



BIOGAS PLANT COMMISSIONING TESTING AND 1 YEAR GUARANTEE MONITORING GUIDELINES



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PREAMBLE

AEPC has hosted different project interventions through support from development partners in the past. In 2011, the GoN and development partners (Danida, DfID, the Norwegian Ministry of Foreign Affairs, KfW, SNV and UNDP) jointly agreed to support formulation of a National Rural and Renewable Energy Programme (NRREP), that it will be a single programme modality in which there will no other programmes or projects funded outside the NRREP and where the GoN has committed itself to reform the subsidy system and finance a higher portion of the subsidies for Renewable Energy Technologies (RET).

The single programme modality implies that the GoN/AEPC will commit to include all future programmes and projects under NRREP where AEPC is the executing partner. The aim is that a number of additional Development Partners (including, but not limited to the World Bank and the Asian Development Bank) can sign up to the NRREP in future in support of the objectives and outputs of NRREP, and follow the overall managerial structure of NRREP in order to avoid parallel implementation structures.

In this context NRREP aim to promote the use of large biogas in Nepal. The GoN has declared a subsidy for the large biogas sector. The sector has been divided into 4 categories as, institutional, community, commercial and municipal scale large biogas plants. To receive the subsidy from the government, the developer should follow certain process. A feasibility study and/or a detailed feasibility study should be approved from the large biogas technical review committee within AEPC. The developer may start the construction/installation of the plants only via a pre-qualified construction company of AEPC. This pre-qualified construction company must abide by certain standards prescribed by AEPC. Before handing over the biogas plant to the developer/owner, the pre-qualified construction company must pass the testing and commissioning test. This guideline has been prepared to aid the respective construction company, developer and AEPC during the testing and commissioning tests that shall be carried out by AEPC or a third party designated by AEPC.



1. CONSTRUCTION COMPLETION AND COMMISSIONING TESTS

1.1 CONSTRUCTION COMPLETION TESTS

The Construction Company shall complete all construction tests required to verify the mechanical, civil, instrumentation and control integrity of the plant. The Construction Company shall provide records of all tests to AEPC as evidence to support the application for the 50% and 90% of the subsidy for commercial/MSW and institutional/community plants respectively to be delivered after successful plant commissioning.

Civil tests:

The Construction Company shall complete, as a minimum, water tightness tests to the liquid retaining structure to prove the civil integrity of the plant, and gas tightness tests of the roof and the biogas pipe to demonstrate that no gas leaks will occur during the operation of the plant.

Operation and Maintenance (O&M) Manuals, Certificates:

The Construction Company shall provide O&M manuals and certificates for all equipment, also including instrumentation calibration certificates where appropriate to the Developer/Operator. The O&M Manuals shall include all drawings relevant to the equipment supplied.

2. PERFORMANCE TESTS

AEPC or a third party designated by AEPC shall carry out the performance tests over 1 week. The Construction Company shall be responsible for keeping records of the parameters stated in the table below. The Construction Company shall present a summary of the records in the table below and submit the table Appendix A with the daily logs as supporting documentation in the “Maximum”, “Average” and “Minimum” columns. The Construction Company shall include the Guaranteed Performance Requirements in the “Guarantee Performance Requirement” (GPR) column as per the feasibility or the detailed feasibility report (FS)/ (DFS) report.

2.1 RESULTS AND GPR TABLE

S. No.	Parameters	GPR	Maximum	Average	Minimum
i)	Throughput Capacity (kg/day)				
ii)	Biogas Production (m ³ /day)				
iii)	Electrical Power Generation (kWh/day) if Applicable				



iv)	Availability of Net Electrical Power for other Use (kWh/day) if Applicable				
v)	Average power generated per m3 of biogas produced after measuring for 7 days (kWh/m3)				

The Construction Company shall state the means of recording each of the parameters above and provide the necessary instrumentation, on a permanent basis, to measure biogas production, overall electricity production and electricity consumption for the operation of the plant.

2.2 GUARANTEED PERFORMANCE REQUIREMENTS – COMPLIANCE

If as a result of the performance test(s), the following minimum level of Guaranteed Performance Requirements is not attained by the construction company, the construction company shall, at its own cost, rectify any deficiencies until the facilities reach minimum performance level specified below:

- a) If the minimum level of biogas and/or power generation attained, during the performance tests is eighty percent (80%) of the Guaranteed Performance Requirements, as declared in the feasibility/detailed feasibility study, it will be presumed as having met the Guaranteed Performance Requirements, provided liquidated damages are paid as per section 4 below.

The testing and commissioning Certificate shall be signed by AEPC, the Developer/End-User and the Construction Company to verify the success of the Performance Tests.

2.3 FAILURE IN GUARANTEED PERFORMANCE REQUIREMENTS AND LIQUIDATED DAMAGES

2.3.1 Failure to attain Guaranteed Generation of Biogas and/or Electricity

If the rate of biogas generation and/or net power generation from the biogas plants attained in the guarantee test, in pursuant to Sub-clause (ii) and (iii) in section 2.1 is less than the guarantee figures specified in the GPR of FS/DFS, then the Construction Company should elect to pay liquidated damages to the developer in lieu of making changes, modifications and / or addition to the facilities. The Construction Company shall pay liquidated damages at the rate of 1 % of **Total Project Cost** for every complete one percent (1 %) of the deficiency in the generation of biogas and / or power. For example: The GPR from the FS/DFS report suggests that the daily rate of biogas production is 6 cum/day, and the total project cost is NPR 700,000.00 (Rupees Seven Lakhs). Let us assume that the average maximum value attained in the flow meter is 5.5 cum/day. This means that the deviated value from the GPR is 8.3 %. As the minimum level of biogas and/or power generation attained, during the performance tests is eighty percent (80%) of the GPR which is 4.8 cum/day and the plant is generating within the minimum level, the construction company is not liable for any compensation.

Suppose that the maximum value attained is 4.5 cum/day, then the attained value is less than 5% of the minimum threshold. Hence the construction company is liable for a penalty of 5% of the total project cost which amounts to NPR 35,000 (Rupees Thirty Five Thousand) as compensation.

Similarly for electrification projects, the attained kwh/day shall be monitored. If the GPR rating is 20 kwh/day, then there shall be no compensation up to 16 kwh/day. If the attained energy value is only 15



kwh/day, then there is a 5% deviation from the threshold value. Hence the construction company should pay 5% of the total project cost (including cost of electrification costs) as penalty.

2.4 LIMITATION OF LIABILITY

Subject to section 2.3 above, the Construction Company's aggregate liability to pay liquidated damages for failure to attain the Guaranteed Performance Requirements shall be limited to the total contract price.

3. 1 – YEAR GUARANTEE PERIOD

3.1 1-YEAR RELIABILITY GUARANTEE

The Construction Company shall be liable to carry out any necessary repairs, modifications or replacement, free of cost, to any defects in the civil structure and/or any mechanical, electrical, instrumentation or control equipment beyond the normal wear and tear for a **period** of one year after the signing of the testing and commissioning certificate.

The Developer/End User shall be responsible for the Operation and Maintenance of all plant and equipment as per the manufacturer's recommendations and as described in the O&M manuals handed over by the Construction Company at the commissioning stage. The Developer/End User shall be responsible of maintaining records that could be inspected in order to satisfy the O&M requirements of all plant and equipment. Failure to do so may breach the guarantee period and liability of the Construction Company to make any rectification on the plant to achieve the GPR.

The Developer/End User shall be responsible for reporting any such defect to the Construction Company and AEPC as soon as the defect has been identified as per the Defect Reporting Form (Appendix C). The Construction Company shall make good any defects as reported by the Developer/End User within a period of 1 month. The Construction Company shall report the rectification of the defect by completing the relevant section of the Defect Reporting Form and submit it to AEPC. AEPC reserves the right to monitor the rectification of defects at any time and shall check a minimum of 10% of the defects reported.

In the event of disputes over liability for rectification of a certain defect, both parties shall contact AEPC in order to mediate between the Construction Company and the Developer/End-User.

3.2 1-YEAR PROCESS GUARANTEE

The above guaranteed figures shall be applicable for a period of 1 year after the signing of the Take Over form, during which the Developer shall keep a record of all of the parameters above. During this period, AEPC shall carry out two Process Guarantee Performance Tests of 1 week duration repeating the performance tests as above. AEPC shall provide two weeks' notice to the Construction Company prior to the commencement of the test, as the Construction Company shall have the right to be present during the duration of the tests. The performance tests shall be carried out, where possible, during the winter and summer months to check the compliance with the GPR under all conditions before the end of the 1-Year Guarantee Period.



The Developer/End-User shall be responsible for operating the facility as per the training and Operation and Maintenance Manuals Provided, and keep sufficient records to demonstrate it. Failure to do so may breach the guarantee period and liability of the Construction Company to make any rectification on the plant to achieve the GPR.

The construction company shall decide and request AEPC to conduct the tests, during the 1-Year Guarantee Period. Upon receipt of the request, AEPC will notify the Construction Company of the conduction of a Performance Test providing it 2 weeks prior-notice. **AEPC shall monitor 100% of the plants commissioned.**

In the event of disputes over liability for meeting the GPR, both parties shall contact AEPC in order to mediate between the Construction Company and the Developer/End-User.

3.3 FAILURE TO COMPLY WITH THE 1-YEAR RELIABILITY AND PROCESS GUARANTEES AND LIQUIDATED DAMAGES

If the Construction Company fails to rectify any defect within the month period allowed, the Construction Company shall be liable to pay two per cent (2%) of the defect rectification cost per extra day.

Regarding the Process Guarantee, same conditions as per section 2 above shall apply.

3.4 LIMITATION OF LIABILITY

Subject to section 3.3 above, the Construction Company's liability for an individual defect shall not exceed the total cost for rectification of that defect, and its aggregate liability to pay liquidated damages for failure to attain the Guaranteed Performance Requirements shall not exceed the contract price.

Regarding the Process Guarantee, same conditions as per section 2 above shall apply.



4. GENERAL PROVISIONS FOR EVALUATION OF PLANT PERFORMANCE AND RELEASE OF GUARANTEED PERFORMANCE REQUIREMENTS

- (i) The Construction Company shall have the right to review and agree to comply with the GPR stated at the Feasibility/Detailed Feasibility Study (FS/DFS) and, once selected, shall have an opportunity to review the FS/DFS. A time frame of 15 days shall be given to review the FS/DFS report. Once the construction company agrees to the FS/DFS, they should comply with the outputs indicated in the report. If the construction company disagrees with the FS/DFS provided to them, it should be informed in writing and with proper justification. A copy of the letter should be provided to AEPC and the developer.
- (ii) The Construction Company shall install all instrumentation required for measuring biogas and electricity production. This instrumentation shall be a permanent component of the biogas plant.
- (iii) AEPC and/or designated Institution will establish procedures for analysis for the different streams which can be strictly adhered to, for all future analysis. Once the characteristics and the procedures for analysis are established, the waste / effluent will be analysed by designated AEPC /its designated Institution for biogas quality for each waste stream at an interval mutually agreed with the developer / technology supplier / selected Construction Company. The total biogas generation will be then worked out based on the average quantity of waste fed to the reactor(s) on daily / weekly / monthly basis.
- (iv) The Performance Test during the commissioning stage shall be conducted by the AEPC or a third party designated by AEPC during commissioning of the facilities or the relevant part thereof to ascertain whether the facilities or the relevant part can attain the Guaranteed Performance Requirements specified in the FS/DFS. The Construction Company, Developer and any other expert / consultant nominated by AEPC may attend the guarantee test. The developer shall promptly provide the Construction Company with such information / assistance as the Construction Company may reasonably require in relation to conduct and result of the performance test (and any repeat thereof).. AEPC shall provide 2-week's notice to the Construction Company in the case to witness the tests.
- (v) , If the Construction Company fails to rectify a defect over the duration of the 1-Year Reliability Guarantee period, it shall be disqualified from receiving the 10% remaining of the subsidy to be provided.
- (vi) If, for reasons attributable to the Construction Company, the minimum level of Guaranteed Performance Requirements specified in the Contract Agreement are not met either in whole or in part during the Performance Tests at the commissioning or 1-Year Guarantee Period stages, the Construction Company shall at its cost and expense make such changes, modifications and/or additions to the Plant or any part thereof as may be necessary to meet at least the minimum level of such Guarantees. The Construction Company shall notify the Developer and AEPC upon completion of the necessary changes, modifications, and/or additions, and shall request the Developer and AEPC to repeat the Guarantee Test until the minimum level of the Guarantees has been met. If the Construction Company fails to meet the minimum level of Guaranteed Performance Requirements, the Developer may consider for termination of the contract and recover the payments by revoking the bank guarantee. The Construction Company shall, in this case, not be qualified for the subsidy from AEPC if the requirements are not met at the Commissioning stage. AEPC shall revoke payment of



- the first 40% subsidy installment disbursed against bank guarantee after the Letter of Commitment /Construction was issued, and shall not disburse the 50% to be issued at the commissioning stage for commercial/MSW and institutional/community respectively. The Construction Company shall not be qualified for the 10% remaining part of the subsidy if the requirements are not met during the 1-Year Guarantee Period.
- (vii) If, for reasons attributable to the Construction Company, the Guaranteed Performance Requirements specified in the contract agreement are not attained, either in whole or in part but the minimum level of the Guaranteed Performance Requirements specified in the contract agreement is met, the Construction Company shall, at the developer option, either (a) make such changes, modifications and / or additions to the facilities or any part thereof, that are necessary to attain the Guaranteed Performance Requirements at its cost and expenses within a mutually agreed time and shall request the developer to repeat the guarantee test or (b) pay liquidated damages to the developer in respect of the failure to meet the Guaranteed Performance Requirements in accordance with the provision in the contract agreement. The above applies to both the Performance Tests to be conducted during the Commissioning Stage and the 1-Year Guarantee Period.
 - (viii) However, if for reasons not attributable to the Construction Company, the Performance Tests of the facility or the relevant part thereof cannot be successfully completed within the period from the date of completion specified in the tender document or any other period agreed upon by the developer and the Construction Company, the Construction Company shall be deemed to have fulfilled its obligations with respect to the Guaranteed Performance Requirements and the sub-clauses (ii), (iv) and (v) mentioned above will not apply.
 - (ix) In case the developer exercises its option to accept the equipment after levy of liquidated damages, the payment of liquidated damages under Sub-clause (vii) mentioned above up to the limitation of liability specified in section 2.5 shall completely satisfy the Construction Company guarantee under Sub-clause no (vii), mentioned above, and the Construction Company shall have no further liability whatsoever to the developer in respect thereof. Upon the payment of such liquidated damages by the Construction Company, AEPC shall issue the take-over certificate (Appendix C) for the facilities or any part thereof, in respect of which the liquidated damages have been so paid.



APPENDIX A – PERFORMANCE TESTS REPORTING TABLE

Start Date:

End Date:

S. No.	Parameters	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
i)	Throughput Capacity (kg/day)							
ii)	Biogas Production (m ³ /day)							
iii)	Electrical Power Generation (kWh/day)							
iv)	Electrical Power Consumption in the Biogas Plant (kWh/day)							
v)	Availability of Net Electrical Power for other Use (kWh/day)							
vi)								
vii)	Power generated per m ³ of biogas produced after measuring for 7 days (kWh/m ³)							

Remarks



DAY 1	
DAY 2	
DAY 3	
DAY 4	
DAY 5	
DAY 6	
DAY 7	



APPENDIX B - TAKE-OVER CERTIFICATE

Testing and Commissioning CERTIFICATE

Alternative Energy Promotion Center, Large Biogas Plants



Project Name	
Location	
Date	
Biogas size plant	
Biogas production GPR	
Electricity Production GPR	

I, _____, representative of the Construction Company _____, declare that the Commissioning Tests have been passed satisfactorily and that the Performance Guarantees have been met or liquidated damages paid to the Developer as per the clauses established in the Biogas Plant Commissioning Testing Guidelines.

Signed
Date

I, _____, representative of the Developer _____, declare that the Commissioning Tests have been passed satisfactorily and that the Performance Guarantees have been met or liquidated damages paid as per the clauses established in the Biogas Plant Commissioning Testing Guidelines.

Signed
Date

I, _____, representative of Alternative Energy Promotion Center, declare that the Commissioning Tests have been passed satisfactorily and that the Performance Guarantees have been met or liquidated damages paid to the Developer as per the clauses established in the Biogas Plant Commissioning Testing Guidelines.

Signed
Date



APPENDIX C – DEFECT REPORTING FORM

DEFECT REPORTING FORM

Alternative Energy Promotion Center, Large Biogas Plants



To be filled by the Developer/End-User

Project Name	
Location	
Name of End-User/Developer	
Construction Company name	
Testing and Commissioning Certificate Issue Date (start of Defects Period)	
End of Guarantee Period (1-Year post the Plant Handover Certificate Issue Date)	
Biogas size plant	
Biogas production GPR	
Electricity Production GPR	
Date defect noticed	
Date defect reported	
Type of defect (mark with an “x”)	Process Guarantee <input type="checkbox"/> Reliability Guarantee <input type="checkbox"/>
Description of the defect	
O&M records available to demonstrate operation and maintenance as per the manufacturer’s recommendations? Please describe	

I, _____, representative of the Developer/End-User _____, report the defect described above, and request AEPC to carry out a Performance Test in my facility/the Construction Company above to rectify the defect (delete as appropriate).

Signed
Date



To be filled by the Construction Company for Reliability Defects

Project Name	
Location	
Name of End-User/Developer	
Construction Company name	
Defect rectification date	
Description of the measures taken to rectify the defect	
Cost of rectification of the defect	

I, _____, representative of the Construction Company _____, declare that the defect above has been rectified satisfactorily.

Signed
Date

I, _____, representative of the Developer/End-User _____, confirm that the defect above has been rectified satisfactorily within the 1-month period and, in case of delays, liquidated damages have been paid as per the guidelines.

Signed
Date

I, _____, representative of Alternative Energy Promotion Center, confirm that the defect above has been rectified satisfactorily within the 1-month period and, in case of delays, liquidated damages have been paid as per the guidelines.

Signed
Date
Phone Number:



APPENDIX D – 1-YEAR GUARANTEE AGREEMENT

1-YEAR GUARANTEE AGREEMENT

Alternative Energy Promotion Center, Large Biogas Plants



Project Name	
Location	
Date	
Biogas size plant	
Biogas production GPR	
Electricity Production GPR	
Number of Defects Raised	
Number of Defects Corrected Within the Allowed Period	
Number of Defects Corrected Outside the Allowed Period	

I, _____, representative of the Construction Company _____, declare that the 1-Year Guarantee Period has been passed satisfactorily or liquidated damages paid to the Developer as per the clauses established in the Biogas Plant Commissioning Testing Guidelines.

Signed
Date

I, _____, representative of the Developer _____, declare that 1-Year Guarantee Period has been passed satisfactorily or liquidated damages paid as per the clauses established in the Biogas Plant Commissioning Testing Guidelines.

Signed
Date

I, _____, representative of Alternative Energy Promotion Center, declare that 1-Year Guarantee Period has been passed satisfactorily or liquidated damages paid to the Developer as per the clauses established in the Biogas Plant Commissioning Testing Guidelines.

Signed
Date



TESTING OF CONCRETE STRUCTURES DESIGNED TO RETAIN AN AQUEOUS LIQUID

1. After cleaning, and as far as practicable before any earth or other filling is placed against the outside wall faces, concrete structures designed to retain an aqueous liquid shall be filled with water at a uniform rate of not greater than 2 m in 24 h. A period shall be allowed for stabilization, after which the water level shall be recorded by approved means at 24-h intervals for a test period of 7 days. During the test period the total permissible drop, after allowing for evaporation and rainfall, shall not exceed $1/500$ of the average water depth of the full tank, or 10 mm, whichever is less.
2. Notwithstanding the satisfactory completion of the above test, any leakage visible on the outside faces of the structure shall be stopped. Any caulking or making good of cracks in the wall section shall, where practicable, be carried out from the inside face.
3. Adjacent internal chambers within a structure shall be tested sequentially. Chambers adjacent to the chamber under test shall be empty during the test.
4. On satisfactory completion of the test, the structure shall be emptied, as far as practicable, unless the water can be used as part of the subsequent activities.