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# VALIDATION REPORT

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## BIOGAS SUPPORT PROGRAM - NEPAL (BSP-NEPAL) ACTIVITY 1

REPORT No. 2005-1164

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DET NORSKE VERITAS



## VALIDATION REPORT

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## Summary:

Det Norske Veritas Certification Ltd. (DNV) has performed a validation of the “Biogas Support Program - Nepal (BSP-Nepal) Activity 1” in Nepal on the basis of UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures, the simplified modalities and procedures for small-scale CDM project activities and the subsequent decisions by the CDM Executive Board.

The validation consisted of the following three phases: i) a desk review of the project design, baseline and monitoring plan, ii) follow-up interviews with project stakeholders and iii) the resolution of outstanding issues and the issuance of the final validation report and opinion.

In summary, it is the validation team’s opinion that the “Biogas Support Program - Nepal (BSP-Nepal) Activity 1” in Nepal, as described in the project design document of 14 November 2005, meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria and correctly applies the simplified baseline and monitoring methodology AMS-I.C. Hence, DNV requests the registration of the “*Biogas Support Program - Nepal (BSP-Nepal) Activity 1*” as a CDM project activity..

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### ***Abbreviations***

AEPC	Alternative Energy Promotion Center (Nepal)
BSP-Nepal	Biogas Sector Partnership Nepal
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDCF	The Community Development Carbon Fund
CEF	Carbon Emission Factor
CER	Certified Emission Reduction
CH <sub>4</sub>	Methane
CL	Clarification request
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> e	Carbon dioxide equivalent
DNV	Det Norske Veritas
DNA	Designated National Authority
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IBRD	International Bank for Reconstruction and Development
IPCC	Intergovernmental Panel on Climate Change
KfW	German Development Bank
MP	Monitoring Plan
N <sub>2</sub> O	Nitrous oxide
NGO	Non-governmental Organisation
ODA	Official Development Assistance
PDD	Project Design Document
SNV/DGIS	Netherlands Development Agency/ Directorate General for International Cooperation of the Government of the Netherlands
UNFCCC	United Nations Framework Convention on Climate Change



## 1 INTRODUCTION

The Carbon Finance Business Unit of the World Bank has commissioned Det Norske Veritas Certification Ltd. (DNV) to validate the “Biogas Support Program - Nepal (BSP-Nepal) Activity 1” (hereafter called “the project”) in Nepal. This report summarises the findings of the validation of the project, performed on the basis of UNFCCC criteria for small-scale CDM projects, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The validation team consisted of the following personnel:

Ms Mari Grooss Viddal	DNV Oslo	Team Leader, GHG auditor
Mr Chandrashekara Kumaraswamy	DNV Bangalore	GHG auditor
Ms Susanne Haefeli	DNV Oslo	GHG auditor
Mr Michael Lehmann	DNV Oslo	Energy Sector Expert, Technical Reviewer

### 1.1 Validation Objective

The purpose of a validation is to have an independent third party assess the project design. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant UNFCCC and host Party criteria are validated in order to confirm that the project design, as documented, is sound and reasonable and meets the identified criteria. Validation is a requirement for all CDM projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of certified emission reductions (CERs).

### 1.2 Scope

The validation scope is defined as an independent and objective review of the project design document (PDD). The PDD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords, the simplified modalities and procedures for small-scale CDM project activities and the relevant decisions by the CDM Executive Board, including the approved simplified baseline and monitoring methodology AMS-I.C. The validation team has, based on the recommendations in the Validation and Verification Manual /17/ employed a risk-based approach, focusing on the identification of significant risks for project implementation and the generation of CERs.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

### 1.3 Description of Proposed CDM Project

In the “Biogas Support Program - Nepal (BSP-Nepal) Activity 1” a total of 9 708 small biogas digesters have been installed from November 2003 to June 2004 in 57 of 75 districts of Nepal. The overall generation capacity of all plants is approximately 14.73 MW.

The project is a sub-project of the BSP-Nepal umbrella biogas program that aims to install a total of 200 000 small biogas digesters all over Nepal. This project is part of the fourth phase of the Nepalese government's biogas program at the national level. Under the first three phases, a total of 111 395 biogas plants have been installed.



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The biogas digesters, which are installed at households with at least 2 heads of cattle (cow or buffalo), will provide biogas for the thermal energy needs of the households. Farming households living in villages in remote areas are the primary buyers of these biogas digesters. The digesters are fed with a mixture of cow and/or buffalo dung and water and the generated biogas will be utilised for cooking. Biogas used for cooking will displace fuel wood and kerosene and thereby reduce greenhouse gases.

The expected annual emission reductions of the project are 46 990 tCO<sub>2</sub>e emission reductions for all 9 708 biogas digesters.

## **2 METHODOLOGY**

The validation consisted of the following three phases:

- I a desk review of the project design, baseline and monitoring plan
- II follow-up interviews with project stakeholders
- III the resolution of outstanding issues and the issuance of the final validation report and opinion.

In order to ensure transparency, a validation protocol was customised for the project, according to the Validation and Verification Manual /17/. The protocol shows in transparent manner criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of three tables. The different columns in these tables are described in Table 1.

The completed validation protocol for the project is enclosed in Appendix A to this report.

Findings established during the validation can either be seen as a non-fulfilment of validation protocol criteria or where a risk to the fulfilment of project objectives is identified. Corrective Action Requests (CAR) are issued, where:

- i) mistakes have been made with a direct influence on project results;
- ii) validation protocol requirements have not been met; or
- iii) there is a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

The term Clarification may be used where additional information is needed to fully clarify an issue.



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<b>Validation Protocol Table 1: Mandatory Requirements for CDM Project Activities</b>			
<b>Requirement</b>	<b>Reference</b>	<b>Conclusion</b>	<b>Cross reference</b>
<i>The requirements the project must meet.</i>	<i>Gives reference to the legislation or agreement where the requirement is found.</i>	<i>This is either acceptable based on evidence provided (OK), a <b>Corrective Action Request (CAR)</b> of risk or non-compliance with stated requirements or a request for <b>Clarification (CL)</b> where further clarifications are needed.</i>	<i>Used to refer to the relevant checklist questions in Table 2 to show how the specific requirement is validated. This is to ensure a transparent Validation process.</i>

<b>Validation Protocol Table 2: Requirement Checklist</b>				
<b>Checklist Question</b>	<b>Reference</b>	<b>Means of verification (MoV)</b>	<b>Comment</b>	<b>Draft and/or Final Conclusion</b>
<i>The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in seven different sections. Each section is then further sub-divided. The lowest level constitutes a checklist question.</i>	<i>Gives reference to documents where the answer to the checklist question or item is found.</i>	<i>Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I). N/A means not applicable.</i>	<i>The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached.</i>	<i>This is either acceptable based on evidence provided (OK), or a <b>Corrective Action Request (CAR)</b> due to non-compliance with the checklist question (See below). A request for <b>Clarification (CL)</b> is used when the validation team has identified a need for further clarification.</i>

<b>Validation Protocol Table 3: Resolution of Corrective Action Requests and Requests for Clarification</b>			
<b>Draft report corrective action requests and requests for clarifications</b>	<b>Ref. to Table 2</b>	<b>Summary of project participants' response</b>	<b>Final conclusion</b>
<i>If the conclusions from the draft Validation are either a <b>Corrective Action Request</b> or a <b>Clarification Request</b>, these should be listed in this section.</i>	<i>Reference to the checklist question number in Table 2 where the <b>Corrective Action Request</b> or <b>Clarification Request</b> is explained.</i>	<i>The responses given by the project participants during the communications with the validation team should be summarised in this section.</i>	<i>This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in Table 2, under "Final Conclusion".</i>

**Table 1 Validation protocol tables**



## 2.1 Review of Documents

The PDD /1/ of 14 September and the revised PDD of 14 November 2005 submitted by the Carbon Finance Business Unit of the World Bank and additional background documents related to the project design and baseline were assessed /2/ - /16/.

## 2.2 Follow-up Interviews

On 12, 13, 17 and 19 November 2005, DNV performed interviews with project stakeholders to confirm selected information and to resolve issues identified in the document review. Representatives of AEPC, BSP-Nepal (the authorized Biogas company responsible for implementing the project), Winrock International, EcoSecurities, the Institute of Engineering at the Tribhuvan University and the Carbon Finance Business Unit of the World Bank were interviewed /19/ -/24/. The main topics of the interviews are summarised in Table 2.

**Table 2 Interview topics**

Interviewed organisation	Interview topics
Alternative Energy Promotion Center AEPC	<ul style="list-style-type: none"> <li>➤ Common practice in Nepal</li> <li>➤ Incentive systems for these projects/ programs</li> <li>➤ Official development assistance (ODA)</li> <li>➤ DNA approval process</li> <li>➤ Sustainable development priorities</li> <li>➤ Environmental requirements, EIA and legal compliance</li> <li>➤ Requirements for local stakeholder consultation process</li> </ul>
BSP-Nepal	<ul style="list-style-type: none"> <li>➤ BSP-Nepal Quality Control Quality Manual, operation and monitoring</li> <li>➤ Contract and distribution of CERs</li> <li>➤ Training and capacity building</li> <li>➤ Implementation, operation and quality control of the biogas digesters</li> <li>➤ Annual system installation report</li> <li>➤ Sampling of biogas plants and monitoring</li> <li>➤ Additionality and barriers</li> <li>➤ BSP-Nepal Environmental Impact Study</li> <li>➤ BSP-Nepal's database on biogas users</li> <li>➤ BSP-Nepal baseline study</li> <li>➤ Emission reductions calculations</li> <li>➤ Local stakeholder consultation</li> </ul>
Winrock International, Nepal	<ul style="list-style-type: none"> <li>➤ Status and expected trends in the forestry sector in Nepal</li> <li>➤ Regional/ geographical differences in Nepal (consumption and availability of wood)</li> </ul>
EcoSecurities B.V.	<ul style="list-style-type: none"> <li>➤ Methodology of the study on fire wood consumption</li> </ul>



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Carbon Finance Business Unit of the World Bank	<ul style="list-style-type: none"> <li>➤ Information on the whole 4 phases program</li> <li>➤ Baseline calculations</li> <li>➤ Additionality</li> <li>➤ Crediting period</li> </ul>
Center for Energy Studies, Institute of Engineering, Tribhuvan University	<ul style="list-style-type: none"> <li>➤ Water supply needed to run the biogas digesters and water demand</li> </ul>

### 2.3 Resolution of Clarification and Corrective Action Requests

The objective of this phase of the validation was to resolve any outstanding issues which needed to be clarified for DNV's positive conclusion on the project design.

Four Corrective Action Requests and two Requests for Clarification have been identified and were presented to the project participants. Additional information provided by the project participants resolved these requests to DNV's full satisfaction. To guarantee the transparency of the validation process, the concerns raised by DNV and the response provided by the project participants are documented in Table 3 of the Validation Protocol in Appendix A.

## 3 VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of verification and the results from validating the identified criteria are documented in more detail in the validation protocol in Appendix A. The final validation findings relate to the project design as documented and described in the revised PDD of 14 November 2005.

### 3.1 Participation Requirements

The project participants are

- Alternative Energy Promotion Centre, Nepal (AEPC),
- Household Maiya Gautam
- Household Suk Man Tamang, and
- Community Development Carbon Fund (CDCF) of the World Bank with the International Bank for Reconstruction and Development (IBRD) as Trustee.

The host Party Nepal and the Netherlands, which authorises the IBRD to participate in the project, meet the requirements to participate in the CDM. Written approval including the authorization of the project participants from the Nepalese and Dutch DNA has been received /5//6/.

### 3.2 Project Design

During the period from November 2003 to June 2004, a total of 9 708 digesters have been installed in 57 of 75 districts in Nepal. The digesters are installed by local companies contracted

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by BSP-Nepal who are also responsible for the training and after sale services. It has been verified that these companies undergo a yearly check by BSP-Nepal, which currently subcontracts sales, installation, training and after sales services to about 60 companies. The contract templates between BSP-Nepal and the subcontractors, and the sales agreements between the companies and the households have been reviewed by DNV, including samples of both contracts and sales agreements. In case companies do not deliver according to contract requirements, BSP-Nepal provides training and support and is responsible for assigning households to other companies as needed.

The digesters applied in this project are deemed to represent good current practice. The digesters are produced locally with the exception of the main valve, which is imported from other countries.

The first biogas digester has been installed in November 2003, which is defined as the starting date of the project activity. A crediting period of 7 years, with the option to be renewed twice, has been chosen, starting on 1 August 2004. Evidence has been provided for the starting date as well as evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity.

The competent agencies of the German and Dutch Government provided affirmation that the public funding provided by KfW and the DGIS, respectively, for this project is not a diversion of Official Development Assistance towards Nepal /15//16/.

The project contributes to Nepal's sustainable development in that it creates local employment and reduces the country's forest depletion. Further, the households suffer less from smoky kitchens. Also, the end product of the biogas digester, which is fed by cattle dung, can be used as fertilizer, instead of buying chemical fertilizer. The DNA of Nepal confirms the project's contribution to the sustainable development of Nepal /5/.

It has been clarified that no construction, operation or environmental permit is needed and that all plants belonging to the project have a signed contract in place.

### 3.3 Project Baseline

Being a renewable energy project with a generation capacity of less than 15 MW the project qualifies as small-scale CDM project activity. The project applies the simplified baseline and monitoring methodology AMS-I.C for *Renewable energy: Thermal energy for the user* project activities (Type I.C) which is deemed appropriate for the proposed project activity.

#### *Calculation of the generation capacity limit*

Based on the manufacturer's data of hourly flow of 425 litre per stove delivered along with the digester, an efficiency of 49% and given a value of 20 MJ/m<sup>3</sup> for the biogas, the thermal power generation capacity of a stove has been calculated to be 1.16 kW. Based on the sampled data on hourly use of these stoves, depending on geographical area and family size, the power output equivalent has been calculated for the different plant sizes (ref. Table 3). A 4 m<sup>3</sup> stove is the reference value because the households with a 4 m<sup>3</sup> capacity biogas digester installed have only one stove installed. Households with larger size biogas plants of 6, 8, and 10 m<sup>3</sup> have a second stove available, but do not often use both stoves at the same time.



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**Table 3 Calculation of average plant generation capacities according to the size of the installed biogas digester and stove based on manufacturer's data and sampled data on hourly use of the stove.**

Plant Size (in m <sup>3</sup> )	Daily Stove Hours (weighted)	Standardized proportionate increase	Power output equivalent in kW
4	1.93	1.00	1.16
6	2.51	1.30	1.51
8	3.31	1.70	1.97
10	3.80	2.00	2.32

The total generation capacity of the selected 9 708 plants has been calculated based on the above capacities and the percentage distribution of the plant sizes in the project (ref. Table 4). The calculated total generation capacity is 14.73 MW. Being a renewable energy project activity with a total capacity of less than 15 MW, the project is thus eligible as small-scale CDM project activity and for applying AMS-I.C.

**Table 4 Percentage distribution of all households in the project with regard to the geographical location and the size of the biogas digester installed.**

Plant Size (in m <sup>3</sup> )	% of Households in Terai	% of Households in Hills
4	2	13
6	39	33
8	10	1
10	1	0

#### *Calculation of baseline emissions*

In accordance with AMS-I.C, the baseline is the fuel consumption and the consumption of non-renewable sources of biomass\* of the technologies that would have been used in the absence of the project activity times an emission coefficient for the fossil fuel and the non-renewable sources of biomass displaced. The project displaces kerosene and non-renewable fuel wood.

It is assumed that all reduced fuel wood consumption is non-renewable. In the absence of any guidance by the CDM Executive Board on how to define non-renewable sources of biomass, this is demonstrated based on a study (annexed to the PDD) that shows that the fuel wood consumption is much higher than the re-growth rate of the forest area in Nepal. The study's sources have been verified and it has been clarified that none of the households included in the project design have access to abundant renewable fuel. In DNV's opinion, the proposed approach for demonstrating that the project will reduce the consumption of non-renewable fuel wood is deemed appropriate and is sufficiently justified.

\* At its 21<sup>st</sup> meeting, the Board agreed to delete the references to "non-renewable biomass" in the simplified baseline and monitoring methodologies. However, the Board agreed that this deletion shall become effective only after the 22<sup>nd</sup> meeting of the Board and thus only after the submission of this project for registration.




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The amount of kerosene and non-renewable fuel wood displaced by the project is estimated based on the results of a survey. For this survey a total of over 576 households have been chosen:

- based on their location in the Terai (100 – 500 meters above sea level.) and Hills (500 – 3 000 meters above sea level),
- based on the size of the households, as well as
- based on their biogas digester size, i.e. 4, 6, 8 or 10 m<sup>3</sup> capacity.

The fuel consumption before and after installation of the digester has been calculated based on interviewing households, and a distinction has been made between the fuel wood and kerosene consumption in summer and winter. The observed consumption variations stem mainly from the variation of size of the households, i.e. the number of members that live in the households.

Based on the reduction in the fuel wood and kerosene consumption determined in the survey (simple mean of observed fuel wood and kerosene consumption reduction), emission reduction factors per household have been determined (see Table 5). These factors depend on the size of the digester and its location and were calculated using the following values, which were correctly calculated based on IPCC default values:

- CO<sub>2</sub> emissions from fuel wood combustion: 1.83 t CO<sub>2</sub>/tonne<sub>fuel wood</sub>
- CH<sub>4</sub> emissions from fuel wood combustion: 0.083 t CO<sub>2equivalent</sub>/tonne<sub>fuel wood</sub>
- CO<sub>2</sub> emissions from kerosene combustion: 2.41 kg CO<sub>2</sub>/litre kerosene (assuming a standard density of 0.71 kgCH<sub>4</sub> /m<sup>3</sup>CH<sub>4</sub>, as given in ACM0001)

**Table 5 Emission reduction factors per household**

Size biogas digester	Terai (tCO <sub>2</sub> eq/digester/year)	Hills (tCO <sub>2</sub> eq/digester/year)	Mountain (tCO <sub>2</sub> eq/digester/year)
4 m <sup>3</sup>	2.94	5.43	5.43
6 m <sup>3</sup>	6.83	7.60	7.60
8 m <sup>3</sup>	8.45	9.42	9.42
10 m <sup>3</sup>	6.61	7.03	7.03

Note: The values are the same for hills and mountains, both for conservativeness reasons and because few biogas digesters are installed in the mountains. The reason for smaller values for 10 m<sup>3</sup> digesters is that these digesters have been installed by families that are often of smaller size than those who installed a 8 m<sup>3</sup> biogas digester, in order to meet forecast increased energy demand due to family size enlargement. Also, as can be seen from Table 4, only very few households have installed a 10 m<sup>3</sup> biogas digester and therefore, the dispersion of consumption reduction is bigger.

### 3.4 Additionality

The additionality of the project has been demonstrated through the existence of technology barriers and investment barriers at the level of the national program and at the level of the households.

DNV was able to confirm that since the start of the first phase of the program, any biogas digesters that have been installed in Nepal have been installed under the national biogas

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program. Before this initiative, the installation of about 11 000 plants of different models took place for research purpose under a pilot project and was supported by government funding.

Despite the program being in its fourth phase, investing in biogas plant remains a non-commercial activity in Nepal. KFW and DGIS have decided to gradually phase out their support to the biogas program by 2009. The interviews with the World Bank clarified that at the end of phase 3 it became obvious that only part of the goal to implement 200 000 biogas digesters could be achieved with the available funding and that additional funding provided by the CDM must be used to complement the seed funding for each household in phase 4 of the program. It was not an option to simply allocate the available funding to a reduced number of digesters.

Documentary evidence that CDM incentives have been considered already in February 2002 and September 2003 and thus prior to the implementation of the first digesters, has been provided /13/ and /14/.

DNV was able to confirm that on the household level the funding provided by the various government programmes was not sufficient to incite households to buy digesters. A Net Present Value (NPV) analysis has been presented which shows a negative NPV for the implementation of digesters in the absence of CDM benefits. Conservative assumptions have been applied in the presented NPV analysis with regards to installation and O&M costs as well as with regards to the discount rate, which is fixed at 15%. Even with a lower discount rate and by increasing the potential savings from not having to buy kerosene and fire wood, the NPV remains negative. Moreover, the implementation of digesters faces an investment barrier. The high installation costs of the digester system - compared to the costs of installing alternative stoves for cooking which use fuel wood or kerosene - prevents private households to invest in a digester.

### 3.5 Monitoring Plan

According to AMS-I.C, the monitoring of emission reductions may be based on annual surveys without metering actual energy generation of the digesters if the emissions reduction per system is less than 5 tCO<sub>2</sub>e. The emission reduction factors per household (see Table 5) that are larger than 5 tCO<sub>2</sub>e are thus capped at 4.99 tCO<sub>2</sub>e in order to meet the 5 tCO<sub>2</sub>e limit. This is deemed acceptable due to the following:

- Metering actual energy generation of all or even a sample of all digesters would entail unreasonable high monitoring costs
- Capping the emission reduction factor at 4.99 tCO<sub>2</sub>e is conservative and is likely to compensate for the potentially higher uncertainty which results from monitoring emission reductions based on annual surveys instead of metering the energy generation of a sample of digesters.

Since the emission reductions per digester are capped at 4.99 tCO<sub>2</sub>e, the project can apply option 8.c) of AMS-I.C for monitoring emission reductions, which requires:

- (1) *Recording annually the number of systems operating (evidence of continuing operation, such as on-going rental/lease payments could be a substitute), and*
- (2) *Estimating the annual hours of operation of an average system, if necessary using survey methods. Annual hours of operation can be estimated from total output (e.g. tonnes of grain dried) and output per hour if an accurate value of output per hour is available.*



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The monitoring plan includes surveys on the number of operating digesters as well as the fuel wood and kerosene consumption before and after the installation of digesters. Emission reductions are directly determined based on the observed reductions in fuel wood and kerosene consumption. This approach is deemed equally accurate as estimating the energy output of the digesters based on estimating the annual hours of operation of an average system. However, in order to comply with AMS-I.C. and to cross-check the results, the annual hours of operation will also be surveyed.

More specifically, the following parameters will be monitored:

- Registration of sales (all digesters) and verification of installation
- Performance monitoring based on statistically significant samples of all installed digesters in order to estimate the number of non-operating digesters and operation hours of working plants;
- consumption of kerosene used for cooking for households with and without installed biodigesters;
- consumption of fuel wood used for cooking for households with and without installed biodigesters;
- accessibility to sustainable biomass.

All data will be registered centrally by BSP-Nepal and kept until 2 years after the end of the last crediting period.

It has been clarified that annually, 50% of the districts where households are installed will be selected and a statistically significant sample size will be defined, based on the geographical area i.e. Terai or Hills and the size of the biogas digester, so as to represent the total population (i.e. according to the percentage distribution shown in Table 4).

Further, every year, 5% of newly installed plants, 5% of plants installed during the previous year and 5% of plants installed two years ago will be surveyed. In order to be statistically significant, the sample size will have to be adjusted *ex-post* based on the observed standard deviations of observed fuel wood and kerosene consumptions.

An equal amount of similar households without biogas digesters will be interviewed to annually validate the *ex-ante* determined fuel wood and kerosene consumption of households without digesters.

Based on the results of the surveys the emission reduction factors given in Table 5 will be adjusted every year to reflect the changes in fuel wood and kerosene consumption reductions.

Parts of these surveys will be carried out by an independent entity, under the auspices of BSP-Nepal. Also, a total of 100 plants per year, included in this project, will be selected from 3-4 districts and visited by BSP-Nepal for cross checking purpose.

All surveys include questions with regards to the fuel wood and kerosene consumption. Similarly, a set of questions will be dedicated to the assessment of whether 100% of the fuel wood consumption continues to be unsustainable. If not, adjustments will be made to the default values.



Procedures for monitoring and quality assurance are in place for BSP-Nepal. BSP-Nepal has been certified to ISO 9001. Training and information is provided to the households through the eligible sales and installation companies.

### 3.6 Calculation of GHG Emissions

Actual emission reductions will be calculated based on the registered number of installed digesters of different size and located in different areas and the emission reduction factors per household given in Table 5, which will be adjusted annually to reflect observed changes in fuel wood and kerosene consumption reductions,

Emission reductions have been estimated *ex-ante* given the percentage distribution of digesters as shown in Table 4 and the emission reduction factors per household given in Table 5. An operating percentage of 97%, determined based on past surveys, has been applied for the *ex-ante* estimation of emission reductions.

Leakage of CH<sub>4</sub> emissions from the biogas digesters including incomplete combustion of all biogas in the stoves are aggregated at 12.5 % of total methane generation of the digester, and the emission reduction factors given in Table 5 are discounted for CH<sub>4</sub> leakage in the project scenario. This is in line with IPCC default values and project-specific experiments.

### 3.7 Environmental Impacts

An Integrated Environmental Impact Assessment (EIA) has been carried out for the program by BSP-Nepal although no such assessment is required by Nepalese law /8/. The EIA concluded that the program has mainly positive benefits related to the reduction of smoke and tapeworm infection and the reduced consumption of non-renewable fuel wood and chemical fertilizer. The following negative environmental impacts have been identified and assessed:

- increased use of water to mix the dung in order to guarantee an optimal functioning of the biogas digester: it has been shown that there is no water shortage in the Terai area and only possible impacts of the project in the Hills is that water needs to be saved over a longer period. It has been confirmed, that water scarcity is not a major problem and that the BSP-Nepal has taken sufficient precautionary measures. Also, the independent entity auditing the households will monitor whether water scarcity becomes an issue.
- increased mosquito breeding has been reported by the households with a biodigester, which might be partly due to the biogas digester and the reduced smoke in the kitchen. The exact link between mosquito breeding and biogas digester has not yet been confirmed and in the meanwhile, corrective measures have been taken. The households reporting an increase in mosquito breeding have been provided with a so-called mosquito trapper, a device specifically developed for this purpose.

In summary, it has been demonstrated that the project has no severe negative environmental impacts and that possible negative impacts are sufficiently mitigated.

### 3.8 Comments by Local Stakeholders

The households included in the project were informed about the project by letter from BSP-Nepal and contracts have been signed with each individual household. The entire program has received much attention in the media i.e. announcements have been made on TV and radio. Two



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meetings were held in May 2005, where potential households, local authorities and NGOs were invited. This type of meeting has also been performed during earlier phases and for most of the households belonging to this project. No negative comment has been received /4/.

#### **4 COMMENTS BY PARTIES, STAKEHOLDERS AND NGOS**

The PDD of 14 September 2005 was made publicly available on DNV's climate change website ([www.dnv.com/certification/climatechange](http://www.dnv.com/certification/climatechange)) and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 20 September to 19 October 2005.

No comments were received.



## 5 VALIDATION OPINION

*Det Norske Veritas Certification Ltd. (DNV) has performed a validation of the “Biogas Support Program - Nepal (BSP-Nepal) Activity 1” in Nepal. The validation was performed on the basis of UNFCCC criteria and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to the Kyoto Protocol criteria for the CDM, the CDM rules and modalities as agreed in the Marrakech Accords, the simplified modalities and procedures for small-scale CDM project activities and relevant decisions by the CDM Executive Board.*

*The host Party is Nepal and the participating Annex I Party is the Netherlands. Both Parties fulfil the participation criteria and the Dutch and Nepalese DNAs have approved the project and authorized the project participants. The DNA of Nepal also confirmed the project’s contribution to sustainable development.*

*The project comprises the installation of biogas digesters in 9 708 households in 57 out of 75 districts of Nepal. The generated biogas is used for cooking, displacing kerosene and non-renewable fuel wood. Being a renewable energy project activity with a total capacity of less than 15 MW which provides thermal energy for the user, the project is eligible as small-scale CDM project activity and can apply the simplified baseline and monitoring methodology AMS-I.C.*

*The baseline methodology AMS-I.C has been correctly applied and it has been demonstrated that the project faces technology and investment barriers. In accordance with AMS-I.C, the baseline scenario is the continued fuel wood and kerosene use for cooking. Appropriate emission reduction factors for digesters of different size and located in different areas have been determined based on the result of extensive surveys on the fuel wood and kerosene consumption of households prior and after the installation of digesters.*

*It is assumed that all reduced fuel wood consumption is non-renewable. In the absence of any guidance by the CDM Executive Board on how to define non-renewable sources of biomass, this is demonstrated based on a study (annexed to the PDD) that shows that the fuel wood consumption is much higher than the re-growth rate of the forest area in Nepal.*

*The monitoring plan provides for the monitoring of the main emission reduction indicators. Detailed responsibilities and authorities for project management, procedures for monitoring and reporting, and QA/QC procedures are described and allow for consistent subsequent verifications of real and measurable GHG emission reductions that give long-term benefits to the mitigation of climate change.*

*An analysis of the project’s environmental impacts has been conducted and the project is not likely to create major adverse environmental impacts. Local stakeholder comments have been adequately consulted.*

*In summary, it is DNV’s opinion that the “Biogas Support Program - Nepal (BSP-Nepal) Activity 1” in Nepal, as described in the project design document of 14 November 2005, meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria and correctly applies AMS-I.C. Hence, DNV requests the registration of the “Biogas Support Program - Nepal (BSP-Nepal) Activity 1” as a CDM project activity.*



## REFERENCES

*Documents provided by the project proponent that relate directly to the project:*

- /1/ World Bank, EcoSecurites and Winrock International: *Project Design Document of the Biogas Support Program - Nepal (BSP-Nepal) Activity 1*, Version 1 of September and version 2 of November 2005.
- /2/ World Bank: *Contact details of all households*, 13 November 2005.
- /3/ World Bank: *Plant level financial assessment*, November 2005.
- /4/ World Bank: *Social Consultations Related to Phase IV of the Nepal Biogas Support Program*, May 2005.
- /5/ DNA of Nepal: Approval letter, 20 November 2005.
- /6/ DNA of Netherlands: Approval Letter, 10 November 2005.
- /7/ BSP-Nepal: *Sales Contract – Household Agreement*, 2005.
- /8/ BSP-Nepal: *Integrated Environmental Impact Assessment*, 20 June 2002.
- /9/ BSP-Nepal: *Baseline calculations*, November 2005.
- /10/ BSP-Nepal: *CDM-data-firewood analysis-rev1*, November 2005.
- /11/ BSP-Nepal: *Stove Hours statistical analysis*, November 2005.
- /12/ BSP-Nepal: *Size of biogas digesters*, November 2005.
- /13/ BSP-Nepal: *Standard Contribution Agreement*, February 2002.
- /14/ BSP-Nepal: *Biogas Programme Phase IV (July 2003- June 2009) – implementation plan*, September 2003.
- /15/ German Ministry for Economic Development and Cooperation: *Declaration of ODA*, 3 November 2005.
- /16/ Dutch Department for Environment and Water Affairs: *Declaration of ODA*, 10 November 2005.

*Background documents related to the design and/or methodologies employed in the design or other reference documents:*

- /17/ International Emission Trading Association (IETA) & the World Bank's Prototype Carbon Fund (PCF): *Validation and Verification Manual*. <http://www.vvmanual.info>
- /18/ Appendix B of the simplified modalities and procedures for small-scale CDM project activities: *Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories*. Version 06: 30 September 2005.

*Persons interviewed during the validation, or persons who contributed with other information that are not included in the documents listed above:*

- /19/ AEPC, Dr. Madan Kumar Basnyat, Executive Director.



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- /20/ BSP-Nepal, Mr Sundar Bajgain, Programme Manager.
- /21/ Winrock International, Nepal, Bikash Pandey, Director South Asia, Clean Energy Program, Country Representative.
- /22/ World Bank, Mrs Sushila Maharjan, Consultant.
- /23/ EcoSecurities B.V., Jan-Willem Marten, Project Manager
- /24/ Institute of Engineering, Tribhuvan University, Jagan Nath Shrestha, Professor and Director, Center for Energy Studies.

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## **APPENDIX A**

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### **VALIDATION PROTOCOL FOR SMALL-SCALE CDM PROJECT ACTIVITIES**

**Table 1 Mandatory Requirements for Small Scale Clean Development Mechanism (CDM) Project Activities**

REQUIREMENT	REFERENCE	CONCLUSION	Cross Reference/ Comment
1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3	Kyoto Protocol Art. 12.2	OK	Table 2, Section E.4.1
2. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof	Kyoto Protocol Art. 12.2, Simplified Modalities and Procedures for Small Scale CDM Project Activities §23a	OK	Table 2, Section A.3
3. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC	Kyoto Protocol Art. 12.2.	OK	Table 2, Section E.4.1
4. The project shall have the written approval of voluntary participation from the designated national authority of each party involved	Kyoto Protocol Art. 12.5a, Simplified Modalities and Procedures for Small Scale CDM Project Activities §23a	GAR-4 OK	The LoA of Nepal and Netherlands have been received.
5. The emission reductions should be real, measurable and give long-term benefits related to the mitigation of climate change	Kyoto Protocol Art. 12.5b	OK	Table 2, Section E.1 to E.4
6. Reduction in GHG emissions must be additional to any that would occur in absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity	Kyoto Protocol Art. 12.5.c, Simplified Modalities and Procedures for Small Scale CDM Project Activities §26	OK	Table 2, Section B.2.1
7. Potential public funding for the project from Parties in Annex I shall not be a diversion of official development assistance	Decision 17/CP.7	OK	
8. Parties participating in the CDM shall designate a	CDM Modalities and	OK	The DNA of Nepal is the Ministry of

REQUIREMENT	REFERENCE	CONCLUSION	Cross Reference/ Comment
national authority for the CDM	Procedures § 29		Population and Environment. The DNA of the Netherlands is the Ministry of Housing, Spatial Planning and the Environment.
9. The host Party and the participating Annex I Party shall be a Party to the Kyoto Protocol	CDM Modalities and Procedures § 30, 31b	OK	Nepal ratified the Protocol 16 September 2005. The Netherlands ratified the Protocol 31 May 2002
10. The participating Annex I Party's assigned amount shall have been calculated and recorded	CDM Modalities and Procedures §31b	OK	The Dutch assigned amount is 92% of the emissions in 1990.
11. The participating Annex I Party shall have in place a national system for estimating GHG emissions and a national registry in accordance with Kyoto Protocol Article 5 and 7	CDM Modalities and Procedures §31b	OK	The validation has not in detail assessed Netherland's compliance with article 5 and 7 of the Kyoto Protocol. However, the Netherlands has in place a national registry and reports annually its GHG inventory to the UNFCCC.
12. The proposed project activity shall meet the eligibility criteria for small scale CDM project activities set out in § 6 (c) of the Marrakesh Accords and shall not be a debundled component of a larger project activity	Simplified Modalities and Procedures for Small Scale CDM Project Activities §12a,c	OK	Table 2, Section A.1
13. The project design document shall conform with the Small Scale CDM Project Design Document format	Simplified Modalities and Procedures for Small Scale CDM Project Activities, Appendix A	OK	
14. The proposed project activity shall confirm to one of the project categories defined for small scale CDM project activities and uses the simplified baseline and monitoring methodology for that project category	Simplified Modalities and Procedures for Small Scale CDM Project Activities §22e	OK	Table 2, Section A.1.3, B and D, AMS I.C.
15. Comments by local stakeholders are invited, and a summary of these provided	Simplified Modalities and Procedures for Small Scale CDM Project Activities §22b	OK	Table 2, Section G

REQUIREMENT	REFERENCE	CONCLUSION	Cross Reference/ Comment
16. If required by the host country, an analysis of the environmental impacts of the project activity is carried out and documented	Simplified Modalities and Procedures for Small Scale CDM Project Activities §22c	OK	Table 2, Section F
17. Parties, stakeholders and UNFCCC accredited NGOs have been invited to comment on the validation requirements and comments have been made publicly available	Simplified Modalities and Procedures for Small Scale CDM Project Activities §23b,c,d	OK	The PDD has been published on <a href="http://www.dnv.com/certification/ClimateChange">www.dnv.com/certification/ClimateChange</a> , and Parties, stakeholders and NGOs have through the UNFCCC CDM website been invited to provide comments on the validation requirement during a period of 30 days, from 20 September until 19 October 2005. No comments were received.

Table 2 Requirements Checklist

CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
<b>A. Project Description</b> The project design is assessed.					
<b>A.1. Small scale project activity</b> It is assess whether the project qualifies as small scale CDM project activity.					
A.1.1. Does the project qualify as a small scale CDM project activity as defined in paragraph 6 (c) of decision 17/CP.7 on the modalities and procedures for the CDM?	PDD A	DR	The project consists of 9 708 small biogas digesters, which will be owned and operated by individual households in various locations in Nepal. Each plant will have a generation capacity of between 1.16 and 2.32 kW and the overall capacity of all digesters is approximately 14.73 MW.		OK
A.1.2. The small scale project activity is not a debundled component of a larger project activity?	PDD A	DR	The project is not a debundled component of the <i>Biogas Support Program - Nepal (BSP-Nepal) Activity-2</i> since different participants are involved. This is in line with the rules for debundling as of Appendix C of the simplified modalities & procedures for small-scale project activities.		OK
A.1.3. Does proposed project activity confirm to one of the project categories defined for small scale CDM project activities?	PDD B	DR	Yes, the project falls under Type-I - Renewable Energy Projects and category AMS-I.C-Thermal Energy for the User.		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
<b>A.2. Project Design</b> Validation of project design focuses on the choice of technology and the design documentation of the project.					
A.2.1. Are the project's spatial (geographical) boundaries clearly defined?	PDD A	DR	Yes, the project is planned in various locations in the Kingdom of Nepal and a majority of the plants are being located in the Hills and Terai. All 9 708 plants are clearly identified.		OK
A.2.2. Are the project's system (components and facilities used to mitigate GHG's) boundaries clearly defined?	PDD B	DR	The project boundary is defined by the individual sites where the biogas plants are installed. The project boundary refers to the operation of the biogas digester at the household level in rural Nepal. The CO <sub>2</sub> emission reductions from lighting, the CH <sub>4</sub> and N <sub>2</sub> O emission reductions from storing and burning of cow dung, and N <sub>2</sub> O emissions from chemical fertilizers in the baseline are not applicable for AMS I.C and therefore need to be excluded from the emission reduction calculations in the final PDD.	CAR-2	OK
A.2.3. Does the project design engineering reflect current good practices?	PDD A	DR	Yes, the biogas digester plants to be used under this project activity will be manufactured based on a uniform design and installed following BSP-Nepal's technical standards. This is the fourth umbrella biogas program. Under the first three phases, a total of 111 395 biogas plants have already been installed in Nepal.		OK
A.2.4. Will the project result in technology transfer to the host country?	PDD A	DR	The valves of the biogas digester have been imported from other countries. The rest is produced locally.		OK
A.2.5. Does the project require extensive initial	PDD	DR	Since the technology transfer related to biomass		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
training and maintenance efforts in order to work as presumed during the project period? Does the project make provisions for meeting training and maintenance needs?	A	I	<p>digesters has taken place over the last ten years through a long-term technical assistance program of the SNV, a large domestic knowledge base on construction, operation and maintenance of high quality biogas plants has been developed.</p> <p>Initial training of each new farm that installs the biogas plant is required. This is performed by an eligible sales company and verified by BSP-Nepal.</p>		
<b>A.3. Contribution to Sustainable Development</b> The project's contribution to sustainable development is assessed					
A.3.1. Will the project create other environmental or social benefits than GHG emission reductions?	PDD A	DR	The project promotes sustainable development by installing biogas plants to bring sustainable fuel for cooking to poorer households living in rural and remote areas of Nepal. Expected benefits are less smoke pollution in the houses, reduced risk for fire, workload reduction and reduction in fire wood consumption.		OK
A.3.2. Will the project create any adverse environmental or social effects?	PDD F	DR, I	<p>More water consumption, more mosquitoes and possible gas leaks have been identified as possible adverse effects. An environmental mitigation plan has been developed to minimise these impacts.</p> <p>Implementation of the environmental mitigation plan has been further checked during the interviews and is deemed appropriate.</p>		OK
A.3.3. Is the project in line with sustainable development policies of the host country?	PDD A	DR I	The proposed project promotes sustainable development through the use of renewable energy technology and replacing older unhealthy ways of cooking and lighting. Confirmation by the DNA of Nepal that the project is in line with the sustainable	CAR-1	OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
			development priorities of the country has however not yet been received.		
A.3.4. Is the project in line with relevant legislation and plans in the host country?	PDD A	DR I	Yes.		OK
<b>B. Project Baseline</b> The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.					
<b>B.1. Baseline Methodology</b> It is assessed whether the project applies an appropriate baseline methodology.					
B.1.1. Is the selected baseline methodology in line with the baseline methodologies provided for the relevant project category?	PDD B	DR	Yes. The project applies one of the simplified baseline methodologies proposed for the small-scale project activity category I.C, i.e. the baseline is the fuel consumption and biomass consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient for the fossil fuel and the non-renewable biomass displaced. Baseline fuel consumption consists of non-renewable fuel wood and kerosene.		OK
B.1.2. Is the baseline methodology applicable to the project being considered?	PDD B	DR I	Yes, the methodology is for Type I, Category C – “Thermal energy for the user” and therefore applicable to the project.		OK

CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
<p><b>B.2. Baseline Determination</b></p> <p>It is assessed whether the project activity itself is not a likely baseline scenario and whether the selected baseline represents a likely baseline scenario.</p>					
<p>B.2.1. Is it demonstrated that the project activity itself is not a likely baseline scenario due to the existence of one or more of the following barriers: investment barriers, technology barriers, barriers due to prevailing practice or other barriers?</p>	<p>PDD B</p>	<p>DR I</p>	<p>The project's additionality has been demonstrated through the existence of investment barriers at national and household level. Investment barriers occur due to up-front investment costs which would inhibit a poor farmer from adopting the technology.</p> <p>In addition, technological barriers exist due to poor quality of biogas systems in the absence of proper quality control program.</p> <p>Three phases of the national biogas program have previously been implemented in similar locations. While 111 395 plants have already been constructed by the end of the third phase, CDM revenues are being claimed only for the implementation of the fourth phase. Although there is additional cash flow available as public funding from the German, Dutch and Nepal governments, this funding is not adequate to meet the implementation target of the fourth phase.</p> <p>During the interviews it has been clarified that at the end of phase 3 it became obvious that only part of the goal of installing 200 000 digesters in Nepal could be achieved with the available funding and that the CDM incentives should be used to complement the seed funding for each household. It was not an option to simply allocate the available</p>		<p>OK</p>

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
			<p>funding to a reduced number of digesters.</p> <p>The Implementation target of the entire 4<sup>th</sup>-phase is to achieve an installation of 200 000 biodigesters. This threshold is needed in order to make the deployment of the technology financially viable so that the biogas sector becomes self-sufficient. The funding of both the KfW and the SNV/DGIS will phase out in 2009. A NPV analysis for an individual household showed that the investment is not financially viable at the household level. Documentary evidence that the CDM has been considered already in February 2002 has been provided.</p>		
B.2.2. Is the application of the baseline methodology and the discussion and determination of the chosen baseline transparent and conservative?	PDD B	DR	<p>Yes, the methodology has been chosen and applied in a transparent and conservative manner. The PDD has to be adjusted so as to take into account only the emission reductions from displacing fossil fuel and non-renewable fire wood, leaving out emission reductions from improved animal manure management.</p> <p>The generation capacity threshold of 15 MW has been calculated based on the maximum thermal heat efficiency, i.e. 49%, and the maximum biogas flow specified by the stove manufacturer.</p> <p>The reductions in fuel wood and kerosene consumption have been compared to similar projects and are deemed reasonable. The kerosene emission factor has to be reduced from 2.54 kgCO<sub>2</sub>/litre to 2.41 kgCO<sub>2</sub>/litre, so as to be in line with IPCC data. The average emission reduction per household, weighted by the</p>	GAR-2 GAR-3	OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
			geographical location and the size of the biogas digester, is 7 tCO <sub>2e</sub> and this value has been capped at 4.99 tCO <sub>2e</sub> per household, which is conservative and in line with AMS-I.C..		
B.2.3. Are relevant national and/or sectoral policies and circumstances taken into account?	PDD B	DR I	National policies favour the development of renewable energy sources, especially biomass based energy generation.		OK
B.2.4. Is the baseline selection compatible with the available data?	PDD B	DR I	<p>Yes. The consumption of kerosene and non-renewable fuel wood in the baseline is calculated based on sampling. The simple average of all 576 observed samples has been taken without consideration of the standard deviation. Given that;</p> <ul style="list-style-type: none"> <li>- the confidence intervals of the average fuel wood and kerosene consumption before and after the implementation of the digesters equal each other out (i.e. the probability that the fire wood and kerosene consumption before the installation of a biogas digester was lower than the simple mean (which would make the choice of the simple mean un-conservative), is only slightly bigger than the probability that the consumption after the installation of a biogas digester was lower than the simple mean (which would make the choice of the simple mean conservative)), and</li> <li>- given the small amount of emission reductions, as well as the overall cap of 4.99 tCO<sub>2e</sub> per household,</li> </ul> <p>This approach is deemed justified.</p>		OK
B.2.5. Does the selected baseline represent the most likely scenario describing what would	PDD B	DR	Yes, it is likely that in the absence of the proposed activity, the households to be enrolled in the project		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
have occurred in absence of the project activity?			would continue to use conventional fuels for their cooking energy needs.		
<b>C. Duration of the Project / Crediting Period</b> It is assessed whether the temporary boundaries of the project are clearly defined.					
C.1.1. Are the project's starting date and operational lifetime clearly defined?	PDD C	DR I	Yes, the project's starting date has been changed to November 2003 and the operational lifetime of each biogas digester is expected to be at least 21 years.		OK
C.1.2. Is the assumed crediting time clearly defined (renewable crediting period of seven years with two possible renewals or fixed crediting period of 10 years with no renewal)?	PDD C	DR	Yes, a renewable crediting period of 7 years has been chosen with the starting date of the first crediting period as being changed to 2004/08/01.		OK
<b>D. Monitoring Plan</b> The monitoring plan review aims to establish whether all relevant project aspects deemed necessary to monitor and report reliable emission reductions are properly addressed.					
<b>D.1. Monitoring Methodology</b> It is assessed whether the project applies an appropriate monitoring methodology.					
D.1.1. Is the selected monitoring methodology in line with the monitoring methodologies provided for the relevant project category?	PDD D	DR	Yes, the methodology adopted for this project is in accordance with AMS-I.C., option 8.c), since emission reductions per system are capped at 4.99 tCO <sub>2e</sub> /year.		OK
D.1.2. Is the monitoring methodology applicable to the project being considered?	PDD D	DR	Yes. The number of systems operating is recorded annually through the BSP-Nepal database on		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
			<p>biogas users.</p> <p>Based on the number of systems operating, the performance ratio is determined and then multiplied by the corresponding CO<sub>2e</sub> emission reduction factor. The calculations are weighted according to geographical location and size of digester.</p> <p>The BSP-Nepal database on biogas users and the survey method have been verified during follow-up interviews.</p>		
D.1.3. Is the application of the monitoring methodology transparent?	PDD D	DR	<p>Yes, the application of the monitoring methodology is simple and transparent. Monitoring is performed through the following elements:</p> <p>1) sales registration and sales monitoring summarised in an annual system installation report per biogas company (15% of all systems sold will be verified by BSP-Nepal within 3 years)</p> <p>2) monitoring of the performance of the biogas digesters. Forecast performance is 97%, calculated based on previous verification of over 26 000 plants out of over 100 000 plants installed. The actual performance percentage will be measured based on sampling and interviewing of Households. The performance ratio is calculated based on the number of biogas plants out of order.</p>		OK
D.1.4. Will the monitoring methodology give opportunity for real measurements of achieved emission reductions?	PDD E	DR	<p>Yes, the following indicators are monitored in accordance with AMS I.C:</p> <p>1) sales registration – continuously</p> <p>2) sales monitoring – annually (5% of each year's total installation, during the first 3 years of installation). This includes monitoring of kerosene</p>		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
			and fuel wood usage.  3) performance ratio – annually a statistically significant number of households with and without an installed biogas digester will be selected based on the geographical location and the size of the biogas digester. A survey will be performed directed to monitor whether or not the biodigester is operational and whether the consumed fuel wood continues to be non-sustainable.		
<b>D.2. Monitoring of Project Emissions</b>  It is established whether the monitoring plan provides for reliable and complete project emission data over time.					
D.2.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the greenhouse gas emissions within the project boundary during the crediting period?	PDD E	DR, I	Project emissions stem from fugitive emissions due to leaks at the biodigester plant and from incomplete CH <sub>4</sub> combustion in the stoves. The latter has not been included in the calculations.	<del>CAR-4</del>	OK
D.2.2. Are the choices of project emission indicators reasonable?	PDD E	DR, I	Yes. The leakage of the biogas digesters has been assumed to be 12.5% of total methane generation, including incomplete combustion from the stoves. This is in line with IPCC values that suggest between 5 and 15%. The 12.5 % is deemed conservative given the samples taken at some project sites that indicated a leakage rate of only 8-9%.		OK
D.2.3. Will the indicators give opportunity for real measurements of achieved emission reductions?	PDD E	DR, I	Yes. The project emissions are based on reference values. This is common practice for these kinds of projects and deemed reasonable.		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
<b>D.3. Monitoring of Leakage</b> It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.					
D.3.1. If applicable, are the choices of leakage indicators reasonable?	PDD E	DR	No leakage is identified.		OK
<b>D.4. Monitoring of Baseline Emissions</b> It is established whether the monitoring plan provides for reliable and complete project emission data over time.					
D.4.1. Is the choice of baseline indicators, in particular for baseline emissions, reasonable?	PDD D	DR	Baseline emissions from storing and burning cow dung, N <sub>2</sub> O emissions from fertiliser and cow dung, and emissions from kerosene used for lighting cannot be included as these emissions are not eligible for AMS I.C. These emission reductions have therefore to be taken out.  Baseline indicators are: i) (reduction in) kerosene used for cooking (litre) ii) (reduction in) fuel wood used for cooking (kg), iii) performance monitoring (%).	<del>CAR-2</del>	OK
D.4.2. Will it be possible to monitor / measure the specified baseline emission indicators?	PDD D	DR, I	The performance ratio of the samples will serve as a starting point for the performance calculation of the whole population i.e. all 9 708 households.		OK
D.4.3. Do the measuring technique and frequency comply with good monitoring practices?	PDD D	DR	Yes. Measuring by using survey methods is appropriate for this type of project and in line with AMS-I.C.		OK
D.4.4. Are the provisions made for archiving	PDD	DR	Yes, the data will be archived in both electronic		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
baseline emission data sufficient to enable later verification?	D		and paper form and will be archived until two years after the end of the last crediting period for later verification.		
<b>D.5. Project Management Planning</b> It is checked that project implementation is properly prepared for and that critical arrangements are addressed.					
D.5.1. Is the authority and responsibility of project management clearly described?	PDD D	DR, I	BSP-Nepal has prepared a BSP-Nepal Quality Control Quality Manual, which is distributed to all subcontracting companies and the households.		OK
D.5.2. Is the authority and responsibility for registration monitoring measurement and reporting clearly described?	PDD D	DR	BSP-Nepal is responsible for the monitoring and quality control of the biogas plant project. AEPC and NBPG carry out quality control of companies installing digesters as per agreement with BSP-Nepal. BSP-Nepal is responsible for setting up random sampling, field visits, collecting and analyzing data.		OK
D.5.3. Are procedures identified for training of monitoring personnel?	PDD D	DR, I	Training and information is provided to the households as part of the sales process. Training of companies installing digesters and biogas owners has been provided by BSP-Nepal.		OK
D.5.4. Are procedures identified for emergency preparedness for cases where emergencies can cause unintended emissions?	PDD D	DR	No such emergency is anticipated which could lead to unintended emissions. Downtime of the biogas digesters is included through the performance ratio calculation.		OK
D.5.5. Are procedures identified for calibration of monitoring equipment?	PDD D	DR	BSP-Nepal has been certified to ISO 9001 Quality Management Systems. This will ensure adequate procedures for calibration of monitoring equipment.		OK

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D.5.6. Are procedures identified for maintenance of monitoring equipment and installations?	PDD D	DR	Yes, as above.		OK
D.5.7. Are procedures identified for monitoring, measurements and reporting?	D.	DR	Yes, as above.		OK
D.5.8. Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)	PDD D	DR	Yes, as above.		OK
D.5.9. Are procedures identified for dealing with possible monitoring data adjustments and uncertainties?	PDD D	DR	It is unclear whether standard deviations will be taken into account in the sampling results during monitoring.	CL-1	OK
D.5.10. Are procedures identified for internal audits of GHG project compliance with operational requirements as applicable?	PDD D	DR	BSP-Nepal is responsible for quality control and ICL Certification Ltd carries out third party audits of BSP-Nepal as part of ISO 9001 certification. This includes the verification of biogas plant sales and compliance with the BSP-Nepal Quality Control Quality Manual as well as the actual monitoring of operation performance at a sample of households.		OK
D.5.11. Are procedures identified for project performance reviews?	PDD D	DR	As above.		OK
D.5.12. Are procedures identified for corrective actions?	PDD D	DR	As above.		OK

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
<b>E. Calculation of GHG emission</b> It is assessed whether all material GHG emission sources are addressed and how sensitivities and data uncertainties have been addressed to arrive at conservative estimates of projected emission reductions.					
<b>E.1. Project GHG Emissions</b> The validation of predicted project GHG emissions focuses on transparency and completeness of calculations.					
E.1.1. Are all aspects related to direct and indirect project emissions captured in the project design?	PDD E	DR	Yes, methane leaks from the biogas digester are included in the project emissions. CH <sub>4</sub> emissions from incomplete combustion do also need to be included.	<del>CAR-2</del>	OK
E.1.2. Have all relevant greenhouse gases and sources been evaluated?	PDD E	DR	See E.1.1.	<del>CAR-2</del>	OK
E.1.3. Have conservative assumptions been used?	PDD E	DR	Yes. The 12.5% rate of fugitive emissions from the biogas digesters (including the emissions from incomplete combustion) is deemed to be conservative.		OK
E.1.4. Are uncertainties in the project emissions estimates properly addressed?	PDD E	DR	Yes. Experimental data shows leakage rates of 8-9%.		OK

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
<b>E.2. Leakage</b> It is assessed whether there leakage effects, i.e. change of emissions which occurs outside the project boundary and which are measurable and attributable to the project, have been properly assessed.					
E.2.1. Are leakage calculation required for the selected project category and if yes, are the relevant leakage effects assessed?	PDD E	DR	No leakage needs to be identified.		OK
<b>E.3. Baseline GHG Emissions</b> The validation of predicted baseline GHG emissions focuses on transparency and completeness of calculations.					
E.3.1. Are the baseline emission boundaries clearly defined and do they sufficiently cover sources for baseline emissions?	PDD E	DR	The baseline emissions are defined in accordance with Type I.C in the CDM small-scale methodology scheme.		OK
E.3.2. Are all aspects related to direct and indirect baseline emissions captured in the project design?	PDD E	DR	All the baseline emission sources have been captured in the project design.		OK
E.3.3. Have all relevant greenhouse gases and sources been evaluated?	PDD E	DR	Yes, all relevant greenhouse gases and sources have been evaluated.		OK
E.3.4. Do the methodologies for calculating baseline emissions comply with existing good practice?	PDD E	DR, I	Appendix B does not indicate any specific method to demonstrate that biomass is non-renewable. Therefore a new step by step approach has been adopted, which is deemed transparent and consistent and in compliance with good practice. Three conditions are introduced and the fuel wood is defined as non-renewable if all these three conditions are met:		OK

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
			i) annual increment < total annual wood consumption ii) fuel wood consumption by households has a significant share in total wood consumption iii) maximum emission reductions claimed cannot be more than the total emission reductions from non-renewable biomass This approach has been further verified during interviews and it has been confirmed that all fuel wood reduced by the project activity can be seen as non-renewable.		
E.3.5. Are the calculations documented in a complete and transparent manner?	PDD E	DR	Yes. All calculations could easily be verified during the interviews.		OK
E.3.6. Have conservative assumptions been used?	PDD E	DR	Yes.		OK
E.3.7. Are uncertainties in the baseline emissions estimates properly addressed?	PDD E	DR	The use of IPCC default values to calculate fire wood emissions is in line with AMS I.C. The kerosene emission factor should be reduced from 2.54 kgCO <sub>2</sub> /litre to 2.41 kgCO <sub>2</sub> /litre, so as to be in line with IPCC data	<del>CAR-3</del>	OK
<b>E.4. Emission Reductions</b>  Validation of baseline GHG emissions will focus on methodology transparency and completeness in emission estimations.					
E.4.1. Will the project result in fewer GHG emissions than the baseline case?	PDD E	DR	The project is expected to reduce GHG emissions of 46 990 tCO <sub>2e</sub> annually.		OK

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
<b>F. Environmental Impacts</b> It is assessed whether environmental impacts of the project are sufficiently addressed.					
F.1.1. Does host country legislation require an analysis of the environmental impacts of the project activity?	PDD F	DR, I	An Integrated EIA has been conducted by BSP-Nepal. The EIA study was conducted by a group of four Nepalese experts under the co-ordination of BSP-Nepal.  This has been further verified during follow-up interviews.		OK
F.1.2. Does the project comply with environmental legislation in the host country?	PDD F	DR	Yes. There are no requirements for environmental assessments. However, BSP-Nepal has performed an EIA and come up with a mitigation plan.		OK
F.1.3. Will the project create any adverse environmental effects?	PDD F	DR	An Integrated Environmental Impact Assessment has been carried out for the program by BSP-Nepal although no such assessment is required in Nepal. The assessment showed that the program has mainly positive benefits related to the reduction of smoke and tapeworm infection and the reduced consumption of non-renewable fuel wood and chemical fertilizer. The following negative environmental impacts have been assessed:  - increased use of water to mix the dung in order to guarantee an optimal functioning of the biogas digester: it has been shown that there is no water shortage in the Terai area and only possible impacts of the project in the Hills is that water needs to be saved over a longer period. It has been confirmed, that water scarcity is not a major problem and that the BSP-Nepal has taken sufficient precautionary measures. Also, the		OK

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
			<p>independent entity auditing the households will monitor whether water scarcity becomes an issue.</p> <p>- increased mosquito breeding has been reported by the households with a biodigester, which might be partly due to the biogas digester and the reduced smoke in the kitchen. The exact link between mosquito breeding and biogas digester has not yet been confirmed and in the meanwhile, corrective measures have been taken. The households reporting an increase in mosquito breeding have been provided with a so-called mosquito trapper, a device specifically developed for this purpose.</p> <p>In summary, it has been demonstrated that the project has no severe negative environmental impacts and that possible negative impacts are sufficiently mitigated.</p>		
F.1.4. Have environmental impacts been identified and addressed in the PDD?	PDD F	DR	Yes.		OK
<b>G. Comments by Local Stakeholder</b>					
Validation of the local stakeholder consultation process.					
G.1.1. Have relevant stakeholders been consulted?	/1/ G	DR	The stakeholders consulted are by and large the farmers who are implementing the biogas plants. These stakeholders were consulted during the sales process. End-user satisfaction surveys are also carried out annually. In addition, consultations were undertaken with biogas users and non-users in two districts in the Terai and Hills regions in May 2005.		OK

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CHECKLIST QUESTION	Ref.	MoV *	COMMENTS	Draft Concl.	Final Concl.
G.1.2. Have appropriate media been used to invite comments by local stakeholders?	/1/ G	DR	Meetings, TV and radio announcements and surveys have been used to invite comments by local stakeholders.		OK
G.1.3. If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder consultation process been carried out in accordance with such regulations/laws?	/1/ G	DR, I	It has been clarified that no formal stakeholder consultation process is required as per the Nepalese legislations.		OK
G.1.4. Is a summary of the comments received provided?	/1/ G	DR	End user satisfaction survey resulted in 94-98% satisfaction based on results from previous installations. Dissatisfaction was mainly related to the performance of the plant and the after sales-services received. End-user satisfaction is forecast to increase because more experience is gained with regards to installation and maintenance of the digesters.  A summary of the stakeholder comments is not provided in the PDD.	CL-2	OK
G.1.5. Has due account been taken of any comments received?	/1/ G	DR	End user satisfaction surveys give continuous input to maintain and improve the quality of the biogas program. A mitigation plan has been implemented with regards to aspects such as the increased mosquito breeding. Subcontracting companies are monitored continuously and their agreements are renewed on a yearly basis only if their performance lives up to expectations and the requirements agreed in the contract.		OK

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**Table 3 Resolution of Corrective Action and Clarification Requests**

Draft report clarifications and corrective action requests by validation team	Ref. to Table 2	Summary of project participants' response	Validation team conclusion
<p>CAR 1</p> <p>A letter of approval from the DNA of Nepal is pending.</p>	Table 1	Submitted on 20 November 2005.	<p>OK</p> <p>The DNA of Nepal has approved the project, authorized all Nepalese project participants and confirmed its voluntary participation in the project activity as well as the project's contribution to Nepal's sustainable development.</p> <p>This CAR is therefore closed.</p>
<p>CAR 2</p> <p>The CO<sub>2</sub> emission reductions from lighting, the CH<sub>4</sub> and N<sub>2</sub>O emission reductions from storing and burning of cow dung, and N<sub>2</sub>O emissions from chemical fertilizers in the baseline are not applicable under AMS-I.C and therefore need to be excluded from the emission reduction calculations in the final PDD.</p>	A.2.2, B.2.2, D.4.1 and E.1.1	Revised PDD submitted in November 2005.	<p>OK</p> <p>These emission reductions have been taken out. The remaining baseline emissions stem from reduced fire wood and kerosene consumption.</p> <p>This CAR is therefore closed.</p>
<p>CAR 3</p> <p>The kerosene emission factor has to be reduced from 2.54 kgCO<sub>2</sub>/litre to 2.41 kgCO<sub>2</sub>/litre, so as to be in line with IPCC data.</p>	B.2.2 and E.3.7	Revised PDD submitted in November 2005.	<p>OK</p> <p>The value is now 2.41 kgCO<sub>2</sub> /litre kerosene and in line with IPCC values.</p> <p>This CAR is therefore closed.</p>
<p>CAR 4</p> <p>Project emissions stem from fugitive emissions due to leaks at the biodigester plant and CH<sub>4</sub> from incomplete combustion in the stoves. The latter has not been included in the calculations.</p>	D.2.1	Revised PDD submitted in November 2005.	<p>OK</p> <p>The overall deduction for project emissions is now set to 12.5% of the methane content in the biogas. This is deemed reasonable as the fugitive emissions from the biogas digesters</p>

Draft report clarifications and corrective action requests by validation team	Ref. to Table 2	Summary of project participants' response	Validation team conclusion
			<p>have been found to be between 8 and 9 % and the CH<sub>4</sub> emissions due to incomplete combustion are below 2% for new stoves such as the ones installed in the project.</p> <p>This CAR is therefore closed.</p>
<p>CL 1 It is unclear whether standard deviations will be taken into account in the sampling results during monitoring.</p>	D.5.9	<p>Yes. Monitoring results will be analysed with regards to confidence margins at a 95% confidence level so as to produce statistically significant results of fuel wood and kerosene consumption reduction. If found insufficient, the initially chosen number of samples taken will be increased.</p>	<p>OK It has been clarified that sufficient capacity exists to perform monitoring of the emission reductions that is statistically significant at a 95% confidence level.</p> <p>This CL is therefore closed.</p>
<p>CL 2 A summary of the stakeholder comments is not provided in the PDD.</p>	G.1.4	<p>Revised PDD submitted in November 2005.</p>	<p>OK The summary has been included in part G of the revised PDD.</p> <p>This CL is therefore closed.</p>

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## **APPENDIX B**

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### **CHANGES IN THE PDD FROM SEPTEMBER TO NOVEMBER 2005**

The following changes have been made in the final PDD version:

- Name change from  
*Biogas Support Partnership (BSP) Nepal Biogas Project – Activity 1*  
to  
*Biogas Support Program - Nepal (BSP-Nepal) Activity 1*
- Change of project participants from
  - o AEPC,
  - o BSP-Nepal,
  - o 6 500 households and the
  - o CDCF (authorized by the DNA of Spain)to
  - o AEPC,
  - o 2 Households and the
  - o CDCF (authorized by the DNA of Netherlands);
- Revision of table depicting the distribution of households amongst districts and revision of the adjacent map;
- Change of 2.3 kW to 1.16 kW installed capacity per stove, because 2.3 kW is the gross output. The stove efficiency is assumed to be 49 % and therefore the generation capacity has been adjusted to 1.16 kW. Consequently, the total number of households included in the project design has been raised to 9 708 and the total generation capacity is now 14.73 MW;
- Exclusion of emission reduction claims from N<sub>2</sub>O and CH<sub>4</sub> emissions from animal manure management, revision of forecast emission reduction calculations based on revised amount and distribution of Households and adoption of more conservative assumptions with regards to the kerosene CO<sub>2</sub> emission factor;
- Adjustment of start of project activity from January 2004 to November 2003;
- Adjustment of start of crediting period from 1 August 2005 to 1 August 2004;
- Adjustment and additional information with regards to the monitoring of biogas digesters' performance;
- Exclusion of the GPS system for household localization as the system's implementation has been delayed;
- Inclusion of a more detailed summary of stakeholder comments;
- Deletion of Annexes containing outdated financial analysis, emission calculations and the EIA for the whole 4 phases program;

- Adjustment of Annex I containing the contact details of all households, for reasons of personal data protection and practicability. The database is available to authorized persons upon request and has been verified by DNV;
- Changes made to header and fonts so as to be in line with the latest PDD template;

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