

Appendix 2: Environmental and Social Management Plan (ESMP)

KaliDevi Namuna Pashu Palan and Organic Farm

Executive Summary:

This Environmental and Social Management Plan (ESMP) has been developed for proposed 20 m³ biogas plant in KaliDevi Namuna Pashu Palan and Organic Farm for mitigating likely environmental and social impacts predicted during environmental and social screening. The screening process indicated that the sub-project intervention will not require any land acquisition as well as displacement of inhabitants. Similarly, as the sub-project reduces wastes and use of waste in order to produce energy, the significant negative impacts are not envisaged. However, the screening process indicated negligible impacts during construction and operation phase. The overall impact caused by the sub-project intervention was classified as “Category C”, which means there is minimum environment impact and hence there is no need of conduction of further environmental or social assessment. Nevertheless, in order to reduce or mitigate thus identified adverse impacts, this “Environmental and Social Management Plan (ESMP)” was prepared prior to sub-project implementation.

Some of the impacts caused by the sub-project are: health and safety issues of construction workers, construction related health risks, seepage due to leakage of slurry liquid, aesthetic degradation due to haphazard disposal of bioslurry, workers health during slurry handling and foul smell. The possible mitigation measures have been proposed in this ESMP and shall be implemented by the Construction Company and developer. The likely impacts not identified during screening as well as in this ESMP, if perceived during construction and/or operation phase shall also be avoided or mitigated by the Construction Company and/or developer.

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1. Introduction

This environmental and social management plan (ESMP) is prepared for KaliDevi Namuna Pashu Palan and Organic Farm, Patakhhet-5, Kavre Nepal to mitigate likely environmental and social impacts during construction and operation phase. There are altogether 27 cows of different sizes. The detail design recommends construction of 20m³ biogas plant within its premise which would produce 3.41m³ of gas per day. The proposed design technology is Modified GGC 2047. Thus generated biogas will be used for cooking purposes and the slurry produced will be used as fertilizers in their agricultural land as well as to sell surplus fertilizer in the market. The project is supported by AEPC/NRREP/SREP.

2. Description of Subproject and Location

The project lies in Dandagaun, Patakhhet-5, Kavre district. The coordinate of the sub-project site **27°35' 33.44" N, 85°36' 24.59" E** with altitude of 1443 m.

The biogas plant is proposed to be constructed within the organization. The Google map of the proposed location is provided below:

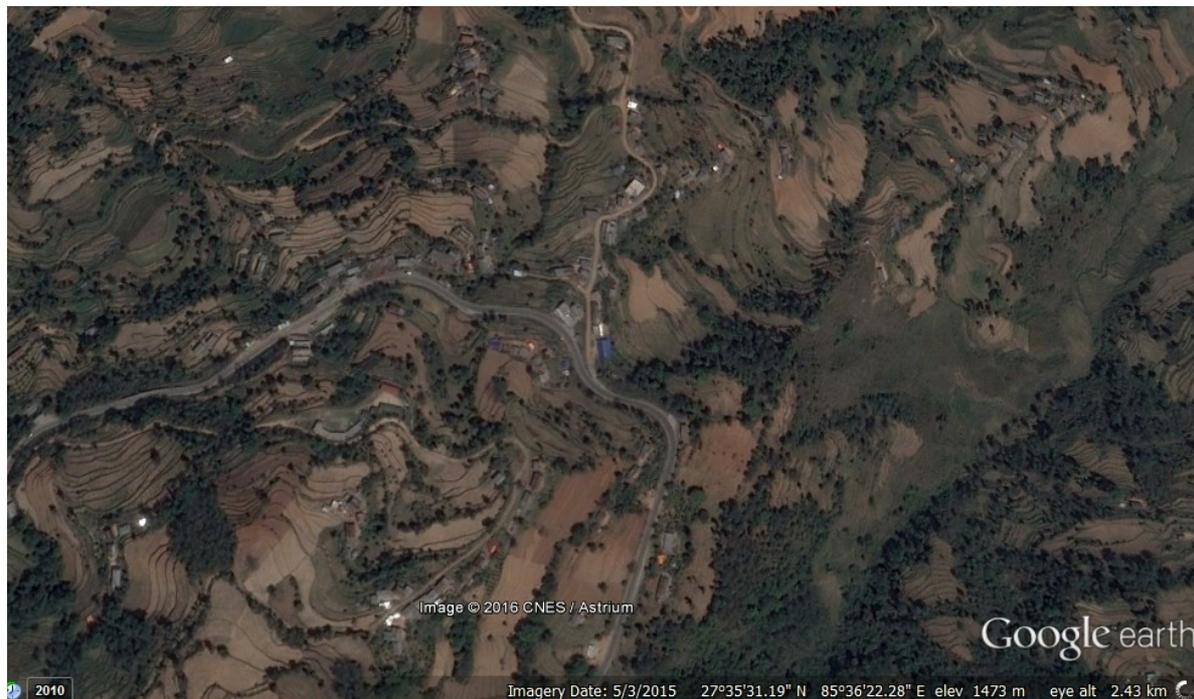


Figure: Location Map of proposed sub-project

The proposed biogas plant size is 20m³ which would produce 3.41m³ of biogas per day. The gas produced will be used for cooking purpose. The plant will produce 189kg of slurry per day which will be stored in compost pit to make dry and convert it into compost manure. The manure will be used in the agricultural land for food and fodder production and are planning to sell surplus fertilizer in the nearby market.

The construction work starts with excavation of earthwork followed by stone lining, and reinforcement and cement aggregate works. Once after the construction completion, the dung will be fed into the digester. The gas produced from the subproject shall be used for thermal process only. AEPC will provide subsidy only after successful testing and commissioning of plant against guaranteed performance requirement as mentioned in detailed design report.

3. Relevancy of preparing ESMP

This Environmental and Social Management Plan (ESMP) has been prepared for the proposed sub-project in order to mitigate the likely environmental impacts predicted during environmental and social screening. Any land acquisition or displacement of inhabitations will not be involved in the sub-project intervention. The significant negative impacts are not envisaged, however, negligible impacts identified during screening process might prevail during construction and operation phase. This sub-project is classified as "Category C", which means there is minimum environment impact and hence there is no need of conduction of further environmental or social assessment. The Environmental and Social Management Plan has been prepared in order to reduce thus identified adverse impacts prior to sub project implementation.

4. Environmental and Social Baseline

Topographically, the project site lies in Hilly region. The meteorological data indicates that the region has warm summer days with cold winter temperature. The land-use pattern of the project area is dominated by agricultural land with sparse settlement. There are no public water sources observed near subproject vicinity.

Developer owns 30 Ropani of land. The biogas plant will be located in flat land prepared by flattening the terrain and cover around 5 aana. Almost all land is being used for agricultural purpose and grass production for cows. The subproject lies within sparse settlement.. Seasonal stream is

the located at about 600 min south east of the subproject location and would not affect due to subproject intervention.

The sub-project location is dominated by Chhetri and Brahman. The settlement pattern is sparse. Agriculture is the main occupation of most of the households in the area. An all weather asphalted road exists to reach the sub-project location at distance of 20 m from BP Highway.

5. Environmental and Social Impacts

During feasibility study of KaliDevi Namuna Pashu Palan and Organic Farm, considering environmental and social screening performed, it is not predicted to have significant negative environmental and social impacts.

The beneficial impact in environment is conversion of cow dung waste into biogas energy and compost. Socially the positive impact is control of foul smell in the surrounding areas.

5.1 Beneficial impacts

Considering benefit to the community, the waste management from the sub-project can enhance the aesthetics of farm and surrounding. The organic compost fertilizer from the sub-project can be used within farm in replacement of chemical fertilizers. The sub-project can also provide job to local un-skilled workers during the construction phase, however the scale of such job opportunity is very minimum and for short term only. The sub-project will provide renewable energy to the farm with replacement of current firewood and fossil fuel.

Moreover, cow manure is rich in organic substances so significant quantity of methane is released to the atmosphere during manure storage with anaerobic condition inside the dump. Methane is highly potent greenhouse gas than CO₂ with global warming potential 28- 36 over 100 years time period. The installation of biogas plant will directly reduce the emissions of methane gas from cattle manure. In addition, the biogas will also replace firewood and fossil fuels such as LPG that is being consumed in the farm thereby further contributing in greenhouse gas reduction.

5.2 Adverse impact

There will be no any major adverse impact to the surrounding community and environment. During construction phase, some minor impacts may be seen such as increased dust and noise level during construction phase and occupational health and safety of construction workers.

Construction Phase

- **Construction related accidents:** There are several processes which will be involved in the site during its construction. Excavation work, use of construction machineries, etc. could lead minor accidents. It is projected that some 12 skilled and unskilled human resources will be involved in construction process. The impact is envisaged as site specific, low in magnitude, short term in duration, and construction workers as receptor.
- **Respiratory problems due to dusty environment:** During construction phase, especially during excavation work, it could lead rise of dust and can cause increased dust level. The dusty environment can directly affect the health of construction workers as well as local people of surrounding vicinity however; the impact is envisaged to be a low in magnitude, short term duration and construction workers as receptor.
- **Increased noise due to construction activity:** The increased noise could be experienced due to vehicular movement and construction activities such as loading and unloading of construction materials and construction activities. This will mainly affect construction workers and partly to resident living close to the construction site. The impact will remain for short duration i.e. construction period only and magnitude is projected to be low.

Operation Phase

- **Health and safety issue due to haphazard disposal and mismanagement of digested slurry:** About 191 kg of liquid slurry will be generated each day from the plant, however the volume is so tiny and manageable. If the slurry is left over near plant location could result formation ditch and wet area, this can favor several disease vectors including flies and mosquitoes. This can affect farm workers as well as local resident living in near vicinity. The impact can be area specific, with moderate magnitude and for long term duration and farm workers and community as receptors.
- **Foul odor from substrate storage area and outlet:** The undigested bio slurry could result foul odors which can be nuisance to farm workers and biogas operator (some 4 workers) as well as local residents. The overfeeding is one of the most reasons of under digestion of feedstock within biogas digester. The magnitude is expected to be low because of biogas plant size but is expected for long term in duration and farm workers as the main receptor.
- **Seepage and leakage from substrate storing area, digester and slurry storage yard into ground water resource:** The seepage of

water from feedstock storage, digester, outlet and compost pit may reach to groundwater increasing nitrogen level. This can affect not only workers but also people living nearby who rely on same source of water. However, because the plant is processing very small amount of slurry, the impact is expected to be low, but long term.

- **Occupational health and safety issues including accidents associated with firing and explosion:** The biogas is highly flammable. The open firing or electrical shorts can cause huge fire and explosion. Also, the gas stoves in use during the operation could lead to fire or accidents. The impact is envisaged as site specific, low in magnitude, occasional but the risk is long term in duration, farm workers as receptor.

6. Mitigation Measures

The environmental mitigation with their time of action, mitigation cost and responsibility are illustrated in the following table:

ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES

S. N.	Environmental/ Social Impacts	Mitigation Measures	Time of Action	Estimated Mitigation Cost (NRs.)	Responsibility
1.0 Construction Phase					
1.1	Construction related accidents	The construction premises shall be barricaded	During construction phase	-	Construction Company
		Provision of personal protective equipments (PPEs) like helmets, boots, gloves, etc for construction workers	During construction phase	-	Construction Company
		Provision of First Aid Kits at construction site	During construction phase	Minor	Construction Company/ Sub-project Developer
1.2	Respiratory problem due to dusty environment/vehicular emission in construction site	Spraying of water during excavation and vehicular use to reduce dust re-suspension, wearing mask by workers	During construction phase	-	Construction Company/ Sub-project Developer
1.3	Increased noise due to construction activity	Work will be conducted from 8:00 AM-6:00 PM. If additional times are needed, local residents will be informed prior to do so.	During construction phase	-	Construction Company/ Sub-project Developer
2.0 Operation Phase					
2.1	Health and safety issue due to	Use of separate pit with cover	During operation	-	Sub-project

	haphazard disposal and mismanagement of digested slurry	for slurry storage and channelize into compost pit	phase		Developer
		Use of personal protective equipments during slurry handling process	During operation phase	5,000	Sub-project Developer
2.2	Foul odour from substrate storage area and outlet	Avoid storing substrate as far as possible and daily feeding with recommended amount shall be performed	During operation phase	-	Sub-project Developer
2.3	Seepage and leakage from substrate storing area, digester and outlet/compost facility	Proper sealing of base of storage area as well as digester and outlet manure storage area with sealing material or concrete casting	During Construct ion Phase	Already included in construct ion cost	Constructio n Company/S ub-project Developer
2.4	Spreading of diseases due to increased disease vectors, flies, mosquitoes etc	Avoid storing substrate as far as possible.	During Operation phase	-	Sub-project Developer
		Prevent haphazard disposal of bio-slurry and prevent formation ditches	During Operation phase	-	Sub-project Developer
2.5	Occupational health and safety issues including accidents associated with firing and explosion	Strictly avoid naked flames near digester	During operation phase	-	Sub-project Developer
		Awareness building of workers on safety practices	During operation phase	-	Sub-project Developer

7. Monitoring

It is also necessary to monitor to ascertain implementation of mitigation measures mentioned as well as to perform impact monitoring to figure out the impacts of the sub-project. The monitoring plan is provided in the table below: Regarding alternatives, the technology selected for this subproject is modified GGC 2047 model from wide range of anaerobic digestion technologies. The compost pit has been proposed as cost effective measures to process digested slurry. The construction work shall be permitted in day time only.

Environmental and Social Monitoring Plan

S.N.	Indicators	Methods	Frequency/Time	Place	Monitoring Authority	Monitoring Cost (NRs.)
1.1 Construction Phase						
1.1.1	The construction premises shall be barricaded	Direct Observation	During construction	Project Site	Sub-project Developer	-
1.1.2	Provision of personal protective equipments (PPEs) like helmets, boots, gloves, etc for construction workers	Direct Observation	During construction	Project Site	Sub-project Developer	-
1.1.3	Provision of First Aid Kits at construction site	Direct Observation	Once prior to start of construction	Project Site	Sub-project Developer	-
1.1.4	Spraying of water reduce dust re-suspension	Records/Photographs	During construction	Project Site	Sub-project Developer	-
1.1.5	Compliance of construction activities performed only in designated time (8:00 to 6:00)	Interview with locals	During construction	Project Site	Sub-project Developer	-
1.2 Operation Phase						
1.2.1	Provision of composting pit	Direct observation/ Photographs/records	During construction	Project Site	Sub-project Developer	-
1.2.2	Provision of personal protective equipments (PPEs) during operation	Direct observation/ Photographs	Once prior to operation	Project Site	Sub-project Developer	-
1.2.3	Avoid storing substrate as far as possible and adopt daily	Direct observation	Bi-weekly	Project Site	Sub-project Developer	-

	feeding with recommended amount of feedstock					
1.2.4	Cover substrate by a polythene sheet, in case of storage of substrate	Direct observation	Bi-weekly	Project Site	Sub-project Developer	-
1.2.5	Storage of compost and wet slurry in designated area	Direct observation	Bi-weekly	Project Site	Sub-project Developer /Site manager	-
1.2.6	Use personal protective equipments during operation	Direct observation	Daily	Project Site	Sub-project Developer /Site manager	-
1.2.8	Proper sealing of base of storage area as well as digester and outlet manure storage area with sealing material or concrete casting	Record of specification of constructed plant	During construction	Project Site	Sub-project Developer	-
1.2.9	Avoid naked flames near digester	Direct observation	Daily	Project Site	Sub-project Developer /Site manager	-
1.2.10	Build awareness of workers on safety practices	Direct observation/ verification of training conducted by technology provider and/or construction company	Once prior to operation	Project Site	Sub-project Developer	-

Most of the mitigation costs are covered within total construction cost and others required minor costs. The monitoring part is assigned to developer and will require one human resource which will be assigned to existing subproject staff and other costs are minor.

7. Conclusion

The above mentioned mitigation measures shall strictly be implemented by the responsible individuals as mentioned in this ESMP. In addition, the

monitoring as mentioned in this ESMP shall also be performed accordingly. The likely impacts not identified during screening as well as in this ESMP, if perceived during construction and/or operation phase shall also be avoided or mitigated by the Construction Company and/or developer.