

## **Appendix 2: Environmental and Social Management Plan (ESMP)**

### **Samyukta Pashu Bikas Farm**

#### **Executive Summary:**

This Environmental and Social Management Plan (ESMP) has been developed for proposed 100 m<sup>3</sup> biogas sub-project in Samyukta Pashu Bikas Farm for mitigating likely environmental and social impacts associated with implementation of large biogas plant. This sub-project is classified as "Category C" and is predicted to have minimum environment/social 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, issues related to excavated earth materials, possible water sources contamination due to leakage of slurry liquid, workers health during operation and handling of slurry 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.

**sfo{sf/L ;f/f+z M ;+o'Qm kz' ljsf; kmfd{df k|:tfljt !)) 3g ld6/sf] afof]Uof; Knf06 lgdf{0f tyf ;~rfngaf6 x'g;Sg] ;Defljt k|lts"n jftfj/0fLo tyf ;fdflhs k|efjx?sf] Go"lgs/0f ug{ o; jftfj/0fLo tyf ;fdflhs Joj:yfkg of]hgf tof/ ul/Psf] 5 . ;Defjotf cWoogsf] l;nl;nfdf ;DkGg jftfj/0fLo tyf ;fdflhs 5gf}6n] klxrfg ul/Psf k|lts"n k|efjx?nfO{ dWogh/ ul/ o; kl/of]hgfnfO{ æu au{Æ dfauL{s/0f ul/Psf] 5 . o; kl/of]hgfaf6 pNn]Vo jftfj/0fLo tyf ;fdflhs k|efjx? kfg]{ gb]lvPtfklg ;fdfGo k|efjx? h:t} lgdf{0f r/0fdf sfdbf/x?sf] ;jf:Yodf x'g;Sg] k|efj, lgdf{0f lf]qdfw'nf]sf] ;fdfGo j[14, 8f]d pTvvg\af6 lg:sg] df6f]sf] Joj:yfkg, :n/Lsf] r'xfj6af6 kfgLsf] >f]tdf x'g;Sg] k|b'if0f, :n/L tyf sDkf]i6dn ;DaGwLsf sfo{ ubf{ x'g;Sg] ;jf:Yo ;DaGwL ;d:of tyf kl/of]hgf lf]qdf x'g;Sg] b'u{Gw h:tf k|efjx? kg{ ;Sg] b]lvG5 . o; jftfj/0fLo tyf ;fdflhsJoj:yfkg of]hgf]n dfly pNn]lvt ;fdfGo k|efjx?sf] Go"lgs/0fsf pkfox? lg]b{i6 u/]sf] 5 / oL k|efj Go"lgs/0fsf pkfox? clgjfo{ ?kdf nfu' ugf{sf ;fy} ;f] sf] cg'udg ;d]t ug{'kg]{ 5 . olb o; of]hgfdf pNn]v gePsf s'g} k|efjx? kl/of]hgf lgdf{0f tyf ;~rfngsf ;dodf pTkGgePdf**

To:tfk|efj x?nfO{ ;d]t Go"lgs/0f ug]{ bflOTj lgdf{0f sDkgL jf ;~rfnssf]  
x'g] 5 .

## 1. Introduction

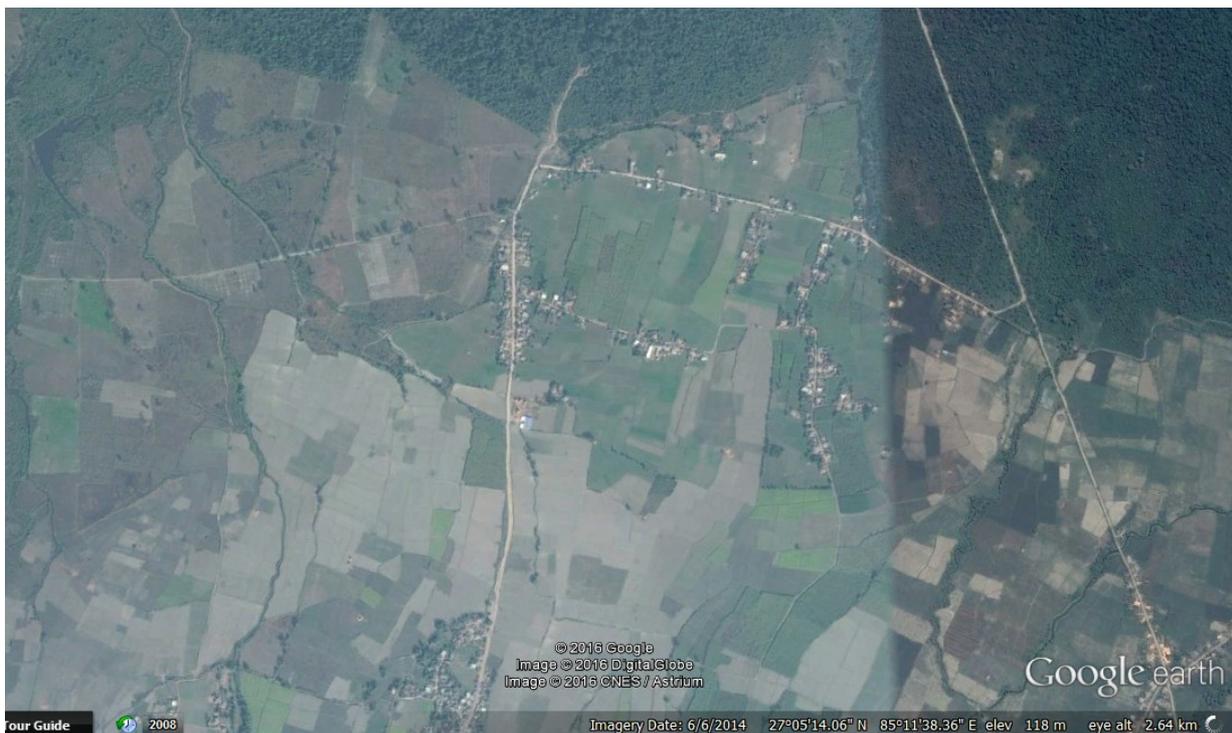
For implementation of proposed biogas sub-project in Samyukta Pashu Bikas Farm from available cow dung and toilet waste, this environmental and social management plan (ESMP) has been prepared. The farm is going to establish a 100 m<sup>3</sup> large biogas plant within its premise. The sub-project is supported by AEPC/SREP and is under evaluation.

## 2. Description of Sub-project and Location

The sub-project lies in Kolvi-8, Bara district. The coordinate of the sub-project site

**Latitude: 27°5' 36.4" N**  
**Longitude: 85°10'43.00"E**  
**Elevation: 95 m**

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



**Figure: Location Map of proposed sub-project**

The detailed design recommends construction of biogas plant of capacity 100m<sup>3</sup> of Modified GGC 2047 Model. The plant will process 545 kg of cow dung and about 1 kg of night soil in each day which will be diluted with 667 liter of water. The gas produced by the plant will be 21.8m<sup>3</sup> per day. The

generated gas will be used for electrification. A total of 30.5 kWhr of electricity will be produced by 15kVA generator and will run for 4 hours daily. The plant will produce 1212 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 electrical purposes 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 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 Terai. The meteorological data from indicates that the region has hot summer days with mild winter temperature. The land-use pattern of the sub-project area indicates of agricultural land as major land-use.

Developer owns 10 bigha (3386 sq.m.) of land and the proposed plant will require 486 sq. m. The nearest settlement is Puranokatta which is located at about 150m north from the the plant site There is presence of governmental forest (Charkose Jhadi) in north. The sub-project location is dominated by Tharu, Brahman Hill, Chhetri and Teli. The settlement pattern is sparse. The distance from highway to the subproject site is 10km and can be reached following Sapahi road.

### **5. Environmental and Social Impacts**

As per environmental and social screening performed during feasibility, it is not predicted to have significant negative environmental and social impacts. However, few impacts have been predicted due to implementation of subproject and are provided below.

## 5.1 Beneficial impacts

There is no direct benefit to the community from this subproject however during construction phase nearby people may have opportunity to work as labour, but this will require very few people (upto 5 people) and will be limited for few months only. The sub-project will provide renewable energy and compost manure to the farm.

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 CO<sub>2</sub> 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 fossil fuels such as diesel that is being consumed in the farm thereby further contributing in greenhouse gas reduction. A total of about 8.9 tons of CO<sub>2</sub> equivalents will be saved by using biogas for electrification with replacement of diesel.

## 5.2 Adverse impacts

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 dust pollution, increased noise level, impact related to excavated earth material 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 machineries, welding etc. could lead accidents, but would be exceptional. It is projected that some 18 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, there will be regular vehicle movements for transportation of construction materials which can generate large volume of dust from gravel road. 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 noise will be created due to vehicular movement and construction activities such as loading and unloading of construction materials and activities such as drilling and welding

at site. 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.

- **Impact associated with excavated earth materials:** The amount of earthen material generated from excavation and civil construction work for digester, outlet and compost pit would generate about 500 m<sup>3</sup>. Open and haphazard piling of these earthen materials would have potentiality to degrade the aesthetic beauty of the area. Similarly, the haphazard disposal of muck in the area and elsewhere is of concern related to water quality issues for proximate nearby rivulet, Gopi Khola, and erosion and sedimentation during rainy season. The envisaged impact is characterized as low, site specific and short term.

### **Operation Phase**

- **Health and safety issue due to haphazard disposal and mismanagement of digested slurry:** 1212 kg of liquid slurry will be generated each day from the plant. If the slurry is left over near plant location could result formation ditch and wet area, this can favour several disease vectors including flies and mosquitoes. The undigested bio-slurry can also contain disease causing pathogens and can harm worker who work closely with bio-slurry and compost handling. The impact can be area specific, with moderate magnitude and for long term duration and Farm workers and community as receptors.

- **Aesthetic degradation due to haphazard disposal and mismanagement of digested slurry:** The haphazard disposal of digested slurry in nearby area of subproject location would be unpleasant. This would decrease the aesthetics of the surrounding. This impact is characterized as site specific, low in magnitude and long term in duration.

- **Foul odor from digester and outlet area:** The undigested bio slurry could result foul odors which can be nuisance to farm workers and biogas operator. The overfeeding is one of the most reasons of under digestion of feedstock within biogas digester. The magnitude is expected to be low but is expected for long term in duration and farm workers (4 to 5 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. The impact is assessed as low in magnitude, long term in duration and farm worker and locals as the main receptors.

- **Occupational health and safety issues including fire related accidents:** 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. Electrical short circuits can also be happened near generator area and its distribution line. The impact is envisaged as site specific, low in magnitude, occasional but the risk is long term in duration, farm workers as receptor.
- **Increased noise level due to operation of biogas generator:** The produced biogas from the plant is proposed to be used for electricity generation. A biogas generator will be used for electricity generation and while in operation, it would result loud noise and can be nuisance to farm workers residing within farm and nearby locality. The impact is envisaged as site specific, low in magnitude, long term in duration, farm workers and nearby locality 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**

<b>S.N.</b>	<b>Environmental/Social Impacts</b>	<b>Mitigation Measures</b>	<b>Time of Action</b>	<b>Estimated Mitigation Cost (NRs.)</b>	<b>Responsibility</b>
<b>1.0 Construction Phase</b>					
1.1	Construction related accidents	The construction premises shall be barricaded by rope or wire	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/ excavated material storage area	Spraying of water during excavation and vehicular use to reduce dust re-suspension Proper compaction for temporary storage of excavated materials	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	During construction phase	-	Construction Company/ Sub-project Developer

		be informed prior to do so.			
1.4	Impact associated with excavated earth materials	Excavated material shall be reused for land preparation and development near plant area.	During construction phase	-	Construction Company/ Sub-project Developer
<b>2.0 Operation Phase</b>					
2.1	Health and safety issue due to haphazard disposal and mismanagement of digested slurry	Use of compost pit for storing and converting bio-slurry into compost fertilizer Avoid formation of ditches; avoid haphazard disposal of bio-slurry near plant location	During operation phase	-	Sub-project Developer
		Use of personal protective equipments during slurry handling process	During operation phase	5,000	Sub-project Developer
2.2	Aesthetic degradation due to haphazard disposal and mismanagement of digested slurry	Avoid haphazard disposal of bio-slurry; Channelize bio-slurry to compost pit	During operation phase	-	Sub-project Developer
2.2	Foul odor from digester and outlet area	Feeding plant with recommended amount of feedstock; prevent overfeeding	During operation phase	-	Sub-project Developer

		Storage of dry manure/compost and wet slurry in designated area only	During operation Phase	-	Sub-project Developer
2.4	Seepage and leakage from substrate storing area, digester and slurry storage yard into ground water resource	Proper sealing of base of storage area as well as digester and outlet manure storage area with sealing material or concrete casting	During Construction Phase	Already included in construction cost	Construction Company/Sub-project Developer
2.5	Spreading of diseases due to increased disease vectors, flies, mosquitoes etc	Avoid discharge of bio-slurry haphazardly; avoid formation of wet slurry ditches near plant location	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
		Installation of fire extinguisher close to digester	During operation phase	5,000	Sub-project Developer
		Use of insulated wires /cables for distributing	During operation	-	Sub-project Developer

		generated electricity	phase		
2.7	Increased noise level due to operation of biogas generator	Provision of generator shed	During operation phase	10,000	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**

<b>S.N.</b>	<b>Indicators</b>	<b>Methods</b>	<b>Frequency/Time</b>	<b>Place</b>	<b>Monitoring Authority</b>	<b>Monitoring Cost (NRs.)</b>
<b>1.1 Construction Phase</b>						
1.1.1	The construction premises shall be barricaded by rope or wire	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	Sub-project Developer	-
1.1.3	Provision of First Aid Kits at construction site	Direct Observation	Once prior to start of construction	Sub	Sub-project Developer	-
1.1.4	Spraying of water reduce dust re-suspension	Records/Photographs	During construction	Sub	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	Sub-project Developer	-
<b>1.2 Operation Phase</b>						
1.2.1	Provision of composting pit	Direct observation/ Photographs/records	During construction	Sub	Sub-project Developer	-
1.2.2	Provision of personal protective equipments	Direct observation/ Photographs	Once prior to operation	Sub	Sub-project Developer	-

	(PPEs) during operation					
1.2.3	Avoid storing substrate as far as possible	Direct observation	Bi-weekly	Sub	Sub-project Developer	-
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	Sub-project Developer	-
1.2.5	Storage of compost and wet slurry in designated area	Direct observation	Bi-weekly	Sub	Sub-project Developer/Site manager	-
1.2.6	Avoid naked flames near digester	Direct observation	Daily	Sub	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	Sub-project Developer	-
1.2.8	Install fire extinguisher close to digester	Direct observation	Once prior to operation	Sub	Sub-project Developer	-

1.2. 9	Provision of generator enclose shed	Direct observation	Once prior to operation	Sub	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.