РЕПУБЛИКА СРБИЈА
МИНИСТАРСТВО
ЖИВОТНЕ СРЕДИНЕ И
ПРОСТОРНОГ ПЛАНИРАЊА

REPUBLIC OF SERBIA
MINISTRY OF ENVIRONMENT
AND SPATIAL PLANNING

По мери природе

National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism

-Waste Management, Agriculture and Forestry Sector -

2010

Authors:
Vladislav Arnoudov
Alexander Horst

Contributing authors:
Aleksandar Bogunović
Ana Seke
Ana Repac
Sandra Lazić
Saša Stamatović

Editor:
Danijela Božanić

Cover page:
Tara (7) and Sara (6)

Published by:
The Ministry of Environment and Spatial Planning

Printed by:
EnergoData

Number of copies: 400

SUMMARY

Project “Development of a National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism (CDM) under the Kyoto Protocol”, implementation of which has been realized with the financial support received from the Government of the Kingdom of Norway, presents efforts made by the Government of the Republic of Serbia towards building and strengthening of the country’s capacities aimed at more efficient implementation of Kyoto Protocol.

The project includes sectors of waste management, agriculture and forestry, and it has identified possibilities for implementation of CDM projects in these sectors in short and long-term period.

Development of the “National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism under the Kyoto Protocol for Waste Management, Agriculture and Forestry Sectors”, as a part of the above mentioned project, has been entrusted to the Ministry of Environment and Spatial Planning. Taking into account the sectors covered by the Strategy, as well as competences of certain ministries of the Government of the Republic of Serbia, the project has been implemented in collaboration with the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia.

Development of the Strategy involved use of the results obtained in the project “Capacity Building in the Area of Climate Change among Stakeholders”. This project, with the financial support received from the Government of the Kingdom of Norway, was implemented by the Regional Environmental Centre.

General aim of the project is capacity building and awareness raising about Clean Development Mechanism among stakeholders.

Specific objectives are identification of potential projects and financial opportunities for implementation of such projects within this mechanism of Kyoto Protocol.

I INTRODUCTION

1.1. Aims of the Strategy

The National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism under the Kyoto Protocol (hereinafter: Strategy) provides basic information about Clean Development mechanism (hereinafter: CDM) of Kyoto Protocol, procedures, experiences and possibilities for implementation of CDM projects; identifies problems in CDM project implementation and provides for potential solutions for waste management, agriculture and forestry sectors.

It is focused on identification of ways and possibilities for improvements in environmental performance followed by economic and social development of the country, through recognition of potentials for implementation of CDM projects in the sectors of waste management, agriculture and forestry.

General aim of the Strategy is to build capacities and to raise awareness about use of CDM projects, as possible ways to encourage sustainable development and to enable faster implementation of Kyoto Protocol in the Republic of Serbia.

In accordance with the general aim, ***specific objectives*** of this Strategy are: to increase in stakeholders' capacities; better knowledge primarily among potential project owners and developers; development of individual and institutional capacities needed for identification, preparation, implementation and evaluation of CDM projects; ensuring strategic overview of possibilities and identification of prospective types of CDM projects, as well as possible challenges in their implementation; identification of key prerequisites needed for faster development and implementation of CDM projects; promotion of investments and provision of information to interested public about the results and gained experience.

Specific aim of the Strategy is to define framework for establishment of CDM projects of national interest and their more efficient implementation through most suitable and most cost-effective ways of implementation.

The Strategy has 8 chapters. Brief description and general information about Kyoto Protocol, CDM mechanism and project cycle are provided in Chapter II. Information about Designated National Authority (DNA), including CDM procedure for project approval in the Republic of Serbia is provided in Chapter III. The following three chapters are dedicated to each of the identified sectors, i.e., to waste management, agriculture and forestry sectors, respectively. These chapters contain overview of the existing knowledge about CDM projects for each sector, as well as guidelines for project developers and CDM investors in the Republic of Serbia. These chapters also contain concrete proposals for Serbian Government about possible ways to support CDM projects in these sectors. It is important that chapter dedicated to forestry sector differs in organizational terms in order to meet specific characteristics of this sector. Chapter VII proposes specific measures for more efficient implementation of CDM projects before 2012, while potential possibilities for the period after 2012 are provided in Chapter VIII.

1.2. Methodology

The National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism under the Kyoto Protocol is the result of a holistic approach that involved representatives from governmental institutions, stakeholders and international experts.

Complexity of the topic, specific national circumstances and necessity for specific measures and actions required combination of a number of research methods, among which the most important are the following: literature research, interviews and talks with stakeholders and cost-benefit analysis with respect to projects which are deemed most feasible in waste management, agriculture and forestry sectors.

Literature research comprised analysis of books, texts, reports, relevant projects, strategic and legislative documents developed and published by relevant institutions at national and international levels. Application of this research method took place during the research period as way to perform double checks, as well as to provide help in selection of relevant data collected in talks and workshops organized with the aim to present the Strategy.

Official documents did not represent a complete source for a comprehensive analysis, particularly bearing in mind that National Communication and National Inventory of Greenhouse Gases are being in preparatory phase.

Therefore, thorough conversations with representatives from relevant institutions have been used in order to gain additional knowledge and obtain more information about potential CDM projects in waste management, agriculture and forestry sectors.

In addition, two workshops had been organized, at the beginning and the end of the project period, intended for stakeholders, including governmental institutions and organizations, local communities, private enterprises, farm owners, owners of agricultural and forest lands and landfills, and so on.

II KYOTO PROTOCOL AND CLEAN DEVELOPMENT MECHANISM

2.1. Relevant information about Kyoto Protocol

The Kyoto Protocol (hereinafter: Protocol) to the United Nations Framework Convention on Climate Change (hereinafter: Convention) is an international legal document adopted at the 3rd session of the Conference of the Parties (COP 3) to the Convention, held in December 1997, in Kyoto, Japan.

The Protocol entered into force in February 2005.

Kyoto Protocol defines quantified greenhouse gas (hereinafter: GHG) emission reduction targets expressed in percentage with respect to referent 1990, for 38 industrially developed countries, including also 11 countries with economies in transition in Central and Eastern Europe

It is important to say that industrially developed countries with quantified GHG emission reduction targets are listed in Annex B of Kyoto Protocol and Annex I of the Convention. The parties which are not listed in Annex I of the Convention are called non-Annex I Parties to the Convention. These countries do not have quantified GHG emission reduction targets, but they are obligated to fulfill general obligations stipulated in the Convention and Protocol.

Greenhouse gases which are regulated by the Protocol are listed in the Annex A of the Protocol, as well as categories of these gases as per sectors/sources. They are the following: Carbon dioxide (CO_2); Methane (CH_4); Nitrous oxide (N_2O); Hydrofluorocarbons (HFCs); Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6).

In accordance with relevant decisions, defined by the Kyoto Protocol, any GHG emission reduction is calculated and expressed through carbon dioxide equivalent (CO_{2e}).

Calculation of CO_{2e} is based on global warming potential (GWP), which is different for different GHG covered by Kyoto Protocol. Global warming potential is shown in Table 1.

GHG	GWP
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous oxide (N_2O)	310
Perfluorocarbons (PFC_S)	6500-9200
Hydrofluorocarbons (HFC_S)	140-11700
Sulphur hexafluoride (SF_6)	23900

Table 1: *GWP values for GHG listed in Kyoto Protocol*

In order to get better understanding, reduction of 1 ton of CH_4 is equal and is expressed as reduction of 21 tCO_{2e}; reduction of 1 tN_2O equals reduction of 310 tCO_{2e}, while 1 tSF_6 is equal to reduction of 23,900 tCO_{2e}. It is obvious that reduction of other GHG with respect to direct reduction of CO_2 ensures higher number of emission reduction units.

The Protocol introduced three flexible mechanisms, i.e., Kyoto Mechanisms. Kyoto Mechanisms may be used by Annex I countries in order to reach their quantified emission reduction targets prescribed by Kyoto Protocol. Flexible mechanisms established through Kyoto Protocol are the following:

1) ***Mechanism of Joint Implementation (JI)*** – defined in Article 6 and states: "For the purpose of meeting its commitments under Article 3, any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy";

2) ***Clean Development Mechanism (CDM)*** – defined in Article 12 and states: "The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3";

3) ***Emissions Trading (ET) Mechanism*** – defined in Article 17, which states: "The Parties included in Annex B may participate in emissions trading for the purposes of fulfilling their commitments under Article 3. Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article".

Based on the provisions of the Kyoto Protocol, non-Annex I Parties can only use the Clean Development Mechanism.

2.2. Clean Development Mechanism (CDM)

In accordance with the Article 12 of Kyoto Protocol, the CDM could be described as one of three flexible mechanisms which allows industrially developed countries (Annex I Party) to invest in projects which contribute to sustainable development, and which at the same time reduce GHG emissions in developing countries (non-Annex I Parties). Doing so, Annex I countries acquire right on emission reduction generated in the project (CER). These Parties may trade with such Certified Emission Reduction (CER), or they may use them to achieve their target values as prescribed by Kyoto Protocol.

As it has been already mentioned, in compliance with relevant decisions that result from Kyoto Protocol, emission reduction generated in project activity is calculated and expressed as CO_2 equivalent (CO_{2e}) emission reduction.

GHG emission reduction units which result from CDM project activity, the so-called Certified Emission Reduction (CER), are equal to 1 ton of CO_{2e}, i.e., 1 ton of CO_{2e} emission reduction, which equals 1 CER.

Taking into account that reduction of one ton of CH_4 is equal to reduction of 21 ton of CO_{2e}, this means that reduction of 1 ton of CH_4 implies issuance of 21 CERs, while direct reduction of 1 ton of CO_2 implies issuance of 1 CER.

Annex I Parties benefit more from their participation in CDM projects because instead of reducing emissions from their companies directly, they achieve emission reduction through project implementation in non-Annex I Parties. Doing so, Annex I Parties will fulfill their obligations towards Kyoto Protocol in more cost-effective manner.

At the same time, CDM project implementation enables non-Annex I Parties to get new and more energy efficient technologies under more favourable economic conditions. The technology remains in non-Annex I Party's ownership after the expiry to contracted CDM project implementation period (credit period). Advantage of CDM projects is that they enable implementation of a project which expected return rate is low due to related risks, i.e., projects which are not particularly profitable, but they still contribute to GHG emission reduction.

Of course, not every project activity which leads to GHG emission reduction will get CDM project activity status. Certain conditions, such as additionality criterion, must be fulfilled in order to qualify project as CDM project, and they are defined in Modalities and Procedures for Clean Development Mechanism (Decision 3/CMP1, paragraph 37). Technically, CDM project fulfill additionality principle if anthropogenic GHG emissions per source are lower that those which would occur in absence of registered CDM project activity implementation. That is to say:

a) The project activity is not prescribed by law, or even if it is prescribed, it may turn out that law "is not systematically in force" or "non-compliance is widely present" in that country;

b) Expected return is low due to the risks involved in the project;

c) Investment is available only under condition that the project has the CDM status;

d) Project developer developers have not developed similar projects in the past outside CDM framework

In accordance to the provisions of the Protocol and relevant decisions, beside the mentioned requirements and fact that Party has ratified the Protocol, there are other basic requirements for approval of the certain project activity as CDM, such as:

1) The project activity must be on a voluntary basis;

2) The project activity shall meet sustainable development criteria, that is, contribute to the sustainable development of the country where CDM project is to be implemented.

Parties participating in the CDM shall establish a Designated National Authority (hereinafter: DNA) for the CDM within Kyoto Protocol.

The role of the DNA is to approve the CDM at the national level which presents obligatory stage within the CDM project cycle.

2.3. CDM Project Cycle

CDM project cycle can be described as the process which starts from planning to distribution of Certified Emission Reduction (CERs). CDM project cycle includes: preparation of Project Design Document (PDD), national approval, validation, registration, monitoring, verification and certification and issuance of CERs.

It is important for the potential project owners and developers to have the basic information about the CDM project cycle in order to be well prepared for project implementation and negotiations related to the price of CERs. CER price depends firstly on the prices at international market, but also on the stage in which the CERs are sold, i.e., it depends on negotiation skills and realistic expectations.

Preparation of Project Design Document (PDD). According to the CDM rules, after planning the specific CDM project activity the project participants shall develop Project Design Document (PDD). PDD contains information about technical and organizational aspects of the project activity, evidence that emission reduction achieved by project shall be additional to any that would occur in the absence of the project and it has to be based on approved baseline methodology. "Baseline scenario" presents GHG emissions which would occur in absence of the proposed CDM project activity. "Baseline scenario" describes expected emission reduction, where determination of "baseline scenario" depends on selected CDM methodology for the specific case. Difference between "baseline scenario" and GHG emissions which occur after the implementation of CDM project activity presents emission

reduction and is equal to the expected certified emission reduction units. PDD must contain clear indications of: length of selected crediting period, average annual emission reduction and total expected amount of CERs which should be achieved during that crediting period.

PDD form has been developed by CDM Executive Board (CDM EB) and it has standard format, whose contents differs depending on the project type.

It is necessary to have certain experience for the development of project design document, and it is also necessary to have good knowledge about methodologies. If this is not the case, development of a PDD may take very long time (usually 2 to 36 months), while approval issued by DNA or CDM EB may become uncertain. To this end, it is recommended to hire experienced consultant for the preparation of PDD, especially bearing in mind that current rules and procedures of CDM implementation pertain to first commitment period (by 2012).

Costs for development of PDD range between 0 and 100,000 US$. Option of 0 US$ is realistic in the case when project owner also prepares PDD.

Costs and time needed for development of project design document depend primarily on the project size, but also on the experience, existing information and data, methodology to be applied in that specific case, etc.

National approval. When PDD has been developed, project participants shall submit that PDD to the DNA for national approval, i.e. in order to obtain Letter of Approval. In most cases, this written approval contains provisions that project activity in on voluntary basis and that it fulfils the sustainable development criteria of the hosting country. In some cases, Letter of Approval contains a provision about compliance of project activity to the provisions of Kyoto Protocol.

Rules of approval procedure and obtainment of the national approval depend on the Party. Letter of approval can be issued in different phases of CDM project cycle, but hosting country shall issue it before a request for registration.

Costs for the approval at national level depend on the DNA decision, i.e., on the Party. There are no charges for issuance of Letter of Approval by DNA in the Republic of Serbia.

Validation is the process of independent evaluation of the PDD and all related documentation. It is a sort of check whether such project activity fulfills CDM project criteria. Once the project passes validation phase, it may be submitted for registration.

Validation is carried out by Designated Operational Entity (DOE), accredited by UNFCCC. Information about accredited DOE may be found at: http//cdm.unfccc.int/DOE/list/index.html.

Costs for validation which are paid to the mentioned DOE range between 40,000 and 50,000 US$.

Registration (final approval) of the project as CDM project activity is done by CDM EB. Registration procedure prescribes that only a project which passed validation may be submitted for registration.

This stage of CDM project cycle may be implemented without participation of Annex I Party. This means that project owner may submit the project to CDM EB for registration even in the case that there is no investor for project implementation at that very moment. If this is the case, only written approval issued by the hosting country is required. At the issuance of CERs, certain amount is paid to CDM EB.

The amount needed for registration depends on the expected annual emission reduction

throughout crediting period.

Generally speaking, for the expected annual emission reduction throughout crediting period of 15,000 tCO_2e, which equals 15,000 CERs, registration fee will be 0.1 US$/CER. In the case when expected annual emission reduction during crediting period exceeds 15,000 CERs, registration fee will be 0.2 US$/CER. Maximal fee may amount to 350,000 US$, while fee will not be paid for CDM projects whose expected annual emission reduction throughout crediting period goes below 15,000 tCO_2e.

If certain project activity is not registered, registration fee which exceeds 30,000 US$ will be refunded.

Monitoring of CDM project activity is a stage which comes after the registration. The aim of this stage is to determine GHG emission reduction which occurs due to implementation of CDM project activity in accordance with the monitoring plan (which is inseparable part of project design document).

On the basis of project type and monitoring methodology, financial means needed for this project cycle stage differ.

Verification and certification is carried out by Designated Operational Entity (DOE). In order to realize this project cycle stage, project participants are obligated to submit monitoring report to DOE, which prepares verification report. On the basis of own verification report, DOE shall issue a certificate that project has achieved the stated GHG emission reduction, and that such reduction is real, measurable and additional (compared to what would have happened in absence of such project activity). The condition for submission of the request for emission reduction certificate which is issued by CDM EB is that DOE submits Certification Report.

Initial costs for this service amount to some 15,000 US$.

Issuance of CERs. CDM EB will issue that many CERs equivalent to verified emission reduction. CERs are issued within crediting period, starting from the registration.

In accordance with the agreement on distribution entered into between project participants, CERs ate distributed to registered accounts opened by the project participants.

Out of the issued CERs, 2% is allocated to Adaptation Fund, in order to help developing countries affected by climate change to adapt to changed climate conditions.

Crediting period may last up to: 7 years, and it can be renewed two times more or it may last for 10 years without renewal possibility. Choice of crediting period depends on the agreement made between project participants. Commencement of crediting period must be stated in project design document.

Issuance of CERs may be required for all GHG emission reductions since 2000.

2.4. Financial needs – possibilities and benefits

In accordance with the existing practice of CDM market, project owners/developers may sell their CERs in various phases of the project development, e.g., when project is at the idea level, during the development of project design document, during the validation, after the registration done by CDM EB, or after the issuance of CERs.

Issued CERs have the highest market value. Project developers who have enough funds to cover all the costs of project development, as mentioned in sub-chapter 2.3, and who are ready to take the risk of price fluctuations, usually delay sale of CERs until issuance thereof.

Issued certificates are kept at special account of CDM project within the Convention Register. In such case, project developer gets new technology without high investment costs.

Unlike that, need for advanced payment or intention to determine a fixed cash inflow from CERs sale entails their lower price.

There are certain international financial institutions and development organizations which offer support to CDM projects, including loans and advanced payments. In such cases, usually the first condition is to sign an agreement, and CERs are sold at pretty low prices. Taking into account low prices of CERs in those transactions, it happens quite often that use of advanced payment for CERs is less cost-effective than taking commercial loans from banks.

At the same time, in order to increase expected benefit from CDM projects, theoretically, the Government or hosting country of a CDM project may provide certain returnable financial support.

Without financial support from the Government, project owners usually sell CERs in early stage of the project cycle, which reduces total possible benefit from CDM project.

Of course, it is the fact that projects that are implemented through CDM would not be otherwise feasible, which is another benefit of CDM.

III INSTITUTIONAL AND LEGISLATIVE FRAMEWORK FOR IMPLEMENTATION OF CDM PROJECTS IN THE REPUBLIC OF SERBIA

3.1. Basic information

Republic of Serbia has been Party to Kyoto Protocol since 17 January 2008. Taking into account its non-Annex I status within the Protocol, one of three flexible mechanisms of Kyoto Protocol is available to the Republic of Serbia – 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. Hosting country is a non-Annex I Party where CDM project activity is implemented, in this specific case, this is Republic of Serbia.

"Designated National Authority for the Implementation of CDM Projects within Kyoto Protocol (DNA)" became operational in the Republic of Serbia on 21 November 2008. DNA was established on the basis of the Government Decision (05 no.: 02-2099/2008-1 dated 5 June 2008), while Agreement on the Establishment of DNA was signed on 30 July 2008. DNA, as separate body, was introduced into the national legislative framework through the Law on Air.

DNA is a multisectoral body in the Republic of Serbia, whose participants are representatives from relevant ministries.

Information related to the DNA are provided on:www.ekoplan.gov.rs/DNA.

3.2. Structure of the Republic of Serbia DNA

Serbian DNA consists of the Expert Group and Secretariat. DNA is chaired by the minister in charge of environmental issues.

The Expert Group consists of nominated representatives of the ministry in charge of water management, construction, economy, energy, environment, agriculture, regional development, mining, transport, finance and forestry. If necessary, in the case of specific

CDM projects, Expert Group's work may be supported by specially invited experts and representatives from institutions whose competences are relevant for certain projects, which do not have permanent representative in the Expert Group.

The Expert Group provides opinion on proposed CDM projects, i.e., it checks compliance of these projects with the provisions referred to in Kyoto Protocol, CDM sustainable development indicators and national legislation of the Republic of Serbia.

The Secretariat is actually composed of the Climate Change Unit, which operates within the ministry in charge of environmental issues.

The Secretariat performs professional and administrative activities for the DNA which in particular are: reception of CDM project proposals, establishment of contacts with stakeholders, coordination of the DNA operation, checks whether project developer had fulfilled all the obligations which result from the Law on Environmental Impact Assessment, submission of CDM project proposals to the Expert Group, preparation of draft Letter of Approval or Rejection and submission of these letters for consent from the ministries in charge of certain proposed CDM project, preparation of final Letter of Approval or Rejection, submission of Letter of Approval or Rejection to project developer and other administrative activities of DNA.

3.3.CDM approval procedure in the Republic of Serbia

The Republic of Serbia has adopted a two-tiered CDM approval process which includes submission of a Project Idea Note (PIN) on voluntary basis, and obligatory submission of a Project Design Document (PDD).

3.3.1. Approval procedure for PDD

In order to check and issue Letter of Approval for a CDM project proposal, project participants submit to the Secretariat an application which contains the following documentation:

1. Request for approval obligatory contains information about project participants, their names and addresses, date of the submission of the request for a specific project and project title. Serbian DNA has prescribed an official form for submission of request for approval, which is inseparable part of the Rules of Procedure of the DNA.

2. Project Design Document (PDD)

Scope, size and form of a PDD are prescribed by the CDM Executive Board (CDM EB). This form and information important for the development of PDD are available at CDM EB web page.

3. Justification for contribution of the proposed project to sustainable development of the Republic of Serbia, i.e., listing of the national CDM indicators of sustainable development, which are inseparable part of the Rules of Procedure of the DNA, with the short justification.

In order to establish contribution of proposed CDM projects to sustainable development of the Republic of Serbia, national CDM indicators of sustainable development have been developed. Sustainable development criteria have been divided into areas and indicators in compliance with the national indicators of sustainable development (Sustainable Development Strategy of the Republic of Serbia). The proposed project must fulfill at least one of the listed indicators for each of three sustainable development criteria. Project participants provide brief explanation on the contribution of the project to these criteria.

4. Preliminary validation report prepared in accordance with procedures prescribed by the CDM EB.

In order to ensure compliance with the Kyoto Protocol, and in order to reduce possibility of rejection of certain project activity as CDM activity in later stage, submission of preliminary validation report is required, whereat such report is to be prepared by DOE. This report is submitted only in English language.

5. Decision on Approval of Environmental Impact Assessment Study of a particular project, if obligatory, or Decision which states that it shall not be necessary to perform the aforementioned assessment for the specific project, all in compliance with law.

Taking into account that environmental impact assessment is obligatory for specific projects, development of such Study helps in avoiding potentially opposite decisions within two processes.

6. Agreement which describes relations among project participants

This condition contributes to better understanding of relations between project participants, if there is more than one.

Project participants submit request for approval, as well as other listed documentation to the ministry in charge of environmental issues, i.e., to the DNA Secretariat. Within 3 days, the Secretariat will establish whether documentation is complete, and if it is not, it will send a request to the project participants to submit the missing documentation items.

Project participants have maximally 10 days to submit the missing documents; otherwise, it shall be deemed that request has been rejected. In the case of further interest, project participants are obligated to submit a new request.

Upon the completion of documentation, the Secretariat publishes project document at the official DNA web page, where it stays for 7 days for public consultations.

Upon the expiry of this period, the Secretariat sends the received documentation, together with relevant comments received from the public, to the Expert Group members so that hey could provide opinion on the proposed project activities.

Expert Group members finalize their work and they send their opinion on behalf of their ministries to the minister in charge of environmental issues, within 15 days.

On the basis of these opinions, the Secretariat drafts Letter of Approval or Rejection, and minister in charge of environmental issues sends graft Letter of Approval or Rejection to the ministry in charge of that specific CDM project for consent, within 3 days as maximal period. Competent ministry is obligated to provide its consent to Letter of Approval or Rejection within 3 days from the day of reception.

Finally, minister in charge of environmental issues signs Letter of Approval or Rejection, and sends it to project participants within 3 days.

Letter of Rejection includes rationale which contains references to those elements according to which the proposed project activity is contrary to provisions of the Kyoto Protocol, national CDM indicators of sustainable development and relevant national legislation of the Republic of Serbia, making reference to certain provisions.

At the end of the process, the Secretariat publishes decision made by the DNA at the official DNA web page.

The procedure may take longer time if members of the Expert Group, upon the reception of documentation, require from the project participants to provide additional information or in the case of negative opinion given to draft Letter of Approval or Rejection.

3.3.2. Approval procedure for Project Idea Note (PIN)

Submission of Project Idea Note (PIN) to Serbian DNA is on voluntarily basis.

In the case of submission of PIN, project participants submit PIN only in the form as prescribed by DNA of the Republic of Serbia (provided in the Rules of Procedure of DNA) with justification on how the project contributes to sustainable development of the Republic of Serbia. Actually, they state which national CDM indicators of sustainable development have been fulfilled, with brief explanation.

Procedure related to the request for letter of approval and manner of making decisions about PIN and PDD are similar. The difference is in length of basic period for the opinion provided from relevant ministries.

The Letter of Support does not oblige the DNA of the Republic of Serbia to issue Letter of Approval once Project Design Document is submitted for check and approval.

IV POSSIBILITIES FOR IMPLEMENTATION OF CDM PROJECTS IN WASTE MANAGEMENT SECTOR

4.1. Aims and definitions

The waste management sector has been attracting a lot of attention since the start of the application of Kyoto Protocol. The main reason is that projects in this sector reduce large volumes of GHG emissions with relatively small investments over a short period of time.

Although the Republic of Serbia has established necessary institutional framework to use the market established by Kyoto Protocol, justification and expected benefit from CDM project implementation may be conditionally put under question, taking into account that we are in the middle of Kyoto period.

On the other hand, certain advantage is seen in possibility of utilization of already existing knowledge and experience in this area at international level. This is particularly possible in waste management sector, where there a number of researches, as well as specific project activities have been conducted in the previous ten-year-period.

In order to use the aforementioned potential advantage, this chapter is prepared with the goal to disseminate the available knowledge about CDM projects and provide guidelines for project owners and developers. The aim of the chapter is to contribute to identification of some of the CDM possibilities in waste sector and ways for provision of support to the implementation of CDM projects by institutions of the Government of Republic of Serbia. More specifically, the aim of this chapter is to identify:

a) Potential for GHG emission reduction and contribution to sustainable development through Clean Development Mechanism;

b) Priority areas for CDM project development;

c) Possible measures in order to ensure more efficient and cost-effective implementation of CDM projects.

The chapter provides overview of the current status and trend of the waste management CDM projects, results and challenges noticed during the development and implementation of these projects, as well as their possible implications for the Republic of Serbia. This is all presented bearing in mind current practice, types of disposal sites and other relevant

characteristics of the sector at national level. The chapter provides overview of specific possibilities for development of CDM projects in the Republic of Serbia and cost and benefits analysis for most viable CDM projects at national level, including theoretical possibilities for provision of financial support.

It should be remembered that activities within Clean Development Mechanism, and in compliance with the Marakesh Accord, are exclusively the activities on voluntarily basis. CDM projects may only be developed at the individual initiative from the project developers, not by the initiative of the Government. Role of the Government is to ensure necessary institutional and legislative structure for project approval at the national level. The Government may possibly create administrative and financial support for specific types of CDM projects that are considered as projects of national interest.

Therefore, guidelines and recommendations cannot be deemed as binding for any party, both for the developers and the Government of the Republic of Serbia.

In order to identify possibilities for implementation of CDM projects in waste management and beside different ***definitions,*** for the purposes of the Strategy, waste sector shall be defined as: ***"Collection and management of solid municipal waste and all related activities".***

4.2. Existing experience at international level

The waste management sector has been attracting a lot of attention since the start of the Kyoto Protocol. The high expectations about waste management sector are also reflected in the fact, two of the three earliest approved CDM methodologies, AM0002 and AM0003 (now consolidated in ACM0001), were related to waste management sector.

The main reason for such interest is that projects in the waste sector could reduce large volumes of methane emissions with relatively small investments. The average payback period of a biogas capture and utilization project is on the average year to year and a half only from the sale of carbon credits (Certified Emission Reduction - CERs).

When some of the first MSW projects started operations and the real emissions from methane avoidance were measured, it became evident that these projects were generating up to 70% less methane than originally estimated in the PDDs of these projects. This was considered to be a very serious issue, especially due to the fact that most of these projects had their financial plans designed, incorporating the original estimates for emission reductions and the associated investments. These unexpected unfavorable developments demanded new methodological work to be undertaken in that area.

Researches have shown that methane emissions depend on the type of waste deposited, on type of waste disposal sites (landfills or dumpsites), climate, and a number of other factors.

It has been noticed that landfill gas (LFG) projects can generate much more methane in tropical and subtropical areas than at waste disposal sites in the temperate climate zone, where Republic of Serbia is situated.

Waste at dumpsites tends to generate less CO_2, as it has more contact with oxygen, compared to waste in managed waste disposal sites, i.e., in landfills.

The obtained results affected the adoption of new models for GHG emission estimation. These models have been approved by the CDM Executive Board, and they can be found in the "Methane Tool" document.

In order to enable that theoretical models, provided in this document, ensure reliable estimations of methane emissions for each individual case, it is necessary to develop

feasibility studies because every landfill has certain individual characteristics. For example, at the territory of the Republic of Serbia, disposal sites where no treatment of waste (like leveling, or where waste is scattered around or transferred from one location of the WDS to another) is performed, will generate on the average much less methane that a similarly sized managed landfill.

These new findings may look disappointing, but it should not be forgotten that they allow design and implementation of CDM projects based on more realistic assumptions about the amount of LFG that a project can generate. Also, implementation of CDM projects in waste management sector in the Republic of Serbia is supported with the fact that such projects may, to great extent, solve long-lasting existing problems in this area.

Justification for the implementation of these projects is supported by current number of CDM projects at global level.

As of September 2009, CDM projects which pertain to use of methane still remain the third most popular type of projects according to their number, preceded only by renewable energy projects and production of energy from waste. So far 1,003 projects have been developed and submitted for validation in the area of methane gas utilization, and among them approximately two-thirds come from LFG projects (Figure 1). From these projects, 138 have already been officially registered by the CDM Executive Board and are generating emission reductions.

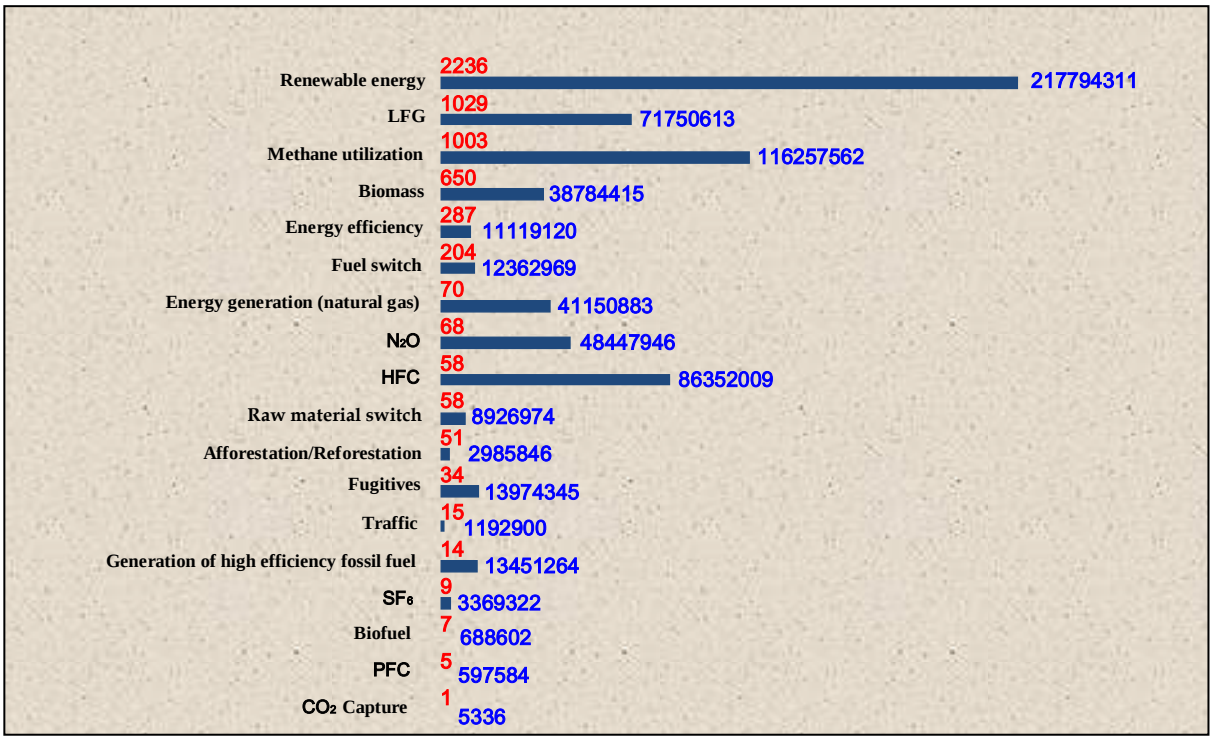


Figure 1 *CDM projects submitted for validation (as of September 2009)*

In terms of regional distribution, China and Brazil are the leaders in the development of LFG capture and utilization projects; however, such projects are also being developed in other countries in Asia, Latin America and Eastern Europe (See Figure 2).

Such regional distribution is a consequence of large populations and climate conditions in these countries, but at the same time it is important to bear in mind that all these countries were some of the early participants in the CDM process. It should be noted that LFG capture

and utilization projects have a much more even distribution around the world compared to other types of CDM projects, because it is easier to implement and use well established and readily available methodologies and technologies.

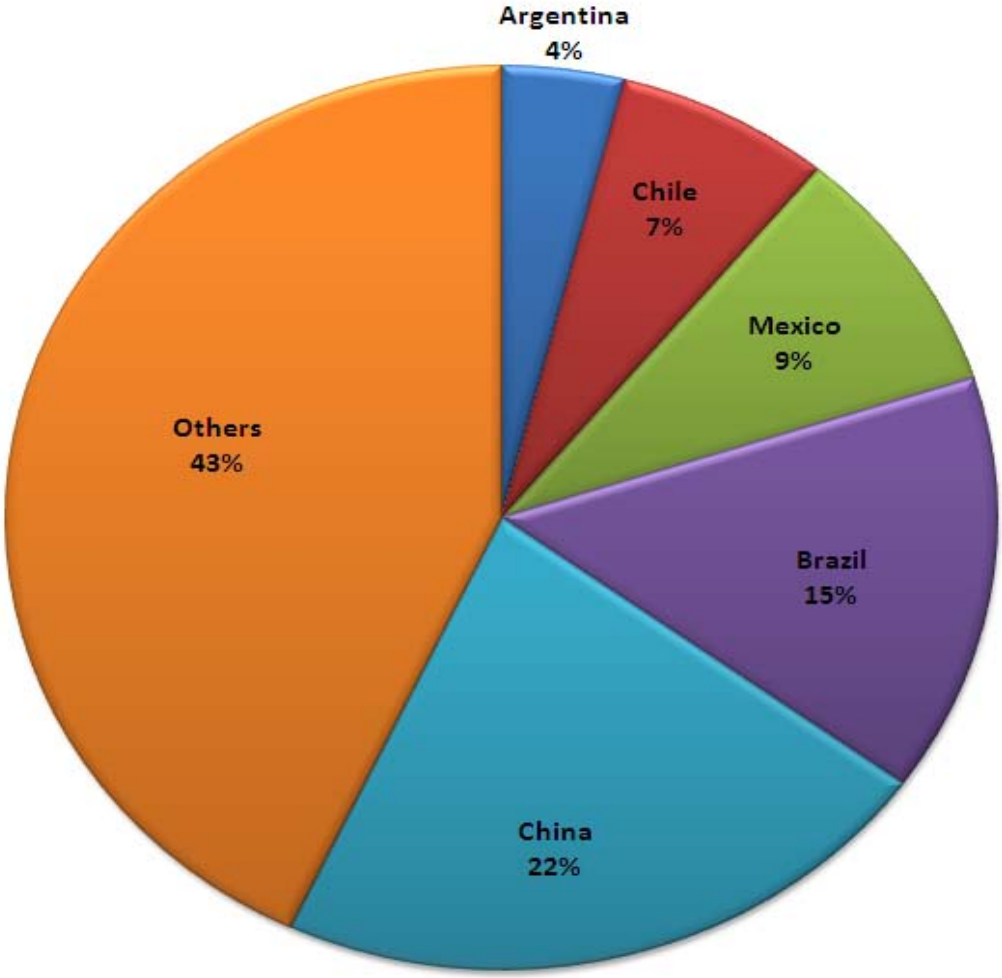


Figure 2. *LFG flaring CDM projects by country*

From the aspect of identification and preparation of CDM projects, it is crucial to remember that each CDM project is required to use an officially approved methodology. Currently approved CDM methodologies cover comprehensively most of the types of projects in the waste management sector.

It is possible to prepare new methodologies, which requires additional time needed for project preparation (may take more than a year). Preparation of new methodology, beside time, requires experience in the field, which means that most commonly it requires support from specialized CDM consultants.

It is not expected that the development of any new methodologies for projects in the Republic of Serbia will be needed up to the end of 2012 (with the exception of Programmatic CDM). Some changes are however expected to adjust the methodology to specific local conditions.

Therefore, this chapter of the Strategy is based on the current state of methodology approval in the waste management sector.

4.2.1. Landfill gas capture and flaring

Landfill gas is formed in the anaerobic process of decomposition of organic waste, i.e. process of decomposition in an oxygen deficient environment. It contains a large share of methane (approximately 50%), with a global warming potential of 21. This means that influence of methane to greenhouse effect is twenty-one times stronger than that of CO_2 direct emission. By capturing methane formed at a landfill and flaring it, methane is oxidized and chemically transformed into CO_2.

The most commonly used methodology for LFG flaring is ACM0001 "Consolidated baseline and monitoring methodology for landfill gas project activities" or AMS-III.G. for small scale project activities (project activities with emission reductions below 60,000 tCO_2e/yr). These methodologies have to be used in combination with the Methane Tool, as well as a number of other methodological tools.

An important factor that ***should not be neglected*** is the estimation method for methane emissions. As the climate in the Republic of Serbia is classified as temperate and humid, the coefficients prescribed for these climatic conditions should be applied. It should be also remembered that in the case of LFG capture projects, CERs are issued based on the amount of captured methane, not the amount of methane generation and capture predicted in the project design document.

4.2.2. Landfill gas capture and electricity/heat generation

Landfill gas generated in anaerobic process of waste decomposition contains high percentage of methane (approximately 50%) and may present a significant energy source. Therefore, instead of being flared, methane can be used for heat or electricity generation.

In this case, in addition to the above methodologies in 4.2.1, project developers should use the relevant methodologies for renewable electricity and heat generation, namely "Tool to calculate the emission factor for an electricity system". For small-scale projects that generate heat or electricity, methodology AMS-I.C. should be used respectively.

All projects related to electricity generation have to calculate the carbon emission factor (CEF) of the electricity grid. National Power Industry of Serbia (Elektroprivreda Srbije, EPS), has calculated annually the CEF of the national grid and that information has been published officially at the DNA web page. This piece of information is relevant for renewable power generation projects.

4.2.3. Injection of LFG (biogenic methane) in the natural gas grid

Injection of LFG in the natural gas supply network is another method for utilization of LFG through CDM project activities. As part of these types of projects, biogas is injected in the natural gas network; it mixes with natural gas and is combusted by end users of the natural gas network, instead of being flared or combusted for heat/electricity generation.

Two methodologies are relevant for these kinds of projects, AM0053 "Biogenic methane injection to a natural gas distribution grid" and AM0069 "Biogenic methane use as a feedstock and fuel for town gas production".

4.2.4. Methane avoidance and alternative forms of waste management

Project types described above involve capture of LFG, which is already formed in the process of organic waste decomposition. CDM project activity can make it possible to avoid emissions of methane, i.e. avoid waste disposal and decomposition through different forms of

alternative waste management. Such alternative forms of waste management involve composting of MSW, pyrolysis, combustion, incineration of MSW and others.

For these types of projects, a different methodology is developed, AM0025 "Avoided emissions from organic waste through alternative waste treatment practices". A special methodology is developed for the case when MSW is co-composted with waste water sludge, AM0039 "Methane emissions reduction from organic waste water and bioorganic solid waste using co-composting".

The methodologies for alternative waste management involve very complex monitoring procedures, especially regarding regular monitoring of waste content and volume. For composting projects monitoring has to be carried out to guarantee that waste is decomposing in aerobic conditions during the production of compost. Emission reduction achieved in such manner is calculated indirectly, unlike the previous examples.

The list of approved methodologies related to the waste management is presented in Table 2.

	Methods	**Regular scale methodologies**	**Small scale methodologies**
Landfill gas	Landfill gas capture and treatment	ACM001 AM0075	AMS-III.G.
Alternative methods for MSW treatment	Composting, gasification, bio-digestion, thermal treatment, incineration	AM0025	
	Aerobic treatment of MSW	AM0039	AMS-III.F.
	Aerobic treatment of MSW	AM0039	AMS-III.F.

Table 2. Approved CDM methodologies relevant for the waste management

4.2. Current status in the waste management sector in Serbia[1]

Data from the report made by Environmental Protection Agency, Ministry of Environment and Spatial Planning (March 2008), National WDS Database of the Republic of Serbia and National Waste Management Strategy with the programme of harmonization with the EU, have shown that there are 164 official municipal waste disposal sites at the territory of the Republic of Serbia. Beside this large number, many of them do not fulfill international standards for sanitary landfills.

This is a large number of disposal sites for a country with population like the Republic of Serbia (according to 2002 census, approximately 7.5 million[2]). In addition to these, there is a large number of unofficial dumpsites, which are not controlled by any municipality.

[1] This section presents a short review of the current state of the waste management sector in Serbia based on reports prepared by the Environmental Protection Agency of the Ministry of Environment and Spatial Planning (Belgrade, March 2008), as well as data from the National WDS Database of Serbia

All municipalities in Serbia except about fifteen have at least one landfill. The oldest operating landfill in Silbas, Backa Palanka Municipality, was opened in 1956, and the newest landfills in Backa Palanka, Obrovac, Bela Palanka, Malo Crnice, Pancevo and Tutin, were opened in 2005.

Territorial distribution of landfills across the Republic of Serbia is shown in Figure 3 below.

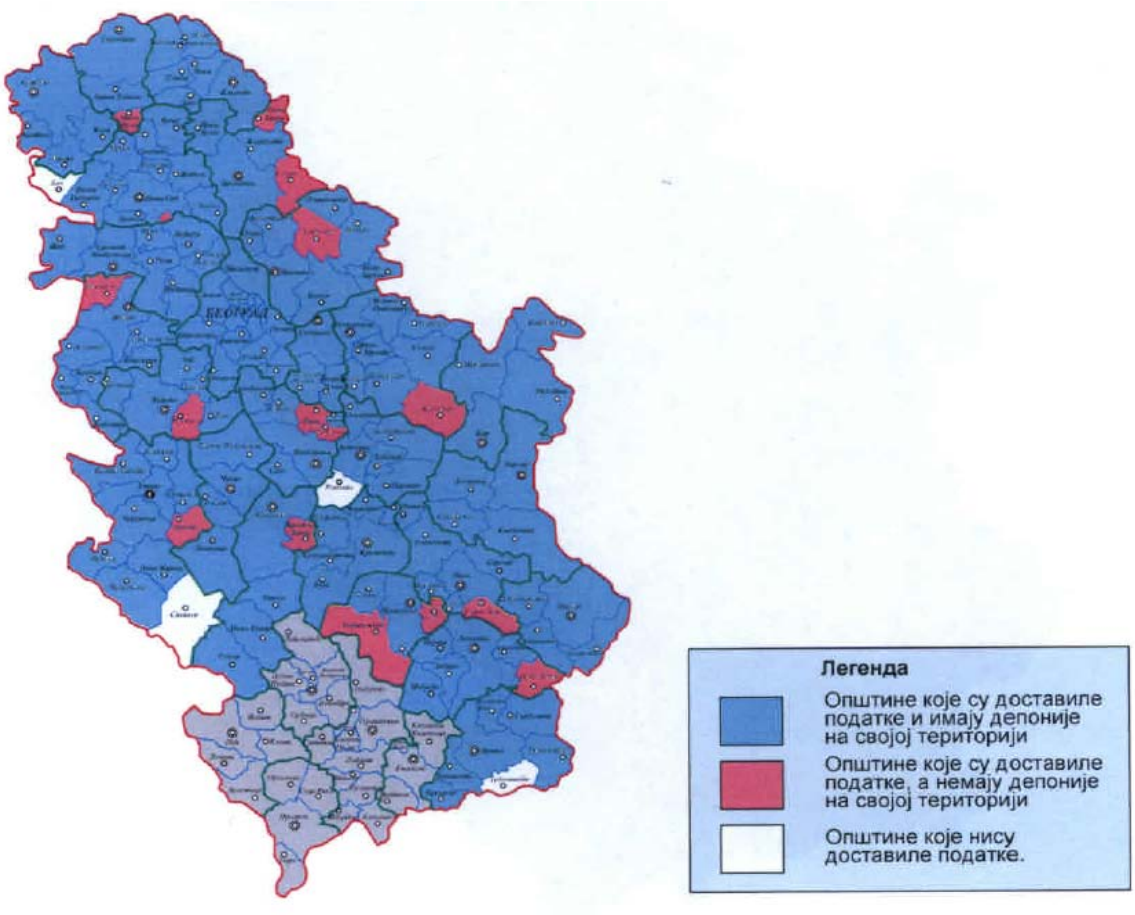


Figure 3. Territorial distribution of landfills in the Republic of Serbia

Approximately 2,200,000 t of MSW are disposed annually in Serbia[3]. It is estimated, on the basis of IPCC Guidelines (from 2006)[4], that approximately 82,000 t of methane is emitted annually from all landfills. This corresponds to a little over 1,700,000 tCO_2e.

The average composition of MSW in the Republic of Serbia is provided in Table 3 below.

Waste Type	Minimum share (%)	Maximum share (%)	Average share (%)
Paper	0	54.0	16.4
Glass	0	20.0	5.2
Plastic	0	50.0	12.9
Rubber	0	23.1	3.4

[2] Excluding Kosovo and Metohija, 2002 Census
[3] National Waste Management Strategy of Serbia with the EU harmonization programme
[4] The bulk-waste method, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste, Chapter 3: Solid Waste Disposal

Ferrous metals	0	19.5	4.8
Aluminum	0	12.8	2.5
Organic waste	5	73.1	29.6
Construction waste	0	50.4	11.6
Textile	0	15.0	3.6

Table 3. *Composition of municipal solid waste in the Republic of Serbia*

Complete and detailed analysis of the composition of organic waste in Serbia has not been thoroughly performed yet. Certain papers and surveys do not differentiate between park/garden waste and agriculture waste. Other surveys summarize all types of waste as biodegradable waste.

In large cities it is estimated that food waste is between 20-30%, and park waste between 5-10% of total disposed waste. For rural areas share of park and agricultural waste may reach 40% of total disposed waste.

Since there are no reliable data about composition of municipal waste, for each potential CDM project in the future, it is recommended that a survey of waste composition, i.e., waste categorization, in accordance with the CDM requirements has to be performed. In this context, it is necessary to establish the waste composition containing wood products, paper and cardboard, food waste, textile, park and agriculture waste and other inert materials, as prescribed by IPCC Guidelines from 2006.

According to a report by the Environmental Protection Agency of Serbia from 2007, covering materials are applied in 117 landfills, or 72 % of all existing landfills, of which at 15 on daily basis, monthly – at one, and at 101 landfills – as appropriate. At ten landfills bulldozers and other equipment are used for waste leveling. Except for four landfills, no additional waste treatment measures are being implemented at most of the landfills. At the Vrsac landfill, waste undergoes chemical and physical treatment, and at Arandjelovac, Vinca and Vranje landfills, conditioning treatment is performed.

Waste separation, with the exception of few examples where this is done on voluntarily basis, is not being performed. Waste is collected and disposed of together. In 163 out of 164 registered landfills, municipal waste is disposed. Medical waste is disposed at 84 ones, animal waste (animal carcasses) at 83, while hazardous waste is disposed at 60 landfills.

Waste management practices in Serbia require significant improvement. It is especially needed in the area of waste separation, and treatment of hazardous waste, medical waste and other types of waste that require special treatment.

Republic of Serbia has already started looking for new solutions for improving its waste management practices. The first step in that direction was the adoption of new Law on Waste Management and Law on Package and Packaging Waste. The reviewing process of the "National Waste Management Strategy Including the Program of Harmonization with the EU", adopted by the Government of the Republic of Serbia in July 2003, is in its final phase. Adoption of the "National Waste Management Strategy 2009-2012" is expected in 2010. The aforementioned documents will contribute to harmonization of standards and practices in the area of waste management with the requirements of EU legislation.

4.3. Potential areas for implementation of CDM projects in the Republic of Serbia

Based on the international experience, primarily existing CDM methodologies, as well as the situation waste management sector in the Republic of Serbia, it is considered that the

following project types have the potential for development under the CDM at the national level:

a) LFG collection and flaring;

b) LFG collection for energy generation;

c) Composting of solid municipal waste;

d) Other alternative forms of waste management.

Significant potential for the Republic of Serbia is seen in the use of *Programmatic CDM*, which will be discussed later.

Implementation of project activity of ***LFG injection is not deemed*** *realistically feasible CDM activity in the period until 2012,* taking into account the lack of a wide-spread natural gas supply network in the Republic of Serbia, and the high investment costs.

4.4.1. LFG collection and flaring

LFG collection and flaring is one of the most common ways for utilization of methane from existing landfills and for prevention of methane emission to the atmosphere.

A standard LFG collection system consists of a system of pipes laid around the landfill, a blower (LFG sucking system) and a flare (See Figure 4). The efficiency of LFG collection systems varies depending on their design, but is usually from 60 % to 80 %[5].

The biggest advantage of flaring systems is that they are relatively cheap and do not require sophisticated equipment. LFG collection and flaring systems can be installed even in medium size landfills that do not have the potential to produce sufficient volumes of methane for electricity or thermal energy generation.

It has been estimated, on the basis of UNFCCC Methodological Tool[6], that if LFG collection systems with an average efficiency of 60% are installed in half[7] of the existing landfills in the Republic of Serbia, approximately 500,000 tCO_2e can be reduced every year, or approximately 30% of the methane emissions from landfills every year in the forthcoming ten-year-period.

In order to obtain accurate data, detailed estimates of possible emission reductions have to be made for each landfill, taking into consideration the exact waste composition and waste management practices at each site.

[5] US Department of Energy

[6] UNFCCC Methodological Tool "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", Version 4

[7] In terms of MSW handled

Figure 4. LFG collection and flaring system

The National Waste Management Strategy with the EU Harmonization Programme proposes most of the existing landfills to be closed. Their functions should be taken over by the new regional landfills. When existing landfills are closed, waste decomposition processes continue and methane continues to be generated and emitted for years ahead.

Therefore, ***closed landfills, or closed sections of operating landfills can be the first candidates for the development of this type of CDM project***.

Since landfills and other waste disposal sites are under competence of ***municipalities***, while ***public utility companies*** operate the landfills, *they can, as well as potential concessionaries become* ***potential developers of CDM projects***.

Implementation of CDM projects would generate additional cash inflow to the municipalities, and would bring significant additional local environment benefits and better living environment in general, as LFG collection will decrease the emissions of odorous gases and will decrease the possibility of occasional uncontrolled fires.

This type of project is suitable even for small-sized landfills, because it does not require huge investments, which could be returned to great extent through sale of certified emission reduction (CERs).

4.4.2. LFG collection for energy generation

The main difference between LFG collection systems for energy generation and simple flaring is in the addition of a steam boiler or electricity turbine to the system described in 4.4.1. If a project involves the installation of a gas turbine, it is necessary to additionally install a gas purification system, and most commonly, LFG collection system.

LFG collection system serves to compensate for the variations in the amount of LFG generated, which occur due to the fact that generation of LFG varies depending on seasons and times of the day.

Utilization of LFG may be an important source of energy, especially taking into account that energy prices are rising, and that Republic of Serbia imports part of its energy.

It should be noted that not every landfill is suitable for the implementation of project activity which will result in energy generation.

As a rule of thumb, *a landfill that generates a minimum of 1,200 m^3/yr of methane (approximately 2,500 m^3 of LFG/yr) can support the work of an electric turbine, with a generation capacity of 1 MW.*

Translated to Serbian conditions, this means that a ***landfill that has been operating for at least ten years and have been accepting between 100,000 – 200,000 t/yr of solid municipal waste with high organic content.*** Smaller landfills may be suitable for installation of lower capacity boilers.

Economic and financial analyses have to be performed in each individual case, including the costs for connection to the grid, and the legal framework regulating the purchase of electricity from renewable power sources. In case of smaller landfills which are located close to villages or towns, landfill gas can be used for generation of thermal energy. This would be usually justified, if there is a district heating network in the town or if there is a near-by direct heat consumer, e.g. a farm or a plant.

Analysis of the data obtained from the Environmental Protection Agency of the Republic of Serbia for individual landfills in Serbia, has demonstrated that ***electric energy generation might be justified in the landfills in the cities of Belgrade, Novi Sad and Nis***.

Estimates of annual emission reductions from methane capture and destruction at each of the three sites are presented in Table 4. The estimates have been done under assumption that LFG system with average capacity of 60% had been installed, on the basis of UNFCCC Methodological Tool.

Of course, individual estimates which take into account composition of waste and waste management practice should be done in case of planned CDM project implementation.

	Belgrade (Vinca)	Novi Sad	Nis
Annual volumes of solid municipal waste handled (t)	750000	487000	175000
Emission reductions from methane capture and destruction (10-year average, tCO_2e)	189402	122988	44196
Emission reductions from methane capture and destruction (2010 – 2012, tCO_2e)	346014	224688	80763

Table 4 Potential of emission reduction at large landfills in Serbia

Installation of methane capture systems at the above three landfills is expected to contribute to a 25%-reduction of the overall methane emissions from solid municipal waste.

If a 1 MW power generator is installed in each of the sites, it would lead to additional annual emission reductions of approximately 6,000 tCO_2e from substitution of grid electricity.

Methane generation, even at these landfills, will heavily depend on the weather conditions. Only small volumes of methane will be generated in the cold winter months. Therefore, careful analysis of such options has to be carried out, and the most appropriate capacity of the turbines to be installed.

4.4.3. Composting of solid municipal waste

Composting of solid municipal waste is one of the common measures for methane avoidance and a widely practiced form of waste management. Not only does it prevent methane emissions through creating conditions for aerobic decomposition of solid municipal waste, but also leads to the production of a clean organic fertilizer.

CDM projects of this type have been commonly developed in many different countries around the world. The biggest challenge for implementation of such projects is the lack of a system for separation of solid municipal waste, because for the production of high-quality compost, the compost producer should use only organic waste.

Implementation of such projects may encounter certain barriers and challenges in the Republic of Serbia, taking into account lack of waste separation system, and therefore, ***composting of solid municipal waste is not deemed a feasible CDM project type*** in the period up to 2012.

4.4.4. Other alternative forms of waste management

Waste management practices under the CDM are not limited to the types of projects described in the previous subchapters of chapter 4.4. Waste collection and incineration for production of thermal and electric energy can be a CDM project and is widely practiced in the European Union, U.S. and Japan (Figure 5).

Figure 5. Waste incineration plant in Osaka, Japan

A prerequisite for efficient waste incineration is waste separation. Construction of waste incineration plants requires very thorough feasibility research, including the logistics of waste transportation and the plants' locations. No such studies are currently available in the Republic of Serbia.

Although Republic of Serbia should carefully look into advanced waste management practices and necessary technologies, none of them are considered to be realistic options until 2012. ***No CDM projects with alternative waste management practices are expected to be developed*** before the end of 2012.

4.4.5. Programmatic CDM

Previously listed possibilities for implementation of CDM projects do not take into consideration CDM projects of small reduction potential. Project activities of small reduction potentials are not feasible under traditional CDM approach, because profit gained in CDM is lower than transaction costs of the CDM itself.

Such example is collection of landfill gas at those ***landfills with annual reception of solid municipal waste below 15,000t***.

Since such cases are not typical only for the Republic of Serbia, in order to reduce transaction costs[8] and in order to establish potentials for implementation of CDM projects of smaller reduction potentials, Programmatic CDM has been developed under Kyoto Protocol.

Programmatic CDM enables implementation of projects of smaller reduction potentials at lower investment costs, under the programme which involves similar measures of GHG emission reduction. All the projects included in Programmatic CDM have to use the same technology and methodology. The Programme itself contains exact description of measures, technology to be applied, as well as methods of baselines scenario determination.

Within the programme, monitoring plans for individual project activities and the programme as whole must be also defined.

Every project which fulfills conditions defined in the programme may be added to it at any time without developing new project design document and passing the complex approval procedure.

Typical example of projects implemented under the ***Programmatic CDM may be LFG collection and flaring at closed landfills.***

In order to be as efficient as possible and attract as much attention as possible, Programmatic CDM may be focused to collect projects leading to a minimum of 100,000 tCO_2e/yr. Such a programme can contribute to a 6% of methane emission reduction from MSW collection.

Since the beginning of Programmatic CDM, there has been general opinion that greatest challenge in the development and implementation of these projects is actually project management. As this programme may involve tens and hundreds of project activities owned by different entities, working coordination between various owners, data collection and processing, as well as other activities require specially trained management team. Such management teams may be located within relevant governmental agencies in charge of specific project types.

Estimates have shown that the following programmes are most suitable for the Republic of Serbia:

a) LFG collection and flaring at closed landfills;

b) LFG collection for electric energy generation;

c) LFG collection and generation of thermal energy.

In order to implement Programmatic CDM as simple and as efficient as possible in the Republic of Serbia, possible organizational structure and implementation of necessary steps to enable establishment of necessary structure are provided below.

[8] Standard term which denotes costs needed for development of project design document, validation, registration, monitoring, verification and issuance of CERs

The procedure described below guarantees full transparency of the programme development and operation, and it provides support to smaller projects.

1) Competent agency (hereinafter: Agency) develops several concepts for Programmatic CDM in waste management.

The Agency, in collaboration with experienced consultants, develops CDM programmatic project idea notes and project design documents for each of the programmes.

The Agency, as necessary and at the proposal from project developers, may add new programme types. The programmes also should be harmonized with priorities of economic development of the Republic of Serbia. Data about all proposed projects may be maintained in specially developed Microsoft Excel © or Access © database.

2) The Agency announces a permanent public invitation for submission of proposals which would be a sort of addition to the programme. Every additional project must contain a special form with the request for project submission, which is pretty similar to the project idea form, on the basis of which such project is introduced into the programme.

In addition, it is necessary to provide an expert opinion, i.e., opinion issued by the Designated Operational Entity or national expert, which confirms that that particular project may be introduced into the programme and that it fulfills all the conditions referred to in the programme.

3) The Agency holds regular meetings where they make decisions on which projects should be added to the existing programmes, as well as on the necessity for development of new programmes.

When official decision has been made, those projects which are introduced into the specific programme are publicized.

4) For each individual project introduced into the programme, monitoring has to be performed, in accordance with the monitoring plan. Monitoring plan makes inseparable part of the project document.

Results from the monitoring are submitted annually to the Agency. At the beginning of each year, the Agency performs verification of monitoring data, and it also performs field visits, if necessary.

4.5. Project development potential until 2012

Analysis of CDM project implementation potentials in waste management in the Republic of Serbia has demonstrated that, theoretically, they could include: LFG capture and flaring, LFG capture and energy generation, composting of solid municipal waste and other alternative waste management practices. *Programmatic CDM* also presents significant potential for the Republic of Serbia.

Taking into account specific conditions and waste management practices in the Republic of Serbia by 2012, it is most realistic to expect ***implementation of LFG collection and flaring projects, as well as LFG collection for electricity generation projects*** under the CDM project activity.

Programmatic CDM may be particularly suitable and feasible in the Republic of Serbia, bearing in mind high number of landfills with low reduction potentials. In these landfills, project activities could not be implemented under individual CDM. It is most realistically to expect implementation of the following: ***LFG collection and flaring at closed landfills, LFG***

***collection for electric energy generation and LFG collection and generation of thermal energy*.**

Republic of Serbia could promote implementation of Programmatic CDM, both at national and regional levels.

In order to maximize the CDM potentials of the Republic of Serbia in the waste management sector until 2012, it is recommended that project developers concentrate their efforts in LFG capture and utilization projects, either involving only flaring or energy generation as well. Implementation of this type of activities may lead to significant increase in cost-effectiveness of project activities and enable implementation of projects which otherwise would not be possible, but they can also contribute to sustainable development at national level.

The two case studies presented below provide justification of CDM project implementation and give a better picture of how the economics of such projects can change with the involvement of additional CDM financing.

4.5.1. LFG utilization for electricity generation (case study)

The case study will demonstrate that, with the CDM, an extremely unprofitable project for electricity generation from landfill gas, can become extremely profitable. Change in the project profitability occurs due to the additional income from the sale of CERs.

As an example we will take a landfill in the Republic of Serbia which has been opened for 10 years, and has been receiving 750,000 ton/yr of solid municipal waste. The landfill is a managed landfill. Inert material cover is applied daily and waste is leveled once a month.

The landfill consists of two sectors. While the old sector of the landfill is closed, the new sector will continue accepting solid municipal waste.

Electricity from renewable energy is purchased at €7 per MWh.

CDM project involves installation of an LFG collection system with 60% efficiency and the installation of a 2 MW_e turbine in the old, closed sector of the landfill.

Table 5 below shows the estimated volumes of methane and electricity generation for the period 2009 – 2012.

Year	2009	2010	2011	2012
tCH_4	10,978	9,896	8,953	8,128
Electricity (kWh)	12,000	12,000	12,000	12,000
Income from the sale of electricity(EUR)	84,000	84,000	84,000	84,000

Table 5. *Quantities of generated methane and electricity from LFG*

If the project is registered as a CDM project activity, the expected revenue from the project is shown in Table 6 below.

Year	2009	2010	2011	2012
tCH_4	10,978	9,896	8,953	8,128
tCO_2e	230,535	207,815	188,009	170,688
CER (10EUR)	2,305,349	2,078,149	1,880,093	1,706,881
CER (15EUR)	3,458,024	3,117,223	2,820,139	2,560,322
Electricity (kWh)	12,000	12,000	12,000	12,000
Income from the sale of electricity(EUR)	84,000	84,000	84,000	84,000

Table 6. *Financial gain from CDM project activity implementation*

Under the assumption that the installation of the turbine and the methane collection equipment will cost approximately 2,200,000 EUR, the project will have a payback period of less than two years.

Without CER revenue the internal return rate of this project is 12%, but with CER revenue in the period 2009 – 2012, depending on the price of CERs, the project will have an internal return rate between 52 % and 70 %.

4.5.2. LFG collection and flaring (case study)

The case study will demonstrate that, with the CDM, an extremely unprofitable project for electricity generation from landfill gas, can become extremely profitable. Change in the project profitability occurs due to the additional income from the sale of CERs.

As an example we will take a landfill in the Republic of Serbia which has been opened for 10 years, and has been receiving 10,000 ton/yr of solid municipal waste. The landfill is a managed landfill, closed and methane collection and flaring system has been installed.

Table 7 provides expected quantities of methane for the period 2009-2012..

Year	2009	2010	2011	2012
t CH_4	135	122	110	100

Table 7. *LFG emissions*

There is no incentive to develop the project without the CDM, as there it can generate no additional revenue. If the project is registered as a CDM project activity, the expected revenue from the project is shown in Table 8 below.

Year	2009	2010	2011	2012
tCH_4	135	122	110	100
tCO_2e	2,837	2,558	2,314	2,101
CER (10EUR)	28,374	25,577	23,140	21,008
CER (15EUR)	42,560	38,366	34709	31,512

Table 8 *Benefits from CDM project activity implementation*

If we assume that the system for LFG collection and flaring will be in the range of €20,000 – €30,000, then the payback period of the project is approximately one year with CER price of €10/CER. With higher price per CER, this period would be surely shorter.

4.6. Conclusion

Although Republic of Serbia is a latecomer to the CDM market, it should be remembered that necessary institutional framework utilization of market under Kyoto Protocol has been established, that there is great interest from the investors, as well as that implementation of CDM projects may contribute to better environmental performance to great extent.

It should not be forgotten that CDM project implementation is important for more efficient achievement of sustainable development criteria at national level.

When talking specifically about waste management, implementation of CDM projects may significantly contribute to long-term issues at national level and faster and more efficient harmonization of waste management practice with the requirements defined at international level.

Efficient implementation of certain types of CDM projects in waste management until 2012. is realistically feasible, bearing in mind that methane emission reduction may be achieved with relatively small investments. For example, average payback period for a biogas collection and flaring project is year, year and a half, only from sale of certified emission reduction.

Advantage for implementation of CDM projects in the Republic of Serbia is seen in potentials of using already existing knowledge and experience gained at international level. This is particularly obvious in the area of waste management where a number of researches and specific project activities have been implemented over the past ten years. It should be noted that approved CDM methodologies for waste management are covering most of the project types, which are feasible in the Republic of Serbia, so there will not be necessary to develop new methodologies but only adjustment of the existing ones.

Taking into account current situation and waste management practices at national level, it may be concluded that CDM projects with highest potential in the period before 2012 are: LFG collection and flaring and LFG collection for electricity generation. Programmatic CDM may be particularly suitable and significantly feasible in the Republic of Serbia in the first commitment period as well.

Estimates have shown that approximately 82,000 tCH_4 or nearly 1,700,000 tCO_2e are emitted from solid municipal waste handling in the Republic of Serbia. Successful implementation of LFG capture and utilization and the Belgrade, Novi Sad and Nis landfills can reduce at least 25% of these emissions.

If a 1 MW power generator is installed in each of the sites, it would lead to additional annual emission reductions of approximately 6,000 tCO_2e from substitution of grid electricity.

Further reductions can be achieved if LFG capture and flaring projects are implemented at smaller landfills, i.e., through implementation of Programmatic CDM.

Efficiency and feasibility of Programmatic CDM implementation primarily depends on stability and continuity in existence of the managing institution. This imposes selection of some of the governmental institutions for programme management.

As for waste management, this could be the *Agency for Energy Efficiency or Environmental Protection Agency*. The possibility remains also for some of the relevant associations.

Implementation of projects which pertain to solid municipal waste composting and to alternative waste management practices requires establishment of solid municipal waste separation system and various economic and other analyses.

Waste separation system and such analyses have not yet been performed in the Republic of Serbia in a detailed and systematic manner. Although Republic of Serbia should carefully explore possibilities for utilization of modern waste management practices and necessary technologies, implementation of this type of CDM projects is deemed realistic option before 2012.

Therefore, in order to maximize potentials of the Republic of Serbia for implementation of CDM projects before 2012, it is desirable to focus potential project developers to projects of LFG collection and utilization, whether through flaring only or through electricity generation as well.

Finally, last but not least, it should not be forgotten that implementation of projects activities under clean development mechanism may lead to significant increase in cost-effectiveness and it may enable implementation of projects which otherwise could not be implemented.

V POSSIBILITIES FOR IMPLEMENTATION OF CDM PROJECTS IN AGRICULTURAL SECTOR

5.1. Aims and definitions

The agricultural sector is one of the largest sources of GHG emissions. The emissions of CO_2, CH_4 and N_2O contribute to approximately one-fifth of total GHG emissions. Taking into account land use changes, including biomass burning and soil degradation, the overall share in radiative forcing amounts to one-third of the anthropogenic impact.

The main sources of GHG emissions in the agricultural sector are N_2O emissions from soil management, mainly anthropogenic soil inputs of nitrogen, as well as methane emissions from anaerobic decomposition of biomass, enteric fermentation and emissions from decomposition of animal manure.

It is estimated that the agricultural sector produces 50% of the total anthropogenic CH_4 emissions and 70% of the anthropogenic N_2O emissions in the world[9]. Another source of GHG emissions is open-field burning of biomass.

Although agriculture is a major source of GHG emissions, it is also a supplier of valuable renewable energy sources. Biomass (plant residues from agricultural activities) and biogas (CH_4 formed by animal manure decomposition), can be used for heat and electricity generation.

The agricultural sector has a large potential for GHG emission reduction, both through improvement of agriculture management practices and the use of agricultural residues for energy applications. Part of these possibilities has been elaborated through CDM projects over the past ten-year-period.

[9] **C.V. Cole et al.**, Global estimates of potential mitigation of greenhouse gas emissions by agriculture, *Nutrient Cycling in Agrosystems 49: 221 – 228, 1997.*

In order to utilize the aforementioned potential, this Chapter of the Strategy is prepared with the goal of disseminating the available knowledge by providing directions to project developers in Serbia.

The aim of the Chapter is to contribute to identification of some of the CDM possibilities in agricultural sector and to provide further suggestions for governmental institutions of the Republic of Serbia on support of CDM projects in the agricultural sector.

More specifically, the aim of the Chapter is identification of:

a) emission reduction potential and contribution to sustainable development through CDM;
b) priority areas for development of CDM projects;
c) possible measures to support more efficient and cost-effective implementation of CDM projects.

This Chapter provides the overview of current state and trend in implementation of CDM projects in agricultural sector, results and problems noticed during the development and implementation of this type of projects, as well as their possible implications for the Republic of Serbia, taking into account current agricultural practice and other relevant characteristics in the sector at national level. The Chapter provides overview of possibilities for development of CDM projects in the Republic of Serbia and cost and benefits analysis for most feasible CDM projects at national level, including theoretical possibilities of provision of financial support for this type of projects, all in agricultural sector.

It should be remembered that activities within Clean Development Mechanism are exclusively the activities on voluntarily basis. CDM projects may only be developed at the individual initiative from the developer, not from the Government. Role of the Government is to ensure necessary institutional and legislative structure for project approval at the national level. The Government may possibly create administrative and financial support for specific types of CDM projects when it is identified that they are projects of national interest.

Therefore, guidelines and recommendations cannot be deemed as binding for any party, both for the developers and for the Government of the Republic of Serbia.

In order to identify possibilities for implementation of CDM projects in agricultural sector, and beside various ***definitions*** for the Strategy purposes, agricultural sector will be defined as: ***"Sector which includes crops planting, animal husbandry and similar activities and it does not cover primary product processing in agricultural industry."***

5.2. Existing experience at international level

Existing experience in CDM project implementation at international level shows that projects of biomass utilization and animal manure management are most common CDM project activities in this sector.

5.2.1. Biomass utilization

Biomass is a traditional energy source having been used for centuries and far before deposits of coal, oil and gas were discovered. However, with the beginning of industrial revolution, switch to conventional fossil fuels became a sort of symbol of development and advancement.

Nowadays, many "leaders of industrial revolution" turn to biomass as valuable energy source. Modern technologies have been developed for production of electric and heating energy from biomass, including technologies for efficient combustion of straw or wood waste, either directly or after briquetting or pelleting.

Biomass utilization together with waste management projects has been attracting a lot of attention since the adoption of the Kyoto Protocol. The high expectations about biomass utilization projects are also reflected in the fact that at the time when there were no approved methodologies, the fourth earliest approved CDM methodology, AM0004 (now consolidated in ACM0006), was related to utilization of biomass for energy generation.

The main reason for that lies in high possibility of application, as well as the fact that payback period for this type of projects is relatively short. For example, average payback period for projects of utilization of biomass for energy production is in some cases estimated at year to year and a half (similar to LFG capture and flaring projects), only from sale of CERs and energy.

High possibility of application is the result of agricultural waste landfilling (as conventional agricultural waste treatment) in many countries around the world.

Landfilling of agricultural waste leads to anaerobic decomposition and formation of large volumes of methane.

By utilizing biomass for energy generation instead of landfilling it, the generation of such large volumes of methane can be avoided. Besides this, biomass can be used as a substitute for fossil fuels (coal or oil). This helps to additional avoidance of GHG emissions.

When talking about utilization of biomass under CDM, it is important to clarify two important concepts: ***"carbon neutral"*** and ***"renewable biomass"***.

The concept of ***"carbon neutral"*** implies that CO_2 emissions generated when biomass is burnt are not accounted for as additional anthropogenic GHG emissions. The reason is that the CO_2 released in the combustion process is of the same amount as the CO_2 that plants took in during the process of plant growth and development. CO_2 released in biomass combustion process is a part of natural cycle, and biomass is deemed carbon neutral (because it does not release additional CO_2). In this sense, biomass, as a source of energy, is similar to other renewable energy sources like water, solar or wind energy.

The concept of ***"renewable biomass"*** may be explained through definition of renewable biomass from the CDM Glossary of Terms[10].

According to this definition, biomass is renewable if the following applies:

1. The biomass is originating from land areas covered by forests (forest definitions as established by the country in accordance with the decisions 11/CP.7 and 19/CP.9 should apply) where:
    a) The land area remains covered by forest;
    b) Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting);
    c) Any national or regional forestry and nature conservation regulations are complied with.
2. The biomass is woody biomass and originates from croplands or grasslands, where:
    a) The land area remains cropland or grasslands or is reverted to forest;
    b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically

[10] http://cdm.unfccc.int

decrease over time (carbon stocks may temporarily decrease due to harvesting);

c) Any national or regional forestry and nature conservation regulations are complied with.

3. The biomass is non-woody biomass and originates from croplands or grasslands where:

   a) The land area remains cropland or grasslands or is reverted to forest;

   b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting);

   c) Any national or regional forestry and nature conservation regulations are complied with.

4. The biomass is a plant residue and the use of that residue in the project activity does not involve a decrease of carbon pools, in particular dead wood, litter or soil organic carbon, on the land areas where the biomass residues are originating from.

   For example, if bagasse from sugar production would in the absence of the CDM be dumped or left to decay, and it is used for energy generation under the CDM, it can be assumed that the use of the bagasse does not affect the sugar cane cultivation practices and hence the carbon pools of the respective soils.

   In contrast, where a CDM project involves the collection of dead wood from a forest, which would not be collected in the absence of the CDM, the extracted biomass cannot be regarded as renewable, since it would result in a decrease of carbon pools.

5. The biomass is the non-fossil fraction of an industrial or municipal waste.

In the cases when none of these conditions can apply, biomass is deemed ***"non-renewable"***.

An example of the use of non-renewable biomass is the case when straw that would have otherwise been used for land application in crop production, e.g. use of straw that would have been ploughed into the soil, is used for energy generation. Use of straw in this case will lead to a decrease in soil carbon, and this straw cannot be considered renewable biomass.

According to the above definition, agricultural residues that are disposed of and not used in agricultural production, e.g. agricultural residues that are dumped, landfilled or burnt are also considered renewable biomass.

All the existing CDM methodologies refer to the direct use of renewable biomass for energy applications, or the prevention of anaerobic decomposition of renewable biomass through the production of secondary products (compost, refuse-derived fuel (RDF) or syngas).

There are CDM small-scale methodologies that refer to switching from non-renewable to renewable biomass, and for energy efficiency improvement in the use of non-renewable biomass.

CDM methodologies which refer to utilization of biomass require application of "Methane Tool", a special methodological tool for estimation of methane emission due to anaerobic decomposition of organic products. Usage of this tool provides precise estimates of the methane emissions for each particular year. On the basis of currently approved methods, estimated volumes of methane avoidance are smaller in the first years of project operation, but they increase over time.

If a biomass utilization project claims methane avoidance, it has to be proven that in the absence of the project, the biomass would have been landfilled or treated in a way that would have led to anaerobic decomposition and methane generation. Otherwise, methane emissions cannot be claimed.

Biomass utilization projects still remain some of the most popular CDM projects. They come after renewable energy, heating energy generation from waste and methane gas utilization projects (Figure 6).

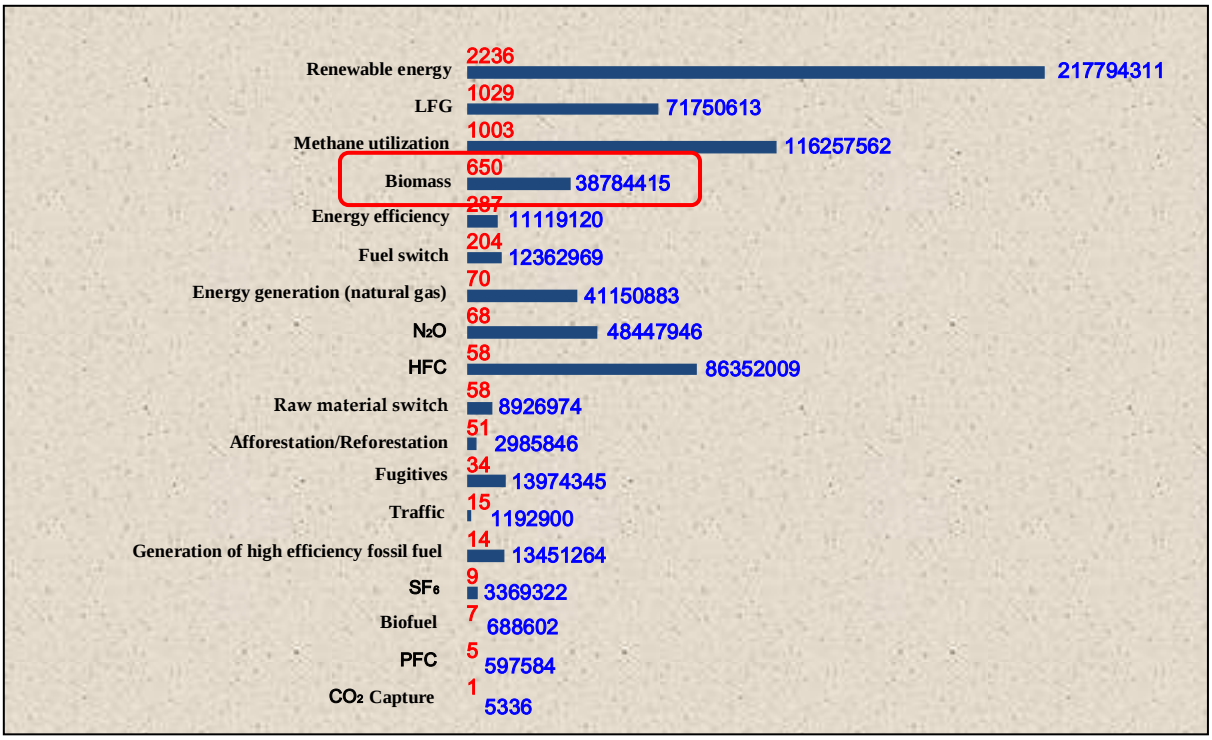


Figure 6. *CDM biomass utilization projects (number of projects)*

By September 2009, 650 projects have been developed and submitted for validation in the area of biomass utilization. Out of these projects, 350 have already been officially registered by the CDM Executive Board and are generating emission reductions.

In terms of regional distribution, India, Brazil and China are the leaders in the development of biomass utilization projects. This type of CDM projects is present in other countries in Asia, Latin America or Eastern Europe (See Figure 7). Such distribution is consequence of a number of factors, such as share of agriculture in overall economy and the fact that these countries were among first participants in CDM process.

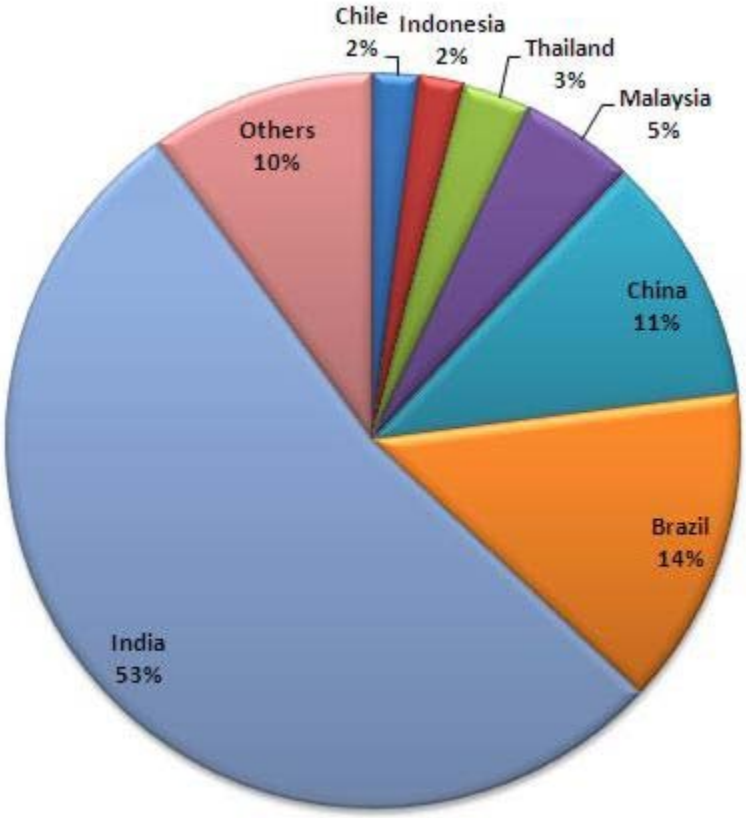


Figure 7. Regional distribution of biomass utilization CDM projects

From the aspect of identification and CDM project preparation, it is crucial to remember again that each CDM project is required to use an officially approved methodology.

Currently approved CDM methodologies cover comprehensively most of the types of GHG emission reduction projects in the area of biomass utilization.

Therefore, it is not expected that the development of any new methodologies for potential projects in the Republic of Serbia will be necessary up to the end of 2012. Certain changes of the existing methodologies are expected in order to adjust an existing methodology to specific local conditions.

Therefore, this chapter of the Strategy is based on the current state of methodology approval in the agricultural sector.

5.2.1.1. Electricity and heat generation using biomass

Biomass[11] presents a valuable energy source and it can be used for electricity or heat generation, as well as for cogeneration.

The most common methodology for electricity generation and co-generation projects is ACM0006 "Consolidated methodology for electricity generation from biomass residues". This methodology covers both GHG emission reductions as a result of renewable energy generation and methane avoidance.

Small-scale projects with installed power generation capacity of less than 15 MW_e (or 45 MW_{th} for cogeneration facilities) and resulting in methane avoidance of less than

[11] Unless specifically indicated, 'biomass' in the rest of this chapter refers to 'renewable biomass'

60,000 tCO_2e/yr can use the combination of methodologies ASM-I.D. "Grid connected electricity generation" (AMS-I.C. "Thermal energy for the user with or without electricity" for co-generation projects) and AMS-III.E. "Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment".

CDM projects involving only thermal applications, e.g. installation of biomass-fired heating boilers or fuel switch from fossil fuels to biomass at district heating plants, can use a different methodology, AM0036 "Fuel switch from fossil fuel to biomass residues in boilers for heat generation", and for small-scale projects (below 45 MW_{th}) can use AMS-I.C., in combination with AMS-III.E.

Recommendations related to use of certain methodologies are based on the list of approved methodologies as of September 2009.

However, as methodologies are being continuously revised and changed in time, it is recommended to observe development of CDM methodologies and to obtain latest information before the beginning of project preparation.

5.2.1.2. Electricity generation using biomass from dedicated plantations

Beside the use of biomass residues, i.e., side products from agricultural activities for electricity generation as CDM project activity, it is also possible to develop special plantations of fast growing trees (e.g. willows, various sorts of reed) for that purpose. This is technologically possible and has been done in a number of developed countries (the UK[12]).

For such CDM projects, AM00412 "Grid-connected electricity generation using biomass from newly developed dedicated plantations" can be applied.

5.2.1.3. Composting of biomass

Biomass, as any other organic waste, will release methane if left to decompose in anaerobic conditions. The project types described in the previous chapter lead to methane avoidance through direct combustion of biomass. There are alternative methods to achieving the same result, like composting of biomass.

For these types of projects, AM0025 "Avoided emissions from organic waste through alternative waste treatment practices" has been developed.

Methodologies which refer to composting of biomass involve very scrupulous monitoring procedures, especially regarding regular monitoring of waste content and volume. Emission reductions achieved in such manner are calculated indirectly, unlike project activities described in the previous sub-chapters.

In addition, for composting projects special monitoring procedures have to be carried out to guarantee that waste is decomposing in aerobic conditions during the production of compost.

5.2.1.4. Non-renewable biomass

As explained earlier, only renewable biomass is considered to be carbon neutral. If a project activity is using non-renewable biomass, the CO_2 emitted during biomass combustion is accounted as additional anthropogenic emissions.

Due to this fact, it is possible to develop projects which involve fuel switch from non-renewable to renewable biomass.

[12] Royal Commission on Environmental Pollution, Biomass as a Renewable Source, London, 2004

An example of such type of projects is switching from illegally harvested wood or dead wood from the forests to biomass briquettes. These projects usually apply AMS-I.E. “Switch from non-renewable biomass for thermal applications by the user”.

No project activities from this type have been developed under the CDM up to now, although there is certain potential in a number of countries, especially in countries where sustainable forest management is not practiced.

The reason is that methodology requires surveys to prove the use of non-renewable biomass from December 31, 1989, which in many cases is not possible due to lack of data.

The list of approved methodologies related to biomass utilization for energy generation is presented in Table 9.

	Methods	**Regular scale methodologies**	**Small scale Methodologies**
Biomass Energy Generation	Electricity and heat generation from biomass residues	ACM0006	AMS-III.E. (Methane avoidance through controlled combustion)
	Grid connected electricity generation using biomass from newly developed dedicated plantations	AM0042	AMS-III.L. (Controlled pyrolysis of biomass, may include heat and electricity generation) ~AMS-I.A. ~AMS-I.D.
	Least cost fuel option for seasonally operating biomass cogeneration plants	AM0007	
	Fuel switch from fossil fuels to biomass for heat generation	AM0036	~AMS-I.C.
Non-renewable biomass	Switch to renewable biomass for thermal applications by the user		AMS-I.E.
	Energy efficiency in thermal applications of non-renewable biomass		AMS-II.G.

Table 9. Approved CDM methodologies (utilization of biomass for energy generation)

5.2.2. Animal manure treatment

Animal manure, being a large source of CH_4 emissions, offers vast possibilities for the development of CDM projects. In a large number of countries animal manure is treated in anaerobic manure treatment systems like lagoons, or open pits. The generated biogas contains a large share of methane and is a viable energy source similar to other renewable energy sources.

Treatment of manure in anaerobic digesters generates large volumes of methane, which can be further used for heat or electricity generation. Anaerobic digesters, unlike solid municipal waste treatment systems, guarantee a relatively stable supply of biogas for energy applications.

Manure treatment projects attracted a lot of attention at the start of the CDM. Similarly to LFG projects, animal manure projects could reduce large volumes of emissions with relatively small investments, primarily from methane avoidance and energy generation.

Implementation of first projects of this type showed on the basis of monitoring, that realistic emission reductions are even 50% lower than those estimated in project design document. The reason was that first calculation models for methane emissions did not take into account impact of temperature and sort of waste treatment to speed and volume of generated methane.

Such results caused implementation of comprehensive and detailed analyses which provided important facts.

Volume and speed of methane emissions in animal manure treatment system greatly depend on the used system itself and temperature. Simple coverage of anaerobic lagoon causes less methane emissions than animal manure treatment in anaerobic digestor.

There is a general rule that more methane will be generated from the same quantity of waste in tropical regions. These discoveries are included into a new methodology, ACM0010 "Consolidated methodology for GHG emission reductions from manure management systems". Small-scale methodology AMS-III.D. "Methane recovery in manure management systems", has been updated. Currently, the largest share of animal manure projects under CDM is developed using AMS-III.D8 methodology. This may be attributed to two facts. Firstly, upper limit of small-scale projects of type III has been changed from 15,000 tCO_{2e} annually to 60,000 tCO_{2e} annually. Secondly, establishment of baseline scenario and monitoring procedures are more simple in comparison to requirements contained in methodology ACM0010.

In the cases when farm has waste treatment plant, e.g. a lagoon, existing methodologies have been applied only in cases when animal manure had been stored at waste treatment system at least for a month and if this system, i.e. lagoon, is more than 1 meter deep.

Although animal manure methodologies are stricter today, they allow project developers in the Republic of Serbia to design and implement their CDM projects based on more realistic assumptions about the amount of methane an individual project can generate and the kind of technology that will have better applicability.

Furthermore, it has to be taken into account that due to the high CDM transaction costs and the climatic conditions in the ***Republic of Serbia, only farms with a certain size (e.g. a minimum of 4,000 sows or at least 1,000 cows)*** can realistically host feasible CDM projects..

It should be taken into account that most of methodologies related to animal manure were constrained to on-site manure collection, capture of biogas and flaring or energy generation.

Since in many cases, however, animals are not bred in large farms, but by individual households or in small farms, methodologies described above, ACM0010 or AMS-III.D., are not suitable for these cases, asthey involve extremely complicated monitoring procedures which an individual household cannot follow.

To resolve this issue, a special methodology, AMS-III.R. "Methane recovery in agricultural activities at household and small farm level", was designed. It allows farmers to install small digesters and use the generated biogas for heating or cooking. However, this methodology requires the grouping of a large number of farmers in one project bundle, and may be difficult to implement without cooperation with a farmers' association or a government organization.

Another technical solution was incorporated in AM0074, "GHG emission reductions through multi-site manure collection and treatment in a central plant". This methodology allows the manure from a few sites to be transported to a central facility (central digester) and to be treated there.

As ***there are a lot of relatively small or medium-sized farms*** which cannot individually develop a viable CDM project ***in the Republic of Serbia***, possibility to ***transport manure from several locations to the central plant for treatment presents good option*** for the Republic of Serbia.

It is important to stress that these projects require cooperation from central or local government or farmers' associations.

New small-scale methodology was also approved, AMS-III.Y. "Methane avoidance through separation of solids from wastewater or manure treatment systems". This methodology covers projects where solid matter is taken from the manure system, dried and further used either as a source of energy (for example for making "manure briquettes") or treated in a different way in order to reduce methane emissions.

Due to the lack of technological availability and know-how, ***this is not deemed a viable option in the Republic of Serbia for the period up to 2012***. It can be explored further as a mid- or long-term option.

List of approved CDM methodologies for utilization of animal manure is provided in Table 10.

Methods	Regular scale methodologies	Small scale Methodologies
Methane recovery in manure management systems	ACM0010	ASM - III.D.
GHG emission reductions through multi-site manure collection and treatment in a central plant	AM0074	
Methane recovery in agricultural activities at household and small farm level		AMS-III.R.
Replacement of anaerobic lagoons with aerobic systems		ASM – III. I.
Methane avoidance through separation of solids from wastewater or manure treatment systems		AMS-III.Y.

Table 10. Approved CDM methodologies for projects of utilization of manure for energy generation

Figure 8 below shows the 1,003 projects that have been developed and submitted for validation in the area of methane gas utilization, and among them approximately one-third comes from manure treatment projects.

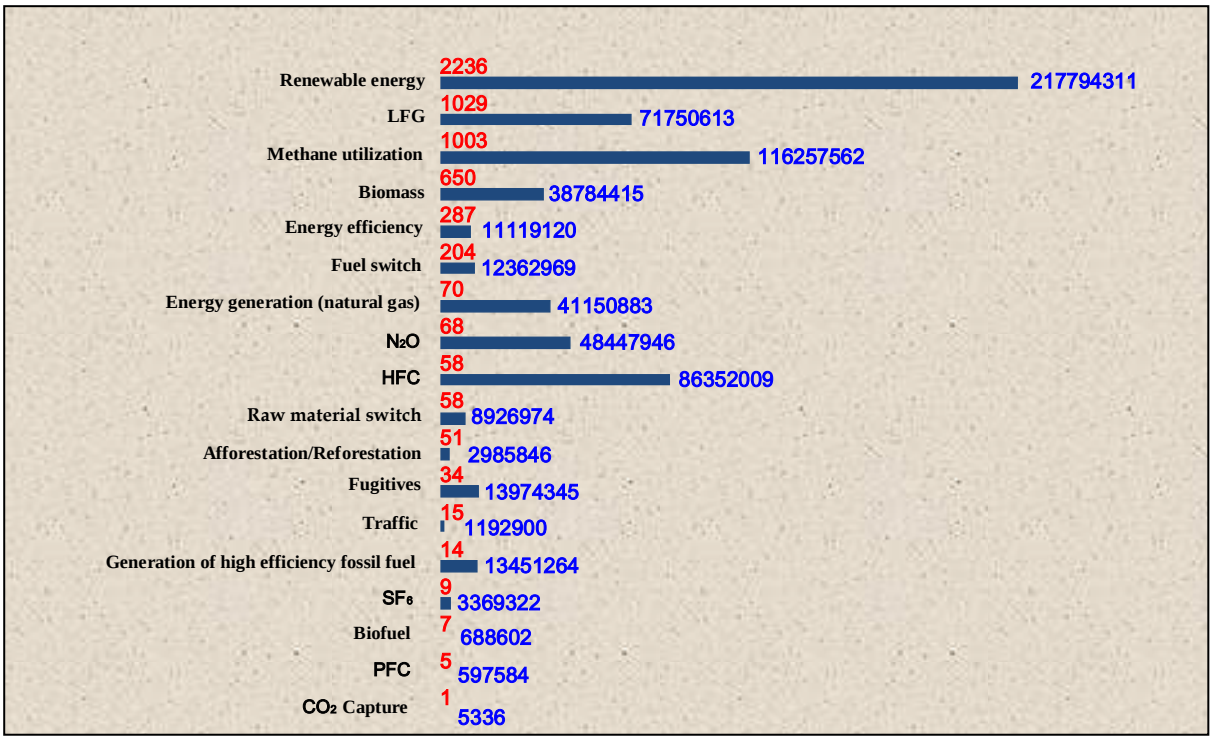


Figure 8. *Animal manure (project flow)*

Of this number, 192 had already been officially registered up to September 2009 by CDM Executive Board and they generate emission reduction.

Geographic distribution of this type of projects is shown in Figure 9.

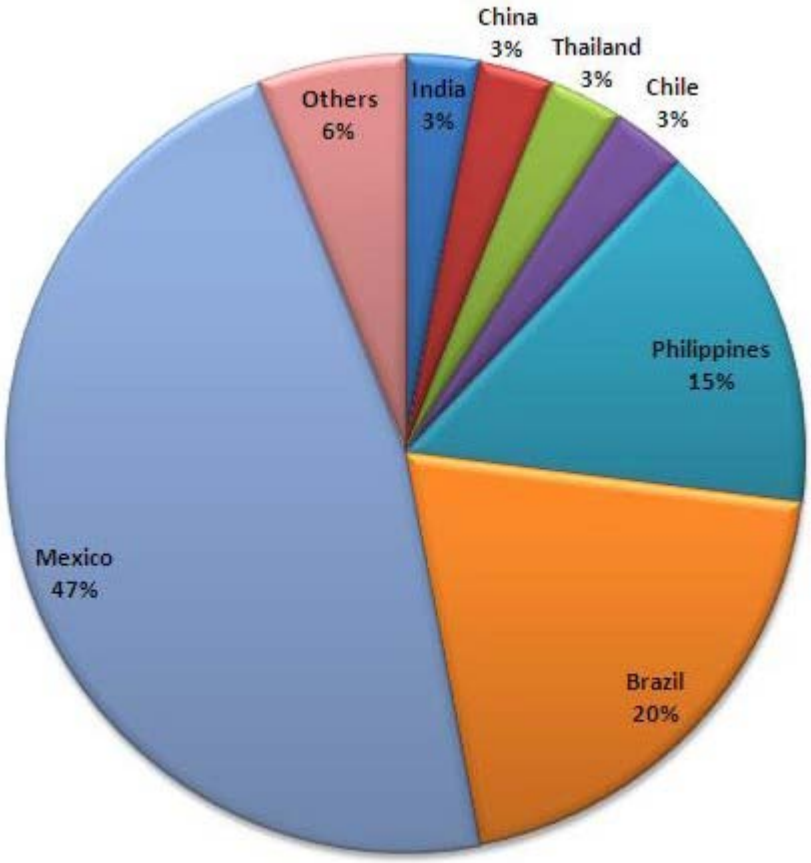


Figure 9. Animal manure (geographical distribution)

5.2.3. Other potential agriculture related projects

Although agriculture is accountable for almost 70 % of the N_2O emissions in the world, mainly from the anthropogenic inputs of nitrogen in the soil, implementation of other CDM projects except for previously mentioned was neglected for a long time. This was mainly due to difficulties related to the establishment of the baseline and insufficient research in this area.

First approved AMS-III.A. which implies other project activities beside those listed in previous chapters, allowed urea to be partially replaced with inoculum in places where crop rotation of soy and maize is practiced.

Republic of Serbia is a producer of both crops, and theoretically may be host to such CDM projects. Precise analysis on possibility to apply this type of project activity cannot yet be done since this is relatively new project type.

Another area that has attracted a lot of attention is the production of biofuels, biodiesel or bioethanol.

Biofuels are considered carbon neutral, and they would not generate additional CO_2 emissions in the process of their combustion, and they can be substitutes of widely used

liquid fossil fuels. Production of biofules as substitutes for fossil fuels was considered to be potential candidate for the CDM project activity.

Although many attempts to propose methodologies in that area were made, as of September 2009, no CDM methodology was approved.

Reason for that is that it was necessary to provide rational justification why agricultural land used for food production is diverted into land for biofuel production. This is a very complex process as such practices were blamed for the food crisis in 2007. A potential solution, which is still under consideration, is to allow the production of biofuels from plants which are grown on wasted lands as CDM project activity.

Another problem in acceptance of such project activity as CDM project is determination of baseline scenario since there is a serious problem related to double counting of emissions. Biofuel production involves the whole cycle from crop planting to fuel consumption, and everybody in this chain more or less equally contribute to emission reduction. That is why it is so difficult to establish who should be allowed to claim emission reductions (farmers, biofuel producers or final consumers).

Due to the above issues, biofuel production and utilization is currently not part of the existing CDM framework.

5.3. Current status in agriculture sector in the Republic of Serbia

Analysis of data obtained from the Ministry of Agriculture, Forestry and Water Management, report prepared by GTZ/WBF Programme for Economic and Employment Promotion in Serbia, German organization for technical co-operation, showed that agriculture presents one of most important economic sectors in Serbia. Agriculture contributes to 14% of the Serbian GDP and employs approximately 25% of the total labor force. The sector actively participates in the foreign trade of the Republic of Serbia, provides food and contributes to the economic development of the rural areas.

Adhering to the structure provided in the previous chapters, analyses which pertain to crop planting and animal husbandry will be separated.

5.3.1. Crop planting

The territory of the Republic of Serbia covers approximately 8,836,000 ha (88,360 km^2), out of which 5,701,000 ha is agricultural land. Arable land is estimated to be approximately 4,867,000 ha, most of which is concentrated in the Autonomous Province of Vojvodina.

Figure 10 below shows the distribution of arable land across the Republic of Serbia.

Approximately 87 % of the agricultural land is privately owned, which means that land ownership is characterized by a large number of very small land estates.

Approximately 778,891 agricultural farms throughout Republic of Serbia (as of 2002) have an average farm size of 2.46 ha.

This makes Republic of Serbia one of the countries with the smallest farm sizes in Europe.

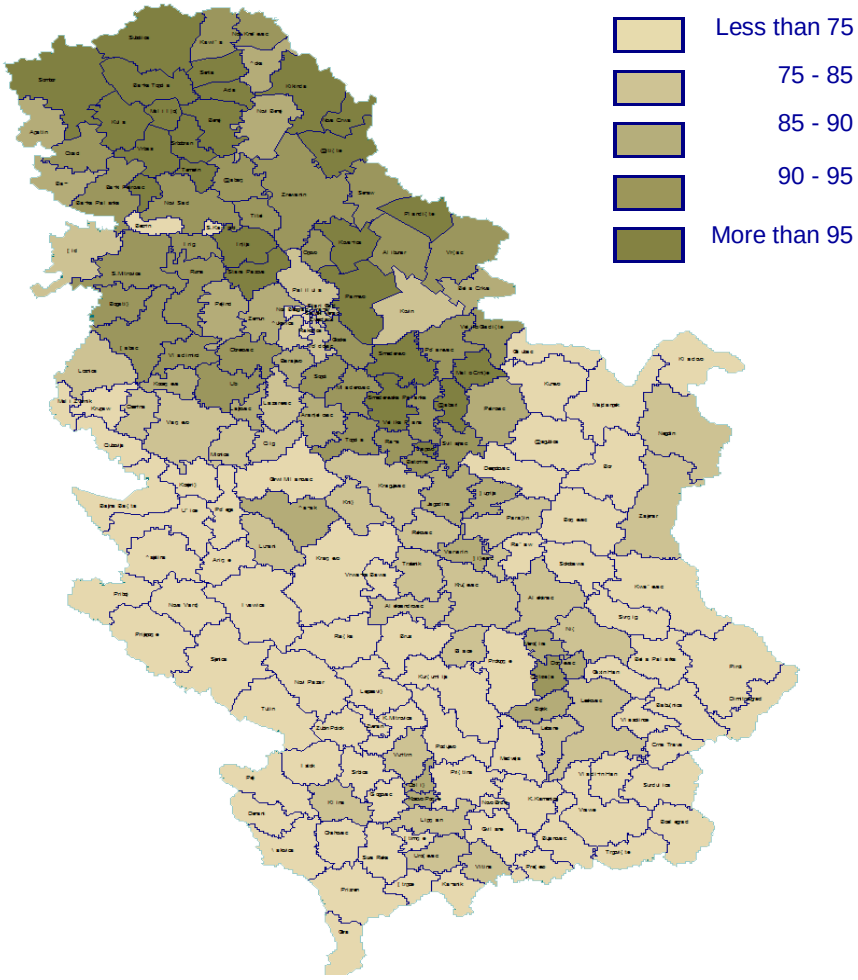


Figure 10. Distribution of arable land in the Republic of Serbia (%)

Large farms specialized in crop farming are mostly located in the northern part of the Republic of Serbia. In central and southern Serbia, farms are smaller and have diverse production, including orchards, vineyards, and vegetable growing farms. The distribution of different crops is shown in Figure 11 below.

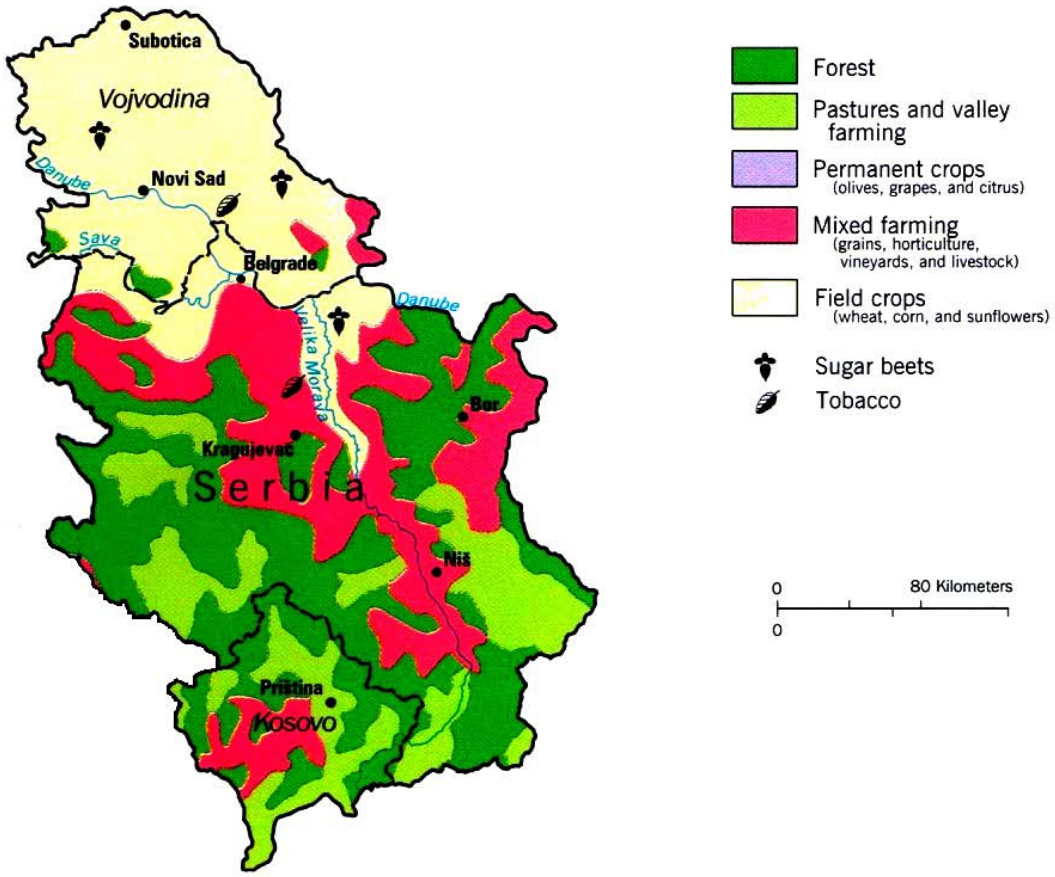


Figure 11 *Distribution of farms in the Republic of Serbia as per crops which are cultivated at those farms*

Agricultural production, mainly crop planting, is a large source of residue (biomass). Most of such residues currently remain unutilized in the Republic of Serbia.

On the basis of data from the Ministry of Agriculture, Forestry and Water Management, it has been estimated that the total ***energy potential of these biomass residues is approximately 1.56 million toe***.

Currently in the Republic of Serbia, straw is used as bedding for animal farms, burnt or used in other agricultural activities. Soy straw and maize residues are either landfilled or burnt in open air.

Estimates, based on methodology prescribed in IPCC Guidelines from 2006[13], show that if all of the biomass residues available in the Republic of Serbia were used for energy generation applications, then the equivalent amount of ***emission reductions (due to displacement of fossil fuels) is estimated at 4.8 million tCO_2e***.

It is realistically possible to use about 20% of biomass residues from small farms and more than 50% of the residues from large farms for energy purposes, which can lead to at least 1 million tCO_2e of emission reduction.

[13] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 1: Introduction

5.3.2. Animal husbandry

Animal husbandry in Serbia is organized mainly in small family-owned farms. There are also a small number of large farms. Recent studies show that there is a decline in the livestock population in Serbia.

Headcount of the different types of animals and manure produced in 2008 in the Republic of Serbia is provided in Table 11. The same table also shows the potential for methane generation from animal manure per head, if animal manure were treated under anaerobic conditions.

	Livestock	Headcount	Manure	Annual Energy Equivalent[14]
Units	-	*m^3/day*	*toe*	*$kgCH_4$/head/year*
Cattle	260,300	5,270	20,140	12
Pigs	1,655,100	4,560	17,500	5
Poultry	2,350,000	480	4,600	0.01
Total	-	-	42,240	-

Table 11. Livestock headcount in the Republic of Serbia (2008)

Analyses have showed that at small farms a large share of the animal manure, including poultry litter, is either directly disposed of in water basins, used for the production of composts to meet the needs of local farmers or spread directly over agricultural land. This practice is a form of anaerobic treatment of animal manure and methane emissions from its decomposition are negligible.

Most large farms have some sort of a waste treatment system, including lagoons, pits or ponds. These farms are deemed to be able to individually develop CDM projects and reduce methane emissions through improvement of manure management practices.

Eleven farms with animal headcounts of over 1,000 cattle and 9,000 sows have been identified.

Estimates related to annual methane emissions were made for these farms according to calculation methods defined by methodologies AMS-III.D. and ACM0010 (Table 12). *Should any CDM project be developed at these sites, the above estimates have to be reconfirmed.* Special attention has to be paid to the existing manure treatment equipment.

[14] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 1: Introduction

Farm	Type of Animals	Headcount	Methane emissions tCH_4/yr	GHG Emissions tCO_2e/yr
Neoplanta	Pigs	150,000	2,577	54,119
PKB	Cattle	22,000	3,023	63,500
Napredak	Pigs	30,000	150	10,824
Dragan Markovic	Pigs	22,469	386	8,107
Vizelj	Pigs	17,109	293	6,137
Pantomarket Stocar	Cattle	1,700	233	4,907
Sava Kovacevic	Cattle	1,200	164	3,469
Kuc Company	Cattle	1,000	137	2,886
Klanica Divci	Cattle	2,000	274	5,773
Pepu Pork	Pigs	9,650	165	3,482
PIK Becej	Pigs	56,000	280	5,880

Table 12. Farms in the Republic of Serbia with CDM potential

Finally, it is noted that prior to the disintegration of Yugoslavia, ten biogas plants were planned to be built. However, due to the lack of financial support most of them were never finished. Those that were finished have not been operational for many years.

5.4. Potentials for implementation of CDM projects in the Republic of Serbia

Based on the international experience, primarily with the existing CDM methodologies, as well as the current agricultural practice in Serbia, the following project types could have potential for development under CDM in the Republic of Serbia:

a) ***Utilization of biomass for energy generation (heat, electricity or co-generation)***
b) ***Co-firing of biomass***
c) ***Energy generation using biomass from dedicated plantations***
d) ***Anaerobic treatment of animal manure and use of biogas for energy generation***
e) ***Composting of animal manure and biomass***

Due to lack of approved methodologies which pertain to *biofuel production from plant seeds* and limited information about projects involving *partial substitution of urea with biomass,* these projects are not deemed feasible in the Republic of Serbia by 2012.

For potential project developers for methane avoidance through use of biomass, information provided below are important.

The project design document must contain proof that in the absence of project anaerobic decomposition of biomass would realistically occur.

It is necessary to perform emission estimates in accordance with most recently approved tools for methane emission estimates, i.e. in accordance with version 4 of the Methane Tool (December 2008). When performing emission estimations, attention should be paid that selected coefficients are in accordance with climate characteristics of the country.

Climate in the Republic of Serbia is classified as temperate and humid. Average annual temperature for the Republic of Serbia ranges between 10 and 11°C. Average rainfall in lowlands are 540-820mm, while in the areas above 1,000 m of altitude it is 700-1,000mm, potential evapotranspiration is 740-900mm.

More information about climate characteristics may be found at the internet address of the Republic Hydro-Meteorological Bureau of Serbia: http://www.hidmet.gov.rs

Models for methane emission estimates are very sensitive to temperature, humidity and potential evapotranspiration, so that it is commonly recommended to use regional instead of national data, when possible.

5.4.1. Utilization of biomass for energy generation

Republic of Serbia is a net importer of energy, both raw fuels (gas and oil) for production and electricity. Republic of Serbia may reach higher rate of energy efficiency through utilization of biomass as energy source. Part of the activities of biomass utilization may be implemented under CDM project activities.

There are a certain number of possibilities within that context.

The climate in the Republic of Serbia is cold in the winter months. Many cities and towns heat is supplied from local boiler houses, which are operated using fossil fuels: heavy fuel oil, coal or gas. At the same time, these boiler houses provide hot water throughout the year.

Repowering of existing fossil-fuel-fired power plants to biomass for heating energy generation may be potential CDM project activity. This process does not involve high technological risk and limitations in the financing resources can be partially overcome if project is implemented as CDM project activity.

With the wide availability of biomass, development of ***fuel-switch-to-biomass projects for heat generation should be considered as priority*** ones among the potential CDM projects in the Republic of Serbia.

Such CDM projects can be developed individually in the district heating plants in large cities (Belgrade, Nis and Novi Sad), and ***as part of Programmatic CDM in smaller cities and towns***. Detailed analysis of the logistic supply of biomass should be carried out for each individual case.

Use of biomass for electricity generation or co-generation is deemed most feasible ***in the case of fuel switch at existing installations***. Such project activity requires lower investment costs compared the investments needed for cleaner technologies.

Estimates show that more than 1,000,000 tCO_2e/yr can be reduced from the utilization of the available biomass residues in the Republic of Serbia through implementation of appropriate projects.

Implementation of projects which require ***construction of new biomass-fired power generation and CHP plants in the Republic of Serbia is not realistic to expect in the period before 2012***. This type of project activities can be viable mid- and long-term option and only with the support from the energy sector.

5.4.2. Co-firing of biomass

Co-firing of biomass and coal is another viable option for biomass utilization through CDM project activities. Due to the relatively high water content of raw biomass, this option is viable if plant biomass is processed in pallets or briquettes.

Important advantage of this process is that substitution of up to 30% of coal with biomass does not require any significant modifications in the existing boilers.

Co-firing of biomass is possible both at district heating plants and at large coal fired TPP in the Republic of Serbia. ***A rough estimate shows that substitution of 10 % of the annual coal consumption at the Obrenovac A TPP may lead to as much as 250,000 tCO_2e emission reductions per year.***

Implementation of the aforementioned potential types of CDM project activities is largely uncertain taking into account that ***there is no organized systematic collection of biomass*** in the Republic of Serbia.

For each individual potential CDM activity it is necessary to analyze possibilities for collection and continual supply of biomass before starting the preparation of a project. It is necessary to raise awareness among Serbian farmers as well as the energy industry, that biomass is an important energy source.

To this end, the development of a few CDM projects in the area of biomass utilization for energy applications can serve as a pioneering example both for the benefits of the CDM and the energy potential of biomass.

5.4.3. Energy generation using biomass from dedicated plantations

Use of biomass from dedicated plantations for energy generation is considered an extremely viable at global level.

However, bearing in mind long time period needed for project implementation, as well as potential problems related to ownership and legal relations in the area of forestry, ***these projects are not considered to have high viability in the Republic of Serbia for the period up to 2012.***

Development of a dedicated plantation of willows or elephant grass (the most suitable plants for temperate areas) will require at least 3 years before the first plants can be harvested. In this sense, a more detailed study is required to examine possibilities for implementation of this type of CDM project activity in mid- or long-term period in the Republic of Serbia.

5.4.4. Anaerobic treatment of manure and use of biogas for energy generation

Animal manure, similar to solid municipal waste, generates methane-rich biogas. Such gas can be used for electricity or heat generation.

There are different technologies for animal manure treatment. The most common one is use of biodigestors for treating manure in an anaerobic environment and capturing biogas which can be used further for electricity and heat generation.

Biodigestor technology is widely available in many countries throughout the world. Few attempts were made to install biodigestors at large farms in the former Yugoslavia, but no operational facilities are known in Serbia as of today.

Unlike the LFG technology, advanced models of biodigestors can generate a stable supply of biogas over time. Doing so, they are even more suitable for electricity generation.

Emission reductions from biogas projects as CDM project activity can be achieved in two ways.

The first way is through avoidance of methane emissions. It is only possible in farms where animal manure is currently treated in anaerobic conditions (lagoons or pits with a depth of more than one meter). This is considered to be the case in the majority of large farms in the Republic of Serbia. When talking about the small family owned farms, however, current practice of manure utilization mostly involves aerobic treatment, i.e. disposal of manure in water basins or its use as a fertilizer. Therefore, no methane avoidance can be claimed in such cases.

The second way is emissions reduction from the generation of energy from a renewable biogas. These projects are similar to other biomass projects, as well as to solar, wind and other renewable energy projects

Due to the above described reasons, it is considered that the highest potential for biogas CDM projects up to 2012 exists in the 11 identified large scale farms in the Republic of Serbia (Table 12).

At all of these farms, manure is treated anaerobically, generating significant volumes of methane. Some of these farms had originally planned developing biogas capture and utilization facilities, so they are considered to be already prepared for the rapid introduction of such technologies.

If biogas capture projects are developed at all eleven identified farms, it is expected that approximately 170,000 tCO_2e/yr of emission reductions can be achieved.

Development of such projects at other smaller farms may be challenging and not economically justifiable.

A project-type with high mid-term potential may involve construction of biogas plants in areas where mid-size farms are located (e.g. 200 – 1,000 cows or 1,000 - 9,000 sows). These plants can develop a joint manure treatment facility where manure would be collected and anaerobically treated for heat and electricity generation.

However, this type of project is suitable for farms that are closely located and that have a nearby direct energy consumer. It is also important to establish coordination with local authorities or farm associations in order to ensure successful implementation.

5.4.5. Composting of animal manure or biomass

Composting of animal manure or biomass, or their co-composting is common in many countries. It is easier than compositing of solid municipal waste as it requires no waste separation.

Composting activities in the Republic of Serbia are limited to individual farmers, without any quality control of such compost, like acidity or nitrogen/carbon content.

Although composting is an advanced way of waste management, such projects are not viable in the Republic of Serbia in the period up to 2012. Basic reason for that is that limited know-how is available for compost production (and from plant biomass), as well as underdeveloped market for compost placement.

5.4.6. Programmatic CDM in agriculture sector

Previously listed possibilities for implementation of CDM projects do not take into consideration CDM projects of small reduction potential. Project activities of small reduction

potentials are not feasible under traditional CDM approach, because profit gained in CDM is lower than transaction costs of the CDM itself

The example for this may be projects of installation of individual biodigestors in smaller farms (AMS-III.R. methodology) or collection of animal manure and transport to the central biodigestor (AM0074 methodology).

Since such cases are not typical only for the Republic of Serbia, in order to reduce transaction costs and in order to establish potentials for implementation of CDM projects of smaller reduction potentials, *Programmatic CDM* has been developed under Kyoto Protocol.

Programmatic CDM enables implementation of projects of smaller reduction potentials at lower investment costs, under the programme which involves similar measures of GHG emission reduction.

All the projects included in Programmatic CDM have to use the same technology and methodology.

The Programme itself contains exact description of measures, technology to be applied, as well as methods of baselines scenario determination. Within the programme, monitoring plans for individual project activities and the programme as whole must be also defined.

Every project which fulfills conditions defined in the programme may be added to it at any time without developing new project design document and passing the complex approval procedure.

Typical example of projects implemented through Programmatic CDM in the Republic of Serbia could be bas capture at individual farms and transport of animal manure and treatment in the central digestor.

Since the beginning of Programmatic CDM, there has been general opinion that greatest challenge in the development and implementation of these projects is actually project management.

As this programme may involve tens and hundreds of project activities owned by different entities, working coordination between various owners, data collection and processing, as well as other activities require specially trained management team. Such management teams may be located within relevant governmental agencies in charge of specific project types.

Estimates have shown that the following programmes are most suitable for the Republic of Serbia:

a) Installation of individual biodigestors at individual farms and utilization of biogas;

b) Collection of animal manure from individual farms, its transport and treatment in the central anaerobic digestor for energy purposes.

In order to implement Programmatic CDM as simple and as efficient as possible in the Republic of Serbia, possible organizational structure and implementation of necessary steps to enable establishment of necessary structure are provided below.

The procedure described below guarantees full transparency of the programme development and operation, and it provides support to smaller projects.

1) Competent agency (hereinafter: Agency) develops several concepts for Programmatic CDM in agriculture sector. The Agency, in collaboration with experienced consultants, develops CDM programmatic project idea notes and project design documents for each of the programmes in accordance with CDM Guidelines. The Agency, as necessary and at the

proposal from project developers, may add new programme types. The programmes also should be harmonized with priorities of economic development of the country. Data about all proposed projects may be maintained in specially developed Microsoft Excel © or Access © database.

2) The Agency announces a permanent public invitation for submission of proposals which would be a sort of addition to the programme. Every additional project must contain a special form with the request for project submission, which is pretty similar to the project idea form, on the basis of which such project is introduced into the programme. In addition, it is necessary to provide an expert opinion, i.e., opinion issued by the Designated Operational Entity or national expert, which confirms that that particular project may be introduced into the programme and that it fulfills all the conditions referred to in the programme.

3)The Agency holds regular meetings where they make decisions on which projects should be added to the existing programmes, as well as on the necessity for development of new programmes. When official decision has been made, those projects which are introduced into the specific programme are publicized.

4) For each individual project introduced into the programme, monitoring has to be performed, in accordance with the monitoring plan, which makes inseparable part of the project document. Results from the monitoring are submitted annually to the Agency. At the beginning of each year, the Agency performs verification of monitoring data, and it also performs field visits, if necessary.

5.5. Project development potential up to 2012

The above analysis demonstrated that the most viable CDM projects in the agricultural sector in the Republic of Serbia are: biomass utilization for energy generation (electricity, heat and co-generation), co-firing of biomass, energy generation using biomass from dedicated plantations, anaerobic animal manure treatment and biogas capture for energy generation. Significant potential for the Republic of Serbia is seen in Programmatic CDM.

Taking into account specific conditions and agricultural practices in the Republic of Serbia, ***it is most realistic to expect implementation of projects related to utilization of biomass for energy production (fuel switch and co-firing) and collection of biogas (at large animal farms)*** under CDM project activities.

Programmatic CDM may be particular advantage and may be significantly feasible in the Republic of Serbia taking into account that there are a lot of small farms with low reduction potentials. Project activities could not be implemented at these farms as individual CDM projects. *It is most realistic to expect projects of gas collection at individual farms and collection, transport and treatment of animal manure to a central digestor,* to be implemented through Programmatic CDM in the Republic of Serbia.

Republic of Serbia could promote implementation of Programmatic CDM, both at national and regional levels.

The two case studies presented below provide justification of CDM project implementation and give a better picture of how the economics of such projects can change with the involvement of additional CDM financing.

Efficiency and feasibility of Programmatic CDM implementation primarily depends on stability and continuity in existence of the managing institution.

This imposes selection of some of the governmental institutions for programme management. As for the institution, if it is based on governmental institutions, this could be

the Agency for Energy Efficiency or Environmental Protection Agency, or possibly some of the farmers' associations at national and regional levels.

In order to maximize potentials of the Republic of Serbia up to 2012 related to implementation of CDM projects in agricultural sector, it is desirable that project developers focus their efforts to projects of substitution of fossil fuels with biomass, co-firing of biomass and utilization of biogas from anaerobic animal manure treatment for energy generation. Implementation of this type of activities may lead to significant increase in cost-effectiveness of project activities and enable implementation of projects which otherwise would not be possible, but they can also contribute to sustainable development at national level.

The two case studies presented below provide justification of CDM project implementation and give a better picture of how the economics of such projects can change with the involvement of additional CDM financing.

5.5.1. Co-firing of biomass and coal in TPP Obrenovac, Block A (case Study)

TPP Obrenovac is one of the largest TPPs in Serbia. Project activity will be to switch part of this plant from coal to wood chips or biomass. As this plant can provide a pioneering example for Serbia and the same project can be replicated at other TPPs or district heating plants, it has been chosen for this case study.

In this case study, a pilot project involving substitution of 10% of coal with biomass at the Obrenovac TPP Block A is considered. Block A has power generation capacity 300 MW_e with average efficiency 30% and operates for 7,000 hr/year.

It has been estimated that the above projects can utilize approximately 2,520 TJ of biomass, thus displacing the use of an average of 380,000 t/year of lignite. No methane emission avoidance is claimed as part of the project.

Table 13 below shows the estimated volumes of emission reductions for the period 2009 – 2012.

Year	2009	2010	2011	2012
Coal displaced (t)	380,000	380,000	380,000	380,000
Emission reductions (tCO_2e)	255,000	255,000	255,000	255,000

Table 13. *Estimated emission reductions due to partial fuel switch*

If the project is registered as a CDM project activity, the expected revenue from the project is shown in Table 14 below.

Year	2009	2010	2011	2012
Emission reduction (tCO_2e)	255,000	255,000	255,000	255,000
CER (10EUR)	2,550,000	2,550,000	2,550,000	2,550,000
CER (15EUR)	3,825,000	3,825,000	3,825,000	3,825,000

Table 14. *Revenues gained from carbon credit sale*

Analyses have shown that the sale of CER can repay the initial investments within a period of one to two years.

The project is also economically efficient as the price of biomass is much lower than the price of coal. Finally, such projects can be easily replicated across the Republic of Serbia.

5.5.2. *Capture of biogas and heating energy generation (case study)*

Assumption is that a CDM project for biogas capture and utilization for heat generation is developed at an animal farm in the Republic of Serbia.

The farm has 9,000 grown milk cows. The manure is currently treated in an open anaerobic lagoon, with average depth of 2 m. The manure spends approximately 1.5 months in the manure treatment system. The farm uses a heavy fuel oil fired boiler for on-site heat and hot water generation.

As part of the project a new anaerobic biodigestor will be installed and the captured biogas will be used for heat generation.

Year	2009	2010	2011	2012
Emissions (tCH_4)	1,237	1,237	1,237	1,237

Table 15. *Estimated emission reductions*

There is no incentive to develop the project without the CDM, as it will generate no additional revenue.

If the project is registered as a CDM project activity, the expected revenue from the project would be:

Year	2009	2010	2011	2012
Biogas (tCH_4)	1,237	1,237	1,237	1,237
Biogas (tCO_2e)	25,977	25,977	25,977	25,977
Emission reduction from heat generation (tCO_2e)	2,400	2,400	2,400	2,400
CERs	28,377	28,377	28,377	28,377
CER (10EUR)	283,770	283,770	283,770	283,770
CER (15EUR)	425,655	425,655	425,655	425,655

Table 16. *Revenues gained from carbon credit sale*

If we assume that a simple biodigestor system costs approximately €500,000 – €600,000, then the payback period of the project is slightly longer than one year with a CER price of €15/CER.

5.6. Conclusion

Although Republic of Serbia is a latecomer to the CDM market, it should be remembered that necessary institutional framework utilization of market under Kyoto Protocol has been established, that there is great interest from the investors, as well as that implementation of CDM projects may contribute to better environmental performance to great extent. It should not be forgotten that CDM project implementation is important for more efficient achievement of sustainable development criteria at national level.

When talking specifically about agriculture, implementation of CDM projects may significantly contribute to long-term issues at national level related to river and other watercourses pollution and faster and more efficient harmonization of agricultural practice with the requirements defined at international level.

Efficient implementation of certain types of CDM projects in agricultural sector until 2012. is realistically feasible, bearing in mind that investment return may be achieved in relatively short period of time.

Advantage for implementation of CDM projects in the Republic of Serbia is seen in potentials of using already existing knowledge and experience gained at international level.

It should be noted that approved CDM methodologies for agriculture sector are covering most of the project types which are feasible in the Republic of Serbia, so before the expiry of 2012 there will not be necessary to prepare new, but only to tailor the existing methodologies.

Taking into consideration current situation and agricultural practices at national level, it may be concluded that CDM projects with highest potential up to 2012 are the following: ***utilization of biomass for energy generation (heating, electrical and co-generation), co-firing of biomass, energy generation from biomass from dedicated plantations, utilization of biogas for energy generation and composting of manure and biomass.*** Significant potential for the Republic of Serbia is seen in implementation of ***Programmatic CDM.***

Bearing in mind high availability of biomass, implementation of projects related to ***substitution of fossil fuels with biomass for heating energy generation should be considered as priority*** ones among CDM projects in the Republic of Serbia.

This type of CDM projects is suitable for heating plants in big cities (Belgrade, Nis and Novi Sad), but also as a part of Programmatic CDM in smaller cities and towns.

Projects of utilization of biomass for electricity generation or co-generation are deemed most feasible only in the case of fuel switch at existing installations. Projects which involve construction of new biomass-fired power generation and CHP plants should not be considered as realistic option in the Republic of Serbia before 2012. These project activities can be developed in mid- and long-term period and only with the support from energy sector.

Co-firing of biomass is possible in local heating plants and big coal fired thermal power plants. For each individual potential CDM activity it is necessary to analyze possibilities for collection and continual supply of biomass before starting the preparation of a project.

In order to implement these projects, it is necessary to raise awareness among Serbian farmers as well as in the energy sector, about biomass as a valuable energy source.

Energy generation from biomass from dedicated plantations presents CDM project type which ***is not deemed viable*** in the Republic of Serbia up to 2012.

Although composting is an advanced waste management option, this project type is not viable in Serbia up to 2012. Basic reason for that is that limited know-how is available for compost production (and from plant biomass), as well as underdeveloped market for compost placement.

Analyses show that situation and agricultural practice limit potentials for implementation of CDM project activities at national level. Still, utilization of existing potentials for implementation of CDM project activities in agricultural sector may significantly contribute to improvement of life standard at national level.

VI POSSIBILITIES FOR IMPLEMENTATION OF CDM PROJECTS IN FORESTRY SECTOR

6.1. Aims and definitions

Human activities in the forestry sector may significantly affect overall GHG concentrations in the atmosphere. Activities, such as uncontrolled harvesting and devastation

of forests, as well as forest fires, lead to reduction of existing GHG sinks, thus affecting overall increase in GHG concentrations at global level. On the other hand, sustainable forest management, afforestation and reforestation result in reduction of overall GHG concentrations.

Depending on the type of activity, manner of forest management may significantly contribute to climate change mitigation, but it can also cause additional negative impact to the Earth climate system.

Change in existing practices and situation in forest management at the national level, in terms of increase in forestry sector contribution to climate change mitigation, may be supported by implementation of Clean Development Mechanism projects.

The aim of CDM project activities implementation in the forestry sector is reflected in removal of GHGs through sinks. According to provisions contained in Kyoto Protocol, the only available CDM project activities in forestry sector in the first commitment period involve afforestation and reforestation projects. Forest management, i.e. carbon sequestration in existing forests and controlled harvesting do not fall under possible CDM project activities in the first commitment period, i.e. between 2008 and 2012.

Although the Republic of Serbia has established necessary institutional framework to use the market established by Kyoto Protocol, justification and expected benefit from CDM project implementation may be conditionally put under question, taking into account that we are in the middle of Kyoto period. Certain advantage, in terms of more efficient implementation of these projects, is reflected in possibility of utilization of already existing knowledge and experience in this area at international level. In order to enable further development of CDM in forestry sector of the Republic of Serbia, this chapter of the Strategy is prepared with the goal to disseminate the available knowledge about CDM projects and provide guidelines for project owners and developers. The guidelines are based on the identified structure and already existing possibilities which exist under CDM in the forestry sector.

The aim of the chapter is to contribute to identification of certain potentials and ways of support to the implementation of CDM projects which could be provided by institutions of the Government of the Republic of Serbia.

The chapter of the Strategy contributes to implementation of the activities which would provide additional revenues to forest owners in Serbia, through carbon credit sale, identification and use of carbon neutral renewable energy sources for energy sector, and provision of additional environmental benefit, particularly with respect to biodiversity conservation, protection of watersheds and erosion control.

Ultimate goal of this chapter is to enable that forestry sector in the Republic of Serbia contributes more significantly to climate change mitigation and to utilize participation in CDM to full extent.

More specifically, the aim of this chapter is to identify:

a) Potentials for GHG removal and contribution to sustainable development through CDM;

b) Potentials for CDM project development in forestry sector;

c) Possible measures aimed at more efficient and cost-effective implementation of CDM projects in forestry sector.

This chapter provides the current status and trend in implementation of CDM projects in forestry sector, results and problems noticed during the development and implementation of this type of projects, as well as their possible implications for the Republic of Serbia. All of the mentioned takes into account current practice and other relevant characteristics in the sector at national level. The chapter provides overview of possibilities for development of CDM projects in the Republic of Serbia and cost and benefits analysis for most feasible CDM projects at national level, including theoretical possibilities of provision of financial support for this type of projects.

It should be remembered that activities within Clean Development Mechanism are exclusively the activities on voluntarily basis. CDM projects may only be developed at the individual initiative from the developer, not from the Government. Role of the Government is to ensure necessary institutional and legislative structure for project approval at the national level. The Government may possibly create administrative and financial support for specific types of CDM projects when it has been established that they are projects of national interest.

Therefore, guidelines and recommendations cannot be deemed as binding for any party, both for the developers and the Government of the Republic of Serbia.

In order to identify possibilities for implementation of CDM projects in forestry sector, and taking into account that the only possible CDM project activities are ***afforestation and reforestation***, ***definitions*** of these activities for the Strategy purposes will include ***any afforestation or reforestation measure, operation or action that aims at achieving net anthropogenic GHG removals by sinks***.

6.2. Existing experience at international level

In order to prepare CDM projects in forestry sector, it is crucial to have available data, information, as well as appropriate definition of forest.

It is significant to bear in mind that according to Kyoto Protocol, ***afforestation*** is defined as the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.

Reforestation is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources. Non-forested land is land that was forested at certain point in the past, but that has been converted to non-forested land.

Compliant to Kyoto Protocol requirements, registration of reforestation project activity under CDM will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

Although there are various definitions of a forest, in order to be eligible to participate in CDM, each country's forest definition must comply with the following criteria defining a "Kyoto forest". According to the Marrakesh Accords, ***forest definition*** must involve the following criteria:

- Minimum crown cover: 10-30 %;
- Minimum height at maturity of vegetation: 2-5 m
- Minimum area: 0.05-1 ha

Basic difference between CDM project activity which results in GHG emission reduction and CDM which results in increased emission removals by sinks is inconsistency. In the first

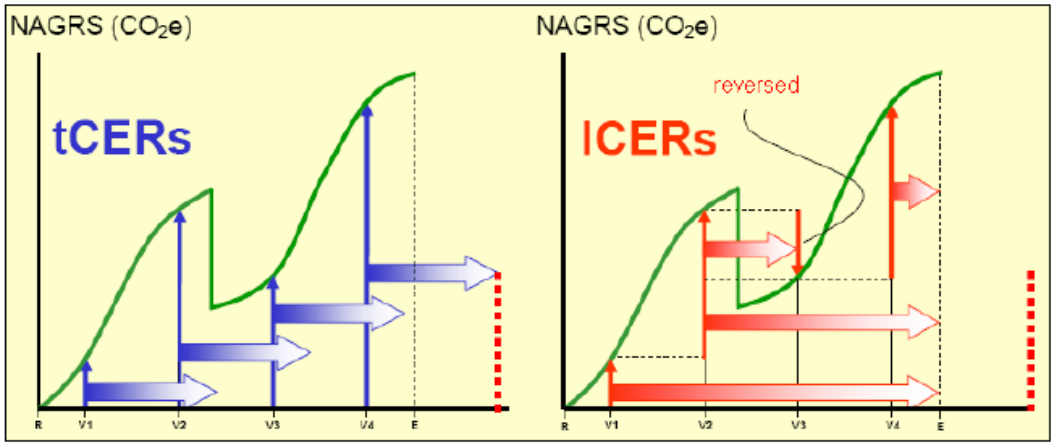
case we have emission reductions that are permanent, while A/R CDM removed reduction is not permanent. With the A/R activity, once removed CO_2 can be re-released into the atmosphere in the case of forest fire or dying of forest due to some disease.

The issue of inconsistency is solved through definition of two types of CER units which are issued for A/R CDM project activities.

Temporary Certified Emission Reduction (tCER) is a unit which expires at the end of the commitment period following the one during which it was issued.

Long-Term Certified Emission Reduction (lCER) is a unit which expires at the end of the crediting period of the A/R CDM project activity.

A tCER is issued based on carbon stock while a lCER is based on stock changes (Figure 13). Both are equal to one metric tonne of carbon dioxide equivalent.



Pedroni, L., 2005. Carbon accounting for sinks in the CDM after CoP-9. Climate Policy. 5:407-418.

Figure 13. *Carbon accounting for CDM A/R*

Taking into account the aforementioned requirements and provisions which significantly reduce possibility and complicate registration procedure under CDM project activity in the forestry sector, as well as risk which is present in implementation and certification of carbon credits resulting from these projects, number of registered CDM projects in this sector is significantly lower compared to other types of CDM.

As of September 2009, a total of eight A/R large-scale project activities had been registered in total (Table 17).

Registered	Title	Hosting country	Investors	Methodology *	Reductions **
10.11.2006.	Reforestation in Guangxi river strip, Pearl River Basin	China	Italy, Spain	AR-AM0001 ver. 2	25795

30.01.2009.	Moldova soil conservation project	Republic of Moldova	Holland	AR-AM0002 ver. 1	179242
23 03 2009.	Afforestation pilot project at private grounds Haryana	India		AR-AMS0001 ver. 4	11596
28.04.2009.	Cao Phong afforestation project	Vietnam		AR-AM0001 ver. 2	2665
11.06.2009.	Afforestation of degraded land	India		AR-AM0001 ver. 2	57792
11.06.2009.	Carbon sequestration through afforestation, Bolivia	Bolivia	Belgium	AR-AMS0001 ver. 4	4341
21.08.2009.	Nile River basin afforestation	Uganda	Italy	AR-AMS0001 ver. 5	5564
06.09.2009.	Afforestation of land in low-income municipalities, Paraguay	Paraguay	Japan	AR-AMS0001 ver. 4	1523

Table 17. Registered A/R CDM project activities (* AM - Large scale, ACM - Consolidated Methodologies, AMS - Small scale ** Estimated emission reductions in metric tones of CO2 equivalent per annum (as stated by the project participants))

Taking into account that number of registered projects is being changed over the time, for more information please refer to: http://cdm.unfccc.int/Projects/projsearch.html.

Time period needed for preparation of CDM projects, generally including forestry sector, greatly depends on the methodology, whether methodology for certain planned project activity had already been approved, or it is necessary to develop a new one. Every newly developed methodology must be approved by the relevant Convention authority, i.e., Kyoto Protocol.

As of September 2009, nine methodologies had been approved for large–scale A/R projects (Table 18).

Methodology number	Methodology (including baseline and monitoring methodologies)	Sectoral size	History of approval
AR-AM0001	Reforestation of degraded land --- Version 3	14	ARNM0010
AR-AM0002	Restoration of degraded lands through afforestation/reforestation --- Version 2	14	ARNM0007-rev
AR-AM0004	Reforestation or afforestation of land currently under agricultural use --- Version 3	14	ARNM0019
AR-AM0005	Afforestation and reforestation project activities implemented for industrial and/or commercial uses --- Version 3	14	ARNM0015-rev
AR-AM0006	Afforestation/Reforestation with Trees Supported by Shrubs on Degraded Land --- Version 2	14	ARNM0020-rev
AR-AM0007	Afforestation and Reforestation of Land Currently Under Agricultural or Pastoral Use --- Version 4	14	ARNM0021-rev
AR-AM0008	Afforestation or reforestation on degraded land for sustainable wood production --- Version 3	14	ARNM0028-rev
AR-AM0009	Afforestation or reforestation on degraded land allowing for silvopastoral activities --- Version 3	14	ARNM0024-rev
AR-AM0010	Afforestation and reforestation project activities implemented on unmanaged grassland in reserve/protected areas --- Version 3	14	ARNM0034

Table 18 Approved methodologies for large-scale A/R projects

Taking into account specific characteristics of forestry sector in the Republic of Serbia, the most relevant methodology for the Republic of Serbia is AR-AM0002 “Restoration of degraded lands through afforestation/reforestation – Version 2” (Republic of Moldova)

For more information about the methodologies, please refer to:

http://cdm.unfccc.int/methodologies/ARmethodologies/approved_ar.html).

Currently, two consolidated methodologies are available, of which AR-ACM0001 “Afforestation and reforestation of degraded land” is particularly relevant for the Republic of Serbia. This methodology is partly based on the previous AR-AM0003 “Afforestation and reforestation of degraded land through tree planting, assisted natural regeneration and control of animal grazing” developed in Albania.

As of September 2009, six simplified baseline and monitoring methodology for small-scale A/R are available (Table 19).

A/R CDM small-scale project activities are A/R measures, operations and actions of afforestation and reforestation aimed at net GHG removal by sinks less than 8 kilotons of CO_2 annually, whereat average designed net GHG removal by sinks for each verification period does not exceed 8 kilotons of CO_2 annually and if such measures, operations and

actions had been developed and implemented with small contribution from communities and individuals, according to hosting country provisions.

Reference	Methodologies Title (including baseline and monitoring methodologies)
AR-AMS0002	Simplified baseline and monitoring methodologies for small-scale afforestation and reforestation project activities under the CDM implemented on settlements
AR-AMS0003	Simplified baseline and monitoring methodology for small scale CDM afforestation and reforestation project activities implemented on wetlands
AR-AMS0004	Simplified baseline and monitoring methodology for small-scale agroforestry - afforestation and reforestation project activities under the clean development mechanism
AR-AMS0005	Simplified baseline and monitoring methodology for small-scale afforestation and reforestation project activities under the clean development mechanism implemented on lands having low inherent potential to support living biomass

Table 19 *Approved simplified methodologies for small-scale A/R CDM projects*

Information on methodologies for small-scale A/R CDM projects are available at: http://cdm.unfccc.int/methodologies/SSCAR/approved.html.

It is important to say that in 2007, according to World Bank data, the international regulated markets regulated by Kyoto Protocol, transacted 2,959.2 $MtCO_2e$, valued at US$ 66,421.5 million.

Beside carbon credit market regulated and established by Kyoto Protocol,, there is a certain number of voluntary markets, which make about 2.2% of the total market.

6.2.1. Expected costs for implementation of CDM project cycle

The costs for implementation of CDM project cycle, especially for large-scale for A/R CDM project activity development can be substantial (Table 20).

Estimates are provided for project activities in forestry sector because of specific characteristics of these projects compared to other CDM projects.

Activity	Cost for large scale CDM (EUR)	Cost for voluntary standards	Type of cost
Initial feasibility study	15,000-20,000	Similar	Consultancy fee or internal
PDD	25,000-100,000	Similar	Consultancy fee or internal
New methodology (if required)	25,000-65,000	Likely lower	Consultancy fee or internal
Validation	10,000-17,000	Similar	Auditor fee

Registration fee	USD 0.10 per ton for the first 15,000 t CO2e p.a. and USD 0.20 per ton for any ton above 15,000 t CO2e p.a.	Likely lower	Administrative fee
Monitoring cost (periodic)	5,000-25,000	Similar	Internal
Verification (periodic)	10,000-20,000	Similar	Auditor fee
Issuance fee	USD 0.10 per ton for the first 15,000 t CO2e p.a. and USD 0.20 per ton for any ton above 15,000 t CO2e p.a.	Likely lower or non-existent	Administrative fee
Adaptation levy	2% of generated CERs	Non-existent	Administrative fee

Table 20. Costs for A/R CDM development (Ecosecurities (2008))

6.3. Current status in forestry sector in the Republic of Serbia

6.3.1. Basic information

Existing strategic framework for forestry sector in the Republic of Serbia is established through the Forestry Development Strategy (hereinafter: FDS) for the Republic of Serbia (2006), which acknowledges the important role of forests in climate change mitigation.

At the same time, the FDS defines a clear policy goal in support of afforestation/reforestation and the establishment of fast growing plantations. FDS defines implementation of Kyoto Protocol as a potential international financing source for the establishment of new forests and the enhancement of actual forests.

Draft Forest Master Plan (2008) devotes an own section to the mitigation of and adaptation to climate change. It sees an important role for the CDM to support the national goal to increase the woodland cover to the projected level of 41% in 2050.

It identifies the following five project categories for the CDM:

1) Afforestation and reforestation of forests for commercial use;
2) Afforestation and reforestation of forests in degraded regions;
3) Afforestation of land used for agriculture and cattle breeding;
4) Rehabilitation of degraded land by afforestation or reforestation;
5) Substitution of fossil fuels by wooden biomass

Draft Forest Master Plan calls for a study for the definition of conditions and possibilities for CDM projects implementation in the forestry sector.

According to data, total forest cover of the Republic of Serbia in 2000 was 26.2%. According to Serbia's National Forest Inventory (NFI, 2007), the forest cover of Serbia[15] is

[15] Without Kosovo and Metohija

29.1%, with marked difference of forest cover between Vojvodina (only 7.1%) and Central Serbia (Figure 14).

The increase of national forest cover is mainly due to natural regeneration. Systematical afforestation was limited in the past 10 years.

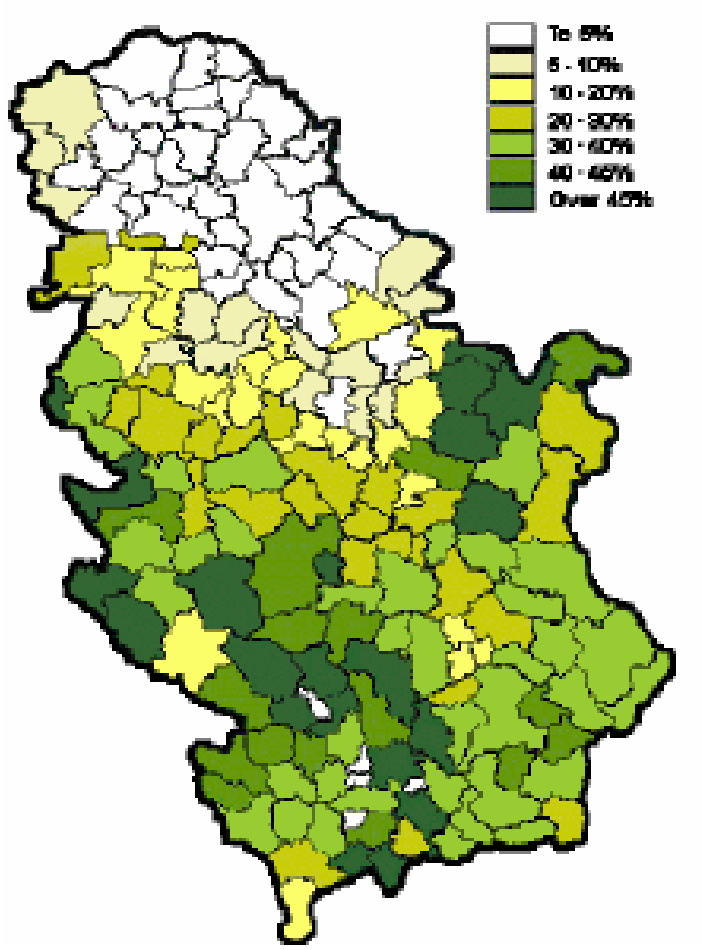


Figure 14. Forest coverage by districts in the Republic of Serbia

In the period of 1960-2006, 219,064 ha of forests were converted to other uses according to the Annual Almanac, and 13,568 ha in the period 1999-2006.

Out of the total forest area of 2,252,400 ha, coppice forests cover almost two third of it, while high natural forests rank second with 28%, followed by artificial plantations (8%) (Figure 15). The share of coppice forest is particularly high for private and other owners (about 75%), while on state-owned forests the share of high natural forests is larger (41.1%).

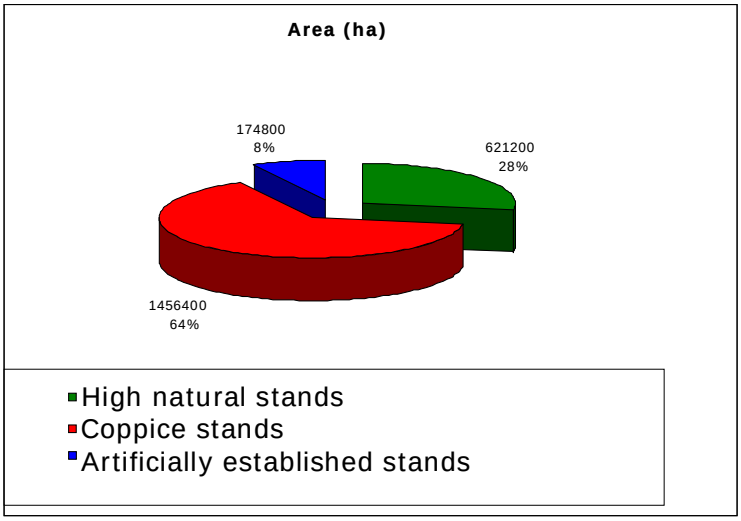


Figure 15. Area according to forest type

Broadleaved forests are dominating in Serbia. The most common vegetation types are beech forests (27.6%) and oak forests (24.6%).

Share of various types of forests in the Republic of Serbia, on the basis of data obtained from the National Forest Inventory, is shown in Figure 16.

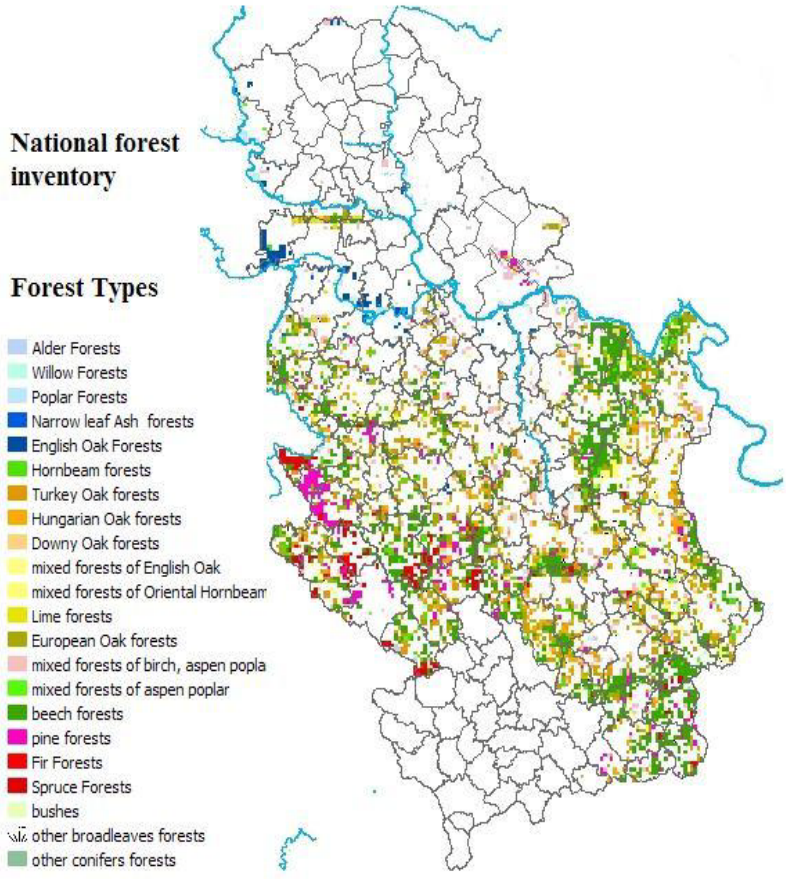


Figure 16. Forest vegetation types in Serbia according to NFI, 2007

Most of the forests in the Republic of Serbia is privately owned (1,175,200ha), while 896,400ha is state-owned and 180,800ha belong to other owners (Figure 17).

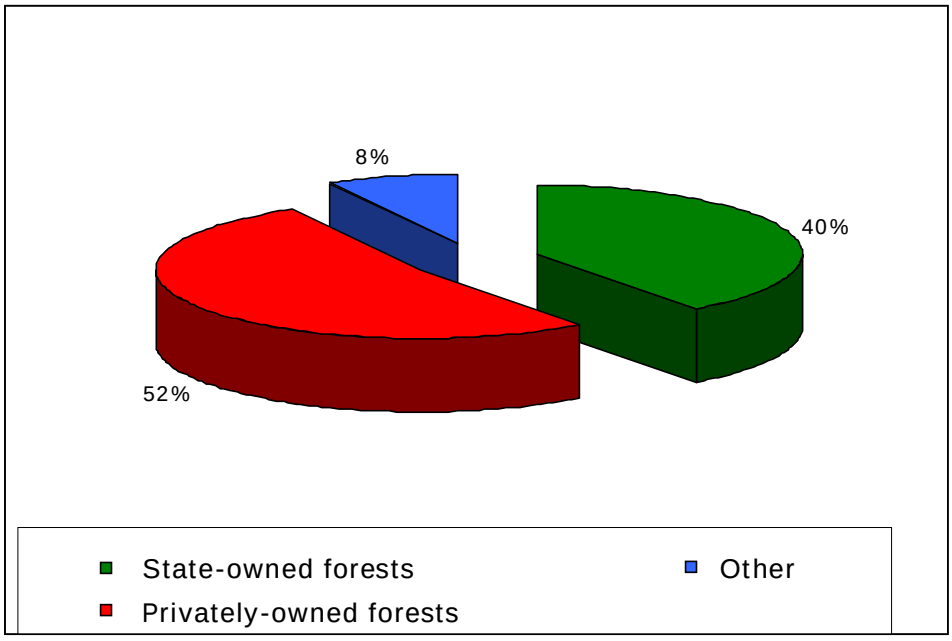


Figure 17. *Ownership structure in the Republic of Serbia*

Privately-owned forests are characterized with small areas which belong to different owners, and this has significant negative impact to professional and consistent forest management.

6.3.2. Growing stock and increment

According to the results for 2007, the total growing stock in the Republic of Serbia was about 362.5 million m^3 and the annual volume increment is about 9.1 million m^3.

Translated into annual level, growing stock of 161 m^3/ha and an average annual increment of 4.0 m^3/ha was recorded (Table 21). High natural forests store have by far the largest timber and carbon stock per ha (254 m3/ha), while artificially established stands have the largest increment per ha (7.1 m3/ha/yr).

As natural coppice stands have the lowest volume (124m3/ha) and increment (3.1 m3/ha/yr) per hectare, from a climate perspective it would be beneficial to convert them either into natural high forests or artificial plantations.

	Area		Volume			Increment		
	ha	%	m^3	ha	%	m^3	ha	%
High natural stands	621,200	27,6	157,511,263	43.5	253,6	3,387,959	37.3	5
Coppice natural stands	1,456,400	64,7	181,188,914	50.0	124,4	4,458,193	49.1	3.1
Artificially established	174,800	7,8	23,787,241	6.6	136,1	1,233,621	13.6	7.1

stands								
Total	2,252,400	100	362,487,418	100	160,9	9,079,772	100	4.0

Table 21. Area, volume and increment of Serbia forests[16]

According to the 2007 National Forest Inventory (NFI), carbon stock in the Republic of Serbia's forests (above-ground vegetation) is about 440 million tons CO_2 in total or 196 tCO_2/ha.

Forest ecosystems in Serbia are characterized by a high reserve of soil organic carbon.

Based on the results of the European forest monitoring programme (ICP Forest)[17], the soil carbon stock amounts to 518 MtCO2 in total or 220 tCO2/ha and is thus higher than the carbon stock of above-ground vegetation. Another 79 MtCO2 or 34 t·CO2/ha are stored in the litter layer.

If we assume that 1 m^3 has an average the wood density of 0.5 t/m^3, a carbon content of wood of 50%, a biomass expansion factor of 1.6, and the relation C/CO2 of 1:1.67, forests in the Republic of Serbia ***sequester approximately 13.3 million tCO2 yearly or 5.9 tCO2/ha/yr.***

6.3.3. Afforestation/reforestation

In the 1950s, Serbia had only 17.6% forest cover. Through a major afforestation effort, Republic of Serbia increased forest area by 540,000 ha until 2005.

In the period between 1946 and 2006, an average of 9,000 ha was afforested annually, with the annual afforestation rate varying from a maximum of 19,569 ha in the period 1981-85 to the current (2001-2006) minimum of only 1,056 ha (**Error! Reference source not found.**18). Since 1995, the annual afforestation has dropped significantly and is below 2000 ha.

[16] As of 2007

[17] Source: Kadovic et al. (2007), Forestry and climate change, Final report of the project "Climate Change and Sustainable development of Serbian Forest Ecosystems

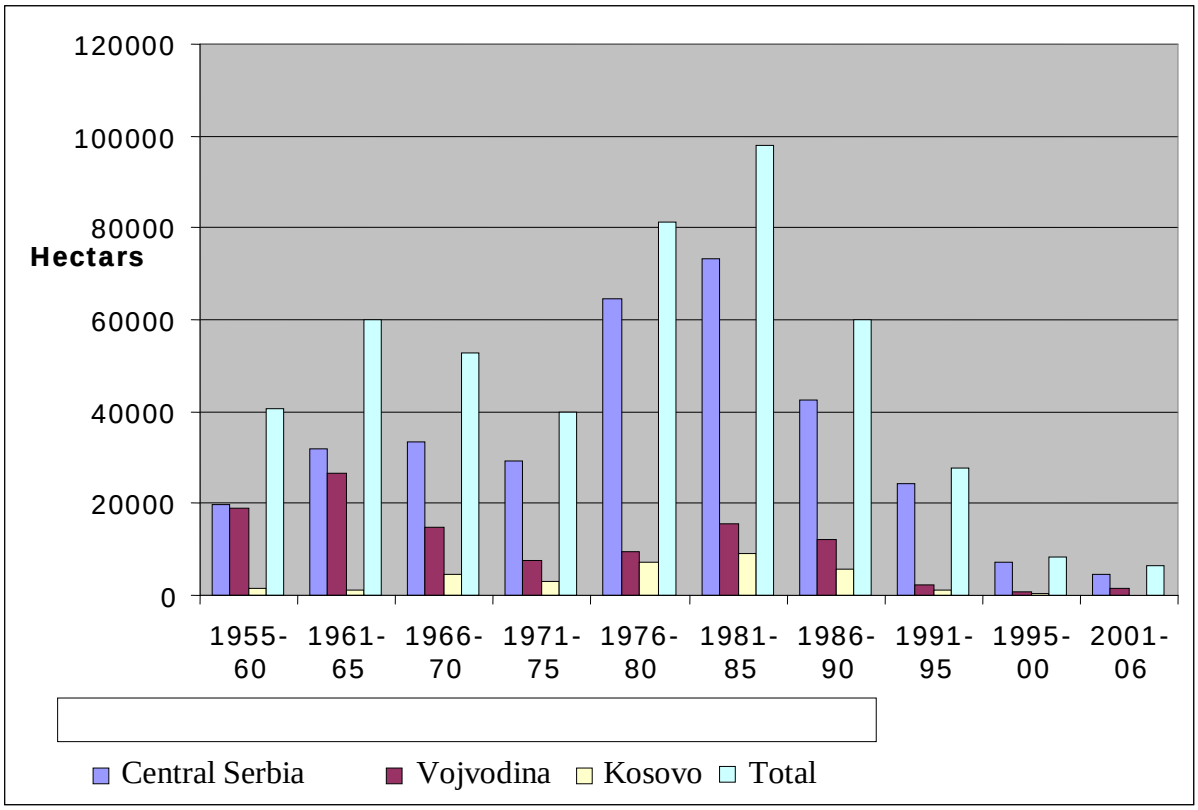


Figure 18. Afforestation of barren terrain in the period 1955-2006 [18]

Republic of Serbia has an ambitious policy to increase forest cover. According to the National Spatial Plan (NSP, 1996), the forest cover shall increase to 31.5% till the year 2010 and to 41.4% by the year 2050. Expressed in hectares, the forest area should increase by 371,000 ha until 2010 and about 1,250,000 ha until 2050. Annual increase of 26,500 ha until 2010 and 23,000 ha until 2050 has been stipulated.

Location	Forest situation in 1993		Optimal forest cover in 2050	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
Vojvodina	146,402	6.8	307,875	14.3
Central Serbia	1,837,417	32.8	2,789,737	49.8
Total	2,412,940	27.3	3,659,184	41.4

Table 22. Planned increase of forest cover in the Republic of Serbia

At the same time, according to the draft FMP, the forest area should be increased by 90,000 ha (or 1.16%) during the next 10 years. Such increase is less than the target of the NSP.

Draft FMP also prescribes what type of measures to be undertaken (Figure 19). About 92% is intended for merely protective functions and only 8% for predominantly economic functions. Two thirds of this amount is to be accomplished on private land, and one third on state-owned land.

[18] Source: Republic Statistic Bureau

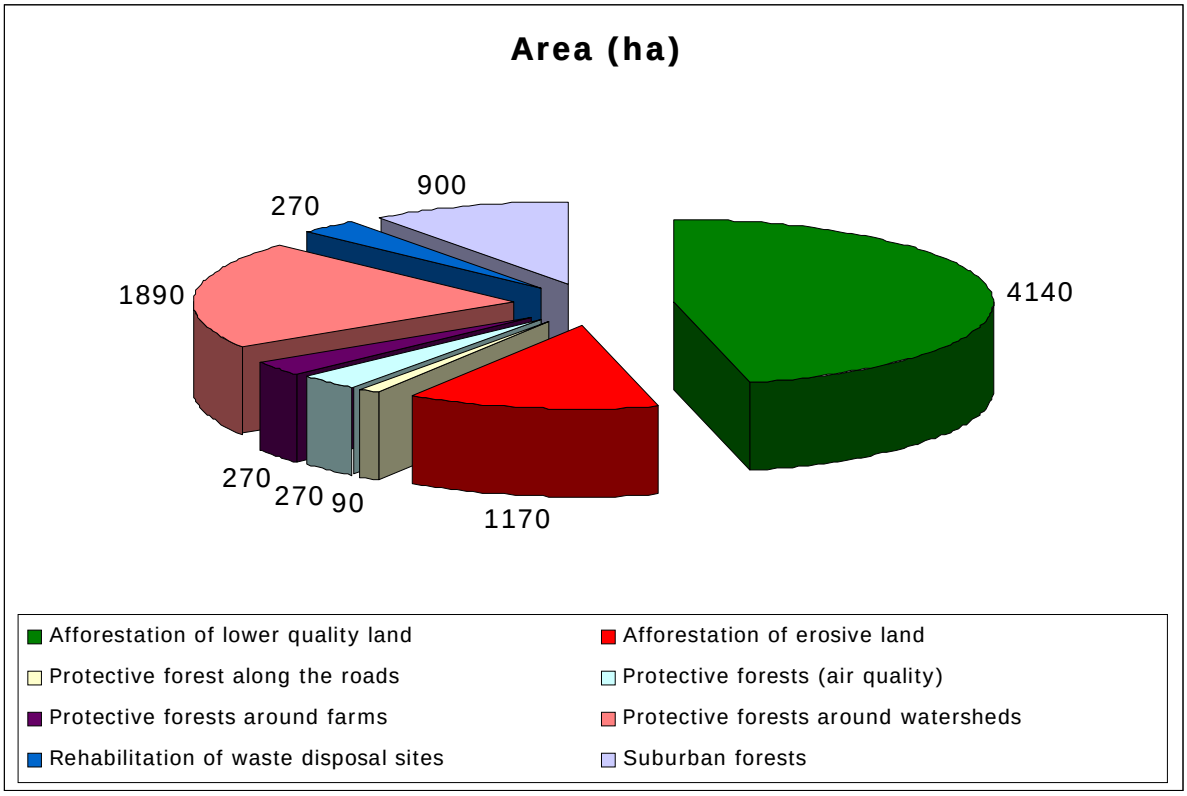


Figure 19. Stipulated annual afforestation target for the next 10 years

It has been estimated by draft FMP that the required public investment costs for the 10 year afforestation programme are € 150 million in total, about € 100 million for afforestation no non-state land, and another € 50 million for state land.

It is proposed that afforestation on state land is paid by 100% from public (budget) subsidies, while public subsidies will be limited to 50% on non-state land. This means that € 50 million need to be mobilized by private funds for the afforestation of non-state land. Possibility to raise those funds is also seen in the CDM.

In regard to A/R CDM activities in the Republic of Serbia, it is evident that the baseline is less than 2,000 ha A/R per annum.

Taking into account that the targets defined in relevant national documents (draft NSP and draft FMP) are very ambitious, it seems unlikely that they can be achieved without CDM funding.

Programmatic A/R CDM may provide additionality in comparison to baseline scenario in the Republic of Serbia.

Taking into account potentials provided by CDM in forestry sector, it is significant that draft FMP identifies possibility to afforestate approximately 1,000,000 ha of agricultural land (types V-VII and part of type IV) that is not used for intensive agricultural production.

This fits well with the estimation that about 0.9 million ha of agricultural land in the Republic of Serbia is marginal/unproductive.

On the basis of certain estimates[19], some 1.3 million land of vacant and abandoned agricultural land could be reforested ***in the long-term***.

[19] The CDM study (2007) conducted by the Italian Ministry of Environment, Land and Sea (IMELS)

In Vojvodina, the overall potential is limited due to the fertility of agricultural land, but agricultural land parcels tend to have a larger size. In Central Serbia, there is more marginal agricultural land; however, the land holdings are smaller, making it difficult to find suitable areas of manageable size.

In terms of available area, most potential for afforestation of agricultural land under CDM is on private land. The challenges are the small land holdings, lack of cadastre, limited knowledge of farmers/rural population about CDM mechanism and organizational issues (e.g. need for active farmer association).

6.4. Potential areas for A/R CDM implementation in the Republic of Serbia

Potential areas for implementation of CDM projects in forestry sector are primarily conditioned with identification of potential project activities. In order to identify potential CDM project activities in forestry sector, it is necessary to have relevant data and information, as well as knowledge on possibilities and advantages that result from CDM project activities.

During the development of this part of the Strategy, related to forestry sector, it was noticed that relevant data for the sector are limited and that there is limited knowledge about possibilities and limitations of CDM.

Although there are some preliminary project idea notes for the sector, it is necessary to check and elaborate them in order to initiate their implementation before the expiry of the first commitment period.

6.4.1. Fast-growing plantations on agricultural land intended for sawn timber

Many agricultural lands in the Republic of Serbia were returned to the former owners as part of the restitution process. Many private owners have a lack of experience and finance to efficiently cultivate agriculture land, or have migrated to urban areas. Thus, ***there are many abandoned plots which could be afforested under CDM with fast-growing forest species like poplar, robinia and tilia***. An issue is the fragmented nature of the restituted parcels.

There is also state owned agricultural land which is procedurally more easily available for A/R than private owned agricultural land.

It has been estimated that ***about 1 million ha of abandoned or marginal agricultural lands exists in the Republic of Serbia***. These lands, particularly the better soil types, offer excellent conditions for fast tree growth and thus optimal carbon sequestration.

Best adapted to the prevailing soil and climate conditions in the Republic of Serbia are poplar varieties.

Most suitable areas for planting of poplars are areas along watersheds. Poplars have shallow root system and they cannot stabilize banks in full, but they help in prevention of wind erosion. Doing so, fire risk could be reduced bearing in mind that abandoned agricultural land would become managed land.

For producing sawn timber, the standard planting scheme for poplar is 4m x 4m, i.e. 625 trees/ha. The planting technique is “afforestation in a hole”. Soil preparation and tending should be foreseen, while coppicing should be done for producing high-quality timber. The duration of rotation will depend on the site and product, i.e. at the age of mean annual increment (MAI) culmination.

In the Vojvodina plain, and particularly along rivers, a MAI >20 m^3/ha/yr can be attained. If we assume that the MAI is exactly 20 m3/ha/yr, about 30 tCO2 would be saved annually.

Planting an area of 10,000 hectares, about 300,000 tCO2 could be sequestered per year. With fast-growing poplars, it may even be possible to generate up around 50 tCO2/ha/yr.

Hypothetical carbon sequestration curve for a 30 poplar plantation producing sawn timber has been shown in Figure 20.

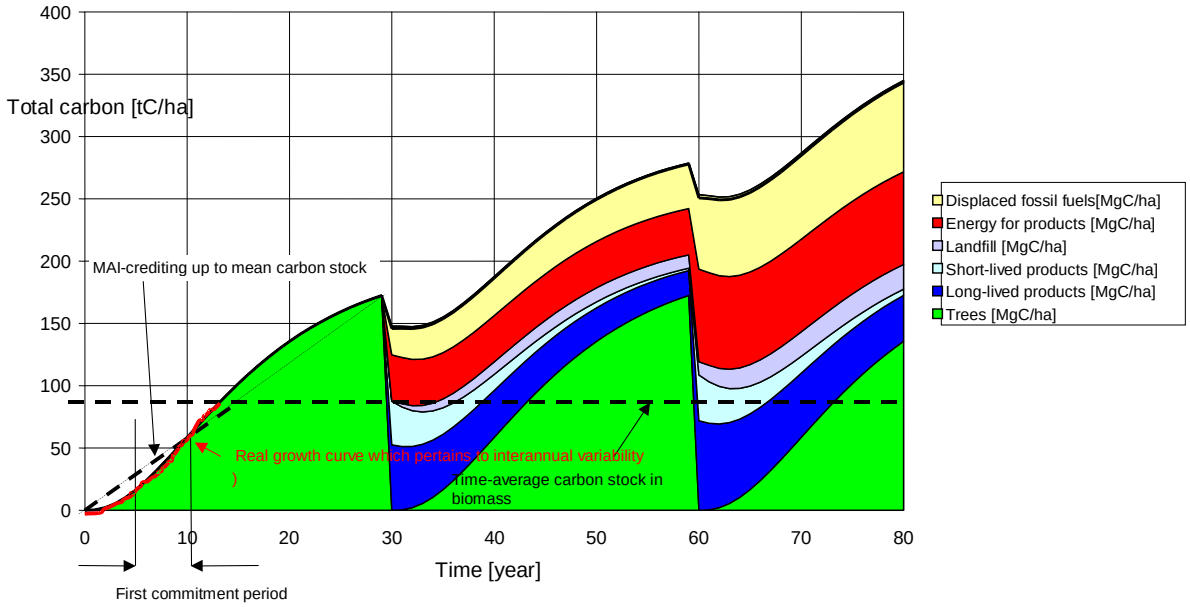


Figure 20. Hypothetical carbon sequestration curve for a 30 poplar plantation producing sawn timber

The A/R activity would have a positive social effect due to the support of private and possible communal forestry practice since it would create new employment opportunities, as well as the possibility for farmers to benefit from the intercropping of maize or vegetable on communal plantations. Poplar planting has positive environmental effects.

6.4.2. Fast-growing plantations at agricultural land for energy generation

The best sites for fast-growing plantation are abandoned agricultural lands on flat terrain. Located there, they allow for mechanized planting and harvesting.

The aim should be to maximize biomass production in a very short rotation period (3-5 years). Compared to forest plantation, the carbon sequestration will be larger; however, the time-average carbon stock will be lower. Maximizing the MAI and on good soils, it seems possible to attain larger carbon sequestration than 30 tCO2/ha/yr.

Fast growing species such as ***poplar, black locust or willow*** are planted densely to maximize biomass production. *Black locust (Robinia pseudoacacia)* is particularly well suited for energy plantations, as it has the following characteristics[20]:

- Vigorous growth in the juvenile phase
- Excellent pruning ability
- High wood density
- High dry matter production
- Favorable combustibility of wood

[20] Rédei, 2001

- Relatively fast drying
- Easy harvesting and wood processing

The rotation age would be about 5 years and the optimum spacing 1.5 x 0.3m.

This A/R activity is very promising, as it can be combined with the use of bio-energy for fuel switch, which generates additional CERs.

One of the examples of such project activity is a ***CDM project activity prepared by the Institute for Lowland Forestry and Environment, University of Novi Sad.***

The idea is to grow fast-growing plantations to produce pellets, briquettes or wood chips on the area which covers 44.2 ha. The land is public property rented by the Institute. The current vegetation consists of grasses and bushes. The area was never covered with forest. It is proposed to plant fast-growing poplar clones, with an estimated mean annual increment of 20 m3/ha/yr, which amounts to roughly 30 tCO2/ha/yr. The proposed planting scheme is with 1m x 0.4m, resulting in 25,000 plants per hectare.

The area would be regularly fertilized and suppression of weeds with herbicides would be done.

The establishment costs are estimated at € 3,000 – 4,000 per hectare.

The project could generate in average about 1,320 tCO2 per year.

6.4.3. Rehabilitation of degraded and barren land

This type of A/R activity would afforest barren and degraded land without forest cover since 1990. Possible A/R activity of this type is also rehabilitation of land degraded due to human activities or due to pollution which is consequence of e.g. mining, industrial dumpsites etc.

It is possible to implement such project activity in the Republic of Serbia in order to rehabilitate salted land in lowland areas (particularly in Vojvodina) and the other is in upland areas which are subject to erosion (Central Serbia).

A possible project idea is presented by PE “Srbijasume”, which proposed to afforest 1,300 ha of land in hilly areas of Central Serbia, namely 200 ha of barren land in state ownership, 600 ha of barren land in private ownership and 500 ha of burned land. The current vegetation is grass and some bushes and the area is prone to fire.

According to Kyoto Protocol rules, only land would be eligible for afforestation which was burnt before 1990 and remained without forest cover ever since. Therefore, particularly the eligibility of the burned areas would need to be checked. It is foreseen to plant autochthon conifers (spruce, white and black pine) and deciduous trees (beech, oak, acacia). The rotation would be 80-100 years, with the first commercial thinning at year 20.

The MAI would be about 5-6 m3/ha/yr, or 6-8 tCO2/ha/yr. It is estimated that the project could sequester about 9,000 t CO2 per year. The afforestation cost are approximately 1,200 €/ha, but will vary according to site conditions. State subvention on private owned land will be 50% of the costs (seedlings will be distributed to individuals free of charge), therefore the calculated costs for the state are only 600 €/ha for private land.

The total project costs would amount to € 1.2 million. The carbon sequestration potential of this activity will be limited (Figure 21), as the profitability.

However, carbon credits may provide an additional incentive.

Species	MAI (m^3/ha/a)	Dry Wood Density (t/m^3) with range	Carbon Sequestration (tCO2/ha/a)
Quercus spp.	2 - 6	0.64 (0.38 – 0.90)	2.2 – 7.0
Pinus spp.	2 - 7	0.49 (0.30 – 0.86)	1.8 – 6.2
Fagus silvatica	4 - 9	0.66 (0.54 – 0.84)	4.8 – 11.0
Picea abies	4 - 12	0.43 (0.37 – 0.54)	3.3 – 9.5
Robinia pseudoacacia	5 - 7	0.73 (0.54 – 0.87)	6.6 – 9.5
Pseudotsuga douglasii	10 - 17	0.47 (0.36 – 0.63)	8.8 – 14.7

Table 23. Carbon sequestration potential of selected tree species

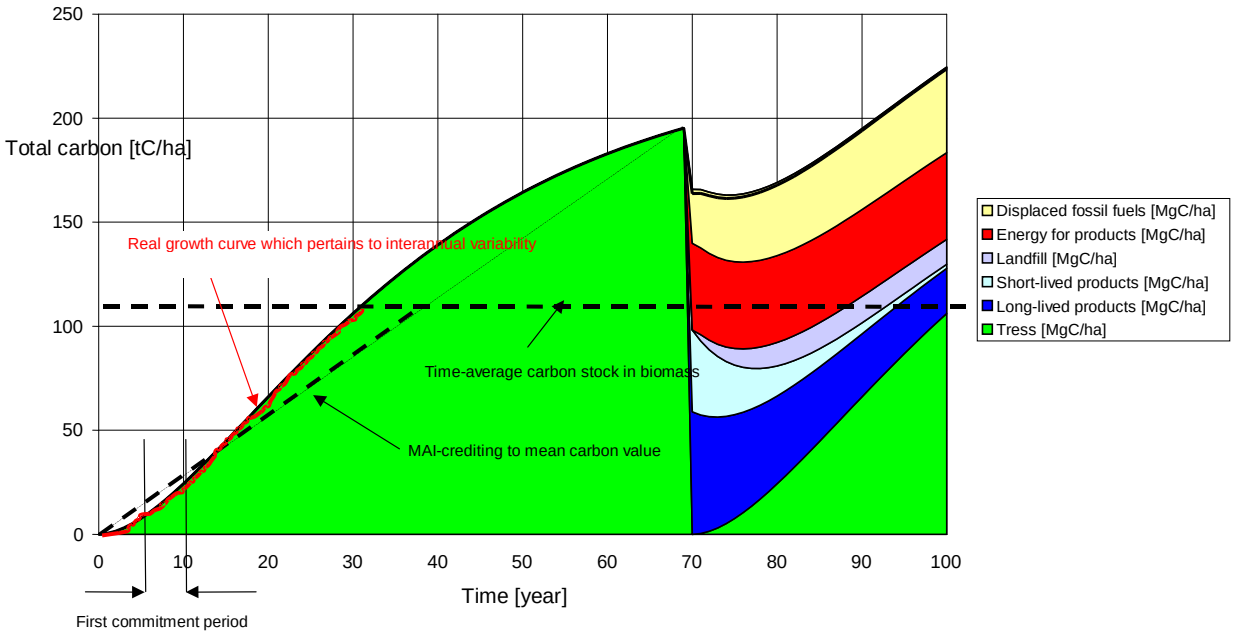


Figure 21. Hypothetical carbon sequestration curve for black pine

On severely degraded sites or waste lands, an alternative could be to plant pioneer species such as Black Locust (*Robinia pseudoacacia*), which have a faster growth and can be managed on shorter rotations (e.g. 20 years). A simply-structured "*Pioneer Forest*" of even age would result, which could later be enriched by more shade-tolerant climax species or managed as coppice.

This way, it should be possible to sequester about 12 tCO2 per hectare and annum (Table 24).

	Robinia pseudoacacia	*Pinus nigra*
Mean annual increment of merchantable timber volume (m^3/ha/yr)	5	3,6
Expansion Factor	1.88	1.521
Total dendromass (m^3/ha/yr)	9.4	5.4
Wood density (kg/m^3)[22]	730	431
Dry weight of biomass (t)	6.86	2.33
Proportion of carbon contained	0.5	0.5
Annual Carbon uptake (t C/ha/yr)	3.43	1.16
Annual CO_2 uptake (t CO_2/ha/yr)	12.6	4.3

Table 24. *Annual CO_2 uptake of Black Locust and Black Pine on degraded sites*

The rehabilitation of degraded waste lands is certainly beneficial from an environmental viewpoint. The barren land is currently subject to wind and soil erosion and the dumping of waste.

Afforestation leads to reduced soil erosion, improved organic content in the soil, more balanced temperatures, increased water storage and improved air quality through the absorption of dust particles.

6.4.4. Establishment of new multi-purpose forests

Establishment of new multi-purpose forests as project activity is somewhat related to the previous one, but would also include the establishment of forests on not degraded sites, with the aim of sustainable forest management, providing various functions. For instance, it might be attempted to connect existing forest areas via a "wildlife" corridor for biodiversity conservation purposes, establish suburban forests for predominantly recreational purposes, or new private forests with a focus on economic profit.

Although the overall potential in terms of areas seems to be limited, it would be worthwhile to support, particularly bearing in mind their multi-purpose function.

It is important to note that the activity would have a limited carbon sequestration potential in the short-run (**Error! Reference source not found.**5 and Figure 22), and they are cost-effective under a long investment horizon (e.g. at least 80-100 years).

Without CERs, it is hardly imaginable that this project activity would be implemented. Even with CERs, it might still not be sufficiently attractive for a potential investor. Additional subsidies may have to be provided to ensure cost-effectiveness, particularly if an overriding national or regional interest exists.

21 Böswald (1996)
[22] Knigge and Schulz (1966)

Mean annual increment of merchantable timber volume (m^3/ha/yr)	4	8
Expansion Factor[23]	1.8	1.8
Total dendromass (m^3/ha/yr)	7.2	14.4
Wood density (kg/m^3)	377	377
Dry weight of biomass (t)	2.71	5.43
Proportion of carbon contained	0.5	0.5
Annual Carbon uptake (t C/ha/yr)	1.36	2.72
Annual CO_2 uptake (t CO_2/ha/yr)	5.0	10.0

Table 25. Carbon sequestration potential of spruce over 100 yr rotation

An example of this type of A/R is establishment of forests of beech, fir and spruce. Adopting selective thinning, the carbon sequestration could be increased.

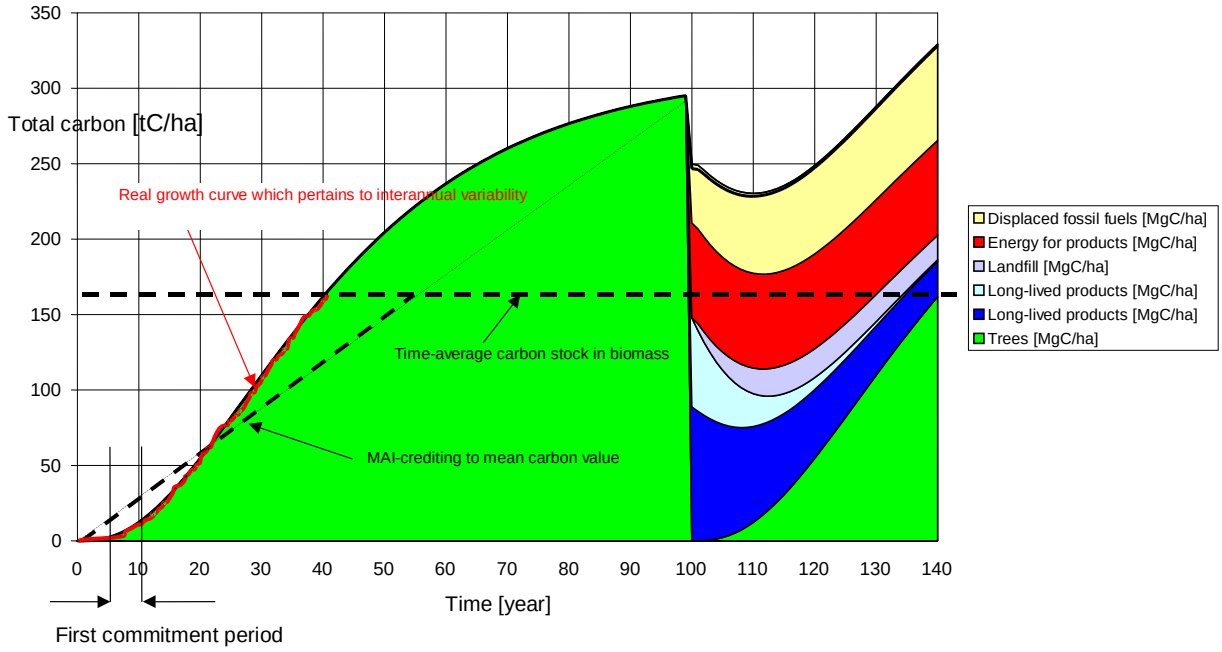


Figure 22. *Hypothetical carbon sequestration curve for spruce*

This type of A/R activity would have a positive social effect, as the development of the private and/or public forestry sector would be supported, which in turn would provide additional employment opportunities. In addition, positive environmental impacts are obvious, such as prevention of soil erosion and mud slides, climate mitigation, watershed protection, and higher biodiversity.

There are certain initiatives and ideas for implementation of this type of activity in forestry sector at the territory of the Republic of Serbia. For most of them it has not been determined whether proposed areas have been without forest cover since 31 December 1989.

[23] Böswald (1996)

Also, most commonly proposed afforestation size is not sufficient for development of a large-scale CDM project, but it is possible to combine and implement them through Programmatic CDM.

6.4.5. Establishment of forest shelterbelts and riverian buffers

Forest shelterbelts are established for protective purposes mainly along roads, rivers, and farm boundaries and they play protective role.

Establishment of shelterbelts has many positive social-economic and environmental effects. Some of them are shown in Table 26.

Positive	Negative
- Increased average yields of grain (up to 35%) and maximum yields (2-3 times higher)24	- Reduction of agricultural area
- Evaporation deduction on agricultural lands	- Shading of crops in the immediate neighborhood
- Decreased wind velocity (up to 60%), up to a distance of 10-15 times of tree height on leeward side and 5x tree height on windward side	- Heterogeneous snow cover distribution along the FSB can cause frost damage for uncovered crops (if belts are too dense)
- Reduced wind erosion	
- Improved microclimate (5-10% higher atmospheric humidity) and water balance (about 50% less water drain, more precipitation and dewdrop)	
- Increased biodiversity, additional wildlife habitat and less habitat fragmentation	
- Facilitating reproduction and genetic cross-fertilization of wildlife through a network of interconnected biological corridors	
- Improved crop protection through existence of beneficial insects and parasites	
- Higher recreation value of the area	
- Employment generation	

Table 26. *Socio-economic and environmental effects of shelterbelts*

Tree species to be planted in forest shelterbelts shall be mainly indigenous hardwoods such as oaks (*Quercus spp*), black locust (*Robinia pseudoacacia)*, ash (*Fraxininus spp)*, *Gleditschia triacanthus*, hornbeam (*Carpinus spp*), walnut (*Juglans regia*), etc.

24 Peev and Hinkov 2000

Three to five planting rows should be foreseen large trees in the center and shrubs to the field edges. The distance between the rows should be at least 3 m, the planting distance within the row no less than 2 m for large trees in the centre (max. 1,666 trees/ha). In between, "accompanying" trees and shrubs should be planted. A strong thinning regime should be applied in order to achieve a height/diameter ratio below 0.8. This would help to reduce the risk for blow-down and possibly ice-break. A forest shelterbelt (FSB) should be thinned regularly (density of 50-70%), in order to avoid wind turbulences and windthrows. The shelterbelts would be managed by selective cutting and coppice, and not by clearcut, as the protective forest cover shall be maintained permanently.

Experiences in Germany suggest that a FSB should be dense on ground level, and open particularly in the tree canopy. Therefore, it is necessary to maintain an understorey of shrubs, which is managed as coppice. This would also provide important habitat for birds and small mammals.

This management regime is particularly suited for the production of firewood, and thus in line with the likely objectives of private and communal land owners.

It is important to say that deciduous trees have only a modest growth rate. Based on experience in North-Western Bulgaria, a mean annual increment of 4 m^3/ha/year should be achievable by a 100 year old FSB dominated by oaks (conservative approach), as the mean annual increment of oak culminates late, normally at the age of 100 to 120 years.

The average annual CO_2 uptake might be about 6.6 t CO2/ha/yr (Table 27 and Figure 23).

Mean annual increment of merchantable timber volume (m^3/ha/yr)	4
Expansion factor[25]	1.6
Total dendromass (m^3/ha/yr)	6.4
Wood density (kg/m^3)[26]	561
Dry weight of biomass (t)	3.59
Proportion of carbon contained	0.5
Annual carbon uptake (t C/ha/yr)	1.8
Annual CO_2 uptake (t CO_2/ha/yr)	6.6

Table 27. Annual CO_2 uptake of an oak shelterbelt

[25] Böswald (1996)
[26] Knigge and Schulz 1966

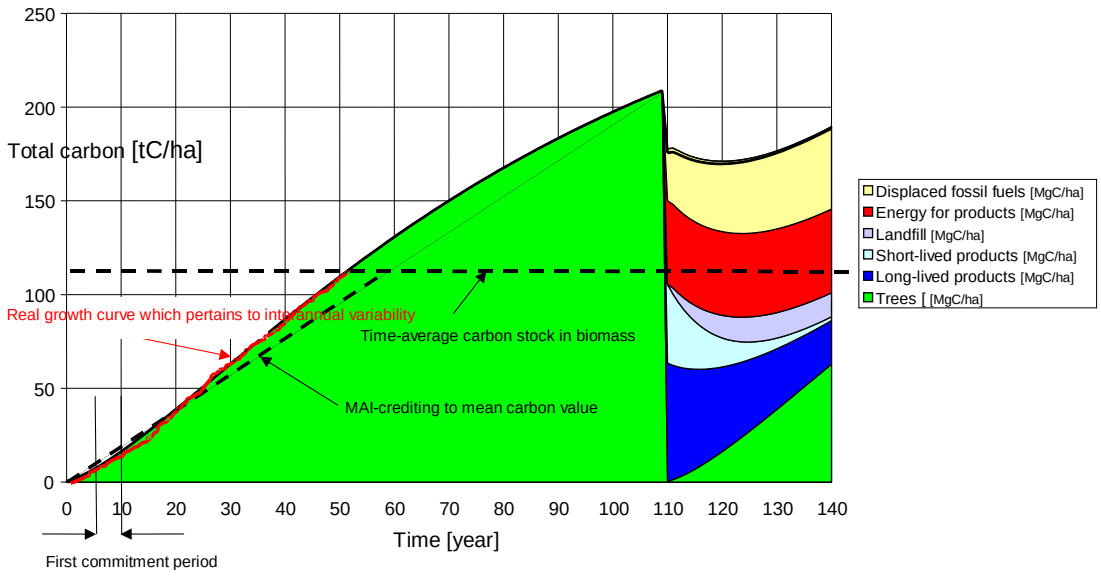


Figure 23. Hypothetical carbon sequestration curve for a oak shelterbelt
(*based on GORCAM model, Quercus spp., 2nd yield class*)

In the absence of accurate data, it is roughly estimated that the internal rate of return (IRR) for oak shelterbelts is small (2-4%), even with carbon credits. For a proper financial and economic analysis, yield tables of the tree species to be planted and annual costs and revenues flows would be required. It also needs to be assessed to what extent co-financing through government subsidies is possible.

One concrete example of this project type in the Republic of Serbia has been identified by the CDM portfolio study of the IMELS from 2007.
The project idea is called "Establishment of forest shelterbelts for agricultural lands". The project proponent is the municipality of Kikinda. It has been proposed to establish 1,815 km of shelterbelts having a width ranging from 7.5 to 12 meter, which amounts to 1,831 ha. In addition, 550 ha of saline land could be also afforested in the municipality, which could be used for recreational purposes.
This would also help to reach a larger area under forest of 2,381 ha.
It has been estimated that the project could sequester around 36,000 tCO_2eq for the period 2008-2018.
The cost for the establishment of the shelterbelts are estimated at € 2.38 million, which would translate in € 1,300 per ha and € 66 per tCO_2 for the first 10 years and ignoring future revenues from wood sale.

6.4.6. Combination of plantations with bio-energetic use

An interesting option is the combination of a fuelwood plantation with a bio-energy "plant" (fuel switch) since it would generate more CERs, especially in the short run, which would also lead to cumulative emission reductions.

According to CDM rules, each of the two project activities needs to use its own methodology and have its own validation, monitoring, etc. Each component should refer to the other in the PDD to proof the additionality.

For example, the methodology AM0036 (Fuel switch) from fossil fuels to biomass residues in boilers for heat generation) may be adopted for the bio-energy component, while for the A/R activity another methodology will have to be used.

Table 28 below, the estimated investment costs are shown.

Activity	Estimated investment (€)	GHG offset (tCO_2) (2009-19)	Abatement cost per tCO_2*
Afforestation	1,250,000	39,000	32.1
Thermal boiler	310,000	7,000	44.2
CHP plant	4,500,000	121,000	37.2
Total	6,060,000	167,000	36.3

Table 28. Estimated investments(* assuming no other revenues)

The profitability of the CHP plant investment will largely depend on the price of eco-electricity as well as the wood price.

Still, the combined afforestation and bio-energetic production is certainly an option which has potential in the Republic of Serbia and should be explored more in detail.

6.4.7. Programmatic CDM for A/R

Implementation of CDM projects in the Republic of Serbia in forestry sector in terms of large-scale A/R CDM projects is hardly possible, primarily due to ownership structure, taking into account that it is almost impossible to identify areas which are large enough for a large-scale A/R CDM project activity.

Programmatic CDM increases potentials for CDM implementation in forestry sector in the Republic of Serbia. This particularly takes into account that Programmatic CDM may be prepared both for large and small-scale A/R activities.

Programmatic CDM must be coordinated by designated institution or authority.

The coordinating/management entity shall prepare a “Programme of Activities Design Document Form for Afforestation and Reforestation project activities” (CDM-POA-DD-AR) and a “CDM Programme Activity Design Document” (CDM-CPA-DD-AR) that is specific for the proposed Programmatic CDM. After the first CPA, every CPA that is added over time to the Programmatic CDM must submit a completed CDM-CPA-DD-AR.

All CPAs of certain Programmatic CDM shall apply the same approved baseline and monitoring methodology, involving one type of technology or set of interrelated measures in the same type of facility/installation/land.

Besides, the coordinating/managing entity would need to set-up and implement operational and management arrangements. This must include a record keeping system for each CPA under the Programmatic CDM and a system/procedure to avoid double counting.

The coordinating/managing entity shall also obtain letters of approval.

In the case of the Republic of Serbia, Government or public enterprises in forestry sector may play this role.

Great potential for the development of Programmatic CDM in the Republic of Serbia is given to project activity which involves afforestation of abandoned agricultural lands. The implementation may start with interested farmer associations or with some large individual farmers in a certain area. Other farmers/districts/regions may join the programme later once positive experiences are available and shared. The aim could be annual afforestation of 10,000 ha of agricultural land.

A similar implementation may be considered for the reforestation of degraded land, which may be of significant national interest for the Republic of Serbia.

Taking into account that according to forest management policies afforestation of 9,000 ha annually was stipulated, and that in the past 10 years less than 2,000 ha have been afforested, implementation of Programmatic CDM may significantly contribute to realization of national forest management policies.

Bearing in mind that stipulated framework has not been realized to greatest extent due to lack of funds, this could be greatly overcome through additional revenues obtained through carbon credits.

While the FMP states a policy target to afforest 9,000 ha annually, in the past 10 years less than 2,000 ha have been afforested, therefore, anything over the current afforestation rate could be considered additional.

6.5. Conclusion

Implementation of A/R CDM project activities is cost-effective if it generates approximately 200,000 tCO_2 for the period 2008-2012 (or approximately 50,000 tCO_2 per annum for Kyoto period 2009-2012).

Assuming that growth rate is 10tCO_2/ha/yr, area covered by the project should be approximately 4,000ha.

To this end, greatest potential for development of A/R CDM project activities in the Republic of Serbia is on private lands. On the other hand, it is easier and faster to initiate and implement projects at state-owned land.

Challenges for implementation of CDM projects in the Republic of Serbia are small holdings, so it is difficult to identify enough related holdings for implementation of A/R project activities.

Availability of land will be main limitation factor, taking into account that simultaneous interest for various uses of the same land occurs.

Great problem may be encountered due to lack of cadastre, as well as organizational issues (support from farmers' associations) and limited know-how and awareness about Clean Development Mechanism.

Possible solution for the Republic of Serbia may be also Programmatic CDM, through afforestation of abandoned agricultural and degraded land.

VII FRAMEWORK FOR MEASURES PROPOSED FOR MORE EFFICIENT IMPLEMENTATION OF CDM PROJECTS

7.1. Aims

The above mentioned experience, analyses and case studies show that revenues obtained from certified emission reduction have key role in the development of project economy and profitability.

Another important notion is that economic cost-effectiveness of a project is improved with the increase of CER price. CER is classified as market commodity, production of which starts with operational initiation of a project. Within the existing CDM practices at the market, project developers may sell their CERs in various stages of project development.

Although these observations may seem redundant, they are key ones in the development of specific measures for maximal utilization of CDM.

As for specific project developers in cases of LFG capture and utilization, potential project developers in the Republic of Serbia could be municipalities or utility companies which operate landfills.

When biomass utilization projects are the subject, potential project developers could be individual agricultural producers or big agricultural husbandries, in collaboration with municipal heating plants, i.e., with PE "Electric Power Industry of Serbia". If biogas project is the subject, that one should be developed by large farms.

Consultations made during the development of the Strategy with representatives from relevant governmental institutions and other stakeholders, have shown that most of potential project developers, primarily municipalities, do not have enough funds to develop such projects. The reasons are, on one hand, municipal budget limits, which cause that municipalities are not able to develop such projects. Also, municipalities in the Republic of Serbia have limited access to international development funds. At the same time, it seems that Serbian banking system so far has not been ready to support innovative projects.

At the same time, process of the Strategy development revealed insufficient information and knowledge about possibilities and identification conditions and CDM project implementation among stakeholders and potential users of such projects.

Such situation may adversely affect maximal utilization of financial advantages which CDM project development and implementation entail.

With proactive approach and ensuring appropriate funds, Serbian Government may help implementation of CDM projects, providing logistic (administrative and capacity building) and financial support.

It should not be forgotten that activities under Clean Development Mechanism are exclusively activities on voluntarily basis. ***CDM projects may only be developed at the individual initiative from the developer, not from the Government***. Role of the Government is to ensure necessary institutional and legislative structure for project approval at the national level. The Government may possibly create administrative and financial support for specific types of CDM projects when it has been established that they are projects of national interest.

The aim of this part of the Strategy is to provide guidelines and recommendations for establishment of specific measures for more efficient implementation of CDM projects at national level, especially when it has been established that they are projects of national interest. They will cover administrative, financial and capacity building recommendations at national level. Of course***, guidelines and recommendations referred to in this Strategy cannot be deemed as binding for any party, both for the developers and the Government of the Republic of Serbia***.

7.2. Administrative support

Administrative support to CDM project implementation is being realized to great extent, taking into account that Designated National Authority for the Implementation of CDM Projects within Kyoto Protocol (DNA) was established and has been operational since November 2008. It is important that procedure for CDM project approval is simple and does not require additional costs, which minimizes the approval risks.

In order to provide information about potential CDM projects, status of the submitted projects, as well as information related to procedures and criteria for issuance of the Letter of Approval, DNA has developed an internet web site in collaboration with the Italian Ministry of Environment, Land and Sea: www.ekoplan.gov.rs/DNA.

Further administrative support could be provided through additional relevant information about CDM consultants, CER buyers, and technology providers interested to operate on the Serbian CDM market. Such list should contain detailed information on what each of these service providers can offer.

In this way, Serbian project developers and CDM buyers will have a clear real time picture of the CDM market environment in Serbia.

7.3. Capacity building

In terms of capacity building, it is necessary to ensure further strengthening of institutional capacities for implementation of CDM projects in all three sectors, i.e., waste management, agriculture and forestry.

Also, further organization of seminars which would be oriented towards potential project owners and developers, as well as general CDM seminars in different regions of the Republic of Serbia could help in awareness raising related to CDM projects among potential project developers.

7.4. Financial support

Financial support directly depends on available budget funds of the Government of the Republic of Serbia. If there are financial possibilities, Government of the Republic of Serbia could allocate some funding to support CDM project development.

Using Serbian state budget funds for financial leverage, the Government could assist project developers in achieving higher prices for their CERs. This would maximize the CDM revenues from the development of projects in the Republic of Serbia. The following two model rotation fund schemes are proposed:

a) Fund for Support of CDM Transaction Costs

For example, as of 1 December 2008, transaction costs for CDM projects (PDD production, validation and registration) were estimated to vary between 50,000 EUR and 100,000 EUR, depending on the type and size of the projects.

This is a large upfront investment and not many developers are able to commit such funds upfront.

As described in the introduction of this Strategy, some buyers and consultants offer to cover the upfront fees against a signed Emission Reduction Purchase Agreement or a share of the CERs.

However, the Serbian Government can offer an alternative to project developers who want to retain full control of their projects and offer to cover the upfront costs for a number of highly feasible CDM projects, if there are appropriate funds for that.

For this purpose, the Government can establish a rotation fund of 500,000 EUR.

The fund can be established within the national Environment Protection Fund, Development Fund or other government agency that has experience with fund management.

For the pilot transaction, the Fund can open a call for CDM project ideas and will select the five most prospective projects. At the same time, the Fund will open a call for consultants who will provide CDM consulting to the five selected projects.

The DOEs for the projects can also be selected by an open bidding procedure.

Once the projects are registered as CDM, the project developers will repay the Government the support for the transactions costs, and the money can be reused for a new batch of CDM projects.

This scheme would allow developers to be in a stronger position to negotiate with potential CER buyers once the projects are at a more mature stage. This scheme can be applicable only to projects that can secure the project investment on their own.

b) Support to project investment

In the case of CDM projects that require support in reaching financial closure, the Government could establish a bigger fund of a few million Euros to support the investment cost of some potential CDM projects.

The projects would be selected based on their "CER efficiency", i.e. priority would be given to projects where the CER revenue represents a larger share of the project revenue (taking into account a number of other factors as well).

Once the projects are registered and when they start generating emission reductions, the developers will repay the support they received from the fund, and the Government can reinvest the money in other future CDM projects.

When it is about forestry sector, it is recommended to develop cost-effectiveness studies, i.e. studies which would analyze costs and benefits in more details.

VIII POSSIBILITIES IN THE POST-KYOTO PERIOD

Basic provisions and rules under the CDM show that this mechanism of Kyoto Protocol has long-term character. According to the existing rules, duration of each individual CDM project is at least seven, and maximally 21 years, while in the forestry sector, projects may have duration of up to sixty years.

Bearing that in mind, it is obvious that implementation of CDM projects significantly exceeds first Kyoto period. Therefore, definition of measures and potentials for the implementation of this type of projects at national level needs inclusion of those projects which pertain to the period after 2012.

This is the reason why the Strategy which primarily refers to the period up to 2012 includes certain guidelines for emission reduction in the period after 2012, on the basis of current results of negotiation process under the Framework UN Convention on Climate Change for the period after 2012.

It should be remembered that as of September 2009 there was no any international agreement related to any key issue for post-Kyoto period. The so far development of international negotiations indicates that specific and thoroughly defined agreement most probably will not be achieved by the end of 2009.

Yet, it should be stressed that it is clear from the negotiation process that implementation of flexible mechanisms under the Kyoto Protocol will continue after 2012.

From the aspect of flexible mechanisms, particularly taking into account CDM, negotiations are based on attempts to simplify procedures and increase flexibility and transparency of the process.

It is expected that possibilities, in terms of project activity types which could be implemented as CDM projects in Kyoto period, would be increased in post-Kyoto period. There are proposals to include those activities which pertain to production and use ofnuclear energy and carbon capture and storage into CDM activities.

There are proposals for preparation of a list of specific project which would be automatically deemed additional ones. Determination of joint baseline scenarios for several projects and sectoral approach are also some of the ideas related to CDM.

In addition, it is expected to see significant advancement in the forestry sector, as well as positive movement towards potentials for CDM project implementation. Negotiation process shows that international policy makers have started to accept the important role of forests in fight against climate change, including the importance of prevention of forest harvesting and degradation.

Negotiation process clearly indicates that activities which involve prevention and avoidance of forest harvesting and degradation will find their place in the list of possible CDM project activities in the period after 2012. Avoidance of forest harvesting, as potential CDM project activity, is of great significance for the countries in tropical region, while possible project type for implementation in the Republic of Serbia would be prevention of forest fires.

This is particularly due to the risk which exists at national level, which refers to more often occurrence of forest fires and areas under forests caught by fire, due to the expected global warming. This is confirmed by the fact that 33,229 ha of forests were lost in fire in the Republic of Serbia in 2007, which is highest ever registered value.[27]

Beside CDM itself, there are proposals for determination of one more trade mechanism, the so-called NAMA (Nationally Appropriate Mitigation Actions). The idea is that implementation of NAMA has programmatic approach within which certain mitigation actions will be applied. The result of such application would be realization of emission reduction credits.

Possible changes which might happen, and in the case that agreement related to the previously listed proposals is reached at global level, they should not have negative impact to development and implementation of CDM in the Republic of Serbia, i.e. to the proposals for identification, possibilities and measures for more efficient implementation of CDM given in the previous chapters of the Strategy.

Moreover, expected reform of CDM, particularly measures for improvement of regional distribution of this type of projects may contribute to possibilities and significance of CDM project developments in the Republic of Serbia, and they may enable easier access for Serbian project developers to global emission market.

It is important to say that negotiation process indicates that number of emission trade schemes will be increased, including trade scheme of the European Union, USA, Australia, New Zealand and Japan.

These emission trade schemes will be a big generator of requests for CERs in post-Kyoto period.

To this end, Republic of Serbia should use the period up to 2012 as an opportunity to increase level of knowledge and experience, in order to be able to continue with the active participation in emission trade at global level.

There may be certain fear about justification of CDM project implementation in the Republic of Serbia among project developers, but also in the Government of the Republic of Serbia, taking into account potential possibility of quantified GHG emission reduction. Bearing in mind strategic goal of the Republic of Serbia, that is accession to the European

[27] Between 1990 and 2004, approximately 150,000tCO_2 (15,000tCO_2 per year) was emitted from forest fires.

Union, it is expected that Republic of Serbia will have to take certain quantified commitments at the EU accession moment, if not earlier.

Taking of quantified emission reduction commitments would mean a change on status of the Republic of Serbia under the UNFCCC, which would make available the two remaining, but not Clean Development Mechanism. Therefore, the issue is what status would CDM projects have in the case that Republic of Serbia takes quantified emission reduction commitments and is transferred to the list of industrially developed, i.e. countries with economy in transition. There is no specific and complete answer to this question at this moment.

What is from this aspect important is that the so far negotiations clearly indicate that some of the CDM hosting countries in the first commitment period (such as Republic of Korea and Singapore) will accept quantified emission reduction. Although concrete decision has not yet been made, it is expected that all countries which started implementation of specific CDM projects may continue those projects, and that existing projects will not affect definition of quantified emission reduction of those countries at global level.

Similar approach was established at the EU level for new member states in the first commitment period, after their accession to the EU Emission Trade Scheme (EU ETS). In other words, implementation of the initiated CDM projects was continued after their accession to this trade scheme.

In order to avoid double counting, each of these countries obtained additional quantity of emission reduction units at the EU level, within their own national distribution plan. Here it is important to say that this applies to JI and CDM projects which already started to generate emission reduction before the accession of that country to the EU trade scheme. Certain problems may occur with newly developed, i.e. projects which still had not started to generate emission reduction before the accession. Similar approach is expected for projects whose implementation will continue in post-Kyoto period at the EU level.

Taking into account the aforementioned, it is obvious that initiation of CDM project activity implementation and generation of GHG emission reduction at the territory of the Republic of Serbia cannot adversely affect, but only can positively contribute to sustainable development of the country. Of course, this applies if it is assumed that quantified commitment and period of its acceptance is in accordance with the national interests, i.e. sustainable development of the country.

List of Acronyms

UNFCCC	United Nations Framework Convention on Climate Change
A/R	Afforestation/Reforestation
CER	Certified Emission Reduction
tCER	Temporary Certified Emission Reduction
lCER	Long-Term Certified Emission Reduction
CDM	Clean Development Mechanism
CDM-CPA-DD-AR	CDM Programme Activity Design Document for Afforestation and Reforestation project activities
CDM-EB	CDM Executive Board
CDM-POA-DD-AR	CDM Programme of Activities Design Document Form for Afforestation and Reforestation project activities
COP	Conference of the Parties
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EIA	Environmental Impact Assessment
ET	Emission trading
EU-ETS	European Union Emission Trading Scheme
GWP	Global warming potential
GTZ/WBF	Programm für Wirtschafts- und Beschäftigungsförderung
IMELS	Italian Ministry for Environment, Land and Sea
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
JI	Joint Implementation
KP	Kyoto Protocol
MESP	Ministry of Environment and Spatial Planning
NAMA	National Appropriate Mitigation Action
OTC	Over-The-Counter Market
POA	Programme of Activities
PDD	Project Design Document
PIN	Project Idea Note
REDD	Reduced Emissions from Deforestation and Forest Degradation
SSC	Small Scale Project Activities