

## **ANNEX VI: Environment and Social Management Plan of Xavier Residential School**

This Environmental and Social Management Plan (ESMP) has been prepared for proposed large biogas construction and operation at Xavier Residential School, Godavari-2, Badegaun, Lalitpur in order to mitigate the 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 intends to use biodegradable waste generated within institution 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” with minimal environmental 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 prepared prior to sub-project implementation.

Some of the impacts caused by the sub-project are: health and safety issues of construction workers, possible ground water contamination due to leakage from digester and slurry storage, workers health during slurry handling and foul smell. The possible mitigation measures have been proposed in this ESMP and shall be implemented by the contractor/Construction Company and developer. 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.

### **sfo{sf/L ;f/f+z M**

uf]bfj/L -@, af8]ufp+ nlnk'/ l:yt ;faLs h]leP/ /]l;8]G;Lon :s'n xfn  
uf]bfj/L /]l;8]G;Lon :s'ndf k|:tfljt 7'nf] jfof]Uof; :yfkf kl/of]hgfaf6  
pTkGg x'g ;Sg] jftfj/OfLo tyf ;fdflhs k|efj Go'lgs/Of ug{sf nflu  
jftfj/OfLo tyf ;fdflhs Aoa:yfkg of]hgf tof/ kfl/Psf] 5 . k|:tfljt  
kl/of]hgf] :s'n lf]qdf pTkfbg x'g] h}ljs kmf]xf]/ phf{ pTkfbgsf  
nflu k|of]u ul/g] x'gfn] pNn]Vo gsf/fTds k|efj gkg]{ b]lvPsf] 5 .  
oBlk kl/of]hgf lgdf{Of tyf ;~rfngsf] ;dodf s]xL k|efj b]lvg ;Sg] klg  
cf^sng ul/Psf] 5 . 5gf}6 qmddf k|fKt glthf cg';f/ s'g} klg pNn]Vo  
k|efj gx'g] b]lvPsf] o; pk-kl/of]hgf]nfO{ ju{ 'u' df jlu{s[t ul/Psf] 5  
. ;Defjotf cWoogn] pkk/of]hgf lgdf{Of tyf ;~rfng cl3 jftfj/Of tyf  
;fdflhs Joj:yfkg of]hgf tof/ ug'kg]{ ;'fj cg';f/ k|efj Go'lgs/Of  
of]hgf / cg'udg of]hgf ;lxt sf] jftfj/Of tyf ;fdflhs Joj:yfkg of]hgf  
k|:t't ul/Psf] 5 .

o; kl/of]hgfaf6 pNn]Vo jftfj/OfLo tyf ;fdflhs k|efjx? kfg]  
{ gb]lvPtfklg ;fdfGo k|efjx? h:t} lgdf{Of r/Ofdf sfdbf/x?sf] :jf:Yodf  
x'g;Sg] k|efj, :n/Lsf] r'xfj6af6 kfgLsf] >f]tdf x'g;Sg] k|b'ifOf, :n/L  
tyf dn pTkfbg ;DalGwsf sfo{ubf{ x'g;Sg] :jf:Yo ;DaGwL ;d:of

cflb /x]sf 5g\ . o; jftfj/0fLo tyf ;fdflhs of]hgfn] dfly pNn]lvt ;fdfGo k|efjx?sf] Go"lgs/0fsf pkfox? lglb{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 . o; of]hgfdf pNn]v gePsf s'g} k|efjx? kl/of]hgf lgdf{0f tyf ;~rfngsf ;dodf pTkGg ePdf To:tf k|efjx?nfO{ ;d]t Go"lgs/0f ug] { bfloTj lgdf{0f sDkgL jf ;~rfnssf] x'g] 5 .

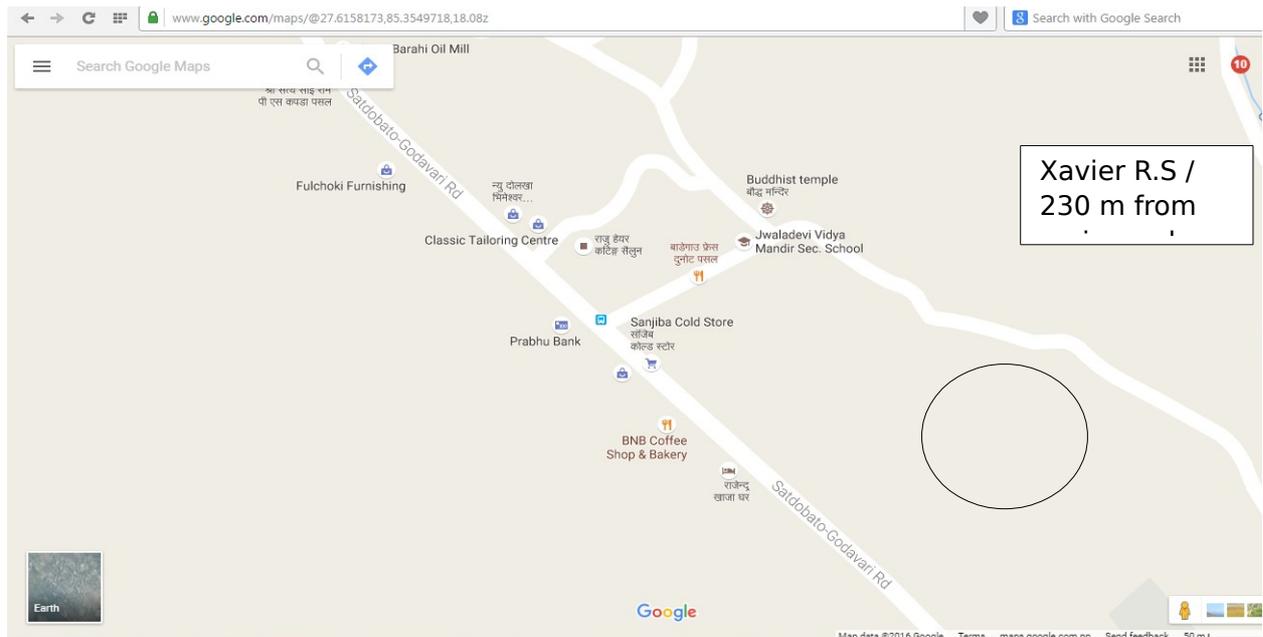
## 1. Introduction

The Xavier Residential school is situated in Godavari-2, Badegaun, Lalitpur. The total land area owned by the school is 763 sq. m. (1.5 Ropani) and there are 440 permanently living student and staff. From available biodegradable waste including toilet waste and kitchen waste, the detail design recommends construction of 35 m<sup>3</sup> biogas plant. The proposed design technology is Modified GGC 2047 model biogas plant. Thus generated biogas is proposed to be used for thermal application. The sub-project is under evaluation for AEPC/SREP support.

## 2. Description of Sub-project and Location

The sub-project is located at Godavari-2, Badegaun, Lalitpur. The coordinate of the sub-project site is 27°36'54.85"N, 85°21'26.47"E with altitude of 1413 m. The figure provided below illustrates the sub-project location as well as environmental setting near the sub-project site.





The proposed plant is 35 m<sup>3</sup> single unit modified GGC 2047 model digester with 7.3 m<sup>3</sup> of biogas production per day. The generated biogas will be used only for cooking. The plant will use toilet waste from 440 students and about 74 kg of kitchen waste as feedstock. The major works that will be carried out during construction are excavation of earthwork for digester, cement aggregate works and civil construction work. Once after the construction completion, 333 kg liquid slurry will be generated each day.

The schematic diagram and technology details of the biogas plant and dewatering unit are provided below:





#### **4. Environmental and Social Baseline**

The sub-project location is situated in the Hill region of Nepal. The topography is flat land with altitude of about 1413 m above sea level. School is spread over 763 sq. m (1.5 Ropani) of land and can be accessed through asphalted road. School has allocated around 156 m<sup>2</sup> of land which is sufficient for construction of biogas plant including compost pit. The ground conditions are favorable to build a biogas plant. School has potential for large biogas plant. Godavari Khola river is flowing about 300 m east from the school however, it is not envisaged to impact the nearby river from subproject implementation. The landuse pattern of the surrounding is agricultural land with sparse settlement.

There will not be any significant negative affect to neighboring settlement because the subproject will be constructed within the school boundary. The nearest settlement of the surrounding is Badegaun, which is densly populated settlement and lies at around 500m north from the sub-project location. The subproject location is devoid of industries and is outskirts of Kathmandu valley. There is no any significant source of air and noise except vehicular source and moreover, the site is located about 100 m far from main road.

Since the subproject site is accessible from the major market points, sourcing of the construction materials will not be a major issue.

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

During feasibility study, considering environmental and social screening performed, it is not predicted to have significant negative environmental and social impacts. However, apart from beneficial impacts, it is predicted to have few environmental/social impacts and is provided below:

##### **5.1 Beneficial Impacts**

Considering the benefit to the nearby community, there seems no any direct advantage to nearby population. but will be benefited to school itself. During construction phase, there would be few numbers of employment opportunities. Nevertheless, the sub-project will be present itself as a show case waste to energy sub-project.

##### **5.2 Adverse Impacts**

There will be no any significant adverse impact to the surrounding community and environment by the implementation of the proposed sub-project. However, during construction and operation phase, minor impacts have been predicted and provided as below:

##### **Construction Phase**

- **Construction related accidents:** There are several processes which will be involved in the site during its construction. Excavation work, use of machineries, and civil construction works could lead accidents, but the occurrence 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, construction workers and students as receptor.
- **Respiratory problems due to dusty environment:** During construction phase, there will be intermittent movements for transport vehicles for transporting construction materials and can lead to generate dusts. Similarly, during excavation of digester and

outlets, such impact could be visible. However the impact is envisaged to be a low in magnitude, short term duration and construction workers and students as receptor.

- **Increased noise due to construction activity:** The increased noise may be experienced due to vehicular movement and construction activities such as loading and unloading of construction materials and other construction activities. This will mainly affect construction workers (18 numbers) and more than 400 school students. 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:** 333 kg of digester slurry will be generated each day from the plant. If the slurry is not well managed and disposed haphazardly in and around subproject site, this could establish favorable breeding environment for disease vectors like mosquitoes and flies. In addition, the aesthetics of the site would also be decreased due to such unmanaged disposal. This can affect staffs and students as well as local residents living in near vicinity. The impact will be area specific, with moderate magnitude and for long term duration
- **Foul odour from digester and outlet of plant:** If not properly managed, the slurry can generate foul odors which can be nuisance to staffs and nearby residents (about 3 households). The fact about the foul odour from biogas plant is that such foul odour would be prevalent only if the slurry is not properly digested. However, the designated compost pits will be installed in order to collect all slurries passed from outlet. The magnitude is expected to be low, long term in duration and farm workers as the main receptor.
- **Impact associated with liquid effluent separated from sludge thickening unit:** The sludge thickening unit shall be installed for biogas plants which use toilet waste as major substrate to maintain total solids in substrate. The liquid separated from the sludge thickening unit would have high BOD and contaminated fecal sludge and hence would have health risk if disposed haphazardly. The magnitude is expected to be moderate, long term in duration and residents as the main receptor
- **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. The impact is envisaged as site specific, low in magnitude, occasional but the risk is long term in duration, kitchen staffs as receptor.

### **6. Mitigation Measures**

The environmental mitigation measures with their time of action and responsibility are prescribed in the following matrix:

There are different ways of management of digested slurry like composting, screw press for producing dry manure instantly, disposal of post digested without using it as manure etc. In this sub-project, a dewatering unit is proposed for producing dry manure from liquid slurry. The implementation of below mentioned mitigation measures shall be strictly done during specified time.

### Environmental and Social Mitigation Plan

| S.N.                          | Environmental/Social Impacts   | Mitigation Measures   | Time of Action            | Estimated Mitigation Cost (NRs.) | Responsibility                                 |
|-------------------------------|--|---|---------------------------|----------------------------------|--|
| <b>1.0 Construction Phase</b> |  |   |                           |                                  |  |
| 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/<br>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/<br>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/<br>Sub-project Developer |
| <b>2.0 Operation Phase</b>    |  |   |                           |                                  |  |
| 2.1                           | Health and safety issue due to haphazard disposal and mismanagement of digested slurry | Storage of digested slurry in designated compost pit to prevent haphazard disposal  | 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                           | Foul odour from digester and outlet of plant   | Appropriate amount of daily feeding shall be done for complete digestion of slurry.   | During operation Phase    | -                                | Sub-project Developer                          |
|                               |  | Storage of dry manure/compost and wet slurry in closed yard/structure   | During operation Phase    | -                                | Sub-project Developer                          |
| 2.3                           | Impact associated with liquid  | Proper sealing of base of sludge  | During Construction       | Already included in              | Construction                                   |

| S.N. | Environmental/Social Impacts   | Mitigation Measures   | Time of Action              | Estimated Mitigation Cost (NRs.)      | Responsibility                             |
|------|--|---|-----------------------------|---------------------------------------|--|
|      | effluent separated from sludge thickening unit   | thickening unit with sealing material or concrete casting   | Phase                       | construction cost                     | Company/Sub-project Developer              |
|      |  | Prevent haphazard discharge of effluent and collection of separated liquid effluent in existing safety tank     | During Construction Phase   | Already included in construction cost | Construction Company/Sub-project Developer |
| 2.4  | Spreading of diseases due to increased disease vectors, flies, mosquitoes etc                  | Avoid formation of ditches and haphazard slurry disposal; storage of digested slurry in designated compost pits | During phase      Operation | -                                     | Sub-project Developer                      |
| 2.5  | Occupational health and safety issues including accidents associated with firing and explosion | Strictly avoid naked flames near digester   | During phase      operation | -                                     | Sub-project Developer                      |
|      |  | Awareness building of workers on safety practices   | During phase      operation | -                                     | Construction company                       |

## **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.

## Environmental and Social Monitoring Plan

| S.N.                                 | Indicators  | Methods                                      | Frequency/Time                      | Place            | Monitoring Authority  | Monitoring Cost (NRs.) |
|--------------------------------------|---|--|-------------------------------------|------------------|-----------------------|------------------------|
| <b><i>1.1 Construction Phase</i></b> |   |  |                                     |                  |                       |                        |
| 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 to 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 | -                      |
| <b><i>1.2 Operation Phase</i></b>    |   |  |                                     |                  |                       |                        |
| 1.2.1                                | Provision of composting pit   | Direct observation/<br>Photographs/records   | During construction                 | Sub-project site | Sub-project Developer | -                      |
| 1.2.2                                | Provision of personal protective equipments (PPEs) during operation   | Direct observation/<br>Photographs           | Once prior to operation             | Sub-project site | Sub-project Developer | -                      |
| 1.2.3                                | Avoid discharge of digested slurry and effluent from sludge thickening unit into nearby area  | Direct Observation                           | monthly                             | Sub-project site | 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-project site | Sub-project Developer | -                      |

| <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> |
|-------------|--|--|-------------------------|------------------|------------------------------------|-------------------------------|
| 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/<br>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.

## **8. Conclusion and recommendation**

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 in this ESMP, if perceived during construction and/or operation phase shall also be avoided or mitigated by the Construction Company and/or developer.