CLEAN DEVELOPMENT MECHANISM

PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	**Date**	**Description and reason of revision**
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Alibunar Biogas Plant Construction Project
Document version: 7.2
Date: 28/12/2012

A.2. Description of the small-scale project activity:

The proposed Alibunar methane recovery and power production CDM project activity (the "project") is improving on the existing open lagoon animal waste management system (AWMS) to reduce harmful greenhouse gas (GHG) emissions through methane recovery and displacement of carbon intensive grid electricity with renewable biogas energy.

The project is situated in the vicinity of farm properties and uses the manure from two swine facilities and maize residue to produce renewable energy.

Prior to the development of this CDM biogas project, the manure from the farms is stored in open manure lagoons where it is allowed to decay anaerobically, generating greenhouse gas emissions and other negative impacts on the farm environment through soil pollution. The proposed project activity includes upgraded infrastructure at the farm sites including the installation of concrete manure tanks to ensure manure is captured effectively and transport to the biogas plant site is facilitated. Manure will be transported daily (34 round trips are planned each week) from the swine farm sources and stored in two manure storage tanks at the biogas plant site. Manure will be stored at the biogas site for less than 24 hours as it is regularly pumped into the anaerobic digester units.

The new biogas plant will use this swine manure and maize residue (taken from the remains of maize harvest at the project site) as feedstock for anaerobic digestion and production of biogas[1]. Renewable, CO_2 neutral energy in the form of electricity will be generated from three 1MW gensets within the plant. The plant is expected to generate a net amount of 22,650MWh/year of renewable electricity which will be delivered to the Serbian national grid.

Consequently, the project will result in reduction of GHG by approximately 31,597 t CO2 annually. It should be noted that only methane emissions avoided through anaerobic digestion of swine manure and replacement of the electricity from the national grid with renewable electricity were taken into account, when calculating the GHG emission reductions. No emission reductions are calculated for the maize residue anaerobic digestion and no emission reductions are calculated for utilisation of any waste heat from the gen sets.

Biogas Energy d.o.o. will be the primary owner of the project with whom three other entities (Biopower d.o.o., Ecopower d.o.o. and Future Energy d.o.o.) will contract for all project activities as represented in figure 1 below. For the purposes of the CDM, Biogas Energy d.o.o. is the only named project entity.

[1] It should be noted that ex post emission reduction calculation for this project activity is limited to the animal manure after accounting for project emissions from all co-digested substrates.

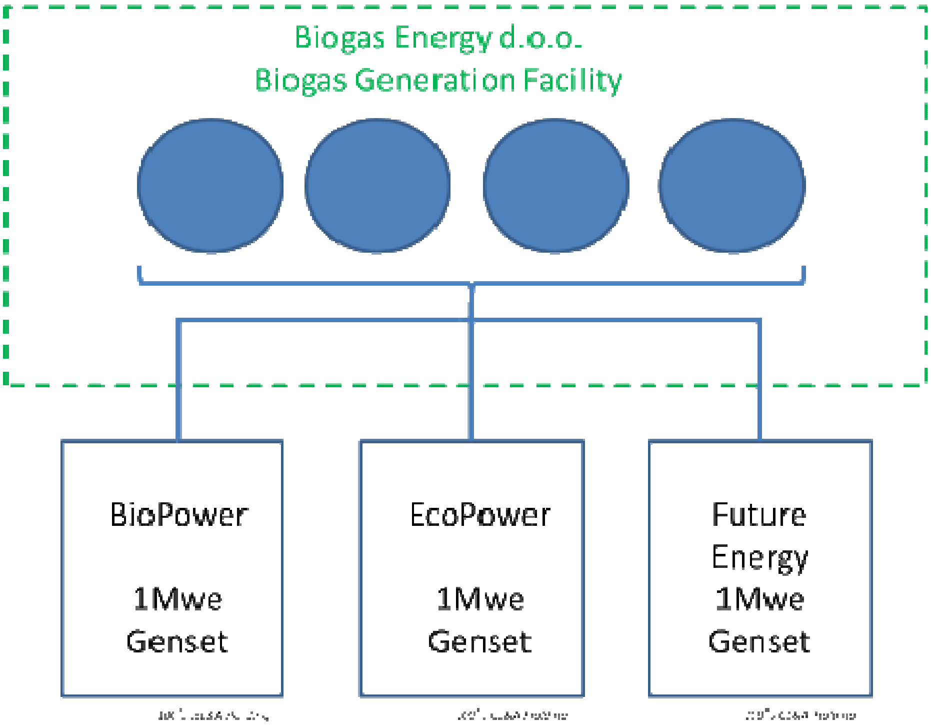

Figure 1: ownership structure of the 2997kW (3MW) Alibunar project

Advantages of Anaerobic Digestion

For the farmer:

- improvement of manure properties: odour reduction, elimination of acid components, viscosity decrease, mineralization of organic nitrogen, reduction of pathogenic germs and weed seeds
- additional income from power production
- waste water treatment without costly sewer connection

For the environment:

- reduction of methane and ammonia emissions from manure
- reduction of nitrate wash-out into groundwater
- recycling of fertilizer compounds from organic wastes
- reduction of carbon dioxide emissions by substitution of fossil resources

Sustainable development:
The Alibunar biogas plant contributes to the sustainable development of Republic of Serbia in the following manner:

Economic benefits

- Investment conditions – The implementation of the project is going to be financed using internal financial sources of Biogas Energy d.o.o. as well as attracting external financial sources from local banks, thus increasing their involvement in helping develop renewable energy projects in the Republic of Serbia.
- Sustainable transfer of technology – The Alibunar Biogas Plant is one of the first projects of this kind commissioned in Serbia using German anaerobic digester technology sourced from OAG. At the same time, gen-sets for power generation are going to be supplied by GE-Jenbacher – the leader in manufacturing of gas turbines with outstanding performance.
- Economic development of the region – the project is going to be implemented in an underdeveloped area of the Republic of Serbia. Thus, it will lead to intensification of economic activity in the area through employment of local people and payment of taxes to the budget. The implementation of the project will result

in increase of working places, as new employees will be required to operate the plant. The project will also result in increase of the work culture, since employees are going to be trained how to operate modern equipment.

- Fit with the sectoral priorities in the Republic of Serbia – Implementation of the project will result in increase of renewable energy share in the total power mix of Republic of Serbia, and at the same time, increasing stability of power supply in the region.

Social Benefits

- Improvement of living conditions – The project activity will result in the increase of employment at the local level. Furthermore, due to the revenue from the sales of electricity the project will contribute to an increase of state revenues at a local/regional level.
- Capacity building – The project activity will contribute to the transfer of knowledge and experience for operation and maintenance of new equipment, since all the personnel required for stable operations of the plant will be trained.

Environment and natural resources Benefits

- Diversification of the energy mix and energy security – The project will result in increase of renewable energy sources in the total power mix of the Republic of Serbia, thus decreasing its dependence on fossil fuels required for conventional power generation.
- Decreased waste – Since all the waste is going to be directed for biogas production purposes, the project will reduce the amount of generated waste. Consequently, the project will result in reduction of emissions of harmful substances into the atmosphere, including greenhouse gases.
- Avoided greenhouse emissions – The project activity will result in decrease of GHG emissions since methane generated during the anaerobic digestion of the substrates is not going to be vented into the atmosphere, and instead used for power generation. The project will result in the reduction of GHG emissions.

A.3. Project participants:

Name of Party(ies) involved. (*) ((host) indicates a host party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate whether the party wishes to be considered a project participant Yes/No
Republic of Serbia (host)	Biogas Energy d.o.o. (Private Entity)	No
United Kingdom of Great Britain and Northern Ireland	Camco Carbon International Limited (Private Entity)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time requesting registration, the approval by the Party(ies) involved is required.		

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A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Republic of Serbia

A.4.1.2. Region/State/Province etc.:

Alibunar municipality, Province of Vojvodina.

A.4.1.3. City/Town/Community etc:

Farm name	Location	Co-ordinates
"Banatski Karlovac",	Banatski Karlovac	45°2'43.66"N, 21°1'46.32"E
"Delta Agrar"	Vladimirovac	45°2'51.01"N, 20°52'40.28"E
Biogas plant location (digesters+generators),	Ilandža	45°9'41.24"N, 20°55'53.52"E

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The Biogas Plant Alibunar Biogas Plant Construction Project consists of the main biogas plant site and the "Vladimirovac" and "Banatski Karlovac" swine farms from where manure will be sourced as feedstock for the anaerobic digester.

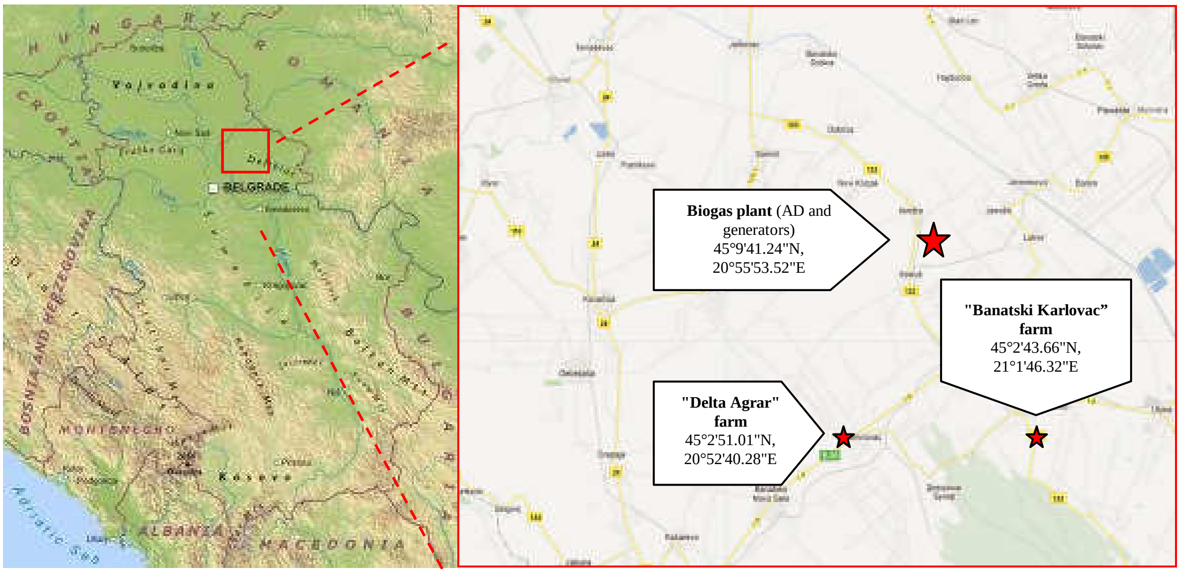

Figure 2: Serbia map, plant location and coordinates

The “Vladimirovac“ and “Banatski Karlovac”   swine farms from which the biogas plant will get its manure feedstock are located 20.8 km and19.2 km from the biogas plant respectively.

Figure 3: The plant and storage silos will be installed on 11.450 m2 land.

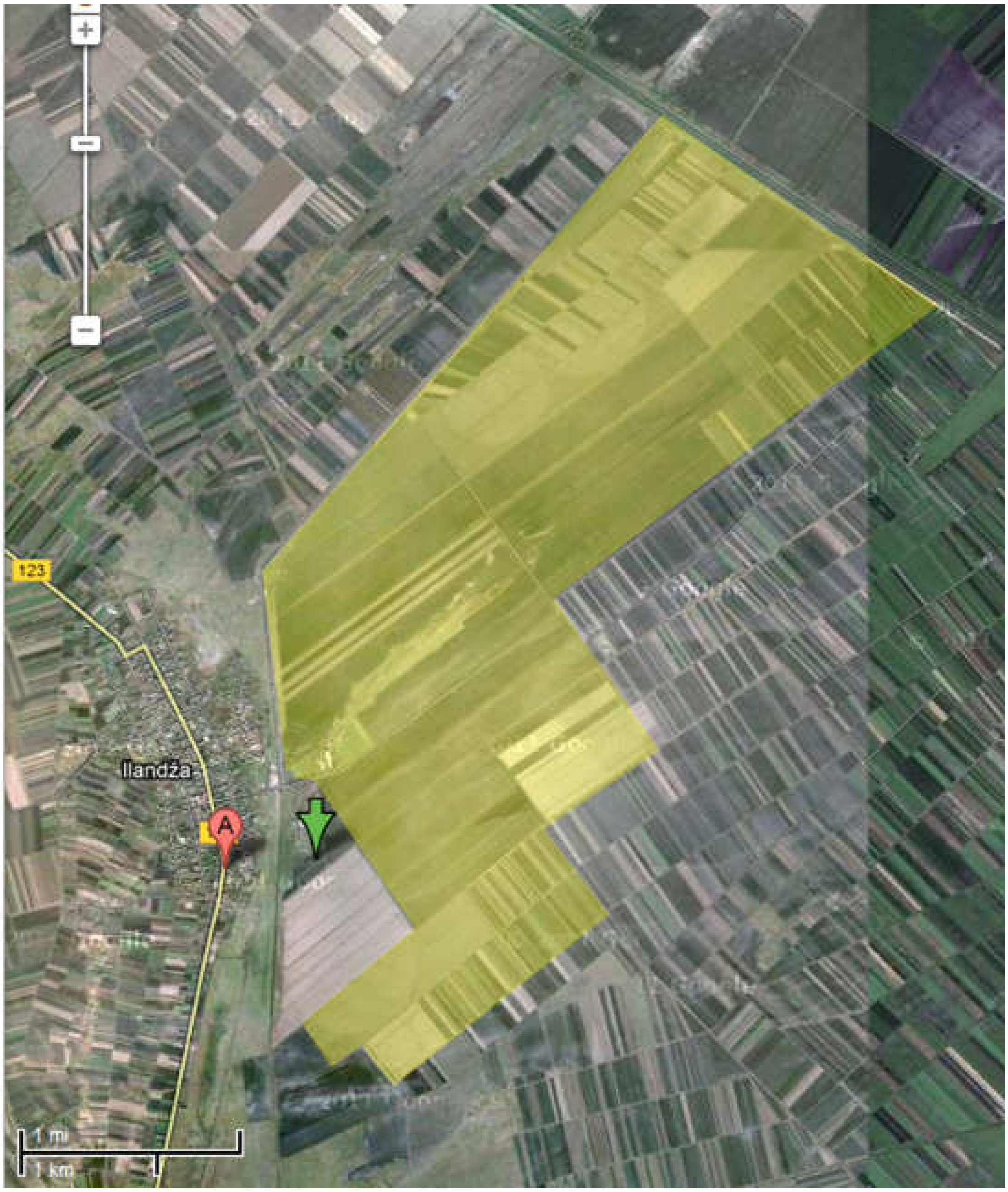

Figure 4: Yellow area shows the 1200 hectares of fully irrigated land where maize residue is collected. Green arrow indicates site of plant and storage silos.

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The project is a small scale CDM project activity which falls under both Sectoral Scopes 13 (Waste handling and disposal) and 1 (Energy Industries – renewable/non-renewable sources) as per the UNFCCC CDM "*List of Sectoral Scopes*". The project conforms to the sectoral scopes since it consists of the improvement of an existing Animal Waste Management System (AWMS) at a dairy facility through the implementation of an anaerobic digestion unit, which will deliver renewable energy to the grid.

According to Appendix B of *simplified modalities and procedures for small scale CDM project activities* the project activity is applicable under following project types and categories:

Type III: Other Project Activities
Project Category: AMS III.A.O – Methane recovery through controlled anaerobic digestion Version 01

Type I: Renewable Energy Projects
Project Category: AMS I.D. – Grid connected renewable electricity generation Version 17

Prior to the development of this CDM biogas project, the manure from the farms is stored in open manure lagoons where it is allowed to decay anaerobically, generating greenhouse gas emissions and other negative impacts on the farm environment through soil pollution.
Prior to the development of this CDM biogas project, biomass residues (husk and stalk) from the production of maize at the project site is left to decay anaerobically on the fields in stockpiles, generating greenhouse gas emissions.[2]

Technology applied in the small-scale project activity
There are two main technology components as part of this proposed CDM project activity. There is the OAG anaerobic digester and the GE Jenbacher gensets.

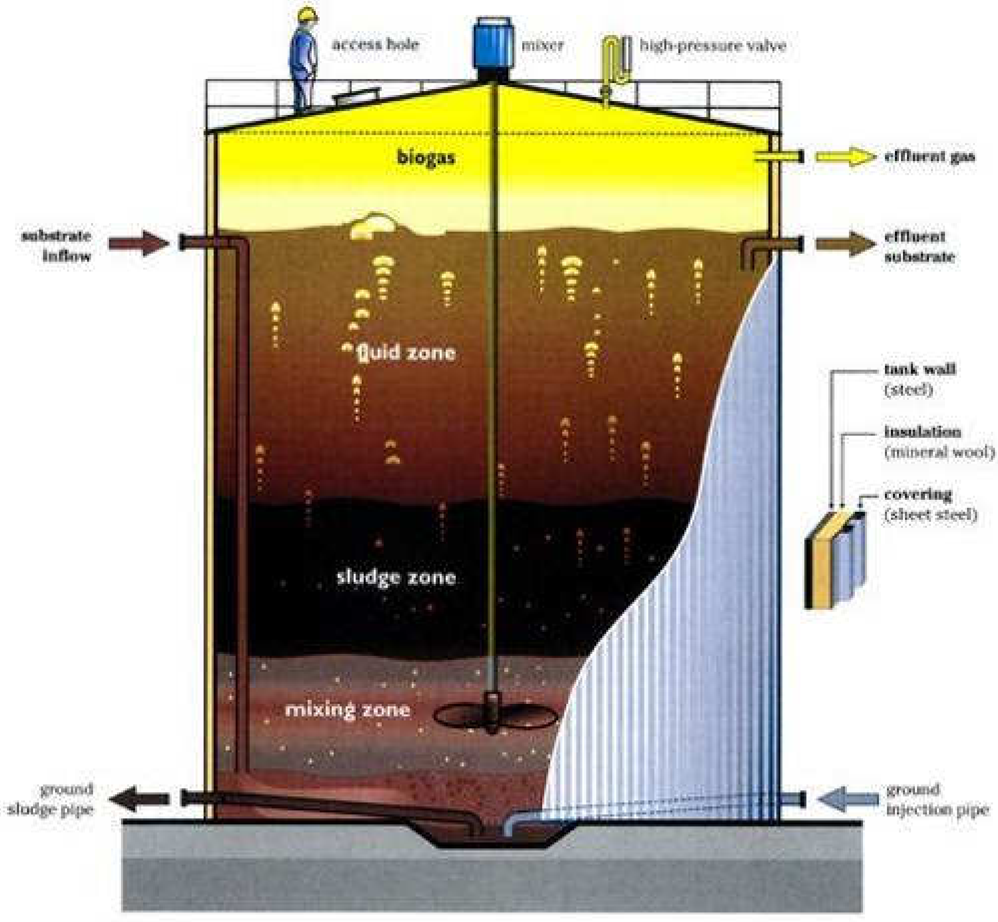

Figure 5: Typical OAG Anaerobic Digester "fermenter" tank

Step 1: Anaerobic digester

[2] It should be noted that ex post emission reduction calculation for this project activity is limited to the animal manure after accounting for project emissions from all co-digested substrates.

The CDM project activity implements an anaerobic digestion system designed and constructed by OAG. OAG is a German based company that is a leader in the anaerobic digestion industry.
Swine manure, maize residue will be used as feedstock for the anaerobic digestion process.

Feedstock is added to the "fermenter" digester vessels where it remains under closed anaerobic conditions for an adequate residence time to produce biogas. The residual waste then passes through in a natural overflow directly into secondary closed anaerobic digester vessels before being removed for further use as described in step 4 below.

It should be noted that only methane (CH4) emission reductions are calculated for the swine manure component of the anaerobic digester feedstock. No emission reductions are calculated for the maize residue anaerobic digestion

Key equipment:

- Delivery truck
- Truck scale
- Fodder silo
- Manure storage tanks (X2)
- Fermenter tanks (X4)

Step 2: Biogas collection

The biogas is collected in the gas reservoir of the primary and secondary "fermenter" vessels contained within air-supported roofs. Following collection of the gas, the methane biogas is piped to the power houses in the neighbouring buildings to the digester structures.

Key equipment:

- Fermenter tank gas reservoirs (X4)
- Biogas desulphurization, cooling, carbon filtering
- Gas analyzer
- Gas Flow meter, temperature gauge and pressure meter

Step 3: Power generation

Three 999kW GE "Jenbacher" gas-fuelled reciprocating engines modified to burn biogas are used to combust the biogas and produce electricity[3].The electricity produced by this gensets is sold directly to the utility grid as a source of renewable energy.

The gensets are equipped to recycle waste heat from the combustion process and some waste heat will be recycled within the closed loop of the digester and genset. Waste heat may also be used in future by the project owner e.g. to provide heat for greenhouses but no emission reductions are claimed for this element of the project.

Key equipment:

- GE Jenbacher 999kW gensets (X3)
- Electricity export meter

The biogas and gensets are designed to operate year round but a flare will also be installed as a safety precaution to destroy excess methane that is not destroyed in the gensets.

Step 4: Digester residual waste removal and separation

The digester effluent is pumped from the secondary fermenter vessels to a manure solids separator. This mechanical process separates the residual waste stream into solid and liquid fractions.

[3] Each genset is technically capable of producing 1.190kW output but is electronically limited only to 999k because of the legal requirements that the equipment should be under 1MW so that the licenses are obtained at the local rather than republic level

Separated solids will be utilized by the project proponent for compost production and sale on the open market. The composting process involves a process of aeration of the solid residual waste (i.e. no anaerobic conditions are applied to the solid residual waste).
The liquid from the residual waste stream separator, now with the majority of the large solids removed, flows into a storage tank. This will be used for onsite irrigation of maize cropland and also given to the swine farms for irrigation as part of the manure supply contract.

Key equipment:

- Residual waste separator (X2)
- Liquid waste pumping station
- Solid waste compost storage facility

Figure 6: Alibunar biogas project site plan and legend

Description of the project layout:

1	Manure storage tank I	14	Administration Building	24	Security
2	Manure storage tank II	15	Genset Block 1MW	25	Truck scale
3	Fermenter I	16	Genset Block 1MW	26	Transformer Station
4	Fermenter II	17	Genset Block 1MW	27	Gas station
5	Fermenter III	18	Maize residue silos I	28	Condensate Shaft
6	Fermenter IV	19	Maize residue silos II	29	De-Sulphurization
7	Waste Storage I	20	Compost storage	30	Gas Cooler
8	Waste Storage II	21	Machine hall	31	Carbon Filter
9	Waste Storage III	22	Tire washing	32	Briquettes Hall
10	Waste Storage IV	23	Security	33	Briquettes Storage Hall
11	Separation			34	Composting Plant
12	Dosing feeder I			35	Pumping Station
13	Dosing feeder II				

The project owner will take integrated measures to ensure successful implementation of the project. These measures include careful specification and design of a complete technology solution, identification and qualification of appropriate technology and service providers, supervision of the complete project installation, and stringent monitoring and management plans. The EPC (Engineering, Procurement and Construction) contract for this project activity with OAG includes a test operation period and verification of performance before final hand over of the project to Biogas Energy d.o.o. As part of the final hand over, the day to day operating staff will be trained to ensure that all installed equipment is properly maintained, operated and calibrated. Data will be carefully monitored and collected as required.

All of the facilities engaged in the proposed project are imported from Germany and the technology applied for the project activity is environmentally safe and sound.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

A fixed (10 year) crediting period is selected for the proposed project. The estimated emission reductions over the crediting period are 315,970tCO_2e. Annual average emission reductions from the methane recovery component and the power generation component are respectively estimated to be 8,852 tCO_2e and 22,745 tCO_2e. Neither the methane recovery component nor power generation component exceeds the upper limitation of the small scale project activities.

Year	**Annual estimated emission reductions in tCO_2e**
2013	31,597
2014	31,597
2015	31,597
2016	31,597
2017	31,597
2018	31,597
2019	31,597
2020	31,597
2021	31,597
2022	31,597
Total estimated reductions (tonnes of CO2e)	**315,970**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**31,597**

A.4.4. Public funding of the small-scale project activity:

No Annex I Party public funding is involved in the project. The project proponent confirms that there is no divergence of Official Development Assistance (ODA) for the project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to the Guidelines on Assessment of debundling for SSC Project Activities (Version 03), paragraph 2:

"A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

a. With the same project participants;
b. In the same project category and technology/measure;
c. Registered within the previous 2 years; and

d. Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point."

The project participants in the Alibunar Biogas Plant Construction ProjectCDM project activity confirm that there is no other project activity with the same project participants, in the same project category and technology/measure registered within the previous two years and whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point. Therefore, this small-scale project activity is not a debundled component of a larger CDM project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

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This project activity proposes to apply two approved baseline and monitoring methodologies and methodological tools. The title and reference of the approved methodologies and tools applied to this small-scale project activity are as follows:

- AMS III.A.O. Methane recovery through controlled anaerobic digestion Version 01, Sectoral Scope: 13
- AMS I.D. – "Grid connected renewable electricity generation", Version 17.0., Sectoral Scope: 1

- General guidance on leakage in biomass project activities, Version 03 (EB 47 annex 28)
- Tool to calculate the Emission Factor for an electricity system, Version 2.2.1 (EB 63 annex 19)
- Methodological Tool: Project emissions from flaring, Version 02.0.0 (EB 68 annex 15)

All UNFCCC approved CDM baseline and monitoring methodologies can be found at:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved

B.2 Justification of the choice of the project category:

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The justification of the choice of project category and methodology is described below.

	Applicability of AMS III.AO.– Methane recovery through controlled anaerobic digestion Version 01, Sectoral Scope: 13	Project Activity
1	Digestion of biomass or other organic matter (excluding animal manure and sludge generated in the wastewater treatment works) as a single source of substrate is included;	Not applicable
2	Co-digestion[4] of multiple sources of biomass substrates, e.g. MSW, organic waste, animal manure, wastewater, where those organic matters would otherwise have been treated in an anaerobic treatment system without biogas recovery is also eligible;	The project entails the co-digestion of animal manure with other biomass substrates (maize residue) which would otherwise have been treated in anaerobic conditions without biogas recovery.

[4] Co-digestion is the simultaneous digestion of a homogenous mixture of two or more substrates from different sources, e.g. co-digestion of MSW (municipal solid waste) and animal manure and/or domestic/industrial wastewater. The most common situation is when a major amount of a primary basic substrate (e.g. manure) is mixed and digested together with minor amounts of other substrates.

3	If for one or more sources of substrates, it can not be demonstrated that the organic matter would otherwise been left to decay anaerobically, baseline emissions related to such organic matter shall be accounted for as zero, whereas project emissions shall be calculated according to the procedures presented in this methodology for all co-digested substrates;	In the baseline scenario, manure is left to decay in lagoons for extended periods of time (> 1 month) under anaerobic conditions. For other substrates used in the project activity, it can not be demonstrated that the organic matter would otherwise been left to decay anaerobically in the absence of the project. Therefore, baseline emissions related to such organic matter shall be accounted for as zero. Project emissions shall be calculated according to the procedures presented in methodology AMS III.AO. (V01) for all co-digested substrates. The ex post emission reduction calculation for this project activity is limited to the animal manure after accounting for project emissions from all co-digested substrates.
4	Project participants shall apply the procedures related to the competing use for the biomass according to the latest General guidance on leakage in biomass project activities;	Procedures related to the competing use for the biomass will be applied as per the *General guidance on leakage in biomass project Activities* (V03)
5	Project activities treating animal manure as single source substrate shall apply AMS-III.D Methane recovery in animal manure management systems, similarly projects only treating wastewater and/or sludge generated in the wastewater treatment works shall apply AMS-III.H Methane recovery in wastewater treatment;	The project entails the co-digestion of animal manure with other biomass substrates. Animal manure is not treated as single source substrate. It should be noted that the ex post emission reduction calculation for this project activity is limited to the animal manure after accounting for project emissions from all co-digested substrates.
6	The project activity does not recover or combust landfill gas from the disposal site (unlike AMS-III.G Landfill methane recovery), and does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS-III.E Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment). Project activities that recover biogas from wastewater treatment shall use methodology AMS-III.H.	The project activity does not recover or combust landfill gas, and does not undertake controlled combustion of waste or recover biogas from wastewater treatment.
7	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.	The project activity is expected to achieve emission reductions of 31.6 ktCO2e/y i.e. less than 60 kt CO2 equivalent annually from all Type III components of the project activity.
8	The location and characteristics of the disposal site of the biomass used for digestion in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions. Guidelines in AMS-III.G, AMS-III.D, AMS-III.E (concerning stockpiles) and AMS-III.H (as the case may be) shall be followed in this regard.	The location and characteristics of the disposal site of the biomass used for digestion in the baseline condition is known and included in the boundary of the project activity.
9	Project activities for co-digestion of animal manure shall also meet the requirements under paragraphs 1 and 2(c) of AMS-III.D. Applicability of AMS III.D. – Methane recovery in animal manure management system Version 18.0. paragraphs 1 and 2(c) are listed below:	-

9.1	The livestock population in the farm is managed under confined conditions;	Livestock is managed under confined conditions (sheds) at both farms within the boundary of this project.
9.2	manure is not discharged into natural water resources (e.g. rivers or estuaries);	manure is not discharged into natural water resources
9.3	annual average temperature in the site where the anaerobic manure treatment facility in the baseline existed is higher than 5°C	the average annual air temperature at the project site is greater than 5°C (average is 12 °C at Banatski Karlovac)[5]
9.4	In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month	In the baseline scenario, manure is left to decay in lagoons for extended periods of time (> 1 month)
9.5	in case of anaerobic lagoons in the baseline, their depths are at least 1 m	In the baseline scenario, manure is left to decay in lagoons. The baseline lagoons at the project sites are greater than 1m in depth[6]..
9.6	No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario.	In the baseline scenario, manure is left to decay in lagoons for extended periods of time with no methane recovery and destruction by flaring, combustion or other gainful use.
9.7	The storage time of the manure after removal from the animal barns, including transportation, should not exceed 45 days before being fed into the anaerobic digester.	Manure is not stored for in excess of 45 days before being fed into the anaerobic digester. Manure is expected to be pumped into the anaerobic digester on a daily basis[7].
10	The following requirement shall be checked ex ante at the beginning of each crediting period: (a) Establish that identified landfill(s)/stockpile(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period; or (b) Establish that it is common practice in the region to dispose of the waste in solid waste disposal site (landfill/stockpile).	Common practice in the region to dispose of the waste has been checked and validated ex ante at site visit and using documentary evidence: Manure: in the baseline scenario, manure is left to decay in lagoons for extended periods of time (> 1 month) under anaerobic conditions. Maize residue: As discussed in section B.6.1, Waste residue from Maize production is particularly noted for emission reduction potential wherein the common practice is that “maize residues are either landfilled or burnt in open air”8. For many Maize farmers, “it is useless to collect maize residues after harvesting” before there are no uses on the farms for this residue and

[5] Average annual temperature for Banatski Karlovac can be found at: http://www.weatherbase.com/weather/weather.php3?s=8131 and http://www.weatherreports.com/Banatski_Karlovac,_Serbia_and_Montenegro?units=c

[6] The Vladimiroyac farm lagoon is approximately 5-10 metres deep.
The Banatski Karloyac farm lagoon/pit is approximately 2-3 metres deep.

[7] daily storage tank dimensions provided at validation

[7] daily storage tank dimensions provided at validation

[8] “National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism, 2010, Page 45. Source: http://80.93.243.155/en/upload-centar/dokumenti/razno/cdm_strategija_engleski_za_stampu.pdf

		“there is no market for selling biomass residues”9. The project activity is located in the agricultural Province of Vojvodina which has “has the highest potential in agricultural waste, providing 8-12 Mtoe of biomass annually” [10.] There is an estimated mass of 390,000t of maize stover (leaves and stalks residue) which is currently not utilised with potential for energy generation in the province of Vojvodina[11]
11	The project participants shall clearly define the geographical boundary of the region referred to in 3(b), and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take into account the source of waste, i.e. if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distances to which the final product after digestion will be transported. In either case, the region should cover a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case it shall be more than 200 km. Once defined, the boundary should not be changed during the crediting period(s).	The geographical boundary of the region referred to in 3(b) is clearly defined in section A.4.1.4.. of the PDD and also includes the wider Vojvodina region. The source of waste is taken into account (approximately 5km from the project site). The distances to which the final product after digestion will be transported is considered negligible as residual waste from the anaerobic digestion process is treated aerobically on site to generate compost for further sale and will be removed from the site by third parties to whom the waste is sold. The region of Vojvodina is approximately 140km wide and 160km in length. Therefore, the radius of the region is not more than 200km.
12	In case residual waste from the digestion is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) for storage and transportation and soil application must be ensured.	The liquid fraction of the residual waste will be submitted to soil application. The solid fraction of the residual waste will be handled aerobically to generate compost for further sale.
13	In case residual waste from the digestion is treated thermally/mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied.	Not applicable. Residual waste from the digestion is not treated thermally/mechanically.
14	In case residual waste from the digestion is stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual waste shall to be taken into account and calculated as per the latest version of the Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”.	Not applicable. Residual waste from the digestion is not stored under anaerobic conditions and/or delivered to a landfill.
15	In case the outflow from the digestion is discharged to a subsequent	Not applicable. The outflow from the

[9] “Industrial Scale Demonstration Plant with Downdraft Gasifier coupled to Pebble Bed Regenerative Heater for CHP Production” (2012). Chapter 2: “2. Biomass potentials – agricultural residues”. Source: http://www.ecos2012.unipg.it/public/proceedings/pdf/RECS/RECS_ecos2012_212.pdf

[10] International Journal of Energy and Environment (IJEE), Volume 2, Issue 1, 2011, Section *“3.1 Biomass”* pp.77. Source: http://www.rit.edu/~w-cenr/documents/data/serbia.pdf

[11] Potentials, practice and prospects of energy utilization of solid Biomass in Serbia, Jefferson Institute, Page 3, Tab 1. 390,000t calculation is the combination of 110t from “big farms” and 280t from “S/M farms”. Source: http://www.altenergija.org/sites/default/files/Solid%20BIOMASS.pdf

	wastewater treatment system or to the natural water receiving body, relevant procedure in AMS-III.H shall be followed to estimate the resultant project emissions.	digestion is not discharged to a subsequent wastewater treatment system or to the natural water receiving body.
16	Technical measures shall be used to ensure that all biogas captured from the digester is combusted/flared.	Biogas is collected in tanks where it is sent to the gensets for combustion. A flaring system is included in the project activity in the case where biogas pressure exceeds safety limits.
17	All the applications to utilise the recovered biogas detailed in paragraph 3 of AMS-III.H are eligible for use under this methodology. The relevant procedure in AMS-III.H shall be followed in this regard.	The project entails the combustion of biogas for energy production. Therefore the options instead of combustion listed in AMS-IIIH are not applicable for this project activity.

	Applicability of AMS I.D. – Grid connected renewable electricity generation Version 17, Sectoral Scope: 1	**Project Activity**
1	This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:[15] (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	This project is a 2997kW (3MW) project producing electricity from biogas supplying electricity to a national grid.
2	Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A[16]) applies is included in Table 2.	The proposed project supplies electricity to a national grid which is a situation under which AMSID should be applied, according to table 2.
3	This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition;[17] (c) Involve a retrofit[18] of (an) existing plant(s); or (d) Involve a replacement[19] of (an) existing plant(s).	The proposed project is a new power plant i.e. a new power plant will be installed at a site where there was no renewable energy power plant operating prior to the implementation of the project activity.

[15] Refer to EB 23, annex 18 or the definition of renewable biomass.

[16] AMS-I.D “Grid connected renewable electricity generation”, AMS-I.F “Renewable electricity generation for captive use and mini-grid” and AMS-I.A “Electricity generation by the user”

[17] A capacity addition is an increase in the installed power generation capacity of an existing power plant through: (i) The installation of a new power plant besides the existing power plant/units; or (ii) The installation of new power units, additional to the existing power plant/units. The existing power plant/units continue to operate after the implementation of the project activity.

[18] Retrofit (or rehabilitation or refurbishment). It involves an investment to repair or modify an existing power plant/unit, with the purpose to increase the efficiency, performance or power generation capacity of the plant, without adding new power plants or units, or to resume the operation of closed (mothballed) power plants. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures.

	Applicability of AMS I.D. – Grid connected renewable electricity generation Version 17, Sectoral Scope: 1	Project Activity
4	Hydro power plants with reservoirs[20] that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir,[21] where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	Not applicable, the project activity is not a hydro power plant.
5	If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel,[22] the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable. The proposed project has no non-renewable components
6	Combined heat and power (co-generation) systems are not eligible under this category.	The proposed project is not a combined heat and power system. Some waste heat is produced from the gen sets but no emission reductions are claimed for this.
7	In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable, the project includes a new power plant where no existing renewable power generation facility exists.
8	In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable, the project includes a new power plant where no existing renewable power generation facility exists.

B.3. Description of the project boundary:

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The project boundary is in accordance to that of both approved methodologies for such project types. Under AMS III.AO. (v01), the project boundary is the physical, geographical site:

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[19] Replacement. It involves investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The installed capacity of the new plant or unit is equal to or higher than the plant or unit that was replaced.

[20] A reservoir is a water body created in valleys to store water generally made by the construction of a dam.

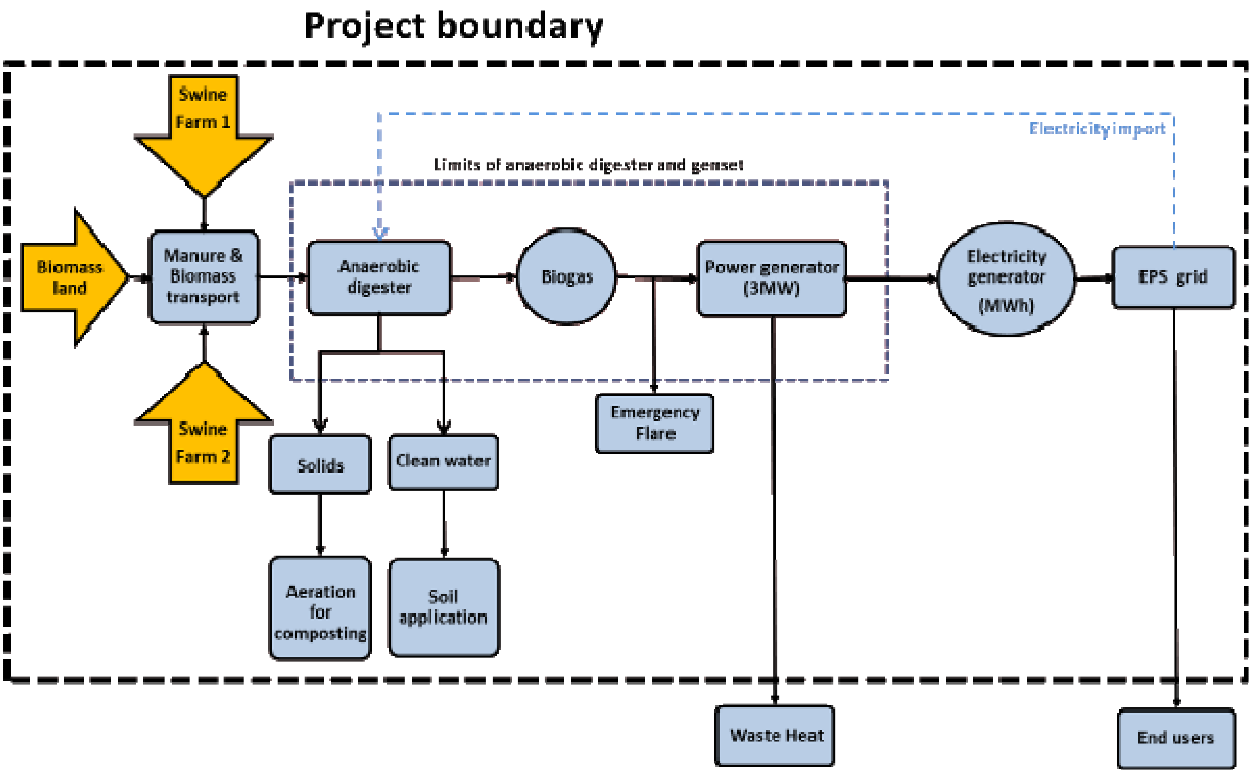
[21] A reservoir is to be considered as an "existing reservoir" if it has been in operation for at least three years before the implementation of the project activity.

[22] A co-fired system uses both fossil and renewable fuels, for example the simultaneous combustion of both biomass residues and fossil fuels in a single boiler. Fossil fuel may be used during a period of time when the biomass is not available and due justifications are provided.

(a) Where the solid waste (including animal manure, where applicable) would have been disposed and the methane emission occurs in absence of the proposed project activity;
(b) Where the treatment of biomass or other organic matters through anaerobic digestion takes place;
(c) Where the residual waste from biological treatment or products from those treatments, like slurry, are handled, disposed, submitted to soil application, or treated thermally/mechanically;
(d) Where biogas is burned/flared or gainfully used, including biogas sale points, if applicable
(e) And the itineraries between where the transportation of waste, where applicable manure, residual waste after digestion, or biogas occurs.

Under AMS ID (v17), the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

Figure 7: Project Boundary



The following emissions sources have been considered for inclusion in the project boundary.

Table 1: Emission sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Methane generation potential of the solid waste anaerobically digested by the project activity	CH4	Included	The major source of emissions in the baseline
		N2O	Excluded	No N2O emission from uncovered anaerobic lagoon according to IPCC 2006 Guidelines
		CO2	Excluded	CO2 emissions from the decomposition of organic manure are not accounted for
	Emissions from grid electricity generation	CH4	Excluded	Excluded for simplification. This is conservative
		N2O	Excluded	Excluded for simplification. This is conservative
		CO2	Included	Main emission source. Biogas is used to generate electricity in order to export to the national electricity grid.
Project activity	Emissions from transport of manure	CH4	Excluded	Excluded for simplification. Assumed to be very small .
		N2O	Excluded	Excluded for simplification. Assumed to be very small
		CO2	Included	Important source of emissions
	Emissions from transport of maize residue	CH4	Excluded	Excluded for simplification. Assumed to be very small .
		N2O	Excluded	Excluded for simplification. Assumed to be very small
		CO2	Included	Important source of emissions
	Direct emissions from physical leakage	CH4	Included	Important source of emissions
		N2O	Excluded	Excluded for simplification.
		CO2	Excluded	CO2 emissions from the decomposition of organic waste are not accounted for.
	Emissions from flaring or combustion of the biogas	CH4	Included	Important source of emissions
		N2O	Excluded	Excluded for simplification.
		CO2	Excluded	CO2 emissions from the decomposition of organic waste are not accounted for.
	Emissions from storage/disposal/treatmen	CH4	Included	Potential source of emissions

	Source	Gas	Included?	Justification/Explanation
	t of residual waste	N2O	Excluded	Excluded for simplification.
		CO2	Excluded	CO2 emissions from the decomposition of organic waste are not accounted for.
	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities	CH4	Excluded	Excluded for simplification. Assumed to be very small .
		N2O	Excluded	Excluded for simplification. Assumed to be very small
		CO2	Included	Important source of emissions
	Emissions from manure storage	CH4	Included	If the storage time of the manure after removal from the animal barns exceeds 24 hours before being fed into the anaerobic digester and the dry matter content of the manure when removed from the animal barns is less than 20%, CH4 emission from storage shall be considered according to AMS-III.D (v18), as per the baseline emission calculation requirements of AMS III.A.O.(V01)paragraph 12.
		N2O	Excluded	Excluded for simplification.
		CO2	Excluded	CO2 emissions from the decomposition of organic waste are not accounted for.

B.4. **Description of baseline and its development:**

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As per the applicable methodologies for this project activity, discussed in section A.4.2 of this document, there are two main components of this project to be considered:

1. Methane recovery through controlled anaerobic digestion
2. Grid connected renewable electricity generation

Component 1: Methane recovery through controlled anaerobic digestion
According to AMS III.AO., The baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter (including manure where applicable) are left to decay within the project boundary and methane is emitted to the atmosphere. The baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass and other organic matter. Baseline emissions shall exclude emissions of methane that would have to be captured, fuelled or flared or gainfully used to comply with national or local safety requirement or legal regulations.

For the case of the proposed project:

- the baseline scenario for manure is the situation where, in the absence of the project activity, manure from the farms included in the project boundary is stored in open manure lagoons where it is allowed to decay anaerobically, generating greenhouse gas emissions and other negative impacts on the farm environment through soil pollution

- the baseline scenario for other biomass substrates used in the project activity is the situation where, in the absence of the project activity, biomass residues are left to decay within the project boundary and methane is emitted to the atmosphere. However, it can not be demonstrated that the organic matter in the biomass substrates (other than the manure) would be left to decay anaerobically in the absence of the project activity. Therefore, baseline emissions related to such organic matter shall be accounted for as zero.
- under Serbian law, there are no national or local safety requirement or legal regulations requiring methane to be captured, fuelled or flared or gainfully used to meet compliance.
- the baseline emissions for this project activity are limited to the animal manure component. .

Component 2: Grid connected renewable electricity generation
As per the AMS ID (v17), paragraph 10, the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

Component 1 & 2 combined baseline summary:
As outlined in the baseline analysis for both components of this project, it is concluded that the baseline scenario for the proposed project is:

- Manure disposed of in an uncovered anaerobic lagoon. Biomass is left to decay in anaerobic conditions (although this cannot be demonstrated and baseline emissions for this element of the project are assumed to be zero).
- Electricity generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Consideration of CDM for this project activity

The table below shows the timeline for the project and illustrates that the possibility of additional revenue through the sale of CERs was a key factor for deciding to proceed with the project.

Figure 8: Project development timeline including consideration of CDM

Date	Item Name	Comments
05/08/2010	PIN completed and submitted to Serbian DNA	PIN
10/08/2010	Prior consideration sent to UNFCCC	Prior consideration
04/10/2010	Letter of support from Serbian DNA	“Letter of no objection”
17/04/2011	Business Plan/Feasibility Study Completed	Considers CDM analysis
06/07/2011	EIA exemptions received for the project activity	
20/07/2011	Groundwork contract signed with Radus BNS D.o.o.	“Start Date”
03/09/2011	Engineering, Procurement and Construction (EPC) contract signed with OAG	

01/08/2013	Expected commissioning and electrical current supply to EPS (Serbian national grid)	Expected commissioning date

As stated with Guidelines on the demonstration of additionality of small-scale project activities, Version 9, EB68, Annex 27, project participants shall provide an explanation to show that the project activity would not have occurred as a result of one of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The additionality of the proposed project will be demonstrated from an investment analysis to show that the project activity would not have occurred due to (a) investment barrier.

Investment barrier analysis

According to “Non-binding best practice examples to demonstrate additionality for SSC project activities”: Best practice examples include but are not limited to, the application of investment comparison analysis using a relevant financial indicator, application of a benchmark analysis or a simple cost analysis (where CDM is the only revenue stream such as end-use energy efficiency). It is recommended to use national or global accounting practices and standards for such an analysis.

The investment comparison analysis method is applicable to projects whose alternatives are similar investment projects. That is not the case for the proposed project, therefore benchmark analysis is chosen.

The internal return rate (IRR) of the total investment is selected as the financial indicator. A project IRR before tax is calculated for the proposed project and this is compared with a benchmark to prove the financial unattractiveness of the project.

Selection of Appropriate Benchmarks:
According to EB 62 Report Annex 5, “Guidelines on the Assessment of Investment Analysis” (Version 05): In cases where a benchmark approach is used, the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average cost of capital (WACC) are appropriate benchmarks for a project IRR. Thus for the proposed project, the local commercial lending rate at the time for decision to proceed with the project is selected as the benchmark.

A benchmark IRR value of 12.5% based on local commercial lending rates from the National Bank of Serbia, valid at the time of the investment decision (April 2011)[23], is chosen .

[23] The April 7th-30th 2011 National Bank of Serbia “NBS Lending and Deposit Interest Rates” set at 12.5% are available at the following link: http://www.nbs.rs/internet/english/80/index.html#arhiva

Based on the important parameters of the proposed project, valid and applicable at the time of the investment decision taken by the project participant[24], the pre-tax Project Internal Rate of Return (IRR) of the proposed project is calculated and compared with the benchmark IRR value.

- **Important parameters in the investment analysis include:**

Parameter	Unit	Value	Source
Period of assessment	Years	15[25]	FSR
Depreciation	Years	20 (varies by asset type)	FSR
Installed Power nameplate capacity	kW	2997.42	FSR
Expected operating hours	hours	8040	FSR
Power Tariff	EUR/kWh	0.14224	FSR
Total output	kWh/year	24,099,257	FSR
Total Fixed Asset costs	EUR	14,458,884	FSR
Compost Sales	EUR	520,000	FSR
Operating & Maintenance costs	EUR/year	1,311,300	FSR
CDM annual income	EUR	770,000	FSR

The decision to proceed with the project was made by the project owner in April 2011 based on the updated feasibility study data[26]. The input values from the FSR were therefore valid and applicable at the time of the investment decision to proceed with the project and to secure CDM status for it.

- **Outcome of Investment analysis:**

Pre-tax project IRR without CDM: 9.68%
Benchmark IRR (based on local lending rates): 12.5%
Pre-tax project IRR with CDM: 14.58%

Project IRR was calculated for the project activity in the absence of CDM based on the parameters above and other inputs resulting in a 9.68% Project IRR outcome. Project IRR was also calculated for the project activity including CDM revenue expected at the time of the investment decision. The resulting Project IRR with CDM is 14.58%.

Therefore, it is concluded that the project activity would be subject to significant investment barriers in the absence of the CDM, falling below the benchmark IRR presented by local lending rates, meaning the project would be infeasible and the baseline scenario would continue.

Sensitivity Analysis:

[24] Parameters for inclusion in the investment analysis are taken from the Business Plan/Feasibility Study Completed on 17/04/2011.

[25] The expected lifetime of the project is 20 years and depreciation has been calculated on this basis. However, a A 15 year analysis has been prepared in the Business Plan at the time of decision to proceed with the investment into this project. However, the expected lifetime of the project at the time of decision to proceed with the investment into this project was 20 years and depreciation has been calculated on this basis. A 15 year period of assessment has beenwas chosen due to requirements from lending authorities. As per *Guidelines to the Assessment of Investment Analysis* (Version 05), paragraph 2, the fair value of the project assets has been included in the 15th year of the investment analysis.

[26] For conservativeness, the most up to date FSR document (completed in October 2011) has been used for Operating & Maintenance costs in this analysis to reflect changes to project design and parameters impacting investment analysis.

Two key parameters (Electricity Sales and Capital Costs) constitute more than 20% of either total project costs or total project revenues[27]. The results of a sensitivity analysis on Project IRR, against the benchmark IRR for Serbia, adjusting both of the parameters by ± 10% are illustrated in Table 1 and Figure 8 below.

Table 1: Results of sensitivity analysis on project costs and revenues

		% change applied		
Cost/Revenue:	**% of Total Revenue/Cost**	-10%	-	10%
Electricity Sales	**81.74%**	6.87%	9.68%	12.36%
Capital Cost	**19.87%**	10.63%		8.81%

Figure 9: sensitivity analysis on key inputs to investment analysis

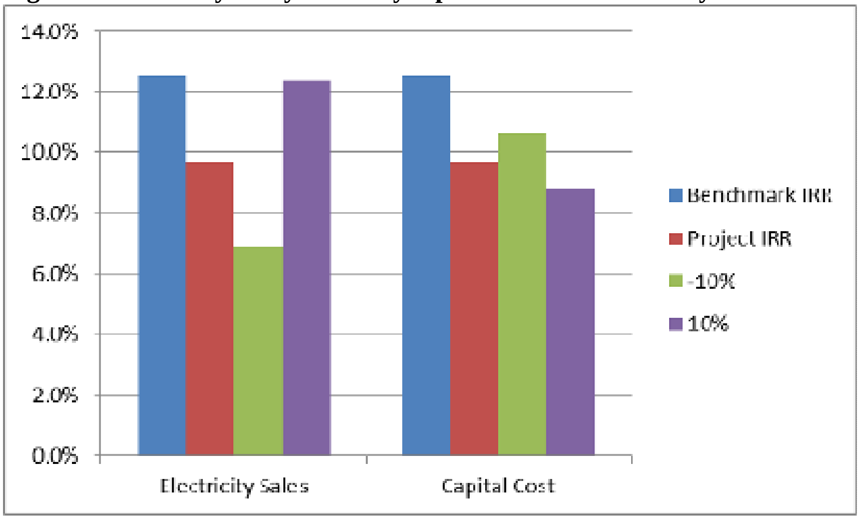

Table 2: Required change in cost/revenue to reach the benchmark IRR of 12.5%

Cost/Revenue:	**% price change required**	**Comments**
Electricity Sales	+11%	**Electricity Prices:** • A feed in tariff is guaranteed at a fixed rate of EUR0.14/kWh for renewable energy projects in Serbia for a period of 12 years[28]. **Power output:** • The project activity is estimated to operate at an optimal 8040 hours per year. Average operational

[27] As per the Guidelines on the Assessment of Investment Analysis (Version 05), only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation under a sensitivity analysis.

[28] Serbia Feed in Tariff decree available at: http://www.ssl-link.com/mre/cms/mestoZaUploadFajlove/Decree_on_feed_in_tariffs_-_OJ_99-2009.pdf

		hours per year for anaerobic digestion are typically lower than this level[29] . **Conclusion:** 11% increase in Electricity Sales is not a plausible assumption for an investment decision over the 15 year life of the financial analysis of this project activity.
Capital Cost	-28%	The Capital Cost for the Biogas 3000kw plant has now been contracted for €6,991,581[30]. The final contracted value is 19% below the estimated value at the time of the investment decision for this project activity. 28% capital cost reduction is therefore not feasible.

Conclusion:
It is concluded that the proposed project activity would be subject to significant investment barriers in the absence of the CDM and even when secondary analysis of potential revenue from heat sales is considered for the project. Therefore, without the CDM, the project would not be financially viable and would not proceed. The project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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1) **Baseline emissions**

- **Methane recovery through controlled anaerobic digestion:**

As per AMS III.AO. (v01), baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass and other organic matter, calculated using the following formula:

$$BE_y = BE_{SWDS,y} + BE_{ww,y} + BE_{manure,y} - MD_{reg,y} * GWP_{CH_4} \quad \textbf{(1)}$$

[29] The median (weighted mean value) operational hours per year for “41 full–scale energy crop digestion plants in Austria” was found to be 7,300 hours in a 2005 study (Laaber et al., 2005), as quoted by the International Energy Agency in tab 5 of the report on “Biogas from Energy Crop Digestion” available at http://www.iea-biogas.net/_download/energycrop_def_Low_Res.pdf

[30] The Engineering, Procurement and Construction (EPC) contract was signed on 03/09/2011 and will be made available at the time of validation.

Where:

$BE_{SWDS,y}$	Where applicable, yearly methane generation potential of the solid waste anaerobically digested by the project activity during the year *x* from the beginning of the project activity (*x*=1) up to the year *y* estimated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (tCO_2e). The tool may be used with the factor "f=0.0" assuming that no biogas is captured, flared or used. With the definition of year *x* as the base year since the project activity started diverting wastes from the SWDS/landfill site. *x* runs from the first year of the crediting period (*x*=1) to the year for which emissions are calculated (*x*=*y*). Where applicable, baseline emission determination of digested waste that would otherwise have been disposed in stockpiles shall follow relevant procedures in AMS-III.E
$BE_{manure,y}$	Where applicable, baseline emissions from the manure co-digested by the project activities, calculated as per the relevant procedures of AMS-III.D
$BE_{ww,y}$	Where applicable, baseline emissions from the wastewater co-digested, calculated as per the procedures of AMS-III.H
$MD_{reg,y}$	Amount of methane that would have to be captured and combusted in the year *y* to comply with the prevailing regulations (tonne)
GWP_{CH_4}	*GWP* for CH_4 (value of 21 is used)

As outlined in section B4, component 1, the baseline emissions for the methane component of this project are limited to the animal manure component.

As a result, the following parameters are considered to be zero in the calculation of baseline emissions:

- $BE_{SWDS,y}$: as per AMS III.AO. (v01), paragraph 1(c) it can not be demonstrated that the organic matter would otherwise been left to decay anaerobically, baseline emissions related to such organic matter shall be accounted for as zero
- $BE_{WW,y}$:not applicable, there is no wastewater co-digested in the project activity.
- $MD_{reg,y}$: not applicable, in Serbia, there is no prevailaing regulations requiring the capture or combustion of methane.

Baseline emissions from manure component:
As per AMS III.AO. (v01), *Where applicable, baseline emissions from the manure co-digested by the project activities, calculated as per the relevant procedures of AMS-III.D.*

According to AMS-III.D (v18), two options are given for calculating baseline emissions:

- option in paragraph 9(a) "using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories)".
- Option in paragraph 9(b) using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (*SVS*) content.

For the proposed project, the option in paragraph 9(b) is chosen.
The maximum amount of methane that can be potentially produced from the project activity manure (B_o) uses a default IPCC value (from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10) as no national specific values exist. Manure characteristics such as the amount of specific

volatile solids (*SVS*) produced by the livestock is calculated using laboratory test results for manure analysis. Methane Conversion Factors (MCF) values for the specific manure management system are identified using default values from IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, Chapter 10 with annual average temperatures using data from the nearest meteorological station.

9 (b) Method

$$BE_{CH4} = GWP_{CH4} \,.\, D_{CH4} \,.UF_{b} \sum_{j,LT} MCF_{j} \,.\, B_{0,LT} \,.\, Q_{manure\,j,LT,y} \,.\, SVS_{j,LT,y} \qquad (2)$$

Where:

BE_{CH4y}	Baseline emissions in year y (tCO2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (21)
UFb	Model correction factor to account for model uncertainties (0.94)
D_{CH4}	CH4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure)
LT	Index for all types of livestock
j	Index for animal manure management system
$Q_{manure,j,LT,y}$	Quantity of manure treated from livestock type *LT* and animal manure management system *j* (tonnes/year, dry basis)
$SVS_{j,LT,y}$	Specific volatile solids content of animal manure from livestock type *LT* and animal manure management system *j* in year *y* (tonnes/tonnes, dry basis)
MCF_j	Annual methane conversion factor (MCF) for the baseline animal manure management system *j*
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type *LT* (m^3 CH_4/kg dm)

- **Grid connected renewable electricity generation:**

As outlined in section B4, component 2, the baseline scenario for power production is the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

Baseline emissions for electricity production

As per AMS- I.D (v17), paragraph 11, baseline emissions from power

$$BE_{power,y} = EG_{BL,y} * EF_{CO2,grid,y} \qquad (3)$$

Where:

$BE_{power,y}$	Baseline power emissions in year *y* (t CO_2)
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid in year y (t CO_2/MWh)

In accordance with paragraph 12 of AMS-I.D (v17), the emission factor of the grid ($EF_{CO2,grid,y}$) can be calculated in a transparent and conservative manner as follows:

"(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system";

OR

(b) The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used."

Calculations shall be based on data from an official source (where available)[31] and made publicly available.

For this project, option (a) is chosen. The calculation of $EF_{CO2,grid,y}$ using the *Tool to calculate the emission factor for an electricity system, version 02.2.1, Annex 19, EB 6* is carried out as follows:

Data relating to the Serbian electricity system has been sourced from official documents released by the Serbian DNA for an official DNA report on EFgrid calculation [32].

Step 1: Identify the relevant electricity systems

The electricity generated by the proposed project will be delivered to the national grid of Serbia (there is only one power grid in Serbia).

Step 2: Choose whether to include off-grid power plants in the project electricity system

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

Option I is chosen.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the Operating Margin emission factor ($EF_{grid,OM,y}$) could be calculated following one of the four methods:

1. Simple OM, or

[31] Plant emission factors used for the calculation of emission factors should be obtained in the following priority:

1. *Acquired directly* from the dispatch center or power producers, if available; or
2. *Calculated*, if data on fuel type, fuel Emission Factor, fuel input and power output can be obtained for each plant; If confidential data available from the relevant host Party authority are used, the calculation carried out by the project participants shall be verified by the DOE and the CDM-PDD may only show the resultant carbon emission factor and the corresponding list of plants;
3. *Calculated*, as above, but using estimates such as: default IPCC values from the 2006 IPCC Guidelines for *National* GHG Inventories for net calorific values and carbon emission factors for fuels instead of plant-specific values technology provider's name plate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply; conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's technology, size and commissioning date; or
4. *Calculated*, for the simple OM and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available.

[32] http://www.ekoplan.gov.rs/DNA/docs/gef%20calculation.pdf

2. Simple adjusted OM, or
3. Dispatch Data Analysis OM, or
4. Average OM.

Justification: The Simple OM (1) was deemed to be the most suitable approach since the part of low-cost/must-run resources[33] in the overall energy production for Serbia is less than 50%. The Simple OM was calculated ex-ante using a 3-year's generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation (i.e., the years 2008,2009,2010), not including low-cost-must-run power plants/units.

Step 4: Calculate the operating margin emission factor according to the selected method
The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The Simple OM was calculated according to Option A, based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$\mathrm{EF}_{\mathrm{grid,OMsimple,y}} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m \mathrm{EG}_{\mathrm{m,y}}}$$

$\mathrm{EF}_{\mathrm{grid,OMsimple,y}}$	Simple operating margin CO2 emission factor in year *y* (tCO_2/MWh)
$\mathrm{EG}_{\mathrm{im,y}}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$\mathrm{EF}_{\mathrm{EL,m,y}}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	All power plants/units serving the grid in year *y* except low-cost/must-run power plants/units
y	The relevant year as per the data vintage chosen in step 3

The CO_2 emission factor for power unit m in year y is calculated with the following formula:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} . NCV_{i,y} . EF_{CO2,i,y}}{EG_{m,y}}$$

Where

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)

[33] Coal has not been considered a must-run resource.

$EF_{CO2,I,y}$	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
m	All power units serving the grid in year y except low-cost/must-run power units
i	All fossil fuel types combusted in power unit m in year y
y	The relevant year as per the ex-ante option

Step 5: Calculate the build margin (BM) emission factor

In terms of vintage of data, Option 1 is chosen.

The sample group of power units used to calculate the build margin consists of:

a) The set of five power units that have been built most recently

Justification: This set of power units comprises the larger annual generation (see Annex 3 for details)

Calculation of the BM emission factor

The build margin (BM) emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units m during the most recent year y for which power generation data is available. It includes data about the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been build most recently.

The BM factor has been calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	Power units included in the build margin
y	Most recent historical years for which power generation data is available

Step 6: Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor (EFgrid,CM,y) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option A) is used as the preferred option.

The combined margin (CM) factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM}$$

Where:

$EF_{grid,BM}$	Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,OM}$	Operating margin CO2 emission factor in year y (tCO2/MWh)
w_{OM}	Weighting of OM emissions factor (%)
w_{BM}	Weighting of BM emissions factor (%)

In accordance with the methodology tool, the default value for w_{OM} and w_{BM} is 0.5.

2) Project activity emissions

According to AMS III.AO. (v01), Project activity emissions consist of:

(a) CO_2 emissions due to incremental transportation distances;
(b) CO_2 emissions from electricity and/or fossil fuel consumption by the project activity facilities;
(c) In case the residual waste from the digestion is stored under anaerobic conditions and/or delivered to a SWDS, or treated in a WWTS: the methane emissions from the disposal/storage/treatment of these residual waste;
(d) Methane emissions from physical leakages of the anaerobic digester;
(e) Methane emissions due to flare inefficiency;

$$PE_y = \begin{Bmatrix} PE_{transp,y} + PE_{power,y} + PE_{res\,waste,y} \\ + PE_{phy\,leakage,y} + PE_{flaring,y} \end{Bmatrix} \quad (4)$$

Where:

PE_y	Project emissions in year *y* (tCO_2e)
$PE_{transp,y}$	Emissions from incremental transportation in the year *y* (tCO_2e)
$PE_{power,y}$	Emissions from electricity or fossil fuel consumption in the year *y* (tCO_2e)
$PE_{res\,waste,y}$	In case residual wastes are subjected to anaerobic storage, or disposed in a landfill: methane emissions from storage/disposal/treatment of waste (tCO2e)
$PE_{phy\,leakage,y}$	Methane emissions from physical leakages of the anaerobic digester in year y (tCO2e)
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year y as per the Methodological Tool: “Project emissions from flaring (Version 02.0.0)” Tool. (tCO2e)

(a) **Project emissions due to incremental transport distances ($PE_{transp,y}$)** are calculated based on the incremental distances between:
(i) The collection points of biomass and/or manure and the digestion site as compared to the baseline solid waste disposal site or manure treatment site;
(ii) When applicable, the collection points of wastewater and treatment site as compared to baseline wastewater treatment site;
(iii) Treatment sites and the sites for soil application, landfilling and further treatment of the residual waste.

$$PE_{transp,y} = (Q_y / CT_y) * DAF_w * EF_{CO2,transport} + (Q_{res-waste,y} / CT_{res-waste,y}) * DAF_{res-waste} * EF_{CO2,transport} \quad \textbf{(5)}$$

Where:

Q_y	Quantity of raw waste/manure treated and/or wastewater co-digested in the year y (tonnes)
CT_y	Average truck capacity for transportation (tonnes/truck)
DAF_w	Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck)
$EF_{,Co2, transport}$	CO2 emission factor from fuel use due to transportation (kgCO2/km, IPCC default values or local values may be used)
$Q_{,res-waste,y}$	Quantity of residual waste produced in year y (tonnes)
$CT_{res-waste,y}$	Average truck capacity for residual waste transportation (tonnes/truck)
$DAF_{res-waste}$	Average distance for residual waste transportation (km/truck)

(b) For the calculation of **Project emissions from electricity and/or fossil fuel consumption by the project activity facilities (*$PE_{power\,y}$*)** all the energy consumption of all equipment/devices installed by the project activity shall be included and “Tool to calculate the emission factor of an electricity system” and/or “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion” shall be followed, respectively. Recovered biogas is not used to power auxiliary equipment so is this not taken into account.

Project emissions from electricity consumption are determined as per the procedures described in AMS-I.D *‘Grid connected renewable electricity generation”*.

Paragraph 20 and 21 of AMS-ID (v17) under Project Emissions from electricity consumption, states the following:
20. For most renewable energy project activities, PE_y = 0. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of ACM0002.

- *Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption);*
- *Emissions from water reservoirs of hydro power plants.*

21. CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the ‘Tool to calculate project or leakage CO2 emissions from fossil fuel combustion.’”

As this project activity is neither related to the operation of a geothermal power plant nor a hydro power plant with a reservoir, Paragraph 20 of AMS-ID (v17) is not applicable.

This project activity consists of anaerobic digestion and utilization of biogas-based power generation connected to the national grid and does not include any co-firing or on-site consumption of fossil fuels.

Therefore, in accordance with AMS-ID (v17), $PE_{power,y} = 0$

Electricity consumption by the project activity facilities is calculated for ex ante estimation to calculate $EG_{BL,y}$ (Quantity of net electricity displaced in the grid as a result of the implementation of the CDM project activity in year y (MWh)). Electricity consumption will be monitored for ex post calculation of net electricity displaced to the grid. Therefore, no project leakage need be considered for the electricity consumption of the project.

Therefore, in accordance with methodologies AMS-ID (v17), and AMS III.AO.(v01):
$PE_{power,y} = 0$

(c) **Methane emissions from anaerobic storage and/or disposal in a landfill of the residual waste from the digestion (*PE* $_{res\ waste\ y}$)** are calculated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Residual waste from the digestion is not stored under anaerobic conditions and/or delivered to a SWDS, or treated in a WWTS: therefore, no methane emissions need to be considered from the disposal/storage/treatment of this residual waste.

(d) **Methane emissions due to Physical leakages from the digester and recovery system (*PE* $_{phy\ leakage,y}$)** shall be estimated using a default factor of 0.05 m³ biogas leaked/m³ biogas produced. For ex ante estimation the expected biogas production of the digester will be used, for ex post calculations the effectively recovered biogas amount shall be used for the calculation.

(e) **Methane emissions due to incomplete flaring in year y**. As per the Methodological tool "Project emissions from flaring (Version 02.0.0)":

The project activity has an enclosed flare installed for emergency situations when excess biogas builds up in the biogas storage tanks. The project is designed to store biogas for prolonged periods with no requirement for flaring. As a result, the project activity is not expected to utilise the emergency flare to combust excess biogas containing methane. Therefore:

$PE_{flare,y} = 0$

For ex post calculation, to account for emergency use of the flare system, project emissions from flaring of biogas will be calculated using the following formula:

$$PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3} \qquad (6)$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas in year y (tCO2e)
GWP_{CH4}	Global warming potential of methane valid for the commitment period (tCO2e/tCH4)
$F_{CH4,RG,m}$	Mass flow of methane in the residual gas in the minute m (kg)
$\eta_{flare,h}$	Flare efficiency in minute m

Leakage

According to AMS-I.D (v17), no leakage calculation is required for this project. According to AMSIIIAO (v1) "If the project technology is the equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects are to be considered (LEy). For the proposed project, no equipment is transferred from another site and no exiting equipment is transferred to another site. Therefore, LEy = 0.

However, as per AMSIIIAO (v1) paragraph 1(d), procedures related to the "competing use for the biomass" according to the latest "General guidance on leakage in biomass project activities" should be considered.
As per *General guidance on leakage in biomass project activities* (v03) Table 1, "Biomass residues or wastes", "competing use of biomass" should be considered as a potentially significant source of leakage and project emissions. "Shift of pre-project activities" and "Emissions from biomass generation/cultivation" do not need to be considered as potentially significant sources of leakage and project emissions.

Competing uses for the biomass:
Agriculture sector waste is specifically included as an important source of emission reduction potential in the "National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism[34]" as it is "one of the largest sources of GHG emissions[35]" in the country. Every year Serbia produces approximately 12.5 million tons of biomass (60% from agricultural production) and "most of it is not used effectively" [36].

Waste residue from Maize production is particularly noted for emission reduction potential wherein the common practice is that "maize residues are either landfilled or burnt in open air"37. For many Maize farmers, "it is useless to collect maize residues after harvesting" before there are no uses on the farms for this residue and "there is no market for selling biomass residues"[38.]

The project activity is located in the agricultural Province of Vojvodina which has "has the highest potential in agricultural waste, providing 8-12 Mtoe of biomass annually" [39]. There is an estimated mass of 390,000t of maize stover (leaves and stalks residue) which is currently not utilised with potential for energy generation in the province of Vojvodina[40]

The project activity utilises an estimated 40,750[41] tons of maize residue per year which would otherwise be left to decay on the field in stockpiles, not used for any other purpose (equivalent to 10.4% of the regions maize residue waste[42]). Therefore, the project activity uses a low quantity of the regions volume of available maize residue (the

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[34] "National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism, 2010. Source: http://80.93.243.155/en/upload-centar/dokumenti/razno/cdm_strategija_engleski_za_stampu.pdf

[35] "National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism, 2010 . Page 31, Chapter V: "Possibilities For Implementation of CDM Projects In Agricultural Sector". Source: http://80.93.243.155/en/upload-centar/dokumenti/razno/cdm_strategija_engleski_za_stampu.pdf

[36] Review and analysis of renewable energy perspectives in Serbia. International Journal of Energy and Environment (IJEE), Volume 2, Issue 1, 2011, Section "*3.1 Biomass*" pp.77. Source: http://www.rit.edu/~w-cenr/documents/data/serbia.pdf

[37] "National Strategy for Incorporation of the Republic of Serbia into Clean Development Mechanism, 2010, Page 45. Source: http://80.93.243.155/en/upload-centar/dokumenti/razno/cdm_strategija_engleski_za_stampu.pdf

[38] "Industrial Scale Demonstration Plant with Downdraft Gasifier coupled to Pebble Bed Regenerative Heater for CHP Production" (2012). Chapter 2: "2. Biomass potentials – agricultural residues". Source: http://www.ecos2012.unipg.it/public/proceedings/pdf/RECS/RECS_ecos2012_212.pdf

[39] International Journal of Energy and Environment (IJEE), Volume 2, Issue 1, 2011, Section "*3.1 Biomass*" pp.77. Source: http://www.rit.edu/~w-cenr/documents/data/serbia.pdf

[40] Potentials, practice and prospects of energy utilization of solid Biomass in Serbia, Jefferson Institute, Page 3, Tab 1. 390,000t calculation is the combination of 110t from "big farms" and 280t from "S/M farms". Source: http://www.altenergija.org/sites/default/files/Solid%20BIOMASS.pdf

[41] As per inputs to the Investment Analysis spread sheet accompanying this Project Design Document.

[42] 40,750/390,000 = .104 (10.4%)

remaining amount of maize residue is 750% larger[43] than the quantity of utilised biomass) so is highly unlikely to have an impact on the competing uses for such biomass residues, should alternative uses be available.
In accordance with the guidance on competing use for biomass, since it is demonstrated using published literature that available quantities of agricultural waste at the beginning of the crediting period (based on 2011 data) for this project activity is far in excess of "*25% larger than the quantity of biomass that is utilised including the project activity*", this potential source of leakage is neglected.
Leakage effects due to Competing use for the biomass for this project activity are considered to be zero.

B.6.2. Data and parameters that are available at validation:

Methane component baseline emissions inputs:
As outlined in section B.6.1, as per AMS III.AO. (v01), baseline emissions from the manure co-digested by the project activities will be calculated as per the relevant procedures of AMS-III.D.

AMS IIID baseline emissions inputs:

Data / Parameter:	GWP_{CH4}
Data unit:	number
Description:	Global Warming Potential of CH_4
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per approved methodology AMS-III.D (v18), Methane recovery in animal manure management systems paragraph 10 and Methodological tool "Project emissions from flaring" (Version 02.0.0).
Any comment:	

Data / Parameter:	D_{CH4}
Data unit:	t/m^3
Description:	Density of CH_4 at room temperature (20 ºC) and 1 atm pressure
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.00067
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per approved methodology AMS-III.D (v18), Methane recovery in animal manure management systems paragraph 10
Any comment:	

Data / Parameter:	MCF_{CH4}
Data unit:	number

[43] Remaining Maize residue: 390,000-40,750 = 349,250. Size comparison (remaining residue vs. utilised): 349,250-40,750 = 308,500. 308,500/40,750= 7.5 (750%)

Description:	Annual methane conversion factor (MCF) for the baseline animal manure management system, an anaerobic lagoon
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, chapter 10, volume 4, table Table 10A-4.
Value applied:	70%
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value of 70% for uncovered anaerobic lagoon is applied in line with the annual average temperature at the project activity site is approximately 12°C
Any comment:	

Data / Parameter:	$B_{0,LT}$
Data unit:	(m^3 CH_4/kg dm)
Description:	Maximum methane producing potential of the volatile solid generated for animal type *LT* (m^3 CH_4/kg dm)
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, chapter 10, volume 4, table Table 10A-7.
Value applied:	0.45
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per approved methodology AMS-III.D (v18), .where no country specific value is available, a default value is applied. A default value of 0.45 for Eastern Europe “Market Swine Characteristics” is applied as this is the location of the project activity and population of market swine.
Any comment:	

Data / Parameter:	UF_b
Data unit:	number
Description:	Model correction factor to account for model uncertainties
Source of data used:	AMS.III.D. Methane recovery in animal manure management systems Version 18, paragraph 10. Referenced, FCCC/SBSTA/2003/10/Add.2, page 25.
Value applied:	0.94
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per approved methodology AMS-III.D (v18), Methane recovery in animal manure management systems paragraph 10
Any comment:	

Project activity emissions:

Data / Parameter:	nd_y
Data unit:	days

Description:	Number of days the animal manure management system is operational in year y
Source of data used:	Project proponents
Value applied:	365
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project farm is operational 365 days per year and manure management system in existing lagoons is operational throughout this time.
Any comment:	

Data / Parameter:	FE
Data unit:	%
Description:	Flare efficiency of combustion of biogas in the year “y”
Source of data to be used:	Methodological Tool “Project emissions from flaring (Version 02.0.0)”
Value of data	0% default value is applied
Description of measurement methods and procedures to be applied:	As per the Methodological Tool: “Project emissions from flaring (Version 02.0.0)” For enclosed flares, either of the following two options can be used to determine the flare efficiency: (a) To use a 90% default value. Continuous monitoring of compliance with manufacturer’s specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer’s specifications, a 50% default value for the flare efficiency should be used for the calculations for this specific hour. (b) Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency). Option A is chosen. In both cases, if there is no record of the temperature of the exhaust gas of the flare or if the recorded temperature is less than 500 °C for any particular hour, it shall be assumed that during that hour the flare efficiency is zero. The flare is expected to run for very short periods of time as it is a safety precaution, not part of day to day project activity. No record of the temperature of the exhaust gas of the flare will be taken. Therefore, it shall be assumed that the flare efficiency is zero.
QA/QC procedures to be applied:	-
Any comment:	The project activity flare is for safety purposes only and is not expected to be used in day to day project activity

Data / Parameter:	$SPEC_{flare}$
Data unit:	Temperature - °C Flow rate or heat flux - kg/h or m^3/h
Description:	Manufacturer’s flare specifications for temperature and flow rate

Source of data to be used:	Flare manufacturer
Value of data	Temperature: > 850°C Flow rate or heat flux - 5.0E-8 - 2.0E-6m^3/h
Description of measurement methods and procedures to be applied:	Document in the CDM-PDD the flare specifications set by the manufacturer for the correct operation of the flare for the following parameters: (a) Minimum and maximum inlet flow rate, if necessary converted to flow rate at reference conditions or heat flux; (b) Minimum and maximum operating temperature; and As per Methodological tool "Project emissions from flaring" (Version 02.0.0): *Only applicable in case of enclosed flares. The maintenance schedule is not required if Option A is selected to determine flare efficiency of an enclosed flare.*
QA/QC procedures to be applied:	-
Any comment:	The project activity flare is for safety purposes only and is not expected to be used in day to day project activity

Data / Parameter:	$W_{CH4,y}$
Data unit:	%
Description:	Default value of methane content in biogas in the year *y* (volume fraction)
Source of data used:	AMS-III.D (v18), Methane recovery in animal manure management systems, Table IIID, item 6.
Value applied:	60%
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value of 60% methane content in biogas is applied.
Any comment:	

Data / Parameter:	$EF_{Co2\ transp}$
Data unit:	tCo2/km
Description:	CO_2 emission factor from fuel use due to transportation (kgCO_2/km, IPCC default values or local values may be used)
Source of data used:	1996 IPCC Guidelines for National Greenhouse Gas Inventories, Table 1-32, (Moderate Control vehicles)
Value applied:	1.011
Justification of the choice of data or description of measurement methods and procedures actually applied :	Co2 emission not available at the time of PDD writing, default value used from 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Table 1-32, (Moderate Control vehicles)
Any comment:	As per AMS IIIF monitoring requirements

AMS ID baseline emissions inputs:

Data / Parameter:	$EF_{CO2,y}$
Data unit:	t CO2e/kWh
Description:	CO2 emission factor of the grid electricity in year *y*
Source of data used:	Calculations based on data from Serbian Ministry of Environment, Mining and Spatial Planning
Value applied:	1.004
Justification of the choice of data or description of measurement methods and procedures actually applied :	For details ofthe approach taken, seeannex 3 of this document. Value is calculated as per approved methodology AMS-ID (v17).
Any comment:	Calculation is available in Annex 3 of this document.

B.6.3 Ex-ante calculation of emission reductions:

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Ex ante estimations

A default value of 60% CH4 content is applied to the biogas. The project activity is expected to produce 12,566,520 m^3biogas/year (7,539,912 m3 CH4/year). [44]

Emission reductions

It should be noted that only methane emissions avoided through anaerobic digestion of swine manure and replacement of the electricity from the national grid with renewable electricity were taken into account, when calculating the GHG emission reductions. No emission reductions are calculated for the maize residue anaerobic digestion and no emission reductions are calculated for any thermal energy production from the gensets.

Emission reductions: Swine manure (AMS III.AO.):

The emission reductions achieved by the project activity will be determined *ex post* through direct measurement of the amount of biogas fuelled, flared or gainfully used. It is possible that the project activity involves biomass treatment with higher methane conversion factor (MCF) than the MCF for the biomass which otherwise would have been left to decay in the baseline situation. Therefore the emission reductions achieved by the project activity is limited to the *ex post* calculated baseline emissions minus project and leakage emissions using the actual monitored data for the project activity (e.g. Q_y, and fossil fuels/electricity used). The emission reductions achieved in any year are the lowest value of the following

$$ER_{y,ex\,post} = min\begin{bmatrix}(BE_{y,ex\,post} - PE_{y,ex\,post} - LE_{y,ex\,post}),(MD_y - PE_{y,power,ex\,post} - \\ PE_{y,transp,ex\,post} - PE_{y,res\,waste,ex\,post} - PE_{y,phy\,leakage,ex\,post} - LE_{y,ex\,post})\end{bmatrix} \quad (8)$$

[44] The project gensets are designed to consume a maximum 12,566,520 m^3biogas/year. Calculation (521x8,040x3 = 12,566,520 m^3biogas/year) uses following parameters: Fuel consumption per Genset (Nm³/h) as per "Jenbacher gas engines Technical Specification" = 521, Operating Hours per year as per ER calc = 8,040, 3 gensets in operation.. 12,614,760 m^3biogas/year @ default value of 60% CH4 amounts to 7,539,912 m^3CH4/year.

where:

$ER_{y,ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year *y* (tCO_2e)
$BE_{y,ex\ post}$	Baseline emissions calculated using equation (1) using *ex post* monitored values (e.g. Q_y) (tCO_2e)
$PE_{y,ex\ post}$	Project emissions calculated using equation (2) using *ex post* monitored values (e.g. Q_y, transport distances, the amount of electricity/fossil fuels used, emissions from anaerobic storage). This calculation shall include project emissions from physical leakage (tCO_2e)
$LE_{y,ex\ post}$	Leakage emissions calculated using *ex post* monitored values (tCO_2e)
MD_y	Methane captured and destroyed or used gainfully by the project activity in year *y* (tCO_2e)
$PE_{y,transp,ex\ post}$	Emissions from incremental transportation based on monitored values in the year *y* (tCO_2e)
$PE_{y,power,ex\ post}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year *y* (tCO_2e)
$PE_{y,res\ waste,ex\ post}$	Methane emissions from the anaerobic decay/treatment of the residual waste/products based on monitored values in the year *y* (tCO_2e)
$PE_{y,phy\ leakage,ex\ post}$	Methane emissions from physical leakages of the anaerobic digester based on monitored values in year *y* (tCO_2e)

Only emission reductions from avoided methane (CH4) emissions from manure management systems in the baseline scenario are considered. No other substrates used by the project activity are considered in emission reduction calculations.

As a result, $(BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post})$ is taken as the relevant and minimum calculation from equation (8) above.

As per the equations listed in section B6.1, the parameters used to calculate emission reductions on this basis are as follows:

A. $BE_{y,ex\ post}$: Baseline Emissions (CH4): 9(b) method:

$$BE_{CH4,y} = GWP_{CH4} \cdot D_{CH4} \cdot UF_b \sum_{j,LT} MCF_j \cdot B_{0,LT} \cdot Q_{manure\ j,LT,y} \cdot SVS_{j,LT,y} \qquad (9)$$

Value	Symbol	Description
14,276.15	**BE_{CH4y}**	**Baseline methane emissions in year y (tCO2e) - formula is multiplied by 1000 to convert from MtCo2e to tCo2e**
21	GWP_{CH4}	Global Warming Potential (GWP) of CH4 (21)
0.00067	D_{CH4}	CH4 density (0.00067 t/m3 at room temperature (20 ºC) and 1 atm pressure)
0.9400	Ufb	Model correction factor to account for model uncertainties

Market Swine	LT	Index for all types of livestock
Market Swine manure	j	Index for animal manure management system
70%	MCF_j	Annual methane conversion factor (MCF) for the baseline animal manure management system j
0.45	$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type LT (m3 CH4/kg dm)
4,035.60	$Q_{manure,j,LT,y}$	Quantity of manure treated from livestock type LT and animal manure management system j (tonnes/year, dry basis)
0.85	$SVS_{j,LT,y}$	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y (tonnes/tonnes, dry basis)

B. $PE_{y,ex\ post}$:

1. Project Emissions (transport):

Value	Symbol	Description
99.39	**Pey,transp**	**Total of Pey,transp-manure and Pey,transp-biomass**
75.16	**Pey,transp-manure**	**formula is divided by 1000 to convert from kgCo2e to tCo2e**
35,400	Qy	Quantity of raw waste/manure treated and/or wastewater co-treated in the year y (tonnes)
20	CT y-manure	Average truck capacity for transportation (tonnes/truck)
42	DAFw - manure	Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck)
1.011	EFC02	CO2 emission factor from fuel use due to transportation [kgCO2/km]
0	Qy,treatment	Quantity of compost produced in year y (tonnes)
0	CT y,treatment	Average truck capacity for compost transportation (tonnes/truck)
0	DAFtreatment	Average distance for compost transportation (km/truck)
24.23	**Pey,transp-biomass**	**formula is divided by 1000 to convert from kgCo2e to tCo2e**
40,750	Qy	Quantity of raw waste/manure treated and/or wastewater co-treated in the year y (tonnes)
17	CT y-biomass	Average truck capacity for transportation (tonnes/truck)
10	DAFw-biomass	Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck)
1.011	EFC02	CO2 emission factor from fuel use due to transportation [kgCO2/km]
0	Qy,treatment	Quantity of compost produced in year y (tonnes)
0	CT y,treatment	Average truck capacity for compost transportation (tonnes/truck)
0	DAFtreatment	Average distance for compost transportation (km/truck)

2. Project Emissions (CH4, biogas leaked):

$$PE_{Pl,y} = 0.10 \cdot GWP_{CH4} \cdot D_{CH4} \cdot \sum_{i,LT} B_{0,LT} \cdot Q_{manure,LT,y} \cdot SVS_{LT,y} \cdot MS\%_{i,y} \quad (10)$$

Value	Symbol	Description

5,324.7	**$PE_{PL,y}$**	**Emissions due to physical leakage of biogas in year y (tCO2e) - formula is multiplied by 1000 to convert from MtCo2e to tCo2e**
21	GWPCH4	Global Warming Potential (GWP) of CH4 (21)
0.00067	DCH4	CH4 density (0.00067 t/m3 at room temperature (20 ºC) and 1 atm pressure)
60%	WCH4,y	Methane content in biogas in year y
630,738	Q,y biogas leaked	Quantity of biogas leaked in year y (m3)

3. Project emissions from storage/disposal/treatment of residual waste (tCo2e): not required
4. Project Emissions (CH4, Flare): not required
5. Project emissions from the use of fossil fuel or electricity for the operation of the installed facilities: not required

C. $LE_{y,ex\ post}$: Project Leakage: not required

Table 3: Emission reductions from Swine manure anaerobic digestion and biogas production

ER_y (tCO_2e)	BE_y (tCO_2e)	PE_y (tCO_2e)	LE_y (tCO_2e)
8,852	14,276	5,424	0

Emission reductions: Renewable electricity (AMS IC/ID):

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (7)$$

where:

ER_y Emission reductions in year y (tCO_2e)
BE_y Baseline emissions in year y (tCO_2e)
PE_y Project emissions in year y (tCO_2e)
LE_y Leakage emissions in year y (tCO_2e)

1. Baseline Emissions (grid electricity):

$$BE_{electricity,y} = EG_{BL,y} * EF_{C02,grid,y} \quad (11)$$

Value	Symbol	Description
22,745	**BE electricity,y**	**Baseline electricity emissions in year y (t CO2)**
22,650	EGBL,y	Quantity of net electricity displaced in the grid as a result of the implementation of the CDM project activity in year y (MWh)
24,096	EGBL,y gross	Quantity of gross genset electricity output as a result of the implementation of the CDM project activity in year y (MWh)
1.004	EFCO2,grid,y	CO2 emission factor of the grid in year y (t CO2/MWh)
2.997	MW	Installed capacity of power plant

8,040	hrs/yr	Hours of operation
1,446	EGBL,y consumed	Quantity of electricity consumed as a result of the implementation of the CDM project activity in year y (MWh)

2. Project Emissions (Power emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y): not required
3. Project Leakage: not required

Table 4: Emission reductions from displacement of Serbian grid electricity with renewable electricity

ER_y (tCO_2e)	BE_y (tCO_2e)	PE_y (tCO_2e)	LE_y (tCO_2e)
22,745	22,745	0	0

Total Emission Reductions:
Total emission reductions for this project activity consist of the combination of the two applicable methodologies for this biogas to energy project.

Emission reductions are calculated as the combined totals of the baseline emissions (BE_y) minus the total project emissions (PE_y), minus the total leakage emissions (LE_y) from the implementation of the project activity.

For this project activity the total emission reductions are summarized in the table below:

Table 5: Total Project Activity Emission Reductions

ER_y (tCO_2e)	BE_y (tCO_2e)	PE_y (tCO_2e)	LE_y (tCO_2e)
31,597	37,021	5,424	0

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
2013	5,424	37,021	-	31,597
2014	5,424	37,021	-	31,597
2015	5,424	37,021	-	31,597
2016	5,424	37,021	-	31,597
2017	5,424	37,021	-	31,597
2018	5,424	37,021	-	31,597
2019	5,424	37,021	-	31,597
2020	5,424	37,021	-	31,597
2021	5,424	37,021	-	31,597

2022	5,424	37,021	-	31,597
Total (tonnes of CO2e)	54,241	370,209	-	315,970

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

AMS IIID Baseline emissions:

Data / Parameter:	$Q_{manure,j,LT,y}$
Data unit:	(tonnes/year)
Description:	Quantity of manure treated from livestock type LT and animal manure management system j (tonnes/year)
Source of data to be used:	Project proponent monitoring reports
Value of data	35,400 is applied for ex ante estimation based on equipment specifications for import of manure. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	Tonnes of manure imported into the biogas plant facility will be measured using a weighbridge at the entrance to the facility. All trucks will be weighed and results will be logged electronically. Reports will be aggregated to monthly and annual levels. See monitoring point 1 in figure 9 of monitoring plan. Recorded electronically for the crediting period plus two years.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration of weighbridge will be carried out periodically.
Any comment:	Used for baseline emissions calculation and project emissions due to transport emissions (as per AMSIIIF monitoring requirements).

Data / Parameter:	$Q_{maize\ residue,\ y}$
Data unit:	(tonnes/year)
Description:	Quantity of maize residue treated in the year y (tonnes)
Source of data to be used:	Project proponent monitoring reports
Value of data	40,750 is applied for ex ante estimation based on equipment specifications for import of residue. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	Tonnes of maize residue imported into the biogas plant facility will be measured using a weighbridge at the entrance to the facility. All trucks will be weighed and results will be logged electronically. Reports will be aggregated to monthly and annual levels. See monitoring point 1 in figure 9 of monitoring plan. Recorded electronically for the crediting period plus two years.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration of weighbridge will be carried out periodically.
Any comment:	Used for baseline emissions calculation and project emissions due to transport emissions (as per AMSIIIF monitoring requirements).

Data / Parameter:	$DM_{\%,manure,LT,j}$
Data unit:	%/tonne
Description:	Dry matter content (%) of manure treated from livestock type LT and animal manure management system j
Source of data to be used:	Project proponent monitoring reports including laboratory tests on manure used in the anaerobic digester.
Value of data	11.4% is applied for ex ante estimation. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	Manure imported to the biogas plant site will be analysed before being pumped into the anaerobic digester chambers. 11.4% value is applied from laboratory analysis results on sample manure from the farm sites conducted as part of the feasibility analysis in the business plan preparation.See monitoring point 2 in figure 9 of monitoring plan. Recorded electronically for the crediting period plus two years.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Measurement and calculation has been carried out in accordance with German industry standard practices relating to dry matter and volatile solid laboratory testing. Standard names: DIN EN 12880 and DIN EN 12879. Monitoring of this parameter will continue to be in accordance with these high standards using specialist measurement and monitoring equipment. Calibration and maintenance of meters will be carried out periodically.
Any comment:	

Data / Parameter:	$SVS_{j,LT,y}$
Data unit:	(tonnes/tonnes, dry basis)
Description:	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y (tonnes/tonnes, dry basis).
Source of data to be used:	Project proponent monitoring reports including laboratory tests on manure used in the anaerobic digester.
Value of data	85% is applied for ex ante estimation. To be monitored throughout crediting period plus two years.

Description of measurement methods and procedures to be applied:	Directly measured through sampling and systematically recording the Specific volatile solids content of the animal manure batches fed into the anaerobic digester, recorded electronically in log books. **Sampling Plan:** • Sampling Objective: to determine the mean batch value of parameter $SVS_{j,LT,y}$ during the crediting period, and with a 90/10 confidence interval. • Field Measurement Objectives and Data to be collected: data to be collected include the Organic Dry matter content of manure (Organic DM%) and Dry matter content of manure (DM%). Method of the survey will involve a sample (or minimum size 0.02g, maximum size 50-200g) taken using a pan from every batch of manure to be imported into the main digestor unit. Batches will be imported on a daily basis resulting in multiple samples per day. The data is used to test the quality of the manure for digestion and is stored for cross checking of data during verification of CDM data. • Target Population and Sampling Frame: target population is each batch of manure to be imported to tha main digester unit. • Sample method: Simple random sample. • Desired Precision/Expected Variance and Sample Size: sampling is expected to is expected to produce results with accuracy of ±0.3-0.6% as per the operating manual of the measurement device. Sample size will be 0.2-200g per sample, per batch of manure. • Procedures for Administering Data Collection and Minimizing Non-Sampling Errors: operating staff working on the project site will be trained to conduct manure sampling as part of essential quality checks in the operation of the plant. Samples yielding a result of 10% or more from mean monthly measurements will be repeated to verify the characteristics of the manure. Quality assurance and document management procedures will be prepared as part of the training and operating manuals for the plant. Results of sampling will be recorded electronically for the crediting period plus two years. • Implementation: Every batch of manure imported to the biogas plant site will be analysed before being pumped into the anaerobic digester chambers to test for quality and suitability for use in digestion process and to adhere to sampling requirements. This is crucial to the smooth operation of the power plant and will be the responsibility of the Operations manager and monitoring team. All personnel will be trained in the use of all equipment and safety precautions. Data collection and document management will be implemented from the beginning of commissioning of the project as part of the training process. Animal manure is treated in a centralized plant, as the case in paragraph 9 (b) of AMS-III.D (v18), testing shall be performed according to the guideline in annex 2 of AM0073. It will be carried out on sample basis by following General guidelines for sampling and surveys for SSC project activities, with a maximum margin of error of 10% at a 90% confidence level. 85% value (9.68%/11.4%) is applied from laboratory analysis results on sample manure from the farm sites conducted as part of the feasibility analysis in the business plan preparation. See monitoring point 2 in figure 9 of monitoring plan. Recorded electronically for the crediting period plus two years.

QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Measurement and calculation has been carried out in accordance with German industry standard practices relating to dry matter and volatile solid laboratory testing. Standard names: DIN EN 12880 and DIN EN 12879. Monitoring of this parameter will continue to be in accordance with these high standards using specialist measurement and monitoring equipment. See monitoring point 2 in figure 9 of monitoring plan.
Any comment:	

Note: The ex post emission reduction calculation for this project activity is limited to the animal manure after accounting for project emissions from all co-digested substrates Emission reductions are only considered from the avoided methane emissions from the animal waste manure management systems in the baseline scenario for this project activity.. No emission reductions are considered for other substrates used by the project activity. Monitoring of substrates is included for ex post project emissions calculations and due care will be taken in the monitoring plan to ensure that only metrics relating to the manure substrate are used in the baseline methane emissions from animal waste calculations.

AMS III.AO. Project emissions:

Data / Parameter:	CT,y
Data unit:	(tonnes/truck)
Description:	Average truck capacity for manure transportation (tonnes/truck)
Source of data to be used:	Project proponent contracted transport plant and machinery
Value of data	20 has been applied for ex ante estimation. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	A 20 tonne liquid tanker truck has been accounted for in the feasibility study for the business plan for this project activity. See monitoring point 1 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	CT,y
Data unit:	(tonnes/truck)
Description:	Average truck capacity for biomass transportation (tonnes/truck)
Source of data to be used:	Project proponent contracted transport plant and machinery
Value of data	17 has been applied for ex ante estimation. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	A 17 tonne trailer has been accounted for in the feasibility study for the business plan for this project activity. See monitoring point 1 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	$DAF_{w\text{-}manure}$
Data unit:	(km/truck)
Description:	Average incremental distance for raw solid manure transportation (km/truck)
Source of data to be used:	Project proponent feasibility study in business plan
Value of data	40 has been applied for ex ante estimation. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	An average 40km round trip per truck collecting manure from the farms that provide manure to the biogas plant facility has been accounted for in the feasibility study for the business plan for this project. Any changes to the source of manure will be logged and recorded electronically for the crediting period plus two years. See monitoring point 1 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	$DAF_{w\text{ - }biomass}$
Data unit:	(km/truck)
Description:	Average incremental distance for biomass transportation (km/truck)
Source of data to be used:	Project proponent feasibility study in business plan
Value of data	10 has been applied for ex ante estimation. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	An average 10km round trip per truck collecting biomass from the fields adjacent to the plant has been accounted for in the feasibility study for the business plan for this project. A map of the field area where biomass will be generated can be seen in section A.4.1.4. Any changes to the source of biomass will be logged and recorded electronically for the crediting period plus two years. See monitoring point 1 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	$F_{CH4,EG,m}$
Data unit:	kg
Description:	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t
Source of data to be used:	Anaerobic digester monitoring software will measure the amount of biogas flared on a per minute basis.
Value of data	0 is used for ex-ante estimation.

Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0): Measure the mass flow of methane in the exhaust gas according to an appropriate national or international standard e.g. UKs Technical Guidance LFTGN05. The time period t over which the mass flow is measured must be at least one hour. The average flow rate to the flare during the time period t must be greater than the average flow rate observed for the previous six months Anaerobic digester monitoring software will measure any flaring of biogas in Nm³/hour and automatically record results electronically which can be displayed at any time. A default methane content of the biogas of 60% can be applied to Recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration and maintenance of flare and meters will be carried out periodically.
Any comment:	The project activity flare is in place for safety reasons only and is not expected to operate as the project has been designed to operate at its designated capacity.

Data / Parameter:	$T_{EG,m}$
Data unit:	°C
Description:	Temperature in the exhaust gas of the enclosed flare in minute m
Source of data to be used:	Anaerobic digester monitoring software will measure temperature on an on-going basis.
Value of data	0 is used for ex-ante estimation.
Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0): Measure the temperature of the exhaust gas in the flare by an appropriate temperature measurement equipment. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Flare manufacturers must provide suitable monitoring ports for the monitoring of the temperature of the flare. These would normally be expected to be in the middle third of the flare. Where more than one temperature port is fitted to the flare, the flare manufacturer must provide written instructions detailing the conditions under which each location shall be used and the port most suitable for monitoring the operation of the flare according to manufacturers specifications for temperature Recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration and maintenance of flare and meters will be carried out periodically.
Any comment:	The project activity flare is in place for safety reasons only and is not expected to operate as the project has been designed to operate at its designated capacity.

Data / Parameter:	$V_{i,RG,m}$
Data unit:	-
Description:	Volumetric fraction of component i in the residual gas on a dry basis in the minute m where i = CH4, CO, CO2, O2, H2, H2S, NH4, N2

Source of data to be used:	Anaerobic digester monitoring software will measure using a continuous gas analyser
Value of data	0 is used for ex-ante estimation.
Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0): Measurement may be made on either dry or wet basis. If value is made on a wet basis, then it shall be converted to dry basis for reporting Recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Analysers will be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas. Alibunar monitoring team will check all records. Calibration and maintenance of flare and meters will be carried out periodically.
Any comment:	As a simplified approach, project participants may only measure the content CH4, CO and CO2 of the residual gas and consider the remaining part as N2.

Data / Parameter:	$V_{RG,m}$
Data unit:	m^3
Description:	Volumetric flow of the residual gas on a dry basis at reference conditions in the minute m
Source of data to be used:	Anaerobic digester monitoring software will measure using a flow meter continuously. Values to be averaged on a minute basis
Value of data	0 is used for ex-ante estimation.
Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0) Recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Analysers will be periodically calibrated according to the manufacturer's recommendation. Alibunar monitoring team will check all records.
Any comment:	The project activity flare is in place for safety reasons only and is not expected to operate as the project has been designed to operate at its designated capacity.

Data / Parameter:	$M_{RG,m}$
Data unit:	kg
Description:	Mass flow of the residual gas on a dry basis at reference conditions in the minute m
Source of data to be used:	Anaerobic digester monitoring software will measure using a flow meter continuously. Values to be averaged on a minute basis
Value of data	0 is used for ex-ante estimation.
Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0) Recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration and maintenance of flare and meters will be carried out periodically.
Any comment:	The project activity flare is in place for safety reasons only and is not expected to operate as the project has been designed to operate at its designated capacity.

Data / Parameter:	$V_{O2,EG,m}$
Data unit:	-
Description:	Volumetric fraction of O2 in the exhaust gas on a dry basis at reference conditions in the minute m
Source of data to be used:	Anaerobic digester monitoring software will measure using a continuous gas analyser continuously. Values to be averaged on a minute basis
Value of data	0 is used for ex-ante estimation.
Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0) Extractive sampling analysers with water and particulates removal devices or in situ analysers for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes) Recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Analysers will be periodically calibrated according to manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard gas. Alibunar monitoring team will check all records.
Any comment:	The project activity flare is in place for safety reasons only and is not expected to operate as the project has been designed to operate at its designated capacity.

Data / Parameter:	$fc_{CH4,EG,m}$
Data unit:	mg/m^3
Description:	Concentration of methane in the exhaust gas of the flare on a dry basis at reference conditions in the minute m
Source of data to be used:	Anaerobic digester monitoring software will measure using a continuous gas analyser continuously. Values to be averaged on a minute basis
Value of data	0 is used for ex-ante estimation.
Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0) Extractive sampling analysers with water and particulates removal devices or in situ analyser for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare in order that the sampling is of the gas after consumption has taken place (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes) Recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Analysers will be periodically calibrated according to manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard gas. Alibunar monitoring team will check all records.
Any comment:	The project activity flare is in place for safety reasons only and is not expected to operate as the project has been designed to operate at its designated capacity.

Data / Parameter:	$Flame_m$

Data unit:	Flame on or Flame off
Description:	Flame detection of flare in the minute m
Source of data to be used:	Anaerobic digester monitoring software will measure using a fixed installation optical flame detector: Ultra Violet detector or Infra Red or both. Once per minute. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off
Value of data	0 is used for ex-ante estimation.
Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0) Recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration and maintenance of flare and meters will be carried out periodically.
Any comment:	The project activity flare is in place for safety reasons only and is not expected to operate as the project has been designed to operate at its designated capacity.

Data / Parameter:	$Maintenance_y$
Data unit:	Calendar dates
Description:	Maintenance events completed in year y
Source of data to be used:	Anaerobic digester monitoring software will measure
Value of data	0 is used for ex-ante estimation.
Description of measurement methods and procedures to be applied:	As per Methodological tool "Project emissions from flaring" (Version 02.0.0) Record the date that maintenance events were completed in year y. Records of maintenance logs must include all aspects of the maintenance including the details of the person(s) undertaking the work, parts replaced, or needing to be replaced, source of replacement parts, serial numbers and calibration certificates Recorded electronically in a maintenance log for the crediting period plus two years and for two years beyond the life of the flare. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration and maintenance of flare and meters will be carried out periodically.
Any comment:	The project activity flare is in place for safety reasons only and is not expected to operate as the project has been designed to operate at its designated capacity.

Data / Parameter:	$Q_{\text{liquid residual waste}}$
Data unit:	Tonnes
Description:	Soil application of liquid residual waste (tonnes)
Source of data to be used:	Project proponent measurement of daily use of liquid residual waste from lagoon.
Value of data	To be monitored ex-post.
Description of measurement methods and procedures to be applied:	The tonnes of residual liquid waste used for soil application will be logged and archived electronically during the crediting period plus 2 years. See monitoring point 6 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	Q $_{res\ waste}$
Data unit:	Tonnes
Description:	Quantity of solid residual waste
Source of data to be used:	Project proponent measurement of solid residual waste using weight bridge.
Value of data	16,000 Tonnes has been applied for ex ante estimation, to be monitored ex-post.
Description of measurement methods and procedures to be applied:	16,000 tonnes of residual solid waste has been accounted for in the feasibility study for the purposes of estimating the composting quantity potential of the waste. The tonnes of residual solid waste will be logged and archived electronically during the crediting period plus 2 years. See monitoring point 6 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration of weighbridge will be carried out periodically in accordance with requirements of weighbridge suppliers.
Any comment:	

Data / Parameter:	CT,res waste
Data unit:	(tonnes/truck)
Description:	Average truck capacity for residual waste transportation (tonnes/truck)
Source of data to be used:	Project proponent contracted transport plant and machinery
Value of data	0 has been applied for ex ante estimation. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	There is no planned incremental transportation for solid residual waste as this is expected to be treated on site through an aeration process to produce compost for on selling. See monitoring point 6 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	DAF $_{res\ waste}$
Data unit:	(km/truck)
Description:	Average incremental distance for residual waste transportation (km/truck)
Source of data to be used:	Project proponent feasibility study in business plan
Value of data	0 has been applied for ex ante estimation. To be monitored throughout crediting period plus two years.
Description of measurement methods and procedures to be applied:	There is no planned incremental transportation for solid residual waste as this is expected to be treated on site through an aeration process to produce compost for on selling. Any changes to the transport of residual waste will be logged and recorded electronically for the crediting period plus two years. See monitoring point 6 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	$BG_{burnt,y}$
Data unit:	m^3
Description:	Biogas volume in year *y*
Source of data to be used:	Flow measurement meters installed on the biogas piping before each of the gensets
Value of data	To be monitored ex-post.
Description of measurement methods and procedures to be applied:	Measurements will be recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	T
Data unit:	^oC
Description:	Biogas thermometers installed on the biogas piping before each of the gensets
Source of data to be used:	Project proponent thermometers.
Value of data	To be monitored ex-post.
Description of measurement methods and procedures to be applied:	Measurements will be recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	P_{biogas}
Data unit:	Pa
Description:	Pressure of the biogas at the flow measurement site
Source of data to be used:	Pressure gauges installed on the biogas piping before each of the gensets
Value of data	To be monitored ex-post.
Description of measurement methods and procedures to be applied:	Measurements will be recorded electronically for the crediting period plus two years. See monitoring point 3 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	

Data / Parameter:	AI_l
Data unit:	Days
Description:	Annual average interval between manure collection and delivery for treatment at a given storage device *l*
Source of data to be used:	Project proponent records of number of days the animal manure management system is operational in year y
Value of data	1 is used for ex-ante calculations. To be monitored ex-post.
Description of measurement methods and procedures to be applied:	Due to the design of the project activity, manure automatically moves to the storage device before being pumped into the anaerobic digester. It is expected that manure will be pumped from this storage chamber daily into the anaerobic digester. To be monitored daily and aggregated to monthly records for annual average checks. Recorded electronically for the crediting period plus two years. See monitoring point 2 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records.
Any comment:	To be used to calculate possible project emissions due the storage of animal manure, as per paragraph 16

AMS ID Baseline emissions

Data / Parameter:	$EG_{grid,y}$
Data unit:	MWh/y
Description:	Gross Quantity of electricity supplied to the grid in year y
Source of data to be used:	Metered data from a meter connected to the Serbian national grid.
Value of data	24,096 is used for ex-ante estimation. To be measured ex-post according to AMS ID.

Description of measurement methods and procedures to be applied:	The calculation is based on the technical specifications of the GE Jenbacher genset and includes and estimated annual operational time of 8,040 hours (22.02 hours/day, 365 days/year) for three fully operational 999kW facilities. Actual measurements will be taken from metered data from a meter connected to the Serbian national grid. MWh values can be cross checked with invoices. Recorded electronically for the crediting period plus two years. See monitoring point 4 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration of meters will be carried out periodically. Metered values can be cross checked with records for sold electricity using invoices as a reference.
Any comment:	

Data / Parameter:	$EG_{consumed\ grid,y}$
Data unit:	MWh/y
Description:	Gross Quantity of electricity consumed by the project activity, purchased from the grid in year *y*
Source of data to be used:	Power meter between project activity and grid transmission.
Value of data	1,446 is used for ex-ante estimation. To be measured ex-post according to AMS ID.
Description of measurement methods and procedures to be applied:	Measurements are undertaken using energy meters. Hourly measurements will be taken and will be recorded at least monthly by the grid operator (ESP) in order to create an energy bill for the project proponent. Recorded electronically for the crediting period plus two years. See monitoring point 5 in figure 10 of monitoring plan.
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration of meters will be carried out periodically. Metered values can be cross checked with records for purchased electricity using bills as a reference.
Any comment:	

Data / Parameter:	$EG_{net\ grid,y}$
Data unit:	MWh/y
Description:	Net quantity of electricity supplied to the grid in year y
Source of data to be used:	Metered data from a meter connected to the Serbian national grid and Power meter between project activity and grid transmission.
Value of data	22,650 is used for ex-ante estimation. To be measured ex-post according to AMS ID.
Description of measurement methods and procedures to be applied:	This measurement is a calculation based on electricity supplied to the national grid less electricity consumed from the national grid. The measurements for these parameters are outlined above. Recorded electronically for the crediting period plus two years. See monitoring point 5 and 6 in figure 10 of monitoring plan. Calculation will be carried out using the following formula: $EG_{net\ grid,y} = EG_{grid,y}$ less $EG_{consumed\ grid,y}$
QA/QC procedures to be applied:	Alibunar monitoring team will check all records. Calibration of meters will be carried out periodically. Metered values can be cross checked with records for sold/purchased electricity using invoices/receipts as a reference.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The implementation of the monitoring plan is to ensure that real, measurable, long-term greenhouse gas emissions reduction can be monitored, recorded and reported. It is a crucial procedure to identify the final CERs of the proposed project. This monitoring plan for the proposed project activity will be implemented by Biogas Energy d.o.o.

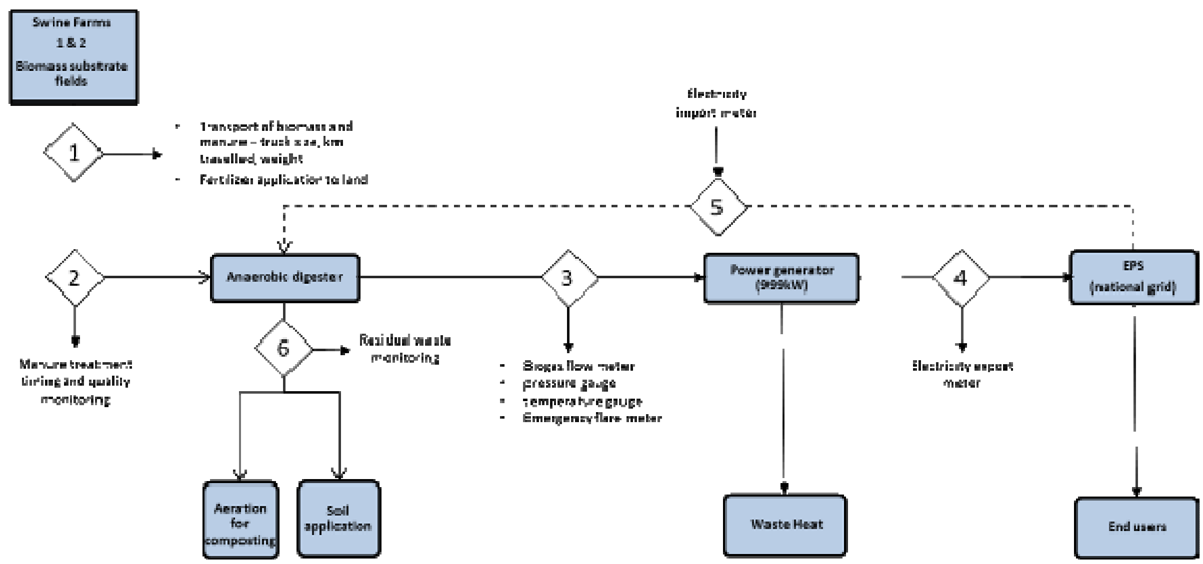
1. What is required in the monitoring plan?

Biogas Energy d.o.o. must sustain a credible, transparent, and adequate data estimation, as well as measurement, collection, and tracking systems to maintain the information required for an audit of an emissions reduction project. These records and monitoring systems are needed to allow the selected DOE to verify project performance as part of the verification and certification process. This process also reinforces that CO_2 reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs).

2. What data will be monitored?

According to methodologies AMS-III.D (v18) and AMS-I.D (v17), the data to be monitored are shown in Section B 7.1, the detailed meters installation is illustrated below:

Figure 10: Project monitoring points



3. How will the data be monitored, recorded and managed?

A CDM management team will be formed to manage all the CDM monitoring activities.

The general manager of the Biogas Energy d.o.o. biogas plant facility will take the overall responsibility for monitoring activities.

A specific CDM manager will be appointed for daily monitoring business, including data reporting and meter calibration along with CDM data security and all QA/QC related management. The management structure is illustrated in figure 10 below.

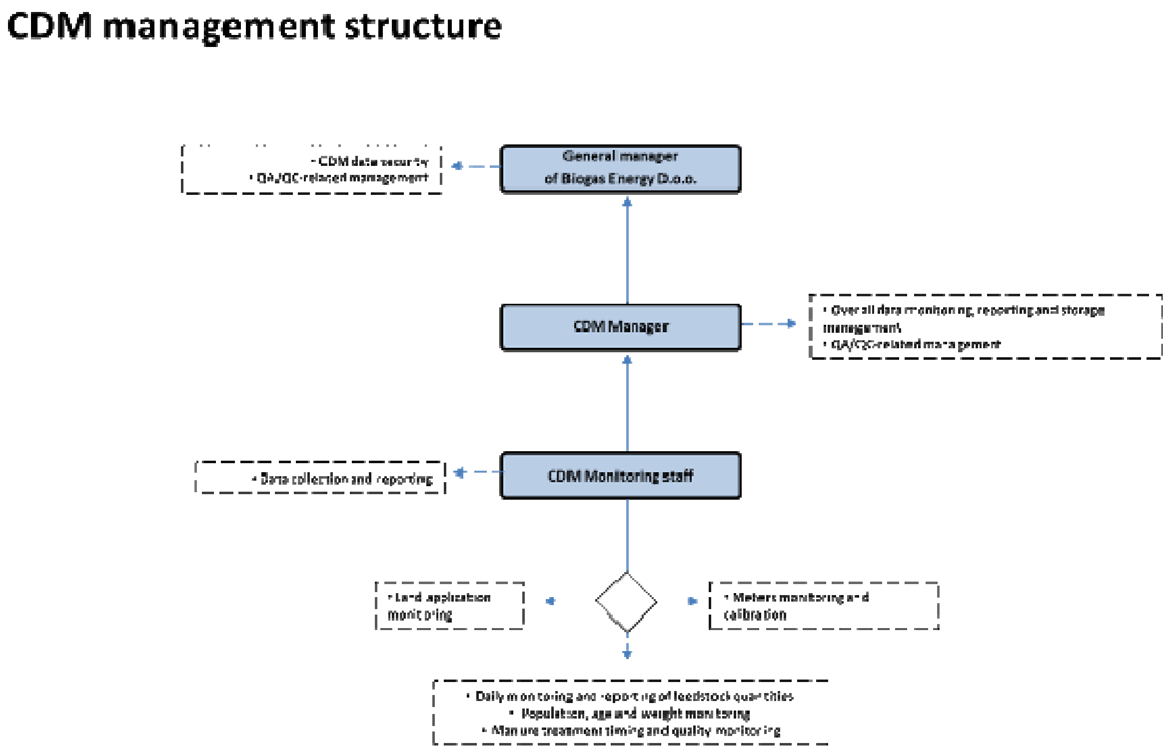
All meters used in the proposed project activity owned by the project proponent will be in accordance with national standard or manufacture's recommendation, including precision requirement, calibration. A Serbian grid power meter will also be used to regularly cross check net power output to the grid from the project activity along with invoices for power sales from the project activity. All the equipment used should be serviced and maintained in accordance with the original manufacturers' instructions and records of maintenance and calibration shall be kept.

The proposed project activity includes its own testing laboratory where each batch of manure is tested for antibiotics before introduction to the fermenter vessels. The process inside the fermenter vessels is also constantly monitored at OAG headquarters for signs of antibiotics contamination, or any other interruption of the process (dry matter content, pH levels etc.) so that it can be timely reacted to correct the problem. The CDM monitoring staff will use both the onsite laboratory and OAG monitoring data as inputs to the required monitoring requirements as discussed in this monitoring plan.

The trained CDM monitoring staff will monitor the parameters according to the monitoring plan, and all the records will be double checked through the relevant QA/QC checks. Furthermore, the CDM manager will collect the receipts/invoices for electricity supplied. At the end of each month, the monitoring data and records will be filed in a spreadsheet and kept as an electronic database and in paper document format.

Physical documentation such as paper-based maps, diagrams, and environmental impact assessments will be collected where they come available, together with this monitoring plan for reference. All the paper- based and electronic database and information will be kept by Biogas d.o.o.
The monitoring report will be prepared according to the data monitored and related information. All paper-based information and the electronic database will be stored by the proposed project owner during the crediting period plus 2 years.

Figure 11: CDM management structure and responsibilities



4. Calibration of Meters and Metering
Biogas flow meters, flare meters, electricity meters and weighing scales will be subject to regular maintenance and testing according to technical specifications from the manufactures to ensure accuracy and good performance.

Equipment calibration will be conducted periodically according to national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years[46].

5. QA/QC
The reliability of monitoring system is determined by attention to detail, quality of measuring meters as well as the data collection procedure. All the meters shall be purchased from well-known and certified manufactures. Meters shall be calibrated according to national standards by qualified institutions or manufacture's recommendations. The monitoring staff shall follow the monitoring plan and a second member of the monitoring staff should double check readings and records. QA/QC will make assurance the precision and steadiness of the metering results and correct reading and records.

6. Training Program
The project owner will entrust the professional engineers and experts to train all the relative staff before operation of the proposed Project. The training contains CDM knowledge, operational regulations, quality control (QC) standard flow, data monitoring and data management requirement. Full training on use of the monitoring plan will also be given and attention will be given to prudent document management and record keeping for the project activity throughout the crediting period and two years thereafter.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completion: 23/02/2011

Name of persons determining the baseline study and monitoring methodology:

Contact Information of the responsible person	**Is organisation a Project Participant *Yes/No***
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[46] In accordance with para 17 (c) of the *General Guidelines to SSC CDM methodologies (Version 17)*, available at: http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid06.pdf

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

20/07/2011[47]

C.1.2. Expected operational lifetime of the project activity:

>>

18 years[48]

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

Not applicable

C.2.1.2. Length of the first crediting period:

>>

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

01/08/2013

C.2.2.2. Length:

>>

10 years

[47] On 20/07/2011, Groundwork contract was signed with Radus BNS d.o.o.for the Alibunar biogas plant project.

[48] In accordance with the “Tool to determine the remaining lifetime of equipment” (Version 01), a default value of 150,000 hours is used for “Gas turbines, up to 50 MW capacity”. The Alibunar Biogas Plant is expected to operate for 8040 hours/year, therefore will have a default technical lifetime of (150,000/8,040) 18.65 years.

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

An Environmental Impact Assessment is not required by the host party.

The requirements of an environmental impact assessment (EIA) in Serbia are regulated by the "Law on Environmental Impact Assessment" which was published in the Official Gazette of the Republic of Serbia, No. 135/2004 ("Službeni glasnik Republike Srbije", br. 135/04).

Article 9 states that a competent authority shall decide on the need for an impact assessment of projects by applying predefined criteria. All three of the entities who own the gensets in this project activity have been granted an Environmental Impact Assessment exemption under the provisions of "Law on Environmental Impact Assessment".

These exemptions will be made available at validation.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

Environmental impacts of the project activity are not considered to be significant by both the project participant and the host party.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

Comments by local stakeholders have been invited through a stakeholder consultation event for the Alibunar Biogas Project held at the premises of Biogas Energy in the village of Ilandža, Alibunar municipality, Serbia on October 28, 2011, at 11:00am.

Public notice invitations were placed in public view at two busy local locations (the bulletin board of the Alibunar municipality town hall and the Ilandža's community center.), ten days prior to the stakeholder consultation event. Official invitations were also sent to the officials from the Alibunar municipality.

The consultation session was structured to present the project idea and allowed stakeholders to ask questions and find out more about the project. The presentation was focused on explaining the general technical concept of how a biogas plant works, as well as its environmental impact through reducing carbon emmisions and creating organic fertilizer.

E.2. Summary of the comments received:

>>

Summary of Questions and subsequent Answers that were given at the Alibunar Stakeholder Consultation:

Q1. What would be a total revenue from electricity sale?
A1: Biogas Plant Alibunar has a planned annual capacity of 8040 work hours during which it will generate some 24 million kilowathours, which at current feed in rates of 14.224 eurocents will generate some 3.4 million euros in revenues.

Q2: Are you planning to employ all of the employees at one or in phases?
A1: According to our business plan, we will startup different segments of our opperation at various times and according to that we will employ certain number of people required for each plase, up to approximatelly 57 employees which were planned for the whole project.

Q3: Will you be purchasing corn residue from small farmers as well?
A3: Yes. Besides our own production and cooperation with large farmers we may have a program for puchasing corn residue from small manufacturers which will be announced by the end of this year for the next season.

Q4: I see from my house that you often work during night, is construction going on non stop?
A4: Only during the construction of the concrete tanks we work late until the evening since the concrete pouring process can not stop once it begins. Also during the summer the temperatures were too hot during the day, so we had to wait until 19h in the evening for the temperatures to drop and then work troughout the night in order to complete the concrete pouring process.

E.3. Report on how due account was taken of any comments received:

>>

The stakeholder consultation was well attended by local representatives who showed a keen interest in the proposed project.
A number of interesting questions were raised and answered.
The site visit was very well welcomed, as the attendees could see hands on how the proposed project would contribute to improving the environmental conditions at the site and for the local neighbourhood.
No objections to the project were made. All attendees welcomed the project and the employment it would bring to the Alibunar area, as well as the environmental benefits that the project could achieve.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Annex I Party public funding is involved in the project. The project proponent confirms that there is no divergence of Official Development Assistance (ODA) for the project activity.

Annex 3

BASELINE INFORMATION

The calculations and input assumptions of the parameter EFgrid,CM,y are calculated and displayed in a separate excel sheet in accordance with Methodological Tool – *Tool to calculate the emission factor for an electricity system, version 02.2.1, Annex 19, EB 6.*

Data relating to the Serbian electricity system has been sourced from official documents released by the Serbian DNA for an official DNA report on EFgrid calculation [49].

Step 1: Identify the relevant electricity systems
Step 2: Choose whether to include off-grid power plants in the project electricity system
Step 3: Select a method to determine the operating margin (OM)

	ELEKTROPRIVREDA SRBIJE 5 economic associations		Plants		Units	Total available capacity (MW)	year -1 Generation in 2010 (GWh)	year -2 Generation in 2009 (GWh)	year -3 Generation in 2008 (GWh)	year -4 Generation in 2007 (GWh)	year -5 Generation in 2006 (GWh)
1	**Thermal Power Plants "Nikola Tesla", plc; Obrenovac**	1	TPP Nikola Tesla A		6	1,651	8,580.80	10,175.70	9,680.40		
		2	TPP Nikola Tesla B		2	1,240	8,113.30	7,439.30	8,377.10		
		3	TPP Kolubara		5	270	1,080.90	829.00	1,091.00		
		4	TPP Morava		1	110	578.30	539.10	635.80		
				TPP Nikola Tesla total	**14**	**3,271**	**18,353.30**	**18,983.10**	**19,784.30**		
2	**Thermal Power Plants and Mines "Kostolac", plc; Kostola**	1	TPP Kostolac A		2	310	1,887.90	1,910.60	1,865.10		
		2	TPP Kostolac B		2	700	2,920.90	3,986.90	3,011.60		
				TPP Kostolac total	**4**	**1,010**	**4,808.80**	**5,897.50**	**4,876.70**		
3	**Combined Heat and Power Plants "Panonske", plc; Novi**	1	CHPP Novi Sad		2	245	209.31	129.80	262.15		
		2	CHPP Zrenjanin		1	110	12.06	8.08	101.26		
		3	CHPP Sremska Mitrovica		3	32	0.95	0.74	3.54		
				TPP Panonske total	**6**	**387**	**222.32**	**138.63**	**366.95**		
				EPS thermal power plants in total	**24**	**4,668**	**23,384.42**	**25,019.23**	**25,027.95**	**28,967.00**	**27,602.00**
4	**Hydro Power Plants "Djerdap", plc; Kladovo**	1	*HPP Djerdap I*		6	1,058	6,395.20	5,760.20	5,397.40		
		2	*HPP Djerdap II*		10	270	1,556.20	1,489.50	1,510.00		
		3	*HPP Pirot*		2	80	211.80	91.20	111.00		
		4	*HPP Vlasina*	Vrla-1			153.80	111.00	54.90		
				Vrla-2			84.90	60.30	30.00		
				Vrla-3			116.10	84.60	45.00		
				Vrla-4			103.00	74.70	38.50		
				HPP Vlasina total	10	129	457.80	330.60	168.40		
				HPP Djerdap total	**28**	**1,537**	**8,621.00**	**7,671.50**	**7,186.80**		
5	**Hydro Power Plants "Drinsko-Limske", plc; Bajina Basta**	1	*HPP Bajina Basta*	HPP Bajina Basta	4	364	1,677.10	1,641.50	1,292.60		
				RHPP Bajina Basta	2	614	679.70	602.70	543.80		
				HPP Bajina Basta total	6	978	2,356.80	2,244.20	1,836.40		
		2	*HPP Limske*	HPP Uvac	1	36	68.30	58.80	45.50		
				HPP Kokin Brod	2	22	74.90	45.70	48.50		
				HPP Bistrica	2	102	414.40	267.20	292.10		
				HPP Potpec	3	51	248.10	198.80	149.10		
				HPP Limske total	8	211	805.70	570.50	535.20		
		3	*HPP Zvornik*	HPP Zvornik	4	96	574.80	509.80	405.30		
		4	*HPP Elektromorava*	HPP Ovcar Banja			36.50	25.20	18.80		
				HPP Medjuvrsie			35.00	23.90	28.80		
				HPP Elektromorava total	4	13	71.50	49.10	47.60		
				HPP Drinsko-Limske total	**36**	**1,298**	**3,808.80**	**3,373.60**	**2,824.50**		
				EPS hydro power plants in total	**64**	**2,835**	**12,429.80**	**11,045.10**	**10,011.30**	**9,930.00**	**10,850.00**
				EPS thermal & hydro power plants in total	**88**	**7,503**	**35,814**	**36,064**	**35,039**	**38,897**	**38,452**
						Share of HPP on the total annual generation	**35%**	**31%**	**29%**	***26%***	***28%***
										Average share of the low-cost/must-run resources (HPP) within the last 5 years	***30%***

Step 4: Calculate the operating margin emission factor according to the selected method

[49] http://www.ekoplan.gov.rs/DNA/docs/gef%20calculation.pdf

Calculation of the generation-weighted average CO_2 emissions per unit electricity generation - simple OM:

year	NET GENERATION		OPERATING MARGIN EMISSIONS FACTOR	Source
	$EG_{m,y}$	weight	$EF_{grid, OMsimple,y}$	
	MWh		tCO_2/MWh	
2008	25,028,150	0.34	0.8579	calculation in the sheet Step 4.1 - OM 08-10
2009	25,019,227	0.34	0.8661	calculation in the sheet Step 4.1 - OM 08-11
2010	23,384,217	0.32	1.2032	calculation in the sheet Step 4.1 - OM 08-12
TOTAL	73,431,594	1		
	$EF_{grid, OMsimple,2008-2010}$ =		$EF_{OM,2008}$*weight2008) + ($EF_{OM,2009}$*weight2009) + ($EF_{OM,2010}$*weight2010	
			0.970660497	tCO_2/MWh

Step 5: Calculate the build margin (BM) emission factor

Option (b) is used for the calculation of the build margin because this set of power units comprises larger annual generation:

Plants/units	Date of the first synchronization	Net generation 2010
	provided	MWh
TPP Kostolac B1	1987	2012200
CHPP Zrenjanin	1989	12061
HPP Pirot A2	1990	102400
HPP Pirot A1	1990	109400
TPP Kostolac B2	1991	908600
Total		**3,144,661**

STN	UNITS	UNIT GENERATION	UNIT EMISSION FACTOR	
	m	$EG_{m,2010}$	$EF_{EL,m,2010}$ = $\frac{(FC \times NCV \times EF)_{i,m,2010}*}{EG_{m,2010}}$	$EG_{m,2010} \times EF_{EL,m,2010,v2}$
		MWh	tCO_2/MWh	
L	TPP Kostolac B2	908,600.00	1.22467432	1,112,739.09
	HPP Pirot A1	109,400.00	0.00000	0.00
	HPP Pirot A2	102,400.00	0.00000	0.00
	CHPP Zrenjanin	12,061.00	0.42496	5,125.40
	TPP Kostolac B1	2,012,200.00	1.21201	2,438,798.81
	TPP Nikola Tesla B2	4,472,200.00	1.18290	5,290,165.81
	HPP Djerdap II	908,600.00	0.00000	0.00
		8,525,461.00		**8,846,829.10**
		$EF_{grid,BM,2010}$=	$\Sigma_m EG_{m,2010} \times EF_{EL,m,2010}$ / $EG_{m,2010}$	
			1.03770	**tCO_2/MWh**

Step 6: Calculate the combined margin emissions factor

Calculation of the combined margin emission factor for the proposed project:											
$EF_{grid,CM,2010}$ = $EF_{grid,SimpleOM,2008-2010}$ * w_{OM} + $EF_{grid,BM,201}$											
$F_{grid,CM,2010}$ =	0.97066		*	0.5	+	1.0376951		*	0.50		
EF_{grid} =		**1.004**				**tCO_2/MWh**					

$EF_{grid,}$ = 1.004 tCO2/MWh

Annex 4

MONITORING INFORMATION

No further information

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