MRAMORAK 1&2 BUNDLED BIOGAS POWER PLANTS

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Mramorak 1&2 Bundled Biogas Power Plants Monitoring Report	
Name of project	*Mramorak 1&2 Bundled Biogas Power Plants*
BCR Project ID	*BCR-RS-493-1-001*
Registration date of the project activity	*24/08/2023*
Project holder	*Zlatar Mramorak Doo*
Contact	*Dušan Dobriković, Plant Manager at Bio Gold Energy doo* *Mail address: Zadružna 6; 26226 Mramorak, Serbia* *Email: dusan.dobrikovic@zlatarmramorak.rs* *Mobile: +381 62 8037029; Phone: 013-2753 230*
Version number of the Project Document applicable to this monitoring report	*Ver. 1.5* *24/08/2023*
Applied methodology	*AMS-III.AO Version 1.0* *AMS-I.D. Version 18.0*
Project location (Country, Region, City)	*Serbia, Belgrade*
Project starting date	*24/06/2020*

Mramorak 1&2 Bundled Biogas Power Plants Monitoring Report	
Quantification period of GHG reductions/removals	*06/24/2020 to 06/23/2027*
Monitoring period number	*1st*
Monitoring period	*24/06/2020 to 31/12/2023*
Amount of emission reductions or removals achieved by the project in this monitoring period	*75,655 tCO2*
Contribution to Sustainable Development Goals	*SDG Goal 7 Affordable and Clean Energy* *SDG Goal 8 Decent Work and Economic Growth* *SDG Goal 13 Climate Action*
Special category, related to co-benefits	*N/A*

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1 General description of project

Mramorak 1&2 Biogas Power Plants (hereafter project and/or Mramorak 1&2 project) is a bundled Greenfield project activity, comprising two identical biogas power plants, implementing anaerobic treatment process to organic wastes to reduce Greenhouse gas (GHG) emissions through methane recovery and displace carbon intensive Serbian Electrical Power Supply (EPS) grid electricity with renewable biogas energy.

The purpose of the project activity is to mitigate methane emission to the atmosphere that would have otherwise been released through anaerobic digestion of cattle manure and municipal wastes, and to generate renewable energy by capturing biogas from the biodigesters. Project aims to contribute to global carbon emission reduction efforts.

Since the commencing of the project, which is the start date of the project first crediting period 24/06/2020, there has been no change in the technical characteristics of the project. In addition, since then Mramorak 1&2 project has been operated smoothly in full capacity. There has been no emergencies or abnormal situations occurred that could negatively affect the operation of the biogas plants and production of electricity, so the reduction of GHG emissions.

Hence, in this first monitoring period, 24/06/2020-31/12/2023, the project has been operated orderly without any overhauling and/or downtimes of equipment. No special events occurred during the monitoring period which may impact the applicability of the methodology.

During this monitoring period, project achieved 75,655 tCO2 emission reductions. Achieved annual emission reduction during the first monitoring period is 22,058 tCO2/year.

1.1 Sectoral scope and project type

Sectoral scope

Scope of the Mramorak1&2 Bundled Biogas Power Plants as per the BCR Standard requirements is provided in the following table.

The scope of the BCR Standard is limited to:	
The following greenhouse gases, included in the Kyoto Protocol: Carbon Dioxide (CO2), Methane (CH4) and Nitrous Oxide (N2O).	X

GHG projects using a methodology developed or approved by BioCarbon Registry, applicable to GHG removal activities and REDD+ activities (AFOLU Sector).	N/A
Quantifiable GHG emission reductions and/or removals generated by the implementation of GHG removal activities and/or REDD+ activities (AFOLU Sector).	N/A
GHG projects using a methodology developed or approved by BioCarbon Registry, applicable to activities in the energy, transportation and waste sectors.	X
Quantifiable GHG emission reductions generated by the implementation of activities in the energy, transportation and waste sectors.	X

Project eliminates CH4 emission through controlled anaerobic bio digestion; and avoids emission of CO2 through generating renewable electricity. Hence project satisfies the following criterion: “The following greenhouse gases, included in the Kyoto Protocol: Carbon Dioxide (CO2), Methane (CH4) and Nitrous Oxide (N2O).”

Project uses CDM methodologies AMS-III.AO and AMS-I.D. which are approved by the BioCarbon Registry. Hence project satisfies the following criterion: “GHG projects using a methodology developed or approved by BioCarbon Registry, applicable to activities in the energy, transportation and waste sectors.”

GHG emission reductions by the project activity are quantifiable as per the AMS-I.D and AMS-III.AO. Hence project satisfies the following criterion: “Quantifiable GHG emission reductions generated by the implementation of activities in the energy, transportation and waste sectors.”

Project type

Mramorak 1&2 is a small scale bundled project falling under the following both categories: “Waste management and disposal” and “energy sector”.

Activities in the AFOLU sector, other than REDD+	N/A

REDD+ Activities	N/A
Activities in the energy sector	X
Activities in the transportation sector	N/A
Activities related to Handling and disposing of waste	X

According to United Nations Framework Convention on Climate Change (UNFCCC) sectoral scopes definition for Clean Development Mechanism (CDM) projects, Mramorak 1&2 project falls under the following category:

Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)

Sectoral Scope 13: Waste handling and disposal

Mramorak 1&2 project is a bundled project by bundling two identical biogas power plant systems. It is not a grouped project as per the definition provided in the BioCarbon Registry Voluntary Carbon Market Standard, Version 2.0, Nov 2022.p.36.

1.2 Project start date

Project start date is 24/06/2020 when the Mramorak 1 facility started feeding electricity to the Serbian EPS grid system.

1.3 Project quantification period

Project's first crediting period is 24/06/2020-23/06/2027 with both days inclusive, renewable twice.

Crediting period of the project activity is 7 years renewable twice.

1.4 Project location and project boundaries

Project location

Mramorak1&2 project site is located in Republic of Serbia, on the eastern part of Belgrade, close to the border with Romania. Its physical address is "Zlatar Doo Mramorak, Zadružna street no. 6, at floor. parc. 690/3 ko Mramorak Serbia."

Geographical coordinates of the project site:

Project Site	**Latitude**	**Longitude**
Mramorak1&2 central treatment plants	44°52'56.72"N	20°57'23.95"E
Mramorak Farm	44°52'56.72"N	20°57'23.95"E
Stari Tamis Farm	44°52'16.63"N	20°46'3.79"E
Liquid digestate storage lagoon	44°52'34.01"N	20°56'52.19"E
Solid digestate storage	44°55'0.56"N	20°57'5.80"E
Waste food sources[1]	Latitude	Longitude
Beotok doo	44°52'9.27"N	20°42'56.78"E
Eko Maber doo	44°51'33.84"N	20°38'22.10"E
Eko Smart doo	44°50'49.01"N	20°40'41.58"E

[1] Food waste source companies' addresses are indicated in the contracts made between the project owner and the food suppliers (Beotok doo, Eko Maber doo and Eko Smart doo). Hence the coordinates given in this table are reflects the address of the companies. Please see the kmz file of the project activity.

Figure 1 Mramorak 1&2 Project -1

Figure 2 Mramorak 1&2 Project -2

Figure 3 Mramorak 1&2 Project -3

Figure 4 Mramorak 1&2 Project -4

Sources of non-hazardous food wastes are listed in the emission reduction excel sheet. All the food sources are coming from the food waste subcontractors which are Eko Maber doo, Eko Smart doo and Beotok doo. Distances of these subcontractors, where the food waste comes from, are Eko Maber, 30.3 km; Eko Smart 30.3 km and Beotok 22.6 km. In the PDD, food sources were indicated the original source of the food wastes such as hotels, shopping malls and restaurants etc. However, the project owner is buying the waste food from Eko Maber, Beotok and Eko Smart. If the project owner does not buy these food wastes from these three companies, Eko Maber, Beotok and Eko Smart would dispose the waste food to the solid waste disposal sites. Therefore, for the project activity, taking the Eko Maber, Beotok and Eko Smart as the source location of the food waste best reflects the actual situation. Therefore, such a change is reflected in this MR report. Hence, as the actual location of the food waste, Eko Maber, Beotok and Eko Smart location is used where the food waste comes to the project site.

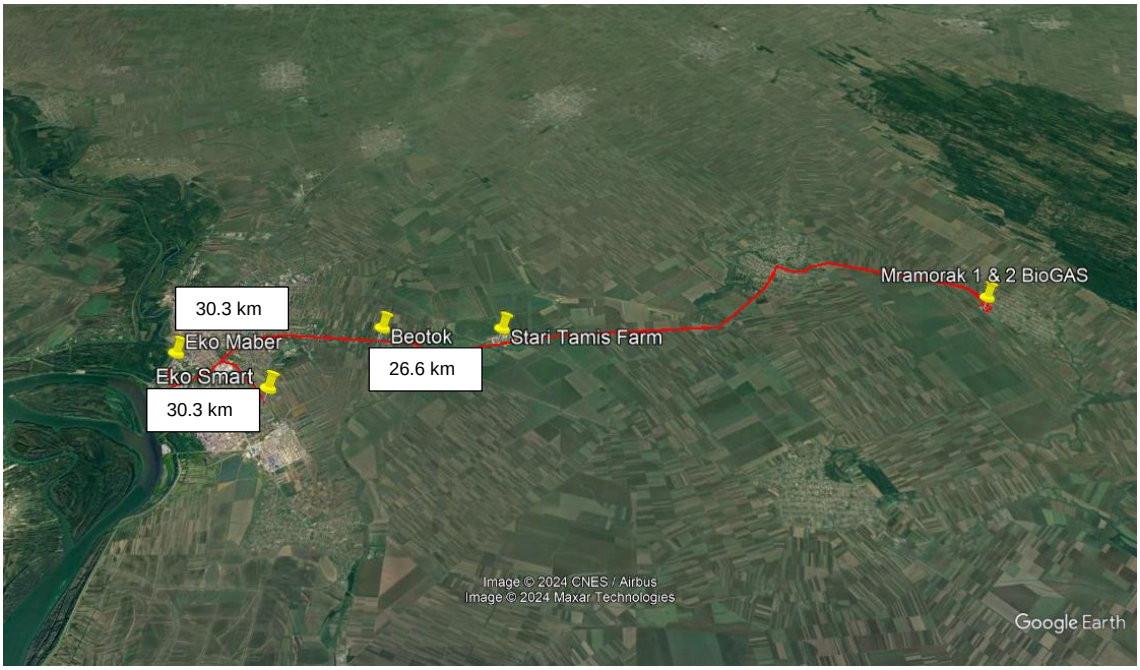

Figure 5 Mramorak 1&2 Project food waste sources

Project boundary

As per the AMS-III.AO, project boundary is the physical, geographical site:

(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) In the case of projects co-digesting wastewater, where the wastewater would have been treated anaerobically in the absence of the project activity;

(c) Where the treatment of biomass or other organic matters through anaerobic digestion takes place;

(d) Where the residual waste from biological treatment or products from those treatments (digestate), like slurry, are handled, disposed, submitted to soil application, or treated thermally/mechanically;

(e) Where biogas is burned/flared or gainfully used, including biogas sale points, if applicable;

(f) And the itineraries between them (a, b, c, d and e), where the transportation of waste, wastewater, where applicable manure, digestate, or biogas occurs.

As per the AMS-I.D (v.18.0), the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system (Serbian EPS grid system) that the CDM project power plant is connected to.

Within the project activity, Stari Tamis and Zlatar Mramorak farms are the sources of cattle manure. Stari Tamis is 18.5 km by road away from the central treatment plant (Mramorak 1&2). Mramorak farm is the location where the central treatment plants are located. Manure transported to the Mramorak1&2 central treatment plants are directly fed to the digester within the 24 hour. Hence, there is no manure storage tank at the project site. Non-hazardous food wastes come from the food waste subcontractors which are Eko Maber doo, Eko Smart doo and Beotok doo., and are directly fed to the biodigesters.

From the main-digesters, digestate comes to the post-digester units where remaining anaerobic digestion completed and remaining methane collected. After post digestion, effluent is separated into liquid and solid form. Liquid effluent through pipelines flows to the open lagoon nearby to the Mramorak1&2 central treatment plants. Solid effluent is transported to two locations on project owner's farm lands which are 1 km and 5 km away from the central treatment plants. Then solid digestate and liquid digestate are used as fertilizer and applied to farm lands by the project owner.

Produced biogas from digester and post digesters are collected and combusted in the gas engine unit and it produces electricity and heat. Electricity is supplied to the Serbia EPS grid system. Heat is used within the project boundary to heat the digesters.

Based on this process flow, the spatial extent of the project boundary encompasses cattle manure and food waste collection points, roads between these points and central treatment plants, trucks carrying manure and food waste from sources to the central treatment plants, Mramorak 1&2 central treatment plants, effluent digestate storages (solid digestate application lands and open lagoons for liquid digestate), the roads between central treatment plants and digestate storage units, digestate land applications. In addition to that, all power plants connected physically to the Serbian EPS electricity grid system (grid) that the project plant is connected to are included.

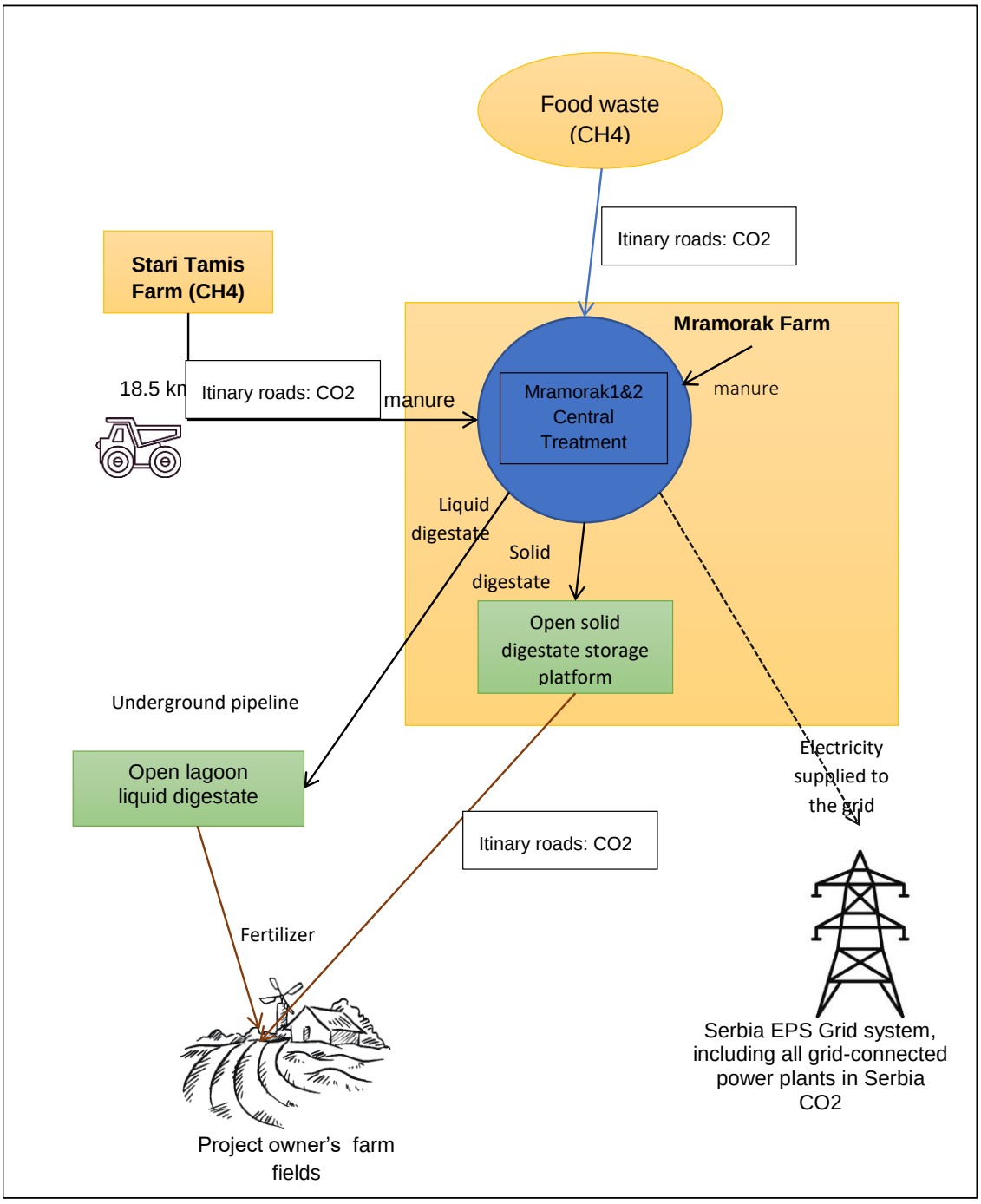

Figure 6 AMS-III.AO and AMS-I.D.-Graphical representation of the project boundary

1.5 Summary Description of the Implementation Status of the Project

Mramorak 1&2 Biogas Power Plants (hereafter project and/or Mramorak 1&2 project) is a bundled Greenfield project activity, comprising two identical biogas power plants, implementing anaerobic treatment process to organic wastes to reduce Greenhouse gas (GHG) emissions through methane recovery and displace carbon intensive Serbian Electrical Power Supply (EPS) grid electricity with renewable biogas energy.

Carbon credits created by the Mramorak1&2 project are represented and owned by the Zlatar Mramorak Doo.

The purpose of the project activity is to mitigate methane emission to the atmosphere that would have otherwise been released through anaerobic digestion of cattle manure and municipal wastes, and to generate renewable energy by capturing biogas from the biodigesters. Project aims to contribute to global carbon emission reduction efforts.

Generated renewable electricity is delivered to the Serbian national EPS grid system. Being a Greenfield activity, project has a total installed capacity of 1.998 MW with each biogas plant having an installed capacity of 0.999 MW separately. Operation start dates are 24/06/2020 and 26/03/2021 for Mramorak 1 and Mramorak 2 respectively.

The operation start date and crediting period start date is 24/06/2020 which is the operation start date of the Mramorak 1 plant, starting generating electricity and feeding the Serbian EPS grid. Mramorak 1 is the earliest project in the bundle starting the operation.

Mramorak1&2 is a small-scale project activity, not a debundled component of a larger CDM project activity.

Project received electricity generation license from the Ministry of Mining and Energy of Serbia. Mramorak 1 received its license on 27/11/2018 with the number of 312-01-01059/2018-06 by the Zlatar Mramorak Doo. Mramorak 2 received its license on 04/12/2018 with the number of 312-01-01058/2018-06 by the Bio Gold Energy Doo.[2] Bio Gold Energy Doo is owned by the Zlatar Mramorak Doo company, which is owned by the Almex Doo. Electricity generation licenses were revised later. Mramorak 1's revised

[2] Ministry of Mining and Energy, https://www.mre.gov.rs/sektori/79/2/0/0

license is dated as 17/06/2020 with the number of 312-01-00353/2020-06 and Mramorak 2's revised license is dated as 05/03/2021 with the number of 312-01-00021/2021-06.[3]

Operation start date is the date of the Mramorak 1 started generating electricity and feeding the Serbian EPS grid. Ministry of Mining and Energy, after approving the Mramorak 1 plant by visiting the project site, revised the electricity generation license (17/06/2020 with the number of 312-01-00353/2020-06) and approved the project to feed the Serbian EPS grid. The Ministry of Mining and Energy mailed the revised license/approval document to the Zlatar doo. After one week, Zlatar Doo received the mail and the next day started to feed the Serbian EPS grid. This is the way of governmental process in Republic of Serbia. Hence, the date feeding the grid is accepted as the operation start date and the project crediting period. Similar to Mramorak 1, Mramorak 2 operation date is the one when the project owner received the mail/letter of the revised generation license (05/03/2021 with the number of 312-01-00021/2021-06) from the Ministry of Mining and Energy. Mramorak 2 mail/letter was received on 26/03/2021 and this is the operation start date of the Mramorak 2.

Regarding the waste management, project received the permits with the registration numbers of 12 and 13 from the Kovin Municipal Administration-Department for Urban Planning and Housing Communal Affairs for each plant respectively.

Project's central treatment plants are located in the province of Mramorak in Serbia, on the "Zlatar Mramorak farm" land.

There are two main technology components of the project activity. These are anaerobic digesters and gas engine units. Main-digesters and post-digesters anaerobically digest/treat organic wastes; and gas engine units produce renewable electricity and heat. From the post-digester units, digestate effluent became a nutrient rich organic fertilizer which is utilized as fertilizer by the project owner.

The project activity has a flare chamber, which is only used in case of digesters goes through maintenance.

Project only claims methane emission reductions from anaerobic digestion of cattle manure and non-hazardous food wastes, and does not claim methane emission reductions from anaerobic digestion of all other wastes and residues used in the project.

[3]Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.

Project also claims emission reduction from the replacement of the electricity from the national EPS grid with renewable electricity.

Based on this claim, project boundary covers the sources of cattle manure and non-hazardous food wastes; central treatment plant; connection to the Serbian national EPS grid system; lagoons and farm lands where the solid and liquid digestate are stored to be used as fertilizer, and the road itineraries, where the transportation of residual waste after digestion.

Regarding the sources of feedstocks to the digesters, part of the manure is supplied onsite from Mramorak Zlatar farm, where the central treatment plants are located; and remaining part comes from the nearby dairy farm called “Stari Tamiš farm”, which is 18.5 km away from the project site and operated by the project owner. Mramorak Zlatar farm is also owned and operated by the project owner. Non-hazardous food wastes come from various food waste subcontractors which are Eko Maber doo, Eko Smart doo and Beotok doo. These food wastes are transported by non-permeable trucks by the entities producing/owning the food wastes to the project site. In the baseline conditions, if not treated in the Mramorak 1&2 project, these food wastes would be transported to the municipal solid waste disposal sites where it would release methane into the atmosphere. Plant based wastes fed to the biogas plants includes silage corn, silage barley and starch waste, including CSL, which are produced by the project owner’s parent company’s starch factories. Plant residues are also produced by the project owner’s farmlands. By the project activity, these wastes are converted into organic fertilizer through anaerobic digestion; preventing methane release in the baseline scenario.

Prior to the project activity, manure produced by the cattle farms, Mramorak and Stari Tamis, were stored in uncovered anaerobic lagoons where they were decayed anaerobically and released methane to the atmosphere. Non-hazardous food wastes were left to decay anaerobically in a solid waste disposal site (SWDS-landfill) and released methane to the atmosphere. Plant based wastes (starch wastes, liquid starch waste and CSL) were stored in open lagoons and left to decay anaerobically. Plant residues that include silage corn and silage barley were used to feed the cattle at Stari Tamis and Zlatar cattle farms. In addition to that, prior to the project activity, amount of renewable electricity generated by the project activity would be utilized from the carbon intensive Serbian national EPS grid system which is dominated by fossil fuel based power plants.

Mramorak 1&2 project is expected to generate approximately 15,500 MWh of renewable electricity annually as per the project activity PDD report, Version 1.5. Consequently, as per the baseline estimated values, project activity is expected to result in average 23,083

tCO2 emission reduction annually, and 161,587 tCO2 emission reduction for the first crediting period.

During the first monitoring period, 24/06/2020 to 31/12/2023, the project activity achieved 49,191.63 MWh net electricity generation, and consequently achieved 75,655 tCO2 emission reductions.

Implementation of the project activity creates many benefits to environment that includes reduction of methane and ammonia emissions from manure, reduction of nitrate wash-out into the ground water, organic fertilizer, and reduction of CO2 emission by substitution of fossil fuel resources.

In terms of sustainable development achievements, project activity contributes to the diversification of energy mix of Serbia from fossil fuel to renewables; eliminates organic wastes and transform them into useful organic fertilizers; and avoids GHG emissions. Project also contributes to local economy through providing job opportunities.

Project timeline

Table 1 Project timeline

Project timeline	Date
Investment decision date for both Mramorak 1 and Mramorak 2	26/07/2016
Construction contract for Mramorak1	12/12/2018
Mramorak 1 energy license, received from the Ministry of Mining and Energy of Serbia with the number of 312-01-01059/2018-06.	27/11/2018
Mramorak 2 energy license, received from the Ministry of Mining and Energy of Serbia with the number of 312-01-01058/2018-06.	04/12/2018
Construction contract for Mramorak2	01/07/2019
Mramorak 1 energy generation license revision, 312-01-00353/2020-06.	17/06/2020
Mramorak 2 energy generation license revision, 312-01-00021/2021-06.	05/03/2021
Mramorak 1 operation start	24/06/2020
Mramorak 2 operation start	26/03/2021
Permit 12 issued for the Mramorak 1 by the Kovin Municipality Administration-Department for Urban Planning and Housing Communal Affairs for storage and treatment of non-hazardous wastes.	23/07/2021

Permit 13 issued for the Mramorak 2 by the Kovin Municipality Administration-Department for Urban Planning and Housing Communal Affairs for storage and treatment of non-hazardous wastes.	02/11/2021

Technology applied to the project activity

Mramorak 1&2 project plant layout is given in Figure 7 Mramorak 1&2 Plants Layout; process flowchart is provided in Figure 8 Mramorak 1&2 Process Flow Diagram.

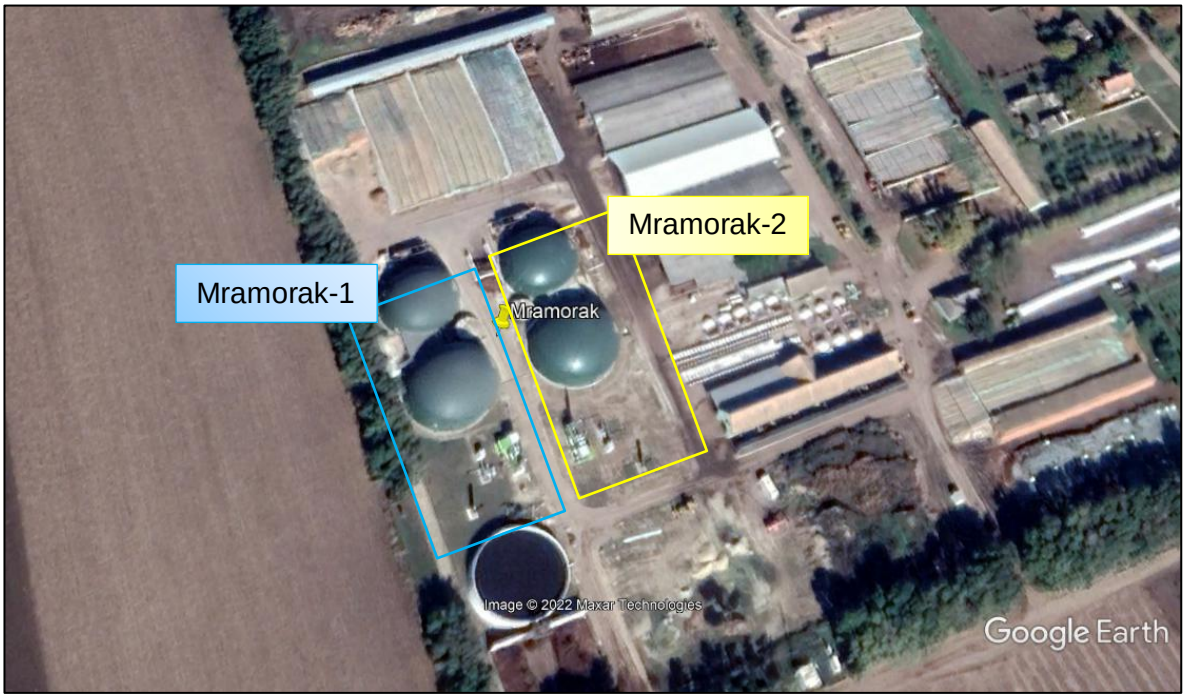

Figure 7 Mramorak 1&2 Plants Layout

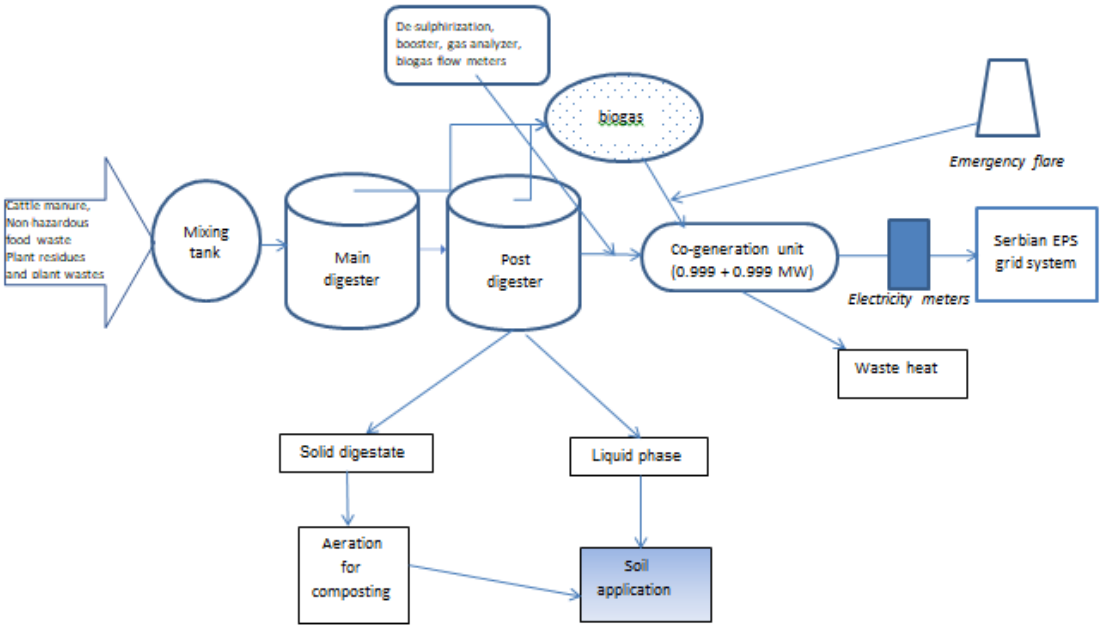

Figure 8 Mramorak 1&2 Process Flow Diagram

Mramorak 1&2 project has the following facilities/units:

Table 2 Mramorak 1&2 Project Site Facilities

Mramorak 1&2 Units	Mramorak 1&2 Sub-units
A- Waste Reception and Preparation Units	
Weighbridge	Wastes coming to the project site are weighted and recorded. Every shipment to the project site has a record in the log-book of the project owner.
Solid waste reception unit	Solid wastes are accepted and stored on a concrete layer.
Liquid waste reception tanks	Liquid wastes are disposed into the “liquid pit”.
Feeding system (waste balancing pool)	Waste is unloaded to the mixing tank
Pre-hygiene unit	Before disposing the wastes to the digesters, it is taken from

	separator.
B- Pump station and solid waste loading system units	
Pump station for liquid	Pump station pumps the liquid waste from the "liquid pit" to the main-digester.
Choppers	Solid wastes are chopped into fine parts before dosing to the main-digesters.
Dosing	Dosing is done by the system.
Solid biomass supply system	"Solid waste loading system" loads the solid waste to the main-digesters.
C- Anaerobic digestion system units	
Digesters	There are two digesters at each biogas plant (Mramorak 1 and Mramorak 2). Main-digester accepts raw wastes both in liquid and solid form. Post-digester accepts the "digested effluent" from the main-digester for further digestion and methane removal.
Mixers	Each digester has 2 mixers to have a homogenous environment within the digesters for a maximum efficiency for anaerobic digestion.
Gas booster	Produced biogas is pressurized before the gas engine unit to increase the combustion efficiency.
Heating system	Heating system keeps the digesters' temperature at the design level. Heat from gas engine unit is used to heat the digester.
Flare system	In case of gas engine unit is out of service, flare system is taken into operation and biogas is combusted.
Biogas analyzer	Gas is analyzed by the Awite gas analyzer, type AwiFLEX Cool+. It measures values of methane, carbon-dioxide, oxygen and hydrogen-sulfide. Serial number of gas analyzer is 2774.
Desulphurisation	Desulphurisation is done by Awite device, type AwiDesulf 500. It is pumping oxygen inside the Digesters in small amounts 0%-

	1% in total, keeping alive the colonies of bacteria which are fed by sulfur.
D- Post-digestion process units	
Separators	Effluent digestate from the Digester-2 goes through separation unit into liquid and solid form.
Solid digestate storage	Solid part of the separated digestate is stored on concrete based layers at the central treatment plants for a short time, approximately 1 or 2 days, then transported to the project owner's farm lands which are 5 km and 1 km away from the Mramorak 1&2 central treatment plants.
Liquid digestate storage	Liquid part of the digestate is pumped to the concrete made open lagoon which is about 1 km away from the Mramorak 1&2 central treatment plants.
E- Energy generating system units	
Gas storage	Gas is stored inside at the upper parts of digesters, between digestate and membranes. Walls of concrete are protected by special layers so the gas doesn't damage them. Membranes are keeping the gas inside.
Gas purification system	Gas purification unit contains special Altair filter which is filtrating H2S from the gas. Also there is a biogas filter in the gas line inside the gas engine unit.
Biogas flow meter	Woodward brand, TecJet 110 mode flow meters are installed to measure biogas flow rate. Mramorak 1 flow meter serial number: 22184210 Mramorak 2 flow meter serial number: 21813660
Gas engine units	Produced biogas is combusted within the gas engines unit and it produces electricity and heat.
Heat system	Produced heat energy by the gas engine is used to heat the digesters.
F- Energy transmission line	

<table>
<tr>
<td>Power meter</td>
<td>Measures the amount of electricity before being transmitted to the Serbian EPS grid system.

Mramorak1&2 power meters within the gas engine units are Landis+Gyr E650 branded with an accuracy class of 0.5/1.0. They are active reactive, bi-directional.

<table>
<tr><td></td><td>Mramorak 1</td><td>Mramorak 2</td></tr>
<tr><td>Brand & Model</td><td>Landis+Gyr E650</td><td>Landis+Gyr E650</td></tr>
<tr><td>Serial number</td><td>43 267 888</td><td>44 202 354</td></tr>
</table>
Electricity generation is measured continously at the gas engine units.

At the substation connecting to the Serbian EPS grid system, the following power meter equiptment system with the following specifications: ST310FV(0.2) 3x58/100V 5-6A 15A23R55-SN00100 pbdqf kl.0.2 + GPRS/GSM modem CM23S-S2.

Serial numbers of power meters at the subtstation:

<table>
<tr><td>Mramorak 1</td><td>Mramorak 2</td></tr>
<tr><td>25 63 21</td><td>25 63 23</td></tr>
</table>
Electricity generation is measured continously at the substation.</td>
</tr>
<tr>
<td>Connection to the grid</td>
<td>Produced electricity is delivered to the Serbian EPS grid system through the sub-station which is 0,1 km away from the project site.</td>
</tr>
</table>

Project has an emergency flare unit located in each power plant. The purpose of it is to combust the biogas during the emergency situations and plant maintanence. Emergency flare units do not have biogas flow meters.

A- Waste reception and preparation unit

Wastes are accepted and handled at the project site as per the requirements and conditions of the Permit 12&13 issued by the Kovin Municipality. Wastes used for biogas generation are both produced onsite at the Mramorak farm and transported from other locations.

Manure is collected from the onsite Zlatar Mramorak farm and the nearby farm Stari Tamiš. Both farms are operated by the project owner. At farms, the livestock comprises

of diary and non-dairy cattle. Approximately in total, there are 3361 number of cattle at both farms.

As per the Permit 12&13, project owner keeps documentation records of all wastes received by the plants, stored and treated etc.

Wheels of trucks which bring wastes to the project site are washed; the wastes are weighted and recorded. Then wastes are taken into the relevant storage units. Liquid wastes are disposed into the “liquid pit”. Liquid pits have dispensers with submersible mixer. Solid wastes are disposed into a warehouse on a concrete base. Annual capacity of the warehouse is 55,050 ton/year.

Figure 9 Waste Preparation and Reception

Liquid manure and liquid wastes

Liquid manure from the onsite facility (Mramorak farm) is collected in a pit (Figure 10, image on the left) from where it is pumped to the “liquid pit” (Figure 10, image on the

right). Liquid manure from the Stari Tamis farm is transported by non-permeable trucks to the project site where it is disposed to the “liquid pit”. Liquid pit has a storage capacity of 3800 m^3.

Solid manure and solid organic wastes/residues

Solid manure produced on site and transported from the Stari Tamis farm goes through a chopping process where they are chopped into fine particulates which make its digestion easy within the digesters. After the chopping process solid manure is directly disposed to the liquid pits.

Manure from the Stari Tamis farm is transported by the impermeable trucks. Each day, two trips from Stari Tamis to the central treatment plants take place to carry manure.

Plant based and food wastes are transported by impermeable trucks which do not leak its content. Solid wastes go through a chopping process where they are chopped into fine particulates which make them easy for anaerobic digestion.

Figure 10 Onsite Manure Collection and Transporting to the Pit

B- Pump station and solid waste loading system units

By the scraper system, solid and liquid organic waste is collected in the pit and then it is pumped to the mixing tanks of biogas plants through underground pipes. Liquid pits are shown in Figure 9.

C- Anaerobic digestion system units

Anaerobic digestion system has two digesters. Main-digester receives raw wastes; post-digester receives the digested waste coming out from the main-digester. Each digester has two mixers.

Both digesters are cylindrical in shape, made with concrete material. Their height is 6 m and maximum loading is up to 5.5 m. Main-digester has a volume of 2920 m^3; post-digester has a volume of 3887 m^3.

Main-digester: The floor is made of concrete with a 30 cm of thickness. Between the floor and walls, there is a special rubber inside the concrete with the purpose of stopping leaking on the connections of walls and floor. Wall thickness is 30 cm. Digester's height is 6 m and 26 m in diameter.

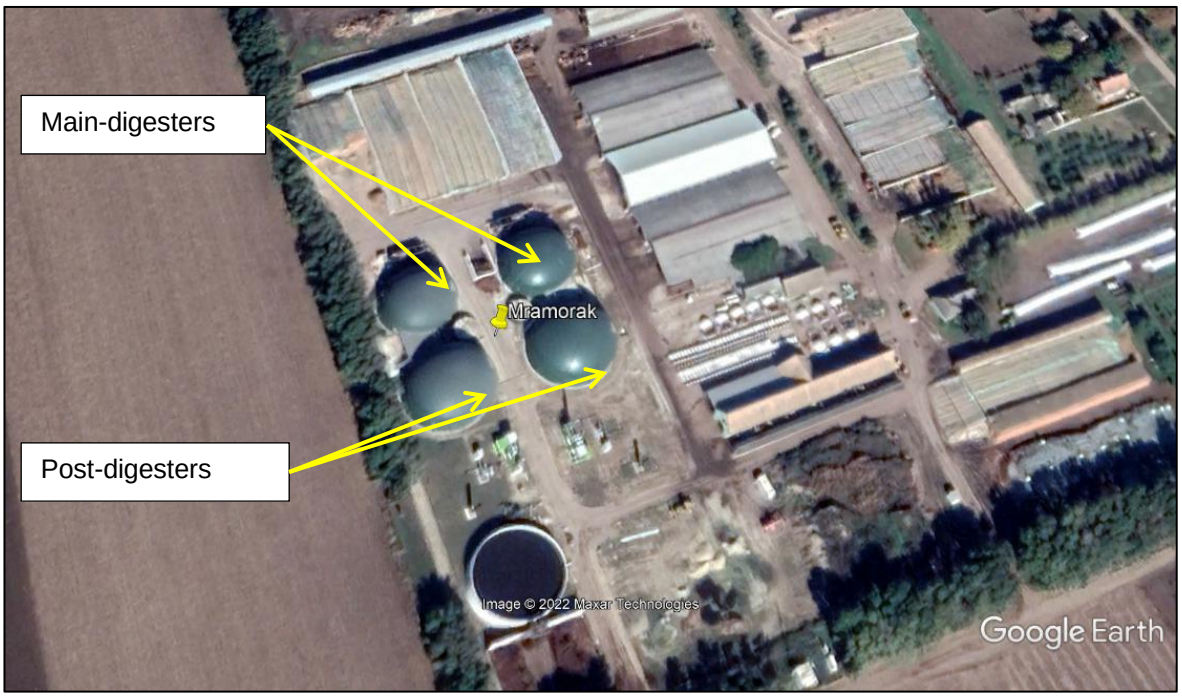

Figure 11 Mramorak 1&2 Digesters

Post-digestion process units

From both post-digesters, effluent flows to the impermeable circular open lagoon, having a volume of 3800 m^3 with a diameter of 30 m (Figure 12). From the circular open lagoon, digestate goes through a mechanical separation process. Solid part is stored right after the mechanical separation on a concrete layer. Solid phase is taken away every second or third day by tractor, and goes to the field for composting to be later used as fertilizer (Figure 14). In autumn, this compost is spread to the field.

Liquid part of the digestate flows to the open lagoon located in the vicinity of the project site through underground pipes. Lagoon is in rectangular shape and has a storage capacity of 28000 m^3. Lagoon is covered with an impermeable polyethylene film which does not allow leakage of waste water down to the ground (Figure 13). Digestate stays at the lagoon until autumn. Every autumn it is taken from the lagoon with special machines. A tractor spreads it on the field about 15 cm in dept. In spring, it is cultivated to the farm fields as fertilizer.

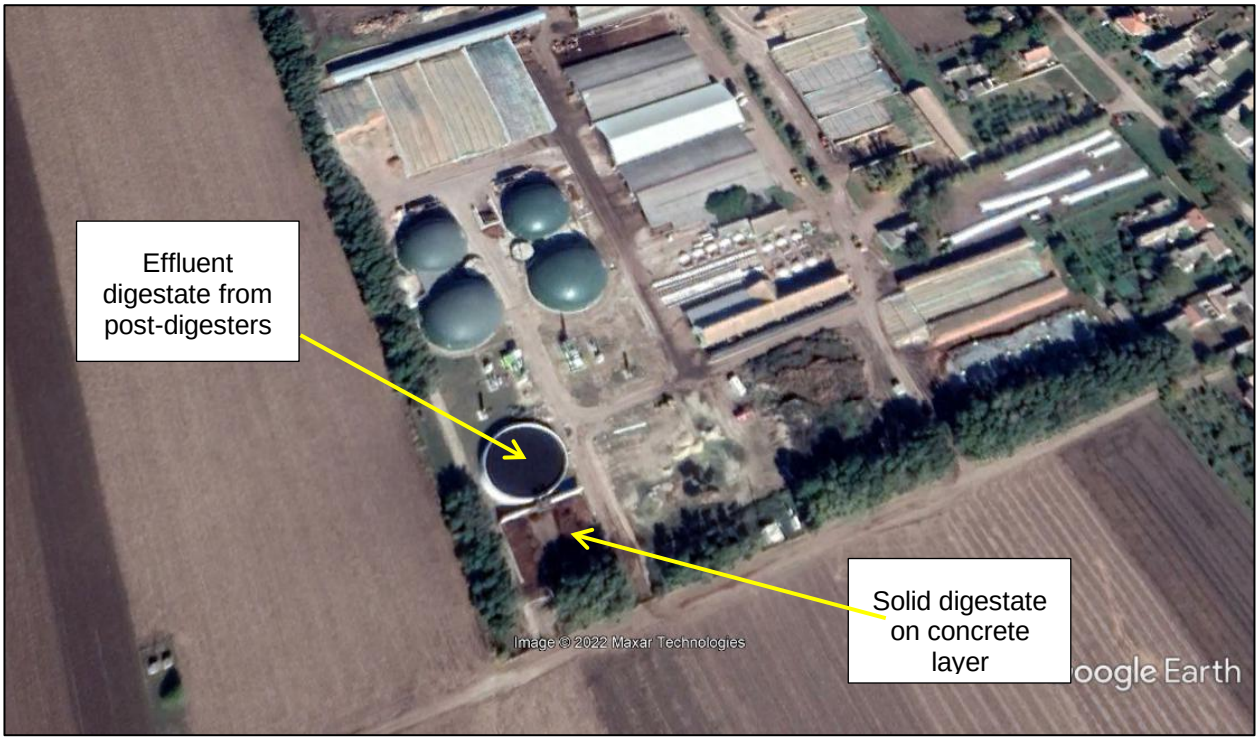

Figure 12 Effluent Digestate Handling Systems

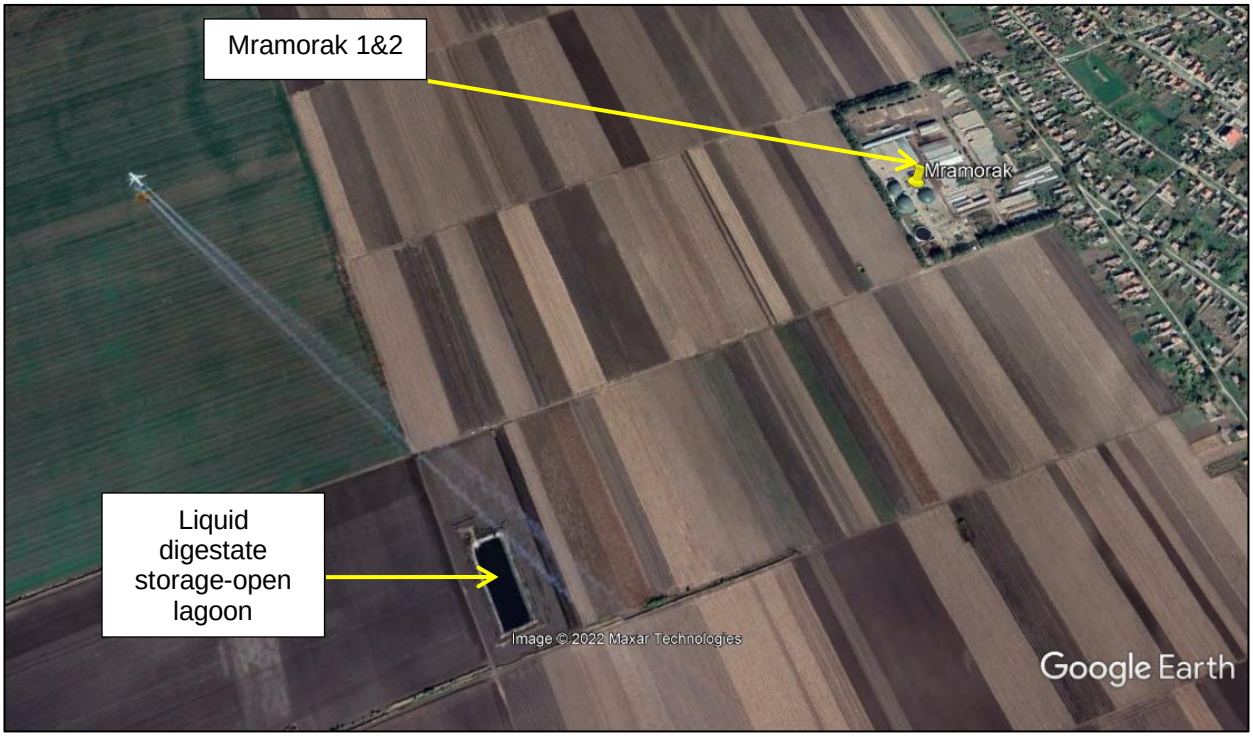

Figure 13 Farms, liquid Digestate Storage and Solid Digitate Storage Units Locations

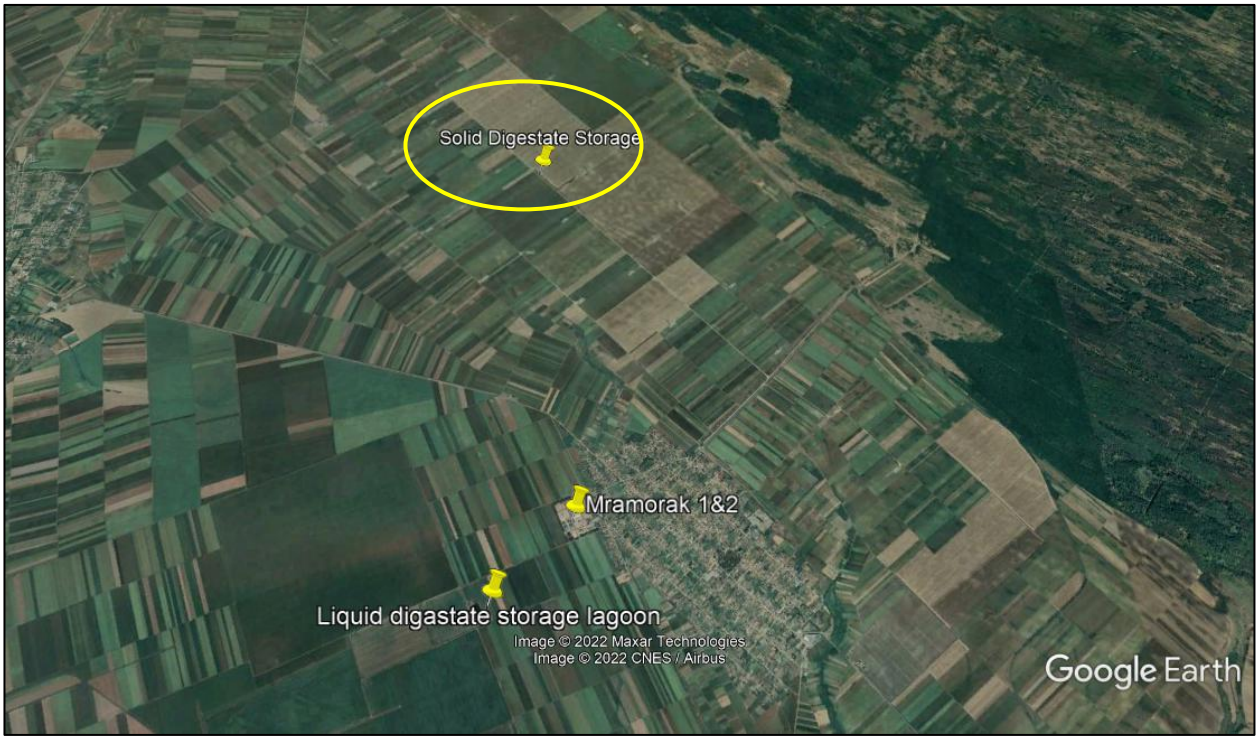

Figure 14 Solid Digestate Storage Location

D- Gas engine: Energy generating system units

At Mramorak 1 and Mramorak 2 biogas power plants, Northeast-Western Energy Systems brand gas engines were installed to generate heat and electricity. Each plant, Mramorak 1 and Mramorak 2, has one gas engine. See the following figure for further technical information about the gas engines.

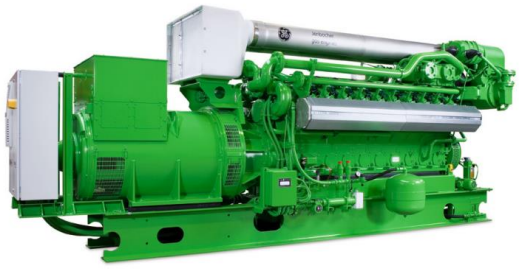	Brand Name: Northeast – Western Energy Systems Model: Jenbacher Model Type: J320 GS BL Fuel type: biogas Electrical Output: 1,059 kW Thermal output: 4,954 MBTU/hr.

Figure 15 Gas engine unit

Generated electricity is delivered to the Serbian national EPS grid. The produced electricity is delivered to the Grid based on the delivery contract with the government owned company, EPS Distribucija doo Belgrade.

Approximately 6% of the produced amount of electricity is consumed by the project activity by the gas engine unit. And the rest is transmitted to the grid. Hence electricity supplied to the grid is the net amount of electricity generated by the project activity.

Thermal energy produced is used to keep the temperature of the biodigesters at the designed level.

E- Energy transmission line

Generated electricity is supplied to the power station of the Serbian national grid system which is about 0.1 km away from the Mramorak1&2 central treatment plants. At the power station, there are two power meters operated by the EPS Distribucija doo. Project owners have no control on these power meters; they are sealed and protected from possible interventions. EPS Distribucija doo makes remote reading to these power meters and every month send invoice to the project owner. Monthly invoices are the sources of electricity generation data of the project activity.

Project owner has also power meters installed within the gas engine units. The readings of these power meters can be used for cross-checking.

Mramorak1&2 power meters within the gas engine units are Landis+Gyr E650 branded with an accuracy class of 0.5/1.0. They are active reactive, bi-directional.

	Mramorak 1	**Mramorak 2**
Brand & Model	Landis+Gyr E650	Landis+Gyr E650
Serial number	43 267 888	44 202 354

Project technical lifetime

Gas engines are the determining factor of the operational lifetime of the project. According to the Tool 10: Tool to determine the remaining lifetime of equipment, Version 01.", operational lifetime of gas engines up to 50 MW capacities is 150,000 hours. The project activity operates full time 365/year, therefore expected default operational lifetime will be at least (150,000/(365x24)) 17.12 years. However, project owner applies regular maintenance; therefore its lifetime will be extended to beyond 20 years.

Hence, technical lifetime of the project activity is accepted as 20 years.

2 Title, reference and version of the baseline and monitoring methodology applied to the project

For waste handling and disposal component of the project activity, AMS-III.AO is used. Project also claims carbon emission reductions due to the replacement of the electricity from the Serbian EPS grid system with renewable electricity produced by the project activity. For renewable component, AMS-I.D. is used.

AMS-III.AO Methane recovery through controlled anaerobic digestion, Version 1.0.[4]

AMS-I.D. Grid connected renewable electricity generation, Version 18.0.[5]

Applicable tools as per the AMS-III.AO., Version 1.0:

1) "Tool 03: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" Version 03.0.[6]
2) "Tool 04: Emissions from solid waste disposal site" Version 8.0.[7] (Previous version of this tool referred in the AMS-III.AO methodology is called as "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
3) "Tool 06: Project emissions from flaring" Version 04.0[8]
4) AMS-III.D. Small-scale methodology: Methane recovery in animal manure management systems, Version 21.0.[9]
5) CDM Annex 24 "Attachment A of Appendix B[10] (for additionality analysis)

Applicable tools as per the AMS-I.D., Version 18.0: [11]

[4] https://cdm.unfccc.int/UserManagement/FileStorage/CDM_AMSU745LJQM81SDJJOJ2S4G7ID9EIKFGD

[5] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK.

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf.

[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v8.0.pdf.

[8] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v4.0.pdf.

[9] https://cdm.unfccc.int/UserManagement/FileStorage/1AWXEKHVTYF423LCN56Z9GIMQOS8JR.

[10] Annex 24, Attachment A of Appendix B, Version 08., https://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf.

[11] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK.

Tool 07: Tool to calculate the emission factor for an electricity system, Version 7.0.[12]

For additionality analysis, AMS-III.AO Version 01 and AMS-I.D: Version 18.0 both refer to the CDM Annex 24 "Attachment A of Appendix B[13]". Financial analysis is applied as per this guideline. However this guideline does not refer to a specific CDM tool for additionality analysis. Therefore, following CDM tools are applied for financial analysis:

1. CDM Tool 21: Demonstration of additionality of small-scale project activities, Version 13.1.[14]
2. CDM Tool 01: Tool for the demonstration and assessment of additionality, Version 7.0.0.[15]
3. CDM Tool 27: Investment Analysis Version 12.0[16]

There are no deviations from the AMS-III.AO and AMS.I.D methodologies and the applied tools to the project activity.

3 Registry or participation under other GHG Programs/Registries

Project did not receive and/or did not apply for any other GHG-related environmental crediting certifications.

Project has not been registered or is not seeking registration under any other GHG programs.

Host country attestation for the project activity has not obtained yet.

4 Contribution to Sustainable Development Goals (SGD)

Regarding the United Nations Sustainable Development Goals (SDGs), Mramorak 1&2 project achieves the following SDGs:

[12] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf.
[13] Annex 24, Attachment A of Appendix B, Version 08., https://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf.
[14] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v13.1.pdf.
[15] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf.
[16] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v12.pdf.

SDG 7 Affordable and Clean Energy */ SDG 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix / SDG 7.2.1 Renewable energy share in the total final energy consumption:*

Project activity generates renewable energy, about 15.5 GWh annually, by capturing biogas from cattle manure, non-hazardous food wastes, plant wastes (starch waste, liquid starch wastes, CSL) and agricultural plant residues (silage corn and silage barley) via anaerobic digestion and supplies it to the fossil fuel dominated Serbian EPS grid system. Through this way, project contributes to the SDG 7.2. target, and the relevant indicator is SDG 7.2.1. During the first monitoring period, the project generated 49,191.63 MWh net electricity and supplied it to the Serbian EPS grid system.

SDG Goal 8 Decent Work and Economic Growth */SDG 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value / 8.5.1 Average hourly earnings of employees, by sex, age, occupation and persons with disabilities*

Project created job opportunities during both construction and operation phases. During the operation, project employs 9 people and 6 of them are from local villages. During the first monitoring period, project has continued to employ at least 9 people at the project facility. Please see the Section 15.2.2 for number of employees for each year of monitoring period.

SDG Goal 13 Climate Action*/ SDG 13.2 Integrate climate change measures into national policies, strategies and planning / SDG 13.2.2 Total greenhouse gas emissions per year:*

The project will naturally play an important role in global climate change mitigation activities through preventing emissions of methane that would otherwise be released to the atmosphere in the baseline conditions. Project activity is expected to achieve 23,083 tCO2 emission reductions annually as per the project PDD report Version 1.5. Through this way, it contributes to SDG 13 goals of the UN. During the first monitoring period, the project activity achieved 75,655 tCO2 emission reductions.

5 Compliance with Applicable Legislation

Mramorak1&2 project was implemented in accordance with the Serbian national laws and regulations. Project received all necessary permissions from the related governmental organizations.

Applicable laws and regulations to the project activity:

1) The Law on Energy (Zakon O Energetici, “Sl. glasnik RS", br. 145/2014, 95/2018 - dr. zakon i 40/2021);[17]
2) Law on Energy Efficiency and Rational Use of Energy (Zakon o Efikasnom Korišćenju Energije, "Sl. glasnik RS", br. 25/2013 i 40/2021 - dr. zakon);[18]
3) Waste management law (Zakon o Upravljanju Otpadom, "Sl. glasnik RS", br. 36/2009 i 88/2010); [19]
4) Environmental Protection Law (Zakon O Zaštiti Životne Sredine, "Sl. glasnik RS", br. 135/2004, 36/2009, 36/2009 - dr. zakon, 72/2009 - dr. zakon i 43/2011 - odluka US);[20]
5) Law on Use of Renewable Energy Sources (Zakon o Korišćenju Obnovljivih Izvora Energije.[21]

Based on these laws, project received the following permissions and licenses to establish and operate the Mramorak 1&2 project.

- **For generating the electricity:** Project received electricity generation license from the Ministry of Mining and Energy of Serbia. Mramorak 1 received its license on 27/11/2018 with the number of 312-01-01059/2018-06 by the Zlatar Mramorak Doo. Mramorak 2 received its license on 04/12/2018 with the number of 312-01-01058/2018-06 by the Bio Gold Energy Doo.[22] Both companies are 100% owned by the parent company, Almex doo.[23]

  Electricity generation licenses were revised later. Mramorak 1’s revised license is dated as 17/06/2020 with the number of 312-01-00353/2020-06 and Mramorak 2’s revised license is dated as 05/03/2021 with the number of 312-01-00021/2021-06.[24]

[17] https://biogas.org.rs/wp-content/uploads/2022/06/zakon_o_energetici.pdf
[18] https://biogas.org.rs/wp-content/uploads/2022/06/zakon_o_energetici.pdf .
[19] Serbian Biogas Association, Legal Frameworks, https://biogas.org.rs/en/legal-framework/, Visited on 13 July 2022.
https://biogas.org.rs/wp-content/uploads/2022/06/ZAKON-o-upravljanju-otpadom.pdf
[20] Serbian Biogas Association, Legal Frameworks, https://biogas.org.rs/en/legal-framework/, Visited on 13 July 2022.
https://biogas.org.rs/wp-content/uploads/2022/06/Zakon-o-zastiti-zivotne-sredine.pdf
[21] https://biogas.org.rs/wp-content/uploads/2022/06/zakon_o_korishcenu_obnovlivikh_izvora_energije_0.pdf .
[22] Ministry of Mining and Energy, https://www.mre.gov.rs/sektori/79/2/0/0
[23] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.
[24] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.

- **For the storage and treatment of non-hazardous wastes-Mramorak1**: Permit (with the registration number 12) was issued to the project owner, “Zlatar”, by the Kovin Municipal Administration-Department for Urban Planning and Housing Communal Affairs based on the Law on Waste Management ("Official Gazette of the RS", No. 36/09, 88/10, 14/16 and 95/18 - other laws).
  Evidences are provided in Appendix 501-56/2021-IV for Zlatar doo.

- **For the storage and treatment of non-hazardous wastes-Mramorak2**: Permit (with the registration number 13) was issued to the project owner, “Bio Gold Energy doo”, by the Kovin Municipal Administration-Department for Urban Planning and Housing Communal Affairs based on the Law on Waste Management ("Official Gazette of the RS", No. 36/09, 88/10, 14/16 and 95/18 - other laws). Permit number is 13. The validity of the permit was 10 years from 02/11/2021 to 02/11/2031. After 10 years, it will be renewed.

6 Climate change adaptation

“The Republic of Serbia has been part of the United Framework Convention on Climate Change – UNFCCC (Convention) since 2001 and the Kyoto Protocol (Protocol) since 2008. The Ministry of Environmental Protection (MoEP) is responsible for climate change issues. The Republic of Serbia supported Copenhagen Accords and in 2012 identified 12 Nationally Appropriate Mitigation Actions (NAMA) actions, seeking support for their implementation.”[25]

“In June 2015, the Government of the Republic of Serbia submitted “Intended nationally determined contributions“(INDCs) - a document that contains as well a section related to losses incurred by natural disasters and indicates the need for adaptation to impacts of climate change. In order to achieve the goals defined in INDCs and fulfill commitments under Paris Agreement, a number of activities were initiated in cooperation with relevant ministries.” [26]

Republic of Serbia fully supports the implementation of climate change mitigation and adaptation projects.

Mramorak 1&2 project applies anaerobic treatment process to organic wastes to reduce Greenhouse gas (GHG) emissions through methane recovery and displace carbon

[25] https://unfccc.int/sites/default/files/resource/SNC%20Eng_Serbia.pdf, p. 13-14.
[26] https://unfccc.int/sites/default/files/resource/SNC%20Eng_Serbia.pdf, p. 13-14.

intensive Serbian Electrical Power Supply (EPS) grid electricity with renewable biogas energy.

Implementation of the project activity creates many benefits to environment that includes reduction of methane and ammonia emissions from manure, reduction of nitrate wash-out into the ground water, organic fertilizer, and reduction of CO2 emission by substitution of fossil fuel resources. This is the contribution of the project to climate change adaptation.

7 Carbon ownership and rights

Carbon ownership of the project activity is belonged to the project owner, which is the Zlatar Mramorak Doo. Bio Gold Energy Doo has transferred its carbon credit related rights to the Zlatar Mramorak Doo by the agreement dated as 05/04/2023. As a note, both Bio Gold Energy and Zlatar Mramorak Doo companies are belonged to the same parent company, Zlatar Doo.

Individual or organization	**Zlatar Mramorak Doo**
Contact person	Dušan Dobriković
Job position	General Manager at Bio Gold Energy doo
Address	Zadružna 6; 26226 Mramorak, Serbia
Phone number	Mobile: +381 62 8037029; Phone: 013-2753 230
Email	dusan.dobrikovic@zlatarmramorak.rs

8 Environmental Aspects

There are no environmental and socio-economic impacts that can be counted as negative by the project activity. On the contrary project has more positive benefits to environment and society. Most important ones are the prevention of methane emissions to the atmosphere that would happen in the absence of the project activity.

As per the legal obligations of laws and regulations of Serbia, project complies with all the environmental and waste management regulations to prevent any potential negative impacts.

According to the Environmental Protection Law of Serbia, biogas power plants with an installed capacity of less than 1 MW are exempted from environmental impact analysis due to their minimal environmental impacts. In the project activity, each biogas plant has an installed capacity of 999 kWe which is less than 1 MW. Therefore, conducting environmental impact analysis was not required.

However, the project activity developed “a working plan for the waste management of the facility” which provides a detailed plan regarding proper management of the waste activities. This work plan also complies with the BCR No Net Harm Environmental and Social Safeguards tool requirements.[27]

However, project activity comprises waste management function that includes collection of organic wastes from the sources, transportation of them to the Mramorak1&2 central treatment facility, anaerobic treatment through biodigester and production of organic fertilizer. According to the Waste Management Law of Serbia, project has to receive a permit from the related municipality to handle wastes within the project activity. Permit is only issued by the municipality as long as the project’s operations are in compliance with all the applicable regulations and laws of Serbia.

For waste management, Mramorak1&2 project received the all required Permits from the Kovin Municipal Administration-Department for Urban Planning and Housing Communal Affairs based on the Law on Waste Management ("Official Gazette of the RS", No. 36/09, 88/10, 14/16 and 95/18 - other laws). Permits were received by the project owner for the facility Mramorak 1 and Mramorak 2 plants separately to manage the non-hazardous organic waste. For Mramorak 1, Permit-12 was received on by the Zlatar Mramorak Doo; for Mramorak 2, Permit-13 was received by the Bio Gold Energy Doo, which is 100% owned by the project owner.

Issuance of the Permit 12 and 13 proves that project activity takes all the measures to comply with the Waste Management Law; and its activities will not pollute air, soil and water environment. [28] Project owner has a written Work Plan document that is used for operating the facility properly as per the laws. Project received the Permit 12 and Permit 13 based on this Work Plan that ensures the protection of environment and worker safety and other related matters as per the laws. Current Work Plan is dated as February 2021 and it will be updated every three years as per the requirement of the Permit to reflect

[27] Please see the folder of “05_EIA_RelatedDocs”.
[28] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.

the changes in the procedures of waste management at the facility. [29] Mitigation measures to prevent potential negative environmental and social impact are based on this Work Plan.

This work plan complies with the requirements of the BCR No Net Harm Environmental and Social Safeguards, as stated in Section 3.1 Environmental Aspects.

Project, during its construction and operations, may cause some negative environmental impacts as stated in the following table.

Impact Area	Potential negative impact
Air environment	Project may release air pollutants to the atmosphere via combustion of biogas.
Soil environment	Project, through handling wastes, may pollute soil environment through possible leakages from the waste storage units (such as digesters, digestate effluent unit etc.) Project produce sanitary solid wastes by the personnel working at the site that needs for proper handling.
Water environment	Project produce sanitary waste water by the personnel working at the site that needs for proper handling.
Noise	Operation of the project may cause noise

However project's these potential negative environmental impacts are either negligible or accepted within the limits as per the applicable laws, or mitigated by the project owner.

Air Pollution

Project, in its routine operation, emits polluting substances into the air as a result of the combustion of the biogas in the gas engine unit. Although the predominant component of biogas is methane, it also contains other gases such as oxygen, nitrogen and hydrogen sulfide. However, the emission of pollutants from the gas engine plant is within the limits permitted by the Environmental Protection Law of Serbia. [30]

[29] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.
[30] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.

Therefore, there is no need for taking mitigation measures.

Wastewater and solid waste generation

There is no technological waste water used or produced in the operation of the project. Only sanitary waste water is produced and it is drained to a watertight septic tank on site, which is regularly emptied and maintained. Sanitary waste water, on a regular basis, is handed out to the JP "Kovinski Komunalac" Kovin.

For the disposal of the silage juice that is produced by silage of the overly moist silage mass, drainage and draining of the juice into a watertight tank of sufficient capacity was carried out. These waters are directed into the fermentation process. [31] Other than these wastes water, project activity does not produce any waste.

Effluent from the digester is not called as waste; on the contrary it is a very nutrient rich fertilizer. Effluent is separated to liquid and solid form which is dried under sun and used as fertilizer. Both liquid and solid digestate coming out from the digester are stored in impermeable storage units (liquid effluent is stored in impermeable open lagoon) hence there is no leakage to ground water. [32]

Therefore, there is no need for taking mitigation measures.

Noise

At the location in question, there is noise generated by gas engines for burning gas, a compressor, etc. The mentioned equipment is located in a closed facility of a technical building that is sound-insulated. The noise generated during transport and storage is within the limit values.[33]

The closest settlement to the project activity is the Mramorak village. Houses at the boundary of the Mramorak village are about 250-300 m away from the Mramorak 1&2 project site.

Therefore, there is no need for taking mitigation measures.

[31] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.
[32] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.
[33] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.

Waste Management

Regarding the management of waste, project owner undertakes to sort, mark and store non-hazardous waste in a correctly marked place. In case of spillage of petroleum derivatives, hazardous waste may be generated, which is handled according to the Rulebook on the Storage, Packaging and Marking of Hazardous Waste ("Official Gazette of RS" No. 92/10).

The operator undertakes to carry out the process of waste management, i.e. storage and treatment of non-hazardous waste, in such a way that soil and groundwater will not be polluted as a result of the above activities.

All the digesters and lagoons in the project are impermeable that prevents the leakage of waste-water into ground water.

As the requirements of the Permit 12 and 13, project owner will keep all the records of the waste management documentation.

During the first monitoring period, no negative environmental and socio-economic impacts have been observed and recorded.

As per the “BCR No Net Harm Environmental and Social Safeguards”, the project owner has a plan No Net Harm Environmental and Social Safeguards

9 Socioeconomic Aspects

Regarding the socio-economic impacts, project is welcomed by the community. Local community found the project as positive contribution to environment. Project employs 9 people, 6 of which are local people, hence providing contribution to local economy.

In regard the distance of the Project site from facilities that may be affected by the waste management operation of the project, there are no facilities in vicinity such as schools, children’s playground, sport and recreation ground etc.[34] hence local people’s life is not affected by the project activity in negative ways.

In addition to that, during the application process for Permit, Kovin Municipality coordinates with interested stakeholders to get their opinions about the project. Project was announced at the web site of the Kovin Municipality during the application process

[34] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.

by the project owner, and no objection or suggestion was received from the public as per the project activity.

During the meeting with stakeholders and on-going face to face communication with stakeholders, they are informed that stakeholders can always contact with the project plant manager face-to-face and by phone anytime to express their grievances in the future. Also assured that a grievance register notebook was placed at the Mramorak village municipality office where stakeholder can register their complaints.

At the current stage, stakeholders can access to plant manager by phone and face-to face ways, as well they can also relay their complaints through the grievance notebook.

During the first monitoring period, stakeholders did not provide any complaints to the project owner. If stakeholders provide negative feedback, project plant manager will contact with the stakeholder and will solve the issue.

The BCR tool No Net Harm Environmental and Social Safeguards suggests that any adverse socioeconomic effects that would be generated, project owner should define actions and corrective measures to prevent them. However, in the project activity, during the first monitoring period, no negative socioeconomic effects has been observed. The project continued to provide jobs to local people (6 people working are local).

10 Stakeholders' Consultation

Comments by local stakeholders have been invited through a stakeholder consultation event for the Mramorak1&2 project. Ten days ahead, participants were invited to the meeting through public notice invitations placed in locations where public can view it easily and frequently. The picture on the left was posted on the official public notice board of the municipality building. The picture on the right was posted on the board in the middle of the village where everyone passes.

Meeting was also announced by the local radio.

Figure 16 Stakeholder meeting announcements on public boards

On 22/08/2022, the meeting was held at the public community center in Mramorak. At the meeting, local participants were informed about how a biogas plant works, as well as its environmental benefits through transforming organic wastes into nutrient rich organic fertilizers. Participants were also informed about the project's potential contribution for climate change mitigations efforts through preventing methane emissions and producing renewable energy.[35]

[35] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.

Figure 17 Stakeholders Meeting at the Community Center, 22/08/ 2022.

Participants written comments, translated into English, and participant list were provided in the validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001. After the meeting, participants stated their positive comments to the project activity. They all stated that they are happy about the project because it does not give harm to environment and produce clean energy. In addition to the meeting, one to one verbal communications with villagers were also so positive. Project did not change their life, did not provide negative consequences, and on the contrary provided job opportunities to local people. In summary project is welcomed by the community.[36]

Participants were also informed to relay their comments that may arise in the future to the project owner. Project owner shared its communication information with them.

[36] Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.

During the first monitoring period, stakeholders did not provide any complaints to the project owner. If stakeholders provide negative feedback, project plant manager will contact with the stakeholder and will solve the issue.

11 REDD+ Safeguards

N/A

12 Special categories, related to co-benefits

N/A

13 Grouped Projects

Mramorak 1&2 project is a bundled project by bundling two identical biogas power plant systems. It is not a grouped project as per the definition provided in the BioCarbon Registry Voluntary Carbon Market Standard, Version 2.0, Nov 2022.p.36.

14 Implementation of the project

14.1 Implementation status of the project

Mramorak 1&2 Biogas Power Plants is a bundled Greenfield project activity, comprising two identical biogas power plants, implementing anaerobic treatment process to organic wastes to reduce GHG emissions through methane recovery and displace carbon intensive Serbian EPS grid electricity with renewable biogas energy.

Project has a total installed capacity of 1.998 MW with each biogas plant having an installed capacity of 0.999 MW separately.

Project produces renewable electricity by using the biogas generated by the anaerobic treatment of organic wastes and plant residues. Organic wastes includes cattle manure, both in liquid and solid form, plant based organic wastes (starch waste, liquid starch waste, CSL), plant residues (silage corn and silage barley) and non-hazardous food wastes. Project operates full time, 24 hr. per day and 365 days per year.

There are two main technology components of the project activity. These are anaerobic digesters and gas engine units. Main-digesters and post-digesters anaerobically digest/treat organic wastes; and gas engine units produce renewable electricity and heat. From the post-digester units, digestate effluent became a nutrient rich organic fertilizer which is utilized as fertilizer by the project owner.

Since the commencing of the project, which is the start date of the project first crediting period 24/06/2020, there has been no change in the technical characteristics of the project. In addition, since then Mramorak 1&2 project has been operated smoothly in full capacity. There has been no emergencies or abnormal situations occurred that could negatively affect the operation of the biogas plants and production of electricity, so the reduction of GHG emissions.

Hence, in this first monitoring period, 24/06/2020-31/12/2023, the project has been operated orderly without any overhauling and/or downtimes of equipment. No special events occurred during the monitoring period which may impact the applicability of the methodology.

During this monitoring period, project achieved 75,655 tCO2 emission reductions.

14.2 Revision of monitoring plan

Monitoring plan is not revised.

14.3 Request for deviation applied to this monitoring period

Mramorak 1&2 project was constructed and operated as described in the BCR Mramorak 1&2 Project Description Report. There has been no deviation from the project description since the commencing date that could have affected the GHG emission reduction.

14.4 Notification or request of approval of changes

Mramorak 1&2 project was constructed and operated as described in the BCR Mramorak 1&2 Project Description Report. There has been no deviation from the project description since the commencing date that could have affected the GHG emission reduction. Therefore this section is N/A.

15 Monitoring system

15.1 Description of the monitoring plan

The purpose of the monitoring plan is to ensure continuous monitoring, recording and archiving of the monitoring parameters in a transparent and credible manner for estimating GHG emission reductions achieved by the project activity. Implementation of the monitoring is the responsibility of the Zlatar Mramorak doo company, which is the project owner.

Monitoring has been implemented as per the AMS-III.AO and AMS-I.D. monitoring methodologies. Data parameters to be monitored are provided in Section 16.1. These parameters have been monitored transparently with meeting the basic quality control conditions.

Project Monitoring Organizational Structure

Project owner, Zlatar Mramorak Doo, at the higher level has the following organization structural which is the bases of the operational and management structure of the monitoring plan.

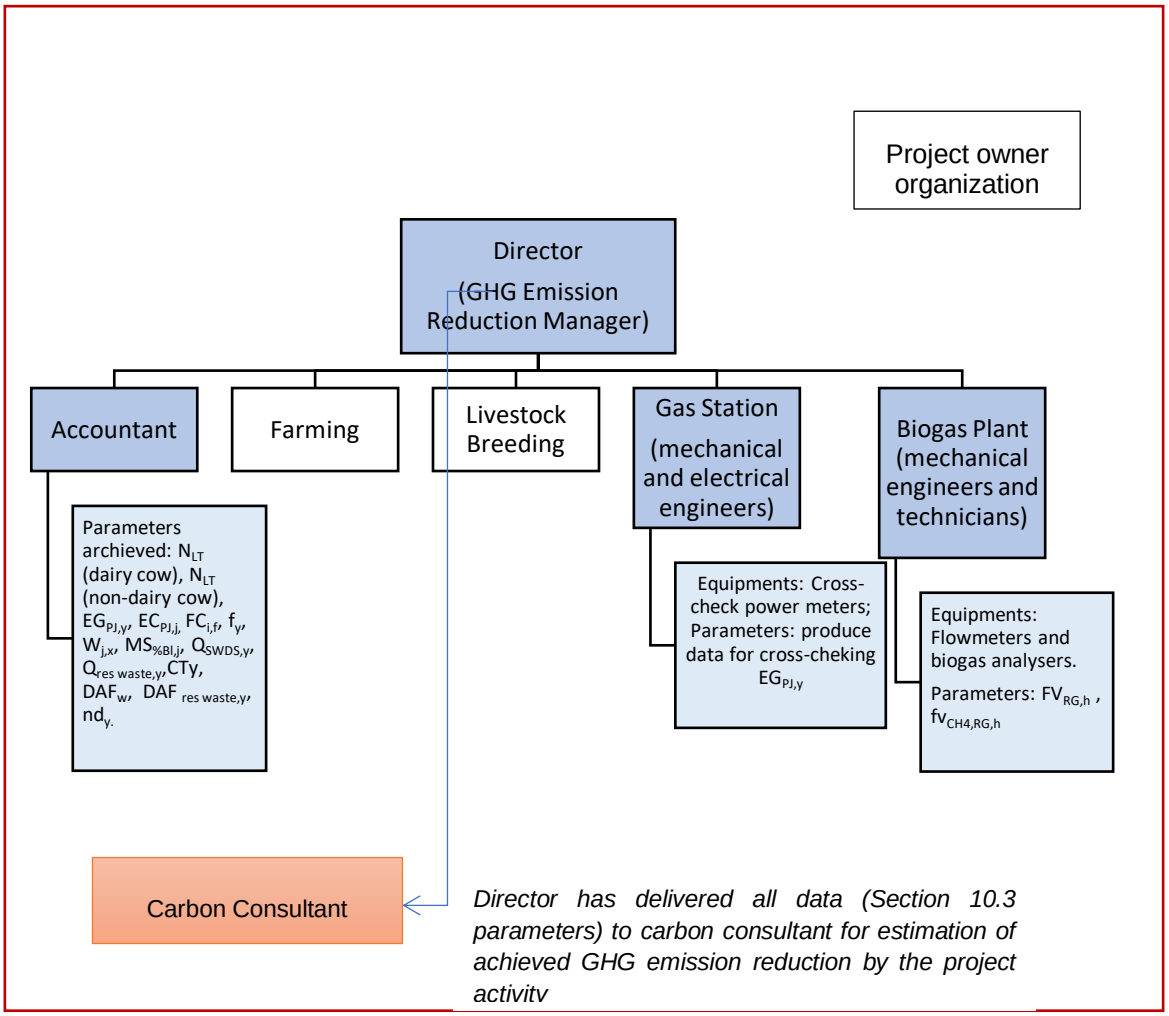

Figure 18 Project Monitoring Organizational Structure and archive of ex-post monitoring parameters

Monitoring points of the monitoring parameters:

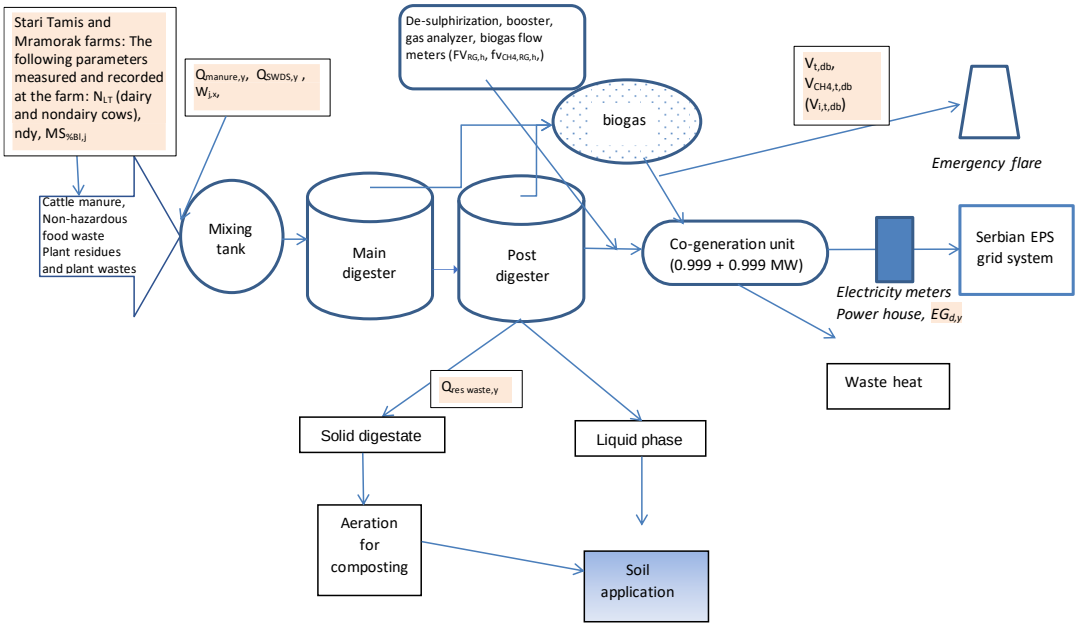

Figure 19 Project monitoring points (not mentioned here are recorded/archived at the accountant office)

Within this structure, the Director, which is the General Manager of the project owner, Zlatar Mramorak doo, is responsible for implementing the monitoring plan. Director has ensured proper monitoring, recording and archiving of the monitoring parameters. There is no need for monitoring ex-ante parameters which were fixed during the validation process and will not be revised during the first crediting period.

Accountant office is the natural identity that already archives some of the monitoring parameters as part of its business (

Figure 18). Average number of animals for diary and non-dairy cows, nd_y value, electricity generation and consumption data, and fuel consumption by the trucks are archived at the accountant office. The volumetric flow rate of the captured biogas and volumetric fraction of methane in the captured biogas are monitored and recorded by the Biogas Plant department. At the Gas Station department, power meters installed within the gas engine units will produce auxiliary data will be used for cross-checking the electricity generation by the project activity. Power meters at the grid substation are not monitored by the project owner. These meters are controlled by the EPS Distribucija doo, which is the government company buying the electricity from the project owner. All

calibration and control of these power meters at the grid substation are under the control of the EPS Distribucija doo.

As it is stated in the project activity PDD report Version 1.5, all these ex-post parameters given in Section 15.2 are already measured and recorded on a routine base within the organizational process of the project owner. Monitoring of these ex-post parameters regarding the monitoring frequency and source of data etc., are indicated in the tables in Section 15.2.

Director ensures the gathering of these recorded data, information and presents to the DOE.

Carbon consultant of the project activity is responsible to estimate the emission reductions of the project activity.

In total there are 9 people working for the project activity, 6 of which is local people.

All data for each monitoring parameters, both ex-post and ex-ante, will be archived during the project and will be kept for more 5 years following the end of the crediting period.

Regarding the environmental aspects, as it is stated in the project activity PDD report Version 1.5, there are no environmental and socio-economic impacts that can be counted as negative by the project activity. On the contrary, the project has more positive benefits to environment and society. Most important ones are the prevention of methane emissions to the atmosphere that would happen in the absence of the project activity.

During the first monitoring period, the project activity continued to comply with the environmental regulations, more specifically the requirements of the Permit 12 and Permit 13 which were issued by the Kovin Municipality. Project owner has been keeping all the records of the waste management documentation. During the first monitoring period, no negative environmental and socio-economic impacts have been observed and recorded.

Metering devices

Biogas flow meters, electricity meters and biogas analyzers are subject to regular maintenance and testing according to technical specifications from the manufacturers to ensure accuracy.

Biogas analyzer

Gas is analyzed by the Awite gas analyzer, type AwiFLEX Cool+. It measures values of methane, carbon-dioxide, oxygen and hydrogen-sulfide. Serial number of the gas analyzer is 2774.

Biogas flowmeter

Woodward brand, TecJet 110 mode flow meters are installed to measure biogas flow rate.

	Mramorak 1	Mramorak 2
Serial number	22184210	21813660

Power meters:

Calibration of power meters are under the control of the EPS Distribucija Doo, and project owner has not access to the power meters.

Mramorak1&2 power meters within the gas engine units are Landis+Gyr E650 branded with an accuracy class of 0.5/1.0. They are active reactive, bi-directional.

	Mramorak 1	Mramorak 2
Brand & Model	Landis+Gyr E650	Landis+Gyr E650
Serial number	43 267 888	44 202 354

Electricity generation is measured continuously at the gas engine units.

At the substation connecting to the Serbian EPS grid system, the following power meter equipment system with the following specifications: ST310FV(0.2) 3x58/100V 5-6A 15A23R55-SN00100 pbdqf kl.0.2 + GPRS/GSM modem CM23S-S2.

Serial numbers of power meters at the substation:

Mramorak 1	Mramorak 2
25 63 21	25 63 23

Electricity generation is measured continuously at the substation.

Project owner has also power meters installed within the gas engine units. The readings of these power meters can be used for cross-checking.

$EG_{PJ,y}$ (net amount of electricity generation by the project activity) will be proved by the EPS Distribucija Doo. monthly invoices. For cross-check, project owner has its own power meters located in the gas engine units.

Calibration of monitoring equipment

Monitoring equipment installed at the project activity that includes power meters, biogas flow meters and biogas analyzers are already calibrated by the manufacturer before the installation. After the installation, calibrations were applied according the applicable national regulation, called as "Pravilnik o overavanju merila"[37] ("Serbian Rulebook on certification of benchmarks" in English).

As per this regulation, power meters at the substation and project site are calibrated every 12 years. Please see the number 29 in the regulation, the line "for direct and semi-indirect connection". Power meter which are calibrated every 12 years are the ones installed at the substation as per the regulation. For power meters installed at the project activity, located in the codigesters, there is no calibration requirement by the law (please see the number 28 in the regulation). And since project start date is 24/06/2020, those power meters at the substation operated by the EPS Distribucija Doo are not calibrated yet. The first calibration will be applied in 24/06/2030. Power meters located in the gas engine units are technical part of the cogenerations and installed by the manufacturer company, Jenbacher, and were already calibrated before the installation. [38]

Flow meters (gas meters) and biogas analyzers are calibrated every 5 years. These meters are called "gas meters" in the line 11 in the regulation. The first calibration to biogas flow meter and biogas analyzers will be applied in 24/06/2025.[39]

Hence, during the first monitoring, there are no calibrations applied to the monitoring equipment.

Management of data quality

[37] http://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/ministarstva/pravilnik/2021/37/4.
[38] http://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/ministarstva/pravilnik/2021/37/4.
[39] http://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/ministarstva/pravilnik/2021/37/4.

Mramorak Zlatar Doo. company, which is the project owner, and fully operates the biodigester has a robust data management system. This system is a natural part of the business activities of the project owner; plus as per the governmental regulations, the company is obeyed to keep all the records from operation of cattle farms to the central treatment plants. Accountant office has been achieving many of the monitoring parameters, the rest of the parameter that includes biogas flowrate and methane composition have been kept by the Biogas plant departments; electricity generation data by the biodigesters are kept by the Gas Station and Accountant office departments.

15.2 Data and parameters to quantify the reduction of emissions

15.2.1 Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter	φ_y
Data unit	Unit less
Description	Model correction factor to account for model uncertainties for year y
Source of data used	CDM Tool 04 Emissions from solid waste disposal, Version 08.0.
Value (s)	0.85
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	Suggested by the CDM Tool 04, Version 08.0.
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**GWP_{CH4}**
Data unit	tCO2/tCH4
Description	Global Warming Potential (GWP) of CH4
Source of data used	IPCC 5th Assessment Report (AR5) Chapter 8, Table 8.7
Value (s)	28
Indicate what the data are used for (Baseline/	Data is used for baseline emission calculations

Project/ Leakage emission calculations)	
Justification of choice of data or description of measurement methods and procedures applied	IPCC 5th Assessment Report (AR5) Chapter 8, Table 8.7
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**$Default_{org,x}$**
Data unit	Unit less
Description	The value of $Default_{org,x}$ depends on the climate zone. These values were derived by an analysis of registered CDM projects with verified waste compositions, and the $Default_{org,x}$ values are selected to ensure conservativeness of the resulting baseline emissions (using 95% confidence and 10% precision)
Source of data used	CDM Tool 04, Version 8.0, Appendix Simplified Approaches, Reduced waste composition monitoring, p.23.
Value (s)	Table 2. $Default_{org,x}$ values for simplified procedure: Tropical wet column.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	CDM Tool 04, Version 8.0, Appendix Simplified Approaches, Reduced waste composition monitoring.
Additional comments	Data will be archive electronically during project plus 5 years.

Data / Parameter	**D_{CH4}**
Data unit	t/m^3
Description	CH4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure)
Source of data used	AMS-III.D Version 21.0., p.7.

Value (s)	0.00067
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	This is a scientifically proven constant value. AMS-III.D Version 21.0., p.7.
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**UF_b**
Data unit	Unit less
Description	Model correction factor to account for model uncertainties (0.94)
Source of data used	AMS-III.D Version 21.0, p.7.
Value (s)	0.94
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	AMS-III.D Version 21.0, p.7.
Additional comments	Data will be archive electronically during project plus 5 years.

Data / Parameter	**$VS_{LT,y}$**
Data unit	kg-dm/animal/day
Description	Volatile solids production/excretion per animal of livestock LT in year y
Source of data used	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10, Table 10A.4.

Value (s)	$VS_{LT,y}$ = 4.5 for dairy cows $VS_{LT,y}$ = 2.7 for other cattle
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10, Table 10A.4.
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**MCF_j**
Data unit	%
Description	Annual methane conversion factor (MCF) for the baseline animal manure management system j (j: anaerobic open lagoon)
Source of data used	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10, Table 10.17.
Value (s)	73%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10, Table 10.17. As climate zone, project area is located in the Warm Temperature Moist zone. The justification for choosing the Warm Temperature Moist zone is based on the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 3, Figure 3A.5.2. For Belgrade average annual temperature is 13.7 ^{o}C (Long term annual average for Belgrade since 1951). In 2021, annual average temperature was measured as 11.4 ^{o}C. According to the figure, Belgrade is either Warm Temperature Moist or Warm Temperature Dry. To be on the conservative side, the lowest value is chosen which is 73%.

Additional comments	Data will be archive electronically during project plus 5 years.

Data / Parameter	**$B_{0,LT}$**
Data unit	$m^3CH_4/kg\text{-}dm$
Description	Maximum methane producing potential of the volatile solid generated for animal type LT
Source of data used	For dairy cow: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10, Table 10.16A, p.10.67
Value (s)	For dairy cow: 0.24 For non-dairy cow: 0.17
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	As per AMS-III.D, .where no country specific value is available, a default value is applied. Defaults values for Eastern Europe from 2006 IPCC Guidelines are applied as this is the location of the project activity.
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**LF_{AD}**
Data unit	Unit less
Description	Methane leakage from anaerobic digesters/ reactor
Source of data used	AMS-III.AO Version 01. P.6. default value for methane leakage factor.
Value (s)	0.05
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations
Justification of choice of data or description of	AMS-III.AO Version 01. P.6. default value for methane leakage factor.

measurement methods and procedures applied	
Additional comments	Data will be archive electronically during project plus 5 years.

Data / Parameter	**CEF_{grid}**
Data unit	tCO_2/MWh
Description	Carbon emissions factor for the grid in the project scenario (tCO2e/MWh)
Source of data used	Calculated value based on the official publications by the EPS- Electric Power of Industry.
Value (s)	1.078674742 fixed ex-ante for the first crediting period
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**$FC_{i,m,y}$**
Data unit	ton
Description	Amount of fuel type i consumed by power unit m in year y y: 2019, 2020 and 2021.
Source of data used	PE Electric Power Industry of Serbia, "2019 Environment Report", 2019, p.12-13. https://www.eps.rs/eng/Documents/energyEfficiency/PE%20EPS%20Report%20on%20Environmental%20State%202019.pdf PE Electric Power Industry of Serbia, "2020 Environment Report", 2020, p.12-13. https://www.eps.rs/eng/Documents/PE%20EPE%20Report%20on%20Environmental%20State%202020.pdf .

	PE Electric Power Industry of Serbia, "2021 Environment Report", 2021, p.9-10. https://www.eps.rs/eng/Documents/energyEfficiency/PE%20EPS%20Environmental%20Report%202021.pdf
Value (s)	Fixed ex-ante for the first crediting period (simple OM and BM calculations. Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	Official publications by the EPS- Electric Power of Industry
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**$NCV_{i,y}$**
Data unit	GJ/ton
Description	Net calorific value (energy content) of fuel type i in year y y: 2019, 2020 and 2021.
Source of data used	NCV_{coal}: The Ministry of Environment and Spatial Planning, "Initial Communication of the Republic of Serbia Under the United Nations Framework Convention on Climate Change", Belgrade, 2010., p.134 https://unfccc.int/sites/default/files/resource/srbnc1.pdf $NCV_{HeavyFuelOil}$: 2006 IPCC Guidelines, Volume 2, Chapter 1., p.18-19. *https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf* NCV_{Oil}: 2006 IPCC Guidelines, Volume 2, Chapter 1., p.18-19. *https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf*
Value (s)	NCV_{coal}= 6.00 GJ/ton $NCV_{HeavyFuelOil}$=39.8 GJ/ton NCV_{Oil}=41.4 GJ/ton

	Fixed ex-ante for the first crediting period (simple OM and BM calculations)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	NCV value for coal is taken from the "Initial Communication of the Republic of Serbia Under the United Nations Framework Convention on Climate Change". Other NVC values are taken from 2006 IPCC Guidelines.
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**$EF_{CO2,i,y}$**
Data unit	tCO_2/GJ
Description	CO_2 emission factor of fuel type i in year y y: 2019, 2020 and 2021
Source of data used	$EF_{CO2,coal,y}$: The Ministry of Environment and Spatial Planning, "Initial Communication of the Republic of Serbia Under the United Nations Framework Convention on Climate Change", Belgrade, 2010., p.134. *https://unfccc.int/sites/default/files/resource/srbnc1.pdf* $EF_{CO2,HeavyFuelOil,y}$: 2006 IPCC Guidelines, Volume 2, Chapter 1., p.23. *https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf* $EF_{CO2,oil,y}$: 2006 IPCC Guidelines, Volume 2, Chapter 1., p.23. *https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf*
Value (s)	$EF_{CO2,coal,y}$: 0.1132 tCO2/GJ $EF_{CO2,HeavyFuelOil,y}$: 75,500 kg CO2/TJ = 0.0755 tCO2/GJ $EF_{CO2,oil,y}$: 72,600 kg CO2/TJ = 0.0726 tCO2/GJ Fixed ex-ante for the first crediting period (simple OM and BM calculations.
Indicate what the data are used for (Baseline/	Data is used for baseline emission calculations

Project/ Leakage emission calculations)	
Justification of choice of data or description of measurement methods and procedures applied	Default values from credible sources, 2006 IPCC Guidelines and "Initial Communication of the Republic of Serbia Under the United Nations Framework Convention on Climate Change"
Additional comments	*D*ata will be archive electronically during project plus 5 years.

Data / Parameter	$\eta_{m,y}$
Data unit	ratio
Description	Average net energy conversion efficiency of power unit m in year y y: 2019, 2020 and 2021
Source of data used	CDM Tool 09: Determining the baseline efficiency of thermal or electric energy generation systems, Version 03.0. Table 2
Value (s)	0.62 Fixed ex-ante for the first crediting period (simple OM and BM calculations)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	Default value from the Tool 09.
Additional comments	Data will be archive electronically during project plus 5 years.

Data / Parameter	$EG_{m,y}$
Data unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit m in year y y: 2019, 2020 and 2021

Source of data used	PE Electric Power Industry of Serbia, "2019 Environment Report", 2019, p.12-13. https://www.eps.rs/eng/Documents/energyEfficiency/PE%20EPS%20Report%20on%20Environmental%20State%202019.pdf PE Electric Power Industry of Serbia, "2020 Environment Report", 2020, p.12-13. https://www.eps.rs/eng/Documents/PE%20EPE%20Report%20on%20Environmental%20State%202020.pdf . PE Electric Power Industry of Serbia, "2021 Environment Report", 2021, p.9-10. https://www.eps.rs/eng/Documents/energyEfficiency/PE%20EPS%20Environmental%20Report%202021.pdf
Value (s)	Validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001. Fixed ex-ante for the first crediting period (simple OM and BM calculations)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Justification of choice of data or description of measurement methods and procedures applied	Official publications by the EPS- Electric Power of Industry
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**NCV_f**
Data unit	TJ/kg
Description	Net calorific value of fuel type f (Diesel oil) in TJ per volume or mass units
Source of data used	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.2, p.1.18.
Value (s)	4.3×10^{-5}
Indicate what the data are used for (Baseline/	Data is used for baseline emission calculations

Project/ Leakage emission calculations)	
Justification of choice of data or description of measurement methods and procedures applied	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.2, p.1.18.
Additional comments	Data will be archive electronically during project plus 5 years

Data / Parameter	**$EF_{CO2,f}$**
Data unit	tCO2e/TJ
Description	CO2 emission factor of the fossil fuel type f (diesel) used in transportation vehicles.
Source of data used	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.2, p.1.18.
Value (s)	74.1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations
Justification of choice of data or description of measurement methods and procedures applied	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.2, p.1.18. At this source it is indicated as 74100 kgCO2/TJ, conversion to tCO2/TJ, 74100 is divided by 1000, resulting in 74.1 tCO2e/TJ.
Additional comments	Data will be archive electronically during project plus 5 years

15.2.2 Data and parameters monitored

Data / Parameter	**f_y**
Data unit	Unit less/fraction
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
Measured /Calculated /Default:	Measured

Source of data	In Republic of Serbia, there is no regulation that enforces the combustion of methane released by the SWDSs
Value(s) of monitored parameter	0 (zero)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	In Republic of Serbia, there is no regulation that enforces the combustion of methane released by the SWDSs.
Measuring/ Reading/ Recording frequency	Annually
Calculation method (if applicable)	N/A
QA/QC procedures applied	Archive electronically during project plus 5 years.

Data / Parameter	$\mathbf{W}_{j,x}$
Data unit	Ton/year
Description	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
Measured /Calculated /Default:	Measured Measurements by project participants. Project proponents log book records that show the municipal organic wastes accepted by the Mramorak1&2.
Source of data	Project proponents log book records that show the municipal organic wastes accepted by the Mramorak1&2. Project received one type of solid waste, which is the municipal food waste.
Value(s) of monitored parameter	Baseline estimated value: 3000 ton/year The first monitoring period achieved values:

	<table><tr><td>Year</td><td>Municipal solid food waste (ton)</td></tr><tr><td>24/06/2020-31/12/2020</td><td>0</td></tr><tr><td>01/01/2021-31/12/2021</td><td>249.22</td></tr><tr><td>01/01/2022-31/12/2022</td><td>3,223.56</td></tr><tr><td>01/01/2023-31/12/2023</td><td>2,378.16</td></tr><tr><td>Total</td><td>5,840.94</td></tr></table>
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Project proponents log book records
Measuring/ Reading/ Recording frequency	Continuously, aggregated at least annually for year x
Calculation method (if applicable)	N/A
QA/QC procedures applied	Archive electronically during project plus 5 years.

Data / Parameter	$N_{LT,y}$
Data unit	Number of cows/year
Description	Annual average number of animals of type LT in year y (numbers)
Measured /Calculated /Default:	Measured
Source of data	Project proponent farm records. Counting the number of cattle at the farms (Mramorak and Stari Tamis farms) is part of the business of the project owner. Project proponent has daily records of animal stocks.

<table>
<tr><td>Value(s) of monitored parameter</td><td>Baseline estimated values
At both Stari Tamis and Mramorak farms, in total:
Ndairy cow : 1340 for dairy cow (expected value)
Neon-dairy cow : 2021 for non-dairy cow (expected value)
The first monitoring period achieved values:
<table>
<tr><td>Year</td><td>Ndairy cow</td><td>Neon-dairy cow</td></tr>
<tr><td>24/06/2020-31/12/2020</td><td>471</td><td>336</td></tr>
<tr><td>01/01/2021-31/12/2021</td><td>1,528</td><td>1,911</td></tr>
<tr><td>01/01/2022-31/12/2022</td><td>1,416</td><td>1,837</td></tr>
<tr><td>01/01/2023-31/12/2023</td><td>1,340</td><td>1,763</td></tr>
<tr><td>Total</td><td>4,754</td><td>5,847</td></tr>
</table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Data is used for baseline emission calculations</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>Counting the number of cattle at the farms (Mramorak and Stari Tamis farms) is part of the business of the project owner. Project proponent has daily records of animal stocks.</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency</td><td>Annually, based on monthly records</td></tr>
<tr><td>Calculation method (if applicable)</td><td>N/A</td></tr>
<tr><td>QA/QC procedures applied</td><td>Counting animals at the farms is a mandatory business process of the project owner. Therefore, all data in correct way is available at the project proponent.
Dead and discarded animals are discounted from the N_{LT}.
Archive electronically during project plus 5 years.</td></tr>
</table>

Data / Parameter	**$MS_{\%BI,j}$**
Data unit	Unit less/fraction
Description	Fraction of manure handled in baseline animal manure management system j

Measured /Calculated /Default:	Measured
Source of data	Project proponent farm records and Mramorak1&2 project waste management records
Value(s) of monitored parameter	Baseline estimated value: 100% The first monitoring period achieved value: 100%. All the manure produced by the farms are taken to the Mramorak1&2 digesters.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency	Annually, based on daily measurement and monthly aggregation
Calculation method (if applicable)	N/A
QA/QC procedures applied	Data will be archived electronically during project plus 5 years.

Data / Parameter	$Q_{manure,y}$
Data unit	Ton
Description	Quantity of raw waste/manure treated and/or wastewater co-digested in the year y (ton)
Measured /Calculated /Default:	Measured
Source of data	Project proponents' records. On-site data sheets recorded monthly using weigh bridge.
Value(s) of monitored parameter	Baseline estimated value: 12,775 ton/year The first monitoring period achieved value:

Year	$Q_{manure,y}$ (ton)

		24/06/2020-31/12/2020	0[40]
		01/01/2021-31/12/2021	4,493.90
		01/01/2022-31/12/2022	7,488.52
		01/01/2023-31/12/2023	7,425.85
		Total	19,408.27
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A		
Measuring/ Reading/ Recording frequency	Monthly		
Calculation method (if applicable)	N/A		
QA/QC procedures applied	Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier. Data will be archived electronically during project plus 5 years.		

Data / Parameter	$Q_{SWDS,y}$
Data unit	Ton
Description	Quantity of raw waste/manure treated and/or wastewater co-digested in the year y (tons)
Measured /Calculated /Default:	Measured

[40] In 2020, manure waste from the onsite farm, Mramorak farm, were put into the digesters. No manure received from Stari Tamis in 2020.

<table>
<tr><td>Source of data</td><td>Project proponents' records. On-site data sheets recorded monthly using weigh bridge.</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Baseline estimated value: 3000 ton/year
The first monitoring period achieved value:
<table>
<tr><td>Year</td><td>$Q_{SWDS,y}$</td></tr>
<tr><td>24/06/2020-31/12/2020</td><td>0</td></tr>
<tr><td>01/01/2021-31/12/2021</td><td>249.22</td></tr>
<tr><td>01/01/2022-31/12/2022</td><td>3,223.56</td></tr>
<tr><td>01/01/2023-31/12/2023</td><td>2,378.16</td></tr>
<tr><td>Total</td><td>5,850,94</td></tr>
</table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Data is used for project emission calculations.</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>N/A</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency</td><td>Monthly</td></tr>
<tr><td>Calculation method (if applicable)</td><td>N/A</td></tr>
<tr><td>QA/QC procedures applied</td><td>Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier).
Data will be archived electronically during project plus 5 years.</td></tr>
</table>

Data / Parameter	$\mathbf{Q_{res\ waste,y}}$
Data unit	Ton
Description	Quantity of residual waste produced in year y.
Measured /Calculated /Default:	Measured

Source of data	Project proponents' records. On-site data sheets recorded monthly using weigh bridge.
Value(s) of monitored parameter	Baseline estimated value: 1040 ton/year The first monitoring period achieved value:

Year	$Q_{res\ waste,y}$
24/06/2020-31/12/2020	2,744.38
01/01/2021-31/12/2021	12,414.86
01/01/2022-31/12/2022	13,199.06
01/01/2023-31/12/2023	12,026.09
Total	40,384.39

Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency	Monthly
Calculation method (if applicable)	N/A
QA/QC procedures applied	Data will be archived electronically during project plus 5 years.

Data / Parameter	**CT_y**
Data unit	Tons/truck
Description	Average truck capacity for transportation (tons/truck)
Measured /Calculated /Default:	Measured
Source of data	Project proponent's on-site measurement

Value(s) of monitored parameter	Baseline estimated value: 18.5 ton/truck for manure 10 ton/truck for food waste The first monitoring period achieved value: 18.5 ton/truck for manure 10 ton/truck for food waste.[41]
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency	Annually
Calculation method (if applicable)	N/A
QA/QC procedures applied	Data will be archived electronically during project plus 5 years.

Data / Parameter	$CT_{res\ waste,y}$
Data unit	Tons/truck
Description	Average truck capacity for residual transportation (tons/truck)
Measured /Calculated /Default:	Measured
Source of data	Project proponent's on-site measurement

[41] For food transportation, sometimes trucks with 20 tons/truck capacity were used, but to be conservative in emission reduction calculations, only 10 ton/truck value is used.

Value(s) of monitored parameter	Baseline estimated value: 10 ton/truck The first monitoring period achieved value: 10 ton/truck
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency	Annually
Calculation method (if applicable)	N/A
QA/QC procedures applied	Data will be archived electronically during project plus 5 years.

Data / Parameter	**DAF_w**
Data unit	km/truck
Description	Average incremental distance for raw solid waste/manure and/or wastewater transportation
Measured /Calculated /Default:	Measured
Source of data	Project proponent's on-site measurement
Value(s) of monitored parameter	Baseline estimated value: • 290 km/truck for food waste transportation • 37 km/truck for manure transportation The first monitoring period achieved values:

Year	DAF_{manure}	DAF_{food}
24/06/2020-31/12/2020	0	0
01/01/2021-31/12/2021	37.0	60.6

	<table><tr><td>01/01/2022-31/12/2022</td><td>37.0</td><td>60.6</td></tr><tr><td>01/01/2023-31/12/2023</td><td>37.0</td><td>60.6</td></tr></table> Project did not receive any manure waste from Stari Tamis in 2020, only used onsite manure generated by the Mramorak farm. DAF_{food} average incremental distance value is taken as 60.6 km (30.3x2=60.6), staying on the conservative side. Beotok distance to the project site: 22.6 km Eko Maber distance to the project site: 30.3 km Eko Smart distance to the project site 30.3 km
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency	Monthly
Calculation method (if applicable)	N/A
QA/QC procedures applied	Data will be archived electronically during project plus 5 years.

Data / Parameter	**$DAF_{res\ waste,y}$**
Data unit	km/truck
Description	Average distance for residual waste transportation
Measured /Calculated /Default:	Measured
Source of data	Project proponent's on-site measurement

Value(s) of monitored parameter	Baseline estimated value: 6.5 km/truck The first monitoring period achieved value: 6.5 km/truck. Residual waste location is not changed, the same location given in the validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency	Annually
Calculation method (if applicable)	N/A
QA/QC procedures applied	Data will be archived electronically during project plus 5 years.

Data / Parameter	**$FC_{i,f}$**
Data unit	kg/km
Description	Specific consumption of fuel type f in volume or mass units per km for vehicle type i
Measured /Calculated /Default:	Measured
Source of data	Project Proponent's project records. In the project activity, trucks use diesel oil for transporting the manure. According to the statement of the project owner, trucks consume 25 liter fuel per 100 km. Density of diesel oil is 0.85 kg/lt. Based on that trucks use 0.2125 kg/km diesel oil.
Value(s) of monitored parameter	Baseline estimated value: 0.2125 kg/km The first monitoring period achieved value: 0.2771 kg/km.

	The fuel type used did not change in the first monitoring period, the same as given in the validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency	Annually
Calculation method (if applicable)	
QA/QC procedures applied	Data will be archived electronically during project plus 5 years.

Data / Parameter	**nd_y**
Data unit	Days/year
Description	Number of days the central treatment plant was operational in year y
Measured /Calculated /Default:	Measured
Source of data	Project proponent. Incoming waste records, measured at the weight scale at the entrance of the project facility. Project farms, which are Stari Tamis and Mramorak, are operational 365 days per year and accordingly manure management systems in both farms, which are uncovered anaerobic lagoons, are operational throughout this time.
Value(s) of monitored parameter	The first monitoring period achieved values: Year | nd_y

		24/06/2020-31/12/2020	191
		01/01/2021-31/12/2021	365
		01/01/2022-31/12/2022	365
		01/01/2023-31/12/2023	365
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations.		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A		
Measuring/ Reading/ Recording frequency	Monthly		
Calculation method (if applicable)	N/A		
QA/QC procedures applied	Data will be archived electronically during project plus 5 years.		

Data / Parameter	**$FV_{RG,h}$**
Data unit	m^3/hr
Description	Volumetric flow rate of the captured biogas in dry basis at normal conditions in hour h
Measured /Calculated /Default:	Measured
Source of data	At Mramorak 1 and Mramorak, Woodward brand, TecJet 110 mode flow meters are installed. These flow meters are an electronic gas metering valve for single point injection. It has integrated sensors and electronics, which provide the correct gas flow under all specified conditions.
Value(s) of monitored parameter	Baseline estimated value: 511.2 m^3/hr for each biogas facility. Hence 1022.4 m^3/hr in total for Mramorak 1&2.

<table>
<tr><td></td><td>The first monitoring period achieved values:
<table>
<tr><td>Year</td><td>$FV_{RG,h}$</td></tr>
<tr><td>24/06/2020-31/12/2020</td><td>503,79</td></tr>
<tr><td>01/01/2021-31/12/2021</td><td>982,61</td></tr>
<tr><td>01/01/2022-31/12/2022</td><td>1,004.75</td></tr>
<tr><td>01/01/2023-31/12/2023</td><td>1,002.12</td></tr>
</table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Data is used for project emission calculations.</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>Biogas coming to the gas engine unit is continuously measured y flow meters and measured data is recorded by the Dia.ne xt4 software program. The data of this program is the only source to determine the gas flowrate parameter.
<table>
<tr><td></td><td>Mramorak 1</td><td>Mramorak 2</td></tr>
<tr><td>Brand & Model</td><td>TecJet 110</td><td>TecJet 110</td></tr>
<tr><td>Serial number</td><td>22184210</td><td>21813660</td></tr>
</table></td></tr>
<tr><td>Measuring/ Reading/ Recording frequency</td><td>Continuously by flow meter</td></tr>
<tr><td>Calculation method (if applicable)</td><td>N/A</td></tr>
<tr><td>QA/QC procedures applied</td><td>Flow meters (gas meters) and biogas analyzers are calibrated every 5 years. These meters are called “gas meters” in the line 11 in the regulation. The first calibration to biogas flow meter and biogas analyzers will be applied in 24/06/2025.[42]
Hence, during the first monitoring, there are no calibrations applied to the monitoring equipment.
Data will be archived electronically during project plus 5 years.</td></tr>
</table>

[42] http://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/ministarstva/pravilnik/2021/37/4.

<table>
<tr><td>Data / Parameter</td><td>$fv_{CH4,RG,h}$</td></tr>
<tr><td>Data unit</td><td>Fraction</td></tr>
<tr><td>Description</td><td>Volumetric fraction of methane in the captured biogas on dry basis in hour h</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Project Proponent.
This is project specific data, and the gas flow meters installed in the gas engine units are the only source of the data</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Baseline estimated value: 0.55
The first monitoring period achieved values:
<table><tr><td>Year</td><td>$v_{CH4,RG,h}$</td></tr><tr><td>24/06/2020-31/12/2020</td><td>54.36</td></tr><tr><td>01/01/2021-31/12/2021</td><td>55.44</td></tr><tr><td>01/01/2022-31/12/2022</td><td>54.67</td></tr><tr><td>01/01/2023-31/12/2023</td><td>55.41</td></tr></table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Data is used for project emission calculations.</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>Biogas flow from both main and post digester units to the gas engine unit are continuously analyzed by the biogas analyzer.
Biogas is analyzed by the Awite gas analyzer, type AwiFLEX Cool+, with a serial number of 2774. It measures values of methane, carbon-dioxide, oxygen and hydrogen-sulfide.
Measured data is recorded by a software program, Dia.ne xt4.</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency</td><td>Continuously by flow meter</td></tr>
<tr><td>Calculation method (if applicable)</td><td>N/A</td></tr>
<tr><td>QA/QC procedures applied</td><td>Biogas analyzers are calibrated every 5 years. These meters are called “gas meters” in the line 11 in the regulation. The first</td></tr>
</table>

	calibration to biogas flow meter and biogas analyzers will be applied in 24/06/2025.[43] Hence, during the first monitoring, there are no calibrations applied to the monitoring equipment. Data will be archived electronically during project plus 5 years.

Data / Parameter	**$EG_{pj,y}$**
Data unit	MWh/year
Description	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
Measured /Calculated /Default:	Measured
Source of data	Project Proponent invoices issued by the EPS Distribucija.
Value(s) of monitored parameter	Baseline estimated value: 15,500 MW/year The first monitoring period achieved values:
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations.

Year	Net electricity generation MWh
24/06/2020-31/12/2020	4,146.36
01/01/2021-31/12/2021	13,752.31
01/01/2022-31/12/2022	15,470.05
01/01/2023-31/12/2023	15,822.92
Total	49,191.63

[43] http://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/ministarstva/pravilnik/2021/37/4.

<table>
<tr>
<td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td>
<td>
Generated electricity is supplied to the power station of the Serbian national grid system which is about 0.1 km away from the Mramorak1&2. At the power station, there are two power meters operated by the government owned company, EPS Distribucija doo. Project owners have no control on these power meters; they are sealed and protected from possible interventions. EPS Distribucija doo makes remote reading to these power meters and every month send invoice to the project owner.
Monthly invoices for generation and consumption by EPS Distribucija doo are the sources of “net electricity” generation of the project.

Power meters

At the substation connecting to the Serbian EPS grid system, the following power meter equipment system with the following specifications: ST310FV(0.2) 3x58/100V 5-6A 15A23R55-SN00100 pbdqf kl.0.2 + GPRS/GSM modem CM23S-S2. Serial numbers of power meters at the substation:

<table>
<tr><td>Mramorak 1</td><td>Mramorak 2</td></tr>
<tr><td>25 63 21</td><td>25 63 23</td></tr>
</table>
Cross-check:

Project owner has also power meters installed within the gas engine units. The readings of these power meters can be used for cross-checking.

Mramorak1&2 power meters within the gas engine unit are Landis+Gyr E650 branded with an accuracy class of 0.5/1.0. They are active reactive, bi-directional. Electricity generation is measured continuously at the gas engine units.

<table>
<tr><td></td><td>Mramorak 1</td><td>Mramorak 2</td></tr>
<tr><td>Brand & Model</td><td>Landis+Gyr E650</td><td>Landis+Gyr E650</td></tr>
<tr><td>Serial number</td><td>43 267 888</td><td>44 202 354</td></tr>
</table>
</td>
</tr>
<tr>
<td>Measuring/ Reading/ Recording frequency</td>
<td>Continuous measurement, but recorded monthly.</td>
</tr>
</table>

Calculation method (if applicable)	N/A
QA/QC procedures applied	Calibration and maintenance of the power meters located at the Serbian EPS substation to which the project electricity is supplied are the responsibility of the EPS Distribucija doo. Calibration and maintenance is done in accordance with the national regulation "The Rulebook on the types of measuring instruments that are subject to legal control".[44] Calibration frequency is 12 years as per this regulation. Data will be archived electronically during project plus 5 years.

Data / Parameter	**Average annual temperature of Belgrade**
Data unit	^{o}C
Description	Average annual temperature for Belgrade
Measured /Calculated /Default:	Measured
Source of data	Government official data published in the following links. https://www.hidmet.gov.rs/data/klimatologija/eng/2020.pdf, Appendix, Chart 1, p.13. https://www.hidmet.gov.rs/data/klimatologija/eng/2021.pdf, Appendix, Chart 1, p.16. https://www.hidmet.gov.rs/data/klimatologija/eng/2022.pdf, Appendix Chart 1, p.16.
Value(s) of monitored parameter	Baseline estimated value: 13.7 ^{o}C (Long term annual average for Belgrade since 1951). In 2021, annual average temperature was measured as 11.4 ^{o}C. The first monitoring period measured values:

Year	Average annual temperature of Belgrade ^{o}C
2020	13.9[45]

[44] Official Gazette of the Republic of Serbia No. 13/18 of 14th February 2018 and enters into force on 22nd February 2018.
https://tehnis.privreda.gov.rs/en/news/Legislative_news/689/published-rulebook-on-types-of-measuring-instruments-that-are-subject-to-legal-control-.html.

[45] https://www.hidmet.gov.rs/data/klimatologija/eng/2020.pdf, Appendix, Chart 1, p.13.

		2021	13.7[46]
		2022	14.5[47]
		2023	Government official data is not available for this year. But the previous years have proven that average temperature is above 5 °C.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for baseline emission calculations.		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A		
Measuring/ Reading/ Recording frequency	Annually		
Calculation method (if applicable)	N/A		
QA/QC procedures applied	Official governmental data.		

Data / Parameter	$\mathbf{V_{t,db}}$
Data unit	m^3 /min
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis (m^3 dry gas/h)
Measured /Calculated /Default:	Measured

[46] https://www.hidmet.gov.rs/data/klimatologija/eng/2021.pdf, Appendix, Chart 1, p.16.
[47] https://www.hidmet.gov.rs/data/klimatologija/eng/2022.pdf, Appendix Chart 1, p.16.

Source of data	For mass flow of methane, the maximum combustion capacity of the flare units capacities will be used. This is a conservative approach.
Value(s) of monitored parameter	Maximum combustion capacities of each flare units are taken from the flare units technical specification documents which is the same with the baseline value during the first monitoring period: Mramorak1: 550 m3/hr Mramorak2: 550 m3/hr
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Since maximum combustion capacity of the flare unit will be used, there is no monitoring device installed.
Measuring/ Reading/ Recording frequency	Annually. Flare units maximum combustion capacity value is used.
Calculation method (if applicable)	N/A
QA/QC procedures applied	-

Data / Parameter	$\mathbf{V_{i,t,db}}$ **(**$\mathbf{V_{CH4,t,db}}$**)**
Data unit	m^3 / m^3
Description	Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m^3 gas i/m^3 dry gas); i: CH4.
Measured /Calculated /Default:	Measured
Source of data	Project Proponent.

	Biogas flow from both main and post digester units to the gas engine unit are continuously analyzed by the biogas analyzer.
Value(s) of monitored parameter	Baseline estimated value: 0.55 m^3 / m^3 The first monitoring period achieved values: Year: 24/06/2020-31/12/2020 — $v_{i,t,db}$ ($v_{CH4,t,db}$) 0.5436 m^3 / m^3 01/01/2021-31/12/2021 — 0.5544 01/01/2022-31/12/2022 — 0.5467 01/01/2023-31/12/2023 — 0.5541
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Biogas is analyzed by the Awite gas analyzer, type AwiFLEX Cool+, with a serial number of 2774. It measures values of methane, carbon-dioxide, oxygen and hydrogen-sulfide. Measured data is recorded by a software program, Dia.ne xt4.
Measuring/ Reading/ Recording frequency	Continuously. Values to be averaged on a minute basis
Calculation method (if applicable)	N/A
QA/QC procedures applied	Biogas analyzers are calibrated every 5 years. These meters are called “gas meters” in the line 11 in the regulation. The first calibration to biogas flow meter and biogas analyzers will be applied in 24/06/2025.[48]

Data / Parameter	η_{flare}

[48] http://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/ministarstva/pravilnik/2021/37/4.

Data unit	Unit less
Description	Flare efficiency in the minute m
Measured /Calculated /Default:	Default
Source of data	CDM Tool 06: Project emissions from flaring. Flare units are enclosed type. As per the Tool 06, option A is chosen as flare efficiency, which is a conservative approach.
Value(s) of monitored parameter	0%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency	Annually
Calculation method (if applicable)	N/A
QA/QC procedures applied	N/A

Data / Parameter	**Number of employees working at the project activity** SDG Goal 8 Decent Work and Economic Growth
Data unit	Number
Description	Number of employees working at the project activity
Measured /Calculated /Default:	Measured

<table>
<tr><td>Source of data</td><td>Number of employees working at the project activity to be validated by the project owner’s employee records and social security records.</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Baseline estimated value: 6
The first monitoring period achieved values:
<table>
<tr><td>Year</td><td>Number of employees working at the project activity</td></tr>
<tr><td>24/06/2020-31/12/2020</td><td>9</td></tr>
<tr><td>01/01/2021-31/12/2021</td><td>9</td></tr>
<tr><td>01/01/2022-31/12/2022</td><td>9</td></tr>
<tr><td>01/01/2023-31/12/2023</td><td>9</td></tr>
</table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>N/A</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>N/A</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency</td><td>Annually</td></tr>
<tr><td>Calculation method (if applicable)</td><td>N/A</td></tr>
<tr><td>QA/QC procedures applied</td><td>N/A</td></tr>
</table>

16 Quantification of GHG emission reduction / removals

Quantification of emission reductions of the project activity is calculated as per the AMS-III.AO and AMS-I.D. Following provides the details of the calculation formulations of emission reductions as per each methodology.

AMS-III.AO Version 1.0 states that

"The emission reductions achieved by the project activity will be determined ex post through direct measurement of the amount of biogas fueled, 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. Qy, and fossil fuels/electricity used). The emission reductions achieved in any year are the lowest value of the following:"

$$ER_{y,ex\ post} = min\begin{bmatrix}(BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}),(MD_y - PE_{y,power,ex\ post} - \\ PE_{y,transp,ex\ post} - PE_{y,res\ waste,ex\ post} - PE_{y,phy\ leakage,ex\ post} - LE_{y,ex\ post})\end{bmatrix} \quad (4)$$

Where,

$ER_{y,\ ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year y (tCO2e)
$BE_{y,\ ex\ post}$	Baseline emissions calculated using equation (1) using ex post monitored values (e.g. Qy) (tCO2e)
$PE_{y,\ ex\ post}$	Project emissions calculated using equation (2) using ex post monitored values (e.g. Qy, transport distances, the amount of electricity/fossil fuels used, emissions from anaerobic storage). This calculation shall include project emissions from physical leakage (tCO2e)
$LE_{y,\ ex\ post}$	Leakage emissions calculated using ex post monitored values (tCO2e)
MD_y	Methane captured and destroyed or used gainfully by the project activity in year y (tCO2e)
$PE_{y,transp,\ ex\ post}$	Emissions from incremental transportation based on monitored values in the year y (tCO2e)
$PE_{y,power,ex\ post}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (tCO2e)

$PE_{y, res\ waste, ex\ post}$	Methane emissions from the anaerobic decay/treatment of the residual waste/products based on monitored values in the year y (tCO2e)
$LE_{y, leakage, ex\ post}$	Methane emissions from physical leakages of the anaerobic digester based on monitored values in year y (tCO2e)

AMS-I.D. CO2 emission reduction calculation:

$$\mathbf{ER_y = BE_y - PE_y - LE_y}$$

Where:

ERy = Emission reductions in year y (t CO2)

BEy = Baseline Emissions in year y (t CO2)

PEy = Project emissions in year y (t CO2)

LEy = Leakage emissions in year y (t CO2)

16.1 Baseline emissions

$$\mathbf{BE_{Mramorak1\&2,y} = BE_{SWDS,y} + BE_{manure,y} + BE_{elect,y}}$$

In this formula, baseline emission as per the AMS-III.AO is indicated as "$BE_{SWDS,y}$ + $BE_{manure,y}$". Baseline emission that comes from AMS-I.D is indicated as $BE_{elect,y}$. Following parts of this section provides how this formula is derived from AMS-III.AO and AMS-I.D**.**

Baseline emission calculations are provided in the associated excel file (Mramorak1&2_ER_CalculationsRev.xls).

As per the AMS-III.AO methodology, baseline emission is as follows:

$BE_y = BE_{SWDS,y} + BE_{ww,y} + BE_{manure,y} - MD_{reg,y} \times GWP_{CH4}$ (Eq. 1)

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" (tCO2e). 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
$BE_{ww,y}$	Where applicable, baseline emissions from the wastewater co-digested, calculated as per the procedures of AMS-III.H
$BE_{manure,y}$	Where applicable, baseline emissions from the manure co-digested by the project activities, calculated as per the relevant procedures of AMS-III.D
$MD_{reg,y}$	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (ton)
GWP_{CH4}	GWP for CH4

In Republic of Serbia, as per the laws, there is no regulation or legal enforcement to capture methane from manure treatment plants, wastewater treatment plants or SWDSs. Therefore $MD_{reg,y}$ is taken as zero in calculations.

GWP for CH4 is taken as 28 as per the IPCC Fifth Assessment Report.[49]

Project activity claims carbon emission reduction for manure ($BE_{manure,y}$) and municipal solid waste ($BE_{SWDS,y}$)

[49] https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf.

Hence the formula is simplified as;

$$BE_y = BE_{SWDS,y} + BE_{manure,y}$$

Baseline Emission for Municipal Solid Waste ($BE_{SWDS,y}$)

AMS-III.AO ver. 1.0. refers to the ""Emissions from solid waste disposal site" Version 8.0." for food waste baseline emission reductions. Project activity only uses organic municipal solid waste and they are wet based. Therefore equation 15 of the Tool 04 is used.

$$BE_{CH4,SWDS,y} = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times \sum_{x=1}^{y} Default_{org,x} \times W_{org,x}$$

$BE_{CH4,SWDS,y}$	Baseline, project or leakage methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (t CO2e/yr)
x	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)
y	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)
φ_y	Model correction factor to account for model uncertainties for year y
$W_{j,x}$	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
f_y	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
GWP_{CH4}	Global Warming Potential of methane
$Default_{org,x}$	The value of $Default_{org,x}$ depends on the climate zone. These values were derived by an analysis of registered CDM projects with verified waste compositions, and the $Default_{org,x}$ values are selected to ensure conservativeness of the resulting baseline emissions (using 95% confidence and 10% precision)

Baseline Emission for Manure ($BE_{manure,y}$)

AMS-III.AO refers to the latest version of the AMS-III.D methodology.

AMS-III.D Methane recovery in animal manure management systems, Version 21.0.[50]

The baseline scenario is the situation where, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere. Baseline emissions (BEy) are calculated by using one of the following two options:

To calculate baseline emission by manure, Option a is chosen.

$$BE_{manure,y} = GWP_{CH4} \times D_{CH4} \times UF_b \Sigma(MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS_{\%Bl,j})$$

Where,

$BE_{manure,y}$ (BE_y)	Baseline emissions in year y (t CO2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH4 applicable to the crediting period (t CO2e/t CH4)
D_{CH4}	CH4 density (0.00067 t/m3 at room temperature (20 ºC) and 1 atm pressure)
LT	Index for all types of livestock
j	Index for animal manure management system
UF_b	Model correction factor to account for model uncertainties (0.94)
MCF_j	Annual methane conversion factor (MCF) for the baseline animal manure management system j

50 https://cdm.unfccc.int/UserManagement/FileStorage/1AWXEKHVTYF423LCN56Z9GIMQOS8JR .

$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type LT (m^3 CH_4/kg-dm)
$N_{LT,y}$	Annual average number of animals of type LT in year y (numbers)
$VS_{LT,y}$	Volatile solids production/excretion per animal of livestock LT in year y (on a dry matter weight basis, kg-dm/animal/year)
$MS_{\%Bl,j}$	Fraction of manure handled in baseline animal manure management system j

Annual temperature in the site where the anaerobic manure treatment facilities in the baseline existed, is 11.4°C[51], which is higher than 5°C.

AMS-I.D. Baseline emission from renewable energy part of the project activity

$$BE_{elect,y}=EG_{pj,y} \times EF_{grid,y}$$

Where:

$BE_{elect,y}$	Baseline emissions in year y (tCO_2)
$EG_{pj,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{grid,y}$	Combined margin CO2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO2/MWh)

In the absence of the project activity, same amount of electricity would be used from the grid. *CEF_{grid}* should be calculated according to Tool 07 *"Tool to calculate the emission factor for an electricity system"*. Version 07.0 is the latest revision of the tool.

[51] https://www.hidmet.gov.rs/data/klimatologija/eng/2021.pdf. P.2. Measured in 2021.

Estimation of CEFgrid Emission Factor for Serbian grid system

Tool 07 was used to determine the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "combined margin" emission factor (CM) of the electricity system.

As per the calculations as indicated in the validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001,

$EF_{grid,CM,y}$ = 1.078674742 tCO2/MWh

In the validated Mramorak1&2 Biogas Power Plants BCR PDD, BCR-RS-493-1-001, The grid emission factor (CEF_{grid}) was fixed ex-ante and will not be updated ex-post.

16.2 Project emissions/removals

Project emissions of the project activity are estimated as per the AMS-III.AO and AMS-I.D methodologies and applicable tools as per these methodologies as provided below.

To estimate project emission reductions correctly, project owner has an robust data management system where it archives applicable parameters which are used in project emission calculations. Please see Section 16.1 to see the parameters required for project emission calculations, which are monitoring parameters at the same time. Monitoring parameters are already monitored in a conservative and provable way as per the AMS-III.AO and AMS-I.D.

As per the AMS-III.AO projects emission of the project activity is as follows:

$$PE_y = PE_{transp,y} + PE_{power,y} + PE_{res\ waste,y} + PE_{phy\ leakage,y} + PE_{flaring,y}$$

Where,

PE_y	Project activity emissions in the year y (tCO2e)
$PE_{transp,y}$	Emissions from incremental transportation in the year y (tCO2e)
$PE_{power,y}$	Emissions from electricity or fossil fuel consumption in the year y (tCO2e)

$PE_{res\ waste,y}$	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 "Tool to determine project emissions from flaring gases containing methane" (tCO2e)

$PE_{transp,y}$ Emissions

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) (ii) When applicable, the collection points of wastewater and treatment site as compared to baseline wastewater treatment site;
(iii) (iii) Treatment sites and the sites for soil application, landfilling and further treatment of the residual waste.

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

where,

Q_y	Quantity of raw waste/manure treated and/or wastewater co-digested in the year y (tons)
CT_y	Average truck capacity for transportation (tons/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 (tons)
$CT_{res\ waste,y}$	Average truck capacity for residual waste transportation (tons/truck)

$DAF_{res\ waste,y}$	Average distance for residual waste transportation (km/truck)

$PE_{power,y}$ Emissions

AMS-III.AO Version 1.0 states that

"if recovered biogas is used to power auxiliary equipment of the project it should be taken into account accordingly, using zero as its emission factor."

Within the project activity recovered biogas is used to power auxiliary equipment. Therefore;

$$PE_{power,y} = 0$$

$PE_{res\ waste,y}$ Emissions

As per the AMS-III.AO, "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"."

Within the project activity, residual wastes from the digesters are stored in open lagoon, and from there they are spread to the farm field as bio-fertilizer. Hence there is no anaerobic storage into a disposal site, therefore project emission from residual waste is accepted as zero.

$$PE_{res\ waste,y} = 0$$

$PE_{phy\ leakage,y}$ Emissions

As per the AMS-III.AO,

"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 m^3 biogas leaked/m^3 biogas, y) shall be estimated using a default factor of 0.05 m^3 biogas leaked/m^3 biogas produced. For ex ante estimation the expected biogas production of the digester may be used, for ex post calculations the effectively recovered biogas amount shall be used for the calculation." Leakage calculations are provided in the associated excel file.

$PE_{flaring,y}$ Emissions

AMS-III.AO Ver. 1.0 refers to the "Tool to determine project emissions from flaring gases containing methane" for project flaring emission reduction. The latest version of this tool is "Tool 06: Project emissions from flaring" [52], version 04.0. According to the Tool 06, following steps applied to calculate project flaring emission.

a) STEP 1: Determination of the methane mass flow of the residual gas;
b) STEP 2: Determination of the flare efficiency;
c) STEP 3: Calculation of project emissions from flaring.

STEP 1: Determination of the methane mass flow of the residual gas;

STEP 1 refers to the „Tool 08: Tool to determine the mass flow of a greenhouse gas in a gaseous stream, Version 03.0"[53] for the determination of the methane mass flow.

As per the Tool 08, methane mass flow ($F_{CH4,t}$) is calculated by using the following formula:

$$F_{i,t} = V_{t,db} \times v_{i,t,db} \times \rho_{i,t}$$ [54]

where,

$F_{i,t}$	Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h). The same value ($F_{CH4,RG,y}$) stated in the $PE_{flare,y}$ equation
$V_{t,db}$	Volumetric flow of the gaseous stream in time interval t on a dry basis (m^3 dry gas/h)
$v_{i,t,db}$ ($v_{CH4,t,db}$)	Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m^3 gas i/m^3 dry gas), i: CH4
$\rho_{i,t}$	Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i/m^3 gas i),

[52] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v4.0.pdf.
[53] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v3.0.pdf.
[54] Tool 08, p.8 and EB102_repan06_Tool06.xls, Step 1 (b) sheet.

$\rho_{i,t}$ value is taken as 0.716 kg/m3[55]

The formula is also present in the Tool 06 excel sheet, EB102_repan06_Tool06.xls[56].

As per the Tool 08, $V_{t,db}$ and $v_{i,t,db}$ are the monitoring parameters.

STEP 2: Determination of the flare efficiency;

Mramorak 1&2 plants flare units are enclosed type. As per the Tool 06, to determine the flare efficiency, "Option A: Apply a default value for flare efficiency" option is chosen. As per this option A, flare efficiency is accepted as 0%.

Project emissions from flaring, as per the Tool 06, are calculated by using the following formula:[57]

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

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)
$F_{CH4,RG,y}$ ($F_{CH4,t}$)[58]	Mass flow of methane in the residual gas in the minute m (kg);
$\eta_{flare,m}$	Flare efficiency in the minute m

[55] EB102_repan06_Tool06.xls, "Constants Used in Equations" sheet. https://cdm.unfccc.int/methodologies/PAmethodologies/EB102_repan06_Tool06.xlsx
[56] https://cdm.unfccc.int/methodologies/PAmethodologies/EB102_repan06_Tool06.xlsx
[57] Tool 06, p.13.
[58] $F_{CH4,t}$ is not a monitoring parameter as per the Tool 08.

As a note, in the project activity, there is no flaring within the normal operation of the project. Flaring chamber is available, but it is only used in case of digesters goes through maintenance. Since it is only used for emergency purposes, for simplification and to be on the conservative side, $F_{CH4,,y}$ is accepted as the maximum combustion capacity of the flare chamber.

Hence, project emission of the project activity as per AMS-III.AO:

$$PE_y = PE_{transp,} + PE_{phy\ leakage,y} + PE_{flaring,y}$$

For the project activity, there are no other sources of project emissions that will require the use of "Tool 03: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion". Project activity's only source of CO2 emission from fossil fuel combustion is transportation which is already calculated by the $PE_{transp,y}$ equation.

As per the AMS-I.D projects emission of the project activity is as follows:

AMS-I.D. states that "For most renewable energy project activities, PEy = 0." Therefore, project emission that comes from renewable energy generation component of the project activity is taken as zero

Hence;

Mramorak1&2 project emissions as per AMS-III.AO and AMS-I.D:

$$PE_y = PE_{transp,} + PE_{phy\ leakage,y} + PE_{flaring,y}$$

Project emission calculations are provided in the associated excel file (Mramorak1&2_ER_Calculations.xls).

16.3 Leakages

As per the AMS-III.AO, "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)."

Project activity did not transfer any equipment from another activity, they are all brand newly constructed. Therefore, leakage emission is accepted as zero.

$$LE_y = 0$$

As per AMS-I.D. in Section 7 states that “The methodology is applicable to a program of activities, no additional leakage estimations are necessary other than that indicated under leakage section above.”

Project activity does not use biomass, and does not claim CO2 emission reduction from the plant residues; therefore leakage of the project activity is taken as zero as per AMS-I.D.

16.4 Net GHG Emission Reductions / Removals

Quantification of Net Emission Reductions

Project net emission reduction is as follows:

Net GHG Emission Mitigations are calculated as follows:

$$EM_y = BE_y - PE_y - LE_y$$

where:

EM_y = Net GHG Emissions Mitigations in year y (tCO_2-e)

BE_y = Baseline emissions in year y (tCO_2-e)

PE_y = Project emissions in year y (tCO_2-e)

PL_y = Project leakage in year y (tCO_2-e).

BE_y, baseline emissions based on AMS-III.AO and AMS-I.D.

Emission reduction achieved by the project activity is as follows as per the AMS-III.AO:

To determine baseline emission, AMS-III.AO states to make ex-post calculation through direct measurement of the amount of biogas fueled, flared or gainfully used. “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. Qy, and fossil fuels/electricity used). The emission reductions achieved in any year are the lowest value of the following:”

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

As per this formula, baseline emission value will be taken the lowest one.

As it can be seen in the attached file (Mramoak1&2_ER_Calculations.xls), MD_y-$PE_{y,power,expost}$ is much higher than $BE_{y,ex\ post}$-$PE_{y,\ ex\ post}$-$LE_{ex,post}$,

Hence, finalized emission reduction calculation is deducted as follows (leakage is taken as zero as per the applicable methodologies):

$$\mathbf{EM_y = (BE_{SWDS,y} + BE_{manure,y} + BE_{elect,y}) - (PE_{transp,} + PE_{phy\ leakage,y} - PE_{flare,y}) - LEy}$$

Emission reduction calculations are provided in the attached emission reduction excel file.

Year	*Baseline emissions / removals (tCO_2e)*	*Project emissions / removals (tCO_2e)*	*Leakage emissions (tCO_2e)*	*Net GHG emission reductions / removals (tCO_2e)*
24/06/2020-31/12/2020	6,102	1,191	0	4,911
01/01/2021-31/12/2021	26,758	3,975	0	22,783
01/01/2022-31/12/2022	28,502	4,558	0	23,943
01/01/2023-31/12/2023	28,628	4,610	0	24,018
Total	89,990	14,334	0	75,655

16.5 Comparison of actual emission reductions with estimates in the project document

Comparison of actual emission reductions with estimates is given below table:

Year	*Ex-ante estimation (tCO2)*	*Monitored impacts (tCO2)*	*%*

24/06/2020-31/12/2020	6,138	4,911	-24.98%
01/01/2021-31/12/2021	21,045	22,783	7.63%
01/01/2022-31/12/2022	24,107	23,943	-0.68%
01/01/2023-31/12/2023	24,374	24,018	-1.48%
Total	75,664	75,655	-0.01%

16.6 Remarks on difference from estimated value in the registered project document

Explanation on difference from estimated value in the registered document is provided in the following table.

Year	*%*	*Explanation*
24/06/2020-31/12/2020	-24.98%	In 2020, there was no food waste received by the project activity, however in the ex-ante estimation food waste was included for each year within the crediting period. Therefore, ex-ante value is higher than the monitored impact.
01/01/2021-31/12/2021	7.63%	There are many parameters that caused difference in ex-ante estimation and monitored impacts, such as net electricity generation, amount of food waste received, number of animals, average distance that the trucks traveled to carry manure, food waste and digestate, etc. All these parameters, depending in their values for that specific year, has increasing or decreasing effect on comparison value (%).
01/01/2022-31/12/2022	-0.68%	
01/01/2023-31/12/2023	-1.48%	
Total	-0.01%	There are many parameters that caused difference in ex-ante estimation and monitored impacts, such as net electricity generation, amount of food waste received, number of animals, average distance that the trucks traveled to carry manure, food waste and digestate, etc. All these parameters, depending in their values for that specific year, has increasing or decreasing effect on comparison value (%). The total effect has been found as -0.01% which can be stated as a very low difference.