756	0.004302	0.004302	0.01147	0.00244	0.08102

Carbon dioxide (CO_2) The most important anthropogenic GHG is carbon dioxide (CO_2). The decrease of CO_2 emissions (from 188,488 Gg in 1989 to 116,361 Gg in 2004) 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 2004 decreased with 47% comparing with the CH_4 emissions in the year 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 (44.8% comparing with the base year) in this period is the highest decrease within GHGs.

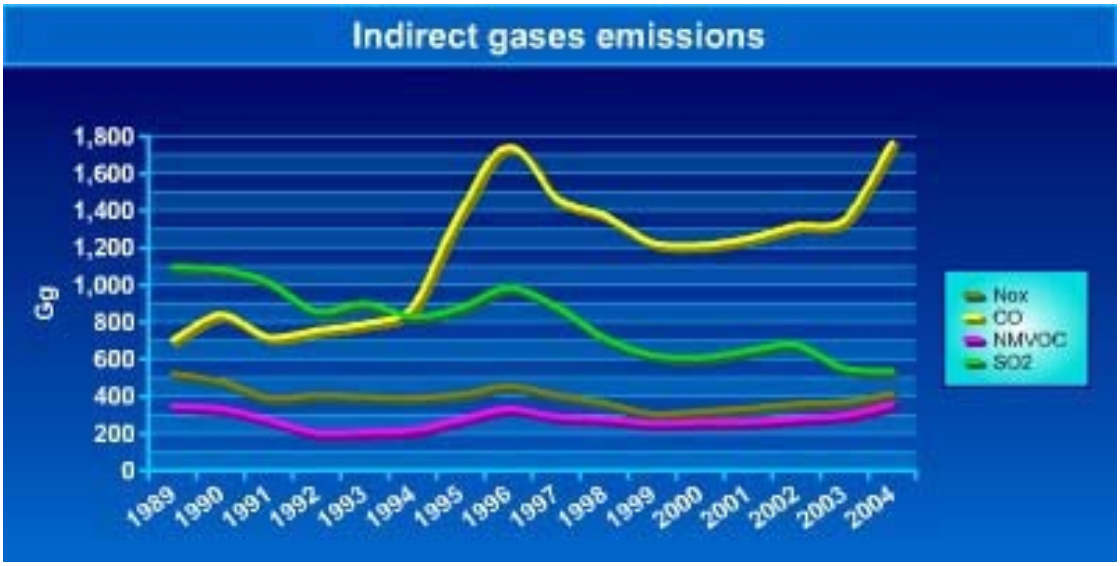
F-gases (HFCs, PFCs, SF_6) The F-gases started to be used as substitutes for ODS in refrigerating and air conditioning systems since 1995. The emissions resulted as a consequence of the use of these substances are estimated since 1995. The PFCs emissions generated in the production of the primary aluminium are reported for the entire period since 1989.

Indirect greenhouse gases and SO_2

The emissions of the precursors and indirect GHGs (NOx, NMVOC, CO and SO_2) are included, as requested by the UNFCCC guidelines. These gases are called "indirect" gases because their influence (decrease or increase) on the warming of the atmosphere is indirectly.

Fuel combustion activities in the "Energy" sector are the major sources of SO_2, NOx and CO emissions. For the NMVOC emissions, another important source is the "Solvent and Other Product Use" sector.

Figure 2 Indirect gases emissions



The NOx, NMVOC and SO_2 emissions evolution follows the general GHG emissions trend. The SO_2 emissions decrease is caused by the decline of the fuels burnt for energy and the decrease of sulphur content in fuels. The unusual increase of CO emissions after 1994 is due to the increase of firewood for households.

Table 5 Indirect gases emissions (Gg)

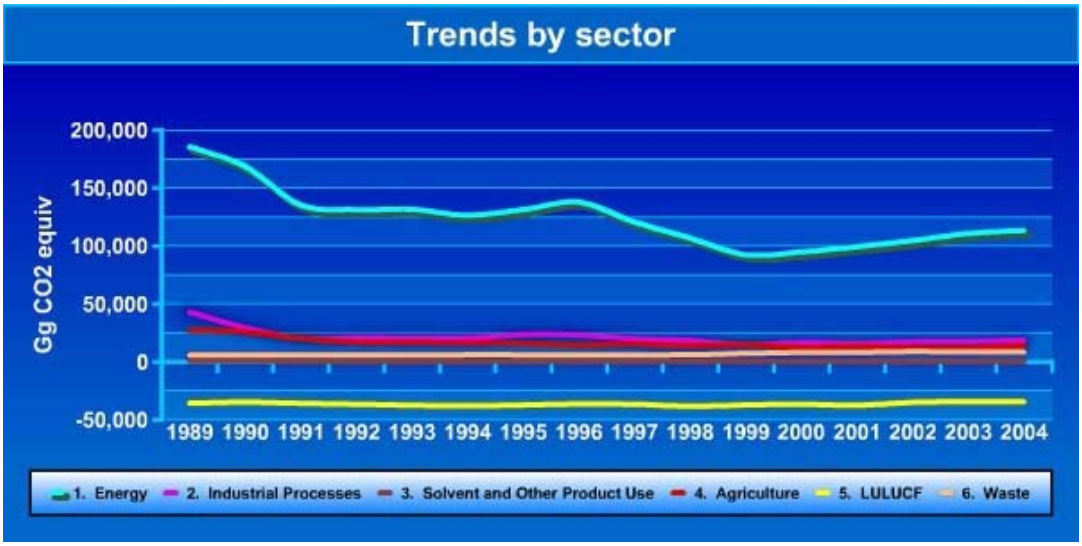
	1989	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
NOx	524.59	483.45	392.14	406.85	396.81	391.21	410.67	454.77
CO	705.29	842.25	719.94	757.07	792.74	884.11	1397.24	1743.92
NMVOC	347.13	335.87	275.75	205.97	207.48	219.52	278.41	333.18
SO_2	1095.20	1084.88	1014.43	858.72	900.55	829.93	878.48	985.29

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
NOx	409.06	366.01	307.35	319.13	336.63	359.98	371.77	414.40
CO	1467.40	1377.27	1229.43	1215.31	1251.95	1320.58	1352.10	1769.13
NMVOC	292.15	279.59	256.29	261.18	263.93	280.80	300.06	358.33
SO_2	884.32	716.03	624.00	609.46	646.11	678	553.53	535

3.3 Trends by sector

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

Figure 3 Trends by sector



Energy is the most important IPCC sector. The Energy sector accounted for 73 percent of the total national GHG emissions in 2004. The GHG emissions resulted from the Energy sector decreased with 39% comparing with the base year.

Industrial Processes contributes to total GHG emission with 12%. A significant decrease of GHG emissions is registered in this sector (56.6% from 1989 to 2004). The most important reason is represented by the decline or phase out in certain production.

Agriculture GHG emissions have also decreased. The GHG emissions in 2004 are 48.7% lower in comparison with the 1989 emissions. In 2004, 9% of the total GHG emissions resulted from the agriculture sector.

LULUCF CO_2 removals by sinks are 3.55 % lower in comparison with the base year.

Waste sector emissions have increased in the period 1989-2004 (48.8%). Contribution of the waste sector to the total GHG emission is 5.4% in 2004

4. Energy

The Energy sector comprises emissions resulting from fuel combustion activities as well as fugitive emissions from fuels. Following the IPCC classification, the combustion processes are divided into the following sub-sectors:

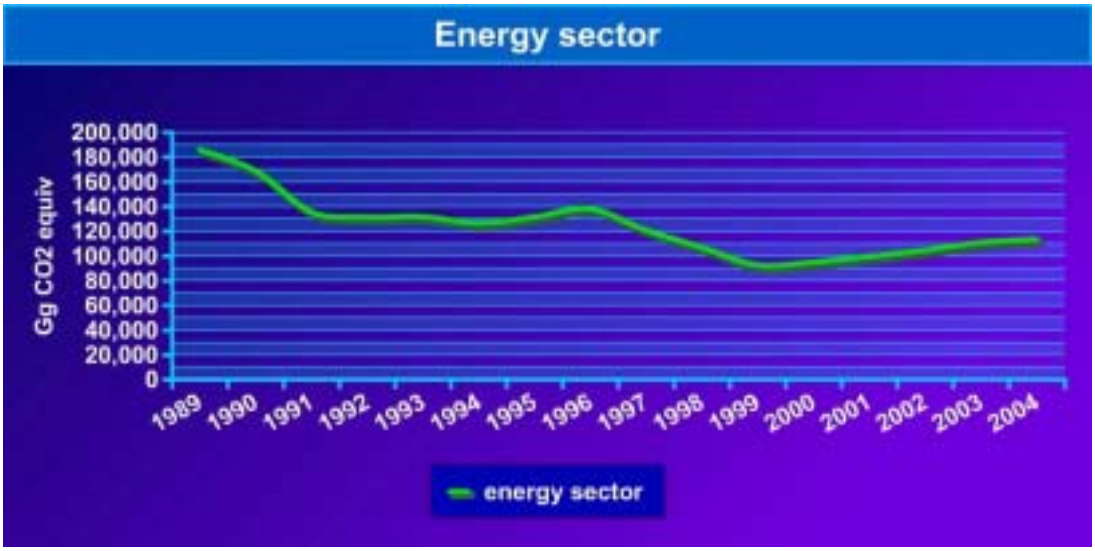
- energy industries
- manufacturing industries and construction
- transport
- other sectors (commercial/institutional, residential, agriculture/forestry/fisheries).

The fugitive emissions from fuels refer to:

- solid fuels
- oil and natural gas

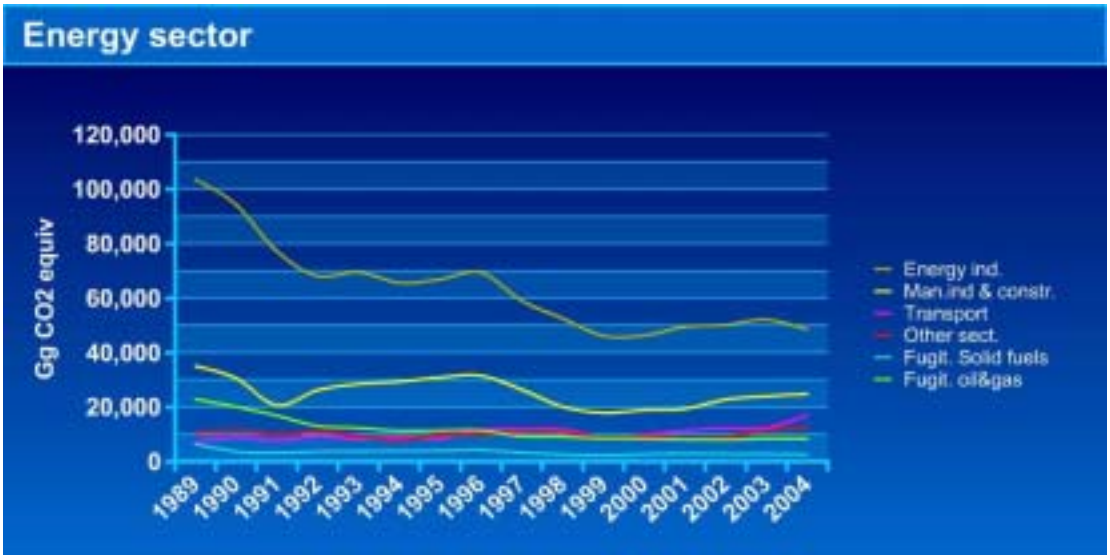
The Energy sector represents the largest source of anthropogenic GHG emissions in Romania. In 2004 emissions the energy sector accounted for 113.4 Tg CO_2 equivalent, which represent 73.3 % of the total GHG emissions. Within the Energy sector, energy industries sector is the most significant, followed by manufacturing industries and construction sector. In terms of GHGs, the most important is CO_2; small amounts of CH_4 and N_2O are also present.

Figure 4 The Energy sector emissions in the period 1989-2004



The Energy sector emissions decreased among the entire period 1989 -2004. The GHG emissions decrease is mainly caused by the decline in fuel combustion activities and the amount of fossil fuels extracted. The emission trend reflects the changes in this period characterized by a process of transition to a market economy. After bringing into operation of the first reactor at the Cernavoda nuclear power plant (1996), the emissions decreased until 1999. After 1999, the emissions have started to increase as a consequence of economy revitalization.

Figure 5 GHG emissions in the Energy sector in the period 1989-2004 (Gg CO_2 eq.)



In the base year 1989, various sub-sectors contributions to the total GHG emissions in the Energy sector were: Energy Industries - 55.7%, Manufacturing Industries and Construction - 18.9%, Transport – 3.9%, Other Sectors - 5.7%, Fugitive Emissions: Solid Fuels - 3.4%, Fugitive Emissions: Oil and Natural Gas - 12.3%. In 2004, various sub-sectors contributions were: Energy Industries – 42.8%, Manufacturing Industries and Construction - 21.8%, Transport – 15.1%, Other Sectors - 10.7%, Fugitive Emissions: Solid Fuels: 2.3%, Fugitive Emissions: Oil and Natural Gas - 7.3%.

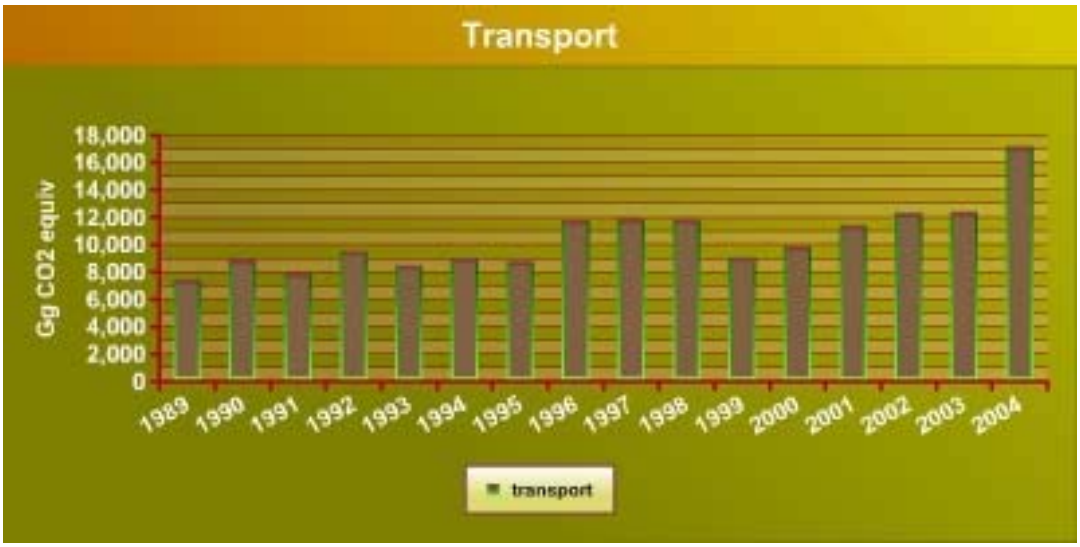
Table 6 GHG emissions in the "Energy" sector (2004) in CO_2 equivalent

Sources	CO_2	CH_4	N_2O
Total GHG emissions (A + B)	**101,220.8**	**11,771.41**	**423.68**
A. Fossil fuels combustion	101,220.8	890.95	423.68
1. Energy industry	48,405.34	19.38	152.41
2. Manufacturing industries and construction	24,662.57	47.36	69.33
3. Transports	16,945.24	56.04	43.67
4. Other sectors	11,207.62	768.15	158.26
B. Fugitive emissions	0.00	10,880.45	0.00
1. Solid fuels	0.00	2,580.41	0.00
2. Liquid and gaseous fuels	0.00	8,300.04	0.00

Transports

This sector includes emissions from civil aviation, road transportation, railways, navigation and pipeline transportation. Within the fuel combustion sector, 16.74% of the CO_2 emissions correspond to the transports sector. While the GHG emissions resulted from the energy industries and manufacturing industries and construction are decreasing over the period, the emissions in transports sector are increasing, as a consequence of increase of mobility and number of vehicles.

Figure 6 Total GHG emissions from the transports sector



5. Industrial Processes

Only the process related emissions are considered in this sector; emissions due to fuel combustion in manufacturing industries are included in the Energy sector. GHG emissions from industrial processes are grouped in the following sub sectors: Mineral products, Chemical industry, Metal production, Consumption of halocarbons and SF_6 and Other production.

In 2004 the GHG emissions from Industrial processes sector contributed with 12% from the total GHG emissions in Romania. Emissions from this sector estimated in 2004 decreased by 56.7% compared with 1989 and increased by 7% compared with 2003. The decrease from 1990 to 2004 is caused by:

- reduction of PFC emissions in aluminium production due to technological changes;
- stopping the adipic acid production from 2001;
- declining the iron and steel and ammonia productions.

Metal production contributed with 40% from the total GHG emissions in Industrial Processes sector in 2004. Mineral products and Chemical industry are the two other main contributing sectors with 31% and 29%, 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: 0.04%.

In the base year, various Industrial processes sub-sector contribution was: Mineral products 24.7%, Chemical industry 29.45 %, Metal production 45.86%, Consumption of halocarbons and SF_6 0%.

Figure 7 GHG emissions in the Industrial Processes sector, 1989-2004 (Gg CO_2 eq)

6. Solvents and Other Product Use

Solvents are chemical compounds, which are used to dissolve substances as paint, glues, ink, rubber, plastic, and pesticides or for cleaning purposes (degreasing). After application of these substances or other procedures of solvent use most of the solvent is released into air. The use of solvents leads to emissions of non-methane volatile organic compounds (NMVOC), which is regarded as an indirect GHG. The NMVOC emissions will oxidize to CO_2 over a period of time in the atmosphere, which is included in the total GHG emissions reported.

IPCC guidelines do not provide methodology to determine NMVOC emissions, which is the main source of emissions in this sector. Due to this reason, the NMVOC emissions resulted from Solvents and Other Product use were estimated based on EMEP/CORINAIR methodology.

The activity data used to calculate emissions are provided mainly by the national statistics. Moreover, local Environment Protection Agency provided additional data related to 3A Paint application category (*car repairing, construction and buildings)*. CO_2 emissions from solvent use were calculated from NMVOC emissions of this sector.

The trend of emissions resulted from this sector follow the general emission trend: emissions decreased seriously after 1989, then the emissions are relatively stable from 1992 to 2002 and after 2002, emissions started to increase, based on the revival of the economic activity.

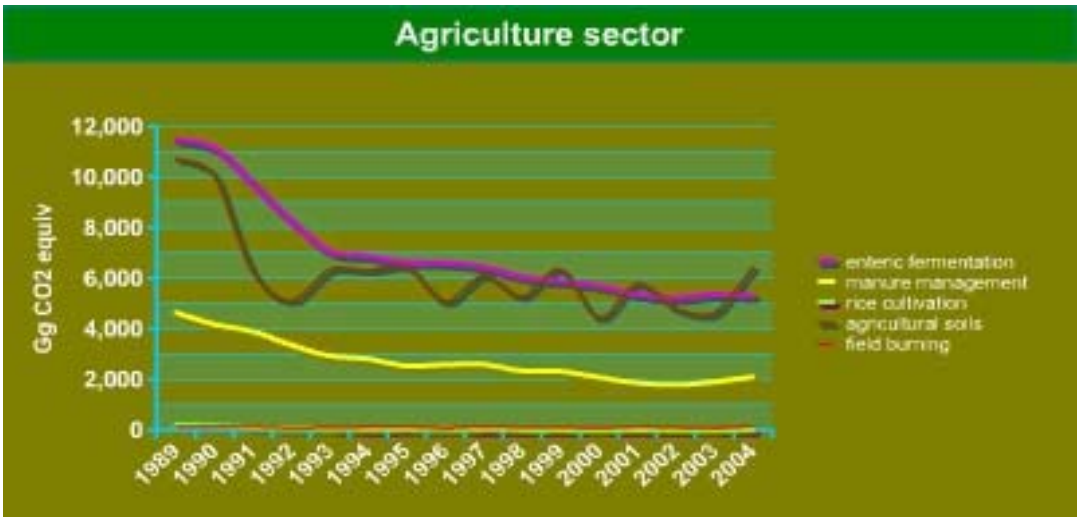
7. Agriculture

The agricultural activities that contribute directly to the GHG emissions refer to:

- livestock: enteric fermentation and manure management
- agricultural soils

Domestic animals are the major source of CH_4 emissions from agriculture, from both enteric fermentation and manure management. Manure management also generates emissions of N_2O.

Figure 8 GHG emissions trends in Agriculture, in the period 1989–2004 (Gg CO_2 eq.)



Microbiological processes in soil lead to N_2O emissions. Three sources of N_2O are distinguishes: direct soil emission from agricultural soils (sources: synthetic fertilizers, animal waste applied to soil, biological nitrogen fixation, crop residue); direct soil emissions from animal production (from grazing animals); indirect soil emissions (atmospheric deposition, leaching and run off).

The agriculture sector accounted for 9% of the total GHG emissions in 2004, reaching 13,933.1 Gg CO_2 equivalent. Within the GHG emissions from the agriculture sector, the CH_4 emissions have the largest contribution (in 2004, CH_4 emissions contribution is 53% to the total agriculture sector's emissions), followed by the N_2O emissions (that account for the remaining 47% in 2004).

Over the period 1989-2004, the GHG emissions resulted from the agriculture sector decreased by 48.7%. In case of emissions resulted from enteric fermentation and manure management, the descending trend reflects the decrease in animal population over the period.

The rice cultivation – an important sub-sector in the past – has been reduced significantly compared to the base year 1989 (95% decrease comparing with the base year).

In case of agricultural soils, the emissions have been decreased over the period (40% decrease in 2004 comparing with 1989), and the evolution of emissions fluctuates, depending on the crop productions that vary from one year to another.

The agriculture sector's CH_4 emissions decreased in 2004 with more than a half the level recorded in the base year (54.4 %) because the methane emissions are mainly resulted in domestic livestock.

N_2O emissions from the agriculture sector decreased with 40% comparing with the base year. The reasons for this decrease are: the decrease of the amount of chemical fertilizers applied to soils and the decline of the domestic livestock.

A set of data requirements has been elaborated following the IPCC Tier 2 methods and it has been transmitted to the National Institute for Statistics and to the Ministry of Agriculture, but the poor data received does not allow for the use of higher tier methods. The procedure to be developed for the National System for estimating the GHG emissions will underline the need to move to higher tier methods in case of key sources in the agriculture sector and it will involve more institution and experts from the agricultural field.

8. LULUCF

The land uses in Romania have been relatively stable over the last 15 years, even strong mutation occurred at political, economic and social levels. Due to various and spatially equilibrated forms of the relief of the Romanian national territory, as well as due to the much diversified climate the land is suitable for a large range of activities and uses.

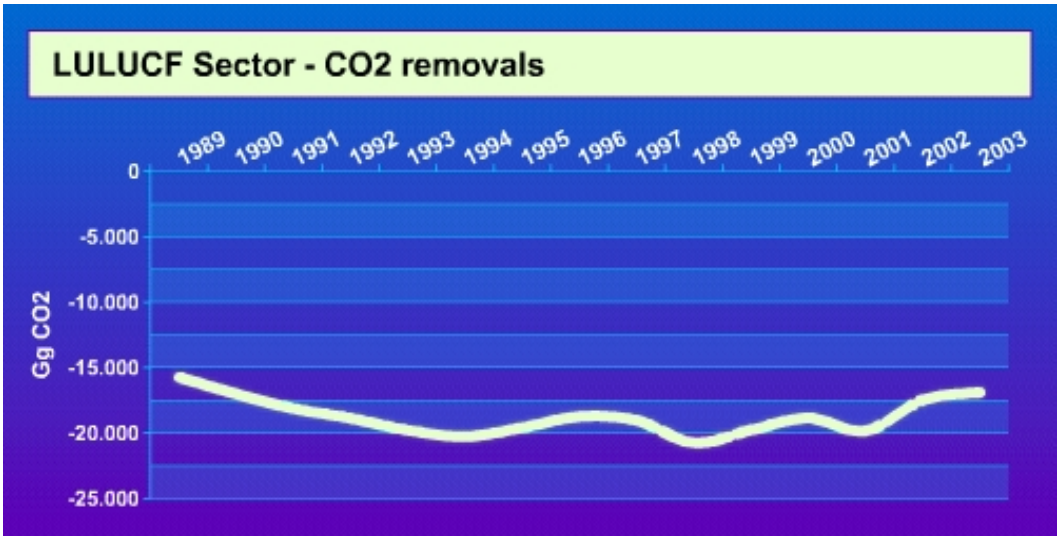
Over the period 1989 - 2004 there was no significant change in the key sinks/sources category in the LULUCF sector. As well, there was no recent input of substantial activity data or new methods. Still, the updated inventory relay on certain figures regarding the repartition of land uses on years and the inventory is timely consistent.

Consequently, Romanian land use sector act as a net sink, at an average uptake of 18,700 Gg/year, relatively stable over the last 16 years. Out of the national territory, agricultural land represents some 62%, forests and other wooded lands accounts for 28%, construction and roads/railways is 4%, water & ponds is 3.7% and other areas

about 2%. Agricultural lands comprise arable lands whose areas were relatively stable to 62% over the 1989-2004 period, pastures and hayfields that increased from 32% at the beginning of the 1990s to 34% in the present. Comparatively, orchards and vineyards areas equally decreased from 4 to 3%.

Land use types strictly follow the national definitions. The estimation of sinks from LULUCF follows the methodology provided in the Good Practice Guidance for Land Use, Land Use Change and Forestry, IPCC, 2003.

Figure 9 CO_2 sinks - LULUCF in Romania over the period 1989-2004



9. Waste

This sector includes emissions from landfills, wastewater handling and waste incineration. Solid waste disposal on land (Landfills) is the main category within the waste sector, accounting for 69.7% of the sector's total GHG emissions. Wastewater handling and waste incineration account for approximately 30.2 and 0.1% respectively. In this sector, the most important GHG emissions are those of CH_4 from solid waste landfills. A minor category is N_2O from wastewater handling

10. Recalculations and Improvements

Recalculation made since the 2005 inventory submission have been carried out to account for better activity data and emission factors and to correct some errors in the calculations. The total GHG emissions have changed in all years due to recalculations in all sectors. All recalculations performed have resulted in better time series consistency and comparability.

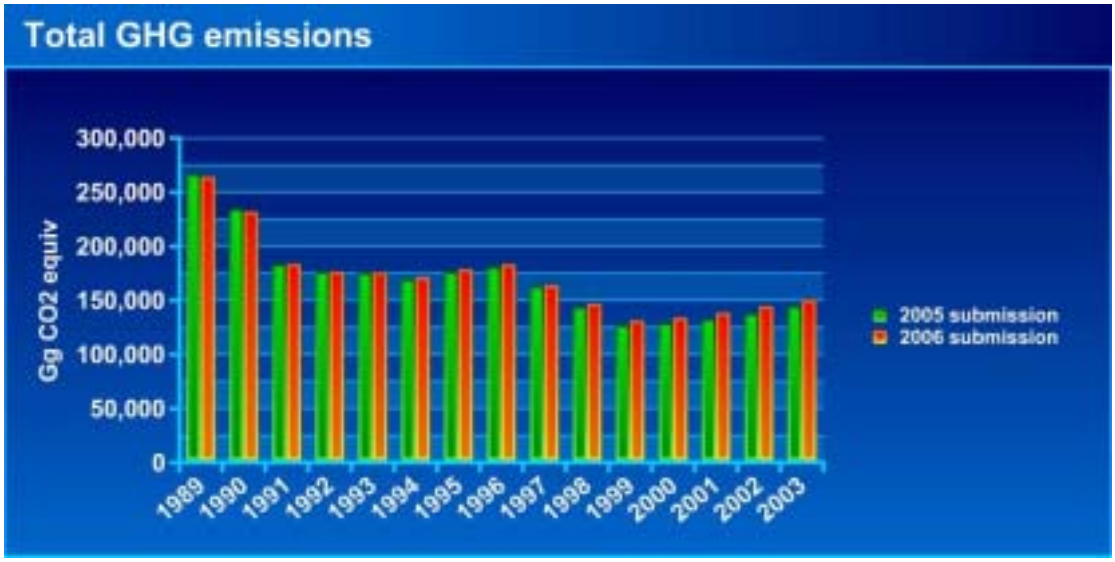
Geographical coverage of the country is complete and consistent over time. There is no part of the territory that has not been taken into account in the inventory. For most sources the emission/uptake has been estimated. Sources not estimated or included in different other chapter:

Table 7 Recalculation difference of the total GHG emissions

Year	Total GHG (excluding LULUCF)		
	Submission 2005	Submission 2006	Difference
1989	265,124	262,282	-1.07
1990	232,938	230,067	-1.23
1991	181,727	181,667	-0.03
1992	174,628	174,523	-0.06
1993	173,500	173,964	0.27
1994	167,719	169,270	0.92
1995	174,744	176,670	1.10
1996	179,335	181,370	1.13
1997	161,120	161,885	0.47
1998	142,246	145,111	2.01
1999	125,668	129,327	2.91
2000	127,423	131,852	3.48
2001	130,961	136,571	4.28
2002	135,937	142,682	4.96
2003	142,905	148,625	4.00

In 1989, 1990, 1991 and 1992 the emissions levels decreased, with the largest decrease, -1.23%, in 1990. In the remaining years the emissions levels increased due to various recalculations. The differences between 2005 and 2006 submission are low: for the base year the GHG emissions are 1.07% lower and for the year 2003 the GHG emissions are 4% higher.

Figure 10 Total GHG emissions based on the 2005 submission and the recalculated 2006 submission (LULUCF excluded)



Chapter 4. Policies and Measures to Mitigate GHG Emissions

1. Introduction

Since 22 June 1995, when Romania submitted formally the application for the accession to the European Union, the European integration has been representing the political objective of all the following Governments and political parties. In 2004 Romania completed the negotiation process followed by the signing of the Accession Treaty on 25 April 2005, establishing the official accession of Romania to the European Union on 1 January 2007.

The Accession Treaty is in the final stage of ratification by all EU member states and the progress report drawn up by the Commission on 26 September 2006 confirmed the accession on 1 January 2007. In order to sustain the integration process all policies and development strategies have been elaborated and implemented in compliance with the harmonization of the EU standards.

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 current level of GHG emissions is far below the Kyoto Protocol's target taken by Romania. 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 any additional measures even in case of the less conservative one.

However, a substantive potential exists to further reduce the carbon intensity of the Romanian economy and to decouple and lower 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 from agriculture and waste sectors can be further reduced, while the sink capacity can be increased with afforestations and reforestations. Finally, N_2O emissions from the agriculture and industrial processes sectors can also be reduced.

2. Strategies and Policies

The goal of the Romanian Government is to reach the convergence with the economic development of the European Union member states, through adopting proper sector

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, integral restitution of properties abusively confiscated by the Communist regime, equal treatment of property
5. Instauration of functional market economy
6. Stimulation of the enterprising spirit
7. Social and economic cohesion, reduction of poverty and social exclusion
8. Equality of chances
9. Respect of the minorities' rights
10. Environmental protection

2.1 Strategy for industrial development of Romania on medium term

The Industrial policy of Romania is in process of harmonization with the strategic targets and the sustainable development concepts of the EU presented in the Lisbon Strategy. The industrial policy for 2005-2008 has been developed within inter-ministerial working groups on different sectors and approved by the Government Decision no. 1172/2005. The main objectives of the industrial policy in 2005-2008 are:

- Enhancement of the competitiveness
- Promotion of the sustainable management of natural resources and environment
- Improvement of training and job development
- Development of cooperation and industrial services

The economic policy in the period 2005-2008 is related to:

- Continuation of the transposition of EU legislation
- Implementation and monitoring of the harmonized legislation
- Continuation of the process for improving the business environment, the diversification and modernization of bank services
- Promotion and enhancement of the IT society and linking the Romanian industry to the European projects
- Enacting relevant legislation for enabling competition within the adoption of EU Custom Code, membership of Russia and China of the WTO, trade globalization
- Development of the integrated industrial waste management
- Launching the large infrastructure projects and trans-boundary long distance energy transport systems
- The development of the Romanian research-development system into an operational EU pattern.

In the period 2005-2008 the Romanian economy has to sustain structural adjustments related to:

- Development of industries generating great value added products, especially increasing green-field investments;
- Development of industrial clusters, technological and industrial parks, business incubators
- Regional development, enhance SME contribution and making good use of local raw materials, tradition and human resources;

- Restructuring of companies and industries through modernization programmes, rationalizing energy consumption and spreading highly efficient management
- Rehabilitation of industrial sites
- Co-operation of native companies with national and/or international consortia in view to develop internal or/and international projects
- Innovative and technological research
- Launching renewable energy promoting programmes

The following outcomes were estimated for the period 2005-2008:

- Competitiveness will turn into an enabling element for economic growth
- Products with great added value-major element for the national product growth
- Green-field direct investments will become a major factor for the economic growth
- Consolidation of the sustainable growth of the processing industry and of the Romanian brands within harsh competition
- Modernization of infrastructure for research, innovation and technological transfer
- Development of equipment production to sustain national programmes in: energy, agriculture, infrastructure, environment, etc
- Sustainable development of the Romanian social-economic system in line with the European policies.

The complexity of the implementation of the industrial policy requires three main aspects to be approached:

- establishing a timeframe for completion of measures and tasks in this sector
- phasing these measures and tasks on medium term
- improving the institutional capacity for management/monitoring

The main tasks and measures for the implementation of the industrial policy are included in the Action Plan for Industrial policies.

2.2 Policies and measures by sector

Energy

The energy development in Romania follows the National Strategy for Energy Efficiency for 2004-2015, approved by the Governmental Decision no. 163/2004. In the context of EU integration, the energy efficiency has turned into an important element of the national energy policy. The main objective of this document is to increase energy efficiency on each sector of exploitation of natural resources, heat and electricity production, transport, distribution, consumption through market economy mechanisms.

In 2005 the primary energy internal consumption was 40.5 million toe and the GDP 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 realizing 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.

In implementing the energy policy, the Romanian Government aims to implement the following strategic objectives:

- Achieving a real competitiveness within the energy field;
- Improving the institutional framework;
- Elimination of the distortions that affect market competition;

The Romanian energy policy is established taking into account that the Romanian market would be a component of the EU energy market and consequently will focus on energy safety, efficiency, and environment and consumers protection. Presently the Romanian energy policy is focused on meeting the obligations committed during the negotiation of the Chapter 14-Energy within the EU integration process.

During the development of the energy policy, Romania must take into account both the environmental acquis communitaire 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 time limits for the transposition and application of the specific energy directives with relevance to the environmental protection shall be co-ordinated with those regarding the transposition of the environmental acquis.

The formal body 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.

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 specialised 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 sector

In Romania the electricity sector is in a continuous consolidating process. Regulation, authorization and control in the field of electric and heat energy 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.

In order to ensure legislative coherence in the field, ANRE is temporary under the co-ordination of the Ministry of Economy and Trade. ANRE establishes prices and tariffs for electricity to captive consumers, based on its methodologies and on the following principles:

- consumers protection
- ensuring the economic and financial viability of the agents in the sector
- encouraging economic efficiency increase
- attracting investors

The wholesale electricity market has two components:

- the regulated market, based on portfolio contracts or type PPA sell-buy contracts between producers and suppliers;
- competition market, meaning the conclusion of bilateral contracts negotiated by eligible consumers and electricity producers, and commercial agreements on the spot market.

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 regulated by The National Gas Regulatory Authority (ANRGN), which ensure regulation, authorisation 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 authorised by the Natural Gas Regulatory Authority - ANRGN.

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 liberalisation. 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:

- Privatization of the main natural gas producer (Romgaz)
- 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 authorisations 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 authorisation 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 sufficient 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 privatisation 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 will accept 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 will not encounter any problems in fully implementing the acquis upon accession.

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 18% of the electric power supply at national level.

Renewable Sources

The Strategy for using renewable energy sources has been approved by the Governmental Decision no. 1535/2003. The document establishes targets until 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 thermal energy
- New renewable energy facilities in 2015 will have 789.0 MW installed electric energy, respectively 3 527 700 toe thermal energy

The renewable energy generated by different types of sources is presented in the next table:

Renewable energy sources	2000 (thousand toe)	2010 (thousand toe)	2015 (thousand toe)
Solar energy	-	7.5	17.0
Wind energy	-	27.0	86.1
Hydro energy	1 272.0	1 565.2	1 608.2
Biomass energy	2 772.0	3 347.3	3 802.0
Geothermal energy	-	17.5	23.9
TOTAL	4 044.0	4 946.0	5 537.2
% total primary energy resources	10.01	11.0	11.2

Taking into account the assumption that in Romania 1 oe releases about 2.38 tCO_2, the reduction of CO_2 emissions during 2008-2012 will be around 26,000 tCO_2/year.

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

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 for 2005-2008, 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.

Romania's Industrial Policy for 2005-2008 and the action plan to implement this strategy in 2005-2006 have been approved through the Governmental Decision no. 1172/2005. 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 in compliance with the EU standards
- 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 highly processed 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 new 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 electric efficiency facilities.

The financial opportunities for the economic operators in different industrial sectors resulted from the participation in the Kyoto Protocol flexible mechanisms will support the achievement of the above mentioned objectives, special consideration being given in this respect.

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, aluminium 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 neighbouring 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.

A new Department for Environment has been recently established within the Ministry of Transport, Construction, and Tourism (MTCT) to strengthen the environmental perspective in transport policies. Climate change and the reduction of GHG emissions from transport is a part of this new department mandate.

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 (GD no 343/2002).

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

1. Review of the existing transport strategy on climate change aspects by the MTCT in cooperation with the MEWM. The current transport strategy does not mention climate change at all. The review will address the future approach to incorporate climate change consideration into key decisions on transport infrastructure
2. Strengthen cooperation with MEWM and other involved institutions through the National Commission on Climate Change
3. Capacity building programme for the new Environment Department at MTCT 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 MTCT 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 modernisation 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 (13% in 2003).

In order to sustain the integration process and conclude the negotiation process with the EU the Ministry of Agriculture has elaborated the Strategy for the development of agriculture, food industry and forestry for the period 2001-2005.

In June 2006 the new Ministry of Agriculture, Forestry and Rural Development 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.

Forestry

In 2004, the forests covered 6,362 thousand hectares, of which 6,222 thousand hectares actually in full coverage, 30% coniferous and 70% foliage trees. The rest of 160 thousand hectares are plots of land prepared for reforestation, culture, production or forest administration land, non-productive lands included in the forestry management facilities.

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 restitution of abusively nationalized forests and the consolidation of private properties under conditions of efficiency is a priority for the Romanian Government forestry policy. By revising the legal framework in 2005, the area of forests to be privately or locally owned is estimated to reach about 65% of the total forest area by 2013.

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 reducing 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 10^{th} rank in Europe.

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

Waste

The Ministry of Environment and Water Management, according to the responsibilities following the transposition of European legislation in the field of waste management and according to the provisions of Emergency Government Ordinance no. 78/2000 on the regime of waste, modified and approved by Law no. 426/2001, has developed the National Waste Management Strategy (NWMS) in order to create the necessary economically sound framework for developing and implementing an integrated waste management system .

The strategy was drafted for the interval 2003 – 2013, and is going to be submitted for approval in the Romanian Government. The provisions in the NWMS apply to all categories of waste as defined in Emergency Government Ordinance no. 78/2000 on the regime of waste, modified and approved by Law no. 426/2001. 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.

Along with the Ministry of Environment and Water Management, the Ministry of Health, the Ministry of Economy and Trade, the Ministry of Transport, Constructions and Tourism, the Ministry of Administration and Internal Affairs, and the Ministry of National Defence have all responsibilities in waste management.

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.

As from 1995, the collection and processing of information referring to the types and quantities of waste has been developed according to the European requirements concerning classification (European Waste Catalogue, replaced in 2002 by the List of wastes and hazardous wastes) and reporting to EUROSTAT and the European Environment Agency (by means of the EIONET network). The information collected and reported refers to: urban waste (household waste, park and garden waste, sludge from the treatment of urban waste waters), (hazardous and non-hazardous) industrial waste, waste generated by medical activities.

Under the negotiation process with EU, Romania has committed to observe the landfill Directive provisions by 2017, as from 2008, to separately collect biodegradable municipal waste at a rate of 8%, and to meet the incineration requirements by 2009.

2.3 Overview of the Climate Change Regime in Romania

Romania's current political outlook regarding environmental protection presents a pro-active approach that is mainly shaped by the impending accession to the EU and approximation of national policy to EU standards. Chapter 18 of Romania's Governmental Programme 2005-2008 (adopted in December 2004) stipulates specific priorities for climate change mitigation and adoption of specific policies and measures in order to reduce GHG emissions.

Important parts of this commitment are already being implemented, such as the elaboration of the National Strategy on Climate Change (NSCC) adopted in 2005, and the National Action Plan on Climate Change (NAPCC), for the implementation of the strategy adopted also in 2005, as well as the development of institutional capacity at the national level. Other provisions of the government's programme concerning climate

change are under development, as is the National Registry, or the updating of the GHG inventory, or establishing the legal procedure for the national system of assessing GHG emissions, or 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 three national communications. In March 1995, Romania submitted its First National Communication (NCI) to the UNFCCC Secretariat, in accordance with Article 12 of the UNFCCC. The Second National Communication (NCII), comprising the GHG emissions inventories for 1989, 1990 and 1991, was submitted in April 1998 and was revised by an international expert review team. Romania's Third National Communication to the UNFCCC (NCIII) was submitted to the Secretariat in May 2005.

In the first half of 2005, the Ministry of Environment and Water Management (MEWM) developed the first National Strategy on Climate Change of Romania, presenting the framework for implementing Romania's climate change policy in the period 2005-2007. The strategy was adopted through Governmental Decision 645/2005.

The National Action Plan on Climate Change (NAPCC), adopted with Governmental Decision 1877/2005, has been developed as the main instrument for implementing the National Strategy on Climate Change (NSCC) and transpose the NSCC's objectives in specific actions for the period 2005-2007. The NAPCC also establishes duties and responsibilities for each institution and identifies the actors that will be involved in each action, as well as the deadlines for implementation and financial resources.

Regarding the general environmental regulations that include climate change aspects, Romania adopted the most important legal acts, including:

- Governmental Emergency Ordinance no. 195/2005 on environmental protection, containing a special chapter regarding atmosphere protection, climate change, emissions trading, national registry, national inventory and the general requirements concerning the environmental permit, the control procedure, and other matters.
- Governmental Emergency Ordinance no. 243/2000 on atmosphere protection, as approved with amendments by Law no. 655/2001 represents the framework for

atmosphere protection aiming “to prevent, eliminate, limit deterioration and improve air quality, in order to avoid negative impacts on human health and the environment” (transposing the Air Quality Framework Directive and its “daughters”). The law required the establishment of the National System for Integrated Air Quality Assessment and Management (Governmental Decision no. 586/2004), coordinated by the Ministry of Environment and Water Management.
- Governmental Emergency Ordinance no. 152/2005 addresses integrated pollution prevention and control (transposing the EU IPPC Directive).

Climate change aspects are also presented in the Governmental Decisions regarding the establishment and operation of the Ministry of Environment and Water Management, the National Environmental Protection Agency and the Regional Environmental Protection Agencies.

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, organisation 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.

A number of new legal acts and regulatory changes will result from the implementation of the National Action Plan on Climate Change in the period 2006-2007, especially related to the EU Directive 2003/87/EC concerning the establishment of the EU Emissions Trading Scheme (EU ETS).

Present institutional framework

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

The Ministry of Environment and Water Management (MEWM) is the environmental protection public authority at the national level which was established on the basis of Governmental Emergency Ordinance no. 195/2005 for environmental protection and Governmental Decision no. 408/2004 with amendments and completion, having 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 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, the “Linking Directive” (Directive 2004/1014/EC); and
- chairing the National Commission on Climate Change.

The main responsibilities of the MEWM, through its Air Quality and Climate Change Directorate, concerning the coordination of the activities related to the implementation of UNFCCC and Kyoto Protocol are detailed in the internal regulation on organisation and functioning of the MEWM.

The MEWM 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 specialised body has legal status and it is subordinated to the MEWM. 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;
- development 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.

Proper implementation of the National Strategy and Action Plan on Climate Change depends on the close coordination between relevant ministries with responsibilities in developing and implementing sectorial policies, as follows:

- Ministry of Economy and Trade, (developing the energy and industry policies);
- Ministry of Agriculture, Forestry and Rural Development;
- Ministry of Finance;

- Ministry of Transport, Construction and Tourism;
- Ministry of Administration and Internal Affairs;
- Ministry of Foreign Affairs;
- Ministry of National Defence;
- Ministry of European Integration;
- Ministry of Health; and
- Ministry of Education and Research.

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 sectorial 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.

2.4 National Strategy and National Action Plan on Climate Change

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

With this Strategy, Romania has taken its first steps towards a targeted and coordinated national effort to limit GHG emissions and to deal with the climate change impacts that are to be expected. The Strategy outlines 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 on the future requirements resulting from the country's upcoming membership of the EU (including participation in the EU Emissions Trading Scheme) as well as from international commitments under the UNFCCC and its Kyoto Protocol.

Key issues and selected highlights include:

- Adaptation to climate change: The Strategy calls for action to improve knowledge and adopt no-regret and cost-effective precautionary adaptation measures

- Complying with international requirements from EU and UN: Romania intends to start trading under the ETS at the expected date of accession to the EU (1st January 2007) and proposed itself to comply with all reporting requirements

- Opportunities from the Kyoto Protocol and its flexible mechanisms: NSCC specifies the environmental and economic benefits for Romania by participating in the flexible mechanisms under the Kyoto Protocol. Romania will pursue JI Track I and II and

also intends to develop a framework for a Green Investment Scheme implementation.

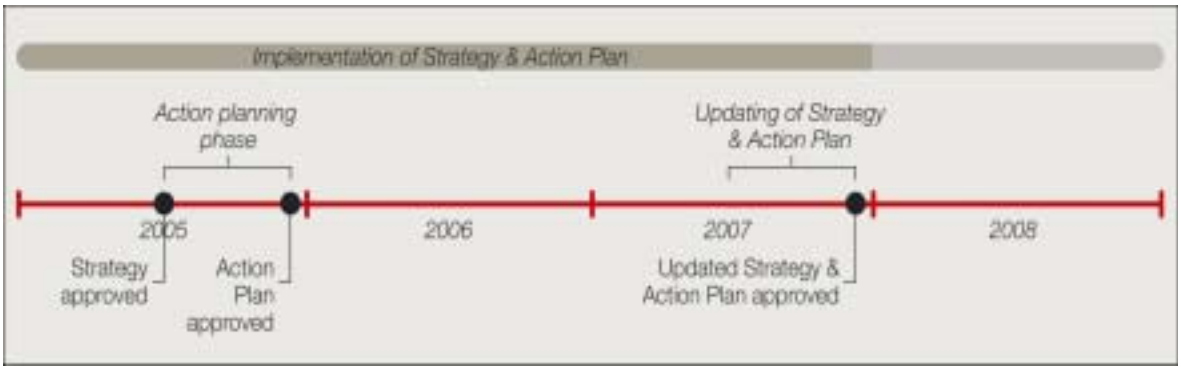
- Policies and measures to limit Romanian GHG emissions: Current emissions are well below the Kyoto target but are set to grow in the coming years. Policies and measures were identified that require a limited contribution from the state budget only while showing economic side-benefits.

- The political, institutional and legal framework for Romania's climate change activities

- Education, Research and Awareness

The NSCC has been developed under the responsibility of the MEWM in close cooperation with other ministries through the National Commission on Climate Change. The NSCC will form the framework for implementing Romania's climate change policies in the period 2005-2007. The process has been supported financially by the Danish Government through the Danish Environmental Protection Agency. Technical assistance has been provided by a team lead by Danish COWI with support from Dutch CAP-SD.

The time frame of the Strategy and its specific objectives cover the period until the end of 2007. The underlying policies and activities as further defined in the NAPCC will be carried out during the same period. In the assessment of the impact of the NSCC, a longer-term perspective is taken, in particular up to the end of the first commitment period of the Kyoto Protocol in 2012. This relatively short period was adopted because the rapid changes in the national economic situation and international climate change framework, particularly with Romania's accession to the European Union, will make an update of the NSCC by 2008 necessary.



The National Strategy on Climate Change of Romania has 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 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. This has been done under a technical assistance project funded by the Danish Environmental Protection Agency. 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.

Part II of the NAPCC presents in detail the Actions developed following the meetings of the four Working Groups created for the drafting of this document. The Working Groups covered four main topics:

- General reporting requirements and the National GHG Emissions Inventory (WG 1)
- Joint Implementation (JI) and Green Investments Scheme-GIS (WG 2)
- EU ETS (Dir. 2003/87/CE), GHG emission reduction policies and measures (WG 3)

- Adaptation, awareness, education and public participation (WG 4)

MEWM will annually make public a report on the state of NAPCC implementation. The results of implementation progress monitoring will be communicated to the members of the National Commission for Climate Change.

NAPCC is a dynamic instrument that will 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. Both documents will be updated in 2007, before the start of the first commitment period of the Kyoto Protocol, 2008-2012.

The detailed Actions of the NAPCC are 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

2.5 Joint Implementation Mechanism in Romania

The Kyoto Protocol allows Parties which ratify it to meet their GHG emissions reduction commitments by combining their domestic policies and measures with the three flexible mechanisms, known as:

- Joint Implementation (JI) - Art. 6
- Clean Development Mechanism (CDM) - Art. 12
- International Emissions Trading - Art. 17

The first two mechanisms are based on actual investment projects through which the Parties may reduce the costs of achieving their own GHG emissions reduction commitments benefiting from the opportunities of developing JI and CDM projects in other countries. These projects shall result in a reduction of GHG emissions or an enhancement of anthropogenic removals by sinks with lower costs comparing with achieving similar reduction in the investing countries. In this way the beneficiaries of the projects leading to GHG emissions reduction, are able to cover a part of the financial scheme by selling ERU's to the investing country involved in the project development.

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). In 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.

Although the Kyoto Protocol's flexible mechanisms are "voluntary", Romania got involved successfully in the development of "Joint Implementation" projects based on the cooperation with different countries, for the reduction of greenhouse gas emissions, being at this moment the most attractive country on JI, according to the Point Carbon Agency. Romania has initiated and continues to develop bilateral cooperation with different states, for the development of this type of projects.

Romania signed 8 Memoranda of Understanding with different developed countries (Switzerland, the Netherlands, Norway, Denmark, Austria, Sweden and France), as well as with the World Bank's Prototype Carbon Fund, representing the legal framework for the development of JI projects and is negotiating other 5 similar agreements.

Until now, 15 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 8.8 million tones of CO_2 equivalent (for the period 2008-2012, and in some cases before 2008), and the transfer will be performed by the MEWM after 2008, 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 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 could mean modernization, re-habilitation, energy efficiency and new technologies, in areas such 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 Joint implementation mechanism was used by Romania, as a host country, even since 2000, and the International Emissions Trading mechanism will be implemented starting with 2007 according with the National Strategy on Climate Change. Romania is not using at this moment and has no plans to use the third mechanism (Clean Development Mechanism), because it refers to the possibility of an Annex I country to invest in GHGs emissions reduction projects in developing countries (non-Annex I) and to get certified emission reductions generated by these projects.

By developing Joint implementation projects in Romania, developed countries achieve their commitments provided in the Kyoto Protocol with lower costs (comparing with the same reduction generated in the investing country), and Romania implements projects which provide environmental benefits, leading to rehabilitations of installations and GHGs emissions reduction in different sectors, such as: energy, industry, agriculture, transportation, waste management, etc. supporting both economical and social development. These mechanisms belong to the "win-win" policies, where both parties have advantages by implementing them. However, Parties need to take into consideration the supplementary principle of using these mechanisms against domestic mitigation policies and measures.

Although the mechanisms provided in the Kyoto Protocol are voluntary, Romania has involved successfully in GHGs emissions reductions projects resulting in energy efficiency improvement and environmental benefits.

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."

The JI projects are developing based on the clear procedures in accordance with those Tracks (Track I and Track II). Taking into account, in present the largest Party of the countries doesn't achieve the criteria for using the Track I, mostly probably the countries will develop, in the future, JI project based on Track II.

These two Tracks of presentations and approval 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

MEWM will realize a national procedure for approving projects and for monitoring and verifying GHG's emission reduction based on Track I.

Track II applies if host country is in accord once with only 3 conditions, as follow: is Party to the Kyoto Protocol, the assigned amount 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.

MEWM 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 under Track II.

NCCC acts as the main advisory body on JI approval advice to the MEWM. 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.

2.6 European Union Emissions Trading Scheme

EU Emission Trading Scheme (EU ETS) is a Community wide "cap & trade" scheme for the greenhouse gas emissions established by the EU Directive 2003/87/EC. The emission trading scheme is one of the key instruments for implementing EU commitments under the Kyoto Protocol (8% reduction in GHG emissions compared to 1990 levels). The first phase of this scheme commenced on January 1st 2005 and will end on 31st December 2007. The second phase will run from 2008 to 2012 as the first commitment period of the Kyoto Protocol

EU ETS is a market-based mechanism, aiming to reduce GHG emissions in an efficient and cost-effective manner. The scheme operates through the allocation and trade of greenhouse gas emissions allowances throughout the EU. One allowance represents one tone of carbon dioxide. Each Member State sets an overall limit or a "cap" on the total amount of emissions allowed from all sectors covered by the Directive (energy, industrial processes). The allowances are than distributed to each installation covered by the Directive within the sectors

The Directive 2003/87/EC has been transposed into the Romanian legislation by the Governmental Decision no. 780/2006. MEWM was designated through this Governmental Decision as the responsible institution for the coordination of EU ETS

implementation in Romania. One of the key tasks for its implementation is the preparation of the National Allocation Plan under the EU Emissions Trading Scheme (NAP) to be submitted to the European Commission. NAP determines the total amount of allowances that the Romanian Government intends to allocate and the way they will be allocated to individual installations. The Romanian NAP will cover the last year of the first trading period (2007) and the second trading period, 2008-2012. For efficiency reasons, Romania developed the two allocation plans in parallel in one single document using the same methodology and principles. The guidance provided by the European Commission for the second phase NAP has, therefore, been applied also for the allocation of the year 2007

The first NAP draft was published for consultations for 30 days (from 30th of August until 29th of September) before notifying it to the EC as required under Romanian legislation by Law 52/2003 regarding decisional transparency within public administration. As a direct result of the comments from the public, at the moment the analyses at the macroeconomic level are reviewed and amended by the MEWM experts.

2.7 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 September 2006, 72 companies and local authorities had received UNDP/GEF financed technical assistance - typically a Feasibility Study - or an equipment grant, or both, of which:

- **36** were 'successes' - meaning firm investment decisions had been taken, and $50 million of environmentally-friendly investments were about to start, under-way or complete.

- **25** were 'open', meaning that studies and analysis were ongoing or complete, but that a firm investment decision had not yet been taken. It is reasonable to assume that several of these will become 'definite' investments in due course.

- **11** were 'closed', meaning that investment was considered unlikely to take place, for technical, economic or financial reasons, or as financial decision-makers had changed, or investment priorities had changed.

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 36 'successes' represented CO_2 savings of 126,250 tonnes per year.

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, organisations 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 (RUE). 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.

The Romanian Energy Efficiency Fund project portfolio is presented below as per 1st October 2006.

No	Client	Project (Commissioning Date)	Investment (US$)		Estimated Annual Performances	
			Total Size (10^3 US$)	FREE Loan (10^3 US$)	Energy Savings (toe/year)	CO_2 emission reduction (ton/year
1	UNIO SA Satu Mare	Replacement of old reciprocating air compressors with highly efficient screw air compressors	**290**	**130**	**440**	**1,530**
2	TRANSGEX SA Oradea	Modernization of the geothermal substation and its 5 DH thermal substation and related distribution networks	**1,178**	**425**	**5,800**	**14,160**
3	CET SA Iasi	Modernization of 4 DH thermal substation and related distribution networks	**1,250**	**980**	**937**	**3,550**
4	ULEROM SA Vaslui	Installation of a new sunflower husk fired boiler for steam generation (biomass)	**560**	**448**	**621**	**1,487**
5	SOMES SA Dej	Modernization of the steam and condensate system to the paper machine and Implementation of an Energy Monitoring System (*October 2006)	**940**	**752**	**1,130**	**2,807**
6	ROVINARI Local Council	Modernization of the public outdoor lighting system	**125**	**100**	**47**	**182**
7	DOROHOI Local Council	Modernization of the public outdoor lighting system	**268**	**209**	**172**	**388**
8	BRAN Local Council	Modernization of the public outdoor lighting system	**125**	**100**	**97**	**373**
9	UNIO SA Baia Mare	Modernization of local heating and installation of radiant tubes (2006)	**257**	**206**	**957**	**2,911**
10	ARC SRL Dorohoi	Modernization of technological equipment for glass and porcelain manufacturing(2006)	**514**	**400**	**898**	**2,218**
11	EMINESCU Local Council	Modernization of the public outdoor lighting system (2006)	**168**	**135**	**44**	**171**
12	PECICA Local Council	Modernization of the public outdoor lighting system (2006)	**250**	**200**	**105**	**405**
13	STEAUA ROMANA SA Refinery Campina	Installation of a new natural gas fired boiler for saturated steam generation (2006)	**580**	**460**	**1,368**	**3,257**
14	COUNTY Clinic Hospital Oradea	Installation of a new wooden pellets fired boiler for steam generation (2007)	**405**	**324**	**187**	**445**
TOTAL			**6,910**	**4,869**	**12,803**	**33,884**

Green Investment Scheme Study

The concept of a green investment scheme (GIS) is relatively new. It 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.

Experience in this field is limited — no country has implemented such a scheme yet, and only two studies are currently available (the World Bank study for Bulgaria and the *Russian Green Investments Scheme — Securing Environmental Benefits From International Emissions Trading*).

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 Water Management 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 will be followed by a real implementation of a GIS in Romania.

“Redusere” database for GHG emissions reduction projects

PricewaterhouseCoopers has been commissioned by the Romanian Ministry of Environment and by the French Ministry of Finance to assist the Romanian Authorities in the setting up of a database dedicated to the inventory of potential Joint Implementation and other GHG emissions reduction projects in Romania, funding being provided by France based on the bilateral Memorandum of Understanding between the two countries on developing JI projects.

Objectives of the project

- Development of a database that will:
  - Enable the systematic inventory of all GHG emissions reduction projects
  - Act as a decision tool to enable the Romanian administration, once the project data has been entered, to deal with the application of the project and instruct it in its different phases
  - Enable the Romanian administration to have an overview on the typology of the GHG projects underway, for management and communication purposes (e.g.: statistics on the typology of projects)
  - Provide publicly available information on the GHG emission reduction projects via a web-interface so that interested parties via a web-interface (or foreign potential investors) can advertise information on their projects
  - Enable foreign investors to identify potential GHG emission reduction projects awaiting to be developed and enable approval and attribution of these projects to different investors
- Organize seminars raising interest around JI and the JI database, both in Romania and in France, so that the database becomes a “living tool” that is fed in with information and so that interested parties can contact each other

General characteristics of the database

- Enable expert processing potential GHG emission reduction projects to:
  - Log in relevant information on a project at each stage of its lifecycle
  - Process a project from one stage to the next as it progresses along its lifecycle (e.g.: identification, screening, validation, implementation and monitoring, closing up of the file)
  - Provide ‘check-points’ where the database checks that a number of criteria are met in order to a project to go on to the next stage
  - Attach relevant files under different formats (*.pdf, *.xls, etc)
- Enable storage of information in predefined fields concerning projects in all stages
- Provide secured and restricted access to the information stored in the database
- Offer a web-interface to explain the objective of the database and display/advertise publicly available information on projects
- Give the possibility to interface with other databases

The typology of projects identified so far is:
- Joint Implementation projects under development (Track 1 and Track 2)
- Joint Implementation projects seeking international partners (not yet developed)
- Green Investment Schemes projects

The project will be finalized in 2007 and advertised accordingly.

Chapter 5. Projections and Assessment of Measures Effects to Mitigate GHG Emissions

1. Introduction

This chapter was prepared by the Institute for Studies and Power Engineering (ISPE) based on a contract with the Ministry of Environment and Water Management for the preparation of a research study on the GHG emissions projections related to the implementation of the EU Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community (EU ETS) that covered also the sectors not included in EU ETS.

Projections and assessment of measures effects to mitigate GHG emissions were prepared taking into consideration the strategic objective of reducing the economic discrepancy between Romania and the European Union member state countries, based on the upcoming accession to the EU on 1st January 2007.

The Romanian Government's policy after the year 2000 was mainly based on the need to sustain an accelerated growth of GDP. The GDP growth trend in the period 2000-2005 is presented in table 1.

Table 1. The GDP growth trend in the period 2000-2015

	2000	2001	2002	2003	2004	2005
GDP growth (%)	100.0	106.1	111.7	118.0	128.7	134.1

The average GDP growth rate over the period 2000-2005 amounts to 5.86%. The contribution of industry in the total GDP shows a decreasing trend.

Macroeconomic and energy related indicators of Romania during the period 2000-2020 were determined taking into consideration the GDP growth and the Romanian Government's economic and social policies and measures. In the following table "base scenario" means "without measures" scenario and "alternative scenario" means "with measures" scenario.

Table 2. Macroeconomic and energy indicators of Romania during the period 2000 - 2020

	U.M.	2000	2001	2002	2003	2004	2005	2010	2015	2020
		Achievements						Forecast		
Base scenario										
1. Population	10^6 inh.	**22.43**	**22.40**	**21.79**	**21.73**	**21.71**	**21.70**	**21.20**	**20.80**	**20.50**
2. Gross Domestic Product (GDP)	10^9 $Euro_{2005}$	**59.13**	**62.70**	**66.00**	**69.77**	**76.09**	**79.26**	**103.59**	**132.21**	**164.82**
GDP/inhabitant	$Euro_{2005}$/inhabitant	2636	2799	3029	3211	3505	3653	4886	6356	8040
3. Final energy consumption	10^6 toe	**22.17**	**22.44**	**23.37**	**25.15**	**27.33**	**28.93**	**30.08**	**33.50**	**37.50**
final consumption/inhabitant	toe/inhabitant	0.988	1.002	1.073	1.157	1.259	1.333	1.419	1.611	1.829
4. Final electricity consumption	TWh	**43.40**	**45.36**	**44.85**	**47.22**	**49.24**	**50.23**	**57.05**	**64.47**	**72.86**
final consumtion/inhabitant	10^3kWh/inhabitant	1.935	2.025	2.058	2.173	2.268	2.315	2.691	3.100	3.554
Alternative scenario										
1. Population	10^6 inh.	**22.43**	**22.40**	**21.79**	**21.73**	**21.71**	**21.70**	**21.20**	**20.80**	**20.50**
2. Gross Domestic Product (GDP)	10^9 $Euro_{2005}$	**59.13**	**62.70**	**66.00**	**69.77**	**76.09**	**79.26**	**99.08**	**123.85**	**154.82**
GDP/inhabitant	$Euro_{2005}$/inhabitant	2636	2799	3029	3211	3505	3653	4674	5954	7552
3. Final energy consumption	10^6 toe	**22.17**	**22.44**	**23.37**	**25.15**	**27.33**	**28.93**	**30.80**	**33.00**	**36.50**
final consumtion/inhabitant	toe/inhabitant	0.988	1.002	1.073	1.157	1.259	1.333	1.453	1.587	1.780
4. Final electricity consumption	TWh	**43.40**	**45.36**	**44.85**	**47.22**	**49.24**	**50.23**	**55.05**	**61.43**	**69.56**
final consumtion/inhabitant	10^3kWh/inhabitant	1.935	2.025	2.058	2.173	2.268	2.315	2.597	2.953	3.393

Considering the "without measures" scenario, gross electricity production structure for the period 2005-2020 is presented in table 3 taking into consideration the installed power structure presented in table 4.

Table 3. Gross electricity production structure

TWh

	2005	2010	2015	2020
TOTAL	**20.2**	**67.6**	**76.5**	**84.9**
Hydro power plants	20.2	16.0	18.0	19.0
Nuclear power plants	5.5	11.0	16.5	16.5
Thermal power plants	33.7	40.6	42.0	49.4
of which in unit on:				
- Coal	21.3	29.6	31.0	33.0
- Hydrocarbons	12.4	11.0	11.0	16.4

Table 4. Installed power structure

MW

	2005	2010	2015	2020
TOTAL	**15,691**	**16,838**	**18,455**	**20,455**
Hydro power plants	6,181	6,381	6,581	7,081
Nuclear power plants	707	1,414	2,121	2,121
Thermal power plants	8,803	9,043	9,753	11,253
of which in unit on:				
- Coal	5,269	5,329	5,329	6,329
- Hydrocarbons	3,534	3,714	4,424	4,924

***Note**: The figures given for the period 2005-2015 are presented in the Road Map for energy sector in Romania.*

Table 5 presents the evolution of energy intensity in various sectors considering the "without measures" scenario.

Table 5. Evolution of energy intensity considering the "without measures" scenario

%

	2005	2010	2015	2020
Agriculture	100.0	98.4	95.6	92.4
Construction	100.0	94.8	89.3	84.3
Mining industry	100.0	97.8	95.2	92.9
Manufacturing industry				
1 Basic material	100.0	86.0	77.0	69.1
1 Machinery and equipment	100.0	85.0	76.7	71.8
1 Other industry	100.0	85.7	77.5	73.8

2. Hypotheses for "Without Measures", "With Measures" and "With Additional Measures" Scenarios

The possible evolution of the GHG emissions has been determined for both energy and non-energy sectors, considering mostly the EU Emissions Trading Scheme sectors.

The following fields of activity have been studied for the non-energy sector:

- agriculture - CH_4 emissions from enteric fermentation and manure management and N_2O emissions from using natural and chemical fertilizers;
- industry - emissions resulting in industrial processes;
- forestry - atmospheric carbon sequestration options;
- solvents and other products - emissions have been determined in correlation with the economic and technological evolution;
- waste - the management options for liquid and solid waste.

The following sub-sectors have been analyzed in the energy sector:

- energy supply from Romania and imports;
- energy conversion - refineries, coke factories, production of electricity and heat;
- energy consumers.

2.1 "Without Measures" Scenario

The forecast of GHG emission has been determined taking into consideration the various hypotheses related to the evolution of activities in the energy sector, which is the most important in the overall GHG emissions in Romania, and the other non-energy sectors.

Energy sector

For the energy supply the following assumptions were made:

- total (maximum) domestic energy resources (including nuclear) are about 24 mil. toe per year for the period 2005 – 2015;
- the quantity of lignite used is about 6.1 mil. toe in the period 2005 – 2015;
- the quantity of used hard coal is about 1.2 mil. toe in the period 2005 – 2015;
- the renewable energy represents about 5% from the total energy resources;
- the import of crude oil and natural gas will be achieved in order to cover the consumers demand;
- the demand of oil products will be assured by refining both the Romanian and imported crude oil in the country;
- the imported quantity of natural gas will increase from 5.8 bill. m^3 in 2004 up to 14.4 bill. m^3 in 2020;
- the nuclear energy program will be continued at Cernavoda Nuclear Power Plant by starting the operation at unit no. 2 in 2006-2007 and unit no. 3 up to 2015;
- the additional economically feasible hydropower generation capacity, estimated at 500-900 MW, will be put in operation in the period 2005 – 2020;
- the new electricity generation capacities will be built and the old capacities will be rehabilitated or retired;
- the modernization of cogeneration plants as well as the programme for achieving new capacities on natural gas.

Table 6 Evolution of installed power for new capacities and retired capacities

MW

Sector	2003-2005		2006-2010		2011-2015		2016-2020	
	New	Retired	New	Retired	New	Retired	New	Retired
Hydro	129		200		200		500	
- New	99	-	200	-	200	-	500	-
- Rehabilitation	30							

Thermal	555		3505		710		1500	
- New		1280	1455	2185	500	-	1500	-
- Rehabilitation	555		2060		210		-	
Nuclear			707		707		-	
Total	**1284**	**1280**	**4412**	**2185**	**1617**	**-**	**2000**	**-**

Note*: The figures given for the period 2003-2015 are presented in the Road Map for the energy sector in Romania.*

The assumptions for the consumption energy sectors are established based on the specific features of the consumers.

The assumptions for households are:

- the decrease of persons per dwelling up to 2.445 in 2020;
- the reduction of the useful energy consumption for house cooking of about 4% during 15 years due to the use of modern cooking methods by the gradual replacement of non-commercial fuels with industrial fuels allowing their utilization in higher efficiency dives;
- the increase of hot water consumption per dwelling by 11% until 2020;
- the increase of the electricity consumption per dwelling with about 100% until 2020 in comparison with the consumption in 2000;
- the improving of thermal insulation degree of residences which determines the reduction of average energy demand by 5% on the forecasted period.

The assumptions in the services sector are:

- the specific consumption reduction of electricity by 20% for old buildings and by 5% for new buildings;
- a specific consumption reduction for thermal energy in new buildings due to a good insulation by about 20% compared to old buildings.

In the transport sectors the development of the activities (goods transport, passengers interurban transport, passengers urban transport) is correlated with the increase of the value added in industry during the period 2005 – 2020, the population evolution, the mobility degree increase and the increase of car participation compared with the passenger transport. The assumptions in this sector are:

- the motor fuel consumption/ton*kilometer is considered to be reduced in the period 2005 – 2020 as following:
  - ∉ by 7% for trucks used for local transport;
  - ∉ by 10% for long distance transport;
  - ∉ by 20% for Diesel transport;
  - ∉ by 18% for electric transport;
- the average motor fuel consumption of a car will decrease in the period 2005 – 2020 by 5% for interurban transport and by 4% for urban transport;
- the average motor fuel consumption of a bus will decrease in the period 2005 - 2020 by 15% for interurban transport and by 8% for urban transport.

Non-energy sectors

The hypotheses taken into account in the agriculture sector are:

- the agricultural area is about 14.9 mil. ha, out of which 63% arable land, 23% pastures, 10% hayfields, 2% vineyards, 2% orchards;
- 60% of agricultural residues are incorporated in soil, 25% are used as animal food, 15% are used in industry;
- the amount of chemical fertilizers per land unit will increase progressively as following: about 280 thou. tons of nitrogenous fertilizers will be used in 2020 in comparison with 239 thou. tons used in 2002;
- the livestock populations will increase in the following mode:
    - ∉ cattle from 2,878 thou. heads in 2003 at 4,600 thou. heads in 2020;
    - ∉ pigs from 5,058 thou. heads in 2003 at 8,000 thou. heads in 2020;
    - ∉ sheep and goats from 7,945 thou. heads in 2003 at 10,000 thou. heads in 2020;
    - ∉ poultry from 77,379 thou. heads in 2003 at 111,000 thou. heads in 2020.

The hypotheses in the forest systems are presented below:

- the forests area is relatively constant, about 6.4 mil. ha until 2020;
- the harvested wood volume will increase from 16.4 mil. m^3 in 2002 to 18 mil. m^3 in 2020;
- the afforestations and reforestations will increase from 16,448 ha in 2002 to about 200,000 ha in 2020;
- all works necessary to regenerate and clean the forests shall be made including the following cutting wood areas:
    - ∉ about 55,000 ha regeneration of the cutting wood covered area;
    - ∉ about 80,000 ha for forest cleaning operations;
    - ∉ about 25,000 ha for attendance cuttings in young forests;
    - ∉ about 50,000 ha for accidental cuttings.

The assumptions in the industry sector are related to the evolution of the main industrial processes. Thus, the production parameters for cast-iron, steel, aluminum, other non-ferrous metals, chemical fertilizers, other chemical products, and cement represent the essential elements that were analyzed for the establishment of GHG emissions projections.

The quantity and quality of the waste are determined in accordance with the increase of the living standard in the period 2005 - 2020. The main elements consist in the growth of the urbanization rate, the growth of water consumption per house by refurbishing the drinkable water network in the places where it exists and extending it to other new areas, also raising the services standard by expanding the responsibility for cleaning the environment and the populated areas.

2.2 "With Measures" and "With Additional Measures" Scenarios

The measures for the GHG emissions reduction have been established on each activity sector taking into consideration various options, but different indirect measures to be developed in the future could have an important effect on Romania's GHG emissions.

Energy sector

The increase of natural gas imported, the development of the nuclear programme and the increase of the hydropower and other renewable sources share in the energy production have been considered as alternatives in the energy supply and electricity generation sector. The development of the industrial and urban cogeneration plants by increasing the output with about 500 MW until 2020 were also taken into consideration in the conditions of the heat loses reduction by about 20% in the same period.

In the consumption sectors an alternative was considered in the reduction of energy intensity in accordance with the Road Map for the energy sector in Romania. In the energy efficiency strategy, the overall energy intensity is to be reduced by 30 – 50% till the year 2015 in a complex process, which involves replacements of the high-energy consumption technologies in a structural adjustment of the economy.

Non-energy sectors

Two basic options were chosen in the forestry sector, considering the process of carbon sequestration, namely the increase of areas covered by forests with about 100 - 200 thou. ha until 2020 and the implementation of special measures in relation with the forest management in order to create optimum structures.

Several activities were considered in order to reduce the methane emission from the enteric fermentation in the agriculture sector and the most important could be the improvement of the nutrition quality by increasing the protein share and the improvement of the livestock performances. The decrease of nitrogenous fertilizers utilization is also considered in order to reduce the N_2O emissions due to the concentrated agricultural land and the economically consolidated farms.

Using new and modern installations and investments for environmental protection are considered in the industrial processes sector in order to reduce the GHG emissions.

3. Projections of CO_2 Emissions

Tables 7, 8 and 9 provide the outcomes of running the three scenarios (without measures, with measures and with additional measures). CO_2 emissions coming from energy sector and non-energy sectors are presented in these tables.

Table 7. Summary of anthropogenic CO_2 emission projections for "without measures" scenario

Gg CO_2/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**95,621.2**	**100,380.4**	**107,626.0**	**113,049.8**	**116,360.5**	**119,259.5**	**160,711.1**	**180,095.6**	**202,399.6**
out of which:									
> Energy sector (fossil fuel combustion)	**82,803.1**	**87,547.2**	**93,980.7**	**98,631.5**	**101,220.7**	**103,426.0**	**136,807.0**	**155,029.0**	**174,848.0**
- Energy industries	46,122.3	49,251.5	49,997.3	51,877.2	48,405.3	49,170.0	72,000.0	79,380.0	87,978.0
- Manufacturing & Construction	18,752.4	19,263.6	22,947.5	23,852.7	24,662.6	25,175.0	29,960.0	36,252.0	42,780.0
- Transportation	9,637.2	11,203.2	12,090.4	12,197.0	16,945.2	17,111.0	19,800.0	21,980.0	24,130.0
- Other sectors	8,291.2	7,828.9	8,945.5	10,704.6	11,207.6	11,970.0	15,047.0	17,417.0	19,960.0
> Industry processes	**12,586.3**	**12,623.1**	**13,365.8**	**14,128.9**	**14,853.6**	**15,540.0**	**23,600.0**	**24,752.0**	**27,227.0**
> Solvent and other product use	**224.3**	**200.5**	**270.0**	**279.9**	**277.4**	**285.0**	**295.0**	**305.0**	**315.0**
> Agriculture	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
> Waste	**7.54**	**9.56**	**9.50**	**9.52**	**8.80**	**8.50**	**9.13**	**9.60**	**9.60**

Table 8. Summary of anthropogenic CO_2 emission projections for "with measures" scenario

Gg CO_2/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**95,621.2**	**100,380.4**	**107,626.0**	**113,049.8**	**116,360.5**	**119,259.5**	**148,689.1**	**164,319.4**	**183,359.5**
out of which:									
> Energy sector (fossil fuel combustion)	**82,803.1**	**87,547.2**	**93,980.7**	**98,631.5**	**101,220.7**	**103,426.0**	**126,240.0**	**140,440.0**	**156,700.0**
- Energy industries	46,122.3	49,251.5	49,997.3	51,877.2	48,405.3	49,170.0	65,000.0	70,000.0	75,000.0
- Manufacturing & Construction	18,752.4	19,263.6	22,947.5	23,852.7	24,662.6	25,175.0	28,300.0	34,100.0	40,500.0
- Transportation	9,637.2	11,203.2	12,090.4	12,197.0	16,945.2	17,111.0	18,900.0	20,190.0	22,950.0
- Other sectors	8,291.2	7,828.9	8,945.5	10,704.6	11,207.6	11,970.0	14,040.0	16,150.0	18,250.0
> Industry processes	**12,586.3**	**12,623.1**	**13,365.8**	**14,128.9**	**14,853.6**	**15,540.0**	**22,150.0**	**23,570.0**	**26,340.0**
> Solvent and other product use	**224.3**	**200.5**	**270.0**	**279.9**	**277.4**	**285.0**	**290.0**	**300.0**	**310.0**
> Agriculture	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
> Waste	**7.54**	**9.56**	**9.50**	**9.52**	**8.80**	**8.50**	**9.10**	**9.40**	**9.50**

Table 9. Summary of anthropogenic CO_2 emission projections for "with additional measures" scenario

Gg CO_2/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**95,621.2**	**100,380.4**	**107,626.0**	**113,049.8**	**116,360.5**	**119,259.5**	**139,499.1**	**156,839.4**	**175,119.5**
out of which:									
> Energy sector (fossil fuel combustion)	**82,803.1**	**87,547.2**	**93,980.7**	**98,631.5**	**101,220.7**	**103,426.0**	**118,700.0**	**134,380.0**	**149,850.0**
- Energy industries	46,122.3	49,251.5	49,997.3	51,877.2	48,405.3	49,170.0	61,000.0	66,500.0	71,200.0
- Manufacturing & Construction	18,752.4	19,263.6	22,947.5	23,852.7	24,662.6	25,175.0	27,100.0	32,980.0	39,050.0
- Transportation	9,637.2	11,203.2	12,090.4	12,197.0	16,945.2	17,111.0	17,350.0	19,200.0	22,100.0
- Other sectors	8,291.2	7,828.9	8,945.5	10,704.6	11,207.6	11,970.0	13,250.0	15,700.0	17,500.0
> Industry processes	**12,586.3**	**12,623.1**	**13,365.8**	**14,128.9**	**14,853.6**	**15,540.0**	**20,500.0**	**22,150.0**	**24,950.0**
> Solvent and other product use	**224.3**	**200.5**	**270.0**	**279.9**	**277.4**	**285.0**	**290.0**	**300.0**	**310.0**
> Agriculture	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
> Waste	**7.54**	**9.56**	**9.50**	**9.52**	**8.80**	**8.50**	**9.10**	**9.40**	**9.50**

The projected CO_2 emissions in 2020 will exceed the CO_2 emissions level estimated for the base year, 1989 considering only the “without measures” scenario. For the other two scenarios projections for the CO_2 emissions show that the difference in the year 2020 comparing with 1989 is 6% below in the “with measures” scenario and 11% below in the “with additional measures” scenario. Thus, the emissions reduction target taken by Romania under the Kyoto Protocol in the period 2008-2012 will be observed taking into account the CO_2 emissions level in 2010, which were projected to be around 70-80% of the base year level.

It should be also highlighted the important projected increase of the energy sector emissions after 2005 mostly due to the fossil fuels combustion and the use of domestic energy resources as lignite and hard coal.

4. Projections of CH_4 Emissions

The projections of CH_4 emissions from fossil fuel combustion considering all three scenarios are presented in the tables 10, 11 and 12.

Table 10. CH_4 emissions from fossil fuel combustion for "without measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**36.40**	**29.18**	**30.68**	**36.04**	**42.43**	**44.38**	**47.06**	**50.37**	**53.00**
out of which:									
- Energy industries	0.88	0.94	1.02	0.92	0.92	0.95	0.99	1.05	1.10
- Manufacturing & Construction	1.73	1.73	2.11	2.49	2.26	2.61	2.89	3.13	3.32
- Transportation	1.37	1.93	1.99	1.88	2.67	3.14	3.62	3.86	4.02
- Other sectors	32.42	24.58	25.56	30.75	36.58	37.68	39.56	42.33	44.56

Table 11. CH_4 emissions from fossil fuel combustion for "with measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**36.40**	**29.18**	**30.68**	**36.04**	**42.43**	**44.38**	**46.05**	**49.38**	**51.29**
out of which:									
- Energy industries	0.88	0.94	1.02	0.92	0.92	0.95	0.97	1.02	1.07
- Manufacturing & Construction	1.73	1.73	2.11	2.49	2.26	2.61	2.80	3.03	3.17
- Transportation	1.37	1.93	1.99	1.88	2.67	3.14	3.48	3.63	3.85
- Other sectors	32.42	24.58	25.56	30.75	36.58	37.68	38.80	41.70	43.20

Table 12. CH_4 emissions from fossil fuel combustion for "with additional measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**36.40**	**29.18**	**30.68**	**36.04**	**42.43**	**44.38**	**45.12**	**48.30**	**50.29**
out of which:									
- Energy industries	0.88	0.94	1.02	0.92	0.92	0.95	0.97	1.00	1.04
- Manufacturing & Construction	1.73	1.73	2.11	2.49	2.26	2.61	2.75	2.93	3.01
- Transportation	1.37	1.93	1.99	1.88	2.67	3.14	3.40	3.57	3.74
- Other sectors	32.42	24.58	25.56	30.75	36.58	37.68	38.00	40.80	42.50

Tables 13, 14 and 15 present the projections of CH_4 fugitive emissions from fossil fuels considering all three scenarios.

Table 13. Fugitive emissions CH_4 for "without measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**532.71**	**520.44**	**521.78**	**527.18**	**518.12**	**548.90**	**696.20**	**699.58**	**705.85**
out of which:									
Solid Fuels	141.16	137.44	145.90	128.78	122.88	143.20	260.80	259.68	250.45
Oil and Natural gas	391.55	383.00	375.88	398.40	395.24	405.70	435.40	439.90	455.40

Table 14. Fugitive emissions CH_4 for "with measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**532.71**	**520.44**	**521.78**	**527.18**	**518.12**	**548.90**	**655.75**	**671.50**	**693.10**
out of which:									
Solid Fuels	141.16	137.44	145.90	128.78	122.88	143.20	230.70	240.70	248.00
Oil and Natural gas	391.55	383.00	375.88	398.40	395.24	405.70	425.05	430.80	445.10

Table 15. Fugitive emissions CH_4 for "with additional measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total emissions	**532.71**	**520.44**	**521.78**	**527.18**	**518.12**	**548.90**	**605.50**	**638.00**	**659.50**
out of which:									
Solid Fuels	141.16	137.44	145.90	128.78	122.88	143.20	200.50	225.50	234.90
Oil and Natural gas	391.55	383.00	375.88	398.40	395.24	405.70	405.00	412.50	424.60

Projections of CH_4 emissions from industrial processes, agriculture, and waste management are presented in the tables 16, 17 and 18 considering all three scenarios.

Table 16. CH_4 emissions from industry processes

$GgCH_4$/year

Year / Scenario	2000	2001	2002	2003	2004	2005	2010	2015	2020
"Without measures"	0.99	0.79	0.91	1.82	1.41	1.53	1.75	1.94	2.12
"With measures"	0.99	0.79	0.91	1.82	1.41	1.53	1.65	1.77	1.98
"With additional measures"	0.99	0.79	0.91	1.82	1.41	1.53	1.59	1.65	1.71

Table 17. Projections CH_4 emissions in agriculture

$GgCH_4$/year

Year / Scenario	2000	2001	2002	2003	2004	2005	2010	2015	2020
"Without measures"	369.81	341.97	334.38	341.93	350.45	355.00	405.00	446.00	468.00
"With measures"	369.81	341.97	334.38	341.93	350.45	355.00	382.00	400.00	426.00
"With additional measures"	369.81	341.97	334.38	341.93	350.45	355.00	368.00	380.00	402.00

Table 18. CH_4 emissions from waste management

$GgCH_4$/year

Year / Scenario	1998	1999	2000	2001	2002	2005	2010	2015	2020
"Without measures"	284.73	348.65	352.50	358.85	370.40	374.10	403.32	461.60	507.00
"With measures"	284.73	348.65	352.50	358.85	370.40	374.10	388.20	423.30	467.00
"With additional measures"	284.73	348.65	352.50	358.85	370.40	374.10	382.70	392.50	427.00

The aggregated projections of the CH_4 emissions are presented in the tables 19 -21.

Table 19. Summary of CH_4 emission projections for "without measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Fuel combustion	36.40	29.18	30.68	36.04	42.43	44.38	47.06	50.37	53.00
Fugitive combustion	532.71	520.44	521.78	527.18	518.12	548.90	696.20	699.58	705.85
Industry processes	0.99	0.79	0.91	1.82	1.44	1.53	1.75	1.94	2.12
Agriculture	369.81	341.97	334.38	341.93	350.45	355.00	405.00	446.00	468.00
Waste management	284.73	348.65	352.50	358.85	370.40	374.10	403.32	461.60	507.00
Total	**1224.64**	**1241.03**	**1240.25**	**1265.82**	**1282.84**	**1323.91**	**1553.33**	**1659.49**	**1735.97**

Table 20. Summary of CH_4 emission projections for "with measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Fuel combustion	36.40	29.18	30.68	36.04	42.43	44.38	46.05	49.38	51.29
Fugitive combustion	532.71	520.44	521.78	527.18	518.12	548.90	655.75	671.50	693.10
Industry processes	0.99	0.79	0.91	1.82	1.44	1.53	1.65	1.77	1.98
Agriculture	369.81	341.97	334.38	341.93	350.45	355.00	382.00	400.00	426.00
Waste management	284.73	348.65	352.50	358.85	370.40	374.10	388.20	423.30	467.00
Total	**1224.64**	**1241.03**	**1240.25**	**1265.82**	**1282.84**	**1323.91**	**1473.65**	**1545.95**	**1639.37**

Table 21. Summary of CH_4 emission projections for "with additional measures" scenario

$GgCH_4$/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Fuel combustion	36.40	29.18	30.68	36.04	42.43	44.38	45.12	48.30	50.29
Fugitive combustion	532.71	520.44	521.78	527.18	518.12	548.90	605.50	638.00	659.50
Industry processes	0.99	0.79	0.91	1.82	1.44	1.53	1.59	1.65	1.71
Agriculture	369.81	341.97	334.38	341.93	350.45	355.00	368.00	380.00	402.00
Waste management	284.73	348.65	352.50	358.85	370.40	374.10	382.70	392.50	427.00
Total	**1224.64**	**1241.03**	**1240.25**	**1265.82**	**1282.84**	**1323.91**	**1402.91**	**1460.45**	**1540.50**

It is worth mentioning the projected increase of CH_4 emissions from all sectors. The most important sources of CH_4 emissions remain oil and natural gas and agriculture sectors.

5. Projections of N_2O Emissions

Projections of N_2O emissions from fossil fuel combustion, industrial processes, agriculture and waste management are presented in the tables 22 to 25 considering all three scenarios.

Table 22. N_2O emissions from fossil fuel combustion

GgN_2O/year

Year / Scenario	2000	2001	2002	2003	2004	2005	2010	2015	2020
"Without measures"	1.13	1.08	1.17	1.29	1.36	1.40	1.54	1.65	1.74
"With measures"	1.13	1.08	1.17	1.29	1.36	1.40	1.52	1.63	1.69
"With additional measures"	1.13	1.08	1.17	1.29	1.36	1.40	1.49	1.58	1.64

Table 23. N_2O emissions from industry processes

GgN_2O/year

Year / Scenario	2000	2001	2002	2003	2004	2005	2010	2015	2020
"Without measures"	6.54	8.83	8.87	8.76	10.21	10.54	14.86	16.56	18.49
"With measures"	6.54	8.83	8.87	8.76	10.21	10.54	13.25	15.99	17.20
"With additional measures"	6.54	8.83	8.87	8.76	10.21	10.54	12.78	14.91	15.90

Table 24. N_2O emissions from agriculture

GgN_2O/year

Year / Scenario	2000	2001	2002	2003	2004	2005	2010	2015	2020
"Without measures"	12.43	19.22	12.91	15.37	21.20	21.84	24.92	27.56	30.27
"With measures"	12.43	19.22	12.91	15.37	21.20	21.84	22.70	25.20	27.40
"With additional measures"	12.43	19.22	12.91	15.37	21.20	21.84	21.90	23.50	25.70

Table 25. N_2O emissions from waste management

GgN_2O/year

Year / Scenario	2000	2001	2002	2003	2004	2005	2010	2015	2020
"Without measures"	2.14	2.14	2.09	2.07	2.07	2.09	2.13	2.17	2.20
"With measures"	2.14	2.14	2.09	2.07	2.07	2.09	2.10	2.14	2.17
"With additional measures"	2.14	2.14	2.09	2.07	2.07	2.09	2.09	2.12	2.15

The aggregated projections of N_2O emissions are presented in the tables 26, 27 and 28 considering all three scenarios. The most important projected N_2O emissions source remains the agriculture sector.

Table 26. Summary of N_2O emission projections for "without measures" scenario

GgN_2O/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Fuel combustion	1.13	1.08	1.17	1.29	1.36	1.40	1.54	1.65	1.74
Industry processes	6.54	8.83	8.87	8.76	10.21	10.54	14.86	16.56	18.49
Agriculture	12.43	19.22	12.91	15.37	21.20	21.84	24.92	27.56	30.27
Waste	2.14	2.14	2.09	2.07	2.07	2.09	2.13	2.17	2.20
Total	**22.24**	**31.27**	**25.04**	**27.49**	**34.84**	**35.87**	**43.45**	**47.94**	**52.70**

Table 27. Summary of N_2O emission projections for "with measures" scenario

GgN_2O/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Fuel combustion	1.13	1.08	1.17	1.29	1.36	1.40	1.52	1.63	1.69
Industry processes	6.54	8.83	8.87	8.76	10.21	10.54	13.25	15.99	17.20
Agriculture	12.43	19.22	12.91	15.37	21.20	21.84	22.70	25.20	27.40
Waste	2.14	2.14	2.09	2.07	2.07	2.09	2.10	2.14	2.17
Total	**22.24**	**31.27**	**25.04**	**27.49**	**34.84**	**35.87**	**39.57**	**44.96**	**48.46**

Table 28. Summary of N_2O emission projections for "with additional measures" scenario

GgN_2O/year

	2000	2001	2002	2003	2004	2005	2010	2015	2020
Fuel combustion	1.13	1.08	1.17	1.29	1.36	1.40	1.49	1.58	1.64
Industry processes	6.54	8.83	8.87	8.76	10.21	10.54	12.78	14.91	15.90
Agriculture	12.43	19.22	12.91	15.37	21.20	21.84	21.90	23.50	25.70
Waste	2.14	2.14	2.09	2.07	2.07	2.09	2.09	2.12	2.15
Total	**22.24**	**31.27**	**25.04**	**27.49**	**34.84**	**35.87**	**38.26**	**42.11**	**45.39**

6. Projections of F-gases Emissions (HFCs, PFCs and SF_6)

The most important sources of HFCs, PFCs and SF_6 emissions are chemical and manufacturing industries. Taking into consideration the uncertainties related to chemical processes for the projections of these emissions, the values estimated in the period 2000-2005 have been extrapolated for 2010, 2015 and 2020 and the outcomes are presented in the table 29 considering all three scenarios.

Table 29. Projections of HFCs, PFCs and SF_6 emissions

Gg CO_2 equivalent

	2000	2001	2002	2003	2004	2005	2010	2015	2020
HFC, PFC, SF_6 emissions	503.20	431.53	450.50	477.02	520.55	550.00	570.00	590.00	600.00

7. Aggregated Projections of GHG Emissions

The aggregated projections of GHG emissions are presented in the tables 30, 31 and 32 considering all three scenarios.

Table 30. Aggregated Emissions of All Direct GHG Emissions into Carbon Dioxide Equivalent, for "without measures" scenario

Gg Carbon Dioxide Equivalent/year

Parameter	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total CO_2 emission	95,621.2	100,380.4	107,626.0	113,049.8	116,360.5	119,259.5	160,711.1	180,095.6	202,399.6
Total CH_4 emission	25,717.4	26,061.6	26,045.3	26,582.2	26,939.6	27,802.1	32,619.9	34,849.3	36,455.4
Total N_2O emission	6,894.4	9,693.7	7,762.4	8,521.9	10,800.4	11,119.7	13,469.5	14,861.4	16,337.0
Total PFC emission	503.2	431.5	450.5	477.0	520.6	550.0	570.0	590.0	600.0
Total aggregated emissions	**128,736.3**	**136,567.2**	**141,884.2**	**148,631.0**	**154,621.1**	**158,731.3**	**207,370.6**	**230,396.3**	**255,792.0**

Table 31. Aggregated Emissions of All Direct GHG Emissions into Carbon Dioxide Equivalent, for "with measures" scenario

Gg Carbon Dioxide Equivalent/year

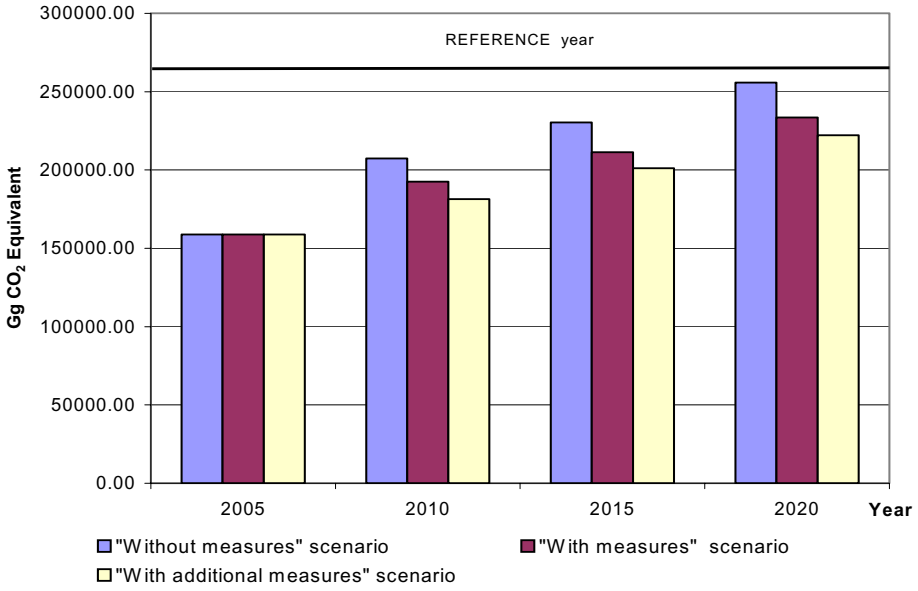
Parameter	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total CO_2 emission	95,621.2	100,380.4	107,626.0	113,049.8	116,360.5	119,259.5	148,689.1	164,319.4	183,359.5
Total CH_4 emission	25,717.4	26,061.6	26,045.3	26,582.2	26,939.6	27,802.1	30,946.7	32,465.0	34,426.8
Total N_2O emission	6,894.4	9,693.7	7,762.4	8,521.9	10,800.4	11,119.7	12,266.7	13,937.6	15,022.6
Total PFC emission	503.2	431.5	450.5	477.0	520.6	550.0	570.0	590.0	600.0
Total aggregated emissions	**128,736.3**	**136,567.2**	**141,884.2**	**148,631.0**	**154,621.1**	**158,731.3**	**192,472.5**	**211,312.0**	**233,408.9**

Table 32. Aggregated Emissions of All Direct GHG Emissions into Carbon Dioxide Equivalent, for "with additional measures" scenario

Gg Carbon Dioxide Equivalent/year

Parameter	2000	2001	2002	2003	2004	2005	2010	2015	2020
Total CO_2 emission	95,621.2	100,380.4	107,626.0	113,049.8	116,360.5	119,259.5	139,499.1	156,839.4	175,119.5
Total CH_4 emission	25,717.4	26,061.6	26,045.3	26,582.2	26,939.6	27,802.1	29,461.1	30,669.5	32,350.5
Total N_2O emission	6,894.4	9,693.7	7,762.4	8,521.9	10,800.4	11,119.7	11,860.6	13,054.1	14,070.9
Total PFC emission	503.2	431.5	450.5	477.0	520.6	550.0	570.0	590.0	600.0
Total aggregated emissions	**128,736.3**	**136,567.2**	**141,884.2**	**148,631.0**	**154,621.1**	**158,731.3**	**181,390.8**	**201,153.0**	**222,140.9**

Figure 1. Aggregated emission projections of GHG



It is obvious that the total GHG emissions level in 2020 for all scenarios will not exceed the aggregated emissions level in the Kyoto Protocol's base year 1989, 262,282 Gg CO_2 eq., Romania being able to meet its emissions reduction target under the Kyoto Protocol although all the scenarios show an increasing trend taking into consideration the Romanian Government's efforts regarding the economic growth and also the harmonization with the EU acquis communautaire in the social and economic fields.

The small differences between the projections in the "without measures" scenario and "with measures" scenario can be explained, as that the "without measures" scenario reflects the progress of Romania towards a functional market economy through the implemented reforms in order to respond to the requirements of the EU accession at 1st January 2007.

Table 33 presents the CO_2 removals for all three scenarios established on the basis of the inventory submitted in 2005, taking also into consideration the various measures for the increase of carbon sequestration potential. In this moment, carbon sinks value represents only about 16% of the total aggregated emissions of GHG.

Table 33. CO_2 Removals

Gg

Year / Scenario	1998	1999	2000	2001	2002	2005	2010	2015	2020
"Without measures"	19518.99	18411.67	17684.97	18541.20	15971.54	16500.0	17500.0	18050.0	18500.0
"With measures"	19518.99	18411.67	17684.97	18541.20	15971.54	16800.0	17800.0	18450.0	18800.0
"With additional measures"	19518.99	18411.67	17684.97	18541.20	15971.54	16900.0	18050.0	18600.0	19050.0

Chapter 6. Climate Change Impacts, Vulnerability Assessment and Adaptation Measures

1. Introduction

Climate variability and change, drought, flooding episodes and other extreme climatic events are able to induce significant effects on all economic sectors, but mostly on agriculture, which is the most dependent on the weather. Every physical, chemical and biological process that determine the growth and development of crops is regulated by specific climatic demands and any deviation from those demands can determine large variability as regards the yields and, implicitly major negative consequences on the nourishment security.

Romania is one of the most rural countries in Europe, with its rural area including 64% of the country's territory, more then 12.000 localities and over 48% of the total population. Agriculture is a major component of the Romanian economy representing almost 20% of its Gross Domestic Product.

The main crops cultivated are winter wheat and grain maize, followed by sunflower, potatoes, sugar-beat and soybeans. In Romania, the wheat crops represent 23% of the arable surface covered by the field crops, 36% of the cereals and 30% of the total cereal production. The maize crop puts Romania on the 9th place in the world as cultivated surface, the mean production/ha representing 59.6% of worldwide mean production (2004).

Romania's climate is temperate-continental. Oceanic influences are present from the west, Mediterranean ones from the southwest and continental excessive ones from the northeast. Average yearly temperatures are latitudinal different some 8ºC in the north and 11ºC in the south, and also altitudinal variable with values of 2.6ºC in the mountain areas and 11.7ºC in the plain areas. Yearly rainfall decreases in intensity from west to east, from 800 mm in the northern Tisa Plain to 500-600 mm in the Romanian Plain and to under 400 mm in Dobrogea.

The extreme phenomena on Romanian territory have specific characteristic related to the continental influences of the temperate climate, with rather large deviations from one year to another as compared with the normal values of climatic, agro-climatic and hydrological parameters.

2. Changes in the Romanian Observed Climate over the 20th Century

Through its role and functions, the agriculture is a major user of natural resources, its long term viability depending on the existence of a sustainable, regenerating resources base, especially the soil and water.

The analysis of the agro-climatic potential data, turned to good account in the agricultural domain, comprises information referring to hydro-thermal resources from the air and soil, correlated with the main vegetation stages of the crops, as well as the extreme values of their production in order to establish the deviations against the norm given the normal evolution of the meteorological elements.

The analysis in multi-annual fluctuation of the mean annual air temperatures and precipitation stresses upon a significant variability from one year to another during the period 1900-2000 (Figure 1 and 2).

Figure 1 The annual mean air temperature trend in Romania over the period 1900-2000

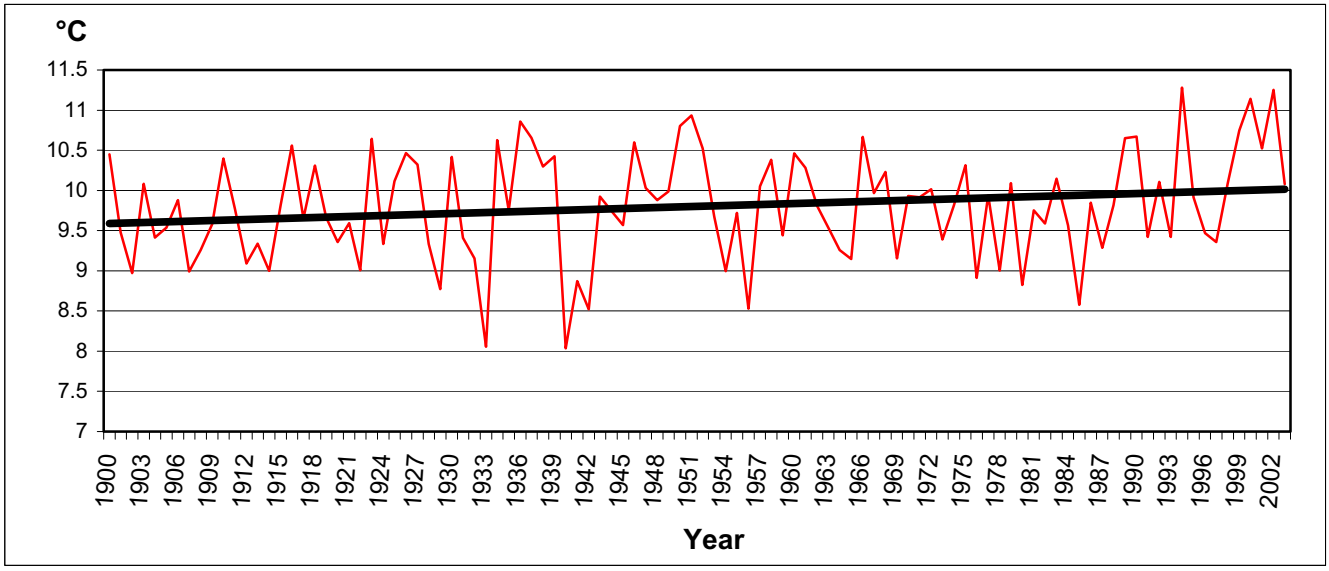
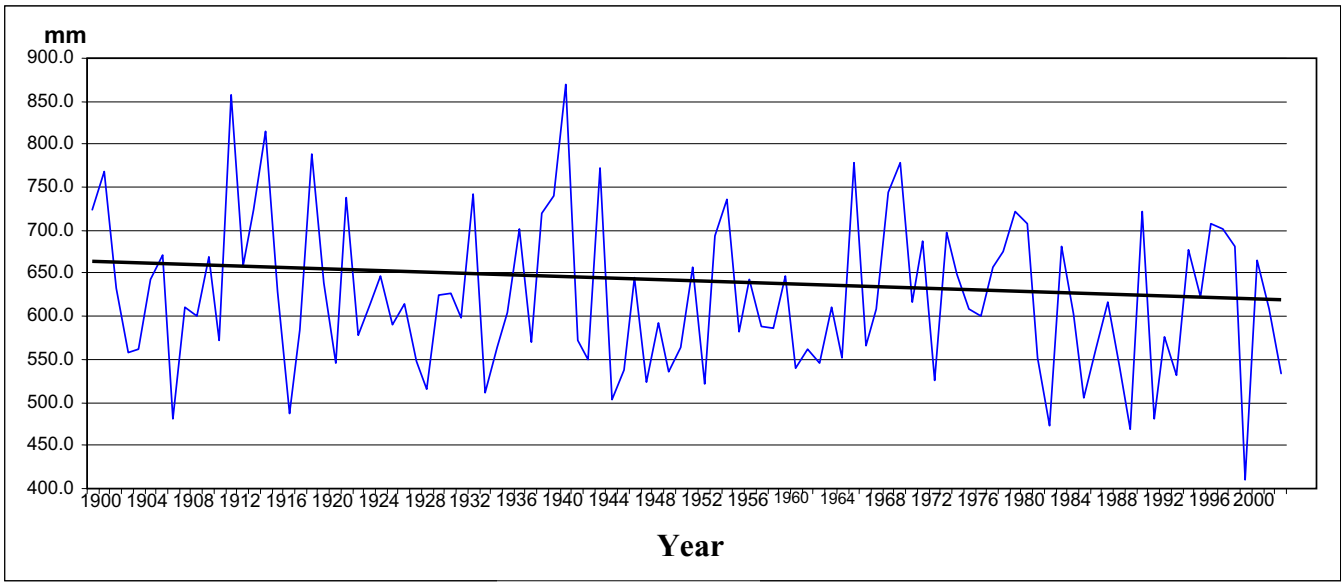


Figure 2 The annual precipitation amount trend in Romania over the period 1900-2000



The evolution of these parameters presents an upward trend as regards the thermic resources comparing to the hydric ones, expressing a natural thermic potential richer than the hydric one, the water coming from precipitations being the limitative factor with negative effects upon field crops productivity.

In the 1991-2000 period, the years 1995, 1996, 1997 and 1999 can be considered as being the most favorable under the agro-meteorological conditions aspect, both for winter grain crops and for the weeding ones. The hydric resources represented by the mean annual precipitation amount reported at the whole Romanian agricultural land, expresses an optimal

rain pattern in 1995 (684.5 mm), 1996 (621.9 mm), 1997 (691.2 mm) and even a rainy one in 1999 (739.6 mm). In the year 2000, the crops productive potential was significantly reduced by the drought phenomenon, being considered a peak year, extremely droughty, both for grains and for weeding.

Drought is one of the major natural processes affecting Romanian agriculture. 48% of the agricultural area (14,717.4 thousand ha) is affected by drought, the south-eastern and eastern parts of the country being the most affected areas. The drought phenomenon, although without a strict cyclical character, generally shows repeatability at 15-25 years intervals. Within such cycles are extremely dry years, but also short-term interruptions of about 1-3 years with rainfalls above the normal amounts. These interruptions do not modify the general features of the droughty period from the point of view of the severe climate characteristics, as well as of the water resources in the soil and in the groundwater and in the surface and hydrographic network. Average yields of various crops in droughty cycles are only 35-60 percent of the potential yields. In the south and southeastern area of Romania, the complex agricultural drought is a climatic hazard phenomenon inducing the worst consequences ever occurred in agriculture.

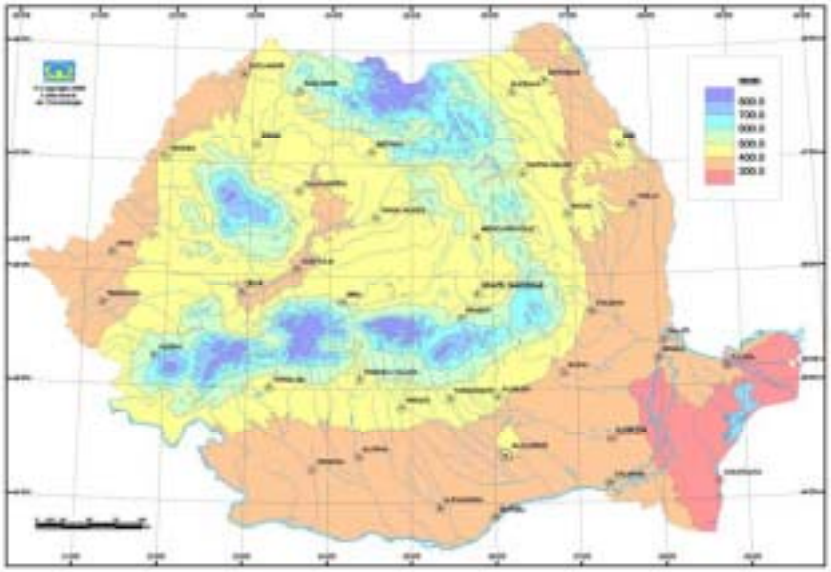
The intensity, duration, frequency and persistence-related characteristics record maximum values especially in the southern part of the Romanian Plain and Dobrogea, the extreme droughts prevailing (30-35%) followed by the droughty cases (15-25%) and moderate droughty (15-20%) in the sowing-springing period of the winter crops (September-October), and in the hoeing crops critical period (July-August), the cases recording above normal values, varying between 40% and 60% at the level of the southern area of the Romanian Plain, reaching even 70% in the south of Dobrogea, followed by those droughty and moderate droughty, 20-30% (Mateescu and all, 2003).

During the last century a long series of extremely intense and extensive droughts was recorded, with serious effects on agricultural production: 1907-1908, 1917-1918, 1923-1924, 1927-1928, 1934-1935, 1945-1946,1947-1948, 1949-1950, 1952-1953, 1982-1983, 1985-1986, 1987-1988, 1989-1990, 1992-1993, 1999-2000.

- Extremely droughty agricultural years in the 20th century:
  - Decade 1901-1910: 1907-1908
  - Decade 1911-1920: 1917-1918
  - Decade 1921-1930: 1923-1924, 1927-1928
  - Decade 1931-1940: 1934-1935
  - Decade 1941-1950: 1945-1946, 1947-1948, 1949-1950
  - Decade 1951-1960: 1952-1953
  - Decade 1981-1990: 1982-1983, 1985-1986, 1987-1988, 1989-1990
  - Decade 1991-2000: 1992-1993, 1998-2000
  - In the last decades in Romania, the rainy years are:
- Extremely rainy agricultural years in the 20th century:
  - Decade 1901-1910: 1907-1908
  - Decade 1911-1920: 1917-1918
  - Decade 1921-1930: 1923-1924, 1927-1928
  - Decade 1931-1940: 1934-1935
  - Decade 1941-1950: 1945-1946, 1947-1948, 1949-1950
  - Decade 1951-1960: 1952-1953
  - Decade 1981-1990: 1982-1983, 1985-1986, 1987-1988, 1989-1990
  - Decade 1991-2000: 1991, 1995, 1997

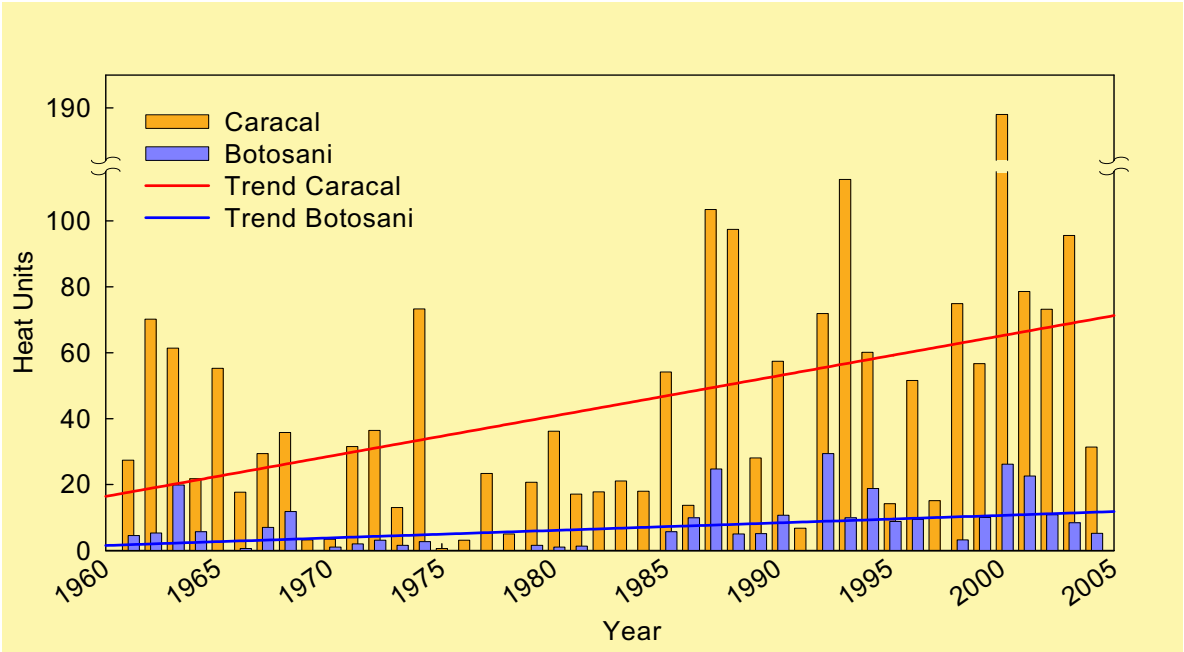
The agricultural regions with high risk of rainfall deficit regime during growing season of agricultural crops (April – October) are especially in the south-eastern, south, east and west area of Romania, where the annual precipitation are below 400 mm (Figure 3).

Figure 3 Multi-annual mean rainfall during growing season of agricultural crops (61-'00)



Another indicator specific to the assessment of the agro-climatic conditions refers to the "Heat Units" phenomenon intensity and duration in the crop critical periods (June-August). Figure 4 presents the trend of the intensity of "heat units" in the period 1960-2005 for two stations situated in different agro-climatic conditions, e.g. Caracal for the south agricultural area and Botosani, for the north one. Thermal stress due to heat spells was consistently increasing in the past 30 years, both in duration and intensity, inducing negative effects on crop development and production.

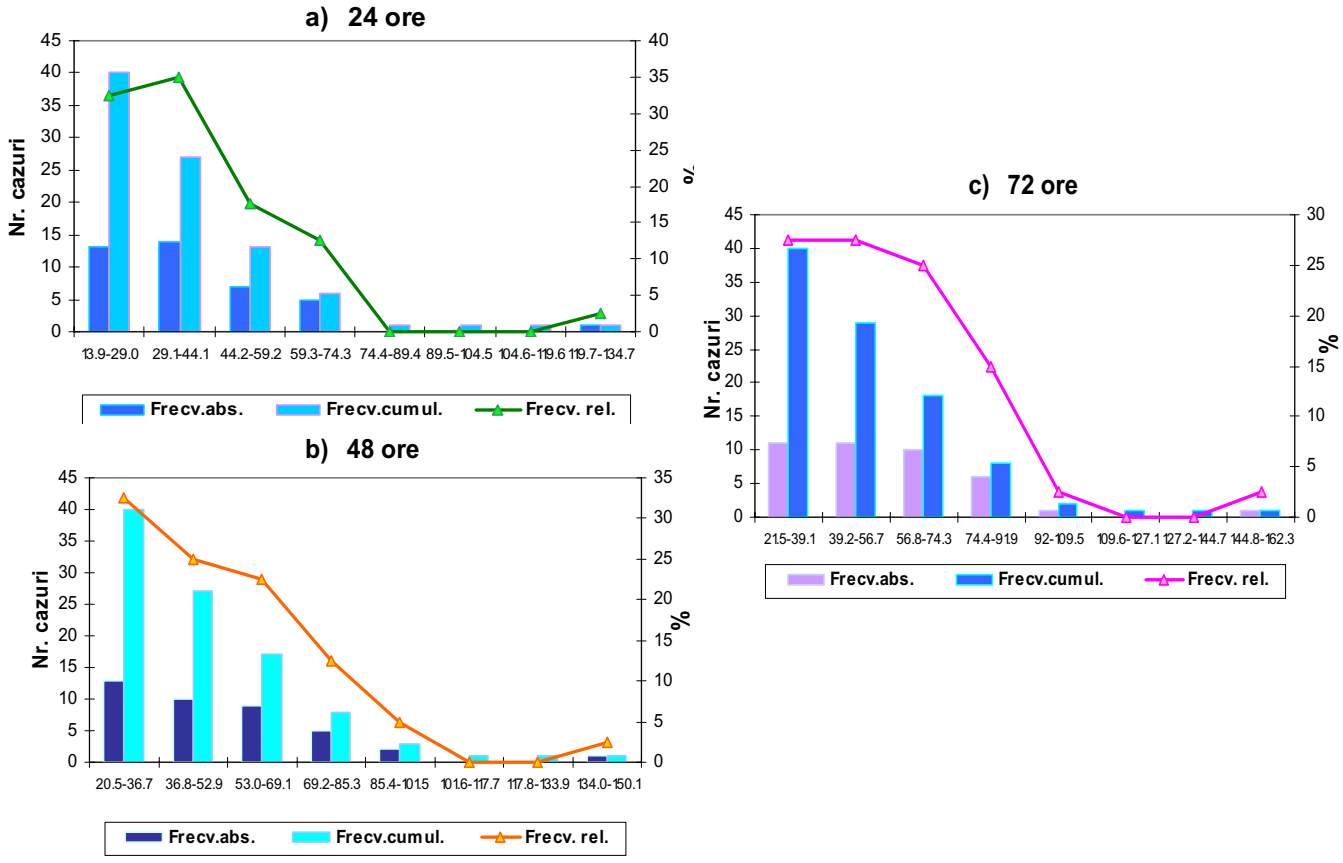
Figure 4 "Heat Units" - Sum of daily maximum temperature units above 32°C



Impact studies elaborated by the agro-meteorological specialists during the period 2003-2005 targeted a wide range of issues, including analysis of the risk generated by the precipitation excesses in the period 1961-2000, as well as the analysis of the historical in-soil humidity data during the vegetation season of the wheat and maize crops, thus aiming to develop and substantiate the agricultural strategies and also to increase the quality of the agricultural yield.

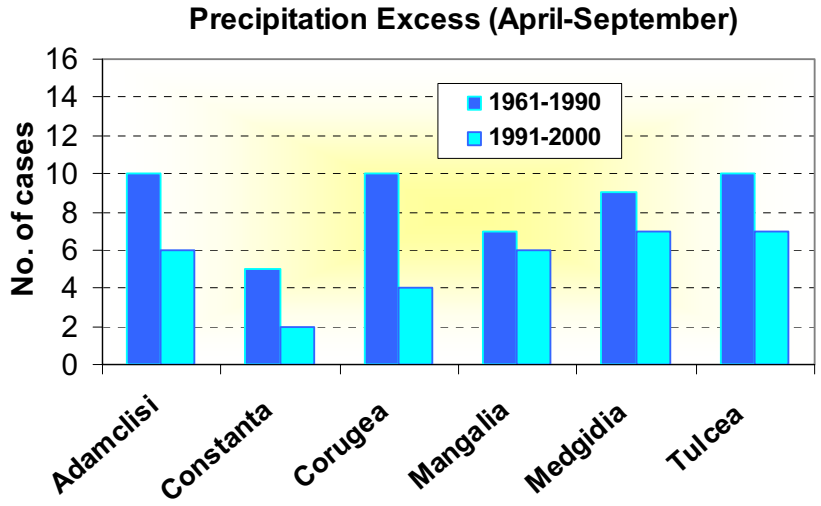
The analysis of the risk induced by precipitation excesses during the period 1961-2000 to the agricultural areas in Dobrogea disclosed excessive precipitation amounts in: 1970, 1971, 1972, 1980 and 1983 in the period 1961-1990, whereas for the last decade of the 20th century- in 1991, 1995, 1997 and 1999. The rainiest months were: May, July, August and September in the interval 1991-2000, whereas for the period 1961-1990: May, June and August. Also, for the whole studied period (1961-2000) the following maximum monthly precipitation amounts are remarkable: 191.1 mm at Tulcea, in July 1997, 188.1 at Mangalia, in September 1995 and 170.5 mm in September 1999 and 167.1 mm at Adamclisi, in August 1972. The analysis of the frequency of the months with hydric significance on the crops during the critical periods (May-June for the autumn cereals and July-August for the weeding crops) computed as total number of cases and that of the extreme values occurred with respect to those situations, reveal large variability of the occurring cases, with the prevalence of the rainy months against the excessively rainy ones (figure 6.5. a, b, c)

Figure 5 a, b, c. Frequency distribution by value classes of the maximum annual precipitation amounts recorded in 24, 48 and 72 hrs. at Tulcea meteorological station in the period 1961-2000



Precipitation excesses occurred during the last decade of the 20th century materialized in 32 cases versus 51 cases in the period 1961-1990 (3 decades), highlighting a higher occurrence frequency in the latest decade (Figure 6).

Figure 6 Occurrence frequency of precipitation excesses (no. of cases / rainy and excessively rainy months) in Dobrogea, in the April-October interval for the periods 1961-1990 and 1991-2000

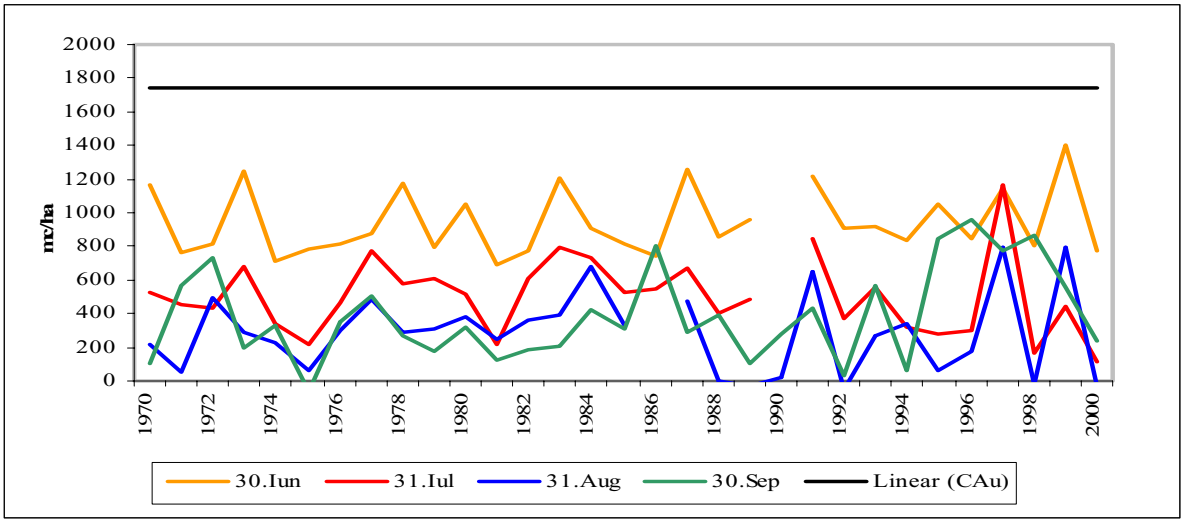


Knowing the multi-annual variability of the humidity reserves and their spatio-temporal distribution is particularly important to efficiently turning to good account the productive potential at both local and national level. That study aimed at assessing the hydric potential of the agricultural areas cultivated with winter wheat and maize against the biological demands of sorts and hybrids, in view to identify the areas where the risk is high for extreme events to occur (drought, humidity excesses etc.).

The dynamic analysis of the in-soil historical humidity data (the period 1970-2000) during the vegetation season of the winter wheat and maize crops proceeded in 2005 at six weather stations with agro-meteorological schedule in Dobrogea. The monthly values of the soil humidity were processed statistically at specific calendar dates and different dates and there was computed the occurrence frequency of the various levels of water supply of the soil with respect to the water requirement of the winter wheat and maize plants.

The analysis of results obtained at the un-irrigated maize crop, for instance, showed satisfactory, close to optimum and optimum water supply in the 0-20 cm profile during the sowing interval in most years at the majority of the analyzed stations (42-87% of cases) and only at two stations (Corugea and Medgidia) humidity excesses are reported at a ratio of 39-55%. In the water-critical period (July-August), in the 0-100 cm soil profile, the pedological drought (extreme, severe and moderate) with a high frequency (67-97%) is recorded at most of the studied stations. In August, the highest frequency of droughty years, 100%, in the 31 analyzed years, is recorded at Corugea and Mangalia weather stations (Figure 7).

Figure 7 Multi-annual dynamics of the humidity reserves accessible to un-irrigated winter wheat over the 0-100 cm soil depth at Mangalia weather station



Crop efficiency is strongly influenced by climate variability, thus the agro-meteorological monitoring methods corroborated with additional specialized field observations form the crucial information needed for correct assessment of the vegetative stage, pointing also to the main characteristic of the limiting factor. Accurate diagnose of agro-meteorological conditions is a crucial process needed for understanding the risks caused by extreme weather events and for decision making and sustainable development actions.

3. Climate Change impacts on Agricultural Crops

The uncertainty related with weather and climate variability and change is a continuous challenge for many societies, both developing and developed. As many other countries, Romania must face extreme weather and climate events, which result in high variability in crop yields and negative consequences for food supply and the national economy. Both climate variability and climate extremes may increase as a result of global warming. It is becoming more and more evident that food supply in our country will be affected by climate variability and climate change, particularly in regions with high present-day vulnerability and little potential for adaptation.

Despite technological advances, such as improved varieties, genetically modified organisms, and irrigation systems, weather is still a key factor in agricultural productivity. Farmers operate in a changeable environment where short-term variation in weather, pests and market conditions occur alongside slower changes in climate and social conditions.

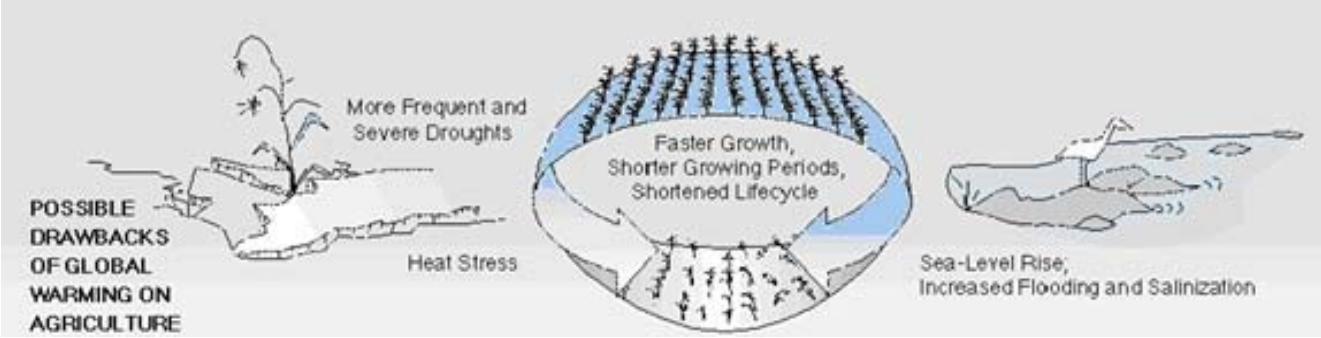
As an example, in the extremely dry years, such as 2000, the largest water shortage and rainfall variability associated with high maximum temperature during the critical phases of maize crop (silking-grain filling) resulted in significant yield reduction up to 90%. During 2005 spring and summer season very large amounts of rainfall compared to the average were reported (in many cases above 150%, equivalent to 350-400 mm). In July and September soil water excess and heavy floods were reported in Romania with severe crop damage. But in those areas not affected directly by flooding, maize yield benefited from abundant summer and early fall rainfall.

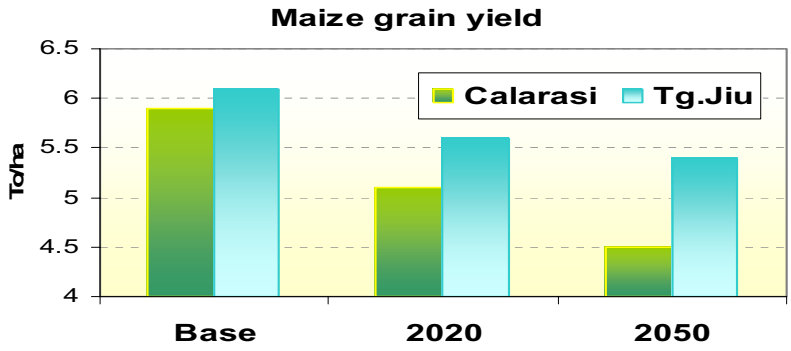
Yields of grains and other crops could decrease across the southern part of Romania due to increased frequency of drought. While losses may be partially offset by beneficial effects from carbon dioxide, crop production would be further threatened by increases in competition for water and the prevalence of pest and diseases and land losses through desertification.

Generally, climate change effects on agricultural crops depend on local conditions of each site, on the severity of changes in climate and on the direct physiological effects of CO_2 concentration.

An investigation with HadCM3 2020 and 2050 climate scenarios and CERES-Maize model resulted in maize yield decreases of 5 up to 20% in 2020 and 10 up to 39% in 2050, compared with the 1961-1990 period. Yield reduction occurs due to shorter grain-filling periods, caused by the higher temperature and lower rainfall. The maize growing season becomes significantly shorter with 8-10 days in 2020 and with 14-16 days in 2050 (Figure 8, 9 and 10).

Figure 8 Changes in the maize yield under HadCM3 scenarios (decades 2020 and 2050) as compared with the baseline period (1961-1990)





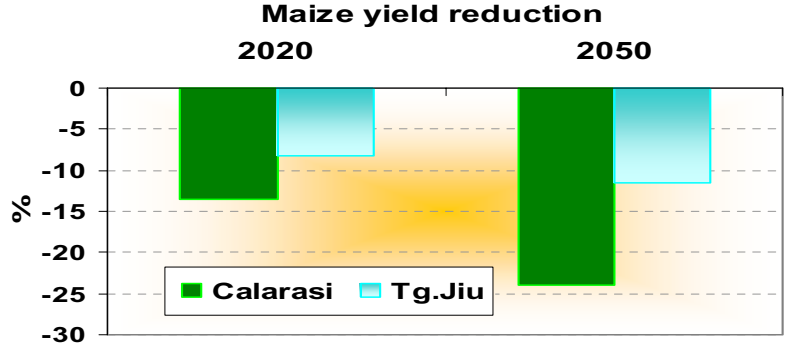


Figure 9 Changes in the growing season length of rain-fed maize crop under HadCM3 scenarios (decades 2020 and 2050) as compared with the baseline period (1961-1990)

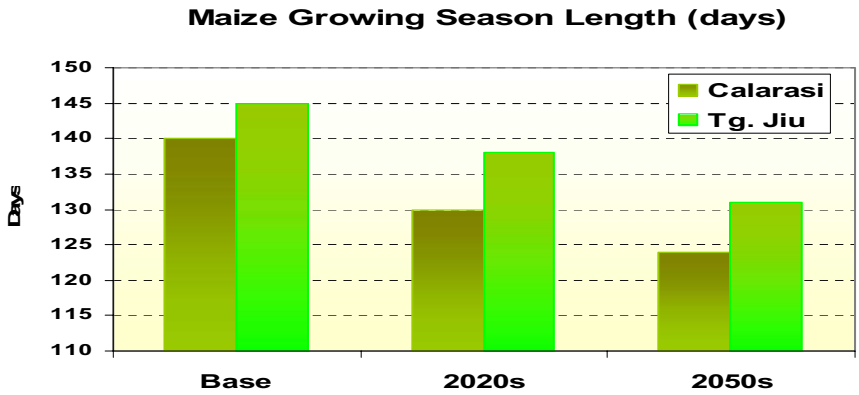
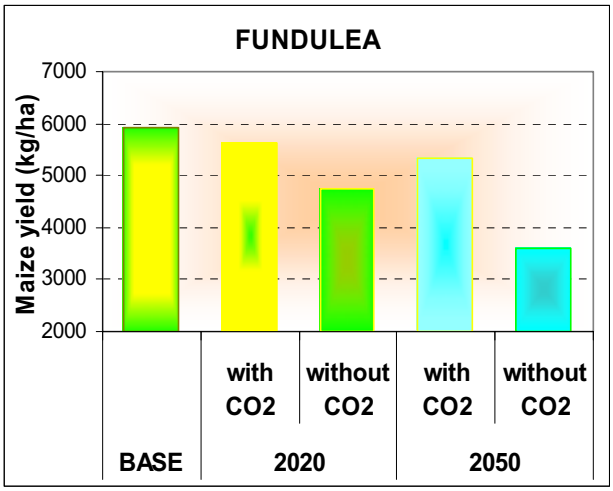
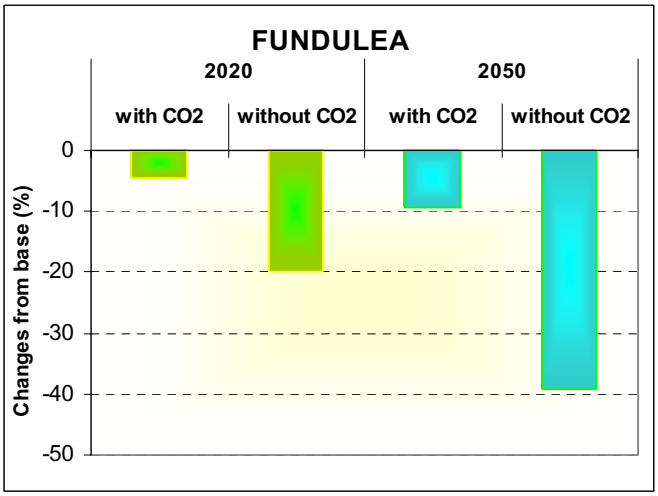
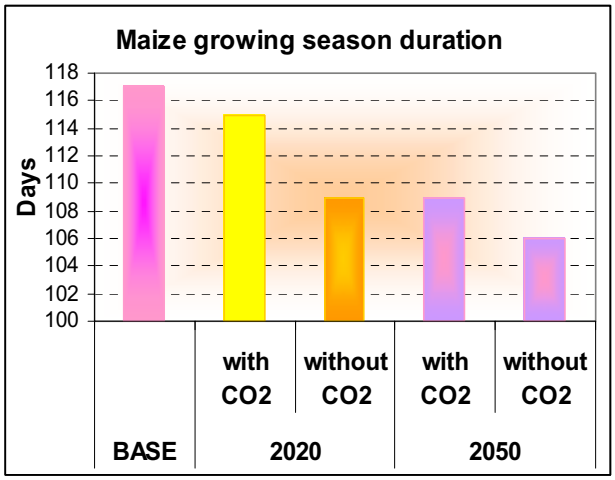


Figure 10 Changes in the grain yield and the growing season length of rain-fed maize crop under HadCM3 scenarios (decades 2020 and 2050, with and without CO_2 effect) as compared with the baseline period (1961-1990)







Impacts of climate change on soil water balance

Agriculture is strongly influenced by the availability of water. Climate change effects could 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 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.

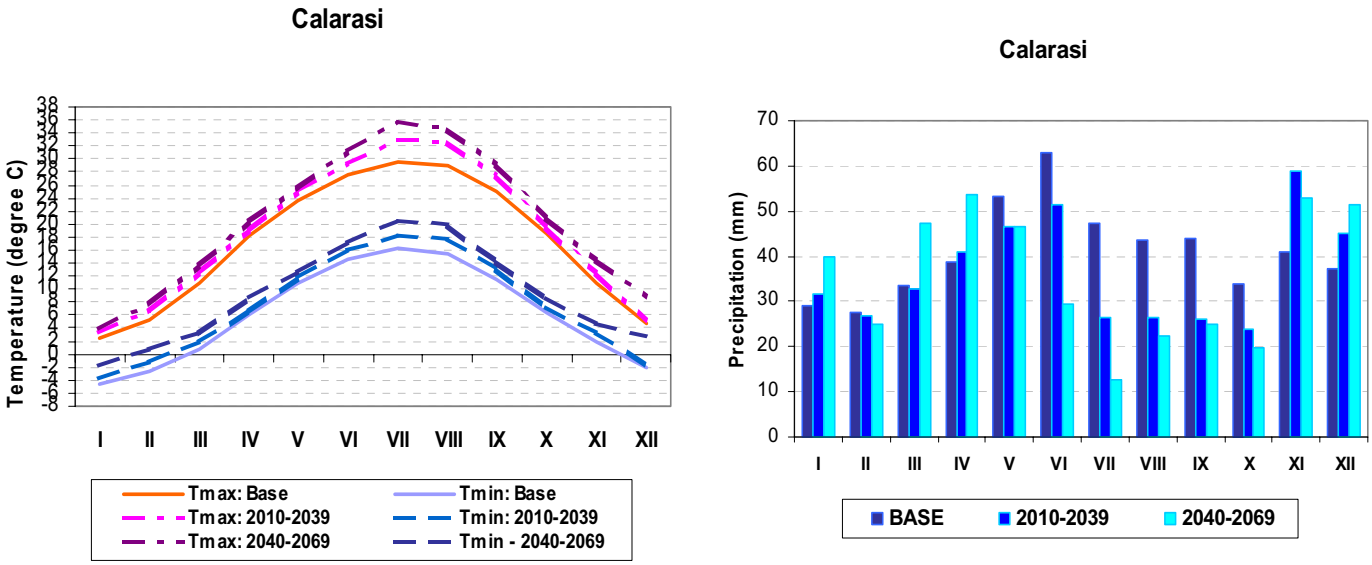
Recent studies on the potential impacts of climate change on the main components of water balance was performed at two sites located in the southern part of Romania, applying the CROPWAT model in conjunction with climate change scenarios derived from global climate models (GCMs). Outputs from the global climate model HadCM3 (SRES scenario A2) were used to create climate change scenarios for two periods in the future (2010-2039 and 2040-2069), centered on the decades 2020s and 2050s. (Table 1 and Figure 11).

The CROPWAT model was run for 30 years, with baseline climate and climate change scenarios. The changes in growing season evapo-transpiration, crop water requirements, crop irrigation requirements/soil moisture deficit and changes in percentage of yield reduction were quantified.

Table 1 Changes in mean monthly maximum and minimum air temperature (°C), and precipitation (mm/month) for the periods 2010-2039 and 2040-2069 against current climate (baseline 1961-1990)

Site/ Scenario	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Calarasi														
2020s	**MaxTemp (∀C)**	**0.7**	**1.5**	**1.5**	**0.8**	**1.2**	**1.8**	**3.3**	**3.4**	**2.5**	**1.1**	**1.6**	**0.5**	**1.7**
	MinTemp (∀C)	**0.8**	**1.5**	**1.1**	**0.8**	**0.9**	**1.3**	**2.0**	**2.5**	**1.7**	**0.8**	**1.2**	**0.6**	**1.3**
	Precipit (mm)	**2.6**	**-1**	**-1**	**2**	**-7**	**-12**	**-21**	**-17**	**-18**	**-10**	**18**	**8**	**-**
2050	**Max Temp (∀C)**	**1.3**	**2.7**	**2.7**	**2.3**	**1.9**	**3.8**	**6.2**	**5.4**	**4.2**	**2.6**	**3.7**	**4.0**	**3.4**
	MinTemp (∀C)	**2.7**	**3.4**	**2.4**	**2.6**	**1.7**	**2.5**	**4.3**	**4.7**	**3.0**	**2.2**	**2.7**	**4.6**	**3.1**
	Precipit (mm)	**11**	**-3**	**14**	**15**	**-7**	**-34**	**-35**	**-21**	**-19**	**-14**	**12**	**14**	**-**
Tg. Jiu														
2020s	**MaxTemp (∀C)**	**0.5**	**1.0**	**1.4**	**0.5**	**1.2**	**1.5**	**3.0**	**4.3**	**3.0**	**1.7**	**1.3**	**0.7**	**1.7**
	MinTemp (∀C)	**0.5**	**1.1**	**1.1**	**0.7**	**0.9**	**1.0**	**1.9**	**2.6**	**1.4**	**0.8**	**1.0**	**0.5**	**1.1**
	Precipit (mm)	**-2**	**0.3**	**-5**	**3**	**-5**	**-1**	**-9**	**-7**	**-6**	**-3**	**5**	**3**	**-**
2050s	**MaxTemp (∀C)**	**2.6**	**1.7**	**2.5**	**1.6**	**1.6**	**3.3**	**5.9**	**6.9**	**5.1**	**3.0**	**3.1**	**3.9**	**3.4**
	MinTemp (∀C)	**2.0**	**2.0**	**2.1**	**2.2**	**1.6**	**2.1**	**4.0**	**4.9**	**2.8**	**2.2**	**2.5**	**4.0**	**2.7**
	Precipit (mm)	**1**	**-2**	**3**	**11**	**4**	**-14**	**-20**	**-8**	**-4**	**2**	**2**	**4**	**-**

Figure 11 Monthly mean minimum and maximum temperatures and precipitation for the baseline climate (1961-1990) and HadCM3 model (periods 2010-2039 & 2040-2069)



Climate change impacts on the water balance components depend on local conditions of each site and the severity of changes in climate. The results obtained in the study have emphasized that changes in climate predicted by the HadCM3 model may have significant negative effects on the main water balance components and maize yield. For example, in 2020s the total soil moisture deficit would be higher by 15-16% at both sites than during the baseline climate. The soil moisture deficit in the 2050s would be higher by 28% at Calarasi and by 24% at Tg. Jiu, respectively. The increase of the soil moisture deficit occurs due to higher daily reference evapo-transpiration, caused by higher temperatures and lower precipitation during summer.

The occurrence of moisture stress especially during flowering, pollination, and grain-filling is harmful to maize crop, resulting in significantly reduced yield. Under climate change conditions the percentage of yield reduction greatly increases in both sites and scenarios, up to 60% at Calarasi and up to 74% at Tg. Jiu, due to higher temperatures that shorten the season length, associated with water stress especially during the grain-filling stage (Table 2 and Figures 12 and 13).

The water availability for maize could decrease due to a combination of increased daily reference evapo-transpiration, enhanced losses of soil moisture deficit and decrease in precipitation.

Table 2 CROPWAT model results by climate change scenarios for two sites in the southern region of Romania.

Site	Scenario	SL (day)	ETo (mm)	CWR (mm)	Eff.Prc. (mm)	SMD (mm)	ETc (mm)	Yield Red (%)
Calarasi	Base	140	652.6	561.5	209.5	356.9	401.8	35.6%
	2020s	**-10**	**-1.4%**	**-1.3%**	**-31.2%**	**15.0%**	**-16.4%**	**38.2%**
	2050s	**-16**	**-1.5%**	**-0.8%**	**-47.6%**	**27.5%**	**-24.4%**	**59.6%**
Tg. Jiu	Base	145	570.9	406.4	312.3	218.7	439.7	14.3%
	2020s	**-7**	**2.5%**	**2.1%**	**-10.1%**	**15.8%**	**-4.2%**	**47.5%**
	2050s	**-14**	**3.2%**	**1.8%**	**-16.6%**	**24.0%**	**-8.0%**	**74.1%**

SL: season length, ETo: growing season reference evapo-transpiration, CWR: growing season crop water requirement, Eff. Prc: growing season effective precipitation, SMD: total soil moisture deficit, ETc: growing season actual crop evapo-transpiration, Yield red.: estimated maize yield reduction due to crop stress. Changes from baseline are shown as a percentage.

Figure 12 CROPWAT model results by climate change scenarios for 2 sites in the southern region of Romania

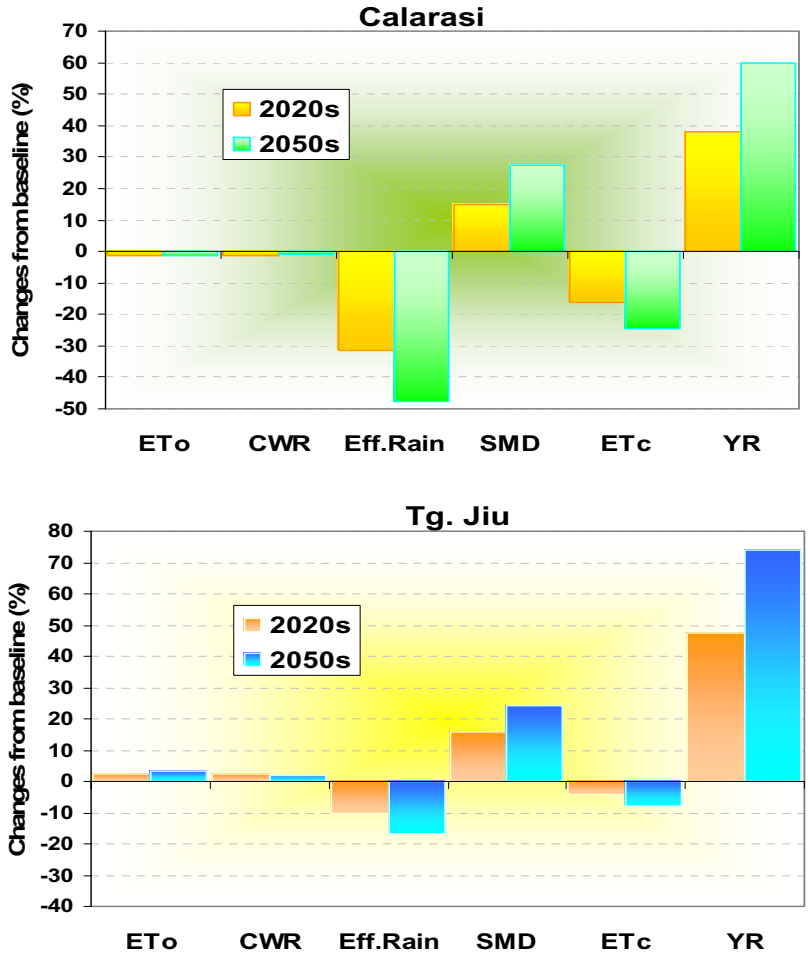
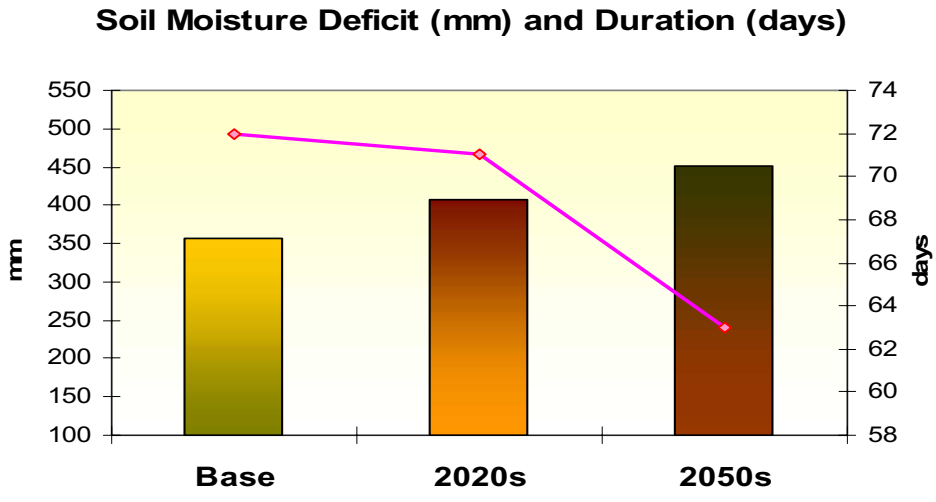


Figure 13 Comparison of the difference in amount (mm) and duration of soil moisture deficit simulated with CROPWAT model in the current climate (base) and the two decades predicted by the HadCM3 model, at Calarasi station



Using long-range predictions to reduce impacts of climate variability

Better knowledge of climatic variability together with the availability of climate forecasts and agro-meteorological models are key components for improving agricultural decision making at the farm or policy level.

Seasonal forecasts play a vital role in long-term agricultural planning which in turn has to adopt different strategies to meet different situations for the benefit of agriculture. Seasonal forecasts predict major climate trends over a period of several months to a few seasons and indicate areas where there is an increased likelihood of some deviation from the climate mean, such as dry or wet, warm or cold conditions.

Many critical agricultural decisions, from farm to policy level, that interact with weather conditions must make several months before those weather conditions are realized. In this context, seasonal climate predictions offer the potential for farmers to predict crop responses to expected climate, and modify decisions to decrease unwanted impacts or take advantage of expected favorable conditions. Seasonal climate fluctuation prediction could:

- reduce some of the losses associated with climate variability;
- help farm managers maintain agricultural productivity despite extreme climate events;
- help water resources managers ensure reliable water deliveries;
- offer the potential for agricultural producers to plan and decide on crop management.

In this context, same case studies seek to demonstrate how seasonal climate forecasting combined with simulation capabilities of CROPWAT model can estimate and predict the soil moisture deficits and maize yield reduction due to crop stress under rain-fed conditions. The 2005 results of direct application of seasonal forecasting to soil moisture deficits and maize yield, using the CROPWAT model, are based on seasonal forecast with 1-3 seasons ahead.

The analysis of the simulated results show that probability of 2005 soil moisture deficit during the growing season was 15.3% lower at Calarasi and 1% at Tg. Jiu comparing with a normal year, mainly due to the estimated growing season rainfall above the normal. As compared with forecasted soil moisture deficit, the real one simulated in the weather conditions of 2005 was much lower by 39% at Calarasi and 47% at Tg. Jiu, respectively. The total maize yield reduction due to crop stress was about 21% at Calarasi and only 12% at Tg. Jiu in the forecasted weather conditions for 2005, while in the real climate conditions at both sites the maize crop was not affected by water shortage, on contrary it benefited from abundant summer and early fall precipitation (Figure 14, 15 and 16).

Figure 14 Difference in the amount of precipitation in 2005 compared to the average (normal) and 2004

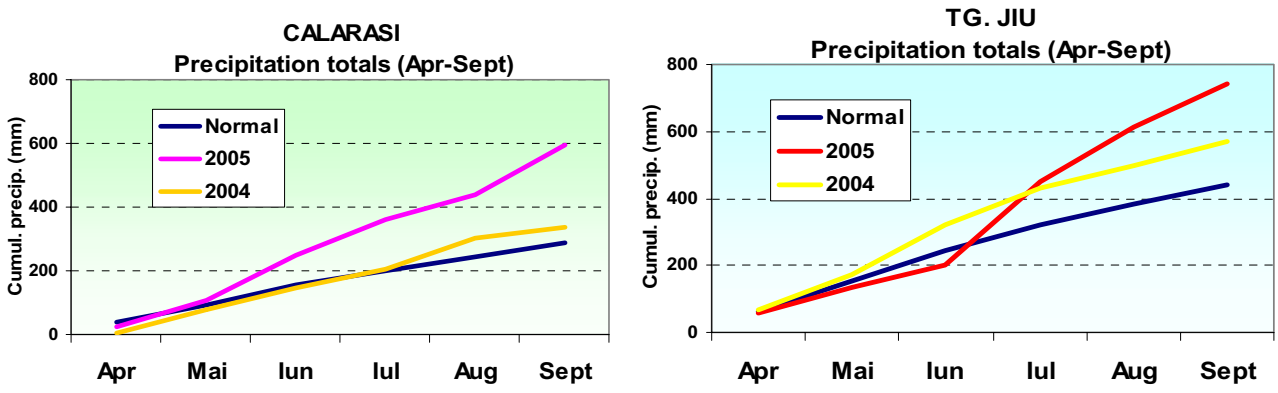


Figure 15 Total soil moisture deficit simulated with CROPWAT model during 2005 maize growing season in the seasonal weather forecast conditions as compared with the real one

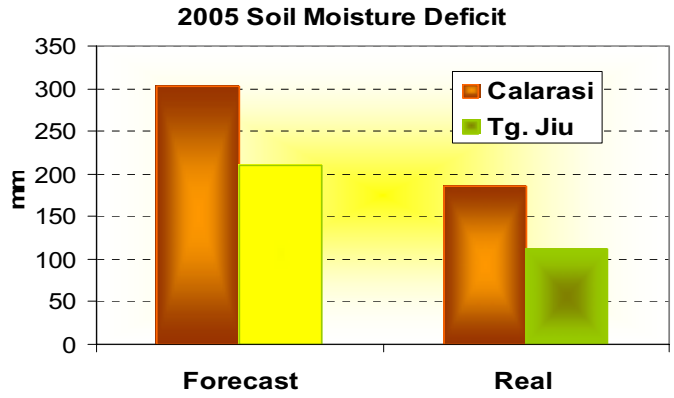
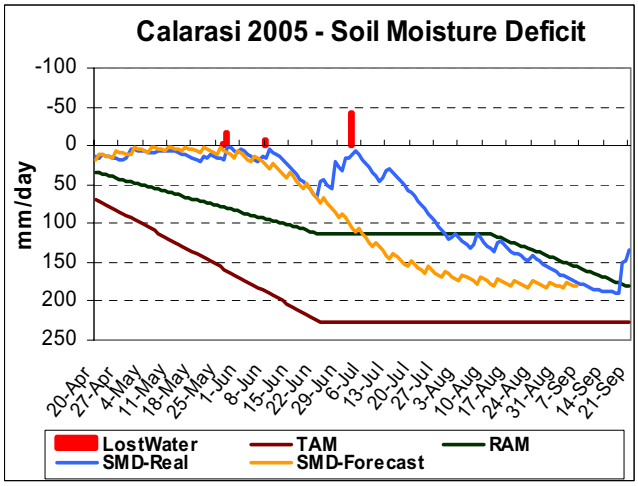
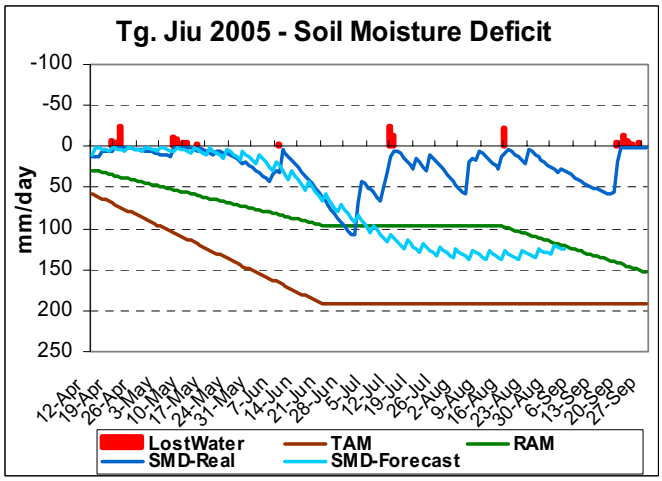


Figure 16 Daily soil moisture deficit simulated with CROPWAT model during 2005 maize growing season, in the weather forecast conditions as compared with the real one



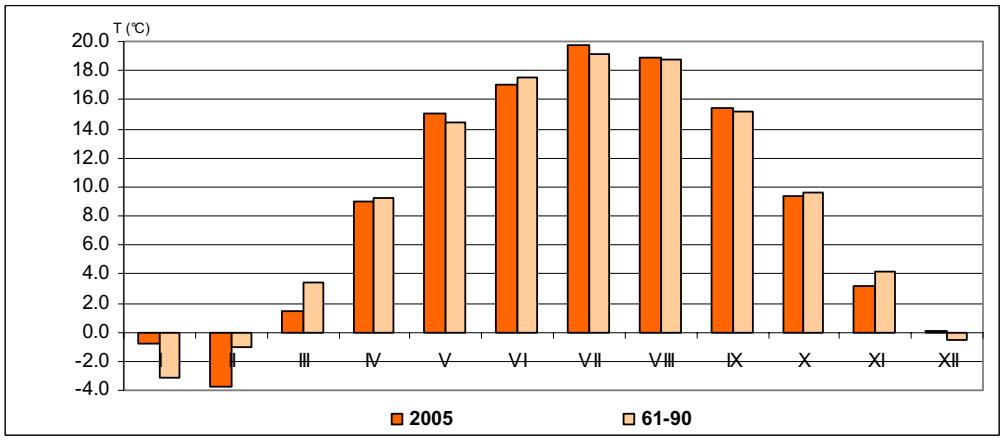


4. Meteorological Characterization of the Year 2005

Climatic characterization

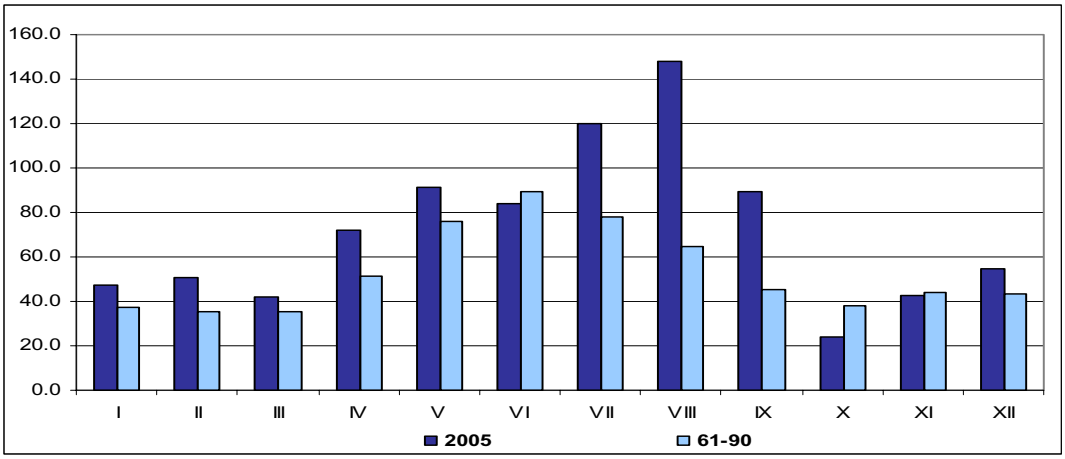
In Romania, the year 2005 was by 0.1º C colder than the climatologically norm (1961-1990). The closeness to the normal values was due to the fact that throughout the year, the all-country thermal pattern was characterized by positive deviations ranging within 0.2 - 2.4º C in six of the year's months (January, May, July through September, December) and by values lower by 0.3 – 2.6º C in the other six months of the year: February through April, June, October, November (Figure 17).

Figure 17 Mean monthly temperature of 2005 against the climatologically norm (1961-1990)



At the country level, the mean precipitation amount in 2005 was 866.5 mm (against a climatologically norm of 647.0 mm). Precipitation amounts, in excess of the average in January through May, July through September and December and the scarce ones in June, October and November, shaped an annual precipitation pattern in excess of the average by 33.9% against the reference period. In August, following large precipitation amounts, the positive deviation against the normal was 124.2%. Analyzing Figure 18, significant positive precipitation deviations against the climatologically normal were also noticeably recorded in April (45.1%), July (46.3%), and September (90.4%).

Figure 18 Mean monthly precipitation in 2005, compared with the climatologically norm (1961-1990)



The 2004-2005 winter period was characterized by a thermal pattern close to the climatologically normal, the eastern and south-eastern areas being excepted, due to the below normal values. The precipitation pattern showed excess around the northern border, locally in the south of the country and it was normal in the rest of the territory. During the winter, there was an alternation of warm spells and cold spells than the climatologically normal. February was colder than normal, with an excessive precipitation pattern and severe winter phenomena (snowfalls over almost the entire country's territory in the 1-4 interval) followed by frosty weather from the 5th to the 11th, snowstorm in the south and south-east of the country on 24 and 27-28 February). On 8 February the minimum temperature of the year was recorded: -35.8º C, at Intorsura Buzaului weather station.

The spring of 2005, characterized by the alternation of warm and cold periods, displayed a thermal pattern close to the normal values, except the west of the country, where it was below normal. Precipitation amounts were in excess of the average, except the north-east and south-east of the country, where they were close to normal values. In April, precipitation fallen in large amounts was accompanied by hail, thunder and hard wind gusts. In the south-west of the country, rains were torrential, with positive deviations larger than 225%. That situation triggered flooding, which caused important damages.

Overall, the summer of 2005 displayed a thermal pattern within the normal limits and a precipitation pattern in excess of the average. However, it was a season of thermal extremes, particularly unsettled, with weather phenomena unusually intense for the latitude where Romania is situated. In the 27 July – 4 August interval, in the south, south-west and east of the country, sultry days were reported. In that period, the maximum temperature of the year was recorded: 37.2º C at Bechet, on 1 August. Torrential rainfalls were frequent throughout the summer and precipitation amounts exceeded the monthly means in July and August, causing flooding and landslides in most regions, which led to life losses and important damages.

A notable deviation of the monthly precipitation amount from the climatologically normal occurred in August, when positive deviations of 100% and even 200% were reported over wide areas.

The autumn of 2005 characterized through mean monthly temperatures within the normal limits. Precipitation amounts were excessive in the south, scarce in the north-east and normal elsewhere.

During the third 10-day period of September, rainfalls were torrential in the south of the country. Exceptionally high 24-hour amounts were recorded: 150-200 mm on the Black Sea coast and over 100 mm in the south of the country, which caused flooding, landslides, resulting in life losses and heavy damages. At Mangalia weather station (on the Black Sea coast) the monthly precipitation amount was 330.4 mm (against a climatologically normal of 32.0 mm). This made the September precipitation pattern excessive, with positive deviations exceeding 275% in the south of the country and reaching 932.5% at Mangalia.

Special weather phenomena recorded

- **Snowstorm,** in the south and east of the country, on 28-29 January; in the east and south-east of the country on 3-4 and 27-28 February respectively; in Transylvania on 6 March and in Moldavia on 19 March; in the mountain area and sparsely in Moldavia on 21-23 April.
- **Hail,** in the north-west, west, centre and south-east of the country in the 14-28 April interval, in Mures and Bihor counties and in Banat Mountains (5 to 11 June) and widely over the country (17 to 27 June, 9 to 19 July, 1 to 8 and 13 to 25 August), in Brasov and Buzau counties (10 to 15 October), in Dambovita county, in Bucharest (17 October) and in Constanta (17 November).
- **Torrential rainfalls**, with thunder and strong wind gusts recorded throughout almost the entire country were recorded from April to September:
  - in southern Crisana, in Banat, in Hunedoara and Cluj counties (15-16 April);

- in Oltenia, Walachia, southern Transylvania and Moldavia (8-9 May), Hunedoara, Gorj, Maramures counties (19 May), locally in Maramures, Transylvania, sparsely in Crisana, Banat, southern Moldavia and in Buzau, Prahova, Vrancea, Constanta counties (24-31 May);
- in 31 counties in the south, south-east and east of the country (1-17 July);
- in Oltenia, Wallachia, Moldavia, Transylvania (4-6, 16-18 and 23-24 August);
- in the south and south-east of the country (19 to 23 September) and in the Black Sea coast area Tuzla-Costinesti (22-23 September);

- **Tornadoes,** in the Topologu forest, Tulcea county (6 May); in Movilita commune, Ialomita county; at Buftea, Ilfov county and at Ciobanu, Constanta county (7 May). In 2005, the research group within the Radar and Now-casting National Meteorological Centre investigated as many as 15 occurrences of tornado-like wind events.

The special weather phenomena occurred in 2005 (precipitation that inflicted wide-scale flooding and landslides, hail, storm-like wind gusts, tornadoes) caused huge damage and life loss. 1734 localities were affected in the 41 counties of the Romanian territory and in Bucharest and 76 fatalities were recorded. There were 93.976 households and house annexes, 656.392 ha of agricultural land, 1063 socio-economic units and a lot of infrastructure means destroyed or affected, the destruction being estimated to amount at 2 billion Euro.

Agro-meteorological characterization of the agricultural year 2004-2005

The analysis of the agro-meteorological conditions throughout the agricultural year 2004-2005 highlights the following aspects:

- A normal winter (11-30 frost units) was recorded in most of Moldavia, northern and central Walachia and Oltenia, southern Banat, central Crisana and western Transylvania. In Maramures, most of Transylvania and Banat, northern and southern Crisana, southern and north-western Oltenia, south-western Walachia and locally in western Moldavia, the winter was severe (31-50 frost units) and even particularly severe (51-160 frost units) in the eastern Transylvanian depressions.

- Specific to the spring of 2005 was the prevailingly rainy feature of the precipitation pattern in the period of the in-soil water accumulation (November 2004 – March 2005) recorded over most of the agricultural area, even excessively rainy over wide surfaces in the west, centre and east of the country. Under those circumstances, the spring sowing activities were significantly delayed, and in the areas where the crops were partially or totally destroyed by flooding, the lots were sown again.

- In the 1 June – 31 August 2005 interval, the “scorching heat” phenomenon, expressed through intensity and duration showed that both the units ratio and the number of days with scorching heat were small or even absent (0-42 scorching heat units/0-20 days) at the level of the whole agricultural territory. The “scorching heat” intensity recorded its highest values especially in the 25 July - 3 August interval, which means that in the summer of 2005, cereal and weeding crops were not subjected to long-term thermal stress (>3-5 consecutive days) or to highly intense stress (over 50 units).

- During the active vegetation season of crops (April-October), a rainy and even excessively rainy pattern prevailed, the impact of the precipitation excess on crops being directly influenced by the intensity and duration characteristics of the excess. The

high humidity in the air and soil also favored the progressive development and expansion of diseases and pests as well as the growing degree of weed-cover with all the cultivated species.

- Throughout the year, the water supply degree of soils varied function of the recorded precipitation amounts and the agricultural plants consumption against the water requirements. As a result, the content of humidity accessible to the winter wheat and maize plants over the depths of 0-20 cm, 0-50 cm and 0-100 cm was within optimum limits, close to optimum and satisfactory in most of the crop areas and during the very rainy intervals, long-term humidity excess and water stagnation were reported. At ground surface, long-term water stagnation was reported in crops and overland whereas in the soil profile, humidity excess affected the vegetation state of the crops, both as regards the winter wheat during its maturity-harvesting period (germination in grain, blackening of ears) and the late maize. Some spatial representations (maps) setting forth the soil humidity by areas on calendar dates specific to winter wheat (July 13, 2005) and maize (May 11, 2005) crops are shown as examples Figures 19 and 20.

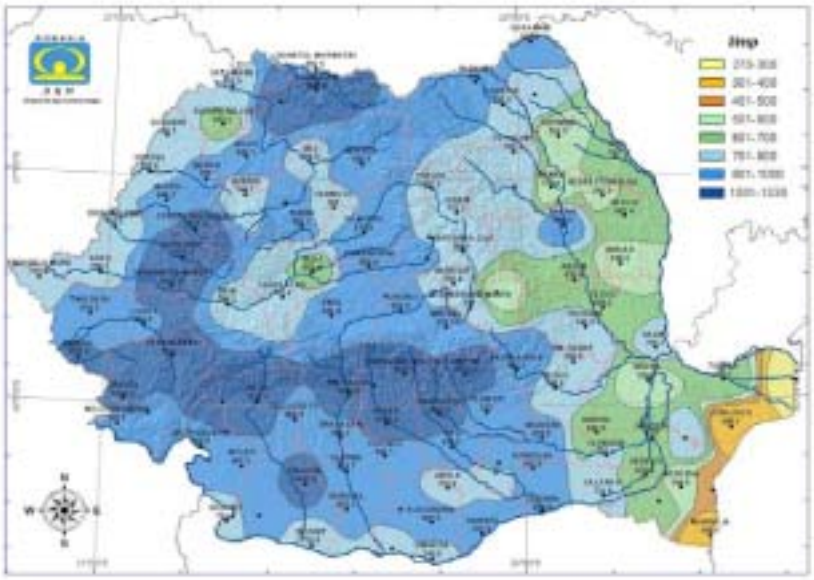
Figure 19 Humidity reserve accessible to winter wheat at 0-100 cm depth on July 13, 2005

Figure 20 Humidity reserve accessible to maize plants at 0-20 cm depth on May 11, 2005

The precipitation amounts fallen throughout the agricultural year, i.e. in the 1 September 2004 – 31 August 2005 interval, are to be ranked as follows:

- abundant and even excessive amounts, 701-1330 mm (rainy, very rainy and excessively rainy precipitation pattern) in Maramures, Crisana, Banat, Oltenia, Transylvania, most of Walachia and Moldavia;
- optimum amounts, 601-700 mm over wide areas in Moldavia, Baragan and the western border of Dobrogea;
- low and very low amounts, 270-600 mm, (very droughty and moderately droughty precipitation pattern) over most of Dobrogea, (Figure 21).

Figure 21 Sum of precipitation recorded in the 1 Sep. 2004 – 31 Aug. 2005 interval



As a conclusion, in the April-October 2005 interval, the partial/total destruction of the crops in Romania was due to the abundant precipitation amounts, situated over the mean monthly multi-annual values and which were recorded in only 1, 2 or 3 consecutive days, causing the fields to be flooded, in-soil humidity excess to occur, along with temporary or long-term (over 3 days in a row) water stagnation at soil surface and in the crops. Locally, the strong wind (squall) flattened plants on the area (10-90%) in the wheat crops, caused fruits to fall at fruit-tress and, over sparse areas, the hail partially/totally affected the leaf apparatus of the weeding and tree-viticulture crops (perforation, breaking). The most affected counties were: Timis, Olt, Dolj, Gorj, Arges, Teleorman, Valcea, Dambovita, Giurgiu, Calarasi, Constanta, Caras-Severin, Arad, Harghita, Covasna, Cluj, Alba, Sibiu, Brasov, Hunedoara, Suceava, Neamt, Bacau, Galati, Vrancea, Braila, Buzau, Vrancea, Vaslui, Iasi, Botosani, Suceava.

The humidity excess is a state of a biological system in which the water supply is above optimum. The negative effects upon the growth, development and formation of crops act function of the growth and development stage of the agricultural plants. Therefore, substantiating the agricultural management practices in the context of reducing the vulnerability of agriculture to the climate fluctuations aims at an integrated the weather-climate relationship. Figures 22 and 23 present the effects of excess precipitation amounts on crops.

Figure 22 Maize crop in Dobrogea (fallen plants, heavily subsided soil and weed-cover as a result of humidity excess)-(July 2005)

Figure 23 Winter wheat crops flooded in Moldavia – April 2005

5. Inter-disciplinary Approach

The National Strategy on Climate Change of Romania (NSCC) was approved by the Governmental Decision no. 645 in July 2005, and the National Action Plan on Climate Change of Romania (NAPCC) approved also by a Governmental Decision (1877/2005) is the main instrument in implementing Strategy's objectives into specific Actions for the period 2005-2007. The NSCC was developed under the responsibility of the MEWM in close cooperation with other ministries through the National Commission on Climate Change. Agro-meteorological Laboratory from National Meteorological Administration (NMA) coordinated the elaboration of key actions for impact assessment, adaptation, awareness, education and public participation.

In 2000, Romania elaborated the „National Strategy and Action Programme concerning desertification, land degradation and drought prevention and control" (NSAP). The Ministry of Agriculture, Forests and Rural Development (MAFRD) is responsible for preparing the National Action Programme to Combat Desertification as well as the National Report regarding the UNCCD Implementation in Romania. Taking into account, that in Romania all the actions developed to reduce the effect of drought and aridization are part of the national strategy, the Romanian Government established in 2004 an interdisciplinary National Committee for Drought Mitigation, Land Degradation and Desertification in the framework of the UNCCD (Governmental Ordinance no. 474/2004) and NMA is represented in the Technical Committee (Ministry Ordinance no. 503/2005). Also, the scientists from NMA were actively involved in the elaboration of the NSAP and National Reports in the framework of UNCCD implementation (i.e. 2000, 2002) and the UNFCCC National Communications 1-3 (1995, 1998, 2004).

Another action relates to the NCSA Project (National Capacity Self-Assessment for Global Environmental Management) which was initiated in January 2004 by the Ministry of Environment and Water Management. The specialists in dynamic meteorology and agro-meteorology from NMA were involved in thematic working groups (Final Report on the Implementation of Rio Convention-UNFCCC, UNCCD, UNCBD / UNDP-GEF: ROM/03/G41, ISBN 92-95047-03-6, 2005). The main activities of the working groups developed within the project framework were: analysis of the current situation of the national capacities, assessment synergies between the three Conventions, and determination of priorities.

6. Future Steps

Main operational agro-meteorological activities:

- Assessment and near-real time monitoring of the risk agro-meteorological factors (drought, heat, water excess/deficit in the soil, etc.) and their zoning over the country's agricultural territory, during vegetation season of crops in order to identify the agricultural areas the most vulnerable and the dissemination of the information to the users for taking adequate measures (irrigation, fertilizing, agro-techniques to preserve the water in the soil, etc.).
- Evaluation and monitoring of the soil moisture dynamics and soil water deficits at the rooting depth of the main agricultural crops, in order to provide necessary information for decision-makers on irrigation management;
- Elaboration of specialized information as agro-meteorological bulletins containing diagnoses and forecasts, graphs and cartographic products and timely warnings regarding

the occurrence and expansion of the drought-affected agricultural surfaces or other extreme events, and their dissemination to users for fast decision-making to diminish the negative consequences;

- ∉ Promotion of more active collaboration with farming community for improved applications of agro-meteorology at the farm level.

Main research agro-meteorological activities:

- ∉ Application of seasonal climate forecasts combined with simulation capabilities of CROPWAT model to estimate and predict the soil moisture dynamics and soil water deficits during crop growing seasons;
- ∉ Development and improvement of agro-meteorological applications by using remote sensing, GIS and modeling techniques coupled with decision support systems for agriculture;
- ∉ Elaborate specialized studies regarding the agro-meteorological risk generated by the heavy rain on the main agricultural crops at the whole agricultural territory of Romania;
- ∉ Quantification of the climatic variability effects on the main components of water balance (evapo-transpiration, crop water requirement, soil moisture deficit, effective rainfall) using the CROPWAT model;
- ∉ Assessment of the climate change and climatic variability impacts on agricultural crops and the main water balance elements, including the effects of agriculturally significant climatic extremes by using modeling approaches;
- ∉ Development of the applications for new methods and technologies to provide additional improved agro-meteorological information for decision-makers and other users, based on a statistical analysis procedure on historical series of soil moisture data to produce agroclimatic classification;
- ∉ Analyze the spatial and temporal evolution of soil moisture dynamic over a 30-year period in order to identify the intervals and zones with high risk at the occurrence of extreme climatic events (droughts, excess moisture, etc.);
- ∉ Calibration and testing of the performance of Hydrus 1D model to simulate the soil moisture dynamic in different climate conditions and soil depths;
- ∉ Increase the scientific and technical research co-operation in the field of agro-meteorology and establish a very close collaboration with a series of International and European bodies such as the Agro-meteorological Division of WMO, FAO, WAMIS, etc.

Chapter 7. Research and Systematic Observations

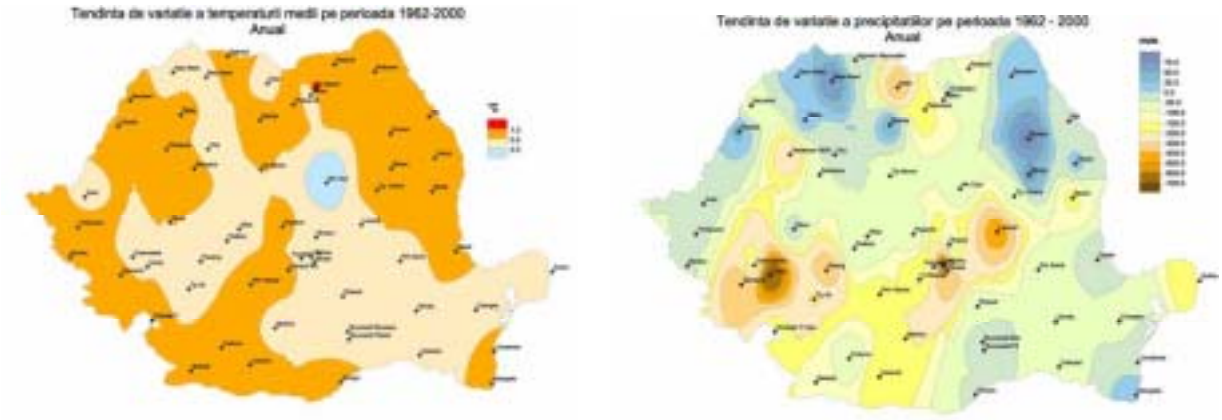
1. Research

During the last period, the main research objective areas on climate change issue referred to:

- Identification of changes (trends and shifts) in the observed long term climatological time series and linkage with changes in the large-scale circulation; special attention was given to the frequency and intensity of extreme climate events (extreme precipitation and extreme temperature) and frequency of certain meteorological phenomena during the cold season (rime, snowstorm, hoarfrost and glazed frost);
- Development of statistical downscaling modeling in order to project global climate change scenarios on regional/local scale;
- Validation of the global/regional climate models in reproducing the regional features and large-scale mechanisms controlling the regional climate variability;
- Construction of climate change scenarios for the Romanian region by applying the statistical downscaling models to the changes in the large-scale parameters derived from global climate change scenarios achieved with various general circulation models (GCM);
- Comparison between statistical and dynamical downscaling results.

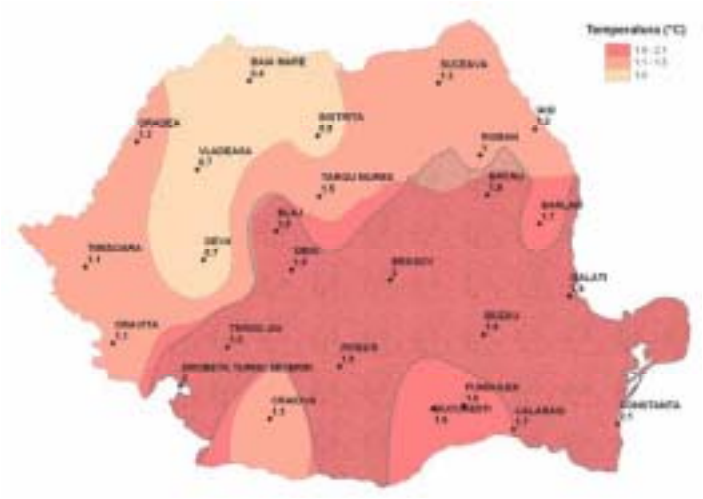
During the analyzed period the long term linear trends of temperature and precipitation were updated by using data set recorded at more stations (61) covering shorter period (1961-2000), compared to results presented in the previous National Communication when trends over the entire 20th century (1901-2000) for 14 stations were presented. The results show that the climate signal is similar but it is more enhanced and with some dissimilarities regarding the spatial patterns. So, the annual precipitation amount decreased, more enhanced in the southern half of the country, whereas in the north-western and north-eastern regions increasing trends were noticed. The mean annual temperature increased over the entire country, significantly in winter and summer-time respectively, whereas even cooling has been identified as concerns the east of the country (Figure 1).

Figure 1 Trends of annual mean temperature and precipitation amount over the period 1961-2000



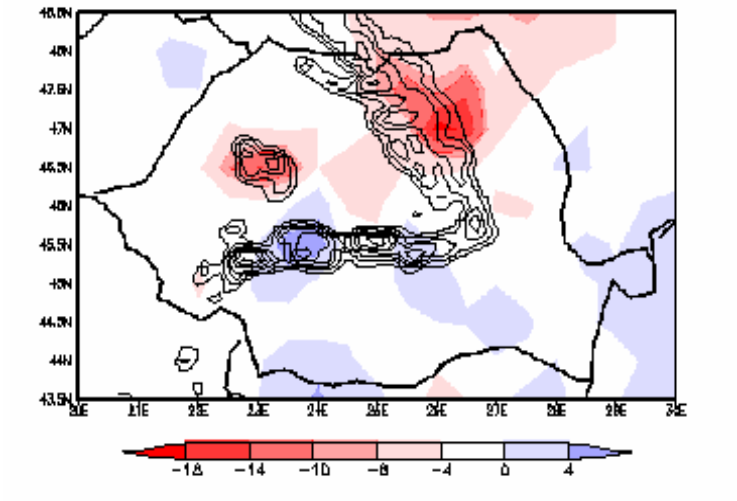
Additionally, other climate parameters (including extreme event indices) were analyzed with respect to identification of possible trends. For the seasonal mean of minimum temperature, significant increases have been highlighted only for the summer season while for maximum temperatures significant increases were found for winter and summer as shown in Figure 2.

Figure 2 Trends of mean maximum temperature in July derived from the observed data (1961-2000); dotted shaded area is significant at 5% level



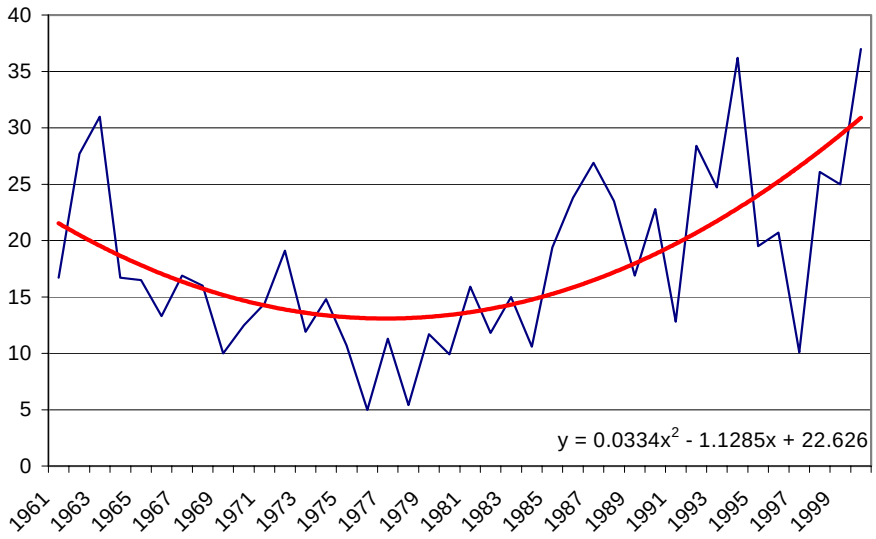
In accordance with the significant increasing trends of winter temperature over the north-eastern and western regions, significant decreasing trends of the snow layer depth has been noticed and presented in Figure 3.

Figure 3 Trends of the snow layer depth in Romania (mm/1961-200)



These decreasing trends are physically consistent with the changes in the North-Atlantic Oscillation (NAO) index, mainly prevailing the positive phase in the latest decades. The time series of extreme event frequency were analyzed for various parameters (cold/hot days, extreme precipitation, and cold season phenomena). The results presented in Figure 4 show that the winter cold days decreased and summer hot days increased.

Figure 4 Temporal evolution of the mean annual number of tropical days over the Romanian territory.



Significant increase in frequency of hoarfrost has been noticed over almost the entire country, (Figure 5) determined by an advance towards the spring, and glazed frost and snowstorm over the intra-Carpathians areas and northern Moldavia. For the maximum duration of the consecutive dry days, an increasing trend over the southern Romania for winter and western regions for summer were identified as showed in Figure 6.

Figure 5 Trends of the annual frequency of the hoarfrost days (1961-2000)

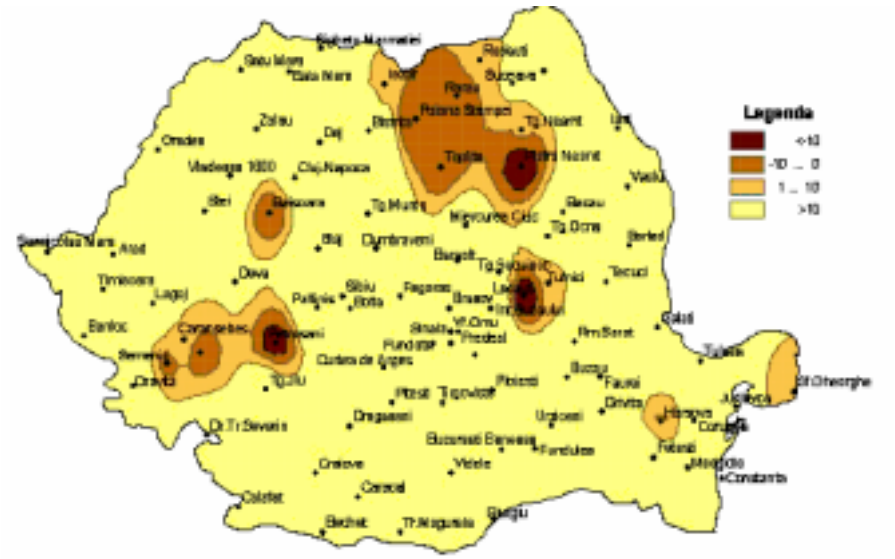
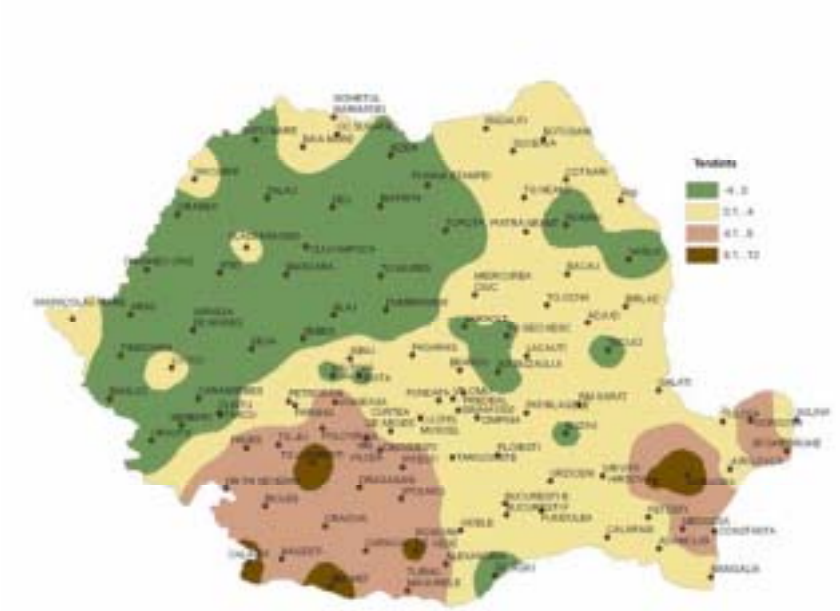
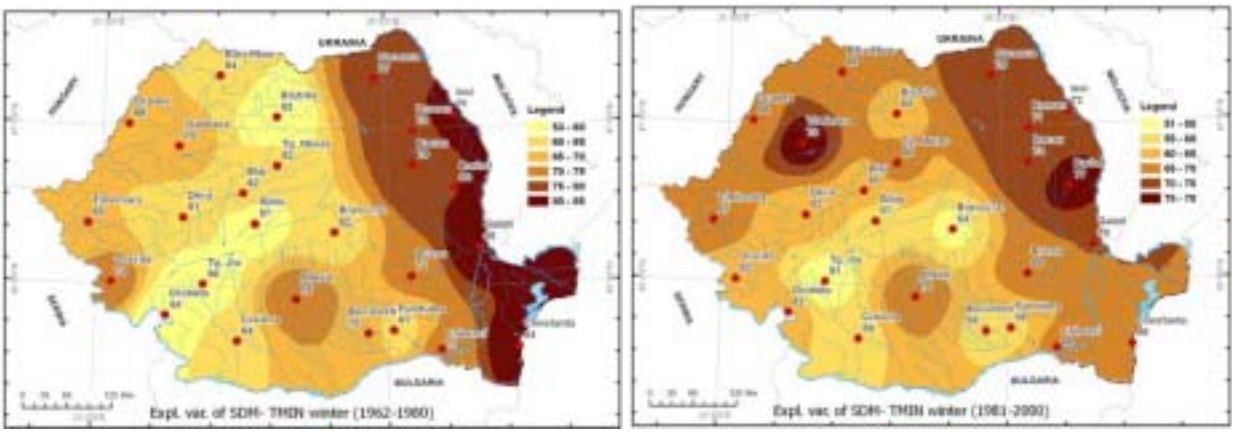


Figure 6 Trends of the maximum duration of consecutive dry days (number of days/45 year) over the period 1961-2005 in winter



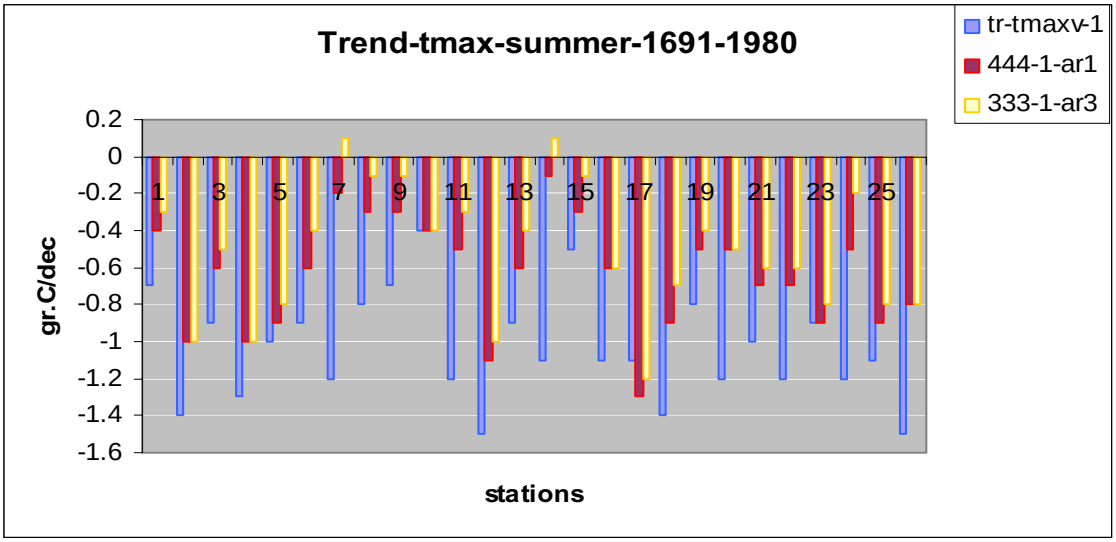
Regarding the statistical downscaling modeling, linear models based on canonical correlation analysis (for seasonal mean and extreme temperature, seasonal precipitation amount) and conditional stochastic models (daily precipitation) were developed. Significant improvements were obtained by adding new predictors (humidity and instability indices, temperature at 850 hPa) and applying more robust techniques to validate the statistical downscaling models, For example, for winter and summer temperatures, a stable and skillful statistical downscaling model was found based on canonical correlation analysis, using temperature at 850 hPa as predictor (Figure 7).

Figure 7 Performance of the statistical downscaling model expressed as fraction of the explained variance (%) of the reconstructed anomalies through statistical downscaling model based on canonical correlation for the winter mean minimum temperature over the sub-intervals 1961-1980 and 1981-2000, considered as independent data set.



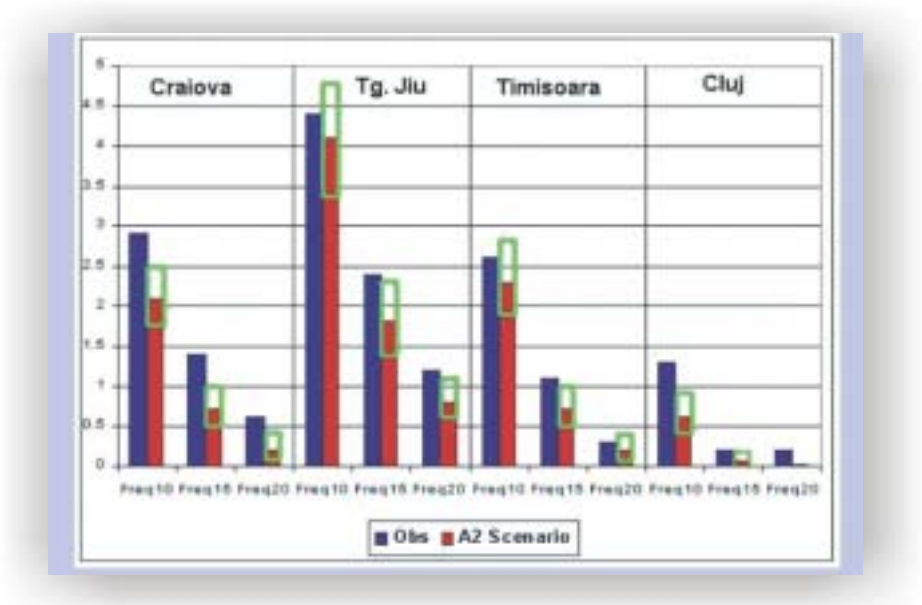
These models also reproduce well the observed linear trend as presented in Figure 8.

Figure 8 Trends (0C/decade) of the mean maximum temperature at 26 Romanian stations over the interval 1961-1980 with the model fitted over the interval 1981-2000



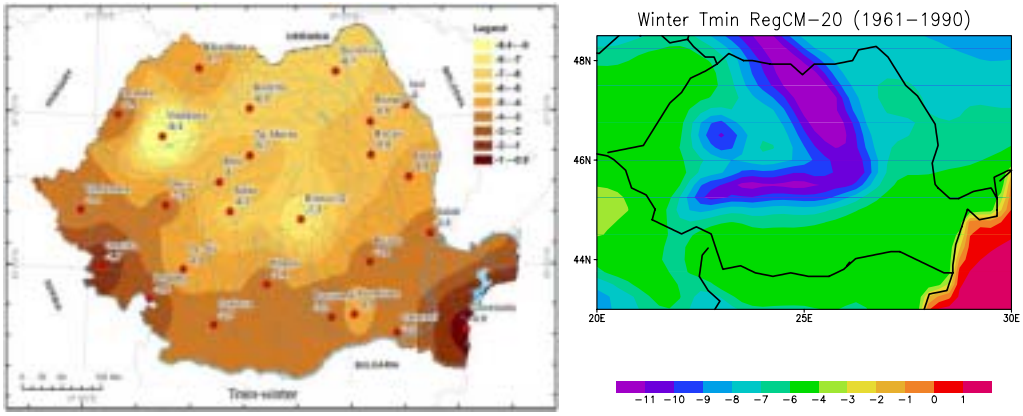
NMA is involved in the FP6 ENSEMBLES project by developing a conditional stochastic model in order to obtain probabilistic climate change scenarios, focusing on extreme precipitation indices. A skilful conditional stochastic model reproducing extreme precipitation indices at some Romanian stations, using the sea level pressure as large-scale predictor, was found for the winter season. For summer, significant improvements were obtained adding an instability index as predictor. Preliminary results show that maximum duration of consecutive dry days is projected to increase in Southern Romania for the period 2070-2099 compared to 1961-1990, under the IPCC A2 scenario as shown in Figure 9.

Figure 9 Changes in the frequency of extreme precipitation at 4 stations in Romania for the period 2070-2099 compared with the period 1961-1990, derived through the conditional stochastic model applied to the outputs of the global model HadCM3, under the IPCC A2 scenario (90% confidence intervals are marked by green)



The performance of global and regional climate models were analysed with respect to their ability to reproduce the Romanian climate characteristics (Figure 10).

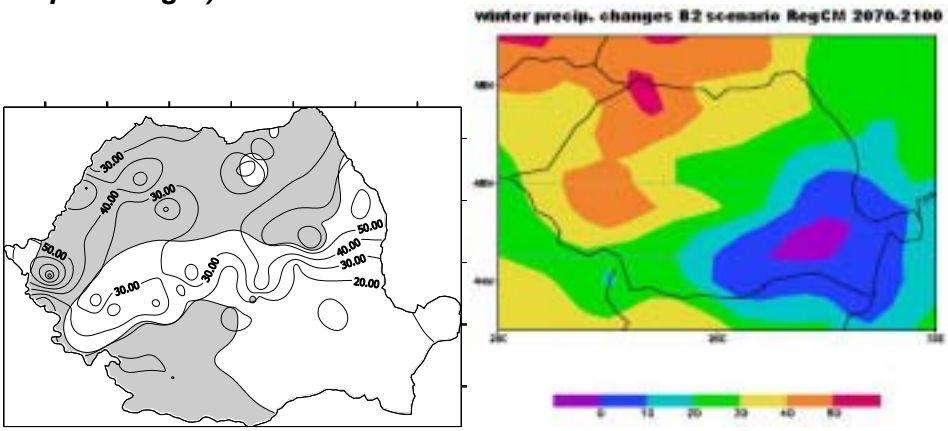
Figure 10 Long term mean of the winter mean minimum temperature derived from observations and from RegCM-20 simulations



Thus, the global (Hadley Centre models HadCM3 and HadAM3H) and regional (ICTP RegCM) climate models were analyzed. It was proved that the RegCM model reproduces the best both the climate variability of winter precipitation in Romania, the pressure variability at European scale and the connection between precipitation in Romania and the circulation at European scale.

The comparison between the dynamical and statistical downscaling techniques was performed in order to assess the uncertainties associated with the local/regional climate changes. For example, comparison between the results obtained with RegCM elaborated by ICTP and statistical downscaling models elaborated by NMA was applied for precipitation and extreme temperatures as shown in Figure 11 and 12.

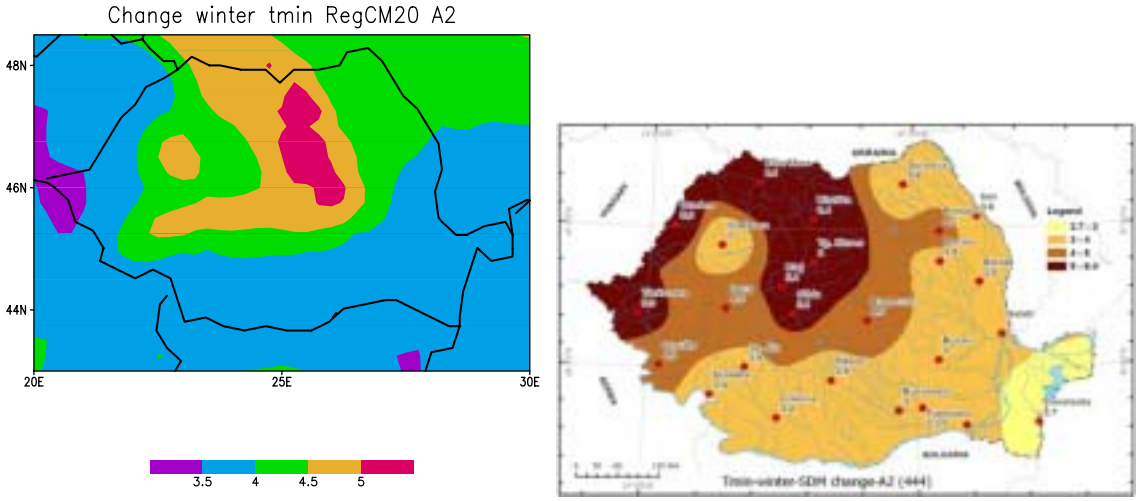
Figure 11 Changes in the winter precipitation at 60 stations in Romania yielded with the "optimum" downscaling statistical model, applied to simulations performed with the HadAM3H model, scenario A2 of IPCC (gray-hatched area displays a 10% statistical significance of the model's performance - left) (changes in the winter precipitation in Romania yielded directly from the RegCM regional climatic model outputs - right)



It was discovered that, for winter precipitation, a similar climate change signal is projected through the two downscaling techniques for the period 2070-2099 against 1961-1990, namely an increase over the north-western regions and slightly decrease over south-

western regions, under A2 scenario, that gives more confidence in these results. Similarly, for extreme temperatures, especially for winter minimum temperatures, both techniques show an increase over northwestern regions of about 5-6^{0}C and over the southern-south-eastern regions of about 2-3^{0}C. For summer, the A2 RegCM climate change scenario shows a precipitation decrease over the entire Romania and for extreme temperatures (maximum and minimum) an increase, more pronounced over south-eastern part (about 5^{0}C).

Figure 12 Changes in the winter mean minimum temperature over Romania for the period 2070-2099 against 1961-1990, derived directly from the RegCM-20 (left) and indirectly through the SDM (A2 scenario) (right)



2. Systematic Observations

The National Meteorological Network is a structure within the National Meteorological Administration (NMA) designed for carrying out measurements and observations, primary validations and data transfer. It is managed by 7 Regional Meteorological Centers and at the end of the year 2005 it was composed by 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).

The year 2003 was marked by establishing 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 made 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.

Agro-meteorological Observations

The Agro-meteorological Laboratory from NMA is a basic component of the operational activity and investigates the impact of climate variability and change on crops (including phenology and yield), and on the main components of soil water balance. It monitors daily agro-meteorological parameters and changes in the soil moisture content at (the) plant level, identifies periods and agricultural areas seriously affected by extreme events, elaborates weekly and monthly agro-meteorological bulletins, carries out long-term agro-meteorological forecasts upon plant growth, development and efficiency. This information is extremely useful in assisting the agricultural producers to choose the appropriate agro-technical solutions. Modeling and GIS techniques are used to monitor the spatial extent of extreme weather phenomena, including drought, and to assess most vulnerable areas.

The agro-meteorological measurement program includes 55 weather stations, out of which 39 are automatic and 16 classic. The agro-meteorological network has been modernized, being endowed with specialized equipment such as 55 portable soil moisture measuring systems (DELTA-T)**,** in order to perform a current monitoring of the actual soil moisture reserves throughout the crops' active vegetation period (March-November). The quantity of supplied water in soil is directly determined using sensors in different observation points (agro-meteorological platforms) representative for agriculture.

The data collection is made every 10 days at the level of the Meteorological Services, by the agro-meteorological specialists in the network, then transmitted electronically via computer to the NMA's Laboratory of Agro-meteorology in order to produce maps of the soil moisture reserve (m^3/hectare) accessible to plants (winter wheat and maize), at calendar dates of agricultural interest and at different depths (0-20 cm, 0-50 cm and 0-100 cm).

Agro-meteorological research activity is consistently improving the agro-meteorological applications in order to ensure a sustainable development of the agricultural strategies. Specifically the objectives are:

- Developing and improving the methods to assess and predict the climatic variability impact (including the extreme events) upon agriculture:
  - Modeling and assessing the effects of climatic variability upon the main components of the soil water balance;

- Researches regarding the oscillation of moisture resources and the impact upon winter wheat and maize crops - case studies for the main agricultural areas in Romania.

- Assessing the Romanian agroclimatic potential and establishing the favorableness for the main crops in order to initiate a sustainable management system in the agricultural domain.
  - Agricultural extreme events/phenomena (drought, frost, floods, etc) with negative impact upon agriculture, technological perspectives and ordinary agricultural practice.
- Assessing the potential impact of climate change upon crops growth, development and formation, using dynamic simulation models and decision-making support systems for agriculture (DSSAT v3.5), combined with different climatic scenarios forecast by the global climatic models (RCMs and GCMs).

3. Participation of Romanian Experts in International Programmes or Projects

- National Meteorological Administration is participating in 4 FP6 European projects**: ENSEMBLES (**ENSEMBLE-based Prediction of Climate Changes and their Impacts, 2004-2009), **DYNAMITE, IPY-CARE and CECILIA (Central and Eastern Europe Climate Change Impact and Vulnerability)**
- Research stages at the ARPA Emilia Romagna and Institut Non Lineare de Nice (INLN) – Sophia Antipolis, France, under the FP5 European project STARDEX (STAtistical and Regional Dynamical dowdscaling of Extremes for European regions; colaboration on statistical downscaling issues
- Research visits at the ICTP (Trieste) for 3 scientists as regular and senior associates, respectively (2003-2005)
- Workstage for the **VALIMOD project** with Universidad de Vigo, Faculdad de Ciencias, Campus Ourense, Espana, 2001-2002
- Workstages at the University of Bremen, Faculty of Geoscience, Project: **"**Multidisciplinary study based on upper Pleistocene and Holocene deposits in the Arges river lower basin for climate reconstruction in connection with Paleolitical and Neolitical chronology", under Human Potential Programme of the EU (2002-2003)
- COST 733 “Harmonisation 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”

The specialists from the Agro-meteorological Laboratory are participating in the **European Project for Cooperation in Science and Technology – COST**, to the following Actions:

- ***Action 718*** – *“Meteorological Applications for Agriculture”* (2000-2005) – The main objective of the action was to improve the meteorological applications to agriculture and environment protection through identifying and defining the requirements in terms of scale and time resolution and end-users' needs. The Romanian researchers have been involved in this action to study and analyze different irrigation models. The most important achievements referring to the application of these models included:
  - validating studies of models (test and check their ability to predict and forecast short and long term outputs) in different climatic conditions;
  - identifying the most suitable models to be used for an operative application in agro-meteorology;

- ∉ using a common procedure at the European level for data collection, archiving and spatialising and for models utilization;
- ∉ developing new methodologies regarding application of the agro-meteorological models for climate variability/change and forecasting studies;
- ∉ implementing and operationalizing the application of CROPWAT model in the agro-meteorological activity;
- ∉ analyzing the possible use of satellite information as input for CROPWAT model in order to compare the daily actual crop evapo-transpiration calculated by the model with the estimated data from satellite images (NOAA-AVHRR data);
- ∉ application of the CROPWAT model coupled with modern remote sensing techniques to evaluate various management decisions regarding the application of irrigations, to provide users in agriculture with more precise information;
- ∉ increasing scientific and technical research co-operation in the field of agro-meteorology and establishing a close co-operation with a series of International and European bodies such as Agro-meteorological Division of WMO, EUMETSAT, etc.

× ***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.

× ***Action 734*** – *"Impacts of **CLI**mate change and **V**ariability on European **AGRI**culture - 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:
- ð Determination of the possible change and variability of climate patterns in European regions with related uncertainties;
- ð Collection and review of agro-climatic indices and simulation models used to assess the impacts of climate and hazards on agriculture processes;
- ð Establishment of analysis methods (definition of frequency, intensity, trend, etc.);
- ð Assessment of required resolution (spatial and temporal) for practical agro-climatological applications;
- ð Analysis of trends of agro-climatic indices and simulation model outputs based on the application of past, present and future climatic conditions;
- ð Evaluation of the impacts on agriculture;
- ð 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.

ACCRETe Project **- Agriculture and Climate Changes: how to Reduce Human Effects and Threats** (2005 – 2007), in the framework of EU Community Initiative INTERREG III B CADSES Program, Measure 4.2: Promoting risk management and prevention of disasters. The partner countries are Italy, Greece, Germany, Czech Republic, Slovenia and Romania. From 27 to 30 October 2005 Bucharest hosted the preliminary meeting of the Scientific Council of the inter-regional ACCRETe Project.

Main goals of the project are:

- Awareness of the mutualism "agriculture - climate change"
- Making private and public actors of the agriculture sector sensitive to the possible production consequences caused by this interaction
- Improving the forecasting - and preventing systems of natural risks affecting agriculture (network)

Scientific pillar:

- Creation of the network for observatory monitoring
- Monitor the mutual relationship between agriculture and climate change in the partner regions;

Socio-political pillar:

- Exchange of experience: 3 thematic trans-national Working Groups in the partner destinations to widely discuss the topics, essentially: a) renewable energies in agriculture; b) better water resource management for agriculture; c) increase sustainable cultivation methodologies.
- Code of Attitudes for farmers easily summarizes agricultural risks due to climate change and advisable attitudes to reduce human-induced climate change effects
- Transnational Declaration: to encourage international and public boards to reflect on the dualism between climate change and agriculture, to encourage cooperation among public authorities, universities, local people, to support farmers with new activities that tone down negative climate change effects, to make consumers more sensitive.

4. Publications

Impacts and Agro-meteorology

1. A. Busuioc, V. Cuculeanu, P. Tuinea, A. Geicu, C. Simota, A. Marica, A. Alexandrescu, N. Patrascanu, V.Al. Stanescu, P. Serban, I. Tecuci, M. Simota, C. Corbus, 2003 Coordinator: V. Cuculeanu, "Potential Impact of Climate Change in Romania, Bucharest; Ed. ARS DOCENDI, National Comity for Environmental Global Change of the Romanian Academy
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4. E. Mateescu, I. Poiana, I. V. Pescaru, O. Oprea, D. Alexandru, 2004, *Agro-meteorological monitoring system – decision-making instrument to prevent and mitigate the agricultural drought in Romania, "*Technical workshop on drought preparedness in the Balkans within UNCCD" 25-26 October 2004, Poiana Brasov, Romania, Proceedings UNCCD Secretariat, Bonn, Germany

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9. A. Marica, A. Busuioc, R. Bojariu, C. Boroneant, 2005. *Application of climatic predictions and simulation models for the benefit of agriculture in Romania,* WMO Expert Team Meeting on Impact of Climate Change/Variability on Medium to Long-Range Predictions for Agriculture, 15-18 February 2005, Brisbane, Australia
10. A. Marica, 2005. *Applications of the CROPWAT model for irrigation planning and management in Romania*, In Irrigation and Pest and Disease Models: Evaluation in Different Environments and Web-Based Applications, Edited by G. Maracchi, L. Kajfez Bogataj, S. Orlandini, F. Rossi, M Barazutti, European Commission, Directorate General XII, Science, Research and Development, Environment programme-COST Action 718
11. A. Marica, G. Stancalie, D. Alexandru, A. Nertan, C. Flueraru, 2005. *Application of GI-based procedures for soil moisture mapping and crop vegetation status monitoring in Romania,* WMO, FAO & COST 718 Workshop on Climatic Analysis and Mapping for Agriculture, 14-17 June 2005, Bologna, Italy
12. A. Marica, 2005. *Applications of the CROPWAT model for irrigation planning and management in Romania*, In Irrigation and Pest and Disease Models: Evaluation in Different Environments and Web-Based Applications, Edited by G. Maracchi, L. Kajfez Bogataj, S. Orlandini, F. Rossi, M Barazutti, European Commission, Directorate General XII, Science, Research and Development, Environment programme-COST Action 718
13. A. R. Palade, E. Mateescu, R. Oprikescu, 2002, *The hydric potential available for the winter wheat and maize crop in the Moldova Plateau,* Annual Scientific Papers Delivery Session NIMH, Bucharest, Papers compendium, 3-6 June 2002
14. R. Povarł, E. Mateescu, R. Oprikescu, 2003, *Assessment of the influence of the precipitation deficit in the autumn months upon the vegetation condition and the wheat crop in Vâlcea district*, Geography of Vâlcea District – Theory and practice, Volume III, Offsetcolor Publishing House, Râmnicu Vâlcea
15. C. Simota, A. Marica, V. Cuculeanu, 2003. *Climate change impact on agricultural ecosystems; vulnerability assessment and adaptation measures*, Ed. ARS DOCENDI, Romanian Academy - National Committee for Global Environmental Changes
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4. R. Bojariu, L. Gimeno, 2003: The influences of snow cover fluctuations on multiannual NAO persistence. Geophysical Research Letters, 30(4)
5. R. Bojariu, L. Gimeno, 2003: Predictability and numerical modelling of the North Atlantic Oscillation. *Earth Science Reviews*, in press.
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Chapter 8. Education, Training and Public Awareness

1. Introduction

In Romania the climate change related activities are under the responsibility of the Ministry of Environment and Water Management which has undertaken a series of activities in this field in the last years in close co-operation with foreign partners like the Netherlands, Denmark and Switzerland and also with some NGOs. Some of the activities developed in this regard were related to distributing the Third National Communication to the UNFCCC, preparing the National GHG Inventory in the specified format (CRF and NIR), re-organizing the National Commission on Climate Change, publishing media articles on climate change issues, and raising awareness through the ministry web page. Awareness of the causes and effects of climate change is not yet so widespread in Romania due to a lack of capacity and financial resources.

The article 6 of the UNFCCC refers directly to education, training public awareness and access to information and international co-operation. Several activities in this field were initiated by the government and also by some Romanian NGOs in cooperation with the government. “TERRA Mileniul III” is probably the most active NGO in the climate relate activities in Romania working on information dissemination, public participation, training and publishing useful information on the matter.

Institutions Involved

- ***Ministry of Environment and Water Management (MEWM)*** is the main public administration authority responsible for climate change policy.
- ***National Commission on Climate Change*** has to review the National Communications to the UNFCCC for approval, discuss national programs on the basis of UNFCCC provisions, approve Joint Implementation projects and promote flexible mechanisms, promote awareness activities under the UNFCCC and Kyoto Protocol, discuss periodical reports and inform the competent authorities and the public about its findings.
- ***Infoterra Romania*** is an autonomous NGO hosted by MEWM, representing the focal point for environmental information.
- ***Other Romanian NGOs*** – associations and foundations focused on climate change issues or related issues, such as energy, transport, waste management, agriculture and forestry.

Legal Requirements

In Romania, the access to information and the public participation in environmental decision-making is well regulated through a set of national laws and ratified international conventions.

1. Ministerial Order no. 864/2002 for approval of trans-boundary environmental impact assessment and public participation in the decision-making procedures for projects with trans-boundary impact

2. Law no. 544/2001 on the free access to information of public interest as amended by the Governmental Decision no. 123/2002 for approving the methodologies norms for applying the law 544

3. Law no. 265/2006 for the approval of EGO no. 195/2005 on environmental protection

4. Governmental Decision no. 780/2006 establishing a scheme for greenhouse gas emission allowance trading (EU ETS)

5. Ministerial Order no. 1008/25 September 2006 to approve the competences and the issuing and reviewing procedure of the greenhouse gas emissions permit

6. Law no. 86/2000 for the ratification of the Convention on access to information, public participation in decision-making and to justice in environmental matters, done at Aarhus, on 25 June 1998

7. Government Decision no. 878/2005 on public access to environmental information

8. Governmental Decision no. 1115/2002 regarding the free access to the environmental information

2. Education

The highest authority involved in this field in Romania is the Ministry of Education and Research. The climate change process is not specifically addressed in the curricula, but it is presented in the broad framework of environmental protection and sustainable development education. Young people in the primary school are the key target for raising awareness and understanding of climate change process and it is very important to know how to present the causes and effects of the phenomena in an understandable manner. At the level of secondary school, the pupils are encouraged to explore more on this field in the same time with some outside activities addressing the need to protect the environment. Unfortunately, there are some barriers in the climate change education area: the lack of trained teachers in this field and also the lack of teaching materials, few special programmes that address climate change related activities.

Regarding higher education climate change activities are addressed at the environmental departments or faculties in the state owned or private universities. In the period 1995-2002, several universities in Bucharest and in other important university centers like Timisoara, Brasov, Cluj, Iasi established faculties or departments studying environmental sciences and in this respect climate change issues were addressed. The most important universities are:

1. Academy of Economical Studies, Bucharest – Economy and Management of Agricultural and Food Production - Environmental Department
2. University of Bucharest – Faculty of Biology, Faculty of Geography
3. Polytechnic University, Bucharest – Faculty of Energy
4. University of Agronomical Sciences and Veterinary Medicine, Bucharest
5. Ecological University, Bucharest
6. Technical Construction University, Bucharest – Faculty of Hydromechanics

7. Technical University “Gh. Asachi”, Iasi – Faculty of Hydromechanics
8. “Al.I. Cuza” University, Iasi – Department of Geography
9. University of Craiova – Faculty of Horticulture
10. “Ovidius” University, Constanta
11. “Babes-Bolyai” University, Cluj Napoca
12. „Dunarea de Jos” University Galati

NGOs – education in schools

The association *Earth Friends* from Galati prepared in 2000 a curriculum for high school on “Energy and Environment”. The curriculum was implemented in the Technical College “Paul Dimo” from Galati for two years. In 2001, they also produced a manual for teachers which focused on the same topic, and probably in the coming years this kind of programmes will be replicated in other cities and at the state level.

Few NGOs have tackled the climate issue in order to raise the awareness among young people through dedicated education projects. The Ecumenical Association of Churches in Romania – AIDROM, Bucharest has initiated in 2003 a project at regional level that focused to promote climate change and energy education among secondary school pupils. On this occasion a set of educational materials has been prepared: a manual “Save the Climate!”, three leaflets: “10 reasons to protect the forests”; “Transport and environment”; “Save the energy” and a parlor game on climate change, both in Romanian and Hungarian. The project also initiated a non-formal network between 5 environmental organizations and schools from 4 localities.

Due to the success of this project, a follow-up has been promoted, and another projects in 2004 “Kyoto Club” and “Green School” in 2005 have been developed. Many more environmental NGOs have been attracted into these projects, covering 8 micro-regions; at present the following are involved: Association ALMA-RO, Bucuresti; Association Floarea Reginei, Sinaia; Asociation Sighisoara Durabila-group for civic initiative, Sighisoara; Association for Nature and Environmental Protection Rhododendron, Târgu Mureş; Amoeba Eco Center Association, Gheorgheni; Association for Tourism and Nature Safeguarding ATON, Miercurea-Ciuc; ONG Mare Nostrum, Constanța; Association CARPATICA Pro-Convention, Târgu Mureş; Environment Association Prietenii Pământului, Galați; Foundation TERRA Mileniul III, Bucureşti.

The educational materials produced during this period referred to “a monthly newsletter: Kyoto Club newsletter”; a manual as a teaching aid and an exercise book for pupils on energy conservation; a manual “How to reduce your energy consumption rate?”; an exercise book “Guide to become an energy detective!”, together with other additional visibility materials of the network.

Activities of NGOs and another’s associates regarding climate change:

1. Title: Kyoto Club (2004- 2005)
Project’s objectives:
- building a functional network of schools based on climate change topics named Kyoto Club
- supporting children to take part on climate change mitigation by reducing energy consumption.

Partners: Ecumenical Association of Churches from Romania AID Romania (project coordinator), Terra Milenium III Bucharest Foundation (Project Secretariat), ALMA-RO Association Bucharest, Association Queen's Flower Sinaia, Rhododendron – Miercurea-Ciuc Environmental Protection Association Amoeba Gheorghieni Association, Sustainable Sighisoara Association - Sighisoara.

2. Title: Energy market opening in Romania (2004-2005)
Scope: increasing awareness level for central and local authorities on energy market opening in Romania.

Developer: Terra Millennium III Foundation

3. Title: Education for democracy (2003- 2004)
Scope: promoting democracy participation values at national level through an active involvement of schools, social an political actors, for community development. The targeted group: 40 teachers responsible with civic education, 10 NGO's representatives and 80 pupils.
Partners: County Inspectorate Iasi, Educational Soros Foundation from Miercurea-Ciuc, National College Vasile Alecsandri - Bacau, Mihai Eminescu High school-Bucharest and International Forum - Timisoara.

4. Title: "The Green School" (June 2005 - May 2006)
Objectives: The project aimed at increasing the awareness of the targeted group concerning climate change and practical methods to reduce energy consumption. Another focus of the initiative was to increase the environmental NGOs capacity to lobby and advocate for reduced energy consumption. The target group was represented by children and teenagers (10-16 years of age), teachers and school administrators in eight Romanian cities.

Activities: As partner of the managing organization, ALMA-RO had the following responsibilities:
- to contribute to the editing and designing of the information materials published during the project
- the elaboration of an information bulletin
- to contribute to the organization of a training session for teachers and NGOs
- the coordination of educational activities in Bucharest

Project supported by: The Kerkinactie Foundation, through "The Earth is taking a Breath" Program.

Partners: AIDRom Romania, Terra Mileniul III Foundation, Amoeba Eco Center, ATON, Prietenii Pamantului, Rhododendron, Sighisoara Durabila.

3. Information and Public Awareness

The Ministry of Environment and Water Management uses different channels for providing information to relevant target groups: mass media, NGOs, business sector. One of the instruments is the ministry's website - www.mmediu.ro. The page contains legislative information, programs and projects developed by the ministry, contacts and other related links. In the near future, the climate change responsible experts in the ministry in co-operation with foreign partners will develop a specific Romanian web

page especially dedicated to the climate change process in addition to the existing one (www.eu-ets.ro) focused only on the development and implementation of European Union Emissions Trading Scheme in Romania.

The ministry organizes press conferences on a weekly basis. After UNFCCC negotiations (COPs and SB meetings), the results of the process are presented to the media. Also, details about Joint Implementation projects are disseminated to the large public via mass media.

Interviews and articles dealing with GHG emissions and the overall effects of climate change were published the last few years in several newspapers. Representatives of the relevant departments of the ministry have presented the issues of global warming and climate change in many radio transmissions and talk-shows, raising the awareness of the general public on these matters.

An important contribution to information dissemination, not only at the national level but also at the regional level, comes from the environmental NGO "TERRA Mileniul III", which coordinated in the period 2001-2003 the regional NGOs network – Climate Action Network Central and Eastern Europe (CANCEE).

It produced in 2002 a report "Access to Information and Public Participation in Decisions Affecting Climate Change", together with an advertising leaflet and 2 newsletters regarding causes and effects of climate change and including recommendations for general public on how to reduce the GHG emissions in their daily life, in the frame of a REC/WRI partnership funded project: "Capacity for Climate Protection in Central and Eastern Europe".

During 2001-2003, Foundation TERRA Mileniul III developed a project that aimed at promoting CEE NGOs involvement in order to avert the threat of global warming. As result, a CAN CEE newsletter and website were elaborated, a manual "Defend the climate – a manual for environmental activists in Central and Eastern Europe" was published, a regional report "Independent NGO Evaluation of the Third National Communication under United Nations Framework Convention on Climate Change" has been released.

During October 2002 – March 2003, TERRA Mileniul III conducted a survey among different interested actors (Ministries, National Agencies, economic actors) that might have an involvement in establishing and running of the National Registry on Climate Change, publishing a conclusion report at the end: "Preparatory study regarding the implementation of the National Registry on greenhouse gases in Romania"

Unfortunately, the activities regarding information dissemination, public awareness and public participation are not so developed in Romania, due to the lack of funding for awareness campaigns. Nevertheless, funding for public awareness activities and other public orientated programmes will be addressed in the future on the basis of Romania's good co-operation in climate change activities (mainly on Joint Implementation Projects) with Denmark, the Netherlands, Switzerland and others.

The Romanian Energy Policy Association (APER) has an important involvement in this process by organizing different workshops and seminars like the APER Forums for dialog and exchange of experience among the specialists from the energy sector,

representatives of public administration, international organizations and consulting companies from Romania, EU and USA, and also for drawing the lines and involving decision makers in the elaboration of policies, strategies adapted to the international standards.

From the activities organized by APER worth mentioning are:

- Implementation of Renewable Energy Sources in Romania, 2005
- Climate Change Impact on Business & Industry, Bucharest, 2003
- Presumable and Possible Influence of Climate Change on the Romanian Energy Sector, 2004

In the frame of a European Union Phare programme funded project: "Development of the Implication of the Non-Governmental Sector in the Adoption and Implementation of the Environmental „Acquis Communautaire" in the Field of Air Quality and Climate Change", that was developed in partnership by TERRA Mileniul III and Polish Ecological Club-Mazovian Branch, a series of publications were elaborated: a manual on climate change: "Climate Change – from awareness to action - training manual for environmental NGOs in the field of air quality and climate change"; a bilingual study (in Romanian and English) on policies and measures for GHG limitation in the European Union, Poland and Romania (comparison between Romania and the EU), together with press releases and articles in media, radio broadcasts on the subject.

The First Romanian Exhibition Dedicated to Renewable Energy Sources

The first edition of an exhibition dedicated to the renewable energy sources was organized in Bucharest in the period 2-5 May, 2006. For four days the companies producing, importing and distributing technologies and equipment aimed at using renewable energy sources had the possibility to exhibit their products to the large public. According to the organizers, the event offered the possibility of an immediate contact between producers, importers and distributors on the one hand and the various public categories on the other, having in view the information of the advantages of using renewable energy sources. Besides being able to visit the exhibited stands, those who were present to the event had the possibility to participate in a series of symposiums, dedicated to some important aspects in the field of energy renewable sources.

The main idea of the exhibition was related to the fact that the efficient use of energy and the use of renewable energy sources on a large scale allow energy savings and reduce the use of primary energetic resources which implies positive effects on social and economic development. Also they contribute to the preservation of natural resources and to reducing the impact of economic activities on the environment by reducing GHG emissions.

4. Training

Several training programmes and activities were developed in Romania based on direct co-operation between the government and NGOs and also on the international cooperation:

- The Environmental Protection Agency and the Center for Clean Air Policy - USA organized in July 2000 a training session on Emission Trading for CEE representatives. Representatives from the Romanian authorities and NGOs took part in this training.

- In the frame of the program Capacity Building in Balkan Countries to Address Climate Change, developed in Romania by the Greek Ministry for the Environment, Physical Planning and Public Works, a training session for enhancing skills to prepare national inventories was organized in April 2002.
- An invited expert from the MEWM participated in September 2002 in the in-country review of the GHG inventory of Hungary as an observer in the review. The review was organized by the UNFCCC Secretariat and provided a great opportunity for the invited experts to share views on the inventory preparation and submission process. Another expert on inventories participated in the training course organized by the UNFCCC Secretariat on reviewing GHG emissions inventories, participating further in different reviews.
- TERRA Mileniul III has a long history in organizing training sessions on climate change related issues that are addressed to various target groups: environmental NGOs, school teachers, civil servants from local administration, business representatives, and national agencies for energy regulation in Romania, mass media in order to enhance their knowledge and develop new skills.
- A very successful training event "Climate Change – from awareness to action" took place in March 2004, where more than 20 NGO representatives benefited of an extremely intensive course, with updated information and lots of additional materials, including 'hot news' from the central authority level.

There is still an urgent need for training programmes in Romania in this field and for skilled experts to work side by side with Romanian experts, and also expert's participation in international courses and workshops.

5. Public Access to Information

Access to Information and Public Participation in Decisions Affecting Climate Change

These activities were performed in the frame of the "Capacity for Climate Protection in Central and Eastern Europe" project, developed by the REC/WRI partnership in 2002-2003. TERRA Mileniul III was the Romanian partner in the project and carried out the Romanian survey.

The objectives of the program were the following:

- Access to general information about GHG emissions and compliance
  - information from national communications and inventories;
  - facility-level information on GHG emissions or fuel use.
- Participation in decision-making affecting climate change
  - sector policies, plans and programs;
  - participation in decisions on Activities Implemented Jointly (AIJ) and/or Joint Implementation (JI).
- Efforts to build the capacity of the public for meaningful participation in climate change-related decision-making
  - government efforts and investment to support understanding and participation in decision making affecting climate change
  - conditions and capacity of private sector to support understanding and meaningful participation in climate issues
  - sources of general understanding of climate change issues by the public.

The target groups consisted of authorities (ministries, governmental agencies); business sector (state-owned and private companies, research institutes); non-governmental organizations.

6. Public Participation in addressing climate change

In May 2004, TERRA Mileniul III and Polish partner in the project have organized a seminar “Policies and measures for greenhouse gases emission mitigation in the energy sector: European Union – Romania – Poland”, which aimed at strengthening the co-operation between Romanian stakeholders in the field of climate change (central and local authorities, consultancy companies, non-governmental organizations) in order to urge the establishment of the Romanian climate policy by disseminating the EU (and Poland) good practices in this area. At the end of this meeting, it was possible for the participants to bring forward recommendations to the Romanian Government on how to overcome obstacles in the implementation of the acquis communautaire in the field of air quality and climate change.

7. International cooperation

Romania has great potential to attract foreign investments through the Joint Implementation mechanism aimed to bring more energy efficiency and cost-effective technologies in the power, industrial and transport sectors.

In this respect, Romania has already signed 8 Memoranda of Understanding with different Annex I country Parties which established the general framework for co-operation on the implementation of concrete JI projects. Based on these Memoranda, Romania has received different capacity building projects related to meeting the commitments under the UNFCCC and Kyoto Protocol.

Romania is an active participant in the international meetings like the COPs, SB meetings, Annex I Expert Group meetings, and also all major international conferences and workshops in the climate change related fields. The Romanian experts were invited to participate in regional or international training on Kyoto Protocol’s flexible mechanisms-Joint Implementation and also in the in-depth reviews of National Communications and centralized or in-country reviews of GHG inventories.

TERRA Mileniul III has developed during 2003-2004 a project in partnership with Polish Ecological Club – Mazovian Branch, addressing Romanian environmental NGO sector in order to raise its involvement and capacity to participate in the adoption and implementation of the environmental acquis communautaire, in the field of „Air Quality and Climate Change”. In this frame, an international conference: “Paving the Road for the Implementation of the European Union’s Climate Policy In Romania” has been organized in July 2004 in partnership with MEWM, Ministry of Administration and Interior, with the support from the Danish Environmental Protection Agency.

On this occasion, important issues of the climate agenda were discussed, presented and debated: National Allocation Plans, good experiences in this field both from the former EU-15 states, with a special focus on a case study concerning the Danish National Allocation Plans, and also from the new member states; responsibilities for the

Romanian public authorities in the adoption and implementation of the policies and measures for reducing the GHG emissions in the energy sector together with the promotion of existing opportunities for financing energy investments which are addressed to them – especially by emphasizing the Joint Implementation projects; NGOs' activities and contribution in the climate protection process, different approaches being: public campaigns on climate in Poland, networking in the CEE on climate decision making or Romanian experiences in the climate related activity.

In an attempt to catch up with the EU member states, the Romanian Government has signed many international environmental conventions and agreements. In order for Romania to fully integrate into the European Union, full compliance with EU legislation is essential. In this sense, at the beginning of 2005, a series of 4 regional seminars have been organized by TERRA Mileniul III, in the frame of the UNDP/GEF and MEWM project: Romanian "National Capacity Self-Assessment for Global Environment Management", which duration covered 18 months: January 2004 - July 2005. The overall objective of the NCSA Project was to enable Romania to identify country level priorities and needs for capacity building to address global environmental issues, in particular those pertaining to the Conventions of Biological Diversity, Climate Change and Land Degradation.

The regional seminars with the theme "The United Nations conventions on global environmental management opportunities and constraints in implementation" were held in 4 key locations, inviting representative of some public institutions (local and regional authorities), decentralized institutions, research institutes and universities, school inspectorates, private companies, NGOs from different regions in Romania: Galati, Pitesti, Brasov and Cluj. The main targets of the regional workshops were as follows: dissemination of the information concerning the three Conventions and the results obtained until that moment by the project teams for the three thematic areas; stakeholders' identification and consultation at the local level as being interested in the existing local capacities and those ones required to be developed or created so as to respond to the requirements of the three international environmental Conventions; stakeholders' consultation as regards priority actions at the local level for the development/creation of these capacities.

The regional workshops highlighted the fact that at the local level, depending of the relief and the climate in the area, phenomena approached by the three Conventions were differently perceived as follows: in Galați, a special importance was awarded to desertification and climate change; in Piteşti, stress was laid on desertification and biodiversity; in Cluj, on biodiversity and climate change, and in Braşov, on biodiversity.

The main identified problems were: necessity for the participatory process in the Conventions' implementation, lack of communication among stakeholders, lack of knowledge as regards Conventions at the local level, no understanding of the basic notions relating to the Conventions' requirements. Discussions led to identification of the capacities to be developed or created at the local level for the Conventions' requirements implementation, the local aspects being considered by the project teams when developing the thematic action plans.