



**Programme of activities design document form  
(Version 09.0)**

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

**BASIC INFORMATION**

<b>Title of the PoA</b>	Nepal Biogas Support Program-PoA
<b>Version number of the PoA-DD</b>	17
<b>Completion date of the PoA-DD</b>	05/09/2019
<b>Coordinating/managing entity</b>	Alternative Energy Promotion Centre
<b>Host Parties</b>	Government of Nepal
<b>Applied methodologies and standardized baselines</b>	AMS.I.E. Switch from non-renewable biomass for thermal applications by the user (Version 09.0)
<b>Sectoral scopes</b>	Type I: Renewable Energy Projects

## PART I. Programme of activities (PoA)

### SECTION A. Description of PoA

#### A.1. Purpose and general description of PoA

The Biogas Support Program (BSP) aims at implementing household biogas applications. These applications displace firewood and fossil fuels with biogas from animal waste and human excreta. The biogas is used as a fuel for cooking, therefore the displacement of non-renewable biomass (NRB) is counted as emission reduction under the Clean Development Mechanism (CDM).

The BSP is centrally managed by Alternative Energy Promotion Centre (AEPC)<sup>1</sup> with the support of partner organizations like Biogas Sector Partnership Nepal (BSP-Nepal)<sup>2</sup> and Biogas Companies. AEPC is a public entity that executes all renewable/alternative energy programs in Nepal including BSP. Its main objectives are disseminating and promoting renewable energy technologies and mitigating environmental degradation. AEPC is responsible for administering the government subsidy, coordination with all relevant stakeholders and monitoring BSP. AEPC is also the coordinating and managing entity of this PoA.

AEPC qualifies biogas manufacturing and installation companies to promote quality digesters and regularly monitors their work. The owners of the digesters are the households that invest in the digesters and thereby obtain an alternative fuel source to firewood and fossil fuel.

Biogas Support Program (BSP) was started in July 1992 with funding from the Directorate General for International Cooperation of the Netherlands (DGIS) of the Netherlands government through the Netherlands Development Organization in Nepal (SNV/N). Government of Nepal (GoN) and the Kreditanstalt für Wiederaufbau of Germany (KfW) also started funding the BSP from the Phase-III, which started in March 1997 and lasted till June 2003. Until Phase-III, BSP was directly implemented by SNV/N. AEPC is executing the BSP Phase-IV (July 2003-December 2010). SNV/N support ended while other donors continued their support. In a subsequent interim phase (January 2011-July 2012), the BSP programme counted among others on carbon finance. Since July 2012 Phase V initiated, which makes BSP part of a wider program for the promotion renewable energy in Nepal. Thus, beyond the carbon component, BSP involves several national and especially international sources of financing.

Under the BSP, two CDM projects were initially registered that cover digesters implemented between 1<sup>st</sup> of November 2003 and 6<sup>th</sup> of April 2005. A revision of the applied methodology, AMS-I.C. prevented further development of the biogas digesters under BSP as CDM project. Supported by Biogas Sector Partnership-Nepal (BSP-Nepal) and the Government of Nepal (GoN), the deadlock was cleared with the approval of AMS-I.E. at the EB meeting after thirteenth COP/MOP in 2007. After the adoption of AMS I.E. on 1 February 2008, two more CDM projects (Project Activity 3 (PA-3) and Project Activity 4 (PA-4)) on biogas have been registered with the CDM EB. PA-3 includes the digesters implemented under BSP between 7 April 2005 and 8 May 2006 and the PA-4 includes the digesters implemented by BSP between 9 May 2006 and 21 June 2007.

Table 1: Registration of other Biogas projects in Nepal

SN	CDM Project No.	Project Name	Registration Date
1	0136 <sup>3</sup>	Biogas Support Program – Nepal, Activity-1	27 December 2005
2	0139 <sup>4</sup>	Biogas Support Program – Nepal, Activity-2	27 December 2005

<sup>1</sup> <https://www.aepc.gov.np/>

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

<sup>3</sup> Link to CDM project 0136: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1132666829.52/view>

3	5415 <sup>5</sup>	Biogas Support Program – Nepal, Activity-3	13 December 2011.
4	5416 <sup>6</sup>	Biogas Support Program – Nepal, Activity-4	13 December 2011.

This PoA was registered on 31<sup>st</sup> January 2013 as CDM PoA and installations implemented under the BSP from 22 June 2007 are gradually included in Component Project Activities (CPAs) under this PoA. All further digesters should be included to subsequent CPAs.

Hence, the objective of the PoA being an integral part of BSP is to further develop and disseminate biogas digesters as a renewable energy solution in rural Nepal, while better addressing poverty, social inclusion and regional balance issues and at the same time ensuring sustainability of the sector. AEPC currently supports to implement up to 20,000 digesters for each CPA under this PoA, which assures to remain within the small scale threshold. Despite the support, the BSP has not been able to develop into a commercial activity in Nepal. Besides investment subsidy to user households, BSP needs funding on program level to maintain its activities.

Target group under the PoA are households who currently use non-renewable biomass (firewood) and/or fossil fuels (kerosene and/or LPG) for cooking purpose. The baseline of the PoA considers only non-renewable biomass replaced through household biogas applications. Only households previously using non-renewable biomass are eligible to the PoA.

Major activities under the PoA are as follows:

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 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 along with 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.

Without the provision of these services by AEPC, the BSP would not have been initiated or would cease to exist. The program is not financially viable and has not been able to develop into a commercial activity. Therefore, the central handling of subsidies and facilitation of the program is crucial.

### **Voluntary action**

The proposed PoA is a voluntary action by AEPC since:

- The implementation of digesters is a voluntary action by the households.
- The targets formulated by the GoN for the implementation of digesters are not mandatory
- The approach of the program is demand driven. Every household makes a substantial part of the investment itself.

### **Sustainable development benefits**

The BSP has a range of sustainable development benefits which are fully attributable to the PoA:

- Improved living conditions in and around the households due to a significant reduction of smoke and fumes from cooking.

<sup>4</sup> Link to CDM project 0139: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1132671435.09/view>

<sup>5</sup> Link to CDM project 5415: <http://cdm.unfccc.int/Projects/DB/RWTUV1321009660.45/view>

<sup>6</sup> Link to CDM project 5416: <http://cdm.unfccc.int/Projects/DB/RWTUV1321020993.82/view>

- 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)
- Demonstration of a successful program at household level with serious potential for development in other countries

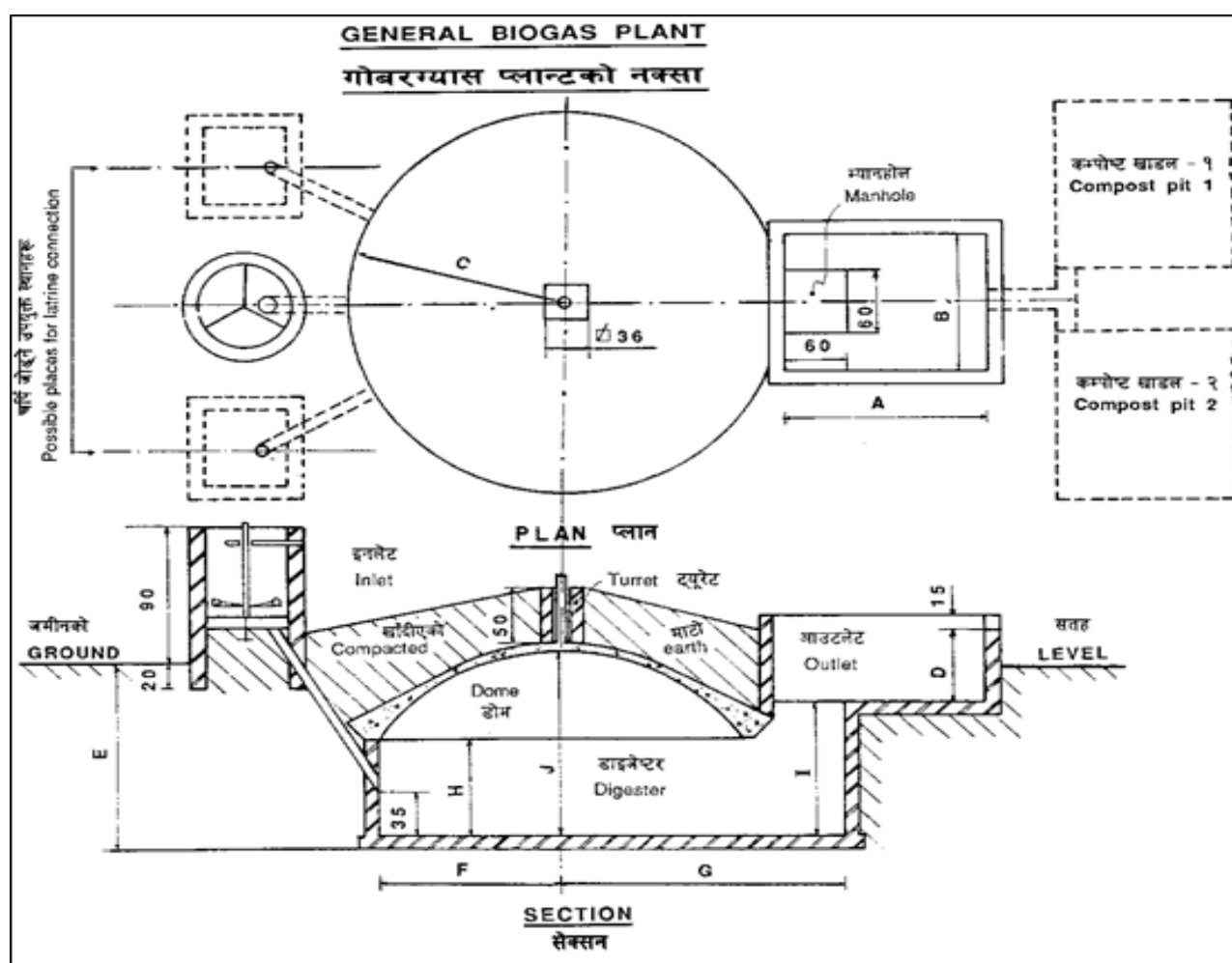
## A.2. Physical/geographical boundary of PoA

The geographical boundary of the PoA will be the Federal Democratic Republic of Nepal. The PoA can include digesters in all areas of Nepal.

## A.3. Technologies/measures

The technologies used in the PoA are household biogas digesters with a sludge and gas holding capacity range of up to 10 m<sup>3</sup>. The different sizes of the digesters that would be included in the programme would be of 2<sup>7</sup>, 4, 6, 8 and 10 m<sup>3</sup>. The programme uses only one design i.e. GGC 2047 model/improvement. The biogas digesters are based on a uniform technical design and are manufactured and installed following established technical standards in Nepal. The digester itself is a closed underground container made of concrete or other materials.

The design of the digester is mentioned below:



<sup>7</sup> The first 2m<sup>3</sup> digester was constructed in 5 May 2009

The biogas digester consists of five main structures or components. They are the inlet, outlet, digester, dome and the compost pits. The required quantity of dung and water is mixed in the inlet tank and this mix in the form of slurry is allowed to be digested inside the digester. The gas produced in the digester is collected in the dome, called as the gas-holder. The digested slurry flows to the outlet tank from the digester through the manhole. The slurry then flows through the overflow opening to the compost pit where it is collected and composted. The gas is supplied to the point of application through the pipeline.

In the PoA, the point of applications is a stove. The biogas is extracted from the digester and transported to the stove. The digester has an over pressure which creates a stable flow of gas for use in the cooking stoves.<sup>8</sup> The biogas consumption capacity of each biogas stove is 400 litre/hour<sup>9</sup>. With an estimated methane content of 52%<sup>10</sup> this gives an annual natural gas capacity of not more than 1.86 kWth per stove. To allow for quality monitoring and continuous digester improvement BSP has a strong Monitoring and Evaluation system in place. This monitoring is crucial to maintain high technical standards. It includes, among others, the following elements:

*Internal quality inspection:* For each plant the digester companies submits completion reports. Only after these reports have been received, AEPC analyse and recommends to release subsidy payment to the biogas user through the digester companies. AEPC, through third party or by itself or through partner organization like BSP-Nepal conducts quality control of newly constructed plants and of the implementation of After Sales Service.

*Performance report (i.e. as part of BUS or internal reporting):* For the all digesters included to a CPA the performance report assesses the share of the systems that are operational.

AEPC qualifies biogas manufacturing and installation companies to promote quality digesters and regularly monitors their work. Annually, it prepares the standing list of those companies that are eligible for the installation of Biogas. The owners of the digesters are the households that invest in the digesters and thereby obtain an alternative fuel source to firewood and fossil fuel.

#### A.4. Coordinating/managing entity

The coordinating, managing entity of the Nepal Biogas Support Project-PoA is the Alternative Energy Promotion Centre (AEPC).

#### A.5. 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) <sup>#</sup>	No
Germany	atmosfair gGmbH, First Climate Markets AG	No

<sup>8</sup> 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

<sup>9</sup> The referred report uses a calculation that "one stove under normal condition consumes about 15 cft. of gas/hr". One cubic feet volume is equivalent to 28.31 liters which thus result into circa 400 liters (15x28.31=424.65).

<sup>10</sup> G.P. Devkota, "Final report on Analysis of Biogas Leakages from Household Digesters, submitted to Winrock International on August 2003, Kathmandu (sec 2.3, pp 3).

#AEPC is a public entity.

## A.6. Public funding of PoA

The program received funding from three sources initially:

- The Government of Nepal,
- Kreditanstalt für Wiederaufbau (KfW),
- Netherlands Development Organisation (SNV) with funding from the DGIS (director general of International Cooperation) or from others in future. DGIS has terminated its support since 2010.

Referring to OECD guidance on use of ODA funding for CDM projects, the issue of diversion of ODA has been addressed for all Development Partners involved in the BSP. Currently, Government of Nepal has mobilized the fund to implement the BSP.

## SECTION B. Management system

AEPC is responsible for overall coordination and the execution of the Nepal Biogas Support Program-PoA. AEPC administers subsidy and biogas credit funds through Central Renewable Energy Fund (CREF), carry out biogas users' survey (BUS) through independent party, and monitor the program including quality assurance and quality control. The implementation of BSP is guided by the subsidy policy and respective delivery mechanisms of Government of Nepal.

The Government of Nepal and Development Partners provide financial support for subsidy to households for constructing biogas digesters.

The BSP-Nepal and/or any other support partners support AEPC to facilitate, backstop, and promote the programme to develop the sector. Besides, BSP-Nepal develops skill enhancement package and implements it for biogas companies (BCs) together with Nepal Biogas Promotion Association (NBPA). BSP-Nepal, if necessary also helps quality control and regular monitoring of the subsidised biogas digesters, including BC's performance evaluation, grading, penalty, bonus as well as monitoring of after-sales services. The NBPA executes skill enhancement packages for masons.

BCs are responsible to promote market and construct quality biogas digesters, regularly visit households and deliver the promised after-sales service and other services fully respecting the promised guarantee. After the installation of digester, BCs handover the Users' Manual and other information materials, and train the users on operation and maintenance of the digesters. BCs also facilitate and coordinate with banks, Micro Finance Institutions (MFIs) and other Community Based Organizations (CBOs)/Non Government Organizations (NGOs) to ease credit flow to beneficiaries.

Further, the local and provincial governments also carry out the promotion and monitoring of the biogas digesters at the local level as and when necessary.

An overview on the operational and management plan for this PoA is summarized below with the key activities and associated responsibilities:

### (i) *A record keeping system for each CPA under the PoA*

Initially, BSP-Nepal used to keep records of all digesters implemented under the PoA in a database and report to AEPC. Now, AEPC is responsible to keep the database through online subsidy application systems. The database will include at least the following information for each digester:

- Biogas Digester code. .
- dome gas pipe number (a unique ID code),

- GPS reading,
- the Biogas Company that supplied the digester,
- the name of the owner,
- address,
- the size of the digester,
- date of commissioning of the digester.

A description of the activities on the record keeping system and the related responsibilities is furthermore included to a CME management manual for the PoA.

- (ii) *A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA*

#### *Avoidance of double counting with other PoAs or CDM activities*

Double counting of the CPAs of this PoA with the CPAs of other PoAs or other registered CDM project not included to the BSP database will be checked from UNFCCC database. In case that other CDM project or programmes using the same technology achieve registration or enter validation for which double counting can not be excluded based on the database check (since these are not included), GPS coordinates will be used to avoid double counting. If applicable, information on location of installations included to corresponding activities will be requested to the involved PPs and the required check on the avoidance of double counting will be carried out.

#### *Avoidance of double counting within the PoA*

Double counting is avoided by giving each digester a unique code (biogas digester code) and GPS reading. Also for maintaining the subsidy scheme, it is important to avoid double counting. To avoid that households try to optimise their subsidy revenues, BSP does not allow that more than one digester is implemented per household. The database system will not accept a single digester twice within the CPA or between CPAs. In case of multiple installations of digesters in the same household, the renewable energy subsidy policy and subsidy delivery mechanism does not allow the same household to receive subsidy twice. In case the household intends to construct next biogas plant on its own, it will not receive government subsidy and the record of the digester will not be included in the central database system.

Thus the database will assure that digester included in a CPA with a unique code is not included in other CPA of the PoA and the maintained database will ensure that there will be no double counting. Also the current status of each CPA can be determined by verifying the database at any time. In case of any implementation of multiple digesters in the same household is revealed (e.g. based on checks on operation carried out as part of CDM monitoring), all the digesters from the household will be disqualified and removed from the central database. Further, the digesters from such household will not be considered in ER calculation.

- (iii) *The SSC-CPA included in the PoA is not a de-bundled component of another CDM program activity (CPA) or CDM project activity.*

The SSC-CPA is not a de-bundled component of a large-scale CDM programme activity. Each of the independent subsystems (bio digesters) included in each CPA is not greater than 1% of the threshold defined for a small scale project.<sup>11</sup> 1% of the 15 MWel (45 MWth) threshold for type I

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<sup>11</sup> Guidelines on Assessment of Debundling for SSC Project Activities – Version 03, (EB 54, Annex 13).

projects is 150 kWel (450kWth)<sup>12</sup>. The capacity of a digester is not more than 1.86 kWth. As part of the PoA operation there is no further activities required on the debundling aspect.

- (iv) *The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;*

The owners of a digester sign an agreement stating “The Biogas Household transfer all legal rights, interests, credits, entitlements, benefits or allowances arising from or in connection with any greenhouse gas emissions reductions arising from the operation of the digester (Emission Reduction), and agrees to take all necessary action required to ensure the transfer of those Emission Reductions to the Alternative Energy Promotion Centre or its nominee, including executing any relevant documents.”

## SECTION C. Demonstration of additionality of PoA

### Voluntary Coordinated Action

The program is a voluntary action. The Nepalese government has formulated targets for the BSP but these are not mandatory. In Nepal there are also no legal obligations with respect to the adoption or the implementation rate of digesters.

### Consideration of CDM

The implementation of the first CPA under the programme started before 2 August 2008 and therefore the analysis should focus on demonstrating awareness of the CDM prior to the PoA starting date, showing that CDM benefits were a decisive factor in the decision to proceed with the project and showing that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.

**Table 2: Timeline with CDM milestones.**

Date	Activity	Evidence
17/10/2006	Memorandum of Understanding between AEPC and KfW on Biogas CDM Project for the long term ERPA, a few months after the EB launched guidelines, procedures and templates for the registration of CDM PoA projects.	MOU between AEPC and KfW dated 17/10/2006
01/02/2008	Approval of New methodology AMS. I. E by UNFCCC during CDM EB-37	<a href="http://cdm.unfccc.int/methodologies/DB/4AWU125UNQLOC5JAMXQFU60KDCJNUA/view.html">http://cdm.unfccc.int/methodologies/DB/4AWU125UNQLOC5JAMXQFU60KDCJNUA/view.html</a>
04/07/2008	Singing of a Consultant Contract between Climate Focus, AEPC and KfW to develop the CDM PoA documents	Contract Letter
17/07/2008	Financing agreement between AEPC and KfW for the CDM project from ERPA	Financing Agreement
15/08/2008	Local Stakeholders Consultation Meeting	Minutes of meeting

Note: evidence to substantiate this timeline can be provided upon request.

<sup>12</sup> Footnote 9 of EB 54, Annex 13, refers to 15 kW that is incorrect since 1% of 15 MW is 150 kW. However, the capacity of a digester is even below 15 kW.



AEPC have pursued the CDM for the biogas support programme since 2002. The timeline above shows the continuing and real actions that AEPC undertook to secure CDM status for this PoA. Two regular CDM bundles are registered since December 2005 under the UNFCCC references 136 and 139 and include digesters implemented between November 2003 and April 2005. A revision of the applied methodology, AMS-I.C., prevented continued development of the BSP under the CDM. The deadlock was cleared after the thirteenth COP/MOP in 2007 and with the approval of AMS-I.E. at the 37thEB meeting. With the approval of AMS.I.E, two more bundle projects (PA-3 and PA-4) were registered. Both PA-3 and PA-4 were registered on 13 December 2011; however, the construction of the digesters for PA-3 was completed by 8 May 2006 and for PA-4 it was completed by 21 June 2007.

As the programmes are required to have starting date after 22 June 2007<sup>19</sup> to seek registration under PoA, PA-3 and PA-4 were approached as regular small scale projects. The early action by AEPC to develop the programme as one of the first CDM projects approved, and its ongoing effort to secure the CDM potential of the program support the claim that also for this PoA the CDM was an important factor in the decision to implement the programme.

### **Additionality**

The additionality of the PoA is demonstrated by following the criteria outlined in "Guidelines for demonstrating additionality of small scale project activities" (version 09) EB 68 Annex 27. The paragraph 2 of this guideline states that,

*"Documentation of barriers, as per paragraph 1 above is not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g. installed capacity up to 15 MW)"*

The sub-section 2 (c) of paragraph states that,

*"Project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size<sup>13</sup> of each unit is no larger than 5% of the small-scale CDM thresholds."*

Each unit of biogas digester has the capacity of not more than 1.86 kW<sub>th</sub> (refer calculation in the emission reduction spread sheet) which is less than 5% of the small-scale CDM threshold, or 750 kW installed capacity. The PoA is thus additional and there is no need for further assessment and demonstration of additionality.

## **SECTION D. Start date and duration of PoA**

### **D.1. Start date of PoA**

22/06/2007, First digester construction date under CPA-1.

### **D.2. Duration of PoA**

The length of the PoA is 28 years.

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<sup>13</sup>That is the size of each unit under 750 kW installed capacity or under 3000 MWh of energy saving per year or 3000 tonnes of emission reduction per year.

## SECTION E. Environmental impacts

### E.1. Level at which environmental impacts analysis is undertaken

1. Environmental Analysis is done at PoA level ☒
2. Environmental Analysis is done at SSC-CPA level ☐

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. It should be noted here that EIA is not a regulatory requirement in Nepal for biogas projects at the individual digester level.

### E.2. Analysis of environmental impacts

Environmental Protection Act (1997) and Environment Protection Rules (1997) exempt the biogas programs from undertaking any environmental impact assessment prior to its implementation. Despite this legal exemption, 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 after the installation of biogas system for cooking and, to a much lesser extent, for lighting during the third phase of the Nepal Biogas Support Program (BSP III)<sup>14</sup>. 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 digesters is used 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. The study reveals that the biogas technology offers various positive impacts (fuel saving, reduces indoor air pollution, applicability of slurry as fertilizer, forest conservation etc) and no negative impacts. Besides, the study has not concluded any trans-boundary impacts due to the biogas technology. The model of biogas digester implemented in BSP III and that is being implemented for the PoA is same i.e. GGC 2047. The targeted beneficiaries, geographical distribution, feeding material and mode of construction are same for the digesters implemented in phase 3 and for this PoA. Therefore, there are no negative environmental impacts due to digester implementation in different phases of BSP.

### E.3. Environmental impact assessment

AEPC holds all necessary permits and approvals from the GoN required implementing and operating this PoA. An individual CPA includes a maximum 20,000 digesters under the program. Nepalese law does not require an EIA for the CPA or the individual digesters there under.

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<sup>14</sup> Phase III includes the digesters implemented between March '97 to June'03.

## SECTION F. Local stakeholder consultation

### F.1. Level at which local stakeholder consultation is undertaken

1. Local stakeholder consultation is done at PoA level ☒
2. Local stakeholder consultation is done at SSC-CPA level ☐

The key stakeholders of the program both at PoA and CPA level are same. They are biogas users, biogas companies, banks and micro-finance institutes, local governments, Development Partners, BSP-N, AEPC and Government of Nepal including other indirect stakeholders and are equally applicable.

### F.2. Modalities for local stakeholder consultation

A stakeholder consultation meeting was held on 15 August 2008 in Kathmandu. After an introduction of the PoA and its CDM background the stakeholder were invited to submit comments.

Further, as per the DNA regulations, the stakeholder discussion on the PIN and PDD of the PoA was held on September 3, 2008 and on November 17, 2009 respectively. The stakeholders included digesters users, representatives from different government ministries, NGO's, Development Partners 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

### F.3. 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 PoA 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 program 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 digester.

### F.4. 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 digester. 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 digesters 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 digesters.
- 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 G. Approval and authorization**

The approval from the Host Country DNA for this PoA was received on 31 December 2009.

## **PART II. Generic component project activity (CPA)**

### **SECTION H. Description of generic CPA**

#### **H.1. Title of generic CPA**

Nepal Biogas Support Program- CPA XXXX

#### **H.2. Reference number of generic CPA**

(9572-XXXX)

#### **H.3. Purpose and general description of generic CPA**

The optimal CPA size will be determined based on the costs of each inclusion, but the number of digesters will not exceed a maximum of 20,000 digesters. The aggregate capacity of a CPA will not exceed 45 MW<sub>th</sub>, whilst the thermal capacity of each individual digester will not exceed 450 kW<sub>th</sub>.

The first CPA consists of digesters 20,000 implemented between 22 June 2007 and 18 March 2009.<sup>15</sup>

The digesters included in each CPA will be based on a time interval. Future CPA documents will be developed once there are enough new digesters implemented that are not yet covered by an existing CPA. A consequence of using time as the parameter that determines what digesters are listed in each CPA, the location, size, owner and digester company involved will be random.

The target group of the BSP is households who currently use non-renewable woody biomass (firewood) and/or fossil fuels (kerosene and/or LPG) for cooking purposes.<sup>16</sup> The programme aims to utilize the methane produced from household biogas digesters to displace the current non-renewable energy sources that is used by households. The main feedstock for digesters is cattle manure and human excreta.

The baseline scenario is continued use of non-renewable biomass (NRB) i.e. firewood for cooking. In addition to non-renewable firewood, the households also use small amount of cow dung and agricultural waste for cooking. Fossil fuels like kerosene and LPG are hardly used.<sup>17 18 19</sup> Only firewood consumption is considered for the baseline estimates. Thus, in the absence of the programme the beneficiaries would have continued the use of non-renewable biomass (firewood) leading to its associated GHG emissions. Hence, use of non renewable biomass is considered as the baselines and emission reductions will be claimed only for the displacement of non renewable fuel-wood.

The technology is environmentally sound. The programme may use accessories like Valve, Multilayer Pipes, Pressure meter, which has been procured from Thailand, China, and may also be procured from other countries.

#### **H.4. Technologies/measures**

Each CPA will employ the technology as described under section A.3. A CPA includes GGC 2047 model or its improvement at different locations throughout Nepal.

### **SECTION I. Application of methodologies and standardized baselines**

#### **I.1. References to methodologies and standardized baselines**

AMS-I.E.: "Switch from Non-Renewable Biomass for thermal applications by the user" (Version 9.0)

#### **I.2. Applicability of methodologies and standardized baselines**

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<sup>15</sup>The Note that the 47<sup>th</sup> EB meeting report, paragraph. 72. granted an exemption to programmes of activities which have commenced validation prior to 31 December 2009.

<sup>16</sup> J.M. Baland "The Environmental Impact of Poverty: Evidence from Firewood Collection in Rural Nepal", Boston University

<sup>17</sup>G.P. Devkota, "Final report on Analysis of Biogas Leakages from Household Digesters, submitted to Winrock International on August 2003, Kathmandu

<sup>18</sup> Nepal Living Standards Survey 2003/04 published by Central Bureau of Statistics, National Planning Commission Secretariat, His Majesty's Government of Nepal, December 2004

<sup>19</sup> E.g. Compare Biogas Users Survey (BUS) 2008/09

The methodology AMS-I.E: “Switch from Non-Renewable Biomass for Thermal Applications by the User”, version 04 was used for the PoA during first crediting period. The same methodology with version 9.0 is applied for crediting period renewable for the second crediting period. The applicability of the methodology is outlined as below:

Criteria AMS-I.E.	Explanation
The methodology is applicable for technologies displacing use of non-renewable biomass by renewable energy.	The PoA will replace non-renewable biomass by introducing the biogas digester producing renewable energy.
Small-Scale project requirement: For biomass, biofuel and biogas project activities, the maximal limit of 15MW(e) is equivalent to 45 MW thermal output of the equipment or the plant (e.g. boilers). For thermal applications of biomass, biofuels or biogas (e.g. the cookstoves), the limit of 45 MW <sub>th</sub> is the installed/rated capacity of the thermal application equipment or device/s (e.g. biogas stoves).	The biogas capacity of each stove is 400 litre/hour. With a methane content of 52%, this gives an annual natural gas capacity of not more than 1.86 kW <sub>th</sub> per stove (validated during registration). This means that around 24,000 stoves would still have an aggregated capacity below the 45MW <sub>th</sub> small scale threshold value, however the CPA will be limited to 20000 installations only.
This methodology comprises of 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, bio-ethanol stoves, solar cookers, passive solar homes.	The digesters are indeed “small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user 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 or referring to published literature, official reports or statistics.	The BUS conducted in 2018 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. 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.
For project activities introducing bio-ethanol cook-stoves, project participants or coordinating and managing entities shall demonstrate that the bio-ethanol 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 PoA does not include the bio-ethanol cookstoves and hence this is not applicable for this PoA

Also, the PoA will not involve any CPA where equipment would be transferred from other project activities. No equipment is transferred from other project activities as only new digester equipment is included in the PoA (included also to eligibility criteria for technology)

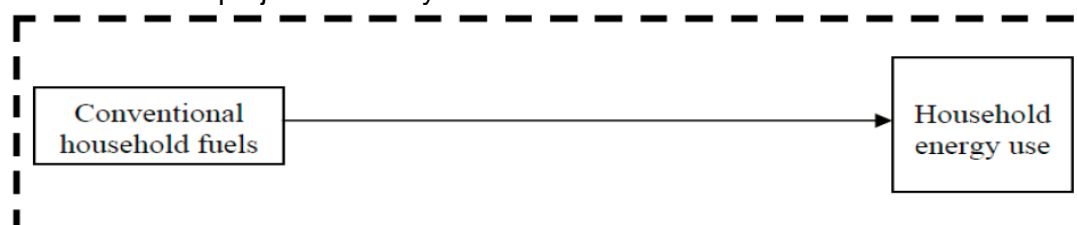
### I.3. Application of multiple methodologies

N/A

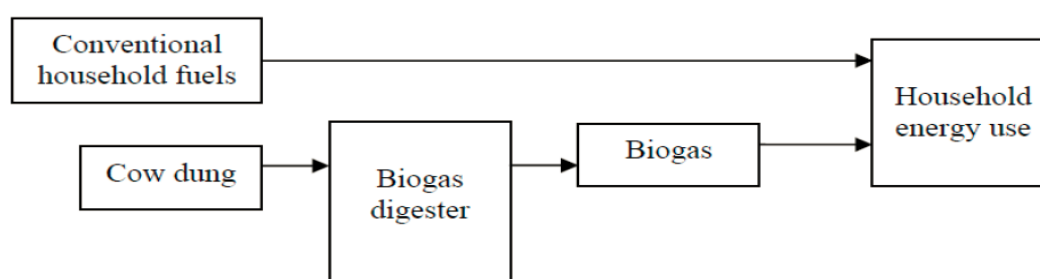
#### I.4. Project boundary, sources and greenhouse gases (GHGs)

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 emission reduction takes place due displacement of non-renewable biomass. Emissions other than those from non-renewable biomass (e.g. from fossil sources for cooking) have not considered in the establishment of the baseline.

Figure B.4.1 and B.4.2 below and the table below 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**

	Source	GHG	Included?	Justification/Explanation
Baseline	Baseline: emissions from NRB use for cooking	CO <sub>2</sub>	Included	
		CH <sub>4</sub>	Not included:	conservative
		N <sub>2</sub> O	Not included:	conservative
	Baseline: emissions from fossil fuel use for cooking	CO <sub>2</sub>	Not included:	conservative
		CH <sub>4</sub>	Not included:	conservative
		N <sub>2</sub> O	Not included:	conservative
Project activity	Project: digester and biogas cooking stove	CO <sub>2</sub>	Negligible	
		CH <sub>4</sub>	Not included,	Negligible

#### I.5. Establishment and description of baseline scenario

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 third 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: Assess the validity of the current baseline for the next crediting period***

***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 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 PoA start date) and latest revision has happened in 2016. Similarly, the Renewable (Rural) Energy Subsidy Delivery Mechanism was initially published in 2000 (prior to PoA 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, m<sup>3</sup> 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 PoA 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 PoA with subsequent development of 8 CPAs using the same baseline. 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 PoA. 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 PoA 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.: version 09 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.

Trends in distance travelled for firewood gathering or trends in time needed for firewood gathering indicating depletion of resources available was monitored through perception survey and the result is given in table below:

Type	% of people perceived							
	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8
Increased	52	58	51	75	39	52	74	56
Same as Previous	39	23	14	23	54	43	26	21
Decreased	08	20	35	2	6	5	0	22

Source: Table 6, Biogas User Survey, 2018 (for all CPAs)

The result above indicates that the sourcing biomass from forest over the years have become even more difficult.

- Increase in fuel wood price:

The households were interviewed on the perceived price of firewood in 1989, 2000 and 2018 during Biogas User Survey 2017/18 for the PoA. The results reveal that the average market price of one bhari<sup>20</sup> of fuel wood in 1989, 2000 and in 2018 is in increasing trend.

Year	Average price of fuelwood (NPR)							
	CPA-1	CPA-2	CPA-3	CPA-4	CPA-5	CPA-6	CPA-7	CPA-8
1989	45	34	41	28	63	61	63	37
2000	182	180	149	126	208	184	208	139
2018	494	494	453	429	502	459	502	390

Source: Table 8, Biogas User Survey, 2018 (for all CPAs)

<sup>20</sup> 1 Bhari is about 35 kg in an average

If the operational lifetime of the biogas digesters is completed within this crediting period, that particular biogas digester will not be considered for the baseline emission calculation from the next consecutive monitoring period. 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 as 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 is updated for the 2<sup>nd</sup> 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**

As per the outcome of step 1, this step is not applicable as the current baseline is still valid.

##### **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 Version 09) for this crediting period. More details can be seen in sections I.6 and I.7 of the PoA-DD.

## **I.6. Estimation of emission reductions**

### **I.6.1. Explanation of methodological choices**

The applied methodology AMS I E (version 9.0), requires methodological choices to be made. The SSC-CPA shall indicate the choices in the following manner. Key components of AMS-I.E. (version 9.0) are the calculation of the emission reductions, differentiation between NRB and renewable biomass and the occurrence of leakage.

#### **Emission reduction calculation**

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 <sub>2e</sub>
$B_y$	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<sub>projected\_fossilfuel</sub> Emission factor for substitution of non renewable woody biomass by similar consumers. Use a value of 63.7 tCO<sub>2</sub>/TJ<sup>21</sup>

B<sub>y</sub> 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 institution<sup>22</sup> 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<sub>y</sub> 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 21a of the methodology, B<sub>y</sub> can be calculated as,

$$B_y = N_{HH} \times (BC_{BL,HH,y} - BC_{PJ,HH,y}) \quad \text{Equation (2)}$$

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 Biogas User Survey for similar project activities were done in 2018 to identify the consumption of woody biomass in the absence of the project activity and the consumption of woody biomass during the project activity by pre-project devices. The results of survey shows the following results

Activity	PA-1 <sup>23</sup>	PA-2 <sup>24</sup>	PA-3 <sup>25</sup>	PA-4 <sup>26</sup>
Average consumption of Woody Biomass before project activity (ton/Year/household): BC <sub>BL,HH,y</sub>	5.06	5.2	5.04	5.09

<sup>21</sup> This value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. The value is calculated, based on the global average ratio of cooking fuels (the normalized ratio of kerosene and liquefied petroleum gas (LPG) excluding coal), i.e. 9 per cent for kerosene (71.5 t CO<sub>2</sub>/TJ) and 91 per cent for LPG (63.0 t CO<sub>2</sub>/TJ).

<sup>22</sup> Institutions such as schools, prisons and hospitals

<sup>23</sup> [Biogas Support Program - Nepal \(BSP-Nepal\) Activity-1](#) (Ref. 0136)

<sup>24</sup> [Biogas Support Program - Nepal \(BSP-Nepal\) Activity-2](#) (Ref. 0139)

<sup>25</sup> [Biogas Support Program - Nepal Activity-3](#) (Ref.5415)

<sup>26</sup> [Biogas Support Program - Nepal Activity-4](#) (Ref.5416)

Average consumption of Woody Biomass by Pre-project device after project activity (ton/year/household): $BC_{PJ,HH,Y}$	0.55	0.53	0.54	0.53
Total woody biomass displaced (ton/year/household)	4.51	4.67	4.5	4.56

The survey has found that the woody biomass consumption varies from 5.04 ton/household/year to 5.20 ton/household/year before the project activity whereas woody biomass consumption by pre-project device after the project activity varies from 0.53 ton/household/year to 0.55 ton/household/year. So, total woody biomass displaced are between 4.50 to 4.67 ton/household/year. These survey were done following the sampling and survey guidelines.

So, the quantity of woody biomass substituted by each household is taken as 4.5 tons/year for this PoA.

### Differentiation between NRB and renewable biomass

The methodology requires the CME to determine the shares of renewable and non-renewable woody biomass in By (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 (version 02).

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 Tonnes/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) <sup>3</sup>
$F_{other,i}$	=	Extent of other wooded land in sub-category $i$ (ha) <sup>2</sup>
$P_{forest}$	=	Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within forest areas (ha)
$P_{other}$	=	Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within other wooded land areas (ha)
$i$	=	Sub-category $i$ of forest areas and other wooded land areas <sup>4</sup>

The forest area and the other wooded land area are taken from the “State of Nepal’s Forest” published on December 2015 by Ministry of Forest and Soil Conservation<sup>27</sup>, 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% (The calculation spreadsheet is attached with ER calculation sheet for the reference). This has also been validated by the Ministry of Forest and Environment, Government of Nepal.

**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):

- CO<sub>2</sub> emissions from on-site consumption of fossil fuels due to the project activity, including the consumption of fossil fuels for any processing of feedstock;
- CO<sub>2</sub> emissions from electricity consumption by the project activity including the consumption of electricity for any processing of feedstock;
- Methane emission from solid waste disposal or waste water in cases where the waste is disposed in anaerobic conditions;
- Project emissions related to cultivation of feedstock
- Project emissions from transportation, if the transportation distance is more than 200 km; otherwise they can be neglected.

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, the above emissions are not applicable to this project activity. So, the project emission for this project activity is neglected and taken as zero.

**Leakage**

As per the methodology, leakage emissions ( $LE_y$ ) shall be calculated using the latest version of “TOOL16: Project and leakage emissions from biomass”. As the conditions for leakage given in the Tool 16 are not applicable for this project, para 24 of the methodology has been used to account

<sup>27</sup> [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)

the leakage. According to the para 24 of the 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:

a) 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  $B_y$  is adjusted to account for the quantified leakage. Alternatively,  $B_y$  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 CME have opted to use the default factor of 0.95 to account for any potential leakage, as prescribed by the methodology.

### Emission Reductions

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

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$ER_y$  = Emission reductions in year  $y$ , tonnes CO<sub>2</sub>eq

## I.6.2. Data and parameters fixed ex ante

<b>Data/Parameter</b>	$f_{NRB,y}$
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.

<b>Data/Parameter</b>	$EF_{\text{projected\_fossilfuel}}$
Data unit	tCO <sub>2</sub> /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 09 requires using this value.
Purpose of data	Calculation of emission reduction
Additional comment	The value will be fixed for the crediting period

<b>Data/Parameter</b>	$N_{HH}$
Data unit	Number
Description	Number of households in each CPA in year y
Source of data	BSP database for each CPA
Value(s) applied	-
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.
Purpose of data	Calculation of baseline emission
Additional comment	During calculation of Emission Reduction, it will be based on actual number of households having the biogas operational

<b>Data/Parameter</b>	$BC_{BL,HH,y}$
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 similar project activities. The woody biomass substituted or displaced is conservatively taken as 4.5 tons/HH/years for ex-ante calculation of emission reduction for which the annual average consumption of woody biomass before the start of the project activities is 5.04 tons/HH/year and the average annual woody biomass consumption by pre-project device during the project activities is 0.54 tons/HH/Year.
Value(s) applied	5.04 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 "Standards:Sampling and surveys for CDM project activities and programme of activities;" Biogas User Survey follows the standard sampling and surveys guidelines
Purpose of data	Calculation of baseline emission
Additional comment	This value is used in the calculations and shall remain fixed for the crediting period.

### I.6.3. Modalities for ex ante calculation of emission reductions

As per para 27 of the AMS I.E version 9, the emission, reduction for each CPAs will be 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,

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\_fuel}$$

For example,  $B_y$  is calculated as using the following values

$N_{HH}$	20,000 (per CPA maximum)
Displacement of Woody Biomass ( $BC_{BL,HH,y} - BC_{PJ,HH,y}$ )	4.50 tonne/household/year <sup>28</sup>
Operational status of Biogas	89% <sup>29</sup>
Number of Household with operational digester	$N_{HH} \times$ Operational status of Biogas

$$B_y = 20,000 \times 0.89\% \times 4.5 = 80,100 \text{ tonne/year}$$

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)

$EF_{projected\_fossil\_fuel} = 63.7 \text{ tCO}_{2e}/\text{TJ}$  (as per the methodology AMS I.E version 9)

Baseline Emission is calculated as  $BE_y = 68,532.99 \text{ tCO}_{2e}$

<sup>28</sup> Conservative value taken as stipulated in section I.6.1 of this PoA DD and is fixed ex-ante.

<sup>29</sup> For ex ante, operational status of the CPA-1 in 2018 identified from biogas user survey has been used. The actual operational status will be arrived using sample survey for ex-post and may vary (higher or lower) for each CPAs.



Considering the leakage of 5% (as per the methodology AMS I.E. version 9), leakage emission is calculated as  $LE_y = 3,426.65 \text{ tCO}_{2e}$

Considering the project emission (PE<sub>y</sub>) as zero as this is not applicable for this PoA, the emission reduction is calculated as  $65,106 \text{ tCO}_{2eq}$ .

While calculating the emission reduction for specific case CPAs, the number of households and operational status for specific CPAs will be used.

This is indicative calculation and the same process will be applied to all the CPAs.

## I.7. Monitoring plan

### I.7.1. Data and parameters to be monitored

<b>Data/Parameter</b>	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

<b>Data/Parameter</b>	$NCV_{biomass}$
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	N/A
QA/QC procedures	N/A
Purpose of data	Calculation of baseline emission
Additional comment	N/A

<b>Data/Parameter</b>	$BC_{PJ,HH,y}$
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	- 0.54 tonnes/household/year for the ex-ante calculation as per the Biogas User Survey for similar project activities. 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 for each CPA and the consumption of the woody biomass by pre-project device if any during the project activities.
Purpose of data	Calculation of baseline emission
Additional comment	ERs will be accounted only for functional biogas in the particular monitoring period

<b>Data/Parameter</b>	<b>B<sub>y</sub></b>
Data unit	tones/year
Description	Quantity of woody biomass that is substituted or displaced
Source of data	Biogas User Surveys
Value(s) applied	This will be calculated based on the operational status of the biogas digesters for particular monitoring period and the woody biomass consumed by pre-project devices during project activity. It ranges from zero when biogas is not in operation to 5.04 tonnes/household/year when BC <sub>PJ,HH,y</sub> is zero and biogas is operational.
Measurement methods and procedures	<p>The calculation of the B<sub>y</sub> 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 B<sub>y</sub> as follows:</p> <p><math>B_y = N_{HH} * (BC_{BL,HH,y} - BC_{PJ,HH,y})</math> where N<sub>HH</sub> will be the household with operational biogas digester for the particular monitoring period.  <math>N_{HH} = N * P_y</math>, where N is the number of bio digesters installed in the project and P<sub>y</sub> is Proportion of Bio digesters operational estimated based on the sample survey</p>
Monitoring frequency	Once in a Year
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 for each CPA.
Purpose of data	Calculation of baseline emission
Additional comment	Once the biogas included in the component project activity completes its operational lifetime, those biogas will not be considered for the next consecutive monitoring.

### I.7.2. Sampling plan

For a matter of completeness, the various aspects to be monitored according to the methodology. The parameter to be monitored for a SSC-CPA is included in I.7.1.

Following parameters will be monitored:

1. Digester performance (Operational %) of the biogas digester in particular monitoring period to calculate the quantity of woody biomass that is substituted or displaced.
2. 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.
3. Monitoring should confirm the displacement or substitution of the non-renewable biomass

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 (EB 86, 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 each CPA. The corresponding sampling plan is given in Appendix 5 of PoA-DD.

The fraction of the Non-renewable biomass displaced by the PoA has been determined ex-ante in the PoA-DD and has been fixed for the second crediting period. The following indicators will be monitored through Biogas User Survey to confirm the displacement of NRB by households and 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.

### **I.7.3. Other elements of monitoring plan**

#### **Internal monitoring activities as part of the overarching BSP programme**

AEPC carries out thorough quality control activities to ensure that the biogas digesters are built according to set quality standards following the subsidy delivery mechanism and other set standard. This includes setting up random sampling, field visits, on the spot advice to biogas companies and biogas owners, collecting and analyzing data obtained through questionnaire during visits, adopting “rewards or punishment” system to biogas companies etc. Note that this quality control is carried out to ensure quality of the digesters but not necessarily to calculate the emission reductions.

#### **Data Archiving Procedure**

The data archiving procedures followed 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 on-line/manual submitted by Biogas Companies.
3. Assess the subsidy forms and commissioning reports by subsidy processing units in AEPC.
4. Check all the forms with supporting documents, rejected forms will be informed to biogas companies.
5. Enter data into database system, action to rejected forms same as above.

6. Recommend for the subsidy to CREF and handling bank for the disbursement.
7. Undertake quality control of constructed plants as per subsidy delivery mechanism and apply the penalty and reward systems

## SECTION J. Crediting period type and duration

Renewable crediting period, 7 years 0 months

## SECTION K. Eligibility criteria for inclusion of CPAs

For this crediting period, following eligibility criteria apply for the inclusion of SSC-CPA in the SSC-PoA.

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	Geographical boundary	<ul style="list-style-type: none"> <li>-All biogas digesters in the CPA are located within the geographical boundaries of Nepal.</li> <li>- This will be confirmed by the CME by ensuring that each individual installation is a) located at an address that lies within the geographical boundaries of Nepal as demonstrated by providing the address of all biogas digesters in the CPA database; and b) has GPS coordinates that are situated within the geographical boundaries of Nepal.</li> </ul>	<ul style="list-style-type: none"> <li>- Commissioning Report from Biogas Companies (BC).</li> <li>- CPA Database indicating digester code, address and GPS coordinate.</li> </ul>
2	Double counting	<ul style="list-style-type: none"> <li>- Double counting is avoided by assuring that no digester is already included to a different CDM project or CPA.</li> <li>- This will be confirmed by the CME based on a) the digester codes listed in the BSP database and b) if necessary also GPS coordinates (the latter applies if biogas projects emerge under the CDM that are not part of the BSP).</li> </ul>	<ul style="list-style-type: none"> <li>- CPA Database indicating digester code, address and GPS coordinate.</li> <li>- Unique GPS reading of each digester.</li> <li>- CDM website indicating potential further projects not included to BSP using the same technology.</li> </ul>
3	Technology	<ul style="list-style-type: none"> <li>- AEPC will implement all CPAs as part of the BSP.</li> <li>- All digesters listed in the CPA shall be household biogas digesters with a sludge and gas holding capacity range of 2-10 m<sup>3</sup>.</li> <li>- Biogas shall be supplied to a stove with a maximum capacity of 400 l/h leading to a maximum annual gas capacity of not more than 1.86 kWth per stove.</li> <li>- The equipment shall be new and not transferred from other project activities.</li> </ul>	<ul style="list-style-type: none"> <li>- Commissioning Report from Biogas Companies (BC).</li> <li>- Technical specification documents detailing digester models and equipment applied.</li> </ul>

4.	Start Date	<ul style="list-style-type: none"> <li>- The start date of a CPA is the date of commissioning of the first biogas digester included to that respective CPA.</li> <li>- The start date of CPA 1 shall be 22 June 2007, which is the date of commissioning of the first digester in CPA 1.</li> <li>- The start of each future CPA shall be after the date of commissioning of the last installation included to a previous CPA.</li> <li>- The date of commissioning is recorded in the Commissioning Report, which is archived and the date recorded in the CPA database.</li> </ul>	<ul style="list-style-type: none"> <li>- Commissioning Report from Biogas Companies (BC), indicating the commissioning date.</li> <li>- CPA Database</li> </ul>
5.	Compliance with applied methodology	<ul style="list-style-type: none"> <li>- The activity shall replace non renewable biomass. This will be confirmed through documenting that participating households use non-renewable biomass as firewood.</li> </ul>	<ul style="list-style-type: none"> <li>- Report confirming use of non-renewable biomass as firewood prior to installation of digesters (e.g. BUS)</li> </ul>
6.	Diversion of official development assistance	<ul style="list-style-type: none"> <li>- The CPA shall not result into the diversion of official development assistance.</li> </ul>	<ul style="list-style-type: none"> <li>- Declaration from CPA implementer / AEPC.</li> <li>- Confirmation of ODA non diversion, as applicable.</li> </ul>
7.	Target Group and distribution mechanism	<ul style="list-style-type: none"> <li>- The target group within the CPA are households.</li> </ul>	<ul style="list-style-type: none"> <li>- Installation confirmation from Biogas Companies (BC) indicating that the digesters are installed in a household.</li> </ul>
8.	Threshold check	<ul style="list-style-type: none"> <li>- Number of biogas digester included in each CPA shall not exceed 20,000 units, which assures compliance with the small scale limit of 45MWth.<sup>30</sup></li> </ul>	<ul style="list-style-type: none"> <li>- BSP/AEPC database to confirm the number of digesters in a CPA is maximum 20,000.</li> </ul>
9.	Other Voluntary action	<ul style="list-style-type: none"> <li>- Each CPA to be included in this PoA should be a voluntary action and not mandated by the Government of Nepal</li> </ul>	<ul style="list-style-type: none"> <li>- Confirmation that each CPA is a voluntary action not mandated by the Government of Nepal</li> </ul>

Also, the PoA will not involve any CPA where equipment would be transferred from other project activities. No equipment is transferred from other project activities as only new digester equipment is included in the PoA.

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<sup>30</sup> Estimated maximum capacity of 1.86 kWth per stove. Considering that the limit for SSC is 45 MW<sub>th</sub>, the maximum number of digesters allowed under a CPA (20,000) remains well below the SSC threshold.

## Appendix 1. Contact information of coordinating/managing entity and project participants

<b>Coordinating/managing entity and/or project participants</b>	<input checked="" type="checkbox"/> Coordinating/managing entity <input checked="" type="checkbox"/> Project participant
<b>Organization name</b>	Alternative Energy Promotion Centre
<b>Country</b>	Nepal
<b>Address</b>	Khumaltar Height, Lalitpur, Nepal
<b>Telephone</b>	+977-1-5539390
<b>Fax</b>	+977-1-5539392
<b>E-mail</b>	Madhusudhan.adhikari@aepec.gov.np
<b>Website</b>	www.aepec.gov.np
<b>Contact person</b>	Madhusudhan Adhikari, Executive Director

## Appendix 2. Affirmation regarding public funding

Information has been provided in section A.6

## Appendix 3. Applicability of methodologies and standardized baselines

See section I.2

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

(Information has been provided in section I.6.3)

## Appendix 5. Further background information on monitoring plan

As per the Guidelines for Sampling and Surveys for CDM Project activities and Programme of Activities Ver. 4.0, the following Sampling plan has been developed.

### (a) Sampling Design:

#### (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. The monitoring would be performed using the level of precision of 10% and a confidence level of 90%. The monitoring plan aims determining the parameters mentioned below:

- 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.

### (ii) Target Population:

The target population is the households using biogas digester units under the PoA throughout Nepal.

### (iii) Sampling method

Stratified random sampling will be applied in conducting the performance reports. An adequate sample size will be chosen in order meet 90/10 precision (90% confidence interval and 10% margin of error) for parameter values used to determine emission reductions.

Thus each CPA will be verified based on a sample of biogas digesters included in that CPA. The design of biogas digester disseminated under the PoA is same throughout the country and uses the same material for construction and installation. Besides, the accessories like stove, pipes, valves etc used for constructing digester are uniform and feeding material (cattle dung) is also same for all digesters. Nevertheless, the location of households using biogas digesters in different ecological zones create heterogeneity and justifies the choice of opting stratified random sampling.

### (iv) Sample size

#### **Proportional Parameter (% of Biogas Operational)**

The sample size is determined using the Guidelines for Sampling and Surveys for CDM Project activities and Programme of Activities Ver. 4.0. As required by AMS I.E Ver.9 at least biennial surveys will be carried out. The level of precision of 10% and a confidence level of 90% will be assessed for the relevant parameter (% of digester operational). The minimum sample size is calculated using the procedure outlined in para 24 of Appendix 1 of the guideline

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

Where,

n= sample size

N=Total number of households using biogas digesters in all ecological zones (i.e. 20000 per CPA)

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

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

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

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 PoA.

Particulars	Symbol	Value	Remarks
Total Number of Population	N	20,000	Maximum allowable in the CPA
Number of Biogas in Terai	$g_t$	10,955	Taken from CPA-1
Expected operational Proportion of Biogas in Terai	$p_t$	0.93	As per Biogas User Survey 2017/18 for CPA-1
Number of Biogas in Hill	$g_h$	8,940	Taken from CPA-1
Expected operational Proportion of Biogas in Hill	$p_h$	0.86	As per Biogas User Survey 2017/18 for the CPA-1
Number of Biogas in Remote Hill	$g_{rh}$	105	Taken from CPA-1
Expected operational Proportion of Biogas in Remote Hill	$p_{rh}$	0.25	As per Biogas User Survey 2017/18 for the CPA-1

Substituting the values in the above equation gives,

$$n = 30.51$$

$$n = 31 \text{ (rounded up value)}$$

The resulting sample (n=31) will be then proportionately assigned to each stratum (i.e. remote hill, hill and terai as 17, 14 and 1 respectively) based on the number of biogas digesters implemented in each stratum under each CPA.

**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, 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,

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

n = Sample Size

N = Total number of Population

SD = Overall standard deviation

m = 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

Where,

$$SD = \sqrt{\frac{(g_a \times SD_a^2) + (g_b \times SD_b^2) + (g_c \times SD_c^2) + \dots + (g_k \times SD_k^2)}{N}}$$

and



$$\text{mean} = \frac{(g_a \times m_a) + (g_b \times m_b) + (g_c \times m_c) + \dots + (g_k \times m_k)}{N}$$

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

Particulars	Symbol	Value	Remarks
Total Number of Population	N	2000	Database
Number of Biogas in Remote Hill	$g_{rh}$	105	Taken from CPA-1
Expected mean for remote hill	$m_{rh}$	1.40	As per Biogas User Survey 2017/18 for the project activity 3
Expected Standard Deviation for remote hill	$SD_{rh}$	0.24	As per Biogas User Survey 2017/18 for the project activity 3
Number of Biogas in Hill	$g_h$	8,940	Taken from CPA-1
Expected mean for hill	$m_h$	0.51	As per Biogas User Survey 2017/18 for the project activity 3
Expected Standard Deviation for Hill	$SD_h$	0.25	As per Biogas User Survey 2017/18 for the project activity 3
Number of Biogas in Terai	$g_t$	10,955	Taken from CPA-1
Expected mean for Terai	$m_t$	0.54	As per Biogas User Survey 2017/18 for the project activity 3
Expected standard deviation for Terai	$SD_t$	0.28	As per Biogas User Survey 2017/18 for the project activity 3

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 woody biomass consumption of pre-project device after project activities, same samples will be taken for the proportional parameters as well. So, for the monitoring of the CPAs, minimum 75 samples will be retained to monitor all parameters including the confirmation of NRB use.

#### (v) Sampling frame

The sample frame consists of selection of households using biogas digester units disseminated under the PoA over Nepal. 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.

#### (b) Data:

##### (i) Field Measurements:

Emission reductions are directly proportional to the number of appliances (biogas digester units in case of the project) that are operating. This will be done through a sample of appliances to ensure that they are operating or replaced by an equivalent in service appliance. The CME will assure the corresponding field measurements.

##### (ii) Quality Assurance/Quality Control:

A performance report will be prepared to seek responses of operating status (yes or no) of biogas digester units and to confirm the displacement of NRB by the user households.

The performance report will be carried out by an experience team consisting of enumerators, supervisors and professionals. The supervisors will also visit the sample district to facilitate and for quality control of the survey. Moreover, the senior member of the survey team will also visit some of the district to cross check the field survey process conducted by the enumerators and supervisors. During the survey, in order to avoid any low response rate and answers bias, the sample size will be enlarged assuming a response rate of 10%, giving a minimum sample size of

75 (for a specific CPA) applied to the parameter. The survey team will ensure that all 75 questionnaires are filled.

There might be changes of getting outliers while sampling. The following approach will be used to identify and address outliers for the samples during monitoring. If the final sample size in any monitoring period is 30 or above, outliers will be defined as those data points with values greater than three standard deviations from the mean of the sample. When the sample size is below 30 then the concept of outliers can be defined using the concept of 'fences' as defined by the upper and lower quartiles of the sampled data shown in the following formula:

Inner lower fence:  $Q1 - 1.5 (Q3 - Q1)$

Inner upper fence:  $Q3 + 1.5 (Q3 - Q1)$

Where Q3 and Q1 are the upper and lower quartiles of the sampled data respectively. Outliers in this case are defined as those data points in the sample below the inner lower fence or above the inner upper fence.

In either case, data points identified as outliers according to the above analysis will be examined further to correct for possible transcription and data entry errors, but will be omitted from the analysis if no such administrative errors exist.

### **(iii) Analysis:**

After the survey, the data from the survey will be analyzed in order to determine the percentage of digesters operational in a year from among the digesters implemented and to assure that there is displacement or substitution of NRB.

Emission reductions are directly proportional to the number of appliances (biogas digester units in case of the project) that are operating. The calculation of emission reduction will be done by using excel sheet. The values of parameters (percentage of digesters operational in a year, displacement of NRB, quantity of woody biomass substituted, leakage from the digesters, etc will be calculated using excel sheet which will determine the emission reductions from all the digesters included in the project. On this basis a monitoring report can be prepared and emission reduction can be calculated.

### **(c) Implementation:**

The parameters will be monitored and the sampling will be done according to the guideline "Guideline for Sampling and Surveys for CDM Project Activities and Programme of Activities Ver. 4.0".

The survey questionnaire will be prepared by the independent third party in close coordination with AEPC. The questionnaire will be pre-tested and field personnel will be trained by the survey team (independent third party) and AEPC team in conducting the survey to ensure the quality of data collected and the survey will be carried out once a year. The field survey team will consist of experienced and qualified enumerators, supervisors and professionals as members of the survey team.

## **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>
09.0	31 May 2019	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 02.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN);</li> <li>• Make editorial improvements.</li> </ul>
08.1	28 June 2017	Revision to: <ul style="list-style-type: none"> <li>• Remove a duplicated instruction;</li> <li>• Make editorial improvement.</li> </ul>
08.0	7 June 2017	Revision to: <ul style="list-style-type: none"> <li>• Improve consistency with the “CDM project standard for programmes of activities” and with the PDD and CPA-DD forms;</li> <li>• Make editorial improvement.</li> </ul>
07.0	25 May 2017	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN) (version 01.0);</li> <li>• Incorporate the “Programme design document form for small-scale CDM programmes of activities” (CDM-SSC-PoA-DD-FORM);</li> <li>• Make editorial improvement.</li> </ul>
06.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
05.0	9 March 2015	Revision to: <ul style="list-style-type: none"> <li>• Include provisions related to choice of start date of PoA;</li> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to local stakeholder consultation;</li> <li>• Add exception for generic CPA where technology is under positive lists;</li> <li>• Make editorial improvement.</li> </ul>
04.1	5 August 2014	Editorial revision to correct the document information table.

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	25 June 2014	<p>Revision to:</p> <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the project design document form for CDM programme of activities (these instructions supersede the Guideline: Completing the programme design document form for CDM programme of activities (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the PoA in B.4 and Appendix 1;</li> <li>• Add general instructions on post-registration changes in paragraphs 2 and 3 of general instructions and Appendix 6;</li> <li>• Change the reference number from F-CDM-PoA-DD to CDM-PoA-DD-FORM;</li> <li>• Make editorial improvement.</li> </ul>
03.0	3 December 2012	<p>EB 70</p> <p>Revision to reflect changes to the <i>Guideline: Completing the programme design document form for CDM programmes of activities</i> (EB 70, Annex 6).</p>
02.0	13 March 2012	<p>EB 66</p> <p>Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, annex 12).</p>
01.0	27 July 2007	<p>EB 33, Annex 41</p> <p>Initial publication.</p>
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