Pilot plant for biogas production
Seini City, Maramureș County

REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT

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Non-technical summary

„Pilot plant for biogas production in Seini City”, is following the achievement of three main objectives:

- To reduce the pressure exercised on environment as a result of providing a better management for the organic wastes resulted from farming activities (from the individual households, but also from the private companies)
- Energy production (electrical and thermal) using as raw materials organic biomass (animal waste – manure and energy crops);
- Developing of a demonstrative frame regarding the good practices in this field.

The investment is financed by the Ministry of Environment and Climate Change – Project Management Unit “Integrated Control of Nutrient Pollution”, project financed by GEF/World Bank, International Bank for Reconstruction and Development and co-financed by the Romanian Government.

With reference to the biogas producing activity, it must be emphasised that a biogas plant, is a complex installation, consisting of a variety distinct elements. A biogas plant operation depends widely on the type and quantity of used raw materials.

Since a large variety of materials, of different origin, may be used as raw material in the digestion process occurring in a biogas plant, there are, consequently, various techniques for treatment of this raw materials and various construction approaches for the digesters and the operational systems.

Furthermore, depending on the biogas plant type, size and operational conditions, different technologies for conditioning, storage and biogas utilisation can be adopted.

As regarding the digestate storage and utilisation, there are mainly oriented to the usage as fertiliser.

The operation of a biogas plant can be described by four major steps:

- **Transport, delivery, storage and if it is the case, pre-treatment of raw materials.**
  The raw material (substrates) is represented by animal wastes – manure and energy crops (maize or sorghum silage); after harvesting, the vegetal crops are chopped and then stored in silos, accommodated on the biogas plant platform, with no other treatment required before being fed into digester. Also, to provide the necessary microorganisms for the fermentation process, the digesters will be primary filled with manure, and after with the silage will be added. The ratio of manure from the total substrate quantity will vary after the start-up, depending on the digestion process parameters until the optimum quantity is determined.

- **Biogas production** - in case of the analysed investment the biogas is produced by anaerobic digestion process undergoing in a fermentation tank (digester)

- **Treatment (especially desulfurization) and biogas storage.** In the case of the studied development, the resulted biogas will be stored within the available gasholder capacity (digester roof) and it will be used for electricity and thermal energy production directly on site. Before burning in the cogeneration unit, the biogas will be desulfurized directly in the digester through specific biological process and the advanced purification will be achieved an activated carbon filter unit.

- **Digestate storage and management.** The digestate will be processed in a liquid-solids separator; the liquid fraction will be stored in the existing basins on the plant site and will be used as fertiliser for agricultural crops. A part of the solid fraction will be dried and packaged and the rest will be stored on the special designed platform. All solid fertiliser will be used as high quality fertiliser.
Constructionally the development requires the settlement of the following components/units:

- **Digester feeding unit**, consisting of:
  - Storage tanks for liquid manure;
  - Substrate feeding system (for liquids and solids);
  - Storage platforms for energy crops and solid manure.

- **Electricity and heat cogeneration unit**: represents the technological unit that allows biogas valorisation through electrical and thermal energy production. The cogeneration unit is a complex functional installation with a capacity of 0.37 MW electric. The cooling engine circuit with the provided heat exchanger associated to exhausting burning gasses will allow heat recovery (0.47 MW).

- **Installations automation and control system**, is represented by a recording and controlling system for fermentation process and biogas production parameters (gas quantity – development curve), temperature in the fermenter, recorded data from the biogas analyser (CH₄, O₂, H₂S etc.) and electricity (frequency, voltage, hours of operation of the cogeneration unit, etc).
  - **Technical building**
  - **Weighbridge**
  - **Plant networks**:
    - Water supply system
    - Sewage system
    - Roads;
    - Low voltage electricity line to supply electricity in the national grid network.

As regards the operation, in the analysed investment two distinct types of activities will take progress:

- Biogas production by the anaerobic fermentation of wastes
- Electricity and heat generation using the resulted biogas as fuel

The biogas plant will be built in the South part of Seini City, on the location of a former wastewater treatment plant, that belonged to the near located agrozootechnical establishment (the old wastewater treatment system included also a plant for biogas production).

The raw material that will be used is consisting from manure from animal farms (waste code 02 01 06) resulted from pig, cattle and poultry farms, and silage, produced from energy crops (maize or sorghum). Also, the biogas plant will be able to treat the manure collected from individual householders and stored on the manure platform build also within the project “Integrated Control of Nutrient Pollution” financed by GEF/World Bank, International Bank for Reconstruction and Development and cofinanced by Romanian Government.

Temporary storage of these materials / wastes will be accomplished on site, before their treatment by mesophilic anaerobic fermentation (approx. 38 – 42 °C). The fermentation product are the biogas, which is used on site for the generation of electricity and heat, and the fermented sludge (digestate), which will be further treated on site also by liquid –solid separation.

A part from the separated solid digestate will be dried – using the recuperated heat from the cogeneration unit, and the rest will be temporary stored on a platform on site. The liquid digestate (after the solid-liquid separation), the solid fraction (wet) and the dried solid represent output materials as agricultural fertilizers.

The liquid sanitary effluents, resulted from the social groups are collected in an emptying tight basin, and disposed to an authorised treatment plant.

Solid or liquid wastes, others then those related to process materials flows, generated on biogas plant site, will be collected and disposed by authorised operators.
The electricity produced on site will be supplied to national energy grid (SEN), based on a convention signed with the local distribution operator, Electrica Nord Vest.

The material resulted after the anaerobic fermentation (digestate) will be separated in two fractions (liquid and solid) on site. The solid fraction will be further dried using the heat recovered from the cogeneration engine. Finally, the digestate (liquid, solid, dried) will be used as agricultural fertiliser.

The maximum waste treatment capacity of this biogas plant is (in tons/year):

- Energy crops (silage) – 2000 tons
- Manure (pig) – 5000 tons
- Manure (cattle) – 8000 tons
- Manure (poultry) – 5000 tons

For this plant a daily feeding rate is associated to this maximum treatment capacity, respectively 54.79 tons/day: 49.31 tons/day manure and 5.78 tons/day energy crops. The daily feeding diet (waste mixture - ratio) may vary as result of many parameters.

For this input the following system output are associated:
- Liquid digestate (3% d.m. content) – 15.150 m³/year
- Solid digestate (raw) – 5.835 ton/year, from which:
  - Solid fertiliser (dried) – 1.200 tons/year
  - Wet solid fertiliser (compost) – 2.335 tons/year

Yearly estimated biogas production is around 1.527.445 m³/year, and its valorisation will lead to a production of approximately 2.923.000 kWh/year electricity, from which after subtracting the plant self-consumption and losses, results approximately 1.400.000 kWh/year electricity supplied to SEN.

**Forecasted impact**

The investment development will have a positive impact on environment not only with respect to environmental standards conformation but also on the sanitary, sanitary-veterinary, phytosanitary and not the least, sanitary aspects.

By using the certified practices in this field, an evaluation of impact in an analytical manner has been conducted (for each environmental component, analysing both negative and positive aspects concerning the objective activity), including also the comparative evaluation between the ideal environmental state and the possible generated state as a result of the activities characteristic to this project. The pollutants evacuated into environment were estimated and compared to the limits admitted by current in-force legislation.

The proposed project will conduct to a sustainable improvement of the existing practices of manure management in the administrative area of Seini City, consisting in:

- a better knowledge and implicitly a better control of this wastes generation and ulterior valorisation as fertiliser, by weighting, and flows control;
- an improved control of nutrients doses/diets (nitrogen, phosphorous, potassium) administered on agricultural lands and consequently risk reduction regarding pollution of water bodies with nitrates;
- significant odour reduction related to unfermented manure land administration;
- a significant reduction of greenhouse gases emissions;

It can be considered that, global environmental benefits, associated to construction and operation of the proposed biogas plant for biogas production are highly exceeding the negative effects.
Among these positive aspects it can be mentioned:

- reduction of local contribution to global warming (in Romania methane emission represents 16% from total emissions at GES inventory in 2002) – by destruction of methane and reduction of greenhouse gases emissions associated to electricity production from fossil fuels (equivalent for the obtained production).
- improvement of air quality in the area by controlling of odour generator gasses, like ammonia and sulphur compounds;
- a significant reduction of pathogens release in the environment as a result of microbiological sterilisation effect of the anaerobic fermentation;
- improvement of underground water quality;
- providing of an alternative source of renewable energy, that will improve energetic security and contributes to green economy.

Social and economic benefits associated to this project:

- a new source of income for the local budget;
- new jobs;
- local contribution to governmental policies objectives achievement regarding the energy production from renewable sources;
- an improved public image of local administration;
- a focal centre for training and information and good practices dissemination in this field.

The direct or indirect negative effects on environment associated to construction and operation of the proposed biogas plant are insignificant.

Thus, it can be concluded that the activity associated to the objective “Pilot plant for biogas production” will affect the environment within admissible limits.
Chapter 1 Introduction

1.1 Information about project beneficiary

Beneficiary name: Seini City Hall

Beneficiary address, phone, fax, email address
Piața Unirii no. 16, Seini City, Maramureș County, code 435400
Phone: 0262 491 090
Fax: 0262 491 000

Name of the contact person: Tulbure Gabriela Florica – Mayor

1.2 Certified Author of the report on Environmental Impact Assessment

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1.3 Project name

„PILOT PLANT FOR BIOGAS PRODUCTION”

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1.4 Context and opportunity

In Romania, the identification of vulnerable or potentially vulnerable areas to the pollution with nutrients was performed by “National Research and Development Institute for Soil Science Agro-Chemistry and Environment - ICPA” together with “Romanian Waters” National Administration. The list of localities, for each county, where there are nutrients from agricultural sources and also the list of localities from the hydrographical basins/areas where there are nitrates sources from agricultural activities (vulnerable and potentially vulnerable areas) were

Seini City is included on the list of localities vulnerable to the pollution with nutrients, code Siruta 108963, the agricultural waste amounts and their impact on the environment justifying the necessity of implementation of specific measurements destined to improve the social and environmental factors of the locality. For this purpose, one of the measures of the Sustainable Development Actions Plan for this area is the “development of alternative energy production systems based on existing renewable energy potential” aiming the reduction of pollutant emissions resulted from existing industrial activities and the reduction of greenhouse gases emissions.

Ministry of Environment and Climate Changes through signing and implementation of „Integrated Nutrient Pollution Control” financed by GEF (Global Environment Facility)/World Bank, International Bank of Reconstruction and Development and cofinanced by Romanian Government, committed to implementing of a measurements plan intended to reduce the pollution with nutrients from agricultural sources. Thus, for the implementation of this Directive, Romania designated, in two distinct phases, a number of 32 areas vulnerable to the pollution with nutrients, which represents 60 % of the total territory area, including 1963 localities. Moreover, Romania updated, in December 2008, the Code of Good Agricultural Practices (CoGAP), including specific measurements in accordance with Nitrate Directive requirements.

Seini, one of the localities designated as vulnerable area to the pollution with nitrates, is eligible for the investment programme implementation for the development of for development of construction works necessary for collection, temporary storage, treatment and utilisation of manure as organic fertiliser, in accordance with provisions of “Code of Good Agricultural Practice (CoGAP) for protection of water bodies against pollution caused by nitrates from agricultural activities” approved by Order no. 1182/22.11.2005 of Ministry of Environment and Water Management, whose provisions are mandatory in the areas designed as vulnerable to the pollution with nitrates.

The main objective of this project is the development of a biogas facility to demonstrate the feasibility of treating manure in order to obtain electricity and heat, through cogeneration, using the resulted biogas as fuel.

Subsidiary, project implementation will promote a new institutional concept regarding manure management at territory administrative unit (TAU) level through partial assumption of responsibilities for the management of this wastes category by the public authority.
Chapter 2 Scope of the Environmental Impact Assessment

In Romania, according to provisions of Emergency Ordinance no. 195/2005, approved by 265/2006 (Environmental Law), article 11, for any new development, including for plants like the one proposed by the currently analysed project, it is necessary to apply for the obtaining of an Environmental Agreement.

According to legal wording, article 11 point 2, “For the obtaining of the environmental agreement, public or private projects that may have a significant impact on environment, by their nature, size or location, are subjected, by decision of competent authority for environmental protection, to environmental impact assessment”.

Framing stage for these investments is developed in accordance with provisions of Governmental Decision no. 445/2009 regarding the establishment of frame-procedure for environmental impact evaluation of public and private projects and of Environment Ministry Order no. 135/2010 regarding the approval of environmental impact evaluation methodology for public and private projects.

According to provisions of G.D. 445/2009, the scopes of projects can be framed in Annex 1: List of projects subjected to EIA and/or to Adequate Evaluation for the assessment of potential impact on Natura 2000 areas, or Annex 2: List of projects that requires the accomplishment of framing procedures for the EIA and/or Adequate Evaluation for the assessment of potential impact on Natura 2000 areas.

Thereby, the classification procedure is controlled by the environmental protection agency and the decision is either in favour of a complete EIA, with or without an Adequate Evaluation, either for a simplified EIA, with or without an Adequate Evaluation.

The used criteria by the environmental protection agency during the framing stage, as provisioned by G.D. 445/200, are listed in Annex 3 of the decision. This are used to analyse, case by case, the particularities of each environmental agreement application.

The Environmental Agreement and the application for this permit belongs to a set of permits and approvals issued by the authorities, that will be obtained before the Building Permit issuance, in order to achieve the approval of a project effective implementation. The list of this permits and approvals is stated in the Urbanism Certificate.

The initial documentation required to apply for the issuance of the Environmental Approval are:

- Notification of project development realisation – according to Environment Minister Order no. 135/2010, Annex 1;
- Copy of urbanism Certificate, including development location and configuration.

These documents are necessary to go through project screening phase at environmental authorities level. If it will be decided after this stage that Environmental Impact Assessment procedure with or without Adequate Evaluation must be followed, a third document will be elaborated and submitted to environmental authorities:

- Presentation memorandum, according to specifications and norms of Minister Order 125/2010, Annex 5.

The Presentation Memorandum represents the information base regarding the scoping stage of the procedure. After the framing stage, if it will be decided to be necessary (if the potential impact on environment will be considered as significant) the complete EIA procedure will be followed, and consequently there will be developed and submitted the:

In case the impact on environment will be considered insignificant, in this stage (of the framing decision), the authorities for environmental protection will issue an administrative document (Framing Decision), which stipulates the rules and conditions that allows the project development.

Otherwise, the projects follow the EIA procedure which ends, if the conditions are being accomplished, with the issuance of the Environmental Approval.

The entire procedure is public and transparent – each procedural stage is publically notified in press, local announcements, and internet and the documentations and technical information are available.

It must be emphasised that, in Romania the procedure for obtaining the Environmental Approval corresponds and is according to the requirements for the EU countries imposed by:

- Directive 85/337/CEE modified by the Directive 97/11/CE of the Council. This directive is applied to evaluate the effects on environment of public and private projects with high probability to have significant effects. The directive from 1997 expanded the implementation filed of the EIA Directive as a result of increase of aimed project categories and of the projects number that requires mandatory evaluation of the environmental impact (Annex I). Also, the Directive endues new selection conventions, including new selection criteria (Annex III) for the projects of Annex II, and settled the minimal information requirements. Directive 97/11/CE brought the Directive in accordance with Espoo UNECE Convention regarding EIA in a transfrontier context.


On the other hand, for the Pilot plant for Biogas production in Seini, considering the financing mechanism, that implied the participation of World Bank, the provisions of 4.01 Operational Policies on Environmental Assessment from the Procedures Manual are applicable.

According to Bank’s policies definitions and objectives:

- EA is a process with dimension (expansion) and analysing procedure depending on the nature, size and potential environmental impact of the proposed project. EA evaluates the potential risks and environmental impact of a project in its area of influence; the projects proposed for the financing requires the environmental assessment to provide the certitude that those projects are sustainable and ecological.

- EA concerns the natural environment (air, water, soil), population health and safety, social aspects (involuntary displacements, native population, cultural resources), examines project alternatives, identifies the possibilities of project improvement including: location, planning, design and implementation, through prevention, minimisation, attenuation or compensation of negative effects on environment and the positive impact and includes the mitigation process and negative effects management during the entire project implementation phase.

- The Bank encourages the prevention measurements over the effects mitigation or compensational measurements, in any case possible.

Starting from these principles, the terms of reference for the analysed project provided, even from the design services acquisition phase, the necessity of an environmental assessment.
Chapter 3 Legal frame and applicable regulations

In this section there are punctually summarised and analysed the legislative package applicable to project development, for the fields with direct implications in the design and operational activities of the future plant.

Thus, some specific regulation categories may be distinguished:

- Prevention of nutrients pollution;
- Organic waste management at locality level and sanitization regulations;
- Animal waste anaerobic treatment;
- Energy production using renewable resources;
- Potential future development of the project and applicable IPPC regulations.


Seini City is included on the list of localities vulnerable to the pollution with nutrients, the agricultural waste amounts and their impact on the environment justifying the necessity of implementation of specific measurements destined to improve the social and environmental factors of the locality. For this purpose, one of the measures of the Sustainable Development Actions Plan for this area is the “development of alternative energy production systems based on existing renewable energy potential” aiming the reduction of pollutant emissions resulted from existing industrial activities and the reduction of greenhouse gas emissions.

The instrument that implements this Water Frame Directive in Seini City area is represented by the Management Plan of Someș – Tisa Hydrographical Area, elaborated by the Someș – Tisa Water Basin Administration. In Chapter V of the up-mentioned Management Plan is presented the identification and mapping of protected areas including areas vulnerable to nitrates pollution.

Starting from underground water body mapping, by Order 137 of 26 February 2009 laying down the approval of cut-off values for Romanian underground water bodies, the references values for the main quality indicators of underground water, including the values for the ammonium ion concentration in Seini area were established.

In our country, the identification of vulnerable or potentially vulnerable areas to the pollution with nutrients was performed by “National Research and Development Institute for Soil Science Agro-Chemistry and Environment - ICPA” together with “Romanian Waters” National Administration, and considering the provisions of G.D. 964/200 laying down the approval of Action plan concerning the protection of water bodies against pollution caused by nitrates from agricultural sources, transposing the Directive (EC) 91/676/EEC to Romanian legislation.

The list of localities, for each county, where there are nitrates from agricultural sources and also the list of localities from the hydrographical basins/areas where there are nitrates sources from agricultural activities (vulnerable and potential vulnerable areas) were approved by common Order no. 241/26.03.2005/196/07.04.2005 of the minister of environment and water management and minister of agriculture, forests and rural development.

Seini City is presented on the approved list by the up-mentioned order, under the code Siruta 108963, which makes this locality eligible for the implementation of the investment programme for development of construction works necessary for collecting, temporary storage,
treatment and utilisation as organic fertiliser of manure, in accordance with provisions of “Code of Good Agricultural Practice (CoGAP) for protection of water bodies against pollution caused by nitrates from agricultural activities” approved by Order no. 1182/22.11.2005 of Ministry of Environment and Water Management, whose provisions are mandatory in the areas designed as vulnerable to nitrates pollution.

It must be mentioned that, in the Seini City, there were implemented the Fertilisations Plans – by the agricultural land owners. Also, the Local Council Decision no. 23/2011 approved the Local action plan regarding the protection of waters against nitrates pollution.

a. Regulations regarding wastes

According to Law 211/2011 provisions regarding wastes, Article 2 lays:

(1) the following are excluded from this Law applicability field:

f) faecal materials, in case these are not under the incidence of paragraph (2) letter b), straws and other vegetal non-hazardous waste resulted from agriculture or sylviculture and that are used in agriculture or sylviculture or for energy production from biomass by processes or methods that do not harm the environment and do not jeopardize population health.

(2) the following are excluded from this Law applicability field, as far as they are regulated by other normative:

b) animal by-products, including altered products, that are under the incidence of (EC) Regulation no. 1.774/2002 of European Parliament and of the Council form 3 October 2002 that establishes the sanitary norms regarding by-products of animal origin not destined to human consumption, excepting the products that will be incinerated, stored or used in a biogas plant or a composting plant: .

This formulation of the legal text (identical in form and fund with the text of the EC Directive 2008/98 regarding wastes) leads to the conclusion that vegetal biomass used as raw material in a fermenter is not a waste, and animal wastes (manure) are considered and assimilated as wastes, in this case, non-hazardous.

As a consequence, the entire manure waste management process will need to meet not only the requirements applicable to animal wastes and by-products, but also the requirements specific to wastes, HG 856/2002 respectively, regarding the recording of waste and all legislative documents with subsequent effects.

b. Regulation regarding animal waste and by-products

Manure is material of animal origin subjected to a special regulation regime.

REGULATION (EC) no. 1069/2009 of THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Animal by-products Regulation) has the following references of interest related to this project.


REGULATION (EC) no. 1069/2009 of THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002, provision that animal wastes are included in category 2 of raw materials (article 5,

1 (EC) Regulation no. 1.774/2002 was abrogated and replaced by the 1069/2009 Regulation.
paragraph 1, letter a), manure and digestive tract content), defined as “any excrement and/or urine of farmed animals, with or without bedding or guano, that may be untreated or treated according to chapter III from Appendix VIII or treated in the biogas production plants”.

According to article 5, paragraph 2, letter e), “the manure, in case the competent authority does not consider it to present a risk for the spread of any serious transmissible disease” may be used “with no treatment as raw material in a biogas or compost plant approved according to article 15 or treated in an approved technical installation for this purpose, according to article 18”.

According to article 15, paragraph 3, the manure storage for the purpose of its usage as raw material in a biogas plant may be accomplished with no use of intermediary installations. The regulation also provisions the possibility of exempting the manure from the collecting and transport conditions required within paragraph 7 of the regulation; this exception may be applied in this case, taking into consideration that bacteriological risk (of any kind) is not estimated.

d. Regulations regarding the promotion of renewable energy imposed by Directive 2009/28/EC of the European Parliament and of the Council of Europe of 23 April 2009 on the promotion of renewable energy, ratified by Romania by Law no. 220/2008 as amended, which sets clear targets for our country in terms of production of electricity from renewable sources, including by using biogas plants, stating that the biogas production is indissolubility related to energy production.

By Romanian Energy Strategy for the period 2007 – 2020 approved by the Government Decision no 1069/2007, our country assumed as Strategic Objectives the national targets level regarding the share of electricity produced from renewable resources (E-RES) from the total gross electricity consumption in the perspective of 2010, 2015 and 2020, as, respectively, 33%, 35% and 38%.

Also, in accordance with article 4, paragraph (3) of Directive 2009/28/CE, National Action Plan in the field of E-SRE, was elaborated and presented to European Commission by Romanian authorities in September 2010, which reiterates Romanian commitment to achieve the national targets level regarding the share of electricity produced from renewable resources from the total gross electricity consumption in the perspective of 2010, 2015 and 2020, as, respectively, 33%, 35% and 38%.

For the accomplishment of national Objectives, even since 2004, Romania adopted, in order to promote the production of renewable energy the system of mandatory shares combined with green certificates (GC) transaction, approved by Government Decision no. 1892/2004 for the assessment of the promotion system of renewable energy production, with modifications and ulterior addenda.

In November 2008 it was adopted Law 220/2008 for the system of promotion energy production from renewable energy sources, which improved the existing promotion system through green certificates, thus increasing the attractiveness for the investors.

The biogas production plant in Seini was developed and designed in a manner that its operation will allow the enframing in the promotion scheme of E-RES.

Additional to the above described regulation mechanism, in order to benefit from the support scheme, for each generator of organic degradable matter supplied as manure or vegetal matter (energy crops) will be necessary the issuance of certificates regarding the material origin, respectively the enforcement of Agriculture Minister Order no 46 of 5 March 2012 provision, laying down the approval of the procedure of Origin Certificate issuance for the biomass resulted from agricultural or related activities, used as raw material or combustible for the electricity production.

e. Regulations regarding local sanitization.

According to the provisions of Law 101/25 April 2006 of the localities sanitization, among the responsibilities of the localities sanitation services, there is also: „collecting, transport and neutralising of animal wastes resulted from population households”.

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Currently, Seini City has approved the Regulation regarding Public Sanitization Service Organization by HCL (Local Council Decision) no. 2/2010. This regulation, refers to municipal waste sector and similar, and do not apply to animal waste (manure) resulted from the population households.

Local regulation of this issue will be correlated with the implementation of analysed project activities.

f. IPPC Framing

The development and operation of the biogas plant Seini is under the provisions of the GD no. 455/2009 regarding Environmental Impact Assessment of certain public and private projects, being framed in Appendix no. 2, point 3 Energetic industry, letter a. industrial installations for electricity, thermal energy and technological steam, others that those from Appendix no. 1, and under point 11. Other projects, letter b. waste eliminations installations, other than those mentioned in Annex no.1.

Considering the possibility of upgrading the treatment capacity of this biogas plant (as a result of a higher absorption degree of the generated manure within the administrative territory and the possibility of diversifying the waste categories undergoing anaerobic fermentation), the design concept started from the beginning in respect to accomplishing the specific requirements of a plant under the provisions of Emergency Ordinance 152/2005 regarding the Prevention and integrated pollution control.

In order to facilitate the accomplishment evaluation of the specific conditions for an IPPC plant, the applicable requirements for this type of activity in accordance with the interpretation from Best Available Techniques from BREF document Best Available Techniques in the Slaughterhouses and Animal By-products Industries- 2005 are presented, synthetized in the following table.

BAT/BREF Comparative analysis

<table>
<thead>
<tr>
<th>Process and general operations</th>
<th>Conformity degree</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses a planned maintenance programme</td>
<td>• applied</td>
<td>In actual conditions - regarding the production capacity/estimated operation incomes/technological equipage/ specific conditions for emplacement, plant is BAT.</td>
</tr>
<tr>
<td>A programme for quantifying water consumption in the technological process and separately for non-process activities will be applied.</td>
<td>• applied</td>
<td>The designed plant, subjected to the approval is abiding the requirements regarding the process and general operations.</td>
</tr>
<tr>
<td>The accumulation of solid materials in the sewage system is prevented</td>
<td>• applied</td>
<td></td>
</tr>
<tr>
<td>The vehicles and transport machineries are cleaned using pressure water and hoses equipped with manual releasers</td>
<td>• applied</td>
<td></td>
</tr>
<tr>
<td>The storage basins are equipped with protection system in case of overflow</td>
<td>• automatized control applied</td>
<td></td>
</tr>
<tr>
<td>It is implemented a management system for energy consumption (for the refrigeration systems, heat recovery, thermostatic control</td>
<td>• non-applicable (it is not the case)</td>
<td></td>
</tr>
<tr>
<td>Proper insulation of water and steam pipelines</td>
<td>• applied</td>
<td></td>
</tr>
<tr>
<td>A management system for working spaces lighting is implemented</td>
<td>• not applied</td>
<td></td>
</tr>
<tr>
<td>The design and execution of equipment and installations allows facile cleaning</td>
<td>• applied</td>
<td></td>
</tr>
<tr>
<td>Storage, working and handling areas are frequently cleaned and hygienized</td>
<td>• applied</td>
<td></td>
</tr>
<tr>
<td>A control and noise reduction system is implemented</td>
<td>• not applied (only periodical monitoring)</td>
<td></td>
</tr>
<tr>
<td>Liquid fuel is replaced as possible with natural gas</td>
<td>• not applicable(it is)</td>
<td></td>
</tr>
</tbody>
</table>
### BAT - according to BREF formulation (2005)

<table>
<thead>
<tr>
<th>Item</th>
<th>Conformity degree</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Process generated heat (if it is the case) is used on site or in the adjacency</td>
<td>not the case)</td>
<td>• applied</td>
</tr>
<tr>
<td>• animal by-products are transported, handled and stored with proofed/closed systems</td>
<td>• applied (liquid manure and digestate, in vats, solid manure with covered trailers)</td>
<td>Using covered transport machineries and of proofed storage tanks. All the storage tanks and technological vessels (digester) are covered and proofed.</td>
</tr>
<tr>
<td>• Offering professional training</td>
<td>• applied</td>
<td>Periodical training of employees will be considered as a condition for Environmental Permit approval.</td>
</tr>
<tr>
<td>• Periodically it is done an audit for odours emissions</td>
<td>• It will applied in case of a capacity upgrade</td>
<td>Odours monitoring programme will be established in the authorisation phase.</td>
</tr>
</tbody>
</table>

### It is implemented an Environmental Management System (EMS)

<table>
<thead>
<tr>
<th>Item</th>
<th>Conformity degree</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>• It is defined an environmental protection policy</td>
<td>• The opportunity of implementing a EMS was not yet considered</td>
<td>The development and implementation of a EMS is pre-conditioned by the institutional organisation of operation. If it is considered necessary, this will be requested by the Environmental Authorisation.</td>
</tr>
<tr>
<td>• System and operational procedures are established and implemented</td>
<td>• Institution of an environmental management system</td>
<td></td>
</tr>
<tr>
<td>• The criteria of performance regarding EMS are defined</td>
<td>• Temporary nonconformity with the requirements</td>
<td></td>
</tr>
<tr>
<td>• System performance is monitored</td>
<td>• EMS is certified within an accredited system (for instance ISO 14001 or EMAS)</td>
<td></td>
</tr>
<tr>
<td>• The elaboration of an adequate maintenance plan</td>
<td>• Temporary nonconformity with the requirements</td>
<td>It will be provided as a condition for the release of Environmental Authorisation</td>
</tr>
</tbody>
</table>

### Collaboration with upstream and downstream activities

<table>
<thead>
<tr>
<th>Item</th>
<th>Conformity to the request</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>• It is developed a collaboration mechanism with the upstream and downstream partners, to create an environmental responsibilities chain, to minimise the pollution and to protect the environment as a system</td>
<td>• Conformity to the request</td>
<td>The collaboration and coordination mechanism of the upstream and downstream activities is already implemented formally and it will be adapted to new institutional conditions (Local action plan to prevent water pollution with nitrates)</td>
</tr>
</tbody>
</table>

### Equipment mounting and cleaning

<table>
<thead>
<tr>
<th>Item</th>
<th>Conformity to the requirements</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Water and detergents quantities are controlled and reduced</td>
<td>• applicable after implementation</td>
<td>Conformity to the requirements</td>
</tr>
<tr>
<td>• Detergents with minimum environmental impact are used with no alteration of cleaning process efficiency</td>
<td>• applicable after implementation</td>
<td>Conformity to the requirements</td>
</tr>
<tr>
<td>• If the equipment is adequate, it is operated as CIP (clean in place) system</td>
<td>• non applicable</td>
<td>Conformity to the requirements</td>
</tr>
</tbody>
</table>

### Wastewater treatment

<table>
<thead>
<tr>
<th>Item</th>
<th>Conformity to the requirements</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>• wastewater stagnation is prevented</td>
<td>• Non applicable – wastewater will not be treated on site (sanitary and</td>
<td>Conformity to the requirements</td>
</tr>
</tbody>
</table>
Report on Environmental Impact Assessment– Pilot plant for biogas production in Seini, Maramureș

**BAT - according to BREF formulation (2005)**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Conformity degree</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>an initial separation of solids using screens and sieves is performed</td>
<td>non applicable</td>
<td>The storage basin is provided with an automatized control system.</td>
</tr>
<tr>
<td>oily fractions from wastewater is separated/eliminated using dedicated separators</td>
<td>non applicable</td>
<td></td>
</tr>
<tr>
<td>a flotation unit is used, combined with flocculants usage, for advanced solids removal</td>
<td>non applicable</td>
<td></td>
</tr>
<tr>
<td>implementation of a monitoring system to prevent manure tanks overfeeding</td>
<td>applied</td>
<td></td>
</tr>
<tr>
<td>flow compensation is considered – an equalisation basin for wastewater will be used</td>
<td>applied</td>
<td></td>
</tr>
<tr>
<td>a sufficient handling/collecting/storage capacity is assured for residual wastewater including the excess</td>
<td>applied</td>
<td></td>
</tr>
<tr>
<td>prevention of liquid ex-filtration and odour emissions from the wastewater treatment basins, by means of walls and floors tightness and aeration and covering</td>
<td>non applicable</td>
<td></td>
</tr>
<tr>
<td>spent effluents are subjected to biological treatment</td>
<td>non applicable</td>
<td></td>
</tr>
<tr>
<td>nitrogen and phosphorous are removed from effluents</td>
<td>applied</td>
<td></td>
</tr>
<tr>
<td>the resulted sludge is disposed and used with other purpose considering its origin (animal by-product)</td>
<td>applied</td>
<td></td>
</tr>
<tr>
<td>the resulted gas (CH₄) during anaerobic treatment process is used for electricity and/or thermal energy production</td>
<td>applied</td>
<td></td>
</tr>
<tr>
<td>periodically there are performed laboratory analyses to determine effluent composition and records are kept. More information regarding the monitoring techniques are available in “Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector” BREF [341, EC, 2002].</td>
<td>applied</td>
<td></td>
</tr>
</tbody>
</table>

**BAT supplementary for animal by-products treatment plants**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Conformity degree</th>
<th>Conformation to the request</th>
</tr>
</thead>
<tbody>
<tr>
<td>dry and continuous operation and continuous separation, of resulted by-products resulted from the treatment process</td>
<td>applied</td>
<td></td>
</tr>
<tr>
<td>if the animal by-product is not possible before their decomposition, they must be refrigerated, as soon as possible, and for the shortest time</td>
<td>non applicable</td>
<td></td>
</tr>
<tr>
<td>if the used substances have inherently a conflictive odour or such substances are produced during animal by-products treatment, the off gases are passing, at low pressure /large volume through a biofilter</td>
<td>applied (by assimilation) to drying digestate</td>
<td></td>
</tr>
<tr>
<td>the usage of tightened vessels/units/equipment for storage, handling, feeding of animal by-products</td>
<td>applied</td>
<td></td>
</tr>
<tr>
<td>usage of a feeding system that allows a minimal exposure of wastes to the environment (for instance automatic feeding using fast actuated systems)</td>
<td>applied</td>
<td></td>
</tr>
</tbody>
</table>

**Analysed plant:**

- uses a reinforced concrete fermenter;
- a reduced water quantity is
Report on Environmental Impact Assessment – Pilot plant for biogas production in Seini, Maramureș

<table>
<thead>
<tr>
<th>BAT - according to BREF formulation (2005)</th>
<th>Conformity degree</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Thermal insulation of digesters, especially of the roof where biogas is accumulating;</td>
<td>• applied</td>
<td>used and no wastewater is generated,</td>
</tr>
<tr>
<td>• Continuous feed of digesters with raw materials</td>
<td>• applied</td>
<td>• digestate undergoes a liquid-solid separation process and a part of the resulted solid phase is dried; it is used as fertiliser in form of liquid or solid (dry or wet);</td>
</tr>
<tr>
<td>• Reduction of nitrogen compounds emissions by optimising C:N ratio</td>
<td>• applied</td>
<td>• the digester is continuously feed through an automatized system.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BAT supplementary for biogas production</th>
<th>Conformity degree</th>
<th>Conformation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Air emissions reduction associated to biogas burning (dust, NOx, SOx, CO, H2S, VOC) by using scrubbers, nitrogen based compounds using SCR techniques, thermal oxidation or activated carbon filters</td>
<td>• applied</td>
<td>This plant uses an activated carbon filtration unit for biogas impurities removal.</td>
</tr>
</tbody>
</table>

The consequences of applying these legislative regulations for the analysed project are as follows:

- The design concept started from the beginning, with the consideration of attending the specific request of a plant under the OUG 152/2005 provisions regarding the prevention and integrated control of pollution
- When used in an anaerobic fermentation plant, the manure is considered non-hazardous waste, code 02 01 06, and the activity regulation in the authorization legal system will be according to this framing. According to Law 211/2011 provisions regarding wastes, the activities that will be developed within the project Plant for biogas production, are subjected to specific provisions, arising from the applicability of this law. A synthetical representation regarding the framing is presented in the table below.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description of plant subsequent operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>R13: Temporary waste storage for R1, R3 and D10 operations</td>
<td>Waste treatment, including chopping, sorting, screening, compacting, mixing and maceration. Temporary storage of manure on a concrete platform.</td>
</tr>
<tr>
<td>R3: Organic substances, other than those used as solvents, recycling or</td>
<td>Fermentation of non-hazardous organic wastes code 02 01 06) and vegetal material (no prior pasteurization required).</td>
</tr>
<tr>
<td>Operation</td>
<td>Description of plant subsequent operations</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>R1: Used mainly as fuel or as other energy source</td>
<td>Off gases treatment by scrubbing (emissions from drier), biological treatment and/or adsorption (H₂S removal from biogas). Gas storage and drying (biogas). Digestate treatment — solid/liquid separation, including drying of a part of the resulted solid fraction Solid digestate (solid fraction) ageing. No waste of animal origin are allowed (other than manure according to the definition from ER 1069/2009) Total quantity of waste accepted on site should not exceed 18,000 tons/year. The usage of combustible gas resulted in the fermentation process, as fuel. Flare usage for short periods of time (malfunction or maintenance of the cogeneration unit).</td>
</tr>
<tr>
<td>D10: Incineration on site (on ground)</td>
<td></td>
</tr>
</tbody>
</table>

- Manure waste management process will need to meet not only the requirements applicable to animal wastes and by-products, but also the requirements specific to wastes, HG 856/2002 respectively, regarding the waste evidence and all legislative documents with subsequent effects;
- Manure treatment in a anaerobic fermentation plant requires special approval from the Sanitary – Veterinary Authorities regarding the derogation from mandatory previous sterilization;
- Necessity of Sanitization Public Service Regulation revision due to implementing of SMID on the one hand and also as a result of the manure collecting system from the population development on the other hand;
- Implementation of a unitary management system, coordinated by the local public authority, regarding generated animal waste at TAU level, including the revision of Local action plan regarding the protection of waters against nitrates pollution.
Chapter 4 Plant site. Localization, local conditions

Seini city is situated in the North area of Romania, at eastern NV limit of Maramureș county, at a distance of 26 km from Baia Mare, county residency.

With a population of approx. 10.000 inhabitants, Seini is a locality with strong tradition in the field of animal agriculture.

The location of the future biogas plant is situated in the south part of the buildable urban area of Seini City, on the first terrace (of 3 – 5 m) of Someş River, at an average altitude of 144m, classified as quasi-horizontal perimeter and flow direction to SSV, towards river bed. The plant will be built on a land parcel, with a total area of 32886 m², is the property of Seini City.
The details regarding the location of the plant site are presented in Figure 1 – Site layout of Annex A.

The details regarding the built objectives location within the site are presented in Figure 2 – Plot overview plan of Annex A.

Analysing this plans it may be noticed that the biogas plant project will not occupy the entire available land surface but only the southern half.

In the vicinity of the plant site there are agricultural farms in north and east, a wastewater treatment facility in the south and in the west side is limited by a channel that flows in Someş, and arable lands.

The entire area, located in south-eastern side of Seini City, between CF (railroad) Baia Mare-Satu Mare and Someş riverbed is used for agricultural activities of two groups of poultry and pig farms, but also for mineral aggregates sorting (there are two sorting stations).

The biogas plant will be placed in the area allocated to a wastewater treatment plant, belonging to the near located pig farm, operated until 1989.

The location is situated in the west-south-western extremity of the site of old farms belonging to IAS Seini.

In the northern side is localised a functional pig farm, that belongs to SC Danamari SRL, and in the eastern side there are located the farms of IAS, most of them currently non-functioning, and some accommodating production or storage activities.

The distance to the administrative centre of Seini City is 4 km, and the distance to the nearest inhabited areas is:

- 1 km towards North
- 2.5 km towards South
- 1.3 km towards East
- 3.5 km towards West

The land is located in the urban area of Seini City, in the zone designated for agrozootechnical activities – A2 Area in Local Urbanism Regulation, as detailed in Figure no. 3 - Urban landscape regulations presented in Annex A.

The land drainage is accomplished through several channels with rectangular or sinuous courses, on two of the sides (west and south), artificial drainage channels for rainwater with discharge in Someş River.

The distance to the Someş river bed, that flows in SV region of the location is 350 m.

Topographically, the plant site is classified as plain land; average altitude on the plot is 145.5 m. The site is located in Someş River meadow, on the right side. The entire drainage (surface and underground) is from East to West, in concordance with the area drainage to Someş.

From the point of view of geological study, the geologic aggregates are formed in Quaternary age and consist of clays, sands and grit.

Geomorphological confinement of the area that includes also the analysed location is classified as plain land with an average altitude of 150.00 m.
The actual plot and the surrounding area are stable without any signalised manifestations of geodynamic phenomena that could affect the behaviour of the existing or future constructions.

In terms of seismic protection, Standard P 100-1-2006, Seini city has a peak level of ground acceleration for IMR = 100 years $ag = 0.12$ g and the control period of response spectrum $T_c = 0.7$ sec.

Frozen depth, STAS 6054 - 77, is -0.90 m under the land elevation.

Geotechnical investigations conducted on site, up to six meters depth, did not intercept underground water.

The access on site may be realized either from DN 1C, using the exploitation road between Săbişa and Seini, that crosses CF Baia Mare-Satu Mare, at a distance of approx. 1.5 km from the national road, either coming from Seini, on Cuza Vodă Street, Fermelor Street followed by an exploitation road of approx. 600 m.
Chapter 5 Project description

5.1 Biogas plant – physical capacities

The future biogas plant will use, yearly, as raw material, the following materials and wastes quantities (classified after the generation type):
- Energy crops (silage) – 2000 tons
- Manure (pigs) – 5000 tons
- Manure (cattle) – 8000 tons
- Manure (poultry) – 5000 tons

For this plant a daily feeding rate is associated to this maximum treatment capacity, respectively 54.79 tons/day: 49.31 tons/day manure and 5.78 tons/day energy crops. The daily feeding diet (waste mixture - ratio) may vary as result of many parameters.

The concept of a biogas plant operation is presented in the figure below.
The biogas plant will produce, yearly, a quantity of biogas estimated to 1.527.445 m$^3$/year, with an indicative composition of 60% CH$_4$, 39% CO$_2$ și 1% O$_2$, COVNM and H$_2$S.

The resulted biogas will be used for the production of electricity, approx. 2.967.030 kWh yearly.

Subsidiary, the plant will produce also thermal power: 970.564 kWh/year, thermal energy used for selfconsumption, to heat the digester and approx. 2.310.000 kWh/year thermal energy for drying of a part of the resulted digestate.

Digestate (fermented medium) is the by-product of the biogas plant that produces methane and heat starting from organic wastes.

In the case of analysed project, the digestate is a liquid product (water content of the digester output is around 95%) that undergoes a liquid/solid separation process.

The resulted digestate quantities in the Seini biogas production plant, according to design parameters are:
- Liquid digestate (3% d.m. content) – 15.150 m$^3$/year
- Solid digestate (raw) – 5.835 tone/year, from which:
  - Solid fertiliser (dried) – 1.200 tons/year
  - Wet solid fertiliser (compost) – 2.335 tons/year

A synthetic image of the plant input and output is presented in the next table:

### Information regarding energetic resources production and requirements

<table>
<thead>
<tr>
<th>Production</th>
<th>Quantity</th>
<th>Energetic resources required during operation stage</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biogas</strong></td>
<td>1.527.445 m$^3$/yr</td>
<td><strong>Energy crops</strong></td>
<td>2000 t/yr Collected based on a contract</td>
</tr>
<tr>
<td><strong>Manure</strong></td>
<td>18000 t/yr</td>
<td><strong>Electricity</strong></td>
<td>1590693 kWh/yr National grid (SEN)</td>
</tr>
<tr>
<td><strong>Electricity</strong></td>
<td></td>
<td><strong>diesel</strong></td>
<td>20353 l/yr Oil products supplier</td>
</tr>
<tr>
<td><strong>Liquid digestate (SU 3%)</strong></td>
<td>15150 m$^3$/an</td>
<td><strong>Thermal energy</strong></td>
<td>970.564 kW th Produced in the plant high</td>
</tr>
<tr>
<td><strong>Digestate/ solid fertiliser</strong></td>
<td>5835 t/an</td>
<td></td>
<td>efficiency cogeneration unit</td>
</tr>
<tr>
<td><strong>Electricity</strong></td>
<td>2.967.030 kWh/'an</td>
<td><strong>Biogas</strong></td>
<td>1.527.445 m$^3$/an Produced in the plant high</td>
</tr>
<tr>
<td><strong>Thermal energy</strong></td>
<td>970.564 kW th</td>
<td></td>
<td>efficiency cogeneration unit</td>
</tr>
</tbody>
</table>

5.2 Project stages

From the institutional point of view, for the proposed project implementation, the following activities will be followed:

- selection and design of technical solutions – Feasibility Study development
- project components approval– obtaining of permits and approvals, including Technical Grid Connection Approval (ATR - Aviz Tehnic de Racordare);
• Detailed design and the elaboration of the Technical Documentation to obtain the Building Permit;
• Obtaining of Building Permit;
• Tender organization for the selection of the Contractor and equipment purchase;
• Organization of the preparation activities for works execution;
• Construction of plant components;
• Equipment testing;
• Preparation for the start-up;
• Institutional training of the project beneficiary (Seini City hall);
• Operational personnel training;
• Start-up and acceptance test.

Construction work for the future biogas plant is forecasted to September 2013. The start-up is estimated to July 2014.

As regards the works technology and the equipment scheme that will be used for the construction site works it must be underlined that no special technologies, equipment or tools will be used. All the works will be executed with equipment currently used on the construction sites (bulldozers, excavators, frontal loaders, crane trucks, motor trucks).

The activities that will be developed on site are specific to the stages of the biogas plant project implementation stages, as follows:

• **Land works**
  - works for vertical systematization – foundations and platforms for equipment and tanks;
  - functional rooms – interior arrangements (laboratory, office, vestiaries, sanitary facility, materials and chemicals storage room);

• **Concrete and metallic construction works**
  - foundations for equipment, installations, pillars and other metallic structures;
  - metallic structures for equipment and installations support;
  - platforms and access ladders;

• **Equipment, installations and pipes mounting works**
  - equipment / installations mounting;
  - pipelines mounting;
  - piping connexions execution for technological processes and utilities supply;

• **Networks settlement**
  - piperacks construction;
  - underground sewage development;
  - networks arrangements: electrical, steam, water;

• **Electrical installations works**
  - installation for electricity supply – exterior connexion to National Power Grid;
  - power and lighting installations;
  - electrical grounding installation for equipment, machineries, metallic structures, technological and utilities pipelines, and also for protection against atmospheric electricity discharge;

• **Automation works**
  - Systems for distributed technological processes control and tracking;
- Automation systems;
- Alarming and interlocking systems;

**water/sewage networks**
- water connexion to the sanitary and technological systems;
- installation connexions and internal junctions;
- hot water connexion to the technological lines / digester heating;
- fire fighting network;

**fire-fighting works**
- execution of the installations used for fire fighting and fire-fighting endowments, according to technological processes and zone classification.

The construction works will be accomplished according to the execution plan detailed above. Following a tender procedure, the Constructor will be designated based on proved similar experience and technical capability.

At the investment objective hand over, the site will be cleared from any construction materials and restored to initial condition.

During the construction period there will be required the following utilities on site: water, electricity, technological air; this will be provided using mobile equipment, powered by heat engines. The electricity will be supplied through a connexion to the local electricity grid.

The Constructor will provide the protection of executed works and site construction materials.

**Used methods** for the works execution but also during the operation and maintenance activities it will follow strict conformation with the normative that refers to construction site activities.

Heavy equipment or machineries that require supplementary permitting in Romania or EC will not be used in the developed activity.

Equipment purchase, civil and mounting works will be accomplished by a Constructor that will be selected after a bidding process conducted according to World Bank procedures.

Site activities organisation, machinery and personal distribution and materials and tools manipulation as well, used for the development of this plant will be the standard ones.

The location allows a proper logistic deployment (the land area that is in public authority property is more than enough) so that the adjoining properties will not be affected.

It must be emphasised that the land assigned for the biogas plant will be free of any anterior constructed facilities (the works will be performed within a separate Seini City Hall project), and the constructor will receive a free of duty land.

The mounting and start-up of equipment and biogas plant units will be accomplished by specialized teams, under the supervision of the specialised designer.

5.3 Technological processes

The description of the technological process is correlated to the objects and equipment indicatives as displayed in *Figure 2 - Plot overview plan, part of Appendix B*, which presents the location of plant equipment.
The plant will be operated according to the following flow diagram:

![Technological flow diagram for biogas production using manure and energy crops](image)

**Figure no. 4 - Technological flow diagram for biogas production using manure and energy crops**

Anaerobic fermentation, as the process producing biogas from manure and vegetal/organic matter is carried out in a circular tank, under controlled conditions.

Substrate supply will follow a different procedure as described below. Thus:

- The energy crops, in this case maize silage, will be transported by the supplier/producer, after harvesting, and weighted and then directed to the long term storage silos. Here it will be discharged from the vehicle and compacted with the tractor that will operate within the biogas facility. After compacting (with the purpose of taking out the air) the silage will be covered with a polyethylene foil.
- The animal waste from the population homestead will be independently transported, with the owner conveyance, or by the City Hall services, using by necessity, a tractor with trail or with a vat (for liquid manure). After weighting, the solid manure will be unloaded on the solid waste platform and the liquid manure will be discharged into the underground reception tank (T100).
- The wastes supplied by the economic operators will be transported by the producers, with their own vehicles, weighted and unloaded on the solids platform or in the liquid tanks, by case
The transport vehicles, disregarding the owner, will be cleaned and weighted before leaving the biogas facility. The hygienation will be accomplished using a mobile high pressure pump. The cleaning water will be supplied from the water well that will be drilled on the platform.

The two buried tanks, for the liquid manure, were designed to be able to provide storage capacity for the daily average supply rate of the digester (estimated to 36 m$^3$ daily – 18 m$^3$ per transport from each generator AGROZOOTEHNICA S.A. and DANAMARI SRL\(^2\)) and also the hydraulic stress of a rainy season.

The storage capacity of solid waste is design to allow even simultaneous delivery from all economic operators considered as animal waste generators.

Considering different categories of used waste materials and in the same time the necessity to provide a homogenous substrate mixture, the feeding the fermenter is a complex operation that assumes combined solid, semisolid and liquid materials feeding through a completely centralised and automatized system.

The feeding diet will be conceived and periodically revised starting from the substrate specific characteristics. Periodically, analytic analyses will be performed in order to determine the wastes composition.

The digester will be fed using a progressive cavity pump that will achieve a homogenous mixture from the solid and liquid substrates. Solid substrates (maize silage, manure with high dry matter content) will be supplied directly into the biomixer pump hopper through the solid feeder, with a gross volume of 40 m$^3$. The solid feeder has a metallic pail where the substrate will be charged with a loader. The solid feeder will assure temporary storage capacity, will accomplish substrate maceration/homogenization being equipped with two augers with cutting knives, powered by two motors and allows solid substrate dosing through an analogue device, connected in series with a balance (linked to the PLC of the biogas plant). The substrate retention time will be of several hours.

The liquid substrate is supplied from the liquid reception tank, by the vertical pump:

- Indirectly, through the biomixer pump, where the liquid phase and the solids are mixed together, resulting a homogenous mixture that is pumped into the digester;
- Directly fed into the fermenter.

The liquid substrates storage tank, has a gross volume of 82.5 m$^3$, it is completely buried, and build of reinforced concrete, constructed with a concrete cover, placed at ground level, to minimise the odours emission into atmosphere; it is equipped with a stainless steel submersible stirrer, to prevent the formation of stratification, floating layers and deposits at the bottom.

Additionally, providing maxim operation flexibility, there were considered:

- Another liquid substrates storage tank, used as a feeding – storage unit for liquid co-substrates, with a 105 m$^3$ gross volume. This tank will allow the storage of leachate from energy crops silos, collected rain water from the platform and biogas condensate and in the same time will provide temporary storage for the liquid co-substrates surplus. It is also completely buried, and build of reinforced concrete with a concrete cover, placed at ground level, to minimise the odours emission into atmosphere, equipped with a stainless steel

\(^{2}\) The two farms dispose of the adequate, in terms of volume, and appropriately technical settled storage capacities. Materials flow optimization will be accomplished during the operation of the biogas plant and with respect to population response as will be determined to actively participate to abandon the temporary storage solutions for the wastes in the inhabited area.
submersible stirrer, to prevent the formation of stratification, floating layers and deposits at the bottom and a submersible pump, which will fed the liquid in to be introduced in the technological flow

- a recycling loop, carried through the central manifold pump, which pumps digestate back in the digester in case of a liquid excess in the process or to the mixing pump in case of a lack of liquid substrates.
- a macerator unit, for a proper preparation of some solid wastes, and its posterior liquefaction in the liquid tank; it is placed on the top of the liquid substrates storage tank and works at 6 m³/h nominal flow. The solid biomass is chopped into small pieces, mixed with slurry, agitated, and the resulting product is pumped into the digester. The maceration process will be also important to enhance the biogas production, reduce the energy consumptions of the agitation and avoid foam problems in the digester.

The liquid tanks will be located near the central pumping room to optimize the pumping system. To minimize the odours emission and the risk of spillage, filling and emptying will be performed by automated pumping system, or by gravity.

The time of storage should not exceed 3 days, due to the loss of energetic properties of the substrate in time.

The considered technology in this configuration is one-step anaerobic fermentation based, carried out in a circular tank, 1 m buried, of 2.814 m³ net volume (internal diameter of the digester will be 26 m and the wall height 6 m) constructed of reinforced concrete, highly resistant to water leakages in environments exposed chemically. The maximum liquid level is around 5.3 m, with 0.7 m the free upper level for safety operation.

Figure no. 5 Anaerobic fermenter (digester)

Digester volume is designed to achieve a sufficient retention time to maximise substrates degradation and consequently to maximize the biomass production. The optimal retention time to maximize biogas production in the plant is about 55 days. The plant is designed to have a lower organic load (MOS up to 2.87 kg/m³/d), value below which the overdose of food supply for bacteria and for the digester is avoided. Another influential parameter for the dimensioning of the plant and in the preparation of the feeding rate is the
concentration of ammonia nitrogen inside the digester. It is very important that the C:N ratio is within the range [20:1 - 30:1].

With respect to feeding flow, the daily feed is estimated to approximately 54 m³ raw materials, the feeding diet (sold waste/liquid waste/energy crop ratio) will however vary as a function of many parameters. Nevertheless, the most important one is the volatile organic load of the fermenter. The operating temperature for the anaerobic digesters is within the optimal range 39 – 41 °C (mesophilic range). The heating system of the digester consists in polyethylene piping system placed inside the digester. Furthermore, both the slab and the walls are thermally insulated.

![Figure no. 6 Constructive elements of a biogas plant](image)

The digester is equipped with two horizontal submersible agitators and a stirrer with oblique external engine to prevent organic matter sedimentation and to ensure substrate homogenization.

The fermenter is covered by a double membrane roof, semipermeable to gas. The outer membrane is a protective layer and is always under pressure as needed for the stability of the structure, while the inner membrane is impermeable to air and acts as gas storage reservoir. The usable storage space corresponds to this inner membrane (maximum capacity storage will be 1110 m³). The air pressure inside the membranes ranges from 1.5 to 3 mbar.

The digester will be equipped with a support structure consisting of a central column, a system of tensors that connect the wall of the digester with the central pillar and a net set up under the tensors.

To prevent the corrosion of the CHP unit, the gas must be almost completely desulfurized. It is necessary to clean the gas, through of a widely tested biological desulfurization process, carried out in the digester. The biological process of desulfurization will be accomplished by the action of bacteria that oxidize hydrogen sulphide into elemental sulphur. These bacteria develop under aerobic conditions, so an automated injection of air will be introduced in the digester using an air compressor. The total air going into the digester should not exceed 2 – 5 % of the biogas (volume) produced. Therefore the required air flow depends on the daily production and the quality of biogas.

To ensure optimal operating conditions for the cogeneration unit, the biogas must be previously treated for advanced humidity and contaminants removal. The biogas produced in the digester will be cooled in the pipes buried underground. It will condense and thus eliminate
the moisture. In addition a drying unit is considered for almost total humidity removal by advanced cooling (7 °C).

Figure no. 7 Schematic representation of the gas storage roof elements

The condensate will be collected and recycled in the process flow. Raw biogas is introduced in the activated charcoal filter where the siloxanes content reduction and advanced hydrogen sulphate removal occurs.

After digestion the resulted digestate undergoes posttreatment processing operations, by solid/liquid separation and drying of the resulted solid phase.

The central pump will transport the digestate directly from the digester to the separator.

The separator performs the mechanical operation of separating the digestate in two fractions: a liquid fraction with almost 93 % water content and a solid fraction containing up to 27 – 30 % dry matter.

The liquid phase will be pumped, using the centrifugal pump, in the existing basins, placed within biogas facility, made of reinforced concrete, equipment that constituted units of the currently de-allocated wastewater facility.

Figure no. 8 A double bank of solid/liquid separators – mounting model
The solid fraction is discharged by gravity and collected on the concrete platform specially designed for this purpose.

Using a screw conveyor, the solid digestate is transported to the belt dryer. The dryer is a complex unit that will use all the available heat resulted in the cogeneration. Using a heat exchanger the warm water is used to heat a nominal flow of 15,000 m$^3$/h air. The hot air is directly contacted with the solids subjected to drying and then exhausted in the atmosphere through a cleaning unit (wet scrubber). The scrubber works with desorbed ammonia recovery, resulted during liquid phase of the digestate evaporation. Using an acid solution (operating pH 4.0, adjusted by sulphuric acid addition) the scrubber generates as by-product an ammonium sulphate solution that can be also used as liquid fertilizer.

After drying, a high quality solid fertilizer is obtained, with dry solids content up to 88% that will be further packed using a packaging machine.

The cogeneration unit of 0.37 MW capacity is a complete functional unit, facilitated in a soundproof metallic container, equipped with its own cooling systems and heat exchangers for exhausted gas heat recovery.

Resulted electricity will be sold to the national electric grid. The thermal energy will be used on the one hand to keep the proper temperature in the fermenter and on the other hand to heat the air used for drying a part of the solid fraction of the digestate. As a safety measure, in case of CHP system failure, the biogas plant will be equipped with a flare that can burn all resulted biogas.

The biogas plant will have an automatic control room, located in a container, which will control all the technical components. The automation system includes: gas analyser, automatic control of substrate pumping system, overcurrent protection and control of temperature and pressure, sensors of gas storage level, sensors of substrate level and for digesters leakage, safety equipment.

Regarding the process control, some important remarks must be added:
- The solid substrate quantity fed into fermenter, is controlled using the weighing system of the solid feeder (four measuring cell placed in the solid feeder feet). Those measurements are registered by a sensor that transmits an analogue signal to the control system;
- During normal operation the digester is emptied by suction using the central pump. This operation is controlled using open/closed pneumatic valves;
- The biogas produced is stored in the digester roof, under the inner membrane;
- The storage capacity can be calculated starting from the height of the inner membrane and the pressure indicated between the two membranes. The biogas pressure is adjusted using a roof ventilator, that is feeding air between the two membranes;
- The air pressure inside the membrane ranges from 1 to 3 mbar. When the pressure exceeds 3.5 mbar, a safety valve opens (safety system on-low pressure) and the gas is allowed to escape to relieve the pressure. The pressure between the two membranes determines the storage capacity of the digester roof and also the gas volume that will be burned in the cogeneration unit.

The biogas quality control is accomplished after the biogas dryer. The measuring device determines the concentration of CH$_4$, CO$_2$, H$_2$S, O$_2$. The value of H$_2$S concentration will determine if the biogas will go through the activated charcoal filter. After this filter, another biogas analyser is installed to check if the H$_2$S content is low enough to comply with a proper CHP operation. From here the biogas goes directly to the cogeneration unit.
The control of cogeneration unit (CHP) and CHP auxiliary devices are controlled by the unit own system – hence, the cogeneration unit has an individual control system to assure the proper functioning.

The flare will be used as a safety measure if the CHP is out of function or if the biogas, whose composition is measured after the carbon filter, does not meet the requirements to be burned in the CHP (a too high H₂S content).

5.4 Operational personnel

The biogas plant operation requires eleven (11) persons trained properly. Two persons will be in charge of the entire plant management (substrate input control, coordination of local waste management services, coordination of the digestate valorisation, control of the energy performances, project communication and promotion). Another two persons will be trained to operate the plant, with the assignment of functional operation and control.

Two persons will be employed in checking the furnished manure conformity and exterior space maintenance (site cleaning, cleaning of the vehicles used for transport before leaving the plant), and another two persons will be engaged to operate the machineries on site (the tractor and the frontal loader).

Without being considered as steady staff a security service will provide permanent guard of the biogas plant (3 persons/24 hours), this service may be also subcontracted.

For administrative and hygiene sanitary activities proper facilities will be accommodated (toilets, warm water showers, vestiaries, dining room).

Also, considering the demonstrative character of the project, a meeting/presentation room near the area of access zone to the plant site will be established.

5.5 Raw materials, substances or chemicals

The raw material that will be used is consisting from manure from animal farms (waste code 02 01 06) resulted from pig, cattle and poultry farms, and silage, produced from energy crops (maize or sorghum).

Also, the biogas plant will be able to treat the manure collected from individual householders and stored on the manure platform build also within the project “Integrated Control of Nutrient Pollution” financed by GEF/World Bank, International Bank for Reconstruction and Development and cofinanced by Romanian Government.

In the future biogas plant there will be used, yearly, as raw material the following quantities of materials and wastes (classified after the generator):
- Energy crops (silage) – 2000 tons
- Manure (pig) – 5000 tons
- Manure (cattle) – 8000 tons
- Manure (poultry) – 5000 tons

For this plant a daily feeding rate is associated to this maximum treatment capacity, respectively 54.79 tons/day: 49.31 tons/day manure and 5.78 tons/day energy crops. The daily feeding diet (waste mixture - ratio) may vary as result of many parameters.

With respect to the 18,000 tons/yr manure (solid/liquid/semiliquid manure) used in the biogas production process, according to statements and information provided by the generators,
systematized from the manure management reports elaborated according to G.D. 856/2002 by each generator, the following synthetic situation resulted:

Currently the entire amount of 18,000 tons manure is collected and temporary stored on the generation site, and seasonally administered as fertiliser on agricultural land within Seini administrative territory on in the vicinity.

**Manure supplied to biogas plant**

<table>
<thead>
<tr>
<th>Generator</th>
<th>Quantity t/an</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danamari SRL</td>
<td>4000</td>
<td>Pig</td>
</tr>
<tr>
<td>Households</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Galinus SRL</td>
<td>1900</td>
<td></td>
</tr>
<tr>
<td>SABISANA srl</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>ALFA CULT</td>
<td>22</td>
<td>Poultry</td>
</tr>
<tr>
<td>Filstar srl</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>Karin SRL</td>
<td>1800</td>
<td></td>
</tr>
<tr>
<td>AGROZOOTEHNICA SA</td>
<td>7000</td>
<td>Cattle</td>
</tr>
<tr>
<td>SIM GREEN AGRO</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Iosif Cheisperger</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Households</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Silage (sorghum / maize)</td>
<td>2000</td>
<td>Biomass 2000</td>
</tr>
</tbody>
</table>

As already mentioned in the previous sections the Biogas plant will undertake from the actual waste flows 18,000 tons manure per year and a quantity of 2000 tons/yr energy crops (maize silage)

**Manure supplied to the biogas plant (parameters)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Input (tone)</th>
<th>Category</th>
<th>Dry matter (%)</th>
<th>Solid matter (tone)</th>
<th>Organic matter (% of d.m.)</th>
<th>Organic matter (tons)</th>
<th>Moisture (%)</th>
<th>Water total volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5000</td>
<td>pig manure</td>
<td>4.7</td>
<td>235</td>
<td>71.9</td>
<td>168,965</td>
<td>95.3</td>
<td>4765</td>
</tr>
<tr>
<td>2</td>
<td>8000</td>
<td>cattle manure</td>
<td>12</td>
<td>960</td>
<td>85.6</td>
<td>821,76</td>
<td>88</td>
<td>7040</td>
</tr>
<tr>
<td>3</td>
<td>5000</td>
<td>poultry manure</td>
<td>32</td>
<td>1600</td>
<td>75</td>
<td>1200</td>
<td>68</td>
<td>3400</td>
</tr>
<tr>
<td>4</td>
<td>2000</td>
<td>energy crops</td>
<td>32.6</td>
<td>652</td>
<td>94.7</td>
<td>617,444</td>
<td>67.4</td>
<td>1348</td>
</tr>
<tr>
<td>Total</td>
<td>20000</td>
<td></td>
<td>3447</td>
<td></td>
<td>2808,169</td>
<td>16553</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Regardless of the source of origin, materials and waste that constitute the substrate of a biogas plant, considering the situation of using the support plan for renewable energies, will have to be accompanied by Certificates of origin, that will satisfy the requirements of the Agriculture Ministry Order no. 46 from 5 march 2012, laying down the Procedure of the Origin Certificate issuance for biomass of agricultural and agricultural related activities provenience, used as fuel or as raw material for energy generation.

The manure transport from the generation unit to the biogas plant will be accomplished by suppliers – economic operators of natural persons. In addition, to increase the manure waste collecting rate from the population, the City Hall will organize a collecting service for these wastes, using the machineries supplied within the project “integrated Control of Nutrient Pollution” financed by GEF/World Bank, International Bank for Reconstruction and Development and co-financed by the Romanian Government.

**a. Cattle farm waste**
Solid and liquid manure resulted from the cattle farming will be supplied by the following units: SC Agrozootehnica S.A. Seini, SIM Green Agro SRL and Iosif Cheisperger – physical person. From SC Agrozootehnica SA it is established the delivery of 6000 tons/year wastes (liquids and solids). The difference needed (considering the calculations) of approx. 1000 tons of this category waste will be supplied directly from and by natural persons or by the City Hall service.

b. Pig farm waste

The manure resulted from pig farming will be supplied by SC DANAMARI SRL, unit situated in the biogas plant proximity. An amount of produced waste, of approx. 4000 tons/year will be supplied.

The waste will be transported by the generator economic agent, with own equipment, or supplied directly through the delivery caisson emplaced on the farm site, or from one of the two existing external basins (each of 5000 m³) used for the manure storage.

The future it will be considered a possible (and economical feasibly) connection using a pipeline for the supply and feed of the pig liquid manure and thus eliminating transport loading and unloading operations.

A differential amount of approx. 1000 tons/year pig waste is considered to be collected by the City Hall service from the households of natural persons.

c. Poultry farm waste

Poultry farming is an important activity for the local economy. In Seini the number of economic operators that develop this activity is quite high, and consequently the amount of manure is significant.

In this stage of project implementation there were considered eligible as input materials for the biogas plant only the waste resulted from a part of the small capacity farms; the large farms (EuroBroiler, Tovira Prod și ROMAVIS) were not included in the substrate supply flux.

d. Energy crops (vegetal biomass)

To allow the optimal operation approach for the biogas plant an annual amount of approximately 2000 tons/year of energy crops is necessary. This amount will be purchased yearly, based on a contract. After harvesting, the supplier economic operator, will transport the vegetal mass to the biogas plant, where it will be stored on the dedicated silos platforms.

e. Fuel

Fuel used for the wastes transportation and handling activities (for their supply) and for the digestate spread on the agricultural land is diesel oil.

Estimated yearly consumption is:
- 10605 litres/year – manure delivery from the generators to the biogas plant
- 9166 litres/year – digestate transport and agricultural land administration
- 9748 litres/year – machinery and vehicles consumption inside the biogas plant area

f. Sulphuric acid

The acid is used to provide an acid environment (pH around 4) for the proper operation of the scrubber that is installed to treat the exhausted air from the digestate dryer. The ammonia absorption is accomplished in low pH environment and the reaction product is ammonium sulphate. The absorption efficiency is around 87 %. The monthly sulphuric acid consumption is estimated to 3160 kg.

It will be provisioned by authorised suppliers, the storage and use on site being subjected to a separate authorization.
5.6 Utilities

For a proper plant operation and function are needed: electricity, water, waste collecting, maintenance services, laboratory services, transportation.

a. **Electricity**, it will be supplied through a connection to the medium voltage grid, located in the Eastern side of the plant site (approx. 300 m distance). Along the existing road (land in public domain) one buried electric cable will be considered, through which it will be accomplished, as required: plant energy supply – in the start-up period (the first 50 days of operation) and then feed into SEN the excess energy produced beside the electrical need of biogas plant.

   According to current legal procedures, all the constitutive elements of ATR (Aviz Tehnic de Racordare - Technical Grid Connection Approval) will be subjected to a separate construction approval and authorization process.

   Average electricity self-consumption of the biogas plant is estimated to 1.590.693 kWh/year.

b. **Water supply** – for hygiene and sanitation, cleaning the platforms and vehicles, fire water, will be accomplished from independent supply – low depth water well, that will be drilled and managed on biogas plant site.

   The water will be pumped, using a submersible pump, from the well to an above ground existing reservoir of 50 m³ capacity.

   Average daily water demand is approx. 3.24 m³/day.

   Drinking water will be delivered, based on a contract, by local supplier.

c. **Wastewater management**. The resulted wastewater from the social groups (toilets, showers) will be collected, together with the wastewater outcoming from the vehicle cleaning area, in the emptying collector basin of 12 m³ capacity. This basin will be periodically emptied by the Regional Water Operator or by an accredited subcontractor. The wastewater will be discharged to one of the treatment facilities located in Seini City.

   The average daily generated wastewaters amount is 1.56 m³/day.

d. **Waste collecting and disposal**

   The garbage and other similar wastes, generated on the platform will be undertaken by local sanitation operator, based on a contract.

   The waste fuel oil – resulted from the cogeneration unit maintenance operation will be temporary stored in a metallic double wall tank equipped with a leak detection system, and it will be collected by one of the authorised operators.

   The dangerous or non-dangerous wastes – accidentally occurred on the public waste storage platform, will be selected by the plant operators, and separately stored in special assigned cans. They will be collected by the local sanitation operator in periodical campaigns dedicated for these types of wastes.

   Animal wastes, others than manure (animal corpses or other corporal animal parts) accidentally occurred on the public waste storage platform, will be sort by the plant operators, and separately stored in a special assigned container, covered. Periodically they will be collected and managed by a special assigned operator.

   **e. Maintenance services** The main equipment will be purchased with two years technical warranty and with the condition of assuring short time intervention.

   **f. Laboratory services** Plant operation and exploitation implies periodical examination of diet feeding plan and its correlation with the recommended process parameters. Periodical
analysis of fresh manure composition and also of the resulted products (dried solid digestate, wet solid digestate – dehydrated, liquid digestate) will be accomplished by specialised local laboratory, accredited.

Furthermore, the services provided (performed tests) by the authorised laboratory are necessary for site environmental monitoring (underground waters, atmospheric emissions, noise).

g. Transportation services

The transportation equipment purchased through the parallel project – Solid manure platform construction (tractor with 2 trailers, frontal loader, vat trailer and a fertiliser spreader) will be able to provide proper services in supplying the fresh waste to biogas facility.

On the contrary, during the campaigns of liquid fertiliser spreading on the agricultural lands (considering long periods of agro-chemical interdiction), sub-letting of additional equipment will be required, equipment that are, in fact locally available\(^3\) for long time periods.

\(^3\) AGROZOOTEHNICA SA and DANAMARI SRL already expressed their intention for collaboration
Chapter 6 Alternatives

The investment is financed by the Ministry of Environment and Climate Changes within the project "Integrated Control of Nutrient Pollution". During the development of the pilot plant for biogas production project, within the Prefeasibility Study, there were followed by now the steps for the selection of an eligible location – locality level.

Seini City was selected based on criteria that estimated local risk of nitrates pollution, livestock population, animal waste rate generation, economic and institutional capability of the beneficiary to implement the project.

Another important criterion of the selection procedure during Prefeasibility Study was the land availability for the investment (land in public property of TAU-Territorial Administrative Unit and with proper topographical location – with respect to waste generator units and protected sites, natural or inhabited).

Taking into account that the location of the investment was chosen based on a set of criteria in a previous project phase, the alternatives considered in the analysis stage of the technical and economic feasibility allowed for the following assumptions:

- Pre-establishment of treatment plant capacity, due to investment value associated restrictions, to 18000 tons/year animal wastes (manure, code 02 01 06) and 2000 tons/year biomass as energy crops silage;
- Convenience of a large plot (the dimensions of provided location is 32886 m², considered more than enough);
- The availability of a second project in the same category, financed by Ministry of Environment and Climate Changes – Construction of a platform for waste storage and machinery allocation for transport and administration on agricultural land;
- Location history and urban works (constructions and installations) still existing on site, some in very good conservation conditions – previously used as manure purification plant and biogas production plant;
- The possibility of accessing the support subsidies for renewable energies for the produced electricity.

The project Biogas plant for biogas production in Seini implementation will be achieved in parallel and correlated with other two projects in the area of waste management, respectively:

- The component Manure storage platform - developed through the project Integrated Control of Nutrient Pollution
- Integrated waste management system in Maramureș County – project submitted to be financed through POS Mediu programme.

On the other hand, of great interest for the implementation program of this project, subjected to permitting procedures, is the investments development plan of Regional Water Operator, regarding the start-up and operation of wastewater treatment plants (three in total) in the Seini Area.

In alternatives evaluation, even from the technical-economic feasibility analysing stage of the project, there were considered two scenarios:

- Scenario A – the development of a biogas plant, incorporating also the manure storage platform, for the production of electricity and heat in a high efficiency cogeneration regime. The cogeneration concept implies simultaneous production of energy in two forms: electrical and thermal, using the same installation, and the same amount of fuel.
• Scenario B - the development of a biogas plant, incorporating also the manure storage platform, with electricity production and without the high efficiency use of the residual heat.

The differences between the two scenarios consist in:

• The similarity of technical equipment and of technological flow until the last process phase for separated digestate solid fraction treatment and utilization, in scenario A, the energy production (electricity and heat) is achieved in high cogeneration regime;
• In scenario A, the thermal energy, obtained using a heat exchanger to recover burning gases heat, installed in the engine and oil cooling system, is used for heating the fermenter, to dry the fermented sludge (digestate) and the excess may be used by a third party;
• The recovery of heat potential is leading to a significant increase of cogeneration system efficiency, overall efficiency of the system reaching to 90 %, provided by the condition that recovered heat is used in a heating system;
• Simultaneous electricity and heat production, using a cogeneration unit is considerable more effective than the separate production. The efficiency is noticeable at the level of used primary fuel consumption, with up to 40 % less fuel consumed;
• The reduction of fuel consumption for the energy production is implying lower costs and implicitly an important economy that concur to a shorter time of investment payback period;
• In scenario B the solid digestate is not dried, and consequently a higher amount of thermal energy resulted from the generator engine cooling process is not recovered, as a difference to scenario A;
• In scenario B, since there is no longer a process of high efficiency cogeneration, the green certificate allocation is lower (implicitly the economic benefits);
• Scenario B, from the point of view of the implications regarding the environmental externalities, is leading to larger quantities of wet digestate that need storage and agricultural soil conditioning management.

Comparison between separate and combined of electricity and heat production

Consequently the alternative presented in Scenario A is recommended, with the development of a biogas plant, incorporating the manure storage platform with electricity and heat production in a high efficiency cogeneration regime.

Alternative 0 (no project)

The proposed project and the technology that will be implemented are leading to major advantages regarding: control of odour associated to unfermented manure, reduction of
gaseous emission resulted from manure decomposing (ammonia) and greenhouse gases (methane), and also the participation to national programme of replacing fossil fuel and energy production using renewable sources.

Additional to economic advantages direct quantifiable, the project contribution to the improvement of life condition within the area is visible, at least related to odour control.

In the conditions of a No Go situation, none of the up-mentioned benefit will be achieved. The alternative 0, thus, is not a viable alternative.
Chapter 7 Potential environmental impact

7.1 Generalities regarding environmental aspects and potential impact quantification

Relevant environmental aspects are the results of identified project activities and are strictly related to the project implementation cycle.

An impact on the surrounding and socio-economic environment may be the result of any identified aspects of the project (of the interaction activity – receptor respectively).

The impact may be direct or indirect. The direct impact is produced quite often outside the project area, as a result of a complex propagation path. Furthermore, the impact may be also classified as residual, cumulative or transfrontier.

The impact level is evaluated considering the diminish or normal control of the impact that is inherent to construction and biogas plant operation (for example it must be taken into account the impact of vehicles and machineries emissions on the air quality, assuming the use of new, modern transportation equipment).

When the types of impact are considered significant even after implementing of diminution measurements, based on the best practice, the detailed evaluation of implication is mandatory.

The quantification of potential impact severity is detailed in the following table.

<table>
<thead>
<tr>
<th>Consequence and quantification</th>
<th>Impact description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Calamitous</td>
<td>Massive effect – persistent and serious environmental damage or a severe inconvenient, reaching a large area. Concerning the commercial or recreational utilization or nature conservation, will imply a major economic loss. Constant, important exceeding of the limits stated by legislation or regulations.</td>
</tr>
<tr>
<td>4 Grave</td>
<td>Major effect – serious damage to the environment. The company must take measures on extended scale to regenerate until initial level the polluted environment. Numerous exceeding of the limits stated by legislation or regulations.</td>
</tr>
<tr>
<td>3 Critical</td>
<td>Localised effect – Repeated exceeding of the limits stated by legislation or regulations. Affecting the adjacency. Damage restoration limited for one year period.</td>
</tr>
<tr>
<td>2 Marginal</td>
<td>Minor effect – Damage large enough to produce an eventual impact on the environment. One overflow of the limits stated by legislation or regulations. No permanent damage of the environment.</td>
</tr>
<tr>
<td>1 Negligible</td>
<td>Minor effect – local environmental damage. Limited to plant location limits.</td>
</tr>
<tr>
<td>0 Zero</td>
<td>No impact.</td>
</tr>
<tr>
<td>+ Positive</td>
<td>Favourable impact– improvement of initial environmental conditions.</td>
</tr>
</tbody>
</table>

It is important to emphasize that quite often is difficult to compare in an unitary manner the environmental impact in different contexts, so that, in the evaluation of environmental aspects specific cause – effect relation must be considered.
Scientific instances, and also the predictions based on observations related to similar previous activities could be and were used in the assessment of environmental potential impact. If a full environmental effect (or just one of its components) quantification of an activity was not possible, or in case of a lack of scientific knowledge, qualitative judgements could be or were used. These kinds of assessments are based on a complete understanding of the proposed project, based on involved team experience and on the recognition of the area where the project will be implemented.

To determine the probability of each action / form of impact, five criteria are defined and hierarchized. The probability criteria are presented in the following table. Level five “certain” expresses the highest probability that the manifestation of the impact form to take place or the fact that it is a form of impact / event characteristic to normal operation of the plant.

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantification</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certain</td>
<td>5</td>
<td>The event will take place under normal operating conditions</td>
</tr>
<tr>
<td>Quite probable</td>
<td>4</td>
<td>The event will take place, very likely, under normal operating conditions</td>
</tr>
<tr>
<td>Probable</td>
<td>3</td>
<td>The event will take place probably sometime, under normal operating conditions</td>
</tr>
<tr>
<td>Improbable</td>
<td>2</td>
<td>The event is not probable, but it might take place sometime under normal operating conditions</td>
</tr>
<tr>
<td>Unlikely probable</td>
<td>1</td>
<td>It is very unlikely that the event may occur under normal operating conditions, but it may take place in exceptional conditions</td>
</tr>
</tbody>
</table>

For each different risk a relevance level is determined based on severity and probability starting from the above mentioned criteria.

Impact significance can be calculated as the multiplication of the severity with probability that an activity/event will take place, expressed as follows:

\[
\text{Significance (impact level) = Severity x Probability}
\]

The risk level is determined using the matrix displayed below:

- H – impact with high significance, no other feasible or economic efficient minimising measure is possible, indemnification or other diminution forms must be assured;
- M – impact with medium significance, it must be confirmed that the residual impact was subjected to all feasible and economic efficient minimising means;
- L – impact with low significance - does not requires minimising actions.

<table>
<thead>
<tr>
<th>Severity</th>
<th>Probabilty</th>
<th>L</th>
<th>M</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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For the evaluation of the potential impact the following manifestations forms or effects are also considered:
- Positive or negative;
- Occurs directly or indirectly as a consequence of project activities;
- Cumulative effects;
- Transfrontier effects;
- Geographical extension of the impact area;
- Impact duration and frequency;
- Receptor sensibilities and impact reversibility.

For each of the environmental aspects / environmental factors considered as relevant for the project subjected to approval, a general evaluation of potential impact forms and of measuring for control and minimisation was conducted starting from the pollutants source of emission.

The nearest sensitive receptors are:
- Someș River, located in the south-south-west from the plant site, at approximately 800 m distance;
- several draining channels that may be integrated as pollution vectors taking into consideration that the receptor is the Someș River;
- the households from Lucian Blaga Street, located at 750 m distance (straight line) in the north-west side of the plant site, across the railway.

As regarding the pollutants transfer ways, the most important are:
1. soil → underground water → Someș;
2. underground water → draining channels → Someș;
3. imissions → sedimentation → soil → underground water → Someș;
4. imissions → odours (habitations).

Environmental and social aspects identified and discussed in this chapter are the following:
- Water quality and quantitative regime;
- Air quality;
- Waste management;
- Soil and soil quality;
- Biodiversity and aquatic ecosystems;
- Noise and vibrations;
- Population and population health.

The following environmental aspects categories or potentially vulnerable environmental factors were considered as irrelevant (involving the absence of a potential impact due to topographical site positioning inside an agroindustrial area):
- landscape/visual environment and
- historical and cultural patrimony, respectively.

On the other hand, given the activities specific and the nature of used materials, an evaluation of chemical or hazardous substances is not applicable to analysed situation (excepting the sulphuric acid for the scrubber, no other chemicals are used on site).
7.2 Water bodies

7.2.1 Site hydrogeological conditions

The plant site is located in the transit area between the two important underground water bodies:

**ROSO01 - Someșului Con, superior Holocene and Pleistocene**

This water body consists of phreatic water trapped in porous permeable deposits of quaternary age (superior Holocene and Pleistocene) that exist within the growing area of Someș River alluvial cone located in the North side of Someș Field until approx. 30 m depth.

**ROSO12 - Baia Mare depression**

In Baia Mare Depression, in the quaternary deposits (sands, grits, clays, silts) located in the area of meadows and terraces of Someș and its affluents (Lăpușul, Bârsăul, Sălajul etc), from the alluvial cones and from the delluvial deposits, where it is developing a phreatic water body of porous – permeable structure with 4 – 7 m thickness.

![Figure no. 9 - Investment location and underground water bodies](image)

The existing exploitation wells of the phreatic horizon (up to 20 m) indicate a good flowing capacity, the alluvial area, meadow type, being water resourceful.

As regards the quality of the underground water, in the plant location area, the existing information due to monitoring campaigns conducted by the neighbouring companies, indicated that, qualitatively, the underground water bodies is affected by historical and/or current activities developed in the area of the analysed location.

---

4 According to Management Plan for the Someș – Tisa Water Basin
Higher values for the CCO-Mn, ammonia, nitrates, nitrites, phosphates and sulphates are recorded. This situation is also illustrated by the reference values established for the underground water bodies (OM 137/2009 regarding the approval of reference values for underground water bodies from Romania).

**Reference values for underground water quality parameters (mg/L)**

<table>
<thead>
<tr>
<th>Water body</th>
<th>NH$_4$</th>
<th>Cl</th>
<th>SO$_4$</th>
<th>As</th>
<th>Cd</th>
<th>Pb</th>
<th>NO$_2$</th>
<th>PO$_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROS001</td>
<td>1.4</td>
<td>250</td>
<td>250</td>
<td>0.01</td>
<td>0.027</td>
<td>0.17</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>ROS012</td>
<td>2.9</td>
<td>250</td>
<td>250</td>
<td>0.03</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

From the hydrographical point of view, *The pilot plant for biogas production* is located in the hydrographic basin of the Someş River, on the right riverside. The distance between the site limit to the river bed is approximately 700 m in the south-west direction.

In the location area of *The pilot plant for biogas production* the phreatic water is at 5 – 7 m depth.

The phreatic flow direction was not determined by direct measurements, but the land geomorphic and the location in the Someş River adjacency indicates a predominant direction from the north-east to south-west.

Information about the phreatic water quality occurring in the farm site area is available starting with 2006, year when S.C. DANAMARI S.R.L. applied for the Integrated Environmental Authorisation for the currently existing farm.

In 2006 samples from the underground water were collected from 12 wells situated in the existing farm location, from which the well no. 12 is situated in the designed location for *The pilot plant for biogas production*.

From the documentation that underlie the Integrated Environmental Authorisation for S.C. DANAMARI S.R.L. results that the quality of underground waters occurring in the future investment location is affected by the historical activities and/or current activities that are developing within the upstream located areas.

Analyses results are indicating values of nitrates, nitrites, zinc and ammonia concentrations higher than the maximum limits admissible by the Law 311/2004, for all six underground water samples, thus suggesting that water quality is affected by the anterior on site progressed activities and/or activities developed in the upstream areas (relative to underground water flow direction).

The results of further underground water analysis do not underline significant changes regarding the quality of phreatic water on the biogas plant location.

The main superficial water course and the nearest to *The pilot plant for biogas production* location is Someş, with the river bed situated at approximately 700 m on the south-west direction from the site.

Someş River has wide plains, with meanders, where the flow rate is very low, and the alluviums accumulation determines the heightening of the plains bed. Someş River (with a discharge of 180 m$^3$/s) is characterized by a hydrological regime with large amounts of water in the spring and with frequent water rushes in the summer, producing floods.

Someş River water quality may be characterized as follows (data taken from the Report regarding the environment for the year 2008 elaborated by Maramureş Environmental Protection Agency):

<table>
<thead>
<tr>
<th>Elements and chemical and physicochemical quality class</th>
<th>Quality class</th>
</tr>
</thead>
<tbody>
<tr>
<td>- thermal regime and acidification</td>
<td>I</td>
</tr>
<tr>
<td>- oxygen regime</td>
<td>I</td>
</tr>
<tr>
<td>- nutrients</td>
<td>II</td>
</tr>
</tbody>
</table>
In the proximity of *The pilot plant for biogas production* in Seini, there are no other superficial stagnant waters.

### 7.2.2 Water consumption

The technology for biogas production using manure (including liquid manure) as raw materials does not require the usage of process water. The water content of materials undergoing the fermentation process is sufficient for the process development. During time of deficit for some liquid manure, the separated resulted digestate may be used as additional liquid phase for the substrate liquefaction.

Nevertheless, the progress of operation objectives in good conditions requires providing a local water source.

Water supply - for hygiene and sanitation, cleaning the platforms and vehicles, fire water, will be accomplished from independent supply – low depth water well, that will be drilled and managed on biogas plant site.

During objective **construction period**, the water will be used for specific activities (work platforms and access roads aspersion in the dry periods), and also for the hygienic-sanitary activities. The water consumption will be very low and the water will be supplied using vats.

During objective **operational period**, the water will have different uses:
- drinking water for the working personnel (will be delivered, based on a contract, by local supplier);
- water for hygiene and sanitation activities of employees;
- water for activities associated to technological activities (platforms daily washing in the areas of manure handling, transportation vehicles washing before leaving the location, equipment hygienation after usage – macerator, solids feeder);
- make-up water for heat transfer circuits (recovered heat from the electricity generator engine) and for the air scrubber that purifies the exhaust gases from the digestate drier;
- water for the maintenance of adjacent areas – green spaces and periodical access road aspersion (until its modernization).

Estimated average daily water demand during operational period is approximately 3.24 m³/day; the water will not be recycled.

Flow repartition for each water consumer, according to the calculation breviary is:

- water for sanitary facilities 0.835 m³/day
- water for vehicles cleaning 0.724 m³/day
- water for platforms and equipment cleaning 0.594 m³/day
- make up water for heat transfer circuits 0.018 m³/day
- make-up water for the scrubber 0.900 m³/day

Estimated drinking and sanitary water consumption during the activities progress will be of approx. 0.835 m³/day for estimated personnel of 11 employees.
Consumption specific flows are:

Daily average requirement (flows):
\[ Q_{\text{day.med}} = 0.0375 \text{ l/s} = 0.135 \text{ m}^3/\text{h} = 3.24 \text{ m}^3/\text{day} \]

Maximum daily flow:
\[ Q_{\text{day.max}} = 0.0506 \text{ l/s} = 0.182 \text{ m}^3/\text{h} = 4.374 \text{ m}^3/\text{day} \]

Maximum hourly flow:
\[ Q_{o,max} = 0.101 \text{ l/s} = 0.364 \text{ m}^3/\text{h} \]

7.2.3 Wastewater management

The generated wastewater sources are characteristic to each of project implementation stages.

Construction stage

Water consumption during the construction period will be limited, since most of the construction materials will be prepared outside construction work site. Water used within
construction site limits will be incorporated in the prepared materials. This activity will not generate wastewater.

The resulted wastewater from the personnel hygienic sanitary activities are categorised as faecal – sanitary. For this purpose, for construction site organisation it is proposed the usage of ecologic toilets and signing of a maintenance contract for the entire construction stage duration.

**Operation stage**

Used/polluted waters collection will be accomplished as follows:

- the resulted wastewaters from the activities developed in the administrative building (sanitary facilities, showers, sink) will be discharged in the sanitary water sewage to which the building is connected. Through this system the wastewater is delivered into the emptying collector basin of 12 m³ capacity;
- wastewaters resulted from the cleaning (of areas/transportation vehicles) will be prior separated in an oily fractions separator and then discharged into the emptying collector basin of 12 m³ capacity;
- the purge from the electricity generator motor will be locally collected and discharged in the rainwater sewage network;
- the purge from the solids drier scrubber will be discharged in the concrete tank with a capacity of 98.5 m³, together with the leachate collected from the manure platform and use collectively as liquid fertiliser. This purge may also be also sprayed on the stored solid digestate (the ammonia sulphate is considered a good fertiliser);
- the wastewater resulted from the platform hygienation activities will be collected through the rainwater sewage system and in the rainwater collection tank (40 m³) from where it will be pumped to the existing concrete storage tanks (basins of the deallocated treatment plant);
- the wastewater drained from the manure platform will be collected through the drainage system and retained into the buried concrete basin with a gross volume of 98.5 m³. This wastewater may be spread on the agricultural land as fertiliser.
- the wastewater drained from the storage platforms (energy crops, solid digestate) will be collected in the two substrate basins (T100 or T110) and used to feed the digester.

Total wastewater flows collected in the sewage system correspond to water requirements respectively:

\[
Q_{day.med} = 0.018 \text{ l/s} = 0.065 \text{ m}^3/\text{h} = 1.56 \text{ m}^3/\text{day}
\]

Daily maximum wastewater flow:

\[
Q_{day.max} = 0.024 \text{ l/s} = 0.087 \text{ m}^3/\text{h} = 2.10 \text{ m}^3/\text{day}
\]

Hourly maximum wastewater flow:

\[
Q_{o.max} = 0.048 \text{ l/s} = 0.1728 \text{ m}^3/\text{h}
\]

For the design (dimensioning) of collecting tanks – rainwater, T100 and T110 (40, 82.5 and 105 m³) some important aspects were considered:

- historical data of rain for calculation was used (40 l/m² in 24 hours), with unitary drainage coefficient (no evaporation, no infiltrations)
- the silage will be covered with polyethylene foil thus it will not retain water
- the filling degree of the liquid manure reception tanks T100 and T110 of 50 %, respectively the usable storage capacity of the three basins is 123.75 m³.

It should be noted that from the rainwater tank (40 m³ capacity), in case of rainfalls, the water will be pumped in one of the existing storage basins (belonging to the deallocated
treatment plant) with a gross capacity of 900 m$^3$. From this basin the rainwater will be used for platforms, roads and green area aspersion.

Excepting the drained surfaces, all the rainwater occurring on the placement (including constructions roofs) will infiltrate in the green area of the location.

### 7.2.4 Forecasted Impact

During the investment construction phase, the waters, especially the underground water, may be polluted by accidental leakage of fuels from the used construction equipment or indirectly as a result of improper storage of some wastes (for example sanitary wastes, packaging wastes, pulverulent materials, etc.). The prevention measurements belong to the category of good practice activities on construction sites, described in the next chapter.

The wastewater resulted from hygiene – sanitary activities of the Constructor personnel will be managed using mobile facilities, their maintenance being contracted by an authorised operator. Consequently, this wastewater will not be considered a pollution source.

During the biogas plant operation period, the wastewater source control will be total. There will not be any wastewater direct discharge into the surface or underground water bodies - excepting rainwater from the free surfaces (unused green areas) during excessive rain period, drained to the marginal channels.

The storage basins, tanks and platforms will be tightened constructions with lateral drainage and collecting piping system for the leachate or potentially polluted water. The manure will be handled with specific mechanical equipment on concrete platforms.

The sanitary wastewaters will be collected separately (and not introduced in the process flow), delivered and treated in an authorised plant. The wastewater will met the requirements of G.D. no. 325/2005 that modifies and completes the G.D. no. 188/2002 – NTPA 002 regarding the conditions of wastewater discharge into the localities sewage systems or directly to the treatment plants.

The potentially polluted rainwater drained from the manure handling areas and also the wastewater resulted from the vehicles and platforms cleaning activities will be collected and introduces in the fermentation flow.

The liquid digestate will be stored in tightened basins during the interdiction periods for agricultural land administration. The temporary storage capacities for the manure and for the digestate are exceeding normal operation necessary. Furthermore, additional storage capacity was considered and provided for the plant.

The transport capacities for the pipes/channels/drainage systems and also the collection basins storage capacities were determined starting from the calculation rain parameters, and considering the pluviometric local characteristics (high precipitation level during summer).

On the other hand, considering the general context of sustainable management of large generated manure volumes at local administrative level, the centralised control promotion, directly, by physical collection from the manure generators, will lead to many advantages. In about three or four years the results of coordinated digestate administration will be distinguished by the improved underground water quality. The efficient implementation of Actions Plan for the
prevention of water pollution with nitrates will have a positive effect. From this perspective the general potential impact is positive.

Stricly referring to the potential influence on underground waters (by accidental pollution during construction period) or on Someș River by eventual unconformities during plant operations (accidental leakage in the plant adjacent channels) the potential impact is insignificant. Moreover, the generation of residual impact it will not be considered.

<table>
<thead>
<tr>
<th>Probability</th>
<th>Severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

It must be mentioned that, there were not taken into account any ill will acts that may lead to accidental pollution – incidents like intentional manure or digestate discharge in the drainage system or leakage as a result of accidents during transportation.

7.2.5 Measurements for impact reduction

The measurements for impact reduction are referring to:
- fuel handling will be conducted in a specific manner, to avoid accidental leaking on soil;
- applying, if the case, of all measurements to prevent and eliminate accidental pollution, in accordance with regulations in force;
- maintenance of normal operation conditions of water supply and wastewater sewage systems (installations and constructions), to minimise water loses or accidental pollution of soil and underground water;
- any material used during construction and operation will be properly stores in special designates areas;
- the utilisation of any toxic substance during construction or operation it will be performed in accordance with their specifications;
- materials or other technological substances will be handled with precaution to avoid dissolution or entrainment by the precipitations;

If all the proposed measurements for impact reduction will be applied, it is safe to consider that the analysed objective implementation and operation will not determine any unbalance in the natural dynamic of hydro-components related to plant location.

7.3 Air quality protection

7.3.1 Local conditions

The climate conditions in Seini City area are characteristic to a moderate continental climate, specific to medium and small mountains climate with some particularities due to the presence of Carpathian Mountains that acts like a fender, obstructing cold air fronts from the north and north-east.

As regards the climatology, Seini area is characterised by an annual average temperature between +9 ÷ +11 ºC.

The average of January is -2.4 ºC and of June is +19.9 ºC.

Aeolian bland regime related to geomorphology is not characterized by strong frost or cold wind from north or north-east.
Seini area microclimate is characterized by high frequency of precipitations (average annual - 979 mm). Considering high moisture air drafts coming from Atlantic Ocean, in general high values of relative humidity can be determined.

7.3.2 Pollutant sources and air protection during construction stage

The main sources and atmospheric pollutants characteristic to the construction phase are represented by:
- works of revamping the existing constructions (existing basins) – particulate pollutants;
- works for platforms construction where the new equipment will be mounted: excavations, fillings, etc;
- handling of construction wastes – particulate pollutants
- constructions works: cutting, welding, painting – pollutants: particles, NOX, CO, volatile organic compounds (VOC);
- operation of motorized equipment, used for different activities, for handling of plant installations/equipment, handling materials, equipment and materials transportation, – pollutants: particles with metals (Cd, Cu, Cr, Ni, Se, Zn), VOC.

Sources specific to construction periods will be superficial, open, free. Their manifestation will be intermittent as a function of the working program (maximum 10 h/day, 6 days/week) and of the works plan. The duration of construction period is estimated to nine months.

After construction works finalization, the up-mentioned pollutant sources will cease.

Measurements for minimising the emissions and pollution level will be technical and also operational:
- using advanced construction machineries, provided with low emissions engines in accordance with the legislation in force;
- reduction of circulation speed on public roads for heavy vehicles used for technological equipment and materials transportation;
- water sprinkle on construction wastes temporary stored on the construction site, during periods with no precipitations;
- minimization of discharge height for the materials that may generate particulate emissions;
- utilization of concrete prepared in specializes stations, thus avoiding the usage of pulverulent construction materials on site;
- cleaning of vehicles wheels that leaves the construction site;
- stopping the equipment engines when not involved in the progressing activities.

It can be estimated that, during the construction period, the level of pollutants concentrations, within the perimeters with sensitive receptors will not be influenced by the activities in progress on the construction site and will be significantly lower than limit values, target values and critical values as laid by Law no. 104/2011 regarding atmospheric air quality and maximal allowable concentrations for total suspended solids (TSS) according to STAS no. 12574/1987.

7.3.3 Pollutant sources and air quality protection during operation stage

As a result of technological process development in the biogas production plant, multiple categories of atmospheric pollutants sources are identified.
These sources are represented by:
- mobile sources – burning gases generated by the transportation vehicles (raw manure, digestate)
- mobile sources – burning gases generated by the machineries within plant area (frontal loader, transport equipment)
- Fix burning source – the engine of electricity generator (continuous operation regime)
- Fix burning source – biogas flare (only in case of generator malfunction)
- Fix source – solid digestate dryer exhauster, after the scrubber.

Uncontrolled ammonia and methane emissions associated to manure handling and temporary storage on site, may be also considered as additional source.

As related to burning gases, resulted from the electricity generator, according to manufacturer’s standard specifications, are in the range of:
- \( \text{NO}_2 \) – 500 mg/Nm\(^3\)
- \( \text{SO}_2 \) – 350 mg/Nm\(^3\)
- \( \text{CO} \) – 1000 - 1500 mg/Nm\(^3\)
- \( \text{VOC}\) total (including methane) – 1000 mg/Nm\(^3\)
- \( \text{VOCNM} \) – 75 mg/Nm\(^3\)

values, for normal operation conditions in terms of temperature and pressure, and a 5% of oxygen concentration.

Using the instruction from the handbook on pollutant emissions inventory EMEP/EEA, for each category of pollution source, the specific emissions were calculated.

Considering the measurements proposed to control on site ammonia emission (covering of digestate storage tanks, treating the emissions from the dryer, temporary liquid manure storage in covered, buried tanks and the optimization of solid manure supply chain, minimizing the temporary on site stored quantity), in this stage, the ammonia emission related to plant operation was not evaluated.

On the other hand, the emissions associated to ammonia and methane production as a result of degradation processed occurring during temporary on site storage are considered significantly lower compared to current emission balance, corresponding to the situation of no implementing of the project – present situation.

The same ratiocination is applicable to the activity of agricultural digestate (liquid and solid) administration, considering that currently, the entire quantity of manure that will be treated (fermented) in the biogas plant are spread on the agricultural lands from Seini area with no prior fermentation and after long temporary storage periods (months).

The main unit designated to control and emissions reduction on site is the wet scrubber, part of the solid digestate dryer (installed after the solid/liquid separator). The required air flow for drying is around 15000 m\(^3\)/h and the entire quantity will go through the scrubber for purification.

The mass balance associated to dryer and scrubber operation indicates the following values:
- Solid digestate amount to be dried 3500 tons/yr
- Working regime (hours/year) 8000 h/yr
- Evaporated water quantity 2306.8 m\(^3\)/yr

\(^5\) Longer storage periods (more than three days) of manure will lead to a significant decrease of plant productivity
- Average ammonia content in the digestate: 4.2 kg/ton
- Desorbed ammonia quantity (going in gaseous phase): 9689 kg/yr
- Scrubber retention efficiency: 87%
- Net ammonia emission: 1260 kg/yr (157.5 g/h)

The hourly masic flow, of ammonia emission, corresponds to an exhausting concentration of 10.5 mg/m³, a value almost 3 times lower than the limit for ammonia laid by 462/1993 Order, of 30 mg/m³.\(^6\)

The efficiency of ammonia retention in the scrubber is controlled by maintaining of washing solution pH in the acidic zone (approx. 4) through sulphuric acid addition. During the gases washing process an ammonium sulphate solution is resulting, which will be also valorised as liquid fertiliser.

The calculation results regarding the emissions associated to project implementation, starting from the source type and regime, including transport distances and fuel consumption are presented in the appended tables.

7.3.4 Air pollution forecast

The impact of a biogas plant on the air quality will manifest in two directions: on the one hand there is a rapid manifestation of the benefits related to odour controlling and minimising of atmospheric emissions of greenhouse effect gases and on the other hand, the contribution of new emissions (fix and mobile) sources, that must be evaluated.

The aspect of new emissions sources impact was taken into account considering at least the aspect related to the absence of limits of emissions for the electricity producing unit (engine). For this unit, the direct values applied to fix combustions sources, according to 462/1993 Order of Technical conditions for atmospheric protection and Methodological norms regarding the evaluation of atmospheric pollutant emissions produced by stationary sources, since this document regulation domain is related to burning furnaces.

On the other hand, this equipment operated in the country or in other member states, has specific emissions in order of 1000 mg CO/Nm³ and 500 mg NO₂/Nm³ (for a 5% O₂ concentration).

Starting from this situation, considering site local context, an evaluation of ambient air quality parameter modification was conducted considering:

- Relevant pollutants for this evaluation, burning gases and particles
- The ammonia was not considered relevant for the evaluation since the biogas plant will lead to a significant reduction of the emissions of this category
- There was taken into consideration the entire adjacent activities spectrum within the impact area (Seini pit, the two sorting stations situated nearby, animal farms – poultry and pigs, and the activities performed in the rented spaces in the precinct of the Suinprod old farm)
- The simultaneity of adjacent activities, including materials handling and the traffic inside the biogas plant

The impact of generated atmospheric pollutants on the quality of ambient air was determined by mathematical modelling of concentration fields considering different averaging intervals, associated to the limit values and cut-off values considered as criteria for air quality evaluation.

\(^6\) 462 Order regulates the emissions sources starting from a masic flow of 300 g/h
The evaluation of the pollution level was accomplished related to limit values, target values and critical levels laid by Law no. 104/2011 regarding atmospheric air quality and maximal allowable concentrations for total suspended solids (TSS) according to STAS no. 12574/1987.

The evaluation was performed by a specialised company in this field - SC Westagem SRL Bucharest.

As dispersion model of atmospheric pollutants AERMOD was used, a Gaussian type multiparameter model. This model was developed in order to include in its theoretical part the main physical phenomena governing atmospheric dispersion of pollutants resulted from industrial sources or other sources types. The model subsumes punctual sources and surface sources.

The input data are:
- Hourly aerology data: generated in a specific format after a pre-processing stage;
- Sources related date: physical sources parameters (punctually sources – furnaces) or geometrical dimensions – length, width, - height for the superficial sources;
- Emission data: mass flows, exhausting temperatures
- Variation time: factor that describes the emissions variation in time for each type of source that was introduced in the model: punctually or superficial;
- Data related to receptors network: defining receptors coordinates in a spherical or rectangular coordinates system.

The output data are represented by the concentrations fields in the defined receptors network nodes. The model generates, in all receptors network nodes, hourly average concentrations and also average monthly, yearly and other statistical values important for the air quality. *Analysed pollutants: NO\textsubscript{2}, NO\textsubscript{x}, CO, total suspended solids and PM\textsubscript{10}.*

For the evaluation and quantification of biogas plant contribution to environmental impact, the model was run considering the current levels of local pollution situation.

Analysing the values presented in Tables 6 – 18 of Annex B it may be observed that the maximal values of the studied pollutant concentrations during the operational stage even considering different mediation intervals is situated under the imposed limit values by applicable legal provisions in all considered sensitive points (residential receptors).

Also, it may be concluded that the higher values of pollutants concentrations in air are distributed within the plant site perimeter and in the object close adjacency.

The graphical representation of the model results are presented in Annex B – Air quality impact assessment.

The unburned biogas emissions and the usage of the auxiliary flare will be minimised. Any significant unburned biogas emissions (including the operation of the relief valves of the digester roof) and the auxiliary flare operation hours will be recorded.

During the investment execution stage, the sources that will generate pollutant emissions into the atmosphere are represented by the construction machineries (excavators, cranes etc.). their operation will be discontinuous, corresponding to working program (maximum 10 h/day, 6 days/week) and to works plan. The duration of construction period is estimated to nine months.
The machineries usage will generate exhausted gases (hydrocarbons, carbon monoxide, nitrogen oxides, sulphur oxides, pulverulent substances, etc.). A reduced quantity of welding gases and some particulate pollutants resulted from construction materials handling will also be considered.

Considering site conditions and proposed technology, there is no modification of local air quality standards forecasted as a result of the implemented solution. The influence area of exhausted gases generated on site will be strictly local – within the plant location and in the near proximity.

Equally, no residual impact can be assumed.

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<thead>
<tr>
<th>Probability</th>
<th>Severity</th>
<th>Significance</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

In these conditions the significance of impact on the air quality reaches value 3, corresponding to an insignificant impact and related to just one pollutant – nitrogen oxides. In this stage, the applicability of additional measures to controlling and reducing of this emissions type is not considered feasible.

As regards the digestate, fermented material, it must be emphasized that the anaerobic fermentation will reduce the odour with more than 80%. The digestate is almost odourless, and the residual ammonia will be rapidly dispersed after the land administration as fertiliser.

A. Volatile fatty acids concentration that determine unpleasant odour in untreated and treated manure/slime

B. The concentration of odour substances in air samples collected from the field, after treated and untreated manure administration on soil (HANSEN, 2004)

7.3.5 Measurements for impact reduction

All necessary measurements required to keep the pollution of atmospheric component at the lowest possible level, will be applied, respectively:
- Clear delimitation of construction areas;
- Water aspersion of the construction area in case of wind and dry air;
- Maintaining of a proper moisture content of construction materials;
- Vehicles used for materials transport will be verified and cleaned to avoid materials spreading outside the construction site;
- Introducing of speed limit for the vehicles that provide materials supply, construction wastes disposal or raw materials supply during biogas plant operation;
- Setting of a limited (as short as possible) on site storage time for the construction wastes to avoid air entrainment and consequently air pollution in the area;
- Usage of new equipment and transport vehicles, provided with Diesel engines with low SOx emissions;
- Monitoring of biogas burning engine emissions, to maintain its operation within normal functional parameters;
- Monitoring of biogas burning parameters, so that the optimal burning temperature for methane to be assured and thus minimising the emissions;
- Proper storage of animal wastes and digestate, to minimise the ammonia and volatile fatty acids air emissions.

The objective characteristics (location with respect to receptors, fermentation process developed in tightened tanks, manure and digestate storage in covered areas), local meteorological conditions (plain area with efficient gases dispersion) the maintenance in proper operating conditions of the biogas burning unit and of the equipment, lead to the framing of the project impact within admissible limits, clean air, level I (on a scale of 1 to 10, the level may be considered at 9, no effects).

7.4 Soil and subsoil

7.4.1 Local conditions


The geological structure of studied area subsoil is characterised by a basement formed by Mesozoic and Palaeogene deposits that belongs to area of trans-Carpathian flysch.

In the drilled wells within the location area of The pilot plant for biogas production in Seini in previous studies revealed the following geological formations:
- vegetal soil – between 0 m and 0.8 ÷ 1 m underground level;
- sandy clay with sand lens – between 0.8 ± 1 m and 1.2 ÷ 1.6 m depth from the surface;
- sand and grit – between 1.2 ÷ 1.6 m and 5.8 ÷ 6.5 m depth from the surface;
- sand, grid and gravel – between 5.8 ÷ 6.5 and 12 ÷ 16 m depth from the surface.

7.4.2 Soil and subsoil pollution sources

The activities that will take progress for project implementation may affect soil and subsoil.

During project development, there are two distinct categories for the activities that can be considered as pollution sources for soil and subsoil:
- Sources specific to the execution stage;
- Sources specific to operation stage.

During the construction period the soil may be contaminated because of specific sources to the execution stage:
- excavation works for the foundations execution;
- diminishing of the historically accumulated reserve of humus, by removing the land area from the natural circuit to develop the constructions;
- uncontrolled waste storage;
- temporary land utilization for storage of construction materials;
• alterations of drainage conditions due to excavation works progress;
• accidental engine fuel leakage form the used construction vehicles;
• accidental leakage of engine fuel, lubricants and oil from equipment;
• temporary uncontrolled storage of paint storage reservoirs;
• improper sanitary waste storage resulted during construction stage (constructor personnel).

**Sources specific to operation stage**
- accidental leakage of materials used in the technological flow;
- pollutants atmospheric emissions resulted from the technological process with negative influence on soil;
- alteration of soil and subsoil elements through accidental leakage/spillage of raw materials or products and by-products (digestate) during transport and handling operations;
- pollution with oily products during the transportation of technological process raw materials and resulted.

*During the two distinct project stages (construction and operation, after the start-up) there will not be any risk of direct soil pollution and there will not be continuous sources of soil pollution.*

### 7.4.3 Forecasted Impact

Pollution or soil affectation is represented by any action that produces alteration of normal soil function as a support for different ecosystems.

The activities that will be performed on the biogas plant location, during the two distinct project sages (construction and operation) will not affect the underground/subsoil (geological elements) and will not produce any change of geologic environment.

The residual impact is considered very low. The severity was evaluated to 1, since all possible forms of impact can occur exclusively between the location limits. Furthermore, due to existing prevention and control systems that will be implemented, the probability for a possible impact form to take place is very little. Thus, the impact significance is very low.

<table>
<thead>
<tr>
<th>Probability</th>
<th>Severity</th>
<th>Significance</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### 7.4.4 Measurements for impact reduction

Soil and subsoil protection measurements during the construction/mounting activities are:
- daily inspection of equipment and machineries technical condition;
- equipment fuel supply will be accomplished under supervision;
- equipment oil change will be accomplished in specialised units and not on plant location;
- the assessment to construction material suppliers of using vehicles with proper technical specifications;
- temporary storage of construction wastes on protected platforms, special designated and accommodated;
- sanitary wastes collection in special designated containers placed on the manure platform;
- the valorisation of inert residues/wastes resulted from construction, for access road rehabilitation;
• non-hazardous or hazardous wastes resulted will be collected in dedicated containers and disposed through authorised operators.

It can be estimated that through the implementation of this measurements in the construction phase, the possibility of soil or subsoil pollution is reduced.

Soil and subsoil protection measurements during operation stage are:
• materials storage on concrete platforms, designed and constructed with piping system for integral collection of leachate and accidental spillages;
• liquid manure storage in covered tanks, tightened;
• waste management according to legislative requirements;
• limitation to minimum of the area of land excluded from natural pedological circuit;
• efficient raw materials and wastes management to minimize biological soil pollution;
• proper construction wastes storage, in special designated areas and for shorter time periods.

It is estimated that the impact on soil and subsoil is situated at a negligible level, as long as all the installations and equipment will be properly exploited, and the wastes will be efficiently managed.

7.5. Biodiversity

7.5.1 Information about the biotopes specific to plant location

Situated near the boundary between Maramureș and Satu Mare counties, the characteristics of plant location, as concerns the biodiversity, are closer to Satu Mare county specifics.

The highest percentage refers to hemicryptophyte (42.1%), that inhabit various ecosystems. The therophytes are also presented in large number (30.2%), especially on anthropic lands and mainly on agricultural lands.

The characteristic mammiferous are rodents: European ground squirrel, European hamster, mouse, filed mouse, mole rat, field rabbit, and in the field superficial water: mouse and rat. Ornitofauna is composed from: bustard (sporadic) quail, partridge, filed kite, hen-hawk, forest owl, barn owl, collared dove, tawny pipit, carrion crow, lark, warbler, house sparrow, western jackdaw.

The fauna of this forest steppe area comprise numerous species of insects, predominantly Orthoptera (locusts, grasshopper, forest cricket, and mantis) and Coleoptera.

Mammals characteristic to meadow area are: musk rat, otter, mouse, fox and wild-boar. Avifauna is mainly comprised of: white stork, whistler, black-tailed godwit, thrush nightingale, sand martin, cuckoo and wagtail.

The pilot plant for biogas production in Seini is located in the South-West part of Seini City, in an agricultural area and it is characterised by fauna and flora specific to anthropic areas. There are no declared protected natural areas in the plant site location.

7.5.2 Forecasted Impact on flora and fauna

The objective is situated in an agroindustrial area, placed between two agrozootechnical building complexes (farms). Practically, the location is in an area where the anthropization
phenomena occurs as a result of agroindustrial activities developed thus the local flora and fauna do not include protected species.

The surrounding land is used as arable (previously, in the nearness there was an orchard).

The only elements of interest for the wild fauna are represented by the brushwood (underwood vegetation) grown along the rainwater draining channels. The project implementation will not modify the present structure of adjacent vegetal formations.

Hence, it might be considered that the components of the flora from the surrounding area will not be significantly affected compared to current situation.

From the point of view of the natural protected elements presence in the adjacent areal, as can be seen in Figure 4 – Protected Natural Areas from Appendix A of the EIA Report, the distances to the closest natural protected areas are very wide.

As concerns to the construction period of the plant, the construction site location, the building yard and the material provision management will be developed according to the best practice and will not lead to negative effects over the wild life. For the Environmental Management Plan that will be elaborated for the construction site, all the aspects necessary to eliminate the risk of spent effluents discharge into Someș River will be considered.

There are not considered necessary any special measurements for the diminishing of the impact over these environmental components (biodiversity).

The residual impact is considered low. Severity was evaluated to 1, due to the fact that all the possible impact forms will occur exclusively between the site limits. Consequently, the impact significance is very low.

<table>
<thead>
<tr>
<th>Probability</th>
<th>Severity</th>
<th>Significance</th>
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<td>1</td>
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</table>

7.5.3 Terrestrial and aquatic systems protection

It is not applicable in this situation since the plant is located in an agro-industrial anthropic area, where there are not present any protected elements of flora or fauna.

In the plant site area, considering its location on an industrial platform, the natural biotic elements were strongly altered by the anthropic intervention, so their presence is only sporadic. Consequently, the project will have an insignificant effect on areal biotic components.

7.6. Social and economic environment

7.6.1 Economic and social environment

The biogas plant will be located in the median area between two agro-industrial platforms, within 1 km distance from the first group of houses from Seini City.
With respect to cadastre and urbanism the investment development will not lead to the necessity of current situation/status modification. The land designated as plant site is in public property and through the implementation no additional land areas will be required.

The valorisation of an otherwise abandoned location is considered to have a positive impact. No attenuation measurements are required.

7.6.2 Local economy and employment

Seini City is a small urban locality, with developing infrastructure. The economic industrial activities have limited expansion; agriculture and animal husbandry on the other hand have an important share of local economy.

Considering local economy characteristics, the project will have an certain positive impact. The project implications are as follows:

- the potential of creating new job opportunities and development of competencies during construction and operation phase;
- during the construction phase, the proposed project will contribute to local economic improvement, by employing local contractors, suppliers and services providers;
- the project is an important capital investment, with potential of leading to existing agricultural activities development (upstream and downstream activities);
- furthermore, considering direct connexion with the activities that will take progress at the biogas plant, another supporting activities (transport, laboratory analyses, maintenance services for specific equipment and machineries, compost/dried digestate valorisation) may become viable businesses at local or regional level (few others biogas plants are in the project phase in the area).

The impact on local economic environment will be positive.

No attenuation measurements are necessary. It is recommended the encouragement of local resources utilization (materials and human), including during construction phase.

7.6.3 Transport and access roads

The vehicles access to the location will be done using modernised roads (in the urban areas) and on technical acceptable roads (ballasted roads) in the land outside buildable area (Fermenlor Street)

Taking into account that the main raw materials (manure) generators are located in the plant site adjacency (the pig and poultry farms) the supplying transport is not considered and issue.

Digestate administration on agricultural lands implies however, longer transit distances and consequently populated areas. However, using modern transportation vehicles will not conduct to any discomfort for the inhabitants.

There is no need for other investments or transport alternatives development.

No other works for residential areas or public objective protection are considered necessary.
7.6.4 Noise

The distance to the administrative centre of Seini City is 4 km, and the distance to the nearest inhabited areas is:
- 1 km towards North
- 2,5 km towards South
- 1,3 km towards East
- 3,5 km towards West

Noise sensitive receptors are located within large distances to the plant location; moreover some constructions and other enclosures with protective purpose against noise propagation will be installed. Furthermore, the noise generators (CHP unit, loading equipment) will be installed in soundproof container and new generation technological equipment will be selected, characterised by low noise emissions level.

The only project element that may generate discomfort, from the noise perspective, is the traffic, not only during the construction phase (limited time period), but also during operation.

The attenuation measurements imply:

- The material supply / delivery schedule (including in the construction phase) will take into consideration the rest intervals and avoid them;
- Assuring of proper conditioned roads infrastructure (by the public administration) that will lead to a better location access.

7.6.5 Location security

The location security (fenced and protected site) it is important in Romania since recovered metals acquisition from natural persons is allowed in the recycling and collecting centres, and the derived criminal phenomena must not be neglected.

The project is proposing fencing the location and continuous protection services. This measurement has a negative effect on operational incomes balance, but is preventing other unpleasant consequences (vandalism activities).

The attenuation measurements must be considered and applied even from the construction phase period.

7.6.6 Impact on human and population health

Considering that the objective will be developed in an industrial area, the risk of creating discomfort for the inhabitants is considerable reduced, during the construction stage and also during the operation interval. Nevertheless, the potential forms of negative impact that may affect anthropic elements during construction and operation periods must be enumerated:

- Construction site organization, that always represents a source of discomfort for the riparian population producing noises and increase of dust level; the possible occurrence of traffic congestion due to heavy duty vehicles used for construction materials transportation or raw materials transportation (after the start-up); in this case the traffic normal values will increase with less than 5 % so, this increase can be considered insignificant;
Uncontrolled construction waste storage that may generate an negative aesthetic impact;
- After the start-up, the objective may become an offensive odours source if the digestate and used manure will not be properly handled; also, this aspect may develop as a source of discomfort for the employed personnel.
- Phonic pollution, that may have a negative impact on population can be considered insignificant since the plant is located outside the residential areas;

Attenuation measurements:
- Before leaving the plant site, the vehicles used for the construction materials transport will be cleaned to avoid roads contamination with construction site wastes;
- Sanitary facilities will be provided on site, preferable mobile, with chemical neutralisation or periodically emptying tightened septic tanks; operations like vehicles and machineries oil change dismantle or disassemble will be forbidden on site;
- The construction site for the designed works will be fenced to delimit the perimeter that will be in the contractor responsibility;
- The construction wastes and the wastes resulted during the operation stage will be managed in a very restrictive manner and disposed only by authorised operators, in order to do no harm for the population health and not to create any stress or discomfort to humans by generating odours or disagreeable visual aspect;
- Atmospheric gases emissions resulted at biogas burning, will be permanently monitored;
- Very strict hygiene measurements will be applied in order to eliminate any risk of biological contamination associated to manure and digestate handling.

On the other hand, manure treatment is a biogas plant is considered a positive activity – as a result of produced advantages – to human health and welfare. Implementing a highly frequency manure collecting service from the urban area (including households) will have an immediate positive effect on the living conditions within the city area.

Manure (from the industrial operators and households) treatment by mesophilic fermentation will lead to a couple of advantages categories: significant reduction of odour-print and also a significant reduction of hazardous bacteria and parasites population (the fermentation has an indirect semi-sterilisation effect on digestate).

Thus, digestate administration on the agricultural lands will significantly reduce the public attitude related to odours issue.

Moreover, in the current management of the issues regarding the agro-industrial activities developed in the south side of Seini City, the daily control of generated manure quantities will lead to the improvement of air quality in the area (as a result of a significant reduction of ammonia and hydrogen sulphide emissions and consequently the reduction of specific odours).

On another hand, the risk of daily exposure to raw manure for the involved personnel will be periodically controlled. Individual protection equipment and specific working procedures will be mandatory.

Hygienic-sanitary facilities will be available on the platform.

By implementing of a high degree of automation for the technological processes development and considering the measurements to assure proper exploitation/operation conditions, the effects that could generate pollution that may affect human health within location area and in the vicinity are limited.
It is considered that, by adopting proposed technical measurements and by strict abidance to technological discipline, according to procedures that will be developed, the objective contribution to inhabited areas pollution and to population health deterioration will manifest in a positive manner.

The residual impact is considered low. It was evaluated a positive severity due to produced advantages. Consequently, the impact significance is very low.

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<tr>
<th>Probability</th>
<th>Severity</th>
<th>Significance</th>
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<td>+1</td>
<td>1</td>
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</tbody>
</table>

The general conclusion of the potential impact evaluation indicates a small level for it – the highest manifestation severity is 1 (insignificant impact) and the highest significance is 3, derived from the highest probability of a phenomena to take place.

The control and diminution measurements considered within this project assure the premises of implementing a technical solution that will determine the improvement of environmental standards in Seini City area.
Chapter 8 Wastes

Waste management within a project assumes the existence of two distinct stages when specific wastes for each of these stages are generated:

- Construction stage of the designed objective, when especially construction waste are generated;
- Operation stage, when wastes, specific to activities in progress, are generated.

8.1 Generated wastes during the construction stage

The main wastes codified according to G.D. 856/2002 that may be generated during biogas plant construction phase and ulterior during the exploitation period, and also waste management are presented in the following table.

<p>| Category of generated wastes on site during construction site organisation and construction works |
|---|---|---|---|---|
| Waste source (project stage) | Waste code acc. to European Waste List | Generated waste | Temporary storage | Handling | Hazard classification |
| Construction site management | 17 09 04 | Mixed construction and demolition wastes | Temporary stored in containers placed on the construction site | Reuse as filling material | non-hazardous |
| | 13 02 08* | Other engine, gear and lubricating oils (from used machineries) | Temporary stored in sealed containers | Disposal through an authorised operator | hazardous |
| | 15 02 03 | Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02* | Temporary stored in sealed containers | Disposal through an authorised operator | non-hazardous |
| | 15 02 02* | Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances | Temporary stored in sealed containers | Disposal through an authorised operator | hazardous |
| | 20 03 01 | Mixed municipal waste (domestic residues generated by the construction personnel) | Temporary stored in containers placed on the construction site | Disposal through a sanitation operator | non-hazardous |
| | 15 01 01/15 01 02/15 01 03 | Waste resulted from non-hazardous raw materials packaging used in constructions | Temporary stored in containers placed on the construction site | Recovered by authorised economic operators | non-hazardous |</p>
<table>
<thead>
<tr>
<th>Waste source (project stage)</th>
<th>Waste code acc. to European Waste List</th>
<th>Generated waste</th>
<th>Temporary storage</th>
<th>Handling</th>
<th>Hazard classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 01 10*</td>
<td>Packaging containing residues of or contaminated by dangerous substances</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Disposal through an authorised operator</td>
<td>hazardous</td>
<td></td>
</tr>
<tr>
<td>17 01 01</td>
<td>Concrete wastes</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Reuse as filling material</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 01 07</td>
<td>Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06*</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Reuse as filling material</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 02 03</td>
<td>Plastics (scraps of PVC pipes, PP/PE mesh, PE foil, expanded PS)</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Recovered by authorised economic operators</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 02 04</td>
<td>Wood containing or contaminated with dangerous substances (resulted from the construction of administrative building)</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Disposal through an authorised operator</td>
<td>hazardous</td>
<td></td>
</tr>
<tr>
<td>17 02 01</td>
<td>Wood (used as encasement)</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Reuse as firing in wood burning installations</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 04 05</td>
<td>Metallic wastes from reinforcements, other constructions</td>
<td>Temporary stored in sealed containers</td>
<td>Recovered by authorised economic operators</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 04 07</td>
<td>Mixed metals</td>
<td>Temporary stored in sealed containers or on a platform</td>
<td>Recovered by authorised economic operators</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 04 11</td>
<td>Cables other than those mentioned in 17 04 10 (from the electrical net and interior illumination system)</td>
<td>Temporary stored in sealed containers</td>
<td>Recovered by authorised economic operators</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 05 04</td>
<td>Soil and stones resulted from excavation for foundation</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Reuse as filling material</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 08 02</td>
<td>Gypsum-based construction materials</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Disposal through an authorised operator</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>17 06 04/17 06 03*</td>
<td>Insulation materials consisting of or containing non-hazardous/dangerous substances</td>
<td>Temporary stored in containers placed on the construction site</td>
<td>Disposal through an authorised operator</td>
<td>non-hazardous</td>
<td></td>
</tr>
<tr>
<td>20 03 01</td>
<td>Mixed municipal waste</td>
<td>Collected in ecological cans</td>
<td>Disposal through a sanitation operator</td>
<td>non-hazardous</td>
<td></td>
</tr>
</tbody>
</table>
Waste management during the construction phase

<table>
<thead>
<tr>
<th>Waste code</th>
<th>Waste category</th>
<th>State/hazard</th>
<th>estimated quantity</th>
<th>Disposal actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 01 10*</td>
<td>Packaging containing residues of or contaminated by dangerous substances</td>
<td>S/hazardous</td>
<td>0,030 t</td>
<td>Separate collection and recovered by an authorised operator/Elimination</td>
</tr>
<tr>
<td>15 02 03</td>
<td>Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02*</td>
<td>S/non-hazardous</td>
<td>0,010 t</td>
<td>Separate collection and recovered by an authorised operator – waste dump class B/Elimination</td>
</tr>
<tr>
<td>17 01 01</td>
<td>Concrete wastes</td>
<td>S/non-hazardous</td>
<td>1,5 t</td>
<td>Local valorisation – road territory/Valorisation</td>
</tr>
<tr>
<td>17 01 07</td>
<td>Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06*</td>
<td>S/non-hazardous</td>
<td>1,5 t</td>
<td>Local valorisation – road territory/Valorisation</td>
</tr>
<tr>
<td>17 02 01</td>
<td>Wood</td>
<td>S/non-hazardous</td>
<td>30 m³</td>
<td>Separated collection and local recovery/Recovery</td>
</tr>
<tr>
<td>17 02 03</td>
<td>Plastics</td>
<td>S/non-hazardous</td>
<td>0,6 t</td>
<td>Separate collection and recovered by an authorised operator/Valorisation</td>
</tr>
<tr>
<td>17 04 07</td>
<td>Mixed metals</td>
<td>S/non-hazardous</td>
<td>1,5 t</td>
<td>Separate collection and recovered by an authorised operator/Valorisation</td>
</tr>
<tr>
<td>17 04 11</td>
<td>Cables other than those mentioned in 17 04 10*</td>
<td>S/non-hazardous</td>
<td>0,3 t</td>
<td>Separate collection and recovered by an authorised operator/Valorisation</td>
</tr>
<tr>
<td>17 05 04</td>
<td>Soil and stones other than those mentioned in 17 05 03*</td>
<td>S/non-hazardous</td>
<td>9 t</td>
<td>Temporary storage on site (north area, unused) and local reuse for roads</td>
</tr>
</tbody>
</table>

Waste management will pursue the risk minimisation for the environment and population and also the control (limitation) of waste quantities disposed to waste dumps.

The provisions of Law 211/2011, regarding wastes, will be abided and the generate wastes quantities will be recorded according to provisions of GD no 856/2002 regarding the waste management and for the approval of waste lists, including hazardous wastes.

For separated collection, the storage and disposal of the wastes resulted in the construction phase there will be accommodated proper facilities.
### 8.2 Waste generated during the operation stage

Synthesis of information regarding the management of generated waste on Seini biogas production plant site, during the exploitation period, is presented in the following table:

<table>
<thead>
<tr>
<th>Waste code</th>
<th>Waste category</th>
<th>State/ hazard</th>
<th>estimated quantity</th>
<th>Disposal actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 01 02</td>
<td>Animal-tissue waste</td>
<td>S/non-hazardous</td>
<td>0,2 t/year</td>
<td>Delivered to a specialised operator/Elimination/Valorisation</td>
</tr>
<tr>
<td>19 08 13*</td>
<td>Sludge from the oily fractions separator</td>
<td>S/hazardous</td>
<td>0,06 t/year</td>
<td>Delivered to a specialised operator/Elimination</td>
</tr>
<tr>
<td>13 02 05*</td>
<td>Mineral-based non-chlorinated engine, gear and lubricating oils</td>
<td>S/hazardous</td>
<td>450 l/year</td>
<td>Delivered to a specialised operator/Valorisation/Recovery</td>
</tr>
<tr>
<td>16 01 03</td>
<td>End-of-life tyres</td>
<td>S/non-hazardous</td>
<td>4 piece/year</td>
<td>Delivered to a specialised operator/Recovery</td>
</tr>
<tr>
<td>06 13 02*</td>
<td>Spent activated carbon</td>
<td>S/hazardous</td>
<td>1 t/year</td>
<td>Delivered to a specialised operator (the hazard classification will be revisited after testing)/Elimination</td>
</tr>
<tr>
<td>19 06 05</td>
<td>Liquor from anaerobic treatment of animal and vegetable waste (liquid digestate)</td>
<td>L/non-hazardous</td>
<td>15.150 t/year</td>
<td>Valorisation on agricultural lands/Valorisation</td>
</tr>
<tr>
<td>19 06 06</td>
<td>Digestate from anaerobic treatment of animal and vegetable waste (solid digestate - wet)</td>
<td>SS/non-hazardous</td>
<td>2,335 t/year</td>
<td>Valorisation on agricultural lands/Valorisation</td>
</tr>
<tr>
<td>19 02 99</td>
<td>Dried digestate</td>
<td>S/non-hazardous</td>
<td>1,200 t/year</td>
<td>Valorisation on agricultural lands - selling/Valorisation</td>
</tr>
<tr>
<td>20 02 01</td>
<td>Biodegradable waste</td>
<td>S/non-hazardous</td>
<td>0,71 t/year</td>
<td>Delivered to local operator and stored in waste dump class B regional/Elimination</td>
</tr>
</tbody>
</table>

The domestic type wastes, and similar, generated on site will be collected in closed containers, temporary stored in designated areas – near the administrative building and will be taken over by the local sanitation operator, based on a signed contract.

Spent oils – resulted from the periodical activities of generator maintenance will be temporary stored in a metallic container, placed in a metallic pan and will be delivered to an operator authorised for this services.
Used metallic parts and components will be collected in special designated areas within plant location and valorised through specialised operators.

Hazardous or non-hazardous wastes – accidentally occurred on the solid manure storage platform (dedicated to wastes collection from households) will be sorted by the plant personnel and separately stored in proper labelled containers. These wastes will be taken over by the local sanitation operator in periodical campaigns, dedicated for these types of wastes.

The wastes of animal origin – other than manure (category animal-tissue waste), accidentally on the solid manure storage platform (dedicated to wastes collection from households) will be sorted by the plant personnel and separately stored in a dedicated container (covered). Periodically these wastes will be collected by a local designated operator for disposal and neutralisation.

For this purpose, the municipality will organise for waste generators and for population dissemination campaigns regarding the incompatibility of these categories of wastes with the activity object of the biogas plant and also to inform about the existence of other local agents for this services.

Digestate resulted during anaerobic fermentation of manure is still considered waste in Romania in absence of any specific norms regarding ceasing the waste status, even if the requirements provisioned in Chapter 5 By-products, Article 5 from Law 211/2011 regarding the wastes are accomplished.

In operational management of Seini Biogas plant, the digestate will be handled as waste that can be valorised, resulted from a treatment process for the valorisation purpose.

This approach will be considered until the provisions of Law 211/2011 regarding wastes, Chapter 6, ceasing of waste status, Article 6 will come in force.

For the resulted digestate, disregarding its stage (liquid, solid, dry) there will be kept records according to provisions of GD 856/2003, including information regarding the quality and composition of digestate.

Also, the digestate transportation to the valorisation place will be performed according to GD 1061/2008 provisions, regarding waste transport.

8.3 Potential impact associated to waste management

The biogas plant was designed and dimensioned in order to assure all the safety conditions necessary for a proper storage, handle and treatment of the wastes considered in the activity object.

The management system that will be implemented for the generated waste of current activity, excludes the possibility of soil and subsoil contamination. For each waste type/category generated on site authorised services for handle and treatment/elimination will be considered.

For this objective (subject of authorisation) the residual impact is considered to be low, all the possible forms of impact present the probability of manifestation exclusively within plant location boundaries.

Additionally, due to prevention and control systems existing or future to be implemented, the probability of a possible impact occurrence is very low. Consequently, the impact significance is very low.

<table>
<thead>
<tr>
<th>Probability</th>
<th>Severity</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Chapter 9 Risk situations

Environmental risk management is one important aspect provisioned by Romanian legislation that considers the development of environmental policies able to ensure a sustainable development.

Essentially, this implies the identification of possible pollution risks, the establishment of occurrence probability, of susceptible environmental factors, and also of the prevention and control modalities for these risks.

The presence of the most important risk situations, which may occur in normal project development, may be split for two reference moments: the implementation period and the operation stage.

The categories of identified risks are:
- natural risks;
- technological risks.

Natural risks
The objective is located in an area with associated relative reduced natural risk (earthquakes, floods, earth flow, etc).

The actual plot and the surrounding area are stable without any signalised manifestations of geodynamic phenomena that could affect the behaviour of the existing or future constructions.

From the point of view of geological study, the geologic aggregates are formed in Quaternary age and consist of clays, sands and grit.

Geomorphic configuration of the area that includes plant location is plain field, and the absolute average altitude is 150.00 m.

In terms of seismic protection, Standard P 100-1-2006, Seini city has a peak level of ground acceleration for IMR = 100 years ag = 0.12 g and the control period of response spectrum Tc = 0.7 sec. Frozen depth, STAS 6054 - 77, is -0.90 m under the land elevation.

Topographically, the area is classified as plain land; average altitude on the plot is 145.5 m. The site is located in Someș River meadow, on the right side.

The plot is delimited on two sides (west and south) by artificial drainage channels for the rain waters, channels that are discharged in Someș River. The distance to the Someș river bed, that flows in SV region of the location is 350 m.

A special situation is generated by a potential risk in case of dry season, which will be followed by the reduction of raw materials availability necessary for biogas plant operation.

This aspect will not generate an impact on environmental quality, but will have an influence on economic – financial conditions of the investment.

Technological risks
A biogas producing plant construction and operation must consider a series of highly important safety norms, otherwise a number of potential risks related to human, inhabitants and environment may occur.

**Accident situation and/or operation trouble** characterised by an increase of environmental pollutant concentrations are leading to important exceeding of maximum
admissible concentrations as provisioned by in force norms for personnel, population and environmental protection.

Depending on the technological flow profile, equipment reliability, provided automation system and on technological discipline, the operation troubles/shut downs could be less frequent or persistent.

Implementing proper safety measurements the occurrence of any risks, unpredicted situations are avoided and in the same time safe conditions for plant operation are provided.

Initial technological risks are depending on chosen or used technology by the beneficiary, and could be eliminated through tender books specifications used for contractor and equipment supplier designation, for the biogas plant and for the cogeneration unit.

Safety measurements that must be considered are mainly referring to below described aspects (the most important and relevant, for the biogas plant, are detailed):

– Explosions and fire prevention. Biogas, in combination with air, may form an explosive gaseous environment. The risk of fire and explosion is especially elevated near the digester and biogas reservoir. Consequently, specific safety measurements must be guaranteed during biogas plant construction and operation.

For the hazardous areas (EX-zone) as classified by European Directive 1999/92/EC, considering the occurrence frequency and duration, adequate prevention measurements will be applied, in the scope of avoiding accidents.

The biogas production plants may be classified as: Zone 1 - A place in which an explosive atmosphere consisting of a mixture with air or flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally and in Zone 2 - A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Despite the fact that explosion may occur only in certain conditions, there is always the risk of fire in case of existing of open fire sources, short-circuits produces by the electric devices or in case of lightning strokes.

– Asphyxiation and poisoning prevention. Especially the presence of hydrogen sulphide (H₂S) in the un-desulfurized biogas may be extremely toxic, even at low concentrations, resulting poisoning or asphyxiation symptoms or even death. Particularly in case of close rooms, with low elevation (for instance underground rooms, basements, etc), the asphyxia may be caused by biogas displacement of oxygen.

Biogas is lighter than air, with an approximate density of 1.2 kg/m³, but has the tendency of separating into its components. Carbon dioxide, which is heavier (D = 1.85 kg/m³), will occupy lower areas, while methane, lighter (D = 0.72 kg/m³), will ascend into the atmosphere.

For this reasons, in close area a series of safety measurements must be taken, with the purpose of providing proper ventilation. Furthermore, protection equipment must be worn (for instance, gas presence warning devices, respiration protection, etc), during the activities in areas with potential danger.

– Mechanical dangers prevention
– Constructions static solidity
– Electrical safety
– Protection against atmospheric electrical discharges
– Thermal safety
– Phonic protection
– Hygiene safety and veterinary control
– Avoiding atmospheric pollutant emissions
– Prevention of leakage in underground and superficial water bodies
Avoiding pollutants discharge during wastes handling
Safety against flooding

Following the biogas plant process flow, there were identified the possible risk situations:

1. Biogas production
   1.1. Reception – storage of raw materials:
   - risk of pollutant release during raw materials handling;
   1.2. Digestion
   - risk of soil contamination with pollutant substances (materials leakage);
   - explosion risk;
   - fire risk;
   - asphyxiation risk;
   1.3. Transport; Biogas burning
   - explosion risk;
   - fire risk;
   - risk of accidental pollution with greenhouse gasses;

2. Energetic biogas valorisation:
   - risk of emissions discharge into atmosphere;
   - mechanical risks;

3. Transformer unit
   - risk of electrocution;
   - risk of burning;

Concerning the fire risk, it can be mentioned that the technological process and the fabrication flow indicated technological equipment operated in moist environment with no fire risk presented.

Thus:
- raw materials storage tanks, preparation tanks and digestate storage basins do not contain flammable materials and are operated in wet media;
- the digester contains also wet media, and the produced biogas is not flammable (due to high CO₂ content its only flammable when compressed) and in the same time, the biogas in digester is at atmospheric pressure, and the digester roof is provided with double valves for over and under pressure;
- the gas meter is provided with a special triple cap, fireproofed, and the excess gas is burned by the special designated flare;
- the cogeneration unit is accommodated in a special explosion-proofed, fireproofed container.

As additional measure to normal fire fighting endowments, it is mentioned:
- the basins for liquid digestate storage will permanently provide a sufficient volume of inert liquid, which may be used as reserve for fire extinction;
- during exploitation all the provisions in force for fire prevention and extinction will be abided;
- materials, equipment, and electrical devices will be provided according to standards;
- electrical equipment mounting will be coordinated with the other installations mounting;
- reliability of electrical installations by assuring continuity and technical parameters;
- installations against electronic atmospheric discharge, lightning discharger with PDA type capturing system;
- fire detection and alarm system;
Risk management represents the process of taking and implementing the decisions regarding accessible or tolerable risks and risk minimisation or modification as a part of a repetitive cycle.

The adopted risk management model will be adapted by the organisation management to the actual conditions that may occur or generate risks.

Events management system is based on danger evaluation procedures and is materialised in prevention programme and emergency plan/programme that incorporates measurements regarding objective safety, civil protection, prevention and fire extinction and not the least environmental protection.

Operational procedures and intervention plans are referring to:
- disasters of geological or meteorological nature like; earthquake, land falls, floods, excessive heat or frosty weather.
- disasters due to human activity; those could be minor, controllable, due to equipment, routing or installations failure, or major as uncontrollable malfunctions (fire, explosion, major manipulation or transport accidents, improper storage);
- malfunction of depollution systems.

Employees’ security and safety represents the ensemble of technical, sanitary, organizational and juridical measurements with the purpose of protecting employees’ life and health by assuring the best working conditions, professional diseases and work accidents prevention, and by assuring special conditions for the personnel involved in heavy or harmful activities as well.

A short presentation of potential risks, affected factors and prevention, control and effects minimising measurements is presented in the table below.

<table>
<thead>
<tr>
<th>No.</th>
<th>Potential risks</th>
<th>Affected factors/amplitude</th>
<th>Measurements for prevention, control and effects reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Explosion and fire risk</td>
<td>- environmental factors (Amplitude); - socio-economic environment; Amplitude: - <em>in space</em>: limited to industrial platform; - <em>in time</em>: immediate effects of short duration (pollutant emissions, etc), and socio-economic effects may have a longer time duration depending on event magnitude</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- storage gas roof and gas transport pipelines are manufactured of resistant materials and designed to comply to plant operating conditions; - for the prevention of explosive air – methane mixtures formation, the plant is provided with ( \text{CH}_4 ) detectors; - to avoid pressure increase in the digester, in case of failure of the CHP unit, the plant is provisioned with a safety consumer (the flare) designed to burn in maximum safety conditions the entire gas flow generated by the plant; - personnel training regarding the explosion and fire danger; - elaboration of an internal regulation regarding prevention measurements regarding the explosions and fire fighting; - elaboration of an emergency situations plan; - in case of fire, there is a fire water reserve available on the location; - the site will be provided with a video surveillance system and the access will be permitted based on electronic cards; - the plant is equipped with lightning protectors; - observance of maintenance and control plans for technical condition of equipment and installations;</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Electrocution and/or burning risk</td>
<td>- human factors</td>
<td>- encapsulated electric transformer; -electricity transport and distribution network designed and constructed with the abidance to specific in force regulations; - interventions at the transformer and additional</td>
</tr>
<tr>
<td>No.</td>
<td>Potential risks</td>
<td>Affected factors/amplitude</td>
<td>Measurements for prevention, control and effects reduction</td>
</tr>
<tr>
<td>-----</td>
<td>----------------</td>
<td>---------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Poisoning/ asphyxiation risk</td>
<td>Human factors; Fauna; Amplitude: locally and temporary</td>
<td>- raw materials storage and the progress of the processes that generates substances that may provoke poisoning / asphyxiation are performed in tightened spaces, with controlled gases evacuation; - personnel training; - providing of adequate protection equipment; - development of an emergency situations and internal and external interventions plan, that provisions measurements for limiting an event effects in space and time;</td>
</tr>
<tr>
<td>4</td>
<td>Risk of pollution with odours generating substances, hazardous substances and of gases with greenhouse effect</td>
<td>Environmental factors (Amplitude); Population health; Fauna and flora; Amplitude: limited in time and space</td>
<td>- raw materials storage and the progress of the processes that generates substances with odours are performed in tightened spaces, with controlled gases evacuation; - digestate storage in tightened reservoirs to prevent odours emissions and delivery for disposal/valorisation by a graphic that will avoid site storage of large amounts; - elaboration of an inspection plan for dangerous substances packaging and storage spaces and their transport installations technical condition; - elaboration and enforcement of a maintenance plan for the components, pipelines and sewage network of the facility, to prevent leakage and odours generating substances deposition; - observance of the maintenance and control plan for the technical condition and continuous monitoring of biogas purification and energetic valorisation processes; - continuous monitoring of methane concentration in the atmosphere with specialised detectors; - flare maintenance in a proper technical condition, to allow burning in any moment the produced excess biogas; - environmental emission monitoring and control - waste management plan elaboration;</td>
</tr>
<tr>
<td>5</td>
<td>Biological pollution risk</td>
<td>Human factor; Environmental factors; Biodiversity</td>
<td>- raw materials transport, handling according to provisions of E.C. Regulation 1774/2002, with ulterior modifications.</td>
</tr>
</tbody>
</table>
Chapter 10 Monitoring process

The standardization and continuous technological development of anaerobic digestion process are possible only with continuous monitoring and by elaboration of documentation regarding the most important process parameters.

In this manner, a fast intervention and employ of necessary corrective measurements becomes possible.

Implementation of this project, the object of current evaluation, involves also periodic activities of environmental factors quality monitoring in the location area.

These activities are additional to monitoring and control procedures of the biogas plant operational parameters that include, among others: raw materials and digestate characterisation, biogas composition, water consumption, electricity, thermal energy, process instrumentation.

The monitoring and control procedures for the biogas plant operational parameters include physical and chemical parameters collection and analyse. Periodical laboratory tests, to optimise anaerobic digestion process and to avoid biogas production process failure, are required.

As a minimal requirement, the following parameters will be controlled:

- Used raw materials quantity and type (daily). Liquid raw materials quantity pumped in the digester may be determined by flow measurement. Flow meters must be robust and dirt resistant. Usually, inductive and capacitive flow meters, but more often lately ultrasound instruments or thermal conductivity meters are used.
- Processing temperature (daily). The temperature inside the digester must be maintained constant, and, consequently permanently monitored. Inside digester there are several temperature measuring points, with the purpose of monitoring during entire process. The measured values are transmitted to a computer and visualised. This data input enables also the automatic control of heating cycle.
- pH value (daily). pH value offers important information on digestion progress. pH monitoring is accomplished by performing periodical representative tests of digester medium; pH value is measured using regular pH meters.
- The quantity and gas composition (daily). Biogas quantity represents an important parameter in determining the process performance. Fluctuations of biogas production indicate process perturbations and facilitate operational conditions adjustment. Gas meters are usually installed in line. Measured biogas quantity is recorded, to evaluate the overall biogas plant operation and process evolution.
- To determine biogas composition, sensors measuring decaescence, heat transfer, infrared radiation absorption, chemisorption or electro-chemical sensors can be used. IR sensors are adequate for methane and carbon dioxide determinations. Electro-chemical sensors can be used for the determination of hydrogen, oxygen and hydrogen sulphide concentrations.
- Filling level. Measuring the level of the internal membrane of the digester roof is very important (for normal operation of the CHP unit for instance). In case of a very low available biogas quantity the CHP unit will be automatically stopped and restarted only if the required gas amount is available. The level is usually adjusted using pressure sensors.

Control and monitoring equipment type varies from simple timers until computer assisted visualisation with automatic alarming system.

As regarding the digestate quality monitoring, the content in nutrients may be determined (DM, VS, N, P, K, pH), prior its valorisation as fertiliser.
On the other hand, the following environmental monitoring plan was proposed for activities effects on environmental factors monitoring:

- Underground water bodies – execution of four wells for monitoring of phreatic water quality by monthly evaluation of water level and semestral sampling for determination of: pH, fix residue, CCOMn, ammonia, nitrates, nitrites, total nitrogen, phosphorus, potassium, sodium.
- Atmospheric emissions – semestral determination of electricity generator engine exhausted gases composition (particles, SO$_2$, NO, CO, CO$_2$).
- Noise – semestral determinations in three site marginal points of noise levels.

The monitoring programme for the biogas plant operation will be provided together with the Environmental Authorisation.

Other provisions:
- Records of waste management will be elaborated and registered according to in force regulations provisions (law 211/2011 and G.D 856/2002 with the ulterior changes).
- Monthly fuel consumptions will be recorded;
- Monthly record of water supplied from the existing well.

The results of monitoring activity will be reported to the territorial authorities for environmental protection according to monitoring programme provisions and terms, enforced by the Environmental Authorisation.

In case of ascertainment of unconformities to legal provisions, the results recorded by the automation monitoring system will be submitted to the authority for environmental protection.

During project execution stage a technological monitoring will be performed, with the main purpose of minimising risk of accidents and proper site restoration after constructions finalisation.

The evaluation of the following aspects will be pursuit:
- excavated soil quality assessment to determine proper storage locations. This will be a contractual assignment of works contractor, provisioned in the contract signed with the beneficiary;
- noise level measurement at the construction site limit during works execution (especially during excavations);
- on site generated waste management;
- disposal of any construction materials existing on the construction site at works finalisation.

The results of monitoring activity will be reported to the territorial authorities for environmental protection in full accordance with the requirements.
Chapter 12 Environmental Management Plan

The main objective of this project is the development of a biogas facility to demonstrate the feasibility of treating organic biomass (especially manure) in order to obtain electricity and heat, through cogeneration. In the final aim it is also considered the reduction of local contribution to minimising the emissions of gases with greenhouse effect by controlled methane production (as a result of manure anaerobic fermentation) and valorisation, through burning.

For the attenuation and the efficient control of all potential impact forms the structure of Environmental Management Plan for this project was developed. The first draft revision of the EMP is attached to this report, and the document will be revised for each determinant implementation stage (Construction Contract assignation, operation authorisation).

Consequently, as authorities for environmental protection (Agency for Environmental Protection Maramureş) already decided, the implementation of the proposed activity is recommended, considering global environmental, social and economic benefits.
Chapter 13 Public information

As per the public information procedures applicable in Romania, any project going through the procedure for the obtaining of the environmental agreement, including the project which is within the scope of this assessment, goes through several stages of information and availability to the public interested in relevant information related to the technical parameters, as well as the potential impact on the environment and human health.

Thus, starting with submission of the public request for the obtaining of the environmental agreement (the request was registered with LEPA Maramures on January 21, 2013), the following information was published:
- the public announcement in the publication “Glasul Maramuresului” dated April 9th, 2013 on the request for the issuance of the environmental agreement
- the public announcement regarding the decision of the Technical Advisory Committee published on the website of LEPA Maramures on May 30th, 2013
- the public announcement published on the website of Seini Town Hall and in the “Glasul Maramuresului” on June 6ht, 2013 regarding the decision of the TAC on the screening of the project.

On February 20th, 2013, a work meeting was held at the headquarters of Seini Town Hall attended by the representatives of the local farmers.

Seini Town Hall organised on June 31st, 2013 at 14:00 at the ROU-UA Business Centre the public debate session on the “Environmental Impact Assessment Report” for the project “Pilot Facility for Biogas Production in Seini, Maramures County”.

The advertising of the organising of the public debate meeting and presentation of the Environmental Impact Assessment Report has been carried out as follows:
- publishing in the newspaper “Graiul Maramuresului” of July 25th, 2013 of the announcement regarding the organising of the public debate and where the documents for study have been made available;
- displaying of the announcement regarding the organising of the public debate starting with July 25th, 2013 at the notice board of Seini Town Hall;
- publishing on July 25th, 2013 of the announcement regarding the organising of the public debate and of the documents made available for public consultation on the website www.seini.ro.

The “Environmental Impact Assessment Report” for the project “Pilot Facility for Biogas Production in Seini, Maramures County” was published on the website of Seini Town Hall and the print version was available for consultation at the town hall headquarters.

The public debate began on 31.07.2013, at 14.00.
The debate was attended by representatives of Seini Town Hall and a small number of citizens (the list of participants is attached in Annex D). Mrs Gabriela Criste – councillor at LEPA Maramures – attended the debate on behalf of the environmental authority.

The following documents were presented during the public debate session:
- Presentation of the “Environmental Impact Assessment report” for the project “Pilot Facility for Biogas Production in Seini, Maramures County”;
Presentation of the project “Pilot Facility for Biogas Production in Seini, Maramures County”.

Both presentations were held by Mrs Ileana Popescu – author of the Environmental Impact Assessment Report.

Within the public debate session for the Environmental Impact Assessment Report no requests for additional information, comments, exceptions, suggestions or objections regarding the project were registered.

Due to the public advertising as per the methods presented above for the development of the Environmental Impact Assessment Report and the organising of the public debate within a public session, no comments, suggestions or objections regarding the project have been registered at the town hall headquarters.

Furthermore, by the date of organising the public debate, there were no requests for the consultation of the written documentation related to the project, made available at the headquarters of the town hall and the environmental authority, were submitted.
Client: Seini City Hall

Environmental Impact Assessment – Pilot plant for biogas production Seini, Maramures

Site Location Plan (1: 10.000)

Contract: July 2013

Figure: 1
Client: Seini City Hall

Environmental Impact Assessment – Pilot plant for biogas production Seini, Maramures

<table>
<thead>
<tr>
<th>Contract:</th>
<th>July 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUG Seini – Urban Landscape Regulation Map (extras)</td>
<td>Figure: 3</td>
</tr>
</tbody>
</table>
Client: Seini City Hall

Environmental Impact Assessment – Pilot plant for biogas production Seini, Maramures

Site location regarding the protected areas - Natura 2000

Contract: July 2013

Figure: 4