ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
of
BIOGAS TO BIO CNG
of
EMERALD ENERGY PVT LTD

Submitted To:

Private Sector Led Mini Grid Energy Access Project (MGEAP)
Biogas Sub-component
Alternative Energy Promotion Centre (AEPC)
Mid Baneshwor, Kathmandu

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ACRONYMS AND ABBREVIATIONS

AEPC	Alternative Energy Promotion Centre
BOD	Biological Oxygen Demand
CBS	Central Bureau of Statistics
CH_4	Methane
CITES	Convention on International Trades of Endangered Species
CNG	Compressed Natural Gas
CO_2	Carbon dioxide
DIA	Direct Impact Area
EMF	Environmental Management Framework
EPA	Environment Protection Act
EPR	Environment Protection Rules
ESIA	Environmental and Social Impact Assessment
FGD	Focus Group Discussion
GoN	Government of Nepal
H_2S	Hydrogen Sulfide
IEE	Initial Environmental Examination
IIA	Indirect Impact Area
IUCN	International Union for Conservation of Nature
MT	Metric ton
MoFE	Ministry of Forest and Environment
NOx	Oxides of Nitrogen
PSA	Pressure Swing Adsorption
SMF	Social Management Framework
SO_2	Sulfur dioxide
SREP	Scaling -Up Renewable Energy Program
TPD	Tons per day
ZoI	Zone of Influence

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यस परियोजनाको उद्देश्य ६० TPD ठूलो आकारको बायोग्यास प्लान्ट निर्माण गर्नु हो जसले दैनिक करिब ६० टन जैविक फोहोरको प्रयोग गरी ९७९ केजी प्राकृतिक ग्यास (बायो-सीएनजी) र दैनिक ९.४ मेट्रिक टन मल उत्पादन गर्ने छ। ।

प्रस्तावित बायोग्यास प्लान्ट प्रतापपुर गाउँपालिका–३ परासीमा निर्माण गरिने छ । प्रस्तावित बायोग्यास प्लान्टले गाईको गोबर र प्रेस मडलाई फिडस्टकको रूपमा प्रयोग गर्नेछ। यस परियोजनाबाट उपलब्ध सब्सट्रेट ६० टन/दिन बाट दैनिक २४०० घनमिटर कच्चा बायोग्यास उत्पादन गरिनेछ। उत्पादन भएको ९७९ केजी प्रति दिन कम्प्रेस्ड बायोग्यासलाई बायो-सीएनजीको रूपमा सिलिन्डर बोतलमा राखेर नजिकका समुदाय र होटलहरूमा आपूर्ति गरिनेछ। थप रूपमा उप-उत्पादनको रूपमा कुल ९.४ मेट्रिक टन कम्पोष्ट मल (७०% DS) उत्पादन गरिनेछ।

परियोजनाको कार्यान्वयनका लागि निर्माण गतिविधिहरूबाट निस्कने सम्भावित प्रदूषणहरू निर्माण सामग्रीहरूबाट हुने प्रदूषण, तरल पदार्थ, निर्माण सामग्री बोक्ने सवारी साधनबाट उत्सर्जन गर्ने ग्यास, धूलो र कणहरू छन् । त्यसैगरी परियोजना सञ्चालनको क्रममा पोस्ट-डिजेस्टेट स्लरीको पानी निकालेपछि प्रशोधित फोहोर पानी, वर्षायाममा कच्चा फिडस्टकबाट जमिनको पानीमा हुने प्रदुषण, फोहोर संकलन र ढुवानीसँग सम्बन्धित समस्या, डाईजेसन पछिको स्लरी व्यवस्थापन, गन्ध, आवाज, ढल व्यवस्थापन र प्लान्ट सञ्चालन कर्मचारीहरुको स्वास्थ्य सम्बन्धी समस्याहरुको व्यवस्थापनका बारेमा न्युनीकरणका उपायहरु तय गरिएको छ । सामान्य नकारात्मक प्रभावहरूका बाबजुद पनि परियोजनाको कार्यान्वयनबाट केहि सकारात्मक प्रभावहरू पनि पर्नेछन् । जस्तै स्थानीयलाई रोजगारीको अवसर, स्थानीयको सीप विकास र स्थानीय अर्थतन्त्रमा बृद्धि निर्माण चरणका केही लाभदायक प्रभावहरू हुन् । त्यसैगरी नवीकरणीय उर्जाको प्रवद्धन, स्थानीयलाई रोजगारीको अवसर, स्थानीयको सीप विकास उप-आयोजनाको सञ्चालन चरणमा हुने केही लाभकारी प्रभावहरू हुन् ।

यद्यपि, यस ESIA प्रतिवेदनमा प्रस्तावित न्यूनीकरण उपायहरूलाई कडाईका साथ पालना गरेर माथिको अनुमानित सम्भावित प्रभावहरूलाई कम गर्न सकिने पस्टै देखिन्छ । निर्माण तथा सञ्चालन चरणमा प्रयोग हुने सबै सवारी साधन र मेसिनरीहरू वन तथा वातावरण मन्त्रालयले तोकेको उत्सर्जन मापदण्ड अनुरूप हुनका लागि व्यवस्था मिलाईने छ , फिडस्टक भण्डारणलाई बर्षायामको पानी बाट

बगेर हुनसक्ने नोक्सानी र फोहर व्यवस्थापनका लागि छोपेर राखिने हुनुपर्छ, एग्रीगेटहरू मिसाउने र धुने कार्य तोकिएको क्षेत्रमा गर्नुपर्छ, स्लरी र डिकेन्टेड फोहोरको प्रत्यक्ष निकासीलाई व्यवस्थित गरिने छ। यसका साथै निर्माण र सञ्चालन दुवै चरणमा सबै कामदारले हेल्मेट, सेफ्टी ज्याकेट, पञ्जा, जुत्ता जस्ता सुरक्षात्मक उपकरण लगाउन अनिवार्य गरीने छ। सम्भावित दुर्घटना र रोगबाट बच्नका लागि परियोजनाका कर्मचारीहरूलाई उचित अभिमुखीकरण गरिने छ । तसर्थ, वातावरण र सामाजिक दृष्टिकोणबाट, परियोजनाका लागि तयार पारिएको वातावरणीय तथा समाजिक व्यवस्थापन योजनामा तय गरीएका प्रभाव न्युनीकरणका उपायहरुको उचित र सहि कार्यान्यनबाट यस परियोजनाले पार्न सक्ने सम्भावित असर वा प्रभावहरुलाई उल्लेखनीय रुपमा न्युनीकरण गर्न सकिने देखिन्छ।

EXECUTIVE SUMMARY

The objective of this sub-project is to construct a 60 TPD large-scale biogas plant that will make use of about 60 tonnes of organic waste per day and produce 979 kg of clean natural gas (Bio-CNG) and 9.4 MT of fertilizer daily.

The proposed biogas plant will be constructed in Pratappur Rural Municipality-3, Parasi. The proposed biogas plant will utilize cow dung and press mud as its feedstock. Based on the assessment, the substrate available for the commencement of the sub-project is 60 tons/day yielding 2400 m^3 of raw biogas daily which is also the target gas generation as proposed by the developer. The produced 979 kg/day of compressed biogas will be bottled as Bio-CNG and will be supplied to the nearby communities and hotels. A total of 9.4 MT of compost (70% DS) will be produced as a valuable by-product.

The potential pollutants resulting from the construction activities for the implementation of the sub-project are construction spoils, mucks, washout liquid wastes, gaseous emission from vehicles carrying construction materials, dust, and suspended particles. Similarly, during the operation phase, processed wastewater after dewatering of post-digestate slurry, leaching of raw feedstock into groundwater during rainy season, issues related with collection and transportation of waste, post-digestate slurry management, odor, noise, drainage management and matter concerning with health of operational staffs are provisioned. There are positive impacts with the implementation of the sub-project as well, despite the associated adverse impacts. Employment opportunity to locals, skill development of locals, and increase in local economy are some of the beneficial impacts during construction phase. Similarly, promotion of renewable energy, employment opportunity to locals, skill development of locals are few of the beneficial impacts during the operation phase of the sub-project.

However, the above predicted potential impacts can be mitigated by strictly following the mitigation measures proposed in this ESIA report. All vehicles and machineries used in the construction as well as operation phase should be in compliance with emission standards set by Ministry of Forest and Environment (MoFE), stockpiles should be covered to avoid washout during rainy season, mixing and washing of aggregates should be done in designated area, direct discharge of slurry and decanted waste should be avoided. Along with this, all the workers should wear Personnel Protective Equipment like helmets, safety jacket, gloves, boots in both construction and operation phase. Proper training should be provided to staff on safety so that accidents and diseases can be avoided. Hence, from the environment and social point of view, if the mitigation measures are followed in a proper way, the sub-project will not cause significant impact.

CHAPTER I: INTRODUCTION

1.1 Project Description and Location

Emerald Energy Pvt. Ltd has proposed to establish large biogas plant at Nawalparasi (Bardaghat Susta Paschim) from cow dung and press mud. The biogas plant will make use of approximately 60 tons of organic waste per day comprising of 30 tons cow dung and 30 tons of press mud, which shall be processed through anaerobic digester of 4000 m^3 capacity. For this, Continuously Stirred Tank Reactor (CSTR) fitted with double membrane gas holder with safety pressure relief valve has been proposed. The produced biogas will be further purified to generate Compressed Natural Gas (Bio-CNG) which will be distributed industries near Bardaghat.

The developer has selected Green Planet Energy Pvt. Ltd., Bhairahawa, Nepal as a technology provider having experience in large scaled biogas sector including biogas purification process. The technology provider is also operating its own large biogas plant at Bhairahawa. The technology provider will be bound to produce desired output as per provision and policy of AEPC for assurance of successful project delivery to the developer.

The Environmental and Social Impact Assessment (ESIA) has been conducted with reference to the criteria cited in Schedule 2 of EPR 2077, and as per the requirement of Environmental Management Framework (EMF) and Social Management Framework (SMF) under SREP Extended Biogas Program. The study team effectively assessed the screening of the environmental and social aspects of the proposed sub-project and prepared this ESIA report to minimize/mitigate the identified impacts. The sub-project will be implemented and will be supported with subsidy after the approval from AEPC/MGEAP.

1.2 Project Location and Accessibility

The project site is situated at the coordinate of 27° 26′ 10.2″ N and 83° 46′ 45.6″ E, at the average elevation of about 124 meters from sea-level. The nearest main road is East-West Highway which is at distance of 13 km from the project site. The nearest settlement to the project site is Somany village. The aerial distance from sub-project site to Somany village is 500 m. **Figure 1** and **Figure 2** depicts the topographic map and google earth image of the sub-project location respectively.

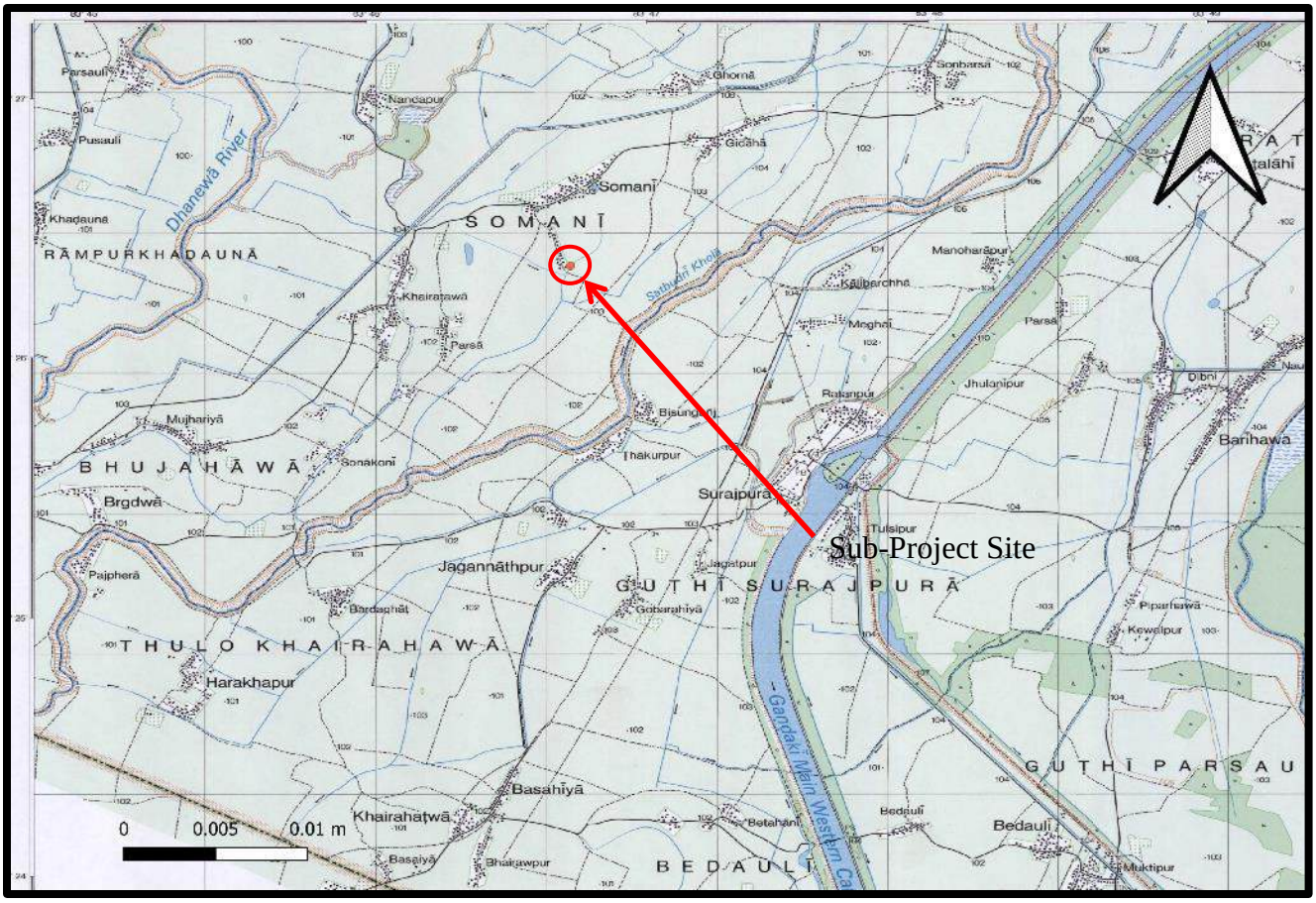

Figure 1: Topographic Map of Proposed Sub-Project Location

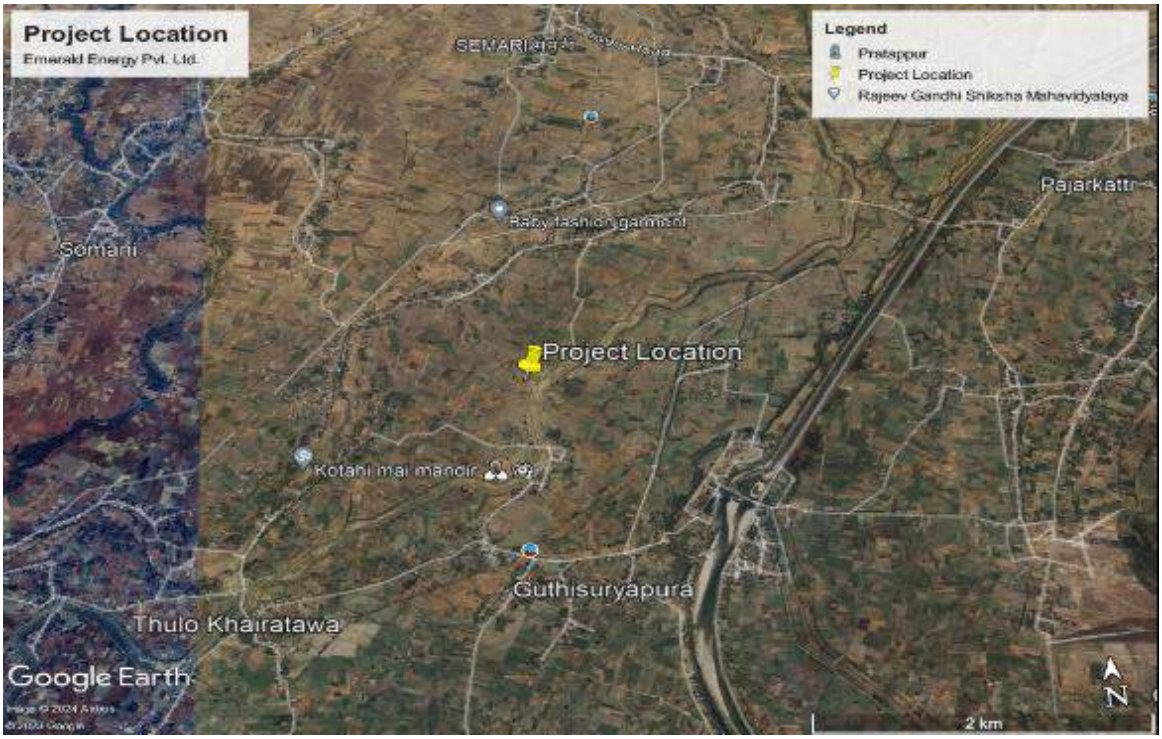

Figure 2: Google Earth Image of the Proposed Sub-Project Location

1.3 Salient Feature of the Sub-Project

The main objective of the sub-project is to install a large biogas plant using anaerobically digestible organic waste from the commercial entities. The produced Biogas will be bottled and distributed to nearby industries for thermal purpose. The salient features of the sub-project are presented in Table 1.

Table 1: Salient Features of the Sub-Project

Name of Commercial Entity:		Emerald Energy Pvt. Ltd.
Address of Commercial Entity:		Pratappur Rural Municipality-3, Nawalparasi
Name of Contact Person (Developer):		Mr. Vineet Kasaudhan
Contact Number of Contact Person (Developer):		9857030341
Biogas Project Location		Pratappur Rural Municipality, Nawalparasi
Recommended Technology:		Continuously Stirred Tank Reactor (CSTR) based biogas plant
Digester Volume (m^3)		4000 m^3
Biogas Production		2400 m^3/day
Saleable Bio-CNG Production		979 kg/day
Compost Production		9.4 tons/day (70% DS)
End Use:		Thermal (Bio-CNG) Captive use and Selling
Tentative Total Project Cost		NPR 217,112,690.44 (With VAT)
Safeguard Document to be prepared during DD	Environmental and Social Safeguard	ESIA (IEE) – Category B project
Legal Clearance Required		IEE approval from GoN

1.4 The Proponent

The Proponent of this sub-project is Emerald Energy Pvt. Ltd., which has been registered in company Registrar office under Registration No. 336692/80/081 on 2024/05/19 as private limited company. Main aim of the company is to promote and develop renewable energy, especially large scale Biogas Plant, in Nepal.

The Name and Address of the Proponent of this Biogas sub-project is:

Emerald Energy Pvt. Ltd.
Gopiganj-08, Nawalparasi (Bardaghat Susta Paschim)
Tel: +977-9857030341

Report Preparing Institution:

Urja Consult Pvt. Ltd. has been assigned for conduction of ESIA of this sub-project. This ESIA has been prepared by multi-disciplinary team specialist on environmental and social aspects.

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1.5 Objective of ESIA

The objectives of ESIA are as follows:

- Identify the environmental and social issues/impacts related to construction and operation of large biogas plant.
- Access potential impacts on physical, biological, and socio-economic environment (based on both field inspection and desk review).
- Propose pragmatic measures aimed at avoiding, minimizing , mitigating or compensating the impacts
- Define monitoring and management systems which are applicable and suitable in the sub-project area. The monitoring plan will be prescribed as provided in EMF and SMF provisions.
- Define the institutional framework required for the execution of monitoring and management programs.
- Integrate environmental and social considerations into sub-project planning, design and costing. Allow proponent, designers, implementing agencies and funding agencies to address environmental and social issues in a timely and cost-effective manner during the pre-feasibility stage.
- Involve stakeholders, including project affected people and other parties who have interests and influence on the project during planning, designing and implementation stages.

1.6 Study Methodology

The ESIA study has been carried out in accordance with the Environment Protection Act, 2076 and Environment Protection Rules, 2077, Environment Management Framework (EMF) and Social Management Framework (SMF) of SREP and National Environmental Impact Assessment (EIA) Guidelines 1993.

1.6.1 Desk Review

The secondary data were collected from various sources such as published reports, topographic maps, land use maps, aerial photographs (Google Earth), etc. Likewise, detailed feasibility study report of the project, environmental standards, Acts and Regulations, etc. were reviewed as necessary. The district profile of Nawalparasi was also reviewed for acquiring demographic information of the sub-project location.

1.6.2 Field Based Study

A field visit was conducted on 8th and 9th Asar, 2081 B.S. (22nd and 23rd June, 2024) for survey, public consultation by multidisciplinary team of environmentalists and socio-economist for collecting information on physical, biological and socio-economic and cultural environment of the sub-project site. The details discussed in public consultation are explained in **Chapter VII** of this ESIA report. The team of expert generated data regarding the physical, biological and socio-economic environment of direct and indirect zone of influence (ZoI) with the methodological approaches as given below:

Physical Environment and Cultural Environment: The field visit team collected the site- specific information using checklist and matrix on following areas:

- Physiography, topography and land-use
- Climate and hydrology
- Geology and soil
- Drainage pattern

The checklist used for the survey during field visit is attached in ***Annex 7*** of this ESIA report.

Biological Environment: Based on expert observation and consultation with local people, not any protected vegetation (rare, endangered, indigenous, etc.) exists in the sub-project influence area.

Socio-economic Environment: The information on socio-economic condition of the people of sub-project affected area was collected through public consultation, key informant survey at sub-project vicinity *(The checklist for Key Informant Interviews is attached in Annex 7)*. The key informants were locals near proposed sub-project vicinity and officials from Pratappur Rural Municipality. The key informants have raised the issues of possible impacts during sub-project construction and operation phase. The mitigation measures of the possible impacts were delivered by the expert team. The issues that were raised are adequately addressed in the impact mitigation measures. Most of the participants of the key informant survey have queried about the employment opportunities to locals after the commencement of the sub-project. The people around the sub-project vicinity are positive about the project. The information about public institution and social infrastructure such as school, health post, and drinking water structure was collected from ward office and public consultation. All sites of religious, cultural and historical importance within the direct zone of influence were visited and observed. The social, cultural and religious values and significance of these sites were noted through consultation with locals.

The surveyed individuals included residents from households located in proximity to the proposed sub-project site, particularly those likely to experience direct impacts during the construction and operational phases. The survey also included key informants such as local leaders, officials from the Pratappur Rural Municipality, and representatives from community organizations.

The sample for the survey was developed by identifying households within the direct zone of influence of the project. The selection criteria focused on proximity to the project site, potential exposure to construction-related disturbances, and socio-economic vulnerability. Random sampling was used within the identified households to ensure a representative sample of the affected population.

The key informants were selected based on their knowledge of the local area, their role within the community, and their understanding of the potential impacts of the sub-project. The selection process included:

- **Local Leaders:** Individuals holding positions of leadership within the community, such as ward representatives, village elders, and heads of local community-based organizations.
- **Officials from Pratappur Rural Municipality:** Officials with insights into local governance, infrastructure, and development plans were included to provide a governmental perspective.
- **Community Representatives:** Individuals who represented specific interest groups within the community, such as women's groups, farmers, and youth organizations, were also interviewed.

The following data of socio-economic and cultural environment of the sub-project vicinity were collected.

- Population, ethnicity, settlement, and occupation of the influenced area
- Social services and other facilities
- Data of local resources like school, health post, temples, etc.
- Major economic activities
- Religious and cultural values of the influenced area
- Educational status of influenced area
- Health and sanitation condition of the influenced area

1.6.3 Impact Assessment

After the complete documentation of baseline environmental data of the sub-project area, each of the environmental parameters were examined against the sub-project activities in the different stages of sub-project development using various methods and tools. Then the impacts were categorized as direct and indirect which were further evaluated in terms of their extent as site-specific, local or regional. Each of these were further analyzed in terms of duration as short-term, medium-term and long-term. The magnitude of each of the impact is then evaluated based on the National Environmental Assessment Guideline (1993).

1.6.4 Public Consultation

In order to ensure public involvement, the team carried out interaction with local communities and related stakeholders during field survey to collect their views and suggestions on the sub-project. The consultation was held on Asar 8, 2081 B.S. The issues raised by the public during consultation meeting have been incorporated in the report ***(Annex 1)***.

1.6.5 Project Impact area Delineation

The project affected areas are classified into direct and indirect impact area based on scale, nature and location of the project. The zone of influence shall be considered within Pratappur Rural Municipality. The reference for the project impact area's delineation; radius for Direct Impact Area (DIA) and Indirect Impact Area (IIA) has been taken from Environmental and Social Impact Assessment (ESIA) of Waste to Energy Project of Ghorahi Sub-Metropolitan City, Dang and Dhangadhi Sub-Metropolitan City, Kailali.

Direct Impact Area (DIA): The high impact area includes the area from 100 m radius from the sub-project site where direct activity during construction and operation occurs. It includes areas where the construction work will be done. However, 100 m periphery from the sub-project site is categorized under direct impact area. This area experiences site specific impacts. The environmental impacts of this area could not be avoided but its effect could be minimized or compensated by taking relevant measures.

Indirect Impact Area (IIA): Indirect impact area includes all the areas that will have indirect impacts by construction and operation activities which can be mitigated or minimized and mostly the activities of construction workers. 500 m periphery is considered as indirect impact zone. The whole stretch of transportation route i.e. substrate generation zone to sub-project location is considered as indirect impact zone. **Figure 3** depicts the Direct and Indirect Impact area delineated in topographic map.

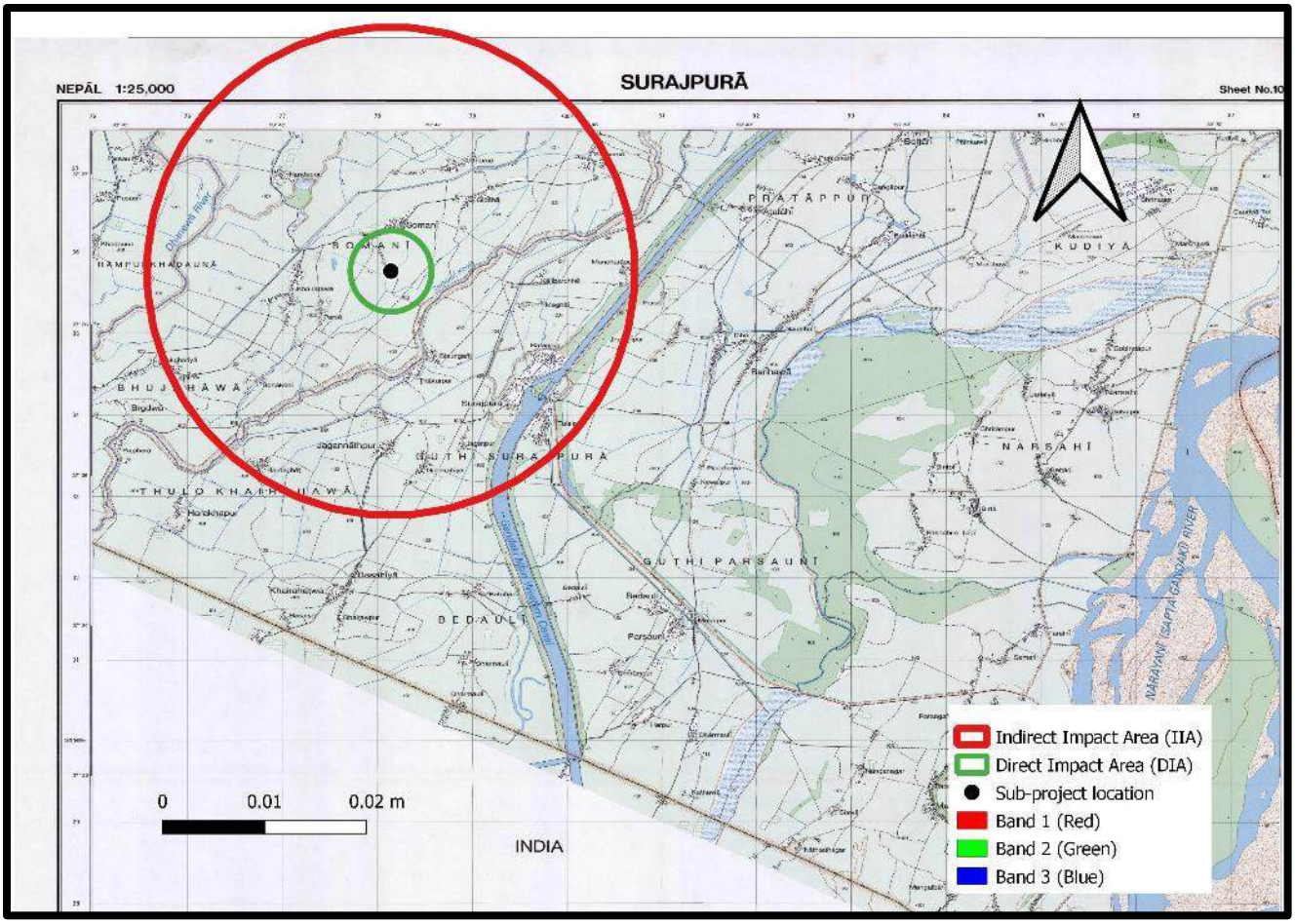


Figure 3: Topographic Map Showing Direct and Indirect Impact Zone

CHAPTER II: PLANT DESIGN AND TECHNOLOGY

2.1 Description of the Technology

Among the variety of waste to energy recovery technologies, anaerobic digestion technology has been proposed for this sub-project. The prime benefit of the anaerobic digestion technology is that the organic fraction of the waste will be decomposed in absence of aerobic (oxygen) environment and finally biogas (CH_4, CO_2 and other traces) is produced. This biogas can be utilized as clean fuel and can be utilized for thermal application. The sub-project proposes use of thus produced gas for thermal application in nearby industries in the form of compressed biogas (Bio-CNG). Apart from biogas, the secondary but valuable by-product (compost fertilizer) will also be produced and can be used as organic manure. So, adoption of anaerobic digestion technology can manage organic wastes by converting it into useful energy source. Thus produced biogas energy is renewable form of energy produced from waste source and replaces fossil fuels (kerosene or LPGs) which ultimately contribute in reducing greenhouse gases emission in the atmosphere.

With regards to model of biogas plant, the developer of the sub-project intends to use Continuously Stirred Tank Reactor (CSTR) based biogas plant equipped with additional heating and stirring facility. Hence, due to additional heating, the environment could be maintained in higher mesophilic range and hence 25-30 days of hydraulic retention time (HRT) is considered for design.

2.2 Components of Proposed Biogas Plant

The types of units and equipment that are required in the proposed CSTR based biogas system are described below:

i. **Substrate Storage and Preparation Area:** The biomass substrates proposed for the sub-project are cattle dung (cow/buffalo) and press mud. The substrate will be continuously fed into the digester in daily basis or need only one or two days of storage.

ii. **Feed Mixer Tank and Substrate Feeding:** The feeding of the BMP (Bio Methane Plant) will work as a semi-automatic storage – flow- process, by which the bio mass is guided into the digester per day. Additionally, Digestate can be pumped from digester outlet to inlet in case of demand. Any process of pumping from and to any containment will be monitored by level switches, which are connected to the PLC - system, and will supervise the pumping system. The digesters are fully mixed by high quality submersible agitators and will be operated in a mesophilic (38˚C ± 1˚C) temperature range. This leads to a stable process and an economical optimized demand for process heat, so a maximum gas yield which results in maximum greenhouse gas reduction will be guaranteed.

iii. **Concrete Biogas Digester:** Digester is comprised of a standing cylindrical tank of reinforced concrete – 24 meters in diameter and 8 meters high including a free board head space for gas

release. The solid that are fed into the digestion system for decomposition or degradation of the Volatile Solids (VS) (Organic Dry Matter) present inside the feed substrate (bio-mass). The Degradation is done in the digester. The proposed plant works on a storage –flow-process. Biomass is guided into the single digester by a solid feeder several times per day. Additionally, re-circulated slurry will be pumped into the digester. The digester is fully mixed by high quality lateral mixers and will be operated in a mesophilic (38°C) temperature range. This combination leads to a stable process with good homogenization of waste and minimized efforts as far as areas requirement and digester volume are concerned. On the other hand, it aims at maximum gas yield which results in maximum greenhouse gas reduction. The digester is standing cylindrical tanks made of reinforced concrete and is equipped with a wall heating system. The digester is covered with a double membrane dome type gasholder.

iv. **Biogas Flare and Flame Arrester:** Biogas flares are used to safely burn biogas that is surplus to the demand of the biogas plant or where the plant fails. The flow rate of the biogas flares to be used is 100 m^3/hr and will be installed at 7 meters height from the ground. It is equipped with moisture trap and flame arrestor.

v. **Biogas Up-gradation:** The biogas collected in the gasholder will be fed to a Roots compressor where pressure of gas is raised to 0.5 kg/cm²g. This gas is then fed to a Proprietary Chemical based purification unit, which has a twin tower arrangement filled with special grade of Chemical; adsorb H_2S and CO_2 from the inlet gas. The outgoing gas will be free from H_2S and will have approximately 7-10% CO_2. While one tower is purifying the gas, the other tower is taken for regeneration, which is achieved by:

a) Depressurization of the tower
b) Creating partial vacuum in the tower

The changeover from one tower to another is fully automatic and accordingly continuous supply of purified gas is available at the outlet of the system. The outgoing purified gas can be bottled in CNG cylinders and be used for Heating/Energy purpose. In order to fill the gas in the CNG cylinders at a pressure of 200 Kg/cm^2g, a methane compressor will be installed. The gas is perfect replacement of LPG for heating application.

vi. **Biogas Compression and Filling Station:** The biogas compressor is used to increase the pressure of the bio-methane to a pressure (200 bar) suitable for it to be injected into the cylinder filling manifold. The capacity of each cylinder will be 14.2 kg of CNG. The working pressure of Cylinder will be 200 bar and its burst pressure will be 300 bars as a safety margin. Normal cascade consists of 6 cylinders; however it can be customized based on end use gas requirement. Safety standards of Petroleum and Explosives Safety Organizations (PESO), Government of India, will be adopted for the activities related to compression and filling of cylinders, as well as other

activities related to Bio-CNG such as manufacture, possession, use, sale, import, export, transport & handling.

vii. Post Digested Slurry Handling and Compost Production

Solid Liquid Separator (Screw Press): The Screw Press unit will be fitted in line of the spent slurry disposal system. Spent slurry that is coming out of the digester will have around 8-10 % dissolved solids, which are pathogen-free bio-fertilizer. The solids in the spent slurry will be separated out in the Screw Press unit. In addition, the dried cake will be sold to farmers as organic fertilizer; the effluent from the Screw Press is further stored and reused. Hence, the plant ensures zero discharge.

Slurry Storage Lagoon: The Digester (liquid fertilizer) storage lagoon will be designed for around 4 week's storage. Solid liquid separating decanters will be connected to outlet of storage lagoon. The lagoon side walls/bottom & solid manure collecting yard would be treated to prevent any leaching. The lagoon / yard would have facility to enable periodic cleaning of the lagoon & yard. The Substrate Handling and Slurry Management plan is provided in the **Section 11.5**.

viii. Compost Production and Packaging Unit: The compost manure separated from the slurry solid separator will be stored in fertilizer yard of area spread to 120 m^2 where the collected manure will be stored and dried to achieve desired TS (70%). Workers manually fill the final compost product in the bag and seal with hand stitching gun.

ix. Monitoring: Process temperature and pH value monitoring will be done in digester or slurry taken from digester. Similarly, the system will have Volatile fatty acids (VFA) monitoring, dew point meter, biogas quantity monitoring through flow meter and quality monitoring through gas analyzer which will indicate the composition of biogas. All of these monitoring indicators can be accessed through computer/control panel in remote location.

2.3 Sub-project Process Cycle

The proponent has considered anaerobic digestion technology for generation of biogas from organic wastes collected. The digester of proposed biogas plant is based on Continuously Stirred Tank Reactor (CSTR) with additional facility of heating and stirring. After generation of biogas in the digester, the biogas will be refined by removing H_2S gas followed by gas up gradation. After this stage, the biogas will be upgraded to methane with 96% purity.

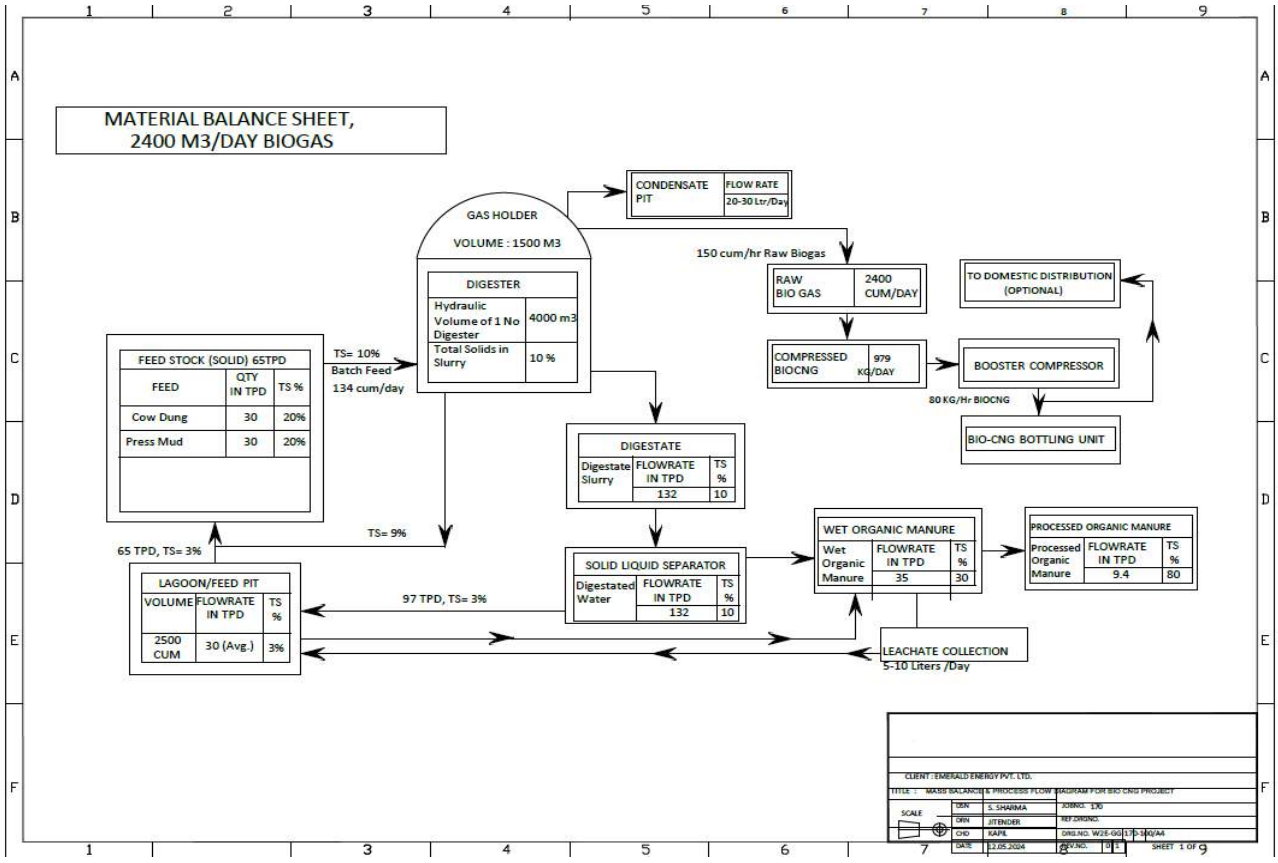


Figure 4: Process Flow Diagram and Mass Balance

2.3.1 Waste Characterization and biogas production potential

The characterizations of various wastes are known and presented in **Table 2**. While designing the biogas plant, sizing and biogas production calculation, following data is used.

Table 2: Waste Characterization

Substrate	Biogas Yield (m^3/kg day)	C: N ratio	TS%	VS (% of TS)
Cow Dung	0.040	20	20	80
Press Mud	0.040	14	24	80

From the above characteristics and available substrate, the biogas production potential is calculated as:

Table 3: Biogas Production Potential from Available Substrate

Substrate	Available Quantity (tons/day)	Biogas Yield (m^3/kg day)	Daily biogas production (m^3/day)	Density of Methane (kg/m^3)	Probable Bio-CNG (Methane) Production
Cow/Buffalo Dung	30	0.040	1200	0.400	480
Press Mud	30	0.040	1200	0.416	499
Total	**60**		**2400**		**979**

2.3.2 Biogas Plant Design

With above parametric conditions, a biogas plant was designed with estimated size of biogas digester volume, quantity of substrates for co-digestion and estimated biogas and compost production. The design of the biogas plant with its parametric conditions is presented in **Table 4**:

Table 4: Design Parameters of Proposed Biogas Plant

Substrates to be used	Cow dung and press mud
Total Substrate quantity	60,000 kg/day (60 tons/day)
Combined TS of substrate	20%
Dilution Water Requirement	**60,000 litres/day**
TS of feedstock after dilution	10-12%
Hydraulic Retention Time	**25-30 Days (Mesophilic)**
Volume of Digester	4000 m^3
Combined CN Ratio	**17**
Total Biogas Production	**2400 m^3**
Total slurry (liquid) from outlet	**132 tons per day**
TS of Slurry	12%
Total compost production	**9.4 tons per day (70% DS)**
Total Liquid slurry available after compost (Screw press)	**97 tons/day** • **Slurry Recirculation : 65,000 kg/day**

The estimated compressed biogas (Bio-CNG) and compost produced from the proposed plant is calculated as approximately 979 kg of Bio-CNG and 9.4 tons of compost fertilizer daily. The composition of raw biogas as claimed by technology provider is 55% to 60% of Methane (CH_4), 40%±5% Carbon dioxide (CO_2), 1000 ppm±400ppm Hydrogen sulphide (H_2S), saturated water (H_2O), less than 2% air and less than 0.5% Oxygen (O_2).

Table 5: Biogas and Compost Fertilizer Production

Total Biogas Generation		**2400 m^3/day**		
Composition	**Percent (%)**	**Volume (m^3/day)**	**Density (kg/m^3)**	**Quantity (kg/day)**
Methane	60%	1440	0.68	979
Carbon dioxide	39%	936	1.98	1,853.28
Others	1%	24	-	
Total Slurry Production		132 tons/day (10 % DS)		
Total Compost Production		9.4 tons/day (70% DS)		

While, in the final product i.e. compressed biogas (Bio-CNG), the composition will be 96% CH4, less than 3% CO_2 and less than 5ppm H_2S.

2.3.3 Calorific Value and Conversion Equivalent

The net calorific value of pure methane is considered as 50 MJ/kg whereas calorific value of LPG (baseline energy source considered for thermal purpose) stands at 45.5 MJ/kg. The proposed sub-project will use Chemical H_2S Scrubbing from NaOH dosing and Pressure Swing Adsorption (PSA) technology for biogas purification and will produce about 96% of pure methane gas as final output. Hence, the calorific value is considered equal for LPG and Bio-CNG. With this assumption, the produced Bio-CNG will replace approx. 69 cylinders of LPG equivalent marketed in Nepal (14.2 kg of LPG in each cylinder).

2.4 Sub-Project Requirements

2.4.1 Water Requirement

During construction period, estimated water requirement is approx. 20-25 m^3/day which will be sourced from ground water extraction within the construction site. A permanent deep boring will be installed for meeting water demand for construction as well as in operation phase.

For the operation of the sub-project, water requirement is estimated to be 60-66 m^3/day. The water demand will be fulfilled through deep boring and recirculation of liquid slurry generated from digester.

2.4.2 Land Requirement

The proposed sub-project location is at Ward No. 3, Pratappur Rural Municipality, Parasi District. The site is about 13 km South from East West highway. The land required for the proposed sub-project is private and agricultural land. The land requirement for the biogas components is presented in the table.

Table 6: Land Requirement for Different Biogas Components

S.N.	Biogas Components	Land Requirement (m^2)
1.	Digester	452.12
2.	Feed preparation and fertilizer pit	50.24
3.	Control room and office block	37.5
4.	Sun drying platform	240
5.	Fertilizer packaging shed	120
6.	CNG filling and storage unit	108
7.	Solid liquid separator	40
Total Land Area		**1047.86**

2.4.3 Work Force Requirement

For the construction period of six months, work force required is approximately 15-20 skilled and 100 semi-skilled/unskilled human resources. During the operation phase, around 12 regular employees and 12 field employees will be employed for the operation and maintenance of the biogas plant. While

employing the workers, preference will be given to the locals especially women and disadvantage groups according to their qualification, skills and interest. It will also be kept in mind that no child labor or forced labor be entertained in the project vicinity.

2.4.4 Energy Requirement

Electricity will be used as a major source of energy for the construction and operation of the sub-project and diesel generator will be used as a backup. The peak load during the operation of the biogas plant will be limited to less than 138.5 kW. LPG cylinders will be used for the labor camp during construction of the biogas plant. The sub-project strictly prohibits illegal extraction of fuel wood.

2.5 Potential Pollutants/Emission Resulting from Implementation of the Proposal

Different types of wastes and pollutants are assumed to be produced during the construction and operation phase of the proposed sub-project. Different nature of wastes produced during the construction phase and operation phase are discussed in **Table 7**.

Table 7: Potential Pollutants/Emissions Resulting from Implementation of the Proposal

Pollutant Category	Pollutants/Emissions	Sources
Construction Phase		
Solid Waste	Muck/ Spoil	Excavation and civil construction work for foundation of digester, sump
	Food wastes, polythene, papers etc.	Construction Workforce
Liquid and Semi-Liquid Wastes	Wash out Liquid Wastes,	Aggregate Washing, Wash outs from concrete
	spent grease, lubricants, spills and leaked petroleum	Vehicles and Generators
Gaseous Emission	Dust, CO_2, CO, NOx, SO_2 and suspended particulate matter	Various excavation processes, crushing and mixing activities, vehicles and diesel generator
Operation Phase		
Solid Waste	Solid slurry production and raw materials	During storage of raw materials and post digestate
Liquid and Semi-Liquid Wastes	Process wastewater after dewatering of post digestate slurry	Biogas production and post digestate management, washing and cleaning
Noise Pollution	Noise level from vehicle movements, pumps	Transportation vehicles, components of plant
Odor Pollution	Foul Odor	Pre-storage of biodegradable raw materials, transportation of feedstock from different locations

CHAPTER III: DESCRIPTION OF EXISTING ENVIRONMENTAL CONDITION

This section describes the existing environmental condition of the sub-project area based on the site-specific information gathered through primary and secondary sources of information. The district and municipality level information of the sub-project is gathered through secondary sources of information. The existing environment related to physical, biological, socio-economic and cultural environment are described below:

3.1 Physical and Cultural Environment

3.1.1 Physiography and Topography

Physiographically, the sub-project location lies in Pratappur Rural Municipality, Parasi District of Nepal. The sub-project area lies at an altitude about 124 m above mean sea level. The sub-project will be commissioned in 3,386.3 m^2 (10 Kattha) land which the proponent has owned. The Pratappur Rural Municipality shares the eastern border with Susta Rural Municipality, western border with Sarawal Rural Municipality, northern border with Bardaghat Municipality and southern border with India. Geographically, Pratappur Rural Municipality lies between 83°25'12" N to $83^0$37'3' N Latitude and 28°22'30" E to 28041'52" E Longitude.

3.1.2 Geology and Soil Type

Geologically it is situated in the foothills of Siwalik Hills of Lumbini Province of Nepal. The area consists of conglomerate, sand and sandstone. It is basically developing in the slope of the Siwalik Hills in the north and some part of it is in the flood plain of Girwari Khola.

3.1.3 Climate

The climate of the sub-project area is sub-tropical and temperature fluctuation in summer and winter ranges from 30°C to 42°C and 6°C to 17°C respectively. The relative humidity ranges from 84 to 87% with estimated average annual rainfall of 2360 – 2375 mm. The maximum rainfall within 24 hours is noted to be 177-175 mm.

3.1.4 Drainage and Hydrology

There is no proper surface drainage facilities established so far at sub-project area. However, there exists 2 km long storm water drain mainly in the main market area. Since the project area is situated at flat terrain, the water logging in rainy season is encountered frequently. There is no perennial river system in and around the service area.

3.1.5 Land Use

The land use pattern of Pratappur Rural Municipality is dominated by agricultural land accounting about 96.15 percent following pond and lake (3.38%). The different land uses and its percentage coverage are presented in **Table 8**.

Table 8: Land Use Pattern of Pratappur Rural Municipality

S.N.	Land Use	Area (Sq.km)	Percentage
1	Agricultural Land	68.38	96.15
2	Pond/Lake	2.41	3.38
3	Settlement	0.33	0.47
Total		**71.12**	**100**

Source: Profile of Pratappur Rural Municipality

3.1.6 Air Quality, Water Quality and Noise Levels

There are no instrumentally monitored baseline data on air quality. The sub-project vicinity (around 500 m) is devoid of any industrial activities and is surrounded by agricultural land. There is earthen road to reach the sub-project site and there is not much vehicular movements and industrial pollution in the project vicinity. However, after the completion and operation of the sub-project, there is possibility of air pollution due to vehicular movement while transporting collected waste from at the proposed land.

3.2 Biological Environment

3.2.1 Vegetation and Forest

The sub-project area is explicitly used as agricultural purpose and hence no any forest stretches lies within the sub-project area. The vegetation type around the sub-project area is dominantly subtropical forest 'associations. Dominant species are Shorearobusta (sal), MicheliaChampaca, BombaxCeiba, TrewiaNeudiflora (Gutel) and acacia c,atechuldalbergiasissoo. "The grasslands are grazed almost year-round. No medicinal herbs, protected, rare, or endangered shrubs and herbs were observed within the sub-project vicinity."

The sub-project area habitat is disturbed and is seldom visited by wild mammals. Occasional visited wild animals are Jackal, Jungle cat, Wood rat etc. Birds living in and around the settlement areas are crow (Corvusmacrorhynchos), Common cuckoo (Cuculuscanorus), House sparrow (Passer domesticus) etc.

3.2.2 Protected Areas

There are no protected areas around sub-project area.

3.3 Socio-Economic and Cultural Environment

3.3.1 Demography and Households

The Parasi district holds a total population of 386,868, of which Pratappur Rural Municipality holds a population of 49,897. The average household size in Pratappur Rural Municipality is 5.12 which is greater as compared to average household size of Parasi district which is 4.68. Figure of sex ratio implies that number of female population is greater compared to male population both at district and Rural Municipality. Male to female ratio at the district stands at 0.94 while the Rural Municipality is 0.98. **Table 9** represents the demographic characteristics of Parasi, Pratappur Rural Municipality and Ward no. 3 of Pratappur Rural Municipality.

Table 9: Demographic Information of Sub-Project District and Rural Municipality

Demographic Parameter	Parasi District	Pratappur RM	Ward No. 3 Pratappur RM
Area (sq.km.)	729	71.12	8.16
Total households	82,738	9,702	1,056
Total Population	386,868	49,897	5,761
Male	188,017	24,798	3,003
Female	198,850	25,099	2,758
Sex ratio (M:F)	0.94	0.98	1.08
Average HH Size	4.68	5.12	5.45

(Source: CBS, 2021)

3.3.2 Population by Age Group in District and Rural Municipality

The population by age group in Parasi District and Pratappur Rural Municipality are presented in the table.

Table 10: Population by Age Group in District and Rural Municipality

SN	Age group	Parasi District		Pratappur RM	
		Both sex	%	Both sex	%
1	0-4	31,133	8.04	9,103	19.51
2	5 -14	70,532	18.23	4,530	9.71
3	15-59	246,509	63.72	29,160	62.48
4	60+	38,694	10.01	3,877	8.30
Total		**386,868**	**100**	**46,670**	**100**

(Source: CBS, 2021)

3.3.3 Caste and Ethnicity in District and Rural Municipality

Ethnic distribution of population shows identical population distribution both in the district and the Rural Municipality. Tharu represent the largest ethnic group in the district (17.6%) and Rural Municipality (17.7%) followed by Brahmin in district and Chamar/Harijan in Rural Municipality. The ethnic distribution of the population in the district and the Rural Municipality is presented in **Table 11**.

Table 11: Ethnic Distribution of the Sub-Project District and Rural Municipality

SN	Caste	Population (%)	
		Parasi District	Pratappur RM
1	Tharu	17.6	17.7
2	Brahmin Hill	11.3	0
3	Chamar/Harijan/Ram	7.2	12
4	Magar	7.1	-
5	Musalman	6.7	7
6	Yadav	5.5	9.6
7	Kshetri	4.6	-
8	Kewat	3.5	3
9	Teli	3.3	4.6
10	Bishwokarma	3.1	-
11	Rajbhar	-	6.5
12	Koiri/Kushwaha	-	5.8
13	Kurmi	-	3
14	Hajam/Thakur	-	2.3
Total		**100.00**	**100.00**

(Source: CBS, 2021)

3.3.4 Languages

Language distribution shows identical population distribution both in the district and the Rural Municipality. Bhojpuri represent the largest language spoken by the people in the district and Rural Municipality followed by Nepali in district and Tharu in Rural Municipality. The language distribution in the district and the Rural Municipality is presented in **Table 12**.

Table 12: Language Distribution in the Sub-Project District and Rural Municipality

SN	Languages	Population	
		Parasi District	Pratappur RM
1	Bhojpuri	197,078	40,550
2	Nepali	111,596	1,846
3	Tharu	53,482	7,245
4	Magar Dhut	14,288	499
5	Gurung	3,875	200
6	Nepalbhasha (Newari)	1,650	499
7	Urdu	1,160	150
8	Tamang	1,160	-
9	Hindi	774	499
10	Maithali	-	499

(Source: CBS, 2021)

3.3.5 Religious and Cultural Environment

The sub-project location does not have any cultural and historical sites. However there exist some cultural, historical and religious sites in the vicinity of the sub-project Rural Municipality. Pratappur Rural Municipality serves as the gateway to Lumbini. Baunna Gadi Devi Mandir is the famous temple of sub-project Rural Municipality.

3.3.6 Industries

Around 41 tonnes per day of the press mud will be sourced from the nearby sugar mills and contractual agreements with the various mills has been made to ensure regular supply of the required quantity of substrate for the daily operation of the plant. The press mud availability in the sub-project area is presented in the table.

Table 13: Availability of Press Mud in the Sub-project Area

Name of Supplier	Type of Substrate	Location	Distance from Site (km)	Supply Capacity (TPD)
Annapurna Sugar and General Industries Pvt. Ltd.	Press mud	Nawalparasi West	45	30
Indira Sugar and Agro Industries Pvt. Ltd.	Press mud	Nawalparasi	13	11
Total Press Mud				**41**

Source: DFS, Emerald Energy Pvt. Ltd.

The bulk size of the cascades or cylinders used for storing the produced Bio CNG makes commercial sectors the primary target customers rather than households. Consequently, hotels and restaurants will be the main end users of Bio CNG. The Bardaghat area, an industrial city with numerous industries and commercial hotels, offers a favorable market for the developer to sell Bio CNG. The list of potential end users for this sub-project is presented in the table.

Table 14: List of Potential End-Users in the Sub-Project Area

S.N	Name of Potential End-users	Daily Tentative Diesel Consumption (Litres/Day)	CNG Equivalent (Cylinders per day)	Remarks
1	Yashoda Foods, Bhalwari	270	23	Industries
2	Pathak Food Products, Bardaghat	240	20	
3	Kissan Tanks	185	16	
4	Nava Nepal Plastics	110	9	
5	Arpit Modern Food Products	245	21	
6	Starex Plastics	220	19	
	Total	**1,270**	**108**	

Source: DFS, Emerald Energy Pvt. Ltd.

3.3.7 Livestock and Poultry

There are 35 livestock and poultry farm in the Pratappur Rural Municipality, among which 2 are poultry and the rest are Cow/Buffalo farm. The list of farm in the Rural Municipality is given in the Table.

Table 15: Livestock Poultry Farm in the Pratappur Rural Municipality

S.N.	Name of Farm	Ward No.	Type of Farm
1.	Binod Pasu Farm	6	Cow/Buffalo Farm
2.	Brijmohan Pashupalan Farm	3	Cow/Buffalo Farm
3.	Ekikrit Krishi Farm	2	Buffalo Farm
4.	Jayma Kotahi Bhaisi Farm	5	Cow/Buffalo Farm

S.N.	Name of Farm	Ward No.	Type of Farm
5.	Sagar Gaipalan Farm	6	Cow Farm
6.	Hariom Ekikrit Krishi tatha Pashupalan Farm	7	Cow/Buffalo Farm
7.	Shubham Bhaisi Farm	9	Buffalo Farm
8.	Sou Poultry Farm	6	Poultry
9.	Yadav Pashupalan Farm	6	Cow/Buffalo Farm
10.	Shanti Pashupalan Farm	9	Cow/Buffalo Farm
11.	Shivanandan Pashupalan Farm	3	Cow/Buffalo Farm
12.	S.G. Pashupalan Farm	1	Cow/Buffalo Farm
13.	Umesh Pashu Farm	8	Cow/Buffalo Farm
14.	Baniya Pashupalan Farm	6	Cow/Buffalo Farm
15.	Jay Laxmi Gai Bhaisi Farm	4	Cow/Buffalo Farm
16.	Mamata Pashupalan Farm	3	Cow/Buffalo Farm
17.	Sabitri Devi Gai Bhaisi Farm	6	Cow/Buffalo Farm
18.	Preeti Bhaisi Farm	8	Buffalo Farm
19.	Guddu Pashu Farm	3	Cow/Buffalo Farm
20.	Pratima Pashupalan Farm	6	Cow/Buffalo Farm
21.	Kamala Pashupalan Farm	9	Cow/Buffalo Farm
22.	Krishna Pashupalan Farm	9	Cow/Buffalo Farm
23.	Kamdhenu Gai Bhaisi Farm	7	Cow/Buffalo Farm
24.	Unnat Pashupalan Farm	6	Cow/Buffalo Farm
25.	Indresh Pashupalan Farm	3	Cow/Buffalo Farm
26.	Suju and Samikshya Krishi Farm	1	Cow/Buffalo Farm
27.	Trishakti Pashupalan Farm	3	Cow/Buffalo Farm
28.	Annapurna Farm	2	Cow Farm
29.	Ramesh Pashupalan Farm	8	Cow/Buffalo Farm
30.	Anjali Pashupalan Farm	9	Cow/Buffalo Farm
31.	Indal Pashupalan Farm	6	Cow/Buffalo Farm
32.	Shivam Bhaisi Farm	6	Buffalo Farm
33.	Bindrawati Bhaisi Farm	6	Buffalo Farm
34.	Yadubanshi Pashupalan Farm	3	Buffalo Farm
35.	Nisha Poultry Farm	5	Poultry

Source: Profile of Pratappur Rural Municipality

3.3.8 Literacy Status in District and Rural Municipality

Of the total population of 355,735 aged 5 years and above, 248,727 are literate in the Parasi district while in Pratappur Rural Municipality is 33,687 are literate out of total population of 37,567. Status of literacy in Parasi District and the Pratappur Rural Municipality is provided in **Table 16**.

Table 16: Population of 5 Years of Age and Over by Literacy Status

Literacy Index	Parasi District	Pratappur RM
Total population (aged 5 years and above)	355,735	37,567
Can Read & Write	213,441	24,296
Can read only	35,286	9,391
Can't read and write	106,720	3,380
Not stated	288	-

(Source: CBS, 2021)

3.3.9 Drinking Water Facility in District and Rural Municipality

Tap/piped and tube well/hand pump are the main source of drinking water, both in the Parasi District and Pratappur Rural Municipality. In Parasi district, 42.64% households rely on Tap/piped source of drinking water followed by Tube well/hand pump (18.38%). Similarly, in Pratappur Rural Municipality, almost 46.89% population depend on Tap/piped water for drinking purpose while almost 34.17% population depend on tube well/hand pump. The details of drinking water source in Parasi and Pratappur Rural Municipality are presented in **Table 17**.

Table 17: Drinking Water Sources in Sub-Project District & Rural Municipality

Source of Drinking Water	Parasi District		Pratappur RM	
	Households	Percent	Households	Percent
Tap/piped	35,270	42.64%	4,194	46.89%
Tube well/hand pump	42,599	51.50%	3,056	34.17%
Covered well/ Kuwa	281	0.34%	13	0.15%
Uncovered well/ Kuwa	632	0.76%	13	0.15%
Spout Water	1,617	1.96%	1,567	17.52%
River/Stream	140	0.17%	-	-
Jar/Bottle	1,781	2.15%	-	-
Other	389	0.47%	101	1.13%
Total	82,709	100.00%	8,944	100.00%

(Source: CBS, 2021)

a. Sanitation Status in District and Rural Municipality

Regarding sanitation, 28.64% of the total households in Parasi district lack toilet. In contrast, almost 95% of the total households in the Pratappur Rural Municipality have toilet facility, either ordinary or flush. The types of toilet in the district, Rural Municipality and ward level are presented in **Table 18**.

Table 18: Sanitation Status in Sub-Project District and Rural Municipality

Types of Toilet	Parasi District		Pratappur RM		Ward No. 3 Pratappur RM	
	Households	Percent	Households	Percent	Households	Percent
Without Toilet	3,638	28.64	464	5.19%	5	0.5%
Flush Toilet	32,359	43.05	2	0.02%	-	-
Ordinary Toilet	46,188	27.68	8,450	94.48%	1049	99.5%
Public Toilet	524	0.62	-	-	-	-
Others	-	-	28	0.31%	-	-
Total	82,709	100.00%	8,944	100.00%	1054	100.00%

(Source: CBS, 2021)

b. Energy for Cooking in District and Rural Municipality

LPG makes the dominant source of cooking in Parasi district with 56.30% households and firewood is the dominant source of cooking in Pratappur Rural Municipality with 66.10% households. LPG is the

second prominent source of energy used for cooking in rural municipality of 27.31% while in district, second prominent source of energy for cooking is firewood which is 41.31% respectively. **Table 19** presents source of energy used for cooking.

Table 19: Energy Source for Cooking

Energy for Cooking	Parasi District		Pratappur RM	
	Households	Percent	Households	Percent
Firewood	34,168	41.31%	5,956	66.10%
Kerosene	36	0.04%	7	0.08%
LP Gas	46,563	56.30%	2,461	27.31%
Cow Dung	387	0.47%	499	5.54%
Biogas	939	1.14%	79	0.88%
Electricity	513	0.62%	-	-
Others	103	0.12%	8	0.09%
Total	**72,830**	**100.00%**	**23,710**	**100.00%**

(Source: CBS, 2021)

c. Energy for Lighting in District and Rural Municipality

For lighting purpose, majority of the population in Parasi and Pratappur Rural Municipality get their electricity supply from the national grid. In Parasi district, more than 96.75% population use electricity as the source of lighting followed by solar users (1.89%). In case of Pratappur Rural Municipality, almost 97.42% households use electricity as the lighting source followed by Kerosene (2.29%). The details of energy source for lighting are presented in **Table 20**.

Table 20: Energy Source for Lighting

Energy Source for Lighting	Parasi District		Pratappur RM	
	Households	Percent	Households	Percent
Electricity	80,023	96.75%	8,713	97.42%
Kerosene	835	1.01%	205	2.29%
Biogas	17	0.02%	-	-
Solar	1,566	1.89%	10	0.11%
Other	268	0.32%	16	0.18%
Total	**82,709**	**100.00%**	**8,944**	**100.00%**

(Source: CBS, 2021)

CHAPTER IV: REVIEW OF PLANS/POLICES/LEGISLATIONS AND GUIDELINES

Government of Nepal (GoN) has adopted various policies, acts, regulations and guidelines to ensure the integration of development with the environmental conservation. In addition, for implementation of SREP large biogas sub-projects, EMF and SMF are prepared for guiding overall safeguard implementation. The ESIA will be guided by the requirements and provisions of the following acts, rules and guidelines as applicable. The descriptions of the legislations attracted by this project are provided in ***Annex 3***.

The Constitution

- The Constitution of Nepal

Plans and Policies

- Fifteenth Plan FY 2076/77- 2080/81
- Sixteenth Plan FY 2081/82- 2085/86
- Fourteenth Plan 2013-2016
- Rural Energy Policy, 2006
- Renewable Energy Subsidy Policy, 2016

Acts and Rules

- Environment Protection Act, 2076 and Environment Protection Rule, 2077
- Local Government Operation Act, 2074 (2017)
- Water Resource Act, 1992
- Solid Waste Management Act, 2011
- Solid Waste Management Regulation, 2013
- Child Labor (Prohibition and Regulation) Act, 2000
- Labor Act, 2074 (2017)

Guidelines/ Framework

- National EIA Guidelines, 1993
- SREP Environment Management Framework (EMF), 2013
- SREP Social Management Framework (SMF), 2013

Standards

- National Ambient Air Quality Standards, 2003
- Nepal Vehicle Mass Emission Standards, 1999
- National Ambient Sound Quality Standard, 2012
- Generic Standard for effluents to be discharged in inland surface water,2003

International Policies and Conventions

- World Bank Safeguard Policy (OP 4.01 Environment Assessment)
- World Bank Safeguard Policy (OP 4.10 Indigenous Peoples)
- World Bank Safeguard Policy (OP 4.11 Physical Cultural Resources)
- World Bank Safeguard Policy (OP 4.12 Involuntary Resettlement)
- Convention on Biodiversity (CBD), 1993
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973
- Convention (No. 169) Concerning Indigenous and Tribal Peoples in Independent Countries, 1989

CHAPTER V: IMPACT ASSESSMENT

This section provides the predicted impact of the implementation of the proposal on environment and community. Every development project comes with some adverse impact along with its community benefit. The main purpose of conducting environmental and social assessment is to enhance the beneficial impacts and to reduce potential adverse impacts. This section distinctly categorizes the envisaged beneficial impacts as well as adverse impacts in the subsequent subsections. The adverse impacts are broadly categorized into physical, chemical, biological and socio-economic environment and assessed with extent, magnitude and duration of the predicted impacts.

5.1 Beneficial Impacts

5.1.1 Construction Phase

a. Employment Opportunity to Locals

The sub-project will require a large number of skilled and unskilled labors throughout the construction period. Depending on the demographic and socio-economic setting in a given location, there will be various employment opportunities for the local population. Total 15-20 skilled labors and 100 unskilled labors will be required for the building construction within the targeted time. While employing the workers, preference will be given to the locals especially women and disadvantage groups according to their qualification, skills and interest. The amount of money flowing into the rural economy in the form of wage earnings will directly enhance the initiation of various ancillary economic activities and enterprise development. *The impact will be direct, high in magnitude, and medium term in duration.*

b. Skill Development of Locals

The biogas plant construction will not only provide employment opportunities but also helps in providing the skills and technical expertise to the local labors. Unskilled Labor will be trained which will enhance their skills and capability in working like construction of walls, fitting of iron frames, and other required items necessary for the Biogas Plant construction. These skills will not only benefit the local workers by providing employment opportunity but also contributes to local human resource development in the sub-project area. The skills will also help unskilled laborers for their self-dependence in the future. *The impact will be indirect, moderate in magnitude, and medium term in duration.*

c. Enterprise Development and Commercialization

A large number of workforces of different categories will reside for the considerable period of time at different locations of the sub-project area during the construction period. Since, the workers will have good purchasing power, they will regularly demand for different types of food, beverage and other daily necessary items. To meet these demands, many local and outside people may operate a number of shops and restaurants around the vicinity of the sub-project area. This will increase local trade and

business in the area. As a result of increased trade and business, local people conducting these businesses shall significantly benefit from the sub-project. *The impact will be indirect, high in magnitude, and medium term in duration.*

d. Boost in the Local Economy

The flow of labors will increase in the sub-project area during the construction period. Increase in the number of people shall increase economic activities within the proposed sub-project area, as the labors require accommodation, foods and others from the nearby market. Thus, the construction activities can help open new stalls and develop new shops and lodges near the construction sites. Various farm based enterprises including a wide range of agricultural and livestock products will gain momentum because of increased demand by labors during construction period. This will increase local trade and business in the area. *The impact will be indirect, high in magnitude, and medium term in duration.*

5.1.2 Operation Phase

a. Employment Opportunity to Locals

For smooth operation of the proposed biogas plant, about 12 skilled regular employees and 12 skilled field employees are required. The regular employees will work in the plant site and field employees will work for marketing of the Bio-CNG and organic fertilizer. For the daily operation of the biogas plant, biogas operators will be employed in different units of the plant. The project will employ the locals as possible, depending on their skills and qualification, at different sectors and also encourage the establishment of small businesses in the surrounding for selling dry fertilizers to the nearby community. This will ultimately helps to uplift the economy of the project area as well as the nearby community. *The impact will be direct, high in magnitude, and long term in duration.*

b. Skill Development of Locals

The locals involved during the operation phase will get to learn skills and techniques required to run and manage the biogas plant. The technology provider will provide complete technical skill training to staff for various aspects of running the plant during its operation period. This will help them to build their capacity and can even use these skills elsewhere in a near future. *The impact will be direct, high in magnitude, and long term in duration.*

c. Promotion of Renewable Energy Technology and Availability of Cleaner Thermal Energy

At present, there are very few large-scale biogas plants operating in Nepal. The proposed project will utilize the organic waste from livestock farms to generate Bio-CNG and organic fertilizers and will serve as an example of renewable energy technology. During the biodegradation of the organic waste, Methane (CH_4) is released which has 28- 36 times higher global warming potential in comparison to CO_2 over 100 years-time period. The installation of biogas plant will directly reduce the emissions of

methane gas such process. In addition, thus produced biogas is expected to replace fossil fuels (LPG). *The impact will be direct, high in magnitude, and long term in duration.*

d. Sustainable Waste Management

The proposed large biogas plant is designed to manage approximately 60 TPD of organic waste. About 30 TPD of waste from cow/buffalo farm and 30 TPD of press mud, waste from sugarcane industry will be utilized. The produced Bio-CNG will be distributed in industries which will reduce the dependency on LPG cylinders as well as also helps to minimize the degradation of forest products like firewood. *The impact will be direct, high in magnitude and long term in duration.*

e. Reduction in Pollution and availability of fertilizer to locals

As biogas becomes available as a clean cooking and lighting fuel, it replaces fossil fuels. This substitution reduces the carbon footprint and lowers the emission of harmful pollutants such as sulfur dioxide, nitrogen oxides, and particulate matter, leading to improved air quality and a healthier environment.

The byproduct of biogas production, known as digestate, is a nutrient-rich organic fertilizer. This digestate contains essential nutrients such as nitrogen, phosphorus, and potassium, which are vital for plant growth. Unlike synthetic fertilizers, digestate is environmentally friendly and improves soil health over time. *The impact will be direct, high in magnitude, and long term in duration.*

5.2 Adverse Issues

5.2.1 Physical Environment

5.2.1.1 Construction Phase

a. Change in Land use

The land use pattern of sub-project area is agricultural land. The land intended for the sub-project is privately owned by the developer, encompassing approximately 5 Bigha. It is currently used for cultivating seasonal crops. However, 10 Kattha (3,386.3 m²) of land has been left barren for the purpose of implementing the sub-project. Since this land is already planned as barren, the land use will not change with the implementation of the proposal. Given that the area allocated for the plant site is minimal compared to the 5 Bigha owned by the developer, there will be minimal or no significant impact on the land use pattern with the implementation of the proposed biogas plant. Additionally, no trees will be cut during the construction and operational phase of the sub-project, therefore; adverse impact is not envisaged. *The impact will be low in magnitude, site-specific in extent and short term in duration.*

b. Issues related to Air Pollution

The construction activities such as operation of vehicles to transport the construction materials, excavation, mixing to aggregates generate dust, smoke, emission of CO_2 and other harmful gases. However, the air pollution is less likely to affect the local people as the nearest settlement is about 3 km away from the sub-project site. Such activities will only continue until the construction work completes. However, dust related impact are envisioned which can affect the villager of Somani, due to the increased traffic during the transportation of construction materials to the subproject site. *The impact will be considered as low in magnitude, site-specific in extent and short term in duration.*

c. Issues Related to Water Pollution

Percolation of wastewater generated from washing of construction materials, spillage of lubricants, grease, petroleum fuels and percolation of black and grey water generated from construction camp could contaminate groundwater. The local people depending on groundwater source for running various domestic purposes can also get affected from such activities. However, there do not seem much construction activities as most of the construction components are prefabricated. *The impact on water sources will be considered as low in magnitude, local in extent and short term in duration.*

d. Issues Related to Soil Pollution

Another impact that could result from construction activities is depletion of soil quality. The construction materials such as cement, contain certain level of chemicals which when mixed with soil can deplete its fertility over the time. Besides, haphazard disposal of construction debris can cause formation of muddy ditches during rainy season which would possibly hinder the staffs and local passers to walk comfortably. Other chemicals like grease and petroleum fuel if spilled will also reduce fertility of soil in the sub-project site. *The impact will be low in magnitude, site specific in extent and short term in duration.*

e. Increase in Noise Level due to Construction Activities

The operations of different machineries during the construction period like excavators, movement of vehicles generate noise in the sub-project site and around sub-project vicinity. However, the locals would not significantly get affected since the nearest settlement is 3 km away from the sub-project site. But the increase in noise is most likely to impact construction workers. *The impact will be low in magnitude, site-specific in extent and short-term in duration*.

f. Issues Related with Spoil Disposal and Stockpiling of Construction Materials

It is likely to have construction debris and stockpiles of construction materials in any construction activities. But haphazard disposal of such materials causes disturbance in aesthetic beauty of the surrounding area and besides, construction material such as cement contains certain level of chemical which when mixed with soil/agricultural field can reduce its fertility. In addition, such activities

increase suspension of dust during windy season and formation of muddy surface during rainy season. However, the sub-project is small scale and most of the components are prefabricated. So, only small quantity of construction material is required and only small quantity of construction debris will be generated which would not cause significant impact in the sub-project vicinity. The spoils will be generated from excavation of feeding pits and lagoons but will be consumed in the area for land labeling and land development. *The impact will be considered low in magnitude, site-specific in extent and short term in duration*.

5.2.1.2 Operation Phase

a. Issues Related to Management of Raw Materials Storage and Post-digestate Slurry

The by-product generated from the anaerobic digestion to produce biogas is organic waste. They are mostly semi solid slurry and liquid slurry, generally known as digestate. These digestate has high BOD, nitrogen content and can contaminate land and water if not managed properly. Besides the digestate, the storage of raw substrate which is in large amount can also create nuisance. If these raw feeds are not stored in a proper roofed place with sealed ground, leaching of such substrate can possibly contaminate groundwater especially during rainy season. *The impact will be moderate in magnitude, site-specific to local in extent and long-term in duration*.

b. Issues Related to Foul Odor during Storage of Raw Material and Post-digestate

The raw materials to be used for biogas production are organic waste. All of these wastes are stored for maximum of 1 week period before they are fed into biogas plant. Open storage of such large amount of substrate could cause foul odor in the sub-project area and would attract flies and vector diseases. Similarly, haphazard disposal of digestate and absence of proper composting system will also create foul smell. However, the foul odor might not possibly impact the surrounding vicinity as the nearest settlement is 4 km away. So, the receptors of impact are apparently the in-house staffs. *The impact will be moderate in magnitude, site-specific in extent and long-term in duration*.

c. Issues Related to Extraction of Water for Meeting Demand

The water required to operate the sub-project is 60-66 m^3/day, which will be sourced from ground water. The sub-project site is mostly agricultural open land and has greater availability of groundwater recharge zone so the extraction of groundwater will not impact significantly on groundwater depletion. *The impact will be low in magnitude, local in extent and long term in duration*.

d. Management of Wastewater from Digested Slurry

The digested slurry produced from anaerobic digestion is proposed to be used as compost. Solid Liquid separator will be used to separate the digested slurry into liquid slurry and solid manure. The semi-solid slurry will be further treated to make dry compost while liquid slurry will be re-circulated in the digester. The remaining liquid slurry, after the recirculation, is proposed to be sold to local farmers as

per demand basis. The liquid effluent is treated in the lagoon pond which would decrease the BOD, total suspended solid and turbidity of the liquid effluent. *The impact due to this activity will be low in magnitude, site-specific to local in extent and long-term in duration*.

e. Impact Associated with Collection and Transportation of Waste from Source to Sub-Project Location

The collection and transport of feed to the sub-project location may create foul smell along the transport route. There is also a possibility of dropping down of waste throughout the route due to improper transportation activity and overloading of waste in the vehicle. In addition, the vehicle will also emit gaseous pollutants such as CO_2, SO_2 in the atmosphere. The collection and transportation of waste can lead to increased traffic and associated emissions from the vehicles used. This can contribute to air pollution and congestion in the areas surrounding the biogas plant. Frequent movement of heavy waste collection vehicles can cause wear and tear on local roads and infrastructure. *The impacts to such activities will be moderate in magnitude, local in extent and short-term in duration.*

f. Increase in Noise Level from Plant Operation

The noise is generated from various components to operate the plant such as agitators, pumps, substrate feed loaders, etc. Such operational activity can increase surrounding noise level greater than 85 dB and can cause temporary hearing loss, annoyance among working staffs if exposed for long time. *The impact will be low in magnitude, site-specific in extent and long-term in duration.*

g. Gas Leakage and Associated Impacts including Fire Hazard

The biogas/methane is highly flammable and a naked flame can easily catch fire if leaked. This will ultimately cause loss of life and property. Moreover, emission of methane gas in atmosphere will contribute in greenhouse gas emission, which is almost 28 times more potent than CO_2 emission on heating up our planet. *The impact due to gas leakage will be moderate in magnitude, site-specific to local in extent and long-term in duration*.

h. Flood Hazard

The subproject site is located 125 meters away from Satbudri Khola, also known locally as Khujura Khola. Consultations with local residents indicate that there have been no reported incidents of flooding in Satbudri Khola. Water from this river is diverted to the Gandaki Main Western Canal. The water level rises during the rainy season but remains dry throughout the rest of the year. According to the villagers, there have been no incidents of flooding to date. Therefore, the risk of flood hazard appears minimal based on past records. However, in extreme conditions, such as during the rainy season when the water volume can rise, there might be a risk of riverbank erosion and land loss. Additionally, the developer owns 10 bighas of land and has allocated the biogas plant site farther from the dry khola. Therefore, the impacts associated with flooding are not anticipated. *The impact will be low in magnitude, local in extent and short term in duration.*

i. Issues with Drainage Management

Proper management of drainage is necessary to channel rainwater without causing any damage to the subproject area. If the drainage is unavailable, can percolate into groundwater and adjoining Satbudri Khola during the monsoon season, affecting water quality. Similarly, drainage is necessary to manage wastewater generated from cleaning the plant units and to channelize the liquid effluent after decantation to avoid contamination of nearby water bodies and groundwater as these wastes are highly pathogenic. The proximity of site to the Satbudri Khola has increased the sensitivity of the impact. *The impact will be direct, moderate in magnitude, local in extent and long term in duration.*

5.2.2 Biological Environment

5.2.2.1 Construction Phase

a. Loss of Vegetation

The construction of the proposed biogas plant will be carried out in the designated own agricultural land. The livelihood of farmers is not affected as they will be employed in the construction as well as operation phase of biogas plant. The sub-project does not require to cut any trees. Therefore, the impact on the biological environment is not foreseen. *The impact will be low in magnitude, site-specific in extent and short term in duration*.

5.2.2.2 Operation Phase

a. Maintenance and Protection of Greenery in the Sub-Project Periphery

There will not be any nuisance to the biological environment as the biogas plant will be installed in a well demarcated land area. Instead, plantation of trees will be done to maintain the greenery in the project area. *The impact will be Moderate in magnitude, site-specific in extent and long term in duration*.

5.2.3 Socio-economic and Cultural Environment

5.2.3.1 Construction Phase

a. Occupational health and safety of workers

During the construction phase, the construction work force is expected to expose to a number of construction related health hazards. The construction fugitive emissions, noise, and physical injury are some of the occupational health issues for construction workforce. Moreover, working in height, confined space and hazardous environment are other potential threats to workers. *The impact will be high in magnitude, site-specific in extent and short term in duration*.

b. Pressure on Existing Infrastructure and Community Resources

The Construction activities generally cause pressure on community water supply system, increase in solid waste generation due to increase in construction workforce, etc. Since the project construction period is only few months long i.e. 8 months and construction workers are in limited numbers, there will be very negligible pressure in utilities in the community. Moreover, the sub-project is going to use deep boring water in its own boundary so there will be no any pressure on community for water supply. Hence, this impact is not envisaged.

The construction of a biogas plant typically involves a significant increase in the movement of construction vehicles, including heavy machinery, delivery trucks, and worker transport. This can lead to traffic congestion, particularly on narrow or previously low-traffic access roads. *The impact will be low in magnitude, site-specific in extent and short term in duration.*

c. Health and Sanitation Related Issues

During the construction phase, the workers are exposed to various kind of machineries which if mishandled can cause injuries. In addition, nearby locals especially children can also get in accident around the sub-project area. *The impact will be moderate in magnitude, local in extent and short-term in duration.*

d. Labor Influx and Associated Impacts in the Local Community

During the development of the sub-project, a diverse workforce will be employed, potentially leading to social conflicts within the community. However, during the construction phase, the project will employ 15-20 skilled laborers and approximately 100 unskilled laborers, causing minimal community disturbances. Due to the limited number of workers and the short construction period, the impact of labor influx on the local community is expected to be negligible. *The impact will be low in magnitude, site-specific in extent and short term in duration.*

e. Involuntary Land Acquisition and Displacement Issue

The proposed land for the construction and implementation of the biogas plant is owned by the developer. Hence the involuntary land acquisition and displacement issue is not applicable for this project. *The impact will be low in magnitude, site-specific in extent and long term in duration.*

f. Grievances Management

The grievances such as low agricultural yield and aesthetic degradation from haphazard disposal of construction debris and improper management of construction materials could be raised from the community. The mishandling of such grievances could invite social demonstration, opposition and conflict. *The impact will be moderate in magnitude, site-specific in extent and long term in duration.*

g. Sexual Exploitation Abuse and Sexual Harassment

Construction workers and other concerned stakeholders may have complaints regarding sub-project activities and the behavior of sub-project staff and workers. Additionally, there may be incidents of gender-based violence (GBV), sexual exploitation, and harassment among workers, sub-project staff, and local people. The large influx of labor in the sub-project area during the construction phase poses a risk related to sexual exploitation and abuse/sexual harassment (SEA/SH). The interaction between workers and community members could lead to increased risks of GBV in the local communities. Therefore, effective and timely mitigation measures must be implemented to address and mitigate the potential risks of SEA/SH and abusive behaviors between sub-project-related staff and the local population. *The impact will be direct in nature, moderate in magnitude, local in extent and short term in duration.*

h. Gender discrimination and child labour

Male and female workers may be paid unequally for the same or similar works. Similarly, contractor may select male and female workers for selective works rather than the capacity of individual workers. Such gender discrimination on works and pay scale may create dispute at workplace and hindrance on progress of works. Similarly, there is probability of using children in the subproject as an employee for as cheap construction labor, which is violation of legal standards, leading to immediate harm, exploitation, or deprivation of education. *The impact will be direct in nature, moderate in magnitude, site specific in extent and short term in duration.*

i. Stakeholder Engagement and information disclosure

Stakeholder engagement and information disclosure is very important for the successful implementation of the proposed subproject. Avoiding or evading the stakeholders on proposed subproject activities may hamper the progress and sustainability of the subproject. Likewise, if information regarding the subproject is not shared with concerned stakeholders and locals, it can also creates problem in subproject implementation and sustainability. *The impact will be direct in nature, high in magnitude, local in extent and long term in duration.*

5.2.3.2 Operation Phase

a. Issues Related to Occupational Health and Safety

The workers are prone to get infected from various diseases as they are required to handle organic waste materials and slurry, during the operation phase. The most common injuries occur due to mishandling of machineries leading to fire hazard. The workers are also exposed to noise from operation of biogas plant. Working safety measures shall be executed by the developer to workers

providing ample numbers but not limited to helmets, boots, gloves and masks while working with the biogas plant. Along with the PPEs, first aid facilities for the labors will also be provided. Awareness programs on the use of PPEs to labors shall also be conducted. Without proper safety measures, prolonged exposure to such activities can cause long term health hazard. *The impact will be high in magnitude, site-specific in extent and long-term in duration*.

b. Issues Related with Health and Sanitation in and around project site

The operation of biogas plant consists of handling of organic waste like cow dung which might be pathogenic to some extent. Haphazard disposal and improper management can cause increase in vector borne diseases and can spread out to nearby communities that can create agitation among the locals and oppose the sub-project. *The impact will be high in magnitude, site-specific in extent and long-term in duration.*

c. Inflow of people in the Sub-Project Area

The workers may hinder the local culture and traditional activities of local people which might create debate, quarrel and misunderstandings in some cases. Similarly, due to unique nature of renewable energy industry, different people from diverse society may also visit the sub-project site. *The impact will be moderate in magnitude, site-specific in extent and long term in duration*.

d. Grievances from nearby Local Communities

The grievances such as foul odor, threat of disease, haphazard disposal of digestate are few grievances that could be raised from the community. The mishandling of such grievances could invite social demonstration, opposition and conflict. *The impact will be moderate in magnitude, local in extent and long-term in duration*.

The summary of impact prediction and its evaluation is presented in **Table 21**.

Table 21: Summary of Impact Prediction

Impact	Direct/Indirect Impact	Magnitude	Extent	Duration	Significance
Beneficial Impact					
Construction Stage					
Enterprise Development and Commercialization	Indirect	H (60)	L (20)	MT (10)	90 Very Significant
Employment Opportunities to locals	Direct	H (60)	L (20)	MT (10)	90 Very Significant
Boost in Local Economy	Indirect	H (60)	L (20)	MT (10)	90 Very Significant
Enhancement of Technical Skills of the locals	Indirect	Mo (20)	L (20)	MT (10)	50 Significant

Impact	Direct/Indirect Impact	Magnitude	Extent	Duration	Significance
Operation Stage					
Sustainable waste management	Direct	H (60)	L (20)	LT (20)	100 Very Significant
Reduction in Pollution	Direct	H (60)	L (20)	LT (20)	100 Very Significant
Reduction in Fossil Fuel Usage and GHG Emission	Direct	H (60)	L (20)	LT (20)	100 Very Significant
Employment Opportunities to Locals	Direct	H (60)	L (20)	LT (20)	100 Very Significant
Showcase Renewable Energy Technology	Direct	H (60)	L (20)	LT (20)	100 Very Significant
Cultural Exchange between the locals and visitors	Indirect	Lo (10)	S (10)	LT (20)	40 Insignificant
Adverse Impacts					
Physical Environment					
Construction Phase					
Change in Land Use	Direct	Lo (10)	S (10)	ST (5)	25 Insignificant
Issues related to Air Pollution	Direct	Lo (10)	S (10)	ST (5)	25 Insignificant
Issues related to water pollution	Direct	Lo (10)	L (20)	ST (5)	35 Insignificant
Issues related to Soil Pollution	Direct	Lo (10)	S (10)	ST (5)	25 Insignificant
Issues due to increase in Noise level due to construction	Direct	Lo (10)	S (10)	ST (5)	25 Insignificant
Issues related to spoil disposal and stockpiling of construction materials	Direct	Lo (10)	S (10)	ST (5)	25 Insignificant
Operation Phase					
Issues Related to Management of Raw Materials Storage and Post-digestate Slurry	Direct	Mo (20)	L (20)	LT (20)	60 Significant
Issues Related to Foul Odor during Storage of Raw Material and Post-digestate	Direct	Mo (20)	S (10)	LT (20)	50 Significant

Impact	Direct/Indirect Impact	Magnitude	Extent	Duration	Significance
Issues Related to Extraction of Water for Meeting Demand	Direct	Lo (10)	L (20)	LT (20)	50 Significant
Management of Wastewater from Digested Slurry	Direct	Lo (10)	L (20)	LT (20)	50 Significant
Impact Associated with Collection and Transportation of Waste from Source to Sub-Project Location	Direct	Mo (20)	L (20)	ST (5)	45 Significant
Increase in Noise Level from Plant Operation	Direct	Lo (10)	S (10)	LT (20)	40 Insignificant
Gas Leakage and Associated Impacts including Fire Hazard	Direct	Mo (20)	L (20)	LT (20)	60 Significant
Flood Hazard	Direct	Lo (10)	L (20)	ST (5)	35 Insignificant
Issues with Drainage Management	Direct	Mo (20)	L (20)	LT (20)	60 Significant
Biological Environment					
Construction Phase					
Loss of Vegetation		Lo (10)	S (10)	ST (5)	25 Insignificant
Operation Phase					
Maintenance and Protection of Greenery in the Sub-Project Periphery	Direct	Mo (20)	S (10)	LT (20)	50 Significant
Socio-economic and Cultural Environment					
Construction Phase					
Occupational health and safety of workers	Direct	H (60)	S (10)	ST (5)	75 Very Significant
Pressure on Existing Infrastructure and Community Resources	Direct	Lo (10)	S (10)	ST (5)	25 Insignificant
Health and Sanitation Related Issues	Direct	Mo (20)	L (20)	ST (5)	45 Significant
Labor Influx and Associated Impacts in the Local Community	Direct	Lo (10)	S (10)	ST (5)	25 Insignificant

Impact	Direct/Indirect Impact	Magnitude	Extent	Duration	Significance
Involuntary Land Acquisition and Displacement Issue	Direct	Lo (10)	S (10)	LT (20)	40 Insignificant
Grievances Management	Indirect	Mo (20)	S (10)	LT (20)	50 Significant
Sexual Exploitation Abuse and Sexual Harassment	Indirect	Mo (20)	L (20)	ST (5)	45 Significant
Gender discrimination and child labour	Indirect	Mo (20)	S (10)	ST (5)	35 Insignificant
Stakeholder Engagement and information disclosure	Indirect	H (60)	L (20)	LT (20)	100 Very Significant
Operation Phase					
Issues related to Occupational Health and Safety	Direct	H (60)	S (10)	LT (20)	90 Very Significant
Issues Related with Health and Sanitation in and around the Sub-Project Site	Direct	H (60)	S (10)	LT (20)	90 Very Significant
Inflow of people in the Sub-Project Area	Direct	Mo (20)	S (10)	LT (20)	50 Significant
Grievances from nearby Local Communities	Indirect	Mo (20)	L (20)	LT (20)	60 Significant

Impact Weightage Criteria, National EIA Guidelines (1993)

Magnitude		Extent		Duration	
High (H)	60	Regional (R)	60	Long Term (LT)	20
Moderate (Mo)	20	Local (L)	20	Medium Term (MT)	10
Low (Lo)	10	Site Specific (S)	10	Short Term (ST)	5

Using this system, the maximum score is 140 points and the minimum score is 25

Significance of Impact

Total Score: *< 45: Insignificant 45-74: Significant ≥ 75: Very Significant*

CHAPTER VI: ENVIRONMENTAL AND SOCIAL IMPACT MITIGATION

Chapter VI has identified the impacts associated with the construction and operation phases of proposed sub-project and evaluated the impacts in without mitigation scenario. This section of the report has prescribed the practical and cost-effective mitigation measures to avoid, minimize and compensate the effects of adverse impacts to acceptable level. The sub-project proponent ensures to implement these measures during the construction and operation of the sub-project.

6.1 Mitigation Measures

In order to prevent the likely environmental impacts identified in previous section, **Table 22** presents prescribed environmental mitigation measures and their estimated mitigation costs.

Table 22: Environmental Matrix Showing Impacts, Mitigation Measures and Costs

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
A. Physical Environment					
A.1 During Construction Stage					
A.1.1	• Change in Land use	• Minimum land disturbance will be made while project construction. Greenery will be maintained	During Construction Phase	25,000	Developer
A.1.2	• Emission of dust, smoke, CO_2 and other harmful gases through vehicular movement, excavation and related construction activities	• All vehicles and machineries used in construction work shall be in compliance with emission standard set for vehicles and machineries by MoFE • Regular maintenance of vehicles and machineries • Regular spray of water in the construction site and access road	During Construction Phase	100,000	Developer, Construction Contractor
A.1.3	• Contamination of groundwater through percolation of wash water from construction materials, spillage of lubricants.	• Wastewater from aggregate washing and washout from concretes will be settled in a sedimentation tank before releasing into the receiving water bodies. • Storage of spent oil and greases in containers and its safe disposal • Provision of proper drainage system	During Construction Phase	25,000	Developer and Construction Contractor
A.1.4	• Decrease in soil fertility of nearby agricultural land from spillage of grease and petroleum fuel from generators and construction materials including vehicles • Formation of muddy ditches during rainy season	• Spent lubricants and greases, petroleum will be stored in designated vessels only. • Covering and storage of construction debris in specific place within the construction site	During Construction Phase	Not required	Developer and Construction Contractor
A.1.5	• Increase in noise from operation of machineries,	• Provision of low sound emitting machineries	During Construction Phase	Not required	Developer and Construction Contractor

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
	excavation and vehicular activities.	• Regular maintenance of vehicles and machines • Prohibition of construction activities in night time and early morning			
A.1.6	• Degradation in aesthetic beauty • Percolation of chemical content in wastewater from construction material into agricultural land • Formation of muddy ditches during rainy season	• Stockpiling the materials in designated place within the construction site • Compaction of soil • Covering of stockpiles to avoid washout during rainy season • Provision of necessary drainage • Using construction spoils to fill up low land area, ditches and land development work	During Construction Phase	35,000	Developer and Construction Contractor
A.2 During Operation Stage					
A.2.1	• Contamination of land and water sources • Leaching of raw materials and post-digestate into underground water due to improper storage system. • Alter in water quality parameter	• Avoid direct discharge of slurry and decanted liquid waste into nearby water bodies and agricultural field • Storing the raw materials in enclosed roofed unit with impermeable base • Provision of compost preparation unit with sealing of base for settling solid and liquid slurry and use of slurry to make compost • Provision of proper drainage system	During Post Construction/ Operation Phase	50,000	Developer
A.2.2	• Increase in flies and vector disease due to improper raw material storage system and haphazard disposal of post-digestate.	• Storing of feedstock and post digestate in enclosed designated area • Covering of feedstock and post digestate	During Operation Phase	50,000	Developer

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
		• Regular cleaning around the screw press manure unit and feedstock storage area • Proper drainage system to channelize the leachate to the lagoon.			
A.2.3	• Depletion of Water Table and Groundwater Pollution	• Extraction of groundwater as per groundwater license • Rechargeable pits will be constructed to recharge ground water	During operation phase	Not Required	Developer
A.2.4	• Increase in BOD, turbidity and TS of nearby water body if discharged directly into it • Groundwater Pollution	• Provision of proper drainage system • Prohibition of direct disposal into nearby agricultural field and water body • Waste water will be settled in a sedimentation tank before releasing to prevent groundwater contamination.	During Operation Phase	Not Required	Developer
A.2.5	• Foul smell along the transportation route • Possibility of dropping of waste on road • Vehicular emission	• Proper covering of feedstock while transporting • Proper compaction of feedstock to avoid dropping • Use of vehicles complying Vehicle Mass Emission Standard, 2056	During Operation Phase	20,000	Developer
A.2.6	• Increase in noise due to operation of biogas plant components, biogas generator, etc. • Temporary hearing loss, annoyance among the staffs due to prolonged exposure	• Use of low sound emitting machineries • Provision of shed wherever necessary	During Construction and Operation Phase	Not Required	Developer

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
A.2.7	• Methane gas being highly flammable can cause fire hazard; loss of property and life • Contribution to GHG emission	• Avoid naked flame near the plant • Provision of fire extinguisher and emergency firefighting water storage and fire hose reel, Temperature sensor (Fire Control Balls) • Designation of assembly location for workers in case of occurrence of firing • Regular checking of leakage in plant	During Operation Phase	50,000	Developer
A.2.8	• Management of filtrate (wastewater) separated from slurry	• The filtrate would be reverted to the slurry preparation area to minimize daily fresh water use and avoid discharge of filtrate.	During Operation Phase	Not Required	Developer
A.2.9	• Flood Hazard	• Conduct regular monitoring of the river's water level, particularly during the rainy season, to detect any significant changes early. • Educate the local community about flood risks and the measures they can take to protect themselves and their property. • Collaborate with local authorities and disaster management agencies to align flood risk mitigation strategies and response efforts.	During Operation Phase	Not Required	Developer
A.2.10	• Drainage Management	• Ensure that the drainage system is capable of handling heavy rainfall during the monsoon season to prevent waterlogging and percolation into the groundwater. • Conduct regular maintenance and inspection of the drainage system to	During Operation Phase	Not Required	Developer

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
		ensure its proper functioning and address any blockages or damages promptly. • Ensure that all drainage and wastewater management practices comply with local environmental regulations and standards.			
B. Biological Environment					
B.1 During Construction Stage					
B.1.1	Felling trees is not required for project development.	• Nevertheless, plantation shall be done after the construction activities to maintain the greenery and healthy ecosystem.	Both construction and operation phase	25,000	Developer
B.2 During Operation Stage					
B.2.1	• Maintenance and protection of greenery in the project periphery	• Haphazard disposal of waste to the vegetated land by the workers should be avoided • A strict rule for workforce to not degrade nearby area • Maintenance of garden in the project area	During Operation Phase	Not Required	Developer
C. Socio-economic and Cultural Environment					
C.1 During Construction Stage					
C.1.1	Occupational Health and Safety • Exposure to fugitive emission, noise and risk of physical injuries • Transmission of infectious diseases	• Provision of Personnel Protective Equipments (PPEs) like helmets, masks, safety jacket, gloves and boots, safety harness to construction workers and they will be educated in using the PEEs • Provision of first aid kits in the subproject premises • The workers, engineers and supervisors working at the active construction sites will be provided	During Construction Phase	200,000	Construction Contractor

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
		with air masks, helmets, safety goggles, earplugs, gloves and boots. The contractors will be made responsible to provide the PPE contractually. • The only authorized personnel will be allowed • Provision of fire-fighting gears and training to the involved workers on fire fighting. • Provision of immediate rescue, primary treatment in the site as well as provision of air ambulance and immediate treatment in case of an accident in the construction site • Provision of proper record of labor, well maintained registration sheet with personal details as well as emergency contact details (native and migrant worker) • Safety Signage shall be placed in construction site • Construction workers will be trained in job hazards, emergency procedures and in any other relevant safety measures. • Orientation to workers and staff possible spread of communicable disease • Provision of reporting mechanism if any incidents occurs • The feedstock storage chamber and by-product slurry chamber will be double fenced to protect workers from the fell down and accident.			

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
C.1.2	Community Health and safety • Possibilities of accident in community which transporting the construction materials to the subproject site • Community children getting into accidents	• Transport management plan will be implanted. • Construction materials will be transported to day time • The subproject site will be barricaded to avoid the trespass of unauthorized person in subproject site • Proper fencing of the each unit is required to prevent from direct entry into the particular unit. • Rehabilitation of existing infrastructures like road, if affected by subproject related activities • Emergency Preparedness Plan, Occupational Health and Safety Plan, Community Health and Safety Plan (a trained staff will be appointed by proponent to prepare these plans) • Sprinkle the water on the road that passes through community to control the dust while transporting material to the subproject site. • Provision of reporting mechanism if any incidents occurs	During Construction Phase (Plans will be prepared prior to construction phase)	200,000	Construction Contractor
C.1.3	Issues related Grievance Redress Mechanism • Grievances related with improper management of construction materials, aesthetic degradation, conflicts.	• Grievance redress Committee (GRC) at subproject level will be established • Management of record keeping system of the grievance received at field level	During Construction and Operation Phase (Plans will be prepared prior to	Not Required	Developer

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
		• Appoint ESS focal person for handling grievances under Grievance Redress Mechanism • Suggestion box will be place at the entrance of subproject premises to receive the suggestions and complaints from community people. Instruct construction company to proceed construction work in compliance to ESIA report • Conduct periodic meaningful consultation with locals and concerned stakeholders regarding the various scope of the project and organize awareness raising program throughout the project cycle.	construction phase)		
C.1.4	Impact associated with gender and SEA/SH • Contractors, project employee and the workforce could discriminate against women and vulnerable groups • The contractor could pay differently to the male and female worker for the same work • The exploitation of children in the construction work.	• Code of Conduct (CoC) including SEA/SH for subproject staff will be implemented • Orientation of SEA/SH and gender based violence to the staff and workers of sub-projects • The use of child labour in subproject construction will be strongly prohibited (Record keeping of labour with identity card showing age will be maintained) • Both women and men and people of excluded groups will be given equal opportunity for employment and no gender discrimination will be done in terms of wages for the same or similar works.	During Construction Phase	Not Required	Developer and Construction Contractor
C.2 During Operation stage					

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
C.2.1	Occupation Health and Safety • Physical injury to staffs • Prone to catch disease from organic waste handling	• Workers shall be provided with PPEs like helmet, safety boots, safety jacket, gloves and masks and they will be educated in using the PPEs • Provision of First aid kit • Staffs shall undergo a regular medical checkup • Proper orientation and training should be provided to the staff on safety so that accidents and disease can be avoided • Provision of necessary safety cautions, signposts and instructions at –project site as well as near moving machineries • Preparation of Emergency Preparedness Plan, Occupational Health and Safety Plan, Community Health and Safety Plan Provision of proper record of labor, well maintained registration sheet with personal details as well as emergency contact details (native and migrant worker) • Conduct periodic meaningful consultation with the local communities and implementation of stakeholder engagement activities throughout the project lifecycle. • The feedstock storage chamber and by-product slurry chamber will be double fenced to protect workers from the fell down and accident.	During sub-project planning and Operation Phase	300,000	Developer

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
C.2.2	Community Health and Safety • Spread of vector borne disease around the community and staffs due to improper management of organic waste • Opposition from the community against the project • Increase in quarrel and debates among workforce and community	• Management of Oder and waste of subproject so that it will not affect the community • Keeping the unit areas clean with disinfectants • Avoid haphazard disposal of digestate • Awareness and training to staffs regarding sanitation and operation of plant • Transportation of feedstocks will be done with covering to prevent spill on the roads • Formulation of code of conduct and dos and don'ts for staffs • Ensure the implementation of respective rules and regulation by staffs • Aware/motivate workers to respect nearby community and their respective cultures. • Provision of periodic consultation with the nearest community and concerned stakeholders	During Operation Phase	20,000	Developer
C.2.3	GRM • Grievances with aesthetics, odor, noise, haphazard disposal of digestate from local residents resulting opposition and conflict	• Implement mitigation measures to avoid potential impacts mentioned in B.1, B.2 and B.3 • Establish Grievance Redress Mechanism (GRM) and manage a trained staff to ensure smooth operation of the mechanism • Appoint ESS focal person and ensure the grievance handling	During Operation Phase	Not Required	Developer and AEPC/MGEAP

S.N.	Environmental Impacts	Mitigation Measures	Time of action	Mitigation Cost (Rs.)	Roles and Responsibility
		through Grievance Redress Committee • Arrangement of handling received grievances and proceeds immediate action through the GRM Periodic meeting with the locals and based on the meeting organize related programs to the nearby settlement regarding the project • Employment opportunities to the locals			

CHAPTER VII: STAKEHOLDER CONSULTATION, COMMUNITY PARTICIPATION AND DISCLOSURE

A public consultation meeting was held within sub-project area in presence of nearby residents on 2081 Asar 08 (June 22, 2024). The probable impacts and their mitigation measures were delivered by the expert team. In addition, the study team in presence of the proponent requested to lodge their issues regarding commencement of this sub-project. Similarly, periodic consultation meeting with the local community, local representative will be planned and execute. During meeting, the issues raised by the public during the consultation meeting were noted, collected and incorporated in the report.

The major concerns and issues raised during public consultation were:

- The locals should be given preference of employment, during the construction and operation phase, according to their skills and abilities.
- Regarding the environmental impacts of the proposed sub-project; the settlement does not lie near the sub-project so there is less environmental impacts and the biogas plant industry should be responsible to minimize the adverse environmental impacts.
- The compost produced from the sub-project should be provided with priority to the locals.
- Suggestion for implementing the sub-project as the sub-project does not have any environmental issues instead the sub-project will manage the other wastes and also generate employment opportunities to locals.

The issues raised during public consultations are adequately addressed in mitigation measures proposed in this report. Similarly, community consultation plan is proposed for this particular sub-project in Annex 1. The mitigation plan strictly mentioned that solid and semi-solid wastes shall not be discharged into public places and surrounding agricultural land. Employment opportunity has to be provided to locals, especially women and vulnerable groups if any, according to their qualifications, competencies and willingness. The construction work has been suggested to be done prior to rainy season which will help several constructions related impacts and reduces costs too. It is also prescribed to appoint a grievance handling officer and establish grievance redress committee to lodge grievances of locals against the sub-project construction and operation approaches and any impacts thereby. Such grievances will be transmitted to grievance redress committee at first then transferred to proponent or project management unit, if not resolved.

CHAPTER VIII: ALTERNATIVE ANALYSIS

In order to ensure the project as an environmentally sound project, alternative analysis was carried out to choose better alternative from the environmental perspective and without compromising the process flow or production. The aim of alternative analysis is to arrive at a development option, which maximizes the benefits while minimizing the unwanted impacts. While exercising the alternative analysis, the following aspects were taken into account.

8.1 Alternative Technology and Design

There are several anaerobic digestion technologies to generate biogas from anaerobic digestion. Modified GGC is the native anaerobic digestion technology promoted in Nepal. While, in this project, high efficient CSTR technology with heating is adopted for higher energy yield. While considering biogas purification, there are several types of PSAs which operates in different pressure range. In this project, medium PSA operated in 0.7 bar pressure is adopted which is very energy efficient in comparison to high PSA system. The end-use has been proposed for thermal application supplied from compressed biogas (CBG). While considering the slurry management, there are different types of solid liquid separators that separates solid from the liquid. In this project screw press is adopted which is highly efficient comparing to other solid liquid separation decanters. The separated solid manure will be dried in fertilizer yard to achieve desired TS of 70%, which is a good quality organic fertilizer. The separated liquid from the solid is further treated in the lagoon pond which is designed for four week of storage and then re-circulated in the digester.

8.2 Alternative Schedule, Process, Raw materials and Resources

The sub-project has been proposed to be constructed within the timeframe of six months. The excavation activities will be accomplished in the dry season in order to reduce the erosion and sedimentation of spoils into nearby farm land and stream. The sub-project machineries will be imported from India whereas the construction materials will be sourced from Nepalese market by competitive bidding process. All the raw materials, sourced from the internal market as far as possible, will be chosen prudently in order to assure quality as well as economic viability.

8.3 No Project Option

This alternative does not allow the implementation of the proposal. This sub-project will be managing about 60 tons of waste daily by converting into **979 kg** compressed natural gas and **9.4 MT** fertilizer. There cannot be another best option to manage solid waste. Rather it is very advantageous as there will be the availability of gas and fertilizer and due to its insignificant environmental impacts; the no project option was rejected.

CHAPTER IX: ENVIRONMENTAL AND SOCIAL IMPACT MONITORING

9.1 Project Management Responsibility

The implementation of mitigation measures responsibility is entrusted to the sub-project proponent. Because of small nature of the sub-project, the monitoring of environmental parameters in the construction and operation period should also be done by the proponent.

9.1.1 Environmental Standards

The Government of Nepal has endorsed several environmental standards, including the National Ambient Air Quality Standards (NAAQS) of Nepal, which must be followed by all projects. These environmental standards shall be treated as binding regulations, similar to other acts and regulations, until the Government of Nepal enforces specific standards in the sector for project environmental compliance purposes.

Considering this, the environmental standards are proposed for proposed sub-project construction and operation for compliance which is attached in ***Annex 4***.

9.1.2 Environmental Monitoring Plan

The environmental monitoring plan designed for the sub-project has three main objectives:

- To ensure that the sub-project baseline conditions were adequately documented such that a comparative assessment of the sub-project baseline before and after the sub-project could be made objectively for impact evaluation.
- To ensure that the mitigation commitments to minimize the predicted adverse impacts and maximize the beneficial impacts including the environmental enhancement programs are sincerely complied and implemented by the sub-project proponent.
- To verify that the sub-project impacts are within limits of the impact prediction or some foreseen impacts also occurred during sub-project development and what measures are taken to minimize the unforeseen impacts.

As baseline environment of the proposal development area is clearly known and also documented in this report, the proponent themselves shall carry out compliance and impact monitoring of the sub-project construction and operation period. The monitoring management plan for compliance and impact is presented in **Table 23** below.

Table 23: Compliance Monitoring, Construction and Operation Phase

S.N	Provisions of compliance	Individuals responsible	Methods	Frequency /Time	Monitoring authority	Place	Financial commitment (NRs.)
Construction Phase							
1	• Vehicular emission in compliance with standard set for vehicles and machineries by MoFE • Regular maintenance of vehicles and machineries • Regular spray of water in construction site	Developer & AEPC/MGEAP	Site Observation/ records	During construction period	Proponent	Project Site	50,000
2	• Provision of drainage system and sedimentation tank • Storing of spent oil and greases in containers and designated place	Developer & AEPC/MGEAP	Site Observation/ records	During construction period	Proponent	Project Site	100,000
3	• Provision of low sound emitting machineries • Regular maintenance of vehicles and machines • Prohibition of construction activities in night time and early morning	Developer & AEPC/MGEAP	Site Observation/ records	During construction period	Proponent	Project Site and nearby community	40,000
4	• Stockpiling of construction materials in designated place within construction site • Provision of drainage to avoid muddy surface during rainy season • Covering of stockpiles to avoid washout during rainy season • Using of construction spoils to fill up low land area and ditches • Compaction of spoil	Developer & AEPC/MGEAP	Site Observation/ records	During construction period	Proponent	Project Site	40,000

S.N	Provisions of compliance	Individuals responsible	Methods	Frequency /Time	Monitoring authority	Place	Financial commitment (NRs.)
5	• Provision of personnel protective equipment (PPE) • Provision of necessary safety cautions, signposts and instructions at construction site as well as near moving machineries • Provision of labor registration log with their personal details as well as emergency contact details	Developer & AEPC/MGEAP	Site Observation/ consultation	During construction period	Proponent	Project Site	50,000
6	• Awareness and orientation to construction workers • Provision of barricade	Developer & AEPC/MGEAP	Site Observation/ records	During construction period	Proponent	Project Site	30,000 annually
7	• Establishment of GRC • Appointing ESS focal person for handling grievances and communicate with community • Record book for registration of grievances at subproject level • Instructing construction company to proceed construction work in compliance to ESIA report • Placement of suggestion boxes • Periodic consultation with relevant stakeholders and information disclosure	Developer & AEPC/MGEAP	Site Observation/Records	During Construction Period	Proponent	Project Site	30,000 annually
Operation Phase							
1	• Avoiding direct discharge of slurry and decanted liquid to nearby water bodies	Developer & AEPC/MGEAP	Site Observation	Before Operation Phase	Proponent	Project Site	40,000

S.N	Provisions of compliance	Individuals responsible	Methods	Frequency /Time	Monitoring authority	Place	Financial commitment (NRs.)
	• Storage of raw materials in roofed unit with impermeable base • Provision of compost preparation unit with proper seal of base						
2	• Storing of feedstock and post digestate in designated area • Covering of feedstock and post digestate • Regular cleaning around the screw press manure unit and feedstock storage area	Developer & AEPC/MGEAP	Observations	Once a year during Operation Phase	Proponent	Project Site	40,000 annually
3	• Proper covering of feedstock while transporting • Proper compaction of feedstock to avoid dropping • Vehicular emission in compliance with emission standards • Sprinkle the road to avoid dust during the transportation.	Developer & AEPC/MGEAP	Photographs/ Records	Twice a year during Operation Phase	Proponent	Project Site	50,000 annually
4	• Avoidance of naked flame near plant • Provision of fire extinguisher (5 nos.) • Provision of Fire hose reel, fire control ball and PPE • Scheduled maintenance and testing of gas leakage in plant	Developer & AEPC/MGEAP	Observation/ Discussion/ Record	Before Operation Phase	Proponent	Project Site	50,000 annually

S.N	Provisions of compliance	Individuals responsible	Methods	Frequency /Time	Monitoring authority	Place	Financial commitment (NRs.)
5	• Provision of personal protective equipment to workers • Provision of first aid kit • Regular check-up of staffs • Proper orientation and training to staffs about operating plant and waste handling	Developer & AEPC/MGEAP	Observation	During construction Phase	Proponent	Project Site	100,000 annually
6	• Cleaning the plant area regularly • Avoidance of haphazard disposal of digestate • Awareness and training to staffs regarding sanitation and operation plant	Developer & AEPC/MGEAP	Observation/ Discussion/ Record	During Operation Phase	Proponent	Project Site	60,000 annually
7	• Implementation of mitigation measures to avoid potential impacts mentioned in A.2, B.2 & C.2 in Chapter VI • Implement Grievance Redress Mechanism • Arrangement of handling grievances from community	Developer & AEPC/MGEAP	Observation/Record	During operation phase	Proponent	Project site	40,000 annually

Table 24: Impact Monitoring, Construction and Operation Phase

S.N	Monitoring Indicator	Individuals responsible	Methods	Frequency /Time	Monitoring authority	Place	Financial commitment (NRs.)
Construction Phase							
1	Effect on productivity of nearby farmland due to construction waste and percolated water	Developer & AEPC/MGEAP	Discussion with local people, visual observation	Twice during construction period	Proponent	Nearby farmland	-

S.N	Monitoring Indicator	Individuals responsible	Methods	Frequency /Time	Monitoring authority	Place	Financial commitment (NRs.)
2	Increased Noise level	Developer & AEPC/MGEAP	Discussion with local people, noise level meter	Once during peak construction work	Proponent	Nearby settlement	60,000.00 annually
3	Water quality of bore well as well as nearby water bodies	Developer & AEPC/MGEAP	Water quality test in the laboratory	During construction period	Proponent	Bore well, Nearby River	20,000 annually
Operation Phase							
1	Aesthetic degradation due to haphazard disposal of organic slurry in nearby water bodies and area	Developer & AEPC/MGEAP	Discussion with local people	Once in a year	Proponent	Nearby settlement/farm land	-
2	Occupational Health and Safety of the staffs/workers	Developer & AEPC/MGEAP	Clinical checkup/ Records/interview with staffs/workers	Half yearly	Proponent	Project Site	-
3	Number of grievances received from community	Developer & AEPC/MGEAP	Registered file/complains	Quarterly	Proponent	Nearby community	-
4	Water Quality of Bore well as well as nearby water bodies (to compare with the baseline assessment)	Developer & AEPC/MGEAP	Water quality tests of source of water supply (bore well water and nearby river	Thrice a year (dry, wet and lean months)	Proponent	Bore well, Nearby River	20,000 annually
5	Increased noise level	Developer & AEPC/MGEAP	Discussion with local people, noise level meter	Half yearly	Proponent	Project site/ Nearby Community	60,000 annually
6	Methane Leakage	Developer & AEPC/MGEAP	Gas Analyzer	Half yearly	Proponent	Project Site	30,000 annually

Table 25: Summary of Environmental Monitoring Cost

Item	Quantity	Rate per month	Rate per year (NRs.)	Total (NRs.)
Construction Phase				
Water Quality Monitoring	-	-	20,000 (Once)	20,000
Noise Monitoring	-	-	60,000	60,000
Operation Phase				
Water Quality Monitoring	-	-	20,000 (annual)	20,000
Noise Monitoring	-	-	60,000 (annual)	60,000
Methane Leakage	-	-	30,000 (annual)	30,000
Human Resource				
Environment Expert	1	60,000	120,000 (Two month input each year)	120,000
Social officer	1	(already in human resource cost)	-	-
Total				**310,000**

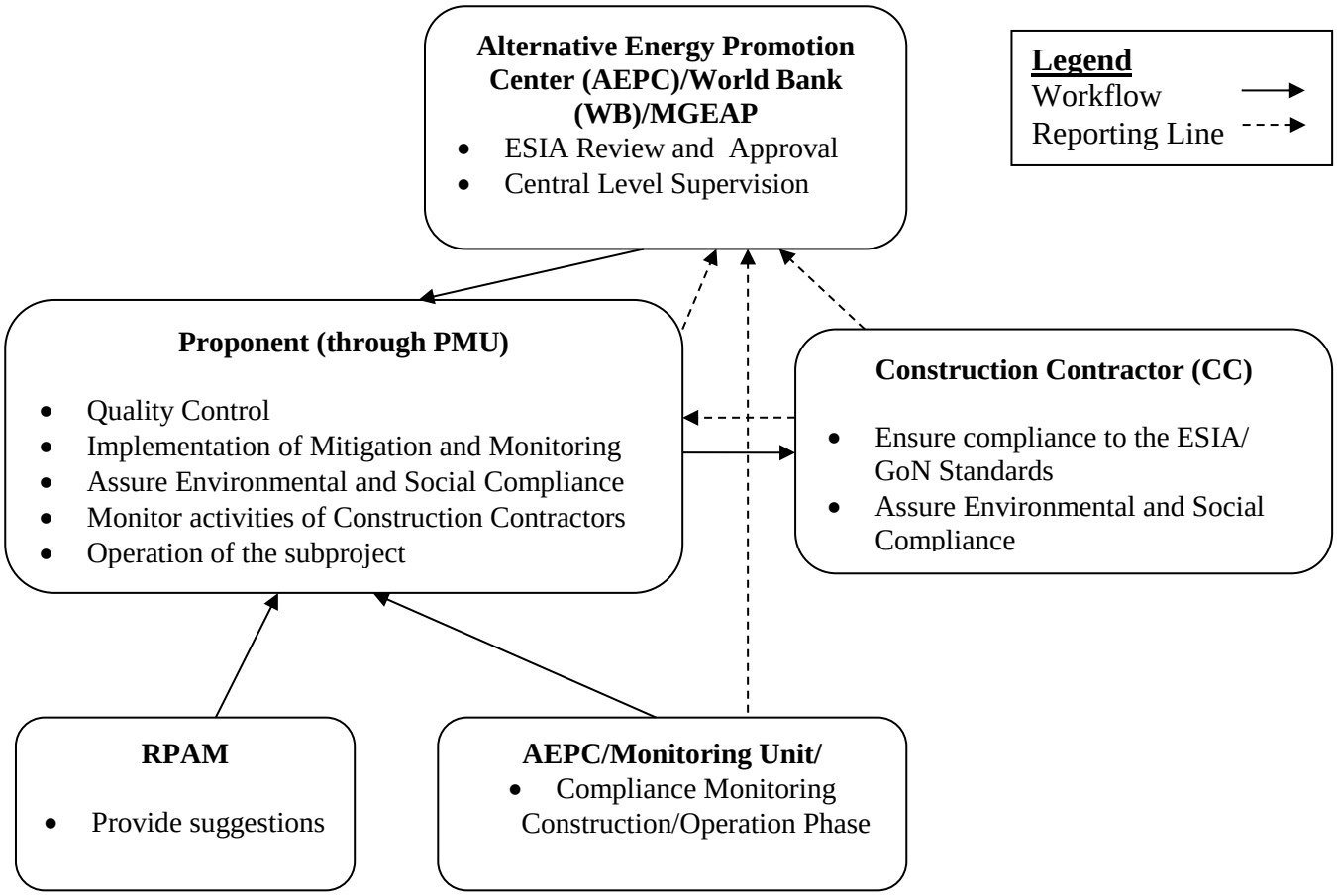
CHAPTER X: INSTITUTIONAL ARRANGEMENT AND GRIEVANCE REDRESS MECHANISM

10.1 Project Environmental Management Plan Structure and Stakeholders Responsibility

The Project Environmental Management Framework of the proposed sub-project is prepared to show linkages with different parties to be involved directly or indirectly during the different phases of project development and operation in compliance with existing Act and Rules.

Overall project environmental and social management is the responsibility of Proponent of the proposed sub-project. Key stakeholders to be involved for project environmental and social management in the hierarchy order are:

- Alternative Energy Promotion Center (AEPC)/ World Bank (WB)/ MGEAP
- Monitoring Unit of AEPC
- Proponent (through Project Management Unit- PMU)
- Construction Contractor (CC)
- Representative from Sub-Project Affected Municipality (SPAMR)

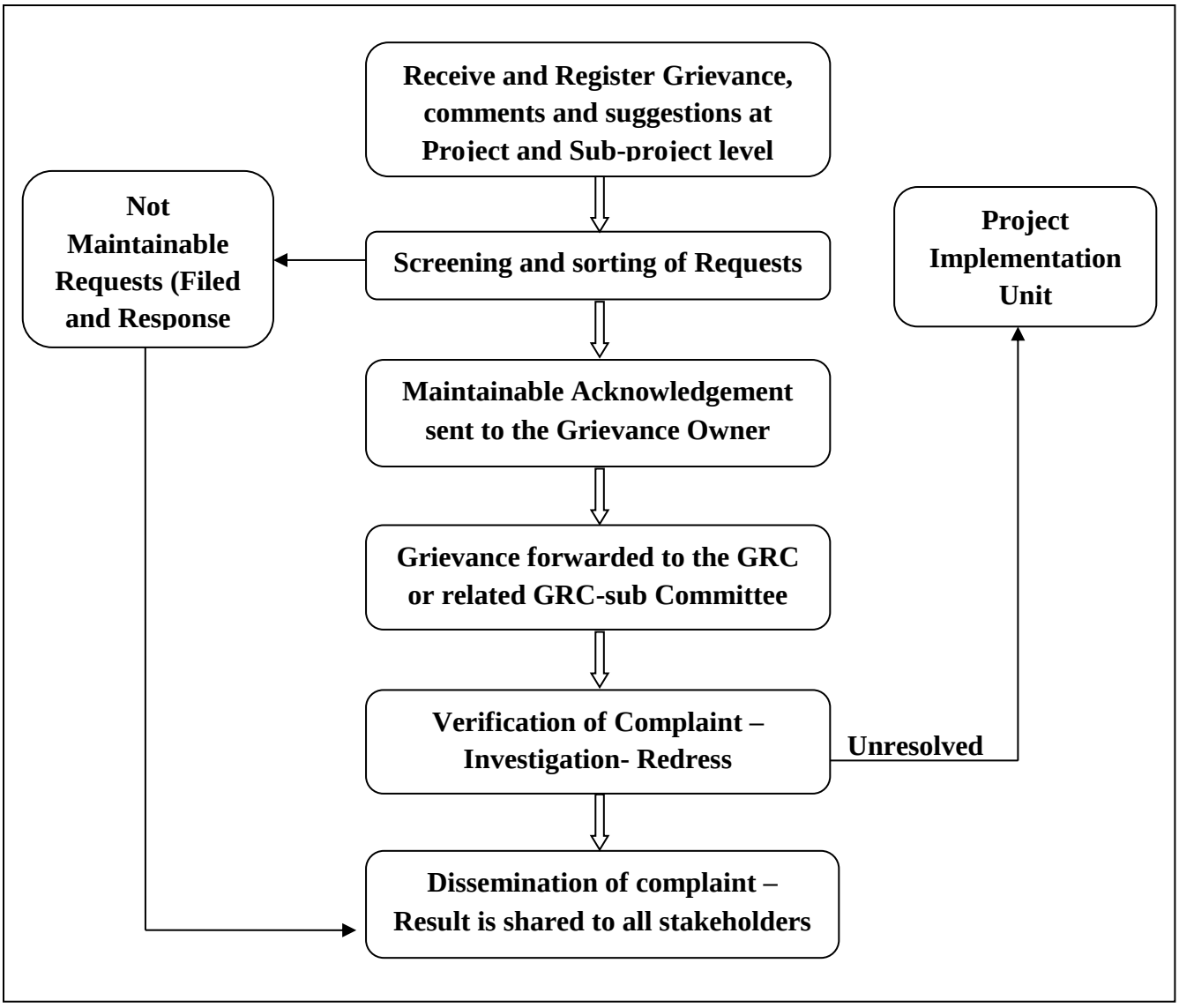


10.2 Grievance Redress Mechanism

Grievance addressing and feedback is important so as to know what negative impact has been occurred in the community due to implementation of the sub-project. Such grievances should be taken care in order to avoid conflicts in the society regarding the sub-project. Grievance redress not only prevents conflicts but will also help developer to take necessary steps to further improve the plant operation and management system.

Grievance Redress Mechanism Process

The figure below describes the process that will be used to resolve any grievances related to this sub-project:



The grievances from the community and nearby inhabitants such as haphazard disposal of organic waste, construction waste, noise pollution, foul odor from the feedstock, increase in flies and vector disease, pollution in nearby water bodies can be received at any stage of the sub-project construction or implementation. Such grievances shall be managed by strictly following the mitigation measures prescribed in this report. In case, if any grievances arise, those complaints will be assessed by the current Grievance Redress Committee (GRC). The management teams of GRC are listed below:

Current Provision of GRC (as in Social Management Framework)

A. Central/AEPC Level Grievance Redress Committee (GRC)

1. BSC Manager of AEPC – Chair**p**erson
2. Representatives of the developers from different categories of waste –Member (1)
3. Representatives of CSO working in the field of waste management - Member (1)
4. Environmental Safeguard Expert at AEPC - Member (1)
5. Social Safeguard Expert at AEPC – Member Secretary

B. Sub-project Level Grievance Redress Committee (GRC)

1. Chairperson/Representative of the ward office or Chairperson/Managing Director of Developer – Chairperson
2. Representative from Sub-Project Affected people – Member (2)
3. Representative from local NGO/CBO – Members (1)
4. Sexual Exploitation Abuse and Sexual Harassment (SEA/SH) Focal person – Female member (1)
5. ESMF focal person of the perspective developer/Project manager – Member Secretary

Note: To be ensured that at least one member of the GRC should be female/vulnerable group (Representatives of developers/CSOs/PAP).

The central monitoring may be done by AEPC during the operation phase at any time of the sub-project cycle.

The grievance redress mechanism will be assessed as described below:

- ESMF focal person of the developer/ Project Manager/ Site In-charge will be appointed as the focal person (Member secretary of the project level GRC) to receive/ handle any kind of grievance related to the project. His/ her name and contact number will be displayed at the entrance of the sub-project site, so that affected people can have direct access to him/her.
- SEA/SH Focal Person will be representative from developers/CSOs/PAP of GRC formed at subproject level and she will be responsible to record and handle any kind of grievances related SEA/SH.
- A register will be maintained including the name of grievant, date and time of grievance recorded, issue raised and time frame to redress the received grievance. (Format presented in ***Annex 5***).The register will provide information on how the grievance was solved.

- A suggestion box will be placed at the entrance of the sub-project site as well as around the project premises to collect grievances from the employees.
- Grievances can be registered via http://www.aepc.gov.np/gform/gform.php
- If the project level GRC is not able to redress the grievance, it will be forwarded to the national level GRC
- Grievances received have to be resolved within 3 weeks from the day of complaint filed.
- Affected persons have the option of accessing the court of law in case of dissatisfaction with the decision of GRC.

10.3 Capacity Development and Enhancement Measure

During the construction period, the job priorities will be given to local people with equal opportunities to women and disadvantage groups as well. The skill development training such as unskilled construction works, scaffolding, casting, etc. will be given to the workers so that they are able to use the learned skills in other similar projects and earn their living. The project will require 12 human resources during operation phase. The priority shall be given to locals for skilled job, if they have required skill and qualification.

Enhancement Measure: There are not any household in the direct impact zone the proposed sub-project. The following enhancement measures have been proposed to ensure that the sub-project fully respects the dignity, human rights, economics, values and cultures of vulnerable groups working in the sub-project site, especially women and the IPs.

- Prior to the construction of the sub-project, the human resource involved in construction work will be informed about construction and consulted to address all the sensitive issues.
- Skill development training such as driving, mechanics, plumbing, electrician, etc. and/ or income generation training such as poultry farming, piggery will be offered.
- Priority will be given to the locals especially women and vulnerable groups for job opportunities.
- The produced compost fertilizers will be provided with subsidized rate for sub-project affected areas.

CHAPTER XI: PROJECT ENVIRONMENTAL HEALTH AND SAFETY PLAN

11.1Occupational Health and Safety Plan

Occupational health and safety plan is a plan of action designed to prevent accidents and occupational diseases. The workers and staffs are prone to getting caught in accidents, injuries and diseases during the construction and operation phase of the sub-project. So, it is the responsibility of the company/ organization to provide safe working environment to workers and staffs. The following safety measures should be provided by the company to its employees.

- Provision of safety equipment such as gloves, masks, boots during construction and operation phase
- Provision of safety aid kit
- Awareness about potential health impacts while handling organic matters to staff
- Orienting staffs to follow proper safety measures during construction and operation phase
- Regular check-up of staffs during operation phase
- Proper maintenance of labor registration for both native and migrant worker along with their detail (name, nationality, contact number, emergency contact detail, etc.) and timely update

To provide a safe working environment to in-house staffs, visitors and the surrounding settlements, it is very necessary to be fully aware of the safety requirements to avoid accidents from the implementation of biogas plant. These provisions are prepared based on mitigation measures suggested against probable impacts. This plan will be prepared before construction and will be implemented during construction and operation phase by developer. The following issues are identified and brief safety plans are provided as follows:

a. General House Keeping

- Workers should be given orientation about the safety/ emergency preparedness plan during construction and operation phase
- The security should inform the concerned staff when visitors arrive. The designated staff should guide the visitor.
- Every person who enters the biogas plant premises should display a valid identification card.
- The sub-project area should be regularly cleaned and ensured that all floors are free from oil spillage and other harmful substances that are flammable.
- No pipe line, power cable shall run across the path ways causing a tripping hazard.

b. Fire Hazard

- Provision of alarm to notify the fire disaster.
- Provision of biogas flaring system for evacuating excess biogas production through combustion.
- Provision of fire extinguisher, fire hydrant, fire control ball and first aid kit.
- Provision of PPE
- Update contact number of fire brigade and ambulance for accidental cases.

c. Vandalism

- Appointing a day and night security guard.
- Provision of physical and technological barriers such as fences, gates, ID card access.
- Ensure lighting of the premises during night time.

d. Leakage detection

- Regular monitoring of leakage detection.
- Provide training to technical staff for handling and resolving gas leakage.

e. Infectious Disease Outbreak

- Effective Vector Control Measures such as regular cleaning in the sub-project area.
- Using gloves, masks and other safety equipment while handling organic materials and feedstock.
- Food and water safety measures to follow within the sub-project premises.
- In case of an outbreak, immediately report to the nearest health authority.

11.2 Emergency Preparedness Plan

The Emergency Preparedness Plan is prepared in order to take immediate action to minimize the loss. The following section gives protective measures to follow incase hazardous events occur in the project site.

a. During Catastrophe

a. Provision of sensor/ alarm to notify the disaster.
b. Awareness and training program with the workers during construction and operation stage on regular basis to discuss about the possible disaster and its evacuation plan.
c. Allocating Emergency exit.
d. Designation of emergency assembly area for evacuation.

b. Malfunction of the System

a. Regular maintenance of the equipment.
b. Proper segregation of waste before feeding to inlet.
c. Employing skilled technicians to operate the plant.
d. Regular orientation, instruction and guidance to staffs about plant operation.

c. Leakage and Burst

a. Provision of fire alarm, extinguishers and sprinklers.
b. Project insurance to cover the cost of loss from the event.
c. Proper orientation and training to staff to operate the plant.
d. Preparation of emergency exit map and orienting the staffs about it.

11.3 Gender Action Plan

Gender Action Plan will work on gender equality and empowerment of girls and women during the construction and operation of the sub-project. It will make sure that women enjoy the same right, resources, opportunities and protections as men during the implementation of the project. To have equal implementation of gender right, following measures should be taken in account:

- Women will be given priority for job opportunity
- Ensure female workers' security at work place
- Provide equal wage to female workers as male workers
- Special effort will be made to involve women during sub-project cycle

11.4 Substrate Handling and Slurry Management Plan

The management of substrate storage and post-digestate is a very necessary task as it will create nuisance in the sub-project area and around the vicinity. It could cause groundwater pollution, increase in flies, risks health of workers, etc. if not properly managed. The following steps should be taken by the developer to have well-managed environment in and around the sub-project area.

- Regular cleaning of the facility will be done to prevent flies and safety of workers.
- The solid slurry separated from manure will be dried and sold in the market
- The liquid will be reused as dilution water in the digester. Remaining liquid slurry will be sold as manure.

11.5 Labor Management Plan

Labor Management Plan describes the requirements for the proposed subproject with regards to labor and working conditions during construction. It aims to ensure the management and control of activities

that may pose labour-related risks. Following measures shall be taken by developers to manage labor during construction.

- Promote fair and equitable labor practices for the fair treatment, non-discrimination and equal opportunity of workers
- Make sure that there is no child labor during construction and operation phases
- Establish, manage and promote a healthy management-worker relationship
- Protect workers' rights including migrant and third-party workers
- Promote healthy, safe, secure and comfortable accommodation that does not impact negatively on the communities in the surrounding area

11.6 Traffic Management Plan

The purpose of this Traffic Management Plan (TMP) is to ensure the safe and efficient movement of vehicles, equipment, and personnel in and around the biogas plant. This plan aims to minimize traffic-related hazards and disruptions while optimizing the operational efficiency of the plant. Following measures shall be taken by developers to manage the traffic.

a) Signage and Markings

- Install clear, visible signs for speed limits, directional guidance, pedestrian crossings, and safety zones.
- Use high-visibility paint for road markings, especially in pedestrian areas and crossings.

b) Speed Limits

- Enforce a maximum speed limit of 20 km/h within the plant premises to ensure safety.

c) Pedestrian Safety

- Designate pedestrian pathways and crossings with appropriate signage and markings.
- Ensure adequate lighting in pedestrian areas, especially during evening and night operations.

d) Vehicle Safety

- Conduct regular vehicle safety checks for all incoming and outgoing vehicles.
- Ensure all vehicles adhere to plant safety rules, including the use of seat belts and compliance with speed limits.

CHAPTER XII: CONCLUSION

Emerald Energy Pvt. Ltd. has proposed to establish a large scale biogas plant of 60 TPD capacity based on single stage continuous digestion with heating and stirring facility producing 2400 m^3/day of raw biogas, the raw biogas is further purified to produce approximately 979 kg of Bio-CNG. The plant will utilize 30 ton of cow dung and 30 ton of press mud. The biogas produced from the plant will be distributed to nearby industries whereas compost will be sold to farmers and in markets. The development of project will reduce the dependency on using fossil fuels as means of thermal energy in the community as well as promote the use of renewable energy encouraging other investors to take the initiatives in similar projects.

Regarding environmental implications, different types of wastes and pollutants are assumed to be produced during the construction and operation phase of the sub-project, most of the identified impacts can be mitigated by adopting prescribed mitigation measures in this report. This ESIA has envisaged the impacts during the implementation of this proposal and also suggested mitigation measures to minimize or reduce the impacts. The sub-project proponent should strictly follow the mitigation measures as prescribed out in this report.

The overall environmental and social impact from the sub-project is considered of lower magnitude. However, this ESIA recommends pragmatic mitigation measures and also formulated the monitoring plan. Hence, it is recommended implementation of large biogas plant. Any impacts, not foreseen in this ESIA study, if perceived during construction as well as operation phase, shall also be mitigated with appropriate mitigation measures.

ANNEXES

Annex 1: Public Consultation

आज मिति २७७ २०८१/०३/०८ गते लुम्बिनी प्रदेश, पर्वासी जिल्ला, प्रतापपुर गाउँपालिका, वडा नं. ३ मा दैनिक २४०० क्युबिक मिटर बायोग्यास र ६.४ मेट्रिक टन प्राङ्गारिक मल उत्पादन गर्ने गरी ईमरल्ड इनर्जी प्रा.लि. द्वारा सञ्चालन गर्न लागिएको ईमरल्ड ईनर्जी उद्योग निर्माण तथा संचालन गर्दा हुन सक्ने भौतिक, जैविक, सामाजिक, सांस्कृतिक तथा आर्थिक वातावरणमा पर्न सक्ने प्रभाव बारे स्थानीयको राय सुझाव संकलन गर्न आरिएको सामुदायिक छलफल कार्यक्रममा ईमरल्ड ईनर्जी प्रा.लि. का प्रबन्ध निर्देशक श्री बिनित कर्सोचनको अध्यक्षतामा बैठक बसी तपसिल बमोजिमको उपस्थितिमा निम्न अनुसारका सुझावहरु आयि छलफल गरि निर्णय गरियो।

उपस्थिती

१. किशोर चमार	अ.पु. वडा सदस्य	किशोर
२. सन्नु चमार	स्थानीय, प्रतापपुर-१	सन्नु
३. जोधारी चमार	स्थानीय, प्रतापपुर-३	जोधारी
४. प्रवीण चमार	स्थानीय, प्रतापपुर-३	प्रवीण
५. जनार्धन माधव	प्रतापपुर-३	जनार्धन
६. राधेश्याम माधव	प्रतापपुर - ३	राधेश्याम
७. धिरेन्द्र प्रसाद चमार	प्रतापपुर - १	धिरेन्द्र
८. बुधदु बघाई	प्रतापपुर -३	बुधदु
९. हिरामन चमार	प्रतापपुर -३	हिरामन
१०. रामराज बघाई	प्रतापपुर -३	रामराज
११. रामशोभन पासी	प्रतापपुर -३	रामशोभन
१२. रामशरण माधव	प्रतापपुर -३	रामशरण
१३. निवास माधव	प्रतापपुर -३	निवास
१४. मोतीलाल माधव	प्रतापपुर -३	मोतीलाल
१५. रामकृष्ण माधव	प्रतापपुर -३	रामकृष्ण
१६. गरीब कहार	प्रतापपुर -३	गरीब
१७. राजकुमार माधव	प्रतापपुर -३	राजकुमार
१८. दुर्गेश माधव	प्रतापपुर -३	दुर्गेश
१९. अर्जुन हरिजन	प्रतापपुर -३	अर्जुन
२०. बिनित कर्सोचन	प्रबन्ध निर्देशक, ईमरल्ड	बिनित
२१. आशिष भट्ट	वातावरण विज्ञ, काठमाण्डौं	आशिष

प्रस्ताव नं. १. स्थानीयलाई रोजगारी प्रदान गर्ने सम्बन्धमा

निर्णय नं. १. प्रस्ताव नं. १ माथि छलफल गर्दा यस बायोग्यास प्लान्ट निर्माण स्थल आसपासका बासिन्दालाई रोजगारीमा प्राथमिकता दिइने।

प्रस्ताव नं. २. उद्योगले समुदायलाई पार्ने प्रभाव सम्बन्धमा

निर्णय नं. २. प्रस्ताव नं. २ माथि छलफल गर्दा समुदाय यस उद्योगबाट टाढा रहेको र वातावरणमा हुने नकारात्मक प्रभाव न्यूनीकरणमा समुदाय र उद्योग मिलि काम गर्ने निर्णय गरियो।

प्रस्ताव नं. ३ उद्योगबाट उत्पादन हुने मल स्थानीयलाई प्राथमिकता सम्बन्धमा

निर्णय नं. ३ प्रस्ताव नं. ३ माथि छलफल गर्दा उद्योगबाट उत्पादन हुने मल स्थानीय कृषकहरुको माग पुरा गरि मात्र अरुलाई दिइनेमा निर्णय गरियो।

प्रस्ताव नं. ४ उद्योग संचालन गर्ने सम्बन्धमा

निर्णय नं. ४ प्रस्ताव नं. ४ माथि छलफल गर्दा यस उद्योगले जैविक फोहोर व्यवस्थापन गर्ने र वातावरणमा कम असर पार्ने देखिन्छ। यसका साथै उद्योग संचालन हुदा स्थानीयले रोजगारी पनि पाउने हुदा समुदाय यस परियोजनाका लागि सकारात्मक रहेको र यस उद्योगलाई संचालन गर्ने निर्णय गरियो।

Summary of Public Consultation

Comments/suggestions received during public consultation and their incorporations in the report:

- The locals should be given preference of employment, during the construction and operation phase, according to their skills and abilities.
- Regarding the environmental impacts of the proposed sub-project; the settlement does not lies near the sub-project so there is less environmental impacts and the biogas plant industry should be responsible to minimize the adverse environmental impacts.
- The compost produced from the sub-project should be provided with priority to the locals.
- Suggestion for implementing the sub-project as the sub-project does not have any environmental issues instead the sub-project will manage the other wastes and also generate employment opportunities to locals.

Community Consultation Plan

Objectives:

- To involve nearby community in the project during its planning, construction and implementation phase.
- Disclosure of safeguard measures to be considered during project construction and implementation
- Management of stakeholder expectations
- Reduction in the potential for delays in future project related issues

Method

The method of community consultation will be public meetings with involvement of nearby community, project developer, construction contractor, representative from local level.

Timing

During project design phase: already accomplished during ESIA phase (Dated: 2076/06/02 BS)

During Construction Phase: At the starting of construction

During Operation Phase: 2 months after successful testing and commissioning

Community Consultation Plan Matrix

Phase	Activities	Responsibility
During Project Design Phase	To disclose non-technical project information to locals Highlighting objectives of preparation of ESIA	Developer/Consultant

	To seek comments and suggestions from community	
During Construction Phase	Informing locals/nearby community about start of project construction Highlighting the project safeguard document provisions and mitigation measures mentioned in ESIA document which will going to be implemented during project construction and operation phase	Developer/ In-house Safeguard Team
During operation Phase	Information on ESIA Implementation and its progress Highlighting the mitigation measures adopted for the project Periodic disclosure of grievances received To seek comments and suggestions from community	Developer/ In-house Safeguard Team

Annex 2: Legal Documents of the Developer

नेपाल सरकार
उद्योग, वाणिज्य तथा आपूर्ति मन्त्रालय
कम्पनी रजिष्ट्रारको कार्यालय
कम्पनी दर्ता प्रमाण - पत्र

दर्ता नं: ३३६६९२/८०/०८१

श्री ईमरल्ड इनर्जी

नामको प्राइभेट लिमिटेड कम्पनी संम्वत् २०८१ साल जेष्ठ महिना ०६ गते रोज १ मा दर्ता भएको हुनाले कम्पनी ऐन, २०६३ को दफा ५ को उपदफा (१) बमोजिम यो प्रमाण-पत्र दिइएको छ ।

मिति: २०८१-०२-०६

स. रजिष्ट्रार
सहायक रजिष्ट्रार

Government of Nepal
Ministry of Industry, Commerce & Supplies
Office of the Company Registrar

Registration No: 336692/80/081

CERTIFICATE OF INCORPORATION OF COMPANY

This Certificate of Incorporation has been issued to M/s Emerald Energy Private Limited having incorporated it on the 19 day of May, 2024 pursuant to sub-section (1) of section 5 of the Companies Act, 2006.

Date: 2024-05-19

Asst. Registrar

शर्त - कम्पनी संस्थापनलाई मात्र कम्पनीको उद्देश्य कार्यान्वयन गर्न इजाजत प्रदान गरिएको नमानिने हुनाले कानून अनुसार लिनुपर्ने अनुमति सम्बन्धित निकायबाट लिएर मात्र कम्पनीको उद्देश्य अनुसार कारोबार गर्नु पर्नेछ ।

नेपाल सरकार
अर्थ मन्त्रालय
आन्तरिक राजस्व विभाग

स्थायी लेखा नम्बर (PAN) दर्ता प्रमाण पत्र

स्थायी लेखा नम्बर	:	६ २ १ १ ४ १ ६ १ ६
आन्तरिक राजस्व कार्यालय	:	आन्तरिक राजस्व कार्यालय भैरहवा
करदाता सेवा कार्यालय	:	परासी

दर्ता मिति

	दिन	महिना	साल
आयकर:	२८	०२	२०८१
मु. अ. कर:	२८	०२	२०८१

कारोबारको नाम	:	ईमरल्ड इनर्जी प्रा. लि.
करदाताको प्रकार	:	प्राइभेट लिमिटेड
ठेगाना	:	वार्ड नं. ३, सोमनी गा.पा.: प्रतापपुर, नवलपरासी (बर्दघाट सुस्ता पश्चिम)
व्यवसायका कारोबारहरु	:	रासायनिक र मलखाद खनिजहरुको उत्खनन्, रासायनिक मल र नाइट्रोजनयुक्त यौगिकको उत्पादन, मल तथा कृषि रसायनका उत्पादनको थोक बिक्री , ग्यासको उत्पादन, मुख्य वितरण प्रणालीद्वारा ग्यास इन्धनको वितरण,

करदाताको दस्तखत

२०८१/०२/२८

राजेन्द्र शाह
कर अधिकृत

कर अधिकृत

करदाताले पालना गर्नुपर्ने कर्तव्यहरू:

- कारोबार गर्दा अनिवार्य रुपमा बिल बिजक जारी गर्नुपर्छ ।
- मू.अ. करमा दर्ता हुनेले प्रत्येक कर अवधि (मासिक वा त्रैमासिक वा चौमासिक) समाप्त भएको २५ दिन भित्र मू.अ. कर विवरण तथा मू.अ. कर रकम बुझाउनु पर्छ ।
- अन्त:शुल्क लाग्ने कारोबार गर्नेले अन्यथा व्यवस्था गरेकोमा बाहेक प्रत्येक महिना समाप्त भएको २५ दिनभित्र मासिकवारी र अन्त:शुल्क रकम बुझाउनु पर्छ ।
- प्रत्येक आर्थिक वर्षको आय विवरण आर्थिक वर्ष समाप्त भएको तिन महिना भित्र बुझाउनु पर्छ ।
- तोकिएको समयमा विवरण र कर रकम नबुझाएमा ब्याज, शुल्क र जरिवाना लाग्नेछ ।
- यो प्रमाण पत्र देखिने गरी कारोबार स्थल/मुख्य कार्यालयमा राख्नु पर्नेछ ।
- कुनै हिकिया भएमा कार्यालयमा सम्पर्क राख्नु होला ।

Annex 3: Reviews of Plans/ Policies/ Legislations and Guidelines

1. The Constitution of Nepal

The Constitution of Nepal prioritizes the human rights and protection of environment. Article 30 (1) of the Constitution asserts that every person shall have the right to live in a healthy environment. Similarly, Article 51 (G) asserts that; the state shall make such arrangements as may be required to keep the environment clean and stated policies relating to protection, promotion and use of natural resources. The state shall give priority to the prevention of adverse impacts in the environment from physical development activities, by increasing the awareness of the general public about environmental cleanliness, as well as to the protection of the environment and special safeguard of the rare wildlife. The state shall make arrangements for the protection of sustainable uses of and equitable distribution of benefits derived from, the flora, fauna and biological diversity.

2. Plans and Policies

a. Fourteenth Plan 2013-2016

According to 14th plan, Government of Nepal has intention to raise the human development index by safeguarding social development and social security. Increase on the average economic growth by 7.2% and industrial economic growth with 10.6% within 2019 is also included in this plan. This plan also comprises the condition to attract the foreign and national investor in goods and services so that there will be comparison and competition in markets.

b. Fifteenth Plan FY 2076/77- 2080/81

The Fifteenth Plan of Nepal (FY 2076/77 to 2080/81) aimed at laying the foundation for transforming Nepal into a middle-income country by 2030, emphasizing sustainable, inclusive, and equitable economic growth. The plan targeted an average annual GDP growth rate of 9.6%, focusing on sectors like agriculture, tourism, industry, and services. Infrastructure development, particularly in transportation, energy, and urban development, was prioritized to support economic activities. The plan also stressed improving education, healthcare, and social protection to enhance human capital and reduce poverty and inequality. Environmental conservation and climate resilience were integral, promoting sustainable use of natural resources. Strengthening governance, enhancing public service delivery, and fostering regional and international cooperation were key elements to ensure effective implementation. The Fifteenth Plan envisioned a holistic approach to development, aiming to elevate the overall well-being of Nepali citizens and create a robust, diversified economy.

c. Sixteenth Plan FY 2081/82 to 2085/86

The Sixteenth Plan of Nepal (FY 2081/82 to 2085/86) outlines a strategic vision for socio-economic development with the goal of achieving a 7.5% annual GDP growth rate and transforming Nepal into a middle-income country by 2030. Key focuses include diversifying the economy, enhancing infrastructure such as transport and digital networks, and boosting energy production from renewable sources. Social development aims to improve education, healthcare, reduce poverty, and promote gender equality. The plan also emphasizes modernizing agriculture, supporting rural development, and ensuring environmental sustainability through climate change mitigation and disaster resilience. Good governance, strengthened institutions, and enhanced

public service delivery are prioritized alongside creating a conducive environment for private sector growth and investment. Sustainable tourism development, fostering innovation and technology adoption, and enhancing regional and international cooperation are integral components. This comprehensive blueprint aims for sustainable, inclusive, and resilient growth to improve the quality of life for all Nepali citizens.

d. Rural Energy Policy, 2006

The main rationale of formulating Rural Energy Policy is to create conducive environment that will self-motivate and mobilize local institutions, rural energy user groups, non-governmental organizations, cooperatives and private sector organization for the development and expansion of rural energy resources. The government will act as facilitator and promoter for involving private sector and non-governmental organizations to be involved in rural energy development for development and expansion of new technologies. It has also envisioned subsidy provision for promotion of such renewable energy technologies.

e. Renewable Energy Subsidy Policy, 2016

The objective of Renewable Energy Subsidy Policy is to encourage very poor households to use RETs and to encourage private sectors and financial institutions to invest in the sector while focusing on providing service delivery of utmost quality. The subsidy policy is based on cost per unit of energy output. Although subsidy amount differs according to technology and region, subsidy amount generally covers 40% of the total costs.

3. Acts and Rules

a. Environment Protection Act, 2076 and Environment Protection Rules, 2077

The Environment Protection Act, 2076 and Environment Protection Rules, 2077 of Nepal together create a robust framework for environmental conservation and sustainable development. The Act mandates Environmental Impact Assessments (EIAs) for development projects to identify and mitigate potential environmental impacts, and establishes guidelines for pollution control, waste management, and natural resource conservation. It emphasizes public participation, transparency, and the establishment of environmental standards and monitoring mechanisms. The Rules, enacted in 2077, provide detailed procedures and standards for implementing the Act, including specific requirements for EIAs, pollution control measures, and penalties for violations. Together, these legal instruments aim to balance economic development with environmental protection, ensuring sustainable use of resources and the well-being of present and future generations.

b. Local Government Operation Act, 2074 (2017)

Local Government Operation Act, 2074 outlines work, responsibility and powers of the local governments (Rural Municipality and Municipality levels). It specifies authorities devolved by the Constitution of Nepal to the local bodies. Section 3 of the act specifies the authorities of the local government bodies. Section 11 empowers local government to formulate local level policy

for the environmental conversation and biodiversity and requires the local bodies to act for the environmental risk reduction, pollution control and control of hazardous substances.

c. Water Resources Act, 1992

The water Resource Act (1992) makes arrangements for the rational use of surface and underground water. The Act seeks to prevent environmental and hazardous effects from the use of water and prohibit water pollution by chemicals, industrial waste or litter. Water may only be used in an manner that does not permit soil erosion, landslide or flood. Pollution of drinking water is prohibited under the Nepal Drinking Water Corporation Act (1989).

d. Solid waste Management Act, 2011

The Solid Waste Management Act, 2011 emphasize on the responsibility of waste producers (individuals/institutions) for the treatment and management of hazardous waste, chemical and industrial waste as per the mandated standards. Section 4 outlines the duties of local government to take actions to control haphazard waste generation, disposal or collection and has provisions for various measures against those engaged in activities detrimental to the intentions of the act. Section 5 emphasizes any individual, organization or institution shall have to reduce the amount of generated solid waste as much as possible while carrying out any work or business. Section 38 of the Act states that "To throw, keep, discharge or cause to discharge chemical waste, industrial waste, medical waste or hazardous waste haphazardly are considered as offensive and could lead to punishment and penalties as mentioned in Section 39 of the Act.

e. Solid Waste Management Regulation, 2013

The Solid Waste Management Regulation 2013 of Nepal provides a comprehensive framework for managing solid waste to protect public health and the environment. It outlines responsibilities for various stakeholders, including government bodies, private sector entities, and individuals, to ensure effective waste management practices. Key provisions include waste segregation at the source, promoting recycling and reuse, and proper disposal methods. The regulation mandates local governments to develop and implement solid waste management plans, conduct public awareness programs, and establish necessary infrastructure such as waste treatment and disposal facilities. It also emphasizes the role of private sector participation through public-private partnerships. The regulation enforces penalties for non-compliance and encourages community involvement to maintain cleanliness and sustainability. Overall, it aims to create an integrated and sustainable waste management system in Nepal.

f. Child Labor (Prohibition and Regulation) Act, 2000

The Child Labor (Prohibition and Regulation) Act 2000 is the main legal expedient to prohibit engaging children in factories, mines or similar risky activities and to make necessary provisions with regard to their health, security, services and facilities while engaging then in other activities.

Under Section 3 of the Act, child having not attained the age of 14 years is strictly prohibited to be engaged in works as a laborer. Similarly, under Section 4, engagement of child in works as a laborer against his/her will by way of persuasion, misrepresentation or by subjecting he/she to

any influence or fear or threat or coercion or by any other means is prohibited. Under Section 6, in case any Enterprise has to engage a child in works, an approval has to be obtained from the concerned Labor Office or any authority or official prescribed by that office and form the father, mother or guardian of the child.

g. Labor Act, 2074 and Labor Rule, 2075 B.S.

This Act strictly prohibits the concerned parties who hire the work force to over utilize them during its different activities. Section 5 of the Act prohibits child labor engagement. Similarly, Section 6 prohibits any kind of discriminations like religion, gender, caste ethnicity, mother tongue etc. among employees. Section 22 states that prior work permit is required for non-Nepali citizens and they are allowed to work in Nepal for certain period only in the area where the Nepali work force is not available or not competent. Section 28 provisioned the working hours as 8 hours a day and 48 hours a week. The same section provisioned that thirty minutes must be allowed for rest and/or refreshments should be given in every five hours of work. Likewise, Section 30 allows employer to engage employee additional of 4 hours per day or 24 hours per week and shall provide over-time payment as 1.5 times the normal wage as per Section 31. Section 74 emphasizes constitution of Safety and Health Committee where 20 or more employees are engaged.

4. Guidelines/ Framework

a. National EIA Guidelines, 1993

To address environmental impact assessment as envisaged by NCS, 1987, National Environmental Impact Assessment (EIA) Guidelines were endorsed by Government of Nepal on 27 September 1992 A.D. and gazetted on 19 July in 1993 A.D., Volume 43, Number 5. The guideline provides criteria for project screening and initial environmental examination (IEE). This also includes scoping, preparation of terms of reference for EIA, methods of EIA report, impact identification and prediction, impact mitigation measures, review of the draft EIA report, impact monitoring, evaluation of impact studies, impact auditing, community participation and schedules and annexes to IEE and EIA.

Many of the guideline provisions are now included in the Environment Protection Act, 1997, and Environmental Protection Regulation, 1997. EIA in Nepal has now become legally mandatory. However, as the National Environmental Guidelines, 1993 have not been issued under the Environmental Protection Act (1997); they do not have any legal force. It is a policy guideline issued by the Government that is still followed in the matters which are not covered by the Environment Protection Act (1997) and Environment Protection Regulations (1997).

b. SREP Environment Management Framework (EMF), 2013

SREP Environment Management Framework (EMF) has been formulated on 2013 during the SREP project formulation. This document is the key document to assure environmental protection while implementing biogas subprojects under SREP Extended Biogas Programme. This document identified generic impacts caused by implementation of biogas subprojects and

prescribed generic mitigation measures. The EMF proposes three levels of interventions for all biogas sub-projects in order to ensure adequate environmental considerations. Environmental Screening and appropriate subproject categorization through comprehensive checklist, preparation of Environmental Management Plan (EMP) based on site specific baseline which will consist alternative analysis, mitigation measures and environmental monitoring plan. The document provides procedure for environmental impact identification and preparation of safeguard documents.

Any project is classified as Category B, if its potential adverse environmental impacts on human populations or environmentally important areas—including wetlands, forests, grasslands, and other natural habitats—are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA a Category B project may vary from project to project, but it is narrower than that of Category A. Category B projects require Initial Environmental Examination (IEE) or more often known as limited EIA.

5. Standards

a. National Ambient Air Quality Standards, 2012

The National Ambient Air Quality Standards, 2012 enforced by GON has set quality standards for seven parameters: TSP, PM10, sulphur dioxide, nitrogen oxide, carbon mono-oxide, lead and benzene for the maintenance of the ambient air quality. The project during its construction and operation will have to comply with the set standards for the ambient air quality.

b. Nepal Vehicle Mass Emission Standards, 1999

Nepal Vehicular Emission Standard, 1999 enforced for the vehicles operating on petrol, gas, and diesel. The emission standards are very specific for two, three and four wheeler vehicles. The vehicles used by the project should comply with the vehicular emission standards during the construction and operation phase.

c. Generic Standard for Discharging industrial effluent in inland surface water, 2001

The government of Nepal exercising the right from Rule 15 of Environment Protection Regulation has set tolerance limits for industrial effluents discharged into inland surface water through Gazette Notification. Since the project is considered as an industry it will have to comply with tolerance limits in the generic standard prior to the discharge of the effluents into the inland surface water during the construction and operation period.

6. International Policies and Conventions

a. World Bank Safeguard Policy (OP 4.01 Environment Assessment)

An Environmental Assessment (EA) shall be conducted to ensure that bank-financed project are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. Any WB project that is likely to have potential adverse environmental risks and impacts in its area of influence requires

an EA indicating the potential risks, mitigation measures and environmental management framework or plan.

EA takes into account the natural environment (air, water, and land), human health and safety, social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources) and trans-boundary and global environmental aspects. EA considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions; the findings of country environmental studies; national environmental action plans; the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. The Bank does not finance project activities that would contravene such country obligations, as identified during the EA. EA is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project.

Limited EIA or IEE examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

b. World Bank Safeguard Policy (OP 4.10 Indigenous Peoples)

The World Bank Safeguard Policy (OP 4.10) on Indigenous Peoples ensures that development projects respect the dignity, rights, economies, and cultures of Indigenous Peoples. Applicable to projects affecting these communities, the policy mandates thorough assessments to identify potential impacts and requires the preparation of an Indigenous Peoples Plan (IPP) or Indigenous Peoples Planning Framework (IPPF). Key elements include ensuring Free, Prior, and Informed Consultation (FPIC) for participation in decision-making, conducting social assessments to analyze impacts, and promoting benefit-sharing aligned with Indigenous preferences. The policy also establishes accessible grievance mechanisms and supports capacity-building initiatives for effective engagement in the development process. Continuous monitoring and evaluation are mandated to ensure compliance and effectiveness. This policy recognizes the unique vulnerabilities of Indigenous Peoples and aims to foster their development while respecting their rights and promoting sustainable outcomes.

c. World Bank Safeguard Policy (OP 4.11 Physical Cultural Resources)

The World Bank Safeguard Policy (OP 4.11) on Physical Cultural Resources aims to preserve and protect cultural heritage within development projects. It applies to projects that may impact cultural resources, including archaeological, historical, architectural, and other culturally significant sites and objects. The policy mandates thorough assessments to identify and evaluate the significance of affected resources and involves stakeholder consultation to ensure informed decision-making. It requires the development and implementation of mitigation measures to avoid, minimize, or mitigate adverse impacts, including provisions for chance finds during project implementation. Physical Cultural Resources Management Plans (PCRMP) are prepared to

outline specific actions and responsibilities, ensuring ongoing protection and management. The policy also supports capacity building and training for effective resource management and mandates continuous monitoring and supervision to track the implementation of mitigation measures. Overall, the policy integrates cultural heritage preservation into sustainable development, ensuring cultural resources are respected and appropriately managed.

d. World Bank Safeguard Policy (OP 4.12 Involuntary Resettlement)

The World Bank Safeguard Policy (OP 4.12) on Involuntary Resettlement aims to mitigate the adverse social and economic impacts of development projects that cause involuntary displacement. The policy requires that resettlement activities improve or at least restore the livelihoods and living standards of displaced persons. Key measures include conducting a comprehensive assessment to identify affected individuals and communities, consulting with stakeholders to ensure their participation in planning and decision-making, and preparing Resettlement Action Plans (RAPs) or Resettlement Policy Frameworks (RPFs). These plans outline measures to provide compensation for lost assets, assist in relocation, and support livelihood restoration. The policy also mandates the provision of adequate housing, infrastructure, and social services at resettlement sites. Additionally, it ensures grievance mechanisms are in place for addressing concerns and disputes. Continuous monitoring and evaluation are required to ensure effective implementation and compliance with the policy objectives. Overall, OP 4.12 emphasizes the need to treat resettled individuals and communities fairly and equitably, aiming to achieve sustainable development outcomes.

e. Convention on Biodiversity (CBD), 1993

The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

f. **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973**

The convention classifies species according to criteria where access or control is important (e.g. I- species threatened with extinction; II- species which could become endangered; III- species that are protected; E- Endangered; V- Vulnerable, R- Rare (CITES 1983)). The project will have to minimize the impacts to the CITES species as far as possible.

g. Convention (No. 169) Concerning Indigenous and Tribal Peoples in Independent Countries, 1989

The Article 7 of the convention provide right to the indigenous and tribal people to decide their own priorities for the process of development. However, for the national development plans and programs, it mandates consultation with them in the formulation of plans and programs. Article

12, 13, 14 and 15 safeguards rights of the indigenous people in the land and natural resources in their territories, it mandates formulation of special provisions under the state legislation for participation in the decision-making process and resettlement process with full compensation of the resulting loss or injury (Article 16).

Annex 4: Environmental Standards

Table A: Standards for Effluents Discharged into Inland Waters

SN	Parameters	Tolerance Limits
1	Total Suspended solids, mg/L, Max	30-200
2	Particle size of total suspended particles	Shall pass 850-micron Sieve.
3	pH	5.5 to 9.0
4	Temperature	Shall not exceed 40 degree C in any section
5	Biochemical oxygen demand (BOD) for 5	30-100
6	Oils and grease, mg/L, Max	10
7	Phenolic compounds, mg/L, Max	1
8	Cyanides (as CN), mg/L, Max	0.2
9	Sulphides (as S), mg/L, Max	2
10	Radioactive materials:	
11	a. Alpha emitters, c/ml, Max	7 OCT
12	b. Beta emitters, c/ml, Max	8 OCT
13	Insecticides	Absent
14	Total residual chlorine, mg/L	1
15	Fluorides (as F), mg/L, Max	2
16	Arsenic (as As), mg/L, Max	0.2
17	Cadmium (as, Cd), mg/L, Max	2
18	Hexavalent chromium (as Cr), mg/L, Max	0.1
19	Copper (as Cu), mg/L, Max	3
20	Lead (as Pb), mg/L, Max	0.1
21	Mercury (as Hg), mg/L, Max	.01
22	Nickel (as Ni), mg/L, Max	3
23	Selenium (as Se), mg/L, Max	0.05
24	Zinc (as Zn), mg/L, Max	5
25	Ammonical nitrogen, mg/L, Max	50
26	Chemical Oxygen Demand, mg/L, Max	250
27	Silver, mg/L, Max	0.1

(Source: Standards adopted from MoEST, gazette on 2058/01/17 by GoN)

Table B: Drinking Water Quality Standards

SN	Parameters	Desirable	Maximum Tolerable
1.	Colour, Hazen units, Max	10	15
2.	Odour	Unobjectionable	
3.	Taste	Agreeable	
4.	Turbidity, NTU, Max	5[1]	10
5.	Total Dissolved Solids, mg/l , Max	500	1500
6.	pH value	6.5 – 8.5	May be relaxed up to 5.5 on the lower and up to 9 on higher side.
7.	Total Hardness (as $CaCO_3$) mg/l, Max	250	
8.	Calcium (as Ca), mg/l, Max	75	
9.	Magnesium (as Mg), mg/l, Max	30	
10.	Copper (as Cu), mg/l, Max	1	may be extended up to 1.5
11.	Iron (as Fe), mg/l, Max	0.3	
12.	Manganese (as Mn), mg/l, Max	0.1	may be extended up to 0.5
13.	Chlorides (as Cl), mg/l, Max	250	
14.	Sulphate, (as SO_4), mg/l, Max	150[2]	
15.	Nitrate (as NO_3), mg/l, Max	45	No relaxation
16.	Fluoride (as F), mg/l, Max	1.5	
17.	Phenolic compounds, (as C_6H_5OH), mg/l,	0.001	May be relaxed up to 0.002
18.	Mercury (as Hg), mg/l, Max	0.001	No relaxation
19.	Cadmium (as Cd), mg/l, Max	0.01	No relaxation
20.	Selenium (as Se), mg/l, Max	0.01	No relaxation
21.	Lead (as Pb), mg/l, Max	0.01	No relaxation
22.	Arsenic (as As), mg/l, Max	0.05	No relaxation
23.	Cyanide (as CN), mg/l, Max	0.05	No relaxation
24.	Chromium (as Cr^{6+}), mg/l, Max	0.05	No relaxation
25.	Residual free Chlorine, (as Cl), mg/l, Min	0.2	
26.	Ammonia, mg/l, Max	1.5	
27.	Aluminium, mg/l, max	0.2	
28.	Boron mg/l, max	0.3	
29.	Nickel, mg/l, max	0.02	
30.	Hydrogen sulphide, mg/l, max	0.1	
31.	Zinc, mg/l, max	3	

[1] Value for turbidity is 5 in FAR(for mineral water), PFA, BS, WHO

[2] Value for Sulphate BS:200, FAR(for mineral water) and PFA:250

(Source: Standards adopted from Department of Water Supply & Sewerage)

Table C: National Standard for Noise Quality

SN	Area of Exposure	Noise Limit (L_{eq}) in decibels	
		Day Time	Night Time
1.	Industrial Area	75	70
2.	Commercial Area	65	55
3.	Rural Residential Area	45	40
4.	Urban Residential Area	55	50
5.	Mixed Residential Area	63	55
6.	Quiet Area	50	40

(Source: Gazette Notification,2012)

Table D: Permissible Emission Standards for Biogas Generator (adopted from Diesel Generator Standard)

Category (KW)	CO (g/kWh)	HC+NOx (g/kWh)	PM (g/kWh)
kW <8	8.00	7.50	0.80
8=kW<19	6.60	7.50	0.80
19=kW<37	5.50	7.50	0.60
37=kW<75	5.00	4.70	0.40
75=kW<130	5.00	4.00	0.30
130=kW<560	3.50	4.00	0.20

Source: Nepal Gazette (Nepal Gazette Notification, 2069 Kartik 13, BS)

Annex 5: Grievance Redress Format

Company's Name

Address (Sub-project Area)

Grievance Record Form

Grievance Record Form
(सल्लाह/सुझाव वा गुनासो टिपोट/रेकर्ड फारम)

Name of Subproject and address (परियोजनाको नाम र ठेगाना):

Name of Developer :

Name of Grievant (सल्लाह/सुझाव/गुनासो राख्ने/हाल्नेको नाम):	Contact detail (सम्पर्क विवरण) Work Phone (कार्यालयको फोन नं.): Home Phone (घरको फोन नं.): Mobile No. (मोबाइल नं.): E-mail (ईमेल) :
Home Mailing Address (घरको ठेगाना):	Work Mailing Address (कार्यालयको ठेगाना):
Date, time and place of grievance recorded (गुनासो टिपोट/रेकर्ड गरिएको मिति, समय र स्थान) :	
Detailed description of grievance (गुनासोको विस्तृत विवरण):	
Proposed solution to grievance (गुनासो समाधानका लागि प्रस्तावित प्रस्ताव):	
_____ Signature of Grievant (गुनासोकर्ताको दस्तखत)	_____ Name and Signature of Grievance Received (गुनासो प्राप्तगर्नेको नाम र दस्तखत)

Grievance Redress Format

गुनासो सुनुवाई दर्ता पुस्तिका

क.स	गुनासो/सल्लाह/सुझाव	गुनासो/सल्लाह/सुझाव दर्ता गर्नेको नाम, ठेगाना र सम्पर्क नम्बर वा इमेल	गुनासो/सल्लाह/सुझाव प्राप्त गरेको माध्यम	गुनासो/सल्लाह/सुझाव प्राप्त गरेको मिति	गुनासो/सल्लाह/सुझावको सुनवाई वा समाधान कसरी भयो	गुनासो/सल्लाह/सुझाव समाधान गरेको मिति	प्राप्त गुनासो/सल्लाह/सुझाव को जानकारी AEPC लाई गराईयो/गराईएन

Annex 6: Study Team

Team Composition

Team Leader : Mr. Ashish Dutta Bhatta
Environmentalist : Mr. Manish Thapa
Environmental Engineer : Mr. Pushkar Thapa
Sociologist : Mr. Krishna Kant Kamali
Waste to Energy Expert : Mr. Kshitiz Subedi

Annex 7: Checklist for Information Collection

Checklist for Physical Environment

A. Topography/Physiography

1. Study of Topographic maps/ other available maps and identify the ground topographic characteristics of land covered by the proposed Biogas Project
2. Verify the topographic characteristics of the land in the field

B. Geology and Soil Type

1. Classify the type of soil found in the project area
2. Study the geological characteristics of the project area
3. Investigate suspended sediment loads data from available literature

C. Climate

1. Study of published data (DHM) of regarding temperature, rainfall, humidity,
2. If possible classify the climatic zone and its verification

D. River Hydrology/ Drainage Pattern

1. Study of Topographic maps/ other available maps and identify the drainage patterns
2. Verify the topographic characteristics of the river system/drainage pattern in the field
3. Collect the available information regarding the quality of river water
4. Investigate flood potential in the river and seasons of occurrence, past history of flooding

E. Land Use

1. Investigate on the land use of the project area from the topo-maps, and other available land use maps
2. Investigate the land use type of areas proposed for project components and support facilities from the statistics published by Department of Forest

F. Air Quality, Water Quality and Noise Levels

1. Collect any data on air, water and noise quality of the area from previous literature, if available
2. Investigate major water and noise polluting sources and activities of the area
3. Identify information related to water use like drinking water source, irrigation facility

Checklist For Biological Environment

A. Forest and Vegetation

A. Forest Classification by types (from expert observation supported by available forest resource maps or GIS based maps)
B. Classification of affected forest (through consultation with locals, CFUGs or management committees)
    i. Community Forest
    ii. Religious Forest
    iii. Government Managed Forest
    iv. Private Forest
C. Vegetation and Biodiversity observed: List of tree, shrub, herbfound within the influence area of the project
D. Conservation significance: The species found shall also be categorized according IUCN, CITES. and Government of Nepal Protection Category

B. Wildlife and Birds:

1. List of wildlife and birds found in and around vicinity through consultation with community and key informants

Checklist for Socio-economic and Cultural Environment

A. Sub-project District and Municipality

The details about the district and municipality will be extracted from the district and municipality profile and investigation with officials from the municipality. Most recent statistics available will be used to study about the socio-economic status of the sub-project area. The following information will be extracted to study about the socio-economic status of the sub-project area.

1. Demographic information (Households, Population with male and female, sex ratio, average household size)
2. Caste and Ethnicity (number of caste group in both district and municipality)
3. Language Spoken (mother tongue, major language)
4. Age wise population (infant, young, economically active, old)
5. Literacy rate
6. Sanitation (HH with and without toilet, Flush toilet/ pan toilet)
7. Drinking water facility (municipal water supply, deep boring, well, river water)
8. Source of energy for cooking and electricity (cow dung, firewood, biogas, kerosene, LPG, national electricity gridline)

B. Cultural Environment

1. Investigate the major historical and religious sites of the sub-project area during the field visit

Checklist for Key Informant Interviews

Name of the Key Informant:

Date:

Venue:

Project description

- Project category (as per MGEAP)
- Proponent, partners, concerned stakeholders, and affected entities (HH, community, etc.)
- Project objectives and targets, dimension of outputs (and inputs)
- Location and affected area
- Project component and their dimensions
- Project benefits/beneficiaries (if different than those mentioned above)

Environmental risks and concerns

Risks to the physical environment

- Contamination of surface water body and ground water

a) Observation of the water bodies/wetlands nearby that can be affected by project components or activities.
b) Disposal of slurry into the water body.
c) Seeping of leachate from the digester or other components

- Gaseous release or air contamination

a) Release of methane from the digester, storage, slurry or incomplete digested slurry, release of excess produced methane
b) Exhaust from the transport as well as dust originating from the roads use for hauling (specially for large scale project)

- Noise from transportation
- Soil contamination

a) Disposal of slurry etc. into the soil

- Slope instability and erosion

a) Slope and terrain condition of the project components sites
b) Construction of components
c) Removal of vegetation, exposure of soil (soil type), and disruption of local drainage

Risks to the biological environment

- Loss of vegetation and diversity (from collection and management of forest – tendency of maintaining preferred species with higher commercial value from the project will motivate removal of other local species reducing diversity)

- Disturbance to animals

a) Wildlife in and around project area (population, diversity, protection status)

- Loss of habitat

a) Project location in and/or in vicinity of the critical habitats that can be affected such as protected area, habitat of endangered species, important corridors
b) Disturbance of habitat (space, food, breeding ground) from collection of resources (e.g. forest products), disposal waste, noise, etc.

Risks to the social environment

- Disruption to the existing water use

a) Source of water for the settlement in the project affected area

b) Possibility of contamination due to project component or activities.
c) Demography, economic, cultural and ethnic composition of the water users
d) Effect on vulnerable groups and women

- Foul odor and sanitation condition

a) Location of settlement/houses close to project components
b) possibility of dispersion of foul order from the digester, storage, transportation and other components
c) Possibility of health hazard from the project to the surrounding settlements e.g. mosquito
d) Demography, economic, cultural and ethnic composition
e) Effect on vulnerable groups and women

- Effect of divergence of the resources to the project that the communities were dependent on, e.g. (a) forest products such as litter and fire wood (b) cow dung for cooking, (c) manure, (d) livelihood they are managing to secure through labor for existing management etc.

a) Demography, economic, cultural and ethnic composition of the affected HHs.
b) Effect on the vulnerable group and women

Annex 8: Pictures of the Sub-Project location and Public Consultation

	
Photo 1: Biogas plant location	**Photo 2: Public consultation**
	
Photo 3: Public consultation	**Photo 4: Public consultation**