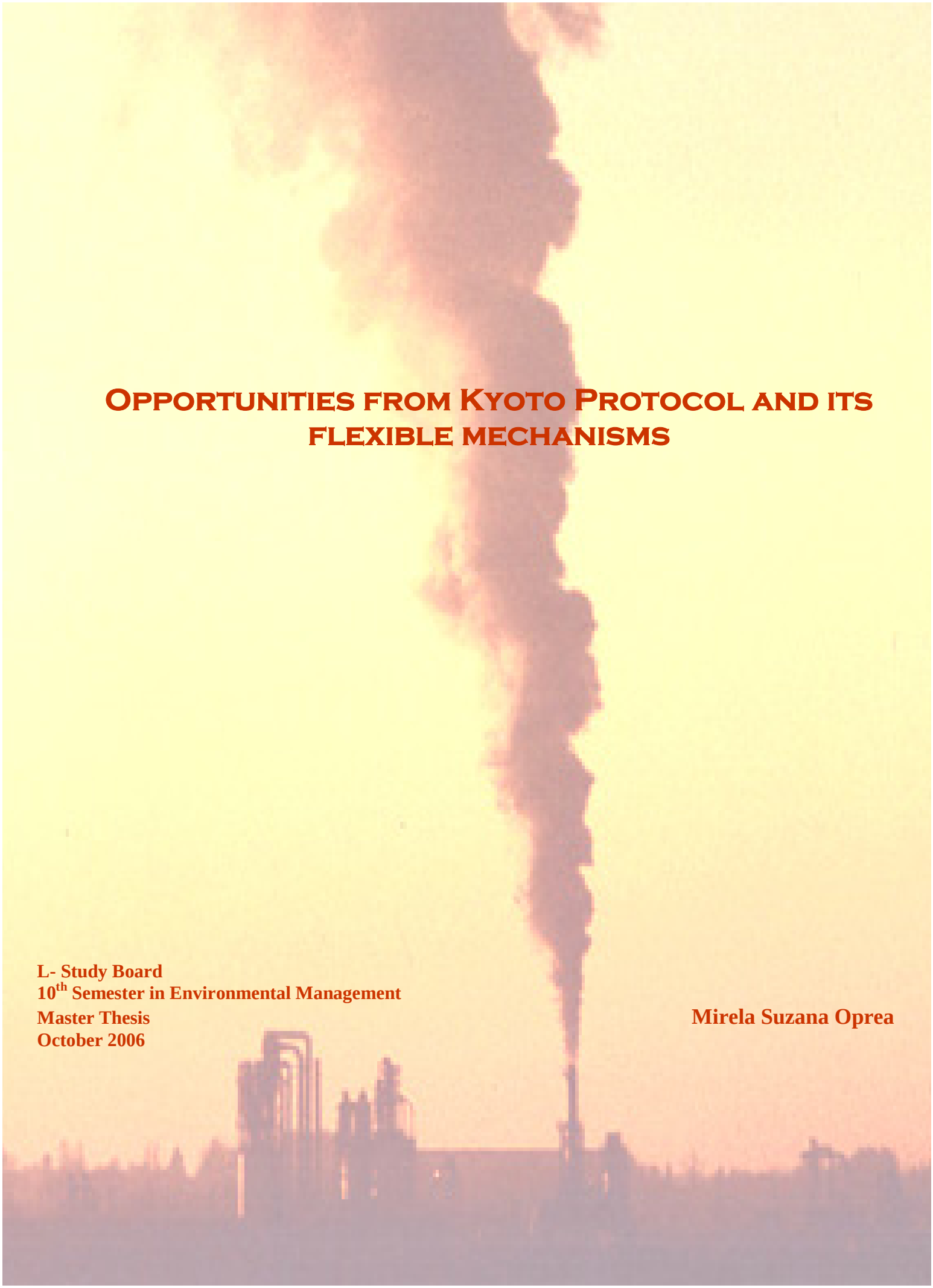

Opportunities from Kyoto Protocol and its flexible mechanisms

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Synopsis:

Global warming is one of the most serious challenges facing us today. To protect the health and economic well-being of current and future generations, there is a need to reduce the emissions of heat-trapping gases by using the technology, know-how, and practical solutions that already exists.

The UN Framework Convention on Climate Change (FCCC) is the first binding international legal instrument to address the issue of climate change. A parallel advance has been the adoption of Kyoto Protocol with its legally binding emissions targets for industrialized countries.

The chosen research issue is connected tightly with the process of implementation of the project "Technical Assistance for National Climate Change Strategy and Action Plan in Romania".

The focus is on the opportunities that Kyoto Protocol and its flexible mechanisms offer in the process of meeting their obligation under the Convention and the Kyoto Protocol. The analysis was done with the use of the scenarios. The purpose of scenario building was not to predict a specific future, but to build some plausible descriptions of what might occur.

In order to discover if Romania will gain from the opportunities that the Kyoto Protocol offers was necessary to look at the economical development, the energy sector (demand and supply) and the greenhouse gases emissions in Romania and to determine the future trends.

Based on the results of the discussion it is concluded that Romania can gain from the Joint Implementation projects and the international trading system if they follow the requirements and take measures to improve the energy efficiency.

Preface

This project is a final thesis of the master program for Environmental Management in the Department of Development and Planning at Aalborg University. The master thesis was prepared during the period April 2006 to October 2006.

The idea of this research question was generated when I was traveling in Romania for meetings in the Ministry of Environment and Water Management during my traineeship in the 9th semester. This Master Thesis takes its point of departure the 9th semester project that analyzed the challenges in the institutional and legal framework in the process of implementing climate change legislation and strategies. The 9th semester project and the Master Thesis are linked with my traineeship prepared in COWI one of the biggest consultancies in Denmark. COWI assists Romania in meeting their obligations in relation to UNFCCC, Kyoto Protocol and EU approximation process. Another important issue discussed during the meetings is the chance that the Kyoto Protocol and its mechanisms offer and it will be the focus of this project. The purpose of this Master Thesis is not to predict what will happen in the future, but what might happen given the specific assumptions and methodologies used.

I want to express deep appreciation to COWI for the opportunity given to be a trainee in the company, as well for the help offered in the process. I want also to thank to the Romanian Ministry of Environment and Water Management for providing valuable information's. Finally, at the personal level, I would like to thank my family and my friends for their precious support and encouragement, especially to my husband and to my colleagues WanLin and Aneta during the last two months.

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Mirela Suzana Oprea

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Part I Scope of the project

Chapter 1 Introduction

> "*The world's climate has always varied naturally, but compelling evidence from around the world indicates a new kind of climate change is now under way, expecting drastic impacts on people, economies and ecosystems*." (UNFCCC, page 1, 2005)

1.1 The challenge of the world

Levels of carbon dioxide and other greenhouses gases (GHG) in the atmosphere have risen during the industrial era due to human activities like deforestation or heavy fossil fuel use, stimulated by economic and population growth. (UNFCCC, 2005) In this way it is a fear that this human-made process can have potential implication for the planet making climate change the most important contemporary global environmental issue. (Carter, 2001) The results of global warming could be devastating making challenging for the entire world to find new solutions to solve existing and future problems.

Like a blanket round the planet, greenhouse gases trap heat energy in the Earth's lower atmosphere. If levels raise too high, the resulting overall rise in air temperatures – global warming – is liable to disrupt natural patterns of climate. Less developed countries will suffer more than others, as their lack of resources makes them especially vulnerable to adapt to these extreme changes. Yet people in developing countries have created only a small proportion of greenhouse gas emissions compared with the rest of the world. (UNFCCC, 2005)

1.1.1 The history UNFCCC and Kyoto Protocol

Scientific evidence of human interference with the climate first emerged in the international public arena in 1979 at the First World Climate Conference. As public awareness of environmental issues continued to increase in the 1980s, governments grew even more concerned about climate issues. In 1988 the United Nations General Assembly adopted a resolution urging: "… protection of global climate for present and future generations of mankind". In the same year, the governing bodies of the World Meteorological Organization and of the United Nations Environment Programme created a

new body, the Intergovernmental Panel on Climate Change (IPCC), to collect and assess scientific information on the subject. (UNFCCC, 2005) The attention was being paid to the possibility that climate change was under way as a result of human activities. In 1990 the IPCC issued its First Assessment Report, which confirmed that the threat of climate change was real. Observations show that the average temperature has risen with 0.6 ± 0.2°C since the late 19th century. (IPCC, 2001) The Second World Climate Conference, held in Geneva later that year, called for the creation of a global treaty. The General Assembly responded by formally launching negotiations on a convention on climate change, to be conducted by an Intergovernmental Negotiating Committee (INC). The INC first met in February 1991 and its government representatives adopted the United Nations Framework Convention on Climate Change (UNFCCC), after just 15 months of negotiations, on 9 May 1992. At the Rio de Janeiro United Nations Conference on Environment and Development (or Earth Summit) of June 1992, the new Convention was opened for signature and 150 nations signed the UNFCCC. It entered into force on 21 March 1994. (UNFCCC, 2005) The convention identified a set of principles e.g. precaution, equity, sustainability and a wide range of measures to enable the international community to stabilize the greenhouse gases emissions. However, no targets or deadlines were established; the developing countries were expected to take the lead and transfer technological and financial resources to developing countries, as well as to reduce their GHG emissions to 1990 levels. (Carter, 2001) Since it entered into force, the countries that ratified the treaty have met annually at the so called Conference of the Parties (COP) where they continue the negotiation on how to tackle the climate change in the best way. The discussions were focusing on more detailed commitments for industrialized countries. (UNFCCC, 2005)

In December 1997, after two and a half years of intensive negotiations, a substantial extension to the Convention that outlined legally binding commitments to emissions cuts was adopted at Conference of the Parties (COP) 3 in Kyoto, Japan. The Kyoto Protocol sketched out basic rules, but did not specify in detail how they were to be applied. It also required a separate, formal process of signature and ratification by governments before it could enter into force. (UNFCCC, 2005)

The adoption of the Kyoto Protocol is much better known than the UNFCCC because of its legally binding emissions targets for industrialized countries and subsequent development of the rules for its implementation. The Kyoto Protocol supplements and strengthens the Convention, providing a

framework for remedial and precautionary action to tackle adverse effects of climate change. Most industrialized nations and some central European economies in transition agreed to legally binding reductions in greenhouse gas emissions of an average of 6 to 8% below 1990 levels between the years 2008-2012, defined as the first commitment period. Developing countries have no specific measures regarding the emissions reduction. (UNFCCC, 2006)

The Kyoto Protocol has caused several concerns which focus on its scientific basis, economic cost and fairness. First, critics of the Kyoto Protocol questioned the results that IPCC offered due to the fact that no specific figure for an acceptable concentration of GHG emission was offered. Another concern is the economic cost to reduce the GHG emissions, this being possible to slow down the economic growth in developed countries. Furthermore, the weaker restrictions for developing countries because there are not considered the main contributors to the GHG emissions during the industrialized period. (Carnegie Endowment, 2006)

1.2 KP mechanisms

In addition to policies and measures to reduce greenhouse gas emissions, countries can use the Kyoto mechanisms. Three procedures established under the Kyoto Protocol were introduced to increase the flexibility and reduce the costs of making greenhouse-gas emissions cuts, i.e. the Clean Development Mechanism (CDM), Joint Implementation (JI) and International Emissions Trading (IET), together called Kyoto Mechanisms (KM). (COWI, 2005) These mechanisms are designed to help member countries from industrialized countries (Annex I) to cut the cost of meeting their emissions targets by taking advantage of opportunities abroad to reduce emissions or increase greenhouse gas removals that are less costly than at home. (UNFCCC, 2005) More details about how the countries are divided in the Convention can be found in appendix one.

The **Clean Development Mechanism** assist developing countries in achieving sustainable development by permitting industrialized countries to finance projects for reducing greenhouse gas emission in developing countries and receive credit for doing so. (COWI, 2005)

Joint Implementation mechanism allows industrialized countries (Annex I) of the UNFCCC and the Kyoto Protocol to invest in emission reducing projects in another industrialized country

(including countries with economies in transition) obtaining Emission Reduction Units when financing projects that reduce net emissions as the costs of emission reductions are significantly lower in other countries. (COWI, 2005)

International Emissions Trading is the mechanism through which countries with emissions commitments may trade units of their emissions allowances with other countries. The aim is to improve the overall flexibility and economic efficiency of making emissions cuts. The **IET** mechanism allows the trade of emission allowances (Assigned Amount Units, AAU's) that industrialized countries have been provided with. If Romania will meet the 8 % reduction goal, will have a surplus of AAU's when compared with the expected GHG emissions in 2008-2012 and thereby it has the opportunity to sell some of the excess AAU's to other industrialized countries. (COWI, 2005) The emissions trading units are explained in appendix seven.
The focus in this project will be on JI projects and IET because Romania is part of industrialized countries and until now have not been involved in CDM.

1.3 Present situation in Romania

In December 1989, Romania began its transition towards a free market economy and democracy. Previously, concepts like sustainable development were not well-known or understood and were therefore neglected by the public. In 1999, Romania adopted a long-term National Sustainable Development Strategy (NSDS) and subsequently prepared a National Action Plan for the implementation of the NSDS and the introduction of the Local Agenda 21 process in the country e.g. as Romania ratified multilateral environmental agreements. In the context of the sustainable development the protection of the environment is very important, as well as the global warming being a sub-aspect of sustainable development. In this way Romania needs to address this issue and to implement the requirements of the signed convention through policies and measures. This has to be applied in sectors and activities that have consequences in the generation of greenhouse gas emissions (GHG), mainly in the production and consumption of energy and transports which are responsible for approximately 85% of Romania's total GHG emissions. (MEWM, 2005)

Romania signed the UNFCCC, in 1992 at the Rio de Janeiro Earth Summit and ratified it by Law no. 24/1994 and is a part of the industrialized countries (Annex I). Romania was the first country to

ratify the Kyoto Protocol by Law no. 3/2001 and it has committed itself to reduce the GHG emission by 8% in the first commitment period 2008-2012 compared with the year 1989 and harmonizing with the EU reduction commitment. The maximum amount of GHG emissions that Romania, according to Kyoto Protocol, may emit over the commitment period 2008-2012 is known as the "assigned amount", also known as the "Kyoto target" for the whole period of 2008-2012. The Kyoto target for Romania equals 92 % compared with the base year 1989. (COWI, 2005) Countries had different achievements in energy efficiency in 1990, so the base year established for Romania is the year 1989 as the year just before the structural changes. This was chosen, in accordance with the UNFCCC decisions, and because 1989 best expresses, Romania's economic output potential directly connected with the Romania's emissions potential. (MEWM, 2005)

Since 1989 the country's economic decline has resulted in a relevant decrease of the GHG emissions from 261,355 Gg to 139,171 Gg representing 46.8 % in 2001 compared with 1989. In the base year 1989, 83% of the GHG emissions were provided by the energy sector. This sector's contribution decreased to 79% in 2001, but it remains the **main polluting sector** in the Romanian economy. (MEWM, 2005) As a result, Romania needs to focus on improvements in the energy sector being the biggest contributor to the GHG emissions.

1.4 Research question

One of the big problems of transition it has been the lack of financial capacity in industry and especially the energy sector for technological investments. Thereby this is a cause for the possible slow-down of the economic growth in Romania. The problem regards the whole society, as we need to produce in order to have economic growth. The economic growth is linked with the increase of incomes that allows people to expand their consumption from food to energy. Consequently, energy production and consumption are linked to a number of economic and environmental issues. Energy production and consumption place considerable pressures on the environment, in form of the emission of greenhouse gases and air pollutants that contribute to climate change and damage natural ecosystems. The energy production in Romania is based on natural gas, oil products and coal, but Romania also produces nuclear, hydroelectric and renewable energy (solar, wind, biomass and geothermal). Regarding the energy demand Romania is based on: energy used in all forms of transport; fuels used to provide heat in houses, commercial buildings and industrial process;

electricity used in industrial, residential services or other end-use sectors. By using more renewable energies and nuclear power Romania can grow economically without having a big impact on the environment e.g. the climate change. By generating energy with no CO_2 emissions, these sources of energy can contribute significantly to reduce the GHG emissions.

The big question appears in the long term in the case of positive economic growth if the GHG emissions are also increasing in the same pace as the economy and the energy demand. In this case Romania will be forced to buy credits from other industrialized countries and not to sell after the first commitment period 2008-2012. With the use of the Kyoto Protocol mechanisms there is a chance that Romania will improve the energy efficiency reaching the target set by Kyoto Protocol and can start the trading system.

This will lead to the following research question:

Will Romania gain from the opportunities that the Kyoto Protocol offers in the process of implementing climate change policies and strategies?

The denotation “will Romania gain” is referring to the potential benefits that Romania will have in this process from the KP mechanisms. First Romania can improve the energy efficiency through the JI projects this helping to meet the commitments under the Kyoto Protocol, and secondly can gain capital by selling credits through the trading system if the country can reach the target set by the Kyoto Protocol . This it will be analyzed through different perspective regarding the future economic growth that can influence the energy demand, as well as the GHG emissions.

In order to discover if Romania will benefit from the opportunities that the Kyoto Protocol offers is necessary to look at the economical development, the energy sector (demand and supply) and the greenhouse gases (GHG) emissions in Romania. The challenges regarding the economy and energy sectors need to be identified in order to determine if the trends will continue in the future. The mechanisms under the Kyoto Protocol are an important tool for the energy efficiency and needs to be studied. The approach to this issue is to build a number of scenarios base on different sources and compare them in order to discover what the perspectives are regarding the future economy in the

same time with the emissions trend. One scenario will take into consideration an accelerated development of the economy in which the overall energy efficiency has to be improved until the year 2020. The other scenario takes into consideration the possible negative impacts of the trend of the world economy on the Romanian market which can slow down some economic process.

Other sub-questions will be use in order to answer the research question:

- What is the past and current situation in the Romanian economy and energy sector?
- What is the evolution of the GHG emissions in Romania?
- What are the opportunities from the Kyoto Protocol and its flexible mechanisms in the implementation of climate change activities in Romania?
- What are the eligibility requirements under the Kyoto Protocol?
- Will be Romania able to reduce the GHG emissions after the first commitment period 2008-2012?
- Will Romania need to buy credits after the first commitment period and not to sell?

The sub-questions will help in structuring the design of the report. First it is necessary to look at the evolution of the Romanian economy and energy sector as this will form the starting point of this project. After, the evolution of the GHG emissions needs to be presented being the key issue in concluding if Romania will benefit in the process of implementing climate change strategies. The opportunities from the Kyoto Protocol mechanisms will be determined in order to discover what benefits Romania can have in this process. Another important issue is to look at the eligibility requirements under the Kyoto protocol and to establish if Romania can meet them and start the trading system. The biggest question is: if the Romanians economy will grow are the emissions going to increase in the same time? With the use of scenarios will be analyzed if Romania can reduce the GHG emissions and can start the trading system.

This project will focus on the Kyoto Protocol Mechanisms, the development of the economy and the energy sector. The trend in the economy is very important to be known in order to predict the future of the Romanian economy. The GHG emissions considered in this project are the total emissions in Romania resulted from all the sectors: energy, industrial process, agriculture, waste and land use and

forestry. The energy sector being the most polluting sector, Romania needs to focus on improvements in the energy efficiency in order to reach the targets set by the Kyoto Protocol.

The mechanisms from the KP are expected to help in the implementation of climate change policy and to replace some of the old technologies by introducing new projects that can help to reduce the emissions. In the first commitment period it will be easy to reduce the GHG emissions, but after 2012 what the future prepared, nobody knows. The focus is on the trading system being one of the mechanisms through which Romania can gain some incentives in the case of selling their credits. This mechanism together with the JI projects can help Romania in the case that the emissions reduction target will be met. The objective of this project is to have a discussion on the strategy that Romania should take in the future in order to gain from the Kyoto Protocol mechanisms.

Chapter 2 Methodology

This chapter contains the description of the research methodology used in this report. The methodology is concerning the research design, sources of evidence used, the reflections upon difficulties and the content of the chapters.

2.1 Research design

The case study is defined by theoretical universe and in this case is interpretative. "*A case study deals with a contemporary phenomenon in its real-life context and relies on multiple sources of evidence*". (Yin, page 14, 2003) Another aspect is that case studies benefits from the prior development of theoretical propositions to guide the data collection and analysis. (Yin, 2003)

The chosen research issue is connected tightly with the 9th semester theme the traineeship completed in one of the consultancies in Denmark (COWI). This concerned the process of implementation of the project "Technical Assistance for National Climate Chance Strategy and Action Plan in Romania". The institutional and legal framework for Romania's CC activities being a challenging issue in the process of meeting the obligation under the Convention and the Kyoto Protocol was the focus in this last research. As concluded in the last project, another important issue in this implementation is the opportunities that Kyoto protocol and its flexible mechanisms offer being the focus of this research. The analysis was done with the use of scenarios. Theoretical propositions such as: the economical influence, together with the energy demand and the evolution of the GHG emissions helped in directing the attention to important issues that needed to be study.

The research style is qualitative because its focuses on interactive processes and events, the researcher is involved and the participant observation is used. Type of research purpose is applied research that considers understanding societal problems such as climate change through the use of the scenario as a central concept for the prospective analysis. The purpose of scenario building it was not to predict a specific future, but to build some plausible descriptions of what might occur. In this sense, scenario describes events and trends as they could evolve.

Unit of analysis is the possible development of the economy and the energy sector that might influence the evolution of GHG emissions. The analysis will be based on two different types of scenarios: the base scenario and the alternative scenario, which will help shaping the evolution of GHG emissions.

2.2 Data collection

The sources of evidence used in the data collection were focusing on three different categories:

- data about **United Framework Convention on Climate Change, the Kyoto Protocol and its mechanisms** from the UNFCCC web site and documents, International Panel on Climate Change (IPPC) publications, Romania's Third National Communication on Climate Change under the UNFCCC, newspapers and other articles appearing in the mass media
- data about the **development of the Romanian economy, energy sector and GHG emissions** from the World Bank, the European Union statistics (Eurostat), the Romanian Ministry of Environment and Water Management (MEWM), the Organisation for Economic Co-operation and development (OECD) web sites and different publications, studies and evaluations of the issues, literature and publications about the Romanian development
- data about the **trends of the economy, energy and GHG emissions** from Romanian Government and International Energy Agency (IEA), reports as well as other agendas and minutes of the meetings and other written reports about Kyoto Protocol mechanisms, drafts of the Action Plan and internal reports of the meetings and observations during the visits and meetings in Romania during the traineeship period.

2.3 Reflections upon difficulties

The project has the strength to answer the research question by using different reports and analysis, as well as existing forecasts from IEA and Romanian Government. Strength of the project is also the unique experience having during the traineeship period and continuing with the same topic as in the last semester. Keeping the contacts with some persons from the Ministry of Environment and Water Management was also useful in this process. This gives an exceptional access to information to the Romanian process of implementing climate change activities.

Unfortunately no interviews were made during the project due to the fact that responsible persons were very busy and the time available was very short not allowing specific visits in Romania. Therefore questions were answered by e-mails and presentations during workshops. The interviews with Romanian responsible for the implementation process or other experts in the field could have been an important input for the project and given new perspectives on the analyses.

2.4 Content of the project

The project was divided in three parts: scope of the project, focal issues in the scenario and scenario findings.

First part is the scope of the project starting with the introduction of this project and the problem formulation. Initial is presented the background of the subject with a focus on the history of UNFCCC and the Kyoto Protocol, followed by the Kyoto Protocol mechanisms. The research question is outlined by presenting the most important factors that contributes to the uncertainties regarding the economy, the energy sector and the GHG emissions.

Chapter two is the description of the research methodology used in this project. The methodology is concerning the project design, methods used, and the reflections upon difficulties. The purpose of chapter two is to give a basis for using the relevant methods and sources of evidence.

The purpose of chapter three is to present the theoretical framework of this project. This includes different methods to predict future trends that will be used in the analytical part of this project contained in scenario findings. The aim of this chapter is to form a base for the scenario analyses.

Part two is concerning the focal issues in the scenario: the economy, the energy sector and the GHG development, as well as the opportunities from the Kyoto Protocol mechanisms. The aim of this part is to present the focal issues that will be used in building the scenarios in the following part.

Chapter four is introducing the economical development of Romania presenting the most important issues in the Romanian economy: the GDP growth, the inflation, the privatization of state-owned

firms and the foreign capital investment. The aim of presenting these issues is to form a background for the analysis.

The purpose of chapter five is to present the specific problems in the energy sector. A description of the energy sector in Romania is made by presenting the main types of supply and the demand side. The challenges in this sector need to be pointed out in order to find out what Romania should improve in the future in order to meet the emissions reduction target set by the Kyoto Protocol.

Chapter six presents the evolution of the GHG emissions in Romania with a focus on the energy sector representing the biggest share in total GHG emissions. In addition the future trends of the energy and emissions will be introduced globally, in Europe and Romania.

The aim of chapter seven is to present the opportunities that the Kyoto Protocol offers. This it will include also the current situation in Romania regarding the mechanisms under the Kyoto Protocol and the experience that Romania gained trough the JI projects.

Part three is the scenario findings. The aim of chapter eight is to build the scenarios and to analyze the possible developments of the gross domestic product (GDP), population energy demand and the GHG emissions. This chapter will present briefly the past developments and the current situation in Romania, forming the foundation for the future scenarios with the objective to estimate the future economic growth and energy developments. On this background the evolution of the total GHG emissions will be estimated based on two different sources that will be compared and analyzed.

Chapter nine presents the conclusion of the analyses and the answer to the research question by identifying the opportunities from the Kyoto Protocol mechanisms.

Chapter 3 Forecast, Scenarios and Foresight

> "*Too many forces work against the possibility of getting the right forecast. The future is no longer stable; it has become a moving target. No single 'right' projection can be deducted from the past behavior*." (Wack, 1985, p.73)

The desire to understand and predict future outcomes has been essential to our ongoing attempts at continued survival ever since mankind emerge from life. One consequence has been the gradual development of a systematic method to deal with the future by analyzing present conditions, projecting continuity and possible changes in the future, and then speculating on what such changes in the future may hold for us. (Tsoukas & Shepherd, 2004) Some methods used to predict the future are: forecasts, foresight and scenario used in areas with long planning horizons, such as energy policy.

Analysis of the future has evolved considerably over the time and a short history of the evolution will help understanding the basic principles involved. Research on the future is complex and has been influenced by a number of organizations and institutes: the RAND Corporation, Stanford Research Institute, Shell, and many others. Futures research emerged in early systems thinking in the 1940s, where it was linked mainly to national security and strategic analysis. During 1950s and 1960s the rationalistic and control-oriented planning approaches emerged used by the military in war games. Implicit these approaches have a mechanistic view of social, economic and technical systems considering that the universe functions as if it is a machine and can be understood and manipulated. This is based on a general supposition that the future of socioeconomic systems is knowable, at least in principle, and could usefully be described by ways of simplified quantitative models. The 1970s emerged a new focus in scenario planning, especially in corporate strategic planning. This is explained by the traumatic effect of the oil crisis in 1973 that drew attention to the possibility of major unexpected changes in the international economic system. On the other hand, long-term predictions have increasingly become discredited because more often have proved to be incorrect. Early futures studies tended either to overestimate the potential of modern technology and the pace of change or to underestimate the role of technology and adaptive behavior by people, organizations and societies. (Berkhout & Hertin, 2002)

More recent approaches recognize that the future cannot be extrapolated through data and relationships of the past, because drivers of change in social systems are not only multiple but also changeable. In addition, humans are uniquely capable of shaping their futures and of acting reflexively in response to new knowledge about what the future may hold. One important element of reflexivity is foresight itself, so that social and economic futures are always the outcome of efforts to bring into reality projections of ideal futures. (Berkhout & Hertin, 2002)

The ultimate aim of futures studies is to explore future trends and potential discontinuities to inform decision-making. While current approaches seek to develop plausible assumptions about the future, the accuracy of projections is not their most important feature. Rather, they aim to provide a systematic framework to draw out, challenge and process information about the future. (Berkhout & Hertin, 2002)

Forecast, scenarios and similar foresight methods are increasingly used in academia, government and industry as a means of coping with uncertainty in areas with long planning horizons, for instance energy or transport policy. (McDowall & Eames, 2006) Such methods can play an important role in the development of shared visions of the future that can avoid crisis such as the 1973 oil crisis.

A forecast is a rigorous statement predicting what will happen in the future under specific conditions by taking the development as it looks today. The forecast is characterized by the use of quantitative methods to predict the futures based on current trends or based on surveys of expert opinion and tend to explore shorter time scales. However, forecasts, particularly over long time-horizons, have been widely criticized for an overly deterministic view of the future, and of technological change. Such criticisms challenge the assumption that new technologies simply replace old ones, without perturbing the technological standards in which they operate: creating new markets, new institutions, and new user behaviors and patterns of consumption. (McDowall & Eames, 2006) Forecasting assumes that it is possible to predict the future and there is one right answer to the strategy. The aim in forecasting is to strategize in the way to get as close as possible to the ‘right answer’. (Heijden, 2005)

Foresight is a way of thinking about the future, of identifying opportunities and threats that may arise over the coming years and decades without considering what is today. (Berkhout & Hertin, 2002) Foresight methods and approaches can play an important role in the development and propagation of shared visions of the future, creating powerful expectations of the economic, social and environmental potential of emerging technologies. This helps in mobilizing the intellectual, financial, political and institutional resources necessary for their realization. (McDowall & Eames, 2006) Futures scenarios represent a heuristic tool for foresight, enabling a range of audiences (business, government, researchers) to envision possible futures in order to improve decision-making and strategy setting. Scenario is based on discovering the mechanisms that have changed the system in the past and examining the current situation. (Berkhout & Hertin, 2002) Scenarios have a fundamentally different starting point compared with the forecasts. This is that the future is not predictable and it contains irreducible uncertainty. Therefore, there is not only one best answer and there is a need to look at the driving forces that can affect the future predictions. (Heijden, 2005)

In a fast-moving and complex world, there are also significant uncertainties about the future shape of markets, governance and social values that will have an important impact on organizations and their capacity to meet their objectives. "*As a systematic and inclusive approach, scenarios offer a means of dealing with critical issues of innovation, reflexivity and framing in analyzing change in socio-economic systems*". (Berkhout & Hertin, page 38, 2002) The scenarios have proven to be particularly suitable to explore environmental issues that are defined by processes of long-term and complex change such as climate change. (Berkhout & Hertin, 2002)

Scenario planning employs qualitative tools to visualize the future, including storylines (often illustrated by images and indicators) to create representations of alternative worlds that resonate with a range of different individuals. Scenarios are plausible representations of the future based on sets of internally consistent assumptions, either about relationships and processes of change or about desired end-states. (Berkhout & Hertin, 2002)

A scenario, as a central concept for the prospective analysis, can be considered as a rich and detailed portrait of a plausible future world. It is a useful tool for policy makers to grasp problems clearly and comprehensively and to better point challenges as well as opportunities in an overall framework. The

purpose of scenario building is not to predict a specific future. Rather it can better be considered as a plausible description of what might occur. In this sense, scenario describes events and trends as they could evolve. (Rihoux & Grimm, 2006)

According to Peter Schwartz, member of the Royal Dutch/Shell scenario team, the process in a scenario development are:

1. identification of the focal issue or decision;
2. identification of the key forces an trends ;
3. ranking the driving forces and trends by importance and uncertainty (selecting the scenario logic);
4. filling out the scenario;
5. assessing the implications;
6. discussion on possible futures. (Schwartz, 1999) The process of scenario development will be used as a tool for sketching the steps in building the structure of this report.

Another important vision is the one of Michel Godet from the Laboratory for Investigation in Prospective Studies in Paris that begins the scenario development by constructing a base image of the present state of a system. In his perspective, this image is described as a broad in scope, detailed and comprehensive, dynamic and descriptive of forces for change. To build up this image is important to define the system that will be study including a list of the variables that should be taken in consideration. The scenario process involves examining the current situation and identifying the mechanisms that have changed the system in the past. (Rihoux & Grimm, 2006)

In this case the scenario will be used because is the most detailed tool since can help policy makers to explore futures and look at current situation by including also trend-breaking developments. Compared with the foresight and forecast scenarios have much more information; they are richer because they give an understanding on why things happen. Scenario can help in dealing with uncertainty compared with the forecasting that assumes that is only one right answer. Also the time frame is an important element of scenarios because they are defined on a long-term. This will help to grasp the problem more clearly and to better point the challenges as well as the opportunities that Romania has in the process of implementing climate change strategies and policies. As observed the

term scenario is used for many different approaches and it is important to define how it will be used in this project. Scenarios will be based on positive and negative visions of the future, taking as past trends their starting point. The steps in building the scenarios are following the development according to Peter Schwartz. The purpose of building these scenarios is to describe events and trends that might occur in this process. The questions that need to be considered in creating these scenarios are: What is uncertain? What is inevitable? What are the driving forces? The reason in using these scenarios is to highlight opportunities and risks that Romania is taking in implementing a new strategy.

In order to explain the framework of the report is better to identify the steps in building the scenario for Romania. The following figure was created in accordance to the Peter Schwartz scenario development.

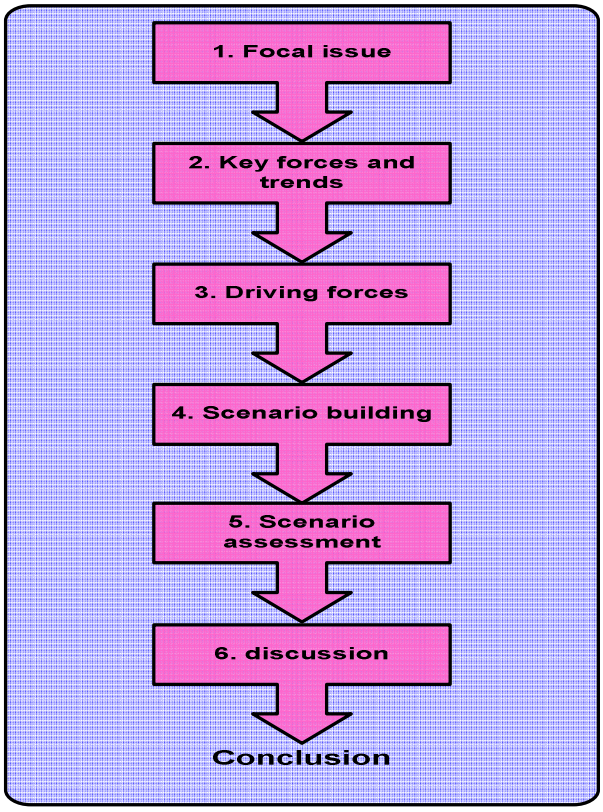

Figure 3.1 Scenario building steps

1. First step was to identify the **focal issue,** which is the evolution of the GHG emissions in this research. If Romania is able to meet the target set by the Kyoto Protocol can trade the credits received for the surplus of emissions reduction. Therefore, the evolution of the GHG emissions is the most important issue in order to discover if Romania can benefit from the Kyoto Protocol flexible mechanisms as being presented in the introduction of this research. In this step it was important also to identify what might be the possible actions that Romania can take in order to influence the evolution of the GHG emissions e.g. through improvements in the energy efficiency. These improvements should be over the entire chain: natural resources, production, transport, distribution and consumption. Another key question was the possibilities that Romania has in this process: implementation of JI projects and trading system.

2. Next step was to **explore** the key forces and trends. In this step it was necessary to find facts about the economy, energy sector, and GHG emissions in Romania that can influence the development. The trends of the economy and energy sector have to be determined in order to predict the future. There are many uncertainties when exploring the key forces and the most important ones were identified as: the macroeconomic conditions, energy and environmental policies, the role of nuclear power and development in the energy technology.
3. The third step was the **investigation** of the driving forces: the GDP growth, the energy demand and the GHG emissions. This investigation was done throughout part II of the project named 'focal issues in the scenario'.

The evolution of the GDP growth influences the energy demand, and further the GHG emissions and therefore their relation among each other is very important.

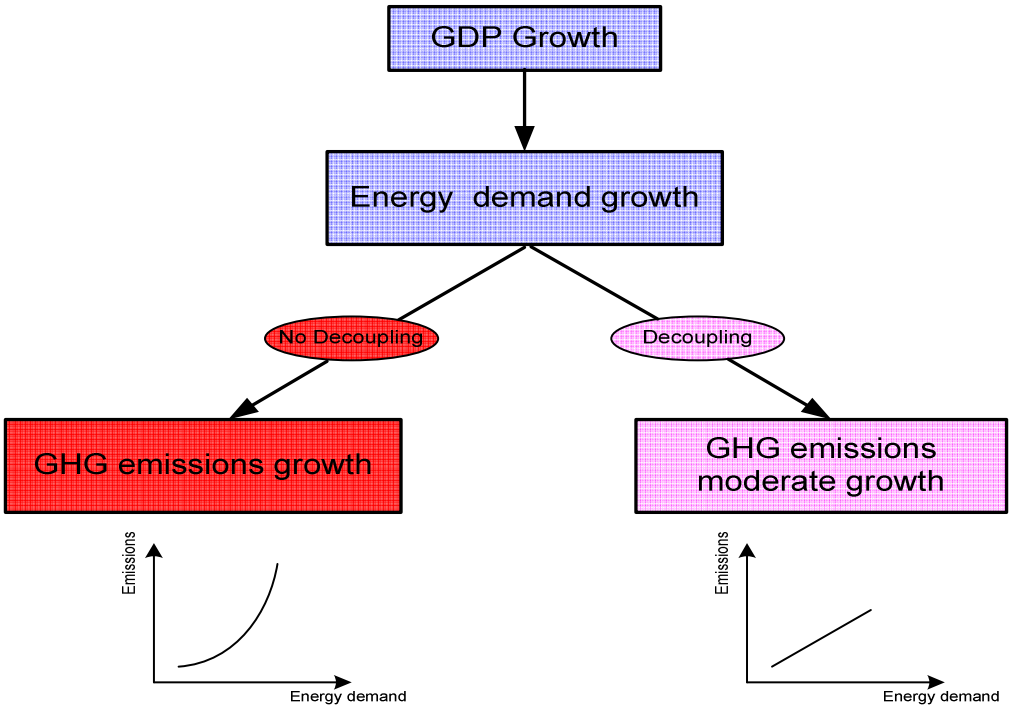

Figure 3.2 Relation between GDP growth, energy demand and GHG emissions

There are two situations that might occur:

- the GHG emissions will increase in the same pace with the energy demand (represented with red in the figure 3.2) In this situation no decoupling exists between the economical growth and the environmental impact and the graph shows an increase in the GHG emissions that follows the increase of the energy demand.

- the GHG emissions will not follow the energy demand trend and they will increase moderate (represented with pink in figure 3.2) because of improvements in the energy efficiency, renewable energies and others. In this situation the economic growth is decoupling from the GHG emissions. The graph shows a moderate growth, which indicates that the emissions will increase but not in the same pace with the energy demand.

It is therefore important to find ways of decoupling economic growth from environmental impact. This means that Romania needs to take measures to decouple the GDP growth from the GHG emissions by implementing energy efficiency through the JI projects in order to reduce their emissions. More details about decoupling can be found in appendix two.

4. Filling out the **scenarios**: the base scenario and the alternative scenario are going to be build based on the uncertainties, trends and driving forces listed in the step 2 and 3. The scenarios have the foundation on trends about GDP growth, energy demand and GHG emissions according to two different sources and will be presented in chapter 8, the third part of the project.
5. **Asses** the results of the scenarios: in this step the two sets of scenarios will be compared and the evolution of the GHG emissions will be established until the year 2020. The uncertainty regarding the emission reduction target in Romania will be clarified in this step in chapter 8.
6. **A discussion** on possible future for Romania will be evolved in this step. Another important matter to be considered here is a perspective on what might happen in different situation if Romania can or cannot reduce their emissions, helping in answering the research question.

Part II Focal issues in the scenario

Growing income allows people to expand their consumption of everything from food products to energy consumption. The greater consumption is essential to reducing poverty in many nations, but this can have a negative impact on ecosystems. Since the Industrial Revolution, development and economic expansion have been tied to increased energy use. The link remains strong today, energy use rising worldwide. Fossil fuels dominate the world's energy supply, yet the resulting greenhouse gas emissions are driving temperature changes and escalating the risks of climate change. Climate models predict that floods, drought and severe storms are likely to become both more frequent and more severe, costing lives, agricultural harvest and economic regress. The challenge for the energy sector is to supply electricity and services more efficiently and with less environmental impact. This challenge is especially great in the emerging economies, where energy needs are growing but available incomes are low. (Doering et al., 2002) In order to continue fighting against the climate change and the economy to growth in the same time it is necessary to improve the energy efficiency. The Kyoto Protocol and their flexible mechanisms will help many developing countries to improve the energy efficiency though the JI projects and bringing new technologies and 'know-how'.

The aim of this part is to present the focal issues that will be used in building the scenarios in the following part. Therefore, it is important to look at the Romanian economical development, energy sector and GHG emissions and the mechanisms that Kyoto Protocol offers in order to discover if the trends will continue in the next 15 years.

Chapter 4 Economical development

This chapter is introducing the economical development of Romania presenting the most important issues in the Romanian economy: the GDP growth, the inflation, the privatization of state-owned firms and the foreign capital investment. The aim of presenting these issues is to provide a background for the future trends in the Romanian economy. By identifying the past and present challenges in the economical situation in Romania it will be easier to predict the evolution of the economy.

4.1 Background

From 1948 until 1989, Romania had a Soviet-style planned economy in which nearly all agricultural and industrial enterprises were state controlled. During those years, the economy was largely based on heavy industry. (MEWM, 2005) The Romanian Government borrowed heavily from the West in the 1970's to build this substantial state-owned industrial base. Following the 1979 oil price shock, the president Ceausescu decreed that Romania would no longer be subject to foreign creditors. By the end of 1989, Romania had paid off a foreign debt of about 10.5 billion $ trough an unprecedented effort that affected the economy and the living standards. Vital imports were cut and food and fuel strictly rationed, while the government exported everything in order to earn currency. Romania has struggled more than most to overcome the political repression and the economic mismanagement of the past due to the peculiar nature of its former communist regime. (BEEA, 2006)

In December 1989, Romania entered into a transition to a market economy. At the beginning of the 1990's, Romania's economic situation was comparable with that of other ex-communist countries from Eastern Europe. After ten years the difference between Romania's economic development towards market economy, compared to that of Poland and Hungary for example, has grown. This is because the investment was slashed and Romania's infrastructure and institutional set-up felt behind remaining one of the poorest European countries. (Balaban, 2000) See also appendix three. The most important issues in the Romanian economy that will be presented next are the evolution of the GDP growth, the foreign trade, the privatization of state-owned firms and the foreign capital investment.

4.2 Economical growth

The main macroeconomic index is the Gross Domestic Product (**GDP**), which represents "*the total value of final goods and services resulted from the production process within the national economy in one year*". (MEWM, page 34, 2005) The following figure represents the evolution of GDP from 1998 until 2005 for Romania.

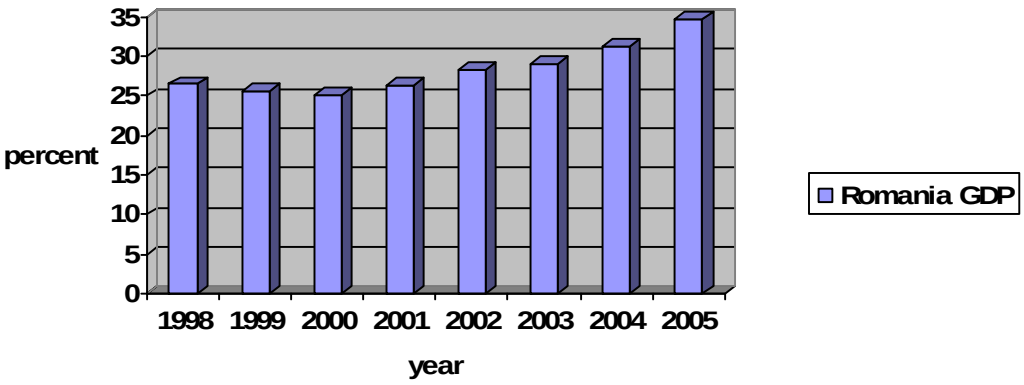

Figure 4.1 The evolution of the Gross Domestic Product (EU Stat, 2006) See Appendix 4

In the late 1990s the Romanian economy struggle under the weight of a weak reform program, political uncertainty and persistent high inflation. However, in 2001 Romania had downwards the economy trend with a return to strong GDP growth. (Data monitor, 2005) In real terms, Romania's economy grew by 4.9 % in 2002, far beyond expectations (see figure 4.1). The growth was credit driven consumption and large minimum wage increase in 2003. Romania thus achieved the highest growth rate among all EU candidate countries. The unemployment rate has been declining as growth picked up falling from 11.8 percent in 1999 to 7.5 percent in 2003. In March 2005 the Romanian's Nation Institute of Statistics reported that the economy registered a new growth record of 8.3 % during 2004. This significant jump from 4.9 % achieved in 2002 was due to a push in output by 22 % jump in agriculture and a 9 % in construction. Consumption also contributed with a 10.3 % increase, this raising also the level of GHG emission. (Country Watch, 2006) The strength of the rebound remains very uncertain, but having this continuous growth for five consecutive years it is expected that this will continue in the future.

A negative impact on the economy has the **inflation** that was one of Romania's most serious economic problems in the 1990s. An historical increase was noticed in the period 1990-1998 being determined by factors such as price liberalization and the elimination of direct and indirect subsidies for certain products. Inflation was further induced by poor economic performance, the increase of interest rates for circulating loans, high-energy consumption per product unit, low productivity and the increase of wages under social and union pressure. Retail price inflation, which monthly averaged was 12.1 % in 1993 (the equivalent of 256 % annually), declined to 28 % annually in 1995. However, inflation picked up again in 1996 and 1997 due to excessive government spending in late 1996, and price and exchange rate liberalization in early 1997. (BEEA, 2006)

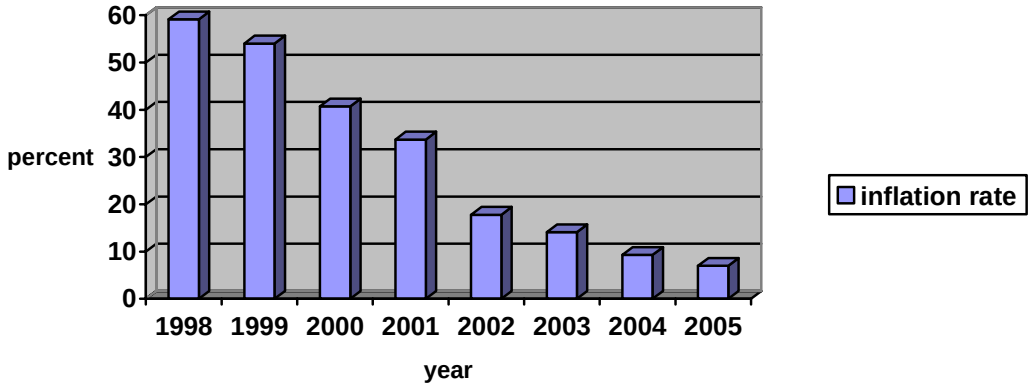

Figure 4.2 Inflation rate in Romania from 1998 until 2005 (EU Stat, 2006a)

The inflation rate has decreased since January 1998 (see figure 4.2). Inflation in 1999 hover around 54 %, and dropped in 2000 to 40.7 %, and 33.7 % by the end of 2001. After 2002 a diminished inflation rate of 17.8 % was notice, and the inflation rate further dropped to 14.1 % in 2003 and 9.3 % in 2004. The government target for 2004 was 9%, and Romanian authorities consider they fulfilled it. Romania's first time single-digit annual inflation rate was largely assisted by the Romanian lei's appreciation. The official target for 2005 was 7%. (BEEA, 2006) The year 2006 started on a hard note, as inflation rose again by too much: 1.3 % month-on-month in January 2006, as a result of another shock increase in the price of gas. Higher income from lower taxes and increased energy prices are going to keep pressuring the overall price level. On the other hand a stronger Romanian currency will deflate import prices, especially those of capital goods and services, which can stimulate production and therefore reduce inflation. (Global Insight, 2006)

Therefore, having the decreasing evolution during the last seven years it is expected that the inflation will continue to increase also in the following years this being considered a positive state for economy.

The development of the economic activity in the period from 1989 was highly influenced by the changes at the political and social level that occurred when Romania entered into the transition period towards a market-orientated economy. Thus, all Romanian Governments after 1989 considered the deep economic reform as the first objective but the results were affected by the world economic crisis, the chosen liberalization policy, the unsuitable legislation, etc. After 2000 the Romanian Government took measures to stop the negative economic trend by trying to eliminate consumer subsidies, float prices, liberalize exchange rates and put in place a tight monetary policy. The economic environment has undergone a revitalization process through a slight increase in economic growth, a reduction in inflation and unemployment rates, an improvement of the main macroeconomic indicators and financial currency balances and an acceleration of the privatization process. (MEWM, 2005)

4.3 Foreign trade, investment and privatization

Romania's **foreign trade** registered dramatic disruptions after the 1989 revolution. The decrease in domestic production, the dissolution of the Common market, and the costs of observing United Nations sanctions against Iraq and Serbia (two of Romania's traditional trading partners) were the main factors causing a sharp decline in Romanian exports and a significant increase in the country's balance of trade deficit. Romania's current foreign trade policy aims at the country's integration into Western markets. Romania's foreign trade continued to grow substantially in 2002, representing a significant share of GDP. Among other things, the export industry had an impact on growth. The foreign trade volume, which totaled USD 31.726 billion and represented a growth rate of 35.6%, (exports: USD 13.8 billion, + 21.8%; imports: USD 17.8 billion, + 14.8%). At the end of 2002, the foreign trade deficit was USD 3.98 billion (6.6% of GDP). It was thus slightly above the rate of the previous year. (MEWM, 2005) Therefore, the increase in the foreign trade will have a positive impact on the Romanian economy.

During 2001-2004 the rate of **imports** slowly decreased from 18.7% in 2001 to 17.8% in 2004. This is the result of the high dependency of the Romanian economy on the energy and raw material imports. In the same time the rate of exports increased from 12.1% in 2001 to 14.1% in 2004. In 2004 the imports accounted for 26,281.0 million, by 24.0% more than in 2003 due both to larger volumes and to higher oil prices in the international markets. The factors underlying the pickup in imports can be attributed to domestic economic developments, the customs policy pursued by the central authorities and the international environment. The bounce in the economy required additional imports of raw materials, machinery, equipment and transport means, as well as energy products. Imports in 2005 accounted for 32,568.5 million by 23.9% more than in 2004. (ANEIR, 2006) The growth on imports reflects the structural weakness in the Romanian economy, as well as the rapid expansion of consumer credit and real wages. A tightening of the policy made in 2006 is expected to decrease the import percentage in the following years. If the imports can be kept at reasonable levels Romanian economic trend can continue to grow in the coming years.

In 2004 **the exports** valued 18935 million EURO by 21.3% more than in 2003. In 2004 compared with 2001 the total exports increased by 48.8%. This was due both to domestic productivity improving and to real depreciation of the Romanian Leu (ROL) versus EURO. The drivers of exports were the authorities aimed at trade development and the strong demand for Romanian merchandise from the EU major partners. In the Romanian exports were widespread the light industry goods, mineral products (crude oil, oil products, coal, ores, salt etc.), machinery, equipment and transport means. For Romania the most important partner was EU; in 2003 the share of the exports to EU in the total was 67.7% (EURO 10571 million). Exports carried out in 2005 amounted to 22,255.1 million , by 17.5% more than in 2004. (ANEIR, 2006) An important element for additional economic growth in Romania is to export more and to decrease the imports.

According to the Romanian Government, Romania needs besides its own funds, significant **foreign investments** and support, in order to accomplish its sustainable development. (MEWM, 2005) Over the last years Romania has made significant progress towards macro-economic stabilization and has achieved high rates of economic growth. As a result of greater political and economic stability and of the implementation of economic reforms, the investment climate has started to improve and international investors are looking at the region with a much more positive attitude, seeing Romania as a real focus for the increase of their trade on the regional market. (ANEIR, 2006) The government

has significantly improved the conditions for foreign investments and the legislation regarding **privatization**. Companies that are sold to private investors have been made more attractive by means of different types of facilities offered. (MEWM, 2005) It is a clear signal by the Romanian Government to the world community, and especially foreign investors, that transition and reform in Romania is moving forward. This event shows that Romania is increasingly a welcoming and potentially profitable destination for foreign investment. While certain challenges remain and require continuing attention, measurable progress is being made in many areas and it is internationally acknowledged. (ANEIR, 2006)

In an attempt to minimize the social costs of transition and often to placate vested interests, the Romanian government initially hesitated to impose tight fiscal constraints and privatize large loss-making enterprises. In the late 1990s, attempts to impose macroeconomic stability without full structural support led to negative economic growth and a doubling of the poverty rate from 20 percent in 1996 to 41 percent in 1999. (World Bank, 2006) **Privatization** of industry was first pursued with the transfer in 1992 of 30% of the shares of some 6,000 state-owned enterprises to five private ownership funds, in which each adult citizen received certificates of ownership. The remaining 70% ownership of the enterprises was transferred to a state ownership fund. With the assistance of the World Bank, European Union (EU), and IMF, Romania succeeded in privatizing most industrial state-owned enterprises, including some large state-owned energy companies. (BEEA, 2006) Privatizing the state-owned companies denote that private market actors can deliver more efficiently any good or service that government can provide. It is considered that government decisions are made primarily for political reasons, personal gain of the decision-maker, rather than economic ones. Private companies make a profit by convincing consumers to buy their products in preference to their competitors. Therefore, by privatizing the state-owned companies not only will the enterprise's clients see benefits, but as the privatized enterprise becomes more efficient, the whole economy will benefit.

The lack of financial capacity is a cause for the possible slow-down of the economic growth in Romania. Therefore, foreign investment can help in improving the energy efficiency in order to be able to meet the target set by the Kyoto Protocol. To decouple the economic performance from environmental impact there is necessary to replace the old technology and for this Romania need

help from foreign investors. An important step for attracting foreign **investments** was the establishment of the Romanian Agency for Foreign Investments, on March 2002, as the only institution for information and promotion of foreign investment activities in Romania. This agency was set up and it is functioning under direct co-ordination of the Romanian Government. (MEWM, 2005)

Foreign capital investment in Romania has been increasing, but remains significantly less in per capita terms than in most other transition economy countries in East and Central Europe. An International Monetary Fund (IMF) standby agreement, signed in 2001, was accompanied by slow but palpable gains in privatization, and the curbing of inflation. The IMF Board approved Romania's completion of the standby agreement in October 2003, the first time Romania had successfully concluded an IMF agreement since the 1989 revolution.(Nation Master, 2005) The IMF projects annual inflows to average out at $2.4 billion until 2008, which will make Romania a large destination for foreign equity in Central Europe. This is to be welcomed as Romania is in great need of foreign capital for its economic development. (OECD, 2005)

The program from IMF aims at strengthening the external current account balance, further reducing inflation, sustaining continued GDP growth, and preparing the economy for EU accession. The current program stresses continued macroeconomic policies and progress with wide-ranging structural reforms. Key stabilization policies include a reduction in the general government budget deficit, a strengthening of the finances of state-owned enterprises through energy price adjustments and wage restraint, and measures to contain credit growth. Other top priorities of this IMF review are to ensure control of inflation and manage the current account deficit. (BEEA, 2006) With the help of IMF for Romania will be easier to continue the improvement in the economical sector trough projects that strengthen the competitiveness of the Romanian economy and accelerate the integration towards EU.

4.4 Economic review

The Romanian economy has shown signs of vigor over the last few years. Both recent administrations have shown a real commitment to work with Romanian’s structural weaknesses, pushing to a necessary increase in administrated energy prices and turning around the a problematic

fiscal situation. Over the long term, the key question will be whether the pace and direction of the reform program can be maintained. (Data monitor, 2005)

Despite robust economic growth over the past five years, important challenges remain. Further structural reforms are crucial to build a competitive market economy capable of withstanding the pressures of EU integration. Moreover, poverty persists with 25.5 percent of the population living below the poverty line. Two-thirds of Romania's poor live in rural areas despite the country's substantial potential in agriculture, forestry, and fisheries. (World Bank, 2006) Key challenges include completing the privatization agenda, improving the business climate by eliminating administrative barriers, and implementing a transparent and efficient tax system and a supportive legal and regulatory framework.

According to the scenario development steps presented in chapter three this chapter was part of step number 2 where the key forces and trends in the economy were explored. As presented in figure 3.2 the economy is the first key force that needs to be studied in order to establish the evolution of the GHG emissions. As part of step three the driving forces in the economy where determined through the inflation, foreign trade, privatization process and foreign investment, all this forming the critical factors that can influence the evolution of the GDP in the next years. A condition for the Romanian economy to grow as it is expected is to keep these factors under control. In this way Romania can align its economy and legislation with the other European countries. One of the next steps is to look at the energy sector in Romania in order to discover what will be its influence on the future GHG emissions.

Chapter 5 Energy Sector in Romania

The purpose of this chapter is to present the specific problems in the energy sector. A description of the energy sector in Romania is made by presenting the main types of supply and the demand side. The challenges in this sector need to be pointed out in order to find out what Romania should improve in the future in order to meet the emissions reduction target set by the Kyoto Protocol.

5.1 Energy supply

Romania is part of the countries from Southeastern Europe and occupy a strategic location on the Black Sea, exporting electricity through the Balkans and transporting Russian natural gas to Western Europe and Turkey. (EIA, 2006)

The main types of primary energy in Romania in the period 1989-2001 were natural gas, oil products and coal. In 1989 the natural gas consumption represented about 32.3% from the total primary energy consumption, the oil products and coal about 17% each. Primary energy consumption is supplied mainly from domestic production. The imported energy represents between 25.5% (year 1999) and 36.3% (year 1990) from the primary energy resources. The import trend shows a decrease for the last decade, this trend being expected to change in the coming years. The biggest share in the imports is represented by the crude oil and other oil products. (MEWM, 2005)

5.1.1 OIL

Romania is net oil importer, depending primarily on Russia for most of the supply. Although Romania is the largest oil producer in Central and Eastern Europe with reserves of 956 million barrels, its oil production has fallen from 252,000 barrels per day (bbl/d) in 1980 to 114,000 bbl/d in 2004 because of the decreasing economic trend. (EIA, 2006) The oil production trend is expected to increase in the future due to the increasing demand in the energy as the Romanian economy started to show signs of vigor.

Romania dominates Southeastern Europe's downstream petroleum industry, with ten of the region's eleven refineries. Because its refining capacity far exceeds domestic demand, Romania exports a wide range of oil products and petrochemicals. The World Bank has pressured Romania to reduce its refining capabilities, as nearly all of its refineries operate below capacity due to a lack of crude oil

supplies and a need for equipment repair. Romania recently privatized several refineries, including Petrotel (majority owned by Russia's LUKoil) and Petromidia (controlled by Dutch Rompetrol Group). LUKoil restarted Petrotel refinery in October 2004, after two years of necessary upgrades to meet EU fuel standards. In 2006, Romanian oil company Rompetrol announced that it will invest more than $140 million in its Petromedia refinery over the next two years in order to increase its capacity 38 percent from its current capacity of 100,000 bbl/d. In addition, it will improve its fuel quality and environmental standards to meet European standards. The Arpechim and Petrobarzi refineries are currently in the process of modernization due to funding from Petrom, Romania's largest oil group, which planned an investment reaching $1.2 billion by 2010. (EIA, 2006) Through all this investments the Romania Government task to comply with the commitments resulted from ratifying the UNFCCC and the Kyoto Protocol will be much easier.

In December 2004, the Romanian Government finalized the $1.5 billion sale of a 51 percent stake in Petrom to Austria's OMV. In January 2005, the Romanian government announced plans to sell an additional 10 percent stake in Petrom on the Bucharest Stock Exchange (BSE). Petrom accounts for the majority of all Romanian oil production at approximately 120,000 bbl/d of oil and 6.1 billion cubic feet (Bcf) of gas in 2004. (EIA, 2006) The main goal of privatizing the state-owned companies is to get into the company the necessary capital and to strengthen the company rather that the maximization of the profits, so that to have stronger and more competitive companies after the privatization in oil, gas and power sector, as well as to avoid unnecessary increase of the tariffs.

Romania imports oil via the Black Sea through two major ports, Constanta and Tulcea, giving the country the capability to be a major energy transport point. Because of its perceived strategic importance, the Romanian government has no plans to privatize Conpet, the state-owned oil transport company, which operates the national pipeline system. (EIA, 2006)

The next figure represents the petroleum production and consumption in Romania from 1990 until 2001.

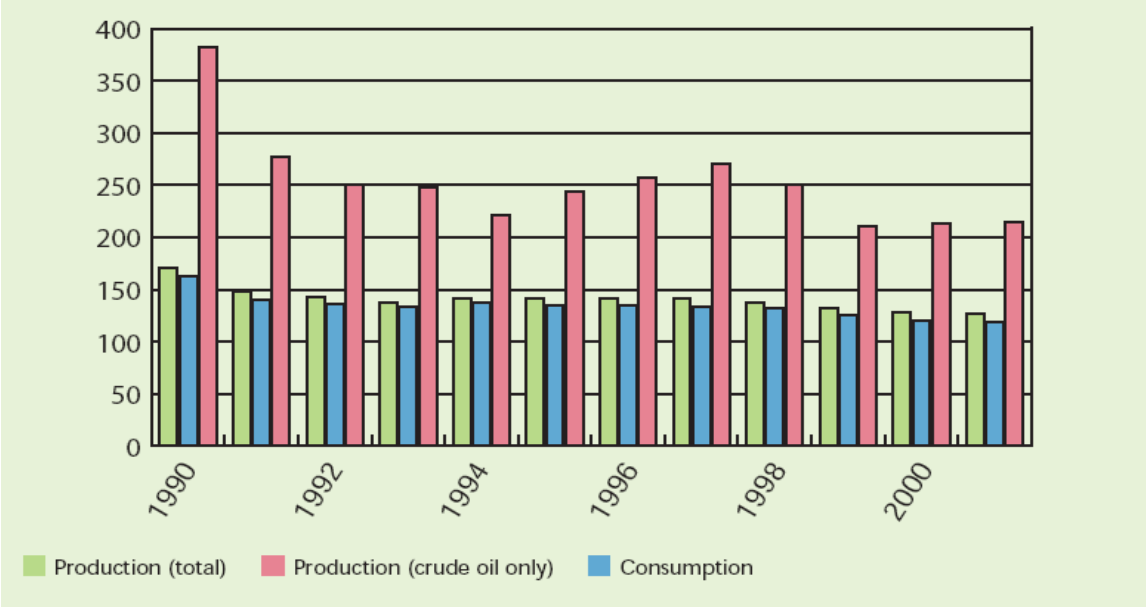

Figure 5.1 Petroleum production and consumption in Romania, 1999-2001 (MEMV, 2005)

Romania has crude oil reserves of about 1.4 billion barrels. Oil production has decreased from 294,000 barrels per day (b/d) in 1976 to 127,200 b/d in 2001. With the opening of 15 oil and gas blocks for exploration in 1996, and the influx of western technology, Romanian reserves and production are expected to rise slightly in the coming years. Romania produces 10% of its crude from offshore wells in the Black Sea, and more exploration is being done there. (MEWM, 2005)

5.1.2 NATURAL GAS

According to "2006 *Oil and Gas Journal"* estimates, Romania contains natural gas reserves of 3.6 trillion cubic feet (Tcf) enough for about 7 years at the current consumption rate. The two in-country production companies, Exprogaz and SNP Petrom cover about 80% of Romania's natural gas needs; the rest is imported. (MEWM, 2005) Although it is central and Eastern Europe's largest producer of natural gas (434 Bcf in 2004), Romania's production has fallen significantly after 1990 (see figure 5.2), but now seems to be leveling off as economic recovery is progressing. Because the country's domestic demand of 636 Bcf (2004) was the highest in the region, Romania imported from Russia around 25 % of natural gas that was delivered via the south-bound Progress pipeline. (EIA, 2006)

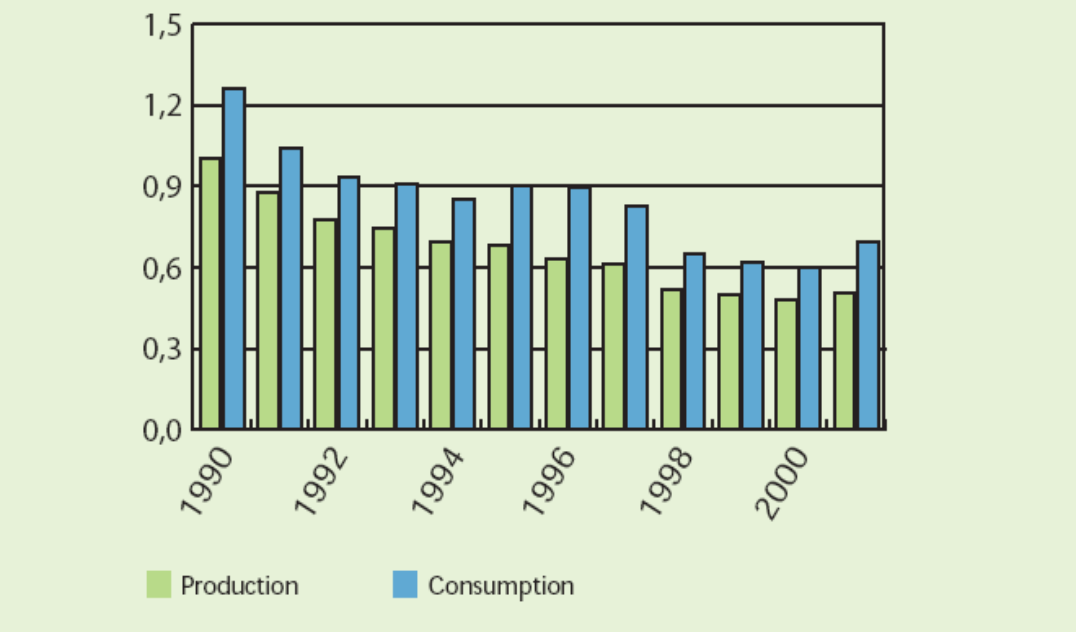

Figure 5.2 Dry natural gas production and consumption in Romania 1999-2001 (in Tcf)

(MEMV, 2005)

Romania's offshore Galata field, with proven reserves of 65 Bcf and plus probable reserves of 90 Bcf, is the country's largest natural gas field. The Galata field began commercial production in June 2004 following the completion of a 36-mile pipeline linking it with Varna. Initial deliveries were estimated at 26.5 million cubic feet per day (Mmcf/d). (EIA, 2006)

The Romanian government plans to fully liberalize the natural gas market by 2007 in order to comply with EU directives on a common gas market. Although it is still heavily regulated, the government has gradually opened the market since 2001, with 75 percent of the market privatized by July 2006. However, this is still far below the 90 percent average of privatization in Central Europe. Attempts to privatize two regional gas distribution companies culminated in August 2004 when the Romanian government announced the sale of a 51 percent stake in Distrigaz Nord to Germany's Ruhrgas and a 51 percent stake in Distrigaz Sud to Gaz de France (GdF). In October 2004, both Ruhrgas and GdF announced interest in purchasing shares in Romgaz, the Romanian gas company, when the government decides to sell its stake in the company. In 2006, Distrigaz Nord Romania announced plans to invest $55.3 million to replace 217 miles of pipeline, upgrade its equipment and installation, and develop new networks. In spring 2006, the Romanian government decided to delay

the sale of a 51 percent stake in Romgaz, the country's largest gas producer, until 2007. The government cited limited options for increasing security of gas supply, limited underground storage capacity, the diversification of supply, and the flexibility of production and imports as reasons for the delay. (EIA, 2006) With the investment planned in Romania the reserves and production of natural gas it is expected to increase slightly in the future.

5.1.3 COAL

Romania has coal reserves of 3.98 billion short tons (Bst). Romania produces low-quality lignite (brown coal) and import anthracite (black coal) for use in thermal power plants. Most of these reserves are lignite and sub-bituminous coal, with the largest reserves located in the Jiu Valley. Less than 10% of the coal produced in Romania is bituminous. Romania produced 33.6 Mmst in 2002, importing 2.7 Mmst. (MEWM, 2005)

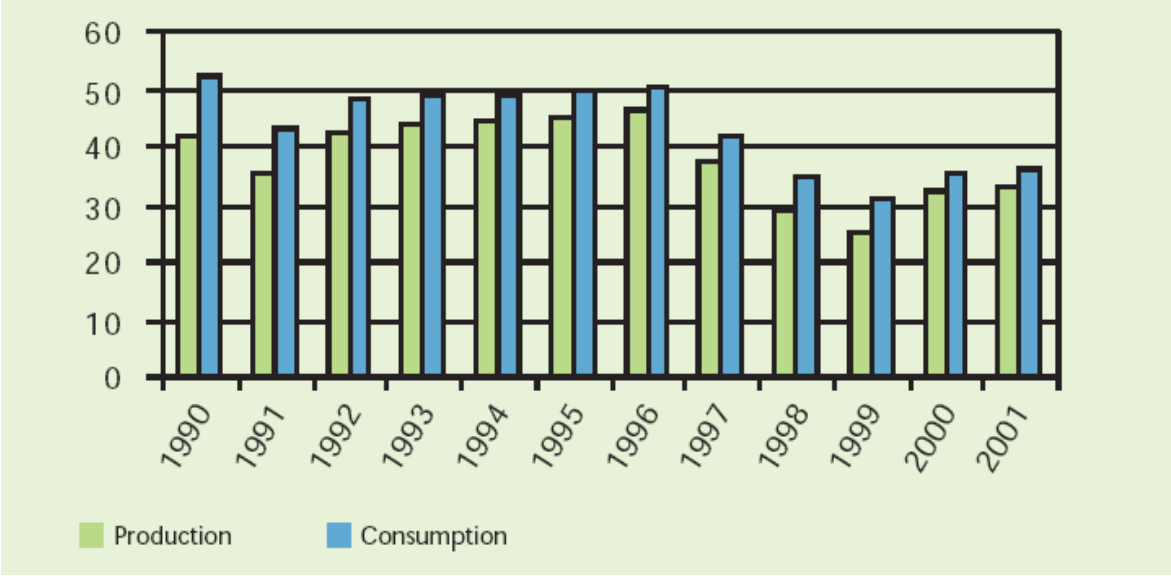

Figure 5.3 Coal production and consumption in Romania, 1990-2001 (MEWM, 2005)

The Romanian coal industry has suffered from declines in production during 1996 to 1999, outdated infrastructure, and labor unrest. (See figure 5.3) Miners' unions have protested wage arrears, mine closures, and working conditions. However, the Romanian government is hoping for a recovery of the coal industry, getting more output from existing mines. This appears to have started in the year 2000, as Romanian coal mine output improved over the previous year's total for the first time in several years and is expected to continue in the following years. (MEWM, 2005)

5.1.4 ELECTRICITY

Romania's supply and demand for electricity has been almost stable over the past decade. (See figure 5.4) The electricity supply is dominated by thermal-electric sources, with hydroelectric power supplying about one-third of the generation. (MEWM, 2005) Romania has one nuclear plant under construction and is using also renewable energy from wind, solar, geothermal, biomass resources.

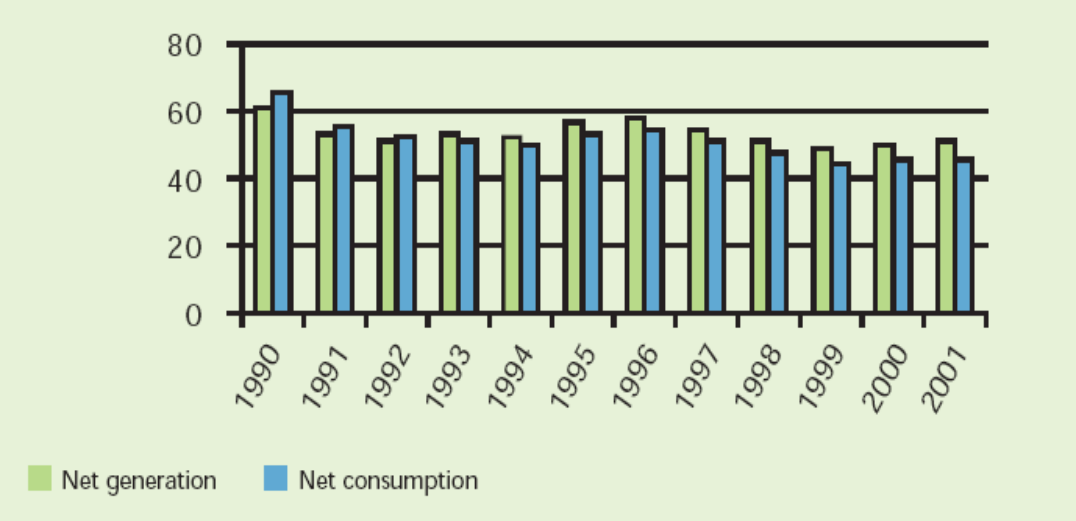

Figure 5.4 Electricity generation and consumption in Romania 1990- 2001 (MEWM, 2005)

Romania's sole nuclear plant, Cernavoda, currently maintains one working reactor. In April 2004, Euratom, the European Atomic Energy Community, approved a $278 million loan to help Romania complete construction on a second reactor, expected to begin generating commercial power in 2006. Romania has also proposed a public-private partnership to finance the construction of Cernavoda's third reactor. Cernavoda nuclear plant now accounts for 10% of the electricity produced in Romania, this being expected to grow in the future. (MEWM, 2005) By generating electricity with no CO_2 emissions, nuclear energy can contribute significantly to the consumption in this way reducing the intensity of GHG emissions. The same affirmation is valid in the case of using more renewable energy in the electricity supply.

Romania is working to privatize state-owned energy assets to meet loan conditions outlined by the IMF and EU membership requirements. See also appendix 6. The government has unbundled its state power utility, RENEL, splitting it into separate companies responsible for power generation, transmission, and distribution. In July 2004, Romania agreed to sell majority stakes in regional

power distributors Electrica Dobrogea and Electric Banat to Italy's Enel, which pledged to invest $1 billion in Romania over 20 years. In February 2005, the Romanian government approved plans to sell 24.6 percent stakes in Electrica Moldova and Electrica Oltenia to Germany's E.ON and the Czech Republic's CEZ, respectively. Each is required to take a majority stake in the power distributors through a capital share increase. In December 2004, Transelectrica, the Romanian state power transmission company announced receipt of a $31 million loan from European Bank for Reconstruction and Development (EBRD) to fund construction of a 400,000-volt power line from Romania's Oradea to the Romanian-Hungarian border. EBRD intends for the aid to help integrate the southeastern and western European electricity markets. (EIA, 2006)

Romania has significant fossil fuel and hydroelectric resources, and has the potential to be energy self-sufficient for several decades. The evolution of Romania's Total Primary Energy Production (TPEP) and Consumption (TPEC) is shown in the next figure. (MEWM, 2005)

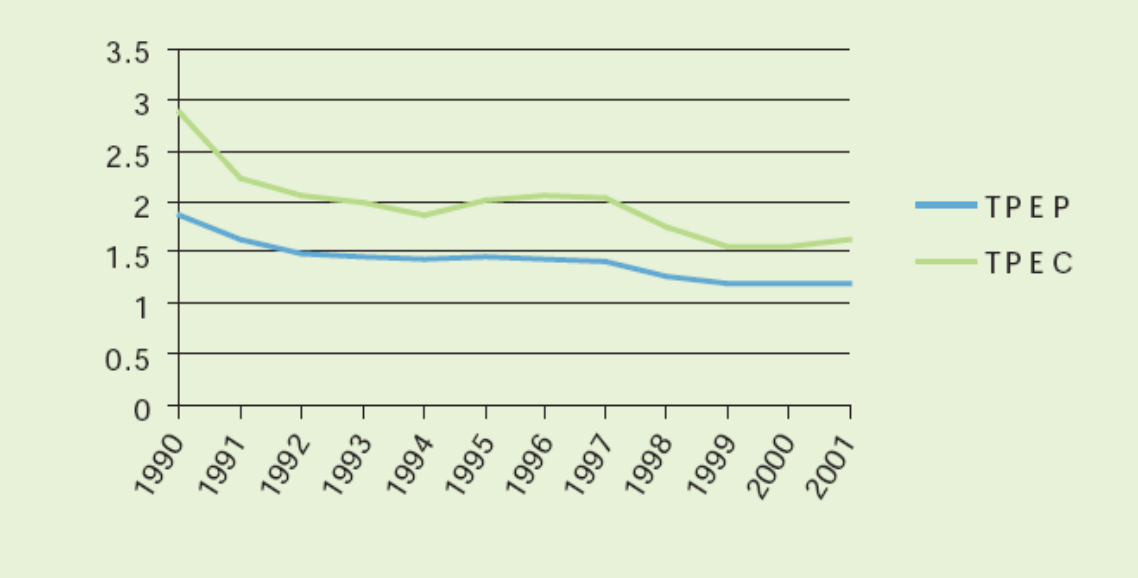

Figure 5.5 Energy production and consumption (in Quads) (MEWM, 2005)

Note: 1 Quad = 1 quadrillion Btu

The evolution of the domestic production of energy in the period 1989-2001 shows a decrease from 49.57x106 toe to 25.92x106 toe. The imported energy decreased in the period 1989-2001 from 32.98x106 toe to 7.6 x106 toe, that means about 76% reduction. During the same period the final energy consumption decreased. (MEWM, 2005) The energy production and reserves are expected to

increase in the future due to the opening of 15 oil and gas blocks, the influx of western technology and the progress of the Romanian economy.

5.2 Energy Consumption

The final energy consumption decreased significantly during the period 1989 until 2001. (See figure 5.5) In 2001 the total energy consumption represented 46.7% of the 1989 consumption. Industry represents the most important energy consumer with a decreased share in total consumption from 77% in 1989 to 48% in 2001. During this period the energy consumption in the industrial sector decreased significantly from 43x106 toe to 12.7x106 toe. Household consumption represented 10% of the total energy consumption in 1989, 21% in 1994 and 32% in 2001. A similar trend was identified regarding the final energy consumption by population in 2001 which increased 1.5 times the consumption in 1989, this trend expected to continue due to economic growth. (MEWM, 2005)

The increase of final energy consumption was recorded not only in the case of household consumption, but also in transport - by more than 76% in 1994 as compared to 1989 and by 94% in 2001, compared with the same base year. As far as industry is concerned, the main branches characterized by significant energy consumption are: chemical industry and metallurgy, iron ores extraction and processing. Chemical industry which is the most important energy consumer in the industrial sector decreased its consumption more than 6 times in 2001 compared with the consumption in the base year. As a matter of fact, all the industrial branches as well as construction, services and agriculture diminished their final energy consumption in 2001 as compared to 1989, due to their production decrease. (MEWM, 2005) Since 2001 the energy consumption increased gradually as the economic development started to progress, this being expected to continue also in the next years.

The evolution of energy indices in the period 1989-2001 corresponds to the general development of the national economy, which had a declining trend in the first 5 years of the period, followed by an increase in the last part of the period. The energy intensity of GDP, related to primary energy consumption decreased by 3% average rate per year from 1989 to 2001. The energy intensity of GDP related to final energy consumption decreased in the same period with 5 % per year due to less energy use. (MEWM, 2005) Energy intensity is a measure of the energy efficiency of a nation's

economy and it is calculated as units of energy per units of GDP. A reduction of the total energy intensity can be the result of positive improvements in energy efficiency, but is not the reason for the decrease in Romania's energy intensity during 1989 to 2001. (EEA, 2006a) The slow down of the economy in that period was the main cause of the energy intensity decrease. More details about energy intensity are presented in appendix five.

5.3 Specific problems in the energy sector

The energy sector in Romania has been plagued by the specific problems faced by most countries with economies in transition:

• High energy intensity (industry) combined with low energy efficiency;

• High marginal cost of energy production;

• Low level of legislative, institutional and regulatory infrastructure leading to high transaction costs;

• Consistent energy price increases above the rate of inflation;

• Low collection rates especially from industrial users but also from individual consumers because of the high share of energy bills in total household expenditure;

• Poor record on energy conservation and compliance with environmental requirements. (MEWM, 2005)

In the case of Romania these problems have become serious because of the stagnation of the economy, particularly over the period 1989-2000, high inflation rates and a disappointing level of foreign direct and portfolio investment. The most important incentive for meaningful reform has been the prospect of accession to the European Union. (MEWM, 2005) See also appendix ten.

In order that Romania will fulfill the targets set by the Kyoto Protocol is necessary to improve the energy efficiency. Romania aims, as mentioned in the National strategy for the energy sector development, to increase the energy efficiency over the entire chain- natural resources, production, transport, distribution and consumption - by using the market economy mechanisms at an optimum level. The Strategy for Energy Sector and Energy Efficiency in Romania is based on setting long - term objectives which are reflecting the needs of the National Economy for securing energy supply and safety, promoting energy efficiency, using renewable energy sources and applying environmental protection. Romania intends to develop a series of projects, with the help of the Kyoto Protocol mechanisms, based on the use of renewable energy sources, such as biomass, micro

hydro, geothermal energy, solar and wind energy, these sources having a great potential to be benefited from in the coming years. (MEWM, 2005)

5.4 Energy sector review

The secure access and efficient functioning of the energy sector represents the basic and vital milestone for the Romanian economy. This is the main reason for the need of a coherent and economically viable strategy in the energy filed, which is a fundamental prerequisite for the achievement of the national objectives related to a sustainable growth and eradication of poverty. In order to upgrade the national energy system in Romania large-scale investments are needed for upgrading, reconstruction, as well as for expansion of the existing capacities. (MEWM, 2005)

For the past decade, radical institutional, regulatory and structural reforms were being carried out with the main goal of deregulation that will improve efficiency and quality of services. The energy market model approach of Romania is based on the liberalization (gradual opening) as an integral part of the overall philosophy of liberalization of the national economy and free movement of goods and services. The aim is to create such structures and market environment to respond and cope with the increasingly integrated European energy market, where national markets are step by step losing their traditional borders and are becoming part of a common European market. (MEWM, 2005) For Romania reforming the energy sector is an important challenge. Although energy sector reforms have been impressive, payment arrears still exist and power sector subsidies continue. These continuing subsidies have been one of the major factors contributing to the country's recent fiscal imbalances. (World Bank, 2006)

In the last three years, several important steps have been taken in the Romanian energy sector, by implementing a deregulation process, based on the need of setting more market principles and free competition, as well as promoting a sustained privatization process. (MEWM, 2005) The privatization is based on attraction of the investments necessary for ensuring efficient, secure and environmentally-friendly energy supply; privatization will be pursued mainly by attraction of private capital into equity combined with buying of an additional package of shares of the companies. (Romanian Government, 2003)

The energy sector is still dominated by unprofitable state-owned firms, issue that continued to represent a drag on economic development and a persistent cause of fiscal and macroeconomic imbalance. Calculations from IMF suggest the fiscal deficit in the energy sector alone (the combined losses and government subsidies to the sector) represented more that 5% of GDP in 2001. The authorities made some progress in restoring financial discipline to this sector, raising administered energy prices to the above cost of production. Nevertheless, it will be several years before the sector's loss-making is turned around. (Data monitor, 2005)

In order to evaluate the evolution of the GHG emissions in the following years is necessary to take into consideration the GDP growth, the reduction of the energy intensity and population energy demand. As mentioned before, the Romanian Government policy is to sustain an accelerated growth of the GDP in view of achieving the strategic objective of reduction of the economic discrepancy between Romania and EU countries. The Government is keen to realize this growth, based on accelerated development of the economy, where industry development has a key role, as well as acceleration of the privatization in the electricity gas and oil sectors, but also accomplishment of the privatization in other sectors of the national economy. In the strategy for energy efficiency, the overall energy intensity has to be reduced by 30-50% till the year 2015, in a complex process which involves replacing of the technologies with high energy consumptions in a structural adjustment of the economy. Population and their increasing energy consumption, by using more house appliances, is also an important objective that needs to be taken in consideration. (Romanian Government, 2003) As presented in chapter 3 figure 3.2 the GDP growth is indicating that the energy demand will increase until 2020 and the GHG emissions can increase as well if specific measures will not be taken. The improvements in the energy efficiency are one of the first challenges that need to be taken in consideration in order to decouple the economic growth from environmental impacts.

According to the scenario development steps presented in chapter three this chapter was part of step two and three, as being one of the key forces and trends. As presented in figure 3.2 the energy sector is the second key force that needs to be studied in order to establish the evolution of the GHG emissions. As part of step three the driving forces in the energy sector where determined through the energy demand and supply. Reducing the energy intensity, controlling the payment arrears and the state subsidies, as well as continuing the privatization process forms the most important factors that

can influence the evolution of the energy production and demand in the future. A condition for the Romanian energy sector to evolve is to improve the energy efficiency. In this way Romania can align its energy market with the other European countries. One of the next steps is to look at the GHG emissions in Romania in order to determine their future evolution.

Chapter 6 GHG emissions in Romania

The aim of this chapter is to present the evolution of the greenhouse gas (GHG) emissions in Romania with a focus on the energy sector representing the biggest share in total GHG emissions. In addition the future trends of the energy and emissions will be introduced globally, in Europe and Romania.

6.1 Current trend in the total GHG emissions

In order to determine if Romania will be able to reduce their emissions set by the Kyoto Protocol is necessary to look at the GHG emissions evolution. The next figure presents the GHG net emissions variation starting with the base year (1989) to the last year for which the inventory was completed, taking into account and subtracting the sinks resulting from the development process of the trees. The first 3 years inventories (1989, 1990 and 1991) were not recalculated yet, based on the new „Revised 1996 IPCC Guidelines" and the revised values will be presented in the next submission. (MEWM, 2005)

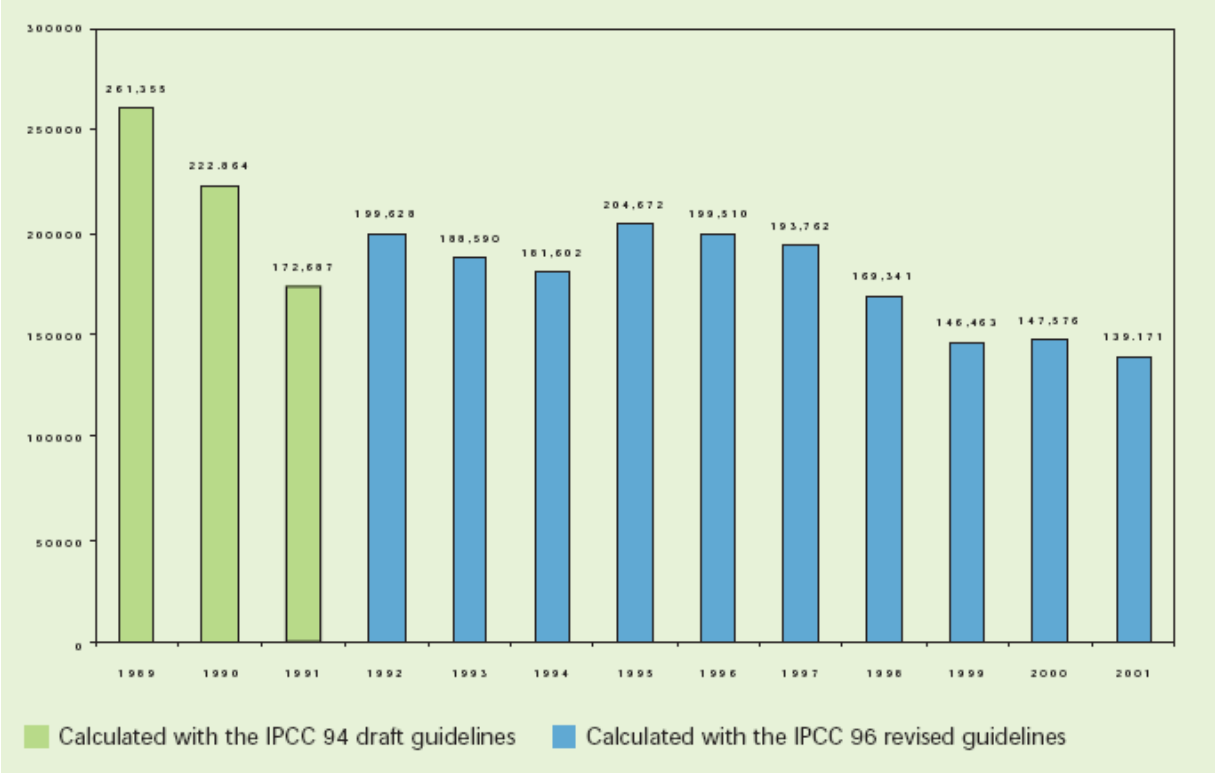

Figure 6.1 Total Romania net greenhouse gas emissions in CO2 equivalent (with CO2 removals) (MEWM, 2005)

The decrease of total GHG emissions over the period 1989-2001 was mainly due to a strong decline of the economy in the period of transition to a market economy, plus startup and operation of the first reactor at the Cernavoda nuclear power plant (1996). An unusual increase of the total annual emissions was recorded in 1995 compared to the previous year, which was the worst economical year in the Romanian transition (1994); 1995 is considered a special year in which consumption in the energy sector and the production in various industrial branches increased significantly. In 2001 a slight decrease of the total GHG emissions was recorded as compared with 2000, this increase is insignificant when is compared to the base year total GHG emissions. (MEWM, 2005) After this period the GHG emissions started to gradually grow due to the positive economic growth encountered in the last years.

Based on these observations, it is very clear that Romania will meet the commitments to reduce GHG emissions in the Kyoto Protocol's first commitment period 2008-2012, as the trend for the period 1989-2001 shows a decrease of 46.8% in the overall GHG emissions. (MEWM, 2005)

Table 6.1 Total net GHG emissions in Romania (MEWM, 2005)

Year	**1989**	**2001**
Total net GHG emissions (Gg)	**261,355**	**139,171**

Important changes regarding the GHG emissions are not expected to occur in the first commitment period, but an increase of them could be noticed after 2012. Some model assessments prepared by the Romanian Government, show that Romania’s net GHG emissions in the 2008 - 2012 period could be between 175,000 - 200,000 Gg CO2 equivalent, if the pace of the economic growth increases. (MEWM, 2005)

The net GHG emissions converted into CO2 equivalent in 2001 (139,170.96 Gg) represented 53.2% of the total net GHG emissions in the base year 1989 (261,355.22 Gg). See table 6.1. The energy sector accounted for the largest part of the GHG emissions and within it the biggest share belonged to the energy industries sub sector. This decrease is mainly due to:

- the decline of the economic activity;
- the bringing into operation of the first reactor at the Cernavoda nuclear power plant;

- the failure of some production units and the rehabilitation and modernization of some old technologies with reduced energy efficiency, in some industrial activities. (MEWM, 2005) In the future it is expected that the economy will continue progressing and the energy demand will slightly increase. The GHG emissions are expected also to increase, but with the improvements in the energy efficiency and the use of renewable energy sources, the increase might not follow the energy demand.

Romania's main objective is to decouple the increase of GHG emissions and the industrial growth, by implementing coherent measures for energy efficiency, renewable energy and others, and to preserve achieved reductions. In the first commitment period Romania will be able to meet its 8% GHG emissions reduction commitment under the Kyoto Protocol as the trend for the period 1989-2001 shows a decrease of 47% in the overall GHG emissions. The total value of the gross GHG emissions in 2001 was 148,202.41 Gg CO2 equivalent where the emissions inventory includes the following gases: CO2, CH4, N2O, PFCs, and the precursors NOX, CO, NMVOC, SO2. The year 1989 was established as the base year for Romania, because 1989 best expressed, Romania's economic output potential directly connected with the Romania's emissions potential. (MEWM, 2005)

The energy sector represents the biggest share in total GHG emissions as presented in the next figure. (MEWM, 2005)

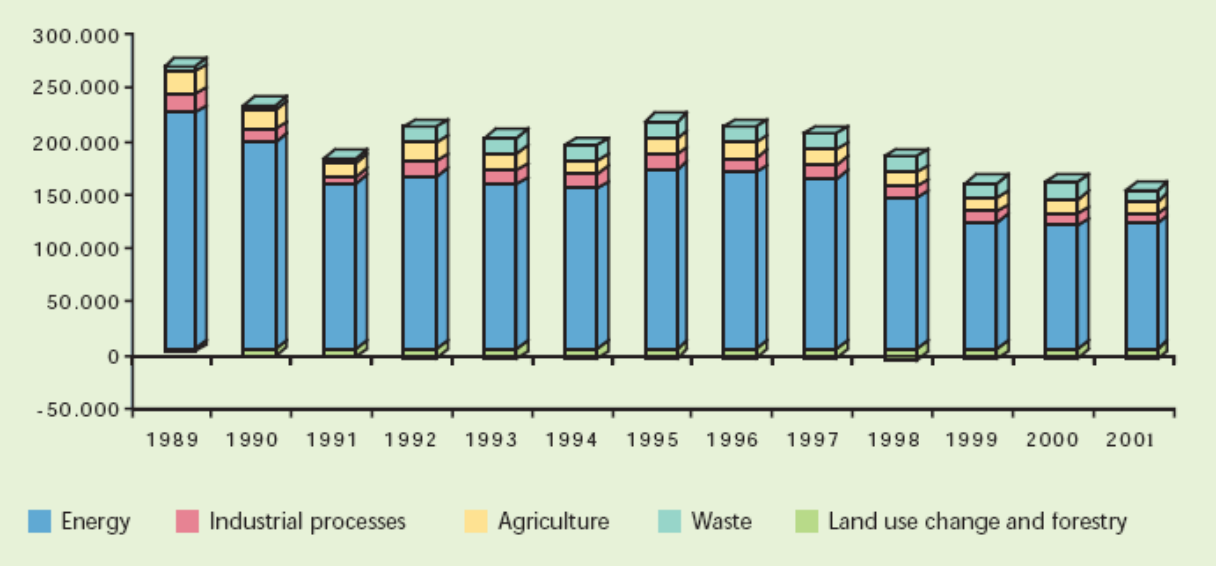

Figure 6.2 Various sectors contribution to the GHG emissions (MEWM, 2005)

The energy sector emissions decreased in the whole period compared with the base year 1989. A relevant increase of the emissions was recorded in 1995, compared to the previous year, due to the stock output increase. In the base year 1989, 83% of the GHG emissions were provided by the energy sector. This sector's contribution decreased in 2001 to 79%, still remaining the main polluting sector in the Romanian economy. (MEWM, 2005)

Table 6.2 GHG emissions by sector in 2001 (MEWM, 2005)

Sector	CO_2 equivalent (Gg)
1. Energy	**117,104.27**
2. Industrial Process	**9,359.47**
3. Solvent and other product use	**0**
4. Agriculture	**12,060.24**
5. land-use change and forestry	**0**
6. Waste	**9,669.61**
Total	**148,202.41**

The energy sector represents the biggest share in the total GHG emissions in 2001. In this sector, the biggest percentage of the overall GHG emissions (117,104.27 Gg CO2 equivalent) was resulted mainly from the fossil fuels combustion and is accounted by the CO2 emissions. (MEWM, 2005)

One of the Romanian Government priorities in the coming years is to start the operation activities at the second group of the nuclear power plant (2006-2007) and also to start the third group in the long term (2010-2015) having 707MW each. Nuclear energy is the main sector to cover the future increase of the energy demand. The nuclear energy represents one of the most efficient energies and is reducing the dependency of imported energy resources. To increase the use of renewable energy sources, such as biomass, micro hydro, geothermal energy, solar and wind energy is another priority that will help in meeting the GHG emissions commitment. Kyoto Protocol's Joint Implementation is an important mechanism for financing in part energy efficiency and rehabilitation projects. (MEWM, 2005)

The price and tariffs policy envisaged will be governed only by economic criteria. The energy prices (gas and electricity) are fixed. An increase in the electricity production costs is expected due to the need of investment expenditures for setting up new power generation capacities and upgrading the existing capacities addressing also the environmental protection requirements. (MEWM, 2005)

The transfer to more efficient forms of energy production, improvement in transportation system, such as better public transportation and better engine technology for private and commercial vehicles, all result in reductions of greenhouse gas emissions. In order to realize sustained economic growth, Romania's GHG emissions are expected to increase slightly until 2008. This increase may continue also after the first commitment period unless Romania is able to preserve the reductions of emissions by implementing energy efficiency and other GHG emissions reduction measures, and also by decoupling economical development and GHG emissions trends. (MEWM, 2005)

6.2 Future trends of the energy and emissions

World energy production rose from 6,600 to 9,352 Mtoe (million tones of oil equivalent) a 42 % increase between 1980 and 2000. Fossil fuels (oil, coal and gas) account for almost all the growth. Currently, renewable energy sources (geothermal, solar, wind and biomass) contribute approximately 11.5 % of the world’s energy consumption and nearly 14% if hydropower is included. Renewable energy sources with lower environmental impacts are growing more quickly on a percentage basis than any other energy sources. (Doering et al., 2002)

The last report from European Environment Agency (EEA) shows that environmental pressures from energy production in Europe were generally reduced between 1990 and 2003. Still, since 1999/2000 this positive trend has slowed and in some cases has even been reversed. More action is thus needed to meet current short (2010) and long-term policy targets. This applies particularly to the energy-related emissions of greenhouse gases. Further reductions of air pollutant emissions are also necessary to achieve long-term air quality targets. (EEA, 2006)

Energy-related greenhouse gas emissions in Europe show recent upward trend after decreases in the 1990s, putting long-term reduction targets at risk. The greenhouse gas emissions fell by 2.6 % between 1990 and 2000, but have been rising slowly since 1999. A major contributing factor to the recent

increase is higher electricity production from coal power plants. In addition, there is a long-term trend of growing transport emissions due to increased transport volumes. This has offset much of the improvements achieved in other sectors. Further substantial decreases of energy-related greenhouse gas emissions are required in order to meet long-term emission reduction targets proposed by the Kyoto Protocol. (EEA, 2006)

World energy consumption continues to grow in the future, making it more difficult to reduce energy-related environmental pressures. Final energy consumption in the European Union (EU) increased 11.6 % between 1990 and 2003. This trend is expected to continue unless additional energy saving measures will be implemented world wide. Rising personal incomes and changes in lifestyle with subsequent growing transport volumes led to an increase in energy consumption of households, services and transport. Transport is now the largest consumer of final energy. At the same time energy consumption in industry decreased as a result of energy efficiency improvements and a shift from energy-intensive industries to services which are typically less energy-intensive. Electricity consumption increased particularly rapidly due to its attractiveness and flexibility in end-use, a growth of the services sector and an increase in the ownership of electrical appliances. Despite the increased recognition of the importance of increasing energy efficiency and ultimately reducing the absolute level of consumption, the slowdown in energy growth seen in the early 1990s has not been replicated since. Without additional policies and measures energy demand and GHG emissions are likely to continue rising in the world. (EEA, 2006)

The world energy trend indicates that the energy production and consumption is slowly increasing making difficult to decouple the economic growth from the environmental impact. The evolution of the GHG emissions in Romania indicates a decrease during 1989-2001, but after this period the GHG emissions started to grow gradually due to the positive economic growth. This trend is expected to continue in the future unless specific measures will not be implemented. In order that Romania will meet the target set by the Kyoto in the following years it is necessary to improve its energy efficiency.
The evolution of the GHG emissions was determined as the focal issue in the scenario building presented in chapter 3, in order to discover if Romania will gain from the opportunities that Kyoto Protocol offers. The next chapter will deal with the opportunities from KP mechanisms with the purpose of determining what Romania can gain in this process.

Chapter 7 The Mechanisms under the Kyoto Protocol

The aim of this chapter is to present the opportunities that the Kyoto Protocol offers. This it will include also the current situation in Romania regarding the mechanisms under the Kyoto Protocol and the experience that Romania gained trough the JI projects.

7.1 Kyoto Protocol mechanisms

The Kyoto Protocol (KP) had introduced three innovative "flexibility mechanisms" to lower the overall costs of achieving its emissions targets. These mechanisms allow countries that signed the Protocol to access cost-effective opportunities to reduce emissions or to remove carbon from the atmosphere in other countries. The cost of limiting emissions varies considerably from region to region, but the benefit for the atmosphere is the same, wherever the action is taken. (UNFCCC, 2006) The Protocol authorizes these three mechanisms of geographical flexibility that facilitate cost effective reductions:

- **Clean Development Mechanism** (CDM)

The clean development mechanism allows **Annex I countries** with emissions obligations to implement projects that contributes to sustainable development and reduce emissions **in non-Annex I countries** (developing countries), in return for certified emission reductions. (UNFCCC, 2006a) More details about how the countries are divided in the Convention can be found in appendix one.

- **International Emissions Trading** (IET)

Through International Emissions Trading **Annex I countries** are allowed to meet their commitments by buying and selling excess emissions credits among themselves. By creating a financial value for emissions credits, it is anticipated that market forces will provide a cash incentive for governments and industry to switch to cleaner fuels and industrial processes, achieving emissions targets and moving towards sustainable development. (CCKN, 2006)

- **Joint Implementation** (JI)

Joint implementation allows **Annex I countries** to implement projects that reduce emissions, or remove carbon from the atmosphere, **in other Annex I countries** (developed or EIT countries), in return for emission reduction units (ERUs). (UNFCCC, 2006b) The difference to the CDM projects is that JI projects are implemented only between Annex I countries.

There are two possible procedures for carrying out a JI project. The first procedure (often called "track one") may be applied when the Annex I country hosting the project fully meets all the eligibility requirements (presented next) to participate in the mechanisms. In this situation, the host country may apply its own national rules and procedures to the selection of JI projects and the estimation of emission reductions from them. The second procedure ("track two") must be applied if the host country does not meet all eligibility requirements. Track two allows JI projects to begin operation before the host country meets all eligibility requirements. However, before it may issue and transfer units (credits), the host country must meet at least those eligibility requirements relating to the calculation of its assigned amount (referring to the quantity of greenhouse gases that an Annex I country can release in accordance with the Kyoto Protocol, during the first commitment period of that protocol 2008-2012) and the establishment of its national registry. (UNFCCC, 2006b) Romania is part of track two because does not fully meet the eligibility requirements.

The Convention provides for Annex I countries to implement policies and measures jointly with other countries. In order to build experience and "learn by doing" at the first Conference of the Parties (COP 1995) was launched a pilot phase of activities implemented jointly (AIJ) under which Annex I countries may implement projects in other countries that reduce emissions of greenhouse gases or enhance their removals. Under the pilot phase, countries may implement projects on a voluntary basis in addition to what would have occurred otherwise, in the territories of other countries. However, no credits may accumulate to any country for such reductions or removals. (UNFCCC, 2006c)

According to the Kyoto Protocol, GHG emission reductions generated by CDM and JI project activities must be additional to those that otherwise would occur. **Additionality** is established when there is a positive difference between the emissions that occur in the baseline scenario, and the emissions that occur in the proposed project. The donor country will receive in return emission reduction units (credits) for the implemented project that will help the country to meet the emissions target set by the KP. **Baseline** is the emission of greenhouse gases that would occur without policy intervention or project activity, like JI or CDM. **Abatement** refers to reducing the degree or intensity of greenhouse-gas emissions. (COWI, 2005)

In order to participate in the mechanisms, Annex I countries must meet the following **eligibility requirements**:

- They must have ratified the Kyoto Protocol.
- They must have calculated their assigned amount, as referred into the Protocol in terms of tonnes of CO2-equivalent emissions.
- They must have in place a national system for estimating emissions and removals of greenhouse gases within their territory.
- They must have in place a national registry to record and track the creation and movement of emission and removal units and must annually report such information to the secretariat.
- They must annually report information on emissions and removals to the secretariat. (UNFCCC, 2006)

The eligibility of each Annex I country is initially to be determined through submitting a report on the above information to the secretariat, at the latest by 1 January 2007 (or a year after becoming a Party to the Protocol). If later a country will be found to not meet the eligibility requirements, it may seek replacement of eligibility through a further accelerated procedure. (UNFCCC, 2006) Romania is in the process of building a national system for assessment of the emissions and establishing a national registry system in order to meet the eligibility requirements and to participate in the emissions trading system.

Through International Emissions Trading (IET) industrialized countries are allowed to meet their commitments by buying and selling excess emissions credits among themselves. By creating a financial value for emissions credits, it is anticipated that market forces will provide a cash incentive for governments and industry to switch to cleaner fuels and industrial processes, achieving emissions targets and moving towards sustainable development. (CCKN, 2006) These acquired credits will be used towards meeting the individual emissions target set by the Kyoto Protocol that each industrialized country has. Transfers and acquisitions of these credits are to be tracked and recorded through the registry system. (UNFCCC, 2006d)

The negotiations on the mechanisms have been concerned with ensuring their integrity. A concern has been that the mechanisms do not confer a “right to emit” for Annex I countries (industrialized

countries) or lead to exchanges of fictitious credits. Another weakness is that the Protocol is not containing penalties for failure to meet the targets. In addition these mechanisms allow participants to meet their targets by purchasing emission credits rather than making reduction themselves. In theory the emission market that the protocol creates thorough the trading system will allow participating countries to meet their reduction goals with minimum disruption to their economies, but is not so easy in practice. Trading and technology will play an important role in enlightening the climate change, but they are only a piece of solution, not the entire answer. An important aspect is that the emission reduction may differ from country to country and the biggest goal is to build the developing world's ability to ensure more reliable compliance and enforcement. Consequently there are many elements that need to be taken in consideration when fighting against the climate change: many countries have incomplete or week regulatory systems, lacking transparency and enforcement, many economies lack market incentives to cut costs and maximize profit. (Bell, 2006)

7.2 Present situation in Romania regarding the KP mechanisms

Romania was the first UNFCCC Annex I country (the developed countries and the transition to market economy countries) that ratified the Kyoto Protocol through Law nr. 3 in 2001, thus committing itself to reduce GHG emissions by 8% in the first commitment period 2008 - 2012, comparing with the base year (1989), with a view to harmonize the European Union's measures of reducing the same percentage. In realizing a sustained economic growth, Romania's GHG emissions are expected to increase slightly until 2008, and also in the first commitment period unless Romania is able to preserve the reductions of emissions by implementing energy efficiency and other GHG emissions reduction measures, and also by decoupling economical development and GHG emissions trends. After signing the Kyoto Protocol in 1997, Romania started to cooperate with different countries on preparing for the implementation of the protocol's flexible mechanisms. Romania was involved firstly in the Activities Implemented Jointly (AIJ) as a „pilot" stage for JI. The main objective of the cooperation between governments in this phase was the need to understand the possibilities of implementing this kind of projects for the further stages. Romania carried out 5 AIJ projects. Details about these projects can be found in appendix nine. (MEWM, 2005)

GHG emission reductions require considerable investments and can be costly in the most industrially developed countries. The most developed economies of the world are normally quite energy efficient,

so the cost of an emission reduction unit is high. GHG emissions reduction can however be much cheaper in less developed economies, for example in the countries of Central and Eastern Europe. (MEWM, 2005) Therefore, it is less costly for many developed countries to invest in projects in countries with economies in transition as the benefit for the atmosphere is the same.

In the last several years Romania has signed a number of Memoranda of Understanding with different countries like: the Netherlands, Norway, Denmark, Austria, Sweden and the World Bank's Prototype Carbon Fund. To date, a total of 11 JI projects have started implementation or have already been commissioned in Romania, with the investments from some of the countries mentioned above. Important investments will generate over 7.5 million emission reduction units in the first commitment period 2008-2012. (MEWM, 2005)

Taking into account the possibilities identified in developing JI projects the first Memorandum of Understanding (MoU), creating the framework for JI projects implementation, was signed with the Switzerland in 1999, and the first JI project started in 2000 (initial as AIJ). The objectives of MoU's are generally to pledge an expedited JI approval process in both host and investing countries, and to represent a governmental guarantee of emission reduction units (credits) transfers from the host to the investing country under the MoU once the Kyoto Protocol enters into force and the official JI procedure starts functioning. (MEWM, 2005) See also appendix eight.

Romania has approved eleven JI projects within the priority areas that break down by project type as follows:

- 5 energy efficiency projects, of which
  - 4 district heating, including 2 co-generation
  - 1 industrial technology improvement (cement plants)
- 4 renewable energy projects, of which
  - 2 hydropower
  - 1 biomass (sawdust)
  - 1 geothermal
- 1 landfill gas recovery project
- 1 afforestation project. (MEWM, 2005)

More details about these 11 JI projects are in appendix ten.

Table 7.1 Joint Implementation projects in Romania

No.	Project	Agreement
1.	Swiss Thermal Energy Project in Buzau and Pascani	MoU Switzerland
2.	Development of the Municipal Utilities - Heating System in Fagaras	MoU Norway
3.	Modernization of 3 Hydro Units at Portile de Fier I Hydropower Plant	ERUPT 2- The Netherlands
4.	Reduction of CO2 Emissions at Alesd and Campulung Cement Plants	ERUPT 2- The Netherlands
5.	Modernization of 4 Hydro Units at Portile de Fier II Hydropower Plant	ERUPT 3- The Netherlands
6.	„Sawdust 2000" Project	MoU Denmark
7.	Geothermal energy	MoU Denmark
8.	Afforestation of 7000 ha of Degraded Agricultural Land	Host Country Agreement
9.	Landfill Gas Recovery in Romania	ERUPT 4- The Netherlands
10.	Targoviste Co-generation Project	ERUPT 4- The Netherlands
11.	District heating system rehabilitation - Bucharest	MoU Switzerland

All projects, especially hydropower ones, require considerable investments and bring revenues in addition to emission reduction units (credits) sales. Credits sales are normally by far insufficient to cover the cost of reducing the intensity of greenhouse-gas emissions (abatement). Investment in clean technology leads not only to emission reductions, but also new technology, fuel cost reductions, and new or upgraded production facilities for electricity and heat. (MEWM, 2005) The expected surplus volume of credits (Assigned Amount Unit) is assessed to be of at least 50 million tons CO_2 annually during the first commitment period which may be available for sale in IET.

In a workshop prepared by the Organization for Economic Co-operation and Development and International Energy Agency, the perspective of the transition countries regarding the Kyoto Protocol was evaluated trough the capacity building needs. Regarding joint implementation, Romania, highlighted both general and specific lessons that could be learnt from the experience with the AIJ pilot phase. At a general level, it was repeated that national circumstances and environmentally-related legislation are changing rapidly in transition countries, particularly in countries planning to accede to the EU such as Romania, and that this has implications for the institutional processes and initial criteria set up to approve AIJ/JI projects. National environmental action plans and sectoral development priorities will therefore need to be taken into account when developing AIJ/JI projects and the baselines for these projects. A coordinated institutional structure (including government, NGOs and others) within the host country is also needed in order to prepare a package of potential JI projects, assess credits (ERU) abatement costs and initiate effective policies and measures to mitigate greenhouse gas emissions. It was also noted that public participation in the review of a project's

baseline and in the assessment of its additionality had been very limited under AIJ. (OECD & IEA, 2001)

At a more detailed level, one of the reasons highlighted for the lack of diversity of projects undertaken under the AIJ pilot phase was that AIJ pilot phase projects were generally "supply" (investor) rather than demand (host) driven. The government has in fact established project categories and criteria for acceptable AIJ/JI projects. However, even if a country establishes project categories that are a priority acceptable, each project may still require individual negotiations on baselines and other technical issues if the host country has no long-term strategy for assessing the additionality of projects. In addition, there are difficulties in setting up a transparent and corruption-free system to approve JI projects in the absence of agreed methodological guidance on project selection and approval. The issue of credit sharing between JI investing and host countries was raised, and suggestions made that credits should be shared in a dynamic fashion, with investors getting most credits at the beginning of a project's crediting lifetime, and hosts getting more credit towards the end. (OECD & IEA, 2001)

Given that potential investors in climate mitigation projects have a choice where to spend their money, most funds may flow to potential host countries and project managers with certain characteristics. Desirable characteristics for the potential host country were identified as: a willingness to initiate joint activities, already established co-operation between relevant government ministries and other bodies (e.g. from the AIJ pilot phase), a draft memorandum of understanding for future common activities, and capacity building activities between different stakeholders already underway. Desirable project manager attributes were outlined as being prepared to take risks for the financial side of the project, being open to the idea of pre-feasibility studies, and having the technical and personnel capabilities to undertake project monitoring and baseline calculations. (OECD & IEA, 2001)

Regarding emission trading, it was indicated that a system in which companies could trade is likely to be more effective in reducing domestic emissions than one in which only the government can trade, because the former motivates companies directly. However, the administrative burden of distributing credits to companies would be likely to make it impractical to distribute emission credits to small companies. The importance of a penalty for breaching domestic credits in order to limit over-selling was highlighted. (OECD & IEA, 2001)

7.3 Review

Up till now, the Kyoto process has been focused on the short-term need to launch the implementation phase, to get ratifications from the industrialized countries listed in Annex I, and thereby to bring the Protocol into force. However, the focus on the longer-term objectives of the UNFCCC cannot be postponed for too long. Industrialized countries are bound to have a prominent role in meeting these goals, both directly (through emission restrictions) and indirectly (through emission trades). In this regards, the Annex I countries are now confronted by both challenges and opportunities. (Najam et al., 2003)

In order that a country can be successful with the Kyoto mechanisms it is required to have a strong government and legal institutions. The stakes are high. Industry wishes to minimize its regulatory costs and inevitably has much better information on their greenhouse gas emissions, future emission projections, and mitigation costs than government departments. Governments want to ensure that the entities take on a fair share of the emission reduction burden, particularly as the main participants in trading systems are large stationary sources of emissions that are relatively easy to address compared to other sectors such as transport.

As presented in chapter 3 in the scenario building steps, in order that Romania's economy will continue growing without increasing to a large extent the GHG emissions is necessary to decouple the economic growth from the environmental impact. The opportunities that the Kyoto Protocol mechanisms offer through the JI projects and IET are solutions that will help to improve the energy efficiency. All these measures trough different projects presented earlier demonstrate the strong will of the Romania Government to comply with the commitments resulted from ratifying the UNFCCC and the Kyoto Protocol.

Part III Scenario findings

In order to discover if Romania will gain from the opportunities that the Kyoto Protocol offers it was necessary to look at the economical development, the energy sector in Romania as is one of the most polluting sectors and the evolution of the GHG emissions. The past developments and the current situation in Romania form the foundation for the future scenarios with the objective to estimate the future economic growth and energy developments. On this background the evolution of the total GHG emissions will be estimated. The next chapter includes also a discussion on how these estimations fit the present approach to the Kyoto Protocol.

Chapter 8 Scenario building and analysis

According to Berkhout & Hertin the scenarios have proven to be particularly suitable to explore environmental issues that are defined by processes of long-term and complex change such as climate change. (Berkhout & Hertin, 2002) In this case the scenario it will be a useful tool in order to grasp the problem clearly and to better point challenges as well as opportunities in an overall framework.

The scenario approach will be used to analyze the possible development of the gross domestic product (GDP), the population energy demand and the GHG emissions. Economic growth is by far the most important driver of energy trends. (IEA, 2000) In order to estimate the GHG emissions is necessary to look first at the GDP trend and the energy demand trend. The link between the energy demand and economic output remains close, because growing income allows people to increase their consumption. The energy related services of demand are: mobility (energy used in all forms of transport); stationary uses (fuels used to provide heat in houses, commercial buildings and industrial process); electrical use (industrial, residential services or other end-use sectors).

The assumptions made are an accelerated development of the economy and improvements in the energy efficiency until the year 2020 in a complex process which involves replacing technologies with high energy consumption and a structural adjustment of the economy. In addition the transportation sector is expected to grow much faster than other sectors. The data used for the assumptions is based on International Energy Agency and the „Road Map for the energy sector of Romania" elaborated by the Romanian Government on July 2003 and is in accordance with the

economical situation in the period 1999-2005 presented by the Romanian Government and the Eurostat statistics. To provide a base for the future scenarios, the past developments and the current situation will be mentioned briefly once more.

8.1 Past development

After 1989 the Romanian **economic development** was highly influenced by the changes at the political and social level that occurred in the process of going from the communist economy towards a democratic market-orientated economy. Thus, all Romanian Governments after 1989 considered the deep economic reform as the first objective by trying to eliminate consumer subsidies, float prices, liberalize exchange rates and put in place a tight monetary policy. However, the results of these were affected by the world economic crisis, as well as the lack of proper legislation and other causes. (MEWM, 2005)

As mentioned before, after 2000 the Romanian Government took measures to stop the negative economic trend. Thus, a disciplined fiscal policy was lunched, which complemented a tight monetary policy and it was increased by progress in structural reform. These reforms resulted in improved financial discipline in the enterprise sector and a much firmer balance of the public finances and the financial system. This resulted in robust **GDP** growth of 39.4 % in the period from 2000 until 2005. (World Bank, 2006) Over the long term, the key question will be whether the pace and direction of the reform program can be maintained because of negative impacts such as spread corruption, poverty, lack of financial resources and proper legislation, and political instability.

Since 2000, the economic environment has undergone a revitalization process through a reduction in **inflation** by 73 % from 2000 until 2005 and **unemployment** rates from 11.8 percent in 1999 to 7.5 percent in 2003, an improvement of the main macroeconomic indicators and financial currency balances and an acceleration of the **privatization** process. Romania is currently engaged in reforming and restructuring its economy and administration with a view to joining the EU in 2007. As part of this, the Government seeks to build institutions in all sectors and design and implement public policies, as well as policies in the field of climate change with the purpose to fundamentally transform Romania's economy. In order to achieve this Romania needs a strong political commitment, considerable expertise and resources, as well as external support. (World Bank, 2006)

Despite robust economic growth over the past five years, important **challenges** remain. Further structural reforms are crucial to build a competitive market economy capable of withstanding the pressures of EU integration. Moreover, poverty persists with 25.5 percent of the population living below the poverty line. Two-thirds of Romania's poor live in rural areas despite the country's substantial potential in agriculture, forestry, and fisheries. (World Bank, 2006) Key challenges include completing the privatization agenda, improving the business climate by eliminating administrative barriers and the state subsidies, implementing a transparent and efficient tax system and a supportive legal and regulatory framework in order to gain from the opportunities from the Kyoto Protocol and other funds that Romania will receive after the accession to EU.

In the last three years, several important steps have been taken in the Romanian **energy sector**, by implementing a deregulation process, based on the need of setting more market principles and free competition, as well as promoting a sustained privatization process. In the period 1989-2001 the main types of primary energy were natural gas, oil products and coal, but Romania also produces nuclear, hydroelectric and renewable energy (solar, wind, biomass and geothermal). Although Romania is central and Eastern Europe's largest producer of natural gas (470 Bcf in 2002), the **production** has fallen significantly in recent years, but now seems to be leveling off as economic recovery is progressing. In the period 1989-2001 the imported energy decreased about 76 %. With the opening of 15 oil and gas blocks for exploration in 1996, and the influx of western technology, Romanian reserves and production are expected to rise slightly in the coming years, implying also an increase in the GHG emissions if specific measures will not be taken. (MEWM, 2005)

During 1989-2001 the evolution of the total energy **consumption** in Romania corresponds to the general development of the national economy, which had a declining trend in the first 5 years of the period, followed by an increase in the last part of the period. The increase of final energy consumption was recorded not only in the case of household consumption, but also in transport - by more than 76 % in 1994 as compared to 1989 and by 94 % in 2001, compared with the same base year. (MEWM, 2005) According to the European Commission statistics (Eurostat) the energy sector in Romania started to show signs of progress in the period 2001-2005 with an increase of 4.3 % in 2003 in the production and of 8 % in 2005 in the consumption. (EU Stat, 2006b)

Another **challenge** for Romania is reforming the **energy sector.** Although energy sector reforms have been impressive, payment arrears still exist and power sector subsidies continue. These continuing subsidies have been one of the major factors contributing to the country's recent fiscal imbalances. (World Bank, 2006)

Over the period 1989-2001, the total **GHG emissions** decreased in Romania and this was mainly because of a strong decline of the economy. After 2000 a slight increase of the GHG emissions was observed in all sectors (energy industries, manufacturing and construction, transportation and other sectors) with an increase of 2.7 % in 2001 and 3.1 % in 2005. (EU Stat, 2006c) The most important CO_2 emitting source is the energy sector due to fossil fuel combustion. (MEWM, 2005) Regarding the GHG emissions one of the big challenges for the Romanian Government is to meet the reduction commitment under the Kyoto Protocol without affecting the economic growth.

8.2 Trends and factors

Concerning the future trends in Romania two sources were used: one is the “World Energy Outlook” prepared by the International Energy Agency (IEA) and the other one is the “Road Map for the energy sector of Romania” prepared by the Romanian Government.

According to International Energy Agency (IEA) the world’s gross domestic product **(GDP)** is assumed to grow worldwide by an average 3% per year over the period 2000 to 2020. The growth is expected to remain steady through to 2010, but will then slow progressively over the next decade as developing countries economies mature. Concerning the transition economies the growth is assumed to be 3.1 % per year until 2020. (IEA, 2000)

Regarding the world **energy supply** the International Energy Agency (IEA) is assumed to grow by 2 % per year until 2020. For the economies in transition the total energy supply will grow by 1.4 % per year from 2000 to 2010 and by 1.6 % per year until 2020. (IEA, 2000)

International Energy Agency (IEA) have predicted that the global primary **energy demand** is expected to increase by 2 % per year from 2000 to 2020, significantly faster in transport 2.4 % than

in other sectors 1.8%. The projected growth is nevertheless slower than the growth over the past decades which ran at 2.1 % per year. For the economies in transitions the energy demand is projected to increase by 1.3 % per year from 2000 to 2010 and 1.7 % per year until 2020. The growth it will be much faster in transport, with an increase of 2.8 % until 2010 that in other sectors 0.5 %. Until 2020 the increase in transportation is expected to be 3.1 % per year than in other sectors where the growth is predicted at only 1.2%. (IEA, 2000)

The **IEA** have looked in the past at energy related environmental issues such as the **GHG emissions**, but is the first time when they focused on the impact of GHG emissions trading. Thus, this is an important instrument that can help countries for fulfilling the Kyoto commitments. Total GHG emissions in the world are assumed to grow by 2.1 % per year until 2020 and for the transition countries the emissions are expected to grow with 1.4 % from 2005-2010 and 1.7 % till 2020. The growth is less than in the rest of the world as the transition countries starts to improve regarding the energy efficiency. (IEA, 2000)

In the Romanian strategy for **energy** efficiency, the overall objective for energy intensity has to be reduced until the year 2015, in a complex process which involves replacing of the technologies with high energy consumptions in a structural adjustment of the economy. Population and their increasing energy consumption, by using more house appliances, is also an important objective that needs to be taken in consideration. According to the **Romanian Government** the gross domestic product (GDP) is expected to grow by 6 % during 2006-2010 and by 5.2 % in the period 2011-2020. The prediction for the final energy consumption are that there will be an increase of 2.9 % per year in the period 2005-2010 and 2.5 % per year from 2010 to 2020. (Romanian Government, 2003) The GDP growth together with the population increase is indicating that the energy demand will increase until 2020 and the GHG emissions can increase as well if specific measures will not be taken. The energy efficiency is one of the first problems that need to be taken in consideration.

In Romania emission projections for 2020 are influenced by the uncertainties related to the privatization process and the continuous efforts for the harmonization of national legislation with the EU legislation. The size of the emissions reductions achieved by 2020 is highly dependent on Romania's economic development. As mentioned before the decrease of 46.8% in the total GHG

emissions over the period 1989-2001 was mainly due to a strong decline of the economy in this period of transition to a market economy, plus startup and operation of the first reactor at the Cernavoda nuclear power plant (1996). (MEWM, 2005) Data from Eurostat shows an increase of 12.1 % in the GHG emissions in the period 2000-2005 and this is expected to continue also in the first commitment period 2008-2012 and after that if additional energy saving measures will not be implemented through the mechanisms that the Kyoto Protocol offers. (EU Stat, 2006c)

Some projections regarding the GHG emissions up to 2020 were prepared by the **Romanian Government** (Ministry of Environment and Water Management). The calculations were defined in two different situations: 1. no specific measures will be taken; 2. specific measures will be taken; and were carried out using the ENPEP (Energy and Power Evaluation Program). The forecast for the GHG emissions has been determined taking into account various hypotheses related with 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. The conclusion of this study was that the GHG emissions level of the base year 1989 will not be exceed up to the year 2020 in both situations. So, the emissions evaluated for the year 2020 are 20 % below the level of the base year 1989 in situation 1 with no specific measures and 25 % below in second situation with measures. In this condition, the Kyoto Protocol commitment of 8 % reduction will be met in the period 2008- 2012 because at the 2010 level, the GHG emissions projections represent only about 65-70 % of the base year level. (MEWM, 2005)

8.3 Scenario building

The foundation of the scenarios is the statement outlined before that the Romanian Government's policy is to support accelerated growth of the GDP in order to reduce the discrepancies between Romania and the EU member states. In relation to this two scenarios (base and alternative define next) are presented in Table 8.1 regarding the GDP growth for the period 2000-2020 in accordance with the „Road Map for the energy sector of Romania"and Eurostat.

Table 8.1 The GDP growth for the period 2000- 2020

Source	Scenario	GDP annual growth rate (%)							
	Year	2000	2001	2002	2003	2004	2005	2006-2010*)	2011-2020*)
Romanian Gov.	Base scenario	1.8	5.3	4.9	5.2 **)	5.5 **)	5.1 **)	6.0	5.2
	Alternative scenario	1.8	5.3	4.9	4.2 **)	4.2 **)	4.6 **)	5.5	5.0
Eurostat	Base scenario	-1.2	4.3	7.2	6.8	7.1	7.8	n.a.	n.a.
	Alternative scenario	-1.2	4.3	7.2	6.8	7.1	7.8	n.a.	n.a.

Notes: *) Forecast values; **) Estimation values; n.a. not available

Sources: (Romanian Government, 2003), (EU Stat, 2006)

It is observed that there are some differences between the two sources. The first source is in accordance with the "Road Map for the energy sector of Romania" prepared by the Romanian Government in 2003 and has some estimation made for the period 2003-2005. On the other hand the source from EU (Eurostat) does not have a forecast for the period 2005-2020. Regardless of the differences between the two sources it is noticed that both confirm the growth during the period 2000-2005. Due to the discrepancy between the available data two sets of scenarios were built: first one based on data available from the Romanian Government and the second based on IEA assumptions. Both sets are presented in two scenarios: base and alternative and there were compared and analyzed. Because the second set based on IEA does not have data from the past (2000-2005), and only predictions about the future, data from Eurostat was used for this period in order to show the past developments.

The time frame for the assumptions made is the period from 2005 until 2020. This time horizon was chosen due to the Kyoto Protocol commitment periods (first period being 2008-2012) and because it

is interesting to look at this issue in the long run. It was relatively reasonable to choose this time horizon until 2020 because is in accordance with the time horizon that the Romanian Government and IEA used for their assumptions. A longer term-horizon could be more uncertain and exaggeratedly deterministic regarding the view of the future.

The assumptions made do not try to predict the future but to identify and analyze what might happen. The reliability of these projections depends on the quality and availability of data. Technological breakthrough cannot be predicted, as a result will be assumed that there will be improvements regarding the technology. Data available was calculated in percents for the entire analysis, so the scenarios will be easier to follow.

The foundation of the scenarios is the data showing the evolution of the GDP, the energy demand and supply and the GHG emissions in the period 2000-2005.

The **base scenario** takes into consideration the accelerated development of the economy, where industrial development has a key role, as well as the acceleration of the privatization in electricity, gas and oil sectors as well as the privatization in other sectors of the national economy. In this scenario the overall energy efficiency has to be improved until the year 2020, in a complex process which involves replacing technologies with high energy consumption and a structural adjustment of the economy.

The **alternative scenario** takes into consideration the possible negative impacts of the trend of the world economy on the Romanian market which can slow down some economic process. A 25 % decrease is related to the base scenario in cases of a slow development due to some unexpected effects. The negative impact of 25 % was chosen in relation to the uncertainties regarding the growth of the GDP and the transportation sector that is assumed to grow more than other sectors.

The next table represents the first set of scenarios for the period 2000 – 2020 with the forecast in accordance with the Romanian Government.

Table 8.2 The annual growth rates in the two scenarios for set number 1 (Romanian Government)

Driver	year	2001	2003*)	2005*)	2006-2010*)	2011-2020*)
	U.M.		Forecast			
		Base scenario				
GDP growth	%	5.3	5.2	5.1	6.0	5.2
Energy demand	%	3.4	2.3	1.6	2.9	2.5
Energy supply	%	n.a	n.a.	n.a.	n.a.	n.a.
GHG emissions	%	4.4	6.9	6.0	2.3	1.6
		Alternative scenario				
GDP growth	%	5.3	4.2	4.6	4.5	4.0
Energy demand	%	3.4	2.3	1.6	2.2	1.9
Energy supply	%	n.a	n.a	n.a	n.a	n.a
GHG emissions	%	4.4	6.9	4.5	1.7	1.2

Note: *) Forecast values in accordance with Road Map; n.a. not available

The **Romanian Government** assumed that the gross domestic product (GDP) is expected to grow by 6 % per year during 2006-2010 and by 5.2 % in the period 2011-2020 in the base scenario. The negative impacts in the alternative scenario show that the growth might be only 4.5 % annually for the first period and 4 % per year until 2020. It is observed that a faster development it is assumed for the period 2006-2010 and after this will gradually slow down after Romanian economy will stabilize.

The prediction for the final energy consumption in the base scenario are that there might be an increase of 2.9 % per year in the period 2005-2010 and 2.5 % per year from 2010 to 2020. For the alternative scenario the increase in the energy demand is less with 2.2 % per year for the first period and 1.9 % annually in the period 2010-2020 due to the negative impact applied to the GDP affecting also the demand. The increase in the consumption implies an increase in the GHG emissions, but this increase does not follow the energy demand trend. It is observed that in the base scenario the total GHG emissions are assumed to grow by 2.3 % per year in the period 2005-2010 and the energy

demand increase was 2.9 % for the same period. This mean that there is decoupling between the energy growth and the GHG emissions growth as the technology progress.

The following table represents the second set of scenarios with the prediction in accordance to International Energy Agency (IEA).

Table 8.3 The annual growth rates in the two scenarios for set number 2 (IEA)

Driver	**year**	**2001*)**	**2003*)**	**2005*)**	**2006-2010**)**	**2011-2020**)**
	U.M.				**Forecast**	
		Base scenario				
GDP growth	%	4.3	6.8	7.8	3.1	3.1
Energy demand	%	3.6	5.0	8.0	1.3	1.7
Energy supply	%	-1.5	4.3	0.7	1.4	1.6
GHG emissions	%	2.7	5.1	3.1	1.4	1.7
		Alternative scenario				
GDP growth	%	4.3	6.8	7.8	2.3	2.3
Energy demand	%	3.6	5.0	8.0	1.0	1.3
Energy supply	%	-1.5	4.3	0.7	1.1	1.2
GHG emissions	%	2.7	5.1	3.1	1.1	1.3

Notes *) Values in accordance with Eurostat; **) Forecast values in accordance with IEA

For the years 2005-2020 the assumptions based on IEA “World Energy Outlook” are not as optimistic compared with the first set of scenarios. Consequently, the GDP in the base scenario it is assumed to grow by 3.1 % per year until 2020 compared with the other predictions from Romanian Government where the growth is 6 % per year for the same period. In the alternative scenario the negative impact shows an increase in the GDP smaller that in the base scenario at 2.3 % per year. This negative impact might occur in the case of a slower economic development than the expected one or not enough improvements in the energy efficiency.

Regarding the energy demand in the base scenario the growth is assumed to be 1.3 % per year until 2010 and 1.7 % per year for the following period. Compared with the assumption made by the

Romanian Government the increase in the demand is less by approximately third times. This can be explained by the much faster economic development that Romania Government predicted. Concerning the energy supply is assumed a growth by 1.4 % per year on the period 2006-2010 and by 1.6 % per year until 2020. Comparison with the Romanian assumption can not be made for the energy supply due to the fact that first set of assumption did not have available data.

According to IEA, the GHG emissions in the base scenario are expected to grow by 1.4 % until 2010 and by 1.7 % from 2011 to 2020. In this case the trend of the GHG emissions follows the energy demand and there is no decoupling between the energy demand growth and the GHG emissions growth. In the alternative scenario the situation is similar with no decoupling. Even if the energy demand is bigger in the first set of scenarios (Romanian Government), the difference between the GHG emissions assumptions is not big. This is due to the fact that Romanian Government takes in consideration specific hypotheses related to the evolution of the energy sectors (transportation, manufacturing, energy industries, household) focusing on the increases in the energy efficiency, as well as hypotheses for the non-energy sectors (agriculture, forestry, industry, waste). The IEA assumptions are made at the general level having assumptions for all the transition countries and not including specific measures for each country.

Comparing the two sets of scenarios it is observed that the forecast data available from the Romanian Government regarding the GDP has some expectations that are more optimistic that the ones from the IEA. The assumptions from Romanian Government take in consideration a faster development and detailed improvements in the energy efficiency. The economical growth is expected to be around 6 % per year a value double compared with the IEA assumptions where the growth is only 3.1 % per year for the period 2005-2020. These assumptions influence also the energy demand and the GHG emissions being connected. As explained in chapter 3 figure 3.2, economic growth implies a growth in the incomes that allows people to increase their consumption and in the same time the emissions will grow in the same pace with the energy demand if specific measures are not taken, as it was seen in set number 2 (IEA). The first set of scenarios based on Romanian Government assumptions show that even if the GHG emissions grow is not necessarily to follow the energy demand and the economic development can be decoupled from the environmental impact.

8.4 Analysis

In the past the energy demand has decreased or risen in an almost linear trend along with the GDP. Since 2000 each increase in **GDP** has yielded an increase in primary energy consumption, a reverse trend as in the previous period where the decrease in GDP had implied a decrease in the energy demand as well. For the first time, after a decade, the Romanian economy has begun to recover with a robust GDP growth for five consecutive years. The recovery appears to be driven by private and public consumption. According to the IEA (second set) the trend will continue to grow with an annual rate of 3.1 % per year until 2020 in the base scenario. In this way the economic recovery in Romania is expected to continue over the next fifteen years as the causes of the slowdown started to dissipate (e.g. price liberalization, privatization). Regarding the alternative scenario a 25 % decrease was applied to the base scenario in case of a slow development or not enough initiatives and measures are taken. In this way the GDP growth is assumed to be only by 2.3 % per year until 2020 in the alternative scenario. In the base scenario the total growth for the IEA predictions (set 2) are 46.5 % until 2020 compared with the alternative scenario where the total economical growth it will be only 34.5 % during the same period 2005 until 2020 because of some possible negative effects in the alternative scenario than can slow down the economical development. Romanian Government predictions (set 1) show a total growth of 82 % for the period 2005-2020 in the base scenario and a growth of 62.5 % in the alternative scenario. The difference between the two sets it can be argued by the different hypotheses that Romanian Government and IEA had considered in their assumptions.

The period from 1989 to 2001 indicates a decrease of 46.7 % in the **energy demand**, but after 2001 was recorded an increase of 17.7 % until 2006. The main factors in the increase in demand include the rapid growth and industrial expansion, population increase, and replacement of fuels. Low energy prices also contribute although this will become less significant as subsidies are reduced. Energy subsidies, particularly those that encourage consumption by keeping prices below cost, impose a heavy burden on economic efficiency, environmental performance and government budget. Eliminating the under pricing of energy would reduce consumption and decrease pollution. This would boost economic growth through improved efficiency and reduce government costs. This is expected to continue because of diverse changes at the policy level with the view to align with to the other EU member states.

Romanian Government (set no. 1) had predicted a total increase in the **energy demand** of 39.5 % in the base scenario and 30 % in the alternative scenario for the period 2005-2020. Projected total energy demand for the second set in the base scenario increases by 23.5 % between 2005 and 2020, at an average annual rate of 1.5 %. This compare with the alternative scenario it is observed that total growth is only 18 % until 2020 when negative impacts are taken in consideration. The energy demand in the first set of scenarios weight against the second one it is almost double due to the higher increase in the GDP.

Romanian energy reserves and production are expected to grow with the opening of 15 oil and gas blocks for exploration in 1996, and the influx of western technology. The **energy supply** in the base scenario (set no. 2) was assumed to increase with 23 % until 2020 at an average rate of 1.5 % annually and this is approximately sufficient to cover the energy demand of 23.5 %. An increase of 17.5 % is assumed in the alternative scenario (set no. 2) until 2020 and there are adequate resources to meet the projected growth of 18 % in the energy demand.

As the trends indicate the energy use and related **GHG emissions** will continue to increase gradually in both cases. Romanian Government (set 1) shows an increase in the energy demand of 39.5 % and for the GHG emissions of 27 % in the base scenario. In alternative scenario is noticed an increase of 30 % in the energy demand and only 20.5 % increase in the GHG emissions for the period 2005 until 2020. Therefore, it is observed that in the first set of scenarios the economic growth is decoupled from the environmental impact. In a different situation is the analysis based on IEA assumptions (set number 2) in the same two scenarios and the same time-horizon that shows no decoupling between the energy demand and the GHG emissions. In the base scenario (set number 2) the GHG emissions will grow steady to a total of 24 % and the energy demand 23.5 % in the period 2005 to 2020. For the alternative scenario the energy demand will increase 18 % and the GHG emissions will follow the trend with 18.5 %.

As a result, the **GHG emissions** estimated for the year 2020 are 19.3 % below the base year 1989 in the base scenario, in contrast with the alternative scenario were the emissions are projected to decrease by 26.3 % compared with 1989 for the assumptions based on Romanian Government (set 1). IEA has predicted a decrease of 22.8 % below the level of the base year 1989 in the base scenario

and 28.3 % below in the alternative scenario. Comparing the two base scenarios (in set 1 and set 2) a difference from 19.3 % to 22.8 % can be observed between the assumptions from the Romanian Government and the assumption made by the IEA. The situation is almost similar in the alternative scenario where a decrease from 26.3 % to 28.3 % is notice when comparing with the base year 1989. The decrease is smaller in the Romanian set of scenarios due to the fact that the GHG emissions are projected to grow much faster than in the IEA predictions.

In this situation, both sets from this analysis prove the decrease in the GHG emissions compared with the base year 1989, showing that the commitment under the Kyoto Protocol of 8 % reduction will be met until 2020. As a result of this analysis, the target under Kyoto Protocol will be reach and Romania will be able to receive the credits that the international trading system offers. It is necessary to remember that this will continue in the future if Romania is able to decouple the increase of GHG emissions and the industrial growth, by implementing coherent measures for energy efficiency, renewable energy and others, and to preserve achieved reductions. In addition, Romania must meet all the eligibility requirements no later than December 31, 2006 in order that can start the trading system.

The data from the Romanian Government was used because it covers the power sector and natural gas sector; some other sectors (coal, lignite and oil) and includes energy efficiency strategies and measures. The numbers used for the first set of scenarios according to the “Road Map”, takes in consideration the economical development assessment up to 2020 and are based on the following main considerations:

- structural change and modernization of the economy;
- different options for the energy supply and for the development of the electricity generation capacity (hydro, nuclear, renewable energy)
- evolution of cogeneration;
- energy intensity reduction (losses reduction in heat networks and in the national power grid; increase of efficiency for new generation units; increase of thermal insulation of buildings; promotion of new and efficient vehicles for freight and passengers transportation; development of the public urban transportation; increase of energy efficiency in households and service sectors, etc.)

IEA predictions were used in the assumptions for the GDP growth, energy demand and supply, as well as for the GHG emissions due to the fact that the analysis is based on a set of assumptions about macroeconomic conditions, population growth, energy prices, and technology. It takes in consideration government policies and measures designed to combat climate change and possible impact of new technologies on energy supply and demand since much of the energy related equipment used today will have to be replaced by 2020.

8.5 Uncertainties

As in any attempt to predict future energy developments, uncertainties surround the projections presented. The main source of uncertainty are macroeconomic conditions, energy and environmental policies (including liberalization and climate change policies), the role of nuclear power and developments in energy technology. Changes in government policies and new measures regarding the environment and especially climate change could have profound consequence for energy markets (the production, pricing, and taxation and subsidy policies). (IEA, 2000)

Economic growth being the most important factor when forecasting future trends it is considered also the key source of uncertainty. This means that deviations from the assumed economic growth have an expected impact on energy demand. Another important source of uncertainty is government initiatives in particular those related with environmental objectives such as the limitation of GHG emissions. (IEA, 2000)

Since 2001 a decrease in the GHG emissions in Romania was notice and this is due to the opening of the first reactor at the Cernavoda Nuclear Plant. With the opening of the second reactor and additional technological changes that improves the energy efficiency it is expected that the increase in GHG emissions will not be so significant. (MEWM, 2005) In the energy long-term use of nuclear power some discussions emerge this being highly controversial and political. Some governments oppose the continued use of nuclear power and others retain a firm commitment to nuclear development, for economic, energy security and climate change related reasons. By generating electricity with no CO_2 emissions, nuclear energy can contribute significantly to reducing GHG emissions and Romania has chosen to use it discussing also the opening of the third reactor. (IEA, 2000)

Another important concern is the continuing improvement in the efficiency of existing energy technologies and the development of new ones. The assumption made is that the efficiency of existing technologies will continue to improve in the next fifteen years, as it is showed through different projects. In particular, the transition countries such as Romania will become much less energy intensive as more energy efficient technologies are introduced, wasteful energy practices are tackled and energy prices are reformed.

The **transportation** sector plays an important role in rising CO_2 emissions, being the sector with fastest energy demand growth. Consequently, the energy efficiency in transportation needs to take in consideration possible additional policy measures. The focuses are on efforts to improve vehicle-fuel efficiency and to increase the use of alternative fuels, and on strategies to encourage o shift in transport demand. Measures to improve passenger vehicle fuel efficiency are the most effective, as they can compensate for the growth in passenger-vehicle transportation. (IEA, 2000)

Investment in the production, transformation, transportation and distribution of energy will be needed to meet expected growth in demand in the following decade. The bulk of investment will be needed in Romania from the industrialized countries in the form of loans, JI projects or direct investment. (MEWM, 2005)

GHG emissions in Romania will increase slowly, but as the analysis demonstrate the commitment under Kyoto protocol will not be affected, Romania being able to reduce their emissions with 8 % compared with the base year 1989. Fulfilling the commitments to limit the GHG emissions without overly affecting the economic growth is clearly a major policy aim for Romania. The Kyoto Protocol provides for the use of emission trading (ET) involving a creation of an international market for GHG emission reductions, to reduce the cost of meeting these commitments compared with an exclusive reliance on domestic policies and measures. The permit trading would constitute a major source of revenue for Romania and other transition countries, which would be the main supplier of these permits. Romania estimated the quantity of emission reduction that Romania will have available after eliminating the 8 % reduction compared with the base year 1989, this representing the commitment under the Kyoto Protocol. As a result it is expected that for the period 2008-2012 to

have available circa 50 million tones per year. In total 250 millions tones emission reduction units might be available plus the development of the projects that generates emissions credits that produce a surplus of credits. From this amount a part has to be kept as a reserve for the period post 2012 and the rest is going to the state budget. (Confidential source)

A discussion could appear in the case Romania cannot reach the target set by the Protocol after the 2020 and what will be the punishment in this case. The Kyoto Protocol specifies sanctions that are meant to be costly for countries that do not meet their commitments. The so-called Marrakesh Accords stipulate sanctions for the Kyoto Protocol. The most important element in this enforcement mechanism is that countries that have exceeded their emissions targets during one period are required to reduce emissions enough in the next period to make up for the excess in the previous period, plus an additional 30 percent. The Marrakesh Accords also specify that a country that has been non-compliant in one period will not be allowed to sell emission permits in the next period. (Cicero, 2006) As a result, if Romania will not reach the target proposed by the Kyoto Protocol in the long-term, will be forced to buy permits from other industrialized countries and implement project in other countries, this being costly and it might have a negative effect to the Romanian economy as well.

Chapter 9 Discussion and conclusion

The aim of the project was to discover if Romania will gain from the opportunities that the Kyoto Protocol offers in the process of implementing climate change policies and strategies. In order to approach this problem was necessary to look at the past developments in the Romanian economy, the energy sector as well as the evolution of the GHG emissions. With a contribution of 79 % of the GHG emissions in 2001, the energy sector is the most polluting sector in the Romanian economy. In recent years, Romania has begun to accelerate the opening and privatization of its energy sector recognizing that greater investment, particularly foreign investment, will be needed to bring Romania into line with the rest of Europe. With hopes to enter the European Union by 2007, Romania is aiming to align its energy sector and economy with the rest of the EU.

It is concluded that the opportunities that Kyoto Protocol and its flexible mechanisms offers in the implementation of climate change activities in Romania are based on the JI project and the trading system. At the moment Romania is involved in eleven JI projects: five in the energy efficiency field, four regarding renewable energy, one in afforestation and one concerning landfill gas recovery. These projects will improve the energy efficiency in Romania, helping to meet the commitment under the Kyoto Protocol. The measures trough different ongoing projects demonstrate the strong will of the Romania Government to comply with the commitments resulted from ratifying the UNFCCC and the Kyoto Protocol.

The other opportunity that the Kyoto Protocol offers is related with the international emission trading system. Romania must meet all the eligibility requirements in order to be able to start the trading system. In 2007, Romania must have in place a national registry to record and track the creation and movement of emission and removal units. Romania is in the process of building a national system for assessment of the emissions, expected to be ready not later that January 1st 2007. The system must include all institutional, legal and procedural arrangements made for estimating emissions, reporting of inventory information as well as filing (archiving) of inventory information. Under the international trading system each Annex I country has a certain number of emission allowances (amount of carbon dioxide it can emit) in line with its Kyoto Protocol reduction targets.

If a country's GHG emissions are below their emission targets set by Kyoto Protocol, they can sell these allowances (credits) to other Annex I countries that are emitting above their Kyoto targets.

By meeting the eligibility requirements from the Kyoto Protocol Romania will be ready to start the emission trading system; now being in the process of building a national system for assessment of the emissions and establishing a national registry system. As concluded based on the analysis Romania will be able to reduce the 8 % emission target set by the Protocol, in the first commitment period as well as after 2012, and will have a surplus of credits that can be sold to other industrialized countries that are not able to meet their target reduction. By selling their credits Romania can invest in new technologies which will improve energy efficiency. This is seen as an important gain from the KP mechanisms.

The conclusions regarding the GHG emissions reductions are based on the analysis made with the use of scenarios. According to the two sources used for building of scenarios, the Romanian Government and the International Energy Agency (IEA), the economy is predicted to grow steady in the period 2005 to 2020 with a higher growth rate in the first 5 years. The GDP growth expected by the Romanian Government is double than the one from IEA. This can lead to the conclusion that the projections from the Romanian Government are more optimistic and maybe much harder to achieve. Through the economic growth, the energy demand and production are expected to rise as well, as people's income increases. The GHG emissions will be also influenced, with a total raise of around 25 % in the next fifteen years, but compared with the base year the 8 % target will be achieved and an extra 12 % of the emission reduction will be available for the trading system. Therefore, the conclusion based on both sets of scenarios demonstrates that Romania will meet the target set by the KP in the period 2005-2020.

Finally the project concluded that Romania can gain from the JI and the trading system if they follow the requirements and take measures to improve the energy efficiency. With better energy efficiency Romania can reach the reduction target and will be able to receive credits and sell them to other industrialized countries, through this improving also the technology (JI).

From the economical point of view Romania can gain by selling their emission credits to other industrialized countries. From this amount of credits expect to be received, a part will be kept as a reserve for the period post 2012 and the rest in going to the state budget for the use in different environmental problems that may arise (need to be solved). Environmentally speaking Romania can gain through different JI projects that other countries will implement in Romania because the costs are less compared with reduction emission projects that can implement in their own countries. In this way the energy efficiency will be improved through many technological changes.

A key question is what it will be the situation after 2020. If Romania will not reach the future target under by the Kyoto, the Romanian Government will be force to buy credits and implement projects in other countries. These sanctions can be costly for the Romanian economy and can affect also other countries with which Romania signed Memoranda of Understandings. Therefore, these countries that implemented projects in the country are expecting to buy credits from Romania. Another negative aspect of not complying with the requirements is that Romania will no longer be able to sell permits to other countries in the next commitment periods.

As it may be seen from the above Romania will gain from the Kyoto Protocol mechanisms economically and environmentally in the period 2005-2020, but in a longer time-horizon many unknown aspects might arise when the trading system will start and when many countries will not be able to deal with their reduction targets.

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Appendixes

Appendix 1 Parties

The Convention divides countries into three main groups according to differing commitments:

Annex I countries: industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT), including the Russian Federation, the Baltic States, and several Central and Eastern European States. (UNFCCC, 2006e)

EU-15, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland, Canada, Hungary, Japan, Poland, Croatia, New Zealand, Russian Federation, Ukraine, Norway, Australia, Iceland.

Annex II countries consist of the OECD members of Annex I, but not the EIT countries. They are required to provide financial resources to enable developing countries to undertake emissions reduction activities under the Convention and to help them adapt to adverse effects of climate change. In addition, they have to "take all practicable steps" to promote the development and transfer of environmentally friendly technologies to EIT countries and developing countries. Funding provided by Annex II countries is channeled mostly through the Convention's financial mechanism. (UNFCCC, 2006e)

Non Annex I countries are mostly developing countries. Certain groups of developing countries are recognized by the Convention as being especially vulnerable to the adverse impacts of climate change, including countries with low-lying coastal areas and those prone to desertification and drought. Others (such as countries that rely heavily on income from fossil fuel production and commerce) feel more vulnerable to the potential economic impacts of climate change response measures. (UNFCCC, 2006e)

Appendix 2 Decoupling

Economic growth often implies increased use of energy and materials in society, which in turn gives rise to environmental degradation through emissions and pressure on ecosystems. Material flows influence the environment from the time a material is extracted, through processing, manufacturing and use, to its ultimate disposal as waste. It is therefore important to find ways of decoupling economic growth from environmental impact. (SEAC, 2000)

There are prospects for continued economic growth in developed countries and for a very rapid growth in many developing countries with high populations. This will lead to increased pressure on ecosystems and to emissions detrimental to human health unless we can decouple economic growth from environmental degradation. (SEAC, 2000)

The Swedish Environmental Advisory Council has outlined that it cannot be expected that the economic growth to solve environmental problems automatically. Sometimes environmental impact is reduced in line with economic development. Such correlation could imply that economic growth automatically leads to reductions in environmental impact. In reality, improvements are generally a consequence of specific environmental policies. Solutions to environmental problems are often triggered by societal debates and regulation. Thus policies are required and these should include:

• price incentives (higher prices on emissions via taxes or permit trade systems)
• technology development incentives (R&D and niche markets)
• regulatory measures (energy efficiency, emissions standards) (SEAC, 2000)

Appendix 3 Transition compared with other countries

Romania's transition, starting in 1990, was more difficult than in the other countries of Central and Eastern Europe in many respects. This was partly because by the late 1980s, Romania's economy was on the verge of collapse after 40 years of rigid central planning that emphasized self reliance, an excessive focus on heavy industry, and large, uneconomic infrastructure projects. (World Bank, 2006)

With one of the most authoritarian political system, with a strong declining economy and a population subject of all sorts of deprivations, Romania started the transition on a lower level compared with Poland and Hungary. One of the most important causes of the slow-down is the intervention of the government into the economy compared with Poland that succeed in depoliticize the economic life. Poland started with a different approach of reforming the economy called shock therapy. This was characterized by a sudden release of prices, withdrawal of state subsidies and immediate trade liberalization. Romania chose another type of transition by keeping state subsidies and low energy prices. Another important aspect of the transition is the ability to choose the right policies and giving the tough situation of Romania in the beginning of transition this task was quite difficult for the

Romania government. So, the reform in Romania did not succeed as quickly as in Poland and Hungary. (EBRD, 2002)

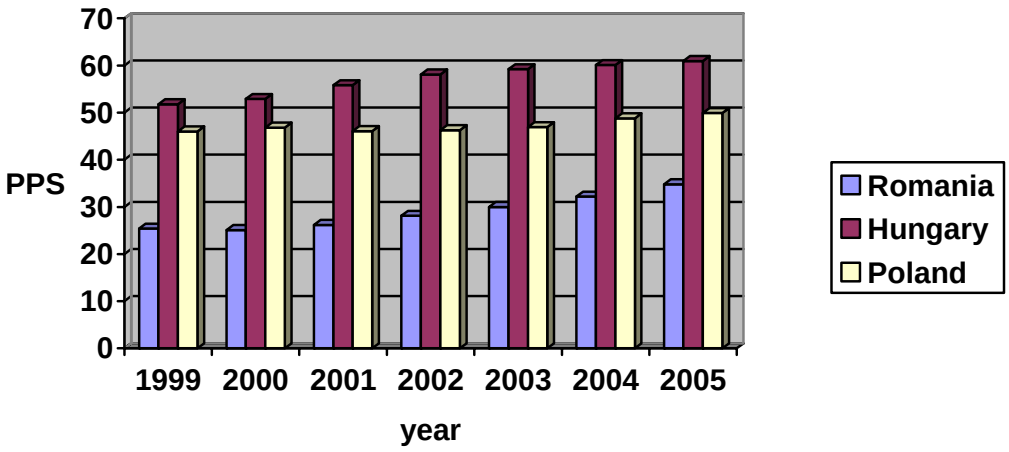

Figure 1 GDP per capita in Purchasing Power Standards (PPS) for Romania, Hungary and Poland (EU Stat, 2006)

From 2000 the economic situation in Romania started to improve compared with Poland and Hungary. In Romania it is observed that the GDP value in 2000 was approximately half than in Hungary and Poland, but until 2005 the growth picked up approaching the other ex-communist countries from Eastern Europe.

The country is currently engaged in reforming and restructuring its economy and administration with a view to joining the EU in 2007. As part of this, the Government seeks to build institutions and design and implement public policies to fundamentally transform Romania's economy and society. This requires strong political commitment, considerable expertise and resources, as well as external support. (MEWM, 2005)

Appendix 4 GDP

GDP growth rates weighted using Purchasing Power Standards (PPS) per person employed (EU25 = 100). Persons employed cover employees and self employed. The definitions used are consistent with International Labour Organization (ILO) definitions. (EU Stat, 2006)

Gross domestic product (GDP) is a measure for the economic activity. It is defined as the value of all goods and services produced less the value of any goods or services used in their creation. The volume index of GDP per capita in Purchasing Power Standards (PPS) is expressed in relation to the European Union (EU-25) average set to equal 100. If the index of a country is higher than 100, this country's level of GDP per head is higher than the EU average and vice versa. Basic figures are expressed using PPS, i.e. a common currency that eliminates the differences in price levels between countries allowing meaningful volume comparisons of GDP between countries. (EU Stat, 2006)

Appendix 5 Energy intensity

Energy intensity is measured by the quantity of energy required per unit output or activity, so that using less energy to produce a product reduces the intensity. Low energy intensity indicates a lower price or cost of converting energy into GDP. The opposite high energy intensities indicate a high price or cost of converting energy into GDP. (USDE, 2006) Economic growth is requiring less additional energy consumption, mainly as a result of structural changes in the economy. However, total energy consumption is still increasing. (EEA, 2006a)

Reductions in energy intensity are influenced in general by structural changes of the economy and improvements in the technical efficiency of appliances or processes or better insulation in buildings. The most important structural changes are in the industrial sector. These includes a shift from industry towards services which are typically less energy-intensive and a shift within the industrial sector from energy-intensive industries towards less energy-intensive industries. The intensity decrease in the countries with economies in transition is influenced by the opening up of the economies and changes in ownership structures (through increasing privatization). (EEA, 2006a)

The transport sector presents the most difficulties in decoupling energy consumption from economic growth, due to continuous increase in the use of transportation. In the household sector, there is hard to decouple the final energy consumption from population growth. The task of improving the final energy intensity in the household sector is influenced by rising living standards, leading to a larger number of households, lower occupancy levels and increased use of household appliances. (EEA, 2006a)

Appendix 6 EU Legislation

In order that Romania could accede to the European Union the country must to align its policies with the EU legislation (acquis) in the energy field. Acquis Communautaire refers to the total body of EU law accumulated so far or needs to be accumulated in the future. The key elements of the energy acquis comprise of Treaty provisions and secondary legislation concerning in particular competition and State aid , the internal energy market (including directives on electricity, price transparency, gas and electricity transit, hydrocarbons, granting of licences, emergency response and security stock obligations), nuclear energy , energy efficiency and environmental protection provisions. (Europa, 2005)

The 2004 Report from the European Commission notes that Romania has made progress regarding the building up of oil stocks, the internal energy market (electricity and gas), including restructuring and privatization of the energy sector, the development of trans-European energy networks, solid fuels and nuclear energy. Progress has been lower regarding price distortions, bill collection rates, arrears and energy efficiency. (Europa, 2005) Recognizing that Romania has continued to make progress towards being a functional market economy, the future is focusing on the remaining steps Romania needs to follow in order to accelerate the alignment of its policies with the EU “acquis” in the energy field.

The energy sector represents a strategic infrastructure of the national economy on which relies the overall development of the country. In the same time the energy represents a public utility with an important social impact. The energy policy, is approaching this important sector of the Romanian National Economy, as a public utility which needs more commercial mechanisms and competitive environments, where the prices to be formed in a free competition between a diversity of suppliers and customers, which are gradually free to purchase their energy, as well as a transparent and stable market mechanisms surveyed by independent regulating authorities and market operators. (Romanian Government, 2003)

Appendix 7 Emissions Trading Units under Kyoto Protocol

The units which may be transferred under the emissions trading, each equal to one metric tonne of emissions (in CO_2-equivalent terms), may be in the form of:

- An assigned amount unit (AAU) issued by an Annex I country on the basis of its assigned amount
- A removal unit (RMU) issued by an Annex I country on the basis of land use, land-use change and forestry activities
- An emission reduction unit (ERU) generated by a JI project
- A certified emission reduction (CER) generated from a CDM project. CERs are the additions to assigned amount units. (UNFCCC, 2006d)

These assigned amount units (AAUs), and other units defined by the Protocol, contribute the basis for the Kyoto mechanisms by providing for a country to gain credit from action taken in other countries that may be counted towards it own emissions target. (UNFCCC, 2006) In order to address the concern that Annex I countries could "oversell" units and subsequently be unable to meet their own emissions targets, each country is required to hold a minimum level of credits (units) in its national registry. (UNFCCC, 2006d)

Appendix 8 MoU

Concluding a bilateral Memorandum of Understanding (MoU) on JI co-operation between host and investing countries is not a requirement under the Kyoto Protocol, but it has become a common practice, or often regarded as pre-requisite by Central and Eastern European countries before implementing JI projects. MoUs are normally expected to serve as an alternative to official rules under the Kyoto Protocol at least until the Protocol becomes operational after its entry into force. In other words, if both host and investing countries can allow the risk of the other country's inobservance of JI Project Agreement prepared on a project-by-project basis, then MoUs might not be absolutely necessary. (MEWM, 2005)

Appendix 9 AIJ projects

Next part presents five projects implemented jointly **(AIJ)** carried out in Romania.

Emission Reduction at Power Plants (Activities Implemented Jointly-AIJ)

The project consists of three phases, the first of which started at the beginning of 1997. During the first phase of the project, a large number of power plants were visited, and then a selection was made at

which plants the emission reductions would take place. The establishment of the baselines followed the first phase. After fact-finding was completed, a program of energy conservation and CO2 reduction was implemented for about two years. One of the activities within this project was the optimization of the management (periodical measurements and training and recommendations for policies and measures). (MEWM, 2005)

Improvement of Wastewater Infrastructure at Targu Mures (AIJ)

The project focused on the improvement of the technology used to collect and treat wastewater. Targu Mures municipal water company (RAGCL) had a sound strategy and vision with regard to its privatization. The most important elements of this strategy were the development of a cost and energy-effective water treatment system, the upgrading of technology and equipment and the training and education of staff. This project is meant to contribute to the realization of this strategy. Another part of the project provided for the opportunity to disseminate the new technologies and management techniques to other water companies. (MEWM, 2005)

Energy Efficiency in Drinking Water Supply (AIJ)

The project improved the drinking water supply system in the city of Targu Mures. The project contributes to the same objectives as the project above. (MEWM, 2005)

District Heating Project Bistrita and Tirgu Mures: Project identification and feasibility study (AIJ)

An identification mission took place for possible Swiss contributions to the improvement of district heating systems in the Romanian cities Bistrita and Tirgu Mures. In this project the assessment of technical, economic and environmental aspects was carried out, including the po-tential for Joint Implementation under the Kyoto Protocol and transfer of GHG emissions reduction units generated by the project. (MEWM, 2005)

Swiss Thermal Energy Project (STEP), Romania(AIJ)

The AIJ project proposed by Switzerland consisted in the retrofitting of two district heating systems in Romania. The tasks performed in the project included participation in the validation process,

implementation of monitoring protocol, AIJ-related training of local counterparts. Switzerland proposed to modify the AIJ project in a Joint Implementation project. (MEWM, 2005)

Appendix 10 JI projects

The JI mechanisms concerns investment projects in Romania that will reduce GHG emission. The mechanism allows private or public actors in Annex I countries to invest in climate projects in Romania or to buy the emission reduction from a Romanian project host, and allows the government of Romania to transfer the GHG emission reductions obtained through the projects. 11 JI projects amounting to a total of 7.5 Mt CO_{2eq} emission reductions have been approved to date.

1. Swiss Thermal Energy Project in Buzau and Pascani (AIJ/JI)

The project rehabilitated a part of the district heating system in the two towns Buzau and Pascani as a demonstration project. The main components financed by Switzerland include: CHP units, thermal substations, electronic energy meters and all materials necessary to replace distribution pipes. The investment amounts to EUR 70 million between 2000-2002, of which EUR 7 million was born by a Swiss national investment-facilitating agency (SECO). GHG emission reductions from the project will amount to 139,000 tCO2 equivalent in the Kyoto Protocol's first commitment period. (MEWM, 2005)

2. Development of the Municipal Utilities - Heating System in Fagaras

The project is implemented based on the bilateral cooperation with Norway aims to rehabilitate the district heating system in Fagaras city. Eight zonal thermal plants with capacities ranging between 7.4 and 16 MW will replace a total of 25 old thermal plants and points. The new system consists of high capacity and efficient boilers and pre-insulated pipe system, and meters at each consumer. The total investment amounts to USD 13 million, of which the emission reduction accounts for USD 0.5 million. The total emissions reductions for the first commitment period were estimated at 35,000 tCO2 equivalent per year or 175,000 tCO2 equivalent in total. (MEWM, 2005)

3. Modernization of 3 Hydro Units at Portile de Fier I Hydropower Plant

The project developed based on the cooperation with the Netherlands consists of the modernization of three hydro units (out of six) within the Portile de Fier I hydropower plant. The project aims to increase the unitary active power from 175 MW to 194.5 MW, to expand the ancillary services and to

extend the hydro units life duration by 30 years. The project development benefits from the solution that has already been successfully applied for the modernization of the other three hydro units within the same plant. The investment amounts to approximately EUR 200 million, which will come from the sources of the owner (Hidroelectrica) through energy sales, and the support from the Dutch government through ERUPT 2 programme. The expected ERUs are 1,674,000 tCO2 equivalent in total for the first commitment period (or 335,000 tCO2 equivalent per year in average). (MEWM, 2005)

4. Reduction of CO2 Emissions at Alesd and Campulung Cement Plants

The project developed based on the cooperation with the Netherlands consists of the upgrading of two Holcim's cement plants in Alesd and Cimpulung in order to improve the energy efficiency of cement production process at these plants. The upgrading includes raw mill feed system, raw mill grinding, pre-heater tower, cooler and cement mills. The total cost of the projects has been estimated at about EUR 30 million for Alesd plant and about EUR 5 million for Campulung plant, while ERUs are expected to account for 888,000 tCO2 equivalent in total for the first commitment period (or 178,000 tCO2 equivalent per year in average). (MEWM, 2005)

5. Modernization of 4 Hydro Units at Portile de Fier II Hydropower Plant

The project developed based on the cooperation with the Netherlands consists of overhauling and modernizing the 4 units out of the existing 8 within Portile de Fier II hydropower plant. The scope of the modernization is to increase the economic efficiency of the hydropower plant by improving its reliability, by raising the power reserve and the output of the plant, thus meeting the conditions required for aligning and including it into the ancillary service category. The supplementary installed power in these four hydro- units will be 22 MW, which will lead to a supplementary energy of 212.133 GWh/year. The investment amounts to approximately EUR 200 million and the expected ERUs to be transferred are 850,000 tCO2 equivalent in total for the first commitment period. (MEWM, 2005)

6. „Sawdust 2000" Project

The project will implement the technology for using sawdust for district heating as the fuel in the small to medium towns of Gheorgheni, Vatra Dornei, Vlahita, Huedin and Intorsura Buzaului, where the existing boiler systems consist of heat only boilers for production of hot water for space heating

and for production of domestic hot water. The project will introduce new automatically controlled biomass boiler systems and a two track pre-insulated district heating network pipe system, construct new or renovate old boiler houses, and construct sawdust storage. The overall project cost is over EUR 13 million, of which EUR 2.6 million (20%) is provided by the Danish Environmental Protection Agency through the JI mechanism. Total GHG emissions reduction until the end of the first commitment period is calculated at 720,000 tCO2 equivalent. GHG emissions reductions are due to the classic fuel substitution and to the CH4 emissions decrease from the anaerobic digestion of sawdust in stock piles. (MEWM, 2005)

7. Geothermal energy

The project to be implemented under the bilateral cooperation between Romania and Denmark and it is a fuel-switching project addressing the district heating systems in the city of Oradea - Area II and in the town of Beius aiming to substitute fossil fuels (lignite, oil and natural gas) with local geothermal energy resources. The project idea is to increase the use of geothermal energy resources in the city of Oradea by erecting a new geothermal heating plant and rehabilitation of existing DH system (pipe network, substation installations etc.) in Area II. In Beius the project idea is to increase the supply of geothermal energy from the new geothermal DH system to public buildings in the town of Beius. The total investment amounts to about EUR 2.2 million and the estimated emissions reductions are 190.000 tCO2 equivalent until the end of the first commitment period. (MEWM, 2005)

8. Afforestation of 7000 ha of Degraded Agricultural Land Project (JI)

The project is implemented on the basis of Romania's cooperation with the World Bank's Prototype Carbon Fund consists of the reforestation of approximately 7000 ha of degraded agricultural land (6,728 ha net area without roads and buildings etc.) and the location is spread across seven counties in the Southwestern and Southeastern Romania (Braila, Dolj, Galati, Mehedinti, Olt, Tulcea and Vaslui). The Romanian counterpart and the implementing organization is the National Public Administration of Forests. Estimated emission reduction is over 1 million tCO2 equivalent over the period of 2002 - 2012. (MEWM, 2005)

9. Landfill Gas Recovery in Romania (JI)

The project to be developed under the cooperation with the Netherlands proposes to build and operate installations for the extraction of methane gas at four landfills in Romania. The extracted biogas will

be converted into electricity by gas engines and will in the future be supplied to the public network or to local users. The investments will be made in gas collection network, permeable pipes, gas domes, gas engines and others. The project will be financed through the sales of ERUs and electricity generated from the collected biogas. The approximate initial investment will amount to EUR 32 million, followed by EUR 12.5 million for annual operational cost. The ERUs estimated to be generated by the project will be 750,000 t CO2 equivalent in total for the first commitment period (or 150,000 tCO2 equivalent per year in average). (MEWM, 2005)

10. Targoviste Co-generation Project

The project is to be implemented under the bilateral cooperation with the Netherlands with the aim to build new co-generation facilities (6.5 MWe) and rehabilitate the existing heat-only boilers, the heat transport and distribution networks in the Municipality of Targoviste. The existing and rather old (around 25-30 years) heat production facilities that are scheduled to be replaced by the project have a very low thermal efficiency, leading to a relatively high consumption of natural gas for the heat produced. The project is based on a study carried out by the Municipality of Targoviste and the municipalityowned heat distributing company S.C. Termica S.A., together with Nuon, the Netherlands. The total investment amounts to EUR 6,5 million. The project intends to reduce the GHG emissions by 400,000 tCO2 equivalent until the end of the first commitment period. (MEWM, 2005)

11. District heating system rehabilitation - Bucharest (JI)

The project is to be developed based on cooperation with Switzerland and is to rehabilitate a part of the district heating system in Bucharest. This will be done by installing automation and control equipment, as well as pumps and frequency converters at around 600 thermal points, and by installing balancing valves for all final consumers connected to about 700 thermal points. The project implementation is expected to save approximately 237,400 Gcal/year of thermal energy, and 20,100 MWh/year of electric energy. The total investment is EUR 51 million, of which EUR 7 million is provided by SECO through the JI mechanism. After full implementation of the rehabilitation program, achieved ERUs will be around 69,000 tCO2 equivalent per year in average during the first commitment period. For the time being the project agreement is under negotiation. All these measures demonstrate the strong will of the Romanian Government to comply with the commitments resulted from ratifying the UNFCCC and the Kyoto Protocol. (MEWM, 2005)

To secure Romania's future participation in flexible mechanisms Romania needs to establish the proper institutional infrastructure and determine procedures, methods, criteria and priorities for the JI and IET mechanisms in Romania. The Government of Romania also needs to establish awareness in Romania of the Kyoto mechanisms and the opportunities they provide, as well as training of staff in those institutions that will be responsible for implementation of the mechanisms and provide assistance to project developers and applicants.

Appendix 11 Energy Sector in Romania

An important aspect in the Romanian energy sector is that effective tariffs - reflecting tariffs and payments discipline - are still below cost recovery levels. In the power sector, power tariffs will have to increase over time to support finance of investments. Collections remains a problem in the power sector, with failure to pay by large state owned enterprises, and a high degree of non-cash settlement. In the gas sector, the main challenge is to increase tariffs to reflect border prices. Though some progress has been made here, further increases are necessary. (Kennedy, 2004)

On the institutional reform side, Romania has made good progress. Outstanding challenges are to further commercialize both the gas and power sectors, through private sector participation where this is feasible. Regarding investments, major rehabilitation of power generation assets is required in the medium term. Failure to secure investments could see Romania go from its current status as a net exporter of power to South-East Europe, to a country dependent on imports/suffering from insecurity of supply. (Kennedy, 2004)

Evidence suggests that introduction of the private sector in power distribution can help to strengthen payments discipline; this has been successful to varying degrees in Albania, Georgia, Kazakhstan, Moldova and in Latin America. Ideally in Romania the private sector should be introduced in distribution through sale of assets to strategic investors, though this might be difficult under current market circumstances. (Kennedy, 2004)