UNIVERSITY OF SARAJEVO
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MASTER'S THESIS

THE IMPLEMENTATION OF KYOTO PROTOCOL IN SOUTH-EASTERN EUROPE

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STATEMENT

I, Nirmela Tatarević do hereby certify to be the author of this Master's thesis written under the mentorship of Professor Dr. Besim Ćulahović in compliance with the Act of Author's and Related Rights-Para 1 of Article 21. I herewith agree this thesis to be published on the website pages of the Faculty of Economics, University of Sarajevo and website pages of the Faculty of Economics, University of Ljubljana.

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INTRODUCTION

Climate change has emerged as one of the most important issues facing the global community in the 21st century. Most scientists agree that the average temperature of the Earth has been increasing more than natural climatic cycles would explain. This episode of global warming is due to human activity. Global warming affects everything, rising sea levels, water shortages, loss of bio diversity, colder climates in some parts, hotter climates in others, and so on. It began with the industrial revolution, two centuries ago, and accelerated over the last 50 years. Fossil fuel burning is mostly responsible, because it releases gases (particularly carbon dioxide) that trap infrared radiation. This greenhouse effect creates a whole system disturbance, that we call climate change (Töpfer & Sorensen, 2005, p. 4). There are many things that adversely affect the environment and which are the result of human activities. The consequence of human negative impact on the environment will be visible for more than a century. Gases we send into the atmosphere 2011 will be retained in the atmosphere to 2111 and even longer.

In order to avoid negative potential outcomes of global warming, countries have adopted the United Nations Framework Convention on Climate Change (UNFCCC) that has so far been ratified by 192 countries. In 1997 the Kyoto protocol, a binding GHG reduction plan, was adopted and entered into force in 2005 after the required number of parties had ratified the agreement (Cirman, Domadenik, Koman & Redek, 2009, p. 31). The Kyoto protocol calls for legally-binding GHG emissions limits by Annex I parties (industrialized countries), while non-Annex I countries (developing countries), have no binding obligations to reduce their emissions.

The Kyoto protocol introduced three flexibility mechanisms to help Annex I countries in meeting their emission reduction commitments. The three mechanisms are: International Emissions Trading (IET), Joint Implementation (JI) and the Clean Development Mechanism (CDM). The main feature of CDM and JI is that countries with reduction obligations under the Kyoto protocol are allowed to achieve the reductions in other countries. A country with a reduction obligation invests – both under CDM and under JI – in a project for reducing greenhouse gas emissions in another country. The investing country then gets the achieved emission reductions in the form of emissions allowances (Meunier, 2004a, p.17). In the case of JI, the project takes place in a country that has a reduction obligation. A CDM project takes place in a developing country that does not have a reduction obligation.

Although developing countries do not have binding emissions targets under the Kyoto protocol, because the problem of emissions is mostly due to the actions of developed countries, we all are in this problem together. So, it is necessary to join forces in order to solve our problem and to have a better and cleaner future. Climate change provides a potent reminder of the one thing that we share in common. It is called planet Earth. All nations and all people share the same atmosphere and we only have one (Watkins, 2007, p. 8). Developing as well as developed countries should do the most possible to reduce GHG emissions. Opinions are very different in this case. Many people wonder why the developing countries should also participate in emission reduction, when GHG emission is mostly due to developed countries. A problem of global warming has an impact on all of us. Unfortunately, it appears that many developing countries bear the brunt of global warming (Töpfer & Sorensen, 2005, p. 4). So we should join forces to move towards improving the current situation in which we are together and to become a better environment for all of us.

The subject of this master's thesis is to analyze the implementation of Kyoto protocol in South-Eastern Europe countries-developing countries, including Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia.

The purpose of this thesis is to analyze CO_2 equivalent emissions by sectors in SEE countries and to compare it with the baseline year 1990 in order to see whether a country increase or decrease its emission, also to analyze and compare CO_2 emission as the most important greenhouse gas, then to give an energy overview in order to see which sector is the largest consumer of energy and therefore the largest emitter of emissions and in the end to analyze potentials of SEE countries which will in the future present ways to reduce emissions. The purpose of this thesis is also to give answers on the following questions: Whether all countries, that have an obligation, will reduce their required level of emissions by the end of the first commitment period 2008-2012? Whether countries, that are not required to reduce emissions, have fulfilled their part of duties? How successful are the countries in the use of Kyoto mechanisms? What about after 2012, the post Kyoto period?

The objectives of the thesis are the following:

- to indicate the problem of global warming, climate change and greenhouse gases,
- to indicate the importance of the Kyoto protocol and its flexible mechanisms in GHG emission reductions,
- to indicate the CO_2 equivalent emissions,
- to understand the CO_2 emissions associated with energy,
- to indicate potentials of SEE countries which will present possible solutions for reducing emissions in the future.

The methods of the thesis are the following: statistical method, comparative method, description method and the thesis is based on secondary data which is collected from secondary sources.

The first and second chapter in this master's thesis explains the climate change, the main effects that cause greenhouse gases and global warming as a result of all these changes. The third chapter deals with theoretical perspective of Kyoto protocol and its three flexible mechanisms. The fourth chapter gives a description about the post Kyoto period. The fifth chapter gives an overview of South-Eastern Europe countries, their CDM (Clean Development Mechanism) potential, emissions of all SEE countries by sector and an energy overview (energy supply, energy consumption by sector) of SEE countries. The sixth chapter analyses the energy use and greenhouse gases – total CO_2 emission and CO_2 emission from energy sector in SEE. Chapter seventh analyses the potential for climate change mitigation in SEE countries which presents ways to reduce emissions in the future. The last part of the thesis gives the conclusion.

1 Global warming and climate change

As global warming is affected by many factors, such as the gulf streams, snow, sea ice, vegetation, etc., this problem has not been scientifically explained yet. As the problem of global warming presents international concerns, there has been established international coordination in the international climate panel, in order to try modeling the phenomenon of global warming. The purpose of the model of global warming is to stimulate climate change arising from changes in the amount of GHG emissions in the atmosphere, in order to discover factors that affect global warming, determine the consequences of global warming and defining the global and national politics and strategies for reducing GHG emissions (Ćulahović, 2008, p. 321).

Climate change means change in the long-term meteorological parameters and variables. A change from one climate mode to another which is outside the range of natural climate variability creates climate change (Rafique, 2009, p. 3).

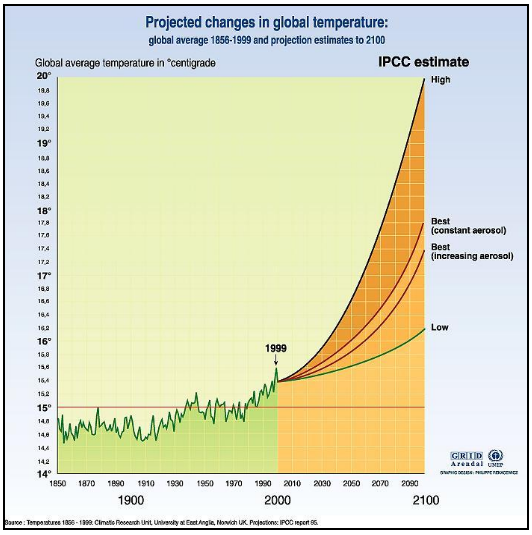
So the climate has, and always will, vary for natural reasons. Factors influencing the climate include changes in solar radiation, volcanic eruptions and natural fluctuations in the climate system itself such as changes in ocean and air circulation. However, natural causes can explain only a small part of the rapid rate of global warming. There is conclusive evidence, supported by the majority of climate scientists that current trends are due to rising concentrations of heat-trapping greenhouse gases in the atmosphere caused by human activities, especially the burning of fossil fuels for energy which results in emissions of CO_2 (Eueopean Commission, 2009).

In brief, global warming refers to the gradual warming of the earth's surface over time through the increase in the level of greenhouse gases (GHGs) in the atmosphere by the burning of fossil fuels including coal, gas and oil and clearing natural forests, while climate change refers to the extreme weather patterns and climate responses to this warming (Wilson, 2007, p.1).

According to Ćulahović (2008, p. 316), since the industrial revolution humans have added a significant amount of greenhouse gases into the atmosphere. The amount of gases that human activities emit into the atmosphere is small when we compare it with the total amount of gas in the atmosphere, but still they have a high potential for the destruction of the balance of the global energy, which maintain the current temperature of the earth's surface. Global warming is a complex issue with which we face today. It is very difficult to understand assumptions about the impact of emissions causing the greenhouse effect. It is also difficult to balance the interests of countries on environmental issues with regard that environmental effects are global and go beyond a single location, state and even region. For this reason, damage from emissions in some countries will be direct to people who live in other, more distant countries. If no changes occur in CO_2 emissions, economic growth in poor countries will be much worse.

As a result of natural changes and changes caused by human activities is that the Earth is becoming warmer and warmer. In the figure 1 we can see projected changes in global temperature to the year 2100.

Figure 1: Projected changes in global temperature



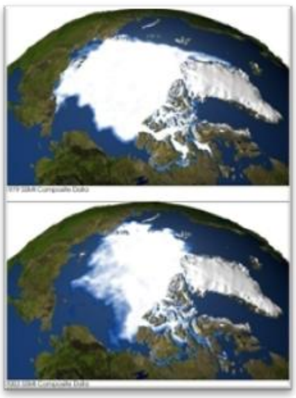
Source: http://weblogsurf.com/rise-in-the-global-temperature/

From 18th century the average temperature of the Earth surface increased by 0.6°C. The latest climate models used by the Intergovernmental Panel for Climate Change (IPCC) predict that global temperatures are likely to increase by 1.1 to 6.4°C during the 21st century. The 100-year trend in the global average surface temperature (1906 – 2005) was a warming of 0.74 °C, with a more rapid warming trend over the past 50 years (0.13 °C per decade) (IPCC, 2007).
So a big problem today is that the temperature increases with incredible speed. Scientists believe that human activities are responsible for such a rapidly warming of the Earth.

According to IPCC (2007) increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level are problems we are facing with. There will be a sea level rise of 18-59 cm during the 21st century.

In the figure 2 we can see dramatic changes on the Arctic ice in 1979 and then another from 2003, the change is both, worrying and visible. Since 1979 more than 20% of the Polar Ice Cap has melted away.

Figure 2: Arctic ice in 1979 and 2003



Source: http://maps.grida.no/go/graphic/satellite-observations-in-arctic-sea-ice-1979-and-2003

Climate change has been blamed for the Arctic ice cover melting. Due to continuous warming over a longer period of time, the loss of large parts of the polar ice cap will almost certainly slow the thermohaline circulation, the main temperature regulating system on earth (IPCC, 2007).

Climate change is already starting to affect some of the poorest and most vulnerable communities around the world (Watkins, 2007, p. 3). The impacts of climate change will negatively affect progress toward development in a number of key areas including agriculture and food security, water resources, coastal zones, climate-related disaster risk management and natural resources management (Pojani & Tola, 2010, p. 1).

According to Ćulahović (2008, p. 321) the consequences of climate change are numerous, such as:

- warmer winters in no tropical areas will be problematic in terms of food production and spread of infectious diseases,
- warmer and wetter climate in temperate zones will expand the number and type of disease (malaria, cholera, yellow fever),
- today's population living in rural agricultural systems in semi-dry and dry areas will be particularly vulnerable,
- climate change will have a range of negative impacts on human health. Changing the geographic distribution of transmission of communicable and infectious diseases (malarial mosquitoes), and changes in the dynamics of the life cycle of viruses, bacteria and infectious parasites will increase the transmission of many diseases to new areas,
- climate change and increasing sea levels and ocean can have numerous negative consequences for the energy, industrial and transport infrastructure, human settlements, industry, property insurance, tourism and the cultural system.

Warming of the atmosphere also affects the quality and length of human life. The World Health Organization (WHO) predicts that humanity will have to face a greater number of injuries, illness and death cases as a result of natural disasters, air pollution and heat waves and an increase of diseases that are transmitted by food, water and vectors. Moreover, in many parts of the world a large part of the population will be displaced due to higher sea levels, drought and hunger (IPCC, 2007). So, extreme weather events like storms, floods, droughts and heat waves are becoming more frequent and more severe.

During the last decades the frequency of major disasters caused by the impact of natural hazards increased significantly. Worldwide, the number of disasters grew from 100 in 1975 to about 400 in 2006 (UNISDR-United Nations International Strategy for Disaster Reduction, 2008).

According to Spasova (2008, p. 27) the climate change is a global phenomenon with local implications. Southeast European governments and people are currently experiencing the adverse effects of climate change on their development and way of life. The projected changes in climate could have major consequences on hydrology and water resources, agriculture and food security, terrestrial and freshwater ecosystems, coastal zones and marine ecosystems, and human health.

According to Feiler, Ivanyi, Khovanskaya and Stoycheva (2009, p. 30) South-Eastern Europe is one of the European regions in which the annual mean temperature has been rising at the highest rate, so the region is exposed to a variety of natural hazards, including floods, droughts, forest fires, wind storms, heat waves, earthquakes and landslides.

Climate change is a global problem that can be solved only by a global reduction of total carbon emissions. Politics of global warming must be directed toward minimizing carbon emissions, with minimal disruption of GDP growth. This includes replacement of existing technologies of production and consumption of energy with technologies that have lower energy intensity and more efficient energy use, and transition to energy fuels with less carbon, which requires huge capital investments. International management of GHG emissions is also difficult because the philosophy of "natural debt" of the industrialized countries. Many countries during its historical development, emitted pollutants into the atmosphere much faster than the speed of pollution should be achieved in a natural way, and so they have "borrowed" from the environment the capacity to assimilate pollution. For this reason, today the global burden of the atmosphere with carbon dioxide and other GHG emissions increased. The total amount of additional load of the atmosphere with GHG emissions, reduced with load from pre-industrial times, is a global natural debt, which is the main cause of current climate changes. The largest natural debt in the past century have highly industrialized countries, which in global carbon emissions participated with 75% (Ćulahović, 2008, p. 322).

2 Greenhouse gases

The main greenhouse gases covered by the Kyoto protocol are: Carbon dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydro-fluorocarbons (HFC_s), Per-fluorocarbons (PFCs), Sulfur hexafluoride (SF_6). The table 1 presents some characteristics for each GHG, like their concentration, lifetime, human activity source and Global Warming Potential.

Table 1: The main greenhouse gases

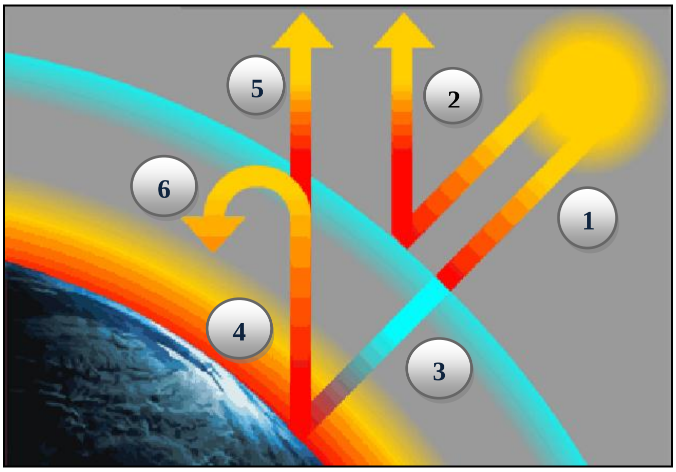
Name	Pre-industrial concentration (ppmv*)	Concentration in 1998 (ppmv)	Atmospheric lifetime (years)	Main human activity source	GWP**
Water vapor	1 to 3	1 to 3	A few days	-	**-**
Carbon dioxide (CO_2)	280	365	variable	fossil fuels, cement production, land use change	**1**
Methane (CH_4)	0.7	1.75	12	fossil fuels, rice paddies, waste damps, livestock	**23**
Nitrous oxide (N_2O)	0.27	0.31	114	fertilizers, combustion industrial processes	**296**
Hydro-fluoro carbons HFC 23 (CHF_3)	0	0.000014	260	electronics, refrigerants	**12,000**
HFC 134 a (CF_3CH_2F)	0	0.0000075	13.8	refrigerants	**1,300**
HFC 152 a (CH_3CHF_2)	0	0.0000005	1.4	industrial processes	**120**
Per-fluoro-methane (CF_4)	0.00004	0.00008	>50 000	aluminium production	**5,700**
Per-fluoro-ethane (C_2F_7)	0	0.000003	10 000	aluminium production	**11,900**
Sulfur hexafluoride (SF_6)	0	0.0000042	3 200	dielectric fluid	**22,200**
*ppmv=parts per million by volume, **GWP=Global Warming Potential (for 100 year time horizon).					

Source: K. Töpfer and S. Sorensen, Vital climate change grafics, 2005, p. 11.

From the data given in the table 1 we can see that the concentration of each GHG has increased comparing to their pre-industrial concentration.

Each GHG has its own Global Warming Potential (GWP). The GWP is the warming effect that one unit of a GHG has as compared to the same unit of the GHG carbon dioxide (CO_2). One Kg of methane (CH_4) has for example the same warming potential as 23 Kg of CO_2. The amount of GHG is measured as "CO_2 equivalents" in order to have only one unit to refer to, when talking about GHG. Anthropogenic GHG emissions have been growing very fast as well as atmospheric concentrations of CO_2 and other GHGs. Carbon dioxide remains the most important greenhouse gas, contributing about 60% to the enhancement of the greenhouse effect (Töpfer & Sorensen, 2005, pp. 11, 12.). The figure 3 presents and explains the greenhouse effect.

Figure 3: The greenhouse effect



We can explain the greenhouse effect in six steps:

1) solar radiation,
2) reflected back to space,
3) absorbed by atmosphere,
4) infra-red radiations emitted from Earth,
5) some of the IR passes through the atmosphere,
6) some absorbed and re-emitted by greenhouse gas molecules.

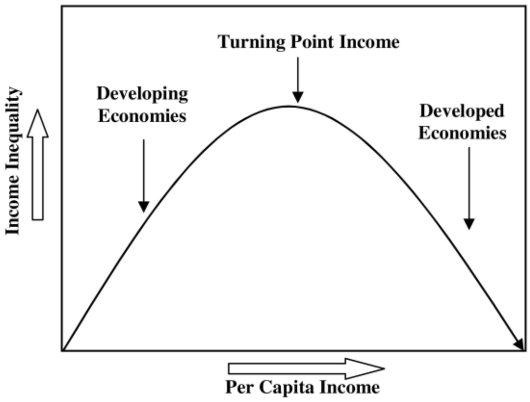
Source: Kyoto Protocol and the CDM, (n.d), p. 4

The figure 3 explains how solar energy is absorbed by the earth's surface, causing the earth to warm and to emit infrared radiation. The greenhouse gases then trap the infrared radiation, thus warming the atmosphere. The amount and concentration of greenhouse gases in atmosphere has increased significantly in the past century (Kyoto Protocol and the CDM, n.d., p. 4).

The scientific evidence on global climate change identifies humans as a major contributor to global warming through the release of greenhouse gases. The increase of greenhouse gas emissions is due to several factors, of which the two most important are population growth and economic growth. The world population increased from 3 billion in 1959 to 6 billion in 1999 and projects a population of 9 billion by 2042. Economic growth has increased more rapidly than population (Baron, 2010, p. 338).

The relationship between pollution and economic growth can be analyzed with the environmental Kuznets curve. The logic of this curve is very simple. Countries at a very low level of economic development do not have sufficient funds for engagement in the production of goods, and therefore they do not produce significant pollution. Growth of income per capita cause higher environmental damage. At a high level of economic growth it leads to reversal. People are already rich enough that they can take steps to reduce pollution. Seen from the microeconomic point of view, clean environment is a luxury commodity, which people spend more and more, as their wealth grows (Ćulahović, 2008, p. 303).

Figure 4: Environmental Kuznets curve



Source: http://thepercolatorblog.files.wordpress.com/2011/02/environmental-kuznets-curve

The logic of the environmental Kuznets curve produces significant implications for both, the rich and the poor countries. First, as countries become richer, they become more willing to invest more resources to reduce pollution. Secondly, the reason for low pollution in poor countries is not their high awareness of clean environment, but the fact that these countries are not able to "sell" more pollution in exchange for greater revenues. Differences in the treatment of pollution in rich and poor countries indicate the potential gains from mutual trading with pollution. The potential of this trade has so far often been used for uncritical and mass migration of dirty industries from developed countries to developing countries. Environmentalist from developed countries require the same restrictions on pollution for the poor and the rich countries, and in this way they want to prevent that the dirty industries only changes the state of pollution, instead of looking for other ways for a general reduction of pollution. Many developing countries oppose such proposals. They need jobs, even at the cost of production of heavy pollution (Ćulahović, 2008, p. 303).

3 Kyoto protocol

The objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous human-induced interference with the climate system (UNFCCC).

The Kyoto protocol shares the ultimate objective of the Convention to stabilize atmospheric concentrations of GHGs at a level that will prevent dangerous interference with the climate system (Boer, 2008, p. 12).

The protocol was initially adopted by consensus at the third session of the Conference of the Parties (COP3) on 11 December 1997 in Kyoto, Japan. Condition for the protocol to enter into force was ratification by 55 countries that cause at least 55% of CO_2 emissions. Of the two conditions, the "55 parties" clause was reached on 23 May 2002 when Iceland ratified the

protocol. The ratification by Russia on 18 November 2004 satisfied the "55%" clause and the protocol entered into force on 16 February 2005 (UNFCCC).
The Kyoto protocol is a legally binding agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990. The goal is to lower overall emissions from six greenhouse gases - carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydro-fluorocarbons (HFCs), and per-fluorocarbons (PFCs) - calculated as an average over the five-year period of 2008-2012. Developing countries have no obligation to reduce emissions because they have low levels of per capita emissions (UNFCCC).

The Kyoto protocol highlights the need for technology transfer, improvement of education and training, and includes recommendations for reducing emissions under the new energy and transport technologies and policies, and recommendations for a new approach to forestry and agriculture (Ćulahović, 2008, p. 324).
According to Boer (2008, p. 12) both Annex I and non-Annex I parties must cooperate in the areas of:

a) the development, application and diffusion of climate friendly technologies,

b) research on and systematic observation of the climate system,

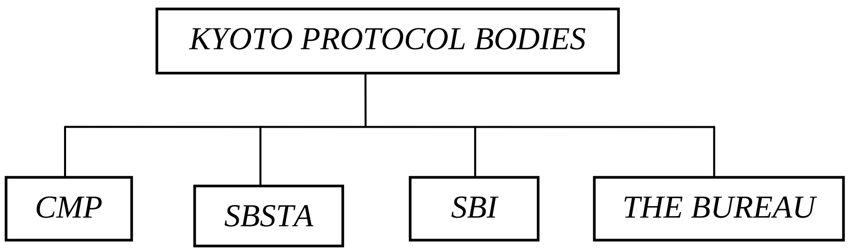
c) education, training, and public awareness of climate change, and

d) the improvement of methodologies and data for GHG inventories.

3.1 Kyoto protocol bodies

According to UNFCCC the Kyoto protocol bodies are: CMP, SBSTA, SBI, THE BURAEU as presents the figure 5.

Figure 5: Kyoto protocol bodies



Source: www.unfccc.int

CMP - This is referred to as the Conference of the Parties serving as the meeting of the Parties to the Kyoto protocol (CMP).
The CMP meets annually during the same period as the COP. Parties to the Convention that are not parties to the protocol are able to participate in the CMP as observers, but without the right to take decisions. The functions of the CMP relating to the protocol are similar to those carried out by the COP for the Convention.

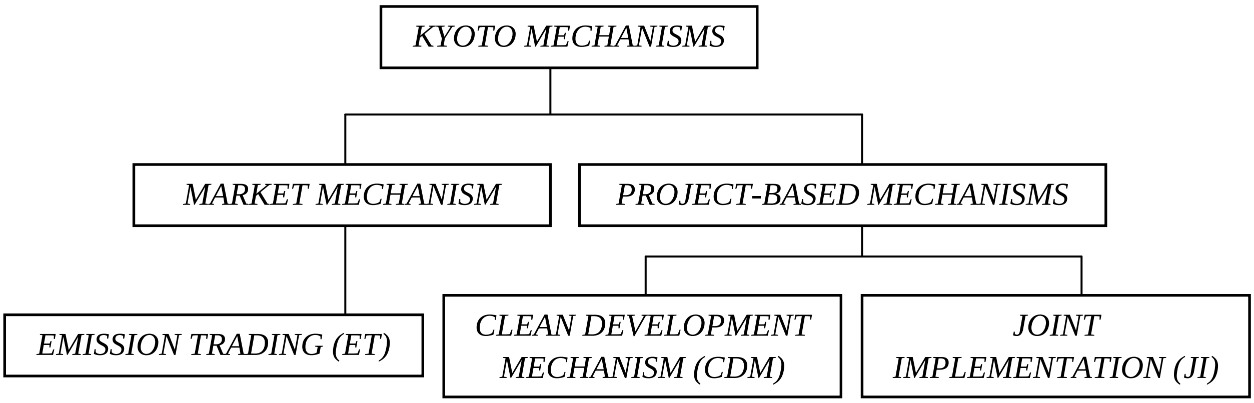
SBSTA (Subsidiary Body for Scientific and Technological Advice) and **SBI** (Subsidiary Body for Implementation) - these two permanent subsidiary bodies established under the Convention also serve the CMP.

THE BUREAU - The Bureau of the COP also serves the CMP. However, any member of the COP Bureau representing a non-party to the Kyoto protocol has to be replaced by a member representing a Kyoto protocol party.

3.2 Kyoto mechanisms

Countries with commitments under the Kyoto protocol to limit or reduce greenhouse gas emissions must meet their targets primarily through national measures. The Kyoto protocol introduced three flexible mechanisms in oreder to help countries to reduce emissions. (UNFCCC). The Kyoto mechanisms are Emission Trading (ET), Clean Development Mechanism (CDM) and Joint Implementation (JI).

Figure 6: Kyoto mechanisms



Source: www.unfccc.int

According to (UNFCCC) the Kyoto mechanisms:

- stimulate sustainable development through technology transfer and investment,
- help countries with Kyoto commitments to meet their targets by reducing emissions or removing carbon from the atmosphere in other countries in a cost-effective way,
- encourage the private sector and developing countries to contribute to emission reduction efforts.

3.2.1 Clean Development Mechanism (CDM)

The CDM allows a country with an emission reduction or emission-limitation commitment under the Kyoto protocol to establish emission reduction projects in developing countries. Such projects can earn saleable CER (Certified Emission Reduction) credits, each equivalent to one tone of CO_2-e, which can be counted towards meeting Kyoto targets (Edwards, 2010, p. 36).

So, under the CDM, Annex I countries (developed countries), may earn CER credits by investing in projects for emission reductions in non-Annex I countries (developing countries). According to Meunier (2004b, p.15) CDM eligibility requirements for Annex I and non-Annex I countries are presented in table 2.

Table 2: CDM eligibility requirements

Annex I countries:	**Non-Annex I countries:**
voluntary participation	voluntary participation
establishment of the National CDM Authority	establishment of the National CDM Authority
ratification of the Kyoto protocol	ratification of the Kyoto protocol
Additional requirements:	
establishment of the assigned amount of emissions	
have in place a national system for the estimation of greenhouse gases	
have in place a national registry to record and track the creation and movement of credits and annually report such information to the secretariat	
have in place an accounting system for the sale and purchase of emission reductions	

Source: P. Meunier, The Clean Development Mechanism, 2004, p. 24.

The mechanism is intended to reduce emissions and stimulate sustainable development, while allowing industrialized countries some flexibility in how they meet emission reduction or limitation targets. A CDM project must provide emission reductions that are additional to what would otherwise have occurred (Edwards, 2010, p. 36).

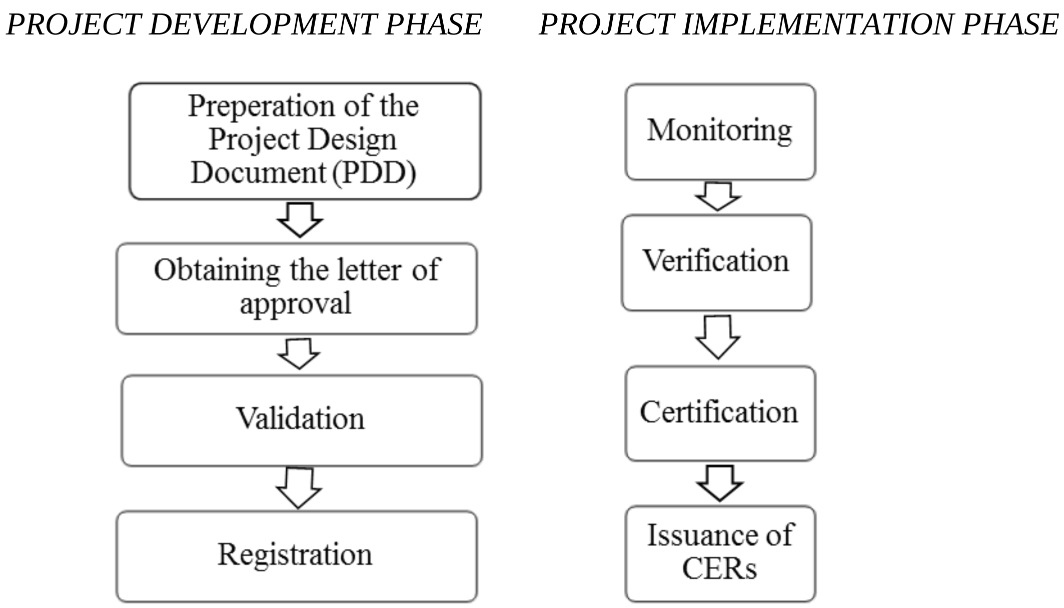
According to Meunier (2004b, p.10) the CDM is the only mechanism in the Kyoto protocol that involves non-Annex I countries, by enabling them to host emission reduction projects on their territory. The CDM is overseen by the CDM Executive Board, which reports to those countries that have ratified the Kyoto Protocol (UNFCCC). The CDM became operational in 2006, and in 2010 has been valued at $2.7 billion. Since its inception, the CDM has facilitated investment in 2,392 mitigation projects in 69 countries, and has generated 3.8 billion Certified Emission Reduction units (CERs).

According to Edwards (2010, p. 1) to qualify under the CDM, a project must:

- be undertaken by an Annex I country in a non-Annex I country,
- result in emission reductions and contribute to long-term sustainable development,
- be additional to emission reductions that would have occurred under the business as usual (BAU) scenario.

Each CDM project has its project cycle wich include two phases, development and implementation phase, as we can see in the figure 7.

Figure 7: CDM project cycle



Source: A. Edwards, Clean Development Mechanism: Supply, demand and future prospects, 2010, p.7.

Acocording to Meunier (2004b, p.16) requirements for countries to be authorized to host CDM projects include:

- ratification of the Kyoto protocol,
- host countries must appoint a Designated National Authority (DNA) - responsible for expressing the country' s interest in participating in the CDM and approving the CDM projects,
- host country must individually approve each CDM project and ensure that it meets the national sustainable development objectives.

According to Galeasso (n.d., p. 12) the CDM provides the opportunity to develop projects in the following sectors:

- reduction of greenhouse gas,
- production of energy from renewable sources,
- reduction of emissions of methane and other landfill gas plants, cement plants, mining,
- energy efficiency on the supply side of energy,
- energy efficiency on the demand side of energy,
- fuel switching,
- afforestation and reforestation,
- reduction of emissions in the transport sector.

3.2.2 Joint Implementation (JI)

Joint Implementation allows Annex I parties to implement projects that reduce greenhouse gas emissions by sources, or enhance removal by sinks, in the territories of other Annex I parties, and to credit the resulting Emissions Reduction Units (ERU) against their own emission targets (Busquin, 2003, p. 7).

Joint Implementation offers parties a flexible and cost efficient means of fulfilling a part of their Kyoto commitments, while the host party benefits from foreign investment and technology transfer (Simić, J., 2010, p. 11).

According to Busquin (2003, p. 15), JI is a project-based tool that holds out considerable hope for transferring modern, clean energy technologies-particularly in the renewable, cogeneration and energy efficiency fields, from more developed countries, to economies in transition. JI offers great opportunities for a large number of clean energy projects. JI project always has several participants. The participants may be either government authorities or private parties that together have taken the initiative to set up a project in a host country where emissions will be reduced.

There are two approaches for verification of emission reductions under JI, called "Track 1" and "JI Track 2". Under Track 1, a host party that meets all of the eligibility requirements may verify its own JI projects and issue ERUs for the resulting emission reductions or removals. Under JI Track 2, each JI project is subject to verification procedures established under the supervision of the Joint Implementation Supervisory Committee (JISC). JI Track 2 procedures require that each project be reviewed by an accredited independent entity to determine whether the project meets the requirements. The emission reductions or removals resulting from the project must also be verified by an accredited independent entity in order for the party concerned to issue ERUs (Boer, 2008, p. 17).

The broad process of establishing validated emission reductions is common to all potential JI projects, although there will be variations between projects, purchasers and countries (Busquin, 2003, p. 20).

The figure 8 presents a conventional project cycle that must pass each JI project. As we can see, the project cycle has five steps, first project identification, than the feasibility of the project, the third step is the project structuring, then follows the implementation of the project, and the last fifth step is the operation of the project.

Figure 8: Conventional project cycle

Source: P. Busquin, Renewable Energy Technologies and Kyoto Protocol Mechanisms, 2003, p. 20.

According to Busquin (2003, p. 20) a Project Idea Note (PIN) generally contains a description of the project, description of the partners involved in it, an indication of the baseline, and an estimation of the ERU that will accrue from the project. This is carried out in parallel with the feasibility assessment of the project. The third step for JI is to develop a Project Design Document (PDD). A PDD is a requirement for each JI project. The key elements of PDD are:

- technical description of the project,
- baseline study,
- projections of estimated ERU accruing from the project,
- monitoring plan,
- approval from the parties involved (investor and host country authorities),
- environmental impact assessment in line with the local legislation and regulation.

The final stage in the JI project cycle comes after implementation of the project when the project operator must monitor and report on the emission reductions generated by the project.

According to Meunier (2004a, p. 28) JI projects generate a number of direct and indirect benefits:

- the project contribution to the environmental, social and economic development of the host country, the transfer of technology and know-how as well as the contribution of a new source of financing linked to the market value of credits,
- an improvement in the financial viability of low GHG emission technologies.

3.2.3 Emission Trading (ET)

Targets for limiting or reducing emissions, which parties with commitments under the Kyoto protocol have accepted are expressed as levels of allowed emissions over the first commitment period (2008-2012). The allowed emissions are divided into Assigned Amount Units (AAUs). Emissions trading allows countries that have unused emission units to sell this excess capacity to countries that are over their targets. Transfers and acquisitions of these units are tracked and recorded through the registry systems under the Kyoto protocol. An international transaction log ensures secure transfer of emission reduction units between countries (Edwards, 2010. p. 37).

It is clear today that carbon needs to be reduced, so the economic purpose of emissions trading is to identify the lowest cost options for emission reduction and successfully to implement these options for reducing emissions.

According to Wilson (2007, p. 27) to prevent a country from overselling emission rights, parties are required to hold a commitment period reserve which may not drop below 90% of the emission target. This reserve may consist of AAUs, ERUs and CERs but if the reserve is too low, countries are forbidden to trade.

The European Union took the lead in the field of emission trading in 2005 by opening a new market. The market is known as the ETS - Emissions Trading Scheme. It is the largest emissions market in the world. In 2006, the EU ETS globally accounted for around 81% of the global carbon market in terms of value and 67% in terms of volume (Cirman, et al., 2009, p. 32).

4 Post Kyoto period

Since the Kyoto protocol is nearing to the end of its firs commitment period (2008-2012) there is much talk about what after that period. What will be the results achieved in an effort to reduce GHG emissions? Will there be a second commitment period? Will the rules be different and so on?

According to Cummings and Scharf (2005, p. 2), if participating countries reach their Kyoto target reductions, they would reduce yearly global CO_2 emissions by just 500 million tons-or 2% of 2004 global CO_2 emissions. That's if non-Kyoto participants maintain, rather than raise, their current emissions rates. But Kyoto imposes no restrictions on the world's largest CO_2 polluter, the United States, which generates about 23% of global emissions, or on developing countries, the fastest growing source of CO_2.

Developing countries are likely to account for more than half of global emissions by 2020, possibly sooner (Olmstead & Stavins, n.d., p. 35). According to Jakeman, Hester, Woffenden, and Fisher (2002, p. 181) the share of non-Annex I countries in global emissions is projected to increase from around 40% in 1990 to 53% in 2015.

So, it is of utmost importance to include developing countries in emission reduction in the second commitment period in order to convert the fight against climate change into an international project.

It can be argued, on an ethical basis, that industrialized countries should take the first steps, since - almost by definition - they are responsible for the bulk of anthropogenic concentrations of greenhouse gases in the atmosphere. But two serious problems remain. First, developing countries currently provide the greatest opportunities for low-cost emissions reductions. Second, if developing countries are not included, comparative advantage in the production of carbon-intensive goods and services will shift outside the coalition of participating countries, pushing nonparticipating nations onto more carbon-intensive growth paths, increasing their costs of joining the coalition later (Olmstead & Stavins, n.d., p. 35). These are important reasons why developing countries should as soon as possible be included in emission reductions.

In the post Kyoto period is also important to improve monitoring of emissions and to better specify appropriate penalties because according to Cummings and Scharf (2005, p. 3) even supporters of Kyoto fear that its basic inspection provisions for monitoring emissions are inadequate, and the agreement specifies no consistent procedures to punish firms that fail to obtain sufficient emissions permits.

Country that fails to meet its quantified objectives will be penalized by the Compliance Committee. Countries that fail to meet their emissions targets by the end of the first commitment period (2012) must make up the difference plus a penalty of 30% in the second commitment period. Their ability to sell credits under emissions trading will also be suspended (UNFCCC).

Due to the increasing threat of climate change, as well as difficulties in the implementation of Kyoto protocol, many NGOs have begun to propose measures to reduce emissions and stabilize the climate. Some measures could have a restrictive character for those countries that have ignored or poorly implemented its commitments to reduce carbon emissions, while for countries which successfully do their obligations, measures implied some form of reward. Restrictive measures may include social and economic sanctions. Social sanctions would for example implied exclusion of countries from international activities such as the Olympic Games, the exclusion from governmental and nongovernmental organizations, etc. Economic sanctions are mainly related to international trade. This kind of measures should be harmonized with the provisions of the World Trade Organization (WTO), about the discrimination of products based on process and production method, however, the WTO does not prevent the imposition of sanctions based on concerns about environmental issues (Ćulahović, 2008, p. 325). These social and economic sanctions for countries that don't fulfill their obligations in terms of emission reductions should be precisely defined and rigorously enforced in order to motivate these countries in meeting their obligations.

Bringing the global South into the next phase of Kyoto will be essential to strengthening the agreement. Key to getting those countries on board is a fairer division of the global carbon budget. In Kyoto's current form, each nation's share of the global carbon pie is based on its percentage of 1990 emissions. A fair treaty would consider at least two additional factors: the centuries-long build-up of carbon in the atmosphere and per capita CO_2 emission. So, a fairer Kyoto would recognize that our atmosphere is a global common resource that belongs to everyone in equal proportion. By insisting that highly industrialized nations, and their corporations, pay for using our atmosphere, and by allocating the carbon budget on an equal per capita basis, we would link together a more just and sustainable development path with a program for climate stabilization-while establishing the necessary incentives to bring the developing world into the Kyoto process (Cummings & Scharf, 2005, p. 3). All this above stated shows how important it is to bring the developing countries into the next phase of Kyoto protocol.

As part of the increasingly integrated treatment of climate and energy issues, new instruments are being proposed in several countries, which both address energy efficiency and renewable energy targets, and climate change issues. Energy efficiency is one of the core policies in most countries' GHG abatement targets. One instrument for energy efficiency improvement that could play a role in the post-Kyoto era is that of White Certificates (WhC), which has been implemented in the UK, Italy, and France, while other countries are considering it. Its basic idea is that specific energy saving targets set for energy suppliers or distributors must be fulfilled by implementing energy efficiency measures towards their clients within a specific time frame. Such fulfillment is acknowledged by means of (white) certificates. Energy suppliers or distributors that save more energy than their targets can sell their surpluses as energy efficiency equivalents in the form of WhC to suppliers/distributors that cannot fulfill their targets (Oikonomou & Gaast, 2007, p. 13). This instrument for the improvement of energy efficiency should be more considered by countries and they also should take necessary preparations in order to be able to use this instrument in the post Kyoto period.

So, while it is clear that the GHG emissions targets of developed countries need to be further tightened in the post-2012 climate change regime, no solution can be expected without the involvement of developing countries. It is therefore crucial to identify the most likely approach to stimulate developing countries to take appropriate action in the post-2012 climate regime (Feiler, et al., 2009, p. 5).

With regard to the post Kyoto period, the seventeenth session of the Conference of Parties (COP 17) was held in Durban, South Africa, November/December 2011. Governments, including 35 industrialized countries, agreed a second commitment period of the Kyoto protocol from January 1, 2013. To achieve rapid clarity, parties to this second period will turn their economy-wide targets into quantified emission limitation or reduction objectives and submit them for review by May 1, 2012 (UNFCCC, 2011).

One more question that is argued is what will be the roll of Kyoto mechanisms after 2012?

What the precise role of JI and the CDM will look like in a future climate policy regime is still unclear, but based on the several scientific and policy proposals for a post-2012 climate regime it is likely that this type of market-based instrument will continue to play a role in climate policy making (Oikonomou & Gaast, 2007, p. 13). So it is almost certain that countries will be able to use these mechanisms in the second commitment period in order to fulfill their obligations in terms of emission reductions.

According to Ćulahović, 2008, p. 326) policy of reducing carbon can range from minimal to dramatic reductions. It is certain that some actions are needed, but there are a variety of reductions and time of their application. For example, in response to climate change can be used preventive policies and measures, which try to reduce or eliminate the greenhouse effect and adaptive policies and measures that try to minimize the greenhouse effect and its impact.

- Preventive measures may include:

- reducing GHG emissions or reduce the level of emissions related to economic activity, or diverting to the energy-efficient technologies that allow the same level of economic activity at a lower level of CO_2 emissions,

- increase reserves of carbon - since trees are recycling CO_2, so protecting the wooded area or reforestation of soils has significant effects on carbon emissions.

- Adaptive measures may include:

- the construction of embankments and breakwaters in order to fight against increase in sea levels and extreme weather conditions like floods and hurricanes,

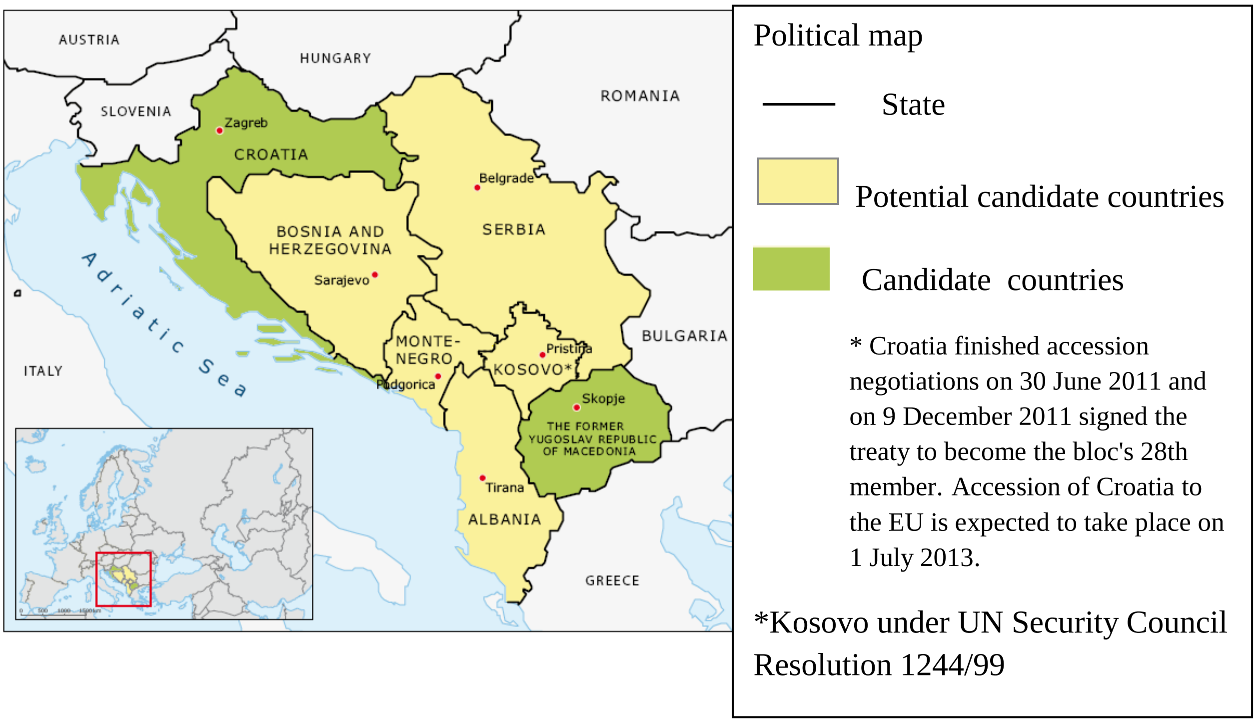
- changing the model of cultivation conditions in agriculture in order to adapt to changing weather conditions in different areas.

There are also a number of other measures that could contribute to reducing emissions, such as introduction of prices on emissions would encourage companies and consumers to seek substitutes and to direct the technological process toward technologies that have lower emissions. Simple policy measures such as carbon taxes, taxes on CO_2 emissions, could fill some of these goals (Ćulahović, 2008, p. 326).

5 South Eastern Europe overview

The SEE comprise six countries - Albania, Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia, Montenegro and Serbia — and the territory of Kosovo under UN Security Council Resolution 1244/99. The figure 9 presents a political map of SEE countries.

Figure 9: Political map of South Eastern Europe



Source: T. Zamparutti, Environmental trends and perspectives in the Western Balkans: future production and consumption patterns, 2010, p. 17.

The area of SEE countries is 275,345km^2. The region's economic and social conditions vary significantly. For example, in 2006, annual income per capita (based on purchasing power parity) ranged from about EUR 5,800 in Albania to more than EUR 14,000 in Croatia. Most of the countries have relatively similar levels in the Human Development Index (HDI) - a measure of the quality of life, incorporating life-expectancy, education, health levels and other measures of quality of life, along with economic prosperity (Zamparutti, 2010, p. 17).

At present, the SEE countries have the total population of 23.979 million people with almost half the population in rural areas. At the beginning of this century, approximately 24% of the population in the SEE region lived below the poverty line. Poverty is more widespread in the remote and rural areas and in larger households with more members unemployed or with low education. GDP per capita in the SEE countries ranges between EUR 1,645 and EUR 3,365. The standard of living, unemployment rates, and relatively modest economic growth rates are the central economic problems. One of the key challenges is the implementation and acceleration of economic reforms and ensuring a balanced economic development, closely related are the challenges of improving the living standards and poverty reduction. Integration of climate change issues into development policies will represent a special challenge. Raising the awareness and capacity building for the inclusion of the concept of climate change in sustainable development strategies is of utmost importance. The current vulnerability in the

SEE region is mainly the consequence of climate extreme events. The SEE region is highly vulnerable to floods, landslides, droughts, forest fires, extreme temperatures, windstorms, earthquakes and technology related hazards. The current climate variability and climate related hazard affect many sectors, including water resources, agriculture and forestry, human health, ecosystems and biodiversity, energy, tourism, infrastructure and coastal zones. Many environmental and developmental problems in the SEE region will be exacerbated by climate change (Spasova, 2008, pp. 43, 44).

According to Dacić (2010, p. 14) all SEE countries face problems with responding to the obligations under the United Nations Framework Convention on Climate Change (UNFCCC). Developing countries in terms of the UNFCCC have a twofold problem. They are faced with growing damage caused by meteorological, hydrological and climate extremes and catastrophes, and on the other hand, they have to cope with poverty and necessity for development. In addition, the SEE countries have limited access to knowledge, technology and financing, and have a great need of capacity building and development (systemic, institutional and individual), that has to be coupled with the requirements of the Stabilization and Association process to the EU.

Since climate change today present as a big problem, all developing countries including SEE need to participate in the fight against climate change. Looking at the role that SEE countries have under the Kyoto protocol it is important to bear in mind the division between Annex I and non-Annex I countries. Annex I countries are developed countries, while non-Annex I are developing countries. As we can see from the figure 10 only Croatia belongs to Annex I, while other SEE countries belong to non-Annex I countries. Croatia, as an Annex I country, has a target to reduce its emissions under the Kyoto protocol. Croatia has a commitment for 5% reduction of GHG emissions in the period 2008-2012. Non-Annex I countries have no obligations to reduce its emissions.

Figure 10: SEE and the Kyoto protocol

Annex I Parties	Non-Annex I Parties
CROATIA	B&H ALBANIA FYR MACEDONIA SERBIA MONTENEGRO

Source: www.unfccc.int

All SEE countries have ratified the UNFCCC and the Kyoto protocol. As we can see from the table 3, the Kyoto protocol was first ratified by FYR Macedonia in 2004, than by Albania in 2005, while B&H, Croatia, Montenegro and Serbia ratified the protocol in 2007.

Table 3: Ratification of the UNFCCC and of the Kyoto protocol

PARTICIPANT	RATIFICATION OF THE UNFCCC Acceptance (A) Accession (a) Succession (d)	RATIFICATION OF THE KYOTO PROTOCOL Ratification (R) Accession (a)
Albania	3 October 1994 a	1 April 2005 a
Bosnia and Herzegovina	7 September 2000 a	16 April 2007 a
Croatia	8 April 1996 A	30 May 2007 R
FYR of Macedonia	28 January 1998 a	18 November 2004 a
Montenegro	23 October 2006 d	4 June 2007 a
Serbia	12 March 2001 a	19 October 2007 a

Source: www.unfccc.int

Annex I and non-Annex I countries have the requirement to prepare national communications. Each non-Annex I party shall submit its initial communication within three years of the entry into force of the Convention for that party, or of the availability of financial resources (UNFCCC).

A national communication is a report that each party to the Convention prepares periodically in accordance with the guidelines developed and adopted by the Conference of the parties. The national communication is the most effective tool and means for the implementation of the Convention. The national communication helps non-Annex I parties to meet their reporting requirements, and serves as a medium for the presentation of information in a consistent, transparent, comparable and flexible manner (Resource guide for preparing the nation Communications of non-Annex I parties, 2009, p. 6).

According to Schmidt (2011, pp. 5, 7), reporting through national communications is the Convention's primary source of information on parties implementation of commitments and collective progress toward meeting its ultimate objective. The reporting requirements for non-Annex I parties are generally considered to be weaker than those for Annex I parties. This is partially because the capacity of many non-Annex I parties for reporting is much lower than that of developed countries and the guidelines were designed with this lower capacity in mind. However, another factor is the contentious nature of negotiations surrounding non-Annex I reporting guidelines.

It is understandable that developing countries have lower capacity for reporting than developed countries and therefore the requirement for these countries are weaker, but on the other hand these countries should try to improve their reporting capacity in order to be able to present a qualitative national communications.

The reporting guidelines require that non-Annex I parties provide a GHG inventory in conjunction with the national communication. The inventory for the first national communications was to cover the year 1994 or 1990, the second the year 2000. As a result, most non-Annex I countries have provided only one inventory to date and for only one year (1994 for most countries). In contrast, since 1999, Annex I parties have been required to submit annual GHG inventories, covering a full time-series from 1990 up to the most recent year. The national communication guidelines require non-Annex I parties to report on only three greenhouse gases in the inventory: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Reporting on the other greenhouse gases, namely hydro-fluorocarbons (HFCs), per-fluorocarbons (PFCs), and sulfur hexafluoride (SF_6) is encouraged, but not required (Schmidt, 2011, p. 9).

The table 4 presents the data of submission of National Communications by South-Eastern Europe countries.

Table 4: National Communications of the SEE countries under the UNFCCC

Countries	Initial NC	Second NC	Third NC	Fourth NC	Fifth NC
Albania	2002	2009	-	-	-
B&H	2009	-	-	-	-
Croatia	2001	2006	2006	2006	2010
FYR Macedonia	2003	2008	-	-	-
Montenegro	2010	-	-	-	-
Serbia	2010		-	-	-

Source: www.unfccc.int

As we can see from the table 4 only Croatia has the fifth National Communication, Albania and Macedonia the second NC, while B&H, Montenegro and Serbia have only the Initial NC.

5.1 CDM in SEE countries

Based on the provisions of the Kyoto protocol, non-Annex I parties can only use the Clean Development Mechanism. Beside entrance into force of the Kyoto protocol, one of binding conditions for a hosting country in the implementation of CDM projects is the establishment of the Designated National Authority (DNA) for the implementation of CDM projects (Arnoudov & Horst, 2010, p. 7).

Table 5: Establishment of the Designated National Authority

Countries	(DNA)
Albania	2008
Bosnia and Herzegovina	-
FYR Macedonia	2006
Montenegro	2008
Serbia	2008

Source: www.unfccc.int

The table 5 shows that Macedonia has first established the DNA in 2006, while the other countries have established the DNA in 2008 except B&H.

According to Meunier (2004b, p. 14), advantages and disadvantages of CDM from the developing country perspectives are:

Advantages:

- to reduce greenhouse gas emissions,
- to meet sustainable development goals,
- to promote additional foreign investment,
- to increase green technology transfer,
- to use of better techniques, technologies and processes,
- to increase environmental awareness.

Disadvantages:

- foreign investors may dominate and exclude domestic entrepreneurs,
- CDM investment could affect national development strategies,
- CDM timeframe may not assist long-term development strategies.

According to Božanić (n.d., pp. 13-15) CDM potential in SEE countries is bind to the following sectors:

Albania
- energy sector,
- renewable energies,
- waste sector,
- LULUCF (Land Use, Land Use Change and Forestry),
- most promising: hydropower and forestry.

Bosnia and Herzegovina
- hydropower, especially SHPPs (Small Hydropower Plants),
- waste management,
- energy efficiency.

Macedonia
- energy (rehabilitation of large power plants, fuel switching to natural gas, CHP (Combined Heat and Power) for district heating, industrial efficiency improvements, hydro power, geothermal),
- waste (production of biogas from agricultural waste),
- forestry sector.

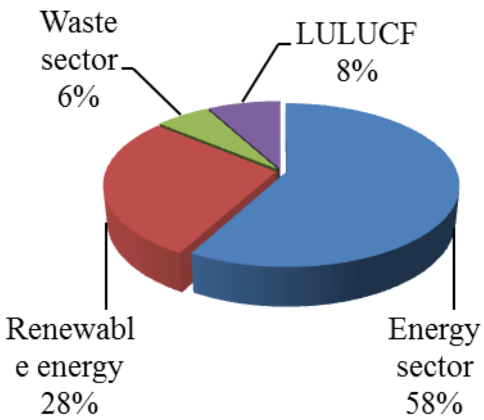
Montenegro
- energy saving (energy, industry, building),
- renewable energy (hydro, biomass, solar, wind, geothermal),
- waste,
- LULUCF (Land Use, Land Use Change and Forestry).

Serbia
- energy saving (energy, industry, building, transport),
- renewable energy (SHPPs, biomass, solar, wind, geothermal),
- waste (waste to energy, production of biogas from agricultural waste),

- LULUCF (Land Use, Land Use Change and Forestry).

According to Sikirica (2007, p. 6), more than half of the CDM potential in SEE countries (B&H is not included) is bind to energy as we can see from the figure 11 and table 6:

Figure 11: CDM potential in SEE



Source: B. Sikirica, CDM activities carried out in the Balkan Region, 2007, p. 7.

Table 6: CDM potential in SEE

Sector type	CER (ktCO$_2$/year)
Energy Sector	16,600
Renewable Energy	8,000
Waste Sector	1,630
LULUCF	2,400
TOTAL	**~28,630**

Source: B. Sikirica, CDM activities carried out in the Balkan Region, 2007, p. 7.

The table 6 presents that the total potential to reduce emission is 28,630 ktCO$_2$ per year. Emission reduction from energy sector make the largest potential (58%), followed by renewable energy (28%), LULUCF (8%) and waste sector (6%). Unfortunately, this potential to reduce emissions which SEE countries have, is not enough used.

According to Montini and Bogdanovic (2009, p. 107), there is one CDM project being developed in FYR of Macedonia, which involve the Netherlands - Skoplje Cogeneration Project. Additionally Albania has established a bilateral agreement with Italy, and the FYR of Macedonia has signed agreement with Italy and Slovenia for the development of CDM projects. Albania has also been receiving assistance from Austrian Development Assistance in

building Albania's capacity to access carbon finance through regulatory procedures. Austrian Development Assistance is aiding Albania in developing two CDM Program Design Documents for small hydro power plant projects with Austria.
The FYR of Macedonia has produced a National Strategy for CDM, identifying high priority areas for CDM financing through the rehabilitation of large power plants, fuel switching to natural gas, combined heat and power for district heating, industrial efficiency improvements, hydropower and geothermal energy. The CDM presents a significant opportunity that should be considered not only within the context of supporting renewable energy and energy efficiency within SEE region but also as a way to generally promote inward investments in new technologies in the region.

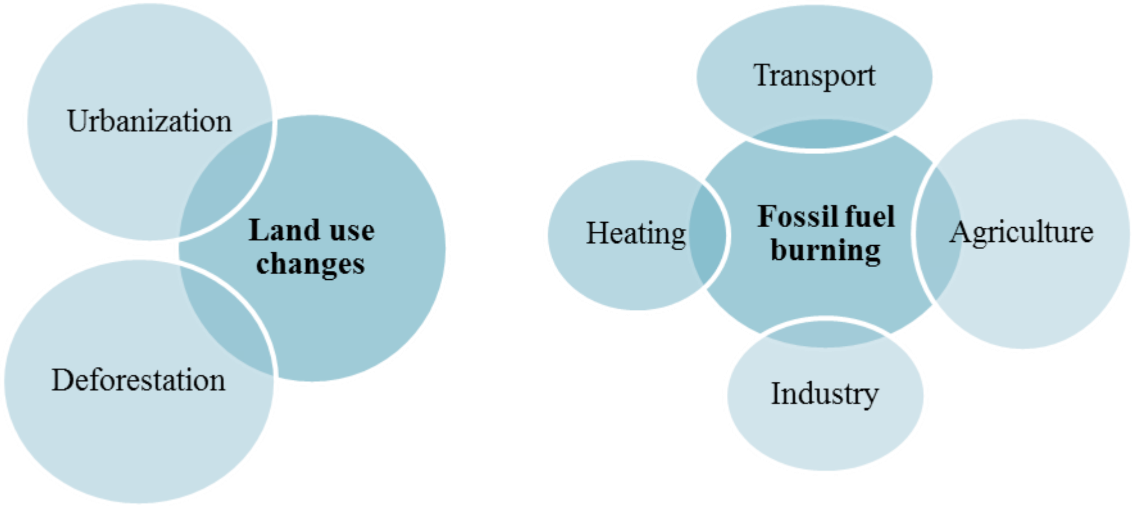
In Montenegro assessments and analysis of potential CDM projects were made in the area of renewable energy, energy efficiency and reforestation. The first set of identified project ideas was presented in 2007 to the representatives of Italian companies and investors interested in CDM projects. After that, in early 2008, both in Montenegro and Italy a public invitation was published for the selection of the best bidders for the preparation of feasibility study and project proposal drafting (PDD - Project Design Document) for the identified project ideas aiming to select an Italian or Italian-Montenegrin company, with appropriate technical and professional qualifications, which would, through irreversible co-financing, prepare the feasibility studies and PDDs, with respect to the selected CDM projects, as a first step under CDM development process (Marković, 2010, p. 96).

Unfortunately almost nothing has been done in terms of the CDM potentials in the South-Eastern Europe countries. So there is a need of investing a lot of efforts to make these countries able to participate in CDM projects and in this way to use their potentials.

5.2 Emission caused by human activities

According to Watkins (2007, p. 32) there is greater than 90% likelihood that most of the observed warming is due to human generated greenhouse gases. Mankind has been releasing CO_2 into the atmosphere through burning and land-use changes for over 500,000 years. The burning of coal and oil, supplemented by natural gas, has transformed human societies, providing the energy that has driven vast increases in wealth and productivity. It has also fuelled climate change.

Figure 12: Human activities that cause greenhouse gas emission



Source: K. Töpfer and S. Sorensen, Vital climate change grafics, 2005, p. 4.

Urbanization can be viewed as one of the most serious problems causing climate change in that in general, the more urbanized a nation, the higher the greenhouse gas emissions per person. Urbanization will bring higher greenhouse gas emissions. Emissions per capita in urban areas are higher than those in rural areas because of big differences in productive and consumptive behaviours between rural and urban populations. But this certainly not always the case. In regard to consumption-levels, in many nations, a high proportion of high-income high-consumption households live in rural areas and are likely to have higher average GHGs per person or per household than urban dwellers with comparable incomes – for instance because of larger less energy-efficient homes and greater use of private automobiles (Satterthwaite, 2009, p. 1).

A large share of global greenhouse gas emissions is attributable to cities, so it is necessary to introduce measures for emission control in cities. The International Energy Agency (IEA) estimates that urban areas currently account for more than 71% of energy related global greenhouse gases and this expected to rise to 76% by 2030.

One of the man-made causes of the greenhouse effect is deforestation. Deforestation is caused by exploitation of natural resources - including expanding populations, logging, agriculture, biofuel production, and wildfires. The world lost about 3% of forest area between 1990 and 2005. Forests absorb between one million and three million metric tons of carbon dioxide each year, perhaps offsetting between 20% and 46% of the country's greenhouse-gas emissions. When trees are burned, harvested, or otherwise die, they release their carbon back into the atmosphere. Due to the disappearance of trees, photosynthesis cannot take place. Cutting deforestation rates by 50% over the next century would provide about 12% of the emissions reductions needed to keep carbon dioxide concentrations to 450 parts per million, a goal that is necessary to prevent significant increases in global temperatures (Johnson, 2009).
In the case of deforestation it is necessary to raise awareness of the consequences that deforestation causes and find ways to reduce this kind of damage done to the nature.

Worldwide, the fossil fuels used for transportation contribute to over 13% of greenhouse gas emissions. Cars with an average fuel efficiency produce nearly 20 pounds of CO_2-eq for every gallon of gasoline burned (Walser, 2010). Today, emissions from traffic present a big problem. This emission is rising every day, more and more cars are produced and more and more people are driving them, and so this kind of emission continuous to grow.

According to Töpfer and Sorensen (2005, p. 15) emissions from air traffic represent 3.5% of the global CO_2 emissions. Aircraft causes about 3.5% of global warming from all human activities. Because the enormous increase in travels done by aircraft, greenhouse gas emissions from aircraft will continue to rise and could contribute up to 15% of global warming from all human activities within 50 years. Still emissions from international air traffic are not controlled by the Kyoto protocol. It is necessary to include the emission from air traffic under the Kyoto protocol in the second commitment period.

Heating and cooling usually consume more energy than any other home appliances. The relative contributions of heating and cooling to an individual's carbon footprint vary by region. In colder states, as much as two-thirds of a household's energy bill is from heating. In warmer areas, summertime air conditioning constitutes the bulk of a household's energy bill (Walser, 2010). We all should think about this energy consumption and therewith about the emissions they cause. Today almost all of us can't imagine working in an office without air conditioning but only a few years ago it was the normal thing.

Emissions of greenhouse gases from the industrial sector are a significant proportion of emissions in Annex I countries. In 2000, industry accounted for approximately 2,108 Mt CO_2 or 15.4% of direct CO_2 emissions from fuel combustion and a similar proportion indirectly from emissions associated with industry use of electricity. Industry also generates process-related emissions of CO_2 as well as emissions of N_2O, CH_4, HFCs, PFCs and SF_6 (Bygrave & Ellis, 2003, p. 8).

Globally, agriculture is responsible for 20% of the greenhouse gas emissions. Agricultural emissions come from greenhouse gases like methane (CH_4) and nitrous oxide (N_2O). While CH_4 and N_2O emissions are far less in quantity in the atmosphere, they have a much more potent impact on the climate (Wightman, n.d., p. 2). Although most of the increase in greenhouse gas concentrations is due to carbon dioxide emissions from fossil fuels, globally about one-third of the total human-induced warming effect due to GHGs comes from agriculture and land-use change (Paustian, Antle, Sheehan & Eldor, 2006, p. 3).

Human activities take place in ecological systems that are not marked by national borders. Unsustainable management of these systems has consequences for the environment and for the well-being of people today and in the future. Current concentrations of greenhouse gases are the net results of past emissions, offset by chemical and physical removal processes. By 2030 greenhouse gas emissions are set to increase by between 50 and 100 percent above 2000 levels (Watkins, 2007, p. 32). These data are very worrying so it is time to wake up and go towards reducing emissions in order to create a better-greener future for all of us.

On the other side of the bad influence of human activities on the environment, the public, government and business recognize the importance of environmental protection and sustainability. Those benefits include improved human health, a more vibrant natural environment, the preservation of ecosystems, and a more sustainable relationship with the natural environment. Programs that aim to achieve environmental goals, such as addressing global climate change, would be very expensive. The cost of environmental protection and sustainability require not only that the environment be protected and sustainability be achieved but that they be accomplished as efficiently as possible. Environmental protection goals pertain to ecosystems, climate change, pollution, habitats and more, and sustainability pertains to energy, forests, and the environment more generally. The principal instruments for achieving these goals come from government, but private initiatives as the policies of firms and the practices of individuals, can also play a role (Baron, 2010, p. 337). So we do not should wait for something to happen, rather we should try to successfully implement the possible private initiatives in order to protect our environment.

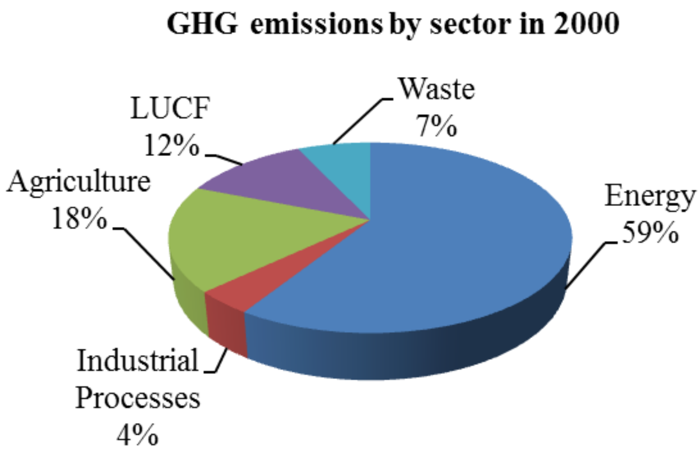
5.3 Emission by sector

All SEE countries have announced the INC (Initial National Communications), some of them only the INC, while others were able to announce the second, or like Croatia the fifth NC. For the analysis by country, we took data for GHG emissions by sector in the last year in which emissions were measured, and we have committed percentage comparisons in relation to 1990. Countries that have emissions data only for 1990 like B&H, these we have specified and expressed in percentages by sectors.

Emission by sector in Albania

Total CO_2 equivalent emission in Albania in 2000 was 7,619.90Gg. Emissions from the energy sector make the largest proportion of total emissions (59%), followed by agriculture (18%), LUCF (12%), waste sector (7%) and industrial processes (4%), as shows the figure 13.

Figure 13: Share of CO_2 equivalent emissions by sector in Albania



Source: B. Islami, M. Kamberi, D.E. Bruci, & E. Fida, Albania's Second National Communication to the Conference of Parties under the United Nations Framework Convention on Climate Change, 2009, p. 54.

The table 7 presents CO_2 equivalent emissions by sector for 1990 and 2000, and a percentage change of emissions in relation to 1990.

Table 7: Comparison of greenhouse gas emissions for 1990 and 2000 in Albania

Greenhouse gas emissions	**Baseline 1990**	**2000**	**Change in relation to 1990 (%)**
	CO_2 equivalent (Gg)		
Energy	3,107.08	4,528.29	45.74%
Industrial processes	209.87	264.92	26.23%
Agriculture	880.33	1,362.75	54.80%
LUCF	3,493.05	903.39	-74.14%
Waste	143.74	560.56	289.98%
Total	**7,834.07**	**7,619.90**	**-2.73%**

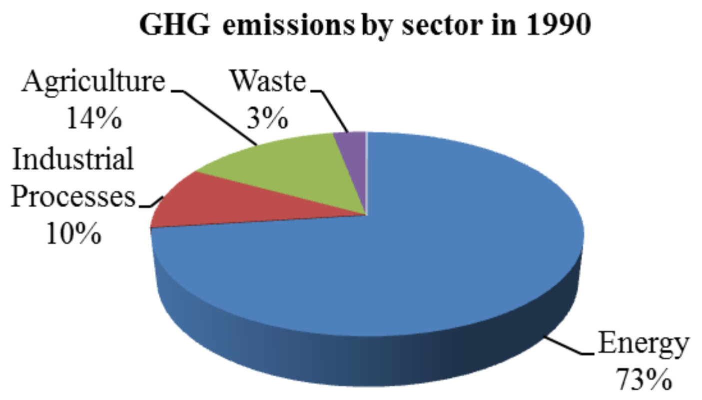
Source: B. Islami, M. Kamberi, D.E. Bruci, & E. Fida, Albania's Second National Communication to the Conference of Parties under the United Nations Framework Convention on Climate Change, 2009, p. 54.

As we can see from the column were the percentage change in relation to 1990 is given, emissions from energy, industrial processes, agriculture and waste have risen comparing to emissions in 1990, while emissions from LUCF have fallen by 74.14%. So the total emissions from all sectors have fallen by 2.73% in 2000 comparing with the year 1990.

Emission by sector in Bosnia & Herzegovina

Total CO_2 equivalent emission in Bosnia and Herzegovina in 1990 was 34,043.49Gg. Emissions from the energy sector make the largest proportion of total emissions (73%), followed by agriculture (14%), industrial processes (10%), and waste sector (3%), as shows the figure 14.

Figure 14: Share of CO_2 equivalent emissions by sector in B&H



Source: G. Vukmir, Lj. Stanišljević, & M. Cero, Initial National Communication of Bosnia and Herzegovina under the United Nations Framework Convention on Climate Change, 2009, p. 15.

The table 8 presents CO_2 equivalent emissions by sector for 1990 in Bosnia and Herzegovina.

Table 8: Greenhouse gas emissions for 1990 in B&H

Greenhouse gas emissions	**Baseline 1990**
	CO_2 equivalent (Gg)
Energy	24,888.95
Industrial processes	3,554.07
Agriculture	4,608.01
LUCF	-7,423.53*
Waste	992.46
Total	**34,043.49**

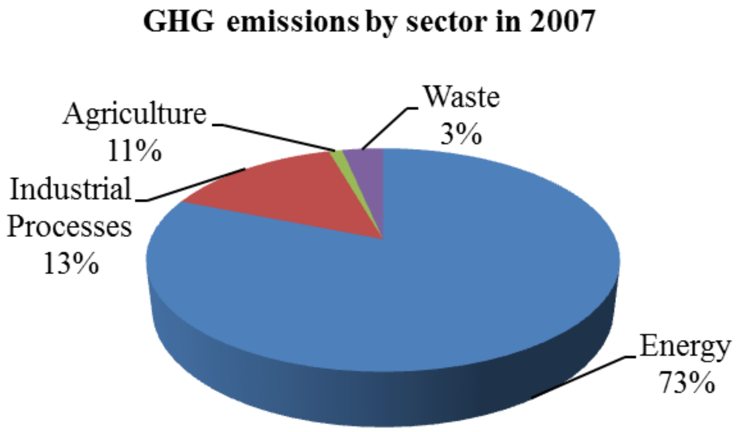
Source: G. Vukmir, Lj. Stanišljević and M. Cero, Initial Natiaonal Communication of Bosnia and Herzegovina under the United Nations Framework Convention on Climate Change, 2009, p.15.

*For CO2 emissions from LUCF the net emissions are to be reported. The sign for uptake is (-) and for emissions (+).

Emission by sector in Croatia

Total CO_2 equivalent emission in Croatia in 2007 was 26,082Gg. Emissions from the energy sector make the largest proportion of total emissions (73%), followed by industrial processes (13%), agriculture (11%) and waste sector (3%), as shows the figure 15.

Figure 15: Share of CO_2 equivalent emissions by sector in Croatia



Source: M. Zdilar, Fifth National Communication of the Republic of Croatia under the United Nation Framework Convention on the Climate Change, 2010, pp. 52-55.

The table 9 presents CO_2 equivalent emissions by sector for 1990 and 2007, and a percentage change of emissions in relation to 1990 for Croatia.

Table 9: Comparison of greenhouse gas emissions for 1990 and 2007 in Croatia

Greenhouse gas emissions	**Baseline 1990**	**2007**	**Change in relation to 1990 (%)**
	CO_2 equivalent (Gg)		
Energy	22,149	23,803	7.47%
Industrial processes	4,185	4,073	-2.68%
Agriculture	4,328	3,410	-21.21%
LUCF	-4,185*	-6,303*	50.61%
Waste	579	868	49.91%
Total	**27,056**	**25,851**	**-4.45%**

*Sign minus (-) stand for emission removals from LULUCF

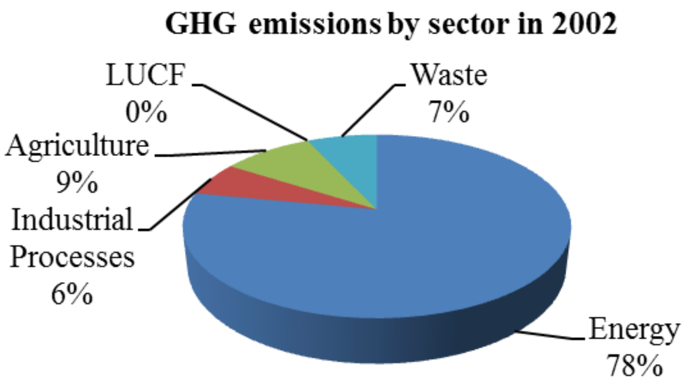
Source: M. Zdilar, Fifth National Communication of the Republic of Croatia under the United Nation Framework Convention on the Climate Change, 2010, pp. 52-55.

The table 9 shows that there was an increase in emission from energy sector (7.47%) and waste sector (49.91%) in 2007 comparing to the year 1990, while there was a decrease of emissions from industrial processes (-2.68%), from agriculture (-21.21%) and the largest emission removal is from LULUCF (50.61%) in 2007 comparing to 1990.

Emission by sector in FYR of Macedonia

Total CO_2 equivalent emission in FYR of Macedonia in 2002 was 12,497.56Gg. Emissions from the energy sector make the largest proportion of total emissions (78%), followed by agriculture (9%), waste sector (7%), industrial processes (6%), while there is no emissions from LUCF, as shows the figure 16.

Figure 16: Share of CO_2 equivalent emissions by sector in FYR of Macedonia



Source: M. Azievska, & P. Zdraveva, Second National Communication on Climate change, 2008, p. 35.

The table 10 presents CO_2 equivalent emissions by sector for 1990 and 2002 in Macedonia and a percentage change of emissions by sector in relation to 1990.

Table 10: Comparison of greenhouse gas emissions for 1990 and 2002 in FYR of Macedonia

Greenhouse gas emissions	**Baseline 1990**	**2002**	**Change in relation to 1990 (%)**
	CO_2 equivalent (Gg)		
Energy	9,939.83	9,755.52	-1.85%
Industrial processes	889.29	792.38	-10.90%
Agriculture	1,908.27	1,073.39	-43.75%
LUCF	283.66	36.49	-87.14%
Waste	785.39	839.78	6.93%
Total	**13,806.44**	**12,497.56**	**-9.48%**

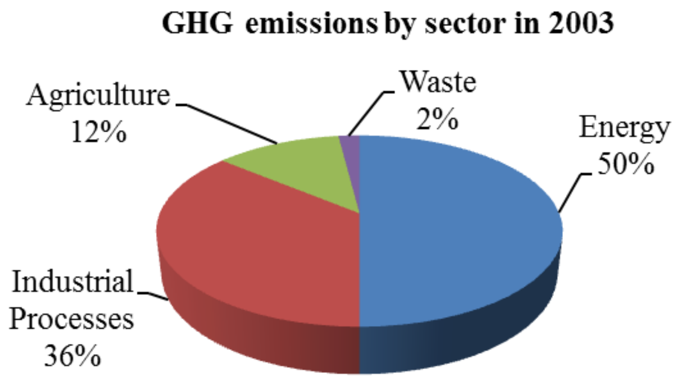
Source: M. Azievska, & P. Zdraveva, Second National Communication on Climate change, 2008, p. 35.

As we can see from the data given in the table 10, emissions from all sectors have fallen except the emissions from waste sector which have risen by 6.93%. Total emissions in Macedonia have decreased by 9.48% in 2002 comparing with emissions in 1990.

Emission by sector in Montenegro

Total CO_2 equivalent emission in Montenegro in 2003 was 4,466.91Gg. Emissions from the energy sector make the largest proportion of total emissions (50%) followed by industrial processes (36%), agriculture (12%) and waste (2%) as shows the figure 17.

Figure 17: Share of CO_2 equivalent emissions by sector in Montenegro



Source: M. Marković, The Initial National Communication on Climate Change of Montenegro to the UNFCCC, 2010, pp. 68, 82.

The table 11 presents CO_2 equivalent emissions by sector for 1990 and 2003 in Montenegro and a percentage change of emissions by sector in relation to 1990.

Table 11: Comparison of greenhouse gas emissions for 1990 and 2003 in Montenegro

Greenhouse gas emissions	**Baseline 1990**	**2003**	**Change in relation to 1990 (%)**
	CO_2 equivalent (Gg)		
Energy	2,540.28	2,656.60	4.58%
Industrial processes	1,642.04	1,889.13	15.05%
Agriculture	783.59	655.16	-16.39%
LUCF	-485.00*	-853.26*	75.93%
Waste	104.37	119.28	14.29%
Total	**4,585.28**	**4,466.91**	**-2.58%**

Source: M. Marković, The Initial National Communication on Climate Change of Montenegro to the UNFCCC, 2010, pp. 68, 82.

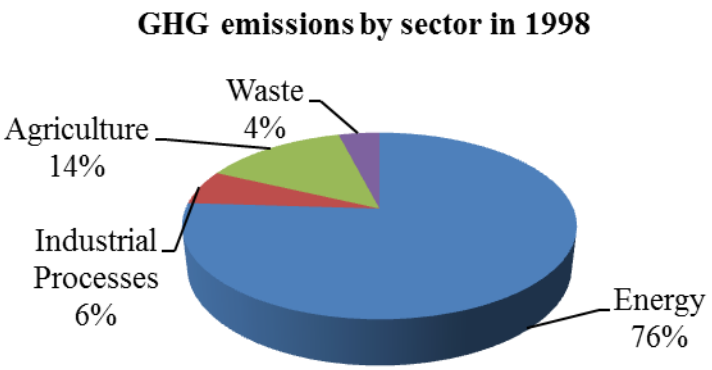
*CO_2 absorption from LUCF

As we can see from the table 11, total emission in Montenegro decreased by 2.58% in 2003 comparing with emissions in 1990. CO_2 absorption from LUCF has increased by 75.93% in 2003 comparing with CO_2 absorption from LUCF in 1990. The largest increase of emissions comes from industrial sector (15.05%) comparing with emissions in 1990, and the smallest increase in emissions comes from energy sector (4.58%).

Emission by sector in Serbia

Total CO_2 equivalent emission in Serbia in 1998 was 57,686Gg. Emissions from the energy sector make the largest proportion of total emissions (76%), followed by agriculture (14%), industrial processes (6%) and waste (4%) as shows the figure 18.

Figure 18: Share of CO_2 equivalent emissions by sector in Serbia



Source: B. Vučićević, Initial National Communication of the Republic of Serbia under the UNFCCC, 2010, pp. 44-67.

The table 12 presents CO_2 equivalent emissions by sector for 1990 and 1998 in Serbia and a percentage change of emissions by sector in relation to 1990.

Table 12: Comparison of greenhouse gas emissions for 1990 and 1998 in Serbia

Greenhouse gas emissions	**Baseline 1990**	**1998**	**Change in relation to 1990 (%)**
	CO_2 equivalent (Gg)		
Energy	62,776	50,549	-19.48%
Industrial processes	4,270.8	3,620	-15.24%
Agriculture	11,827	9,500	-19.68%
LUCF	-6,665*	-8,661*	29.95%
Waste	1,929.5	2,678	38.79%
Total	**74,138.3**	**57,686**	**-22.19%**

Source: B. Vučićević, Initial National Communication of the Republic of Serbia under the UNFCCC, 2010, pp. 44-67.

*CO_2 removals

The table 12 shows that in 1998 was a decrease in emissions from all sectors except the waste sector, comparing with emissions in 1990. Total emissions have decreased by (-22.19%). CO_2 removals from LUCF in 1998 have increased by 29.95% comparing with these removals in 1990. The largest decrease in emissions came from agriculture sector (-19.68%), followed by energy sector (-19.48%), industrial processes (-15.24%), while the waste sector have an increase in emissions by (38.79%).This is really impressing reduction of emissions bearing in mind that this emissions have been reduced in the period of eight years.

As we have given data for emissions by sectors in all SEE countries we can conclude the following:

Total emission by sectors in all SEE countries in 1990 is 161,463.58Gg. Emissions from Serbia make the largest proportion of total emissions (45.92%) in 1990, while emissions from Montenegro make the smallest proportion of total emissions (2.84%) in 1990 in SEE countries.

It is important to mention that all countries in SEE have decreased its total emissions comparing with total emissions in 1990. Most successful in emission reduction is Serbia (-22.19%), while the smallest emission reduction come from Montenegro (-2.58%). For B&H there are only data for emissions in 1990 so we could not make any comparing.

It is also interesting that in all SEE countries the largest emissions are caused by the energy sector. Macedonia has the largest proportion, which emissions from energy sector include 78%, while Montenegro has the smallest proportion and his emissions from energy sector include 50%. Emissions from energy sector in B&H are 73%.

5.4 Energy overview

All the energy markets in SEE countries require significant domestic and foreign investment to refurbish existing infrastructure and to build new energy facilities for production, generation, transmission and distribution. At the same time, these countries need to demonstrate their political stability and economic reform to compete successfully within the world market for investment capital. A common feature of the South Eastern Europe region is that key elements of the energy infrastructure (e.g. major thermal power plants) were built in the 1960s and 1970s, with standard Eastern Block technology. This concentration in age and type of technology, combined with inadequate maintenance in the 1990s, is now creating serious policy challenges. There is an urgent need for widespread rehabilitation and replacement of infrastructure. Some markets are particularly affected by low day-to-day efficiency and the constant risk of technical failure. A second common feature is that all SEE markets depend heavily on hydrocarbons imported from outside the region. Shared infrastructure also creates a high level of interdependence within the region itself (e.g. all countries participate in extensive daily and seasonal exchanges of electricity; Serbian oil refineries rely on deliveries through the Croatian pipeline network) (Bergasse & Kovačević, 2008, pp. 14, 15). So, it is of utmost importance to replace the existing infrastructure in SEE countries, start to apply new technology in order to increase efficiency and reduce technical failure.

According to Kubiš (2009, p. 4) increasing energy efficiency globally is one of the most promising ways to tackle climate change. The countries of South-Eastern Europe are challenged with numerous economic and environmental problems caused by their inefficient and polluting energy systems. However, these problems present an opportunity for a significant increase in energy efficiency and reduction of greenhouse gas emissions.

5.4.1 Energy supply

The table 13 presents the data for TPES (total primary energy supply) by countries, percentage share of TPES by countries in TPES of the SEE region, domestic energy production and energy import dependency.

Table 13: Main energy supply data across the SEE region, 2005

Country	Total primary energy supply (Mtoe)	Share of TPES in TPES of the SEE region	Domestic production (Mtoe)	Import dependency
Albania	2.4	6.23%	1.2	51%
B&H	4.9	12.73%	3.3	32%
Croatia	8.8	22.86%	3.8	58%
FYR Macedonia	2.7	7.01%	1.5	45%
Montenegro	1.0	2.60%	0.4	40%
Serbia	16.7	43.38%	11.4	32%
Kosovo	2.0	5.19%	1.2	40%

Source: E. Bergasse and A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, p. 16.

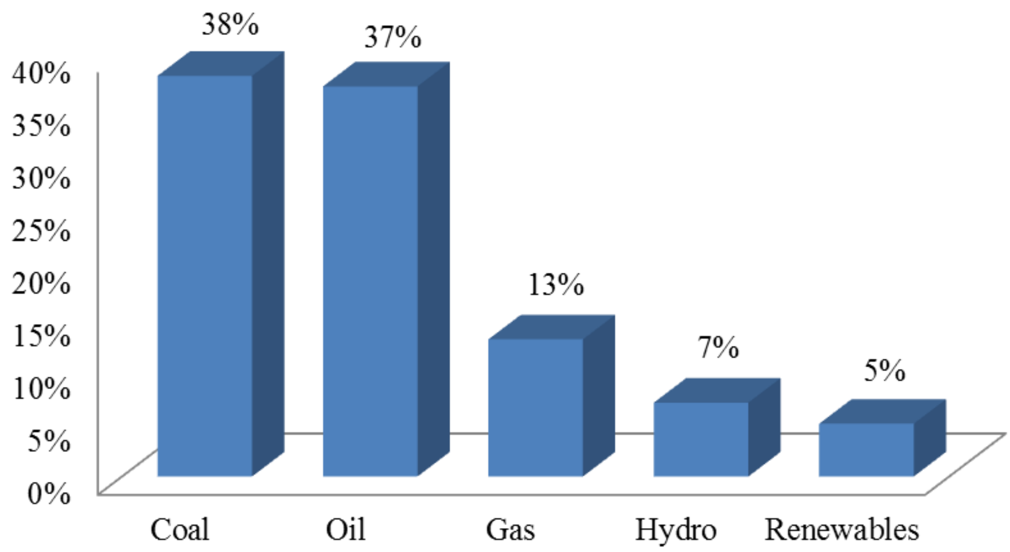
The table 13 shows that the highest TPES has Serbia with 16.7Mtoe or 43.38% of TPES in SEE region, followed by Croatia with 8.8Mtoe or 22.86% of TPES in SEE region. The smallest TPES has Montenegro 1.0Mtoe or 2.60% of TPES in SEE region. B&H's TPES is 4.9Mtoe or 12.73% of TPES in SEE countries. Total TPES of SEE region is 38.5Mtoe.

When we look at the column were data for domestic production of energy is given, we can see that the highest domestic energy production has Serbia 11.4Mtoe, followed by Croatia 3, 8Mtoe. The smallest domestic production has Montenegro 0.4Mtoe. B&H's domestic energy production is 3.3Mtoe. Total domestic energy production in SEE region is 23.0Mtoe.

When we look at energy import dependency, we can see that the highest dependence has Croatia 58%, followed by Albania 51%. The smallest dependency for energy import has B&H and Serbia 32%.

According to Bergasse and Kovačević (2008, p. 16) oil and gas production is limited and located mostly in Albania, Croatia and Serbia. Natural gas production in Croatia is the region's most significant hydrocarbon resource, accounting for 80% of Croatia's natural gas consumption. Montenegro shows some small potential for offshore oil and gas development. To date, only Croatia and Serbia are significant consumers of natural gas; markets in Bosnia and Herzegovina and FYR Macedonia are small, whereas Albania, Montenegro and Kosovo are not gasified.

Figure 19: Total primary energy supply in SEE region, 2005



Source: E. Bergasse and A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, p. 16.

The figure 19 shows that coal dominates in the primary energy supply in the SEE region, accounting for 38% of TPES in 2005, followed by oil (37%), natural gas (13%), hydropower (7%) and other renewable (5%).

By 2005, the TPES of the region had reached almost 90% of the 1990 level (Bergasse & Kovačević, 2008, p. 16).

5.4.2 Energy consumption

The table 14 presents the data for TFC (total final consumption) by countries, percentage share of TFC in TFC of the SEE region and energy consumption per capita.

Table 14: Main energy consumption data across SEE region, 2005

Country	Total final consumption (Mtoe)	Share of TFC in TFC of the SEE region	Energy consumption per capita (toe)
Albania	2.1	8.33%	0.77
B&H	3.0	11.90%	1.27
Croatia	7.1	28.17%	2.00
FYR Macedonia	1.7	6.75%	1.35
Montenegro	0.6	2.38%	1.59
Serbia	9.7	38.49%	2.26
Kosovo	1.0	3.97%	0.63

Source: E. Bergasse & A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, pp. 121-345.

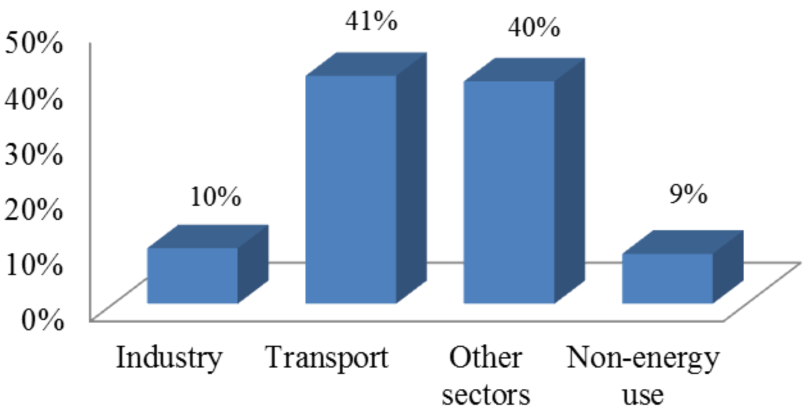
The table 14 shows that the highest TFC has Serbia (9.7Mtoe) or (38.49%) of TFC of the SEE region, followed by Croatia (7.1Mtoe) or (28.17%) of TFC of the SEE region. The smallest TFC has Montenegro (0.6Mtoe) or (2.38%) of TFC of the SEE region, followed by Kosovo (1.0Mtoe) or (3.97%) of TFC of the SEE region. B&H's TFC is 3.0Mtoe or 11.90% of TFC of the SEE region.

When we look at the energy consumption per capita, we can see that the highest energy consumption per capita has Serbia (2.26toe/capita), followed by Croatia (2.00toe/capita). The smallest energy consumption per capita has Kosovo (0.63 toe/capita), followed by Albania (0.77toe/capita). B&H's energy consumption per capita is 1.27toe.

5.4.3 Energy consumption by sector

The figure 20 presents the data for total final consumption by sector in Albania.

Figure 20: Albania's total final consumption by sector, 2005



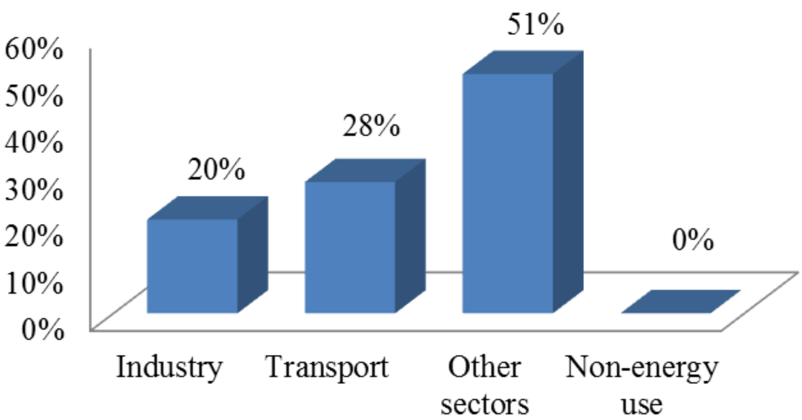
Source: E. Bergasse & A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, p. 376.

Total final consumption in Albania in 2005 was 2,127 thousand tons of oil equivalents (Ttoe). Total final consumption by the transport sector make the largest proportion of TFC (41%), followed by other sectors (40%), industry sector (10%) and non-energy use (9%) as shows the figure 20.

Other sectors include: residential, common and public services, agriculture/forestry and non-specified.

The figure 21 presents the data for total final consumption by sector in B&H.

Figure 21: B&H's total final consumption by sector, 2005

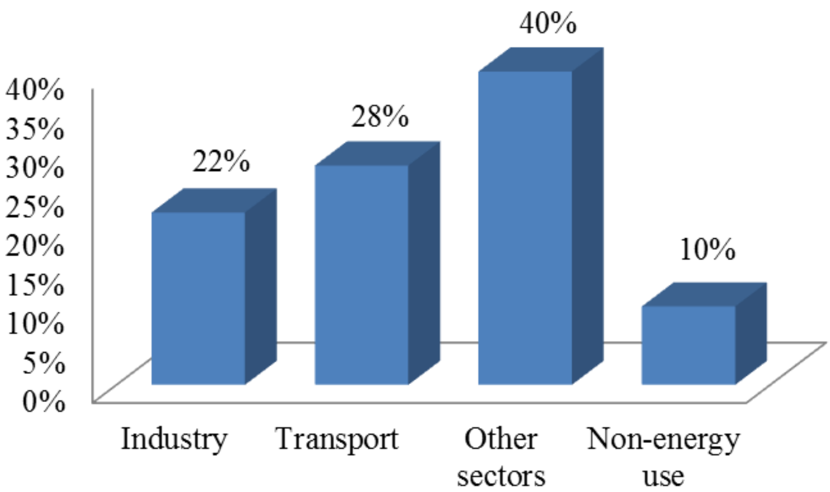


Source: E. Bergasse & A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, p. 380.

Total final consumption in B&H in 2005 was 3,046Ttoe. Total final consumption by the other sectors make the largest proportion of TFC (51%), followed by the transport sectors (28%), industry sector (20%) and non-energy use (0%) as shows the figure 21.

The figure 22 presents the data for total final consumption by sector in Croatia.

Figure 22: Croatia's total final consumption by sector, 2005

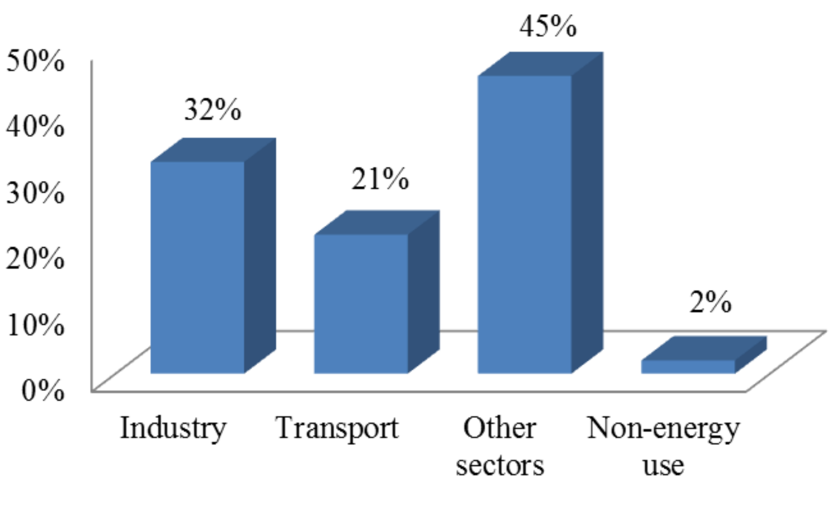


Source: E. Bergasse & A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, p. 384.

Total final consumption in Croatia in 2005 was 7,087Ttoe. Total final consumption by the other sectors make the largest proportion of TFC (40%), followed by the transport sector (28%), industry sector (22%) and non-energy use (10%) as shows the figure 22.

The figure 23 presents the data for total final consumption by sector in Macedonia.

Figure 23: Macedonia's total final consumption by sector, 2005

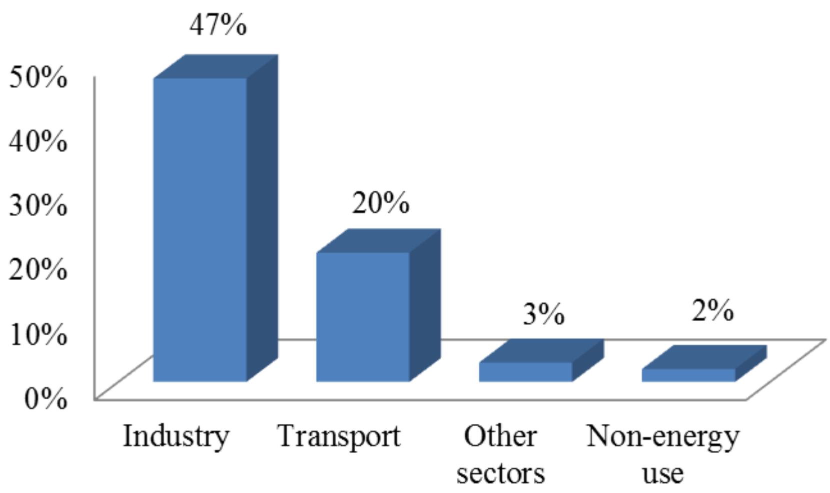


Source: E. Bergasse & A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, p. 388.

Total final consumption in Macedonia in 2005 was 1,701Ttoe. Total final consumption by the other sectors make the largest proportion of TFC (45%), followed by the industry sector (32%), transport sector (21%) and non-energy use (2%) as shows the figure 23.

The figure 24 presents the data for total final consumption by sector in Montenegro.

Figure 24: Montenegro's total final consumption by sector, 2005

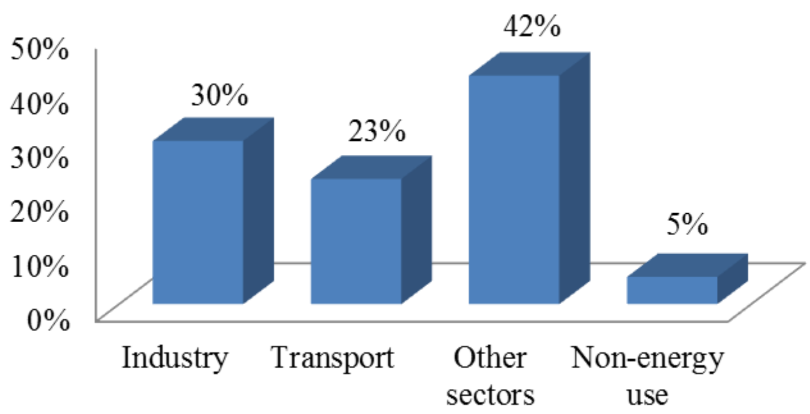


Source: E. Bergasse & A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, p. 392.

Total final consumption in Montenegro in 2005 was 750Ttoe. Total final consumption by the industry sector make the largest proportion of TFC (47%), followed by the transport sector (20%), other sectors (3%) and non-energy use (2%) as shows the figure 24.

The figure 25 presents the data for total final consumption by sector in Serbia.

Figure 25: Serbia's total final consumption by sector, 2005



Source: E. Bergasse & A. Kovačević, Energy in the Western Balkans-The path to reform and reconstruction, 2008, p. 394.

Total final consumption in Serbia in 2005 was 9,663Ttoe. Total final consumption by the other sectors make the largest proportion of TFC (42%), followed by the industry sector (30%), transport sector (23%) and non-energy use (5%) as shows the figure 25.

6 Energy use and greenhouse gases

Energy has always played an important role in human and economic development and in society's well-being. Strange as it may appear, it is precisely at a time when more and more energy is produced, traded, transformed and consumed, when energy dependency is increasing, and when greenhouse gas emissions are high on the international agenda, that it becomes more and more difficult to provide a timely and reliable picture of the energy situation in many countries. Without the heat and electricity from fuel combustion, economic activity would be limited and restrained. Modern society uses more and more energy for industry, services, homes and transport. This is particularly true for oil, which has become the most traded commodity, and part of economic growth is linked to its price. However, neither oil nor any of the other fossil fuels, such as coal and natural gas, are unlimited resources (Garnier, 2005, p. 13).

Today it is impossible to imagine living without energy. If we think about the activities we do every day, we will see that for most of these activities energy is needed. Although energy is part of our daily lives, unfortunately the energy sector is the largest contributor to greenhouse gas emissions.

According to Ćulahović (2008, p. 313), today we are facing with pollutions in our daily lives, in our homes, workplaces, and wherever we are. All the pollution that surround us, affect climate change. Pollutant emissions from energy systems are a major source of human diseases, secondary particles of sulfur and nitrogen gases affect respiratory diseases. Today, environmental problems are trying to have a higher level of importance. Fuel emissions for households dominate in poor countries, while industrial and automobile pollution dominate in countries with middle income. Environmental problems of households and urban communities in rich countries were put on a global level because of GHG emissions.

There is a need to put environmental problems on a higher level of importance in all countries and not only in the rich one. In this way, environmental problems would not be in last place when it comes to solving the priority problems.

Since pre-industrial times, the atmospheric concentration of greenhouse gases has grown significantly. Carbon dioxide concentration has increased by about 31%, methane concentration by about 150%, and nitrous oxide concentration by about 16% (Töpfer & Sorensen, 2005, p. 14). Unfortunately since preindustrial times these emissions are increasing more and more. It is normal that we can't live without producing any kind of pollution, but the current condition is alarmingly so we urgently need take steps to reduce emissions.

Carbon dioxide emissions are mainly generated in power plants based on fossil fuel. Such emissions account for almost 75% of overall emissions, which is a very high percent. In developing economies they are very significant because these countries mainly try to use coal for power generation which has the highest emission intensity (UNFCCC, 2009).

According to Garnier, (2005, p. 23) reduction in CO_2 emissions from an existing economic activity is not possible overnight and it needs a well thought long term strategy. There are four possible strategies of reducing CO_2 emissions from an economy:

• reduce absolute level of energy consumption for given level of economic activity i.e. improve energy efficiency,

• change energy-mix to increase share of cleaner fuel like gas as well as share of non-fossil based energy,

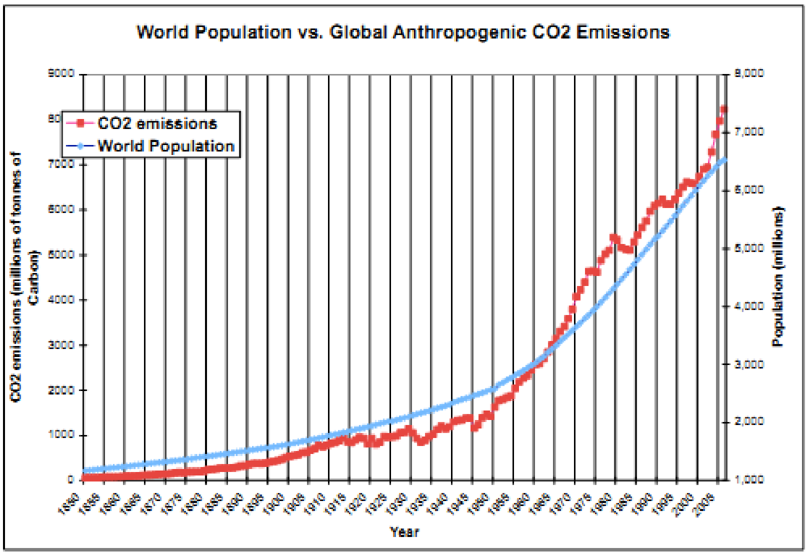
• capture CO_2 at major emitting centers and inject it back into earth for a possible application like enhanced oil recovery,

• increase the area under forest to provide natural sink for emissions.

6.1 Total CO2 emission and CO2 emission from energy sector in SEE

According to Ćulahović (2008, p. 318), since 1800 the amount of carbon dioxide in the atmosphere is constantly increasing. Before 1800 the concentration of carbon in the air was 267-290 parts per million, while in the late 20th century, the concentration of carbon was 355 parts per million. It is believed that this is a 31% increase, which is now growing at a rate of 0.5% per year, resulting from the increased scale burning of fossil fuels, 80%; while for the other 20% is responsible the intensive deforestation and other changes in land use. On carbon emissions a significant impact has also population growth, as we can see from the figure 26.

Figure 26: World population vs. global anthropogenic CO_2 emissions



Source: http://www.easterbrook.ca/steve/wp-content/Pop-vs-emissions.pdf

The relationship between emissions and population can be also seen from the other side. For example, if there is a close relationship between emissions and population, then countries with large populations, would dominate in emissions. But, the United States, with only 4% of world population account for 23% of global GHG emissions. This means that the levels of emissions are much more influenced by other factors such as income per capita, climate, location, socio-economic systems, energy prices, the degree of urbanization, energy endowment, etc. (Ćulahović, 2008, p. 319). All these factors accelerate the increase in emissions, so each of these factors should be seriously and thoroughly analyzed in an attempt to reduce emissions.

Carbon dioxide is one of the most important greenhouse gases, especially where the consequences of human activities are concerned. Carbon dioxide is estimated to be responsible for around 50% of global warming. Almost everywhere in the world, the most common anthropogenic sources of CO_2 are combustion of fossil fuels (for power production, industry, transport, heating, etc.), industrial activities (steel and cement production), land use change and forestry activities. The most significant source of CO_2 is certainly the energy sector, which contributes more than 70% of total CO_2 emission (Vukmir, Stanišljević & Cero, 2009, p. 47).

Without energy it is impossible to perform any economic activities and life in general. Although the energy in the global GDP accounts for 5%, the remaining 95% of GDP is not possible to achieve without energy inputs. Energy consumption by countries and regions is very uneven. Although in many parts of the developing world, energy consumption per capita grows, still developing countries are far behind the developed countries. Even today, at the beginning of the 21st century, over one third of humanity still has no access to commercial energy sources. Still energy consumption is increasing and so there are no signals that in the future the current trends in energy demand will be stopped. Energy consumption in the period 1970 - 2000 doubled. In 2030 should be expected new doubling of energy consumption, which will occur mainly in developing countries (Ćulahović, 2008, p. 289). This assumption needs to be taken seriously and developing countries should try to ensure that these assumptions are not being realized because increase in energy consumption causes increase of emissions.

The table 15 presents data for total CO_2 emission and CO_2 emission from energy in each SEE country and a percentage change in relation to the year 1990.

Table 15: CO_2 emission in SEE countries and percentage change in relation to 1990

Country	Total CO_2 emission (Gg)		Change in relation to 1990 (%)	CO_2 emission from energy (Gg)		Change in relation to 1990 (%)
Albania	1990	2000		1990	2000	
	6,578.92	5,571.50	-15.31%	2,902.95	4,419.78	52.25%
B&H	26,461.07	-	-	23,121.74	-	-
Croatia	1990	2007		1990	2007	
	23,081	26,843	16.30%	20,583	23,803	15.64%
Macedonia	1990	2002		1990	2002	
	10,545.33	10,059.08	-41.61%	9,469.008	9,348.403	-1.27%
Montenegro	1990	2003		1990	2003	
	2,691.56	2,817.75	4.69%	2,491.92	2,614.12	4.90%
Serbia	1990	1998		1990	1998	
	62,970	50,605	-19.64%	59,259	47,430	-19.96%

Source: National communications of SEE countries

Albania has reduced its total CO_2 emission in 2000 comparing to 1990 by 15.31%, but unfortunately CO_2 emission from energy has doubled comparing to 1990, there was an increase by 52.25%. Total CO_2 emission in B&H in 1990 was 26,461.07Gg, huge amount of this CO_2 emission was caused by energy (23,121.74Gg). Croatia has increased its total CO_2 emission in 2007 comparing to 1990 by 16.30% and also its CO_2 emission from energy by 15.64% comparing with 1990. Macedonia has reduced its total CO_2 emission in 2002 comparing to 1990 by 41.61%, and also the CO_2 emission from energy by 1.27% comparing to 1990. Montenegro has increased its total CO_2 emission in 2003 comparing to 1990 by 4.69%, and also its CO_2 emission from energy by 4.90%, comparing to 1990. Serbia has decreased its total CO_2 emission in 1998 comparing to 1990 by 19.64%, and also its CO_2 emission from energy by 19.96% comparing to 1990.

7 Potential for climate change mitigation in SEE countries

The South-Eastern Europe countries have joined international efforts to mitigate climate change and to adapt to its effects. Between 1998 and 2007, they ratified the United Nations Framework Convention on Climate Change and between 2004 and 2008 Albania, Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia, Montenegro and Serbia have each ratified the Kyoto protocol. These countries will take part in the implementation of the ambitious EU goals under the post-2012 regime. Once the Kyoto protocol entered into force in the SEE countries, the countries became eligible to participate in one of the three flexible mechanisms of the Kyoto protocol - that is, the Clean Development Mechanism (CDM). As non-Annex I parties they are eligible to host CDM projects. CDM reduction potential is concentrated in the energy sector and energy efficiency sectors. The countries' status with respect to Annex I to the UNFCCC can change with EU accession, after which they cease to be eligible (Feiler, et al., 2009, pp. 29-33). After the EU accession these countries would be able to use the other to mechanisms, Joint implementation and Emission trading and so they would have more opportunities to reduce their emissions.

South-Eastern Europe countries are the least industrially developed countries in Europe. They have, compared to other EU countries, by far the lowest emissions of carbon dioxide if assessed per person. While EU countries are reducing GHG emissions by investments in modern technologies and projects of energetic efficiency, the SEE countries still need to do that (Cirman, et al., 2009, p. 7). This is another indication of the enormous difference that exists between developed and developing countries.

Although SEE countries have potentials to participate in CDM projects, this potential isn't used enough. According to Feiler, et al. (2009, p. 34) every country in the SEE region is keenly interested in the establishment of the framework for the CDM, which is a good channel for foreign direct investments. The reduction potential in the region is high enough to attract donors. However, whether or not this potential will be realized depends heavily on the modalities for flexible mechanisms in the next commitment period. However, it is hard to expect from SEE countries, some of which still suffer from post-war conditions, the same commitments and activities that are feasible for developed countries.

Albania

Albania has a relatively low impact on global environment through low per capita GHG emissions, mainly due to the fact that over 90% of electricity is generated by hydro-sources. Albania is currently using most of the available hydro potential, which will not be able to accommodate the demand in the future. Increasing demand can be supplied with electricity from new thermal power plants, which will cause new GHG emissions. The projection anticipates a 2.54 fold increase of GHG emissions from the power sector from 1,500Gg in 1999 to 3,812Gg in 2025. The main contribution will come from planned higher efficiency thermal power plants. Total GHG emissions from energy and waste are rising. Among energy sub-sectors, transport is the fastest growing sector. The share of LUCF is significantly reducing. Total GHG emissions/removals from LUCF sector, are expected to change from – 2,082.66Gg (emissions) in the year 2000 to + 3,426.76Gg in the year 2025 (removals). So Albania has potential to reduce its GHG emissions. Forestry is the key sector contributing to GHG emissions reduction and increase of sinks. Also introduction of natural gas power plants, mini hydro power plants and large hydropower plants have a big impact on reduction of GHG emissions (Islami, Kamberi, Bruci, & Fida, 2009, pp. 11-151). So, Albania should use these potentials in order to reduce emissions and try to keep emissions constant in the other sectors if there aren't opportunities to reduce them. Special attention should be focused on energy sector, waste and transport because the emissions from these sectors are increasing.

The development of the infrastructure and construction in Albania during recent years has caused an increase in urban and construction waste. Due to this unforeseen increase in waste and its weak management, the impact on the environment and human health is considerable. Weak waste management leading to dumping of waste without any separation and treatment in landfill sites causes pollution emissions to air and water. Prevention and reduction of generated waste through recycling and incineration is one of the main standards of the waste management policy (Europen Environment Agency-EEA, 2010). This also confirms that among the priority sectors to which Albania should be directed primarily to reduce emissions is the waste sector. According to Islami, et al. (2009, p. 146) promoting sustainable waste management practices can reduce GHG emissions. The main goals of integrated waste management are to reduce solid waste, pursue recycling and reuse of material, and regulate the disposal of solid waste.

As in many countries also in Albania the energy sector cause the largest emissions. So in this sector a lot of work and investment is needed to achieve certain results. According EEA (2010) the Intersectorial Environment Strategy found that the main focus for climate change is to improve energy efficiency in all sectors in order to reduce the demand for power and the level of emissions. The measures envisaged by the Intersectorial Environmental Strategy to mitigate climate change include:

- Change of legal basis:

- legal framework for energy efficiency in new buildings,
- legal framework for energy efficiency of household equipment.

- Establishment of economic incentives:

- setting the carbon tax,
- creation of a grants or subsidy scheme for energy efficiency.

- Reduce GHGs released by transport and energy:

- review of the transport strategy in accordance with the provisions of the strategic environmental assessment for the improvement of road transport infrastructure,
- introduction of vehicles with low levels of emissions,
- review the strategy for the energy sector in accordance with the provisions of the strategic environmental assessment to enable the promotion of renewable energy sources.

- Awareness campaign to reduce the amount of greenhouse gases:

- promotion of energy efficiency in industry,
- improvement of thermal insulation and reducing unnecessary use of power for heating or cooling systems in houses,
- promotion of solar heating systems.

B&H

The ratification of the Kyoto protocol opened an opportunity for B&H to reduce its greenhouse gas emissions, mobilize resources for clean technologies and contribute to the sustainable development of the country. Establishment of an appropriate institutional framework for Kyoto participation would send a signal to the international community and potential investors that the country is ready for Kyoto implementation. B&H is at the moment responsible to implement the Kyoto protocol under the international law but will also share the responsibility with other EU member countries under the EC law once it becomes a full member (Kozomara, n.d., pp. 1, 3). Unfortunately, preparations for EU accession are going very slowly, so in B&H is a lot of hard work, effort and investment needed. Regarding to the Kyoto protocol, B&H should at first establish the DNA in order to open the possibility to participate in the only mechanism that developing countries can use- the CDM.

The most significant source of CO_2 emissions is certainly the energy sector, which contributes 73% of total CO_2 emissions. In the energy sector, solid fuels-coal make the largest proportion (77%), followed by liquid fuels (17%) and gas (6%). The largest source of CO_2 in industrial processes is iron and steel production, with more than 67%. The main sources of methane are agriculture, fugitive emissions from coalmines, and waste disposal. The largest amount of N_2O emissions results from agricultural soils through soil cultivation and crop farming. (Vukmir, et al., 2009, p. 19). As Albania, B&H should also at first concentrate on the energy sector in order to reduce emissions.

When we take into account the industry sector in B&H we know that it is quite undeveloped so the emissions from this sector aren't worrying. According to EEA (2010), industry was before the war the most important polluter: this includes the steel industry in Zenica, thermal power plants in Kakanj, Tuzla, Ugljevik, and Gacko; cement factories in Kakanj and Tuzla; wood processing industry in Doboj and Maglaj; acetylene, chlorine, and chloric acid factory in Jajce; chemical, detergent, and fertilizer industry in Tuzla; and many more. Before the war, there were 122 industrial wastewater plants in B&H (only 40 % were operating properly). Currently none of these is working. Most industry collapsed during the war, and has not yet been restored to the pre-war levels. Therefore, pollution is much lower than before the war.

The basic characteristic of the energy sector of B&H is low energy efficiency. Energy production in B&H is based on technologies developed approximately thirty years ago. In the case of construction of new plants and in major reconstructions of existing facilities, new technologies should be introduced whenever possible. Considering that the largest share of energy is used for heating, and that the relative consumption of energy for heating in B&H is much higher than in EU countries, there is obviously significant potential to reduce energy consumption in this sector (EEA, 2010). It is very important to work on improving energy efficiency in B&H and also on the replacement of existing old technologies with new one.

Measures to reduce GHG emissions in energy sector include reducing methane emissions, increasing the energy efficiency of the existing facilities (both production and transmission facilities), developing renewable energy sources, using biomass or lower-carbon fuels, and reducing N_2O emissions. The country should designate a fund that would be used to finance renewable energy source and energy efficiency projects (Vukmir, et al., 2009, p. 103). With regard that B&H has a lot of renewable energy sources that are unused priority in the use of this fund should first of all have renewable sources.

As in many other countries emission from traffic present a big problem. A significant quantity of air pollutants comes from traffic (EEA, 2010). In the transport sector a lot need to be done as sooner as possible and there are several options. According to Vukmir, et al. (2009, p. 20) it is necessary for the transport sector in B&H to introduce stricter measures for passenger motor vehicles when conducting regular vehicle inspections and preventive maintenance inspections. That way, 5% of motor vehicles a year would have to be barred from traffic, which would result in a considerable renewal of the passenger vehicle pool in the next 20 years, as well as a 30% reduction in GHG emissions. By encouraging a large number of passengers to use public transportation services, and their number would increase by about 40,000 passengers a year, it would be possible to save about 2,100,000 tons of fuel by 2030.

Other major problem as in many other countries is the waste sector. It is necessary to introduce more stringent measures and penalties for illegal dumping of waste in the nature. According to EEA (2010), waste represents one of the main environmental issues in B&H with issues arising mainly due to the inadequate management, lack of infrastructure and social attitude towards waste. The current problem of insufficient waste disposal system capacities has led to considerable quantities of waste being dumped illegally at roadsides, in rivers, abandoned mines, and similar places, posing threats to public health and the environment. No waste incineration facilities are currently operated in B&H. Recyclables separated from the mixed municipal waste amount to less than 5% of the total municipal waste mass, while at least 95% of the collected mixed municipal waste is disposed of mostly on non-sanitary disposal sites.

Croatia

To achieve the target set by the Kyoto protocol Croatia has adopted numerous policies, projects, actions and measures. Emissions started to rise in the 1996-2002 period by an average of 3.3% per year because of the revitalization of the economy. However, as a consequence of the war and the process of transition, Croatia has a very low initial level of GHG emissions. In European terms, Croatia has a relatively well-preserved environment. The preserved environment is the result of less ‘heavy’ industries in the overall industrial structure, but investments in environmental protection are also lower than in developed European countries. Consequently, international assistance including technical and financial assistance is essential in this process (Cirman, et al., 2009, p. 11). So, there is a need to increase the protection of the environment in Croatia and in this way achieve an approximate environmental protection which exists in developed European countries. A lot of investment is needed in order to accomplish this goal.

Despite the fact that greenhouse gas emissions from Croatia account for less than 0.1% of global emissions and the country has some of the lowest per capita emissions in Europe compared to other Kyoto protocol Annex I countries, the effects of climate change will not be avoided (EEA, 2010). Therefore, Croatia should also consider the possibilities of reducing emissions or at least maintain the current level of emissions without increasing.

In industrial processes, a significant reduction could be achieved in the production of nitric acid with the installation of catalytic devices for the reduction of N_2O emission. In the agricultural sector the estimates show that emission levels will increase and for now the most significant measure is the increased utilization of bio-waste for energy purposes, and the production of bio-diesel. In the period of 2000-2004 total energy consumption in Croatia grew at a rate of 3.1% annually and the use of energy from renewable sources (wind and biomass energy) is in the initial stage. Forest degradation is growing because of trans-boundary air pollution and forest certification has begun. The unfavorable structure of transport is growing because public passenger transport has decreased and the road transport of goods has risen considerably. In the period of 1997 to 2003 the number of passenger cars rose by 39% (Cirman, et al., 2009, p. 11). So, Croatia should try to increase the use of renewable energy sources. As the transport sector present a growing problem, Croatia need urgently to introduce strict measures to ensure that emissions from this sector could be reduced.

Waste management, is one of the main concerns or priorities among environmental issues. Croatia has less total and municipal waste per capita than certain European countries. However this is due to small number of controlled landfills and large number of uncontrolled dumps. The organization of responsibilities has not ensured an integral approach to chemical management. There is no integrated system for monitoring the transport of chemical substances, but specific groups of chemicals such as hazardous chemicals are covered by monitoring. The average amount of municipal waste generated in 2004 was 295 kg per capita, which is a 20% rise compared to the 1997-2004 period. A significant reduction in emissions could be realized by avoiding the unnecessary production of waste and intensifying the classification and recycling the waste (Cirman, et al., 2009, p. 11). Like B&H, Croatia should also introduce more stringent measures and penalties for illegal dumping of waste in the environment.

Macedonia

The mitigation of climate change effects has become one of the key priorities in the Republic of Macedonia. Such effects have negative impact on the health and wellbeing of the people and have continuous impacts on the state of biodiversity, indigenous habitats, agriculture and numerous social segments that define the country in wealth of natural habitat, forestry or rivers and lakes (EEA, 2010). Macedonia has seriously taken the negative consequences of climate change on many factors and for this reason the mitigation of climate change set as priority.

The main contributor to the total CO_2 equivalent emissions in 2002 is the energy sector with 78% of total emissions. The second biggest contribution comes from the agriculture sector with 9%, while all other sectors contribute less than 10% each. Besides the significant downfall in economic activities in the 1990s, total annual GHG emissions in Macedonia remained almost constant throughout this period (Azievska & Zdraveva, 2008, p. 40). Although Macedonia's total annual GHG emission remained almost constant, Macedonia still need to be careful not to have an increase in emissions, and attempt to reduce emissions from the energy sector.

According to Cirman, et al. (2009, p. 11) energy generation capacities are based primarily on domestic lignite coal, imported liquid fuels and natural gas, hydro resources and wood biomass. Only 15 to 18% of the annual electricity production comes from hydro power plants. The geothermal energy contributes 2.4% in the heat production sector. Also solar energy is being used at a very low level. Therefore, a lot of opportunities exist for increasing the exploitation of the existing and new geothermal sources and for intensifying the use of solar energy.

The CDM potential in Macedonia is considerable. Some of the biggest and most important CDM projects that should be realized in the future (some of them have already started) are: hydropower projects, a project for the construction of 29 new small hydroelectric plants with a total capacity of 89 MW, rehabilitation of the small hydro power plants, coal-powered plant's rehabilitation, natural gas-powered cogeneration project, rehabilitation of the district heating systems and the geothermal central heating system project (Cirman, et al., 2009, p. 11). Macedonia should focus on this CDM projects and invest its strengths and investments in order to realize these projects as soon as possible.

If we consider the waste sector, municipality and industrial waste is one of the biggest challenges in Macedonia. Since the economy started to recover, the volume of municipal waste has been growing and is projected to reach 828,000 tons per year by 2025 (Azievska & Zdraveva, 2008, p. 39). This projection is worrying, so Macedonia should focus on reducing the municipal waste and ensure that this projection won't be realized. The primary goal of the Former Yugoslav Republic of Macedonia is to decouple the waste generation and the use of natural resources from economic activity in order to minimize the environmental burden. According to the waste legislation, the priorities in waste management in the Republic are (EEA, 2010):

- avoidance of waste generation and reduction of harmful impacts of waste on the environment and human life and health,
- improvement of production technologies to reduce waste generation, and use of ecological products and less packaging,
- waste recycling and reuse either in another process for raw materials extraction or through energy recovery.

Montenegro

Montenegro has set several objectives that are to be achieved by 2020. It intends to reduce its GHG emissions by 20% and increase energy efficiency and reduce energy consumption as well by 20%. The share of bio-fuels is to be raised by a minimum of 10% and the share of renewable energy sources will be raised to 20%. To improve environmental quality and reduce emissions, several initiatives have been taken. Montenegro has great potential to generate a large number of carbon credits over the next few years by leveraging investments in a number of sectors (energy, waste, forestry and agriculture). In order to achieve this, projects that reduce GHG emissions or enhance sequestration have to be implemented. A preliminary analysis shows that the aggregate potential in terms of CO_2 is around 2.5 million tons of CO_2 equivalents per year (Cirman, et al., 2009, p. 9). Montenegro should use this potential and focus on the sectors that generate reduction of emissions in order to achieve the set objectives.

If we talk about the industry sector in Montenegro, we know that this sector as in many other SEE countries is underdeveloped. There is an urgent need for technology replacement in order to reduce the huge amount of emissions that old technology cause. According to EEA (2010), industrial production in Montenegro is characterized by outdated technology, low energy and raw material efficiency. The technologies applied in Montenegro are characterized by high greenhouse gas emissions and the production of large amounts of waste. Such technologies are represented in the currently active mining and metal industries, and were also characteristic for the plants and mines that are no longer in operation. Technologies with the most significant negative impacts on the environment are used in metallurgy, plants where combustion of coal is used – thermo-power plant and mining.

If we consider the transport sector in Montenegro, this sector is responsible for approximately 10 % of total energy consumption. Almost 90 % of the energy consumed in transport comes from road traffic, predominantly cars. Because this large percentage of energy consumption it is necessary to take measures to reduce them. According to EEA (2010) in order to reduce GHG emissions in road traffic, it is necessary to implement a package of measures including:

• an increase in the energy efficiency of Montenegro's vehicle fleet,
• the introduction of alternative fuels and substitutes for existing fossil fuels,
• the planning and establishment of a more efficient transport system.

Like in other SEE countries waste is also a serious problem in Montenegro with acute as well as long-term impacts on both environment and human health. Waste means unnecessary depletion of natural resources, unnecessary costs and environmental damage that could be avoided. Sustainable waste management is about using resources more efficiently. Future sustainable and practicable ways have to be found to deal with waste. Moving towards sustainable waste management will mean dramatic changes over the next ten years, where producers as well as consumers have to be encouraged to generate as little waste as possible (EEA, 2010). As the waste has enormous harmful effect on human health and the environment in general it is necessary to respond as quickly as possible in an attempt to reduce this problem.

In order to ensure environmental awareness among the general public, many activities were already undertaken such as the promotion of renewable energy sources, minimization of environmental impact and promotion of energy-saving schemes. The non-governmental organization sector has increased and with its various activities and campaigns has raised public involvement in environmental issues (Cirman, et al., 2009, p. 9). Montenegro should continue with these activities in order to increase the environmental awareness.

Serbia

A preliminary analysis estimates that the carbon abatement potential in Serbia is in the range of 20 million tons CO_2 equivalent to 25 million tons CO_2 equivalent per year (Stanković, Steiner & Tuerk, 2007, p. 6). Serbia should focus her investments in projects for reducing carbon emissions in order to use the existing reduction potential.

The biggest polluter in Serbia is traffic. Namely, 50% of the air pollution in Serbia is due to traffic. One of the solutions to cutting the air pollution that is caused by traffic is to build a metro and establishing a ring around the capital of Serbia, Belgrade. However, this would take time, since local and national governments cannot afford such a demanding infrastructure investment. So the country's infrastructure is at an unsatisfactory level, which causes many problems, mainly traffic and parking related. Recently, some regulations have been improved. Another important issue is river pollution. Serbia has already many projects underway aimed at reducing river pollution: the system of alerting for floods and chemical accidents, implementation of the GIS (geographical informational system) and the identification of all hot-spot enterprises on rivers all around the country (Cirman, et al., 2009, p. 8). Serbia needs to increase measures to protect the rivers as well as penalties for those who do not comply with the measures for river protection.

An interesting fact is that there are no wind turbines in Serbia yet, but strategies to develop them by 2015 are being prepared. Serbia also has six thermal power plants, but with over 90% the production mostly relies on fossil fuels (3,936MW) and only 353MW of production relies on natural gas and oil. The main strategy is to switch to the use of biomass and natural gas and oil. The industrial sector has great potential for increasing its energy efficiency and reducing its consumption. The biggest savings can be achieved by the optimization of the combustion processes (potential savings of around 940GWh), an increase in efficiency of the existing boilers, modernization of the control and regulatory systems of industrial processes (potential savings of around 1,880GWh), the reuse of waste heat from industrial processes and a change of existing electric engines (potential savings of around 188GWh) (Cirman, et al., 2009, p. 9). Serbia should use this potential in the industry sector in order to increase its energy efficiency, reduce energy consumption and therefore reduce the emissions from this sector.

If we consider the waste sector in Serbia, it is similar like in other SEE countries that this sector presents a big problem. A lot needs to be done in order to improve the waste management and the cooperation in solving this problem. According to EEA (2010), poor waste management has been identified as one of the most important environmental problems in Serbia, resulting mainly from previous inadequate approaches. High-costs, low levels of service and inadequate care for the environment are consequences of the poor organization of waste management. Concerning waste management, CO_2 savings could be approximately 410 ktCO_2/per year. The existing legislation defines local municipalities as the entities responsible for managing communal waste. However, people generally tend to consider wastes as somebody else's problem, so solutions are expected from the government, its agencies, local authorities, industry, etc. The need for cooperation in solving the problems of waste disposal is only recognized in moments of crisis and public concern.

When we talk about the potentials for reducing emission it can be said that Serbia has great potential for the GHG project development but a lot of things are needed to be improved in order to realize these projects. According to Cirman, et al., (2009, pp. 8, 9) some projects are already in progress, mainly those focusing on alternative energy sources. The total hydro potential in Serbia is 25,000 GWh a year, including 3 Mtoe/ 10 years, of renewable energy potential. Biodiesel also has some prospects. Serbia has already opened the first biodiesel plant. The final goals of Serbia are to improve environmental protection and mitigate climate changes by raising public awareness and to speed up the CDM projects and building national capacities of all relevant governmental bodies and other stockholders. These strategies could also finally help improve Serbia's position in the region.

Another problem that is present in all SEE countries is that of climate change negotiations. According to Feiler et al. (2009, p. 37) SEE countries have certain difficulties participating fully in international climate change negotiations. The reasons for this include:

- the limited financial and human resources of these countries, as a result of which, a limited number of negotiators are able to attend rounds of negotiations,

- the increasing number of agenda items under all the bodies (COP, SBI, SBSTA, AWG-LCA - Ad Hoc Working Group on Long-term Cooperative Action under the Convention, AWG-KP - Ad Hoc Working Group on Further Commitments for Annex I parties under the Kyoto protocol) as well as the increasing number of meetings. Those few people serving as negotiators for their SEE country are not physically able to follow all of them. In addition, they have to continue fulfilling their duties in their home ministries,
- the need for capacity building on negotiation skills. While representatives of SEE countries are able negotiators, they sometimes lack knowledge of the technicalities of the negotiation processes.

CONCLUSION

In the fight against climate change should participate both, developed and developing economies. Although developed economies are responsible for the most of past greenhouse gas emissions, developing economies are becoming even more important emitters. The Kyoto protocol as an international agreement on the reduction of GHG emissions is the biggest step in order to ensure a greener future.
According to Cirman et al. (2009, p. 50) SEE countries can turn their absence of energy efficiency into a comparative advantage in the global market of gas emission. Certainly, every market has its own risks although risks in the gas emission market do not exist for developing countries, except for those that invest by themselves in projects and even then the risk is limited to the loss of additional profit from emission credits and not to the loss of invested capital because an improvement in energy efficiency is an investment in itself and not an expense.

Level of GHG emissions in SEE countries will strongly depend on how they are going to satisfy their energy and electricity needs in the future. The more advanced the installed technologies, the less carbon pollution will be caused by growth. Information of this kind can also significantly strengthen the position of SEE countries in future negotiations. SEE countries should strength their negotiation teams because delegations from SEE countries are small, and so negotiators are unable to follow all the negotiation contact groups on a number of important questions and therefore have difficulty representing their countries' interests. Also there is a need to strengthening capacities for reporting exercises. In the post-2012 context, even non-Annex I countries will clearly be obliged to do more reporting both on GHG emissions at national level and on implemented policies and measures. Accession to the EU will require reporting at enterprise level (Feiler, et al, 2009, p. 39).

Answers to the questions we set as the purpose of this master's thesis are the following:

- Whether countries, that have an obligation, will reduce their required level of emissions in the first commitment period 2008-2012?

Among SEE countries only Croatia as Annex I country has an obligation to reduce its emissions by 5% in the first commitment period. Other SEE countries which were concerned in this thesis are non-Annex I countries-developing countries and so they have no obligation to reduce their emissions.

Republic of Croatia keeps fulfilling its obligations undertaken by signing the Kyoto protocol on reducing emissions by 5% in the period 2008-2012 as compared to the emissions in 1990. Calculations show that by 2012 Croatia will fulfill its commitments under the Kyoto protocol even without additional emission allowances, since due to the implementation of emission reduction measures, as well as due to recession and the related economic downturn, in 2008 and 2009 Croatia recorded a significant reduction in greenhouse gas emissions. Emission calculations for the indicated years and emission estimates for the 2010-2012 period show that in the first Kyoto commitment period, 2008-2012, Croatia will fulfill its obligations to reduce emissions by 5% compared to 1990, even without applying additional 3.5 million tons of emissions which will remain available to Croatia after 2012. However, at that time Croatia will, as an EU Member State, be included in the overall EU system and its commitments in the post-Kyoto period (Ministry of Environmental Protection, Physical Planning and Construction, 2011).

- Whether countries, that are not required to reduce emissions, have fulfilled their part of duties?

Except Croatia, other SEE countries (Albania, Bosnia and Herzegovina, FYR of Macedonia, Montenegro and Serbia) as developing countries have no obligation to reduce their emissions. The most important for these countries is to provide national communications. According to Schmitdt (2011, p. 9) reporting guidelines require that non-Annex I parties provide a GHG inventory in conjunction with the national communication. The inventory for the first national communications was to cover the year 1994 or 1990, the second the year 2000. Most non-Annex I countries have provided only one inventory to date and only for one year.
Each developing SEE country has provided the first national communication, only Albania and Macedonia provided also the second national communication. The least year that Albania cover for the GHG inventory is 2000, B&H only the year 1990, Macedonia – 2002, Montenegro – 2003, and Serbia cover the year 1998 for the GHG inventory. Each of these countries should update national inventories of anthropogenic emissions.

According to Schmidt (2011, p. 9), since 1999, Annex I parties have been required to submit annual GHG inventories, covering a full time-series from 1990 up to most recent year.
Croatia as an Annex I country has submitted the first, second, third, fourth and fifth national communication. The least year that Croatia covers for the GHG inventory is 2007.

- How successful are the countries in the use of Kyoto mechanisms?

Developing countries are able to use only one Kyoto mechanism-the CDM. Although these countries in SEE have great potential for CDM projects, this potential is not enough used.
According to Montini and Bogdanovic (2009, p. 107), there is one CDM project being developed in FYR of Macedonia, which involve the Netherlands - Skoplje Cogeneration Project. Additionally Albania has established a bilateral agreement with Italy, and the FYR of Macedonia has signed agreement with Italy and Slovenia for the development of CDM projects.

As an Annex I country Croatia can use all three mechanisms – CDM, JI and ET in order to meet her obligation to reduce its emission for 5% in the first commitment period.
Analyses have shown that Croatia could meet the requirements in the first commitment period of the Kyoto protocol by domestically applied emission reduction measures, which means that use of flexible mechanisms is not planned. In case domestic measures would fail to realize their full potential and meeting the requirements of the Kyoto protocol would become uncertain, application of flexible mechanisms and possible purchase of emission units in international market would be considered. Croatia decided not to enter JI projects as a host until the end of 2012 (Zdilar, 2010, p. 106).

- What about after 2012, the post Kyoto period?

After the first commitment period under the Kyoto protocol, it is important to involve developing countries in reducing emissions, and stimulate them to take appropriate actions in the post-2012 climate regime, because according Olmstead and Stavins, (n.d., p. 35) developing countries are likely to account for more than half of global emissions by 2020, possibly sooner.
In the post Kyoto period GHG emission targets of developed countries need to be further tightened, and bringing developing countries into the next Kyoto phase is essential to strengthening the agreement.

Ways to reduce emissions in SEE countries is that these countries successfully use their potential that they have for reducing emissions. Conclusions and recommendations for each SEE country are the following:

Albania

In order to improve its CDM potential Albania should concentrate on the most promising sectors, which are hydropower and forestry. In the period of 10 years (1990-2000) Albania has succeed to reduce its emissions by 2.73%. As in 1990 also in 2000 the largest emission was caused by the energy sector. An alarming fact is that the CO_2 emission from energy in the period of 1990-2000 has increased by 52.25%, so Albania should find ways to reduce this emission caused by the energy sector.

The data that Albania's domestic energy production in 2005 was only 1.2Mtoe, and that its import dependency was 51%, indicates the need that Albania should be oriented on domestic energy production trough hydropower, natural gas and other renewable.

With regard to TFC, although Albania in 2005 had small energy consumption per capita (0.77toe), the largest proportion of TFC made the transport sector with 41%, so Albania should try to be more oriented on public transport, and find other ways to reduce this energy consumption and therewith to reduce emission from the transport sector. One of the key sectors which are contributing to GHG emission reduction is forestry, so Albania should be based on this sector, but also the introduction of natural gas power plants, small and large hydro power plants could have a big impact to reduce GHG emissions.

B&H

The most important for B&H is to establish the Designated National Authority, because it is one of the binding conditions for the implementation of CDM projects. This is the first step that B&H should take. After this first step is done, B&H should base her CDM potential on hydropower, especially small hydropower plants. It is very important for B&H to take place in CDM projects because in that case it would be able to promote additional foreign investment and become the chance to use better techniques, technologies and processes.
While for B&H there are only available data for the year 1990, B&H should as soon as possible publish data for the last years like other countries.

Like in Albania, the largest CO_2 equivalent emissions in B&H cause the energy sector. When we talk about TPES, it is important to mention that B&H with Serbia in 2005 had the smallest import dependency (32%). With regard to TFC in B&H, the largest proportion of TFC (51%) in 2005 made other sectors which include residential, common and public services, agriculture/forestry. B&H should orient on this sectors and find ways to reduce this energy consumption.

It is also important to mention that in 1990 B&H was after Serbia, the second country with the highest CO_2 emission. Unfortunately there are no data of emissions for the last years so we couldn’t know if there was increase or decrease of emissions.
B&H should at first try to reduce its GHG emissions trough an increase in energy efficiency and development of renewable energy sources.

The data that in B&H the exploitation of hydropower is less than 40% signalize that B&H should focus to increase the exploitation of hydropower.

In the future B&H should also introduce stricter measures for passenger motor vehicles and influence on the increase of public transport. One more necessary point for B&H is to improve the system of waste management.

Croatia

That what separate Croatia from other SEE countries is that Croatia belongs to Annex I countries and therewith has the commitment to reduce its GHG emissions by 5% in the first commitment period. One of the benefits to be part of the Annex I countries is that Croatia isn't limited to use only the CDM. Croatia is also able to use the other two flexible mechanisms (JI, ET) in order to meet its commitments. In the period of 17 years (1990-2007) Croatia has succeed to reduce its emissions by 4.45%.

Like in other SEE countries, also in Croatia the largest emission cause the energy sector, but the largest increase in emission in relation to 1990 is evidenced from the waste sector (49.91%). Croatia should take steps to decrease these emissions by avoiding unnecessary production of waste and intensifying the classification and recycling the waste.

When we talk about TPES, Croatia had in 2005 the highest import dependency among SEE countries (58%), so Croatia should take initiatives to increase the production of natural gas because it's the most significant resource. It is also important that Croatia take steps to decrease energy consumption per capita, because after Serbia, Croatia has the highest energy consumption per capita. When we look at the energy consumption by sectors Croatia should at first try to decrease energy consumption in the following sectors: residential, common and public services, agriculture and forestry, by increasing the use of energy from renewable sources.
Also what is worrying is that the number of passenger cars is rising and therewith also the emission of CO_2, so Croatia should increase the use of public transport and find other ways to reduce these emissions.

Macedonia

The CDM potential in Macedonia is bind to the energy sector, waste and forestry sector, so Macedonia should focus on these sectors in order to develop CDM projects. Also one of the most important CDM projects that should be realized are hydropower projects, rehabilitation of small hydropower projects, coal-powered plant's rehabilitation, natural gas-powered cogeneration project etc.

In the period of 12 years (1990-2002) Macedonia has succeed to reduce its emissions by 9.48%. Like in other SEE countries also in Macedonia the largest emission was caused by the energy sector. Although the energy sector cause the largest emission, these sector and also the industrial sector, agriculture sector, LUCF, have a reduction in 2002 comparing with the year 1990. Only the waste sector has an increase in emissions by 6.93% in 2002 comparing with these emissions in 1990. So Macedonia should focus on the waste sector in order to reduce the emissions the waste sector cause. In the waste management priorities should be oriented on avoidance of waste generation, improvement of production technologies to reduce waste generation, use of ecological products and also on waste recycling.

If we look at CO_2 emissions, Macedonia is with Serbia the only country in SEE which CO_2 emissions has decreased, in the period of 1990-2002 Macedonia has a decrease by 1.27%.

When we look at the TFC, in Macedonia the TFC in 2005 was 1.7Mtoe, which was small comparing with TFC for example in Croatia (7.1Mtoe) or in Serbia (9.7Mtoe). Macedonia should try not to increase this energy consumption and orient on the rehabilitation of large power plants, fuel switching to natural gas, CHP (Combined Heat and Power) for district heating, on hydro power and take the opportunities that exist for increasing the exploitation of the existing and new geothermal sources and for intensifying the use of solar energy (Božanić, n.d.; Cirman, 2009).

Montenegro

Montenegro should focus on energy saving, renewable energy, waste sector and LUCF in order to use its CDM potential in this sectors for developing CDM projects.

In the period of 13 years (1990-2003), Montenegro has reduced its emissions by 2.58%. The largest emission in 2003 was caused by the energy sector, but the highest increase in emissions comparing to the year 1990 have the industrial and waste sector.

If we look at TFC, Montenegro had the smallest TFC (0.6Mtoe) in 2005 among SEE countries analyzed in this thesis, but her energy consumption per capita in 2005 was 1.59toe, so Montenegro should try to decrease energy consumption per capita. Montenegro should also focus on the industrial sector to decrease energy consumption because this sector had the largest energy consumption (47%) in 2005. In this sector should be at first replaced the technology used because it is outdated and produce high greenhouse gas emissions and large amounts of waste.

Serbia

Serbia's CDM potential is bind on energy saving like in the industry and transport sector, on renewable energy like SHPPs, solar and geothermal energy, on waste sector and LULUCF. So Serbia should try to develop CDM projects in the area of these sectors.

In the period of 8 years (1990-1998) Serbia has decreased its emissions by 22.19%. This is very successfully reduction keeping in view that this decrease happened in only 8 years. Like in other SEE countries also in Serbia the largest emission was caused by the energy sector in 1998, but only the waste sector had an increase in emissions by 38.79% comparing with emissions in 1990. Other sectors had a decrease in emissions. Serbia should invest efforts to reduce emissions that cause the waste sector because there is potential for CO_2 savings, according to EEA (2010), these savings could be approximately 410ktCO_2/per year.
When we look at TFC, Serbia had in 2005 among SEE countries the highest TFC (9.7Mtoe) and also the highest energy consumption per capita (2.26toe), so it is of utmost importance that Serbia takes steps for energy savings. At first Serbia should try to decrease energy consumption and therewith emissions in common and public services, residential and agriculture/forestry sector because these sectors were responsible for 42% of energy consumption in 2005.

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APPENDIXES

TABLE OF APPENDIXES

Appendix A: List of Abbreviations

AAU – Assigned Amount Unit
AWG-KP – Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AWG-LCA - Ad Hoc Working Group on Long-term Cooperative Action under the Convention
BAU – Business as Usual
B&H – Bosnia and Herzegovina
CDM – Clean Development Mechanism
CER – Certified Emission Reduction
CH_4 – Methane
CHP – Combined Heat and Power
CO_2 – Carbon Dioxide
CO_2eq – Carbon Dioxide equivalent
COP – Conference of the Parties
DNA – Designated National Authority
EEA – European Environment Agency
ETS – Emission Trading Scheme
EU – European Union
EC – European Commission
ERU – Emission Reduction Unit
FYR – Former Yugoslav Republic
GDP – Gross Domestic Product
Gg – Giga gram
GHG – Greenhouse gas
Gwh – Giga watt hours
GWP – Global Warming Potential
HDI – Human Development Index
HFCs – Hydro-fluorocarbons
IEA – International Energy Agency
IET – International Emission Trading
INC – Initial National Communication
IPCC – Intergovernmental Panel for Climate Change
IR – Infra-red radiations
JI – Joint Implementation
JISC – Joint Implementation Supervisory Committee
kg – kilogram
LULUCF – Land Use, Land Use Change and Forestry
Mtoe – Million tons of oil equivalents
Mw – Mega watt
NC – National Communication
N_2O – Nitrous Oxide
ppmv – part per million by volume
PDD – Project Design Document
PFCs – Per-fluorocarbons
PIN – Project Idea Note
SBI – Subsidiary Body for Implementation
SBSTA – Subsidiary Body for Scientific and Technological Advice
SEE – South-Eastern Europe

SF_6 – Sulfur Hexafluoride
SHPPs – Small Hydro Power Plants
TPES – Total Primary Energy Supply
TFC – Total Final Consumption
Ttoe – Thousand tons of oil equivalents
UN – United Nations
UNFCCC – United Nations Framework Convention on Climate Change
UNISDR – United Nations International Strategy for Disaster Reduction
WhC – White Certificates
WHO – World Health Organization

Appendix B: Calculation for share of CO_2 equivalent emissions by sector

Albania

Energy = $\frac{4,528.29}{7,619.90} \times 100 = 59.43\% \approx 59\%$; 4,528.29Gg – emission from energy sector

7,619.90Gg – total emission from all sectors

Industrial Processes = $\frac{264.92}{7,619.90} \times 100 = 3.48\% \approx 4\%$;

Agriculture = $\frac{1,362.75}{7,619.90} \times 100 = 17.88\% \approx 18\%$; LUCF = $\frac{903.39}{7,619.90} \times 100 = 11.86\% \approx 12\%$;

Waste = $\frac{560.56}{7,619.90} \times 100 = 7.36\% \approx 7\%$.

Bosnia and Herzegovina

Energy = $\frac{24,888.95}{3,4043.49} \times 100 = 73.11\% \approx 73\%$;

Industrial Processes = $\frac{3,554.07}{34,043.49} \times 100 = 10.44\% \approx 10\%$;

Agriculture = $\frac{4,608.01}{34,043.49} \times 100 = 13.54\% \approx 14\%$; Waste = $\frac{992.46}{34,043.49\%} \times 100 = 2.92\% \approx 3\%$.

Croatia

Energy= $\frac{23,803}{26,082} \times 100 = 73.50\% \approx 73\%$; Industrial Processes = $\frac{4,073}{26,082} \times 100 = 12.58\% \approx 13\%$

Agriculture = $\frac{3,410}{26,082} \times 100 = 10.53\% \approx 11\%$; Waste = $\frac{868}{26,082} \times 100 = 2.68\% \approx 3\%$.

FYR of Macedonia

Energy = $\frac{9,755.52}{12,497.56} \times 100 = 78.06\% \approx 78\%$;

Industrial Processes = $\frac{792.38}{12,497.56} \times 100 = 6.34\% \approx 6\%$;

Agriculture = $\frac{1,073.39}{12,497.56} \times 100 = 8.59\% \approx 9\%$; Waste = $\frac{839.78}{12,497.56} \times 100 = 6.72\% \approx 7\%$.

Montenegro

Energy= $\frac{2.656.60}{5,320.17}\times 100 = 49.90\% \approx 50\%$; Industrial Processes= $\frac{1,889.13}{5,320.17}\times 00 = 35.5\% \approx 36\%$;

Agriculture = $\frac{656.16}{5,320.17}\times 100 = 12.3\% \approx 12\%$; Waste = $\frac{119.28}{5,320.17}\times 100 = 2.3\% \approx 2\%$.

Serbia

Energy = $\frac{50,549}{66,347}\times 100 = 76.19\% \approx 76\%$; Industrial Processes = $\frac{3,620}{66,347}\times 100 = 5.46\% \approx 6\%$;

Agriculture = $\frac{9,500}{66,347}\times 100 = 14.32\% \approx 14\%$; Waste = $\frac{2,678}{66,347}\times 100 = 4.04\% \approx 4\%$.

Appendix C: Calculation for comparison of greenhouse gas emissions in relation to 1990

Albania – change of emissions in 2000 in relation to 1990

Energy = $\frac{4,528.29 - 31,078.08}{3,107.08}\times 100 = 45.74\%$; 4,528.29Gg – emission from energy in 2000; 3,107.08Gg – emission from energy in 1990;

Industrial Processes = $\frac{264.92 - 209.87}{209.87}\times 100 = 26.23\%$;

Agriculture = $\frac{13,62.75 - 880.33}{880.33}\times 100 = 54.80\%$; LUCF = $\frac{903.39 - 3,493.05}{349.05}\times 100 = -74.14\%$;

Waste = $\frac{560.56 - 143.74}{143.74}\times 100 = 2.89\%$; Total = $\frac{7,619.90 - 7,834.07}{7,834.07}\times 100 = -2.73\%$.

Croatia – change of emissions in 2007 in relation to 1990

Energy = $\frac{23,803 - 22,149}{22,149}\times 100 = 7.47\%$; Industrial Processes = $\frac{4,073 - 4,185}{4,185}\times 100 = -2.68\%$

Agriculture = $\frac{3,410 - 4,328}{4,328}\times 100 = -21.21\%$; LUCF = $\frac{-6,303 - (-4,185)}{4,185}\times 100 = 50.61\%$;

Waste = $\frac{868 - 579}{579}\times 100 = 49.91\%$; Total = $\frac{25,851 - 27,056}{27,056}\times 100 = -4.45\%$.

FYR of Macedonia – change of emissions in 2002 in relation to 1990

Energy = $\frac{9,755.52 - 9,939.83}{9,939.83}\times 100 = -1.85\%$;

Industrial Processes $= \frac{792.38 - 889.29}{889.29} \times 100 = -10.90\%$;

Agriculture $= \frac{1{,}073.39 - 1{,}908.27}{1{,}908.27} \times 100 = -43.75\%$; LUCF $= \frac{36.49 - 283.66}{283.66} \times 100 = -87.14\%$ Waste $= \frac{839.78 - 785.39}{785.39} \times 100 = 6.93\%$; Total $= \frac{12{,}497.56 - 13{,}806.44}{13{,}806.44} \times 100 = -9.48\%$.

Montenegro – change of emission in 2003 in relation to 1990

Energy $= \frac{2{,}656.60 - 2{,}540.28}{2{,}540.28} \times 100 = 4.58\%$;

Industrial Processes $= \frac{1{,}889.13 - 1{,}642.04}{1{,}642.04} \times 100 = 15.05\%$;

Agriculture $= \frac{655.16 - 783.59}{783.59} \times 100 = -16.39\%$;

LUCF $= \frac{-853.26 - (-485.00)}{-485.00} \times 100 = 75.93\%$; Waste $= \frac{119.28 - 104.37}{104.37} \times 100 = 14.29\%$;

Total $= \frac{54{,}466.91 - 4{,}585.28}{4{,}585.28} \times 100 = -2.58\%$.

Serbia – change in emission in 1998 in relation to 1990

Energy $= \frac{50{,}549 - 62{,}776}{62{,}776} \times 100 = -19.48\%$;

Industrial Processes $= \frac{3{,}620 - 4{,}270.8}{4{,}270.8} \times 100 = -15.24\%$;

Agriculture $= \frac{9{,}500 - 11{,}827}{11{,}827} \times 100 = -19.68\%$; LUCF $= \frac{-8{,}661 - (-6{,}665)}{-6{,}665} \times 100 = 29{,}95\%$

Waste $= \frac{2{,}678 - 1{,}929.5}{1{,}929.5} \times 100 = 38.79\%$;

Total $= \frac{57{,}686 - 74{,}138.3}{74{,}138.3} \times 100 = -22.19\%$.

Appendix D: Calculation for share of TPES in TPES of the SEE region

Albania: $\frac{2.4}{38.5} \times 100 = 6.23\%$; 2.4Mtoe – Total primary energy supply in Albania

38.5Mtoe – Total primary energy supply in SEE region

B&H: $\frac{4.9}{38.5} \times 100 = 12.73\%$; Croatia: $\frac{8.8}{38.5} \times 100 = 22.86\%$;

Macedonia: $\frac{2.7}{38.5} \times 100 = 7.01\%$; **Montenegro**: $\frac{1.0}{38.5} \times 100 = 2.60\%$;

Serbia: $\frac{16.7}{38.5}\times 100 = 43.38\%$; Kosovo: $\frac{2.0}{38.5}\times 100 = 5.19\%$.

Appendix E: Calculation for share of TFC in TFC of the SEE region

Albania: $\frac{2.1}{25.2}\times 100 = 8.33\%$; 2.1Mtoe – Total Final Consumption in Albania

25.2Mtoe – Total Final Consumption in SEE region

B&H: $\frac{3.0}{25.2}\times 100 = 11.90\%$; **Croatia**: $\frac{7.1}{25.2}\times 100 = 28.17\%$;

Macedonia: $\frac{1.7}{25.2}\times 100 = 6.75\%$; **Montenegro**: $\frac{0.6}{25.2}\times 100 = 2.38\%$;

Serbia: $\frac{9.7}{25.2}\times 100 = 38.49\%$.

Appendix F: Calculation for TFC by sector in SEE region

Albania

Industry $= \frac{207}{2,127}\times 100 = 9.73\% \approx 10\%$; Transport $= \frac{874}{2,127}\times 100 = 41.09\% \approx 41\%$;

Other sectors $= \frac{856}{2,127}\times 100 = 40.24\% \approx 40\%$; Non-energy use $= \frac{189}{2,127}\times 100 = 8.88\% \approx 9\%$.

B&H

Industry $= \frac{617}{3,046}\times 100 = 20.25\% \approx 20\%$; Transport $= \frac{866}{3,046}\times 100 = 28.43\% \approx 28\%$;

Other sectors $= \frac{1,563}{3,046}\times 100 = 51.31\% \approx 51\%$.

Croatia

Industry $= \frac{1,572}{7,087}\times 100 = 22.18\% \approx 22\%$; Transport $= \frac{1,947}{7,087}\times 100 = 27.47\% \approx 28\%$;

Other sectors $= \frac{2,852}{7,087}\times 100 = 40.24\% \approx 40\%$; Non-energy use $= \frac{716}{7,087}\times 100 = 10.10\% \approx 10\%$.

Macedonia

Industry $= \frac{547}{1,701}\times 100 = 32.15 \approx 32\%$; Transport $= \frac{352}{1,701}\times 100 = 20.69\% \approx 21\%$;

Other sectors $= \frac{765}{1,701}\times 100 = 44.97\% \approx 45\%$; Non-energy use $= \frac{36}{1,701}\times 100 = 2.11\% \approx 2\%$.

Serbia

Industry = $\frac{2,907}{9,663} \times 100 = 30.08\% \approx 30\%$; Transport = $\frac{2,259}{9,663} \times 100 = 23.37\% \approx 23\%$;

Other sectors = $\frac{4,068}{9,663} \times 100 = 42.09\% \approx 42\%$; Non-energy use = $\frac{428}{9,663} \times 100 = 4.42\% \approx 5\%$.

Appendix G: Calculation for comparison of total CO_2 emission and CO_2 emission from energy in relation to 1990

Albania

Change $_{\text{(total CO2 emission)}} = \frac{5,571.50 - 6,578.92}{6,578.92} \times 100 = -15.31\%$;

5,571.50Gg – CO_2 emission in 2000; 6,578.92Gg – CO_2 emission in 1990

Change $_{\text{(CO2 emission from energy)}} = \frac{4,419.78 - 2,902.95}{2,902.95} \times 100 = 52.25\%$

4,419.78 – CO_2 emission from energy in 2000, 2,902.95 – CO_2 emissions from energy in 1990

Croatia

Change $_{\text{(total CO2 emission)}} = \frac{26,843 - 23,081}{23,081} \times 100 = 16.30\%$;

Change $_{\text{(CO2 emission from energy)}} = \frac{23,803 - 20,583}{20,583} \times 100 = 15.64\%$

Macedonia

Change $_{\text{(total CO2 emission)}} = \frac{10,059.08 - 10,545.33}{10,545.33} \times 100 = -41.61\%$;

Change $_{\text{(CO2 emission from energy)}} = \frac{9,348.403 - 9,469.008}{9,469.008} \times 100 = -1.27\%$

Montenegro

Change $_{\text{(total CO2 emission)}} = \frac{2,817.75 - 2,691.56}{2,691.56} \times 100 = 4.69\%$;

Change $_{\text{(CO2 emission from energy)}} = \frac{2,614.12 - 2491,92}{2,491.92} \times 100 = 4.90\%$

Serbia

Change $_{\text{(total CO2 emission)}} = \frac{50,605 - 62,970}{62,970} \times 100 = -19.64\%$

Change $_{\text{(CO2 emission from energy)}} = \frac{47,430 - 59,259}{59,259} \times 100 = -19.96\%$