

Terms of Reference (ToR)

For

Conducting Technical Training on Operation and Maintenance of Large Biogas/Waste to Energy Projects

1. Introduction

Alternative Energy Promotion Centre (AEPC) is a Government institution established on 3 November 1996, under then Ministry of Science and Technology with the objective of developing and promoting renewable and alternative energy technologies in Nepal. Currently, it is under the Ministry of Energy, Water Resources and Irrigation. AEPC is mandated for the promotion of renewable energy, energy efficiency and related climate change activities. It is also a prime actor and has good experience in formulation of the climate change and carbon related projects in Nepal.

The World Bank has been supporting in the areas of waste to energy and large biogas in Nepal since 2014, The World Bank has already supported establishment of 20 waste to energy projects through the Scaling up Renewable Energy Program (SREP) and Private Sector Led Minigrid Support Program (MGEAP).

Background

Most of the large plants in Nepal are based on continuous stirred tank reactor (CSTR). This is a biogas reactor equipped with an impeller or other mixing device to provide efficient mixing. The name CSTR is often used to refer to an idealised agitated tank reactor used to model operation variables required to attain a specified output. Biogas equipped with features to continuously feed and exhaust reactants is an example of a mechanically mixed flow reactor. Amongst many advantages of CSTR plants over conventional models, the low hydraulic retention time (HRT) proved to be very useful. The low HRT allows large volumes of waste to be digested within smaller digester enclosure, minimizing the space requirements and increasing throughput.

Similarly there are MIBR technologies also installed in Nepal. Microbe-induced batch reactors, also known as microbial batch reactors, are a type of bioreactor used for cultivating microorganisms under controlled conditions to carry out specific biological processes.

With support from the World Bank, AEPC has successfully commissioned more than 20 large scale large biogas plants and are in the process of installing more plants ranging from 3000 m³ to 10,000 m³. Most of the installation companies are from abroad. Even though post-commissioning operation and maintenance (O&M) is done by the parent company, the O&M is eventually handed over to the Nepalese counterpart. In this aspect, it is essential that a pool of experts is available for O&M of large-scale biogas plants. This shall enable Nepalese experts to independently solve any problems related to operation and maintenance of large biogas plants.

2. Objectives

The specific objective of the assignment is to:

- Train 25 participants from private biogas developers who are currently operating large scale biogas or in the verge of completing large biogas plants in Nepal, who had received AEPC/World Bank grants.
- Propose and recommend way forward for promotion of large biogas plants under Waste to Energy component.

3. Scope of work (activities)

- Prepare training curriculum and modules in close coordination with AEPC.
- Arrange and/or manage necessary logistics for conducting the training smoothly.
 - Arrange all human resources required for the training program.
 - Prepare PowerPoint presentations for theory lectures and distribute hand-outs for each session.
 - In association with AEPC, arrange for a venue to conduct practical training for carrying out hands-on operation and maintenance of biogas plant.
 - Arrange logistics for the participants attending the training program including training hall, stationary (notebooks, pens, etc.), beamer and bags.
 - In coordination with AEPC, arrange certificates for distribution to successful participants after the training.
- Smoothly conduct the training with particular focus on the following categories:
 - Weighing of substrate and problems related to weighing of input materials. Train participants on data acquisition related to mass balance for the input material.
 - Repair and maintenance of input pumps. Introduce participants to the types of semi-solid pumps, the problems associated with it and remedial measures in case of failure.
 - Removal of impellers, heat-exchangers, membranes and sensors of digester for large biogas plants including the problems associated during operation of the individual components and remedial measures.
 - Assess the effectiveness of technology choice, selection process, project design process including but not limited to, the suitability/appropriateness of the proposed anaerobic reactor design for treatment of a specific waste for large scale biogas developers in Nepal.
 - During training, share past experience of the technology (Reactor Design) for treatment of similar nature of waste and provide solutions for optimization.
 - Conduct the field visits to operational biogas (waste to energy) plants – combination of the ones generating bio-methane and electricity as the final outputs -- as advised by AEPC and assess the O&M processes & protocols and analyse the primary O&M process and requirements such as but not limited to, developer's O&M structures, spare parts requirements, plant safety/security, contractual arrangements with vendors, supply chain, feed preparation requirements, feed/catalyst/chemical storage requirements, waste water treatment, HSE requirements; reasonableness of gas/electricity outputs etc. and provide recommendations for improvement.

- Support in technology tie ups arrangements (in terms validity of know how transfer agreement, propriety equipment if any, capacity building of counterpart in Nepal, etc.)
- Prepare a training conduction report after the completion of training with key recommendations on the way forward for promotion of large biogas plants under Waste to Energy component.
- The Consultant need to manage the following:

SN	Requirement	Quantity	Unit
1	Accommodation and food cost of participants for 25 participants (Standard about 3 Star facilities)	8	Days
2	Transportation of participants for site visit (3 Days or 3 times in different sites)	6	way
3	Bags for participants (Standard and Good Quality Office Backpack)	25	Nos
4	Banner/Signage (Standard about 4x10 ft)	1	Pc
5	Note Book (Standard about A4, 50 pages), standard Pen and Pencil	25	Set

4. Timeline and deliverables

The key deliverables of the assignment along with the timeline of the assignment shall be as follows:

- An Inception Report (Training preparation report) within one week after signing the agreement
- A Draft Training Manual on operation and maintenance of biogas plant within three weeks after approval of the inception report by AEPC
- Conduction of training should be done within the seventh week of the specified period.
- A Draft Training Report within one week of completion of the training for comments and feedback
- The Final Training Completion Report including training manuals (two printed copies and an e-copy) within one week of receiving consolidated comments, if any, on the draft training report

To the extent possible, AEPC shall provide written comments and feedback on the reports submitted by the Consultant within seven days.

5. Proposed Team Composition

Three people are sought to conduct the training. Two international experts and one local training Expert shall conduct the training. The minimum qualifications and experience of the proposed team members should be as follows:

- **Team Leader (International) (One):** Mechanical, Civil or Environmental Engineer with at least Bachelor's Degree in the field of energy/environment/water and sanitation and more than **7 years' experience in designing and conducting of O&M of large biogas systems training programs in the past.**
- **Biogas Expert (International) (One):** with at least a Bachelor's Degree in the field of energy/environment/water and sanitation and more than **5 years of professional hands-on experience in dealing with biogas technology.** Experience in the Nepalese biogas sector would be an advantage.
- **Training expert (National) (One):** with at least a Master's degree in any discipline and experience of a minimum of 5 years and having experience in conducting of training on large biogas in the past.

6. Duration of the Assignment

The assignment, in totality, shall be completed within 1 (One) month from the date of signing of contract agreement.

7. Required Documents from Consultant

- Cover letter for submission of Expression of Interest (EoI), need to indicate clearly about the applied assignment
- Firm/Company Registration Certificate (with updated renewed)
- VAT/PAN Certificate (For Domestic Consultants only)
- Tax Clearance Certificate of FY 2081/82 (For Domestic Consultants only)
- Power of Attorney for authorized signatory
- Self-declaration of eligibility
- Profile of Key Human Resources (During EoI Stage) and Signed CVs of proposed experts (During RFP Stage only)
- Documents to demonstrate:
 - General work experience within the last 10 years
 - Specific work experience within the last 10 years
 - Technical and Managerial capacity of the Consulting Firm including Audit Reports of last three years

8. Consultant Selection Method:

A Consultant for each cluster will be selected in accordance with the **Consultants Qualifications-based Selection (CQS)** method set out in the prevailing Procurement Regulations of the World Bank.