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Scaling up Renewable Energy Program (SREP)
Waste to Energy Project Nepal
Environmental Management Framework (EMF)

Government of Nepal
Ministry of Science, Technology and Environment
Alternative Energy Promotion Centre (AEPC)

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EXECUTIVE SUMMARY

The purpose of Scaling-Up Renewable Energy Program (SREP) in Nepal is to support initiatives to recover energy from the waste. Nepal Government is keen to develop such projects (hereafter termed as Waste to Energy (W2E) project) because waste are produced regularly in a large quantity which are either landfilled or disposed improperly causing air, water or soil contamination. The government's executive agency for the W2E projects is Alternative Energy Promotion Centre (AEPC). Recently, AEPC has already started awareness campaigns like Energy Bazar at national and regional levels. In consultation with the relevant stakeholders including the World Bank, AEPC is going to launch a "Call for Proposal" to solicit W2E projects from all across Nepal.

The possible W2E projects that are envisioned under SREP are

(i) Municipal W2E that intends to recover energy from municipal waste in urban centre, cities, etc.;
(ii) Commercial W2E that intends use of waste produced at the commercial establishments like poultry litter, agro-waste, biomass crop residue, liquor industry, etc.;
(iii) Institutional W2E that intends to recover energy from the kitchen or other waste of hospitals, prisons, boarding schools, university campus, military barracks, police barracks, etc.;
(iv) Biomass (forestry and agriculture) W2E intends to recover energy from agricultural wastes or biomass from forest which are not used and/or have minimum use such as forest litter.

The W2E projects are environmentally beneficial by nature, since these intend to recover energy from the waste to minimise disposal of waste reducing level of pollution. However it can still have environmental impacts/risks such as generation of greenhouse gas, threat to sanitation etc. In order to address these impacts, an environmental management framework (EMF) has been prepared. The purpose of the Environmental Management Framework (EMF) is to provide guiding principles to identify, assess, mitigate and monitor potential environmental impacts/risks of projects and activities targeted under the SREP. It is intended to guide project developers in preparing the project proposals that are in compliance with the safeguard requirements.

The possible environmental impacts/risks associated with the W2E projects and their possible mitigation measures are presented below:

Environmental risks/impacts	Mitigation measures
Waste fall off the trucks during transport which can create a sanitary threat to communities living along the route.	Transfer route and project has to be strategically determined to minimize interaction of waste with the communities.
Growth of disease vectors such as flies, mosquitoes, rodents etc., which might spread disease to communities living in the surrounding area.	The waste transport vehicles' waste compartments should be properly maintained, particularly containers, lid and locks.
Occupational health and safety risks to waste	The workers shall be given proper

workers. Risk of avian influenza outbreak	equipment and protective measures that could minimize the risk of health hazards. Furthermore, proper sanitation facilities including showers, cleaning materials shall be provided to the workers. A regular health check-up and health insurance shall be provisioned as a part of the employment agreement. Awareness on "health and sanitation" to the community, and "occupation safety and health" The projects compulsorily have the measures for preventive, control and quarantine procedure to control avian influenza according to the Nepal Government's standard procedure.
Foul odour from the W2E can cause impact on the population living around the facilities.	Ensuring that the facilities are enclosed structures, and reduce water spillage from the facilities. This will prevent direct dissipation of odour to the neighbours. Trees and other windbreakers around waste storages help reduce agitation by the wind, and help promote vertical air mixing and dilution of the odours. This further reduces the transport of odours to neighbours.
Disposal of dairy wastes (urine and dung) into open pits can lead to (a) creation of breeding sites for mosquitoes, flies and other pest that can spread disease to nearby communities, (b) contamination of the water bodies and ground water with the leachate leading to algal growth, deplete oxygen in water, and eutrophication of stagnant water bodies. Leachate from municipal waste is considered most hazardous in comparison to other sources because of mixing of hazardous waste.	The facilities shall be lined and enclosed to prevent spillage and seepage of the leachate, Cover the waste storage and processing facilities with drainage network to control leachate spillage, and channelize them into the digester. The digesters shall be lined with water proofing materials to prevent seepage of leachate into the ground water. Uncontaminated rainwater from the facility roofs shall be drained into influence stream or rain water drainage. MOSTE (2001) had developed "generic standards of tolerance limits for industrial effluents to be discharged into inland surface waters". According to this, the tolerance limit for BOD for 5 days at 20^{o}C is between 30 – 100 mg/L.

Vehicular emission and release of dust from the earthen road during transportation of waste to the W2E facilities and fertilizer (by-product) to the market. The combustion and pyrolysis will also result in emission of GHG to the atmosphere. The charring and charcoal making process requires involves slow burning of the biomass which is likely to release carbon monoxide gas.	Location of the facilities and route to these shall be strategically determined to minimize use of vehicles. Promote development of metaled road on the route to minimize dust pollution. Ensuring the W2E project meet national standards of ambience air quality and vehicular exhaust. Furthermore, the emission standard for pyrolysis of MSW is not available in national standard therefore "Directive 2000/76/EC of the European Parliament and of the Council of 4th December 2000, on the incineration of waste" shall be referred.
If the facilities will be located in a forest area, then a number of impacts can be anticipated such as loss of vegetation, disturbance to wildlife, and threats to protected vegetation and wildlife species. If the facilities will be located in cultivated land that will result in loss of agricultural productivity and food security of the families depended on that land. **C**ommercialization of charring and briquette production requires consistent supply of input These can increase pressure on the forest for the biomass, and thus, the biomass might be over-extracted and/or other valuable species might be extracted in the process.	Minimize removal of vegetation, particularly clear felling of trees. Compensatory plantation of 1:2 of local tree species shall be carried out if the tree are clear felled. The project should not be located in environmentally sensitive area of any sort, such as protected areas, sensitive habitat, culturally, archeologically and historically important sites. Avoid removal and damage of protected species of vegetation and wildlife. Support agriculture intensification to compensate loss of cultivated land and productivity. Biomass W2E projects have to define forest waste to be collected from the forest. Furthermore, to ensure sustainable use of the forest wastes and to avoid their over-use, it is strongly recommended to carry out their detailed inventory prior to establishing any forest W2E projects. Furthermore, rotational biomass collection is recommended to continuous biomass collection from the same patch of forest to promote the natural regeneration of biomass.

The EMF proposes three levels of interventions for the SREP in order to ensure adequate environmental consideration in the W2E projects.

(1) **Environmental screening**- will be done together with technical, economic and social screening of the proposed W2E project to identify likely environmental impacts/risks associated with it. Screening will be done on the basis of criteria mentioned in Schedule 1 and 2 of EPR97, (ii) other government acts and regulations (Forest, National Park and Wildlife Conservation, etc.) and (iii) potential impacts and risks as per World Bank Operational Policies (OPs). The environmental screening checklist is provided in Annex 1.

The primary responsibility of undertaking environmental screening of the proposed W2E project is the proponent. It is envisaged that the proponent prepares environmental screening report based on the format proposed in 0 along with the project proposal. The EFP at AEPC has the responsibility to review the screening report, and recommend if the project require EIA or IEE or EMP based EPR97 and WB's OP 4.01. Furthermore, the EFP can also carry out independent verification and/or preparation of screening report if the need arises.

(2) **Environmental management plan** - In order to manage minor environmental issues/impacts that may arise during construction activities, as a result of the screening process, the following Environmental Management Plan (EMP) is presented. The W2E project proponent will prepare its own plan for the activity, as needed. It will be reviewed for acceptance and clearance, unless changes are requested, by the AEPC during clearance of the detailed design of activity under the AEPC.

The site specific EMP will reflect the GON's and/or the WB's *Environmental Guidelines for Contractors* as well as measures to mitigate construction and post construction period's environmental impacts. The contractor must prepare the EMP and submit to the AEPC, along with bid documents along with cost estimates, specification, and contract/agreement clauses. Plantation, erosion control, hazard avoidance/mitigation, and construction period's accident/risk reduction strategies, etc., as applicable, will be part of the EMP.

The EMP presents detail pictures of the project impacts and mitigation measures. It includes environmental issues, and its significance for consideration under the W2E project. An issue's significance should be based on supporting information and their explanation. The issues that can come under EMP may vary from project to project. These may include occupational safety and health, sanitation, foul odour, dust and air pollution control, protection of water sources, tree cutting, disturbance to wildlife, etc.

- *Alternatives:* The EMP can also recommend any alternative measures for avoiding impacts;
- *Mitigation:* The EMP identifies site-specific, cost effective and detailed measures for each impact that will reduce the identified adverse impact to acceptable levels. The plan should include compensatory measures (such as tree plantation, IP-related, etc.) if mitigation measures are not feasible, cost effective, or sufficient.

- *Capacity Development and Training: If* necessary, the EMP can recommend specific, targeted training for project staff, contractors, and community groups to ensure the implementation of environmental recommendation.
- *Implementation Schedule and Cost Estimates:* For all mitigation and capacity development, the EMP provides (a) an implementation schedule for measures that must be carried as a part of the project, and (b) cost estimates for implementing the EMP.
- *Integration:* The EMP must be integrated into the project's plan and design, budget, specifications, cost estimated, bid documents, contract/agreement clauses. The AEPC can help the W2E project proponent(s) in proper implementation. Bid documents are only finalized when site-specific EMP recommendations are adequately and appropriately incorporated in the plan and design, cost estimates, specification, and the W2E project proponent's clauses.
- *Timing:* Site-specific EMP shall be prepared at initial stage of the W2E activities/detailed design. THE PIU, with help from EFP/HQ, will certify that EMP recommendations are incorporated in Bid documents. EFP/HQ will consult the MOEST, in case of complexity in EMP. Past experience has shown that it is being prepared after a project's detailed design, allowing limited time for incorporating the environmental costs, and implementation mechanism and procedures.

(3) **Environmental monitoring** - Experience has shown that the overall sustainability of a project depends on how well environmental issues are managed during the implementation. The mechanisms have been proposed to ensure successful implementation of environmental impacts. To conduct monitoring, the AEPC will identify a detailed set of monitoring and reporting guidelines.

The EFP will carry out central level supervision to check progress and timely correct shortcomings of the W2E projects. The main aim of central level supervision is to observe the problem and to support the implementation team at local level.

The proponent(s) will be responsible for regular monitoring and reporting of progress and achievements of the W2E projects. The AEPC, from time to time, may conduct an oversight of the results add how the process was implemented. While most of the monitoring oversight will be conducted by the AEPC, if necessary, it can use the services of competent third party monitors to provide periodic and objective assessments of progress, shortfalls and challenges in the implementation of specific project components/sub-components, especially those related to field projects. It may also seek assistance of the WB for advice and guidance.

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ACRONYMS/ABBREVIATIONS

ADB	Asian Development Bank
AEPC	Alternative Energy Promotion Centre
BOD	Biological Oxygen Demand
CF	Community Forest
CFUG	Community Forest Users Group
EFP	Environmental Focal Point
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EPA97	Environmental Protection Act 1997
EPR97	Environmental Protection Regulations 1997
ESMF	Environmental and Social Management Framework
FAO	Food and Agriculture Organization
GHG	Greenhouse Gas
GHG	Greenhouse Gas
GON	Government of Nepal
HH	House Hold
IEE	Initial Environmental Examination
MLTM	Ministry of Labour and Transport Management
MOAF	Ministry of Agriculture and Food, Ontario, Canada
MOFALD	Ministry of Federal Affairs and Local Development
MOI	Ministry of Industry
MOSTE	Ministry of Science, Technology and Environment
MOUD	Ministry of Urban Development
OP	Operational Policy
SREP	Scaling- Up Renewable Energy Program
TSP	Total Suspended Particles
TSS	Total Suspended Solids
W2E	Waste to Energy
WB	World Bank
WHO	World Health Organization

1 PROJECT OVERVIEW

1.1 Scaling-Up Renewable Energy Program (SREP)

The World Bank's Scaling-Up Renewable Energy Program (SREP) has been initiated in Nepal with the objectives to (i) leverage complementary credit, grant and private sector equity co-financing, (ii) bring about transformational impacts through scaling up energy access using RETs, poverty reduction, gender and social inclusiveness and climate change mitigation, and (iii) ensure sustainable operations through technical assistance and capacity building.

Nepal Government is keen to develop a program to generate energy from the waste with the SREP support. The concept behind this initiation lies on the fact that a large amount of wastes produced in Nepal regularly, which are either landfilled or disposed improperly causing air, water or soil contamination. Any biodegradable material, whether plant or animal origin, can be used to produce energy. However, no significant efforts exist in Nepal to generate energy from the organic waste at larger scale. Therefore, organic waste is viewed as a problem rather than an opportunity.

Though the government is keen to develop waste to energy (W2E) projects, its sustainability is an important question. The government's executive agency for this initiative – Alternative Energy Promotion Centre (APEC) and its partner IDA are in agreement that "they do not want the legacy of SREP to be a few public-sector-led demonstration projects and then back to business as usual. In order to ensure sustainability, there is a recognized need to assist existing and/or interested Nepali private companies by itself or in joint venture with international and regional private companies under approved arrangements of government to identify and implement commercially viable W2E projects as a new line of business."Recently, AEPC has already started some of the awareness campaigns e.g. organization of Energy Bazar at national and regional levels. In consultation with the relevant stakeholders including the World Bank, AEPC is going to launch a "Call for Proposal" to solicit W2E projects from all across Nepal.

Potential W2E projects

W2E is a form of energy-recovery schemes which generate energy in the form of electricity or heat from the biodegradable and non-degradable waste. W2E addresses the issues of waste management and energy recovery at a same time. The possible W2E projects under SREP are categorized in the following four groups, namely:

I. **Municipal W2E** that intends to recover energy from municipal waste in urban center, cities, etc.
II. **Commercial W2E**that intends use of waste produced at the commercial establishments like poultry litter, agro-waste, biomass crop residue, liquor industry, etc.
III. **Institutional W2E**that intends to recover energy from the kitchen or other waste of hospitals, prisons, boarding schools, university campus, military barracks, police barracks, etc.
IV. **Biomass (forestry and agriculture) W2E** intends to recover energy from agricultural wastes or biomass from forest which are not used and/or have minimum use such as forest litter.

1.2 Rationale for Preparation of Environmental Management Framework (EMF)

General thrust of the project interventions can be conceived as environmentally beneficial, as these intend to recover energy from the waste, which will minimising disposal of waste reducing level of pollution. However, these projects can still have environmental impacts/risks; for instance generation of greenhouse gas (GHG) from pyrolysis, gasification or combustion plant or from anaerobic digestion of waste, escape of slurry to the water bodies, health impact association with waste handling, etc. In order to assess and mitigate these potential impacts and risks, EMF has been formulated.

1.2.1 Objectives of the EMF

The purpose of the Environmental Management Framework (EMF) is to provide guiding principles to identify, assess, mitigate and monitor potential environmental impacts/risks of projects and activities targeted under the SREP. It is intended to guide project developers in preparing the project proposals that are in compliance with the safeguard requirements.

Specifically, the EMF intends to:

- Ensure compliance and due diligence with World Bank's safeguard policies as well as with related Government policies, regulation, guidelines and procedures as applicable to the type of project activities financed by the project,
- Provide outline of the process for identifying and assessing potential environmental and social impacts of the projects;
- Provide the guidelines for preparing mitigation plans to address predicted impacts and to provide guidelines for monitoring
- Ensure that environmental issues related to the project are thoroughly evaluated and necessary interventions are incorporated in planning, decision making, and implementation of project activities;
- Identify possible measures to enhance positive environmental outcomes;
- Provide a mechanism for consultation and disclosure of information.

1.3 Revision/Modification

The EMF will be an 'up-to-date' or a 'live document' enabling revision, when and where necessary. Unexpected situations and/or changes in the project or sub-component design would therefore be assessed and appropriate management measures will be incorporated by updating the Environmental Management Framework. Such revisions will also cover and update any changes/modifications introduced in the legal/regulatory regime of the country. Also, based on the experience of application and implementation of this framework, the provisions and procedures would be updated, as appropriate in agreement with the World Bank and the implementing agencies/ departments.

1.4 Limitations

This EMF has been developed in line with World Bank's Operational Policies (OPs) and is based on the national and state laws and regulations, as applicable at the time of preparation of this document. Any proposed modifications in the laws, regulations or guidelines that were notified as 'draft' at the time of preparation of this document have not been considered.

1.5 Methods

The study methodologies adopted for preparing EMF is based on desk study, consultative meetings and field study.

1.5.1 Desk Study

In desk study project documents and relevant literatures particularly applicable GON's social regulations and guidelines, World Bank social safeguard policies were thoroughly reviewed.

1.5.2 Field Study

In field study, some of the sites of the awarded project proposals during Waste to Energy (W2E) Bazaar 2013 were visited and interaction and consultation meetings were carried out with stakeholders to explore the likely social implication of the proposed project and corresponding mitigation measures. The stakeholder consultation exercise was conducted with the help of check list (0).The details of the participants and issues raised during the consultation meetings are presented in ANNEX 4.

1.5.3 Data Analysis and Interpretation

The data collected through various tools and sources were mainly analysed using qualitative methods. Qualitative data like socio-cultural characteristics, knowledge, practices and attitudes and perceived need and problems expressed, suggestions and comments made by the people of the study areas have been analysed under appropriate context under different categories and sub-headings. Necessary maps, tables and charts have been presented in the appropriate sections.

The religious, cultural, and historical sites were evaluated in terms of their religious and historical significance based on the spiritual and historical linkage of the people of the area.

2 OVERVIEW OF EXISTING CONDITION

2.1 A brief overview of Nepal's Environmental Condition

Nepal is a land locked country, nestled between China and India. The total land area of Nepal is 147,181 Km^2. A large variation in altitude within approx. 200 Km from south to north can be observed i.e. between less than 60 m in Southern Tarai region and more than 8000 m in the Himalayas in the north. Geologically and ecologically, the country can be divided into three distinct regions namely the Tarai, Hill Region (consisting of Siwaliks and Middle Himalayas), and Greater/High Himalayas. The Tarai or the plain region is about 300 m above sea level. The Hill Region is situated at 1000 m to 4000 m above sea level, encompassing the Kathmandu valley. The high elevation Mountain Region has the world's highest peak at 8,848 m (Mount Everest). All three regions run parallel to each other as continuous ecological belts with unique and diverse ecological zones (see Figure 2-1). Broadly, the Tarai plain occupies about 20 percent of the total area of the country and the rest is hills and mountains.

Distribution of the climate pattern in Nepal mimics physiographic regions, which are as follows:

- Tropical and sub-tropical zone (altitude below 1200 m);
- Cool, temperate zone (altitude between 1200 to 2400 m);
- Cold zone (altitude of 2400 to 3600 m);
- Sub-arctic climatic zone of altitude 3600 to 4400 m.
- Arctic zone with altitude above 4400 m.

The average annual precipitation is around 1600 mm of which almost 80 percent occurs during the period of June-September. The variation ranges from less than 300 mm in the rain shadow dry region to around 5000 mm in the wet region.

The vegetation distribution in Nepal follows the climate spectrum. The Terai and Churia ranges are covered in moist deciduous vegetation consisting of *Khair* (*Acacia catechu*), *Sal* (*Shorea robusta*), *Sisoo* (*Dalbergia sisoo*). At elevations between 1500 m and 3000m encompasses the Maharabhata ranges. The vegetation consists mostly of a Pines, Oak, Rhododendrons, Walnuts and Larch. Beyond this vegetation belt, Birch and Rhododendrons are found.

Rugged topography, young geology and monsoon climate, all combine to produce high rate of run-off, erosion and sedimentation. At times, tremendous natural forces as earthquakes, floods and landslides are unleashed. Human activities have also resulted in pressure on bio-physical resources of the country. Such natural features associated with intense monsoon rainfall as well as human interventions render the country highly vulnerable to water induced disasters such as floods, landslides, debris flow etc. demanding effective and sustainable counter measures.

Fragile geology, steep topography, high intensity rainfall and drainage congestion have made Nepal's eco-system delicate. Floods, landslides and debris flows have been a common feature and have become a matter of great concern for human security, livelihood and sustainability of infrastructure.

2.1.1 Municipal W2E

Projects to generate energy from municipal solid waste (MSW) might be the largest projects under the W2E concept. Such projects are based on possibility of combusting MSW as fuel with minimal processing; also known as *mass burn*. The MSW undergoes processing prior to combustion as refuse-derived fuel, and alternatively these can also be gasified using pyrolysis or thermal gasification techniques.

The municipal W2E project proposed currently to AEPC consists of (a) waste segregation and resource recovery component,(b) anaerobic digestion component of MSW to produce biogas and manure, (c) biogas-to-electricity conversion component, and (d) refuse derives fuels production component.

A brief overview of municipal waste situation in Nepal

Though Nepal is still a rural set up country, rate of urbanization 6.5 is one of the highest in Asia (GP, 2008). According CBS (2012)17% of the total population of Nepal i.e. 4,523,820 is living in urban areas, whereas two decades ago the percentage urban population was about half of it; 9.2 % of population were living in urban area in 1992 (Adhikari, 2000). This growth has occurred mostly because of migration of rural population.

Currently there are 58 urban centres (municipalities) in Nepal, out of which 50% are located in Hilly regions, followed by 38% in Tarai and 12% in Siwalik region. The distribution of urban centres is presented in the map.

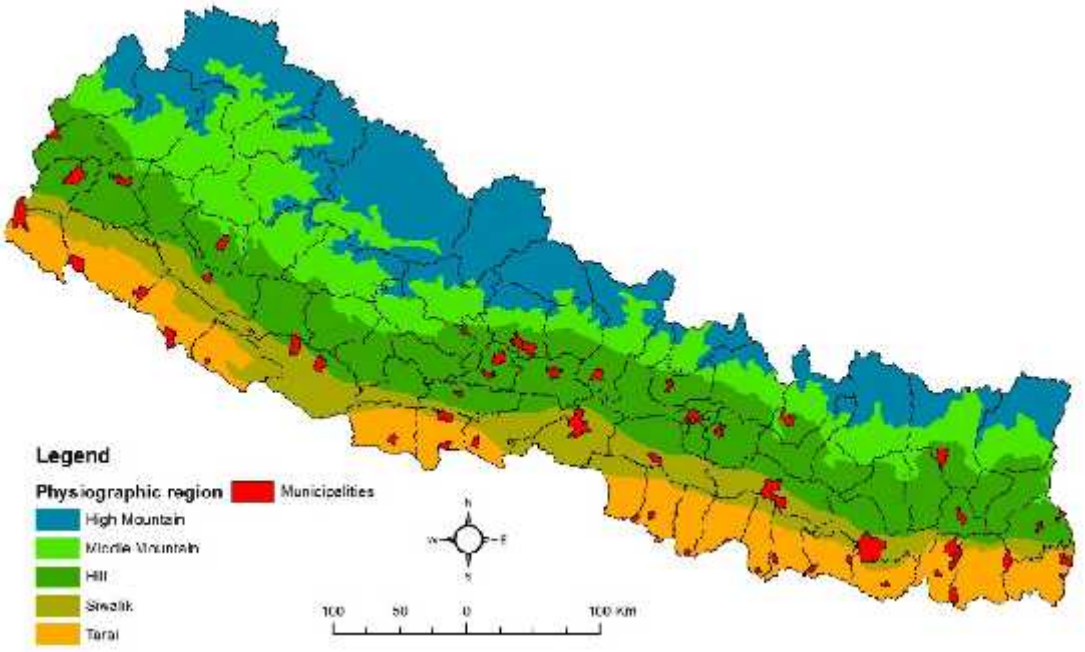

Figure 2-1: Distribution of urban centres

Solid waste management in Nepal is still a challenge; particularly situation is severe in urban centres. An ADB study (2013) emphasized on the fact that the waste management and disposal are unsanitary. Larger portion of waste still goes uncollected. At present average waste collection efficiency in the urban centres is 65% and only 6 municipalities use sanitary

landfill sites for the final disposal and 45 municipalities are still practicing open dumping in riverside and/or road sides.

The factors like consumer patterns, food habits, cultural traditions of inhabitants, lifestyles, climate and economic status etc. found to determine characteristic of the waste. The organic fraction in waste was found higher in Tarai municipalities than in the mountain and hill municipalities. Furthermore, average daily waste generated in the Tarai municipalities was also found to be highest (0.88 Kg/HH), followed by the hill municipalities and then mountain municipalities.

This ADB study considered municipal waste consisting of (a) household waste, (b) institutional waste, and (c) commercial waste[1]. The total waste generated in all 58 municipalities estimated to be 1,435 tons/day or 524,000 tons/year[2].

- The household waste composition analysis indicated that highest waste fraction was organic matter (66%), followed by plastics (12%), paper (9%), glass (3%) and others (5%).
- The institutional waste (from school, offices, and colleges) mainly consisted of paper (45%), organic waste (22%), plastics (21%) and others (8%).
- The commercial waste (from shops, hotels, and restaurants) comprises of 43% organic waste, 23% paper, 22% plastics, 4% glass and 4% others.

Pokhara and Biratnagar have shown their intent to AEPC for developing municipal W2E projects in their constituencies. A brief overview of the solid waste situation of Pokhara and Biratnagar is presented in below.

Pokhara MSW W2E

Pokhara Sub Metropolitan City (PSMC) is a growing city and one of the most popular tourist destinations in Nepal. It is located in hilly region of Nepal, and is the headquarters of Kaski District, Gandaki Zone and the Western Development Region of Nepal. Pokhara city is located in the north-western corner of the Pokhara Valley, which is a widening of the Seti Gandaki River. The Seti Gandaki River and its tributaries have created several gorges and canyons in and around the city which gives long sections of terrace features to the city and the surrounding areas. The city borders with the infamous Fewa Lake. The water flowing out the lake ultimately meets with Seti Gandaki River.

The climate of city is sub-tropical, however, the elevation keeps temperature moderate with summer temperature of 25 to 35^{o}C and -2 – 15^{o}C in winter. Pokhara receives a high amount of precipitation i.e. 5600 mm/year.

According to (CBS, 2012)the total population of PSMC is 255,465 (men - 126,238 and women - 129,227) with a total households of 66,236. The average household size is 4.40. It has a total area of 55.22 km² with build-up area covering 28.44 km² and population density of 4,799 person per km².

[1] This study does not include waste from streets, parks and garden, and the waste brought from the surrounding VDCs as municipal waste.
[2] This study does not provide fraction of HH waste, commercial and institutional waste within the total municipal solid waste.

Picture 2-1: Sanitary landfill site of Pokhara Municipality

Waste collection in Pokhara is carried out largely by PSMC. It collected 42 tons of waste on a daily basis out of 50 tons generated. It also engages a private contractor - Pokhara Waste Management Services Pvt Ltd (PWMS) for collection remaining 8 tons of waste. The contract between PWMS and PSMC is based on a 60 – 40 percent revenue sharing. PWMS relies on waste collection fees, and sale of the compost and recyclables (plastics, metals, paper).

Biratnagar Sub Metropolitan City (BSMC)

Biratnagar Sub Metropolitan City (BSMC) is also a growing city of Nepal, located in Tarai region. It is the headquarter of Morang District and is also a major industrial, commercial as well as agricultural hub of the Eastern Nepal. The climate of city is tropical with average annual temperature of 30^{o}C. Biratnagar receives a high amount of precipitation during the monsoon season. The average yearly precipitation for the region is 1,891.8 mm/year.

The total population of BSMC is 201,125 (101,994 men and 99,176 women) (CBS, 2012). The total number of households of BSMC is 45132 with an average household size of 4.8. It has a total area of 58.48 km² with a built-up area of 10.84 km² and population density of 3,505 persons per km².

At present, Health and Peace for Environment (HPE) - a private company, is managing entire solid waste of BSMC from collection to disposal based on resource and fees sharing mechanism. BSMC produces a total of 50tons of MSW on a daily basis. They also operate two small informal transfer stations and a compost facility. The contract with BSMC allows, HPE to collect service charges from households, industries and commercial areas, out of which 10% goes to the Municipality fund and another 25% goes to Tole Lane Organizations, a judging body composed of local people.

At present, despite of this arrangement, MSW is still a serious threat to city's health and sanitation condition due to inadequacy of the management. Particularly slum and squatter areas with low capacity to pay are often ignored. Furthermore, in absence of proper landfill site, waste are disposed in open area close to poor urban settlements(ADB, 2013).

Municipal solid waste generation and collection efficiency in Pokhara and Biratnagar Municipalities is presented in the table below:

Table 2-1: Solid waste management at Pokhara and Biratnagar

Details MSW Generation	**Municipalities**	
	Pokhara	**Biratnagar**
Average HH Waste (Kg/day)	0.97	0.68
Average HH Size(number of members)	4.40	4.80

Details MSW Generation	Municipalities	
	Pokhara	Biratnagar
Average Per Capita HH Waste(g/capita/day)	220.97	142.39
Total Waste(tons/day)	58.55	29.18
Total Commercial Waste (tons/day)	27.29	25.48
Total Institutional Waste (tones/day)	4.00	3.70
Average Per Capita MSW (g/capita/day)	441.94	284.78
Total MSW Generation (tons/day)	117.11	58.37
Estimated Waste Collection (tons/day)	50.00	50.00
Collection Efficiency (%)	42.70	85.70

Source:(ADB, 2013)

2.1.2 Commercial and Institutional W2E

The projects categorized under commercial and institutional W2E are medium to large scale biogas plant to generate energy. The end form of energy might have different form e.g. gas, heat and electricity. Different commercial and institution bodies have shown interest during the Energy Bazar 2013, which consists of poultry, commercial cow farm, prison etc.

Poultry Farm

Poultry farm is one of few successful commercial agricultural enterprises in Nepal. It started in late 1960s with establishment of poultry farms in and around urban areas of Kathmandu and Chitwan. Currently a significant private sector investments have gone into poultry meat production (PACT, 2008).

The application of W2E has high relevancy in poultry industries. It can solves two of their major problems (a) insufficient supply of energy from the national grid and (b) management of faeces. On one hand, poultry farms are undergoing energy deficiency due to on-going load shedding. Poultry farm is an energy intensive industry, and thus in order to meet their energy demand they are forced to install diesel generators. On the other hand, waste management has been a major headache in the poultry farms, which creates smell, disease and health risks, and affluent that runs off to the water bodies (Kaphle, 2013). During the discussion with the stakeholders, it was learnt that the waste management challenge does not lie on the final disposal as the faeces have good demand as manure from local farmers. However, the demand arises only at beginning of cultivation season. The poultry farms therefore have to store faeces, and all of the environmental and social issues related to poultry waste are associated with the storage of the faeces.

Picture 2-2: Poultry feces collection and storage chamber

The faeces have high potential of generating energy. As mentioned by (Singh, Karki, & Shrestha, 2008), with the country's poultry population of 28.6 million and availability of 1,575.6 million Kg/year, the biogas yield of 11.6 million m^3/year can be expected which can generate 648 GWh/year of thermal energy

and 550 GWh/year electricity. However, according to AEPC, commercial W2E can only be successful in poultry with minimum of 500 bird population

The primary component of this project is anaerobic digester, which produces gas consisting mainly of methane. Other components – moisture, hydrogen sulphide, carbon dioxide and other impurities are also present. Separation of moistures and other impurities particularly sulphide gases, make the biogas suitable for internal combustion. The pure biogas and/or biogas with high methane content has high calorific value, and have wide range of applications e.g. running an oil engine, driving a motor car Engine, and operating a gas electricity turbine(AEPC, 2012).

Commercial Dairy Farm

Similar to the poultry farms, commercial dairy farms (cow) also have high relevancy for application of W2E. The potential of energy recovery from the cow farm with larger amount of substrate (dung and urine) is high. The small scale household biogas have long history in Nepal. This intervention can be taken as up-scaling of household biogas. The higher capacity of biogas plants can be installed with thus produced larger amount of dung.

Lumbini Agro Products and Research Centre, Rupandehi was established about 5 years ago in 2008 in Tikuligadh VDC, Rupandehi. Currently, the farm is spread over 32 Bigha (216,717 m^2). During the discussion with the farm official, the farm currently has a total population of 269 cows, and about 3,374 Kg of dung and 2,638 litre of urine are produced daily. All of the wastes from the farm are disposed into open ponds built within the premise of the farm.

Picture 2-3: Waste disposal pond at Lumbini Agro Products and Research Centre

Considering amount of the farm waste, a biogas plant of 270 m^3 capacity can be installed. This biogas can be used to produce 386 KWh electricity. The electricity generated from the plant can easily meet farms own energy demand (AEPC, 2012).

2.1.3 Biomass (Forestry & Agricultural) to W2E

This category of W2E considers recovery of energy from biomass wastes of agricultural and forestry activities. These biomass mainly consists of ground level litters in forest and agricultural residues. These biomass usually have no use or have insignificant use thus have no economic and social value.

In Nepal, government, non-government and donor agencies have been supporting small-scale briquette projects. Despite of demand and production potential, enterprise around it is yet to be established due to lack of reliable value chain. The W2E initiative intends is to contribute to low-emission, climate-resilient development through a well-established green, fair and

integrated bio-briquette value chain. This includes scaling-up of promising model of sustainable production and consumption of biomass-based energy products. The model is designed to contribute addressing growing energy crisis while promoting pro-poor economic growth and sustainable management of community forests producing energy from forest and agricultural waste.

Dolakha district has been considered for piloting biomass W2E project. Currently charcoal making and charring are on-going in Dolakha, which is estimated to be 7,623 kg/ha/year, using fuel wood and non-timber woody biomass extracted during harvesting, thinning, pruning and cleaning (MinEnergy, 2013). Besides, Dolakha also has possibility of using woody wastes from forest-based enterprises sawmills and plywood/veneer. Currently, there are 40 furniture enterprises, 30 sawmill, 5 veneer enterprises and a plywood industry in Dolakha. *Dibya Ply Udhyog* alone produces 3 tons of waste per day that includes sawdust, *jabara* (small pieces of veneer that cannot be used for plywood making), wood chips and small pieces of wood. One-third of these materials are currently used as fuel in ply processing and rest are left unused as waste. Of all those wastes, wood chips and small pieces of wood can be used for briquettes and charcoal making, whereas sawdust and *jabara* can also be used after their densification(MinEnergy, 2013).

Picture 2-4: Storage of tree and forest litter for charring

3 INSTITUTIONAL ARRANGEMENT FOR IMPLEMENTATION OF ESMF

3.1 Implementation Arrangement of W2P

The responsibility for implementation of W2E project lies with the Alternative Energy Promotion Centre (AEPC) under the Ministry of Science, Technology and Environment, Government of Nepal. The AEPC is geared to launch the SREP Waste to Energy Market Development competition through the "call for proposals" from potential firms and other entities, which might consist of non-government organizations (NGOs) and any public private ventures.

3.1.1 Biogas Sub-Component (BSC)

In order to manage the day-to-day implementation (including technical and fiduciary responsibilities) of the project, the Biogas Sub Component (BSC) of AEPC will bear the responsibilities of overall supervision, monitoring and evaluation of the activities and coordination between various sub-components of the project and work as bridge between MoSTE, AEPC and other implementing agencies—perspective developers which include--commercial firm, private companies, an NGO, a consortium of local bodies and private companies and NGO/CBO. The biogas subcomponent will also be responsible for regular reporting of the progress to the MoSTE, National Planning Commission and the other related agencies. Besides, the biogas subcomponent shall carry on coordination and reporting functions with the World Bank and other donors.

3.1.2 Implementation and Monitoring of EMF

The Biogas Sub Component (BSC) will also be responsible for implementation and monitoring of EMF. An **Environmental Focal Point (EFP),** possibility an environmental specialist, is envisioned to be embedded in the AEPC/BSC to ensure undertaking of environmental interventions. It would have two primary mandates (a) to carry out the environmental interventions in accordance with the World Bank and the GON environmental rules and regulations, and (b) to build the capacity of the AEPC/BSC, and participating stakeholders of the W2E projects.

The **environmental and energy officer** at the District Development Committee (DDC) will have to coordinate with/report to EFP/BSC to carry out regular and as need environmental monitoring of the W2E projects.

3.1.3 Public Consultation and Disclosure

Public consultations are critical in preparing effective and sustainable W2E projects. This requirement supports the participatory planning process as required by the GON and the WB. It also applies to local level governments when W2E projects covering local areas are being identified. The W2E projects, being a participatory project, it is important that beneficiaries are involved in the project cycle, from the design to implementation and monitoring. The same applies to relevant stakeholders including: the municipality where the sub-project is proposed.

The first step in this process, for the W2E project proponents is to hold public consultations with the local communities and all other interested/affected parties during the screening process and where needed, when preparing an EIA/IEE/EMP. These consultations shall identify key issues and determine how the concerns of all parties will be addressed (again by the W2E proponent).

To facilitate meaningful consultations, the local governments shall be provided with all the relevant material and information in a timely manner, and in a form and language that are understandable. Also, location of the relevant documents should be advertised through commonly used media. Depending on the public interest in the potential impacts of the sub projects, a public hearing may be required to better convey concerns especially in case of EIA.

Once the project has been reviewed and cleared by the relevant local community, including the VDC/municipality, EFP/Field will inform the public about the results of the review. It is important to note that any affected or interested individual or group has the right of appeal, if dissatisfied with the decision reached at any stage in the Environmental Assessment process. The appeals process will be according to the GON's and the WB's Environment Act and provisions respectively. The Contractor should seek guidance from the EFP/Field, if needed.

4 ENVIRONMENTAL SCREENING

The environmental screening has to be carried out for W2E projects to be funded under SREP as a part of their selection for implementation. The purpose of the screening process is to:

- determine whether future sub-projects are likely to have potential negative environmental and social impacts;
- to establish the level of environmental assessment required,
- to help the project offices understand environmental issues related to the project before they are considered for implementation, and
- to assist in the decision making process

4.1 Environmental Screening of W2E projects

The environmental screening will be done together with technical, economic and social screening. Screening will be done on the basis of criteria mentioned in Schedule 1 and 2 of EPR97, (ii) other government acts and regulations (Forest, National Park and Wildlife Conservation, etc.) and (iii) potential impacts and risks as per World Bank Operational Policies (OPs). The environmental screening checklist is provided in Annex 1.

Each sub-project within SREP shall go through environmental screening in order to identify likely environmental impacts and suggest need for undertaking additional environmental assessment. Three categories (A, B and C) are proposed for further environmental assessment prior to sub-project implementation.

4.2 Assigning Appropriate Environmental Category

Based on the screening results, the EFP/Filed, with oversight (and input, if needed from the EFP/HQ and/or its representative) will be responsible for assigning the appropriate environmental category to the proposed W2E projects. Such assignments must be in accordance with the requirements of (a) schedule 1 and 2 of EPR97 including its location and scale criteria and (b) OP 4.01. The W2E projects need to be filtered through the following Environmental Categories to assure proper categorization.

The following are some of the relevant projects listed in schedule 1 and 2 that might be formulated within this program.

WB OP 4.01 Category A/EPR97 Schedule 2: A proposed project is classified as Category A if it is likely to have potentially significantly adverse environmental impacts. These impacts may affect an area broader than the sites or facilities subject to physical works. An EIA level study shall be required for Category A project. Furthermore, EPR schedule 2 lists the projects that require undertaking of EIA study, and thus falls in category A, and some of the listed W2E projects are:

- Collection of forest related products more than 50 tons/year
- Clearing of any forest with the area greater than 5 ha
- Sub project with the capacity of generating electricity greater (powered by gas) than 5 MW
- Selecting, picking, disposing, and recycling waste through chemical, mechanical or biological techniques in an area more than 10 Ha

- Activities relating to compost plants in an area ranging more than 10 Ha
- Fall under threshold environmental criteria for sub projects on the basis of EPR 1997 Schedule 2

WB OP 4.01 Category B/ EPR Schedule 1: EPR schedule 2 lists the possible projects that require application of EIA. Some of the potential W2E projects are mentioned in schedule 2 are:

- Clearing of any forest with the area less than 5 ha
- Collection of 5 to 50 tons of forest product other than timber per year
- Selecting, picking, disposing, and recycling waste through chemical, mechanical or biological techniques in an area up to 5 to 10 Ha
- Activities relating to compost plants in an area ranging between 5 and 10 Ha
- Sub project with the capacity of generating electricity greater (powered by gas) from 1 MW to 5 MW Supply of electricity through installation of transmission lines
- Fall under threshold environmental criteria for sub projects on the basis of EPR 1997 Schedule 1

Furthermore, the environmental screening will also indicate potential adverse environmental impacts of the project. If those potential impacts are anticipated to be less adverse than those of Category A, the project will be in Category B as per the definition of OP 4.01. Usually the impacts are assessed to be less significant as these are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed and implemented more readily than for Category A projects. These projects are subjected to limited EIA with narrower scope than that of category A project. EPR97 has specified these projects as Initial Environmental Examination (IEE).

In the case that the anticipated impacts of the project are considered significant, yet, EPR97 lists it in schedule 1 requiring IEE, the project shall be subjected to the EIA study.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further environmental action is required for a Category C project. Such projects qualify for what is popularly called, Categorical Exclusion (CATEX or CE). Since minimal environmental impacts can still be expected from such projects, it is recommended that a brief environmental management plan shall be prepared (ANNEX 7)

The formats for EIA and IEE studies shall be carried out in accordance with the procedure provided in EPA97 and EPR97. The format of the IEE and EIA studies are proposed in EPR97 as schedule 5 and 6 respectively (ANNEX 6). The scope of EIA for a Category B project may vary from project to project, but it is narrower than that of Category A. Like Category A, it 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.

The EIA examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives, including a no-action i.e. *no-project,* alternative and also incorporates public consultations as per the GON's requirements. The EIA will recommend needed measures to prevent, minimize, mitigate or compensate for adverse impacts and help improve environmental performance.

4.3 Screening Procedure

The primary responsibility of undertaking environmental screening of the proposed W2E project is the proponent. It is envisaged that the proponent prepares environmental screening report based on the format proposed in 0 along with the project proposal. The EFP at AEPC has the responsibility to review the screening report, and recommend if the project require EIA or IEE or EMP based EPR97 and WB's OP 4.01. Furthermore, the EFP can also carry out independent verification and/or preparation of screening report if the need arises.

4.4 Relevant Policy and Legislation of Government of Nepal

A policy review revealed that the following policies and legislation are relevant for the SREP program:

i. **Environment** – Environment Protection Act 1997 and Environment Protection Regulations 1997
ii. **Solid Waste Management** – Solid Waste Management Act 2011 and Solid Waste Management National Policy 1996
iii. **Energy** – Renewable Energy Subsidy Policy 2013
iv. **Forest product use**–Forest Act 1993 and Forest Regulations 1995

Table 4-1: Applicable environmental policies, acts, and regulations

Act/Regulation	Key Requirement	Applicability
Environmental Protection Act, 1997	Any development project, before implementation, to pass through environmental assessment, which may be either IEE or an EIA depending upon the location, type and size of the project.	Depending on the location, type and size, a W2E project may require an IEE or an EIA
Environmental Protection Rule, 2054 BS (1997; Amendment, 1999)	Obliges the proponent to inform the public on the contents of the proposal in order to ensure the participation of stakeholders.	This would apply to individual sub-project as well as the over-all operation.
Forest Act1993	Section 68 of the Forest Act, 1993 empowers the Government in case of no alternatives, to use the Forest Area for the implementation of the project if it is considered as a national priority by the Government.	if a sub-project is proposed on forest land.
	If there are no significant adverse effects on the environment while conducting such a plan, the Government may give assent to use any part of the Government Managed Forest, Community Forest, Leasehold Forest or Religious Forest for the implementation of such a plan or project.	if a sub-project is proposed on forest land.

Act/Regulation	Key Requirement	Applicability
	According to the clause 32 (4), the users' group of community forestry are allowed to run industry based on forest products according to the work plan, however, the industrial activities shall be carried outside of the forest after obtaining the approval of concerned agency on the recommendation of the District Forest Officer.	if a sub-project is proposed on forest land.
Solid Waste Management and Resource Mobilization Act 1987 (with amendment in 1992)	The Act describes the procedures for disposing solid waste. It categorizes harmful hazardous wastes and provides information on several controlling measure. There is provision to appoint inspection officer for checking and monitoring solid waste control and management. The inspector has authority to take action against the polluter or polluting agency. Disposal of battery and electronic goods can be carried out on the basis this act but it does not provide specific guidelines for the disposal of such wastes. Auctions are the procedure usually followed to dispose such wastes. Proposed amendment of 2011 for this act is under the process of endorsement.	Depends on type of waste generated during construction and operation of facilities supported by the project.
The Labor Act, 2048 BS (1992)	Regulates the working environment and deals with occupational health and safety aspects.	Yes.
Local Self Governance Act, 2055 BS (1999)	Empowers the local bodies for conservation of soil, forest and other natural resources. Sections 28 and 43 of the Act provide the Village Development Committee (VDC) a legal mandate to formulate and implement programs related to protection/conservation of environment during the formulation and implementation of a district level plan.	Yes.
Local Self Governance Act, 2055 BS (1999)	The Act provides more autonomy to District Development Committees (DDC), Municipalities and Village Development Committees. Empowers the local bodies for the conservation of soil, forest and other natural resources and implements environmental conservation activities. Sections 28 and 43 of the Act provide the Village Development Committee (VDC) a legal mandate to formulate and implement programmes related to protection of environment during the formulation and implementation of a district level plan.	Yes

4.4.1 Environment

The existing environmental legislations – Environment Protection Act 1997 and Environment Protection Regulations 1997 cover two aspects that are relevant to this program.

Provision of EIA/ IEE

- Section 3, EPA97 has explicitly mentioned the need of undertaking EIA or IEE for the prescribed projects.
- Section 4, EPA97 prohibits implementation of the project without taking approval of the concerned body or ministry.
- Section 5, EPA97 has made it obligatory that the proponent has to submit IEE or EIA report of the proposed project to the concerned body (ministry related to the proposal) or MOSTE.
- Section 6, EPA97 authorizes the concerned body to approve the IEE report after its examination and if it is satisfied that the project will not bring significant adverse environmental impact. Furthermore, if concerned body finds significant impacts from the project, it can also order the proponent to undertake EIA study. In case of the EIA, the concerned body has to send the EIA report and its associated reports along with its comment to MOSTE for approval.
- EPR97 has provided lists of projects in its schedule 1 requiring IEE study, and those requiring EIA study in its schedule 2.
- EPR97 also stipulates that the project are also screened based on their location in environmentally sensitive area and financial threshold. Those projects located in protected area, historically, culturally and archeologically and environmental critical area requires to under EIA process. Furthermore, the project with the financial capacity above NRs 250 million will also have to go through EIA procedure.

The project/schemes formulated within the SREP for implementation have to consider the provision of EIA/IEE. The first step for integration will be screening based on project type, size, location and cost. Stipulated in the regulation to determine the level of environmental required.

Pollution- Similarly EPR97 also describes to control the pollution and made provision against the violations of the rules given below:

- Complaint against the pollution: In cases where any individual, institution or industry does not control pollution or emits waste in contravention of the conditions or standards prescribed under the Acts or these Rules, the individual, institution or VDC of Municipality affected by such action may lodge a complaint with the concern body.
- Notice to be issued to control pollution: In cases where the concern body finds in the course of an investigation conducted on its own of following a complaint lodged under Rule 17 that any individual, institution or industry has not controlled pollution or has emitted waste in contravention of the conditions or standards prescribed under the Act and these Rules, it shall immediately issue a notice to the concerned individual, institution or industry to control pollution or not to emit waste according to the prescribed conditions or standards.
- While issuing a notice to the concerned individual, institution or industry under sub-rule (1) the concerned body may order to take all or any of the following actions immediately by prescribing a time limit on behalf of: (a) measures to be adopted immediately for controlling or reducing pollution or not generating waste.**,** (b) to use,

operate or improve any device or equipment.(c) To adopt various alternative measures for controlling pollution and avoiding emission of waste.

4.4.2 Solid Waste Management

The National Policy on SWM was formulated in 1996 to address the emerging SWM problems. Its main objectives were to (a) make SWM simple and effective, (b) minimize the impact of solid waste on the environment and public health, (c) **treat solid waste as a resource**, (d) include private sector participation, and (e) improve public participation by increasing public awareness about sanitation.

This act addresses W2E technology and clearly emphasized the responsibility of local body such as:

- **Section 3, SWM Act 2011**mentioned that the responsibility to manage Solid Waste rests with the local body. This clause is mentioned in the sub-section (1) – "the responsibility to construct and operate the infrastructure or structure required for the collection, final disposal and processing of solid waste, including construction of any transfer station, landfill site, processing plant, compost plant, and bio gas plant for the management of solid waste shall rest with the Local Body".
- Similarly **the Section 6, SWM Act 2011** highlights segregation of solid waste in subsection (1) & (2) that encourages the W2E technology properly and clarifies the role of local body as: (a) the local body prescribes segregation of solid waste at source by dividing the solid waste into different categories including at **least organic and inorganic**, (b) the responsibility to segregate solid waste at source as prescribed by the local body pursuant to the sub-section (1) and carrying them into the collection center shall rest with the person, institution or entity who produces the solid waste, and for this purpose the Local Body *may provide necessary technology, goods, equipment, containers, etc. to them*.
- **The section 10, SWM Act 2011**explicitly mentions about the promotion and coordination part of the local body regarding Solid Waste Management which directly indicates the W2E technology as: (1) The Local Body shall take necessary steps **for the promotion of reduction, reuse and recycling of solid waste** and may frame and **enforce necessary directives for effective implementation thereof, and (2)** the Local Body may ***coordinate with the concerned industry to promote activities for the reduction of solid waste produced by encouraging the reuse of materials during production and packaging by such industry.***
- **In the Section 13** there is a provision of License regarding the involvement of Private Sector of Community in Solid Waste Management. It is clearly mentioned that nobody should do or work on solid waste management without getting license from concerning Local Body. ***In clause 14 there is a provision to involve Private Sector and in Section 17 mentioned about the public private partnership approach.***
- **In Chapter 7 clause 23**, there is a provision of **Solid Waste Management Council** to determine the policy to adopt Solid Waste Management (SWM). So it is high level council which functions, duties and power are mentioned in the **clause 24**. This council can formulate the national level policy on SWM and submit to GON for approval.

4.4.3 Renewable Energy

RE Subsidy Policy 2013is very new and covered all current issues related with renewable energy particularly justification of subsidy grants. In this policy under large biogas topic it is mentioned as follows:

> Waste-to-energy is the energy production in the form of electricity or heat from the waste source. The current concept envisions utilizing waste produced in large scale, such as the municipal wastes for energy production through biogas. The concept of Waste to Energy tries to address both the issues of waste management and energy recovery. The subsidy in case of waste to energy plants has been calculated on the basis of the capacity of the installed plant to handle waste in tons of waste per day.

There is a provision of subsidy which is categorized in 4 different segments that is a main attraction and encouragement parts of W2E sector.

4.4.4 Forest Product Use

The schemes of the program need to comply with the provisions of Forest Act 1993 and Forest Regulations 1995 when it requires to use forestland for its project and/or to use forest products.Clause 68 (1) of the Forest Act 1993 states that government may permit use of any part of government-managed forest, leasehold forest or community forest, if there is no alternative for the implementation of a plan or project of national priority without significantly affecting the environment.

According to the clause 68 (2), if any loss to persons or community is involved while permitting use of such land, it is required to compensate the loss.

The Forest Act also discusses on the use of forest products. According to the clause 32 (4), the users' group of community forestry are allowed to run industry based on forest products according to the work plan, however, the industrial activities shall be carried outside of the forest after obtaining the approval of concerned agency on the recommendation of the District Forest Officer.

4.5 World Bank Environmental Safeguard Policies

4.5.1 Environmental Assessment (EA) OP 4.01

An EA is 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.

4.5.2 Natural Habitats (OP 4.04)

The Natural Habitats Policy is triggered by any project (including any subproject under a sector investment or financial intermediary loan) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project). The policy has separate

requirements for critical (either legally or proposed to be protected or high ecological value) and non-critical natural habitats. The Bank's interpretation of "significant conversion or degradation" is on a case-by-case basis for each project, based on the information obtained through the EA.

4.5.3 Forestry (OP 4.36)

This policy is triggered by forest sector activities and other Bank sponsored interventions, which have the potential to impact significantly upon forested areas. The Bank does not finance commercial logging operations but aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty and encourage economic development.

4.5.4 Physical Cultural Resources (OP 4.11)

The Bank seeks to assist countries to manage their physical cultural resources and to avoid or mitigate adverse impact of development projects on these resources. This policy is triggered for any project that requires an EA.

5 ENVIRONMENTAL IMPACTS/ RISKS ASSESSMENT

The W2E projects are environmentally beneficial projects, primarily because these projects reduce the amount of waste that have to be disposed. Nepal's experiences with waste disposal had been troublesome. Out of 51 municipalities, 45 municipalities are practicing open dumping in riverside and roadsides and only 6 municipalities use sanitary landfill sites for final disposal (ADB, 2013). Furthermore, operation of sanitary landfill sites also has been a challenge, and is facing frequent local protest, lack proper management, and unavailability of necessary equipment, leading to unsanitary methods of disposal. The W2E is an innovative approach of recovering energy from the waste as well as managing it.

Some of environmental benefits of municipal W2E projects are elaborated below:

Recovery of greenhouse gas (GHG), which would have otherwise been emitted to the atmosphere: The methane gas produced from the MSW disposed in open area or in sanitary landfill sites cannot be directly collected for use. However, the anaerobic digester, installed as a part of the municipal W2E, is designed to generate and capture methane, and use it for energy production.

Recovery of recyclable and reusable materials such as metal, rubbers, leathers etc. from MSW which would otherwise be disposed to the landfill sites. Such practices can be found in almost all of the municipal landfill sites of Nepal.

Reduction in volume of waste to be disposed in landfills will extend life of the landfill facilities and/or reduce the size of landfill sites. This means necessity for land acquisition and related possible environmental and social issue associated with it like loss of property, change in land use, loss of vegetation and disturbance to wildlife, loss of agriculture and livelihood etc. will be minimized.

Adverse environmental impacts/risks associated with the W2E project will still exist. The following are such adverse impacts resulted from the W2E projects raised during local and district level stakeholder consultations (ANNEX 4):

Sanitation, Occupational Safety and Health Risks and Impacts

The W2E projects will have to handle a large amount of waste. The health risks and impact from handling of waste are expected in these projects can affect workers as well as nearby communities. The primary risks to the health are:

- The storage and processing of waste can promote growth of disease vectors such as flies, mosquitoes, rodents etc., which might spread disease to communities living in the surrounding area. Furthermore, vehicles transporting wastes are usually improperly covered. As a result, wastes fall off the trucks during transport which can create a sanitary threat to communities living along the route.
- Occupational health and safety are not considered seriously in Nepal. Usually, the waste workers belong to poor or marginal communities (Pandey, 2005), and either they show leniency toward their safety or their health concerns are inadequately addressed by the management. During the field visit, the waste workers were found handling waste without using proper protective measures.

- The poultry farms have the risk of avian influenza outbreak which is popularly known as "bird flu". In Nepal, the first case of avian influenza was detected on January 16, 2009 in a small non-commercial poultry farm in Kakarvitta, Jhapa. Since then it has occurred at many places in the country (Manandhar, Chataut, Khanal, Shrestha, & Shrestha, 2013). The outbreak of avian influenza can significantly affect the workers as well as can spread to the communities as well. Poultry wastes also contain such viruses during outbreaks and can lead to serious impact to workforce handling slurry as well as wastes. The Government of Nepal formed an inter-sector task force and prepared and endorsed a National Avian Influenza and Influenza Pandemic Preparedness and Response Plan in early 2006, with assistance from the Food and Agriculture Organization (FAO) and the World Health Organization (WHO). The plan provided a strategic framework for response, with pillars on planning and coordination, surveillance and laboratory strengthening, prevention and containment, health systems response, and risk communication. An operational version of the plan for 2007-11 was published and endorsed in December 2006, outlining major actions that needed to be taken and assigning responsibilities, primarily to the Ministry of Health and Population and the Ministry of Agriculture and Cooperatives (WB, 2013).
- Similarly, undigested slurry (manure) may contain disease causing pathogens. While handling such undigested slurry for application in agricultural field may affect health condition of the workers/handlers.

Foul Odour

Foul odour from the W2E can cause impact on the population living around the facilities. Decomposition of organic matter in municipal solid waste, faeces and manure create most offensive odours. The hotspots for generation of foul odour are mostly the waste storage area. During the consultation with stakeholders, the neighbours of poultry farms have made complaints of foul odour. According to (MOAF, 2003), tolerance to foul odour depends on four factors – frequency, duration, offensiveness and sensitivity. Neighbours may tolerate frequent or intense odours that are of short duration and do not linger in air, whereas offensiveness and sensitivity to odour varies from person to person. Some people who are more sensitive to odour, simply smelling a small amount of odour can cause headaches and nausea. Sensitive populations include young children, pregnant women, elderly and people with chronic health problems like asthma, emphysema and other respiratory diseases, etc.

Water Body Contamination

The dairy farms are currently disposing waste (urine and dung) into open pits. Such open disposals practice can lead to (a) creation of breeding sites for mosquitoes, flies and other pest that can spread disease to nearby communities, (b) contamination of the water bodies and ground water with the leachate leading to algal growth, deplete oxygen in water, and eutrophication of stagnant water bodies. Leachate from municipal waste is considered most hazardous in comparison to other sources because of mixing of hazardous waste.

Spillage of leachate from the waste storage facilities can enter nearby water bodies as well as seep into ground water contaminating these water bodies. The leachate usually consists of disease causing germs and vectors that can threaten sanitary condition. Furthermore, the leachate high organic load can increase BOD affecting aquatic life.

Air Pollution

The air pollution from biogas plants are insignificant, in fact the net GHG emission is much lower than if waste were not treated in biogas chamber. This is primarily that methane are captured and used for energy production. Methane is an efficient fuel for burning, and thus carbon dioxide is produced as a result of complete combustion.

- Among line sources of pollution there is transport of waste to the W2E facilities as well as transport of fertilizer (byproduct). The vehicular emissions as well as release of dust from the earthen road can impart local air quality. The significance of this impact has to be determined for each W2E projects.
- The combustion and pyrolysis will also result in emission of GHG to the atmosphere.
- The charring and charcoal making process requires involves slow burning of the biomass. These processes are likely to produce carbon monoxide as a result of incomplete combustion. The carbon monoxide is considered as GHG and is also toxic to human health

Impact on Ecosystem and Agriculture

The area required by the facilities depends on the capacity of the scheme, and thus the large scale projects like MSW W2E will envisage significant land use change and thereby can affect ecosystem and agriculture in greater magnitude. However, type of land and its environmental importance needs to be considered while determining significance. Following are the impacts/risks associated with the project intervention:

- If the facilities will be located in a forest area, then a number of impacts can be anticipated such as loss of vegetation, disturbance to wildlife, and threats to protected vegetation and wildlife species.
- If the facilities will be located in cultivated land that will result in loss of agricultural productivity and food security of the families depended on that land.

Commercialization of charring and briquette production requires consistent supply of input These can increase pressure on the forest for the biomass, and thus, the biomass might be over-extracted and/or other valuable species might be extracted in the process.

Legal issues – the forest legislation does not allow commercial activities to be carried out within the forest, and has to be carried out 3 Km outside of the boundary. Currently charring is carried out inside the forest, which are in conflict with the existing legislation. The projects need to comply with the provisions of Forest Act 1993 and Forest Regulations 1995 which require government to permit use of any part of government-managed forest, leasehold forest or community forest, if there is no alternative for the implementation of a plan or project of national priority without significantly affecting the environment.

Table 5-1: Environmental risks of Municipal W2E

Municipal W2E interventions	**Environmental risks/impacts**
Transportation of Solid waste to site	**Air pollution**- Number of vehicle transporting waste will depend on size of waste generated and capacity of W2E scheme. Air pollution from vehicular emission can be expected. Furthermore, dust from earthen road

	is expected to disperse, particularly in dry area and during the dry season. **Health issue**- Trucks transporting waste to landfill sites are usually improperly covered. As a result, waste can fall off the trucks, which can create a sanitary threat to communities living along hauling route.
Pilling Segregation of solid waste Anaerobic digestion Electricity generation	**Ecosystem change** – the area of facilities required will depend on the capacity of the scheme, and thus significance will land use change as an impact will depend on this. However, type of land use and its environmental importance needs to be considered to determine its significance. Conversion of forest land into project component area may cause loss of vegetation, disturbance to wildlife, and threats to protected vegetation and wildlife species. **Loss of agriculture** - Conversion of cultivated land into project component area will result in loss of agricultural productivity and food security of the families depended on that land. **Water body contamination** – It is important to identify water bodies and more importantly source of drinking water around the proposed site. The leachate might contaminate water bodies deteriorating sanitary conditions and increasing the health risk of local residents. **Spread of disease vector** – Disease vectors such as flies, mosquitoes, rodents etc. can increase due to availability of solid wastes during storage, which could spread to the residents living in surrounding area. **GHG emission** – decomposition of solid waste with limited or no oxygen during storage will continue producing GHG, particularly methane. **Foul odour** – the decomposition will also create foul odour that could be nuisance to local residents **Occupational health risks –** Due to negligence or lack of use of personal protective equipment, occupational health might seriously be affected. **Noise Pollution:** Increased noise level from generators during electricity generation

Table 5-2: Environmental risks/impact of commercial W2E

Commercial W2E Project	**Environmental risks/impacts**
Storage of waste	**Water body contamination** – It is important to identify water bodies and more importantly source of drinking water around the proposed site. The leachate might contaminate water bodies deteriorating sanitary conditions and increasing the health risk of local residents. **Spread of disease vector** – Disease vectors such as flies, mosquitoes, rodents etc. can increase due to availability of solid wastes during storage, which could spread to the residents living in surrounding area. **Foul odour** – the decomposition will also create foul odour that could be nuisance to local residents **Occupational health risks –** Due to negligence or lack of use of personal protective equipment, occupational health might seriously be affected.
Anaerobic digestion Electricity generation	**Land use change** – the area of facilities required will depend on the capacity of the scheme, and thus significance will land use change as an impact will depend on this. However, type of land use and its environmental importance needs to be considered to determine its

	significance. • Conversion of forest land into project structures will cause loss of vegetation, disturbance to wildlife, and threats to protected vegetation and wildlife species. • Conversion of cultivated land into project structures will result in loss of agricultural productivity and food security of the families depended on that land. **Noise Pollution:** Increased noise level from generators during electricity generation

Table 5-3: Environmental risks/impact of institutional W2E

Institutional W2E interventions	**Environmental risks/impacts**
Anaerobic digestion Electricity generation	**Water body contamination** – It is important to identify water bodies and more importantly source of drinking water around the proposed site. The leachate might contaminate water bodies deteriorating sanitary conditions and increasing the health risk of local residents. **Spread of disease vector** – Disease vectors such as flies, mosquitoes, rodents etc. can increase due to availability of solid wastes during storage, which could spread to the residents living in surrounding area. **Foul odour** – the decomposition will also create foul odour that could be nuisance to local residents **Occupational health risks –** Due to negligence or lack of use of personal protective equipment, occupational health might seriously be affected.

Table 5-4: Environmental risks/impact of biomass W2E

Forest biomass W2E interventions	**Environmental risks/impacts**
Collection of litter and agricultural residues	**Definition of forest waste -** First challenge associated with the collection of biomass is to define forest waste. Depending on location, accessibility, and use, forest use can vary. A blanket definition of forest waste can lead to extraction of valuable forest product for charring. **Over extraction of forest biomass** – **C**ommercialization of charring and briquette production requires consistent supply of input These can increase pressure on the forest for the biomass, and thus, the biomass might be over-extracted and/or other valuable species might be extracted in the process. **Divergence of inputs** – currently agricultural residues are used primarily in subsistence cattle rearing, e.g. hay is fed to cattle etc. Due to immediate financial gains, these might be used for charring, as a result cattle rearing might suffer.
Charring	**Safety** – charring is carried out by slow burning of forest litter in pits. These pits could cause injury to workforce, visitors as well as wildlife. **Legal issues**–forest legislation does not allow commercial activities to be

	carried out within the forest, and has to be carried out 3 Km outside of the boundary. Currently charring is carried out inside the forest, which are in conflict with the existing legislation. **Carbon emission** – The slow charring process also means burning with limited oxygen supply, thus, more carbon monoxide (CO) instead of CO_2 will be produced from the process, which has higher impact factor as a GHG.
Briquette/ pellet production	**Loss of soil** – 3 parts char and 1 part soil is mixed to produce briquette. This will require borrowing soil that can result in the removal of vegetation, erosion, and also instability of forest slope. **Occupational health risks –** Due to negligence or lack of use of personal protective equipment, occupational health might seriously be affected.

6 ENVIRONMENTAL MANAGEMENT PLAN

In order to manage minor environmental issues/impacts that may arise during construction activities, as a result of the screening process, the following Environmental Management Plan (EMP) is presented as part of the EMF. The W2E project proponent will prepare its own plan for the activity, as needed. It will be reviewed for acceptance and clearance, unless changes are requested, by the AEPC during clearance of the detailed design of activity under the AEPC.

The site specific EMP will reflect the GON's and/or the WB's *Environmental Guidelines for Contractors* as well as mitigates environmental impacts during construction and post construction period. The contractor must prepare the EMP and submit to the AEPC, along with bid documents along with cost estimates, specification, and contract/agreement clauses. Plantation, erosion control, hazard avoidance/mitigation, and construction period's accident/risk reduction strategies, etc., as applicable, will be part of the EMP.

The EMP presents detail pictures of the project impacts and mitigation measures. It includes environmental issues, and its significance for consideration under the W2E project. An issue's significance should be based on supporting information and their explanation. The issues that can come under EMP may vary from subproject to subproject. These may include occupational safety and health, sanitation, foul odour, dust and air pollution control, protection of water sources, tree cutting, disturbance to wildlife, etc.

- *Alternatives:* The EMP can also recommend any alternative measures for avoiding impacts;

- *Mitigation:* The EMP identifies site-specific, cost effective and detailed measures for each impact that will reduce the identified adverse impact to acceptable levels. The plan should include compensatory measures (such as tree plantation, IP-related, etc.) if mitigation measures are not feasible, cost effective, or sufficient.

- *Capacity Development and Training: If* necessary, the EMP can recommend specific, targeted training for project staff, contractors, and community groups to ensure the implementation of environmental recommendation.

- *Implementation Schedule and Cost Estimates:* For all mitigation and capacity development, the EMP provides (a) an implementation schedule for measures that must be carried as a part of the project, and (b) cost estimates for implementing the EMP.

- *Integration:* The EMP must be integrated into the project's plan and design, budget, specifications, cost estimated, bid documents, contract/agreement clauses. The AEPC can help the W2E project proponent(s) in proper implementation. Bid documents are only finalized when site-specific EMP recommendations are adequately and appropriately incorporated in the plan and design, cost estimates, specification, and the W2E project proponent's clauses.

- *Timing:* Site-specific EMP shall be prepared at initial stage of the W2E activities/detailed design. THE PIU, with help from EFP/HQ, will certify that EMP recommendations are incorporated in Bid documents. EFP/HQ will consult the

MOEST, in case of complexity in EMP. Past experience has shown that it is being prepared after a project's detailed design, allowing limited time for incorporating the environmental costs, and implementation mechanism and procedures.

6.1 Potential environmental impacts/risks and their mitigation measure

Majority of the W2E project's potential environmental impacts are likely to come during implementation of W2E projects. The following lists of key potential environmental impacts may be associated with the proposed W2E project interventions as discussed earlier.

- Issues of sanitation, occupational safety and health associate with the handling of the waste and slurry;
- Spread of foul odor to the neighboring communities;
- Potential pollution and/or contamination of nearby water bodies;
- Loss of vegetation, disturbance to wildlife, and potential loss of protected species;
- Dusts and emission of pollutants from project equipment, machineries and facilities etc.;
- Loss of agricultural land and productivity.

6.1.1 Mitigation measures

Sanitation, Occupational Safety and Health

- Appropriate transport route and project location –transfer route and project has to be strategically determined to minimize interaction of waste with the communities. Preferably the route and location shall be chosen that are away from densely populated areas. The waste transport vehicles' waste compartments should be properly maintained, particularly containers, lid and locks. It has to be ensured that the waste containers are properly locked during transportation. All waste handling areas should be paved and covered. It will improve general working conditions and also improve possibility of controlling disease vector. A number of legislations namely - Town Development Act 1988 (MOUD, 1998)[3], Municipality Act 1990 (MOFALD, 1990)[4], Industrial Enterprise Act 1992 (MOI, 1992)[5] and Environmental Protection Act and Rules 1997 (MOSTE, 1997)[6] prohibits waste handling that can affect public health.
- The workers shall be given proper equipment and protective measures that could minimize the risk of health hazards. Furthermore, proper sanitation facilities including showers, cleaning materials shall be provided to the workers. A regular health check-up and health insurance shall be provisioned as a part of the employment agreement.Awareness on "health and sanitation" to the community, and "occupation

[3] Town Development Act 1988 (section 9) have empowered the Town Development Committee to regulate, control or prohibit any act or activity which has adverse effect on public health or aesthetics of the town, or pollute environment.

[4] Municipality Act 1990 emphasizes on management of wastes (solid and liquid) detrimental to public health.

[5] Industrial Enterprise Act 1992 stipulates that an industrial entrepreneur is entitled to run a proposed industry in an environmentally sound manner with posing adverse environmental impact and implications on health of neighbors.

[6] EPA97 (sub-article 7.1) also prohibits waste disposal that can have impact on environmental and civic health.

safety and health" particularly related to the waste handling shall be provided to the neighboring communities and workers. The proponent shall ensure that the workers receive medical treatment facilities on a regular basis. The Labor Act 1992 (MLTM, 1992) have ensured occupational health and safety of workers, and requires necessary safety wares made avail to the workers. Furthermore, the law has also emphasized to make arrangements for removal of waste accumulated during production process and prevention of dust, fumes, vapor and other waste materials, which can adversely affect health of workers (MLTM, 1992). The Environmental, Health and Safety (EHS) Guidelines (IFC, 2007) requires employer to take reasonable precautions to protect health and safety of the workers. Preventive and protective measures should be introduced according to the following order of priority

-
    i. Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;
    ii. Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;
    iii. Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
    iv. Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.
- Avian influenza is a real threat for the poultry based W2E projects as discussed earlier. Therefore such projects compulsorily have the measures for preventive, control and quarantine procedure to mitigate possible threat in accordance with the Nepal Government's standard procedure.

Control of Foul Odour

- Odor from waste handling facilities cannot be completely prevented, however, attempts to keep or dissipate odors within the facilities, thus minimizing odor complaints from neighbors.
- Processing of waste in anaerobic digester is one of the remedies for addressing foul odor from the waste. The anaerobic digester is an enclosed chamber within which organic waste is decomposed to produce primarily methane gas, which is odorless.
- Ensuring that the facilities are enclosed structures, and reduce water spillage from the facilities. This will prevent direct dissipation of odor to the neighbors.
- Trees and other windbreakers around waste storages help reduce agitation by the wind, and help promote vertical air mixing and dilution of the odors. This further reduces the transport of odors to neighbors.

Water Pollution Control

- The facilities shall be lined and enclosed to prevent spillage and seepage of the leachate
- Cover the waste storage and processing facilities with drainage network to control leachate spillage, and channelize them into the digester.

- The digesters shall be lined with water proofing materials to prevent seepage of leachate into the ground water.
- Uncontaminated rainwater from the facility roofs shall be drained into an influence stream or rain water drainage.
- MOSTE (2001) had developed "generic standards of tolerance limits for industrial effluents to be discharged into inland surface waters". According to this, the tolerance limit for BOD for 5 days at 20^{o}C is between 30 – 100 mg/L. Some of relevant parameters are presented below in the table and the complete standards are presented in ANNEX 2.

Table 6-1: generic standards oftolerance limits for industrial effluents to be discharged into inland surface waters

Characteristics	**Tolerance Limit**
TSS [mg/L] max	30-200
Particle size of TSP	Shall pass 850 micron sieve
pH	5.5 – 9.0
Temperature [^{o}C]	Shall not exceed 40^{o}C in any section of the stream within 15 m down-stream from the effluent outlet
BOD for 5 days at 20^{o}C [mg/L] max	30 – 100

Air Pollution Control

- Location of the facilities and route to these shall be strategically determined to minimize use of vehicles.
- Promote development of metaled road on the route to minimize dust pollution.
- The significance of the air pollution can be determined for each W2E projects.
- MOSTE (2003) had developed "generic standards of tolerance limits for ambience air". Some of relevant parameters are presented below in the table below. The emission from the W2E project plants shall be monitor in accordance to the standard:

Table 6-2: National Ambient Air Quality Standards 2003

Characteristics	**Averaging Time**	**Concentration in ambient air, max**
TSP [µg/m^3]	24 hours	230
PM_{10} [µg/m^3]	24 hours	120
SO_2[µg/m^3]	Annual	50
	24 hours	70
NO_2 [µg/m^3]	Annual	40
	24 hours	80
CO [µg/m^3]	8 hours	10,000
	15 minute	100,000
Lead [µg/m^3]	Annual	0.5
Benzene [µg/m^3]	Annual	20

- During pyrolysis of MSW to generate electricity, several kinds of air pollutants are emitted. As the government has not yet produced any generic standard or tolerance limit, the reference emission value can be taken from other countries legislation. "Directive 2000/76/EC of the European Parliament and of the Council of 4th December 2000, on the incineration of waste" provides following air emission limit values for incineration and co-incineration.

Table 6-3: Air emission limits for incineration and co-incineration (Directive 2000/76/EC)

Daily Average Values	
Total Dust	10 mg/m^3
Gaseous and vaporous organic substances, expressed as total organic carbon	10 mg/m^3
Hydrogen Chloride (HCL)	10 mg/m^3
Hydrogen Fluoride (HF)	1 mg/m^3
Sulphur dioxide (SO_2)	50 mg/m^3

- The vehicles to be used for wasW2E project shall be regularly maintained and the exhaust from these shall be monitored as per the provisions made by EPR97, and National Vehicle Mass Emission Standard, 2001 (ANNEX 8).

Ecosystem Safeguard

- Minimize removal of vegetation, particularly clear felling of trees. Compensatory plantation of 1:2 of local tree species shall be carried out if the tree are clear felled.
- The project should not be located in environmentally sensitive area of any sort, such as protected areas, sensitive habitat, culturally, archeologically and historically important sites.
- Avoid removal and damage of protected species of vegetation and wildlife.
- Support agriculture intensification to compensate loss of cultivated land and productivity.
- Biomass W2E projects have to define forest waste to be collected from the forest. Depending on location, accessibility, and use, forest waste can vary. A blanket definition of forest waste can lead to extraction of valuable forest product for charring. Furthermore, to ensure sustainable use of the forest wastes and to avoid their over-use, it is strongly recommended to carry out their detailed inventory prior to establishing any forest W2E projects. Furthermore, rotational biomass collection is recommended to continuous biomass collection from the same patch of forest to promote the natural regeneration of biomass. It is also recommended that local CFUG need to be mobilized as monitoring committee to ascertain the proper use of non woody biomass (and the woody are not over used) and to manage the plantation for sustainable harvesting.

6.2 Monitoring, Evaluation and Reporting

Experience has shown that the overall sustainability of a project depends on how well environmental issues are managed during the implementation.

The following mechanisms are proposed to ensure successful implementation of environmental impacts. To conduct monitoring, the AEPC will identify a detailed set of monitoring and reporting guidelines.

The Environmental Focal Person EFP will carry out central level supervision to check progress and timely correct shortcomings of the W2E projects. The main aim of central level supervision is to observe the problem and to support the implementation team at local level.

The proponent(s) will be responsible for regular monitoring and reporting of progress and achievements of the W2E projects. The AEPC, from time to time, may conduct an oversight of the results add how the process was implemented. While most of the monitoring oversight will be conducted by the AEPC, if necessary, it can use the services of competent third party monitors to provide periodic and objective assessments of progress, shortfalls and challenges in the implementation of specific project components/sub-components, especially those related to field projects. It may also seek assistance of the WB for advice and guidance.

The monitoring and reporting of the EMF will include:

a) Environmental monitoring of construction related activities including, new construction, to ensure that necessary safeguard measures, especially by the construction contractors, have been duly implemented.
b) Environmental compliance will be checked regularly by the AEPC and EFP, as applicable; and

At the following stages, monitoring will be done:

A: Pre-construction to ensure that: (i) proposed upgrading / construction activities, as applicable at each site(s), are subjected to environmental screening; plan and design for construction activities *confirms to the Environmental Guidelines of the WB and/or the GON for Planning and Design;* and (ii) site specific (simple) Environmental Management Plan (EMP) is prepared in time and incorporated into bidding documents for submission to the AEPC for review and approval;

B. During construction: The AEPC, on an ongoing basis, may conduct compliance monitoring, using the specific environmental measures relevant to, and prescribed for the activities as well as to assess general environmental management/performance. Supervision, as well as progress report(s), should contain information with regard to environmental compliance as well as any difficulty or outstanding works need to be prepared. The findings should be discussed with the Project's Steering Committee. The AEPC will establish monitoring mechanism for operational stage monitoring. In addition, the GON may consider commissioning an annual independent monitoring on environmental management and performance. The AEPC and the GON's relevant offices will record these findings.

C: Operation: The AEPC and the WB may agree to jointly prepare a post-construction, post WTEP completion report for their records. In addition, joint reviews by the GON and the World Bank each year when the project is under implementation may also be conducted. The objective is to ensure the collection of reasonably complete and credible data from all participating project institutions on the key performance indicators and others.

The monitoring parameters, methods, schedule and location are presented in ANNEX 5.

6.2.1 Evaluation

The objective of evaluation is to judge the impact of implementation effectiveness. It will be done through independent consultants having experience in similar tasks. This will be undertaken during midterm and end of the project. The evaluation will assess EMF's effectiveness in addressing environmental impacts of the project. The midterm evaluation will give feedback for implementation of the EMF.

6.3 Indicative Budget

Conformance of the environmental safeguards including bearing the costs for various environmental tasks is the responsibility of AEPC through PCU. Adequate provision for financing different requirements suggested under this framework should be made while allocating budget for the W2E projects.

Table 6.1 Budget Estimation for Implementation of EMF

EMF Activities	Tentative Costs in 000(NRs) per project	Remarks
Project specific environmental screening & assessment	200.00	
Project specific EMP preparation	300.00	
Disclosures and dissemination of environmental safeguard documents	50.00	
Implementation of EMP	400.00	
Supervision, monitoring and reporting	100.00	
Midterm and final impact evaluation	300.00	
Capacity building for safeguard staff	50.00	
Social /community monitoring /audit	50.00	
Total	**1550.00**	

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A N N E X 1 . ENVIRONMENTAL SCREENING FORMAT

Project Brief

Company Name/ Registration/ Address	
Contact Details (Telephone, Email)	
Technology (type and capacity)	
Implementation approach (approach, schedule, institution involved, and stakeholders)	
Total Project Cost	

Environmental setting of the project locality

2.1 Location		
Location of the project (settlement/ ward/ VDC/ District)		
Adjoining/nearby settlement(s):		
Community facilities (school, playground, etc.):		
Is the project located in forest area or close to forest	Yes	No
If Yes,		
Name of forest		
Management regime		
Does vegetation need to be removed for the project? Give estimate?		
Permission to operate in the forest?		
Is the project located in the protected area or any protected area in vicinity	Yes	No
Is yes, please provide details on		
(a) name of PA		
(b) area to be acquired		
(c) distance to PA from the project site		
(d) access from the project to the PA		
2.2 Water sources/ water bodies		
Area there any water sources/ water bodies in and around the project site	Yes	No
If yes provide details on		
Location/Type		
Use of water		
Potential impact by the project		
2.3 Air pollution		
Number and type of vehicles to be used per day		

Capacity of vehicles	
Condition of the road (asphalted, earthen)	

2.4 Land use			
Land required for the project and type of land use			
Facilities (1) (2)	Required Area	Land use type	Location

2.4.1 Impact due to land use change

a) Loss of private land …….
b) Loss of agricultural product ……..
c) Loss of private structures/community structures ……
d) Loss of Forest and vegetation …….
e) others ……

2.5 Waste input for the project	
Define waste (type)	
Quantity of waste	
Location of collection	
Workers involved	
Legal clearance required	

2.6 Technology	
Type Capacity Components Gas production Liquid slurry production Solid slurry production Remarks	

2.7 Waste from the project implementation	**Yes**	**No**
Generation of solid waste? If yes, …….		
Are any wastes required to be stored on-site either for reuse or off-site disposal? If yes, …….		
Are effluents required to be discharged to a sewer or combined drainage system? If yes, …….		
2.7 Other observations		

Can vector disease spread to the adjoining settlements?	
Can foul odor affect the adjoining settlement?	
Slurry use (proposed)	

Recommendations

ANNEX 2. Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters

Published in Nepal Gazette in 2060/03/09

Government of Nepal
Ministry of Population and Environment
Kathmandu

GENERIC STANDARDS
Generic Standard
Part I
Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters

Generic Standard
Part II
Tolerance Limits for Industrial Effluents to be Discharged into Public Sewers

Characteristics	Tolerance Limit
Total Suspended solids, mg/L, Max	600
pH	5.5 to 9.0
Temperature, 0C, Max	45
Biochemical oxygen demand (BOD) for 5 days at 20 degree C, mg/L, Max	400
Oils and grease, mg/L, Max	50
Phenolic compounds, mg/L, Max	10
Cyanides (as CN), mg/L, Max	2
Sulphides (as S), mg/L, Max	2
Chloride (Cl), mg/L, Max	1000
Insecticides	Absent
Sulphates (SO_4), mg/L, Max	500
Fluorides (as F), mg/L, Max	10
Arsenic (as As), mg/L, Max	1
Cadmium (as, Cd), mg/L, Max	2
Total Chromium, mg/L, Max	2
Copper (as Cu), mg/L, Max	3
Lead (as Pb), mg/L, Max	0.1
Mercury (as Hg), mg/L, Max	0.01
Nickel (as Ni), mg/L, Max	3
Selenium (as Se), mg/L, Max	0.05
Zinc (as Zn), mg/L, Max	5
Ammonical nitrogen, mg/L, Max	50
Chemical Oxygen Demand, mg/L, Max	1000
Silver, mg/L, Max	0.1
Total Dissolved Solids, mg/L, Max	2100
Mineral Oils, mg/L, Max	10
Inhibition of nitrification test at 200ml/l	< 50%

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Government of Nepal
Ministry of Population and Environment
Kathmandu

GENERIC STANDARDS
Generic Standard
Part I
Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters

Characteristics	Tolerance Limit
Total Suspended solids, mg/L, Max	30-200
Particle size of total suspended particles	Shall pass 850-micron Sieve
pH	5.5 to 9.0
Temperature	Shall not exceed 40 degree C in any section of the stream within 15 meters down-stream from the effluent outlet.
Biochemical oxygen demand (BOD) for 5 days at 20 degree C, mg/L, Max	30 100
Oils and grease, mgT, Max	10
Phenolic compounds, mg/L, Max	1
Cyrides (as CN), mg/L, Max	0.2
Sulphides (as S), mg/L, Max	2
Radioactive materials:	
a. Alpha emitters, c/ml, Max	10^{-7}
b. Beta emitters, c/ml, Max	10^{-6}
Insecticides	Absent
Total residual chlorine, mg/L	1
Fluorides (as F) mg/L, Max	2
Arsenic (as As), mg/L, Max	0.2
Cadmium (as, Cd), mg/L, Max	2
Hexavalent chromium (as Cr), mg/L Max	0.1
Copper (as Cu), mg/L, Max	3
Lead (as Pb), mg/L, Max	0.1
Mercury (as Hg), mg/L, Max	0.01
Nickel (as Ni), mg/L, Max	3
Selenium (as Se), mg/L, Max	0.05
Zinc (as Zn), mg/L, Max	5
Ammonical nitrogen, mg/L, Max	50
Chemical Oxygen Demand, mg/L, Max	250
Silver, mg/L, Max	0.1

ANNEX 3. Checklist for stakeholder consultation

Environmental and Social Management Framework for SREP Waste to Energy Market Development Component

Date:
Venue:

Project description

- Project category (as per SREP)
- 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
    - Observation of the water bodies/wetlands nearby that can be affected by project components or activities.
    - Disposal of slurry into the water body.
    - Seeping of leachate from the digester or other components
- Gaseous release or air contamination
    - Release of methane from the digester, storage, slurry or incomplete digested slurry, release of excess produced methane
    - 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
    - Disposal of slurry etc. into the soil
- Slope instability and erosion
    - Slope and terrain condition of the project components sites
    - Construction of components
    - 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
    - Wildlife in and around project area (population, diversity, protection status)
- Loss of habitat
    - 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
    - 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
    - Source of water for the settlement in the project affected area
    - Possibility of contamination due to project component or activities.
    - Demography, economic, cultural and ethnic composition of the water users
    - Effect on vulnerable groups and women

- Foul odor and sanitation condition
    - Location of settlement/houses close to project components
    - possibility of dispersion of foul order from the digester, storage, transportation and other components
    - Possibility of health hazard from the project to the surrounding settlements e.g. mosquito
    - Demography, economic, cultural and ethnic composition
    - 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.
    - Demography, economic, cultural and ethnic composition of the affected HHs.
    - Effect on the vulnerable group and women

Existing Institutional setup to address environmental concerns

- Institutions
- Position in the organizational setup
- Human resources (#, qualifications, skills)
- Skill and instruments available
- Experience
- Budgetary allocation
- Necessity of capacity building

Mitigation measures

Mitigation

- Alternatives of the project to avoid impact and other possible preventive measure (e.g. No go, project component alternate, activity alternate)
- Preferred correctional measures (Treatment or pollutant, plantation, slope stabilization measures, etc.)
- Preferred compensations (Budget allocation for management of impacts)
- Cost of the activities

Role and institutional setup for undertaking of mitigation

- Identification of the concern authority and stakeholders
- Role of proponent, authority and other stakeholders
- Schedule
- Capacity of the institution to handle this responsibility (which can be addition to their current work)
- Necessity of capacity building
- Cost

Monitoring and evaluation

- Indicators of monitoring of impacts and mitigation measures

- Method and frequency of measurement
- Role of proponent, authority, and stakeholders
- Identification of appropriate institution for the third party monitoring and their scope in monitoring and evaluation
- Reporting mechanism
- Cost

Other environment related concerns of the stakeholders

Participants

SN	Name	Organization/ position	Address	Phone	Email

ANNEX 4. PARTICIPANTS OF DISTRICT LEVEL STAKEHOLDER MEETINGS

Venue: DDC Office, Dolakha **Date:** 2070/07/10

S. N	Full Name	Sex	Post / Occupation	Office / Organization	Address	Phone Number
1.	Tubaraj Pokhrel	M	LDO	DDC	Dolakha	9854040015
2.	Narayan Sedai	M	Social Development Officer	DDC	Dolakha	9744033838
3.	Jagadish Aryal	M	Account Officer	DDC	Dolakha	9744033838
4.	Hari Prasad Bhattarai	M	Consultant	AEPC/WB	Kathmandu	9841892751
5.	Shyam Kishor Yadav	M	Energy Officer	DDC	Dolakha	9851089880
6.	Suresh Rawat	M	Engineer	Bhimeshwor Municipality	Dolakha	9851002074
7.	Ramkumar Bhandari	M	Assistant forest Officer	DFO	Dolakha	9841331358
8.	Sita K.C	F	President	FECOFUN	Lakuridada	9744022094
9.	G. Khatiwada	M	Office Assistant	DDC	Dolakha	9841070458
10.	Dhagya B. Siwakoti	M	Customer	Suspa Community Forest	Dolakha	9841003869
11.	Ramsran Dhami	M	Secretary	Suspa Community Forest	Dolakha	9844307778
12.	Anil Maharjan	M	Researcher Coordinator	Minergy	Lalitpur	9841336256
13.	Pech Kr. Sunuwar	M	DC	REMREC	Kavre	9744025614
14.	Sanjita Sunuwar	F	Technical Assistant	DADO	Dolakha	049421130
15.	Ajay Mathema	M	Consultant	AEPC/WB	Kathmandu	9841638502
16.	Aayush Ghimire	M	Student		Kathmandu	9818651889
17.	Rakesh Tuladhar	M	Engineer	Rimrek	Dhulikhel	049421130
18.	Susil Gyawali	M	Technical Assistant	Himalayan Naturals Pvt.ltd	Kathmandu	9851127784
19.	Tika P. Joshi	M	Office Assistant	DDC	Dolakha	9844091098
20.	Ashuta Bhattarai	F	Student		Kathmandu	9813108668
21.	Kamala Basnet	F	Secretary	Himawanti, Dolakha	Dolakha	9844060271
22.	Nawaraj Khadka	M	President	Harit Industry	Dolakha	9754201578
23.	Dilli P. Poudel	M	Student	Bergen University, Norway	Sarlai	9841178010

24.	Bir B. Thami	M	President	Suspa Kshemadevi CFUG	Sarlai	9741094248
25.	Birkha Chhetri	M	Businessman	Minergy Pvt.ltd	Lalitpur	9844060410
26.	Dinesh Neupane	M	Messenger	Chamber of Commerce & Industry, Dolakha	Dolakha	9844090463
27.	Kumar Budhathoki	M	Office Assistant	DDC Dolakha	Dolakha	9744022246

Venue: Sikre Briquette Industry, Attarpur-8, and Sindhpalchowk **Date:** 2070/07/10

S.N	Full Name	Sex	Post / Occupation	Office / Organization	Address
1.	Dev B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
2.	Padam B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
3.	Yam B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
4.	Ga Kumari Shrestha	F	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
5.	Deu Kumari Shrestha	F	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
6.	Nanda Kumari Shrestha	F	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
7.	Ramesh Shakya	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
8.	Ratna B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
9.	Som B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
10.	Shiva Lal Shakya	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
11.	Bhakta B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
12.	Prem B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
13.	Nar B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
14.	Bek Lal Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
15.	Prem Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
16.	Binod Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
17.	Tek B. Shrestha	M	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
18.	Putali Maya Shrestha	F	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
19.	Lila Maya Shakya	F	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
20.	Sher Kumari Shakya	F	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
21.	Tika Maya Shrestha	F	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk
22.	Padam Kumari Shrestha	F	Entrepreneur	Sikre Briquette Industry	Attarpur-8, Sindhpalchowk

Venu:DDC, Chitwan Bharatpur **Date:** 2070/07/13

S. N	Full Name	Sex	Post / Occupation	Office / Organization	Address	Phone Number
1.	Purushotwam Sharma	M	Planning Officer	DDC, Chitwan	Bharatpur	9841779776
2.	Ganesh Jha	M	DFO	DFO, Chitwan	Bharatpur	9755000493
3.	Bal Ram Luitel	M	Communication Officer	DDC	Chitwan	9855059010
4.	Hari P. Bhattarai	M	Consultant	AEPC/WB	Kathmandu	9841892751
5.	Prachin Lal Shrestha	M	Entrepreneur	Subha Biomasss Pvt.ltd	Chitwan	9855054025
6.	Er. Birat Ghimire	M	Env. Section Chief	Bharatpur Municipality	Bharatpur	9855056035
7.	Rishiram Adhikari	M	Program officer	ECOSCENTRE	Bharatpur-2	9855061026
8.	Ishwor Kr. Shrestha	M	Engineer	NEA Bharatpur	Bharatpur	9845706765
9.	Kesab Debkota	M	Director	National Biogas Company Pvt.ltd	Bharatpur	9855055151
10.	Ramchandra Gautam	M	Exective Director	National Biogas Company Pvt.ltd	Bharatpur	9855056758
11.	Dipak Raj Bista	M	Program Officer	Chamber of Commerce and Industry	Narayangad Chitwan	9845247758
12.	Rashik Pradhan	M	Executive Director	Chamber of Commerce and Industry	Narayangad Chitwan	9845084242
13.	Surbir Pokhrel	M	Chairperson	FECOFUN, Chitwan	Bharatpur	9855055477
14.	Rajaram Adhikari	M	Chief	DADO	Bharatpur	9855059570
15.	Ajay Bhakta Mathema	M	Consultant	AEPC/WB	Kathmandu	9841638502
16.	Dr. Ram Kumar Karki	M	Sr. Veterinary Officer	DLSO	Bharatpur	9855065176
17.	Damodar Subedi	M	M.D	Janata Urja Bikash Company	Bharatpur	9855058042
18.	Bishal Lamichhane	M	Energy Officer	DDC	Bharatpur	9841763680
19.	Ashis Shrestha	M	Operation Analyst	World Bank	Kupandol, Lalitpur	9801054392
20.	Sita Subedi	F	OA	DDC	Bharatpur	9845278212
21.	Dev Kumari Joshi	F	SM	DDC	Bharatpur	9845436051
22.	Surya Man Shrestha	M	Poultry	Suryodaya Poultry & Feed Industry	Narayangad	9855056717

23.	Ranjana Adhikari	F		DDC	Bharatpur	

Venue: DDC Office, Kaski **Date:** 2070/07/14

S.N	Full Name	Sex	Post / Occupation	Office / Organization	Address	Phone Number
1.	Santosh Poudel	M	Executive Officer	Pokhara Waste Management Pvt.Ltd	Pokhara-10,	9856032638
2.	Pusparaj Koirala	M	R.P.O	NBPA	Pokhara	9804188987
3.	Ashis Shrestha	M	Operation Analyst	World Bank	Kupandol, Lalitpur	9801054392
4.	Uttam P. Jha	M	Advisor	AEPC/NRREP	Khumaltar, Lalitpur	9851066828
5.	Ravi Bhandari	M	Local Representative	Gold Rush Pvt.Ltd	Pokhara	9846038302
6.	Uttam Joshi	M	First Vice President	Tole Coordination Committee	Pokhara	9846140877
7.	Ganga B. Thapa	M	SDADO	DADO	Pokhara	9746003997
8.	Narayan Shrestha	M	Acting LDO	DDC, Kaski	Pokhara	9856027721
9.	Smriti Gurung	F	Acting PO	Kaba Foundation Nepal	Newroad, Pokhara	9847642626
10.	Resh B. Gurung	M	President	Heralo	Pokhara	9856020776
11.	Nishanraj Gautam	M	Planning Officer	DDC, Kaski	Pokhara	9856023830
12.	Gopal Khadka	M	V. President	NGO Federation Nepal	Pokhara	9856024288
13.	Er. Arjun Neupane	M	EEO	DDC, Kaski	Pokhara	9846128094
14.	Hari Bhattarai	M	Consultant	AEPC/WB	Kathmandu	9841892751
15.	Ajay Mathema	M	Consultant	AEPC/WB	Kathmandu	9841638502
16.	Sashi Pokhrel	M	Engineer, DEEU	DDC, Kaski	Tanahun	9846093233
17.	Lila Nath Poudel	M	Forester	DFO	Pokhara	9846023509
18.	Bal Bhadra Puri	M	Waste Management	Batabaran Sundar Nepali Pvt.Ltd	Syanga	9840331554
19.	Bidur Giri	M	Waste Management	Batabaran Sundar Nepali Pvt. Ltd	Syanga	9856029309

ANNEX 5. ENVIRONMENTAL MONITORING PARAMETER, METHODS, SCHEDULE, AND LOCATION

Stage	Indicators	Methods	Frequency	Responsibility
Pre-construction	Population of settlement and HH along the waste transport route	Census	Once a year	Proponent/ AEPC EFP
	Population of settlement around waste processing facilities	Census	Once a year	Proponent/ AEPC Environment Focal Person
	Design of waste processing facilities – enclosed facility, paved floors, drainage coverage	Design review	Once	Proponent/ AEPC Environment Focal Person
	Lining of the digester with water proof material to prevent seepage	Design review	Once	Proponent/ AEPC Environment Focal Person
	Condition of existing road/ design of proposed road	Design review	Once	Proponent/ AEPC Environment Focal Person
	Location of facilities in relation to environmentally sensitive area – PAs, wetland, habitat of vulnerable species, occurrence of protected species	Design review	Once	Proponent/ AEPC Environment Focal Person
	Location of facilities in cultivated land, area and productivity loss	Design review	Once	Proponent/ AEPC Environment Focal Person
Construction	Number of awareness campaigns on health and sanitation	Review of bi yearly progress reports	Twice a year	AEPC/ Consultant/ Third party
	Plantation of trees and windbreakers around the waste facilities to prevent odor spreading	Records of plantation/ Observation	Twice a year	Proponent/ AEPC Environment Focal Person
	Number of tree removed for site clearance	Records of tree clear felled/ Observation	Twice a year	Proponent/ AEPC Environment Focal Person
	Number and species of compensatory plantation	Record of plantation/ observation	Twice a year	Proponent/ AEPC Environment Focal Person/ Third party
	Rehabilitation of temporarily acquired forest and cultivated land	Record of rehabilitation/ observation	After construction period	Proponent/ AEPC Environment Focal Person/ Third party
Operati	Cleanliness of waste transport	Observation	Once a	Proponent/ AEPC

on	vehicles		month	Environment Focal Person
	Type of vehicle used for waste transport and provision of covering of the compartment for waste transport	Observation	Once a month	Proponent/ AEPC Environment Focal Person
	Presence of waste along the route that have fell of the vehicle	Observation	Once a month	Proponent/ AEPC Environment Focal Person
	Number of awareness campaigns on occupation health and sanitation for workers	Observation	Twice a year	AEPC/ Consultant
	Provision of Personal Protective Equipment for workers	Stock record verification	Quarterly	Proponent/ AEPC Environment Focal Person
	Availability of shower, toilets, hygiene products for worker	Stock record verification	Quarterly	Proponent/ AEPC Environment Focal Person
	Sanitation and hygiene condition of facilities – enclosures for waste processing plants, frequency of cleaning, cleanliness of toilets, shower, and other facilities, and compound	Observation	Yearly	Proponent/ AEPC Environment Focal Person
	Condition of the enclosure of the facilities, paved floors, drainage and disposal of drainage	Observation	Yearly	Proponent/ AEPC Environment Focal Person/ Third party
	Occurrences of disease of workers and neighbouring HHs and HH living in the route	Medical record check	Quarterly	Proponent/ AEPC Environment Focal Person/ Medical consultant
	Complaints from the neighbours on foul odour	Records of complaints	Quarterly	Proponent/ AEPC Environment Focal Person
	Spillage of waste outside of facilities	Observation	Quarterly	Proponent/ AEPC Environment Focal Person
	Waste water quality testing	Laboratory testing of the waste water sample	Quarterly	Proponent/ AEPC Environment Focal Person/ Third party (once a year)
	Dust deposits in the vegetation and house along the route	Observation	Half yearly	Proponent/ AEPC Environment Focal Person
	Air Quality Monitoring (For MSW only)	Laboratory test of sampled air from the route	Once a year[7]	Proponent/ AEPC Environment Focal Person/ Third party

[7] Frequency of ambience air monitoring shall be increased in case of high complaints from residents

	Contamination of slurry (by product) with pathogens	Laboratory testing of sampled digested slurry	Half yearly	Proponent/ AEPC Environment Focal Person/ Third party

ANNEX 6. IEE AND EIA FORMATS (EPR97)

Schedule-5 (Relating to Rule 7)
Matter to be mentioned while preparing reports relating to

Initial environmental examinations:

1. Name and address of individual or institution preparing the report:

2 Summary of the proposal: (To briefly mention the following matters in regard to the possibly impact of the implementation of the proposal on the environment):

(a) Objectives of the proposal,
(b) Impact on land-use.
(c) Adverse impact on the environment impact on human life, and population pressure,
(d) Damage to be suffered by local goods or objects,
(e) Other necessary matters.

3. The following matters must be explicitly mentioned in respect to the proposal:

(a) Type of proposal,
    (i) Processing,
    (ii) Manufacturing,
    (iii) Installation,
    (iv) Service delivery,
    (v) Others.
(b) If related to delivery, the nature and type of goods to be delivered.
(c) Proposal's
    (i) Installed capacity
    (ii) Number of hours to be operated per day or year.
(d) Materials to be used (quantity and year to be mentioned).
(e) Emission resulting from the implementation of the proposal (the time of operation and the consequent volume of emission to be specified)
    (i) Solid
    (ii) Liquid
    (iii) Air,
    (iv) Gas,
    (v) Noise
    (vi) Dust,
    (vii) Others
(f) Energy to be used:
    (i) Type,
    (ii) Sources
    (iii) Volume of consumption (per day and year)
(g) Human Resource requirements:
(h) Resources required for the implementation of the proposal:
    (i) Total (Gross) capital
    (ii) Working capital
    (iii) Land area,
    (iv) Building and their types,
    (v) Machinery and tools
    (vi) Others.
(i) Detailed particulars of the area where the project is to be implemented:
    (i) Maps,

(ii) Population and condition relating to settlements in the area as well as in the nearby areas,
(iii) Particulars of any sensitive things or objects, if any, located close to the area where the proposal is to be implemented
(iv) Current situation
(v) Sources of water
(vi) Arrangement made for disposing or processing the waste
(vii) Paths for movement in the area where the proposal is to be implemented

(j) Manufacturing processes
(k) Details of the technology
(l) Other necessary matters.

4. Impact of the implementation of the proposal on the environment:
(a) Impact on the social, economic cultural spheres:
(i) Impact on human health,
(ii) Degradation of cultivable land,
(iii) Destruction of forests,
(iv) Changes in social, cultural and religious norms and value,
(v) Others.

(b) Biological Impact:
(i) Population,
(ii) Flora and fauna.
(iii) 'Natural habitat and communities

(c) Physical Impact:
(i) Land,
(ii) Atmosphere,
(iii) Water,
(iv) Noise,
(v) Man-made objects,
(vi) Others

5. Alternatives for the implementation of the proposal:
(a) Design
(b) Project site
(c) Processes, time-schedule,
(d) Raw materials to be used,
(e) Others

6. Alternatives to reduce or control the impact of the implementation of the proposal on the environment.
7. Matters to be monitored while implementing the proposal.
8. Other necessary matters.

Note: - Data, maps, Photographs, tables, charts graphs etc. shall be enclosed, as required, while preparing the report.

Schedule – 6 (Relating to Rule 7)
Matters to be mentioned while preparing Reports Relating to

Environmental Impact Assessment

1. Name and Address of the individual or intuition preparing the report:
2. Summary of the proposal: (to mention the following matters in regard to the possible impact of the implementation of the proposal on the environment.):
    (a) Objectives of the proposal,
    (b) Impact on land-use,
    (c) Adverse impact on the environment, impact on human life, and population pressure,
    (d) Damage to be suffered by local goods or objects
    (e) Other necessary matters.
3. Summary of the Report: Brief particulars of the matters mentioned in the report relating to the environmental impact assessment.
4. Particulars of the proposal:
    (a) To specify the technical, geographical, environmental, economic, social, cultural and physical aspects of the proposal.
    (b) To specify the objectives, working policies and work-schedule of the activities to be undertaken during each phase of the implementation of the proposal.
5. Basic information relating to the proposal: To mention basic information about the geo-physical, cultural, biological, and social and economic conditions of the area to be assessed, as well any possible change that may occur there before the implementation of the proposal. In case there are any data which may not be available or any Subject which may not be covered by the study, they too should be mentioned.
6. Identification of environmental Impact: To mention the possible positive and negative impact on the following spheres of the environment while implementing the proposal, and estimate and specify the volume of possible impart according to time and work schedules as far as possible.
    (a) Geographical area likely to have positive or negative impact of the implementation of the proposal and thereof time-schedule.
    (b) Impact of waste and pollution to be emitted through the implementation of the proposal.
    (c) Direct or indirect and cumulative impact of the implementation of the proposal on the environment.
7. Analysis of the alternatives for the proposal: The following matters are to be analysed:
    (a) Matters concerning the design of the proposal, project site, technology, operation procedure, time –schedule and raw materials to be used.
    (b) Comparison is to be made on the basis of the fixed and working capital, local suitability , institutional training and supervision needed for the implementation of the proposal, and the environmental cost and returns and economic significance of each alternative measures are to be analysed as far as possible.
    (c) Short, medium and long – term adverse impact of the implementation of the proposal.
    (d) Sources of energy to be used for the implementation of the proposal and measures to be adopted for saving such energy.
    (e) Analysis of the consequences of the non- implementation of the proposal.
8. Measure to reduce environmental impact:
    (a) To mention practical preventive measures to be adopted for all activities which could have a negative impact on the environment.
    (b) In case the environmental impact cannot be fully avoided through preventive measures, arrangements made for payments of compensation shall be mentioned. The

effectiveness of the preventive measures shall be analyzed from the view point of their cost on the basis of the comparison with other possible alternatives.

(c) The effectiveness of the preventive measures shall be analyzed from the viewpoint of their cost on the basis of a comparison with other possible alternatives.

9. To mentioned matters concerning environmental management plans.

10. Review of policy and Legal Provisions: To review the related policies, laws, and Rules on the basis of the nature and scale of the proposal. If any policy or legal provision, needs to e reformed, to specify the same.

11. Monitoring of the Proposal: To mention the procedure of monitoring the impact of the implementation of the proposal on the environment, as well as the monitoring agency, time-schedule, monitoring and evaluation Indicators etc.

12. To mention the format and relevancy of environmental examinations.

13. Reference materials: To make at list of publications quoted as references while preparing the report in the following manner:

(a) Author,

(b) Date of Publication,

(c) Title of the material quoted,

(d) Year volume, number, etc. (if any)

(e) Page number

14. To include the following particulars in the Annexes:

(a) Maps relating to the land structure, geographical location, land-use and land-capacity and other maps related to the study.

(b) Aerial photographs as far as possible of the proposal implementation site and the surrounding areas,

(c) Questionnaires or lists of Subject matters used for field research.

(d) Matters connected with the evaluation of the environmental impact such as charts and photographs.

ANNEX 7. ENVIRONMENTAL MANAGEMENT PLAN

1) Project Overview

2) Summary of environmental impacts and their assessment
   a) Impacts expected during construction phase and their significance
   b) Operation expected during operation phase and their significant

3) Mitigation Measure:
   a) Mitigation measures to be implemented during construction phase
   b) Mitigation measures to be implemented during operational phase
4) (Practical preventive measures to be adopted to mitigate negative impacts, and/or in case impacts cannot be fully avoided through preventive measures, arrangements of compensation and/or application corrective measures shall be proposed)

5) Monitoring
   a) monitoring indicator,
   b) schedule,
   c) Cost required
   d) Responsibility (in house monitoring to be carried out the proponent/ Verification will be done by AEPC)
   e) Institutional arrangement within proponent for undertaking monitoring

ANNEX 8. NEPAL VEHICLE MASS EMISSION STANDARD, 2001

(Nepal Vehicle Mass Emission Standard, 2056) English Version

A. Vehicles Fueled with Gasoline (Positive Ignition Engines)

1. For Passenger Cars with Up To Six Seats and Gross Vehicle Weight (GVW) less than 2.5 tons

1.1 Type I Test - verifying exhaust emissions after a cold start.

	grams per kilometer	
	Carbon monoxide (CO)	hydrocarbons plus oxides of nitrogen (HC + NOx)
Type Approval*	2.72	0.97
Conformity of production**	3.16	1.13

Note: The test shall be as per the Driving Cycle adopted by different countries, with cold start on Chassis Dynamometer.

1.2 Type II Test - carbon monoxide emission at idling speed.

This test applies to vehicles fueled with leaded gasoline only.

The carbon monoxide content by volume of the exhaust gases emitted with engines idling must not exceed 3.5% at the settings used for the Type I test.

1.3 Type III Test - verifying emissions of crankcase gases.

The crankcase ventilation system must not permit the emission of any of the crankcase gases into the atmosphere.

1.4 Type IV Test - determination of evaporative emission

This test applies to all vehicles fueled with leaded and unleaded gasoline.

Evaporative emissions shall be less than 2 g/test.

1.5 Type V Test - durability of pollution control devices.

This test applies to vehicles fueled with unleaded gasoline only.

The test represents an endurance test of 80,000 kilometer driven on the road or on a chassis dynamometer.

* Please see the explanatory note

** Please see the explanatory note

2. For Light-Duty Commercial Vehicles and Vehicles with Gross Vehicle Weight (GVW) more than 2.5 tons

2.1 Type I Test - verifying exhaust emissions after a cold start.

Reference Mass (kg)		*grams per kilometer*	
		Carbon monoxide(CO)	hydrocarbons plus oxides of nitrogen (HC + NOx)
RM < 1250	Type Approval	2.72	0.97
	Conformity of production	3.16	1.13
1250<RM<1700	Type Approval	5.17	1.4
	Conformity of production	6.0	1.6
RM>1700	Type Approval	6.9	1.7
	Conformity of production	8.0	2.0

Note:

- The test shall be as per the Driving Cycle adopted by different countries, with cold start on Chassis Dynamometer.
- Reference mass means the "unladen mass" (mass of the vehicle in running order without crew, passengers or load, but with the fuel tank full and the usual set of tools and spare wheel on board, when applicable) of the vehicle increased by a uniform figure of 100 kg.
- Includes passenger vehicles with seating capacity more than six persons or reference mass more than 2,500 kg.

1.3 Type III Test - verifying emissions of crankcase gases.

The crankcase ventilation system must not permit the emission of any of the crankcase gases into the atmosphere.

1.4 Type IV Test - determination of evaporative emission.

Not applicable

1.5 Type V Test - durability of pollution control devices.

The test represents an endurance test of 80,000 kilometer driven on the road or on a chassis dynamometer.

2. **For Light-Duty Commercial Vehicles and Vehicles with Gross Vehicle Weight (GVW) more than 2.5 tons**

2.1 Type I Test - verifying exhaust emissions after a cold start.

Reference Mass (kg)		*grams per kilometer*		
		CO	(HC + HOx)	PM
RM < 1250	Type Approval	2.72	0.97	0.14
	Conformity of production	3.16	1.13	0.18
1250<RM<1700	Type Approval	5.17	1.4	0.19
	Conformity of production	6.0	1.6	0.22
RM>1700	Type Approval	6.9	1.7	0.25
	Conformity of production	8.0	2.0	0.29

Note:

The test shall be as per the Driving Cycle adopted by different countries, with cold start on Chassis Dynamometer.

Reference mass means the "unladen mass" (mass of the vehicle in running order without crew, passengers or load, but with the fuel tank full and the usual set of tools and spare wheel on board, when applicable) of the vehicle increased by a uniform figure of 100 kg.

Includes passenger vehicles with seating capacity more than six persons or reference mass more than 2500 kg.

2.2 Type II Test - carbon monoxide emission at idling speed.

Not applicable

2.3 Type III Test - verifying emissions of crankcase gases.

The crankcase ventilation system must not permit the emission of any of the crankcase gases into the atmosphere.

2.4 Type IV Test - determination of evaporative emission

Not applicable

2.5 Type V Test - durability of pollution control devices.

The test represents an endurance test of 80,000 kilometer driven on the road or on a chassis dynamometer.

3. **For Heavy-Duty Vehicles and Vehicles with Gross Vehicle Weight (GVW) more than 3.5 tons**

3.1 Type I Test - verifying exhaust emissions after a cold start.

Pollutants	Type Approval	Conformity of Production
CO (grams per kilo-watt hour)	4.5	4.9
HC (grams per kilo-watt hour)	1.10	1.23
NOx (grams per kilo-watt hour)	8.0	9.0
PM (grams per kilo-watt hour) for engines with power less than 85 KW	0.61	0.68
PM (grams per kilo-watt hour) for engines with power more than 85 KW	0.36	0.40

Note: *The test shall be as per the Test Driving Cycle adopted by different countries with 13 Mode Emissions Engines Dynamometer Test.*

3.2 Type II Test - *carbon monoxide emission at idling speed.*

Not applicable

3.3 Type III Test - *verifying emissions of crankcase gases.*

The crankcase ventilation system must not permit the emission of any of the crankcase gases into the atmosphere.

3.4 Type IV Test - *determination of evaporative emission.*

Not applicable

3.5 Type V Test - *durability of pollution control devices.*

The test represents an endurance test of 80,000 kilometer driven on the road or on a chassis dynamometer.

Explanatory Notes

1.0 Type Approval

Most countries require some form of certification or type approval by vehicle manufacturer to demonstrate that each new vehicle sold is capable of meeting applicable emission standards. Usually, type approval requires emission testing of prototype vehicles representative of planned production vehicles. Under ECE and J apanese regulations, such compliance is required only for new vehicles. U.S regulations require that vehicles comply with emission standards throughout their useful lives when maintained according to the manufacturing specifications.

The advantage of a certification or type approval program is that it can influence vehicle design prior to mass production. It is more cost effective because the manufacturers identify and correct the problems before production actually begins.

2.0 Approval of a Vehicle

Vehicle manufacturers apply for approval of a vehicle type with regard to exhaust emissions, evaporative emissions and durability of pollution control devices to the authority responsible for conducting the tests. The application for approval also includes details like description of engines type comprising all the particulars, drawings of the combustion chamber and of the pistion, description of evaporative control system, particulars concerning the vehicles, descriptions of pollution control devices etc. If the vehicle type submitted for approval meets the requirements of various types of tests mentioned, only then the approval of that vehicle is granted.

3.0 Conformity of Production

The conformity of production is a assembly line testing system. The objectives of assembly line testing are to enable regulatory authorities to identify certified production vehicles that do not comply with applicable
emission standards, to take remedial actions (such as revoking certification and recalling vehicles) to correct the problem, and to discourage the manufacture of non-complying vehicles. This test provides an additional check on mass-produced vehicles to assure that the designs found adequate in certification are satisfactorily translated into production, and that quality control on the assembly line is sufficient to provide reasonable assurance that vehicles in use meet standards. The basic difference between TA and COP is that TA is based on prototype vehicle or design of the vehicle while COP measures emissions from real production vehicles.

As per the requirements set forth by the European Union, a sufficient number of random checks are made of serially-manufactured vehicles bearing the type approval mark of vehicles bearing all the types of tests mentioned above. The tolerance limits are provided for conformity of production in Type I tests.