

Appendix 2: Environmental and Social Management Plan (ESMP)

Gupteswor Multipurpose Krishi Farm

Executive Summary:

This Environmental and Social Management Plan (ESMP) has been developed for proposed 40 m³ biogas sub-project in Gupteswor Multipurpose Krishi Farm for mitigating likely environmental impacts predicted during environmental and social screening. 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. Some of the impacts caused by the sub-project are: health and safety issues of construction workers, construction related health risks, possible water sources contamination due to leakage and haphazard disposal of slurry liquid, 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

For implementation of the biogas sub-project, this environmental and social management plan is prepared for Gupteswor Multipurpose Krishi Farm, Sarada Batase-3, Kavre, Nepal. The organization is going to establish a 40 m³ large biogas plant from available cow dung, goat manure and night soil within its premise. The sub-project is supported by AEPC/NRREP/SREP.

2. Description of Sub-project and Location

The sub-project lies in Sarada Batase-3, Kavre district. The coordinate of the sub-project site 27°35' 26.9" N, 85°37' 39.5" E with altitude of 1406 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 gas produced by the plant will be 8.44m³ per day. The plant will produce 381 kg of slurry per day which will be stored in compost pit to make dry and convert it into compost manure.

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 and kitchen waste will be fed into the digester. The gas produced from the sub-project 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 DFS report.

3. Relevancy of preparing ESMP

This Environmental and Social Management Plan (ESMP) has been done 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 sub-project site lies in Hill. The meteorological data from indicates that the region has warm summer days with cold winter temperature. The land-use pattern of the sub-project area indicates of agricultural land and forest as major land-use. Two small seasonal streams, which joins Bhotekate khola, a tributary of Jhiku khola, flows with proximity of about 130m-150 m east and west from the subproject area.

Developer owns 30 ropanis of land in form of hilly terrain. The biogas plant will be located in center of the flat land on hill top and cover around 6 aanas. The nearest settlement (about 15-20 scattered households) from the plant site is more than 100 meter away. Hence, there will not be any significant negative affect to neighboring settlement. The Dhungeban community forest is 500 meters in west from the sub-project site and does not affect the forest. In addition, the seasonal river are sourced for irrigation purpose in farm using pumps. The sub-project does not affect the water source as it is upstream from the site.

The sub-project location is dominated by Chhetri and Brahman-hill. The settlement pattern is sparse. An all-weather gravel road exists to reach the sub-project location at distance of 3 km from BP Highway.

5. Environmental and Social Impacts

During feasibility study of Gupteswor Multipurpose Krishi 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 waste into compost and gas. Socially the positive impact is control of foul smell in the surrounding areas. This may encourage the developer to install large biogas plant utilizing all the farm waste and produce large quantity of fertilizer sufficient of farms in the community.

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.

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 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 level and increased noise level during construction phase and occupational health and safety of construction workers. Similarly, due to the proximity of seasonal stream, it could have change to deteriorate water quality if the post digestate slurry is discharged directly.

5.2.1 Adverse impact (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.

5.2.2 Adverse Impact (Operation Phase)

- **Health and safety issue due to haphazard disposal and mismanagement of digested slurry: About:** 381 kg of liquid slurry will be generated each day from the plant, however the volume of this is 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 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 of slurry 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.

- **Aesthetic degradation and impact on nearby streams due to haphazard disposal of bio-slurry:** The haphazard disposal of digested slurry in nearby area of subproject location would be unpleasant. The moist dampen surrounding not only degrade the aesthetic beauty but also can promote disease vectors. In addition, as the subproject site is located nearby to seasonal stream within distance of 150m, during rainy season, the left out

digested slurry could even reach to stream and can cause increased BOD and turbidity. In this regard, this impact is characterized as site specific, low in magnitude and long term in duration.

- **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:

ENVIROMENTAL AND SOCIAL MITIGATION PLAN

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	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 haphazard disposal and mismanagement of digested slurry	Use of separate pit with cover for slurry storage and channelize into compost pit	During operation phase	-	Sub-project Developer
		Use of personal	During operation	5,000	Sub-project

		protective equipments during slurry handling process	n phase		Developer
2.2	Foul odor 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
2.4	Seepage and leakage of slurry 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
2.5	Aesthetic degradation and impact on nearby streams due to haphazard disposal of bio-slurry:	Prevent haphazard disposal of bio-slurry and prevent formation ditches	During Operation phase	-	Sub-project Developer
		The post digested slurry shall be collected and processed in compost pit only	During Operation phase	-	Sub-project Developer
2.6	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

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	Sub-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	Sub-project Site	Sub-project Developer	-
1.1.3	Provision of First Aid Kits at construction site	Direct Observation	Once prior to start of construction	Sub-project Site	Sub-project Developer	-
1.1.4	Spraying of water reduce dust re-suspension	Records/Photographs	During construction	Sub-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	Sub-project Site	Sub-project Developer	-
1.2 Operation Phase						
1.2.1	Provision of composting pit	Direct observation/ Photographs/records	During construction	Sub-project Site	Sub-project Developer	-
1.2.2	Provision of personal protective equipments (PPEs) during operation	Direct observation/ Photographs	Once prior to operation	Sub-project Site	Sub-project Developer	-
1.2.3	Avoid storing substrate as far as possible and adopt daily feeding with recommended amount of	Direct observation	Bi-weekly	Sub-project Site	Sub-project Developer	-

	feedstock					
1.2.4	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	Sub-project Site	Sub-project Developer	-
1.2.5	Storage of compost and wet slurry in designated area	Direct observation	Bi-weekly	Sub-project Site	Sub-project Developer/ Site manager	-
1.2.6	Avoid naked flames near digester	Direct observation	Daily	Sub-project Site	Sub-project Developer/ Site manager	-
1.2.7	Build awareness of workers on safety practices	Direct observation/ verification of training conducted by technology provider and/or construction company	Once prior to operation	Sub-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 sub-project 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.