



**Project design document form
(Version 11.0)**

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION

Title of the project activity	Biogas Support Program - Nepal Activity-4
Scale of the project activity	<input type="checkbox"/> Large-scale <input checked="" type="checkbox"/> Small-scale
Version number of the PDD	11.1
Completion date of the PDD	10/02/2020
Project participants	Alternative Energy Promotion Centre (AEPC)
Host Party	Nepal
Applied methodologies and standardized baselines	AMS I.E. Version 09, Switch from non-renewable biomass for thermal applications by the user
Sectoral scopes	Type I: Renewable Energy Projects
Estimated amount of annual average GHG emission reductions	75,307 tCO _{2e}

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The purpose of this project is to promote household biogas digesters and biogas stoves to households with one or two cattle located in Nepal through the capacity enhancement of the private sector to be able to carry out feasibility, installation and after sales services of the biogas plants. The digesters enable households to displace firewood and fossil fuels with biogas from animal waste and human excreta. The generated biogas will feed biogas cook stoves, and replace the firewood used for cooking in wood stoves in the baseline scenario. The replacement of firewood that is non renewable biomass (NRB) is counted as emission reduction under the Clean Development Mechanism (CDM). Emission reductions are determined by defining the percentage of NRB in the firewood replaced, since firewood is the only biomass source replaced by the project of which a part is NRB.

This project is centrally managed by the Alternative Energy Promotion Centre (AEPC)¹ with the support of Biogas Sector Partnership Nepal (BSP-NEPAL)², the implementing agency of AEPC. AEPC is a government entity that executes renewable/alternative energy programs in Nepal, including this project.

The proposed project activity includes 20,318 digesters which were implemented between 9 May 2006 and 21 June 2007. Table 1 provides an overview of the digesters, categorised according to their size and location.

Table 1: Digesters listed in the Biogas Support Program - Nepal Activity-4

Region Size (m ³)	Terai	Hill	Mountain or Remote Hill	Total
4	408	2,408	16	2,832
6	9,604	5,944	117	15,665
8	1,503	177	4	1,684
10	109	28	0	137
Total	11,624	8,557	137	20,318

Major activities under the project include:

1. Assigning investment subsidies and support in providing micro credit facilities to reduce the investment barrier for households.
2. Quality control and assurance, monitoring and biogas program evaluation to ensure long-term performance of the digesters and ensure that digester companies deliver their maintenance obligations.
3. Support innovation in many aspects of the program including digester design and program monitoring.
4. Raising awareness among potential users about the possibilities and advantages of the digesters.
5. Carry out capacity building activities targeted at the digester companies, including training in digester production and implementation but also training in business management.
6. Motivate and train new biogas companies in remote areas to expand their coverage and enable further expansion of the areas served by biogas companies.

Sustainable development benefits

- The BSP has a range of sustainable development benefits which are fully attributable to the project:
- Improved living conditions in and around the households due to a significant reduction of smoke and fumes from cooking.
- Reduced deforestation, avoiding loss of biodiversity and soil erosion.
- Reduced time spent on fuel collection.
- Improved sanitary conditions in and around the house, in particular when connecting the toilet to the digester.
- Improved safety (less fire incidents)
- Improved fertilizer quality through the production of bio-slurry.
- Reduced dependence of households on purchased fuels and purchased chemical fertilizers.

Project Type

¹ Alternative Energy Promotion Centre, web-site: <http://aepec.gov.np>

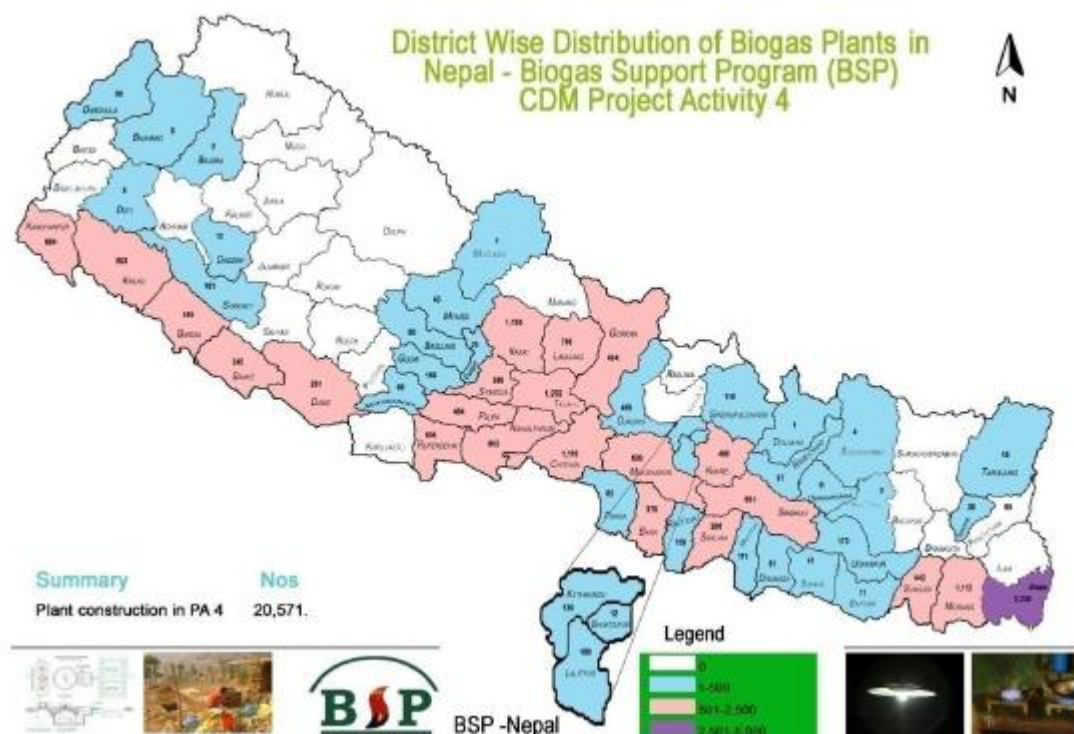
² Biogas Sector Partnership Nepal, web-site: <http://www.bspnepal.org.np>

According to the project standard for the CDM project activity, the project activity belongs to Type I: Renewable Energy Projects as the maximum output from the project is below 45 MW_{th}. There are 20,318 biogas individual units under the project activities with the estimated capacity ranges from 1.16 KW to 2.32 KW, the individual bio-digester also qualifies for the Type-I Micro-scale project which meets the limit of micro-scale of 5 MW capacity.

The estimated average annual emission reduction from the project activity during this crediting period is 75,307 tCO₂eq.

A.2. Location of project activity

The digesters are located in various regions and provinces in Nepal. Each digester is uniquely identified through a plant code in the BSP database. Since the project sites are scattered across the country, the range of geographical coordinates of the country, i.e. 26°N – 30°N, 80°E – 88°E is provided as the reference for this project activity. Locations of the biogas plants are also shown in the map below.



A.3. Technologies/measures

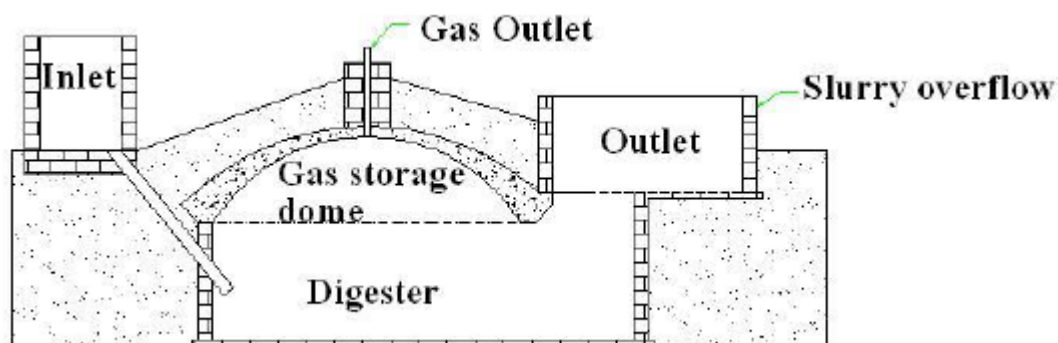
The target group of the project are households with at least one head of cattle (generally cows or buffalos) who currently use non-renewable woody biomass (firewood) and/or fossil fuels (kerosene and/or LPG) for cooking purposes. The project aims to utilize the methane produced from household biogas digesters to replace the current non-renewable energy sources that is used by households. The main feedstock for digesters is cattle manure and human excreta. Digesters are available in different sizes. The size of the digester suitable for a given household depends on the number of people living in the house and the number of head of cattle present.

The technology is environmentally sound. The digesters provide a decentralized source of energy and bring several sustainable development benefits as indicated in section A.1. The project also contributes to technology transfer since the technology is based on a Chinese design which has been tailored to the Nepalese situation with support of the Netherlands Development Organization SNV.

Technical Description of the project activity

The technologies used in the proposed project are biogas stoves that are fed by household biogas digesters. The digesters have a sludge and gas holding capacity range of up to 10 m³. The biogas plants are based on a uniform technical design and are manufactured and installed following established technical standards in Nepal. These digesters include a compartment for the preparation of the digester feedstock at the inlet, the main digester and an overflow for the digestion product. The digester itself is a closed underground container made of concrete or other materials.

The feedstock consists mainly of cattle manure and human excreta to which water is added. The biogas is extracted from the digester and transported to a stove. The digester has an overpressure which creates a stable flow of gas for use in the cooking stoves³. The gas has a methane content of 52%⁴. The biogas produced from the digester will be fed into the stove. The biogas consumption of each stove is 400 litre/hour.



To allow for quality monitoring and continuous digester improvement, BSP has a strong Monitoring and Evaluation system in place. This system confirms the existence of each plant and determines its performance. This monitoring is crucial to maintain high technical standards. It includes the following elements:

Quality inspection: For each plant the digester companies should submit to BSP-NEPAL completion and maintenance reports. Only after these reports have been received, BSP-NEPAL recommends AEPC to release grant payment to the biogas user through the digester companies. Companies that fail to meet BSP-NEPAL's quality standards for construction and maintenance are penalised. Technical staff from BSP-NEPAL conducts quality control of newly constructed plants and of the implementation of After Sales Service contracts. They inspect five percent of newly constructed plants and another 2.5 percent each of digesters after two and three years respectively of plant operation to ensure that After Sales Service has been delivered as required.

Biogas Users' Survey (BUS): The BUS uses a random sample of biogas plant users of the programme to primarily assess 1) the reduction in woody biomass post biogas installation and 2) the portion of non renewable woody biomass displaced .

Biogas Impact Study (BIS): A detailed study of the impact of the biogas systems on a wide range of development indicators of health, socio economic and environmental conditions is carried out after every three years for the programme, together with the BUS.

General Evaluations and Assessments: Periodic evaluations are carried out by the donors. Several other assessment such as biogas loan surveys, gender assessments, and environmental impact assessments are also conducted. Implementation and operation problems can also be detected through a customer complaint system within BSP.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of Nepal (Host)	Alternative Energy Promotion Centre (AEPC)	No

³ The same stove types and capacity (biogas burners) are used by all the project participants. The stove and biogas burners are manufactured by various biogas companies with the uniform technical design approved by BSP- Nepal.

⁴ G.P. Devkota, "Final report on Analysis of Biogas Leakages from Household Digesters, submitted to Winrock International on August 2003, Kathmandu.

Each household participating in the project agrees by contract to transfer the title to the CO₂ emission reductions from the digester to AEPC.

A.5. Public funding of project activity

The project receives funding from three sources:

- Nepalese government,
- Kreditanstalt für Wiederaufbau (KfW),
- Netherlands Development Organisation (SNV) with funding from the DGIS (directorate general of International Cooperation). DGIS will terminate its support for the program in 2010. Other sources of support will be sought for the activities to be implemented in future.

The providers of the public funding will not purchase any emission reductions generated by the proposed project and affirms that the funding of the project activities for the biogas program has not resulted in the diversion of ODA and that this funding is not counted towards the financial obligation of the concerned Parties. Additionally AEPC has also affirmed the same understanding regarding this funding.

A.6. History of project activity

The project activity (Ref: 5416) was registered as a project activity on 13 December 2011 and the project has successfully completed first crediting period. The project activity is proposed for second crediting period renewal. This project activity is neither registered as another CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA). The proposed CDM project activity is neither a project activity that has been deregistered nor CPA that has been excluded from a registered CDM PoA.

A.7. Debundling

The proposed project is not a de-bundled component of a large-scale CDM project activity.

The section B.3 of Guidelines on assessment of debundling for SSC project activities (Version 03 annex 13, EB54) states that "If each of the independent subsystems/measures (e.g., biogas digesters, residential solar energy systems, kerosene or incandescent lighting replacements) included in one or more CDM project activities is no greater than 1% of the small scale thresholds defined by the applied methodology and the subsystems/measures are indicated in the PDDs to be implemented at or in multiple locations (e.g., installed at or in multiple homes) then these CDM project activities are exempted from performing a de-bundling check, i.e., considered as being not a de-bundled component of a large scale activity."

The capacity of each biogas stove is 400 litre/hour. With a methane content of 52%, this gives an annual natural gas capacity of 1.86 kW_{th} per stove. This value is 0.01233% which is less than 1% of the small scale thresholds of 15MW for type I project. Also the biogas digesters are implemented in multiple locations across the country. Hence the project activity is not a debundled component of a large scale CDM project activity.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

The approved baseline and monitoring methodology AMS-I.E "Switch from Non-Renewable Biomass for thermal applications by the user" (version 09) is used in implementing the project.

The detail of the methodology can be accessed from the UNFCCC website:

<http://cdm.unfccc.int/methodologies/DB/IO5FJLJFWT91R6B8SO5BC7TXSK27I2>

The following tools are referred

1. Calculation of the fraction of non-renewable biomass (Tool30)
<https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-30-v2.0.pdf>
2. Assessment of validity of the original/current baseline and update of the baseline at the renewal of a crediting period" Version 03.0.1 (EB 66, Annex 47 (Tool11)
<https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-11-v3.0.1.pdf>
3. Project and leakage emissions from biomass (tool 16)
<https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-16-v4.pdf>

B.2. Applicability of methodologies and standardized baselines

The methodology AMS-I.E - Switch from Non-Renewable Biomass for Thermal Applications by the User, Version 04 was used for the project during first second crediting period. The project activity conforms to the Procedures for renewal of the crediting period of a registered CDM project activity, Version 06 (EB 63, Annex 29). The same methodology with version 9 is applied for the second crediting period renewable for the third crediting period. The applicability of the methodology is outlined as below:

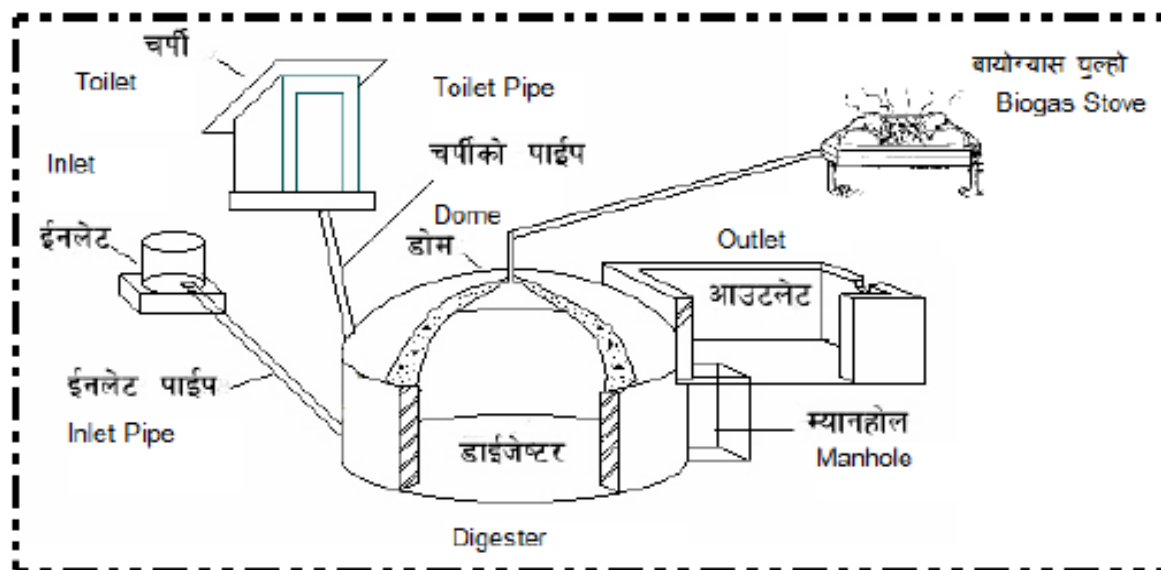
Criteria AMS-I.E.	Explanation
This category comprises activities to displace the use of non-renewable biomass by introducing renewable energy technologies. Examples of these technologies include but are not limited to biogas stoves, solar cookers, passive solar homes	The biogas cook stoves used in the project are indeed “activities to displace the use of non-renewable biomass by introducing renewable energy technologies”. AMS-I.E. even lists biogas stoves as an example of eligible end user technologies.
Project participants are able to show that non-renewable biomass has been used since 31 December 1989, using survey methods.	<p>The BUS for the period 2017/18 demonstrated that the time needed to gather firewood, the price of firewood and the distance travelled to gather firewood is increasing at least since December 1989. This conclusion was confirmed in the NRB survey⁵ conducted at the end of 2008. In that survey the respondents were asked to provide averages for the time needed to gather firewood, the distance travelled and the price. The average of the estimates from all respondents, showed a clear increase on all three indicators.</p> <p>In addition, these trends seen are not on the account of the enforcement of national legislation. A relevant policy initiative is the development of community forests. However, the Nepal National Action Programme⁶ shows that community forestry has the opposite effect and significantly reduces the time spend on firewood gathering. Therefore the increase demonstrated by the BUS cannot be a result of this policy.</p>
The methodology is applicable for technologies displacing use of non-renewable biomass by renewable energy.	The Project is displace the usage of traditional fire wood based cook stoves hence applicable
Project participants or coordinating and managing entities shall describe in the PDD/PoA-DD how the double counting of emission reductions has been addressed (e.g. between end users, distributors and producers of stoves).	The Biogas digesters distributed in Nepal by AEPC is identified uniquely by the gas pipe number, hence double counting is avoided. The database for each project is maintained by the PP which can be verifiable.
For project activities introducing bio-ethanol cook stoves, project participants or coordinating and managing entities shall demonstrate that the bioethanol cook stoves are designed, constructed and operated to the requirements (e.g. with regard to safety) of a relevant national or local standard or comparable literature. Latest guidelines issued by a relevant national authority or an international organisation may also be used.	The Project is using biogas digesters and bio-ethanol is not used and safety requirement does not arise here. Hence it is applicable

⁵ The Non Renewable Biomass (NRB) survey was conducted in 2008 to confirm that the biomass used by households has been subject to the trends listed in AMS-I.E. paragraph 7 since 31 December 1989.

⁶ Nepal, National Action Programme on Land Degradation and Desertification in the context of the United Nations Convention to Combat Desertification (UNCCD), Kathmandu, April 2004 (page 52)

B.3. Project boundary, sources and greenhouse gases (GHGs)

The project boundary follows the definition in AMS-I.E. and is the physical, geographical area of the use of biomass or the renewable energy. This includes the digesters and the cooking stoves where the reduction takes place.



The project activity includes the following sources and gases:

	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from NRB use for cooking	CO ₂	Yes	Main emission source.
		CH ₄	No	Excluded for simplification. This is conservative.
		N ₂ O	No	Excluded for simplification. This is conservative.

	Emissions from fossil fuel use for cooking	CO ₂	No	Excluded for simplification. This is conservative
		CH ₄	No	Excluded for simplification. This is conservative
		N ₂ O	No	Excluded for simplification. This is conservative.

Project activity	Emission from digester and biogas cooking stove	CO ₂	No	This is not required by AMS.I.E
		CH ₄	No	This is not required by AMS.I.E
		N ₂ O		

Figure B.4.1 and B.4.2 show the physical relation between the emission sources and the project boundary.



Figure B.4.1: Baseline emissions. Sources of GHG emissions and uses

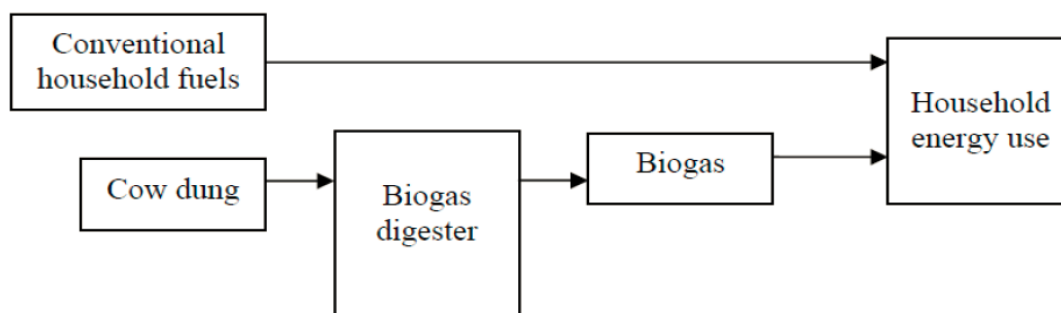


Figure B.4.2: Project emissions. Sources of GHG emissions and uses

B.4. Establishment and description of baseline scenario

As per the per the Procedures for renewal of the crediting period of a registered CDM project activity, Version 06 (EB63, Annex 29) and as per paragraph 286 of the CDM Standard for project activities version 2, the demonstration of the validity of the original baseline or its update does not require a reassessment of the baseline scenario, but rather an assessment of the emissions which would have resulted from that scenario. For cooking, rural households use non renewable biomass as firewood, cow dung and agricultural waste. The use of fossil fuels like kerosene and LPG is insignificant. Research indicates that use of firewood has a low sensitivity to economic determinants. As the small scale project activity displaces the use of non renewable biomass by introducing a renewable energy technology, AMS-I.E, Version 09 is used to estimate the emission reductions for the second crediting period. According to AMS-I.E, Version 09, “in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs”. As per the methodology, the baseline scenario adopted for the project is the use of fossil fuels for thermal energy applications. This is a conservative approach to determine the baseline scenario. For the second crediting period, the Methodological tool “Assessment of validity of the original/current baseline and update of the baseline at the renewal of a crediting period” Version 03.0.1 (EB 66, Annex 47) is used to assess the continued validity of the original baseline. This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period.

Step 1: Assess the validity of the current baseline for the next crediting period The “Procedures for the renewal of the crediting period of a registered CDM project activity” requires assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline.

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

There are no mandatory national and/or sectoral policies that affect the baseline scenario during the renewal of the crediting period.

The fundamental elements of the baseline have not changed since the project was first registered. The relevant national and sectoral policies for the promotion of the biogas digester in the Nepal are the Rural Energy Policy, the Renewable (Rural) Energy Subsidy Policy and the Renewable (Rural) Energy Subsidy Delivery Mechanism.

The Rural Energy Policy was published in the year 2006. The Renewable (Rural) Energy Subsidy Policy was initially published in 2000 (prior to project start date) and latest revision has happened in 2016. Similarly, the Renewable (Rural) Energy Subsidy Delivery Mechanism was initially published in 2000 (prior to project start date) and latest revised in 2017.

The Renewable (Rural) Energy Subsidy Policy has made provisions of financial subsidy support for the installation of the household biogas plants. The Rural Energy Policy has put emphasis to increase efficiency, reduce cost of the household biogas production technology, and to promote it in high mountains.

The Renewable (Rural) Energy Subsidy Policy 2016 has made provisions of financial subsidy support for the installation of the household biogas plants in the range from 2, 4, 6, m³ and above. The subsidy support is categorised based on the location of the biogas plants in the Terai (Southern Plains), Hills and Remote Hills. The subsidy support provided would cover a maximum of around 40% cost of installation of the biogas plants.

The Renewable (Rural) Energy Subsidy Delivery Mechanism, prepared based on the Subsidy Policy, has made arrangements to channel the subsidy to the biogas users through the pre-qualified biogas companies, which provide installation and after sales services related to biogas as per the standard and guidelines approved by the AEPC.

The above policies only provide the incentives for the installation of household biogas plants and do not provide any obligations or enforced targets, nor do they ban the use of fuel wood for cooking. The baseline scenario established for the project is therefore still valid.

Step 1.2: Assess the impact of circumstances

There is no impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions.

As demonstrated in Step 1.1, the promotion of household biogas plants through national policies set up is on voluntary basis. The Renewable (Rural) Energy Subsidy Delivery Mechanism is part of the package design to enhance the Biogas Support Program. No other market transformation activities or circumstances outside the implementation of the BSP have influenced households shift from non-renewable biomass for cooking in rural areas or the shift to rural households biogas plants using renewable biomass. The deployment of BSP has continued during the first crediting period of the Project Activity 1 with subsequent development of Project Activity 2, Project Activity 3, Project Activity 4 and Nepal Biogas Support Programme-PoA using the same baseline as used in the Project Activity 1. As described in Step 1.3, despite the policies, NRB continue to be the main energy source for cooking in rural areas. This is confirmed by the Biogas Users Survey 2017/18 for project activity 4. The conditions used to determine the baseline emission in the previous crediting period are still valid.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

This sub-step is applicable to the project activity since the baseline is the continuation of the existing practice, i.e. the households will rely on traditional cook stoves using non-renewable biomass in the absence of the project activity. The traditional stoves made from local materials are expected to continue in the absence of the project. Therefore, the continued use of baseline materials is possible.

To confirm that NRB based cook stoves continue to be used, the project participants conducted a survey to check whether the firewood replaced by the digesters is subject to the trends defined in AMS-I.E.: increasing amount of time needed or distance travelled for firewood gathering, increasing firewood prices or changes in the type of firewood used. The indicators selected to monitor the continued displacement of NRB in the project are:

- 1) Increase in time needed to gather firewood or increase in distance travelled to gather firewood
- 2) Increasing trend in fuel wood price.

The Biogas Users Survey 2017/18 reveals the following:

- Increase in time and distance travelled to gather firewood. Average time taken to reach forest, collect fuelwood, and return home has increased from 28, 87 and 36 minutes in 1989 to 33, 94 and 42 minutes in 2000 and 37, 115 and 43 minutes in 2018. This indicate that the sourcing biomass from forest over the years have become even more difficult.
- Increase in fuel wood price: The results reveal that the average price of 1 bhari of fuelwood was NPR 28 in 1989 which increased to NPR 124 in 2000 and to NPR 410 in 2018

As it can be seen that, the continuation of use of current baseline equipment, (non-renewable biomass based cook stove) is the most likely scenario for the crediting period for which renewal is being requested.

Step 1.4: Assessment of the validity of the data and parameters

There are some parameters such emission factors per fuel source (IPCC default values), emission reduction factor of the biogas units, which were determined at the start of the first crediting period and not monitored during the first crediting period, are not valid anymore. AMS-I.E, Version 09 provides new guidance on key parameters, different default values and emission reductions calculation formulas. So the current baseline was updated for the second crediting period according to the AMS-I.E, Version 09. Application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the current baseline is valid for the second crediting period, but data and parameters needs to be updated. Therefore step 2 is used.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline The baseline emissions for the second crediting period have been assessed based on the latest approved version of the AMS-I.E (Version 09). More details on the updated baseline emissions for the second crediting period can be seen in section in B 6.3.

Step 2.2: Update the data and parameters As mentioned in step 1.4 above, many default parameters have been updated and new parameters have been used (as per AMS-I.E) for this second crediting period. More details can be seen in sections B.6 and B.7 on the monitoring parameters relevant for the second crediting period.

B.5. Demonstration of additionality

The relevant national and sectoral policies for the promotion of the biogas digester in the Nepal are the Rural Energy Policy, the Renewable (Rural) Energy Subsidy Policy and the Renewable (Rural) Energy Subsidy Delivery Mechanism.

The Rural Energy Policy was published in the year 2006. The Renewable (Rural) Energy Subsidy Policy was initially published in 2000 (prior to project start date) and later revised in 2006 and 2009. Similarly, the Renewable (Rural) Energy Subsidy Delivery Mechanism was initially published in 2000 (prior to project start

date) and later revised in 2006 and 2010⁷.

The Rural Energy Policy has put emphasis to increase efficiency, reduce cost of the household biogas production technology, and to promote it in high mountains.

The additionality of the project is demonstrated by following the criteria outlined in "Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities" which is described below:

Alternatives to the project

Two alternatives to the project have been identified: 1) the continuation of the current situation in which households will continue using biomass and fossil fuels for cooking purposes, which has been reported to be traditional source of energy for cooking; 2) implementing the project without CDM. Both the alternatives stated above are consistent with mandatory laws and regulations as Nepalese legislation does not prevent the use of firewood or fossil fuels for cooking. A barrier analysis has been applied to demonstrate the additionality of the project activity (Alternative 2)

The Renewable (Rural) Energy Subsidy Policy has made provisions of financial subsidy support for the installation of the household biogas plants in the range from 2, 4, 6, 8 and 10 m³⁸. The subsidy support is categorised based on the location of the biogas plants in the *Terai* (Southern Plains), Hills and Remote Hills. The subsidy support provided would cover a maximum of around 40% cost of installation of the biogas plants.

The Renewable (Rural) Energy Subsidy Delivery Mechanism prepared based on the Subsidy Policy, 2009 has made arrangements to channel the subsidy to the biogas users through the prequalified biogas companies, which provide installation and after sales services related to biogas as per the standard and guidelines approved by the AEPC. There are 111 pre qualified biogas companies, and so far the installation has reached around 20,000 plants per year, which is expected to increase in the coming years. The above policies only provide the incentives for the installation of household biogas plants and do not provide any obligations or enforced targets.

1. Investment barrier at household level

The proposed project is a bundle of households owning biogas stoves for cooking using biogas generated from bio digesters. Households face an investment barrier due to their low purchasing power and the high investment costs of digesters. In 2006/07 the weighted average¹⁷ investment cost of a digester was around EUR 281.69 (Refer to Table 5). These investment costs are very high compared to the Gross National Income per capita, which for 2006 is EUR 260 but in rural areas income per capita is EUR 102, which is significantly lower than the investment required for installing a digester (see Table 6).

Table 5: Historic digester investment costs over the period 2004-2007 (EUR)⁹.

Fiscal Year		4 m ³			6 m ³			8 m ³			10 m ³		
Eng	Nepali	Terai *	Hill	R.Hil l**	Terai	Hill	R.Hil l	Terai	Hill	R.Hil l	Terai	Hill	R.Hil l
2006/07	2063/64	231	252	283	273	298	335	315	347	391	350	385	435
2005/06	2062/63	189	201	235	220	233	272	259	274	322	286	301	354
2004/05	2061/62	179	198	228	203	224	257	249	273	273	274	301	347

In rural areas the annual income lies below the national level, as substantiated by the United Nations Development Programme¹⁰ and the Human Development Centre¹¹. Since the target households of the BSP

⁷ The copies of these documents have been shared with the DOE.

⁸ The 2m³ digester was not included in the earlier subsidy policy of 2000. This has only been covered under the Renewable (Rural) Energy Subsidy Policy, 2009 and hence the same is not included in this PDD which covers the digesters installed between 09/05/2006 to 21/06/2007. The subsidy for the 10m³ has been removed from 2009 as discussed in the Renewable (Rural) Energy Subsidy Policy 2009

⁹ Exchange rate, June, 2006: 0.7968 EUR/USD (<http://www.gocurrency.com/v2/historic-exchange-rates.php?ccode2=USD&ccode=EUR&frMonth=5&frDay=30&frYear=2006>)

¹⁰ Nepal Human Development Report 2004 (Inequality between Urban and rural areas), The Human Poverty Index value in Nepalese rural area is 42 which surpass that of urban areas which is 25. See also: <http://hdr.undp.org/en/reports/nationalreports/asiathepacific/nepal/name,3287,en.html>

¹¹ Human Development Centre, 2007, "Report on Human Development in South Asia", page 2, 22-32, available at <http://www.mhhdc.org/html/ahdr.htm>

are required to have cattle, they are typically rural households in the agricultural sector.¹² The average annual income of these households can be estimated by comparing the contribution of the agricultural sector to the national GDP with the share of the population working in this sector. About 81%¹³ of the Nepalese population work in the agricultural sector, and this sector's contribution to the Nepalese GDP in the year 2006 was 31.8%.¹⁴ Surveys held among digester owners shows that in 2005-2006 the target households had on average 7.56 members¹⁵, bringing rural household income at an estimated EUR 806 for Terai and EUR 724 for the Hill region (table 6). This means that investment in a biogas unit constitutes to be more than 35% of the household income, which represents a major portion of the income and hence it acts as a significant barrier for the households to invest in biogas units.

Table 6: Gross national income per capita and per rural household in 2006-2007¹⁶

Year	GNI per capita (EUR)	Agriculture value added (% of GDP)	Share of population in agriculture	GNI per capita rural (EUR)	Household members	Household income (EUR)
2006/07 Terai	260	31.8%	81%	102	7.56	806
2006/07 Hill					7.56	724

The Biogas Credit Unit of AEPC BSP helps overcome the investment barrier by supporting financial institutions with the provision of micro finance loans to the households.

2. Investment Barrier at the Programme Level:

The project activity is part of a broader program (Biogas Support Program) to promote biogas units in rural areas of Nepal. The Biogas Support Program (BSP) is not a commercially viable program and requires substantial donor funding for its continuation.

Funding is divided into two categories - project funding (for project management and the provision of post-installation services) and subsidy funding (providing financial investment support to the households). In general donors are more willing to provide funding for subsidies as it is easier to monitor the proper use of these funds. The only donor that has provided project funding is DGIS, whose funding is expected to cease soon. Due to the nature of the project activity, project management and post installation services form an important element of the overall cost that counts towards sustainability of the program. Lack of financing for these components acts as a prohibitive barrier for implementation of the project activity.

A central organisation is needed to perform the activities listed in section A.2 and to help households overcome the investment barrier. Banks are still reluctant to provide financing to households to facilitate investments in the biogas digesters. Therefore, AEPC through its Biogas Credit Unit provides financial support to the Micro finance institutions to lend to the biogas customers at the local level. AEPC also provides training to micro finance institutes to encourage them to provide loans for renewable energy investments on household level. Without this support, households would not have access to credit support to install the biogas digesters. Thus the CER revenues provide funding for the operation costs of AEPC to fulfil its central role. Without proper financial support to AEPC, the biogas project cannot sustain.

3. Conclusion

The project faces an investment barrier, which can be overcome with the CDM. The other alternative to the project, which is continuation of the current situation is, not prevented by any of the barriers discussed above, making the project activity additional to what would otherwise occur.

¹² Human Development Centre, 2007, "Report on Human Development in South Asia", page 24.

¹³ Nepal National Action Programme on Land Degradation and Desertification in the context of United Nations Convention to Combat Desertification (UNCCD), Ministry of Population and Environment (Kathmandu, 2004)

¹⁴ Review of 10-year plan of Government of Nepal (<http://www.npc.gov.np/uploads/plans/20081228115635.1-2>)

¹⁵ Biogas Users Survey 2005/06, Weighted average based on the regional distribution of the digesters listed in this project.

¹⁶ Sources: <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

The small-scale methodology, AMS-I.E, Version 09 has been adopted for the second crediting period as per the requirement of the Procedures for the renewal of the crediting period of a registered CDM project activity" version 06. Details assessment is provided in B.4. The AMS-I.E, Version 09, is used to demonstrate the emission reductions achieved based on the quantity of non-renewable biomass substituted with the biogas digester units of the project.

According to methodology AMS-I.E. version 09 para 20, baseline emission reductions would be calculated as:

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel} \quad \text{Equation (1)}$$

Where:

ER_y Baseline emissions during the year y in tCO_{2e}

B_y Quantity of woody biomass that is substituted or displaced in tonnes

$f_{NRB,y}$ Fraction of woody biomass used in the absence of the project activity in year y that can be established as non renewable biomass

$NCV_{biomass}$ Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel: 0.0156 TJ/tonne)

$EF_{projected_fossilfuel}$ Emission factor for substitution of non renewable woody biomass by similar consumers. Use a value of 63.7 tCO₂/TJ

B_y can be determined by using one of the following options.

- Calculated as the product of the number of households multiplied by the estimate of average annual consumption of woody biomass per household that is displaced by the project activity (tonnes/household/year).
- Calculated as the product of the number of persons served per household multiplied by the number of households and the estimate of the average annual consumption of woody biomass per person that is displaced by the project activities (tonnes/person/year).
- Calculated as the product of the number of persons served per institution¹⁷ multiplied by the number of institutions and the estimate of average annual consumption of woody biomass per person that is displaced by the project activity (tonnes/person/year).

The methodology requires choosing one of the three options mentioned above for calculating the "Quantity of woody biomass that is substituted or displaced". Option a) has been selected, as it is feasible to determine B_y based on number of households multiplied by the estimate of average annual consumption of woody biomass per household substituted (tonnes/household/year) derived from historical data or estimated using survey methods.

As per para 21 a of the methodology, B_y can be calculated as,

¹⁷ Institutions such as schools, prisons and hospitals

$$B_y = N_{HH} \times (BC_{BL,HH,y} - BC_{PJ,HH,y})$$

Equation (2)

Where:

N_{HH} = Number of households in the project activity, number

$BC_{BL,HH,y}$ = Average annual consumption of woody biomass per household before the start of the project activity, tonnes/household/year

$BC_{PJ,HH,y}$ = If it is found that pre-project devices were not completely displaced but continue to be used to some extent, average annual consumption of woody biomass per household in the pre-project devices during the project activity, tonnes/household/year

The survey was done to identify the average annual consumption of woody biomass per household substituted in 2018 for Project Activity 4. The survey has found that the woody biomass consumption is 5.09 tonnes/household/year before the project activity whereas 0.53 tonnes/household/year of the woody biomass consumption is found after the project activity. It means net annual average woody biomass displaced per household is 4.56 tonnes/household/year.

Differentiation between NRB and renewable biomass and determining $f_{NRB,y}$

The methodology requires the Project Participants to determine the shares of renewable and non-renewable woody biomass in B_y (the quantity of woody biomass used in the absence of the project activity); the total biomass consumption using nationally approved methods (e.g. surveys or government data if available) and then determine $f_{NRB,y}$ as per TOOL30: Calculation of the fraction of non-renewable biomass (EB 97, Annex 9).

As per the tool, the shares of renewable and non-renewable woody biomass in the quantity of woody biomass consumption shall be determined following the steps described below:

$$f_{NRB} = \frac{NRB}{NRB + RB}$$

where

f_{NRB} : Fraction of non-renewable biomass (fraction or %)

NRB : Quantity of non-renewable biomass (t/yr)

RB : Quantity of renewable biomass (t/yr)

The quantity of the NRB can be determined by calculating the total consumption of wood in the country or region and then deducting the quantity of renewable biomass from it.

$$NRB = H - RB$$

Where

H : Total annual consumption of wood in the absence of the project activity (t/yr)

The total quantity of wood consumption is provided by the Ministry of Forest and Environment of Government of Nepal which is estimated as 128 Million Tonne/Year. Renewable biomass (RB) in the country/region/area is estimated using the equation below:

$$RB = \sum (MAI_{forest,i} \times (F_{forest,i} - P_{forest})) + \sum (MAI_{other,i} \times (F_{other,i} - P_{other}))$$

Where:

$MAI_{forest,i}$	=	Mean Annual Increment of woody biomass growth per hectare in sub-category i of forest areas (t/ha/yr)
$MAI_{other,i}$	=	Mean Annual Increment of woody biomass growth per hectare in sub-category i of other wooded land areas (t/ha/yr)
$F_{forest,i}$	=	Extent of forest in sub-category i (ha) ⁴
$F_{other,i}$	=	Extent of other wooded land in sub-category i (ha) ⁴
P_{forest}	=	Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within forest areas (ha) ⁵
P_{other}	=	Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within other wooded land areas (ha) ⁵
i	=	Sub-category i of forest areas and other wooded land areas

The forest area and the other wooded land area are taken from the “State of Nepal’s Forest” published by Ministry of Forest and Soil Conservation¹⁸, whereas the mean annual increment of woody biomass is calculated using Global Forest Resources Assessment 2000 by the FAO for “Distribution of total forest area by ecological zone” (Table 14) and 2006 IPCC Guidelines for National Greenhouse Gas Inventories for “Above-ground biomass growth rates (t/ha-yr) for different ecological zones” (Chapter 4, Table 4.9) as suggested in the tool. As per the tool the, fraction of NRB is calculated as 86.1%.

Project Emissions

As per the AMS IE Version 09, the project emissions (PE_y) from cultivation, use and processing of biomass shall be calculated using the latest version of “TOOL16: Project and leakage emissions from biomass”. In doing so, the following sources of project emissions shall be considered as applicable, bearing in mind that some sources may be only relevant for specific fuels (e.g. production of bio-ethanol):

- CO₂ emissions from on-site consumption of fossil fuels due to the project activity, including the consumption of fossil fuels for any processing of feedstock; - No fossil fuels is used or any processing of feed stock is involved, as the slurry from the existing bovine population is alone used in the digesters, hence not applicable
- CO₂ emissions from electricity consumption by the project activity including the consumption of electricity for any processing of feedstock; - Electricity is not used for any feedstock processing many take the animal for grazing and use agricultural residues as before the start of the project activity.
- Methane emission from solid waste disposal or waste water in cases where the waste is disposed in anaerobic conditions – the solid waste is the composted manure and not disposed in anaerobic conditions
- Project emissions related to cultivation of feedstock – feedstock are not cultivated due to the implementation of this project activity, the scenario before the start of the project activity is still prevalent- i.e. feeding with agricultural residues and taking animals for grazing.
- Project emissions from transportation, if the transportation distance is more than 200 km; otherwise they can be neglected. – no transportation of any kind is involved in the project

The fuelwood are basically sourced from the nearby and natural forest, which does not require processing of the feedstock and also does not include the cultivation, and there is no use of electricity or fossil fuel for feedstock processing and hence the above mentioned project emissions are not applicable to this project activity. So, the project emission for this project activity is neglected and taken as zero.

Leakage emissions

As per the methodology, leakage emissions (LE_y)

- shall be calculated using the latest version of “TOOL16: Project and leakage emissions from biomass”. The renewable biomass used in the project activity is not cultivated or procured by the project proponent or it is from the result of agro-industrial process. Hence tool 16 is not applicable

¹⁸ [http://www.dfrs.gov.np/downloadfile/State%20of%20Nepals%20Forests%20\(DFRS\)_1457599484.pdf](http://www.dfrs.gov.np/downloadfile/State%20of%20Nepals%20Forests%20(DFRS)_1457599484.pdf)

- b) But according to the para 24 of methodology, leakage related to the non-renewable woody biomass saved by the project activity shall be assessed based on ex-post surveys of users and the areas from which this woody biomass is sourced (using 90/30 precision for a selection of samples). The following potential source of leakage shall be considered The use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass used by the non-project households/users that is attributable to the project activity then By is adjusted to account for the quantified leakage. Alternatively, By is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required. In order to avoid expensive monitoring, the Project Participants have opted to use the default factor of 0.95 to account for any potential leakage, as prescribed by the methodology.
- c) Project activities switching from baseline device using firewood to efficient project device using charcoal or switching from firewood to processed biomass (briquette, pellets, and woodchips) shall take into account the leakage effects related to the charcoal or processed biomass production. The project does not involve any device using charcoal or processed biomass (Briquette, Pellets and woodchips), the above provision on leakage is not applicable.

Emission Reductions

As the methodology AMS IE version 09, para 27, the emission reduction are to be estimated based on the following equation:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$$ER_y = \text{Emission reductions in year } y, \text{ tonnes CO}_2\text{eq}$$

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$f_{NRB,y}$
Data unit	%
Description	Fraction of woody biomass saved by the project activity during year y that can be established as non-renewable biomass
Source of data	Calculated as per "TOOL30: Calculation of the fraction of non-renewable biomass"
Value(s) applied	86.1 %
Choice of data or measurement methods and procedures	The value is calculated as 86.1% using the national statistics and also validated by the Ministry of Forest and Environment, Government of Nepal. This value is for the national level, so will not be monitored.
Purpose of data	Calculation of baseline emission
Additional comment	This parameter shall remain fixed for the crediting period.

Data/Parameter	$EF_{\text{projected_fossilfuel}}$
Data unit	tCO ₂ /TJ
Description	Emission factor for the projected fossil fuel consumption in the baseline.
Source of data	IPCC
Value(s) applied	63.7
Choice of data or measurement methods and procedures	AMS-I.E. version 9 requires using this value.
Purpose of data	Calculation of emission reduction
Additional comment	The value will be fixed for the crediting period

Data/Parameter	N_{HH}
Data unit	Number
Description	Number of households in the project activity in year y
Source of data	BSP database
Value(s) applied	20,318 Established ex ante prior to start of the project activity
Choice of data or measurement methods and procedures	The registration procedure of the BSP database avoids double counting of digesters and the registration of digesters that have not been commissioned. The BSP database is the basis for subsidy disbursement.
Purpose of data	Calculation of emission reduction
Additional comment	During calculation of Emission Reduction, it will be based on actual number of households having the biogas operational

Data/Parameter	$BC_{BL,HH,y}$
Data unit	tonne/household/year
Description	Average annual consumption of woody biomass per household before the start of the project activity
Source of data	Based on survey (Biogas User Survey (BUS)) for the project activity.
Value(s) applied	5.09 tonne/household/year

Choice of data or measurement methods and procedures	Calculated using option (b) Historical data or a sample survey conducted as per the latest version of the "Standard: Sampling and surveys for CDM project activities and programme of activities;" Biogas User Survey follows the standard sampling and surveys indicated in the PDD registered for first crediting period.
Purpose of data	Calculation of baseline emission
Additional comment	This value is used in the calculations and shall remain fixed for the crediting period.

B.6.3. Ex ante calculation of emission reductions

The emission reduction calculation is based on data that is specified to digester size and region. This section provides a short explanation of the calculations made. Table A.1 provides an overview of the number of digesters in this project.

Emission reduction

As per para 27 of the AMS I.E version 9, the emission reduction is estimated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

where,

ER_y : Emission Reduction
 BE_y : Baseline Emission
 PE_y : Project Emission
 LE_y : Leakage Emission

Now,

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

The B_y is calculated as using the value as follows

N_{HH}	20,318
$BC_{BL,HH,y}$	5.09 tonne/household/year ¹⁹
$BC_{PJ,HH,y}$	0.53 tonnes/household/year ²⁰

$$B_y = 20318 \times (5.09 - 0.53) = 92,650.08 \text{ tonne/year}$$

Considering

$f_{NRB,y} = 86.1\%$ (calculated using Tool 30: calculation of the fraction of non-renewable biomass)

$NCV_{biomass} = 0.0156 \text{ TJ/tonne}$ (as per the methodology AMS I.E version 9)

$EF_{projected_fossil_fuel} = 63.7 \text{ tCO}_2\text{e/TJ}$ (as per the methodology AMS I.E version 9)

Baseline Emission is calculated as $BE_y = 79,270 \text{ tCO}_2\text{e}$

Considering the leakage of 5% (as per the methodology AMS I.E. version 9), leakage emission is calculated as $LE_y = 3963 \text{ tCO}_2\text{e}$

Considering the project emission (PE_y) as zero as this is not applicable for this project activity, the emission reduction is calculated as $75,307 \text{ tCO}_2\text{e}$.

¹⁹ Biogas User Survey 2017/18 for PA-4

²⁰ Biogas User Survey 2017/18 for PA-4

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO ₂ e)	Project emissions (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions (t CO ₂ e)
13/12/2018 - 12/12/2019	79,270	0	3,963	75,307
13/12/2019 - 12/12/2020	79,270	0	3,963	75,307
13/12/2020 - 12/12/2021	79,270	0	3,963	75,307
13/12/2021 - 12/12/2022	79,270	0	3,963	75,307
13/12/2022 - 12/12/2023	79,270	0	3,963	75,307
13/12/2023 - 12/12/2024	79,270	0	3,963	75,307
13/12/2024 - 12/12/2025	79,270	0	3,963	75,307
Total	554,890	0	27,741	527,149
Total number of crediting years	7 years			
Annual average over the crediting period	79,270	0	3,963	75,307

B.7. Monitoring plan**B.7.1. Data and parameters to be monitored**

The various aspects that need to be monitored according to the methodology AMS-I.E, Version 09, and their applicability to the project are discussed below.

The biogas plants will be monitored continuously for non-usage. The emission reduction will be calculated only for usage days of all the constructed and operational units based on which $BC_{PJ,HH,y}$ will be determined and B_y calculated for each of the household.

Monitoring should confirm the displacement or substitution of the non-renewable woody biomass at each location. This shall be ensured by monitoring at least two of the following supporting indicators to exist:

- A trend showing an increase in time spent or distance travelled for gathering fuel-wood, by users (or fuel-wood suppliers) or alternatively, a trend showing an increase in the distance the fuelwood is transported to the project area;
- Survey results, national or local statistics, studies, maps or other sources of information, such as remote-sensing data, that show that carbon stocks are depleting in the project area;
- Increasing trends in fuel wood prices indicating a scarcity of fuelwood;
- Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass.

Data/Parameter	Date of commissioning of project device of type i
Data unit	Date
Description	Actual date of commissioning of the project device.
Source of data	Internal database/records
Value(s) applied	-
Measurement methods and procedures	The registration procedure of the BSP database avoids double counting of digesters and the registration of digesters that have not been commissioned. The commissioning date is the basis for subsidy disbursement.
Monitoring frequency	Fixed and recorded at the time of commissioning
QA/QC procedures	This can be checked from the commissioning report and subsidy application form.
Purpose of data	Calculation of baseline emission
Additional comment	N/A

Data/Parameter	NCV _{biomass}
Data unit	TJ/tonne

Description	Net calorific value of the non-renewable woody biomass, briquettes or charcoal used in project devices
Source of data	Methodology AMS I.E. Version 09
Value(s) applied	0.0156
Measurement methods and procedures	De-fault value will be applied from the methodology AMS I.E version 09
Monitoring frequency	Yearly
QA/QC procedures	N/A
Purpose of data	Calculation of baseline emission
Additional comment	N/A

Data/Parameter	$BC_{PJ,HH,y}$
Data unit	tonnes/household/year
Description	Average annual consumption of woody biomass per household in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent.
Source of data	Biogas User Survey
Value(s) applied	- 0.53 tonnes/household/year for the ex-ante calculation as per the Biogas User Survey 2017/18 for PA-4. For this crediting period, this parameter will be determined using regular user survey.
Measurement methods and procedures	Biogas User Survey will be conducted on a sample of households. The sample size is determined to achieve 90% confidence interval and a 10% margin of error. During the survey, the estimates of the biogas users on the average annual consumption of woody biomass during the monitoring period will be captured.
Monitoring frequency	At least once every two years (biennial)
QA/QC procedures	Though the methodology requires sample survey biannually, PP conducts the user survey annually to ensure the number of biogas digesters operational for that particular year.
Purpose of data	Calculation of baseline emission
Additional comment	ERs will be accounted only for functional biogas in the particular monitoring period

Data/Parameter	B_y
Data unit	tonnes/household/year
Description	Quantity of woody biomass that is substituted or displaced
Source of data	Biogas User Surveys to be carried out once in a year
Value(s) applied	Ranges from zero when biogas is not used to 5.09 tonnes/household/year and 103,418.62 tonnes/year for 20,318 household, when $BC_{PJ,HH,y}$ is zero and all biogas are operational.

Measurement methods and procedures	<p>The calculation of the By depends on the operational status of the biogas units for the particular monitoring period and the operational status will be checked annually during the Biogas User Survey. From the total population of biogas units included in the project activity, statistically representative samples will be drawn for the purpose of carrying out the survey. The sample size is determined to achieve 90% confidence interval and a 10% margin of error. The percentage of biogas units found to be operational during the sample survey shall be used to calculate the weighted average operational status of the biogas which then will be used to calculate By as follows:</p> <p>$By = N_{HH} * (BC_{BL,HH,y} - BC_{PJ,HH,y})$ where N_{HH} will be the household with operational biogas digester for the particular monitoring period. $N_{HH} = N * P_y$, where N is the number of bio digesters installed in the project and P_y is Proportion of Bio digesters operational estimated based on the sample survey</p>
Monitoring frequency	Once in a Year
QA/QC procedures	Every year, the Internal Quality Control System samples 5% of the digesters that are newly implemented in that year, 2.5% of the digesters that implemented a year before and another 2.5% of the digesters implemented two years before that particular year. However, since the digesters included in this project activity were implemented back in 2006/2007 and the second crediting period is started only in 2018, results from the internal quality system will not apply to the project activity for future monitoring. This parameter will therefore be monitored as part of the annual biogas users' survey.
Purpose of data	Calculation of baseline emission
Additional comment	Once the biogas included in the project activity completes its operational lifetime of 20 years, those biogas will not be considered for the next consecutive monitoring.

Data/Parameter	Trends in distance travelled for firewood gathering or trends in time needed for firewood gathering indicating depletion of resources available
Data unit	-
Description	This parameter is use to confirm the displacement or substitution of the non-renewable woody biomass at each location
Source of data	Biogas User Surveys
Value(s) applied	Increased distance and time spent for firewood gathering
Measurement methods and procedures	Annual Biogas User Survey will be conducted on a sample of households. The sample size is determined to achieve 90% confidence interval and a 10% margin of error. During the survey, the perceptions of the biogas users on the distance travelled and the time spent for firewood harnessing to price will be captured and analysed to show the depletion of resources.
Monitoring frequency	Once in a Year
QA/QC procedures	The number of households in the sample is increased to remedy the possibility of incomplete questionnaires. The surveyors are trained and supervised to minimize any bias.
Purpose of data	To confirm the displacement and substitution of the non-renewable woody biomass
Additional comment	N/A

Data/Parameter	Trends in price of firewood indicating demand and scarcity
Data unit	-
Description	This parameter is use to confirm the displacement or substitution of the nonrenewable woody biomass at each location
Source of data	Biogas User Surveys
Value(s) applied	Increased demand and scarcity of firewood

Measurement methods and procedures	Annual Biogas User Survey will be conducted on a sample of households. The sample size is determined to achieve 90% confidence interval and a 10% margin of error. During the survey, the perceptions of the biogas users on the price of firewood will be captured and analysed to show the increase demand and scarcity of firewood
Monitoring frequency	Once in a year
QA/QC procedures	The number of households in the sample is increased to remedy the possibility of incomplete questionnaires. The surveyors are trained and supervised to minimize any bias.
Purpose of data	To confirm the displacement and substitution of the non-renewable woody biomass
Additional comment	N/A

Data/Parameter	Trends in type of cooking fuel collected that could indicate scarcity of fire wood
Data unit	-
Description	This parameter is use to confirm the displacement or substitution of the nonrenewable woody biomass at each location
Source of data	Biogas User Surveys
Value(s) applied	Scarcity of firewood
Measurement methods and procedures	Annual Biogas User Survey will be conducted on a sample of households. The sample size is determined to achieve 90% confidence interval and a 10% margin of error. During the survey, the type of cooking fuel used by households will be assessed to demonstrate the scarcity of firewood.
Monitoring frequency	Once in a year
QA/QC procedures	The number of households in the sample is increased to remedy the possibility of incomplete questionnaires. The surveyors are trained and supervised to minimize any bias.
Purpose of data	To confirm the displacement and substitution of the non-renewable woody biomass
Additional comment	N/A

B.7.2. Sampling plan

Parameters to be monitored

The project monitoring system implemented in the project includes assessment of the performance of biogas units and collection of data to confirm the displacement of NRB.

Following parameters will be monitored:

1. Average annual consumption of woody biomass per household in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent.
2. Digester performance (Operational %) of the biogas digester in particular monitoring period to calculate the Quantity of woody biomass that is substituted or displaced. .
3. Monitoring should confirm the displacement or substitution of the non-renewable biomass at each location (using the indicators on the use of NRB as detailed earlier).

The annual Biogas User Survey (BUS) will be conducted to assess the parameters given above. The survey will be conducted following statistically sound sampling procedure. The Annual Biogas User Survey will be conducted following the Guidelines for Sampling and Surveys for CDM Project activities and Programme of Activities Ver. 4.0 (EB86, Annex 4). As part of the survey, statistically representative sample of biogas users will be surveyed and in order to achieve 90% confidence interval and a 10% margin of error requirement for the sampled parameters. Stratified random sampling will be applied in conducting survey. The sample to be surveyed will be drawn randomly from the population of biogas digester distributed in each stratum (i.e. remote hill, hill and terai) spread within the project boundary of the PoA. To make it more representatives, different development regions and the size of the plants will also be considered while drawing the sample. In order to have an unbiased and independent assessment, the survey will be carried out through an independent agency to check the operation/functioning of the biogas units installed as part of the project activity.

The fraction of the Non Renewable Biomass displaced by the project activity has been determined ex-ante in the PDD and has been fixed for the second crediting period. The indicators for the NRB is confirmed through the Biogas User Survey 2017/18 and it is confirmed that firewood scarcity has been increasing since December 1989. The increased scarcity of firewood confirms continued use of NRB, also by non-user households.

The following indicators will be monitored through annual survey to confirm the displacement of NRB use by households, Perceptions of the biogas users on these indicators would be captured through survey and analysed. These indicators include:

- a. Trends in distance travelled for firewood gathering or trends in time needed for firewood gathering indicating depletion of resources available
- b. Trends in price of firewood indicating demand and scarcity
- c. Trends in type of cooking fuel collected that could indicate scarcity of fire wood

At least two of the above indicators should confirm the displacement of non-renewable biomass. The survey will seek to collect the data pertaining to the indicators for monitoring year.

Internal Audit Procedures

The QA/QC includes the following elements:

- Quality inspection: For each plant the digester companies should submit to BSP-NEPAL completion and maintenance reports. Only after the review of the reports, BSP-NEPAL recommends AEPC to release grant payment to the biogas users through the digester companies. BSP-NEPAL conducts quality control of newly constructed plants after the implementation of sales service contracts. They inspect five percent of newly constructed plants and another five percent of digesters after two and three years of plant operation to ensure that After Sales Service has been delivered as required.
- Biogas User's Survey (BUS): The BUS uses a random sample of biogas plant users to measure a wide-range of health, economic, social and environmental indicators. The information obtained from the BUS is used to enable continuous improvement of the program and the technology applied.
- General Evaluations and Assessments: Periodic evaluations are carried out by the donors. Several other assessment such as biogas loan surveys, impact assessments, customer satisfaction surveys, gender assessments, and environmental impact assessments are also conducted. Implementation and operation problems can also be detected through a customer complaint system within BSP.

Data Archiving Procedure

The data archiving procedures followed by the BSP after the completion of the construction of the biogas plant:

1. Update database annually as per subsidy policy and quality standard.
2. Receive and registered forms at Reception, BSP-Nepal submitted by Biogas Companies.
3. Handover forms to Subsidy Administration & Database Unit, BSP-Nepal.
4. Check all the forms with supporting documents, rejected forms will be kept separately in pigeon hole (Company wise).
5. Enter data into Database system, action to rejected forms same as above.
6. Check printed data with original.
7. Publish & compile regular progress report.
8. Verify reports and sign report
9. Dispatch report to AEPC with recommendation for subsidy reimbursement to Biogas Companies.
10. Random sample 5% of data for Quality Control for both New Plant and Plant within guarantee period.
11. QC data entry.
12. Verify data by the controller.
13. Send early warning report to the companies.
14. Regular back up of database.
15. Generate Biogas Performance Index for all companies.

B.7.3. Other elements of monitoring plan

The detailed description of the monitoring plan along with the QA/QC procedures, organization chart, monitoring, reporting and roles and responsibilities have been discussed in Appendix 5 to this PDD.

SECTION C. Start date, crediting period type and duration**C.1. Start date of project activity**

09/05/2006

The start date of the project is taken as the completion of the construction of the first digester listed in this project.

C.2. Expected operational lifetime of project activity

The operational lifetime of each digester is 20 years. With the first digester of the project is implemented on 09/05/2006, the operational lifetime of the project is up to 09/05/2026.

C.3. Crediting period of project activity**C.3.1. Type of crediting period**

Renewable

C.3.2. Start date of crediting period

13/12/2018 as the first crediting is ended on 12/12/2018. This pertains to the starting date of the second crediting period.

The length of the first crediting period was from 13/12/2011 to 12/12/2018.

C.3.3. Duration of crediting period

The duration of the crediting period of this project is 7 years.

SECTION D. Environmental impacts**D.1. Analysis of environmental impacts**

The Integrated Environment Impact Assessment (IEIA) study was conceived and carried out with the basic objective of quantifying, as far as possible, the potential impacts of the third phase of the Nepal Biogas Support Project (BSP III)³⁸ as a result of the installation and use of biogas systems for cooking and, to a much lesser extent, for lighting purposes. The study assessed the potential impacts and need for mitigation actions of BSP III in the following areas:

- Energy situation, particularly the energy obtained from biogas plants for cooking and to a much lesser extent for lighting;
- Environmental situation, in particular: sustainable land use, forest resources, and the contribution of greenhouse gasses (carbon dioxide, methane, and nitrous oxide) to climate change; and
- Health and socio-economic situation of the households, including gender relations.

The Integrated Environmental Impact Assessment (IEIA) study provided insight in the positive and negative impacts of biogas technology in Nepal. Based upon the IEIA study, the Environmental Management and Mitigation Plan (EMMP) was prepared to address the issues identified in the IEIA study.

AEPC and BSP-NEPAL hold all necessary permits and approvals from the government of Nepal required to implement and to operate the BSP. The project includes a certain number of digesters under the program. Nepalese law does not require an EIA for the BSP or the individual digesters there under.

In addition, as per the Environment Protection Act dated 30 January 1997 and Environment Protection Rules dated 26 June 1997, 12 sectors are required to undertake environmental impact assessment studies. Biogas plants do not figure in the list of these 12 sectors. Therefore, EIA is not a regulatory requirement in Nepal for biogas projects at the individual plant level.

D.2. Environmental impact assessment

As per the environment protection act dated 31 January 1997 and environment protection rule dated 27 June 1997, 12 sectors are required to take environment impact assessment studies. It should be noted that EIA is not a regulatory requirement in Nepal for biogas projects at the individual digester level.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

Households participate voluntarily in the project and by buying the digesters they value the environmental, social and economic benefits that the project brings.

In addition, the satisfaction of the digester users is annually evaluated through the Biogas Users Survey. The BUS is an in-depth analysis of a broad range of topics, including social-economic impact, agriculture, energy and environment, health and sanitation, gender and finally digester operation. The BUS is implemented by an external consultant and concludes with a set of recommendations for improvement of the project. Some quotes from the conclusions of the BUS for 2007/08 are:

- “The biogas plant, as per the present finding, shows a strong positive impact on socio-economic status of the user households.”
- “Biogas has been successful at making positive environmental impacts at local national and global level. From local perspective, biogas has been successful at improving indoor air quality at homes which before availability of biogas used to use traditional stoves. From a national perspective, biogas systems have helped reduce pressure on forest resources.”
- “Deriving from the findings, it can be concluded that the level of awareness among people regarding the significance of health, hygiene and sanitation in and around their household has increased remarkably.”
- “Women in Nepal are normally confronted with high workload. (...) Workload of women has further increased due to deforestation as more time has to spend on collection of firewood and fodder. Introduction of biogas has made a positive effect in reducing women's workload.”
- “All of the surveyed HHs was found satisfied with the plant operation.”

Despite this effort to continuously improve the programme, a dedicated stakeholder consultation meeting was held on 15 August 2008 in Kathmandu. After an introduction of the project and its CDM background the stakeholder were invited to submit comments. The stakeholders included digesters users, representatives from different government ministries, NGO's, donors and BSP-NEPAL and AEPC.

The comments have been filed and taken into account in the design of the BSP. Since the BSP has been successfully operated for many years, there were little comments on the technical aspects or negative side-effects of the program.

Key recommendations from the stakeholders seemed motivated by concerns over the ability of the program to maintain a certain pace of digester implementation and aimed at the institutional and financial aspect of the program.

E.2. Summary of comments received

The recommendations expressed by the stakeholders were:

1. Carbon revenue should be used for research and further development of the biogas sector.
2. The After Sales Service/Internal Quality Control system should be expanded from the current three-years to at least the length of the first crediting period. Apart from securing project performance in terms of reducing emissions, this also allows current digester owners to benefit from CDM funded maintenance of their systems.
3. Provide additional financial support to the individual households covered under the CDM project to ensure timely maintenance and reliable operation of their digesters.
4. Provide additional subsidy to the poor households in remote areas to help them overcome investment barrier and allow them access to the biogas technology.
5. Organize awareness programs about CDM at different levels in Nepal to create further awareness of the CDM and the opportunities it creates in Nepal.
6. Provide incentives from the CER revenues to the companies involved in digester manufacturing, installation and maintenance to secure their long-term commitment to supply high-quality digesters.

7. Carbon revenue can be used to develop additional carbon projects.
8. Invest in opportunities for household to generate financial revenues from time they save due to the installation of the biogas plant.

E.3. Consideration of comments received

Some of the recommendations, for example on the further promotion of CDM in Nepal, extend beyond the key objectives of the BSP. Most recommendations relate to use of the CDM revenues. First priority of AEPC is to sustain the BSP and create the financial means needed to increase the pace of implementation. Technical support to digester users are an integrated part of the BSP and CDM revenues will be used to sustain and, if possible, improve that support. CDM revenues will also be allocated to sustain and where possible improve subsidy rates and stimulate further dissemination of digesters.

Of lower priority are measures to further enhance the programs' contribution to sustainable development, for example by implementing programs to create opportunities for household to generate financial revenues from time they save due to the installation of the biogas plant. Another example is support to other CDM projects or promotion of the CDM in Nepal. However, AEPC does support initiatives in these areas.

The remaining recommendations were taken into account as follows.

- AEPC, executive agency of the Biogas Support Program (BSP), has given high importance to the received suggestions and committed to address the suggestions to the benefit of the program and the stakeholders, especially the biogas users.
- AEPC has proposed to utilize 80 percent revenue to increase subsidy for new plants and thereby stimulate digester adoption by poorer and more remote households. The remaining 20 percent may be allocated to sustain the program and secure continued maintenance and other technical support to existing and future plants.
- AEPC also agreed to create further incentives to the private companies involved to provide additional technical service to the biogas users and maintain or further improve their quality standards.

SECTION F. Approval and authorization

Letter of Approval from the Host Party was issued on 18 October 2011 for this project

Appendix 1. Contact information of project participants

Organization name	Alternative Energy Promotion Centre (AEPC)
Country	Nepal
Address	14237, Khumaltar, Lalitpur
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Contact person	Mr. Madhusudhan Adhikari, Executive Director

Appendix 2. Affirmation regarding public funding

N/A

Appendix 3. Applicability of methodologies and standardized baselines

Estimate of average annual consumption of woody biomass

As per AMS-I.E, version 09, the quantity of woody biomass that is substituted or displaced by the project activity can be calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per biogas user household (tonnes/year). This can be derived from historical data or estimated using survey methods. This is calculated based on survey and historic data, such as Biogas User Survey (BUS). The BUS is based on survey techniques.

Confirmation of the Use of Non-Renewable Biomass

Different sources have been used to confirm that NRB is used in Nepal. To determine the actual percentage, national statistics on the supply and demand of firewood have been used. To confirm that NRB continues to be used, the project participants conducted a survey to check whether the firewood replaced by the digesters is subject to the trends defined in AMS-I.E.: increasing amount of time needed or distance travelled for firewood gathering, increasing firewood prices or changes in the type of firewood used. The indicators selected to monitor the continued displacement of NRB in the project are:

- 1) increase in time needed to gather firewood or increase in distance travelled to gather firewood
- 2) Increasing trend in fuel wood price.

The Biogas Users Survey 2017/18 reveals the following:

- Increase in time and distance travelled to gather firewood. The time required to reach the forest, collect one bundle of fire wood and return back now is 37 minutes; 115 minutes and 43 minutes respectively whereas before eighteen years it was 33 minutes, 94 minutes and 42 minutes respectively. Likewise, 28 years before; it was 28 minutes 87 minutes and 36 minutes respectively. This indicate that the sourcing biomass from forest over the years have become even more difficult.
- Increase in fuel wood price: The results reveal that the average price of 1 bhari of fuelwood was NPR 28 in 1989 which increased to NPR 124 in 2000 and to NPR 410 in 2018

The trend reported in the above survey is also confirmed by another study by Jean-Marie Baland²¹, where forest in the Nepalese Himalayas is reported to be degrading at an alarming rate, which could have serious environmental and economic consequences. The following are some of the findings of this study:

²¹ Jean Marie Baland, "The Environmental Impact of Poverty: Evidence from Firewood Collection in Rural Nepal", Boston University - The Institute for Economic Development Working Papers Series, 30 June 2007.

- Nepal's forest cover declined at an annual rate of 1.8% per year between 1980 and 2000.
- Forest degradation leads to increased fuel scarcity. "The time needed to collect firewood has increased 60% over the past quarter century, while collections per household have decreased by 40%."
- Deforestation "is partly irreversible as fertile topsoil is being washed out by soil erosion in deforested areas."
- The report also concludes that collection time is a good indicator of forest degradation since "A major impact of forest degradation for the villagers is the resulting increase in collection time."

A report by the Ministry of Population and Environment²² confirms deforestation trends in Nepal and connects them with firewood use:

- "The forest area has declined from 45 per cent in 1966 to 29 per cent by the end of the 20th century. The quality of forest has also declined as the shrub land area has doubled from 4.8 per cent in mid-1980s to 10.6 per cent in mid-1990s. The annual deforestation is estimated at 1.7 per cent with 2.3 per cent in the Hill, and 1.3 percent in the Terai."
- "In general, forest depletion is increasing due to firewood collection, cattle grazing, and conversion of forests to agricultural land."
- "Although firewood consumption is slightly decreasing over the years, forest depletion and deforestation is increasing as a majority of the people depend on it."

The price of firewood is not used as indicator for firewood scarcity since very little firewood used is bought from the market.²³ The main source of firewood is government forests controlled by the Ministry of Forest and Soil Conservation which allocates forest areas to the Timber Corporation of Nepal (TCN). Since supply from TCN is insufficient, unofficial firewood extraction for self-consumption and trade remain substantial, also in government forests.

Firewood consumption by households in the baseline scenario are predominantly non-renewable. Table below provides an overview of the firewood consumption for cooking in the baseline scenario.

Table: Energy use for cooking before implementation of the digester and stove.²⁴

	Terai	Hills	Remote Hills
Fire Wood (tons/household/year)	5.02	5.18	5.46

The above data clearly indicates that firewood is the predominant source of cooking energy for households.

Appendix 4. Further background information on ex ante calculation of emission reductions

N/A

Appendix 5. Further background information on monitoring plan

Sampling Plan

As per the Standard for Sampling and Surveys for CDM Project activities and Programme of Activities Ver. 7.0 the sampling plan for this activity is as follows:

(a) Sample Design

²² His Majesty's Government of Nepal Ministry of Population and Environment, NEPAL National Action Programme on Land Degradation and Desertification in the context of United Nations Convention to Combat Desertification (UNCCD), Kathmandu, April 2004

²³ Government of Nepal Water and Energy Commission Secretariat, Energy Synopsis Report: Nepal 2006 Report No: 7, Seq. No. 489, June, 2006, Kathmandu, page 15;

²⁴ Annual Biogas Users' Survey 2009/2010 for Biogas Support Program – Nepal (BSP - Nepal) Activity – I

Objectives and Reliability Requirements

The sampling objective is to obtain a reliable estimate of the key variables used in the estimation of emission reductions. According to AMS-I.E. Version 9, the parameters chosen by project participants for monitoring are:

- Average annual consumption of woody biomass per household in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent.
- The percentage of digesters operational in a year from among the digesters implemented to calculate By. This will be done through a survey of a sample appliances once every year to ensure that they are operating or replaced by an equivalent in service appliance.
- The confirmation of the displacement or substitution of the non-renewable woody biomass by households. This has to be captured through the measurement of two of the following parameters: a) Trends in distance travelled for firewood gathering or trends in time needed for firewood gathering indicating depletion of resources available, b) Trends in price of firewood indicating demand and scarcity, c) Trends in type of cooking fuel collected that could indicate scarcity of fire wood.

Sampling approach is proposed to be implemented to measure the above parameters. For representative sampling methods, AMS-I.E, Version 09 requires a 90% confidence interval and a 10% margin of error for annual inspection, which will be adopted for the sample design.

Moreover, the percentage of digesters operational and the average annual consumption of woody biomass per households is the most important parameter that directly affects the emission calculation and that can only be estimated from field survey. Therefore, those parameter will be used to calculate the sample size while the same sample will be used to determine all above parameters to confirm the continuous use of the non-renewable biomass.

Target population

The target population is the households using biogas digester units spread over in Terai, hill and Remote Hill of Nepal where a total of 20318 biogas digesters units were installed under the Biogas Support Program - Nepal Activity-4.

Sampling method

The stratified random sampling method will be used to take into account different ecological zones (Terai, Hills and Remote Hills) as strata. To make it more representatives, districts and villages and different biogas plants sizes will also be considered while samples picked up randomly from each category. The sample size is distributed proportionally to account for the number of biogas units installed per districts and sizes. This approach allows to derive a value that capture difference between locations and households.

Sampling size

The sample size determination is applied to the entire population of users of biogas plants (households). The total population is used for the sampling size calculation is 20,318 biogas plants. As required in AMS-I.E, Version 09, for annual survey, the sample has to be determined with 90/10 confidence/precision level.

Proportional Parameter (Biogas Performance)

The percentage of digesters operational is a proportion value for the categorical data requiring two possible answers (YES or NO). The minimum sample size is calculated using appendix 1 para 24 of Guidelines for Sampling and Surveys for CDM Project activities and Programme of Activities Ver. 4.0 (EB86, Annex 4).

$$n \geq \frac{1.64^2 NV}{(N-1) \times 0.1^2 + 1.64^2 V}$$

Where:

N = Total Population (20,318)

n = sample size

$$V = \frac{SD^2}{\bar{p}^2} = \frac{\text{overall variance}}{\bar{p}^2} \text{ and } \bar{p} \text{ is the overall proportion.}$$

$$SD^2 = \frac{(g_a \times p_a(1 - p_a)) + p_b(g_b \times (1 - p_b)) + (g_c \times p_c(1 - p_c)) + \dots + (g_k \times p_k(1 - p_k))}{N}$$

and

$$\bar{p} = \frac{(g_a \times p_a) + (g_b \times p_b) + (g_c \times p_c) + \dots + (g_k \times p_k)}{N}$$

Where,

g_i is the size of the i_{th} group and p_i is the expected proportion of i_{th} group

The sample in each strata then will be calculated as below:

$$n_i = \frac{g_i}{N} \times n$$

To calculate the sample size, following parameters are considered for this project activities.

Particulars	Symbol	Value	Remarks
Total Number of Population	N	20,318	Database
Number of Biogas in Terai	g_t	11,624	Database
Expected operational Proportion of Biogas in Terai	p_t	0.85	As per Biogas User Survey 2017/18 for the project activity
Number of Biogas in Hill	g_h	8557	Database
Expected operational Proportion of Biogas in Hill	p_h	0.72	As per Biogas User Survey 2017/18 for the project activity
Number of Biogas in Remote Hill	g_{rh}	137	Database
Expected operational Proportion of Biogas in Remote Hill	p_{rh}	0	As per Biogas User Survey 2017/18 for the project activity

The sample size is calculated as 69. In order to anticipate any low response rate and answers bias, at least 10% oversampling has to be done with minimum sample of 75 is retained for the monitoring of operational status of the Biogas digesters.

For the first monitoring, the values as described above are applied. For the following monitoring periods, the estimates shall be adjusted taken the results of the previous monitoring period(s) into account. The project participants can use a sample size larger than the minimum calculated depending on budget availability. The actual sample size will be established for each annual biogas users survey.

Mean value parameter (Average annual consumption of woody biomass by pre-project device during project activity)

The minimum sample size for the monitoring parameters is determined using the equation given in para 60 of appendix 1, EB 86 Annex 4, Guidelines for Sampling and Surveys for CDM Project activities and Programme of Activities Ver. 4.0.

$$n \geq \frac{1.645^2 NV}{(N - 1) \times 0.1^2 + 1.645^2 V}$$

Where,

$$V = (SD/Mean)^2$$

n = Sample Size

N = Total number of Population

SD = Overall standard deviation

Mean = Overall mean for the average annual woody biomass consumption by pre-project device during project activity

1.645 = Represent 90% confidence required

0.1 = Represent the 10% relative precision

To calculate the sample size, following parameters are considered for this project activities.

Particulars	Symbol	Value	Remarks
Total Number of Population	N	20318	Database
Overall standard deviation	SD	0.26	As per Biogas User Survey 2017/18 for the project activity
Overall mean	Mean	0.53	As per Biogas User Survey 2017/18 for the project activity

The sample size is calculated as 68. In order to anticipate any low response rate and answers bias, at least 10% oversampling has to be done with minimum sample of 75 is retained for the monitoring of operational status of the Biogas digesters, same samples will be taken for the proportional parameters as well. So, for the monitoring of this activity, minimum 75 samples will be retained to monitor all parameters. .

Sampling frame

The sampling frame is the complete listing of 20,318 family size biogas plants installed in various districts across Nepal. The districts covered under the project activity will be grouped into three strata as: i) Remote/High Hills, ii) Hills and iii) Terai regions.

A stratified random sampling will be used ensuring development regions and district-wise distribution of the samples for better representation.

Quality Assurance/Quality Control:

A survey questionnaire will be prepared to seek responses of operating status (yes or no) of biogas digester units, estimate the average woody biomass consumption per household during project activities and to assess the displacement of NRB by biogas digester user households.

The project entity will ensure that all 75 questionnaires are filled. To remedy the incomplete questionnaires, additional households will be drawn randomly until the required number (75) is met at per the sample size determined.

Moreover, after completing a day's work the enumerators will check each questionnaire in the evening and correct any mistakes or inconsistencies immediately the next day by revisiting the household in question and verifying the information.

Analysis:

The data collected will be compiled in Excel sheets and/or other software and analyzed to derive the percentage of digesters in operation, average annual consumption of woody biomass during project activity and displacement or substitution of NRB by households. The final results are arranged per ecological zones. The weighted average of the values are calculated and use for emission reductions calculation.

Emission reductions are directly proportional to the number of appliances (biogas digester units in case of the project) that are operating and displacement or the substitution of NRB.

(c) Implementation

The following activities consist in the implementation plan:

- Preparation of survey questionnaires. The survey questionnaire will be prepared by the project entity or its consultant.
- Recruitment and training of enumerators. For the purpose of the survey, enumerators will be selected based upon their experiences in previous biogas users' survey and their involvement in

the field of social survey. As in previous BUS, orientation-days training will be conducted for the enumerators prior to field mobilization.

- Pretesting of the questionnaire. The initially finalized questionnaires will be used during the pre-test exercise. Based on the outcome of pre-test, the questionnaires will be further improved and finalized before the deployment of the survey
- Supervision of the survey. The supervision team will consist of supervisors and professional members of the survey team. The Supervisors will visit the assigned districts to facilitate the quality control of the survey work in their respective districts. Moreover, the Senior Member of the Survey Team will also visit some of the districts to cross check the field survey process conducted by the Enumerators and Supervisors.

ORGANISATIONAL STRUCTURE

BSP is supported by the Nepalese government and international donors including the German Development Bank (KfW) and the Netherlands Development Organisation (SNV funded by DGIS). The responsibilities of different organizations are listed below:

Alternative Energy Promotion Centre- Operation and Management Plan

- The AEPC is responsible for overall coordination and the execution of the BSP. The AEPC provides feedbacks to GoN for policy formulation and executes the policies.
- The AEPC is responsible for overall monitoring and evaluation together with SNV/N and other development partners). This also includes endorsing new modalities e.g. the modality to be developed to target the poor.
- The AEPC is responsible for carrying out Annual Biogas Users' Survey that is also in line with the requirements of the CDM. The survey would report the performance of the digesters as well as perceptions of biogas users on the various indicators that confirm the displacement of NRB.
- The AEPC administers subsidy and biogas credit fund as per developed guidelines and procedures and also explores possibilities to flow credit fund through other institutions beside the MFIs.
- The AEPC is responsible for coordination with national level financial institutions (e.g. ADB/L.) and other government agencies relevant for promotion of biogas technology.
- The AEPC advocates and promotes biogas programme at macro level.

Netherlands Development Organization in Nepal

- The SNV/N provides advisory services to organizations of the biogas sector. The advisory services will be provided on a demand-driven basis from the partners in technical; promotion; marketing; poverty linkage; gender and social inclusion; capacity strengthening, etc.
- The SNV/N administers financial support for the BSP Phase-IV to BSP-NEPAL based on approved plans and budgets, on behalf of the DGIS.
- The SNV/N is responsible for overall monitoring and evaluation together with the AEPC and other development partners). This also includes endorsing new modalities e.g. the modality to be developed to target the poor.

Kreditanstalt für Wiederaufbau of Germany

- KfW continues to provide financial support for subsidy to households constructing biogas plants under the BSP Phase-IV.
- KfW is responsible for overall programme evaluation together with the AEPC and other development partners. This also includes endorsing new modalities e.g. the modality to be developed to target the poor.

BSP-Nepal

- The BSP-NEPAL as an implementing agency facilitates, backstops, promotes as well as regulates to develop the sector.
- The BSP-NEPAL with the involvement of the NBPA and others is responsible to implement BSP-IV as per agreement signed among the AEPC, SNV/N, and BSP-NEPAL.
- The BSP-NEPAL is responsible for R&D for optimization of biogas plant operation and new designs.
- The BSP-NEPAL facilitates and provides technical assistance to the NBPA and BCs.
- The BSP-NEPAL processes the subsidy applications and recommends to AEPC for subsidy reimbursement to the users through the BCs.
- The BSP-NEPAL also assists the AEPC in finding appropriate modalities or organizations for credit fund flow.

- The BSP-NEPAL is responsible for quality control and regular monitoring of the subsidized biogas plants, including company qualification, performance evaluation, grading, penalty, bonus, disqualification as well as for provision of after-sales services and warrantee.
- The BSP-NEPAL together with the NBPA (and the AEPC, when participation fee is used) develops skill enhancement package and implements it for BCs.
- The BSP-NEPAL co-ordinates with other development partners for the biogas promotion at macro and meso levels.
- The BSP-NEPAL acts as a secretariat for BCC and CST.
- The BSP-NEPAL is also responsible for the overall market development of the sector through various promotion activities.
- BSP-NEPAL is responsible to present the any new modalities to be developed under the BSP Phase-IV for endorsement of the AEPC, SNV/N and KfW.
- The NBPA will promote interests of the BCs and self-regulate them through the code of conduct and other appropriate mechanisms. When necessary, NBPA seeks help from BSP-NEPAL and others for this purpose.
- The NBPA is responsible to arrange and supply biogas plant materials (kits), especially to BCs that have low business volume.
- The NBPA together with BSP-NEPAL and BCs coordinates with development partners at micro and meso levels.

Biogas Companies

- BCs are responsible to disseminate information on the programme, its benefits, the subsidy, credit, etc. verbally or distributing the materials from BSP-NEPAL and other partners.
- BCs are responsible to promote market and construct quality biogas plants.
- BCs are responsible to handover the Users' Manual and other information materials from BSP NEPAL and train the users on operation and maintenance of the plants.
- BCs are responsible for training users on proper use of slurry, composting and use of it.
- BCs are responsible to complete documentation required for processing of subsidy, and for release of the after-sales service guarantee money and submit them to BSP-NEPAL in a timely manner.
- BCs are responsible to cooperate and accompany BSP-NEPAL personnel in the field for quality control and other verification purposes.
- BCs regularly visit households and deliver the promised after-sales service and other services fully respecting the promised guarantee. They continue providing these services perpetually even after expire of the guarantee period.
- BCs are responsible to expand their product lines by constructing plants within and outside the subsidy programme for improved commercialization of the biogas industry.
- The BCs facilitate and coordinate with banks, MFIs and other CBOs/NGOs to ease credit flow to beneficiaries.

BCs are responsible for other activities that help to promote the technology by linking it with other rural development agencies at the local level to better benefit the users improving their livelihood.

Appendix 6. Summary report of comments received from local stakeholders

N/A

Appendix 7. Summary of post-registration changes

N/A

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
11.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Improve consistency with the “CDM project standard for project activities” and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with the “CDM project standard for project activities” (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the “Project design document form for small-scale CDM project activities” (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: <ul style="list-style-type: none"> • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
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