

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

### **Dang Krishi Tatha Pashupalan Farm**

#### **Executive Summary:**

This Environmental and Social Management Plan (ESMP) has been developed for proposed 40 m<sup>3</sup> biogas sub-project in Dang Krishi Tatha Pashupalan Farm for mitigating likely environmental 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 itself 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, “Environmental and Social Management Plan (ESMP)” was recommended to prepare 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, possible water sources contamination due to leakage 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 Dang Krishi Tatha Pashupalan Farm, Narayanpur-6, Khaira, Dang, Nepal. There are altogether 32 cows of different sizes. From available 218kg/day of substrate and 266 liter of dilution water, the detail design recommends construction of 40m<sup>3</sup> biogas plant within its premise which would produce 8.76m<sup>3</sup> of biogas per day. The proposed design technology is native Modified GGC 2047 model. 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 sub-project is supported by AEPC/NRREP/SREP.

## 2. Description of Sub-project and Location

The sub-project lies in Narayanpur-6, Khaira, Dang district. The coordinate of the sub-project site 28° 3' 52" N, 82° 24' 7" E with altitude of 637m.

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



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

The proposed biogas plant size is 40m<sup>3</sup> which would produce 8.76m<sup>3</sup> per day of gas. 218kg of cow dung generated within farm will be used as substrate as daily feeding with 266 litres of dilution water. The gas produced will be used for cooking purpose. The plant will produce kg 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 their own agricultural land 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. A total of 12 construction workers including supervisor will be involved and the construction shall be completed within 1 month. 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 DD 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 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 (ESMP) 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 inner 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 is dominated by agricultural land with sparse vegetation in sub-project location.

Developer owns 10 bigha of flat land which is currently in use for livestock ranching, fodder production and remaining for agricultural practice. . The biogas plant will be located in flat land prepared by flattening the terrain and cover around 0.5 kaththa. Almost all land is being used for agricultural

purpose and grass production for cows. The nearest settlement from the plant site is more than 200 meter away. Hence, there will not be any significant negative affect to neighboring settlement. The tube well is the nearest water source and is 40m from the shed. As the sub-project is far from other water sources (Hapur river). Most of the households source drinking water from tubewell.

The sub-project location is dominated by Chhetri and Brahman. The settlement pattern is sparse. An all weather gravel road exists to reach the sub-project location at distance of 400 m from Ghorahi Tulsipur road.

The current status of respiratory diseases of the community is not documented however, in rural areas of Nepal, the respiratory diseases are caused mainly because of burning of traditional energy sources especially firewood and cow dung cake. The major diseases that the community are commonly suffered are diarrhea, dysentery, flues and in some cases cholera too and are mostly transmitted because of unhygienic condition and through disease vectors like flies and mosquitoes.

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

During feasibility study of Dang Krishi Tatha Pashupalan 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 biogas. 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 reduce the pollution on the surrounding. The fertilizer from the sub-project can be sold to farmer community at low cost helping them to produce more agricultural products. The farm is also buying grass from farmers giving them opportunity to earn money. The sub-project will provide renewable energy to the farm.

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 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 heap. In addition, the biogas will also replace fossil fuels such as firewood and 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 impacts to the surrounding community and environment. During construction phase, some minor impacts may be seen such as dust pollution, increased noise level and occupational health and safety of construction workers.

- **Construction related accidents:** There are several processes which will be involved in the site during its construction. Excavation work, masonry work and piping and instrumentation etc could lead minor accidents, but would be exceptional. 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, there will be increased dust blown in construction site as well as nearby locality due to vehicular movements for transportation of construction materials in gravel road and excavation work. The dusty environment could be nuisance to workers (12 numbers of workers) and nearby settlement (about 5 to 6 households within 100m of periphery) and can directly affect the health of construction workers as well as local people of surrounding vicinity. However this impact would be prevailed for construction period only. 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 dome casting and concreting etc at site. This will mainly affect construction workers (12 workers) and partly to resident living close to the construction site (about 5 to 6 households within 100m of periphery) and the impact would be prevailed during construction time i.e. day time . The impact will remain for short duration i.e. construction period only and magnitude is projected to be low.

### 5.2.1 Adverse Impact (Operation Phase)

- **Health and safety issue due to haphazard disposal and mismanagement of digested slurry:** 484 kg of liquid slurry will be generated each day from the plant. If the slurry is not well managed and disposed haphazardly, this could establish favourable environment for disease vectors like mosquitoes and flies. In addition, the aesthetics of the site would also be decreased due to such haphazard disposal. This can affect farm workers (12 numbers) as well as local resident living in near vicinity (about 5 to 6 households). The impact will be area specific, with moderate magnitude and for long term duration.
- **Foul odor from substrate storage area:** If not properly managed, the slurry can generate foul odors which can be nuisance to farm workers (some 4 workers/operators) as well as local residents (about 5 to 6 households). But such foul odour would be prevalent only if the slurry is not properly digested. However, the compost pit constructed to manage slurry will reduce the smell. The magnitude is expected to be low, long term in duration and farm workers as the main receptor.
- **Ground water intrusion of slurry due to seepage and leakage from substrate storing area, digester and slurry storage yard:** The seepage of water from manure and slurry can pollute downstream water sources decreasing its quality with increasing nitrogen level and organic matter load. The case could be more prominent in case of toilet attached plants. This can affect not only workers but also people living nearby (about 5 to 6 households) who rely on same source of water. Since the water source is upstream the magnitude can be moderate with long term impact and farm workers and local resident as the main receptor.
- **Occupational health and safety issues including accidents associated with firing and explosion:** The biogas is highly flammable and can happen accidental firing in anytime 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**

<b>S . N .</b>	<b>Environmenta l/Social Impacts</b>	<b>Mitigation Measures</b>	<b>Time of Action</b>	<b>Estima ted Mitigat ion Cost (NRs.)</b>	<b>Responsib ility</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	-	Constructio n Company
		Provision of personal protective equipments (PPEs) like helmets, boots, gloves, etc for construction workers	During construction phase	-	Constructio n Company
		Provision of First Aid Kits at construction site	During construction phase	Minor	Constructio n Company/ Sub-project Developer
1 . 2	Respiratory problem due to dusty environment/v ehicular emission in construction site	Spraying of water during excavation and vehicular use to reduce dust re-suspension	During construction phase	-	Constructio n 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	-	Constructio n Company/ Sub-project Developer
<b>2.0 Operation Phase</b>					
2 . 1	Health and safety issue due to haphazard disposal and mismanageme nt of digested slurry	Use of separate pit with cover for slurry storage and composting in closed yard	During operation phase	-	Sub-project Developer
		Use of personal protective	During operation	5,000	Sub-project

		equipments during slurry handling process	phase		Developer
2 .2	Foul odour from substrate storage area	Avoid storing substrate as far as possible	During operation phase	-	Sub-project Developer
		Appropriate amount of daily feeding shall be done for complete digestion of slurry.	During operation Phase	10,000	Sub-project Developer
		Storage of dry manure/compost and wet slurry in closed yard/structure	During operation Phase	-	
2 .3	Ground water intrusion of slurry due to seepage and leakage from substrate storing area , digester and slurry storage for producing dry manure	Proper sealing of base of storage area as well as digester and outlet/dewatering unit/ manure storage area with sealing material or concrete casting	During Construction Phase	Already included in construction cost	Construction Company/Sub-project Developer
2 .4	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 project. The monitoring plan is provided in the table below:

## **Environmental and Social Monitoring Plan**

<b>S.N</b>	<b>Indicators</b>	<b>Methods</b>	<b>Frequen cy/Time</b>	<b>Place Monitoring Authority Monitoring Cost (NRs.)</b>		
<b><i>1.1 Construction Phase</i></b>						
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	-
<b><i>1.2 Operation Phase</i></b>						
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 slurry handling	Direct observation/ Photographs	Once prior to operation	Project Site	Sub-project Developer	-
1.2.3	Avoid storing substrate as far as possible	Direct observation	Bi-weekly	Project Site	Sub-project Developer	-
1.2.4	Storage of compost and wet slurry in designated area	Direct observation	Bi-weekly	Project Site	Sub-project Developer/ Site manager	-

1.2.5	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	-
1.2.6	Avoid naked flames near digester	Direct observation	Daily	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	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.

## 8. 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.