LOW CARBON AGRICULTURE SUPPORT
PROJECT MANAGEMENT UNIT

INCEPTION REPORT

BIOGAS VALUE CHAIN PHYSICAL AUDIT
(Package 24)

Submitted to

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LOW CARBON AGRICULTURE SUPPORT PROJECT (LCASP)

INCEPTION REPORT

BIOGAS VALUE CHAIN PHYSICAL AUDIT (Package 24)

REPRESENTATIVE OF THE PROJECT OWNER

LOW CARBON AGRICULTURE SUPPORT PROJECT MANAGEMENT UNIT

REPRESENTATIVE OF THE CONSULTANT

THE CENTER FOR RURAL COMMUNITIES RESEARCH AND DEVELOPMENT

Director

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ABBREVIATIONS

ADB	The Asian Development Bank
PMU	Project Management Unit
MARD	Ministry of Agriculture and Rural Development
BVC	Biogas Value Chain
CDM	Clean Development Mechanism
LBPs	Large Biogas Plants
LCASP	Low Carbon Agriculture Support Project
MBPs	Medium Biogas Plants
SBPs	Small Biogas Plants
DARD	Department of Agriculture and Rural Development
TOR	Terms of Reference
PC	People's Committee

1. PROJECT AND PACKAGE OVERVIEW

1.1. General information about the project

1.1.1. Background

- Low Carbon Agriculture Support Project - Loan No. 2968-VIE;
- Donor: The Asian Development Bank (ADB);
- Implementing Agency: Agriculture Project Management Board; Low Carbon Agriculture Support Project Management Unit.
- Duration: 2013 – 2019.
- Office: 8th floor, 16 Thuy Khue, Tay Ho, Hanoi
- Total project costs: 84 million USD;

Project areas: Lao Cai, Son La, Phu Tho, Bac Giang, Nam Dinh, Ha Tinh, Binh Dinh, Tien Giang, Ben Tre and Soc Trang.The Low Carbon Agricultural Support Project (LCASP) has been launched by the Government of Vietnam (GoV) since 2013 using loan from the Asian Development Bank (ADB). The Project is expected to increase the uptake of climate smart agriculture waste management practices (CSAWMP) as measured by increased use of clean biogas energy and organic bio-slurry fertilizers. The Project will also improve the capacity of various stakeholders by disseminating skill and knowledge of established good CSAWMP to beneficiaries.

The project's specific objectives are as below:

i. Improve the management of livestock waste, by-products in biogas production; reduce environmental pollution; generate clean energy sources, organic bio-slurry fertilizers and income from the Clean Development Mechanism (CDM).

ii. Improved uptake of established good climate smart agriculture waste management practices (CSAWMP); increased use of renewable energy and organic bio-slurry fertilizers; replicate CSAWMP models to reduce greenhouse gas emissions and improve livelihoods and quality of life of rural people.

iii. Improved capacity of various stakeholders by disseminating skill and knowledge of established good CSAWMP to beneficiaries.

The project will be implemented in 10 provinces nationwide including Bac Giang, Ben Tre, Binh Dinh, Ha Tinh, Lao Cai, Nam Dinh, Phu Tho, Soc Trang, Son La and Tien Giang for 6 years (2013-2018) with 4 components and expected outputs are as follows:

Component 1: Expanded use of livestock waste management infrastructure

- The Project will support construction of 36.000 small biogas plants, 40 medium biogas plants and 10 large biogas plants, and associated value chain infrastructure. At least 5% of total small biogas plants will be constructed for ethnic minorities in at least three of the project provinces.

- Training 36.000 households (at least 50% of trainees will be women), 500 masons (at least 20% of trainees will be women), 160 technicians (at least 20% of trainees will be women) on contents related to construction, operation, environment of small biogas plants; 10 engineers and 10 contractors will be trained and registered in biogas associations by 2018.
- Database system (including registration in both husband's and wife's names) to manage effectively on the construction and application of biogas plants.

Component 2: Credit lines for biogas value chains

- The credit is provided through two FIs for 36.050 households, farm owners, enterprises to construct BPs and environmental items.
- At least 50% of credit recipients will be registered under husband-wife joint accounts or on behalf of women; technical training on livestock waste management and biogas for staffs of FIs.

Component 3: Enhanced CSAWMP technology transfer

- Training and implementing extension demonstration models for CSAWMP technology transfer in 10 project provinces, at least 50% of beneficiaries will be women and with participating community associations.
- "One long-term, community-based CSAWMP technology transfer and research strategy is elaborated by 2014, and includes communication, dissemination, and mainstreaming plans.

Component 4: Project Management

- Project management system will include CPMU and PPMUs established and operated with adequately skilled staff and facilities, at least 30% of staff are women and a gender focal point will be appointed by 2014.
- Monitoring and Evaluation system will include gender and ethnicity data developed and collected.
- Carbon market coordinator is assigned and 36.050 biogas owners are organized through associations.

Impact assessment is included in component 4 of the project.

1.1.2. Project Objectives

1.1.2.1. Overall objectives

- Build a sustainable, efficient and environment-friendly agricultural production through development and replication of studies and technology transfer models in agricultural production towards greenhouse gas emission reduction and adaptation to/mitigation of climate change, efficient use of natural resources and agriculture by-products, effective management of produce processing activities and post-harvest preservation.

- Minimize environmental pollution due to agricultural wastes through the expansion and development of biogas program from small-scale household projects to large and medium-scale projects creating clean energy sources; improve livelihoods and enhance the quality of life of rural people.

1.1.2.2. Specific Objectives

- Improve the management of livestock waste, by-products in biogas production; reduce environmental pollution; contribute to the development of sustainable animal husbandry and livestock for farmers and farms; generate clean energy sources; improve livelihood and enhance the quality of life of rural people; generate revenues from CDM projects;
- Study to apply technologies in low carbon agricultural production in the field of aquaculture and farming that have been recognized in the world, in the conditions of Vietnam and selectively replicate models on cultivation, livestock and aquaculture in order to enhance economic efficiency, adaptation to / mitigation of climate change and reduce greenhouse gas emissions.
- The Project (i) supports construction of about 36,000 small biogas plants (SBPs), 40 medium biogas plants (MBPs) and 10 large biogas plants (LBPs); (ii) empowers biogas plant operators, masons, technicians, engineers, contractors, and biogas relevant agencies to follow good biogas value chain (BVC) management practices. To support national policies, strategies and programs aimed at compliance with BP technical and environmental standards.

1.2. Information about the package

1.2.1. Package Objectives

The objective of small biogas value chain physical audit is to verify and monitor the construction status and quality of biogas plant construction, under the LCASP program. The audit will:

- Ascertain the adequacy of digester volume with respect to available feedstocks and livestock numbers.
- Ensure that the technical standards for the digester to be eligible for LCASP support were applied
- Assess the quality and impacts of items of environment packages applied to small biogas plants
- Confirm the receipt of incentive funds for the construction and installation of the digesters by the source of project funds.
- Confirm the digester is a LCASP supported digester and is not linked to other digester subsidy programs.

1.2.2. The tasks of the consultant

To conduct the biogas value chain physical audit in 10 provinces; activities include: (i) work with representatives of the PPMU and check records stored at PPMU office; (ii) work with

household representatives and conduct physical audit at 500 households that have constructed digesters and 100 households with under-construction digesters; (iii) work with other stakeholders (digester service providers, masons, technicians, local authorities and communities)

1.2.2.1. Information to collect from PPMUs

The consultant will work with the PPMU and request for database on digesters of the province. Based on that, a random sample will be identified to: (i) select a list of records to be checked at the PPMU (14,400 records) and (ii) select a list of households for physical audit at their houses.

On a step by step basis the consultant will work with the PPMU offices to:

- Access to the biogas plants database and records of the PPMUs
- A random sample will be identified to obtain a complete list of LCASP supported digesters including: the owners name, financial record reference, size and description of digester and the environment technology package, date of installation, name and contacts of the mason or supplier, date of inspection, description or classification of construction inspection findings, financial payment and accounting transfer date and reference.
- Conduct a detailed assessment of selected records for their adequacy and completeness including the financial approval processing forms being Forms 1, 2, 3, and 4 for incentive approvals and the methods for building and managing the project database (form 6).
- Check training program records to estimate and confirm the participation rate of constructed biogas household's in the training;
- Identify the process and responses for problem solving and remedial actions of technicians that receive information/report from grass root level;
- Describe the actual procedures for the confirmation and payment of financial incentives, confirm the date of payment and the record of recipient within the PPMU financial records.

1.2.2.2. Information to collect from field visits

Based on the list of households selected randomly at the PPMU, the consultant will carry out physical audit with 500 constructed biogas plants and 100 under-construction ones. The list of households for physical audit will be added with some other similar households so that they can be surveyed substitutively in case the consultant can not reach the households initially selected. The consultant will directly interview the household representatives and independently check the biogas plants. In the process, the consultant will also interview at least 60% of mason teams and composite biogas agencies/enterprises. In addition, the consultant will also work with other stakeholders such as local authorities, environmental management agencies, technicians and the community etc.). Specifically:

- For household interviews, the following information will be collected: (i) general household information (name, address, telephone number, number of people, etc.),

information on their animal production and livestock waste management (livestock numbers, waste treatment methods, etc.); (ii) information on the biogas plant construction process (project participation time, construction time, consultancy/information channel, type of digester, digester volume, basis of plant selection, etc.); (iii) information on plants quality and project support (incidents in construction/installation/operation and ways of handling, guarantee, plant construction costs and support from the project, mobilization of household contribution, household's level of satisfaction on quality of the works, etc.); (iv) efficiency of biogas plants (participation in training courses and access to and use of materials, socio-economic and environmental performance of constructing biogas plant according to the project's DMF framework). In addition, there are also a number of other information related to assessing mason teams/biogas enterprises and the role of technicians, etc.

- For physical audit at households, the following information will be collected: Inspection of the installation and measurement of biogas plants and related works (Type and size of biogas plant, plant code, geometric dimension, position of digester, inlet tank, outlet, compensation tank and environment packages, etc.); Examine and evaluate livestock waste management, the use of slurry and wastewater from biogas digester, environmental efficiency of biogas plants, etc. This independent audit will be based on the criteria in form 3 for under-construction and acceptance check, and form 4 for checking completed construction.
- For mason teams/biogas enterprises, agencies, the following information will be collected: Quantity and quality of the mason/installer teams; Ability of technical consultancy and informing people about biogas plants and other relevant issues; Incidents in construction/installation/operation and ways of handling; Ability to coordinate with local authorities, coordinate with technicians in implementing related activities etc.
- For technicians, the following information will be collected: Capacity and qualifications of technicians; Knowledge of technicians on livestock production, livestock waste management in the locality; Ability of doing technical consultancy; Ability to coordinate with local authorities, mason teams/ enterprises and other stakeholders to implement the Project, etc.
- For local authorities, the following information will be collected: Status of livestock production and livestock waste management in the locality; Environment status and pollution from livestock production in the locality; Government attention to the implementation of the LCASP Project; Coordination, support from local authorities to technicians, mason teams and other stakeholders in implementing LCASP; Effectiveness of LCASP project; Local replicability from LCASP, etc.
- For communities around selected households for physical audit, the following information will be collected: Livestock waste management of households with constructed digesters; Environmental efficiency of households with constructed digesters; Response of

surrounding households in their livestock production and livestock waste management, etc.

Based on collected information at the field, the Consultant will identify areas for improvement and provide recommendations for each PPMU and CPMU to improve quality control system of LCASP. The consultant will reflect these recommendations in a consolidated format in the final report. The consultant will categorize which are common issues of the 10 provinces and which specific for each locality. Also, the consultant will identify these issues are objective or subjective and provide appropriate solutions for each.

2. IMPLEMENTATION ARRANGEMENTS

2.1. Key findings and some notes/suggestions for implementing the package:

In addition to developing methodology and research toolkit to ensure that all objectives and requirements of the package are met, through studying TOR and secondary materials, the consultants find that there are some issues that need to focus on in order to achieve the highest results. Specifically:

2.1.1. Implementation results of Livestock waste management component by 30th September 2017

According to synthesis reports from project provinces by 30th September 2017, the number of biogas plants constructed by the project and training activities provided to the biogas users are as follows:

Table 1: The number of completed biogas plants and disbursement rate of the project

No.	*Province*	*Number of completed plants*	*Number of disbursed plants*	*Ratio %*
1	Bac Giang	7,245	7,000	96.61%
2	Ben Tre	5,064	4,872	96.20%
3	Binh Dinh	7,465	7,185	96.24%
4	Ha Tinh	4,847	4,686	96.67%
5	Lao Cai	2,562	2,092	81.65%
6	Nam Dinh	4,632	4,552	98.27%
7	Phu Tho	9,738	6,573	67.49%
8	Soc Trang	2,936	2,734	93.11%
9	Son La	2,256	1,889	83.73%
10	Tien Giang	2,831	2,729	96.39%
	Total	**49,576**	**44,312**	89.38%

(Source: The Central Project Management Unit)

Table 2: **Training activities on operation and use of biogas plants to the users**

No.	*Province*	*Number of training courses*	*Number of participants*
1	Bac Giang	354	7,000
2	Ben Tre	168	6,311
3	Binh Dinh	192	7,300
4	Ha Tinh	136	6,192
5	Lao Cai	66	2,303
6	Nam Dinh	104	4,439
7	Phu Tho	399	7,248
8	Soc Trang	98	3,103
9	Son La	85	1,707
10	Tien Giang	133	2,667
	Total	**1,735**	**48,270**

(Source: The Central Project Management Unit)

2.1.2. Findings and notes for implementing the package

- ***Comparing set objectives and implementation results by 30th September 2017***

According to initial approved design of the project, by June 2019, the project would support the construction of 36,000 small biogas plants, 40 medium biogas plants and 10 large biogas plants. But by the end of 2016, the project has adjusted its objectives to 65,000 small biogas plants, 40 medium biogas plants and 02 large biogas plants. Thus, compared to initial objectives, the number of small biogas plants of the project has nearly doubled (by September 2017, the total number of small biogas plants supported by the project was 49576, reaching 89.38% compared to adjusted objectives). The increased number of digesters means that the demand for building biogas digester remains very high, and demonstrates the role and effectiveness of LCASP project in livestock waste treatment/management for farmers. However, the increased number of digesters also means that additional activities will be required, such as training, communication, project management, quantity and quality of mason teams and technicians etc., especially project management activities. This requires the PMUs to strengthen monitoring and inspection activities through various forms. In particular, it is required to do monitoring and checking of records in PPMUs and physical audit at households to ensure the quality and effectiveness of the project.

Regarding training activities, as of 30th June, 2017, the project has held 1,735 training courses for users with the participation of 48,270 people (out of a total of 45,879 constructed small biogas plants). As such, user training has exceeded project objectives. However, the number of training courses and number of participants in provinces are very different. In other words, the average number of participants per training course was significantly different in project provinces (For example: Bac Giang held 354 training classes for 7,000 people - 20 people/class on average; Binh Dinh organized 192 classes for 7,300 people - 38 people/class on average; Ha Tinh had 136 classes for 6,192 people - 45 people/class on average). This shows that it is necessary to study and review the training programs, training contents and scale so that training activities will be most effective for both people and the project.

- ***For desk study activities:***

- According to TOR requirement, in each province, the consultant must randomly select at least 40% of the total number of records kept at the PPMUs for checking. However, according to progress report, by 30th September 2017, the whole project has constructed 49,576 plants; hence if choosing 40% of those records, it is a very large number, which is so difficult to be done in such short field time in provinces. Therefore, the consultants propose to retain the random inspection rate of 40% in the total number of 36,000 records (as originally planned) and the records reviewed are records of the plants that were completed before 31st December 2016.
- Prior to March 2016, PPMUs used form 06 to aggregate project data for management, monitoring and evaluation. However, after that, the data has been imported online at http://khisinhhocvietnam.com. Shifting to data entry and management on website has

many advantages. However, to conduct this assignment, the consultants need support of CPMU, as well as technical staff of the online data management software development unit in order to exploit data from website for assignment activities.

- Under terms of the project, CPMU and PPMUs are responsible for inspecting at least 5% of the total constructed biogas plants. Therefore, the consultant will study to understand and be aware of the CPMU and PPMU's inspection procedures to propose a suitable physical audit process appropriate with requirements in the TOR.

- For the project forms, each form has different main information but still has some common sections (information on households). Therefore, attention will be paid to the consistency of this information when checking records kept at the PPMUs. In addition, the statistics from software show that many provinces still enter insufficient data from forms 01 to 04. Therefore, when checking the records at provinces, the consultants propose to check a certain percentage of records with missing information as identified by the software. This is to clarify the missing of information is due to entering or because the forms provided by technicians lack needed information in order to come up with solution for supplementing.

➢ ***For field study activities:***

- The environment package of the project is defined as part of biogas plant construction. This is a specific factor and an added value of the LCASP compared to other biogas projects. Applying the environment package in accordance with project's regulations will increase the efficiency of environmental sanitation activities in livestock production, livestock waste management and reduce greenhouse gas emissions. In practice, it is possible that some households apply the package just in order to receive support. This results in a reduction in its efficiency and benefits. Therefore, in order to ensure maximum efficiency and benefits of the environment package, in addition to checking adequacy, the consultants will also check the quality and usability of the components thereof. From which, the consultants will propose an optimal solution for applying the package as a part of biogas plant construction.
- Local technicians play a very important role in project implementation, giving technical consultancy to farmers, supporting and checking/monitoring mason teams, doing acceptance and ensuring full compliance with project's regulations. They have been fully trained by the project on the technical and related skills to well perform their work. However, the local technicians are usually agriculture staff of the district, working part-time for the project, hence staff rotation and replacement can happen to this team. Therefore, in order to ensure the project is well implemented and achieves its objectives in provinces, it is necessary to assess the ability to do consultancy, support and manage of this technician team, especially in the context that the number biogas plants constructed under the project has nearly doubled.

- For some important indicators in physical audit, in addition to checking the checklist, the experts will have to photograph relevant details, such as signs, work signs. For digesters, need to do measurement of radius and overflow height. Open gas valve to use. For gas-used appliances, check the actual performance.

- The project has paid much attention to plants quality and has trained the mason teams, granted codes to them as well as evaluate quality of the biogas composite providers. However, if the actual construction is technically incorrect or of poor quality, it surely may affect the efficiency of the biogas digester. Therefore, it is necessary to thoroughly check the quality of biogas digester at households and actual specifications against contract and approved design drawings.
- During operation, damage to biogas digesters may occur. Hence, timely guarantee and maintenance is very important. Attitude and quality of guarantee and remedial fixes also draw the project's attention. As a result, it is necessary to compare the evaluation of people, local authorities, project management unit and technicians with that of enterprises and mason teams on this issue.
- In the project areas, besides LCASP there are other projects supporting construction of biogas plants (small projects of non-governmental organizations, socio-political organizations and subsidy programs by Decision 50 of the Prime Minister etc.). Thus, the risk of duplicate support is possible. It is, hence, necessary to check and compare the identification characteristics of the digesters supported by the Project against the ones of other programs through the information on records and via physical audit at households.
- The physical audit process will include checking at households that have constructed digesters (500 household) and households with under-construction ones (100). Thus, for these two groups of households, the consultants need to define specific criteria for inspection and evaluation according to TOR requirements. In which, a set of general criteria (household information, type of digester, digester volume, etc.) and a set of separate information for each of the two groups will be identified. Developed questionnaires will base on information from forms in mandatory project records.
- The physical audit requires experts to have comprehensive knowledge on construction and operation of biogas plants as well as other LCASP regulations, typically the compliance with environment package of households. Therefore, to ensure accuracy of collected information during the audit, the consultants will develop a set of guidelines for audit process, organize a testing survey and conduct training for member experts. Also, in the process of gathering information, the consultants will combine using multiple methods, such as interviews with questionnaires combined with observations, photographing and actual measurement etc.

In order to carry out the physical audit in consistent with assignment objectives, through studying TOR and secondary materials, the consultant have developed an indicator framework/major collected information as follows:

Analysis of project objectives and requirements

Objectives of project and assignment	Questions to answer	Indicators/Information to be collected	Surveyed objects	Questions in questionnaires/checklists
Inspect and monitor the current construction status and quality of biogas plants under LCASP project				
A.Project participation and biogas plant construction process	1. Complied with the process of receiving applications, signing contracts, construction supervision, acceptance, money transfer or not? (adequacy) 2. How was the monitoring and evaluation process? 3. Process of records and database keeping? 4. Able to sell carbon credits?	- Way, time and channel to access project information. - Receive and sign the application form - Sign construction contract - Date of commencement, date of completion of plant construction and installation - Construction and installation process, supervision and acceptance - Procedures for transferring and receiving support money - Management of records and database keeping - Sell carbon credits	- Project database - Records kept at the PPMUs - Household representatives - Representatives of mason teams and composite digester service providers - Project technicians	- Questions C11, C12, C13, C14, C15, C16, C22, C23, C24, C35, C36 - questionnaire no.01 - Questions C11, C12, C13, C14, C15, C16, C18, C19, C20, C21 - questionnaire no.02 - Question C5 - checklist no.02
B. Quality of plants and training activities	1. Check the compliance of plants' dimension against the approved technical drawing; adequacy of inputs as per PMU's requirements; suitability of installation position, inlet and outlet positions. 2. Are there any faults during operation, content with the quality of construction, maintenance and fixes in case of incidents or not?	- Design specifications: type and size of biogas plant, date of construction, plant code, geometric dimension of digester. - Installation position of items (suitability) - Fault items, remedial methods and results. - Satisfaction on plants quality, guarantee, maintenance and troubleshooting regime. - Training activities: Number of training courses, number of participants, participants, plant operators. - Trainers and reading instruction to training material	- Records kept at the PPMUs - Household representatives - Representatives of mason teams and composite digester service providers - Representatives of local government - Physical audit at households - Project technicians	- Questions C17, C18, C19, C20, C21, C25, C26, C27, C28, C29, C30, C31, C32, C39, C40, C41, C42, C43, C44, C45, C46 - questionnaire no.01 - Questions C1, C2, C3, C4, C7 - checklist no.01 - Questions C1, C2, C3, C4- checklist no.02

Objectives of project and assignment	Questions to answer	Indicators/Information to be collected	Surveyed objects	Questions in questionnaires/checklists
	3. How were training/instruction activities on plant usage and operation?			
C. Incentive provision/scheme	1. Receive duplicate support from other sources? 2. Is incentive provision adequate? 3. Is incentive provision quickly provided? 4. What are the obstacles to receiving incentive provision?	- Compare collected information of plant's owners in the list with database. - Compare information provided by surveyed people about: type of plant, plant code, digester volume, demographic information and type of livestocks. - Procedures for receiving incentive and any obstacles to following these procedures. - Incentive amount and time to receive	- Project database - Records kept at the PPMUs - Household representatives - Representatives of mason teams and composite digester service providers - Representatives of local government - Project technicians	- Questions C1, C2, C3, C4, C5, C6, C13, C15, C16, C17, C18, C33, C35 - questionnaire no.01 - Questions C1, C2, C3, C4, C5, C6 - questionnaire no.02 - Questions C1, C2, C3 - checklist no.01 - Questions C1, C2, C3, C4, C5 - checklist no.2
D. Environmental efficiency and others	1. Are environment items adequate according to regulations? 2. Is there an overload of available feedstocks to plants? What is the percentage? 3. Is there an excess of gas? What is the percentage? 4. Using biogas by-products efficiently or not? Usage percentage? If not using, is there secondary treatment? Treatment methods?	- Number and the ability to use items of environment packages. - Digester volume - Livestock numbers at the start of digester construction and the highest numbers. Percentage of feedstocks into digester? Methods to treat feedstocks not entered into digesters. - Proportion of gas used out of the total amount of gas produced. Methods to treat excess gas (if any) - Percentage of gas-leaking plants Gas-leaking positon and remedial methods? Percentage of wastewater and bio-slurry from	- Household representatives - Representatives of mason teams and composite digester service providers - Representatives of local government - Physical audit at households - Project technicians	- Questions C7, C8, C9, C10, C37, C38, C47, C48, C49, C50, C51, C57, C58, C59, C60 - questionnaire no.01 - Questions C7, C8, C9, C10, C22, C26, C29, C30, C31 - questionnaire no.02 - Questions C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18 - checklist no.01 - Questions C6, C7, C8, C9 - checklist no.02

Objectives of project and assignment	Questions to answer	Indicators/Information to be collected	Surveyed objects	Questions in questionnaires/checklists
		biogas plants used for agricultural production. Percentage discharged to the environment. Methods to treat unused wastewater and bio-slurry. Air, water pollution. Wastewater color.		
E. Economic efficiency	Are small biogas plants economically efficient?	Daily time spent on firewood collection, cooking, cleaning of cages etc. of women and children before and after construction of biogas digesters. Current gas-used appliances of households Fuel costs before and after having biogas digesters (the amount of fuel saved and current fuel price in the locality)	- Household representatives - Physical audit at households	- Questions C47, C52, C53, C54, C55, C56 - questionnaire no.01 - Questions C23, C24, C25 - questionnaire no.02
F. Replicability	1. Can biogas plants be replicated or not? 2. What support is needed to replicate? 3. What is the suitable volume range of digesters?	- Numbers of livestock households and households with biogas digesters. - Demands for constructing biogas digesters in project areas. - Type and size of common digesters - Recommendations for support during digester construction.	- Project database - Records kept at the PPMUs - Household representatives - Representatives of mason teams and composite digester service providers - Representatives of local government - Physical audit at households - Project technicians	- Questions C33, C34, C61 - questionnaire no.01 - Questions C27, C28 - questionnaire no.02

2.2. Methodology

To meet the required objectives and tasks of the biogas value chain physical audit, the consultant will use following major methods, including: (i) Desk study; (ii) Questionnaires/technical forms survey; (iii) In-depth interview; (iv) Observations and physical audit; (v) Testing survey; (vi) Sampling and (vii) Data analysis using SPSS software. In addition, the consultants also designed a checklist at the PPMU to check and evaluate 14,4000 records in 10 project provinces. To ensure accuracy, the consultant will conduct a testing survey of the toolkit and revise it for approval by the CPMU before conducting a formal survey.

2.2.1. Desk study

The desk study will focus on following key documents: (i) a complete list of LCASP supported digesters; (ii) technical standards and quality control regulations in the construction of LCASP supported digesters; (iii) provisions on adequacy and completeness of digester documentation, including the financial approval processing forms for LCASP supported digesters; (iv) provisions on the organization of training activities for households with LCASP supported digesters; (v) reports and work plans of the PPMUs. Based on the analysis of relevant documents, the consultant will: (i) identify a random sample of 14,400 records that is stored at PPMU for checking in PPMU offices; (ii) identify a random sample of 500 records of constructed biogas plants and 100 records of under-construction plants for physical audit at households; (iii) check records of training courses organized for households supported by LCASP Project; (iv) define roles and responsibilities of technicians in responding and solving issues related to construction and operation of biogas digester from the grassroots; (v) review the procedures related to receipt and payment of incentive at the PPMU; etc.

Based on the number of digesters in the provinces, the consultants estimate the number of records to be checked in each province as follows:

Table 3: The number of records to be checked at PPMUs

No.	Province	Number of records
1	Bac Giang	2276
2	Ben Tre	1583
3	Binh Dinh	2335
4	Ha Tinh	1522
5	Lao Cai	680
6	Nam Dinh	1479
7	Phu Tho	2136
8	Soc Trang	888
9	Son La	614
10	Tien Giang	887
	Total	**14,400**

For checking records at the PPMUs, the consultants will develop a technical form to evaluate the record system based on forms according to CPMU' regulations and guidelines.

2.2.2. Questionnaires survey

For physical audit at households, the consultants will develop two direct interview questionnaires and two technical forms for evaluation/independent monitoring. Questionnaires and forms will have specific information that is appropriate with household's situation, but also has general information for subsequent data and evaluation result comparison. The questionnaires follow closely the project's DMF framework and other relevant indicators, especially about environment.

- For survey questionnaires for households that have constructed digesters: The consultants designed the questionnaire for households with constructed digesters with the following parts: (i) General household information; (ii) Biogas plant construction process; (iii) Quality of the plant and project's support; (iv) Efficiency of biogas plants. Technical forms for independent monitoring at households with constructed digesters, focus on the main indicators as follows: Type and size of biogas plant, date of construction, plant code, geometric dimension of digester, position of digester, inlet tank, outlet, compensation tank and environment packages etc. These contents focus on collecting basic information including:
  - Identify general household information (name, address, number of people, economic conditions, etc.)
  - Identify information on livestock production of households (type of livestocks, livestock numbers) and livestock waste management before having biogas digesters.
  - Identify the access to information, information channels, consultation activities on LCASP Project, time of plant construction and type of digesters, etc.
  - Identify information on the process of construction/installation/operation, plant quality, environment package, remedial fixes and guarantee activities, people's satisfaction with the relevant issues, etc.
  - Identify plant code, geometric dimension of digester, position of digester, inlet tank, outlet, compensation tank and environment packages
  - Identify information related to receiving incentive from the project, support procedures, sources of capital that people mobilized from for biogas plant construction.

- Identify the efficiency of biogas plants in terms of economic, social and especially environmental aspects in accordance with MF framework and other related indicators.
- And some other information etc.

- For households with under-construction digesters, the consultants designed the questionnaire with following parts: (i) General household information; (ii) Biogas plant construction process; (iii) Expected use of biogas plant. Technical forms for independent monitoring at households, focus on the main indicators as follows: the quality of construction materials for biogas digesters, position of digesters, inlet tank, compensation tank and environment packages, etc. These contents focus on collecting basic information including:
  - Identify general household information (name, address, number of people, economic conditions, etc.)
  - Identify information on livestock production of households (type of livestocks, livestock numbers) and livestock waste management before having biogas digesters.
  - Identify the access to information, information channels, consultation activities on LCASP Project, time of plant construction and type of digesters, etc.
  - Identify information on the process of construction/installation, plant quality, environment package, etc.
  - Identify geometric dimension, position of plant against technical drawing
  - Determine expected use of gas, slurry and wastewater from household's biogas digester.
  - Identify time, costs of households for cooking, barn cleaning, preparing meals, etc. before having biogas digesters.
  - Identify issues arising from environmental pollution for households when without biogas plant.
  - And some other information etc.

To ensure quality of the questionnaires and independent checklists, the consultant will consult with CPMU during tool design process. These forms before being used in field surveys in 10 provinces will also be tested to assess the suitability of the toolkit in practice.

The experts will be trained on completed technical forms to minimize errors during field work. The consultant will develop a survey manual that includes the following: (i) general instructions: (ii) instructions on surveying construction/equipment installation techniques;

(iii) instructions on checking activities performance; (iv) instructions on checking project records and financial procedures. Member experts are responsible for cross-checking collected information from the questionnaires and technical forms during field surveys. The Team leader will overall check the survey results in each area. All missing information will be added/completed on the survey date. In order to improve survey quality, experts will be requested to prepare field reports for each locality, including information on survey progress, findings and initial results.

2.2.3. In-depth interview

In-depth interview is used to clarify, explain and supplement quantitative survey data. It is used to interview the target groups, including: (i) representatives of the PPMUs; (ii) representatives of mason teams/biogas enterprises/agencies; (iii) representatives of technicians; (iv) representatives of local government; (v) community representatives.

2.2.4. Observations and physical audit

Observation method is used to support the collection of information using survey questionnaires. Accordingly, the consultants will record the construction/operation specifications, geometric dimension, position of digester, inlet tank, outlet, compensation tank and items of environment packages etc. to determine the compliance of the plants in practice with CPMU's regulations as well as effectiveness of the biogas plant. The consultants will combine using technical forms for independent monitoring with other approaches such as photographing in this method.

2.2.5. Testing survey

After completing the toolkit, the consultants will conduct a testing survey in Bac Giang province to finalize it. The testing survey will be conducted both at the provincial and household level.

After that, the consultants will proceed to revise the toolkit and seek approval from the PMU through organizing workshop to collect consultation and comments from relevant stakeholders. Once approved, the consultants will conduct training for experts to prepare for the official survey in 10 provinces.

2.2.6. Sampling method

According to TOR, the physical audit must be carried out with at least 500 constructed biogas plants and 100 under-construction ones. The numbers of biogas plants to be audited in provinces are different from one another, in line with their total number of biogas plants. Therefore, to ensure representativeness of physical audit activities, the consultants propose sampling method as follows:

Step 1: Synthesis a complete list of households with LCASP supported digesters including a list of households with constructed/installed biogas plants and a list of households with under construction/installation plants.

Step 2: Determine project areas in the provinces to select surveyed districts.

Step 3: Determine surveyed communes from selected districts.

Step 4: Identify households to be surveyed and substitute ones in case of inaccessibility of selected households to ensure sufficient number of surveyed households as in the Table 3. In particular, the consultants will balance the number of samples by type of digesters (KT1/KT2, composite), proportionally to the construction and installation of these types in reality.

Table 4. **The number of digesters to be audited at households in 10 provinces**

No.	Province	Completed biogas plants	Under-construction biogas plants
1	Son La	30	5
2	Lao Cai	30	5
3	Phu Tho	70	12
4	Bac Giang	80	15
5	Nam Dinh	50	8
6	Ha Tinh	60	15
7	Binh Dinh	60	13
8	Tien Giang	40	10
9	Ben Tre	50	10
10	Soc Trang	30	7
	Total	**500**	**100**

(Source: The Central Project Management Unit

2.2.7. Official survey in 10 project provinces

To prepare for the official survey in 10 project provinces, the consultants will organize training for experts. At the same time, a detailed plan was prepared for submission to CPMU, on which the PCMU is kindly requested to provide support to inform the PPMUs.

The consultants will respectively carry out survey activities in each locality to ensure that experience can be drawn during the survey. The number of experts participating in field survey in one province is 4 persons on average. In particular, for localities with large workloads (big number of records and biogas plants to be examined), the working time of the experts is 6 days, 2 days longer than the other provinces. In all 10 provinces of the project, the consultant team will have a first working day with the PPMU to understand the baseline

information of the project implementation in the locality and the requirements of the physical audit activities. Based on that, the consultants will arrange the follow-up work plan that best fit the reality of each locality, including the assignment of personnel to check the records at PPMU and physical audit at households.

In order to ensure quality of the survey, on a daily basis, the consultants will quickly summarize the results obtained from physical audit (including the completed workload and findings). All missing information detected will be supplemented right at the locality. The field survey information will be aggregated quickly and exchanged immediately with the PPMU through small workshops in 10 provinces. This information will then be compiled into a field report for each province after the consultants has completed the field trip and will be used in the final report.

2.2.8. Data processing and report writing

The collected data will be imported and processed using SPSS software for storage and report writing. In particular, the consultant will mainly use SPSS software to process information in terms of frequency, percentage of the data to be collected. In addition, depending on the specific needs, the consultant will use SPSS software to compare data between households with constructed digesters and those with under-construction ones; compare between 10 project provinces; compare between constructed and composite digesters etc. The consultant will also use SPSS software to calculate statistical indicators such as: Mean, Maximun, Minimun, Mod; Median etc. to serve the assessment of the project's economic, social and environmental performance according to DMF framework and other relevant indicators.
Synthesis report will be developed by the consultants based on the outline approved by CPMU. At the same time, during field survey, the consultant will add other findings (if any). Survey results and report will be disclosed and consulted through workshops. Based on comments from the CPMU and other stakeholders, the consultant will finalize the final report as per requirements.

3. IMPLEMENTATION PLAN AND PERSONNEL SCHEDULE

Planning for the implementation of tasks under the TOR has been set up specifically by the consultants. With the plans have been established, the consultants will develop a detailed plan for each activity and submit to the PMU, including a list of respondents in the survey area.
Personnel schedule and assignment have been implemented to meet the objectives set. A detailed implementation plan is shown in the table below:

No.	Activities	Consultants Ressponsible	TIMING																			
			Month 1				Month 2				Month 3				Month 4				Month 5				Month 6			
		Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
I	**Inception Phase**																									
1	Collect materials and efiles	All team																								
2	Initial desk review of documents																									
3	Initial consultations																									
4	Adapt workplan																									
5	Confirm structure and contents of the Report																									
6	Develop logframe for assessment																									
7	Determine contents of surveys and interviews																									
8	Determine the methodology																									
9	Draft methods and formats for processing data																									
10	Testing the tools																									
11	Complete guidelines for biogas value chain physical audit																									
12	Prepare and submit Inception report to CPMU																									
II	**Implementation Phase**																									
13	Refine and finalize survey plan and program	All team																								
14	Confirm plan with Client and local partners																									
15	Arrange timetables for interviews and meetings																									
16	In-depth interviews with key informants																									

No.	Activities	Consultants Ressponsible	TIMING																			
			Month 1				Month 2				Month 3				Month 4				Month 5				Month 6			
		Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	(CPMU, PPMUs)																									
17	Interview and FGD with local level authorities																									
18	Interview, FGD, casestudy and questionnaires with local residents																									
III	**Synthesis phase - Report writing & Presentation of findings**																									
19	Set up processing formats and programs	All team																								
20	Process data and identify gaps																									
21	Follow up gaps and questions in data																									
22	Synthesis of findings in VN and EN																									
23	Validation of findings																									
24	Discuss aggregated results in the Report sections																									
25	Consultation with key stakeholders																									
26	Prepare Draft Final Report																									
27	Submit Draft Final Report to CPMU																									
28	Present findings, gather comments of the CPMU and related stakeholders																									
29	Revise the draft final report according to feedback and comments																									
30	Revise findings and recommendations																									
31	Finalize and submit the final report																									
Deliverables (Exact date of submitting reports will be agreed with the client while negotiating the contract)																										

No.	Activities	Consultants Ressponsible	TIMING																			
			Month 1				Month 2				Month 3				Month 4				Month 5				Month 6			
		Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
D-1	**Inception Report**	All team																								
	1) Draft Report			x																						
	2) Incorporating comments			x																						
	3) Submitting finalized report to the client			x																						
D-2	**Draft Final Report**	All team																								
	1) Draft Report																				x					
	2) Incorporating comments																				x					
	3) Submitting finalized report to the client																				x					
D-3	**Final Report**	All team																								
	1) Draft Report																							x		
	2) Incorporating comments																							x		
	3) Submitting finalized report to the client																							x		

Note: K-1: Team Leader; K-2: Biogas Expert No.1; K-3: Biogas Expert No.2; K-4: Environment Expert No.1; K-5: Environment Expert No.2; K-6: Environment Expert No.3

Full-time basis

Intermittent basis

Personnel schedule

No.	Full name	Expert inputs (by person-month) for each deliverable (are listed in FORM TECH 5)							Total inputs (by person-month)		
		Position		D-1		D-2		D-3	Home	Field	Total
KEY EXPERTS											
1	Pham Van Thanh	Team leader:	Home	0.4		0.9		0.3	1.60		4.00
			Field	0.1		2.3				2.40	
2	Nguyen Duc Thinh	Biogas Expert No.1	Home	0.4		1.1		0.3	1.80		4.00
			Field	0.1		2.1				2.20	
3	Tran Hiep	Biogas Experts No.2	Home	0.4		1.1		0.3	1.80		4.00
			Field	0.1		2.1				2.20	
4	Pham Van Hoi	Environment Expert No.1	Home	0.4		1.1		0.3	1.80		4.00
			Field	0.1		2.1				2.20	
5	Nguyen Manh Khai	Environment Expert No.2	Home	0.4		1.1		0.3	1.80		4.00
			Field	0.1		2.1				2.20	
6	Luu The Anh	Environment Expert No.3	Home	0.4		1.1		0.3	1.80		4.00
			Field	0.1		2.1				2.20	
				Sub-total					10.60	13.40	24.00

4. ASSIGNMENT

4.1. The task of the consultant

According to the requirements of the TOR, the consultant will have to implement the project according to the work order: desk study, data collection, data entry and analysis, and writing reports, including Inception report, mid-term report and final report. Besides, the consultant will also participate in meetings with the CPMU, PMU to learn from or have new information related to the package. The assignment of the team leader to the consultants will depend on the specific work that is appropriate to the capacity and expertise of each consultant.

4.2. Coordination of the CPMU and PPMU

During the implementation of the project, the consulting unit has to work closely with the CPMUs and the PMUs of 10 provinces to facilitate the collection of relevant information. On the other hand, the consulting unit will have to develop a detailed implementation plan for each activity and submit it to the CPMU and the PPMU. From there, the CPMU and the PPMU will assist in contacting and sending a letter of introduction to the sites requested by the consultant. In addition, during the implementation of the project, the CPMU and PMU will send their comments for the consulting unit or for reports.

4.3. Coordination of the local authority and people

When conducting the survey at the selected sites, Commune People's Committees will support the consulting unit on working with enterprises, technicians and masons and provide information related to the project and socio-economic development situation, and support the consultant on working with selected households.

5. REPORTS

Submission Schedule will be presented in the following table:

Submission Schedule:

Name of reports:	Quantity		Time of submission	Contents
	English	Vietnamese		
Inception Report (maximum 10 pages for main text)	4	4	2 weeks after mobilization	The report will incorporate: The main findings and observations following from the desk study Methodologies and surveying planning; The draft data collection tools built by consulting firm A detailed work schedule for the survey The proposed outline of content for the final report
Mid-term report	5	5	3 months after mobilization	Summary information, work progress, relevant issues and draft contents and annexes of

Name of reports:	Quantity		Time of submission	Contents
	English	Vietnamese		
				the final report
Final Report	5	5	2 weeks before the contract ended	Based on CPMU comments, consulting firm will prepare and complete final report and accepted by the Project.

6. ANNEXES

- Annex 1. Terms of reference
- Annex 2. Checklists at the provincial project management unit
- Annex 3. Questionnaires for households
- Annex 4. Outline for In-depth interview
- Annex 5. Outline of the Final Report
- Annex 6. List of selected survey households

Annex 1. Terms of reference

TERMS OF REFERENCE

I. Background

The Low Carbon Agricultural Support Project (the Project) is a 6-year (from 2013 to 2018) ADB funded project. The total investment for LCASP is 84 million USD, of which 74 million USD as a loan from ADB, 3.7 million USD from Government of Viet Nam and 6.3 million USD from Financial Intermediaries (FIs). The project impact will be less agriculture-related pollution, as measured by better water quality due to reduced presence of livestock waste effluent. The project outcome will be increased CSAWMP uptake, as measured by increased use of clean biogas energy and organic bio-slurry fertilizers. The Project comprises 4 components: (i) Expanded use of livestock waste management infrastructure; (ii) Credit lines for biogas value chains; (iii) Enhanced CSAWMP technology transfer; and (iv) Effective project management.

The Ministry of Agriculture and Rural Development (MARD) is the Project Executing Agency. The Central Project Management Unit (CPMU) was established under the Agricultural Projects Management Board (APMB) to coordinate and manage the whole project. A technical support unit (TSU) was also established within CPMU. 10 Provincial Project Management Units (PPMUs) were established under the Departments of Agriculture and Rural Development (DARD) of provinces participating in the project to manage all project activities at the provincial/city level. Financial intermediaries (FIs) including Viet Nam Bank of Agricultural and Rural Development and Cooperative Bank of Viet Nam have been selected to provide credit for biogas value chains management.

The Project is being implemented in the 10 provinces of Bac Giang, Ben Tre, Binh Dinh, Ha Tinh, Lao Cai, Nam Dinh, Phu Tho, Soc Trang, Son La, and Tien Giang.

The Project (i) supports construction of about 36,000 small biogas plants (SBPs), 40 medium biogas plants (MBPs) and 10 large biogas plants (LBPs); (ii) empowers biogas plant operators, masons, technicians, engineers, contractors, and biogas relevant agencies to follow good biogas value chain (BVC) management practices. To support national policies, strategies and programs aimed at compliance with BP technical and environmental standards.

As of June 2016, 10 provinces had constructed/installed about 35,700 biogas plants and accepted over 30,000 biogas plants. According to project implementation manual, PPMU and CPMU will inspect accounts for at least 5% of the total biogas plants constructed. The inspections are undertaken at construction using the District Technician of DARD whose findings form the basis for the release of funding from the LCASP PPMU accounts. In addition, LCASP intend to undertake a physical audit of the bio digesters constructed and installed to verify the quality control monitoring.

II. Objective of physical audit

The objective of small biogas value chain physical audit is to verify and monitor the construction status and quality of biogas plant construction, under the LCASP program.

The audit will (i) ascertain the adequacy of digester volume with respect to available feedstocks and livestock numbers, (ii) ensure that the technical standards for the digester to be eligible for LCASP support were applied, (iii) assess the quality and use of environmental package as part of the construction package, (iv) confirm the receipt of incentive funds for the construction and installation of the digesters by the source of project funds, and (v) confirm the digester is a LCASP supported digester and is not linked to other digester subsidy programs.

III. Detail task

A consultant will be contracted to undertake the audit using a fixed budget selection (FBS) contract. This comprises desk research and fieldwork based study.

1. Desk study

The team shall review PPMU documentation for the LCASP digesters database, as part of this review a random sample will be identified for inspection, the records will be extracted for the sample and financial payment records obtain form the PPMU LCASP financial accounts. The consultant will also compare the details of the selected sample with the records of the NBP and SNV digester databases to ensure no-overlaps.

On a step by step basis the consultant will work with the Provincial PPMU offices to:

(i) Obtain a complete list of LCASP supported digesters including the owners name, financial record reference, size and description of digester and the environment technology package, date of installation, name and contacts of the mason or supplier, date of construction check, name of construction inspector, the outcome of the construction inspection, description or classification of construction inspection findings, financial payment and accounting transfer date and reference.

(ii) For each PPMU, the consultant will conduct an assessment of records for their adequacy and completeness of digester documentation - including the financial approval processing forms being Forms 1, 2, 3, and 4 for incentive approvals and the methods for building and managing the project database (form 6). In each province, the consultant must select a random check at least 40% acceptance file that is stored at PPMU;

(iii) Check training program records to estimate and confirm the participation rate of constructed biogas household's in the training;

(iv) Identify the process and responses for problem solving and remedial actions of technicians that receive information/report from grass root level;

(v) Describe the actual procedures for the confirmation and payment of financial incentives, confirm the date of payment and the record of recipient within the PPMU financial records.

2. Field study

The consultant will undertake field work and will visit selected households, inspect digesters and interview the recipient of the digester. Further the consultant will also interview at least 60% of mason teams and composite biogas agencies to identify the number of construction inspections they have received, the number of recommended upgrades or remedial fixes, and

the number of rebuild or rejections. A listing of the reasons for remedial work or rejection will be developed.

The consultant will visit, based on a random sample that is drawn for the PPMU data base by the contractor, at least 500 constructed/installed biogas plants and 100 under construction/installation plants (detail attached in annex 1). Each digester included in the sample will be visited and a site inspection and household interview completed. Where no access to a beneficiary is obtained additional households will be added by the consultant through selection of the next nearest beneficial household.

During site visits, all collected information will be recorded in a field data survey form that is prepared by the consultant and shared with the CPMU for prior approval.

In addition, a coding sheet will be provided that provides a listing of response categories. The collected information must be filled in the quality control form right at the site.

During site visits the consultant will use the technical form to evaluate the following parameters:

(i) Interview farmer on: number and type of livestock and feedstock availability, purpose of construction biogas plant, identify what environmental package was sought and installed, participation in user training, access to user handbook, satisfaction of household with construction quality, technical support provided by technicians, and the receipt of the incentive – amount received, time taken and confirm that the beneficiary as eligible for the payment.;

(ii) inspect the BVC installation and measure: Type and size of biogas plant, date of construction, plant code, geometric dimension, and position of digester, inlet tank, outlet location, and compensation tank and environment packages. The assessment will include and specifically report on the provision of the environmental package, the final disposal of slurry.

(iii) interview operator to identify operation standards and process, gas use of plant owner in term of safety and convenience;

(iv) The validity of the plan (compliance with the design of the Project; constructed by project's mason team; installed by certified biogas composite agencies; built in the year of implementation)

(v) Assess if the mason team comes from another province belonged to the project, do they work according to the procedure of LCASP, if not what variations were there and why? Is there a local technician to manage the installation?

(vi) Identify what training was provided to the biogas users after construction completed. Please detail, how many courses were delivered and the level of participation at each course reconcile against the number of installations? During site visits identify the number of households that receive the training and resource material, identify who provided these materials from where/whom, any reading instruction has been given to them;

(vii) During the site visits ascertain consumers knowledge of the availability of guarantees and their use of these. Provide a cross check that the guarantee paper has been provided to the plant's owner by mason;

(viii) Identify if there have been any technical faults and how these were responded to, with the outcome of these responses categories as solved, ongoing or unresolved.

(ix) All data forms are to be integrated into a final minute that will be discussed in a closing meeting that proposes technician to follow and send the result by document to PPMU in the agreed time.

(x) Skill of plant checking (in accordance with criteria in form 3 for under-construction and acceptance check, in form 4 for checking completed construction. Ability of doing technical consultancy of technician;

(xi) Construction techniques (are the design specifications followed, follow dimension designed, the visible physical presence of the LCASP digester mark on the digester, attach plant label).

(xii) Assess and evaluate satisfaction of biogas households and carry out assessment on the operation and maintenance aspects of biogas plants, the biogas value chain and its benefits, and the effectiveness of the environmental package in terms of operator benefits, and environmental protection;

Based on collected information at the field, the Consultant should identify areas for improvement and provide recommendations for each PPMU and CPMU to improve quality control system of LCASP. The consultant will reflect these recommendations in a consolidated format in the final report. The consultant should classify if there are common mistakes or malfunctions between the 10 different provinces for the technicians or if it is coincidental mistakes.

IV. Qualification of the consultant

A consulting firm will be recruited in accordance with the Guidelines on the Use of Consultants by Asian Development Bank and Its Borrowers (March 2013, as amended from time to time), using Fixed Budget Selection (FBS), with biodata technical proposal (BTP).

The consulting firm should have (i) sufficient experience in the biogas sector, (ii) sufficient technical expertise in monitoring and inspection of physical works and (iii) sufficient experience in surveying rural households.

To conduct physical audit of the Project, prospective Consulting Firm staff need to satisfy the following requirements:

i. Demonstrable biogas technical knowledge and field experience including an ability to technical design drawings direct experience of biogas plant construction and comprehensive knowledge of alternative construction techniques;

ii. Experience on conducting quality control and inspection field surveys that involve biogas plant, agriculture, rural development and environment;

iii. Previous experience in related projects financed by ADB, WB or other relevant donors;

iv. Evidence through references of experience, professionalism, hard work and responsibility in completing relevant or similar assignments;

v. Good communication skill, proven experience in effective work with local people at the commune level;

vi. Be able to make summary report in both Vietnamese and English languages.

Prospective consulting firm needs to offer as a single team comprising three (03) biogas experts (one of whom is an experienced team leader) and three (03) environment experts as follows:

Team leader: (01 National expert - 4 person months)

A minimum of 10 years experience in the biogas sector with knowledge of small scale bio-digester and biogas value chains, knowledge of the national biogas program systems and procedures, experience in field assessment.

General requirements:

- Having a university degree (prefer a higher/advance degree) in a field related to environment; agriculture or animal production or veterinary…;
- Having at least 10 years of experience on biogas and understanding biogas technical drawing;
- Experience of team leader or relevant positions in similar assignments. Demonstration of team leadership in at least three (3) similar assignments will be advantage;
- Having experience in conducting quality control, especially on biogas technology and project related areas;
- Comprising knowledge and experience in development economics, environment, livestock waste, agriculture and rural development;
- Good experience and skill in writing and communication; synthesizing and presenting information coherently and accurately;
- Ability in report preparation and team management;
- Proficient in English and computer use.

The candidate will be responsible for the following:

i. Act as the contact person point between the firm and the CPMU and prepare inception report;

ii. Organise and provide logistical support for team members, the government staff and other stakeholders to collect necessary information related to the above tasks,

including preparation of questionnaires (for masons, technicians etc.) using the current LCASP's forms;

iii. For delivery of planning, coordination and quality of all deliverables;

iv. Supervision of team members implementation in the field trips;

v. Check the way of solving a problem of technician when receiving information and reports from grass root level;

vi. Check the incentive provision/ scheme to farmers and obtain farmers' feedbacks

vii. Participate in all physical audit trips to evaluate the quality of under construction and already installed, completed and operation of SBVCs;

viii. Evaluate satisfaction of biogas households and carry out assessment on the operation and maintenance aspects of biogas plants;

ix. Suggest solutions to improve quality control system of LCASP;

x. Analyze and summarize the outcome of the identified mistakes in the final report of the provinces;

xi. Prepare final report for project provinces and for the contract as a whole;

xii. Other related tasks assigned by Project's Director.

Biogas experts: (2 national experts, 8 pm – each expert 4 pm)

The proposed candidates will have the following qualifications and experience:

i. Having a university degree related to a field in environment or agriculture environment or agriculture (animal production or veterinary);

ii. Having at least 10 years of experience of biogas and understanding biogas technical drawing and project related areas;

iii. Having experience in conducting quality control, especially on biogas technology and also related fields;

iv. Good experience and skill in writing and communication; synthesizing and presenting information coherently and accurately;

v. Proven ability in report preparation and teamwork;

vi. Proficient in English and computer use.

The tasks will cover

i. Biogas experts are in charge of providing professional inputs to team leader on necessary information relating above tasks, include: way of management of biogas documents, skill of checking file, the sufficient of recorded biogas file; way of solving a problem of technician when receiving information/report from grass root level; the incentive provision/ scheme to farmers, farmers' feedbacks

ii. Participate physical audit trips at least 6 provinces to evaluate the quality of under construction/under installation, completed and operation of SBVCs;

iii. Evaluate satisfaction of biogas households and carry out assessment on the operation and maintenance aspects of biogas plants;

iv. Evaluate the impact of biogas utilization in the household and livestock farms;

v. Analyze and summarize the outcome of the identified mistakes in the final report of visited provinces;

vi. Other related tasks assigned by Team Leader and CPMU.

Environment Experts: (03 nationals, 12 pm – each expert 4 pm)

The proposed candidates will have the following qualifications and experience

i. Having a university degree in a field related to environmental science;

ii. Having at least 10 years of experience in environmental management/ assessment assignments in Viet Nam.

iii. Having experience in Environmental impact assessment or environmental screening, environmental quality control or small-scale technology and supply chains, prefer experience in agricultural waste management or agricultural environment;

iv. Good experience and skill in writing and communication; synthesizing and presenting. Proven ability in report preparation and teamwork, Proficient in English and computer use.

The detailed task will cover

i. Environment experts are in charge of providing professional inputs to team leader on necessary information relating above tasks, especially on compliance to environment package of SBVCs and other related environment issues

ii. Participate physical audit trips to evaluate the quality of under construction and installation, completed and operation of SBVCs

iii. Evaluate satisfaction of biogas households and carry out assessment on the environment package of SBVCs

iv. Identify areas of improvement for environmental packages

v. Suggest solutions to improve environment package of LCASP

vi. Other related tasks assigned by Team Leader

V. Client's input and counterpart personnel

The Client will support the Consultants in the following matters:

(i) Assign project staff to collaborate with and to support the consultants during their implementation of the assignment.

(ii) Allow the consultant to access to necessary technical documents and data related to the project;

(iii) Consultants shall arrange by themselves personal facilities that needed for their work.

VI. Duration

The assignment will be implemented within the period of six months, expected from June to December 2017.

VII. Expected output and deliverables

Four (4) copies of the Inception Report in both English and Vietnamese 2 weeks after mobilization. This report will incorporate:

- The main findings and observations following from the desk study
- Methodologies and surveying planning;
- The draft data collection tools built by consulting firm;
- A detailed work schedule for the survey;
- The proposed outline of content for the final report.

The CPMU shall provide comments and suggestions on the inception report within 7 working days. Based on CPMU comments, consulting firm must complete and submit CPMU before conducting field trip.

The five (5) copies of final reports written in both English and Vietnamese and a CD ROM has the all the files formatted in word and pdf. A folder keeps all original physical audit report and or check list forms that have been used in the field. The draft final report should be provided to CPMU at least 2 weeks before the contract ended. Based on CPMU comments, consulting firm will prepare and complete final report.

VIII. Detailed contact

Low Carbon Agriculture Support Project

Agriculture Project Management Board

8th floor, 16 Thuy Khue, Tay Ho, Hanoi

Annex 2. Checklists at the Provincial Project Management Unit

CHECKLISTS AT THE PROVINCIAL PROJECT MANAGEMENT UNIT

Record No.:……..

No	Contents	Record		Notes/Missing items
		Enough	Not Enough	
I.	**FORM 1. PROPOSAL AND INFORMATION FORM**			
1.	**Application for the construction of biogas plant**			
1.1.	*Information must be filled in the blanks*			
1.2.	*Confirmation of Commune People's Committee*			
1.3.	*Signature of residents*			
2.	**Family information**			
2.1.	*Information must be filled in the blanks*			
2.2.	*Signatures of residents*			
II.	**FORM 2. FINANCIAL AND TECHNICAL ASSISTANCE CONTRACTS**			
1.	*Information must be filled in the blanks*			
2.	*Confirmation of the PMU (Party A)*			

No	Contents	Record		Notes/Missing items
		Enough	**Not Enough**	
3.	*Signatures of residents (party B)*			
4.	*Confirmation of the biogas contractor (party C)*			
5.	*Annex on design*			
III.	**FORM 3. MINUTES OF INSPECTION AND TECHNOLOGY ACCEPTANCE**			
1.	*Information must be filled in the blanks*			
2.	*Signature of technicians (party A)*			
3.	*Signatures of residents (party B)*			
4.	*Confirmation of the biogas contractor (party C)*			
IV.	**DAIRY OF INSPECTION**			
1.	*Full information*			
2.	*Contents*			
3.	*Signature of technicians and residents*			
V.	***CERTIFICATE OF TRAINING***			

Annex 3. Questionnaires/checklists for households

Questionnaire 01: QUESTIONAIRE FOR HOUSEHOLDS THAT ALREADY BUILT BIOGAS PLANTS

LOW CARBON AGRICULTURE SUPPORT PROJECT (LCASP)

BIOGAS VALUE CHAIN PHYSICAL AUDIT

QUESTIONAIRE FOR HOUSEHOLDS THAT ALREADY BUILT BIOGAS PLANTS

PROVINCE	DISTRICT	COMMUNE
VILLAGE	SIGNATURE OF RESPONDENT	SIGNATURE OF EXPERT

PART 1. GENERAL INFORMATION

C1. Full name:……...
Village……Commune……District……..Province…….

C2. Date of Birth: ……

C3. Gender: 1. Male 2. Female

C4. Marital status?
0. Single 3. Divorced
1. Married 4. Widowed
2. Separated

C5. Ethnicity:
1. Kinh 2. Others (specific):……
Ethnicity of wife/husband??
1. Kinh 3. Others (specific):……
2. Single/Separated/Divorced/Widowed

C6. At the time of constructing the biogas plant, what kind of your family did you have (according to the CPC list)?
1. Poor household 4. Good household
2. Near poor household 5. Rich household
3. Average household

C7. Number of family members today? (only people who are living people in households)
1. Total number of people: ..... .In particular:
- Number of men: .... people
- Number of women: ..... people
- Number of children (under 16 years): .... people

C8. Number of animals before building the biogas plant?
1. Pig: ..... head, including sow: ..... .head 3. Others (specific) .... .head

2. Cow/buffalo ....head
C9. Number of animals at the highest point since building the biogas plant? 1. Pig: ..... head, including sow: ..... .head 3. Others (specific) .... .head 2. Cow/buffalo ....head
C10. Number of animals at present? 1. Pig: ..... head, including sow: ..... .head 3. Others (specific) .... .head 2. Cow/buffalo ....head

PART 2. BIOGAS PLANT CONSTRUCTION

C11. When did you know about this program? 1. On day/month/year 2. Do not remember
C12. He/she knows information about this program from whom? 1. Commune officials 2. Agricultural extension staff 3. Neighbors 4. Mass media 5. Mason/Biogas agency 6. Others (specific) ....
C13. Time to sign the application for construction/installation? On day/month/year
C14. Are you guided on how to prepare an application? 1. Yes 2. No If yes, who is the instructor? 1. Technician 2. Mason team 3. Neighbors 4. Others (specific)……
C15. Starting time of works? On day/month/year
C16. Completion time of works? On day/month/year
C17. Type of biogas? 1. KT1 3. Composite: (provided by……..) 2. KT2 4. Others (specific)……
C18. Volume of biogas plant? ……..m^3
C19. Pursuant to choose the volume of biogas plant? 1. The amount of waste to be treated 2. Biogas demand of household 3. Construction/installation costs

4. Volume which is common in the locality 5. Others (specific) ....
C20. The main purpose for building plant? 1. Waste treatment 2. More fuel 3. Others (specific) .....
C21. Who is the consultant for building plant? 1. Technician 2. Enterprise/mason team 3. Local authorities 4. Neighbors, relatives 5. Option 6. Others (specific)……..
C22. From the time of preparation until the biogas plant is accepted, how often did the technician go to your family? 1. …….times 2. Don't remember
C23. Is the family provided technical drawings before the construction works? 1. Yes 2. No
C24. Did the family monitor construction/installation works? 1. Yes 2. No

PART 3. QUALITY OF BIOGAS PLANTS AND SUPPORT OF THE PROJECT

C25. During the construction/installation, are there any incidents? 1. Subsidence 2. Change the location into part in the system 3. Collapse/leaking joints (for composite tanks) 4. Submerged/floating tank (composite) 5. Others (specific) ....
C26. General assessment of the quality of construction/installation of the service provider (mason/composite tank supplier)? 1. Good 2. Normal 3. Not Good

C27. Is the plant damaged?
1. Yes (What items damaged) ……. 2. No **(MOVE TO C32)**

C28. Who is the repairer?
1. Mason/enterprise 2. Technician 3. Self-repairing 4. Others…….

C29. From the plant is damaged, how long does it take to repair?
. …… day

C30. How long does the repair last??
. …… day

C31. How much does the repair cost??
1. ……Thousand dong (specific: Reason for no warranty ……..……)
2. Free

C32. Levels of satisfaction about services after construction/installation? (scoring 1-5 from unsatisfied to very satisfied)
…….point

C33. Total cost of construction (million dong)
…….million dong. ***In particular, the actual amount received from the LCASP project:***
……million dong

C34. Did the family have to borrow money to build the biogas plant?
1. Yes 2. No
If Yes, is this amount borrowed from?
1. From friends
2. From relatives
3. From the bank
4. From other credit sources (specific) ....

C35. Procedures for receiving financial support?
1. Simple 2. Complex 3. Others (specific)……..

C36. Satisfaction levels about support procedures (scoring 1-5 from unsatisfied to very satisfied)
…….point

PART 4. EFFICIENCY OF BIOGAS PLANTS

C37. Before having biogas plants, How is livestock waste of the family collected and treated?
1. Composting (estimate ….%)
2. Decomposition (estimate …….%)
3. Discharge into the garden/field/ pond of the family (estimate ….%)
4. Discharge into the sewer/lake (estimate ….%)
5. Others (specific) .....

C38. When having biogas plants, how is livestock waste of the family collected and treated?
1. Biogas: Rate%: ....
2. Organic compost: Rate%: ....
3. Dry: Rate%: ....

4. Discharge into the environment around the farm: Rate%: ....
5. Discharge into surface water: Rate%: ....

C39. Are you guided how to operate?

1. Yes 2. No

C40. Who is the instructor?

1. Technician
2. Mason/Biogas agency
3. Others (specific) .....

C41. Are you attended the LCASP training courses?

1. Yes

Number of days: ..... day

Training time: ....Date ..... month ..... 201 ...

2. No

C42. Are the materials provided and are you guided how to read?

1. Yes 2. No (Move to C45)

C43. Are Documents easy to understand and easy to apply?

1. Yes 2. No

C44. Do you still keep documents?

1. Yes 2. No

C45. Who participated in the LCASP training?

1. Wife 2. Husband 3. Others (specific)……..

C46. Who is the main operator?

1. Wife 2. Husband 3. Others (specific)……..

C47. What are the main gas appliances of the family?

Gas stove (number ....., capacity……)

1. Lamp (number ....., capacity……)
2. Generator (number ....., capacity……)
3. Others .....

Name: (number ....., capacity……)

C48. Does your family use gas for?

1. For family members
2. For cooking rice bran (number of animals used to cook bran: ....head)
3. For cooking wine (liter/day: ..... liter)
4. For running generator
5. For lighting
6. For boiling water, slaughtering livestock (liter / day: ..... liter)
7. Sharing for neighbors (..... people)
8. Processing noodles, beans (kg/day …..)\

9. Others (specific)……

C49. Is the amount of gas generated?

1. Excess 2. Enough 3. Not Enough

C50. Estimate the amount of gas used each day (cooking, lighting ...)

……% total amount of gas

C51. FOR HOUSEHOLDS HAVE EXCESS GAS, How is excess gas used?

1. For neighbors
2. Burning
3. Discharge into the environment (.....% of total gas)
4. Others (specific) .....

C52. Before building the biogas plant, how long does the family take to clean the livestock pens every day?

……hour/day

C53. After building the biogas plant, how long does the family take to clean the livestock pens every day?

……hour/day

C54. Before building the biogas plant, how long do women and children spend on food preparation and cooking for their family everyday (collecting firewood, fuel for cooking)?

1. Women:……hour/day
2. Children:……hour/day
3. Inappropriate (in the case of no women/children participating in these activities)

C55. After building the biogas plant, how long do women and children spend on food preparation and cooking for their family everyday (collecting firewood, fuel for cooking)?

1. Women:……hour/day
2. Children:……hour/day
3. Inappropriate (in the case of no women/children participating in these activities)

What do they do in their free time?

1. Women:……..
2. Children:……...

C56. How much money does the family spend on buying fuel each month before and after the construction?

1. Before the construction ..... thousand VND / month
2. After the construction ..... thousand VND / month

C57. How is Wastewater of the biogas plant used?

1. For Gardening, estimated .....%
2. For fish, estimated .....%
3. Discharge into the environment: Estimated .....%
4. Others (specific) .....%

C58. How is slurry used? 1. For Gardening, estimated .....% 2. For fish, estimated .....% 3. Discharge into the environment: Estimated .....% 4. Others (specific) .....%
C59. Did Neighbors have any complaints about the livestock of your family? 1. Before the construction 2. After the construction Why (specific)?.....
C60. Level of satisfaction about the environmental package (scoring from 1 - 5 from unsatisfied to very satisfied) .....point
C61. Demand for building biogas plants in the locality in the future? 1. High 2. Low 3. Unknown

THANK YOU!

Questionnaire 02: QUESTIONNAIRE FOR HOUSEHOLDS THAT ARE BUILDING BIOGAS PLANTS

LOW CARBON AGRICULTURE SUPPORT PROJECT (LCASP)

BIOGAS VALUE CHAIN PHYSICAL AUDIT

QUESTIONAIRE FOR HOUSEHOLDS THAT ARE BUILDING BIOGAS PLANTS

PROVINCE	DISTRICT	COMMUNE
VILLAGE	SIGNATURE OF RESPONDENT	SIGNATURE OF EXPERT

PART 1. GENERAL INFORMATION

C1. Full name:……...
Village……Commune……District……..Province……
….

C2. Date of Birth: ……

C3. Gender: 1. Male 2. Female

C4. Marital status?
0. Single 3. Divorced
1. Married 4. Widowed
2. Separated

C5. Ethnicity:
1. Kinh 2. Others (specific):……
Ethnicity of wife/husband??
1. Kinh 3. Others (specific):……
2. Single/Separated/Divorced/Widowed

C6. At the time of constructing the biogas plant, what kind of your family did you have (according to the CPC list in 2016)?
1. 1. Poor household 4. Good household
2. Near poor household 5. Rich household
3. Average household

C7. The number of family members today? (only people who are living people in households)
1. Total number of people: ..... .In particular:
- Number of men: .... people
- Number of women: ..... people
- Number of children (under 16 years): .... people

C8. Number of animals before building the biogas plant?
1. Pig: ..... head, including sow: ..... head 3. Others (specific) .... head

2. Cow/buffalo ....head
C9. At present, how to treat livestock waste? 1. Composting (about…… %) 2. Decomposition (about ….%) 3. Discharge the garden/field/ pond of the family (about…… %) 4. Discharge into the sewer/lake/pond (about…… %) 5. Others (specific) ....
C10. Is the current environment of the family polluted? 1. Air pollution 2. Water pollution 3. No pollution
PART 2. BIOGAS PLANT CONSTRUCTION
C11. When did you know about this program? 1. On day/month/year 2. Do not remember
C12. He/she knows information about this program from whom? 1. Commune officials 2. Agricultural extension staff 3. Neighbors 4. Mass media 5. Mason/Biogas Team 6. Others (specific) ....
C13. Time to sign the application for construction/installation works? On day/month/year
C14. Are you guided on how to prepare an application? 1. Yes 2. No If yes, who is the instructor? 1. Technician 2. Mason team 3. Neighbors 4. Others (specific)……
C15. Starting time of works? On day/month/year
C16. Why did the family choose to sign the construction/installation contract with mason team/enterprise? 1. From neighbors 2. From friends 3. From technicians 4. From mason team 5. From Enterprise 6. From the mass media 7. Others (specific) .....

C17. Are you attended the LCASP training courses?

1. Yes

Number of days: ..... day

Training time: ....Date ..... month ..... 201 ...

2. No

C18. Pursuant to choose the volume of plant?

1. Amount of waste to be treated
2. Household gas demand
3. Construction/installation costs
4. Common volume in locality
5. Others (specific) ....

C19. Purpose of construction?

1. Waste treatment
2. More fuel
3. Others (specific) .....

C20. Is the family provided technical drawings before the construction works?

1. Yes 2. No

C21. Did the family supervise the construction/installation?

1. Yes 2. No

PART 3. PROPOSED USE OF THE BIOGAS PLANT

C22. Does your family plan to use gas for?

1) For family members
2) For cooking rice bran (number of animals used to cook bran: ....head)
3) For cooking wine (liter/day: ..... liter)
4) For running generator
5) For lighting
6) For boiling water, slaughtering livestock (liter / day: ..... liter)
7) Sharing for neighbors (..... people)
8) Processing noodles, beans (kg/day …..)
9) Others

C23. How long does the family take to clean the livestock pens every day?

……..hour/day

C24. How long do women and children spend on food preparation and cooking for their family everyday (collecting firewood, fuel for cooking)?

1. Women:……hour/day 2. Children:……hour/day

C25. How much money does the family spend on buying fuel each month (gas, firewood, coal)?

…… VND thousand/month

C26. How do you plan to use wastewater after biogas?

1. Irrigation
2. For fishes
3. Discharge waste into the sewer
4. Discharge waste into the canal
5. Others (specific)……

C27. If the family is not supported by the project, Will the family build the biogas plant?

1. Yes
2. No

C28. Did the family have to borrow money to build the biogas plant?

1. Yes 2. No

If Yes, is it borrowed from?

1. From friends
2. From relatives
3. From the bank
4. From other credit sources (specific) ....

C29. Did neighbors complain about the livestock waste of the family?

1. Yes
2. No

C30. Is the family reminded about environmental pollution caused by the waste of their own livestock?

1. No
2. Yes

If yes, who is the reminder? (specific)……

C31. Is the family punished for environmental pollution due to livestock waste?

1. No
2. Yes

If yes, what is the form? Punished by? (specific)……

THANK YOU!

Checklist 01: CHECKLIST FOR HOUSEHOLDS THAT ALREADY BUILT

Items	Answer	How to test
1. Code of works	*LCASP……*	Capture the code of each work, compare with the record
2. Location	1. House surroundings 2. Others (specific)……	Actual observation
3. Size of works	……m3	Measure the height of discharge (Hxa) of the works .... cm
4. Design compliance	1. Disinfection Tank or faucets 2. Slurry Tank 3. Waste collection system 4. Gas appliances	Investigator's assessment about sufficiency of all project items. Compare with the record
5. Solid Waste Collection	Investigator's assessment about waste collection system: 1. Is solid waste collected? a/ Yes b/ No 2. Is there solid waste storage? a/ Yes b/ No 3. What is solid waste used for? a/ Decomposition b/ Apply directly to plants c/ Others (specific)	Observation and evaluation
6. Liquid Waste Collection	1. Is all liquid waste released into the biogas plant? a / All b / A part ***(Move to 2)*** 2. What is liquid waste used for if it is not released into the biogas plant? a / For fishes b / Discharge directly to the field c / Others (specific)	Observation and evaluation
7. By-product tank	Size: length ... ..m, width ..... m, depth ....m 1. Is it divided? a / Yes b / No 2. Is there a cover? a / Yes b / No	- Using a ruler - Observation and evaluation
8. Bio-Slurry of the by-product tank	a / Gardening b / For fishes c / Discharge into the environment d/ Others (specific)……	Observation and evaluation

9. Waste water after the by-product tank	a / Irrigation b / For fishes c / Discharge waste into the sewer d / Discharge waste into the canal e / Others (specific)……	Observation and evaluation
10. Disinfection Tank or faucets	1. Disinfection Tank 2. Faucets	Check faucets/Tank are used or not
11. Color of waste water	1. Yellow 2. Light Black 3. Dark Black 4. Fizzy 5. Others (specific)……	Observation and evaluation
12. Neighbor's response about waste of the works	1. Good 2. Not Good 3. Others……..	Direct observation or ask neighbors
13. Equipment for the use of gas	1) Kitchen (number .....) 2) Lamp (Number .....) 3) Generator (capacity .....) 4) Others	It is important to observe and check the gas appliances based on the documentation
14. Purpose of using gas.	1. For cooking in daily life 2. For cooking rice bran 3. For cooking wine 4. For running generator 5. For lighting 6. For boiling water, slaughtering livestock 7. Sharing for neighbors 8. Processing noodles, beans 9. Others (specific)…….	Direct observation
15. Gas leak	1. Yes 2. No 3. Leak position (specific)…….	Observation and feeling

16. Safety valve	1. Yes 2. No	Direct observation
17. In livestock pens	1. Investigator's assessment about livestock pens a / Clean b / Relatively clean c / Dirty. 2. How does the smell in livestock pens? a / No odor b / Less smells c / Much smells 3. Flies and other insects in livestock pens a / Many b / Few c / No	Observation and feeling
18. Around livestock pens	1. Investigator's assessment about livestock pens a / Clean b / Relatively clean c / Dirty. 2. How does the smell in livestock pens? a / No odor b / Less smells c / Much smells 3. Flies and other insects in livestock pens a / Many b / Few c / No	Observation and feeling

THANK YOU!

Checklist 02: CHECKLIST FOR HOUSEHOLDS THAT ARE BUILDING BIOGAS PLANTS

Items	Answer	How to test
1. Location of works	1. House surrounding 2. Others (specific)……	Direct observation
2. Ground	1. Hard 2. Soft	Use a shovel for digging
3. Size of works	……m3	Measure the digester's diameter and calculate the volume
4. Type of works	1. KT1 2. KT2 3. Composite	Direct observation
5. Check the record	1. Three-party contract 2. Technical drawings	Review the record of the owner of construction
6. Waste treatment?	1. Composting 2. Decomposition 3. Discharge the garden/field/ pond of the family 4. Discharge sewer 5. Discharge the lake 6. Others (specific)	Direct observation
7. Observe livestock pens	1. Investigator's assessment about livestock pens a / Clean b / Relatively clean c / Dirty. 2. How does the smell in livestock pens? a / No odor b / Less smells c / Much smells 3. Flies and other insects in livestock pens a / Many b / Few c / No	Observation and feeling
8. Observe livestock areas	1. Investigator's assessment about livestock pens a / Clean b / Relatively clean c / Dirty. 2. How does the smell in livestock pens? a / No odor b / Less smells c / Much smells 3. Flies and other insects in livestock	Observation and feeling

	pens a / Many b / Few c / No	
9. Neighbor's response about waste of the works.	1. Good 2. Not Good 3. Others……..	Direct observation or ask neighbors

THANK YOU!

Annex 4. Outline for In-depth interview

IN-DEPTH INTERVIEW GUIDANCE FOR

PROVINCIAL PROJECT MANAGEMENT UNIT

I. General Information

1. Full name
2. Address
3. Position in PMU

II. Livestock status and disposal of animal waste in the locality

1. Number of livestock households in 2016
2. Scale of livestock and Livestock mode?
3. Common livestock?
4. Current status of livestock waste disposal in the locality
5. Number of biogas plants that were built, which plants are supported by the LCAP?

III. Assessment of the implementation of the LCASP in the locality

1. Overview of the implementation status of the project's components in the locality? Advantages and disadvantages in implementing the project?
2. Implementation of the project: Process for residents' participation; process of monitoring and evaluating the quality and effectiveness of the project; Record keeping process, database
3. Evaluation of the Provincial PMU on quality of works;
4. Number of enterprises, mason teams on biogas in the province? Evaluation of the supply capacity, quality, warranty and maintenance issues of enterprises, mason teams involved in the project?
5. General assessment of the suitability of the scale of livestock with the volume of plants built? Is the status that the scale of livestock is larger than the volume of plants built common or not? If so, How to handle this issue?
6. Assessment of awareness and behavior of people on construction and operation of biogas works? What is the difference between the knowledge and skills of people equipped/trained with actual operation? Do people use biogas by-products for organic fertilizer?
7. Assessment of the implementation of credit support of the project? What are the difficulties and obstacles to the implementation of credit support?
8. Overview of the project's socio-economic and environmental impacts on localities, households and localities? Construction/installation needs?
9. Is Biogas the only solution and the best solution to handle animal waste or not? According to you, Are there any better solutions?
10. Recommendations of the local PMU to implement the project in the future

IN-DEPTH INTERVIEW GUIDANCE FOR TECHNICIANS

1. GENERAL INFORMATION

- Full name
- Address, Tel, email

2. Information on project activities

- Overview of the implementation of the project in the locality
- Number of enterprises and mason teams in providing biogas service in the area. What is the quality of service provided by these teams and enterprises?
- Businesses and mason teams under the management of the LCASP. How does the quality of service provided by these teams and enterprises compared to other units outside the project?

3. Training process of technicians

- When did the technician join the project? Why did the technician join?
- Did the project technician have any training courses? Who is responsible for the training of the technician?
- How many courses are the technician participated? What are the courses? When did the training take place? Duration? Who? Which units?
- What are the contents of the training courses? (Management skills, teaching skills, skills of examination and evaluation of works, construction techniques, operation of biogas works)
- What is the application of this knowledge to the actual implementation of the project?

4. Assignment of the technician

- Did the technician participate in the management of mason teams and enterprises in the construction and installation of biogas plants? How did they manage?
- Did the technician participate in the assessment of the works? How does the process take place?
- Did the technicians participate in training for mason teams and enterprises in construction/installation as well as operation of biogas plants? How does the application of this knowledge in direct instruction to residents?
- Did the technician participate in training courses for people on using biogas works? What is their role?
- What is the technician's response when received feedbacks?
- In the process of participating in the project, Is the technician mobilized to support other localities under the LCASP?
- When a mason team or enterprise from other localities is mobilized to support their localities, how will the technician manage them? Are there any adjustments during implementation process? How to solve these problems?

5. Qualification and knowledge of the technician

- What is the overloaded biogas plant?
- How to discharge excess gas?

- How to discharge wastewater after biogas?
- What is the role of the by-product tank?
- Safe operation of biogas equipment and plants
- Notes on repairing biogas plants
- The technician will advise people to build biogas plant according to scale of livestock or demand for gas
- Does the technician have an understanding of LCASP's technical and financial support procedures?
- How many biogas plants have been consulted and accepted by the technician?
- Is Biogas the only solution and the best solution to handle animal waste or not? According to you, Are there any better solutions?

IN-DEPTH INTERVIEW GUIDANCE FOR REPRESENTATIVE OF THE LOCAL AUTHORITIES

I. General Information

1. Full name
2. Address
3. Position

II. Status of animal husbandry and waste treatment in the locality

1. Number of livestock households in 2016/2017
2. Scale of livestock and Livestock mode?
3. Common livestock?
4. Status of waste treatment in the locality
   - What are the common methods of livestock waste treatment in the locality today?
   - What are the environmental impacts of these livestock waste treatment methods?
   - Assessment of people's awareness and concern level in environmental issues, livestock waste treatment and management.
5. Number of plants which were built, which plant are supported by the LCASP?

III. Implementation Status and Impact of the LCASP

1. When the LCASP officially was launched in the locality?
2. Preliminary description of the activities that have been implemented in the locality?
3. Assess the process of selecting applications for biogas plant construction support of LCASP?
   - What are the conditions for households to receive biogas plant construction support? How were the project information dissemination and selection process for eligible households to receive project support?
   - How is the participation of local authorities in this process?
   - Please assess the transparency in the selection process of households to receive project support??
4. Assess the quality of LCASP's biogas plant:
   - Quality of biogas plants
   - Quality of construction/installation of the mason team/provider
   - Assess M&E of project staff, technician
   - Assess the warranty work of the mason teams/enterprises for the biogas plants
   - Assess the response of project technicians, mason team/enterprises when there are problems with biogas plants.
   - Role and involvement of local authorities in quality management?
5. Evaluate the training activities for biogas users after completion of construction works

- How many training courses have been provided?
- Number and level of participation of people in each training course? Are training participants included in their project operations?

- Assessment of material supply (material delivery, guidance on how to read), comprehension of documents (level of understanding of the document contents)?

6. Assessment of financial support:

- Are there any other projects in the locality? Does a household receive support from two different sources (including the support from the LCASP)?
- Is the financial support from the LCASP fast? Are there any difficulties for people in the process of receiving support?
- Role of local authorities in financial support

7. Assess the environmental efficiency of biogas plants supported by the LCASP project:

- Evaluate the level of use of the items of the environmental package.
- Evaluate overloading in biogas plants. When this phenomenon occurs, how do people handle?
- How is gas used in households? How do they handle that excess gas?
- What are the by-products after biogas (sludge, wastewater) treated?
- General assessment of the local environment before and after the project
- Role and involvement of local authorities in environmental protection and processing in the locality.

8. Assess the economic efficiency of biogas plants supported by the LCASP?
9. Assess changes in livestock waste management of residents before and after building the biogas plant
10. Biogas plant demand of people in the coming time

IN-DEPTH INTERVIEW GUIDANCE FOR REPRESENTATIVES OF ENTERPRISES

I. General Information

1. Full name
2. Address
3. Tel

II. General Information about enterprise

1. Enterprise name
2. Address/Tel/fax/website/email
3. Type of business
4. Does your enterprise have any branches outside this province/city?

III. Construction status of biogas plants supported by the LCASP

1. When did the construction activities of biogas plants start in the locality? What are the features of pioneer households in the construction of biogas plants? (Features related to livestock activities (scale of livestock, types of livestock, methods,); household economic conditions; types of biogas plants that they have chosen...)
2. Assessment of local biogas service providers?
3. What are the advantages / disadvantages of your enterprise in providing biogas products/services?
4. Level of community response and concern in the implementation of project activities (especially the construction of biogas plants))
5. Process of selecting local biogas service providers of LCASP?
6. Level of completion (quality, timeline of the biogas service implementation) compared to the requirements??
7. What is the warranty/maintenance/repair of the service provided by the enterprise?
8. The response of residents about the biogas plant provided by the enterprise. How to handle the negative feedback of the business.
9. Assess the role (participation, understanding) of locals in monitoring and supervising the installation of biogas plants supported by the LCASP?
10. What are the differences between the biogas plants supported by the project and those which are not? (i.e. cost, technique, quality, longevity, warranty, maintenance, environmental impacts)

IV. Assess the impacts/effects of biogas plants supported by the Low Carbon Agriculture Support Project?

1. Assess the impacts/effects (i.e. on environment, local economic development, household economy development, changing the perceptions of people, etc.) of biogas plants for the locality and households.

2. Assess the benefits and disadvantages of local biogas plant construction. The suitability and incompatibility of the construction and usage of biogas plants for local production characteristics.

V. Level of enterprises' understanding about environmental management

- Understanding the Overloaded plants and impact
- Understanding excess gas and impact
- Impact of bio-slurry on the environment
- Role of by-product tank

VI. Assess the needs of the enterprise in implementing support activities of LCASP

1. Please indicate some advantages and disadvantages of your enterprise in providing Biogas service value chain?
2. Needs of enterprise in implementing support activities of LCASP?

IN-DEPTH INTERVIEW GUIDANCE FOR MASON TEAM

(Masons have participated in the construction of biogas plants supported by the LCASP)

I. General Information:

1. Full name:
2. Address:
3. Tel

II. Status of construction of biogas plants supported by the Low Carbon Agriculture Support Project

1. Please provide information about yourself and mason team of the LCASP?

- Where are you from? (Local people or people from other places)
- When did you join the mason team? Reason?
- What are criteria for the LCASP mason team?
- The current number of mason team? How does the level of membership change for the mason team? The reason for the change of the member?
- Do you participate in LCASP training courses related to the installation, operation and maintenance of biogas plants? If yes, please provide time, duration (number of days), contents, venue?

2. Activities of the LCASP mason team

- How is the process of construction and installation of biogas plants supported by the LCASP?
- How does the implementation of consultancy for households on biogas plant construction work? (time and contents)?
- What are your tasks?
- Level of completion of work requirements? (quality, deadline to complete installation, etc)
- In addition to the biogas plant, what are some enclosed items? Mandatory installation of enclosed items? Proportion of people installing the enclosed items?
- How is the quality of biogas plants tested? (who/time/what)
- What are the common technical errors when installing biogas plants? How often do technical errors occur? How are these errors solved?
- How are the maintenance and warranty of biogas plants conducted?? Namely:
- Assess the role (involvement, understanding) of residents in verifying and supervising the installation of biogas plants supported by the LCASP??

3. In addition to construction activities, what other activities does the mason team support residents? (Training on the operation and maintenance of biogas plant, etc)

4. Evaluation of mason team from other provinces (if any)?

- Qualification, installation techniques?
- Level of response according to LCASP process?

- Supervision of local technicians managing the installation?
- Warranty/maintenance issues, issues arising/technical errors/failures?

5. What is the difference between biogas plants supported by the project and biogas plants which are not supported by the project? (cost, technology, quality, support).

6. What are general assessment about the level of satisfaction of people with biogas plants which are built?

III. Assess the impacts/effects of biogas plants supported by the Low Carbon Agriculture Support Project?

1. Assess the impacts/effects (i.e. on environment, local economic development, household economy development, changing the perceptions of people, etc.) of biogas plants for the locality and households.

2. Assess the benefits and disadvantages of local biogas plant construction. The suitability and incompatibility of the construction and usage of biogas plants for local production characteristics.

IV. Level of understanding about the environmental management of the mason team

- Understanding the Overloaded plants
- Understanding excess gas
- Impact of bio-slurry on the environment?
- Role of by-product tank

V. Needs of masons during the implementation of the LCASP's support?

1. Please indicate some advantages and disadvantages of the mason team during the implementation of the LCASP's support activities?

2. Needs of mason team in the implementation of the LCASP's support activities?

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Biogas's contribution to the impact indicators and outputs of the project

Impact 1. Livestock wastewater pouring into water sources is reduced by at least 50%.

Impact 2. GHG emission reduction is equivalent to about 0.2 tons of CO2 per year per cubic meter volume of biogas plants.

Output 1. At least 70% of bio-slurry are converted into organic fertilizer.

Output 2. At least 80% of energy produced from biogas plants are used.

Output 3. Daily workload of women and children decreases by an average of 1.8 to 2 hours.}

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ANNEX

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