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Low Carbon Agricultural Support Project (LCASP)
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Contract No. 12112015/HDTV01-LCASP

INCEPTION REPORT

Hanoi, 18 May 2016

Prepared for
Central Project Management Unit
Ministry of Agriculture and Rural Development
by
Agrifood Consulting International

Agrifood Consulting International

in association with

Asia Development Consultants Joint Stock Company (ADConsult)

PREFACE

This document[1] is the Inception Report for the assignment Technical Assistance for Project Implementation Management *Low Carbon Agricultural Support Project (LCASP) s*upported by Asian Development Bank (ADB) and the Government of Vietnam through Ministry of Agriculture and Rural Development of Vietnam (MARD*)*, contract No. 12112015/HDTV01-LCASP. The report has been prepared under the guidance of the Central Project Management Unit (CPMU) of the Agriculture Project Management Board (APMB) of MARD. The Consultant's Team would like to thank the guidance of Mr. Nguyen The Hinh, Project Director. The Consultant Team is grateful to the numerous persons met in Institutes, Organizations under MARD, Project Partners and 10 project provinces for sharing their ideas and generously giving their time. The views in the report are those of the Consultant's Team and do not necessarily reflect the views of MARD.

[1] To be referred to as ACI 2016, Inception Report. Technical Assistance for Project Implementation Management *Low Carbon Agricultural Support Project (LCASP),* Agrifood Consulting International and ADConsult, Hanoi 2016

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ABBREVIATIONS

ADB	Asian Development Bank
ADF	Asian Development Fund
AFS	Audited Financial Statements
AP	Affected people
APMB	Agricultural Projects Management Board
BVCM	Biogas Value Chain Management
CEA	Committee for Ethnic Affairs
CPMU	Central Project Management Unit
CQS	Consultant Qualification Selection
CSAP	Climate Smart Agriculture Practices
CSB	Commune Supervision Board
CSAWMP	Climate Smart Agricultural Waste Management Practices
DARD	Department of Agriculture and Rural Development
DLP	Department of Livestock Production
DMF	Design and Monitoring Framework
DONRE	Department of Natural Resources and the Environment
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
EGM	Effective Gender Mainstreaming
EIA	Environmental Impact Assessment
EMDP	Ethnic Minority Development Plan
EMP	Environmental Management Plan
ESMS	Environmental and Social Management System
GACAP	Governance and Anti-corruption Action Plan
GAP	Gender Action Plan
GDP	Gross Domestic Product
GHG	Green House Gas
IA	Imprest Account
IARS	Imprest Account Reconciliation Statement
ICB	International Competitive Bidding
IEE	Initial Environmental Examination
IPPF	Indigenous People Planning Framework
LIBOR	London Interbank Offered Rate
LBP	Large Biogas Plant
MARD	Ministry of Agriculture and Rural Development
MBP	Medium-sized Biogas Plant
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and Environment
NBP	National Biogas Programme (I & II)
NCB	National Competitive Bidding
NGOs	Non-Governmental Organizations
PAM	Project Administration Manual
PIM	Project Implementation Management
PIU	Project Implementation Unit
QSEAP	Quality & Safety Enhancement of Agricultural Products (project)
RRP	Report and Recommendation of the President to the Board
PPMU	Provincial Project Management Unit
SBD	Standard Bidding Documents

SBP	Small Biogas Plant
SOE	Statement of Expenditure
TSU	Technical Support Unit

SUMMARY

1. LCASP Background

The Low Carbon Agricultural Support Project (LCASP) is loan-sponsored by the Asian Development Bank (ADB) and executed by the Ministry of Agriculture and Rural Development (MARD) running from 2013 to 2018 with a closing date of 30th June 2019. There are 10 direct beneficiary provinces: Bac Giang, Ben Tre, Binh Dinh, Ha Tinh, Lao Cai, Nam Dinh, Phu Tho, Soc Trang, Son La and Tien Giang. The total budget is$84 million, including $74 million from ADB, $3.7 million from the Government of Viet Nam and $6.3 million from financial intermediaries.

The Project is expected to increase the uptake of climate smart agriculture waste management practices (CSAWMP) as measured by the increased use of clean biogas energy and organic bio-slurry fertilizers.

The Project has four components:

i. Expanded use of livestock waste management infrastructure
ii. Credit lines for biogas value chains
iii. Enhanced CSAWMP technology transfer
iv. Effective project management

The Design and Monitoring Framework (DMF) of the Project indicated that by 2018 (from baselines in 2013) the envisaged outcomes in the project areas include:

- At least 70% bio-slurry is converted to organic fertilizers;
- At least 80% energy produced by Biogas Value Chains (BVCs) is utilized;
- Daily workload of women and children is reduced by 1.8–2 hours, on average.

2. Comments on the Project Design

A number of design issues has contributed to slower output production and reduced disbursement rates compared to target. Specifically:

- Component 1. It seems that the scope for the development and sale of medium and large biogas plant is commercially constrained due to market imperfections most notably in the use and sale of biogas energy, which cannot compete with State produced electricity - the Vietnam Electricity Company-EVN-will pay no more than USD 4.5 cents per Kilo Watt Hour, which is less than biogas production costs. Equipment reliability issues e.g. buildup of sulphur due to low quality filters affecting generator efficiency) are another factor affecting the production of biogas fuel. A range of technical and economically viable options are being assessed by the LIC team – with a view to producing organic fertilizer as well as more community based energy sale options are being prepared assessed by the LIC team to determine whether they are technically and economically viable to overcome these constraints.
- Component 2 covering credit was delayed by approximately one year. The credit products are commonly agreed to be unduly 'narrow' and the financial institutions have displayed limited flexibility in adapting to circumstances and coming up with an alternative and more customer relevant product. Collateral requirements are considered unduly onerous and are often not prepared to submit their "red book' or land title against a relatively small loan. Based upon evidence from the Quality and Safety Enhancement of Agricultural Products (QSEAP), it is acknowledged by all concerned, including the ADB, that the demand for credit was overestimated.

- Component 3. Progress in implementing component 3 has been significantly delayed by the failure to prepare a research strategy during design stage; this was further exacerbated by the lack of an implementation plan in the Project Administration Manual.

3. Situation/Problem Analysis

The agricultural waste situation in the 10 project provinces is considered to be generally reflective of the whole country situation. The purpose of LCASP is not just to provide solutions for the 10 provinces but also to identify approaches – by demonstration or through research that will enable the eventual scaling up of successful practices to the whole country

Problems in waste treatment

- At present, Vietnam has a total of 7.9 million livestock farming households, 4.1 million of which are engaged in pig farming as well as 8,300 livestock farms/enterprises (with a turnover of more than 1 billion VND per year, equal to 50,000USD). In 2014, there was total of 26.3 million heads of pig, 2.52 million buffalo, 5.55 million cattle (255 thousand dairy cows) and 328 million poultry - which produced over 83 million tons of livestock manure, 54 million m^3 of urine and more than 1 billion m^3 waste water from animal washing and cleaning .
- Until now, 25.6% of the farms and 37.3% of households have yet to apply any form of waste treatment solution and discharge directly into the environment. In cultivation, 45.9% of the waste is being burnt, causing both air pollution and loss of a considerable volume of nutrients, especially nitrogen, phosphate, and sulphur; whilst in aquaculture, millions of tons of bio-slurry, especially from the catfish farming ponds, is untreated and not reused. Furthermore, the rate of dry matter in waste (especially on pig farms) is very low (2.8 – 3.0%) causing difficulties in the separation process.
- Meanwhile, the quantity of biogas plants is in the region of 500,000 family scale and 1,000 are medium and large size. This is some way off the national target of 2 million SBPs, 21 thousand MBPs and LBPs by 2020. As such, a considerable amount of livestock waste cannot be treated by biogas systems alone.

4. LIC Team Establishment, TORs and Resource Configuration and Staffing Issues

The recruitment of the LIC Team was delayed by approximately one year. The contract between the CPMU and the contractors commenced in late November 2015, when the LIC office was established and four key consultants mobilized. Towards the end of December the majority of the national team were on board including 9 of the 10 provincial co-coordinators. The team leader was mobilized on 1st February 2015.

With respect to the TORs (see Appendix A), they are clearly set out and there are no particular issues as to the requirements. In the main, the individual team members have the skills and capabilities to execute the content requirements of the TORs.

However, it must be noted that reducing the contract period from four to three years (compared to bidding stage) and cutting key Biogas Value Chain (BVC) and CSAWMP expertise by the same amount – when expected outputs remained the same - makes it a challenge to complete project outputs in timely and thorough way. In light of this and the heavy (and additional to the TORs)l workload required of the Biogas Value Chain specialist and Deputy Team Leader (DTL) we shall be recommending a reconfiguration of LIC resources – as noted further below.

In view of the intensive work being undertaken for component three and the need to pick up disbursement speed – as elaborated upon in the report – we believe there is a need to use proportionately more of the

LIC provincial coordinator time in year one (i.e.2016) than in 2017 and 2018. It was originally envisaged that the coordinators would generally spend their 18 months working on a 50% or half-time basis each month through the project period of 36 months.

Approach and Methodology

The intensity of the workload over the past three months and the project being behind schedule has obliged the LIC Team to take adaptive and pragmatic approach to implementing the TORs.

Circumstances have inevitably placed pressure upon the LIC Team to pursue an output driven approach; rather than our preferred one, which is process based with a view to building capacity at the provincial level. As such, we have been obliged to take a more pragmatic approach that both takes account the imperatives of output delivery whilst seeking to systematically build provincial capacity through guideline, knowledge transfer and 'on the job' training approaches.

When the LIC team commenced work in December it was agreed with the CPMU that our focus would be upon:

- Support the development and efficient use of medium and large scale biogas plants, and report upon the assessment of medium scale biogas technologies being implemented in Vietnam and potential opportunities for LCASP;
- Support the development and implementation of pilot/demonstration proposals on BVC and CASWMP;
- Support effective project management at all levels.

Overall Principles

Participatory Approach

Allowing for time constraints and the need to expedite output delivery the LICs will nevertheless seek to apply a participatory and strongly consultative operational methodology. A 'bottom up' approach is also considered a priority of the ADB, which the LIC team strongly endorses.

Establishment of Procedural Guidelines

The central LIC team have provided the methodological and research framework to enable the provincial co-coordinators to guide and, in part, train up provincial PMU colleagues.

A guideline procedural basis has been established from consultation and identification through to the establishment of feasibility based criteria covering key needs, market demand, technical and economic viability of the proposed projects to the point where they reach tender and bidding stage.

5. Project Performance

Table 1 Overview of Disbursement Performance (as of April 2016)

STT	Main Outputs	Budget ($)	Committed Disbursed ($)	Disbursed as Percentage of Budget	Variation between Budget and Disbursement ($)	Percentage of Project Time since beginning of Project
1	Expanded use of livestock waste management infrastructure	12,549,849	4,982,824	39.70	7,567,025	50%
2	Credit lines for biogas value chains	32,100,000	3,630,000	11.31	28,470,000	50%
3	Enhanced CSAWMP technology transfer	12,008,478	594,720	4.95	11,413,758	50%
4	Effective project management	7,865,676	5079786	64.58	2,785,890	50%
5	**Total (1+2+3+4)**	64,524,003	14,287,330	22.14	50,236,673	
6	Interest rate	2,410,000		-		
	Total (5+6)	**66,934,003**				

OUTPUT 1: Expanded Use of Livestock Waste Management Infrastructure

The objective of the project is to construct and support a total of 36,000 small scale plants. As of 30/04/2016, the construction of a total of 31,713 (88%) has been carried out whilst 24,909 have received their financial incentive payment of VND 3 million from the project. This compares to an SBP construction cost for a typical 10 m³ SBP of VND 15 million, effectively representing a 20% government contribution to this *generally* household based investment.

Although the design technology has been in place for sometime (particularly through the SNV/Netherlands support National Biogas Programme) a number of operational and performance issues have been raised by the LIC specialists:

- As yet there are no effective solutions to the use of by-products (bio-slurry) ;
- The capacity of small biogas plants (SBPs) is often fixed by design according to locality, whilst the size of livestock farming has tended to expand beyond planned design capacity. . The evidence from other projects is that where bio-digester capacity is too low, much of scum and sludge will be discharged untreated into the environment.
- The surplus biogas from most of the MBPs and LBPs is often emitted without flaring - resulting in avoidable and unnecessary increase of greenhouse gas emissions.

Based upon CPMU estimates, the scope for constructing medium and large scale plants is still quite high, totaling 8,300 animal farms (Quoted from ADB Aide Memoire, August 2015). However, this may be constrained by a number of economic and market related factors which constrain the on-sale to the national grid of biogas fuel. The reliability of generator and sulphur hydro removing equipment available in the market is a related concern. For medium and large plant, outside of HDPE (High Density Polyethylene) covered lagoon, suitable technologies have not been identified – which is something the LIC team are in the process of addressing.

In order to ensure the quality of SBP construction, CPMU and PPMUs have inherited technicians and masons from the previous projects (SNV, QSEAP, etc.). CPMU has organized 12 technician training courses for 626 participants for 10 PPMUs. PPMUs have then provided 14 technician training courses for 459 participants. All PPMUs but Nam Dinh have provided 14 training courses for 531 masons (There are currently 321 masons working in the Project). CPMU – HDPE contractors. (Please refer to Appendix J for consolidated figures

100% SBPs have been checked and monitored by a technician before acceptance. Moreover, CPMU and PPMUs carry out random check of over 5% SBPs constructed in the previous year:

STT	Province	Number of constructed SBPs from the beginning of the Project until end of 2014	Number of checked SBPs in 2015*	Rate (%)
1	Nam Dinh	1,147	170	14.8
2	Phu Tho	1,500	980	65.3
3	Ben Tre	1,000	50	5.0
4	Ha Tinh	1,686	69	4.1
5	Tien Giang	469	45	9.6
6	Binh Dinh	2,021	80	4.0
7	Soc Trang	600	69	11.5
8	Bac Giang	2,272	379	16.7
9	Son La	424	86	20.3
10	Lao Cai	645	173	26.8
	Total	**11,764**	**2101**	**17.9**

*Figures are based on a lag period of up to one year as PPMU's variously determine when to carry out quality spot checks in the year following construction.

OUTPUT 2: Credit Lines for Biogas Value Chains

The financial institutions of the project include: Vietnam Bank for Agriculture and Rural Development and Central People's Credit Fund (Coop-bank). The low disbursement has been recorded: To date, only 4.961 billion VND has been disbursed for 182 biogas plants.

Performance of this component has been a major concern and a credit consultant is currently undertaking a substantive survey and evaluation in an attempt to determine the reason for slow disbursement and propose solution in terms of bank lending products and support to borrowers for biogas credit.

OUTPUT 3: Transfer of Technology for Enhanced CSAWMP

In the detailed plan of the project, only the BVC related activities came within the PAM. Technologies and solutions for other agricultural waste source management were not incorporated such that a research strategy had to be prepared (a 'living document') in order to

- Elaborate research strategy: including identifying the gaps related to the need for the comprehensive management of waste in both animal husbandry and cultivation sectors and associated solutions at all levels.
- Design of demonstrations to support the technical, business and environmental models which are seen as being capable of replication (in the province and more widely later).
- Identification of effective technologies in the management of bio slurry source, processing of organic fertilizer, and use of biogas and effective utilization of the agricultural by-product sources in the cultivation and aquaculture.

Implementation arrangements for component three have been subject to serious delay and urgent attention is being given to making up for lost time. In March 2015, a long list of 77 research topics was identified for potential application at the provincial level. This was refined by the Department of Science and Technology (DSTE) down to 23 pilots, all but one of which came from MARD Institutes. In conjunction with a first draft Research Strategy, these were submitted to ADB in August. However, an ADB appointed consultant raised concerns as to the limited engagement with the provinces in the consultation process and that the MARD Institutes were ineligible to implement under ADB procurement guidelines.

The LIC became intensively involved in February, a guideline procedure was put in place that covered for an appropriate 'bottom up' consultation process for the identification and selection of both research topics as well as biogas related demonstration projects. The process through to procurement and implementation of the research topics is still under discussion. At this stage, the LIC has supported the CPMU in the preparation of 6 research packages. A plan of action for each stage of the project cycle has been issued to the ADB and is contained in chapter 4 on implementation arrangements. An updated research procurement plan has been submitted to ADB for comment on a no-objection basis.

For the demonstration projects a guideline procedures document covering the entire project cycle through to procurement and implementation was submitted to the ADB on 25th March and is currently under consideration. If acceptable, revised and recommended consultation procedures will be immediately implemented for a selection of the listed 32 selection demonstration sub-projects.

In the first instance the CPMU will seek to move expeditiously to TOR preparation and bidding for 'model' sub-projects in Nam Dinh and Binh Dinh for which feasibility studies have been prepared. Based upon lessons learned the remaining proposals will be prepared, one per province (with technical and training support from the LIC). It is envisaged that the provincial PMUs will then have the capacity to work up other proposals accepted for their province. For convenience, the 32 provisionally selected demonstration projects have been grouped into six categories for which an in-depth technical, economic and environmental dossier has been prepared.

OUTPUT 4: Effective Project Management

LCASP has been under implementation for 3 years with a CPMU based in Hanoi and 10 PPMUs based in provinces. A Provincial Implementation Manual has been prepared and is updated on a yearly basis for the guidance of province activities. Consulting packages: (1) Package 1: Project Management Consulting Services (LIC): is signed with ACI in association with ADConsult in late November, 2015; (2) Package 3: Baseline Survey: technical proposal is under evaluation by APMB (3) Package 4: Project Auditing: is under implementation.

The LIC National M&E Specialist has provided extensive guidance to the CPMU on reporting requirements (and associated templates) and building the M&E system at both the central and provincial level. This has included TOT type training for provincial co-coordinators and on-the-job training for PPMU staff in a number of provinces (Binh Dinh, Nam Dinh and Bac Giang). An initial assessment of the National Biogas Database has been conducted in conjunction with the National Information Technology and Communications specialist. Work on carbon credits and associated monitoring data requirements has recently commenced.

6. Conclusions and Recommendation

LIC Staffing mobilization

The present staffing configuration is already stretched and this is likely to increase in the coming months when a substantive number of demonstration sub-projects will be processed, primarily at the province level.

i. In view of this we believe there is a need to allocate more time in the first half of the assignment to provincial coordinator mobilization. We are therefore recommending that their current half-time (50%) assignments are reallocated to allow for 9 months in year one, 5 months in year two and 4 months in the last year of the project.
ii. With a view to balancing out the workload of individual national consultants we recommend that the DTL position be reallocated to the current National CSAWMP specialist.

Near term project tasks

iii. With respect to the overall Design and Monitoring Framework (DMF) and preparation for the MTR, the CPMU, with support from LIC should consider reviewing all output performance targets and indicators with a view to proposing relevant revisions for the remainder of the project.
iv. Once research and demonstration packages have been approved by the MARD and ADB, the LIC will seek to provide intensive support to the CPMU and PPMUs to update their detailed implementation plans for each package accordingly.
v. Taking into account training needs (as part of the training and extension specialist's TORs), the LIC will assist the CPMU/PPMUs prepare a Training Master Plan in accordance with the DMF output performance targets and indicators.
vi. Making the implementation plan for Gender Action Plan
vii. Prepare semi-annual Environmental Monitoring Reports

Project Design and Budget Reallocation

viii. For the project itself it seems clear that the budget and targets for component 2 were unduly ambitious and cannot be met. By the same token the targets for small biogas compared to potential demand appear to be understated, particularly as over 80% of the target of 36,000 has already been met by the project.

ix. Notwithstanding product design (and diversification) and quality control issues to be resolved, there is scope to transfer a proportion of the funds from component 2 so as to increase the number of small biogas plants.

x. At present it is arguable that there is too much reliance on a 'one size fits all' approach to local household scale biogas design capacity, where the size is generally fixed in any given location i.e. standard size (between 6 and 10 m^3) when a range of models/capacities might be offered. Where the composite construction method is used there is a tendency – apparently due to the relatively high cost of production – to produce one standard size of molding for the immediate locality, rather than a selection of them.

xi. Furthermore, it would seem there is scope for a more integrated approach to biogas design, credit and farm size – from a business development perspective. Based upon estimates/predictions of growth of livestock numbers, small biogas plant could be designed with capacities to more accurately reflect waste throughput. In the context of an overall HH/farm business plan, banks could additionally allow for credit going beyond bio-digesters and allowing for related farm infrastructure and purchase of animal stock.

Biogas Value Chain and Agricultural Waste Management

xii. From a technological (and business) perspective, technologically scaling up to large biogas represents a major challenge compared to small (≤50 m^3) rural household level units, serving mainly cooking purposes. Therefore, the success of scaling-up to large scale biogas crucially depends on technological diversification and innovation. The BVC and Biogas Technology specialist are therefore looking at a range of possible design (and commercial) solutions to address these issues.

1 INTRODUCTION

1.1 Organization of the Report

This chapter covers a description of the project – its objectives and main outputs, institutional arrangements for implementation and the role of supporting entities. The role of LIC team, contracting, office establishment and team mobilization is described and includes a summary of our contractual obligations. A short commentary on the TORs, project timeframe leads into an explanation of our approach and methodology and human resource configuration. At this point scheduling issues are raised in the context of the reduced timeframe for the LIC contract i.e. from four years a bidding stage to three years at contract negotiation (and a reduction in key specialist input work-months).

In chapter 2 we seek to set the scene by providing an overall sector and sub-sector status review for LCASP related activities, particularly as they affect the biogas technology/biogas value chain and agricultural waste sectors. Credit is touched upon but not in-depth since we are awaiting the outcome of an in-depth study on the credit program currently in process.

Chapter 3 looks at project progress for each of the main components and the LIC contribution made over the past three months since the core consultant team was mobilized (including the team leader, delayed until 1st February). Here there is a strong focus upon the component 3 and component 1 respectively and our contribution to the preparation of 32 sub-project identification stage proposals for biogas related demonstration projects and 19 research topics to test different approaches for agricultural waste treatment.

Chapter 4: Based upon our work experiences to date and in conjunction with the CPMU workplans are providing per key central consultant until the end of the project as well as the next year (incorporating the next quarter) and the same generically for the provincial co-coordinators whose workload will be fairly similar.

This is followed by a chapter of our overall conclusions and recommendations. This places emphasis upon the capacity building at the provincial level in the application of working procedures and guidelines and the use of LIC specialist training methods expertise.

1.2 Project Development Objective and Main Project Outputs

1.2.1 Overall Objective and Purpose

The Project objective is to increase the uptake of climate smart agriculture waste management practices (CSAWMP) as measured by the increased use of clean biogas energy and organic bio-slurry fertilizers. The purposes include:

i. Improve management of livestock waste, bio-slurry; reducing environmental pollution; creating clean energy; bio-organic fertilizer; generating incomes from Clean Development Mechanism (CDM).
ii. Increasing the application of CSAWMPs that are effectively certified; greater use of renewable energy and bio-fertilizer from agricultural waste; replicating models in order to reduce greenhouse gas emissions, and improving the livelihoods and quality of life of rural people.
iii. Capacity building of stakeholders and disseminating knowledge and skills of good CSAWMP to beneficiaries.

1.2.2 Expected Outcome

Greater uptake of CSAWMP with target by 2018 (from baselines in 2013) in the project areas:

- At least 70% bio-slurry is converted to organic fertilizers.
- At least 80% energy produced by Biogas Value Chains (BVCs) is utilized
- Daily workload of women and children is reduced by 1.8–2 hours, on average.

1.3 Main Project Outputs

1.3.1 Expanded use of livestock waste management infrastructure

-
- 36,000 SBPs, 40 MBPs and 10 LBPs and associated value chain infrastructure constructed and operating by 2019.
- At least 5% of total SBPs will be constructed for ethnic minorities in 3 selected provinces.
- 36,000 SBP operators, 500 masons, 160 technicians, 10 engineers and 10 contractors trained and registered in biogas associations by 2019.
- At least 50% of trainees on biogas use will be women, 20% of trainees on SBP construction, and 20% of those trained on biogas management and technical issues will be women.
- BP database managed effectively by 2014, including registration in both husband's and wife's names.

1.3.2 Credit lines for biogas value chains

- 50% of credit recipients will be under joint accounts and/or on behalf of women.
- BVC infrastructure financing products mainstreamed in two FIs.
- ICMD funds are fully channeled to 36,050 accounts of beneficiaries.

1.3.3 Enhanced CSAWMP technology transfer

- Well-established CSAWMP packages are disseminated in 10 participating provinces.
- One long-term, community-based CSAWMP technology transfer and research strategy is elaborated by 2014, and includes communication, dissemination, and mainstreaming plans
- Critical CSAWMP knowledge gaps are identified and at least 21 research, dissemination, and mainstreaming packages carried out according to a priority list, by 2018. 30% of research projects will include gender issues by 2016.

1.3.4 Effective project management

- A CPMU and 10 PPMUs established and operational with adequately skilled staff and facilities in MARD by first quarter of 2013.
- At least 30% of staff are women and a gender focal point will be appointed by 2014.
- PPMS with sex-disaggregated and ethnicity data collected and reported operating effectively in 10 provinces by 2015.
- Carbon market coordinator and 36,000 biogas owners are organized through associations by 2014.

1.4 Project components

The project comprises four components:

- Component 1. Expanded use of livestock waste management infrastructure
- Component 2. Credit lines for biogas value chains
- Component 3. Enhanced climate-smart agriculture waste management practice technology transfer
- Component 4. Effective Project management

1.4.1 Component 1. Expanded use of livestock waste management infrastructure

Sub-component 1.1. Management of Livestock waste and carbon markets

Activities:

- Standardize and disseminate design package for BVC
- Register program of activities for large, medium and small biogas plants for the relevant carbon market requirements.
- Strengthen relevant agencies to handover the monitoring of all constructed biogas plants.
- Monitor annual attributable CO_2 reduction and issuance of carbon revenue from the certified emission reduction.

- Provide capacity building to government staff and relevant agencies to continuously manage biogas development.
- Developing training modules for CSAWMP and providing training to supervisors, operators and other stakeholders for application and mainstreaming in the Project Provinces.

Sub-component 1.2. Providing Support for Biogas Plant Development

Activities:

- Monitoring use of biogas plants with adequate environmental facilities.
- Training and certifying of technicians, engineers, contractors and masons for the construction of BVC and permitting staff from FIs to attend such training sessions.
- Provision of financial support to certified biogas plants constructed.

1.4.2 Component 2. Credit line for biogas value chains

Activities:

- Facilitate FIs to provide credit line to finance the construction of Biogas Value Chain Infrastructure[2] which satisfy the Subproject Eligibility Criteria.
- Encourage other financial intermediaries to finance BVC infrastructure.
- Coordinate technical training programs between CPMU, PPMUs and FIs.
- Monitor the disbursement of credit from FIs and financial incentives paid to eligible beneficiaries who carried out eligible subprojects.

1.4.3 Component 3. Enhanced climate-smart agriculture waste management practice technology transfer

Subcomponent 3.1. Preparing a research strategy to direct project research activities on CSAWMP.

Activities:

- Utilizing farmer-based research including using biochar and other agricultural wastes as organic fertilizers, applying other efficient low greenhouse gas emission agricultural practices which generate bio-energy, managing waste treatments in aquaculture and other CSAWMP.
- Establishing an information system, for sharing CSAWMP
- Support and train research staff and extension staff in CSAWMP including organizing study tours.
- Developing training program, textbooks and syllabus for training farmers on appropriate techniques for CSAWMP and providing vocational training for farmers.
- Upgrading CSAWMP-based map sets for seven agro-ecological regions to forecast the direct impact of climate change and provide support for agricultural planning.

Subcomponent 3.2. Constructing low carbon agricultural demonstrations for agricultural waste management

Activities

- Developing livestock waste management models for agricultural production and greenhouse gas emissions reduction.
- Training extension staff and farmers in low-carbon agricultural production technologies to promote application of the technologies in agricultural production.

1.4.4 Component 4. Project management

[2] Including construction of sewage drains, gas pipes, environmental facilities, and electricity generators, facilities for using gas and bio-slurry but excluding animal houses, stalls or pens.

- Establish CPMU and PPMUs.
- Engage consultants for start-up, and auditing, and to develop the monitoring and evaluation system with sex- and ethnicity - disaggregated data and including gender action plan monitoring.
- Explore all potential carbon markets.
- Undertake baseline survey in all project provinces with collection and analysis of ethnicity and sex - disaggregated data.
- Conduct a gender awareness raising workshop for project's staff.
- Establish appropriate institutional mechanisms for Biogas plants owners and CSAWMP beneficiaries.
- Prepare progress reports and submit to ADB on a regular basis.

1.5 Institutional and Implementation Arrangements

The project management arrangements are prescribed in Decree No.38/2013/ND-CP of the Government and Circular No.01/2014/TT-BKHDT of Ministry of Planning and Investment.

1.5.1 Executing Agency of the Project

- Ministry of Agriculture and Rural Development (MARD) through the Central Project Management Unit established by the Agriculture Projects Management Board: Executing Agency of the Project.
- Vietnam Bank for Agriculture and Rural Development (VBARD), Cooperative Bank of Vietnam (Co-op Bank) are the Implementation Agencies that will undertake Component 2.
- Provincial People's Committees (PPC) of 10 project provinces will be the implementing agencies in their respective provinces. They will act through their respective Departments of Agriculture and Rural Development (DARD) who will each establish a Provincial Project Management Unit to be responsible for specific day-to-day project implementation.

1.5.2 Central Project Management Unit (CPMU)

The CPMU is established by MARD under regulation of the Article 39 of Decree No. 38/2013/ND-CP, Decision No.10/QD-BNN-TCCB dated 04/01/2013. The Director of CPMU appointed by Minister of MARD at the request of the Director General of APMB. Director General of APMB appoints, assigns Deputy Directors, accountants, staffs, support staffs and additional new contracted staff at the request of the Director of CPMU.

Pursuant to Decision No.10/QD-BNN-TCCB dated 4/1/2013 of Minister of Agriculture and Rural development, CPMU will be responsible for project implementing management of the project in accordance with the objectives, progress, results, quality, location and resources approved by MARD; implementing functions and duties under the provisions of Decree No. 38/2013/ND-CP of the Government and Circular No.01/2014/TT-BKHDT of Ministry of Planning and Investment on guiding on functions, duties and implementing arrangement of management unit of ODA program/ project, compliance with the current regulations of MARD, Government and signed loan agreement.

1.5.3 Technical Support Unit (TSU)

Technical support unit of LCASP was established by MARD under the Decision No.107/QD-BNN-TCCB dated 20/1/2014. The TSU will provide technical and advisory support to the CPMU for BVC management development and CSAWMP. The TSU will also advise the CPMU on policy issues and guide the CPMU to ensure sector coordination. The CPMU will provide the incremental costs incurred by the TSU in support of the project. The terms of reference for each representative of the TSU will be determined during project

implementation and shall be subject to the concurrence of ADB. Specific tasks of each TSU member are assigned and supervised by the Head of TSU. TSU members work on part-time basis.

1.5.4 Provincial Project Management Unit (PPMU)

The PPMUs were established by DARD of each project province or using the existing management board of previous project to manage the project directly. The PPMUs will be responsible for overall management and coordinator of the activities at the provincial level. The functions and duties of PPMUs are defined in the accordance with the provisions of Article 40 of Decree No.38/2013/ND-CP and Article 16 Chapter IV of Circular No.01/2014/TT-BKHDT.

1.5.5 Financial Intermediaries (FI)

Vietnam Bank for Agriculture and Rural Development (VBARD) and Cooperative Bank of Vietnam (Co-op Bank) will undertake credit service of the project. FIs will develop specific manuals for credit activities.

1.5.6 Project consultants

The CPMU shall select eligible organizations, individual consultants which have full capacity and experience to provide consulting services for the project. Depending on the characteristics and quality requirements of consulting service, the project will apply consultant recruitment method in accordance with ADB's guidelines and following prescribed arrangements described in the Project's Procurement Plan. All consultants, firms, non-governmental organizations and consulting service provider funded by ADB will be selected under the Guidelines on the use of consultants by ADB (July 2013, as amended from time to time). The recruitment of consultants was reviewed on a prior basis by the ADB.

1.6 LIC Team Establishment

1.6.1 Contractual arrangement

CPMU has entered into a contract with Agrifood Consulting International (ACI) in association with Asia Development Consultants Joint Stock Company (AD Consult) on 20 November 2015.

The Consultant Contract provides for approximately 44 person months of International and 374 person-months of national consulting inputs. The TORs for the LIC team are contained in **Appendix A.**

The Consultants will provide expertise in the fields of project management, biogas value chain management development (BVCM), climate-smart agricultural waste management practices (CSAWMP), biogas technology, extension/training, monitoring and evaluation, social, gender and ethnic minority, environment safeguard, GIS and ICT, policy and institution, provincial coordinators.

1.6.2 Initial mobilization

Following signature of the Consultancy Contract on 20 November 2015, mobilization of the Consultant's team started immediately on 26 November 2015.

- The initial startup and office establishment took place in December with the Deputy Team Leader (DTL) and specialists of biogas technology (BT), CSAWMP working full time at consultant office. Short term national consultants for ICT and M&E were also mobilized.

- They were followed by the mobilization of the Provincial Coordinators (except for Ha Tinh PC) who were in place at the end of December 2015. .
- The International CSAWMP Specialist participated for a 12 day period in January for an overview of the situation in conjunction with his national counterpart.
- The appointment and mobilization of a team leader was eventually concluded to enable him to commence on 1st February.
- In early April the team expects to reach full strength with the mobilization of the full time (replacement) Training and Extension Specialist, the Provincial Coordinator for Ha Tinh, Gender and Ethnic Minority Specialist, Environmental Safeguards Specialist. Other national and international consultants will come on board as planned.

The table below provides a summary of the total number of work-months allocated per consultant specialist over the three year period.

The package of consultants consists of the following specialists:

Table 2 List of Experts and Person Months

International Key Experts		**Person Months**
1	Team Leader/Management/Agricultural Waste Specialist)	30
2	CSAWMP Specialist (LCA Crop Waste)	8
3	Monitoring and Evaluation Specialist	2
4	Policy and Institutional Specialist on CSAWMP	4
Total Person-Months (International)		**44**
National Key Experts		**Person Months**
1	Deputy Team Leader/BVC Development Specialist*	36
2	CSAWMP Specialist (LCA Crop Waste)*	36
3	Biogas Technology Specialist	36
4	Extension/Training & Curriculum development Specialist	36
5	Monitoring an Evaluation Specialist	8
6	Social, Gender and Ethnic Minority Specialist	6
7	Environment Safeguard Specialist	12
8	Geographic Information System (GIS) Specialist	6
9	ICT specialist	12
10	Policy and Institutions Specialist for CSAWMP	6
	Provincial Coordinators (all part time at 50%)	
11	Provincial coordinator for Lao Cai	18
12	Provincial coordinator for Son La	18

13	Provincial coordinator for Phu Tho	18
14	Provincial coordinator for Bac Giang	18
15	Provincial coordinator for Nam Dinh	18
16	Provincial coordinator for Ha Tinh	18
17	Provincial coordinator for Binh Dinh	18
18	Provincial coordinator for Tien Giang	18
19	Provincial coordinator for Ben Tre	18
20	Provincial coordinator for Soc Trang	18
Total Person-Months (National)		**374**

Note. In the original proposal the starred * consultants were allocated 48 months. Their workload and expected outputs remain the same within the three year contract

1.7 Comments on the TOR and LIC Team Resource Configuration

With respect to the TORs, they are clearly set out and there are no particular issues as to the requirements. In the main, the individual team members have the skills and capabilities to execute the content requirements of the TORs.

The recruitment of the LIC Team was delayed by approximately one year. The contract between the CPMU and the contractors commenced in late November 2015, when the LIC office was established and four key consultants mobilized. Towards the end of December the majority of the national team were on board including 9 of the 10 provincial co-coordinators. The team leader was mobilized on 1st February 2015.

However, it must be noted that reducing the contract period from four to three years (compared to bidding stage) and cutting key Biogas Value Chain (BVC) and CSAWMP expertise by the same amount – when expected outputs remained the same - makes it a challenge to complete project outputs in timely and thorough way. As such, the relatively limited person months in these key (and senior) level will almost certainly negatively impact upon component 3 outputs for the remainder of the year. Neither is it possible to draw upon unused resources. [3]

In light of this and the heavy (and additional to the TORs)l workload required of the Biogas Value Chain specialist and Deputy Team Leader (DTL) we shall be recommending a reconfiguration of LIC resources – as noted in the recommendations section below.

In view of the intensive work being undertaken for component three and the need to pick up disbursement speed – as will be elaborated upon in the report – we believe there is a need to 'front end' the use of LIC provincial resources. As such we shall be recommending that there time is reallocated to allow for 9 months in year one, 5 months in year two and 3 month in the last year of the project.

The intensity of the workload over the past three months also has a bearing upon the approach and methodology of the team as is explored immediately below.

[3] As officailly confirmed by the contractor, ADConsujlting.

1.8 Approach and Methodology

1.8.1 Adaptive and Pragmatic Approach

The LIC team were appointed with just three years of this six year loan project remaining. With the project also behind schedule, this inevitably places pressure on the team to pursue an output driven approach; rather than our preferred one, which is process based with a view to building capacity at the provincial level. As such, we have been obliged to take a more pragmatic approach that both takes account the imperatives of output delivery whilst seeking to systematically build provincial capacity through guideline, knowledge transfer and 'on the job' training approaches.

When the LIC team commenced work in December it was agreed with the CPMU that our focus would be upon:

- Support for development and efficiency using of medium and large scale biogas plants;
- Support for development and implementation of pilot/demonstration proposals on BVC and CASWMP;
- Support for effective project management at all levels.

1.8.2 Overall Principles

Allowing for time constraints and the need to expedite output delivery the LICs will nevertheless seek to apply a participatory and strongly consultative operational methodology with a view ensuring needs at the provincial level are fully reflected and local capacity for project management enhanced in a way that is sustainable. A 'bottom up' approach is also considered a priority of the ADB, which the LIC team strongly endorses.

Generally speaking, the LICs seek to ensure and maintain close coordination and communication among parties, namely CPMU, PPMUs, and Institutes under MARD and the Vietnam Government especially MARD, provincial PPC and ADB as well as with other stakeholders including civil enterprises, suppliers, and farmers to ensure smooth and effective operation of the services.

1.8.3 Guidance from the CPMU and linkage to ADB

The initial work of the team tended to be of an ad hoc nature as directed by the CPMU and influenced by the ADB. Communication channels were, at times, inadequately synchronized resulting in mixed messages between the LICs, CPMU and ADB respectively. As of mid-February these issues seem to have been largely overcome and all parties appear to be on the same wavelength regarding the activities and tasks to be dealt with in the next quarter including preparation for the MTR. The LIC have been briefed on the overall MARD approved LCASP plan and seek to align activities accordingly.

1.8.4 Good communication

With respect to the LICs-CPMU regular planning meetings taking place to determine priorities - and dedicate resources to the components with the greatest immediate need. These are usually on a weekly basis and always within a fortnight of each other. In addition the LIC team enjoy cordial relations with the various consultants (Credit and Business & Finance specialists respectively, the latter of whom sits in our office). Indeed, Ms. Hanh, the Business and Finance Specialist has spent a good deal of time working with the LIC national consultant team in supporting the economic and financial analysis of the six main category types of biogas related CSAWMP demonstration sub-projects.

1.8.5 Day to day interaction

With respect to the LICs-CPMU regular planning and activity management meetings are taking place – *at least on a weekly basis* - to determine priorities in the use of LIC resources. Since mid-February the immediate priority has been work on component three, pilot demonstration sub-project and research topic proposals, as well as the preparation of the feasibility study for the E-Library.

1.8.6 Establishment of procedural guidelines

The central LIC team have provided the methodological and research framework to enable the provincial co-coordinators to guide and, in part, train up provincial PMU colleagues.
A guideline procedural basis has been established from consultation and identification through to the establishment of feasibility based criteria covering key needs, market demand, technical and economic viability of the proposed projects to the point where they reach tender and bidding stage.

A copy of the guidelines and forms used for the preparation of component 3 sub-project demonstration and Research Pilot proposals is contained **in Appendix H**. This is further elaborated upon in chapter 3.

2 SECTOR AND SUB-SECTOR STATUS: OVERVIEW AND OBSERVATIONS

The chapter covers the overall situation with agricultural waste and biogas as it applies generally in Vietnam and more specifically to the 10 LCASP provinces. It commences with a statistical description of current treatment status in each of the key agricultural sub-sectors.

We then look at the general situation with respect to biogas and agricultural waste treatment i.e. the two functional component strands of the project. This provides the platform for the review of project performance in chapter 3 and the contribution of the LIC team over the past quarter to the end of March 2016.

2.1 Problems in waste treatment[4]

2.1.1 National level

i. At present, Vietnam has a total of 7.9 million livestock farming households, 4.1 million of which are engaged in pig farming including approximately 8,300 livestock farms (with a turnover of more than 1 billion VND per year, equal to 50,000USD) . In 2014, there was total of 26.3 million heads of pig, 2.52 million buffalo, 5.55 million cattle and 328 million poultry - which produced over 83 million ton of livestock waste.

ii. Until now, 25.6% of the farms and 37.3% of households have yet to apply any form of waste treatment solution and often discharge waste directly into the environment. In cultivation, 45.9% of the waste is being burnt, causing both air pollution and loss of a considerable volume of nutrients, especially nitrogen, phosphate, sulphur; whilst in aquaculture, millions of tons of bio-slurry, especially those from the catfish farming ponds, is untreated and not reused.

iii. Meanwhile, the quantity of biogas plants is in the region of 500,000, 1,000 of which are of the medium and large size, which is far from the target of 2 million SBPs, 21 thousand MBPs and LBPs by 2020. As such, a considerable amount of livestock waste cannot be treated by biogas systems alone.

2.1.2 LCASP Provinces: Agricultural Waste Situation

Overview

In 2014 the project completed a baseline survey on the current situation of agricultural waste management in 10 provinces. On the whole it found that waste treatment in the 10 project provinces is not different to the general situation of the whole country.

The total agricultural area of the 10 project provinces is 3,013,494 hectares, of which 603,216 hectares is paddy land accounting for 20% of all agricultural land (equivalent to 15.87% of paddy land of the whole country. Perennial crops land occupied 401,907 hectares, accounting for 13.30% of total agricultural area; therefore the agriculture waste in the 10 project provinces in 2013 was estimated at 39.76 million tons, including 13.77 million tons crop residues (34.40%) and 26,083 million tons of livestock waste (63.60%).

This source of by-products is now being used wastefully, mostly burned (6.29 million tons/45.9%), used as feed for cattle (3.97 million tons/29.0%), left in field (1.18 million tons/8.6%), compost as fertilizer (0.69 million tons/5.0%), used in cultivation (0.56 million tons/4.1%), and the remaining (1 million ton/7%) is used

[4] **Source: Draft Research Strategy for LCASP, 2015**

as straw wood, medium for growing mushrooms or poultry bedding. Burning straw directly in the fields is the major reason of environmental pollution and declining soil fertility.

Livestock Sub-sector

According to the Department of Livestock Production (2013): the percentage of waste used for biogas is low, accounting for 3.7%, the percentage of applying compost is higher than the average rate of the whole country, at 10% (equivalent to 1.8 million tons of manure). Some provinces have high percentage of applying compost such as Bac Giang, Phu Tho and Tien Giang with the respective rate of 21.6%, 17.4% and 9.2%. These provinces have large areas of industrial plants and fruit trees so have high demand for organic fertilizer.

The mountainous provinces have low rate of composting. The proportion of untreated manure (for direct use) is very high, with the average rate of the 10 provinces at 62.2%, equivalent to 11.4 million tons. Other measures such as discarding into ponds, ditches and canals account for 24.1% (equivalent to 3.7 million tons).

In summary, livestock waste presents significant problems for the rural environment. The percentage of treated manure (via biogas or compost) is very low at 13.7%. The rest with 86.3% (nearly 16 million tons) is used to fertilize fields or discharged into canals, ponds, lakes, besides 7.2 million m^3 of urine discarded out annually . This is the major source of pollution, spreading diseases, thus impacting directly on public health.

Crop Sub-sector

With the advantages of an agricultural country, Vietnam has a great potential of crop by-product/wastes (residues). According to statistics (2013), the amount of by-product from main crops in 2010 (rice, maize, sugarcane, peanut, soybean) reached to 76.76 million tons, including 53.77 million tons of rice residues, 12 million tons of sugarcane residues and 10 million tons of maize residues.

Aquaculture sub-sector:[5]

As yet, there is not an official report on by-products/waste from the aquaculture sector. Nevertheless, the reality is that fishery wastes mostly come from feed waste that sediments as sludge in aquaculture ponds (shrimp, fish) and by-products from processing factories.

According to report of Directorate of Fisheries in 2015, it is estimated about 750,000 hectares of raising brackish water shrimp (prawn and vannamei), and 5,280 hectares of raising catfish over the country. The aquaculture output in 2014 reached up to 3,800,000 tons, including 710,000 tons of brackish water shrimp (prawn and vannamei) and 1,100,000 tons of catfish. Based on that aquaculture area, the amount of mud from shrimp ponds is estimated at about 67.82 million tons. Since most of shrimp farming areas use brackish water, the waste mud from shrimp ponds is salinized and hard to be used as fertilizer for crops, so it is normally discharged.

The amount of by-products from catfish and pangasius production is estimated at about 0.41 million tons (nationwide). Currently, there are very few farmers use the waste source from catfish and pangasius (approximately below 10%) for crop cultivation and this is the raw source which can be processed to produce organic fertilizer.
The 10 project provinces estimate their by-products with 10.06 million tons of mud from shrimp ponds (usually discharged) and about 69,407 tons of mud from catfish and pangasius ponds (that can be used as

[5] **Source: Fisheries Directorate, 2015 Annual Report, published January 2016**

fertilizer/additive). The provinces which have great potential of using mud of farming ponds as fertilizer/additive include Ben Tre (52,772 tons), Tien Giang (11,210 tons) and Soc Trang (5,425 tons).
In case of processing seafood, there is not any detailed statistic of seafood manufacturers. However, these seafood manufacturers often apply modern technology of processing and the amount of by-product are mostly used for producing livestock feed that is less harmful to environment.

2.2 CSAWMP: Commentary and Assessment

2.2.1 Research Strategy Rationale

In general the project has the objective of developing a sustainable agricultural production, efficient and friendly to the environment through development/replication of research models and transferring technology on agricultural production towards reducing greenhouse gases emission (GHG) and response/mitigation to the impacts of climate change, utilizing effectively the natural resources, agricultural wastes, managing effectively agricultural processing and post-harvest preservation.

2.2.2 Biogas Related Issues

According to MARD figures of 2014, over 500,000 household bio-digesters and over 1,000 medium to large scale bio-digesters have been constructed, which are mainly covered lagoons using high density polyethylene (HDPE) sheeting technology.

The catalyst for the growth in the household sector has been the SNV/Netherland's supported National Biogas Project, which lasted over 14 years and installed approximately 190,000 small biogas digesters. Even so, there is still a good deal of untapped potential particularly in the medium and large segment of the market. About 7.9 million households keep animals of which there are over 8,300 animal farms with an annual income in excess of 1 billion VND per year or USD$ 48,000.[6].

These larger farms utilize considerable amounts of water for cleaning animal houses and untreated wastewater is often discharged into streams or lakes.

The targets for output 1 were construction and operation of 36,000 SBPs, 40 MBPs, and 10 LBPs and associated value chain infrastructure operated by 2018. The establishment of SBP is being implemented according to the plan with over 30,000 SBPs constructed representing just over 80% of the target figure. Having said this a number of design and operational concerns have been identified (including other projects) and confirmed by the LIC team:

- The capacity of biogas plants is fixed by design and insufficient to match the *often predictable* growth of household and farm livestock numbers and associated growth in animal waste volumes. Overloading the digester has significantly reduced efficiency, at times to the point of break down. This risks scum and manure flowing out of the system un/under treated, causing liquid and gaseous pollution problems.

- As livestock production continues to grow more biogas is being produced that is in excess of the household's capacity to utilize. Rather than flaring this if often discharged directly into the environment (as was observed in two medium scale in Binh Dinh) thereby contributing to an avoidable increase in greenhouse gas emissions.

[6] **Vietnam Statistical Data, 2015, and Survey on Agricultural Production and Rural Development, 2012**

2.2.3 Medium and Large Scale Biogas Plant

As yet, no medium and large scale digesters installations have been supported by the Project, likely due to the relatively level of financial support from the Project, which is not attractive for investors to follow the environment packages. Whilst the 'incentive' of 3 million VND can represent around 20% of the cost of a small biogas plant (10 m^3) the amounts of 10 million VND and 20 million VND for medium and large scale biogas plants respectively are considered insignificant in terms of the overall investment. The CPMU survey data indicates potential market size for large scale technology to be around 130 and for medium scale around 3,200.[7]

Utilization of gas and bio-slurry[8]

Some of the major challenges with larger scale biogas production relate to the poor utilization of the gas and bio-slurry produced , which are significant concerns. For the MBP and LBP the production of biogas will often be too high compared to the gas demand on-site.

Solutions could be electricity generation by Combined Heat and Power (CHP) and selling electricity to the grid and using heat for heating up digesters improving the process and increasing the gas output of the digesters. Furthermore the use of heat for drying bio-slurry or bio-fibers could be an option. However the feed-in-tariff of electricity is usually too low to make a profit[9] so in most cases selling electricity or gas to a local grid would be more feasible in cases where this is an option. In some circumstances farms might have a slaughterhouse integrated as a part of the livestock production and in these cases high amounts of steam, hot water and electricity is needed which might make electricity production feasible. Flaring the gas is another option that still will reduce the GHG emissions significant but without the additional positive impact of reducing the use of fossil fuels. Furthermore, burning the gas would not create any income and there is a risk that the farmer will not invest in equipment for burning the gas properly and some gas will be vented directly. (As has been observed at one MSP plant in Binh Dinh).

Issues in Biogas Design Technology

The most common design form used in Vietnam for producing biogas on larger farms today is covered lagoons. This is a very simple and cheap technology but is not as efficient as more advanced systems using steel or concrete tanks as seen in Europe. These plants are more efficient and can be made much smaller with the same input and can be heated to have a constant temperature. Investment in more advanced technology will put a demand on reducing the amount of water used in the livestock production to reduce the amount of manure and thus the sizes of the digesters but also for the more simple digesters water saving will be of high value beneficial. At the moment the livestock manure is so dilute[10] that more advanced digesters are unlikely to be feasible.

[7] **Source, ADB Aide Memoire, August 2015**

[8] Extracted from mission report of Mr.Henrik Moller, January 2016.

[9] The EVN ceiling price of USD$ 4.5 cents per KWh is less than the cost of production of biogas fuel, which is nearer to 6 cents a KWh. We understand that a proposal has been put to the government feed-in tariff to be increased to 7.8 KWh. (Source GIZ Study)

[10] One thing that makes both recovery of nutrients in bio-slurry and biogas production difficult in Vietnam is the very dilute nature of Vietnamese livestock manure. The amount of water used for animals is about 100 L of water/pig/day, mainly for washing and cooling pigs (FAO, 2003). According to Vu et al. (2015) pig slurry for biogas contains around 2,8% Dry-matter in cases where all fractions of the manure are mixed to one fraction while in cases where solid and liquid are separated in the pig houses the liquid part only contains 0,4% dry-matter.

If the gas should be used for electricity generation efficient removal of sulphur from the gas is essential to protect the gas engines. Technology for biological sulphur removal is the cheapest technology and can be done in a separate process where atmospheric oxygen is added to the biogas and the sulphur is oxidized. Experience with large-size digesters and with removal of sulphur to protect the engines during electricity production is limited and so is experience with electricity generation.

Since access to the electricity grid and low feed in tariffs for electricity is a concern and this mean that implementation of MBP and LBP is a challenge. As such there is a need for the research gaps to be identified in relation to large scale biogas production where poor utilization of the gas and bio-slurry produced are the main concerns.

2.2.4 Agricultural Waste: Research Gaps and Opportunities

At this stage focus has been on livestock manures and bio-slurry and less focus has been put on crop wastes. To achieve a high reduction of GHG emission from livestock production the use of biogas technology is in general regarded as the most efficient way if the gas is converted and used for energy purpose or alternatively converted by burning or flaring without energy use the last being the least efficient. However if a large part of the gas is vented the methane in the gas will significantly contribute to GHG thus conversion of methane by energy recovery or burning without recovery is essential to have a large impact on GHG. Both methods ensure that the methane is converted to CO2 and since methane has a global warming potential equal to 31 times compared to CO2 even biogas production with flaring without energy recovery will have a large positive impact on GHG emissions. How large a proportion of the gas that can be vented without flaring before the biogas production has a negative impact depends on several factors like what will be done with the manure if there was no biogas production involved. If the manure still would be kept in a lagoon the same amount of methane would be emitted as if 100% of the biogas was released so even a small energy recovery or gas flaring would have a positive impact.

For an efficient use of livestock manure, the biogas process will only have minor positive impact due to the fact that bio-slurry is only slightly better fertilizer than untreated manure and because bio-slurry has a higher hygienic standard that might encourage arable farmers to use it instead of inorganic fertilizer. However if the bio-slurry is discharged the effect in terms of pollution and eutrophication by nitrogen and phosphorous is similar as if the manure was discharged directly without biogas, only the oxygen demand in terms of COD and BOD is reduced. Because of this proper management of livestock manure is crucial to obtain a sustainable livestock production either as an integrated biogas and bio-slurry management or by a system with livestock manure treatment without integrating a biogas system. Additionally, the biogas plant could be made for treating only part of the manure or only the liquid part to cover only the on-site energy demand which will make the investment more profitable but have a lower impact on GHG reduction.

Today the fertilizer value of the manure produced on the medium and large scale farms are not sufficiently recovered. The biogas production from the manure will not directly solve this problem. The best use of the fertilizer value will be to use digested manure on land adjacent to the livestock production but because of the high amounts of nutrients and large area needed for proper utilization this is not likely to happen in all cases since the low concentration of plant nutrients makes it is expensive to transport the surplus plant nutrients from areas with high livestock density to areas with arable farms.

Pumping of the liquid bio-slurry could be a possibility over a certain distance and furthermore there is a potential of reducing transport and spreading costs by separating the manure into a nutrient-rich solid fraction and a liquid fraction, where only the solid fraction are exported.

Solid-liquid separation before the biogas digester will reduce the amount of gas and the biogas production will be closer to the demand of the farmer and at the same time if used as a compost the emission of methane from the solid fraction will be limited.

A wide range of solid-liquid separators are available on the market which vary in efficiency especially for the amount of phosphor that can be separated (bow sieve, screw press separator, decanter centrifuge etc.).

In general the highest separation efficiency is achieved with centrifuges but they are expensive in investment and running costs (Møller et al. 2000, Møller et al 2002, Burton 1997). The chances for selling the compost for a market can be significant improved by having private companies making organic fertilizers involved. Such companies might also *make mobile separation systems* that can be moved between farms enabling also the smaller farms to get to the market for organic fertilizers.

Correct use of the liquid fraction is very important since it will often contain more than 70% of (NH4) of total manure nitrogen (Moller 2016). Water savings in the livestock production can improve the quality of the liquid product and make it more valuable for arable farmers since a smaller amount should be transported and applied to secure the crops nutrient demand. Technologies for removing the nitrogen in the form of ammonia and capturing it in a concentrated form is also a possibility but strong acids are required to capture the ammonia and the fertilizer product will be in a liquid but very concentrated form. Membrane technologies in the form of ultrafiltration or reverse osmosis for upgrading the liquid fraction to a more concentrated product and almost clean water that can either be discharged or used for washing etc. in the livestock production is possible. However the membrane technology is expensive and with the present technology not economical feasibly and thus probably not interesting for Vietnamese conditions.

Use of water plants like water hyacinths or algae growing in lagoons for purifying bio-slurry by removing nutrients that subsequent can be harvested as biomass and used for compost or animal feed could be another option. In the case where the biomass from water plants should be used for animal feed initial use of a biogas process is beneficial in terms of reducing pathogens. The water hyacinths has a high nutritional value and several countries like Indonesia, Thailand etc. cooked water hyacinths are used as feed for pigs (Malik, 2007). In the rural areas, water hyacinth could be used in an integrated manner for bio-slurry treatment systems coupled to biogas and compost production from the resulting biomass (Malik, 2007).

There are studies indicating that 50-92% of nitrogen and 50-99% of phosphor from piggery waste and bio-slurry can be removed by growing water hyacinth in lagoons with a 20 days hydraulic retention time (Malik 2007).

Systems for waste management integrating biogas and bio-slurry management are thus crucial and finding ways to secure proper use of bio-slurry and securing that the gas is either recovered for the farm in the form of gas or electricity or eventually flared to avoid methane emissions, should be prioritized.

2.3 Key research gaps and support themes

Meeting the research objectives of the project entails conducting research and demonstration within different themes livestock manures, biogas technology and bio-slurry. For all research themes it is important also to include studies on the impact on GHG, energy supply and economy resulting in decision support for the best overall systems. In the following different research and demonstration themes that could be relevant within each theme are further described:

2.3.1 Livestock manure

Manure may be managed as solid manure or a liquid. Cattle production systems are a major producer of solid manure and excreta from fattening pigs are often collected as slurry. Sustainability concepts vary between the two animal categories where the major problems in Vietnam are associated with liquid pig manure and therefore research should be focused on this. Liquid manure is a mixture of feces, urine and water used for washing and the composition thus can be very variable. In Vietnam there is a tradition for using a high amount of water which makes recovery of nutrients difficult because the manure is very diluted with low concentrations of nutrients. Solid-liquid separation and water savings could be a way to make more valuable fractions of the livestock manure and at the same time have a positive impact on biogas production. The following research and demonstration themes could be included[11]:

- Initial characterization of the livestock manure on selected large scale farms.
- Identification and demonstration of possibilities to save water in the livestock production to make livestock manure more valuable for biogas and separation or as direct fertilizer.
- Identification of technologies for solid-liquid separation and test and demonstration of efficiency of selected technologies in terms of transferring nutrient to the solid fraction preferably integrated in a biogas system.
- Demonstration of the nutrient quality of solid fractions.
- Identify market potentials for compost in cooperation with the organic fertilizer industry.
- Identification and demonstration of possibilities for use of all or part of the liquid for composting with straw and making a product that can be exported out of the farm.

2.3.2 Crop Waste

Along with livestock waste management, mitigation of incorrect use of crops waste are also very important. According to statistics, Vietnam annually consumed more than 10 millions tons of fertilizers of all kind, worth around 4 billions USD, equal to 25% of total turn over of crop product export. So, if we can recycle all crop residue, in principle it would be possible save up to 30% against current inorganic fertilizers usage. In case of rice, estimation shows that, the current amount of straw containing 315-350 thousands tons of N; 100-115 thousands tons of P_2O_5 and 780-870kg K_2O/year[12]. In addition, effective use of crops residues not only reduce inorganic fertilizers, mitigating GHG emission, eutrophication, but also establishing intensification background for crop production.

[11] At the moment, biogas digester capacity is often fixed while the number of pig is changeable, up and down any time depending on the market. Having said this, the overall trend is towards increased livestock production. Biogas right now is one of the best technologies to treat livestock waste. However, it is not perfect/completed solution for livestock waste management due to the excessive amount of manure when the number of pigs significantly increases. That is a big GAP that previous projects did not deal with while LCASP is aiming to address this issue. That is also one of the main reasons that the Component 3 come up with, using research and demonstration to deal with the excessive of manure

[12] Nguyen Van Bo, 2013. Increasing fertilizers use efficiency. In Proceedings of National Workshop on Improving the Efficiency of Management and Use of Fertilizers in Vietnam, conducted in Can Tho, 05 March 2013. Agricultural Publishing House, 2013. Pages: 13-42

2.3.3 Biogas Technology

From a technological (and business) perspective, technologically scaling up to large biogas represents a major challenge compared to small (<50 m^3) rural household level units, serving mainly cooking purposes. Therefore, the success of scaling-up to large scale biogas depends on technological diversification and innovation.

The following research and demonstration themes are either being included or under consideration as part of the project brief:

- Demonstration of a biogas plant design integrated with solid-liquid separation for farms with low energy need. (Currently under consideration for a number of provincial sub-projects).
- Evaluation of the present biogas technology in terms of possible improvements
- Identify bottlenecks in terms of electricity production and demonstration of electricity production from biogas with connection to local or district grid
- Demonstration of biogas production on farms with high energy and electricity need for slaughterhouse, milk processing, cooling etc.
- Identify and demonstrate cheap and efficient systems for sulphur removal to improve economy in electricity production by protecting the engine to corrosion and increasing lifetime.
- GHG emission analysis in the biogas context
- Economically analysis of biogas production chain and integrated systems.

2.3.4 Bio-slurry

In the context of LCASP, the digested effluent after biogas production and waste water after cleaning the manure are considered as bio-slurry. During the biogas process methane is produced by degradation of organic dry matter and after the biogas process the dry-matter content is 40-50 % lower than in the livestock manure fed to the biogas digester. The macro nutrients in the form of N, P and K are conserved in the process and are almost not affected besides the effect of sedimentation in the digester tank or lagoon. Especially part of the phosphor and some nitrogen will sediment. This means that the bio-slurry contains a lower nutrient content than the livestock manure fed to the digester. The following research and demonstration themes could be included:

- Initial characterization of the bio-slurry on selected large scale farms;
- Identify possibilities and potentials for recovering nutrients, by e.g. cultivation and harvest of water hyacinths, pumping and use as fertilizer etc.;
- Demonstrate water purification with water hyacinth and investigate market potentials for the biomass as feed, compost or else.

2.4 Conclusion

This chapter has given an indication of both the LCASP provinces and national scale of the agricultural waste problems facing the country. Whilst the focus of the project to date has been upon animal waste, crop residues will also be considered in the future. Some of the impediments to a productive use of livestock waste in the production of bioenergy are structural in the sense that prevailing EDF prices are lower than the cost of bioenergy per KWh, which makes the latter uncompetitive. The role of LCASP is not only identify research gaps but also provide solutions with demonstrable benefits at each of the technical, environmental and economic viability perspectives. In the next chapter we note some of the demonstration project categories where, for example, business based models for the production of organic fertilizer have the scope to produce 'Brown Gold' De Groot and Bodanski, 2012).

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3 PROJECT PERFORMANCE AND PROGRESS

3.1 Introduction

This chapter begins with an introduction to the work assigned to the LIC since contract commencement. This is followed by a summary statement of the perceived project design issues and is followed by an assessment of project progress per component and core activity area including the contribution of the LIC team.

We then provide commentary on the work done by the LICs since December, when the core of the national consultant (including provincial) team were mobilized. This is followed by a more in-depth review of the work according to the priorities set by the CPMU at the outset as well as on a component by component basis. There has been a very strong emphasis upon the detailed provincial planning exercise and also component 3. This is because the work on component 1 is well advanced in terms of the building and provision of small biogas plant and component 2 is subject to a number of structural and operational constraints to credit provision pending an in-depth survey due in late May.

When the LIC team commenced in December it was agreed with the CPMU that the focus would be upon:

- ✓ Support to the development and enhanced efficiency of biogas plants, with a particular focus upon medium and large.
- ✓ Support (particularly provincial coordinators in the preparation of detailed provincial plan and element of biogas technology as part of the identification and selection of biogas related demonstration sites).
- ✓ Support to the development and implementation of demonstration pilot BVC and CSAWMP sub-projects (with CSAWMP research topic at the provincial level added soon after).
- ✓ Support for effective project management at all levels.

The team has responded to these priority needs as directed by the CPMU – which itself was responding to the important concerns raised by the ADB on LCASP disbursement performance and operational methodologies. In particular this relates to the preparation of detailed project plans for each province and the need to kick-start the implementation of component three. These matters alone have arguably taken up about 75% of LIC team time. A good deal of time has been spent responding to 'on demand' requests from the CPMU to which the team has done its best to respond expeditiously.

An example of the latter is time recently spent analyzing the approach, methodology and design format for the delayed baseline survey. Likewise support to the credit consultant upon her introduction to the LIC team in February. Very little time has been spent to date on component 2, which has more or less stalled and is subject to an in-depth survey and evaluation of the significant fall (a trend started with earlier projects such as QSEAP) in bank credits. At the peak of its performance QSEAP disbursed USD$8.1 million a year. By comparison the overall target for LCASP is $42 million, which seems to be over-ambitions. More so, since the credit component startup was delayed by one year after start up as the Prime Minister's Office needed to intervene to resolve interest matters. . Nevertheless performance has been very disappointing. The LIC team, particularly our provincial co-coordinators are co-operating and supporting the consultant team dealing with the study. The LIC additionally contributed to a review of the Credit Consultant's Inception Report as was also the case for the Economic and Business Development Consultant who sits in the LIC office.[13]

[13] Both the Credit Consultant and the Economic and Business Development Consultant are not part of the LIC Team. They are hired directly by the CPMU. The latter sits in the office of the LIC Team. This is an arrangement that works

3.2 Design Issues

A number of project design issues combined with the delayed appointment of the LIC has resulted in relatively poor and low disbursement rates. With respect to the former:

- Component 1. It seems that the scope for the development and sale of medium and large biogas plant is commercially constrained due to market imperfections most notably in the use and sale of biogas energy, which cannot compete with SOE produced electricity tariffs. Equipment reliably issues are another factor. A range of more commercial oriented options – with a view to producing organic fertilizer as well as more community based energy sale options are being accessed by the LIC team to determine whether they might overcome existing constraints.
- Component 2 covering credit was delayed by approximately one year Furthermore, the selected financial intermediaries have disbursed funds for a relatively small number of loans. The reasons for this are currently being investigated by a financial credit market specialist who will be providing an in-depth analytical report around the end of May.
- Component 3. In part, progress in implementing component 3 was significantly delayed by the failure to prepare a research strategy at design stage, which was further exacerbated by the lack of an implementation plan in the Project Implementation Manual.

Constraints related to the credit component will necessarily affect disbursement performance to the extent that targets cannot be fulfilled. As will be explored later, consideration should be given to reallocating some of the funds from this component into component 1, particularly for increasing the output of SBP, which is in front of schedule and for which there is plenty of additional demand.

3.3 Overview of Disbursement Performance

very well and good relations have been established with Ms. Hanh. Her interaction with the LIC team is very much appreciated.

Table 3 Overview of Disbursement Performance (as of April 2016)

STT	Main Outputs	Budget ($)	Committed Disbursed ($)	Disbursed as Percentage of Budget	Variation between Budget and Disbursement ($)	Percentage of Project Time since beginning of Project
1	Expanded use of livestock waste management infrastructure	12,549,849	4,982,824	39.70	7,567,025	50%
2	Credit lines for biogas value chains	32,100,000	3,630,000	11.31	28,470,000	50%
3	Enhanced CSAWMP technology transfer	12,008,478	594,720	4.95	11,413,758	50%
4	Effective project management	7,865,676	5079786	64.58	2,785,890	50%
5	**Total (1+2+3+4)**	64,524,003	14,287,330	22.14	50,236,673	
6	Interest rate	2,410,000		-		
	Total (5+6)	**66,934,003**				

Source: CPMU

At the mid-point of the project just 17% of funds have been contractually committed or disbursed and there is a clear need to pick up speed. Whilst it is acknowledged that other loan projects typically disburse most funds over the last two years this is all but impossible due to the situation with the component 2.

3.4 Project Progress and Achievements

This section takes activities from the MARD/LCASP plan and notes outputs to March 2016 compared to targets. Where applicable it notes the LIC contribution to the activity, in the main, from the 1st quarter of 2016.[14]

3.4.1 OUTPUT 1: Expanded Use of Livestock Waste Management Infrastructure

As of 30/04/2016, the construction of a total of 31,713 (88%) has been carried out whilst 24,909 have received their financial incentive payment of VND 3 million from the project. Of the total constructed 799 have been constructed for ethnic minorities in selected provinces i.e. Son La (531), Bac Giang (225) and Soc Trang (43).

Although the design technology has been in place for some time (particularly through the SNV/Netherlands support National Biogas Programme) a number of operational and performance issues have been raised by the LIC BVC (Deputy TL) and Biogas Technology specialists respectively.

The gaps identified include:

[14] A full version of the latest CPMU monitoring data matrices or each main component/output is contained in A**ppendix E.**

- As yet there are no effective solutions to the use of by-products (bio-slurry);
- The capacity of SBPs is fixed by design (for composite plant at least), while the size of livestock farming is changing. Where bio-digester capacity is too low, much of scum and sludge will be discharged untreated into the environment. This may result can result in the formation of bio slurry bubbles.[15]
- The surplus biogas from most of the MBPs and LBPs is often emitted without flaring - resulting in avoidable and unnecessary increase of greenhouse gas emissions.

As yet, no medium and large scale digesters installations have been supported by the Project. Intuitively at least, this will be influenced by the low level of financial l support from the Project, which is not attractive for investors to follow the environment packages. The CPMU survey data indicates potential market size for large scale technology to be around 130 and for medium scale around 3,200.

However, this may be constrained by a number economic and market related factors which constrain the on-sale to the national grid of biogas fuel. The reliability of generator and sulphur cleaning equipment is a related concern. For medium and large plant, outside of HDPE (High Density Polyethylene) plant, suitable technologies have not been identified – which is something the LIC team are in the process of addressing. Furthermore the financial incentives of VND 10 million for medium scale (50-499 M^3) and VND 20 million for large scale (>500 M^3) biogas respectively are not significant in terms of a business investment decision.) This compares to a cost of VND 500 million for a 500 m^3 medium scale plant. CPMU proposes to increase to 50 million VND for a MBP and 200 million VND for a LBP.

In order to ensure the quality of SBP construction, CPMU and PPMUs have inherited technicians and masons from the previous projects (SNV, QSEAP, etc.). CPMU has organized 12 technician training courses for 626 participants for 10 PPMUs. PPMUs have then provided 14 technician training courses for 459 participants. All PPMUs but Nam Dinh have provided 14 training courses for 531 masons (There are currently 321 masons working in the Project). CPMU has organized 2 training courses for engineers, HDPE contractors with 59 participants. (Please refer to Appendix J for consolidated figures. 100% SBPs have been checked and monitored by technician before acceptance. Moreover, CPMU and PPMUs carry out random check of over 5% SBPs constructed in the previous year.

Table 4 SBPs built and checked

STT	Province	Number of constructed SBPs from the beginning of the Project until end of 2014	Number of checked SBPs in 2015*	Rate (%)
1	Nam Dinh	1,147	170	14.8
2	Phu Tho	1,500	980	65.3
3	Ben Tre	1,000	50	5.0
4	Ha Tinh	1,686	69	4.1

[15] Bubbles develop in the slurry if the dung does not remain long enough in the digester long enough to complete the digestion process. Under previous projects, including QSEAP and National Biogas Programme II, this was found to occur 60% of cases in Ben Tre province – which also comes under LCASP. Source: MTR of the SNV Programme 2007-2015. Final Report – 2013.

STT	Province	Number of constructed SBPs from the beginning of the Project until end of 2014	Number of checked SBPs in 2015*	Rate (%)
5	Tien Giang	469	45	9.6
6	Binh Dinh	2,021	80	4.0
7	Soc Trang	600	69	11.5
8	Bac Giang	2,272	379	16.7
9	Son La	424	86	20.3
10	Lao Cai	645	173	26.8
	Total	**11,764**	**2101**	**17.9**

Source: CPMU

****Figures are based on a lag period of up to one year as PPMU's variously determine when to carry out quality spot checks in the year following construction.

At this juncture we would note the concern of the ADB as to the speed of implementation and concern that insufficient attention is being given to quality control. However, in addition to the above noted checks, an independent and random physical audit of 500 completed and 100 under construction SBP, originally requested in October (with an answer from the ADB in April) should take place before the end of the year and can definitely address these issues.

Biogas design type

The team has commenced investigating the scope for different SBP design types and implementing economically and technologically viable medium and large scale biogas plant. Consideration is being given to product diversification so that design types and capacities may be increased to allow the growth, particularly in the livestock sector. Related to this are general concerns as to after sales service and operational and maintenance issues. This work will be deepened as time permits and depending upon the priorities of the CPMU.

Biogas design manual and operations and maintenance guideline

The team has commenced a first stage review of these documents and it is envisaged they will provide support to the editing and refinement of the documentation in due course.

Additionally:

- Initial support to progress the feasibility study for the Capacity Building on Environmental Monitoring, Evaluation and Management.
- Contribution (with ITC and M&E specialists respectively) in the preliminary assessment work on the development of the biogas data-base.

- Field trips of central BVC and Biogas Technology Specialists to Nam Dinh, Binh Dinh, Ha Tinh and Bac Giang to advise PPMUs upon a range of biogas related issues for each of SBP, MBP and LBP.
- A field trip to Thai Binh was arranged to review a combined enterprise and community based biogas plant that was able to utilize gas for fuel. This looked to be an interesting model and consideration is being given to adapting it to LCASP provinces.
- Support to the preparation training materials in biogas technologies to be delivered in three provinces at the end of April.

We note below performance specifically related to the MARD Plan for LCASP, performance, briefly denoting the LIC contribution. A full matrix for each of the component activities is contained in Appendix E.

Activity 1: Develop training modules for CSAWMP and provide training to supervisors, operators and other stakeholders for application and mainstreaming in the project provinces.

- ✓ Developed 5 training modules for farmers, extension staffs and other stakeholders on livestock waste and biogas management.

LIC Contribution- Completed and Ongoing

LIC is providing support for training material development and guideline documentation and has additionally provided an input into the overall training plan.

Activity 2: Standardize and disseminate design package for BVC

- ✓ Communication campaign and dissemination programs through various mediums (broadcasting on TV, radio, newspaper, local broadcast system, posters, etc.);
- ✓ 1085 training courses on biogas plant operation for 31,488 farmers (of which 9367 or 29.7% were women);
- ✓ 151 workshops on dissemination of institutions, policies and standards of biogas technology and livestock waste management for 5,838 households;
- ✓ 11 study tours for 210 staff to learn and share experience on biogas technology.
- ✓ Guidelines drafted for implementing large and medium HDPE biogas plants.

LIC Contribution-Completed and Ongoing

LIC team have commenced looking at a wider range of small biogas plant (SBP) with capacities related to typical household and small farm/enterprise sizes.

LIC team has commenced research and will advise on potential of advanced technologies such as biogas utilizing HS filter, biogas generators and relevant safety methodologies.

Activity 3: Register program of activities for small, medium and large scale biogas plants for relevant carbon markets

- ➢ Preparation due to commence in second quarter

LIC Contribution- Ongoing

The LIC team has begun looking at the research basis for this work during the second quarter including engaging with the SNV/DLP (MARD) team who have established the foundation and operational methods to further work in this activity area. In addition the National M&E specialist is in the process of testing a formula based reporting mechanism to accurately measure and record carbon savings.

Activity 4: Strengthen relevant agencies to handover the monitoring of the constructed biogas plants.

- ✓ Draft Feasibility Study (FS) report for environmental package of biogas digesters is under processing by ADB.

LIC Contribution- Ongoing

The LIC are assisting the CPMU in preparing a list of environmental monitoring equipment to track performance of constructed biogas plant to meet national standards.

The LIC team has met with the National Biogas Programme and the Vietnam Biogas Association to contribute and share information. LIC is also assessing their request for strengthening.

LIC has visited and discussed the prospects for co-operation with a number of national and regional research institutes.

Activity 5: Monitor annual attributable CO_2 reduction and issuance of carbon revenue from the certified emission reduction

- ➢ Database system of biogas plants under LCASP is developing with contributions from Biogas Program for the Animal Husbandry Sector of Vietnam (BP). The system is expected to be completed by the end of the 2nd Quarter of 2016.

LIC Contribution- ongoing

National M&E specialist engaged in supporting this process. A quick review of the IT situation has taken place. by the

Information Technology and Communications Specialist (ITC). LIC are awaiting a copy of the CPMU separately commissioned study on this subject.

Activity 6: Provide capacity building to relevant agencies to continuously manage the national biogas development program

- ➢ A training workshop for strengthening capacity building under carbon credit market mechanism is implemented with support from LPD.

LIC Ongoing Contribution-

LIC have discussed the materials for the above workshop with the CPMU and how it might I contribute to the design of materials for knowledge transfer and/or the training program for staff of relevant agencies responsible for management and monitoring of the National Biogas Programme.

Activity 7: Monitor operation of biogas plants with adequate environmental facilities

- ➢ Operation and maintenance training courses following construction and quality control activities are being implemented by both CPMU and PPMUs.

LIC Ongoing Contribution-

LIC National M&E, Biogas Technology Specialists are discussing with CPMU how to support PPMUs to set up quality control network at the provincial level. This includes recently commencing research to identify at least one advanced technology to apply.

Activity 8: Train and certify technicians, masons, engineers, and contractors for supporting construction of BVC

- ➢ 10 training course for 321 masons (including 18 women)
- ➢ 24 technician training courses and study tours for sharing experiences for 896 participants to construct SBP.
- ➢ Selected 5 contractors for providing large and medium HDPE biogas plants;

- Organized 4 training courses for contractors and technicians on HDPE covered lagoon in large and medium scale; organized 4 refresher trainings for project provinces;

LIC Contribution-Ongoing

BVC and Training Specialists respectively have reviewed the draft training materials/guideline/manuals for medium and large scale biogas digesters.

This includes checking and preparation for the revision of technical drawings and design specifications before construction/installation for quality control purposes.

Update on new technologies and knowledge on biogas plant as well as CSAWMP technology to eventually transfer to PPMUs.

Activity 9: Providing incentive for carbon market development

- By end of March 2016, 29,735 small biogas plants (SPBs) have been constructed from which 24,531 HH have received financial incentive payment.

LIC Contribution-Ongoing

LIC have raised concerns in regarding the need for product diversification (i.e. different capacity models of the SBP and have also stressed the need for enhanced quality control in construction and after sales service. [16]

3.4.2 OUTPUT 2: Credit Lines for Biogas Value Chains

The financial institutions of the project include: Vietnam Bank for Agriculture and Rural Development and Central People's Credit Fund;

Performance of this component has been a major concern and a credit consultant is currently undertaking a substantive survey and evaluation in an attempt to determine the reason for slow disbursement and propose solution in terms of bank lending products and support to borrowers for biogas credit.
In advance of the survey our initial thoughts are that the loan products offered by cooperating Banks are too narrow (applying only to biogas plant) and restrictive (collateral requirements are unduly onerous for a small loan where applications are often unwilling to put forward their 'Red Book' or land title document as security.

Furthermore, It would seem there is scope for a more integrated approach to biogas design, credit and farm size – from a business development perspective. Based upon estimates/predictions of growth of livestock numbers, small biogas plant could be designed with capacities to more accurately reflect waste throughput.

[16] The ADB and MARD, MONRE Sector Portfolio Review Meeting of 5th November 2015, raised concerns as to 'The rapid implementation of the incentive program and construction of many SBVC may compromise the quality of the construction and sustainability.' A physical audit of SBVCs was therefore proposed with a view to ensuring that technical standards were being met. This has additionally been brought into sharp focus by a fatal accident (in Ca Mau province, a non-LCASP site) where methane leakage resulted in the death of three family members and serious injuries to six neighbors.

In the context of an overall HH/farm business plan, banks could additionally allow for credit going beyond bio-digesters and allowing for related farm infrastructure and purchase of animal stock.

Activities against plan that have been completed to date and the LIC contribution and additional comments are noted below.

Project Financial Intermediaries (FIs) are Vietnam Bank for Agriculture and Rural Development (VBARD) and Central People's Credit Fund (CCF);

- 2 training courses on term for reference for credit finance or biogas plant construction was organized with 100 participants from financial intermediaries, biogas technicians and project contractors. By Q1/2016, VBARD has disbursed 4.961 billion VND for 182 biogas plants

LIC Contribution-Comments

Through the provincial coordinators, LIC is supporting the work of the credit specialist in completing survey work including the 1st stage assessment after field visits Nam Dinh, Ha Tinh, Bac Giang and Lao Cai.

3.4.3 OUTPUT 3: Enhanced climate-smart agriculture waste management practice technology transfer

Introduction

The main focus of the LIC team since commencement has been directed towards the completion of the identification and selection detailed of biogas related demonstration projects and research topics pilots. This has been carried out in the context of the detailed provincial planning exercise) for this component.
A CSAWMP research and demonstration strategy is being developed in line with a MARD Decision (Decision 3119: Program of GHG emissions in Agriculture and Rural Development Sector up to 2020).

Based upon this Decision, the CPMU, LIC consultants supported the PPMUs to survey local conditions, prepare demonstration models in line with the priority needs of each LCASP Province. CPMU has also submitted to ADB the demonstration model selection procedure, technical and economic content requirements, procurement and implementation plans. The other core outputs cover the preparation of 6 packages of CSAWMP Research Topics pilots and a feasibility study for the E-Library as the main information dissemination tool to reach the 10 provinces.

In the detailed plan of the project, only the BVC related activities came within the Project Implementation Manual (PIM). Technologies and solutions for other agricultural waste source management were not incorporated such that a research strategy had to be prepared (a living document) in order to

- Elaborate a research strategy: including identifying the gaps related to the need for the comprehensive management of waste in both animal husbandry and cultivation sectors and associated solutions at all levels.
- Design of demonstrations to support the technical, business and environmental models which are seen as being capable of replication (in the province and more widely later).
- Identification of effective technologies in the management of bio slurry source, processing of organic fertilizer, and use of biogas and effective utilization of the agricultural by-product sources in the cultivation and aquaculture.

Evolution

Implementation arrangements for component three have been subject to delay and urgent attention is being given to making up for lost time. In the first instance this was because the RRP and PAM were 'equally silent' on the subject of implementation and no direction was provided (Ref: Output 3; LCASP: Project Approval Documents 1.1 undated).

Additionally, the failure to secure 'expected Norwegian Development Fund grant funding' was cited as reason for delay). Consequently an ADB staff consultant was appointed to support the preparation of a work plan and research strategy – with the latter perceived as a 'living document' to be drafted over the lifetime of the LCASP. An additional factor has been the lack of continuity with four project officers being variously assigned to the project over the past three years contributing to difficulties in timely implementation.[17]

Since the last day before TET, the LIC central and provincial consultant team have worked closely with the CPMU and provincial PMU to speed up the implementation of a range of pilot demonstration and research topics respectively forming detailed provincial work plans. Through the LIC team a guideline procedure was put in place (since formally documented) that covered for an appropriate 'bottom up' consultation process for the identification and selection of both research topics as well as biogas related demonstration projects. On 4th March the CPMU submitted a list of proposed demonstration sub-projects and research topics along with a request for a no-objection approval of the biogas related demonstration sub-project in Nam Dinh. Although the CPMU (along with the LIC) had believed that ADB concerns about the consultation process had been addressed, this was not the case. This has since been clarified and the CPMU submitted a LIC prepared Procedural Guideline document to the ADB for the biogas related demonstration projects on 25 March for review. If the procedural basis outlined in the document – from consultation and identification through to selection and procurement – is acceptable to the ADB – then this can be put into practice leading to the working up of proposals to full feasibility stage.

Research topic pilots

Following the MARD Decision 5773/QD-BNN-KH of December 2014, the Department of Science and Technology (DSTE) advertised in newspapers and also organized a workshop on the requirements for preparing proposals – which was only made available to MARD Institutions. The initial 77 proposals (received March 2015), were then cut down to 23 pilot proposals of which 22 were from MARD institutions. A review (in October 2015) by the LCASP recruited consultant (Lindsay) raised concerns about the extent to which provinces were consulted and their priorities accommodated as part of the selection process.

An outcome of the communications between the ADB/CPMU and the LIC team since it fully commenced in December has been to review and reduce the number of research topics and use them as a comprehensive list or menu *as the main but not exclusive choice* for provinces to determine their priorities following further consultation with farming communities and enterprises. Provincial PMU's were thus in a position to identify and pursue other concepts *on demand* providing, of course, they came within LCASP criteria.

[17]Derived from the document 'Output 3: LCASP prepared by the ADB appointed consultant, Mr. Lindsay.

The demand and selection of each proposal has been underpinned by a survey and gap/needs analysis carried out by the LIC (provincial coordinators)/PPMU in each province.

LIC provincial co-coordinators have been working closely with provincial PMUs/district and commune level staff to determine priorities and, at the same time, further the process of establishing a systematic working methodology for the identification (including consultation stage), feasibility, contracting and implementation for the sub-project activities to LCASP. This was also part of the process for the demonstration of sub-projects noted above and was covered in the aforementioned day long workshop.

Since mid-February the LIC Provincial Coordinators (PCs) have supported PPMUs in preparing a 'first cut' of priority proposal areas. These were presented by the PCs on 26th and 27th February. Based upon prepared criteria each proposal was scrutinized by a panel of LIC central experts, a CPMU representative and peer provincial co-coordinators. In each case a consensus was reached as to whether the proposal was:

i. Selected > Provisionally recommended to proceed to full feasibility
ii. Review and reworking: Go back to the province for further information or development
iii. Rejected: Panel disagrees

At this stage, the LIC has supported the CPMU in the preparation of 6 packages of research topics (19 sub-projects). A plan of action for each stage of the project cycle has been issued to the ADB and is contained in chapter 4 on implementation arrangements.

The process through to procurement and implementation of the research topics is still under discussion within the CPMU/MARD. A full list of the proposed sub-projects – as packaged – is **in section 4.7.**

Biogas Related Agricultural Waste Demonstration types[18]

Identification and selection of biogas related waste treatment demonstration/pilot sub-projects for all ten LCASP provinces. The process by which this sub-component has been developed since mid-February is fully documented within the guideline document for demonstration projects attached in Appendix H. For the moment we summarize the process.

The provincial coordinators then engaged with the PPMUs to guide them on the process of project selection in order that they could first identify and critically assess first stage proposals with a view to forward for consideration by a panel of central and provincial coordinators to review their economic and technical viability. Following an in-depth panel review – based on laid down criteria – the panel made recommendations that were taken forward to a half day workshop where the combined leadership of the PPMUs determined whether to take forward to an in-depth pre-feasibility assessment.

The Overall Process of consultation and selection

The steps completed and envisaged across the project cycle from identification through to contracting are noted below:

- Survey-gap/needs analysis.
- Selection of proposals at provincial level; review and provisional selection at central/CPMU/LIC and; final assessment and agreement to proceed at a special session following the National LCASP Workshop on 2nd March > incorporation into detailed provincial plan.

[18]Initially carried out concurrently at the provincial level with the identification of research topic sub-projects.

- In-depth consultation with potential beneficiaries at the local level commencing with mass media advertising and partner selection criteria based upon transparent criteria.
- Prepare for detailed feasibility to take procurement, contracting and implementation
- First submission to be subject to prior review and, subject to approval, the following batches advance on the basis of post review procedures. (Dependent upon acceptance of working guidelines).

The outcome of the process to date has been the selection of 32 sub-projects that are broadly fall into six categories as noted below. For each category a dossier has been prepared assessing key technical, economic and environmental viability to be met before proceeding to full feasibility.

Table 5 Categorization of demonstration sub-projects

	Demonstration Categories By Technology Type	Participating provinces										Total
		BG	BT	BD	HT	LC	ND	PT	ST	SL	TG	
1	Comprehensive management of livestock waste (for biogas product-ion, power generation, organic fertilizer)		1	2	1	1	3			2	1	**11**
	Size of 2000-3000 head of pigs (equivalently converted)		*1*	*1*	*1*	*1*	*1*			*1*	*1*	
	Size of 3001-5000 head of pigs (equivalently converted)			*1*			*1*			*1*		
	Size of >5000 head of pigs (equivalently converted)						*1*					
2	Separating slurry of biogas digester – scattered collection system for organic fertilizer production	2		1			1		2		1	**7**
	Small scale (family)	*1*		*1*					*1*		*1*	
	Medium scale (household-based livestock producer)	*1*					*1*		*1*			
3	Shared biogas and linkage in organic fertilizer production from livestock waste	1				1		1			1	**4**
4	Utilization of digested effluent as the fertilizer of the crops and grass			1				1	1			**3**
5	Utilization of cattle dung as the feedstock for red worm raising			1				1				**2**
6	Separating the pig manure for organic fertilizer production		1	1	1			1	1			**5**
	No. of selected demonstrations	**3**	**2**	**6**	**2**	**2**	**4**	**4**	**4**	**2**	**3**	**32**
	Total no. of project demonstrations	**32**										

Source@ LIC Team

Activities against plan that have been completed to date and the LIC contribution and additional comments are noted below

Activity 1: Research and trial activities on CSAWMP

- The first draft of research strategy was submitted to ADB and comments received from ADB independent consultant (October 2015). This proposed for the research strategy to be a 'living document and developed over the course of the project'.
- The ADB appointed consultant also commented upon the list of 23 prioritized research topics (cut down from an initial first cut of 77), which he felt lacked an appropriate level of local consultation having been substantially prepared on the basis of topics put forward by MARD related research institutes.

LIC Contribution-Comments

The number of research topics has since been reduced to 19 and the procurement method is currently under discussion with the ADB. The LIC team has extensively supported with the preparation of the research proposals at the provincial level and 'packaging' up the proposals at the central level. It is envisaged that 6 packages will be prepared by the end of April.

Activity 2: Establishing an information system for sharing CSAWMP

- Preparation of E-Library study and proposal

LIC Contribution-Comments

As a core output of the ITC specialist, a Feasibility Study report on e-library system was submitted to the ADB for a no-objection review on 15th March. This involved extensive work with the CPMU and the Vietnamese Association of Social Sciences (VASS) that was eventually chosen as the lead management agent for operationalizing the E-Library. Part of the process involved a comparative analysis with cloud based IT technologies as well assessing the most sustainable operational and management form.

Activity 3: Train research and extension staff in efficient CSAWMP

A first cut of training of training options was prepared by CPMU in late March with inputs from LIC.

Under preparation Q2, 2016 with a view to implement in Q3 and Q4.

CPMU in collaboration with the Vietnamese Academy of Social Sciences (VASS) is in the process of selecting training topics for CSAWMP for research staff.

Activity 4: Develop training program, textbooks, and syllabus for training farmers on appropriate techniques for CSAWMP and provide vocational training for farmers.

Commencing Q2, 2016

CPMU and LIC consultants have developed 8 vocational training programs on CSAWMP for livestock, crops and aquaculture, which will be implemented in 2016.

Activity 5: Upgrade CSAWMP – based map sets for 7 agro-ecological regions to forecast the direct impact of climate change and provide support for agricultural planning

Envisaged Q4, 2016

Activity 6: Develop livestock waste management demonstrations for agricultural production and greenhouse gas emission reduction

32 demonstration sub-projects have been prepared with intensive LIC support.

LIC Contribution-Comments

This has resulted in 32 pre-feasibility rated demonstration projects covering 6 core category types. Two 'model' sample demonstration sub-projects have been prepared by the LIC, one in Nam Dinh and the other in Binh Dinh. A Procedural Guideline document (including templates) for the demonstration sub-projects was submitted to the ADB on 25th March. It is expected that this will form the basis for provinces to prepare and develop feasibility stage sub-project proposals.

Activity 7: Training extension staff and farmers in CSAWMP production technologies.

PPMUs is now carrying out training courses for extension staff and key farmers on CSAWMP to meet the project objectives

LIC Contribution-Comments

LIC contributed to the vocational training programs and discussions on the preparation of a long list of possible training topics. When the replacement Training and Extension Specialist comes on board in April, needs assessment will be carried out as the basis for elaborating a training program on CSAWMP production technologies.

3.4.4 OUTPUT 4: Effective Project Management

Project Reporting and Performance Monitoring System

The LIC National M&E Specialist has provided extensive guidance to the CPMU on reporting requirements (including LIC and TSU reporting), associated templates and building the M&E system at both the central and provincial level. Initial capacity building work has commenced in 3 provinces (Binh Dinh, Nam Dinh and Bac Giang) and lessons learned will be used, in conjunction with the LIC Training Specialist, to prepare an M&E training program for all provinces. In addition the provincial co-coordinators attended an internal workshop being brief on provincial M&E requirements to prepare the groundwork with colleagues in the PPMUs. Work on carbon credits and associated monitoring data requirements has recently commenced as well as an initial view of the National Biogas Database (in conjunction with the ITC Specialist. [19] The section below covers the main areas of activity of the National M&E specialist and his assessment to date.

Project Performance and Monitoring System (PPMS)

System description

A PPMS primarily collects and tracks information at the level of the input/output of the project with information usually gathered through in the form of project reports.

PPMS's functions are contained in the comprehensive Monitoring Information System (MIS), to enable on-going monitoring for management purposes, and to provide the means to examine the Project's

[19] A full copy of Mr. Pham Van Binh's Inception Report contribution is available upon request

technical performance in the longer term context; to evaluate the delivery of planned facilities; to assess the achievement of project outputs and outcomes; to ensure compliance with social safeguards; and to measure project benefits.

The PPMS enables managers to regularly monitor both efficiency (quantities delivered, people trained, and meetings, etc.) and effectiveness (quality of the goods and services delivered).

For the next level of concern, the MIS generates data on both the immediate and the broader impacts of project investments to be expected to increase the uptake of climate smart agriculture waste management practices (CSAWMP) as measured by the 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.

Given the many stakeholders engaged in the Project: MARD, DLP, Donor, CPMU, 10 PPMUs, Provincial, District and Communal authorities, households and farming enterprises, there is a substantive range of data which to be selected and organized. This represents a major challenge in the design and operation and maintenance of the PPMS.

Design

The design of PPMS is guided by the basic question: *Who Needs to Know What?*

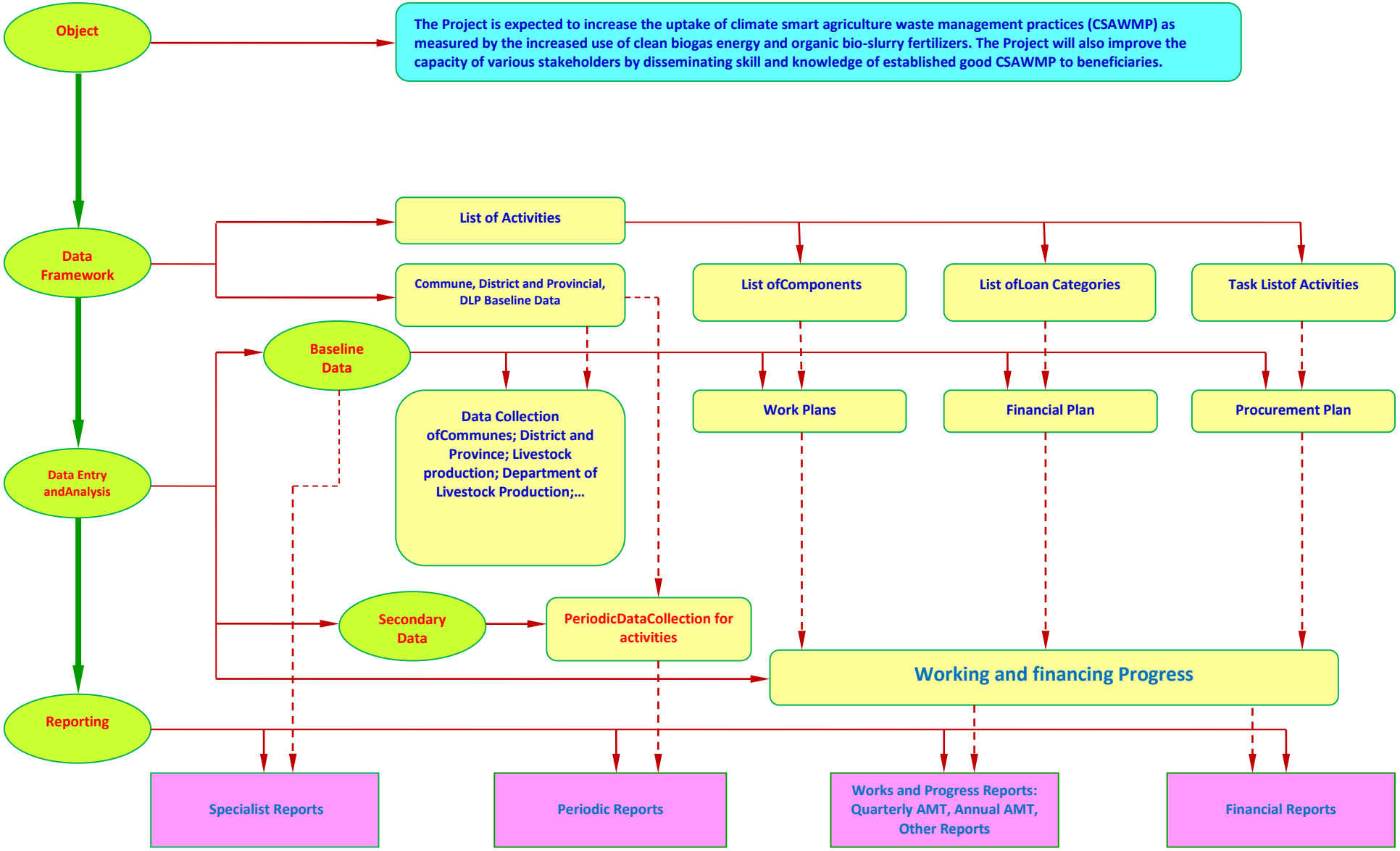
Most of the answers are provided in the requirements of official reports; but a significant number of answers about *what* to measure, are scattered in other documents and agencies, such as the PAM, PIM and other central and provincial agencies respectively.

Consequently, our approach to the design during Inception Phase has been:

- To research and define a structure, and a method, which can be set up, operated and maintained in widely different contexts, with widely varying capacities of agencies;
- To collate Project documents so as to ensure inclusion of all the needs specified in the PIM of Project, the Aligned Monitoring Tool (AMT) of the Ministry of Planning and Investment (MPI), the Quarterly Project Report and Annual project report;
- To identify what parts of the desired PPMS are already established and operational in PCU, and PPMUs;
- To appreciate the systems and data being used by Provincial Departments and agencies related to husbandry.
- To identify the actual scope for cooperation across systems for sharing common processes and products for data measuring, recording, collecting, processing, analyzing, checking, storing, reporting, publishing, distributing, evaluating and responding;
- To specify links across data files, and into reporting formats.

Monitoring and Evaluation has been conducted throughout the project to date – but not always in a timely manner. These included Progress Monitoring, Implementation Monitoring and Compliance Monitoring and Evaluation. Monitoring and Evaluation has been conducted in all central and local levels covering the activities and interventions of LCASP as related to the Design and Monitoring Framework (not always consistently) and the MARD approved annual planning and reporting exercise.

Figure 1 Diagram on relation of Database and Reports in PPMS of LCASP



The National M&E Consultant has followed the requirement of the TOR to integrate PPMUs and PCU PPM Subsystems into PPMS of LCASP, and to facilitate and empower the work of PPMUs, CPMU and local level partners and stakeholders. This has been done by designing a single large database to include managing, implementing, monitoring, evaluation and reporting across all levels and locations.

The Design and Monitoring Framework (DMF) associated milestones as noted within the PIM and Gender Action Plan are contained in **Appendix B**.

The process: Central and Provincial M&E staff collect data necessary to monitor the indicators which are important for management and supervision during project implementation. Ideally, baseline data should be made available early in the project. Once the framework has been agreed, the data can then be incorporated in the PPMS to allow stakeholders (at both provincial and central level) to track progress and realign activities to match performance objectives and targets as considered necessary.

Unfortunately this has not been the case since the baseline survey team have only just commenced the testing phase of their working methodology almost three years into the project. The LIC team have therefore made a number of recommendations to CMPU and the survey consultants to apply quasi and/or proxy indictors to help create a baseline scenario from which ongoing performance can be measured. Overall the LIC team felt that some serious rethinking needed to be done to simplify the exercise. This is something that is likely to come out of the testing phase place in mid-April. We believe the baseline consultant team may be able to use parts of the National Biogas Survey (SNV 2013) as a quasi-survey baseline (where designs and locations are the same). information upon the interaction with the baseline survey team and LIC recommendations is contained in **Appendix D[20].**

Project report system

The national M&E specialist has worked hard and methodically since December to provide the reporting framework and associated template documents for the entire project.

The reports noted here contribute to the Report of the Government-Donor Aligned Management Tool (ATM) and, as such, constitute the backbone of the PPMS. These include:

Quarterly Report

Quarterly Report of PPMU: Within 10-15 working days after the end date of the previous quarter PPMU must send Quarterly Reports by hard copy, fax and email to CPMU, DARD and the Provincial People's Committee. This includes DMF, GAP and the Training Tool for updating relevant data.

Quarterly Report of LCASP**:** Within 15 working days after the end date of the previous quarter, CPMU must send Quarterly Reports by hard copy, fax and email to MARD, the Ministry of Planning and Investment, the Ministry of Finance and the Provincial People's Committees of the localities where the project is implemented, the relevant line ministries and the Donor (in English, unless there are other agreements).

Annual Report

[20] Since the inception report was drafted the baseline survey consultants have since tested their questionnaire-survey form and formally commenced the survey (as of 16th May)

Annual Report of PPMU**:** Before 15st January of the following year, PPMU must send report with application of the Annual Report by hard copy, fax and email to CPMU, DARD and the Provincial People's Committee.

Annual Report of LCASP: Before 31st January of the following year, CPMU must send report with application of the Annual Report by hard copy, fax and email to MARD, the Ministry of Planning and Investment, the Ministry of Finance and the Provincial People's Committees of the localities where the project is implemented, the relevant line ministries and the Donor (if required).

Project Completion Report

Project Completion Report of PPMU: Within 3 months of the completion date of the project, the PPMU must send report using the Project Completion Report by hard copy, fax and Email to CPMU, DARD, and the Provincial People's Committees.
Project Completion Report of LCASP**:** Within 6 months of the completion date of the project, the CPMU must send report using the Project Completion Report by hard copy, fax and email to MARD, the Ministry of Planning and Investment, the Ministry of Finance and the Provincial People's Committees of the localities where the program or project is implemented, the relevant line ministries and the Donor.

A detailed list of the M&E specialist's outputs including reporting forms is contained in **Appendix I**

The project has been operational for 3 years with a CPMU based in Hanoi and 10 PPMUs based in provinces.

A Provincial Implementation Manual has been prepared and is updated on a yearly basis for the guidance of province activities.

Consulting packages: (1) Package 1: Project Management Consulting Services (LIC): is signed with ACI association with ADConsult in late November, 2015; (2) Package 3: Baseline Survey: technical proposal is under evaluation by APMB (3) Package 4: Project Auditing: is under implementation.
Gender Awareness workshop for PMUs 2016: A consultant has been engaged and will co-operate with LIC Gender and Ethnic Minorities specialist in the preparation of materials and delivery of the workshop in quarter 2, 2016.

Organize biogas owners and CSAWMP participants through relevant agencies. This is being implemented through the National Biogas Programme.

Other activities have involved the procurement office and transport facilities at the central and provincial levels.

4 WORK PLAN

4.1 Three Phases of the Work Plan

The three-year assignment of the LCAP is divided into three phases as follows:

Phase 1 – Inception (3 months) from January 2016.
Phase 2 – Development (8 months).
Phase 3 – Implementation (25 months).

4.2 Deliverables

The list of deliverables and the due dates are illustrated in Table 6.

The preparation of production of each major report (Inception, Midterm, Draft Final, and Final) will be based on the following process:

Step 1: Preparation of Draft Report
Step 2: Submission to CPMU for Comments
Step 3: Revision of the Report based on Comments
Step 4: Comments from PPMUs at the Dissemination Workshop
Step 5: Preparation of Final Report based on Comments

The length of this process depends on the time needed by various reviewers to send their comments to the Consultants' Team. It is expected that between submission of the first draft (Step 1) and final draft of each major report, there is a period of about 3 weeks. This period will be continuously monitored to assure timely completion of the report.

Table 6 Core Deliverables and Date Due

No..	Deliverable	Date Due	Comment
1.	Inception Report	26th April 2016	
2.	Quarterly Progress Reports	Within 15 days from the end of March, June, Sept. & Dec.	A request has been made to combine the first quarterly report with the inception report
3.	Annual Progress Report	Within 15 days from the end of the year	
4.	Expert monthly report	Within 7 days after each month	
5.	Mid-term Report	1 month prior to the Mid-term Workshop	
6.	Draft Project Completion Report (PCR)	3 months before end of project	
7.	Final Project Completion Report (PCR)	Within 2 weeks after receipt of comments on Draft PCR	
8.	Position Assignment Completion Report	Within 7 days after completion of each position's input	

4.3 Work Planning

At a functional level overall work planning for the project is guided by the MARD-LCASP Masterplan, which is updated on an annual basis. From this the CPMU guides and instructs the LIC (and TSU) as to the priorities and timing starting at the yearly down to a monthly plan that is agreed a few days in advance of the next month. The principles and policies for core outputs per component e.g. demonstrations and research topic pilots are determined at central level and then applied under the guidance of the PPMUs. As such, CASP provinces have their own (essentially similar plans). Indeed the LIC provincial consultants have played an important role in the preparation of detailed provincial plans that were completed in March 2016. Likewise the LIC central team guide and support provincial co-coordinators to assist and facilitate the PPMUs in implementing the project. .

The Inception report provides work planning schedules for the

1. Overall Project per component
2. Each individual consultants envisaged contribution per the TOR.
3. Core activities to the provincial level e.g. demonstration sub-projects and research topic pilots including provisional timeframe along the project management cycle through to implementation.
4. For participating provinces (all similar plans) using Nam Dinh as a specimen example)

4.4 Overall Project Workplan

The overall work plan for the assignment is illustrated in Figure 2 . This covers the LIC contribution to each of the four core outputs of the project over the three years. Figure 3 summarizes the status as of April 2016.

4.5 Individual Consultants Workplans

The individual LIC specialists' workplans and their status are presented in Figure 4 to Figure 28.

Figure 2 Work Plan for the LIC Team

No.	DELIVERABLES	Year	2016											2017											2018										
		Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
D1 - EXPANDED USE OF LIVESTOCK WASTE MANAGEMENT INFRASTRUCTURE																																				
1.1	Review institutional capacity and policy environment in relation to LCA and CSAWMP																																			
1.2	Review and identify biogas technologies																																			
1.3	Establish digester design parameters for small, medium and large operations																																			
1.4	Develop SOPs and equipment testing protocols for small, medium and large operations																																			
1.5	Identify successes among pilots and project supported systems																																			
1.6	Scale up successes																																			
1.7	Review current and proposed carbon market systems																																			
1.8	Advise on piloting/establishing carbon market system and incentive mechanisms																																			
D2 - CREDIT LINES FOR BIOGAS VALUE CHAINS																																				
2.1	Analyze institutional and policy gaps to private investment in LCA and CSAWMP technologies																																			
2.2	Develop inspection and certification systems for LCA and CSAWMP service providers																																			
2.3	Evaluate current and potential credit providers and systems																																			
2.4	Establish communication channels with VBARD, CCF and other financial intermediaries																																			
2.5	Deliver credit related training programs																																			
2.6	Establish a transparent system for assessing eligibility to access credit																																			
2.7	Establish a database of registered, accredited sector specific service providers																																			
2.8	Advise on adaptation/replication of successful business and extension service models																																			
2.9	Facilitate PPP, particularly in relation to investment in medium-large biogas systems																																			
D3 - TRANSFER OF TECHNOLOGY FOR ENHANCED CSAWMP																																				
3.1	Pilot biogas plants																																			
3.2	Facilitate producer and wider interest group forums/association establishment																																			
3.3	Assess national and provincial capacity needs and deliver of training																																			
3.4	Design and piloting of producer and service provider training programs																																			
3.5	Scaling up of technology transfer; train the trainer programs																																			
3.6	Develop technology transfer materials and programs																																			
3.7	Update of CSAWMP-related maps																																			
3.8	Update the national biogas database																																			
3.9	Establish CSAWMP research and demonstration priorities																																			
3.10	Advocacy and awareness raising																																			
D4 - EFFECTIVE PROJECT MANAGEMENT																																				
4.1	Mobilize the Consultant team; establish required project management infrastructure																																			
4.2	Coordinate with CPMU/PPMUs; deliver inception reports and workshop(s)																																			
4.3	Advise on the conduct of baseline assessments																																			
4.4	Establish M&E system																																			
4.5	Mainstream gender and ethnic minority and indigenous people safeguards																																			
4.6	Establish environmental impact monitoring system																																			
D5 - REPORTS																																				
5.1	Inception																																			
5.2	Quarterly																																			
5.3	Annual																																			
5.4	Mid-term																																			
5.5	Draft Final																																			
5.6	Final																																			
5.7	Individual Consultants Completion Reports																																			

Figure 3 Work Plan for the LIC Team – Status April 2016

No.	DELIVERABLES	Year / Month	2016 1	2	3	4	STATUS (done, ongoing, not yet started)	COMMENTS	DELAYS (on time, late)
D1 - EXPANDED USE OF LIVESTOCK WASTE MANAGEMENT INFRASTRUCTURE									
1.1	Review institutional capacity and policy environment in relation to LCA and CSAWMP						Done	Firm understanding achieved	On time
1.2	Review and identify biogas technologies						Done	in-depth understanding achieved	On time
1.3	Establish digester design parameters for small, medium and large operations						Ongoing		On time
1.4	Develop SOPs and equipment testing protocols for small, medium and large operations						Ongoing	initial assessment completed	Delayed
1.5	Identify successes among pilots and project supported systems						Not yet started		
1.6	Scale up successes						Not yet started		
1.7	Review current and proposed carbon market systems						Ongoing	Recently commenced - to reschedule	Delayed
1.8	Advise on piloting/establishing carbon market system and incentive mechanisms						Not yet started		
D2 - CREDIT LINES FOR BIOGAS VALUE CHAINS									
2.1	Analyze institutional and policy gaps to private investment in LCA and CSAWMP technologies						Ongoing	Awaiting in-depth report from CPMU credit study	On time
2.2	Develop inspection and certification systems for LCA and CSAWMP service providers						Not yet started		
2.3	Evaluate current and potential credit providers and systems						Ongoing	Awaiting in-depth report from CPMU credit study	On time
2.4	Establish communication channels with VBARD, CCF and other financial intermediaries						Not yet started		
2.5	Deliver credit related training programs						Not yet started		
2.6	Establish a transparent system for assessing eligibility to access credit						Not yet started		
2.7	Establish a database of registered, accredited sector specific service providers						Not yet started		
2.8	Advise on adaptation/replication of successful business and extension service models						Not yet started		
2.9	Facilitate PPP, particularly in relation to investment in medium-large biogas systems						Not yet started		
D3 - TRANSFER OF TECHNOLOGY FOR ENHANCED CSAWMP									
3.1	Pilot biogas plants						Not yet started		
3.2	Facilitate producer and wider interest group forums/association establishment						Ongoing	Activities commenced	On time
3.3	Assess national and provincial capacity needs and deliver of training						Ongoing	Good understanding of capacity needs	on time
3.4	Design and piloting of producer and service provider training programs						Not yet started		
3.5	Scaling up of technology transfer; train the trainer programs						Not yet started		
3.6	Develop technology transfer materials and programs						Not yet started		
3.7	Update of CSAWMP-related maps						Not yet started		
3.8	Update the national biogas database						Not yet started		
3.9	Establish CSAWMP research and demonstration priorities						Ongoing	Essentially complete, packages to go to ADB	On time
3.10	Advocacy and awareness raising						Not yet started	Awaiting confirmation of Training & Extension Consultant	
D4 - EFFECTIVE PROJECT MANAGEMENT									
4.1	Mobilize the Consultant team; establish required project management infrastructure						Ongoing	in the main complete	On time
4.2	Coordinate with CPMU/PPMUs; deliver inception reports and workshop(s)						Ongoing	Slight delay to rescheduled inception report	Slight delay
4.3	Advise on the conduct of baseline assessments						Ongoing	Dependent upon other consultant team	Slight delay
4.4	Establish M&E system						Ongoing	Main M&E and reporting system in place	On time
4.5	Mainstream gender and ethnic minority and indigenous people safeguards						Ongoing	Commenced April	On time
4.6	Establish environmental impact monitoring system							Commenced April	On time
D5 - REPORTS									
5.1	Inception						Completed		Slight delay
5.2	Quarterly						Completed		Slight delay
5.3	Annual						Not yet started		On time
5.4	Mid-term						Not yet started		On time
5.5	Draft Final						Not yet started		On time
5.6	Final						Not yet started		On time
5.7	Individual Consultants Completion Reports						Not yet started		On time

Figure 4 Work Plan of Team Leader

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Make a presentation at the kick off workshop organized by CPMU…		■										
2	Establish LIC office & consultant team respectively with associated management procedures	■	■										
3	Province guidance to the team and assume responsibility for overall performance and achievement of LCASP outputs	■	■	■	■	■	■	■	■	■	■	■	■
4	Prepare the inception report & make a presentation at meeting organized by CPMU		■										
5	Organize regular team meetings to discuss progress and identify emerging issues that need to be taken up and discussed with the client.	■	■	■	■	■	■	■	■	■	■	■	■
6	Advise and assist the M&E specialist with the development of the Project Performance Management System (PPMS) and with implementation of the PPMS.	■	■				■				■		
7	Advice and assist the CPMU with the development and update of the detailed implementation plan (DIP) for project implementation, in consultation with PPMUs, FIs, and other key stakeholders	■	■	■	■	■	■	■	■	■	■	■	■
8	With inputs from individual consultants, prepare the work plan for the consultant Team . The work plan will be regularly updated and be available on a common computer drive.	■	■	■	■	■	■	■	■	■	■	■	■
9	Advise the CPMU and PPMUs in preparing their annual work plans and budgets.				■				■	■			
10	Advise and assist the CPMU in preparing and submitting to ADB necessary project documents for approval or reporting	■	■	■	■	■	■	■	■	■	■	■	■
11	Advise and assist the CPMU with procurement of goods and services according to ADB procedures and guidelines.		■										
12	Advise and assist CPMU in preparing the inception report, quarterly reports, midterm review report, and the Project Completion Report in accordance with ADB requirements and standards	■	■	■	■	■	■	■	■	■	■	■	■
13	Advise with the procedure for formulation of Pilots & Demonstrations (P&Ds) in consultation with PPMUs and private, beneficiaries, and submit P&Ds to CPMU for onward submission to ADB.	■	■	■	■								
14	Advise with the preparation of consultants' technical working papers and progress reports, and presentations at workshops, etc...	■	■	■	■	■	■	■	■	■	■	■	■
15	Advise and assist the CPMU with coordination meetings on between CPMU, PPMUs, FIs TSU, MARD departments, VRM, consultants and other agencies and parties involved in implementation such as VBA.	■	■	■	■	■	■	■	■	■	■	■	■
16	Advise on the updating of the Project Administration/Implementation Manuals, and provide an input where required.		■		■		■		■		■		
17	Assume other task that may be requested by the Project Director and that are reasonably within her/his duties and competence on Project Management	■	■	■	■	■	■	■	■	■	■	■	■
	Technical Tasks												
T1	Advise on the design of a website for the LASCP, and assist with its implementation.		■	■									
T2	Review the ICT consultant webpages, e-information exchange, and advise on the development of the common biogas database, in close consultation with CPMU, PPMUs, FIs, VBA, ICT consultant	■	■	■	■								
T3	Review the business models and feasibility studies prepared by the technical consultants for Biogas Value Chains, and for CSAWMP.		■		■		■		■				
T4	Identify and analyze financial and economic issues for the project, determining optimum solutions for the reduction of GHG.		■			■		■		■			
T5	Advise CPMU on the development of the policy/institutional framework for implementation and monitoring of BVCM, CSAWMP, GAP, standards, certification, and inspection			■		■		■		■			
T6	Prepare and update guidelines for BVCM, CSAWMP, and supporting investments funded by the Project		■	■			■	■					
T7	Assist in developing an effective accreditation and certification system, if required for BVCM, CSAWMP and other investments funded by the Project			■	■		■		■	■			
T8	Help prepare detailed technical specifications through consultation with the other team members, relevant institutes, financial intermediaries, partner agencies and other stakeholders		■	■	■	■	■	■	■	■			
T9	Advice and act as resource person for capacity building activities for staff of MARD, DARDs, financial intermediaries, coordinating and managing entity (CME), VBA and project staff	■	■	■	■	■	■	■	■	■	■	■	■
T10	Advise and assist with the provision and/or arrangement for necessary training programs and study tours to be provided for by the Project			■	■	■	■	■	■	■	■	■	■
T11	Assist with and advice on other technical matters that are within the scope of her/his technical expertise and experience.	■	■	■	■	■	■	■	■	■	■	■	■
	Number of TA months per each quarter	3	3	2	2	3	3	2	2	3	3	2	2
	Number of TA months per each year	**10**				**10**				**10**			
	Total of TA months input	**30**											
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★					★			
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report												★
	Individual Consultant Completion Report												★

Figure 5 Work Plan of Team Leader – Status as of April 2016

No.	Activity	2016 Q1	STATUS (done, ongoing, not yet started)	COMMENTS	DELAYS (on time, late)
1	Make a presentation at the kick off workshop organized by CPMU…			See note	
2	Establish LIC office & consultant team respectively with associated management procedures		Done	TL delayed, Training specialist replaced	slight delay
3	Province guidance to the team and assume responsibility for overall performance and achievement of LCASP outputs		Ongoing	-demo. Research pilots, guide procedures delivered	On time
4	Prepare the inception report & make a presentation at meeting organized by CPMU		Ongoing	inception report delivered - workshop to arrange	Slight delay
5	Organize regular team meetings to discuss progress and identify emerging issues that need to be taken up and discussed with the client.		Ongoing	Regular meetings LIC & with CPMU & ADBs	On time
6	Advise and assist the M&E specialist with the development of the Project Performance Management System (PPMS) and with implementation of the PPMS.		Ongoing	Progress well with inputs from Nat M7E consultant	On time
7	Advice and assist the CPMU with the development and update of the detailed implementation plan (DIP) for project implementation, in consultation with PPMUs, FIs, and other key stakeholders		Ongoing	Assisting PPMU with plans - almost complete	On time
8	With inputs from individual consultants, prepare the work plan for the consultant Team . The work plan will be regularly updated and be available on a common computer drive.	Ongoing	Ongoing	Workplans prepared on monthly basis in advance	On time
9	Advise the CPMU and PPMUs in preparing their annual work plans and budgets.		Not yet started	Due end of year	
10	Advise and assist the CPMU in preparing and submitting to ADB necessary project documents for approval or reporting		Ongoing	Done for demo-research pilot, E-Library, M&E procedures	On time
11	Advise and assist the CPMU with procurement of goods and services according to ADB procedures and guidelines.		Ongoing	Guidelines procedures prepared	On time
12	Advise and assist CPMU in preparing the inception report, quarterly reports, midterm review report, and the Project Completion Report in accordance with ADB requirements and standards		Ongoing	Slight delays with inception and Quarterly	Slight delay
13	Advise with the procedure for formulation of Pilots & Demonstrations (P&Ds) in consultation with PPMUs and private, beneficiaries, and submit P&Ds to CPMU for onward submission to ADB.		Ongoing	Preceding well after initial procedural issues ADB	On time
14	Advise with the preparation of consultants' technical working papers and progress reports, and presentations at workshops, etc...	Ongoing	Ongoing	Paper on research and 6 demo dossiers prepared	On time
15	Advise and assist the CPMU with coordination meetings on between CPMU, PPMUs, FIs TSU, MARD departments, VRM, consultants and other agencies and parties involved in implementation such as VBA.		Ongoing	Inc. co-operation with VASS etc.	On time
16	Advise on the updating of the Project Administration/Implementation Manuals, and provide an input where required.			Available on demand	
17	Assume other task that may be requested by the Project Director and that are reasonably within her/his duties and competence on Project Management		Ongoing	Inc. support to baseline study and credit study	On time
	Technical Tasks				
T1	Advise on the design of a website for the LASCP, and assist with its implementation.		Not yet started	Due second quarter	
T2	Review the ICT consultant webpages, e-information exchange, and advise on the development of the common biogas database, in close consultation with CPMU, PPMUs, FIs, VBA, ICT consultant		Ongoing	Initial scoping of national database completed	On time
T3	Review the business models and feasibility studies prepared by the technical consultants for Biogas Value Chains, and for CSAWMP.			Due second quarter	
T4	Identify and analyze financial and economic issues for the project, determining optimum solutions for the reduction of GHG.			Due commence second quarter	
T5	Advise CPMU on the development of the policy/institutional framework for implementation and monitoring of BVCM, CSAWMP, GAP, standards, certification, and inspection			Due later	
T6	Prepare and update guidelines for BVCM, CSAWMP, and supporting investments funded by the Project			Commences second quarter	
T7	Assist in developing an effective accreditation and certification system, if required for BVCM, CSAWMP and other investments funded by the Project			Due later	
T8	Help prepare detailed technical specifications through consultation with the other team members, relevant institutes, financial intermediaries, partner agencies and other stakeholders			Due later	
T9	Advice and act as resource person for capacity building activities for staff of MARD, DARDs, financial intermediaries, coordinating and managing entity (CME), VBA and project staff			Initial contribution to CPMU training plan made	
T10	Advise and assist with the provision and/or arrangement for necessary training programs and study tours to be provided for by the Project			Due second quarter	
T11	Assist with and advice on other technical matters that are within the scope of her/his technical expertise and experience.			Review of economic & managerial viability dossiers	On time
	Number of TA months per each quarter	3			
	Number of TA months per each year	**10**			
	Total of TA months input	**30**			
	OFFICAL DELIVERABLES			**CPMU Requested Deliverables this Quarter**	
	Overall Coordination and Preparation of Inception Report			Demonstration proposal for each province	Done
	Overall Coordination and Preparation of Quarterly Report			Research topic proposals for each province	Done
	Overall Coordination and Preparation of Annual Report			Consolidated list of selected demonstrations	Done
	Overall Coordination and Preparation of Mid-term Report			Consolidated list of selected research pilots	Done
	Overall Coordination and Preparation of Draft Final Report			Guideline Procedures for demonstration projects	Done
	Overall Coordination and Preparation of Final Report			Detailed dossier of 6 demonstration categories	Ongoing
	Individual Consultant Completion Report				

Figure 6 Work plan of Deputy Team Leader

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Assist TL in the carrying out managerial duties and responsibilities for overall project management and assume the role of acting TL during periods of absence of the TL.												
2	Assist the CPMU with capacity building activities for staff of MARD, DARDs, FIs, CPMU and PPMUs, VBA, etc..												
3	Promote and facilitate coordination between CPMU, MARD agencies and institutions, PPMUs and other consultants.												
4	Update the institutional, management structure, coordination, monitoring and evaluation mechanisms for a nationwide biogas program for both household and medium- to large-scale biogas including recommendation to empower relevant agencies;												
5	Assist CPMU to supervise the provincial coordinators and report to CPMU director;												
6	Assist the CPMU with the preparation of the Project Completion Report, drawing on estimates of outputs, outcomes and impacts in accordance with ADB/ GOV guidelines and requirements, identify lessons learnt, make recommendations for follow up after project completion.												
7	Undertake other task as requested by the TL or CPMU's Project Director that are within the reasonable duties and scope of her/his assignment.												
8	Work in close coordination with CPMU, the Consultant Team Leader, and the ICT specialist in consolidate information relating to the progress of biogas plants construction and its biogas value chain development;												
9	Coordinate with financial intermediaries to consolidate information relating to biogas plants constructed over the 10 provinces that were funded using the Project's credit lines and update the consolidated progress of the ICMD distribution in the project areas;												
10	Coordinate with PPMUs, service providers, and training agencies to facilitate the implementation of component 3 at commune levels;												
11	Lead the provincial coordinators to organize project activities at provincial to commune levels.												
12	Assist the Project Management Consultants in coordinating with PPMUs when formulating detailed investment activities from provincial to commune level for component one of the Project;												
13	Facilitate communication between the CPMU and PPMUs to ensure that the CPMU adequate provisions for incentive disbursements relating to the Project's financial assistance when a certification of compliance on the technical and environmental requirements of BVCM constructions has been secured; and												
14	Facilitate coordination with PPMUs as it relates to the gathering of specific information and data necessary for various carbon trading activities												
15	Consolidate information relating to biogas plants constructed over the 10 provinces that were funded using the Project's credit lines.												
16	Lead the coordination effort, in close consultation with the CPMU, Project Management Consultants, and 10 PPMUs, in implementing component 3 investment activities up to the commune level;												
17	Coordinate with provincial coordinators in reporting implementation progress of component 3 investment activities for their respective provinces.												
	Technical Tasks												
T1	Review and develop standards and codes of conduct for the promotion of BVC Management and CSAWMP.												
T2	Develop policy and institutional framework for implementation and monitoring of BVC, CSAWMP, good waste management practices, standards, certification, etc.												
T3	Work with the training consultant to identify the necessary training programs for PPMUs and FIs, and ensure implementation of the training programs.												
T4	Advise on the development of biogas digester design and guidelines for use by households, livestock farms, government institutions, financial institutions and other stakeholders, review and update the existing "best-practice" and "state-of-the-art" BVCM and CSAWMP in Viet Nam.												
T5	Assess the viability of livestock farms for new biogas investments and estimate the potential improvement of the existing biogas systems and potential promotion of SBPs, BPs and LBP); assess how readily various potential technologies can be utilized for large-scale applications.												
T6	Review, assess and update national and appropriate international experience with small, medium and large scale biogas plants design technologies and the implication for local authorities and other stakeholders												
T7	Carry out a review of docs on manure types and local climates and assess technology options available in Viet Nam, and provide recommendations regarding priority technologies, marketing, and management for bio-slurry based CSAWMP development;												
T8	Review, strengthen and finalize FS for selected livestock farms for MBPs and LBPs to be assisted by the project, including for acquiring credit from FIs.												
T9	Appraise the biogas technical and design soundness of the representative sample livestock farms and other relevant enterprises and develop criteria to assess the technical feasibility for biogas plants proposed by investors.												
T10	Recommend technical inputs needed to improve existing biogas programs and assist the team leader and other team members in preparing the detailed proposals for proposed investments.												
T11	Develop demonstration ideas, demonstration models, procurement guideline and critic for LCASP research topics, LCASP research proposals												
	Number of TA months per each quarter	3	3	3	3	3	3	3	3	3	3	3	3
	Number of TA months per each year	12				12				12			
	Total of TA months input	36											
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report					★				★			
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report											★	

*CPMU Requested Deliverables this Quarter
Demonstration proposal for each province
Research topic proposals for each province
Consolidated list of selected demonstrations
Consolidated list of selected research pilots
Guideline Procedures for demonstration projects
Detailed dossier of 6 demonstration categories
Consolidated List of training topics
Trip report from the visit to provinces

Figure 7 Work Plan of Deputy Team Leader – Status as of April 2016

No.	Activity	2016 Q1	STATUS (done, ongoing, not yet started)	COMMENTS	DELAYS (on time, late)
1	Assist TL in the carrying out managerial duties and responsibilities for overall project management and assume the role of acting TL during periods of absence of the TL.		Ongoing	TL delayed until Feb.,	slight delay
2	Assist the CPMU with capacity building activities for staff of MARD, DARDs, FIs, CPMU and PPMUs, VBA, etc..		Ongoing	Assisting CPMU and PPMU staff in training course and developing workplan	on time
3	Promote and facilitate coordination between CPMU, MARD agencies and institutions, PPMUs and other consultants.		Ongoing	Participated meeting between CPMU and Partners (DOTE under MARD, VASS), PPMU (2015 LCASP Overview Meeting in Binh Dinh, 3/2016)	on time
4	Update the institutional, management structure, coordination, monitoring and evaluation mechanisms for a nationwide biogas program for both household and medium- to large-scale biogas including recommendation to empower relevant agencies;		Not yet started	Due end of data survey	slight delay
5	Assist CPMU to supervise the provincial coordinators and report to CPMU director;		Ongoing	Follow up activities of provincial consultants by their regular report	on time
6	Assist the CPMU with the preparation of the Project Completion Report, drawing on estimates of outputs, outcomes and impacts in accordance with ADB/ GOV guidelines and requirements, identify lessons learnt, make recommendations for follow up after project completion.		Not yet started	Project will ended in the end of 2018	on time
7	Undertake other task as requested by the TL or CPMU's Project Director that are within the reasonable duties and scope of her/his assignment.		Ongoing		on time
8	Work in close coordination with CPMU, the Consultant Team Leader, and the ICT specialist in consolidate information relating to the progress of biogas plants construction and its biogas value chain development;		Ongoing	Read and comment for e-library FS report (done and delivered to ADB)	on time
9	Coordinate with financial intermediaries to consolidate information relating to biogas plants constructed over the 10 provinces that were funded using the Project's credit lines and update the consolidated progress of the ICMD distribution in the project areas;		Ongoing	Read and comment for IR of credit consultant and their initial finding report	on time
10	Coordinate with PPMUs, service providers, and training agencies to facilitate the implementation of component 3 at commune levels; and		Not yet started	Demonstration proposals have been done and delivered, waiting feedback from ADB to implement	slight delay
11	Lead the provincial coordinators to organize project activities at provincial to commune levels.		Ongoing	Current status reports and list of potential farms are developed and delivered	on time
12	Assist the Project Management Consultants in coordinating with PPMUs when formulating detailed investment activities from provincial to commune level for component one of the Project;		Ongoing	Field visit	on time
13	Facilitate communication between the CPMU and PPMUs to ensure that the CPMU adequate provisions for incentive disbursements relating to the Project's financial assistance when a certification of compliance on the technical and environmental requirements of BVCM constructions has been secured;		Ongoing	Assisting province coordinator team to gather information and inform to CPMU their findings	on time
14	Facilitate coordination with PPMUs as it relates to the gathering of specific information and data necessary for various carbon trading activities		Starting up	Overview and comment IR for data survey team	slight delay
15	Consolidate information relating to biogas plants constructed over the 10 provinces that were funded using the Project's credit lines.		Ongoing	Not so much	
16	Lead the coordination effort, in close consultation with the CPMU, Project Management Consultants, and 10 PPMUs, in implementing component 3 investment activities up to the commune level; and		Ongoing	Develop proposal and guideline	on time
17	Coordinate with provincial coordinators in reporting implementation progress of component 3 investment activities for their respective provinces.		Ongoing	Close contact and keep information from PC team	on time
	Technical Tasks				
T1	Review and develop standards and codes of conduct for the promotion of BVC Management and CSAWMP.		Ongoing	Assist CPMU develop standard guide to construct of BVC and CSAWMP	on time
T2	Develop policy and institutional framework for implementation and monitoring of BVC, CSAWMP, good waste management practices, standards, certification, etc.		Ongoing	Contribute with M&E consultant to develop tools for implementing	on time
T3	Work with the training consultant to identify the necessary training programs for PPMUs and FIs, and ensure implementation of the training programs.		Ongoing	Overview and comment for training topics, program, and materials	on time
T4	Advise on the development of biogas digester design and guidelines for use by households, livestock farms, government institutions, financial institutions and other stakeholders, review and update the existing "best-practice" and "state-of-the-art" BVCM and CSAWMP in Viet Nam.		Ongoing	Overview and comments for guideline, process, materials developed by CPMU, national consultants. Review and update existing documents, process..	on time
T5	Assess the viability of livestock farms for new biogas investments and estimate the potential improvement of the existing biogas systems and potential promotion of SBPs, MBPs and LBP); assess how readily various potential technologies can be utilized for large-scale applications.		Ongoing	Field trip to provinces (Bac Giang, Nam Dinh, Ha Tinh, Binh Dinh) to support and apprise assessment of provincial coordinator team	on time
T6	Review, assess and update national and appropriate international experience with small, medium and large scale biogas plants design technologies and the implication for local authorities and other stakeholders (govt Inst-Fis, NGOs & HHs)		Ongoing	One short research on medium and large biogas technologies have been done and delivered (with a lesson learn from domestic and international experiences)	on time
T7	Carry out a review of docs on manure types and local climates and assess technology options available in Viet Nam, and provide recommendations regarding priority technologies, marketing, and management for bio-slurry based CSAWMP development;		Ongoing	Initial knowledge and experiences support for developing research topic and technical solution of demonstration proposals	on time
T8	Review, strengthen and finalize FS for selected livestock farms for MBPs and LBPs to be assisted by the project, including for acquiring credit from FIs.		Ongoing	Develop detail plan of demonstration proposals (both solution for technology and financing)	on time
T9	Appraise the biogas-related technical and design soundness of the representative sample livestock farms and other relevant enterprises and develop criteria to assess the technical feasibility for biogas plants proposed by potential investors.		Ongoing	Field trip to farms and enterprises. Discuss with CPMU, PPMU to develop criteria	on time
T10	Recommend technical inputs needed to improve existing biogas programs and provide inputs and assist the team leader and other team members in preparing the detailed proposals for proposed investments.		Ongoing	WPs developed every month, review and comment WP of consultant team	on time
T11	Develop demonstration ideas, demonstration models, procurement guideline and critic for LCASP research topics, LCASP research proposals		Ongoing	Develop list of potential demonstration, criteria. Contribute with TL develop a guide for implementing	on time
	Number of TA months per each quarter	3			
	Number of TA months per each year	**3**			
	Total of TA months input	**3**			
	REPORT DELIVERABLES				
	Overall Coordination and Preparation of Inception Report				On time
	Overall Coordination and Preparation of Quarterly Report				On time
	Overall Coordination and Preparation of Annual Report				
	Overall Coordination and Preparation of Mid-term Report				
	Overall Coordination and Preparation of Draft Final Report				
	Overall Coordination and Preparation of Final Report				
	Individual Consultant Completion Report				

***CPMU Requested Deliverables this Quarter**				
Demonstration proposal for each province		Done	Finalized, got comments from PPMU	On time
Research topic proposals for each province		Done	Finalized, got comments from PPMU	On time
Consolidated list of selected demonstrations		Done	Submitted to TL, CPMU and DOSTE	on time
Consolidated list of selected research pilots		Ongoing	Submitted to TL, CPMU and DOSTE. Need further action: Objectives and Expected outputs	On time
Guideline Procedures for demonstration projects		Done	Late feedback from ADB	delay
Detailed dossier of 6 demonstration categories		Done	Need feedback from ADB	Delay
Consolidated List of training topics		Done	Submitted to TL and CPMU	On time
Trip report from the visit to provinces		Done	Submitted to CPMU	On time

Figure 8 Work Plan of CSAWMP National Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Make a presentation at the kick off workshop organized by CPMU…												
2	Establish LIC office & consultant team respectively with associated management procedures												
3	Province guidance to the team and assume responsibility for overall performance and achievement of LCASP outputs												
4	Prepare the inception report & make a presentation at meeting organized by CPMU												
5	Organize regular team meetings to discuss progress and identify emerging issues that need to be taken up and discussed with the client.												
6	Advise and assist the M&E specialist with the development of the Project Performance Management System (PPMS) and with implementation of the PPMS.												
7	Advice and assist the CPMU with the development and update of the detailed implementation plan (DIP) for project implementation, in consultation with PPMUs, FIs, and other key stakeholders												
8	With inputs from individual consultants, prepare the work plan for the consultant Team . The work plan will be regularly updated and be available on a common computer drive.												
9	Advise the CPMU and PPMUs in preparing their annual work plans and budgets.												
10	Advise and assist the CPMU in preparing and submitting to ADB necessary project documents for approval or reporting												
11	Advise and assist the CPMU with procurement of goods and services according to ADB procedures and guidelines.												
12	Advise and assist CPMU in preparing the inception report, quarterly reports, midterm review report, and the Project Completion Report in accordance with ADB requirements and standards												
13	Advise with the procedure for formulation of Pilots & Demonstrations (P&Ds) in consultation with PPMUs and private, beneficiaries, and submit P&Ds to CPMU for onward submission to ADB.												
14	Advise with the preparation of consultants' technical working papers and progress reports, and presentations at workshops, etc...												
15	Advise and assist the CPMU with coordination meetings on between CPMU, PPMUs, FIs TSU, MARD departments, VRM, consultants and other agencies and parties involved in implementation such as VBA.												
16	Advise on the updating of the Project Administration/Implementation Manuals, and provide an input where required.												
17	Assume other task that may be requested by the Project Director and that are reasonably within her/his duties and competence on Project Management												
	Technical Tasks												
T1	Advise on the design of a website for the LASCP, and assist with its implementation.												
T2	Review the ICT consultant webpages, e-information exchange, and advise on the development of the common biogas database, in close consultation with CPMU, PPMUs, FIs, VBA, ICT consultant												
T3	Review the business models and feasibility studies prepared by the technical consultants for Biogas Value Chains, and for CSAWMP.												
T4	Identify and analyze financial and economic issues for the project, determining optimum solutions for the reduction of GHG.												
T5	Advise CPMU on the development of the policy/institutional framework for implementation and monitoring of BVCM, CSAWMP, GAP, standards, certification, and inspection												
T6	Prepare and update guidelines for BVCM, CSAWMP, and supporting investments funded by the Project												
T7	Assist in developing an effective accreditation and certification system, if required for BVCM, CSAWMP and other investments funded by the Project												
T8	Help prepare detailed technical specifications through consultation with the other team members, relevant institutes, financial intermediaries, partner agencies and other stakeholders												
T9	Advice and act as resource person for capacity building activities for staff of MARD, DARDs, financial intermediaries, coordinating and managing entity (CME), VBA and project staff												
T10	Advise and assist with the provision and/or arrangement for necessary training programs and study tours to be provided for by the Project												
T11	Assist with and advice on other technical matters that are within the scope of her/his technical expertise and experience.												
	Number of TA months per each quarter	3	3	2	2	3	3	2	2	3	3	2	2
	Number of TA months per each year	**10**				**10**				**10**			
	Total of TA months input	**30**											
	DELIVERABLES												
Overall Coordination and Preparation of Inception Report													
Overall Coordination and Preparation of Quarterly Report													
Overall Coordination and Preparation of Annual Report													
Overall Coordination and Preparation of Mid-term Report													
Overall Coordination and Preparation of Draft Final Report													
Overall Coordination and Preparation of Final Report													
Individual Consultant Completion Report													

***CPMU Requested Deliverables this Quarter**
Demonstration proposal for each province
Research topic proposals for each province
Consolidated list of selected demonstrations
Consolidated list of selected research pilots
Guideline Procedures for demonstration projects
Detailed dossier of 6 demonstration categories
Consolidated List of training topics
Trip report from the visit to provinces

Figure 9 Work Plan of CWAWMP National Specialist - Status as of April 2016

No.	Activity	2016	STATUS (done, ongoing, not yet started)	COMMENTS	DELAYS (on time, late)
		Q1			
1	Mobilization and Inception Activities.		Done	Accepted by TL	
2	Reviewing the Draft of Output 3 implementation Strategy		Done	Accepted by CPMU	
3	Contribute to the Research Strategy on CSAWMP for Crop Waste and Low Carbon Agriculture		Ongoing	Not many activities related to Crop waste and LCA	Delay
4	Participate in a Workshop for potential pilot research and demonstrations for the Crop Waste and LCA		Ongoing	Made a presentation at Annual 2016 CPMU meeting in Bind Dinh	on time
5	Participate in relevant workshops and training sessions as and when requested, including making presentations		Ongoing	Made a presentation at TSU, ADB, Traning meetings	on time
6	Work closely with PPMUs and provincial coordinators to ensure that the implementation strategy successfully implemented.		Ongoing	Started on Topics and Guidelines development	on time
7	Advice on the hiring of additional technical specialists to address specific technical matters on CSAWMP identified during formulation of the research strategy		Not yet started		
8	Assist with the acquisition of equipment. Assist equipment's providers in providing on the job training on the operation and maintenance of the equipment		Not yet started		
9	Attend regular team meetings organized by CPMU and TL to discuss progress and identify emerging issues that need to be taken up and discussed.		Ongoing	Active participation	On time
10	Advise and assist the Biogas, Training and IT specialist with the development of the related activities' implementation plan.		Ongoing	Make presentation on relevant topics for training. Provide comments to E-Library before sending ADB	on time
11	Advice and assist the CPMU with the development and update of the detailed implementation plan for project implementation, in consultation with PPMUs and other key stakeholders		Ongoing	Draft of implementation for Component 3 submitted	on time
12	Advise and assist the CPMU in preparing and submitting to ADB necessary project documents (mainly component 3) for approval or reporting		Ongoing	Accepted by CPMU	on time
13	Advise and assist the CPMU with procurement of goods and services according to ADB procedures and guidelines.		Just started	1st draft submitted to ADB and DOSTE	on time
14	Advise and assist the CPMU with procurement of research projects according to Vietnam and MARD procedures and guidelines.		Just started	1st draft submitted to ADB and DOSTE	on time
15	Advise and assist TL and CPMU in preparing the inception report, quarterly, annual reports, midterm review report, and the Project Completion Report		Done	Accepted by TL	On time
16	Work closely with other consultants to coordinate crosscutting issues		Ongoing	Team work on baseline survey, communities Biogas, E-Library, training..	On time
17	Advise and assist the CPMU with coordination meetings on between CPMU, TSU, MARD departments, related consultants and parties involved in the project implementation.		Ongoing	many meeting has been arranged	On time
18	Undertake other tasks as requested by the Team leader and Project Director.		Done	Review/Contribution to revised LCASP Mater plan.	On time
	Technical Tasks				
T1	Provide an input for the outline work plan for LCA Crop Waste Management developed by the International CSAWMP Specialist		Ongoing	International CSAWMP Specialist still doesn't provide the outline work plan	Delay
T2	With the involvement of the other specialist and institutions, identify potential Pilots and Demonstrations (P&Ds) on Crop Waste Management		Done	32 demonstrations have been identified and grouped into 6 categories	On time
T3	In collaboration with other specialist, prepare the concept paper for specific Pilot or Demonstration activity for the P&D prior approval by ADB.		Ongoing	Started with TOR writing for 6 Demonstration categories	On time
T4	Prepare, support and update guidelines for research and demonstration pilots' implementation		Done	Guidelines has been finalized, submitted to LIC, CPMU adv. DOSTE for comments	On time
T5	Contributing to categorization of pilot-demonstration sub-projects designing		Done	Red worm dossier has been finalized and submitted	On time
T6	Supporting PPMU, DOSTE and CPMU in developing research sub-projects for ADB and MARD approval		Ongoing	4th draft has been submitted to TL, CPMU and DOSTE. But according to plan, much behind the schedule due to late LIC mobilization	Delay
T7	Identify suitable practices and technologies for crop waste management		Ongoing	Some practices identified like hydrothermal technologies; Recycle PE biogas plant; cleaning H2S in BVC	On time
T8	Contributing in Identifying and analyzing economic issues for the pilot-demonstration sub-projects		Ongoing	Contributed to economic analysis for 6 dossier of demonstration	on time
T9	Advice and act as resource person for capacity building activities for staff of related authority.		Ongoing	Provide comments to baseline survey, strategy development, master plan development…	
T10	Identify institutions and industries that are interested to participate in specific Pilots or Demonstrations		Ongoing	Identified some companies providing technologies for waste processing technologies	On time
	Number of TA months per each quarter	3			
	Number of TA months per each year	**3**			
	Total of TA months input	**3**			
	REPORT DELIVERABLES				
	Contribution to Preparation of Inception Report made by TL		Done		On time
	Research Strategy on CSAWMP and LCA has been reviewed		Done		On time
	Preparation of Quarterly Report		Done		on time
	Preparation of Annual Report		Not yet started		
	Preparation of Mid-term Report		Not yet started		
	Preparation of Draft Final Report		Not yet started		
	Preparation of Final Report		Not yet started		
	Individual Consultant Completion Report		Not yet started		
	***CPMU Requested Deliverables this Quarter**				
	Demonstration proposal for each province		Done	Finalized, got comments from PPMU	On time
	Research topic proposals for each province		Done	Finalized, got comments from PPMU	On time
	Consolidated list of selected demonstrations		Done	Submitted to TL, CPMU and DOSTE	on time
	Consolidated list of selected research pilots		Ongoing	Submitted to TL, CPMU and DOSTE. Need further action: Objectives and Expected outputs	On time
	Guideline Procedures for demonstration projects		Done	Late feedback from ADB	delay
	Detailed dossier of 6 demonstration categories		Done	Need feedback from ADB	Delay
	Consolidated List of training topics		Done	Submitted to TL and CPMU	On time
	Trip report from the visit to provinces		Done	Submitted to CPMU	On time

Figure 10 Work Plan of Training and Extension Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Conducting a needs assessment on BVCM and other low carbon technologies in the project provinces												
2	Review and evaluate the current training programs/curricula and models relevant to LCASP for transfer to farmers in the project provinces												
3	Collaborate with relevant agencies to develop/improve the training program and curricula for training farmers on biogas value chains and other low carbon agriculture production												
4	Work closely with relevant consultants to conduct training for staffs, researchers, farmers on climate smart agricultural waste management technology and practices												
5	Work closely with relevant consultants to develop and replicate business models and extension models in the provinces												
6	Assist PPMUs in implementation of pilot research and demonstrations (P&Ds) in the project provinces												
7	Design, develop and implement an information dissemination program on project activities for provincial and national level												
8	Undertake tasks as required by the TL and CPMU as related to LCASP												
	Number of TA months per each quarter	1	2	3	3	3	3	3	3	3	3	3	3
	Number of TA months per each year	9				12				12			
	Total of TA months input	33											
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★				★				
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report												★
	Individual Consultant Completion Report												★

Quarterly Deliverable as Requested by CPMU

None requested to date. Awaiting replacement Training & Extension Specialist

Figure 11 Work Plan of Training and Extension Specialist - Status as of April 2016

No.	Activity	2016 Q1	STATUS (done,	COMMENTS	DELAYS (on time, late)
1	Conducting a needs assessment on BVCM and other low carbon technologies in the project provinces		Ongoing	Awaiting ADB approval of replacement specialist	Late
2	Review and evaluate the current training programs/curricula and models relevant to LCASP for transfer to farmers in the project provinces		Not yet started		Late
3	Collaborate with relevant agencies to develop/improve the training program and curricula for training farmers on biogas value chains and other low carbon agriculture production		Not yet started		Late
4	Work closely with relevant consultants to conduct training for staffs, researchers, farmers on climate smart agricultural waste management technology and practices		Not yet started		Late
5	Work closely with relevant consultants to develop and replicate business models and extension models in the provinces		Not yet started		Late
6	Assist PPMUs in implementation of pilot research and demonstrations (P&Ds) in the project provinces		Not yet started		Late
7	Design, develop and implement an information dissemination program on project activities for provincial and national level		Not yet started		Late
8	Undertake tasks as required by the TL and CPMU as related to LCASP		Done	Range of extention related activities completed	On time
	Number of TA months per each quarter	1			
	Number of TA months per each year	12			
	Total of TA months input	36			
	REPORT DELIVERABLES				
	Overall Coordination and Preparation of Inception Report				On time
	Overall Coordination and Preparation of Quarterly Report				On time
	Overall Coordination and Preparation of Annual Report				On time
	Overall Coordination and Preparation of Mid-term Report				on time
	Overall Coordination and Preparation of Draft Final Report				On time
	Overall Coordination and Preparation of Final Report				Slight delay
	Individual Consultant Completion Report				
	***CPMU Requested Deliverables this Quarter (LIST) (EXAMPLE)**				On time
	Demonstration proposal for each province				On time
	Research topic proposals for each province				On time
	Consolidated list of selected demonstrations				on time
	Consolidated list of selected research pilots				On time
	Guideline Procedures for demonstration projects				Slight delay
	Detailed dossier of 6 demonstration categoies				

Figure 12 Work Plan of M&E National Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Mobilization and Inception Activities.	■											
2	Assist CPMU in establishing an appropriate project performance management system (PPMS) at all levels.	■	■										
3	Work closely with the database development consultant and PPMUs to ensure that the PPMS will be generating adequate and reliable data that meets the requirements of the CPMU and the ADB.	■	■	■	■	■	■	■	■	■	■	■	■
4	Assist the CPMU in developing formats of quarterly, semi-annual and annual reports at all project implementation levels, that meet the requirements of the ADB.	■											
5	Work closely with the TL and DTL to collect financial and economic data that is required to analyze the impact of the project's activities.	■	■	■	■	■	■	■	■	■	■	■	■
6	Work closely with other consultants to obtain all relevant data required for M&E reports, in particular data and information of the impact of the project on environment, gender, ethnic minorities.	■	■	■	■	■	■	■	■	■	■	■	■
7	Deliver training for M&E staff at the central, provincial and district levels to implement effective monitoring and evaluation activities.	■	■										
8	Assist CPMU to prepare relevant M&E reports in accordance with the regulations of the Government on monitoring and evaluation of foreign loaned projects.	■	■	■	■	■	■	■	■	■	■	■	■
9	Assist CPMU to monitor the operation of the PPMS and make recommendations to improve the system where necessary.		■				■				■		
10	Undertake other tasks as requested by the Team leader and Project Director.	■	■	■	■	■	■	■	■	■	■	■	■
	Technical Tasks-NB Consultant Added												
T1	Support and suggest to consultantive unit performing basic survey.	■	■	■									
T2	Develop a simple computer based monitoring system for collecting M&E data from CPMU, PPMUs and relevant agencies.	■	■	■									
T3	Prepare training materials for monitoring and evaluation, including the identification of problem indicators and their mitigation.	■											
T4	Identify problem areas based on M&E lags, and present mitigating measures to PPMUs, CPMU and CTA.		■				■				■		
T5	Develop appropriate, practical measuring methods to support the collection of monitoring and evaluation data during project implementation.	■				■				■			
T6	Develop appropriate, practical measuring methods to evaluate technical, economic and environmental project impacts.						■				■		
T7	Monitor Project Performance, Compliance and Specific Assurances.		■	■	■	■	■	■	■	■	■	■	■
	Number of TA months per each quarter	3.00	0.25	0.25	0.50	0.25	0.25	0.25	0.75	0.25	0.25	0.25	1.00
	Number of TA months per each year	**4**				**1.5**				**1.75**			
	Total of TA months input	**7.25**											
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★				★				
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report											★	
	Individual Consultant Completion Report											★	

Figure 13 Work Plan of Monitoring and Evaluation National Specialist – Status as of April 2016

No.	Activity	2016 Q1	STATUS (done,	COMMENTS	DELAYS (on time, late)
1	Meeting with the Project M&E staff.		completed	Supported to establish the M&E System.	on time
2	Field trip in Bac Giang Province. Meeting with Bac Giang PPMU.		completed	Collection the data in situation of project.	on time
3	TA Meeting.		completed	Regular meetings LIC & with CPMU & ADBs.	on time
4	Meeting with the Specialists, Team Leader and Agrifood Consulting International.		completed	Meeting is held as planned.	on time
5	Support the Team Leader to develop the Inception Report.		completed	Developed the Inception Report.	on time
6	Meetings with CPMU, Team Leader and Specialists on demonstration pilot deployment.		completed	Meetings are held as planned.	on time
7	Meeting with the CPMU, TL and Specialists to review work, product and project progress.		completed	Meeting is held as planned.	on time
8	Meeting with the CPMU's staffs about M&E Tools, Forms of Tables and Forms of Reports.		completed	Meeting is held as planned.	on time
9	Meeting with M&E Staff of LCASP on data collection for ADB Mid Term Review Mission.		completed	Meeting is held as planned.	on time
10	Meeting on Specialist management and Methods of planning, establishment demonstration pilot.		completed	Meeting is held as planned.	on time
11	Coordinate with the Provincial coordinators to develop plan for Component 3 of Provinces.		completed	Project component 3 was deployed late.	on time
12	Work with ICT Specialist and Evaluated the Database of Project.		ongoing	Prepare ro design the Database of Project.	on time
13	Support the Provincial Coordinators and Provincial M&E Staffs to update data into DMF.		ongoing	Updated data into DMF.	on time
14	Supported Provincial Coordinators and Provincial M&E Staffs to update data into GAPIF.		ongoing	Updated data into GAPIF.	on time
15	Supported the Provincial Coordinators and Provincial M&E Staffs to update training data.		ongoing	Updated training data.	on time
16	Worked with Bac Giang PPMU on M&E activities and M&E data update.		completed	Updated data into DMF.	on time
17	Undertake other tasks as requested by Team Leader.		completed	Comply TOR.	on time
	Technical Tasks				
T1	Develop M&E Plan in 3 years and in 2016 EN VN.		completed	M&E Plan suited project status.	on time
T2	Develop the form of Quick survey table selecting the demonstration pilot VN.		completed	Form used in first period.	on time
T3	Develop the Form of DMF updated EN VN.		completed	Form of DMF updated EN VN.	on time
T4	Develop the Tool aggregating data to update DMF VN.		completed	Tool aggregating data to update DMF VN.	on time
T5	Develop the Form of LCASP Quarterly Report under the TT01 VN.		completed	Form of LCASP Quarterly Report under the TT01 VN.	on time
T6	Develop the Form of CPMU Quarterly Report submitting to ADB VN.		completed	Form of CPMU Quarterly Report submitting to ADB VN.	on time
T7	Develop the Form of PPMU Quarterly Report submitting to CPMU VN.		completed	Form of PPMU Quarterly Report submitting to CPMU VN.	on time
T8	Develop the Form of Gender Action Plan EN VN.		completed	Form of Gender Action Plan EN VN.	on time
T9	Develop the Form of Monitoring in GAP implementation updated EN VN.		completed	Form of Monitoring in GAP implementation updated EN VN.	on time
T10	Develop the Tool aggregating data to update Monitoring of GAP implementation VN.		completed	Tool aggregating data to update Monitoring of GAP implementation VN.	on time
T11	Develop the Form of Monthly Results Report - Coordinator VN		completed	Form of Monthly Results Report - Coordinator VN	on time
T12	Develop the Form of Work Progress Report on direct demand of CPMU - Coordinator VN.		completed	Form of Work Progress Report on direct demand of CPMU - Coordinator VN.	on time
T13	Develop the Form of Monthly Progress Report - Specialist and Coordinator EN.		completed	Form of Monthly Progress Report - Specialist and Coordinator EN. It was changed following the form of CPMU.	on time
T14	Develop the Monthly Progress Report EN.		completed	Monthly Progress Report EN. It was changed following the form of CPMU	on time
T15	Develop the Tool aggregating data of Training monitoring VN.		completed	Tool aggregating data of Training monitoring VN.	on time
T16	Developed the Table monitoring implement of Loan agreement VN.		completed	Table monitoring implement of Loan agreement VN.	on time
T17	Review and revised the Table monitoring implement of LA outlined by ADB EN VN.		completed	Table monitoring implement of LA outlined by ADB EN VN.	on time
T18	Develop the Form of LCASP Annual Report under the TT01 VN.		completed	Form of LCASP Annual Report under the TT01 VN.	on time
T19	Develop the Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants.		completed	Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants	on time
T20	Evaluated the Database of Project.		completed	Database of Project.	on time
	Number of TA months per each quarter	3			
	Number of TA months per each year	**3**			
	Total of TA months input	**3**			
	REPORT DELIVERABLES				
	Overall Coordination and Preparation of Inception Report				On time
	Overall Coordination and Preparation of Quarterly Report				On time
	Overall Coordination and Preparation of Annual Report				On time
	Overall Coordination and Preparation of Mid-term Report				on time
	Overall Coordination and Preparation of Draft Final Report				On time
	Overall Coordination and Preparation of Final Report				Slight delay
	Individual Consultant Completion Report				
	***CPMU Requested Deliverables this Quarter (LIST) (EXAMPLE)**				On time
	As already noted above				

Figure 14 Work Plan of Gender Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Development and support the CPMU gender focal point to update Gender Action Plan (GAP), and Ethnic Minority Development Plan (EMDP)												
2	Review of social reports on ethnic minorities and gender and community consultation in conformity with related regulations at national and specific in local regulations in the 10 participating provinces												
3	Assist and advise the CPMU and PPMUs on the implementation of the Gender Action Plan, Ethnic Minority Development Plan (EMDP)/Indigenous People Plan (IPP) to promote gender equality and ensure that women and ethnic minority participate and benefit equally from the project												
4	Conduct community consultation in the Project area, to obtain feed back for making recommendations												
5	Conduct awareness raising for CPMU, PPMUs and provincial coordinators to ensure that social safeguard and gender equality policies are appropriately addressed												
6	Advise CPMU to conduct social impact assessment and on any other preparatory surveys, feasibility studies or assessments												
7	Work closely with M&E specialists and provincial coordinators to ensure that baseline sex-disaggregated data and ethnic minority data is adequately included in the PPMS, and implementation is reported in progress reports from PPMUs and consolidated progress report from CPMU to ADB												
8	Work closely with other relevant consultants to ensure that adequate gender and ethnic minority concerns and participation are considered in the design of demonstration activities												
9	Assist the international team leader and CPMU in developing TOR for end-line survey ETC.												
10	Produce reports that cover the ToR of assignment, in particular on the social, gender, and minority aspects of the project												
11	Any other activites as detemined by TL or CPMU related to LCASP												
	Number of TA months per each quarter	0	1	1.5	0	0	1	1.5	0	0	0	1	0
	Number of TA months per each year		**2.5**				**2.5**				**1**		
	Total of TA months input						**6**						
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		✸										
	Overall Coordination and Preparation of Quarterly Report		✸	✸	✸	✸	✸	✸	✸	✸	✸	✸	
	Overall Coordination and Preparation of Annual Report				✸					✸			
	Overall Coordination and Preparation of Mid-term Report						✸						
	Overall Coordination and Preparation of Draft Final Report										✸		
	Overall Coordination and Preparation of Final Report											✸	
	Individual Consultant Completion Report											✸	

Figure 15 Work Plan of Gender Specialist – Status as of April 2016

No.	Activity	2016 Q1	STATUS (done,	COMMENTS	DELAYS (on time, late)
1	Development and support the CPMU gender focal point to update Gender Action Plan (GAP), and Ethnic Minority Development Plan (EMDP)		Not yet started	Consultant starts 20th April	On time
2	Review of social reports on ethnic minorities and gender and community consultation in conformity with related regulations at national and specific in local regulations in the 10 participating provinces				
3	Assist and advise the CPMU and PPMUs on the implementation of the Gender Action Plan, Ethnic Minority Development Plan (EMDP)/Indigenous People Plan (IPP) to promote gender equality and ensure that women and ethnic minority participate and benefit equally from the project				
4	Conduct community consultation in the Project area, to obtain feed back for making recommendations				
5	Conduct awareness raising for CPMU, PPMUs and provincial coordinators to ensure that social safeguard and gender equality policies are appropriately addressed				
6	Advise CPMU to conduct social impact assessment and on any other preparatory surveys, feasibility studies or assessments				
7	Work closely with M&E specialists and provincial coordinators to ensure that baseline sex-disaggregated data and ethnic minority data is adequately included in the PPMS, and implementation is reported in progress reports from PPMUs and consolidated progress report from CPMU to ADB				
8	Work closely with other relevant consultants to ensure that adequate gender and ethnic minority concerns and participation are considered in the design of demonstration activities				
9	Assist the international team leader and CPMU in developing TOR for end-line survey etc				
10	Produce reports that cover the ToR of assignment, in particular on the social, gender, and minority aspects of the project				
11	Any other activites as detemined by TL or CPMU related to LCASP				
	Number of TA months per each quarter	1			
	Number of TA months per each year	**2.5**			
	Total of TA months input	**6**			
	REPORT DELIVERABLES				
	Overall Coordination and Preparation of Inception Report				On time
	Overall Coordination and Preparation of Quarterly Report				On time
	Overall Coordination and Preparation of Annual Report				
	Overall Coordination and Preparation of Mid-term Report				
	Overall Coordination and Preparation of Draft Final Report				
	Overall Coordination and Preparation of Final Report				
	Individual Consultant Completion Report				

***CPMU Requested Deliverables**					
None this quarter					

Figure 16 Work Plan of Environmental Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Advise and assist CPMU and PPMUs in ensuring the project's compliance with environmental safeguards of the Government and the ADB of the Project												
2	Review all relevant project documentation to environmental management, supervision and protection as far as relevant to the project												
3	Screen proposed MBPs and LBPs and other waste management technology implemented by the LCASP on environmental impact, according to ADB and Gov environmental safeguard standards, based on the completed screening checklists; in particular prepare a screening checklist based on the relevant ADB Rapid Environmental Assessment Checklists and the environment categorization form for all proposed MBPs and LBPs as part of the Project												
4	Assist CPMU and PPMUs in submitting the required documentation to report to ADB the outcome of the screening and categorization process												
5	In the case of category C biogas plants, notify ADB of the screening findings and the categorization of the subprojects												
6	Identify and report to CPMU to exclude proposed biogas plants which may have major adverse environmental impact and would be classified as "A Category" for environment under the ADB guidelines												
7	Upon ADB's confirmation on the categorization of the biogas plants, prepare IEE, in both Vietnamese and English, for all medium and large biogas plants, proposed as part of the Project, which are classified as B category. This will include preparing an Environment Management Plan (EMP) with support from PPMUs.												
8	Assist CPMU,PPMUs in organizing meaningful stakeholder consultations on all proposed medium and large biogas plants as required by ADB Safeguard Policy Statement 2009												
9	Consult with the Consultants for Livestock Waste Management on recommendations for technologies that make full use of the biogas and bio-slurry produced by biogas plants												
10	Provide training and organize workshops as necessary on safeguard policies and environmental monitoring of biogas plants, according to the EMP/CPMU/PPMU specialists												
11	Assist CPMU and PPMUs in the environmental monitoring of biogas plants as required. Monitoring of all medium and large biogas plants is prioritized although sample environmental monitoring of small biogas plants may also be required												
12	In consultation with other technical specialist on the Team, prepare cost estimates for the environmental measures to mitigate any adverse impact;												
13	Ensure disclosure of project information on environment for affected persons and other stakeholders according to ADB Safeguard Policy Statement 2009												
14	Assist CPMU and PPMU to prepare regular environmental monitoring reports to ADB according to the PAM												
15	As instructed in the PAM, produce the Environmental Reports for Sub-projects that are proposed for implementation under the LCASP												
16	Undertake other tasks as requested by the Team leader and Project Director.												
	Number of TA months per each quarter	0	1	2	2	0	2	2	0	0	2	1	0
	Number of TA months per each year	**5**				**4**				**3**			
	Total of TA months input	**12**											
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report	★											
	Overall Coordination and Preparation of Quarterly Report	★	★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★				★				
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report												★
	Individual Consultant Completion Report												★

Quarterly Deliverable as Requested by CPMU

Due to commence in May 2016

Figure 17 Work Plan of GIS Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Work closely with MARD and other Ministries to review existing GIS facilities, identify gaps relevant to the LCASP and how this information may be included into existing GIS facilities, with a differentiation to the 7 agro-ecological zones of Viet Nam				■								
2	In consultation with relevant Ministries, institutions , draw up a list of information available from GIS and related to the purpose of the LCASP. Particular attention should also be given to include the information of a common data base on biogas installations				■								
3	Identify the parameters that need to be collected to be included in the GIS for each map overlay for each agro-ecological zone, and the procedures for updating the information				■								
4	Draw up the design parameters for the GIS and hardware and software needed for the GIS					■							
5	Organize a workshop where the proposed design of the GIS is discussed and incorporate comments in final design parameters for the GIS					■							
6	Draft the detailed ToR and technical criteria for subcontracting the construction of the proposed GIS to a local contractor					■							
7	Advise and assist CPMU with the engagement of the GIS contractor					■	■						
8	Draft the data collection requirement that is needed for inputting into the GIS, and make a proposal for the collection of this data.						■						
9	Supervise the data collection on consistency and quality						■						
10	Supervise the progress with the GIS construction and installation, and testing						■						
11	After completion of the construction phase of the GIS, provide training on the use and maintenance of the GIS							■					
12	Other activities as determined by TL and/or CPMU related to LCASP												
	Number of TA months per each quarter	0	0	0	1	2	2	1	0	0	0	0	0
	Number of TA months per each year	**1**				**5**				**0**			
	Total of TA months input	**6**											
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★					★			
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report											★	
	Individual Consultant Completion Report											★	

Figure 18 Work Plan of ICT Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Work closely with MARD and other Ministries to review existing ICT facilities that are relevant to LCASP; identify gaps related to access of information relevant to the LCASP and how this information could become widely accessible through internet	■		■	■		■			■			
2	Submit a detailed work plan for the various tasks to be undertaken by the ICT specialist during the course of her/his assignment.	■		■	■		■			■			
3	In consultation with CPMU, specify design criteria for a Website (Vietnamese and English language version) on LCASP and assist CPMU to draw up a contract for a web site development studio. Supervise the implementation of this LCASP website	■		■	■		■			■			
4	Advise and assist VBA with the improvement of its web site.			■	■		■			■			
5	Make an assessment of existing web sites of MARD and MONRE institutions that are relevant for LCASP. In particular review the content of the website, and to what extend information (organizational structures; list of staff with contact information; research programs; technical reports; budgets; etc..) is			■	■		■			■			
6	Identify the need for additional hardware and software that some institutions may require to make all relevant reports and other information available from their e-library.	■		■	■		■			■			
7	Prepare proposals on policies and protocols for publishing information on the websites of relevant institutions involved in LCA.				■		■			■			
8	In close collaboration with the CPMU and TL, develop a management system for the project, using MS Project Manager software.	■			■								
9	Advice and assist with the expansion of the computerized common data base on biogas installations, make it accessible from internet, and specify required hardware and software.	■			■		■			■			
10	In close consultation with the GIS Specialist, develop a system whereby the GIS facility for LCASP can be accessed from internet.				■		■			■			
11	Whenever required, organize a workshop where the ICT specialist will submit his/her proposals, and include the comments from the workshop into the final designs.			■	■		■						
12	Draft the detailed ToR and technical criteria for subcontracting the improvement or new websites (with e-library attached to it) to a local contractor.			■	■								
13	Advise and assist CPMU with the engagement of the website contractor.			■	■								
14	Maintain and upgrade whenever required all computer hard and software of the CPMU, in particular ensure protection against viruses and unauthorized use.	■			■		■			■			
15	Undertake other tasks as requested by the Team leader and Project Director.	■		■	■		■			■			
	Number of TA months per each quarter	3	0	3	2	0	2	0	0	1	0	0	0
	Number of TA months per each year	**8**				**2**				**1**			
	Total of TA months input	**11**											
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★					★			
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report											★	
	Individual Consultant Completion Report											★	

Quarterly Deliverable as Requested by CPMU

Take E-Library to technical (hardware and software) feasibility stage ★

Figure 19 Work Plan of ICT Specialist – Status as of April 2016

No.	Activity	2016 Q1	STATUS (done, ongoing, not yet started)	COMMENTS	DELAYS (on time, late)
1	Work closely with MARD and other Ministries to review existing ICT facilities that are relevant to LCASP; identify gaps related to access of information relevant to the LCASP and how this information could become widely accessible through internet		Ongoing	Initial assessment completed	On time
2	Submit a detailed work plan for the various tasks to be undertaken by the ICT specialist during the course of her/his assignment.		Ongoing	Preliminary plan in place	Slightly delayed
3	In consultation with CPMU, specify design criteria for a Website (Vietnamese and English language version) on LCASP and assist CPMU to draw up a contract for a web site development studio. Supervise the implementation of this LCASP website		Not yet started		
4	Advise and assist VBA with the improvement of its web site.		Not yet started		
5	Make an assessment of existing web sites of MARD and MONRE institutions that are relevant for LCASP. In particular review the content of the website, and to what extend information (organizational structures; list of staff with contact information; research programs; technical reports; budgets; etc.) is		Ongoing	Preliminary review made	On time
6	Identify the need for additional hardware and software that some institutions may require to make all relevant reports and other information available from their e-library.		Ongoing	Assessment for VASS & E-Library generally	On time
7	Prepare proposals on policies and protocols for publishing information on the websites of relevant institutions involved in LCA.		Not yet started		
8	In close collaboration with the CPMU and TL, develop a management system for the project, using MS Project Manager software.		Done	initial contribution later advanced by team	On time
9	Advice and assist with the expansion of the computerized common data base on biogas installations, make it accessible from internet, and specify required hardware and software.		Ongoing	Preliminary review of system completed	On time
10	In close consultation with the GIS Specialist, develop a system whereby the GIS facility for LCASP can be accessed from internet.		Not yet started		
11	Whenever required, organize a workshop where the ICT specialist will submit his/her proposals, and include the comments from the workshop into the final designs.		Not yet started		
12	Draft the detailed ToR and technical criteria for subcontracting the improvement or new websites (with e-library attached to it) to a local contractor.		Not yet started		
13	Advise and assist CPMU with the engagement of the website contractor.		Not yet started		
14	Maintain and upgrade whenever required all computer hard and software of the CPMU, in particular ensure protection against viruses and unauthorized use.		Ongoing	Up to date as of end of quarter	On time
15	Undertake other tasks as requested by the Team leader and Project Director.		Ongoing	Absolute priority was the Feasibility E-Library	
	Number of TA months per each quarter	3			
	Number of TA months per each year	**3**			
	Total of TA months input	**3**			
	REPORT DELIVERABLES				
	Overall Coordination and Preparation of Inception Report				On time
	Overall Coordination and Preparation of Quarterly Report				On time
	Overall Coordination and Preparation of Annual Report				
	Overall Coordination and Preparation of Mid-term Report				
	Overall Coordination and Preparation of Draft Final Report				
	Overall Coordination and Preparation of Final Report				
	Individual Consultant Completion Report				
	***CPMU Requested Deliverables this Quarter**				
	E-Library Feasibility Study for hardware and software			Intensive effort completed on time	On time

Figure 20 Work Plan of Policy National Specialist

No.	Activity	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	2018 Q2	2018 Q3	2018 Q4
1	Work closely with MARD, other Ministries, institutions and members of the team to review existing policies that are relevant to the LCASP and identify gaps related to the policy and institutional frame work that impinge on private investment for LCA.												
2	In particular review present incentives that are available to investors in LCA (Feed-in-Tariff rates; carbon credits, tax breaks, and other incentives) that are available and assess how they compare to other countries.												
3	In close collaboration with the consultant for National Appropriate Mitigation Action (NAMA) identify policies and institutions that play a role in the effective implementation of NAMA and Monitoring, Reporting and Verification System (MRV).												
4	Organize a workshop where proposals for policy and institutional support for LCASP will be discussed, and contribute as a resource speaker.												
5	Based on the comments received at the Workshop, finalize the proposal for policy and institutional support for LCA, including details for an advocacy program												
6	Organize a workshop where proposals for policy and institutional support for LCASP will be discussed, and contribute as a resource speaker.												
7	Other activities as determined by TL and/or CPMU												
	Number of TA months per each quarter	0	0	2	2	2	0	0	0	0	0	0	0
	Number of TA months per each year	**4**				**2**				**0**			
	Total of TA months input	**6**											
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		✸										
	Overall Coordination and Preparation of Quarterly Report		✸	✸	✸	✸	✸	✸	✸	✸	✸	✸	
	Overall Coordination and Preparation of Annual Report				✸				✸				
	Overall Coordination and Preparation of Mid-term Report						✸						
	Overall Coordination and Preparation of Draft Final Report									✸			
	Overall Coordination and Preparation of Final Report											✸	
	Individual Consultant Completion Report											✸	

Quarterly Deliverable as Requested by CPMU

Not yet applicable

Figure 21 Common Work Plan of Provincial Coordinators

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	information relating to the progress of biogas plants construction and its biogas value chain development;												
2	constructed biogas plants funded using the Project's credit lines and update the consolidated progress of the ICMD distribution in the project areas;												
3	Coordinate with PPMUs, service providers, and training agencies to facilitate the implementation of component 3 at commune levels; and												
4	lead the provincial and commune personnel in organizing project activities at provincial to commune levels.												
5	**For component 1, the Provincial Coordinator will:**												
1.1	gathering information related to baseline/database development for biogas value chain management (BVCM), CSAWMP and other project investments to ensure that the PPMS is well prepared, monitored												
1.2	Work closely with PPMU staff to ensure that district representatives are able to properly monitor the progress of data gathering in support of the Project's various carbon market initiatives.												
	For component 2, the Provincial Coordinator will:												
2.1	qualified contractors for medium biogas plants (MBPs) and large biogas plants (LBPs) maintained by the PPMUs to participating financial intermediaries and potential biogas owners; and												
2.2	contractors to be more proactive in establishing biogas value chain facilities; and ensure that the technicians and engineers properly insert the incremental BVCM facilities to update the database.												
	For component 3, The Provincial Coordintor will:												
3.1	associations/cooperatives on exploring use and trade opportunities for treated bioslurry in fresh water fishery development, tree crops, and other crops; and												
3.2	associations/cooperatives on targeted technologies for storage and utilization of surplus biogas produced by digesters.												
	Undertake other tasks as requested by the Team leader and Project Director.												
	Number of TA months per each quarter	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Number of TA months per each year		6				6				6		
	Total of TA months input						18						
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		✸										
	Overall Coordination and Preparation of Quarterly Report		✸	✸	✸	✸	✸	✸	✸	✸	✸	✸	
	Overall Coordination and Preparation of Annual Report				✸					✸			
	Overall Coordination and Preparation of Mid-term Report						✸						
	Overall Coordination and Preparation of Draft Final Report										✸		
	Overall Coordination and Preparation of Final Report												✸
	Individual Consultant Completion Report												✸

Quarterly Deliverable as Requested by CPMU (Per your specialization)-some examples ✸

Demonstration proposals gathered, reviewed, selected and listed ✸

Research topics gathered reviewed, selected and listed

Figure 22 Common Work Plan Provincial Coordinators – Status as of April 2016

No.	Activity	2016	STATUS (done, ongoing, not yet started)	COMMENTS	DELAYS (on time, late)
		Q1			
1	information relating to the progress of biogas plants construction and its biogas value chain development;		Ongoing	Proceeding well	on time
2	constructed biogas plants funded using the Project's credit lines and update the consolidated progress of the ICMD distribution in the project areas;		Ongoing	Delayed as structural problems with credit scheme	Delayed
3	Coordinate with PPMUs, service providers, and training agencies to facilitate the implementation of component 3 at commune levels; and		Ongoing	Delayed due, in part, to late start of LICs	Delayed
4	lead the provincial and commune personnel in organizing project activities at provincial to commune levels.		Ongoing	Proceeding well	On time
5	**For component 1, the Provincial Coordinator will:**				
6	gathering information related to baseline/database development for biogas value chain management (BVCM), CSAWMP and other project investments to ensure that the PPMS is well prepared, monitored		Ongoing	Discuss more with staff other PPMU	on time
7	Work closely with PPMU staff to ensure that district representatives are able to properly monitor the progress of data gathering in support of the Project's various carbon market initiatives.		Ongoing	Support more CPMU on training technical staff.	on time
8	**For component 2, the Provincial Coordinator will:**		not yet started	Due later	Delayed
9	qualified contractors for medium biogas plants (MBPs) and large biogas plants (LBPs) maintained by the PPMUs to participating financial intermediaries and potential biogas owners; and		not yet started	Due later	Delayed
10	contractors to be more proactive in establishing biogas value chain facilities; and ensure that the technicians and engineers properly insert the incremental BVCM facilities to update the database.		not yet started	Due later	Delayed
11	**For component 3, The Provincial Coordintor will:**				
12	associations/cooperatives on exploring use and trade opportunities for treated bioslurry in fresh water fishery development, tree crops, and other crops; and		not yet started		
13	associations/cooperatives on targeted technologies for storage and utilization of surplus biogas produced by digesters.		not yet started		
14	Undertake other tasks as requested by the Team leader and Project Director.		Ongoing	wide ranging activities inc monitoring, training PPMUs in PCM for demo.research topic pilots	Slight delayed
	Number of TA months per each quarter	3			
	Number of TA months per each year	3			
	Total of TA months input	3			
	REPORT DELIVERABLES				
	Overall Coordination and Preparation of Inception Report				On time
	Overall Coordination and Preparation of Quarterly Report				On time
	Overall Coordination and Preparation of Annual Report				
	Overall Coordination and Preparation of Mid-term Report				
	Overall Coordination and Preparation of Draft Final Report				
	Overall Coordination and Preparation of Final Report				
	Individual Consultant Completion Report				
	***CPMU Requested Deliverables this Quarter (LIST) (EXAMPLE)**				On time
	Demonstration proposal for each province		Ongoing	Sub-projects prepared and submitted to schedule	On time
	Research topic proposals for each province		Ongoing	Sub-projects prepared and submitted to schedule	On time

Figure 23 Work Plan of CSAWMP International Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	In consultation with the Team Leader of the LCASP and other specialists, prepare an outline work plan that will differentiate between the (complimentary) work of National and International Crop Waste Specialist. To be regularly updated and expanded. .	■		■									
2	Under the overall guidance of the TL and in close collaboration with the PPMUs, & LIC Colleagues etc. prepare a Research Strategy on CSAWMP for Crop Waste and Low Carbon Agriculture (LCA).	■		■	■		■	■			■	■	
3	Participate as the resource person in a Workshop where proposals for potential pilot research and demonstrations (P&Ds) for the short and medium term on Crop Waste and LCA are presented and discussed, revise the P&D strategy accordingly.			■	■		■	■			■	■	
4	Under guidance of the TL and in close collaboration with other members of the Team and the PPMUs, help to implement the research strategy that deals with Crop Waste and other LCA.			■	■		■	■			■	■	
5	Identification of suitable practices and technologies for crop waste management. This includes practices and technologies for rice straw and rice husk, sugar cane tops, waste from agriculture processing industry and aquaculture.			■	■		■	■			■	■	
6	With the involvement of the others specialist and institutions identify potential Pilots and Demonstrations on Crop Waste that will contribute to the purpose of the LCASP.			■	■		■	■			■	■	
7	Identify institutions, farmers and industries (the "client-beneficiary") that are interested to participate in the specific Pilots & Demonstrations (P&Ds).			■	■		■	■			■	■	
8	Prepare and submit to the TL the concept paper for each proposed Pilot or Demonstration activity following the format provided by the TL for the P&D prior approval process by ADB.				■		■	■			■	■	
9	Advice on the hiring of additional CSAWMP technical specialists to address specific technical matters for CSAWMP that have been identified in the research strategy.			■	■		■	■			■	■	
10	Advise and assist with the identification of relevant overseas and local study tour and training programs for CSAWMP.			■	■		■	■			■	■	
11	Advise and assist with the acquisition (preparing technical specifications; input in procurement documentation; identification of suppliers; evaluation of bids, etc.) of equipment that is required to implement the P&D.				■		■	■			■	■	
12	Advise and assist with the installation of the equipment and related facilities, and commissioning of the same at the farmer of entrepreneur's premises. Assist with on the job training for the operation of equipment and facilities.			■	■		■	■			■	■	
13	Advise and assist with the testing and adaptation (making modifications) to the equipment during the pilot phase to optimize the technology given the local conditions.			■	■		■	■			■	■	
14	Identify the essential enabling environment for making the practice and technology an attractive proposition for farmers or agro industries (for example, feed-in-tariffs; tax holidays; exemption of import duties; carbon credits, etc.).			■	■		■	■			■	■	
15	Identify scope for the local manufacture of the equipment or components in order to reduce investment cost, and identify a service provider (for installation, maintenance and repair).			■	■		■	■			■	■	
16	Propose modalities on how the technology can be promoted and widely accepted (rolling out phase).			■	■		■	■			■	■	
17	At all stages of the process described above, ensure that designated MARD and provincial DARD staff are involved in the implementation of above activities and organize technical meetings to exchange views.			■	■		■	■			■	■	
18	Participate in relevant workshops and training sessions as and when requested, including making presentations.			■	■		■	■			■	■	
19	Under overall guidance of the LCASP Team Leader, provide concise technical (progress) reports on the work performed, findings, and recommendations on a regular basis (as specified by TL).			■	■		■	■			■	■	
	Other tasks as requested by TL and/or CPMU in relation to LCASP			■	■		■	■			■	■	
	Number of TA months per each quarter	1	0	1	1	0	2	1	0	0	1	1	0
	Number of TA months per each year		3				3				2		
	Total of TA months input						8						
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report	★											
	Overall Coordination and Preparation of Quarterly Report	★	★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★				★				
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report												★
	Individual Consultant Completion Report												★

Quarterly Deliverable as Requested by CPMU (Per your specialization)-some examples

Demonstration proposals gathered, reviewed, selected and listed ★

Research topics gathered reviewed, selected and listed

Figure 24 Work Plan of CSWAMP International Specialist – Status as of April 2016

No.	Activity	2016 Q1	STATUS (done,	COMMENTS	DELAYS (on time, late)
1	In consultation with the Team Leader of the LCASP and other specialists, prepare an outline work plan that will differentiate between the (complimentary) work of National and International Crop Waste Specialist. To be regularly updated and expanded. .	■	Ongoing	Additional inputs required as plan develops	On time
2	Under the overall guidance of the TL and in close collaboration with the PPMUs, & LIC Colleagues etc. prepare a Research Strategy on CSAWMP for Crop Waste and Low Carbon Agriculture (LCA).	■	Ongoing	Research strategy is living doc - so further support required	On time
3	Participate as the resource person in a Workshop where proposals for potential pilot research and demonstrations (P&Ds) for the short and medium term on Crop Waste and LCA are presented and discussed, revise the P&D strategy accordingly.	■	Ongoing	Crop waste strategy still under formation	Delayed
4	Under guidance of the TL and in close collaboration with other members of the Team and the PPMUs, help to implement the research strategy that deals with Crop Waste and other LCA.		Not yet started	Implementation currently at feasibility stage	Delayed
5	Identification of suitable practices and technologies for crop waste management. This includes practices and technologies for rice straw and rice husk, sugar cane tops, waste from agriculture processing industry and aquaculture.	■	Ongoing	Will continue with next mission in August	Delayed
6	With the involvement of the others specialist and institutions identify potential Pilots and Demonstrations on Crop Waste that will contribute to the purpose of the LCASP.	■	Ongoing	Initial identification in January	On time
7	Identify institutions, farmers and industries (the "client-beneficiary") that are interested to participate in the specific Pilots & Demonstrations (P&Ds).	■	Ongoing	Support to projects in Nam Dinh	On time
8	Prepare and submit to the TL the concept paper for each proposed Pilot or Demonstration activity following the format provided by the TL for the P&D prior approval process by ADB.	■	Ongoing	specialist has reviewed drafts prepared by National CSAWMP	On time
9	Advice on the hiring of additional CSAWMP technical specialists to address specific technical matters for CSAWMP that have been identified in the research strategy.		Not yet started		On schedule
10	Advise and assist with the identification of relevant overseas and local study tour and training programs for CSAWMP.		Not yet started		On schedule
11	Advise and assist with the acquisition (preparing technical specifications; input in procurement documentation; identification of suppliers; evaluation of bids, etc.) of equipment that is required to implement the P&D.		Not yet started		On schedule
12	Advise and assist with the installation of the equipment and related facilities, and commissioning of the same at the farmer of entrepreneur's premises. Assist with on the job training for the operation of equipment and facilities.		Not yet started		On schedule
13	Advise and assist with the testing and adaptation (making modifications) to the equipment during the pilot phase to optimize the technology given the local conditions.		Not yet started		On schedule
14	Identify the essential enabling environment for making the practice and technology an attractive proposition for farmers or agro industries (for example, feed-in-tariffs; tax holidays; exemption of import duties; carbon credits, etc.).		Not yet started		On schedule
15	Identify scope for the local manufacture of the equipment or components in order to reduce investment cost, and identify a service provider (for installation, maintenance and repair).		Not yet started		On schedule
16	Propose modalities on how the technology can be promoted and widely accepted (rolling out phase).		Not yet started		On schedule
17	.nsure that designated MARD and provincial DARD staff are involved in the implementation of above activities and organize technical meetings to exchange views.	■	Ongoing	Contact established central and in some provinces	On schedule
18	Participate in relevant workshops and training sessions as and when requested, including making presentations.		Not yet started		On schedule
19	Under overall guidance of the LCASP Team Leader, provide concise technical (progress) reports on the work performed, findings, and recommendations on a regular basis (as specified by TL).	■	Ongoing	Working paper on Research Strategies Issued	On schedule
20	Other tasks as requested by TL and/or CPMU in relation to LCASP	■	Done	For first mission	On schedule
		3			
		3			
	Number of TA months per each year	**8**			
	Total of TA months input				
	REPORT DELIVERABLES				
	Overall Coordination and Preparation of Inception Report				On time
	Overall Coordination and Preparation of Quarterly Report				On time
	Overall Coordination and Preparation of Annual Report				
	Overall Coordination and Preparation of Mid-term Report				
	Overall Coordination and Preparation of Draft Final Report				
	Overall Coordination and Preparation of Final Report				
	Individual Consultant Completion Report				
	***CPMU Requested Deliverables this Quarter**				
	Demonstration proposal for each province			Support to proposals in each province	On time
	Research topic proposals for each province			Support to proposals in each province	on time

Figure 25 Work Plan of M&E International Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Advise and assist the national Monitoring in Evaluation Specialist with the design and implementation of the M&E program for the project, to ensure high quality of outputs, and compliance with Government and ADB requirements.		■	■	■	■	■	■	■	■	■	■	■
2	Advise and assist with the formulation of the TOR for baseline surveys and review the scope and methodology of the survey, survey questions and the collection of baseline data;		■	■	■	■	■	■	■	■	■	■	■
3	Advise the CPMU in establishing an appropriate project performance management system (PPMS) at all levels;		■	■	■	■	■	■	■	■	■	■	■
4	Review the design of the PPMS to ensure that the Project Performance Monitoring System (PPMS) will be generating adequate biogas data;		■	■	■	■	■	■	■	■	■	■	■
5	Advise on the design and development of a simple computer based monitoring system for collecting M&E data from CPMU, PPMUs and relevant agencies;		■	■	■	■	■	■	■	■	■	■	■
6	Review and advise on the formats of quarterly, semi-annual and annual reports at all project implementation levels		■	■	■	■	■	■	■	■	■	■	■
7	Undertake other tasks as requested by Team Leader and CPMU related to LCASP		■	■	■	■	■	■	■	■	■	■	■
	Number of TA months per each quarter	0	1	0	0	0	0	1	0	0	0	0	0
	Number of TA months per each year		1				1				0		
	Total of TA months input						**2**						
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★					★			
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report												★
	Individual Consultant Completion Report												★

Deliverable as Requested by CPMU

To be determined

Figure 26 Work Plan of Policy International Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Work closely with MARD, other Ministries, institutions and members of the team to review existing policies that are relevant to the LCASP and identify gaps related to the policy and institutional frame work that impinge on private investment for LCA.			■									
2	In particular review present incentives that are available to investors in LCA (Feed-in-Tariff rates; carbon credits, tax breaks, and other incentives) that are available and assess how they compare to other countries.			■									
3	In close collaboration with the consultant for National Appropriate Mitigation Action (NAMA) identify policies and institutions that play a role in the effective implementation of NAMA and Monitoring, Reporting and Verification System (MRV).			■									
4	Organize a workshop where proposals for policy and institutional support for LCASP will be discussed, and contribute as a resource speaker.				■								
5	Based on the comments received at the Workshop, finalize the proposal for policy and institutional support for LCA, including details for an advocacy program.				■								
6	Undertake other related tasks to the ToR as requested by the Team leader and Project Director.					■							
	Number of TA months per each quarter	0	0	1	2	1	0	0	0	0	0	0	0
	Number of TA months per each year		3				1				0		
	Total of TA months input						**4**						
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★					★			
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report												★
	Individual Consultant Completion Report												★

Quarterly Deliverable as Requested by CPMU

Not yet applicable

Figure 27 Work Plan of Biogas Technology Specialist

No.	Activity	2016				2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Visit project provinces and discuss with provincial staff to identify and facilitate BD planning, technology application and transfer	■	■	■	■	■				■			
2	Review and advise documents on optimal design, materials and methods of construction for BD with medium and large size .	■	■			■				■			
3	Prepare optimal design, materials and methods of construction for BD			■	■	■				■	■		
4	Recommend optimal options for monitoring the quality of biogas technology related activities and BD construction	■		■		■					■	■	
5	Discuss with provincial staff on optimal solutions for linking BD construction with associated biogas value chain related investments;			■	■			■			■		
6	Discuss with MARD and VBA to develop policies and mechanism for biogas technologies and Biogas Value Chain Management (BVCM)				■			■				■	■
7	Visit project provinces to assess training demand and training course content of biogas technologies	■				■				■			
8	Prepare training documents and train technical staff, trainers/extension staff and masons for technologies, management and efficient utilization of biogas technologies	■			■		■				■		
9	Discuss with technicians and masons to estimate costs for technical items and others inputs for biogas technologies with differentiation to location.		■	■	■			■			■		
10	Discuss and consult with Department of Livestock Production (DLP), DSTE to develop appropriate methodologies in order to assess impacts on social of biogas technologies		■	■	■				■				
11	Prepare demonstration documents for applying biogas technology and livestock waste management.	■	■	■	■	■	■		■	■	■		
12	Advise research thesis on biogas technology and livestock waste management	■	■						■				
13	Propose methods to disseminate and replicate biogas technologies in Viet Nam.				■				■				■
14	Undertake other tasks as requested by the Team leader and Project Director.	■	■	■	■	■	■	■	■	■	■	■	■
	Number of TA months per each quarter	3	3	3	3	3	3	3	3	3	3	3	3
	Number of TA months per each year		12				12				12		
	Total of TA months input						**36**						
	DELIVERABLES												
	Overall Coordination and Preparation of Inception Report		★										
	Overall Coordination and Preparation of Quarterly Report		★	★	★	★	★	★	★	★	★	★	
	Overall Coordination and Preparation of Annual Report				★					★			
	Overall Coordination and Preparation of Mid-term Report						★						
	Overall Coordination and Preparation of Draft Final Report										★		
	Overall Coordination and Preparation of Final Report												★
	Individual Consultant Completion Report												★

Quarterly Deliverable as Requested by CPMU (Per your specialization)-some examples

Demonstration proposals gathered, reviewed, selected and listed ★

Demonstration Guidelines for provinces prepared and sent to ADB ★

Detailed dossier of 6 demonstration categories ★

Figure 28 Work Plan of Biogas Technology Specialist – Status as of April 2016

No.	Activity	2016 Q1	STATUS (done, ongoing, not yet started)	COMMENTS	DELAYS (on time, late)
1	Visit project provinces and discuss with provincial staff to identify and facilitate BD planning, technology application and transfer		Ongoing	Visited only three project provinces	on time
2	Review and advise documents on optimal design, materials and methods of construction for BD with medium and large size .		done	For two hands book and one film on biogas technology	on time
3	Prepare optimal design, materials and methods of construction for BD		not yet started	Due second quarter	
4	Recommend optimal options for monitoring the quality of biogas technology related activities and BD construction		Ongoing	Discussed with staff of CPMU and PPMU	on time
5	Discuss with provincial staff on optimal solutions for linking BD construction with associated biogas value chain related investments;		not yet started	Due second quarter	
6	Discuss with MARD and VBA to develop policies and mechanism for biogas technologies and Biogas Value Chain Management (BVCM)		not yet started	Due end of year	
7	Visit project provinces to assess training demand and training course content of biogas technologies		Ongoing	Discussed with staff of CPMU and PPMU	on time
8	Prepare training documents and train technical staff, trainers/extension staff and masons for technologies, management and efficient utilization of biogas technologies		Ongoing	Support CPMU on training technical staff.	on time
9	Discuss with technicians and masons to estimate costs for technical items and others inputs for biogas technologies with differentiation to location.		not yet started	Due second quarter	
10	Discuss and consult with Department of Livestock Production (DLP), DSTE to develop appropriate methodologies in order to assess impacts on social of biogas technologies		not yet started	Due end of year	
11	Prepare demonstration documents for applying biogas technology and livestock waste management.		Ongoing	Prepared 5 demonstration documents on applying biogas technology and livestock waste management	on time
12	Advise research thesis on biogas technology and livestock waste management		Ongoing	Advise and add research thesis for the project	on time
13	Propose methods to disseminate and replicate biogas technologies in Viet Nam.		not yet started	Due second quarter	
14	Undertake other tasks as requested by the Team leader and Project Director.		Ongoing	Taking the duty as a provincial coordinator for Ha Tinh Province on preparing plan of component 3.	on time
	Number of TA months per each quarter	3			
	Number of TA months per each year	**3**			
	Total of TA months input	**3**			
	REPORT DELIVERABLES				
	Overall Coordination and Preparation of Inception Report				On time
	Overall Coordination and Preparation of Quarterly Report				On time
	Overall Coordination and Preparation of Annual Report				
	Overall Coordination and Preparation of Mid-term Report				
	Overall Coordination and Preparation of Draft Final Report				
	Overall Coordination and Preparation of Final Report				
	Individual Consultant Completion Report				
	***CPMU Requested Deliverables this Quarter**				On time
	Demonstration proposal for each province				On time
	Consolidated list of selected demonstrations				slight delay
	Detailed dossier of 6 demonstration categories				

4.6 Core Activities at the Provincial Level – Demonstration Subprojects

The tables below show the demonstration sub-projects selected for implementation and will constitute an important part of the workload for the LIC Provincial consultants. This is followed by a time schedule for stage of the preparation process through to procurement and implementation.

Table 7 Demonstration Subprojects in Bac Giang Province

No.	Title of demonstration	Objective	Expected output
1.	Demonstration of community biogas (shared biogas)	(i) Exploit, to the maximum, biogas source (ii) Reduce environmental pollution (iii) Contribute to the new rural development via the supply of biogas energy as fuel for even the households which do not involve in the livestock farming. (iv) Create the linkage and share benefits in the residential community	i) install one system of medium scale biogas with a biogas distribution system for the community (15 – 30 households) ii) Model of effective management and operation at the community level.
2	Processing the organic fertilizer from bio-slurry and mushroom cultivating medium for the safe vegetables, contributing to the environmental pollution reduction.	(i) Production of organic fertilizer from the bio-slurry and mushroom planting waste for safe and organic vegetables. (ii) Improve the crop productivity and the fertility of agricultural land. (iii) Create more jobs and improve the income of farmers	i) Process of organic fertilizer production from bio slurry and mushroom cultivating medium ii) The results of experimentation on a typical crop of the province iii) Contribute to raising the income of participating households
3	Demonstration on the collection of biogas slurry and livestock waste from the farm households and farms for organic manure production	- Contribute to the establishment of one sustainable, effective and environment-friendly agriculture (i) Apply the advanced technology and science to the production of organic fertilizer from biogas slurry and livestock waste (ii) Reduce environmental pollution (iii) Improve the crop productivity and the fertility of agricultural land. (iv) Create more jobs and improve the income of farmers.	i) 1 effective collection model of slurry from small biogas plants to produce fertilizer.

Table 8 Demonstration Subprojects in Ben Tre province

No.	Title of demonstration	Objective	Expected output
4	Comprehensive management of pig farming waste (medium and large scale) in Ben Tre province	(i) Install the system of collecting and separating the manure for high quality organic fertilizer production, contributing to the effective management of waste in pig farming, improving the economic efficiency, protecting the environment and reducing the GHG emission. (ii) Construct the medium biogas plant to treat the livestock wastewater, produce the energy and power to serve the demands of the farm.	i) 1 manure separation system ii) Establish 1 medium scale biogas system
5	Separate the fresh manure from the pig farms for producing the bio-organic fertilizer for: i) Intensive farming of Da Xanh pomelo (green skin pomelo) ii) Coconut cultivation	1. Set up the teams which support linking production with the product consumption 2. 2 types of crops (green skin pomelo and coconut) shall be tested. 3. Transfer the technique of composting, growing and tending the crops to the farmers and relevant subjects. 4. Set up cooperative team/production linking team, linkages among 4 entities, linking production with consumption.	i) Pig manure separation system as the feedstock for organic fertilizer production. ii) Process of testing on 2 kinds of crops (green skin pomelo and coconut) iii) Effective organizational and management model

Table 9 Demonstration Subprojects in Binh Dinh province

No.	Title of demonstration	Objective	Expected output
6	Demo: Separate the fresh manure from the medium and large scale pig farms for producing the bio-organic fertilizer for crops	+ Apply the manure separating technology to produce the feedstock in place of peat to as inputs for the organic fertilizer production enterprises. + Generate more income from the sale of solid waste (pig manure).	+ 1 fresh manure separation system + Generate more income for breeders
7	Comprehensive management of livestock waste, application of technologies, utilization of biogas for running power generator to serve the industrial scale pig farming.	+ Power generation from the biogas source, partly replacing the grid electricity. + Exploit and make full use of the biogas from biogas plants, prevent the environmental pollution.	+ 2 power generator systems from biogas + Utilize 100% of the biogas amount produced from the installed biogas plants.
8	Use the cow dung and biogas slurry for raising red worm or as organic fertilizer for the rice or as additional feed for chicken in Hoai My commune, Hoai Nhon district, Binh Dinh province.	- Livestock waste treatment helps reduce environmental pollution. - Use cow dung and biogas slurry as livestock feed - Evaluate the efficiency of utilizing red worm manure as the organic fertilizer for high quality rice cultivation as per the VietGap standard. - Evaluate the efficiency of utilizing red worm as the additional feed for chicken. - Technical training for the farmers on red worm raising and product utilization from red worm	+ At least 80% of the bio slurry amount from the biogas plants of 30 cow raising households shall be used for red worm raising. + Evaluation report on the effectiveness of using red worm as the fertilizer and the feed for the chicken
9	"Utilizing bio slurry for high quality grass planting to serve the cow raising"	+ Utilize the bio slurry as the fertilizer + Reduce the environmental pollution from the livestock households who do not know where to discharge their waste. + Utilize effectively the area under cultivation and improve the soil fertility. + Reduce costs for fertilizer + Supply the high quality green feed source for cow + Generate more income for the farmers who plant grass for cow raising.	+ Model on the effective utilization of bio slurry to plant grass as the feed for cow. + At least 70% of the chemical fertilizer amount shall be replaced.
10	Production of bio-organic fertilizer from biological bedding in chicken raising in combination with trichoderma for safe vegetables in Phuoc Hiep commune, Tuy Phuoc district, Binh Dinh province.	+ Treat chicken manure by biological bedding in combination with organic matter decomposition, etc. + Produce bio-organic fertilizer from biological bedding for chicken raising in combination with Trichoderma. + Use organic manure from chicken raising bedding to produce the fertilizer for safe vegetables.	

Table 10 Demonstration Subprojects in Ha Tinh province

No.	Title of demonstration	Objective	Expected output
11	Utilize all the effluence and bio-slurry waste from the biogas plant for fruit trees and biogas for producing power at one pig farm in Ha Tinh. Fattening pig farm of Mr.Hung in Son Kim commune, Huong Son district, Ha Tinh province.	(i) Treat all the livestock waste and wastewater using HDPE lagoon to produce biogas for running power generator, contributing to power with a yearly saving (125.9 MW/h) for the farm. (ii) Utilize the whole water discharged from biogas lagoon as the fertilizer for the fruit trees and rubber tree; protect the watershed water source	i) Construct one HDPE lagoon to produce 125.9 MW/h per year ii) Replace 525 ton of organic fertilizer per year
12	Produce the organic fertilizer from industrial scale fattening pig farming waste	(i)Re-establish the system of liquid matter collection system, (ii) Separate the dry matter from liquid matter to reduce environmental pollution (iii) Work with 1 cooperative to produce 1,350 ton of organic fertilizer, treat 78,800 m3 of wastewater.	i) Treat 78,800 m3 of wastewater. ii) Produce 1,350 ton of organic fertilizer

Table 11 Demonstration Subprojects in Lao Cai province

No.	Title of demonstration	Objective	Expected output
13	Comprehensive management of waste from medium and large pig farm to produce the electricity and bio-organic fertilizer.	i) Produce high quality organic fertilizer from the pig manure, contributing to waste management in pig farming, improving the economic efficiency, protecting the environment and reducing GHG emission. ii) Construct large scale biogas plant to treat waste and install one power generation system to meet the demands for biogas and electricity of the farm.	+ 1 manure separation system as the feedstock for organic fertilizer production + 1 large scale biogas system + 1 power generation system from biogas
14	"Establishment of integrated system of farm household scale livestock waste treatment for the sparsely populated mountainous area.	- Set up livestock waste management team - Provide the training and dissemination to the farm households - Support the local people with materials, equipment, tapes/disks, etc. - Form the bio-organic fertilizer production teams to meet the high demand of the market.	+ 1 treatment and collection system of scattered waste with the participation of ethnic group people.

Table 12 Demonstration Subprojects in Nam Dinh province

No.	Title of demonstration	Objective	Expected output
15	Separate the fresh manure from medium and large fattening pig farm to produce organic fertilizer and power generation.	Comprehensive and effective management of livestock waste to produce high quality organic fertilizer and provide the energy.	+ 3 manure separation systems + 3 large scale biogas plants + 3 power generation systems from biogas
16	"Formation of system of collecting and separating slurry from biogas plants to process organic fertilizer	- Environmental pollution reduction in the livestock sector - Waste collection for processing into the organo-mineral and microbiological organic fertilizer, etc.	+ 1 model of collecting and separating slurry from scattered biogas plants to produce organic fertilizer

Table 13 Demonstration Subprojects in Phu Tho province

No.	Title of demonstration	Objective	Expected output
17	Demonstration on the application of biogas technology to treat the waste from pig farm and share the biogas benefits in Thanh Thuy district and Phu Tho town in Phu Tho province.	+ Manage and utilize effectively the quantity of biogas produced from the medium biogas plants to reduce the environmental pollution and lower GHG emission. + The successful implementation of demonstration is a good lesson for others to follow and replicate in the whole province with the different livestock scales.	1 model of shared biogas
18	Demonstration on the utilization of cow dung to raise red worm as the feed (protein supplementation) for the hill chicken in Huong Non commune, Tam Nong district and the whole city of Viet Tri of Phu Tho province.	- Livestock waste treatment helps reduce environmental pollution. - Use cow dung and biogas slurry as feed for red worm - Evaluate the efficiency of utilizing red worm as the additional feed for chicken. - Technical training for the farmers on red worm raising and product utilization from red worm	+ At least 80% of the bio slurry amount from the biogas plants of 30 cow raising households is used for red worm raising. + Evaluation report on the effectiveness of using red worm as the fertilizer and the feed for the chicken
19	Separate the fresh manure from medium and large fattening pig farm to produce bio-organic fertilizer for the	- Apply the manure separation and post-separation solid waste treatment technology as the substrate for organic fertilizer production. - Generate more income for the local people.	+ 1 manure separation system as the feedstock for organic fertilizer production
20	Utilize the biogas slurry for high quality grass planting to serve the cow raising	+ Utilize the bio slurry as the fertilizer for high quality grass planting + Reduce the environmental pollution from the livestock households who do not know where to discharge their waste. + Utilize effectively the area under cultivation and improve the soil fertility. + Reduce costs for grass planting fertilizer + Generate more income for the farmers who plant grass for cow raising.	+ Model on the effective utilization of bio slurry to plant grass as the feed for cow. + At least 70% of the chemical fertilizer amount shall be replaced.

Table 14 Demonstration Subprojects in Soc Trang province

No.	Title of demonstration	Objective	Expected output
21	Demonstration development of separating the fresh manure from pig farm as the feedstock for bio-organic fertilizer production for the crops.	- Separate the solid matter from pig farming waste as the feedstock for producing organic fertilizer; minimize the quantity of waste to be treated via biogas technology. + Improve the organic fertilizer production via composting technology. + Generate more income for livestock households.	+ 1 manure separation system + Process of composting
22	Demonstration development of separating the biogas slurry from pig farm as feedstock for producing organic fertilizer for the crops and power generation.	- Separate the solid matter from biogas slurry and the sediment of biogas system as the feedstock for producing organic fertilizer. + Improve the biogas run power system in the farm.	+ 1 manure separation system as the feedstock for organic fertilizer production. + 1 biogas system + 1 power generation system from biogas
23	Utilize the biogas slurry for high quality grass planting to serve the cow raising	+ Utilize the bio slurry as the fertilizer for high quality grass planting + Reduce the environmental pollution from the livestock households who do not know where to discharge their waste. + Utilize effectively the area under cultivation and improve the soil fertility. + Reduce costs for grass planting fertilizer + Generate more income for the farmers who plant grass for cow raising.	+ Model on the effective utilization of bio slurry to plant grass as the feed for cow. + At least 70% of the chemical fertilizer amount shall be replaced.
24	Development of slurry separation demonstration from small biogas plant to produce organic fertilizer for the subsidiary crops as per Global GAP standard	+ Separate solid matter from biogas slurry and sediment of the biogas system as the feedstock for organic fertilizer production + Improve the power system used the biogas in the farm	+ System of collecting and separating the slurry of scattered small biogas plants to produce the fertilizer.

Table 15 Demonstration Subprojects in Son La province

No.	Title of demonstration	Objective	Expected output
25	Development of comprehensive management demo. of industrial scale dairy cow raising waste	Set up the effective and comprehensive management demo. of dairy cow raising waste for producing bio-organic fertilizer for the crops right in Moc Chau district, supplying the energy and forming the practical basis for training on and replicating the demo. to the farms of the similar scale.	+ 1 cow dung separation system for organic fertilizer production. + 1 large biogas system + 1 power generation system from biogas
26	Development of comprehensive management demo. of industrial scale pig raising waste	Set up the effective and comprehensive management demo. of raising waste for producing high quality organic fertilizer, renewable energy and forming the practical basis for training on and replicating the demo. to the farms of the similar scale.	+ 1 pig manure separation system for organic fertilizer production. + 1 large biogas system + 1 power generation system from biogas

Table 16 Demonstration Subprojects in Tien Giang province

No.	Title of demonstration	Objective	Expected output
27	Comprehensive management demo. of livestock waste applying the manure separation and power generation technology from the biogas for the medium and large livestock farms	Manage the livestock waste, inclusive of manure and wastewater, to reduce environmental pollution and produce energy for the production.	+ 1 pig manure separation system for organic fertilizer production. + 1 large biogas system + 1 power generation system from biogas
28	Demonstration of separating the slurry from small biogas plant to produce bio-organic fertilizer to serve the planting of durian as per the Global Gap standard	Control the waste from the small biogas plant to produce bio-organic fertilizer to serve the planting of durian as per the Global Gap standard; generate more income for the local people and reduce environmental pollution.	+ System of collecting and separating the slurry of scattered small biogas plants to produce the fertilizer.
29	Demonstration of shared biogas supply and production of organic fertilizer from medium biogas plant	Enhancing the use of biogas energy via the community sharing, contributing to the lower environmental pollution.	+ 1 effective shared biogas model

Source: LIC: Huong Ho Thi Lan

* Three additional proposals are currently under consideration making 32 in total.

Table 17 Provisional Schedule for Demonstration Sub-Projects

No.	Demonstration Sub-projects	Date
1	Selection procedure and criteria submitted by CPMU to ADB	25/3/2016
2	Selection procedure & criteria commented by ADB	4/4/2016
3	Selection procedure and criteria finalized by CPMU and approved by ADB	14/4/2016
4	Selection of beneficiaries for demonstrations processed and report submitted by PPMU to CPMU	15/5/2016
5	Selection report submitted by CPMU and approved by ADB	25/5/2016
6	Bidding document prepared and submitted by PPMU to CPMU	1/6/2016
7	Bidding document submitted by CPMU to ADB	3/6/2016
8	Bidding document commented by ADB	13/6/2016
9	Bidding document finalized by CPMU and approved by ADB	24/6/2016
10	Bidding document submitted by PPMU and approved by DARD	9/7/2016
11	Advertisement placed by PPMU on newspapers	14/7/2016
12	At least 3 qualified quotations obtained by PPMU	14/8/2016
13	BER submitted by PPMU to CPMU	21/8/2016
14	BER submitted by CPMU to ADB	24/8/2016
15	BER commented by ADB	3/9/2016
16	BER finalized by PPMU & CPMU and approved by ADB	13/9/2016
17	BER submitted by PPMU and approved by DARD	20/9/2016
18	Contract negotiated and signed by PPMU & contractor	27/9/2016
19	Advance payment 50% done by PPMU to contractor	28/10/2016
20	Works completed by contractor	9/5/2018
21	Works finally checked by PPMU with assistance of LIC	9/8/2018
22	Last payment 50% done by PPMU to contractor	9/9/2018
23	Expenditure liquidated by CPMU with ADB	9/12/2018

4.7 Core Activities at the Provincial Level – Research Topic Pilots

Table 18 below shows the core research topic pilots that have been consolidated into six packages for implementation and will constitute an important part of the workload for the LIC Provincial consultants. This is followed by a time schedule for stage of the preparation process through to procurement and implementation.

Table 18 LIST OF PROPOSED RESEARCH PACKAGES - Method of Recruitment: Quality and Cost Based Selection (QCBS)

	Package of research projects	Indicative objective	Expected Output	Budget/ 1,000 USD
1	**Research on organic fertilizer production from livestock waste and bio slurry**	1. Improvement of the technology and equipment for separating the livestock waste and bio slurry in place of peat for organic fertilizer production 2. Improvement of the technological process for the specialized organic fertilizer production (in solid and liquid state) from the livestock waste 3. Proposal of policy for the organic fertilizer utilization encouragement in agricultural production	1. Technology of separating manure from livestock waste and sediment from biogas plant improved; separation capacity: 10 – 15m^3/h; rate of water in the separated mixture not exceeding 70% (> 30% of dry matter) 2. Synchronous manure separation system (manure separator, pump and agitator) designed and manufactured; rate of solid waste separation from bio slurry achieves more than 75%, equivalent to the foreign advanced equipment in terms of the efficiency but 30 – 40% cheaper (in terms of prime cost) 3. New technology in livestock waste treatment improved (red worm raising helps treat the solid waste and waste stabilization pond/aquatic pond helps treat wastewater, etc.) 4. Technology of bio-organic fertilizer production (microbiological-organic and organo-mineral) from the livestock waste and bio slurry is recognized by the scientific council (of the provincial level and higher). The agronomical efficiency of organic fertilizer (using the livestock waste) is at least 15% higher than that using the peat (where the prime cost is the same). 5. The liquid waste from the livestock activities and biogas plant is treated meeting the standard of agricultural irrigation water and/or processed into the liquid organic fertilizer. 6. Recommendation on the policy of collection and processing of livestock waste and bio slurry put forward 7. Apply the research results for developing the specialized organic fertilizer production models (fertilizer	1,200

	Package of research projects	Indicative objective	Expected Output	Budget/ 1,000 USD
			of solid and liquid state) in 4 provinces representing 4 ecological zones (1 model/province): Bac Giang, Ha Tinh, Binh Dinh and Tien Giang. 8. Model of organic fertilizer utilization (solid and liquid state) in each participating province (2ha/province) developed for practicing safe agricultural production, production according to VietGAP (standard) and organic cultivation.	
2	**Research on biogas technology improvement according to value chain and effective biogas utilization**	1. Improvement of design of biogas plant of small, medium and large scale. 2. Improvement of technology for power production from the biogas 3. Proposal of biogas development encouragement solutions for livestock waste treatment and effective utilization of this fuel source	1. The advanced technology selected and design of biogas plants of small, medium and large scale improved meeting the high requirement on livestock waste treatment efficiency and suiting the geological condition of the weak soil (plain), solid soil (midland), swept-away easily soil, sliding soil (sandy), etc. together with the guidelines on the biogas construction and operation with the high economic and environmental efficiency. 2. Set of technical drawings of the large and medium scale plants. 3. Power generation equipment (run on biogas) is designed and manufactured with an output range of 10 – 125kW and of the quality equivalent to the ones manufactured in the region (biogas consumption rate of 0.5 – 1m3/kWh; output factor of >0.5); the life-span of the equipment is more than 10 years, easy to operate and procure its spare parts. 4. Technology of manufacturing steam and air filtering system from biogas has a high efficiency (more than 95% of H2S and steam is removed from the biogas); the filtering material is easy to replace and with reasonable cost. Rate of filtering and equipment size are suitable for the biogas-run power generators with an output range of 10-125kW.	1,000

	Package of research projects	Indicative objective	Expected Output	Budget/ 1,000 USD
			5. Encouragement policy for application of biogas at both centralized and decentralized scale proposed. 6. At least 7 biogas models (combined with organic fertilizer production) and 3 biogas models (combined with power generation) are developed, for purposes of economizing on the cooking and lighting cost of the households (at least 30%), contributing to GHG emission reduction (at least 0.2 ton of CO2/m3 of the biogas plant/year)) and reducing the workload of the women and children (at least 2 hours/day).	
3	**Research on the water-saving pig farming technology**	1. Formulation of technological process of water-saving fattening pig farming 2. Formulation of livestock wastewater re-utilization procedure 3. Technology of biological bedding from crop waste improved with higher economic efficiency (at least 20% higher than the controls)	1. Evaluation report on the current status of water utilization in pig farming in Vietnam, status of water-saving pig farming technologies and international experience on water-saving livestock farming. 2. Technological process of fattening pig farming which helps save at least 40% of water. 3. The biological bedding which utilizes the crop residues with low cost, suiting to Vietnam's condition 4. Policy on water-saving fattening pig farming encouragement proposed. 5. Model of water-saving farming with a scale of 300-500 head of fattening pigs in the participating provinces, helping save 40 % of the water amount (for pig house cleaning), compared to the existing pig farming method.	600
4	**Research on effective utilization of crop waste according to value chain**	1. Diversification of products processed from crop residues (rice straw, corncob, stem and top of corn): pellet and bar; biochar and activated carbon 2. Improvement of technology for value added crop waste treatment and organic fertilizer production	1. Technological process of continuous production of activated carbon and biochar, with a capacity of at least 1 ton/hour 2. Technological process of processing the crop residues into composite pellet/bar (straw pellet, corn pellet, etc.) with a minimum capacity of 5 ton (of product)/hour and	1,000

	Package of research projects	Indicative objective	Expected Output	Budget/ 1,000 USD
		3. Improvement of cattle-feed processing technology from crop waste 4. Proposal of policy for crop waste utilization encouragement and reduction in the rate of burning (causing the environmental pollution)	the calorie achieving more than 80% (compared with that of husk pellet). 3. Technological process for livestock feed production from crop residues (rice straw, stem and top of corn) for the cattle in dry/winter season. The feed can be preserved between 3 and 6 months. 4. Technological process for edible and medicinal mushroom production (wood ear, mushroom) from crop waste improved and recycling of the mushroom cultivation waste into the organic fertilizer. 5. Technological process for treating quickly decomposed rice straw into organic fertilizer (less than 20 – 25 days) which is easy for application at different scales (on-site or off-site). 6. Technological process for organic fertilizer production from the crop waste meeting the standards set by MARD. 7. Recommendation on the policy of collection and processing of crop waste 8. On-site crop waste treatment model (50 ton/location) and industrial scale organic fertilizer production (500 ton) 9. Model of utilizing organic fertilizer and biochar from crop waste in each participating province (2ha/province) for safe agricultural production, production according to VietGAP (standard) and organic cultivation at cooperative and farm level.	
5	**Research on the treatment of sludge sediment in shrimp farming**	1. Assessment on the pollution status of the industrial scale shrimp farming ponds and treatment technologies 2. Development of the technological process for the sludge sediment	1. Report on the current pollution status of shrimp farming ponds, treatment technologies and international experience 2. Technological process for the sludge sediment treatment in the industrial scale shrimp farming ponds for	800

	Package of research projects	Indicative objective	Expected Output	Budget/ 1,000 USD
		treatment in the industrial scale shrimp farming ponds for safe shrimp production 3. Development of the technological process for treatment and re-utilization of shrimp farming pond wastewater	safe shrimp production, suiting to different production scales. 3. Technological process for treatment and re-utilization of shrimp farming pond wastewater 4. Model on shrimp farming pond waste treatment (sludge sediment and wastewater) with a scale of 1 – 2 ha/province in 4 provinces: Nam Dinh, Ha Tinh, Binh Dinh and Soc Trang with a higher efficiency (at least 20% higher than the current level)	
6	**Research on the cultivation techniques for GHG emission reduction**	1. Research on and proposal of the scale and solution for the transformation of ineffective rice land and re-utilization of by-products for improving the value chain in the agricultural production. 2. Research on and proposal of technical packages for improving the efficiency of utilizing the fertilizer for purposes of improving the production efficiency and GHG emission reduction. 3. Proposal of the encouragement policy for transformation of ineffective rice land	1. Report on the current status of ineffective rice land, assess on the existing transformation policies, international experience on the production/crop restructuring. 2. Production model according to value chain in rice-based cropping system (including cultivation, animal husbandry and aquaculture). 3. The encouragement policy for transformation of rice land proposed. 4. Model of ineffective rice land transformation developed with a scale of 3 – 5 ha/province in 10 participating provinces; 100% of waste treated and reused; the value chain sees an increase by 25 – 30% as a minimum; GHG emissions reduced by 25 – 30%.	1,018
	Total			**5,618,000**

* The list is consolidated at request of ADB at the letter dated 20 April 2016 signed by Mr.Rustam Ishenaliev, Head, Project Administration Unit, of which ADB recommended: Research and pilot projects be consolidated into a few packages for administrative efficiency by combining them in terms of similarity in research topic and/or georgraphic coverage and presented with details including the names of proposed research/pilot activity, areas of coverage, cost estimates, terms of reference and proposed method of recruitment.

Table 19 Provisional Schedules for Research Topic Pilots

No.	Research Topic Pilots	Date
1	CPMU/DSTE/LIC finalize list of research & demonstrations packages and submit to ADB	29/4/2016
2	List of research & demonstrations, and their packaging proposal commented and approved by ADB	14/5/2016
3	CPMU/DSTE submit to MARD the List of research & demonstrations for approval.	16/5/2016
4	Updated project procurement plan submitted to ADB	18/5/2016
5	Updated project procurement plan commented and approved by ADB	2/6/2016
6	CPMU/DSTE submit to MARD the procurement plan for approval	9/6/2016
7	CPMU/DSTE/LIC prepare Submission 0s (TOR, cost estimate) to submit to ADB	14/7/2016
8	Submission 0s commented and approved by ADB	29/7/2016
9	CPMU/DSTE submit to MARD the Submission 0s for approval	13/8/2016
10	CSRN placed on ADB's website and newspaper	18/8/2016
11	CPMU/DSTE/LIC prepare Submission 1s and submit to ADB	19/10/2016
12	Submission 1s commented and approved by ADB	3/11/2016
13	CPMU/DSTE submit to MARD the Submission 1s for approval	13/11/2016
14	RFP issued to shortlisted consulting firms	18/11/2016
15	CPMU/DSTE/LIC prepare Submission 2s and submit to ADB	27/1/2017
16	Submission 2s commented and approved by ADB	11/2/2017
17	CPMU/DSTE submit to MARD the Submission 2s for approval	21/2/2017
18	CPMU/DSTE/LIC prepare Submission 3s and submit to ADB	20/3/2017
19	Submission 3s commented and approved by ADB	4/4/2017
20	CPMU/DSTE/LIC prepare Submission 4s and submit to ADB	19/5/2017
21	Submission 4s commented and approved by ADB	3/6/2017
22	CPMU/DSTE submit to MARD the Submission 4s for approval	13/6/2017
23	Contracts signed by CPMU and consulting firms	23/6/2017
24	Advance payments 50% done by CPMU to consultants	24/7/2017
25	Research completed by consultants	30/6/2019
26	Last payments 50% done by CPMU to consultants	30/9/2019

4.8 Provincial Plans and Implementation Schedule

Most provinces will substantially undertake a similar programme of activities and for this reason we note just one plan for Nam Dinh Province which may be considered both typical and indicative of the requirements for the other provinces. Only budgets and the quantity of different activities will vary.

Table 20 Example of Overall Province Activity Plan and Outputs (Nam Dinh)

No.	Activity	Cost Estimate (USD.)	Expected Outputs	Envisaged LIC Contribution
I. Expanded Use of Livestock Waste Management Infrastructure				
1	Provide training on livestock waste management	645	Training on CSAWMP for 70 extension officers and 700 farmers.	Design of training courses and TOR preparation.
2	Standardizing and disseminating a design package for BVC infrastructure	3,397	4,700 SBP operators trained and registered in biogas associations by 2018. At least 40% of trainees on biogas use will be women	Central LIC specialist assess and revise, if necessary infrastructure design packages
3	Monitor and ensure the effective use of biogas plants with adequate environment facilities	1,936	At least 5% constructed BPs will be monitored to ensure the effective use of biogas plants with adequate environment facilities by CPMU and PPMU	LIC will review TORs for audit process and monitor and advise on results
4	Provide training and certifications to technicians, contractors, masons through relevant agencies for the construction of BVC infrastructure and permitting staff of FIs	108	20 installers, 30 technicians for SBP, 5 technicians for MBP and LBP. At least 20% of trainees on using biogas, and 20% of those trained on biogas management and technical issues will be women.	LIC will assess training materials and process towards certification and advise on quality control.
5	Provide the financial incentives to household constructing BVC	14,083	4,700 SBPs, 10 MBPs, and 6 LBPs and associated value chain infrastructure will be constructed and come to operation by 2018.	Support to monitoring of performance and assessment of the relevance of financial incentives provided
III. Enhanced Climate Smart Agricultural Waste Management Practices Technology Transfer (CSAWMP)				
6	Develop and implement a program of disseminating information on CSAWMP via mass media	232	Information of CSAWMP disseminated by PPMU through mass media and other means	LIC central specialist will contribute to the preparation and delivery of mass media related materials
7	Organize domestic study tours	473	At least 3 domestic study tours organized by PPMU to improve capacity building for local staff	LIC to provide advice upon request.
8	Develop livestock waste management models for agricultural production and greenhouse gas emission reduction	10,215	At least 6 extension models on livestock waste management developed by PPMU	LIC will contribute through training and extension specialist inputs

No.	Activity	Cost Estimate (USD.)	Expected Outputs	Envisaged LIC Contribution
9	Provide training to local farmers on low-carbon agricultural production technologies to promote application of the technologies in agricultural production	1,075	Local farmers trained by PPMU on low-carbon agricultural production technologies to promote application of the technologies in agricultural production.	LIC to support preparation and delivery of training materials
IV. Effective Project Management				
10	PPMU operation	9,274	Operation expenditures of PPMU financed. PPMU established and operational with adequately skilled staff and facilities in DARD by first quarter of 2013. -- of -- staff are women (--%) and a gender focal point was appointed in 2013.	LIC Provincial co-coordinators provide on-going support, where relevant upon request.
	Total	**41,438**		

Source: Prepared by CPMU/PPMU with LIC Central Specialist and Provincial Coordinator Support

Table 21 Example of Detailed Project Implementation Plan: Nam Dinh

No.	Activity	Implementation Status	Detailed Implementation Plan		
			Task	Deadline	LIC Contribution
1	Provide training on livestock waste management	Due commence end June .	10 courses to be implemented by PPMU	30/6/2016	LIC will contribute to design and delivery of training programs
			PPMU liquids payment with ADB	30/9/2016	
			15 courses to be implemented by PPMU	30/10/2016	
			PPMU liquids payment with ADB	31/1/2017	
2	Standardizing and disseminating a design package for BVC infrastructure	7 talking programs on TV and 204 radio programs were implemented by PPMU, 9 programs were broadcast on district radio, 204 instruction boards about the Project, 70 training courses were implemented by PPMU for 3.978 households.	PPMU organizes 01 talking program on TV	30/9/2016	LIC will contribute to design and delivery of training programs
			PPMU liquids payment with ADB	30/12/2016	
			20 training courses on operation to be implemented by PPMU	30/6/2016	
			PPMU liquids payment with ADB	30/9/2016	
			Organize 02 dissemination workshops on CSAWMP	30/10/2016	
			PPMU liquids payment with ADB	30/1/2017	
			PPMU implements 9 dissemination programs on district channel	30/9/2016	
			PPMU liquids payment with ADB	31/12/2016	
			PPMU prints 10.000 leaflets and booklets on BVC and livestock waste management	30/9/2016	
			PPMU liquids payment with ADB	31/12/2016	
			PPMU develops code list for composite biogas plants to introduce the Project to households	30/12/2016	
			PPMU liquids payment with ADB	30/3/2017	
			25 training courses on operation to be implemented by PPMU	30/11/2016	
			PPMU liquids payment with ADB	28/2/2017	

No.	Activity	Implementation Status	Detailed Implementation Plan		
			Task	**Deadline**	**LIC Contribution**
			30 dissemination workshops on benefit of biogas plant in livestock waste treatment for potential livestock households to be implemented by PPMU	30/11/2016	
			PPMU liquids payment with ADB	28/2/2017	
			PPMU liquids payment with ADB	28/2/2017	
			PPMU organizes 20 dissemination workshops on benefit of biogas plants	30/6/2017	LIC will contribute through preparation of materials for workshop and support delivery
			PPMU liquids payment with ADB	30/9/2017	
			PPMU organizes 25 training courses on operation of biogas plant	30/9/2017	
			PPMU liquids payment with ADB	31/12/2017	
3	Monitor and ensure the effective use of biogas plants with adequate environment facilities	PPMU has checked 170 biogas plants, and organized 7 fields trips to check and monitor the operating biogas plants, Technicians have accepted, provided guidance of operation for 2.455 BPs construction/installation households	PPMU organize 10 assessment missions in 2016	30/6/2016	LIC will provide support to design of assessment and certification procedures including quality of after-sales service from a monitoring perspective
			PPMU liquids payment with ADB	30/9/2016	
			PPMU organize 10 assessment missions in 2016	30/9/2016	
			PPMU liquids payment with ADB	31/12/2016	
			PPMU will implement 30 assessment missions in 2017 (Q 2,3,4)	31/12/2017	
			PPMU liquids payment with ADB	30/3/2018	
			Technicians accept and certificate 400 biogas plants	30/6/2016	
			PPMU liquids payment with ADB	30/9/2016	
			Technicians accept and certificate 400 biogas plants	30/9/2016	
			PPMU liquids payment with ADB	30/12/2016	
			Technicians accept and certificate 500 biogas plants	31/12/2016	
			PPMU liquids payment with ADB	30/3/2017	

No.	Activity	Implementation Status	Detailed Implementation Plan		
			Task	Deadline	LIC Contribution
			Technicians accept and certificate 500 biogas plants	30/6/2017	
			PPMU liquids payment with ADB	30/9/2017	
			Technicians accept and certificate 445 biogas plants	30/9/2017	
			PPMU liquids payment with ADB	30/12/2017	
			PPMU will implement 20 assessment missions in 2018	30/6/2018	
			PPMU liquids payment with ADB	30/9/2018	
4	Provide training and certifications to technicians, contractors, masons through relevant agencies for the construction of BVC infrastructure and permitting staff of FIs	No action was taken yet.	PPMU organizes 01 training courses for 30 technicians	30/6/2017	LIC to assess course and certification materials and make recommendations
			PPMU liquids payment with ADB	30/9/2017	
5	Provide the financial incentives to household constructing BVC	Construct and operate 4.700 small biogas plants and associated value chain. Provided incentives for 2.455 small biogas plant households.	PPMU will provide incentives for 400 small biogas plants	30/6/2016	Support to monitoring of performance and assessment of the relevance of financial incentives provided
			PPMU liquids payment with ADB	30/9/2016	
			PPMU will provide incentives for 400 small biogas plants	30/9/2016	
			PPMU liquids payment with ADB	30/12/2016	
			PPMU will provide incentives for 500 small biogas plants	30/12/2016	
			PPMU liquids payment with ADB	30/3/2017	
			PPMU will provide incentives for 500 small biogas plants	30/6/2017	
			PPMU liquids payment with ADB	30/9/2017	
			PPMU will provide incentives for 445 small biogas plants	30/9/2017	
			PPMU liquids payment with ADB	30/12/2017	

No.	Activity	Implementation Status	Detailed Implementation Plan		
			Task	**Deadline**	**LIC Contribution**
			PPMU will construct the last biogas plants	30/9/2017	
			PPMU liquids payment with ADB	30/12/2017	
6	Develop and implement a program of disseminating information on CSAWMP via mass media	No action was taken yet.	PPMU develops 1 radio program on mass media	30/6/2016	LIC will provide specialist support to the exercise
			PPMU liquids payment with ADB	30/9/2016	
			PPMU develops 1 radio programs on mass media	3/30/12017	
			PPMU liquids payment with ADB	30/6/2017	
7	Organize domestic study tours	Finalize 1 study tour in Northern provinces for 10 people, in which 3 female	PPMU expects to organize 01 domestic study tour in Tien Giang, Ben Tre for 10 people	30/9/2016	LIC provincial coordinators may help facilitate upon request
			PPMU liquids payment with ADB	31/12/2016	
			PPMU expects to organize 02 domestic study tours in Binh Đinh for 20 people	30/6/2017	
			PPMU liquids payment with ADB	30/9/2017	
8	Develop livestock waste management models for agricultural production and greenhouse gas emission reduction	PPMU has submits CPMU the list of beneficiaries from the demonstrations to submit ADB. However, ADB has not approved yet, because the selection criteria and procedure has not been submitted to ADB for approval.	CPMU submits ADB the selection criteria and procedure	31/3/2016	LIC has and will continue to play a substantive role through central specialists and provincial coordinators for this major project output
			ADB comments on the selection criteria and procedure	10/4/2016	
			CPMU finalizes the selection criteria and procedure submits ADB for approval	20/4/2016	
			PPMU select beneficiaries from demonstrations and submits reports to CPMU	21/5/2016	
		The selection criteria and procedure is developed by LIC. LIC will develop the proposal form of demonstration.	CPMU submits ADB the selection report for approval	31/5/2016	LIC has assisted the CPMU in the preparation of a demonstration procedures that has submitted to ADB for review – for which feedback is awaited.
			PPMU prepares bid invitation and submits CPMU	7/6/2016	
			CPMU submits bid invitation to ADB	9/6/2016	
			ADB comments on bid invitation	19/6/2016	
			CPMU finalizes bid invitation and submits ADB for approval	30/6/2016	

No.	Activity	Implementation Status	Detailed Implementation Plan		
			Task	**Deadline**	**LIC Contribution**
			PPMU submits bid invitation to DARD for approval	15/7/2016	
			PPMU advertises bid invitation on newspaper	20/7/2016	
			PPMU receives at least 3 qualified proposals	20/8/2016	
			PPMU submits Selection Minutes to CPMU	27/8/2016	
			CPMU submits Selection Minutes to ADB	30/8/2016	
			ADB comments on Selection Minutes	9/9/2016	
			PPMU finalized Selection Minutes submits ADB for approval	19/9/2016	
			PPMU submits DARD the Selection Minutes for approval	26/9/2016	
			PPMU and the contractor sign the contract negotiation	3/10/2016	
			PPMU pays 50% in advance for the contractor	3/11/2016	
			The contractor accomplish the tasks in the contract	15/5/2018	
			PPMU and LIC check the last time	15/8/2018	
			PPMU pay the remaining of 50% for the contractor	15/9/2018	
			CPMU liquids payment with ADB	15/12/2018	
9	Provide training to local farmers on low-carbon agricultural production technologies to promote application of the technologies in agricultural production	PPMU has implemented 10 courses on composting fertilizer for 319 livestock households, in which 38% female	PPMU organizes 10 training courses for farmers on CSAWMP (300 people)	30/9/2016	LIC will contribute to design of training courses and follow up monitoring of impact
			PPMU liquids payment with ADB	30/12/2016	
			Assess the training results	30/12/2016	
			PPMU organizes 23 training courses for farmers on CSAWMP (700 people)	30/6/2017	

No.	Activity	Implementation Status	Detailed Implementation Plan		
			Task	**Deadline**	**LIC Contribution**
			PPMU liquids payment with ADB	30/9/2017	
10	PPMU operation	On going	Beginning	6/2013	LIC provincial coordinators provide support to PPMU 'on-demand' where activity relevant to LCASP
			Finalize ADB capital	30/06/2019	
			Finalize Counterpart capital	31/12/2020	
Total		**Deadline (ADB Loan)**		**30/6/2019**	

Source: Prepared by CPMU/PPMU with LIC Central Specialist and Provincial Coordinator Support

Table 22 Provincial Work Plan Second Quarter 2016

No	ACTIVITIES	Quarter II			Responsibility	
		4	5	6		
1	1. Component 1. Livestock Waste Management					
	1.1 . Sub-component 1.1 : Comprehensive management of livestock waste and carbon markets					
1.1	1.1.1 . Activity 1 : Develop training modules				PPMU	LIC Spec & PC
1.2	1.1.2 . Activity 2 : Standardization and dissemination / communication of design packages for biogas chain management .				PPMU	LIC Spec & PC
1.3	1.1.3 . Activity 3 : Registration for the program activities of the biogas small , medium and large with the appropriate carbon market .				PPMU	LIC Spec & PC
	1.1.4 . Activity 4 : Strengthening the capacity of relevant agencies to monitor biogas projects built .				PPMU	LIC Spec & PC
	1.1.5 . Activity 5 : Monitoring of CO2 emissions every year , and revenue from certified carbon emission reduction				PPMU	LIC Spec & PC
	1.1.6 Activity 6 : Strengthening capacity of govt officials & relevant bodies to continue to manage/develop Nat biogas program.				CPMU implement with LIC Support	
	1.2. Sub-component 1.2 : Support development of biogas					
	1.2.1 . Activity 7 : Monitoring operation of biogas plants with the environmental category .				PPMU	LIC Spec & PC
	1.2.2 . Activity 8 : Training /certification of technicians , builders , technicians biogas Med/Large scale ,				PPMU	LIC Spec & PC
	1.2.3 . Activity 9 : Financial support for biogas projects .				PPMU	Prov Coordinator
2	2 .. Component 2. Credit to the biogas value chain					
2.1	2.1 Activity. 10 : The project will provide credit for businesses and farmers (with priority on gender)				PPMU	Coordinator
3	3. Component 3. Transfer of technology in agricultural production of low carbon					
	3.1 . Sub-Component 3.1 : Promoting agricultural applications low carbon					
3.1	3.1.1 . Activity 11 : Research and testing technologies in agricultural production of low carbon				CPMU/ PPMU/ LIC identify tech and design research TORs	

No	ACTIVITIES	Quarter II			Responsibility	
		4	5	6		
	3.1.2 . Activity 12 : Setting up information systems for the sharing of agricultural applications of carbon				CPMU implement with LIC Specialist Support	
	3.1.3 . Activity 13 : Training for researchers and extension staff on efficient application technologies for agricultural production of low carbon					
	3.1.4 . Activity 14 : Develop training programs , curriculum, syllabus on CSA					
	15 3. Activity 15: Upgrading the map based on 7 agro-ecological zones					
3.2	3.2 . Sub- component 3.2 : Building the model low-carbon agriculture					
	3.2.1 . Activity 16 : Develop models for livestock waste management for agricultural production and reduce greenhouse gas emissions				PPMU	Coordinator -BTH
	3.2.2 . Activity 17 : Training extension workers and farmers in agricultural production technology of carbon				PPMU	Coordinator -BTH
4	Component 4. Project Management					
	4.1.1 . Activity 18 : Support for operating expenses for the units involved in project management , including:				PPMU	
	4.1.2 . Activity 19 : Implement basic survey and monitoring system construction project evaluation				PPMU	Coordinator -BTH
	4.1.3. Activity 20 : Workshops , training management capacity building and project implementation				PPMU	Coordinator -BTH
	4.1.3. Activity 20 : Workshops , training management capacity building and project implementation				PPMU	Coordinator -BTH

Source: LIC Provincial Coordinator with Local PPMU

5 CONCLUSIONS AND RECOMMENDATIONS

LIC Staffing mobilization

The present staffing configuration is already stretched and this is likely to increase in the coming months when a substantive number of demonstration sub-projects will be processed, primarily at the province level.

In view of this we believe there is a need to front-end provincial coordinator mobilization, we are recommending that their half-time (50%) assignments are reallocated to allow for 9 months in year one, 5 months in year two and 3 month in the last year of the project.

With a view to balancing out the workload of individual national consultants we recommend that the DTL position be reallocated to the current National CSAWMP specialist.

Near term project tasks

i. With respect to the overall Design and Monitoring Framework (DMF) and preparation for the MTR, the CPMU, with support from LIC should consider reviewing all output performance targets and indicators with a view to proposing relevant revisions for the remainder of the project.

ii. Once research and demonstration packages have been approved by the ADB & MARD, the LIC will seek to provide intensive support to the CPMU and PPMUs to update their detailed implementation plans for each package accordingly.

iii. Taking into account training needs (as part of the training and extension specialist's TORs), the LIC will assist the CPMU/PPMUs prepare a Training Master Plan in accordance with the DMF output performance targets and indicators.

iv. Making CPMU and PPMUs implementation plan for Gender Action Plan

v. Prepare semi-annual Environmental Safety Monitoring Reports

Project Design and Budget Reallocation

vi. For the project itself it seems clear that the budget and targets for component 2 were unduly ambitious and cannot be met. By the same token the targets for small biogas compared to potential demand appear to be understated, particularly as over 80% of the target of 36,000 has already been met by the project.

vii. Notwithstanding product design (and diversification) and quality control issues to be resolved, there is scope to transfer a proportion of the funds from component 2 so as to increase the number of small biogas plants.

viii. At present it is arguable that there is too much reliance on a 'one size fits all' approach to local biogas design capacity– when a range of models/capacities might be offered.

ix. Furthermore, It would seem there is scope for a more integrated approach to biogas design, credit and farm size – from a business development perspective. Based upon estimates/predictions of growth of livestock numbers, small biogas plant could be designed with capacities to more accurately reflect waste throughput. In the context of an overall HH/farm business plan, banks could additionally allow for credit going beyond bio-digesters and allowing for related farm infrastructure and purchase of animal stock.

Biogas Value Chain and Agricultural Waste Management

x. From a technological (and business) perspective, technologically scaling up to large biogas represents a major challenge compared to small (≤50 m3) rural household level units, serving mainly cooking purposes. Therefore, the success of scaling-up to large scale biogas crucially depends on technological diversification and innovation. The BVC and Biogas Technology specialist are therefore looking at a range of possible design (and commercial) solutions to address these issues.

6 REFERENCES

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APPENDIX A TOR OF CONSULTANTS

Table 23 Original TOR of Consultants

Position	Term of Reference (TOR)
i. Team Leader (Project Management/Agriculture Waste Specialist, international)	**Project Management:** (i) Make presentation at the Kick-off Workshop that the CCPMU will organize for PPMUs and relevant agencies and institutions involved in the project implementation. (ii) Establish the Consultants' Team office; establish Consulting Team (Human Resource) management procedures; in collaboration with the national ICT specialist, establish information sharing system and procedure for the Team (common drive) and an electronic and hard-copy filing system that is easily accessible. (iii) Provide guidance to the Team and assume responsible for its overall performance and achievement of the LCASP Outputs. (iv) Prepare the Inception Report and make a presentation at the Inception Meeting which will be organized by the CPMU. (v) Organize regular Team meetings to discuss progress and identify emerging issues that need to be taken up and discussed with the client. (vi) Advices and assist the M&E specialist with the development of the Project Performance Management System (PPMS) and with implementation of the PPMS. (vii) Advice and assist the CPMU with the development and update of the detailed implementation plan (DIP) for project implementation, in consultation with the PPMUs, financial intermediaries (FIs), provincial PPMUs and other key stakeholders; (viii) With inputs from individual consultants, prepare the work plan for the consultant Team using a readily available software (e.g. MS Project Management or other suitable off-the-self software package. The work plan will be regularly updated and be available on a common computer drive. (ix) Advise the CPMU and PPMUs in preparing their annual work plans and budgets. (x) Advise and assist the CPMU in preparing and submitting to ADB necessary project documents for approval or reporting such as consolidated withdrawal applications, and documentation for procurement of civil works, goods and services according to ADB requirements, as well as other documents. (xi) Advise and assist the CPMU with procurement of goods and services according to ADB procedures and guidelines. (xii) Advise and assist CPMU in preparing the inception report, quarterly reports, midterm review report, and the Project Completion Report in accordance with ADB requirements and standards. (xiii) Advise and assist technical consultants with the procedure for formulation of Pilots & Demonstrations (P&Ds) in close consultation with PPMUs and private, beneficiaries, and submit P&Ds to CPMU for onward submission to ADB approval on no-objection basis. (xiv) Advise with the preparation of consultants' technical working papers and progress reports, and presentations at workshops, etc... (xv) Advise and assist the CPMU with the organization of coordination meetings on regular intervals between CPMU, PPMUs, FIs TSU, MARD departments, VRM, consultants and other agencies and parties involved in implementation such as VBA. (xvi) Advise on the updating of the Project Administration/Implementation Manuals, and provide an input where required. (xvii) Assume other task that may be requested by the Project Director and that are reasonably within her/his duties and competence on Project Management. **Technical Support** (i) Advise on the design of a website for the LASCP, and assist with its implementation. (ii) Review the proposal of the ICT consultant for webpages, Project Management (e.g. MSProject), e-information exchange, and advise on the development of the common biogas database, in close consultation with CPMU, PPMUs, FIs, VBA, ICT consultant, and other relevant agencies to prepare for the development of a common national biogas database. (iii) Provide guidance on the technical design and investments that are proposed for Medium and Large Digesters (iv) Provide guidance on the technical design of Pilots & Demonstrations that are proposed by the technical consultants for implementation under PART 3.

Position	Term of Reference (TOR)
	(v) Review the business models and feasibility studies prepared by the technical consultants for Biogas Value Chains, and for CSAWMP. (vi) Identify and analyze financial and economic issues for the project, determining optimum solutions for the reduction of GHG. (vii) In close collaboration with the members of the Team, PPMUs, CPMU, and other relevant stakeholders, advise and assist on the development of the policy and institutional framework for implementation and monitoring of BVCM, CSAWMP, good agricultural practices, standards, certification, and inspection funded by the Project; (viii) prepare and update guidelines for BVCM, CSAWMP, and other supporting investments funded by the Project; (ix) assist in developing an effective accreditation and certification system, if required for BVCM, CSAWMP and other investments funded by the Project; (x) help prepare detailed technical specifications through consultation with the other team members, relevant institutes, financial intermediaries, partner agencies and other stakeholders; (xi) Advice and act as resource person for capacity building activities for staff of MARD, DARDs, financial intermediaries, coordinating and managing entity (CME), VBA and project staff. (xii) Advise and assist with the provision and/or arrangement for necessary training programs and study tours to be provided for by the Project; (xiii) Assist with and advice on other technical matters that are within the scope of her/his technical expertise and experience. **Key Qualifications** a) Relevant university degree in agriculture and/or management b) Prefer 10 years experience in project implementation management in a developing country, and management of a diverse team of consultants. c) Experience with the implementation of ODA funded projects, preferably ADB projects. d) Experience with agriculture waste management, formulation of business plans and feasibility studies related to agriculture waste management, e) Excellent communication skills in written and spoken English, reporting and interpersonal communication skills; f) Computer literate, and good ability to make presentations. g) Preferably significant familiarity with commercial agriculture in Viet Nam including with biogas or other agricultural waste management
ii. Deputy Team Leader/Biogas Value Chain (BVC) Development Specialist (national, 36 pm)	**The Deputy Team Leader/BVC Development Specialist will:** (i) Assist the international TL in the carrying out of his managerial duties and responsibilities for overall project management, including assistance related to procurement, disbursement and project monitoring, and assume the role of acting TL during periods of absence of the TL. (ii) Review and develop standards and codes of conduct for the promotion of BVC Management and CSAWMP. (iii) Develop policy and institutional framework for implementation and monitoring of BVC, CSAWMP, good waste management practices, standards, certification, etc. (iv) Work with the training consultant to identify the necessary training programs for PPMUs and FIs, and ensure implementation of the training programs. (v) Assist the CPMU with capacity building activities for staff of MARD, DARDs, FIs, CPMU and PPMUs, VBA, etc.. (vi) Promote and facilitate coordination between CPMU, MARD agencies and institutions, PPMUs and other consultants. (vii) Advise on the update and development of biogas digester design and guidelines for use by households, livestock farms, government institutions, financial institutions and other stakeholders, review and update the existing “best-practice” and “state-of-the-art” BVCM and CSAWMP in Viet Nam. (viii) Assess the viability of livestock farms and other enterprises with respect to new biogas investments and estimate the potential improvement of the existing biogas systems and potential promotion of small biogas plants (SBPs), medium biogas plants (MBPs) and large biogas plants (LBPs); assess how readily various potential technologies can be utilized for large-scale applications in the project areas;

Position	Term of Reference (TOR)
	(ix) Review, assess and update national and appropriate international experience with small, medium- and large-scale biogas plants design technologies, and the implications for local authorities (provinces, districts and communes) and other stakeholders (government institutions, financial institutions, NGOs, private, enterprises and households); (x) Carry out a review of basic documents on manure types and local climates and assess technology options available in Viet Nam, and provide recommendations regarding priority technologies, marketing, and management for bio-slurry based CSAWMP development, based on local conditions; (xi) Update the institutional, management structure, coordination, monitoring and evaluation mechanisms for a nationwide biogas program for both household and medium- to large-scale biogas including recommendation to empower relevant agencies; (xii) Review, strengthen and finalize feasibility studies for selected livestock farms for MBPs and LBPs to be assisted by the project, including for acquiring credit from FIs. (xiii) Appraise the biogas-related technical and design soundness of the representative sample livestock farms and other relevant enterprises and develop criteria to assess the technical feasibility for biogas plants proposed by potential investors. (xiv) Recommend technical inputs needed to improve existing biogas programs and provide inputs and assist the team leader and other team members in preparing the detailed proposals for proposed investments. (xv) Assist CPMU to supervise the provincial coordinators and report to CPMU director; (xvi) Assist the CPMU with the preparation of the Project Completion Report, drawing on estimates of project outputs, outcomes and impacts in accordance with ADB and Government of Viet Nam guidelines and requirements, and identify lessons learnt, and suggest directions and recommendations for follow up after project completion. (xvii) Undertake other task as requested by the TL or CPMU's Project Director that are within the reasonable duties and scope of her/his assignment. **Under the supervision of CPMU, the DTL will supervise the team of provincial coordinators, s/he will have additional duties as follow:** (i) work in close coordination with CPMU, the Consultant Team Leader, and the ICT specialist in consolidate information relating to the progress of biogas plants construction and its biogas value chain development; (ii) coordinate with financial intermediaries to consolidate information relating to biogas plants constructed over the 10 provinces that were funded using the Project's credit lines and update the consolidated progress of the ICMD distribution in the project areas; (iii) coordinate with PPMUs, service providers, and training agencies to facilitate the implementation of component 3 at commune levels; and (iv) lead the provincial coordinators to organize project activities at provincial to commune levels. For component 1, the DTL will: (i) Assist the Project Management Consultants in coordinating with PPMUs when formulating detailed investment activities from provincial to commune level for component one of the Project; (ii) Facilitate communication between the CPMU and PPMUs to ensure that the CPMU adequate provisions for incentive disbursements relating to the Project's financial assistance when a certification of compliance on the technical and environmental requirements of BVCM constructions has been secured; and (iii) Facilitate coordination with PPMUs as it relates to the gathering of specific information and data necessary for various carbon trading activities. For component 2, the DTL will: (i) Consolidate information relating to biogas plants constructed over the 10 provinces that were funded using the Project's credit lines. For component 3, the DTL will: (i) Lead the coordination effort, in close consultation with the CPMU, Project Management Consultants, and 10 PPMUs, in implementing component 3 investment activities up to the commune level; and

Position	Term of Reference (TOR)
	(ii) Coordinate with provincial coordinators in reporting implementation progress of component 3 investment activities for their respective provinces. **Key Qualifications** a) Master degree in agriculture, environment, and/or management or any other relevant education. b) Prefer over 5 years experience with Biogas Value Chain Management and formulating of business plans and feasibility studies for the investments proposed under the project. c) Experience with other agriculture waste management and business management. d) Prefer 10 years experience with project implementation, have participated at least 3-5 relevant ODA projects), in particular ADB projects, and supervision and management of consultants. e) Proven planning, management, reporting and interpersonal communication skills; f) Experience with the organization of quality and management systems. g) Good communication skills in written and spoken English; h) Computer literate, and good ability to make presentations
iii. International CSAWMP (LCA Crop Waste) Specialist (8 pm)	**Duties and Responsibilities** The Specialist will be working under overall supervision of the Team Leader and Director CPMU, and in close consultation with other consultants that are involved in the implementation of Part 3 of LCASP. The duties and responsibilities of this LCA Crop Waste Specialist include but are not limited to: i. In consultation with the Team Leader of the LCASP and other specialists, prepare an outline work plan that will differentiate between the (complimentary) work of National and International Crop Waste Specialist, and that will be regularly updated and expanded during the course of project implementation. ii. Under the overall guidance of the TL and in close collaboration with the PPMUs, National CWASMP Specialist, the Specialists for Livestock Waste/Biogas Energy, and other relevant persons and institutions, prepare a Research Strategy on CSAWMP for Crop Waste and Low Carbon Agriculture (LCA) taking into account the information and criteria provided in the component 1 of Part 3. iii. Participate as the resource person in a Workshop where proposals for potential pilot research and demonstrations (P&Ds) for the short and medium term on Crop Waste and LCA are presented and discussed, and based on comments received, revise the P&D strategy for implementation by the project. iv. Under guidance of the TL and in close collaboration with other members of the Team and the PPMUs, help to implement the research strategy that deals with Crop Waste and other LCA. v. Identification of suitable practices and technologies for crop waste management. This includes practices and technologies for rice straw and rice husk, sugar cane tops, waste from agriculture processing industry and aquaculture. Some examples for potential use are given in the text for Part 3. vi. With the involvement of the others specialist and institutions identify potential Pilots and Demonstrations on Crop Waste that will contribute to the purpose of the LCASP. vii. Identify institutions, farmers and industries (the "client-beneficiary") that are interested to participate in the specific Pilots & Demonstrations (P&Ds). viii. Prepare and submit to the TL the concept paper for each proposed Pilot or Demonstration activity following the format provided by the TL for the P&D prior approval process by ADB. ix. Advice on the hiring of additional CSAWMP technical specialists to address specific technical matters for CSAWMP that have been identified in the research strategy. For example, gasification of rice husk and generation of energy; converting rice straw and bagasse in animal feed; export of sugar cane tops as livestock feed; and similar and other practices and technologies that may have high potential for Low Carbon Agriculture (LCA). x. Advise and assist with the identification of relevant overseas and local study tour and training programs for CSAWMP.

Position	Term of Reference (TOR)
	xi. Advise and assist with the acquisition (preparing technical specifications; input in procurement documentation; identification of suppliers; evaluation of bids, etc.) of equipment that is required to implement the P&D. xii. Advise and assist with the installation of the equipment and related facilities, and commissioning of the same at the farmer of entrepreneur's premises. Assist with on the job training that will be provided to the client and his workers for the operation of equipment and facilities. xiii. Advise and assist with the testing and adaptation (making modifications) to the equipment during the pilot phase to optimize the technology given the local conditions. xiv. Identify the essential enabling environment for making the practice and technology an attractive proposition for farmers or agro industries (for example, feed-in-tariffs; tax holidays; exemption of import duties; carbon credits, etc.). xv. Identify scope for the local manufacture of the equipment or components in order to reduce investment cost, and identify a service provider (for installation, maintenance and repair). xvi. Propose modalities on how the technology can be promoted and widely accepted (rolling out phase). xvii. At all stages of the process described above, ensure that designated MARD and provincial DARD staff are involved in the implementation of above activities and organize technical meetings to exchange views. xviii. Participate in relevant workshops and training sessions as and when requested, including making presentations. xix. Under overall guidance of the LCASP Team Leader, provide concise technical (progress) reports on the work performed, findings, and recommendations on a regular basis (as specified by TL). **Key Qualifications** a) Relevant education from a technical institution or university in engineering (environmental, agricultural, civil, agro industrial engineering or mechanical engineering). b) Preferably the national and international LCA Crop Waste Specialists should complement each other in experience related to specific Low Carbon Agriculture Crop Waste Management technologies and practices. c) The international consultant must have comprehensive knowledge about the technologies that are successfully applied elsewhere and that have potential for commercial application in Viet Nam. d) Knowledge of procedures for procurement in ADB projects or similar organizations will be an additional advantage. e) Preferably 5 years experience with working in a commercial setting related to Crop Waste Management and related technology, f) Have experience in a developing country, preferably in Vietnam or southeast Asia. g) Has hands-on-experience with the design, installation, modification and commissioning of technology that is proposed within the scope of the project. h) Solid experience in dealing with private sector clients, i) Is output & impact oriented and can work with minimum supervision; j) Is willing to travel and work frequently in rural areas, and k) Has excellent communication skills in English language, and is computer literate.
iv. National CSAWMP (LCA Crop Waste) Specialist (36 pm)	**Duties and Responsibilities** This National Specialist Consultant will work under the technical supervision of the International Specialist Consultant. Both will work under the overall guidance of, and report directly to the Team Leader or Deputy Team Leader. The duties and responsibilities of the National and International Specialists consultants are largely similar but will be complementary in terms of specific waste management matters to be addressed. For example, the national consultant may concentrate on rice straw and rice husk, while the international consultant may focuses on agro processing waste. The duties and responsibilities of the national specialist include but are not limited to: i. Provide an input in the preparation by the International CSAWMP Specialist for the outline work plan that will differentiate between the (complimentary) work of National and

Position	Term of Reference (TOR)
	International LCA Crop Waste Specialist, and that will be regularly updated and expanded during the course of project implementation. ii. Contribute to the preparation of a Research Strategy on CSAWMP for Crop Waste and Low Carbon Agriculture (LCA) taking into account the information and criteria provided in the component 1 of Part 3. iii. Participate as the resource person in a Workshop where proposals for potential pilot research and demonstrations (P& Ds) for the short and medium term on Crop Waste and LCA are presented and discussed, and based on comments received, revise the strategy for implementation by the project. iv. Under guidance of the TL and International CSAWMP specialists and the PPMUs, help to implement the research strategy that deals with Crop Waste and other LCA. v. Identify suitable practices and technologies for crop waste management. This includes practices and technologies for rice straw and rice husk, sugar cane tops, waste from agriculture processing industry and aquaculture. Some examples for potential use are given in the text for Part 3. vi. With the involvement of the other specialist and institutions, identify potential Pilots and Demonstrations (P&Ds) on Crop Waste that will contribute to the purpose of the LCASP. vii. Identify institutions, farmers and industries (the "client-beneficiary") that are interested to participate in specific Pilots or Demonstrations. viii. In collaboration with the International Specialist, prepare and submit to the TL the concept paper for specific Pilot or Demonstration activity following the format provided by the TL for the P&D prior approval by ADB. ix. Advice on the hiring of additional technical specialists to address specific technical matters on CSAWMP that have been identified during formulation of the research strategy. For example, gasification of rice husk and generation of energy; converting rice straw and bagasse in animal feed; export of sugar cane tops as livestock feed; and similar practices and technologies that may have high potential for Low Carbon Agriculture (LCA). x. Assist with the acquisition (preparing technical specifications; input in procurement documentation; identification of suppliers; evaluation of bids, etc.) of equipment that is required to for specific P&Ds. xi. Assist with the installation of the equipment and related facilities, and commissioning of the same at the farmer of entrepreneur's premises. Provide on the job training to the client and his workers on the operation and maintenance of the equipment. xii. Undertake testing and adaption (making modifications) to the equipment during the pilot phase to optimize the technology. xiii. Identify the essential enabling environment for making the practice and technology an attractive proposition for farmers or agro industries (for example, feed-in-tariffs; tax holidays; exemption of import duties; carbon credits, etc.). xiv. Identify scope for the local manufacture of the equipment or components in order to reduce investment cost, and identify a service provider (for installation, maintenance and repair). xv. Propose modalities on how the technology can be promoted and widely accepted (rolling out phase). xvi. At all stages of the process described above, ensure that designated MARD and provincial DARD staff are involved in the implementation of above activities, and organize technical meetings to exchange views. xvii. Participate in relevant workshops and training sessions as and when requested, including making presentations. xviii. Under overall guidance of the LCASP Team Leader and the international Specialist, provide concise technical (progress) reports on the work performed, findings, and recommendations on a regular basis (as specified by TL). **Key Qualifications** a) Relevant education from a technical institution or university in engineering (environmental, agricultural, civil, agro industrial engineering or mechanical engineering). b) Preferably the national and international specialists should complement each other in experience related to specific Low Carbon Agriculture Crop Waste Management technologies and practices. c) Knowledge of procedures for procurement in ADB projects or similar organizations will be an additional advantage.

Position	Term of Reference (TOR)
	d) The national consultant will have at least about 5 years experience in low carbon agricultural production in the field of cropping and at least 3 years experience with working in a commercial setting related to Crop Waste Management and related technology. e) Preferably the consultant has hands-on-experience with the design, installation, modification and commissioning of technology that is proposed within the scope of the Part 3 for CSAWMP. f) He/she must have solid experience in dealing with private sector clients, is output & impact oriented, can work with minimum supervision, is willing to travel and work frequently in rural areas, g) Good communication skills in English language and computer literate
v. National Biogas Technology Specialist (36 pm)	The consultant will be working under supervision of the international Team Leader and work with technical consultants and provincial staff on implementation of biogas digester construction. He/she will be based in Hanoi, but will be required to travel frequently to the participating provinces. Specific tasks and duties include but are not limited to: (i) Work closely with provincial staff to identify and facilitate biogas digester planning, technology application and transfer, including advise on optimal design, materials and methods of construction for biogas plants in specific project areas; (ii) Evaluate and recommend optimal options for monitoring the quality of biogas technology related activities and biogas plant construction; (iii) Propose optimal solutions for linking biogas plant construction with associated biogas value chain related investments; (iv) Advise MARD and other institutions such as VBA, to develop policies and mechanism for biogas technologies and Biogas Value Chain Management (BVCM); (v) Collaborate with CPMU, PPMU and provincial extension agencies to assess training demand and training course content, and train technical staff, trainers/extension staff and masons for technologies, management and efficient utilization of biogas technologies; (vi) Estimate costs for technical items and others inputs for biogas technologies with differentiation to location. Collaborate and consult with Department of Livestock Production (DLP), DSTE to develop appropriate methodologies in order to assess impacts on social, economy and environment of biogas technologies applied in the project; (vii) Collaborate with M&E specialist to develop M&E indicators, evaluate and report for biogas technology activities in 10 project provinces; (viii) Propose methods to disseminate and replicate biogas technologies in Viet Nam. (ix) Undertake other tasks as requested by the Team leader and Project Director. **Key Qualifications:** a) Preferably a Bachelor degree in relevant engineering topic, biogas technology, environmental protection, or related fields. b) Preferably ten years of experience in biogas technology and agriculture project experiences. c) Participated at least 3 similar ODA projects. d) Knowledge of bio-slurry utilization and scum composting. e) Good command of spoken and written English; and f) Good skills on computer (Word, Excel, Internet Explorer and Power Point).
vi. National Extension/Training & Curriculum Development Specialist (36 pm)	The consultant will be working with relevant consultants and will report to the international team leader. He/she will be based in Ha Noi but be required to undertake frequent travel to the participating provinces. Duties include but are not necessary limited to: (i) Conducting a needs assessment on BVCM and other low carbon technologies in the project provinces; (ii) Review and evaluate the current training programs/curricula and models relevant to LCASP for transfer to farmers in the project provinces; (iii) Collaborate with relevant agencies to develop/improve the training program and curricula for training farmers on biogas value chains and other low carbon agriculture production; (iv) Work closely with relevant consultants to conduct training for staffs, researchers, farmers on climate smart agricultural waste management technology and practices; (v) Work closely with relevant consultants to develop and replicate business models and extension models in the provinces;

Position	Term of Reference (TOR)
	(vi) Assist PPMUs in implementation of pilot research and demonstrations (P&Ds) in the project provinces; (vii) Design, develop and implement an information dissemination program on project activities for provincial and national level; (viii) Undertake other tasks as requested by the Team leader and Project Director. **Key Qualifications:** (ix) Preferably a bachelors' degree in agriculture, extension and training, or related education relevant to the ToR. (x) Ten years of working experience in agricultural extension, training and curriculum development. Good understanding of issues related to CSAWMP and BVCM. (xi) Participated at least in three similar ODA projects. (xii) Good command of spoken and written English; and (xiii) Good computer skills.
vii. International Monitoring and Evaluation Specialist (2 pm)	The consultant will be reporting to the TL and Director CPMU, and will basically have an supervisory and advisory role to the national Monitoring and Evaluation Specialist, who will carry out the actual monitoring and evaluation program. He/she will be based in Hanoi with travel to the project area, and also work at home office given the nature of the input. Specific tasks include but are not limited to: (i) Advise and assist the national Monitoring in Evaluation Specialist with the design and implementation of the M&E program for the project, to ensure high quality of outputs, and compliance with Government and ADB requirements. (ii) Advise and assist with the formulation of the TOR for baseline surveys and review and comment on the scope and methodology of the survey, survey questions and the collection of baseline data; (iii) Advise the CPMU in establishing an appropriate project performance management system (PPMS) at all levels; (iv) Review the design of the PPMS to ensure that the Project Performance Monitoring System (PPMS) will be generating adequate biogas data; (v) Advise on the design and development of a simple computer based monitoring system for collecting M&E data from CPMU, PPMUs and relevant agencies; (vi) Review and advise on the formats of quarterly, semi-annual and annual reports at all project implementation levels; and (vii) Provide other advice and assistance tasks as requested by the Team leader and Project Director. **Key Qualifications:** (viii) Preferably a Master degree in agricultural economics, social science, M&E or other relevant field of education. (ix) Ten 10 year experience in monitoring and evaluation, preferably with ADB or WB projects and including having experience in Viet Nam; (x) Good knowledge in statistics, development of M&E systems, surveys; computer software for processing surveys, PPMS for ODA projects, and other experience of relevant to the assignment; (xi) Good communication, reporting and intercultural skills for communication with different stakeholders; (xii) Proficiency in verbal and written English; (xiii) Advanced computer and presentation skills.
viii. National Monitoring and Evaluation Specialist (8 pm)	The consultant will be working under the guidance and quality control of the international Monitoring and Evaluation (M&E) Specialist, CPMU and in close collaboration with PPMUs. The consultant will be based in Hanoi office but will require frequent travel to the participating provinces for survey work and M&E. Specific tasks include but are not limited to: (i) Under the supervision and guidance of the international M&E Specialist, develop a TOR for baseline surveys and develop appropriate scope and methodology, survey questions, and arrange for collection of baseline data;

Position	Term of Reference (TOR)
	(ii) In case selection of baseline data is to be subcontracted, advise the CPMU on the selection and engagement of a suitable national institution, NGO, or company, and prepare details on scope of work and ToR for the survey. (iii) Assisting CPMU in establishing an appropriate project performance management system (PPMS) at all levels; (iv) Work closely with the database development consultant and PPMUs to ensure that the PPMS will be generating adequate and reliable data that meets the requirements of the CPPMU and the ADB; (v) Develop a simple computer based monitoring system for collecting M&E data from CPMU, PPMUs and relevant agencies; (vi) Assist the CPMU in developing formats of quarterly, semi-annual and annual reports at all project implementation levels, that meet the requirements of the ADB; (vii) Work closely with the TL and DTL to collect financial and economic data that is required to analyze the impact of the project's activities; (viii) Work closely with other consultants to obtain all relevant data required for M&E reports, in particular data and information of the impact of the project on environment, gender, ethnic minorities, and (ix) Undertake other tasks as requested by the Team leader and Project Director. **Key Qualifications:** (x) Preferably a Bachelor Degree in agricultural economics, social science, M&E or other relevant field of education; (xi) 5 years of experience in M&E work in the agriculture and rural development sector; (xii) Worked at least in five ODA projects as M&E specialist, preferably with ADB; (xiii) Knowledge of biogas development, agricultural waste management or climate change in agriculture is an advantage; (xiv) Good command of spoken and written English; and good skills on computer (Word, Excel, Internet Explorer and Power Point), and ability to make lucid workshop presentations.
ix. National Social, Gender and Ethnic Minority Specialist (6 pm)	The consultant will be working under the Direction of the Director CPMU and supervision of the Team Leader, and have close consultations with other consultants, CPMU and PPMUs. He/she will be based in Hanoi but will require frequent travel to the participating provinces. The duties and responsibilities of the consultant include, but are not necessary limited to the following: (i) Review of ADB's and Government's policies on gender equality and vulnerable groups in development and support the CPMU gender focal point to update Gender Action Plan (GAP), and Ethnic Minority Development Plan (EMDP); (ii) Review of social reports on ethnic minorities and gender and community consultation in conformity with related regulations at national and specific in local regulations in the 10 participating provinces; (iii) Assist and advise the CPMU and PPMUs on the implementation of the Gender Action Plan, Ethnic Minority Development Plan (EMDP)/Indigenous People Plan (IPP) to promote gender equality and ensure that women and ethnic minority participate and benefit equally from the project; (iv) Conduct community consultation in the Project area, to obtain feed back for making recommendations; (v) Conduct awareness raising for CPMU, PPMUs and provincial coordinators to ensure that social safeguard and gender equality policies are appropriately addressed; (vi) Advise CPMU to conduct social impact assessment and on any other preparatory surveys, feasibility studies or assessments. (vii) Work closely with M&E specialists and provincial coordinators to ensure that baseline sex-disaggregated data and ethnic minority data is adequately included in the PPMS, and implementation is reported in progress reports from PPMUs and consolidated progress report from CPMU to ADB; (viii) Work closely with other relevant consultants to ensure that adequate gender and ethnic minority concerns and participation are considered in the design of demonstration activities;

Position	Term of Reference (TOR)
	(ix) Assist the international team leader and CPMU in developing TOR for end-line survey and any other evaluation assessment; (x) Produce reports that cover the ToR of his/her assignment, in particular on the social, gender, and minority aspects of the project; and (xi) Undertake other tasks as requested by the Team leader and Project Director. **Key Qualifications:** (xii) Bachelor degree or higher in appropriate specialties on social science or related education. (xiii) 10 years of experience in issues related to ethnic minorities, gender and vulnerable groups in either international or national development programs or other related field. (xiv) Familiar with Vietnamese Law and regulations related to gender and ethnic minority development. (xv) Experience with working for donors' funded development projects as well as familiar with relevant ADB's policies is an advantage. (xvi) Good command of spoken and written English; and (xvii) Good skills on computer (Word, Excel, Internet Explorer, statistical software, and Power Point).
x. National Environment Safeguard Specialist (12 pm)	The Environment Safeguard Specialist will report directly to the Project Director. The specific duties of this specialist are (but not necessary limited to): (i) Advise and assist CPMU and PPMUs in ensuring the project's compliance with environmental safeguards of the Government and the ADB of the Project (ii) Review all relevant project documentation including, Loan Agreement, Design and Monitoring Framework of LCASP, Monitoring and Evaluation Framework on Environment; Environmental Assessment Review Framework (EARF), Initial Environmental Examination (IEE), Project Administration Manual (PAM) and other related documents, ADB policies, and Government laws related to environmental management, supervision and protection as far as relevant to the project; (iii) Screen proposed MBPs and LBPs and other waste management technology implemented by the LCASP on environmental impact, according to ADB environmental safeguard standards and according to those of the Government, based on the completed screening checklists; in particular prepare a screening checklist based on the relevant ADB Rapid Environmental Assessment Checklists and the environment categorization form for all proposed MBPs and LBPs as part of the Project; (iv) Assist CPMU and PPMUs in submitting the required documentation to report to ADB the outcome of the screening and categorization process; (v) In the case of category C biogas plants, notify ADB of the screening findings and the categorization of the subprojects; (vi) Identify and report to CPMU to exclude proposed biogas plants which may have major adverse environmental impact and would be classified as "A Category" for environment under the ADB guidelines; (vii) Upon ADB's confirmation on the categorization of the biogas plants, prepare IEE, in both Vietnamese and English, for all medium and large biogas plants, proposed as part of the Project, which are classified as B category. This will include preparing an Environment Management Plan (EMP) with support from PPMUs in accordance with ADB Guidelines to assure these documents to be endorsed in conformity with ADB's standards. The EMP shall highlight proposed mitigated measures and recommend required monitoring and supervision; (viii) Assist CPMU and PPMUs in organizing meaningful stakeholder consultations on all proposed medium and large biogas plants as required by ADB Safeguard Policy Statement 2009; (ix) Consult with the Consultants for Livestock Waste Management on recommendations for technologies that make full use of the biogas and bio-slurry produced by biogas plants; (x) Provide training and organize workshops as necessary on safeguard policies and environmental monitoring of biogas plants, according to the EMP, to CPMU and PPMU environmental specialists; (xi) Assist CPMU and PPMUs in the environmental monitoring of biogas plants as required. Monitoring of all medium and large biogas plants is prioritized although sample environmental monitoring of small biogas plants may also be required. (xii) In consultation with other technical specialist on the Team, prepare cost estimates for the environmental measures to mitigate any adverse impact;

Position	Term of Reference (TOR)
	(xiii) Ensure disclosure of project information on environment for affected persons and other stakeholders according to ADB Safeguard Policy Statement 2009; and (xiv) Assist CPMU and PPMU to prepare regular environmental monitoring reports to ADB according to the PAM. (xv) As instructed in the PAM, produce the Environmental Reports for Sub-projects that are proposed for implementation under the LCASP; (xvi) Undertake any other duties relevant to the ToR, that may be requested by the CPMU Director. **Key Qualifications:** a) Bachelor degree or higher qualifications on environmental management or related study; b) Experience in safeguard policies, environmental assessments, and the preparation of environment reports, environment supervision in the ODA funded projects, including projects funded by ADB; c) Thorough understanding of Vietnamese Law and relevant regulations on environmental protection and other provisions, and related ADB guidelines. d) At least 10 years of working experience including 5 years working on environment, and preferably with work experience in biogas technology and/or on other agriculture waste management; e) Good command of oral and written English; f) Good computer skills (Words, Excel, Internet Explorer and Power Point).
xi. National Geographic Information Systems (GIS) Specialist (6 pm)	The consultant will be working under supervision of the international Team Leader and Director CPMU and work closely with relevant MARD and other institutions that have GIS systems already developed and that may be expanded to include additional information relevant to LCASP, differentiated to the 7 agro-ecological zones of Viet Nam. He/she will be based in Hanoi, but will be required to travel to the participating provinces. Specific tasks and duties include but are not limited to: i. Work closely with MARD and other Ministries to review existing GIS facilities, identify gaps related to information relevant to the LCASP and how this information may be included into existing GIS facilities, with a differentiation to the 7 agro-ecological zones of Viet Nam. ii. In consultation with relevant Ministries, institutions and other members of the team, draw up a list of information that should be available from GIS and related to the purpose of the LCASP. Particular attention should also be given to include the information of a common data base on biogas installations. iii. Identify the parameters that need to be collected to be included in the GIS for each map overlay for each agro-ecological zone, and the procedures for updating the information. iv. Draw up the design parameters for the GIS and hardware and software needed for the GIS. v. Organize a workshop where the proposed design of the GIS is discussed and incorporate comments in final design parameters for the GIS. vi. Draft the detailed ToR and technical criteria for subcontracting the construction of the proposed GIS to a local contractor. vii. Advise and assist CPMU with the engagement of the GIS contractor. viii. Draft the data collection requirement that is needed for inputting into the GIS, and make a proposal for the collection of this data. ix. Supervise the data collection on consistency and quality. x. Supervise the progress with the GIS construction and installation, and testing. xi. After completion of the construction phase of the GIS, provide training on the use and maintenance of the GIS. xii. Undertake other tasks as requested by the Team leader and Project Director. **Key Qualifications:** a) At least Bachelor degree in relevant subject such as Geography, ICT, Database Management, or any other relevant education. b) Five years experience with GIS development. c) Participated at least 3 similar ODA projects. d) Good command of spoken and written English; and e) Good skills on computer (Word, Excel, Internet Explorer, Power Point, etc.).

Position	Term of Reference (TOR)
xii. National Information and Communication Technology (ICT) Specialist (12 pm)	The consultant will be working under supervision of the international Team Leader and Director CPMU and work closely with relevant MARD, other institutions and PPMUs. The Specialist will be responsible for the development of all web sites/pages that are proposed by CPMU, Develop a project Management Information System, using off-the-shelf software, e-information exchange (e-libraries), e-database on biogas installations, and any other ICT requirement. He/she will be based in Hanoi, with limited travel to the participating provinces. Specific tasks and duties include but are not limited to: i. Work closely with MARD and other Ministries to review existing ICT facilities that are relevant to LCASP; identify gaps related to access of information relevant to the LCASP and how this information could become widely accessible through internet. ii. Submit a detailed work plan for the various tasks to be undertaken by the ICT specialist during the course of her/his assignment. iii. In consultation with CPMU, specify design criteria for a Website (Vietnamese and English language version) on LCASP and assist CPMU to draw up a contract for a web site development studio. Supervise the implementation of this LCASP website. iv. Advise and assist VBA with the improvement of its web site. v. Make an assessment of existing web sites of MARD and MONRE institutions that are relevant for LCASP. In particular review the content of the website, and to what extend information (organizational structures; list of staff with contact information; research programs; technical reports; budgets; etc..) is up-to-date posted on the website, in an easily accessible manner, and how it can constitute an e-library. vi. Identify the need for additional hardware and software that some institutions may require to make all relevant reports and other information available from their e-library. vii. Prepare proposals on policies and protocols for publishing information on the websites of relevant institutions involved in LCA. viii. In close collaboration with the CPMU and TL, develop a management system for the project, using MS Project Manager software. ix. Advice and assist with the expansion of the computerized common data base on biogas installations, make it accessible from internet, and specify required hardware and software. x. In close consultation with the GIS Specialist, develop a system whereby the GIS facility for LCASP can be accessed from internet. xi. Whenever required, organize a workshop where the ICT specialist will submit his/her proposals, and include the comments from the workshop into the final designs. xii. Draft the detailed ToR and technical criteria for subcontracting the improvement or new websites (with e-library attached to it) to a local contractor. xiii. Advise and assist CPMU with the engagement of the website contractor. xiv. Maintain and upgrade whenever required all computer hard and software of the CPMU, in particular ensure protection against viruses and unauthorized use. xv. Undertake other tasks as requested by the Team leader and Project Director. **Key Qualifications:** a) At least Bachelor degree in Computer Science, ICT, Database Management, or any other relevant education. b) Five years experience with ICT development. c) Participated at least 3 similar ODA projects. d) Good command of spoken and written English; and e) Excellent computer hardware and software skills (Familiar with Ms Project; Word, Excel, Internet Explorer, Power Point, etc.).
xiii. International Policy & Institutional Specialist on CSAWMP (4 pm)	The Specialist will be working under supervision of the international Team Leader and Director CPMU and work closely with relevant MARD, other institutions and PPMUs. The Specialist will be responsible for development of a proposal for an enabling environment to attract private investment in waste management technologies and other LCA. He/she will be based in Hanoi, with travel to the participating provinces. Specific tasks and duties include but are not limited to: i. Work closely with MARD, other Ministries, institutions and members of the team to review existing policies that are relevant to the LCASP and identify gaps related to the policy and institutional frame work that impinge on private investment for LCA.

Position	Term of Reference (TOR)
	ii. In particular review present incentives that are available to investors in LCA (Feed-in-Tariff rates; carbon credits, tax breaks, and other incentives) that are available and assess how they compare to other countries. iii. In close collaboration with the consultant for National Appropriate Mitigation Action (NAMA) identify policies and institutions that play a role in the effective implementation of NAMA and Monitoring, Reporting and Verification System (MRV). iv. Organize a workshop where proposals for policy and institutional support for LCASP will be discussed, and contribute as a resource speaker. v. Based on the comments received at the Workshop, finalize the proposal for policy and institutional support for LCA, including details for an advocacy program. vi. Undertake other related tasks to the ToR as requested by the Team leader and Project Director. **Key Qualifications:** a) Preferably Master degree in Development Economics or any other relevant education. b) 10 years experience with policy formulation and institutional organization. c) Participated at least in 3 similar ODA projects. d) Good command of spoken and written English; e) Excellent presentation skills, and f) Computer literate (Power Point; Ms Word, etc.).
xiv. National Policy and Institutional Specialist on CSAWMP (6 pm)	The National Specialist will be working under the guidance of the International counterpart and under supervision of the international Team Leader and Director CPMU. S/he will work closely with relevant MARD, other institutions and PPMUs. The National Specialist will be instrumental for collecting the data and information that is needed for the assignment and for development of a proposal for an enabling environment to attract private investment in waste management technologies and other LCA. He/she will be based in Hanoi, with travel to the participating provinces. Specific tasks and duties include but are not limited to: i. Work closely with the international specialist, MARD, other Ministries, institutions and members of the team to obtain information on existing policies that are relevant to the LCASP and identify gaps related to the policy and institutional frame work that impinge on private investment on LCA. ii. In particular obtain all information on existing incentives that are available to investors in LCA (Feed-in-Tariff rates; carbon credits, tax breaks, and other incentives) that are available. iii. In close collaboration with the national consultant for National Appropriate Mitigation Action (NAMA) identify policies and institutions that play a role in the effective implementation of NAMA and Monitoring, Reporting and Verification System (MRV). iv. Assist in the organization of a workshop where proposals for policy and institutional support for LCASP will be discussed and contribute as a resource speaker. v. Based on the comments received at the Workshop, finalize the proposal for policy and institutional support for LCA, including details for an advocacy program. Translate the proposal into Vietnamese language. vi. Undertake other related tasks to the ToR as requested by the Team leader and Project Director. **Key Qualifications:** a) Preferably Master degree in Development Economics or any other relevant education. b) 8 years experience with policy formulation and institutional organization. c) Participated at least in 3 similar ODA projects. d) Good command of spoken and written English; e) Excellent presentation skills, and f) Computer literate (Power Point; MS Word, etc.).
xv. Provincial technical coordinators (10 nationals, 180 pm – One person, 18 pm for each province)	The facilitators will assist their PPMU to implement project activities such as: (i) work in close coordination with PPMU, the National Coordinator, and the ICT specialist in consolidate information relating to the progress of biogas plants construction and its biogas value chain development; (ii) coordinate with the local branches of financial intermediaries in consolidating information relating to the constructed biogas plants funded using the Project's credit lines and update the consolidated progress of the ICMD distribution in the project areas; (iii) coordinate with PPMUs, service providers, and training agencies to facilitate the implementation of component 3 at commune levels; and

Position	Term of Reference (TOR)
	(iv) lead the provincial and commune personnel in organizing project activities at provincial to commune levels. For component 1, the Provincial Coordinator will: (i) Work closely with qualified technicians, contractors and masons in conducting surveys, which includes gathering information related to baseline/database development for biogas value chain management (BVCM), CSAWMP and other project investments to ensure that the PPMS is well prepared, monitored and reported (for quarterly, yearly, midterm, and completion report); and (ii) Work closely with PPMU staff to ensure that district representatives are able to properly monitor the progress of data gathering in support of the Project's various carbon market initiatives. For component 2, the Provincial Coordinator will: (i) Ensure the regular disclosure of the list of qualified masons for small biogas plants (SBPs); and qualified contractors for medium biogas plants (MBPs) and large biogas plants (LBPs) maintained by the PPMUs to participating financial intermediaries and potential biogas owners; and (ii) Facilitate meetings between potential biogas owners, financial intermediaries, qualified masons and contractors to be more proactive in establishing biogas value chain facilities; and ensure that the technicians and engineers properly insert the incremental BVCM facilities to update the database. For component 3, the Provincial Coordinator will: (i) Coordinate activities of the Project Management Consultants with the PPMU as it relates to the formulation and development of detailed investment activities for climate smart agriculture waste management practices; (ii) Assist PPMUs in organizing consultation workshops with biogas owners and relevant associations/cooperatives on exploring use and trade opportunities for treated bio slurry in fresh water fishery development, tree crops, and other crops; and (iii) Assist PPMUs in organizing consultation workshops with biogas owners and relevant associations/cooperatives on targeted technologies for storage and utilization of surplus biogas produced by digesters. **Key Qualifications:** a) a master degree in agriculture, economic, management or other relevant fields; b) priority for experience in providing the similar services on CSAWMP and BVCM based investments for loan and/or grant project funded by ADB, WB, AFD, JBIC, KFW and/or other donor funded projects; c) 5 years of working experience including 3 years working for the donors' funded development projects; d) thorough understanding of Vietnamese Law and regulations related to CSAWMP and BVCM as well as ADB's policies is an advantage; e) good command of oral and written English; and f) good computer skills (Word, Excel, Internet Explorer and Power Point). g) These consultants will be based in the Project's provinces and be able to frequently travel to the sites as required.

APPENDIX B DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines[a]	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact Less agriculture-related pollution	By 2024 (from baselines in 2013) in selected participating communities: (i) Livestock waste effluents in water resources is reduced by at least 50%. (ii) GHG emissions are reduced by about 0.2 tons of CO_2 equivalent annually per cubic meter capacity of biogas plants.	MARD data MONRE data National statistics	**Risk** Limited sustainable long-term financing for waste management infrastructure.
Outcome Greater uptake of CSAWMP	By 2018 (from baselines in 2013) in the project areas: (i) At least 70% bio-slurry is converted to organic fertilizers. (ii) At least 80% energy produced by BVCs is utilized.[b] (iii) Daily workload of women and children is reduced by 1.8–2 hours, on average.[c]	PPMS Biogas users' survey	**Assumption** The government does not subsidize inorganic fertilizers.
Outputs 1. Expanded use of livestock waste management infrastructure	From baselines in 2013: (i) 36,000 SBPs, 40 MBPs, and 10 LBPs and associated value chain infrastructure constructed and operating by 2018. At least 5% of total SBPs will be constructed for ethnic minorities in 3 selected provinces. (ii) 36,000 SBP operators, 500 masons, 160 technicians, 10 engineers and 10 contractors trained and registered in biogas associations by 2018. At least 50% of trainees on biogas use will be women; 20% of trainees on SBP construction, and 20% of those trained on biogas management and technical issues will be women. (iii) Biogas plant database managed effectively by 2014, including registration in both husband's and wife's names.	PPMS	**Assumption** Livestock waste generation is stable and accessible. **Risk** Catastrophic climatic events exceed waste management infrastructure design thresholds. Catastrophic animal disease outbreak adversely affects viability of livestock waste management infrastructure.
2. Credit lines for biogas value chains	(i) 50% of credit lines will be under joint accounts and/or on behalf of women by 2018. (ii) BVC infrastructure financing products are mainstreamed in two financial intermediaries by 2018.	PPMS	**Assumption** Close coordination between financial intermediaries, CPMU and PPMUs in managing the subprojects.

Design Summary	Performance Targets and Indicators with Baselines[a]	Data Sources and Reporting Mechanisms	Assumptions and Risks
	(iii) ICMD funds are fully channeled into 36,050 accounts of beneficiaries by 2017.		
3. Enhanced CSAWMP technology transfer	(i) Well-established CSAWMP packages are disseminated in 10 participating provinces by 2016.[d]	PPMS	**Assumption** The government supports research strategy and plans for climate-smart agriculture practices. **Risk** Low enforcement of existing policy hampers CSAWMP effectiveness.
	(ii) One long-term, community-based CSAWMP technology transfer and research strategy is elaborated by 2014, and includes communication, dissemination, and mainstreaming plans.		
	(iii) Critical CSAWMP knowledge gaps are identified and at least 21 research, dissemination, and mainstreaming packages carried out according to a priority list, by 2018. 30% of research projects will include gender issues by 2016.		
4. Effective project Management	(i) A CPMU and 10 PPMUs established and operational with adequately skilled staff and facilities in MARD by first quarter of 2013. At least 30% of staff are women and a gender focal point will be appointed by 2014.	PPMS	**Assumption** The government will equip the project with skilled central and provincial personnel.
	(ii) PPMS with sex-disaggregated and ethnicity data collected and reported operating effectively in 10 provinces by 2015.		
	(iii) Carbon market coordinator and 36,000 biogas owners are organized through associations by 2014.		

Activities with Milestones	Inputs
1. Expanded use of livestock waste management infrastructure	**ADB: $74.0 million** Credit lines for BVC management construction ($35.70 million) ICMD ($8.31 million) BVC management and CSAWMP civil works ($5.30 million) Equipment ($1.00 million) Vehicles ($0.40 million) Training and workshops ($3.00 million) Consulting services ($2.94 million) Research and development ($6.18 million) Organizing CSAWMP transfer ($3.43 million) Incremental operating costs ($2.32 million) Contingencies/unallocated ($3.01 million) Interest during implementation ($2.41
1.1 Train and certify technicians, contractors and masons through relevant agencies for construction of BVC management facilities by 2013.	
1.2 Standardize and disseminate design package for BVC management by 2013[e].	
1.3 Develop training modules for CSAWMP stakeholders by 2014.	
1.4 Register program of activities for SBPs by 2013 and for MBP and LBPs by 2014 for the relevant carbon market requirements.	
1.5 Monitor use of biogas plants with adequate environmental facilities by 2018.	

Activities with Milestones	Inputs
1.6 Strengthen relevant agencies to hand over the monitoring ofthe constructed biogas plants by 2018.	million) Government: $3.7 million Training, workshops ($0.40 million) Research and development ($1.11 million) Organizing CSAWMP technology transfer ($1.00 million) Incremental operating costs ($0.10 million) Staff salaries and allowances ($1.09 million) Financial intermediaries: $6.3 million Credit lines for BVC management infrastructure construction ($6.3 million)
1.7 Monitor annual attributable CO2 reduction and issuance of carbon revenue from the certified emission reduction by 2018.	
1.8 Provide capacity building to relevant agencies to continuously manage biogas development by 2018.	
2. Credit lines for biogas value chains	
2.1 Encourage the selected two financial intermediaries to provide credit lines by 2018.	
2.2 Encourage other financial intermediaries to finance BVC management infrastructure by 2016.	
2.3 Coordinate training program between CPMUs, PPMUs and financial intermediaries by 2017.	
2.4 Monitor the disbursement of incentive for carbon market development through financial intermediaries by 2018.	
3. Enhanced CSAWMP technology transfer	
3.1 Organize farmer-based research including using biochar and other agricultural wastes as organic fertilizers; applying other efficient low greenhouse gas emission agricultural practices which generate bio- energy; managing waste treatments in aquaculture and otherCSAWMP by 2018.	
3.2 Establish an information system, e-library, journals, and database for sharing CSAWMP research and training by 2018.	
3.3 Train staff in efficient, CSAWMP, including organizing overseasstudy tours by 2018.	
3.4 Develop training programs, textbooks, and syllabus for training farmers on appropriate techniques for CSAWMP; provide vocational training for farmers by 2015.	
3.5 Upgrade CSAWMP-based map sets for 7 agro-ecological regions to forecast the direct impact of climate change (sea level rise, salt sea intrusion, flood, drought) and provide support for agricultural planning by 2014.	
3.6 Develop livestock waste management models for agricultural production and greenhouse gas emission.	
3.7 Train extension staff and farmers in low carbon agricultural production technologies to promote application of the technologies inagricultural production by 2018.	
4. Effective project management	
4.1 Establish CPMU and PPMUs to be operational by 2013.	
4.2 Engage consultants for start-up and auditing, and to develop the PPMS, with sex- and ethnicity-disaggregated data and including genderaction plan monitoring by 2013.	
4.3 Explore all potential carbon markets by 2014.	
4.4 Undertake baseline surveys in all project provinces with collectionand analysis of sex- and ethnicity-disaggregated data by2014.	

Activities with Milestones	Inputs
4.5 Conduct a gender awareness raising workshop for PMUs by 2016.	
4.6 Organize biogas owners and CSAWMP participants through relevant agencies.	
4.7 Prepare progress reports and submit to ADB on a regular basis by 2018.	

ADB = Asian Development Bank, BVC = biogas value chain, CO2 = carbon dioxide, CPMU = central project management unit, CSAWMP = climate-smart agricultural waste management practices, GHG = greenhouse gas, ICMD = incentive for carbon market development, LBP = large biogas plant, MARD = Ministry of Agriculture and Rural Development, MBP = medium-sized biogas plant, MONRE = Ministry of Natural Resources and Environment, PPMS = project performance management system, PPMU = provincial project management unit, SBP = small biogas plant.

[a] The baseline for performance indicators will be established during project inception phase soon after loan effectiveness in 2013.

[b] Annual energy substitution from gas stove of each SBP (for a 10 square meter [m^3] size) is estimated to average 40.5 kilograms (kg) of liquid petroleum gas; 9,734 kg of coal, or 1,175 kg of wood. The biogas is estimated to be converted to electricity at an annual rate of 1.4 to 1.7 kilowatt-hours per m^3 of biogas depending on the efficiency of the generators.

[c] Workload includes collecting firewood, cooking, and taking care of livestock.

[d] At least 50% of participants for dissemination packages are women by involving community-based women's associations and other community groups.

[e] Including viable technical and financial biogas plant models; to communes, private sector, financial intermediary frontline staff, private sector banks, and other development partners active in the subsector.

Source: Asian Development Bank and Government of Viet Nam estimates.

APPENDIX C LIST OF PERSONS MET

S/N	Person Met	Sex	Position	Organization	Contacts	
					Phone no.	Email
	ADB					
1	Sanath Ranawana	M	Snr NR Economist	ADB Hanoi	3933 1374	
2	Oscar Badiola	M	Project Analyst	ADB Hanoi	3933 1374	
3	Ho Le Phong	M	Assoc Project Analyst	ADB Hanoi	3933 1374	
4	Truong Thi Minh Hue	F	Assoc Project Analyst	ADB Hanoi	3933 1374	
	CPMU					
5	Nguyen The Hinh	M	Director	CPMU	37286122	
6	Hoang Thai Ninh	M	Vice Director	CPMU	37286122	
7	Nguyen Tien Dung	M	Vice Director	CPMU	37286122	
8	Nguyen Van Chung	M	Chief technology	CPMU	37286122	
9	Nguyen Thi Minh Huong	F	Training	CPMU	37286122	
	MARD					
10	Le Quoc Doanh	M	Vice Minister			
11	Nguyen T. Thanh Thuy	F	DG	DOSTE	37286122	
12	Tran Kim Long	M	DG	ICD		
13	Chu Van Chuong	M	DDG	ICD		
14	Dinh Vu Thanh	M	DDG	DOSTE		
15	Tong Xuan Chinh	M	DDG	LPD		
16	Dinh Cong Chinh	M	Deputy Head	Crop Production Dept		
17	Nguyen Thi Lien Huong	F	Deputy Head	Agr. Extension Center		
18	Bach Van Hanh	M	Expert	Fishery Administration		
19	VAAS					
20	Trinh Khac Quang	M	Acting President			
21	Tran Danh Suu	M	Director	Infor Dept./VAAS		
22	Nguyen Hoang Long	M	Deputy Director	Information Dept		
23	Bui Quang Dang	M	Director	S-T Dept./VAAS		
	PPMU Bac Giang					
24	Vu Dinh Phuong	M	Director of DARD	PPMU		
25	Dao Xuan Vinh	M	Vice – director	PPMU		
26	Vu Xuan Khiem	M	Technician	PPMU		
27	Do Van Tuan	M	Technician	PPMU		
28	Ha Van Khiem	M	Technician	PPMU		
29	Duong The Khoa	M	Technician	PPMU		
30	Do Ha Giang	F	Technician	District		
	Ha Van Du	M	Technical Staff	PPMU		
	Ha Van Thiem	M	Planning Staff	PPMU		
	Nguyen Thu Huyen		Office Staff	PPMU		

S/N	Person Met	Sex	Position	Organization	Contacts	
					Phone no.	**Email**
	Luu Thi Phuong Dung		Technical Staff	PPMU		
	Research Center for fertilize and soil in central area – Dong Phong, Hiep Hoa District, Bac Giang					
31	Dam The Chien	M	Director			
32	Tran Thi Thu Trang	F	Vice Director			
33	Ngo Xuan Hien	M	Vice Director			
34	Hoang Tuan Cay	M	Farm Owner	Pig Farm		Thai Son, Hiep Hoa, BG
35	Nguyen Van Dien	M	Director	Fertilizer company		Hiep Hoa, Bac Giang
	PPMU Nam Dinh					
36	Hoang Thi To Nga	F	Vice Director of DARD	PPMU		
37	Nguyen Trong Tan	M	Head of Division	PPMU		
38	Le Thi Thao	F	Deputy Head of Division	PPMU		
39	Mai Dang Nhan	M	Technician	PPMU		
40	Tran Thi Hue	F	Technician	PPMU		
41	Luong Thanh Tung	M	Technician	PPMU		
42	Trieu Ngoc Son	M	Chairman	Livestock Cooperative		Hien Khanh, Vu Ban, Nam Dinh
43	Tran Quang Hung	M	Vice Chairman	Livestock Cooperative		Hien Khanh, Vu Ban, Nam Dinh
44	Tran Quang Thuyet	M	Vice Chairman	CPC		Hien Khanh, Vu Ban, Nam Dinh
45	Nguyen Van Toan	M	Farm Owner	Pig Farm		
46	Nguyen Thanh Nhan	F	Vice Director	Bien Dong Co.		Hai Nam, Hai Hau, ND
	PPMU Ha Tinh					
47	Nguyen Xuan Hoan	M	Vice Director	PPMU	0944667999	xuanhoansnn@gmail.com
48	Le Van Khanh	M	Planning Division	PPMU	0918477011	Danhkhanh.xda@yahoo.com.vn
49	Dinh Ngoc Duc	M	Technician	PPMU	0911095586	Dinhngocduc50dhv@gmail.com
50	Le Van Danh	M	Director	Center for Technical transfer in Cam Xuyen	0982517833	Ledanhkhcn@yahoo.com
51	Ha Huy Khoi	M	Technician	Center for Technical transfer in Cam Xuyen	01664184679	huykhoicx@gmail.com
52	Nguyen Thi Hoai Thu	F	Technician	PPMU		
53	Nguyen Thi Hai Yen	F	Technician	PPMU		
54	Tran Nghe Tinh	M	Farm Owner	Pig Farm	0983024959	Cam Thang, Cam Xuyen, Hà Tinh
55	Mr. Hung	M	Farm Owner	Pig Farm	0913088377	Son Kim, Huong Son, Ha Tinh
	Agriculture Science Institute of Northern Central Vietnam (ASINCV)					
56	Pham Van Linh	M	Director	ASINCV		
57	Le Van Vinh	M	Vice Director	ASINCV		
58	Trinh Duc Toan	M	Vice - Director	ASINCV		
59	Pham Van Chuong	M	Senior - Advisor	ASINCV		
60	Le Van Truong	M	Head of Department	ASINCV		

S/N	Person Met	Sex	Position	Organization	Contacts	
					Phone no.	**Email**
61	Pham Van Chung	M	Researcher	ASINCV		
	PPMU Binh Dinh					
62	Phan Trong Ho	M	Director of DARD	Binh Dinh DARD		
63	Dao Van Hung	M	Director	PPMU		
64	Tran Thi Thu	F	Chief Accountant	PPMU		
65	Le Ngoc Hung	M	Coordinator	PPMU		
66	Vo Hoang Hiep	M	Technician	PPMU		
67	Ho Thi Giac Ngan	F	Accountant	PPMU		
68	Phan Thanh Giang	M	Technician	PPMU		
69	Nguyen Thi Mai	F	Farm owner	Hoai Nhon		
70	Minh	M	Farm Owner	Phu My		
71	Huy Tuyet	M	Farm Owner	Hoai An		
72	Vo Tan Toan	M	Director	Fertilizer Co.		
	ASISOV					
73	Ho Huy Cuong	M	Director	ASISOV		
74	Hoang Minh Tam	M	Senior Adviser	ASISOV		
75	Lai Dinh Hoe	M	Deputy Director	ASISOV		
	Thai Binh Province					
76	Vo Van Dong	M	Director	Green Tech Company		
77	Mr. Trung	M	Vice Director			
78	Hoang Ngoc Sang	M	Chairman	Nam Cuong Coop		
	Thanh Hoa Province					
79	Nguyen Xuan Viet	M	Farm Owner	Hoang Hoa		
	Potential Companies					
	Kunio Yoshikawa	M	Professor	Tokyo Institute of Technology		
	Van Dinh Son Tho	M	Vice Director	Vietnam-japan Institute for S-T		
	Klaus Ferk	M	Area Sale Manager	Bauer Company	+43 3142 200 - 311	k.ferk@buer-at.com
	Hoang Thu Huong	F	Sales consultant	Bauer Company	0946416866	h.hoang@bauer-at.com
	Baseline Survey Consultant Team			**Baseline Survey Consultant Team**		
	Pham Bich San	M				
	Luu The Anh	M				
	Le Van Duy	M				
	Nguyen Van Thuc	M				
	Nguyen Duc Thin	M				
	Dang Dinh Long	M				
	Miscellaneous			**Miscellaneous**		
	Jacqueline Lilinshtein	F	Senior Researcher	Bloomberg New Energy Finance		

APPENDIX D CONTRIBUTION TO BASELINE SURVEY TEAM WORK[21]

The core LIC team reviewed the baseline survey team inception report and spent a half day discussing presentational and methodological issues – not least of which is the significantly delayed timing. A short note was prepared to advise the survey team Below we note some key points:

Establishing a baseline for 2013: Quasi/Proxy Indicators to measure performance against baseline
We suggest using data from the National Biogas Project - Biogas User Survey of 2013. This disaggregates data by biogas technology utilized per province covered.
It might therefore be possible to use data from Binh Dinh and Ben Tre since they are two LCASP. This covers relevant information e.g.

- By technology design i.e. KT1, KT2 and KT3 etc. as well as the size of biogas plant;
- The number of animals kept in relation to biogas plant size – which is a predictor of potential problems where the amount of animal waste is considered too high for the capacity of plant constructed.
- Indicators in terms of satisfaction with the construction quality (comparatively analyzed against other project designs.
- Misuse of the plant (overfilling with waste) and poor operations and maintenance resulting a buildup of scum effecting plant efficiency.

The Biogas User Survey also provides feedback on satisfaction with biogas cooking equipment and reliability of supply that could be used as a baseline to compare to LCASP biogas plant. For example, 24% of users complained about the gas cooking appliances in the QSEAP project. Scum formation was a problem in 8% of National Biogas Programme and is something I know to be a concern of Ms. Huong and Mr.Chinh.

Overall usage: The coverage of the National Biogas Survey is very comprehensive and touches upon a whole number of socio-economic and technical matters that are also relevant to the LCASP survey. So it would be worthwhile to take a good look at what LCAPS might be able to utilize from the 2013 survey as well as the 2016 survey that is at bidding stage.

Conclusion: The LIC team felt that some serious rethinking needed to be done to simplify the exercise. This is something that is likely to come out of the testing phase place in mid-April. We believe the baseline consultant team may be able to use parts of the 2013 as a quasi-survey baseline (where designs and locations are the same).

It was also considered to be of interest that there has been an advertisement to carry out the next stage of the survey this year. The deadline for expressions of interest and bids is the middle of April As such there should be scope to co-operate and get some data gathered through the SNV team? The link to the 2016 Survey TORs was noted http://www.biogas.org.vn/english/Tin-tuc-Su-kien/Thong-tin-moi-thau/Tender-Invitation--(BUS-2016--CARBON-MONITORING-SU.aspx

[21] As of mid may the baseline survey team have completed a trial run of the questionnaire/survey form, completed their inception report and commenced the survey (on 16th May).

APPENDIX E LCASP PERFORMANCE OUTPUT DATA MATRIX

Outputs					
1. Expanded Use of Livestock Waste Management Infrastructure					
Project Specific Indicators	Unit of Measurement	Target Year	Target Value	Cumulative Achievements	Progress/ Status
From baselines in 2013: 1.1. 36,000 SBPs, 40 MBPs, and 10 LBPs and associated value chain infrastructure constructed and operating by 2018. At least 5% of total SBPs will be constructed for ethnic minorities in 3 selected provinces.	Number	2018	36050		As of 31 March 2016, a total of 29,735 SBVCs have been constructed by livestock farming HH of which 799 SBPs (2.7%) are constructed for ethnic minorities in 3 selected provinces. (Son La: 531 SBPs, Bac Giang: 225 SBPs, Soc Trang: 43 SBPs)
1.2. 36,000 SBP operators, 500 masons, 160 technicians, 10 engineers and 10 contractors trained and registered in biogas associations by 2018. At least 50% of trainees on biogas use will be women; 20% of trainees on SBP construction, and 20% of those trained on biogas management and technical issues will be women.	Number	2018	36680		31,488 SBP operators, 321 masons, 330 technicians, 28 engineers and 5 contractors trained. 9,367 trainees on biogas use are women (accounting for 29.7%). 18 trainees on SBP construction are women (accounting for 5.6%). 89 technicians are women (accounting for 27%).
1.3. Biogas plant database managed effectively by 2014, including registration in both husband's and wife's names.	Y/N	2018	Y		In close consultation with the ongoing National Biogas Development Program (NBDP) managed by DLP with the supports of the Netherlands Development Organization (SNV), the Project is developing a biogas database system that consolidates information from ongoing biogas-related programs

					being implemented in Viet Nam. CPMU recruited a service provider to assist NBDP to develop an unified database, which is expectedly completed by 30 June 2016. Project has proposed a fund to support DLP to become the focal point for management of all carbon credit from the biogas plants implemented by the Projects under MARD. This activity is expectedly implemented in Q3/2016.

Recent Developments

Information on HH that receive incentives for construction of SBVC under the Project are maintained by the PPMUs and CPMU, and expected to incorporated into the database maintained under the National Biogas Development Program (NBDP).

The CPMU was requested to clarify the status of current environmental protection and regulatory requirements for livestock, and biogas waste streams and the need for additional strengthening.

CPMU and PPMUs are running information campaigns on biogas development, comprehensive management of biogas plants and livestock waste management, introduction of Project's credit facilities, etc.

To date, the Project is progressively implementing activity relating the construction of medium and large scale value chains (M&LVC).

No.	Activities	Target Completion Date	Completed	Progress/ Status
1	1.1 Train and certify technicians, contractors and masons through relevant agencies for construction of BVC management facilities by 2013	Q2 2017	N	As of Q1/2016, the Project has organized 10 training courses for 321 masons and 24 technical training course for 896 participants to construct SBVCs.
2	1.2 Standardize and disseminate design package for BVC management by 2013	Q2 2013	N	- CPMU recruited a service provider to conduct disseminating activities on biogas value chain, such as producing and publishing documentary

				films on biogas technologies, techniques of operating biogas plants, carbon credit in biogas sector and Developing and publishing documents on biogas value chain and comprehensive livestock waste management. - PPMUs implemented communication and dissemination programs through various mediums (16.130 leaflets, 516 posters, banners, 11 programs on television and radio) - Project has organized 1.085 training courses on small biogas plant value chain operation for 31.488 farmer households. - CPMU has issued guidelines for construction of medium and large HDPE and fixed-dome brick digesters. 5 HDPE biogas construction service providers and 6 mason teams have been recognized eligible under LCASP.
3	1.3 Develop training modules for CSAWMP stakeholders by 2014	Q2 2013	N	The CPMU is developing 5 training modules for training farmers on

				livestock waste management.
4	1.4 Register program of activities for SBPs by 2013 and for MBP and LBPs by 2014 for the relevant carbon market requirements	Q2 2013	N	Being implemented. National Biogas Development Program (NBDP) will be formulated as a carbon market coordinator for all biogas plants supported under MARD's biogas projects. However, Project proposed National Biogas Development Program (NBDP) under DLP to propose PoA and CPA registered in the other appropriate carbon markets. The project will provide funding to NBDP to participate in the carbon market at NBDP's requirement
5	1.5 Monitor use of biogas plants with adequate environmental facilities by 2018	Q2 2013	N	- CPMU is now collecting the demands of 10 project's provinces and some relevant institutes of MARD to propose the environment facilities for monitoring after-biogas environment. A physical audit of SBVCs will be carried out to check that the technical standards are being met and that the subsidies have reached the intended

				beneficiaries. The CPMU has finalized the TOR for such an audit and expects to submit to ADB by the week of 18/04/2016. - CPMU and PPMUs frequently organize regular missions to check the operating biogas plants funded by the Project. By Q1/2016, a total of 2.086 SBVCs checked.
6	1.6 Strengthen relevant agencies to hand over the monitoring of the constructed biogas plants by 2018	Q2 2013	N	CPMU and LIC consultants are preparing the list of environment monitoring equipment for monitoring the constructed biogas plant environment to meet the national standards. The equipment shall be provided to 10 provinces and relevant agencies to strengthen the livestock environment monitoring capacity.
7	1.7 Monitor annual attributable CO2 reduction and issuance of carbon revenue from the certified emission reduction by 2018	Q2 2013	N	CPMU recruited a service provider to develop a database system which will support NBDP to monitor CO2 reduction and issuance of CERs. The database system expectedly completed by 30 June 2016. The service provider has conducted and is now

				submitting the design document for the approval of NBDP and LCASP
8	1.8 Provide capacity building to relevant agencies to continuously manage biogas development by 2018	Q2 2013	N	- A training workshop was organized by CPMU to 50 staff of the Government and relevant agencies. - CPMU will recruit a service provider to provide equipment to continuously manage biogas development. -The CPMU is developing a training program for staff of relevant agencies to be responsible for the management and monitoring of the National Biogas Program

Outputs					
2. Credit Lines for Biogas Value Chains					
Project Specific Indicators	Unit of Measurement	Target Year	Target Value	Cumulative Achievements	Progress/ Status
2.1 50% of credit lines will be under joint accounts and/or on behalf of women by 2018	Percent	2018	50		By Q1/2016, 182 sub-loans have been disbursed with total 4.56 billion VND of which 33% of credit lines are under account on behalf of women.
2.2. BVC infrastructure financing products are mainstreamed in two financial intermediaries by 2018	Y/N	2018	Y		The 2 financial intermediaries participated in Project are VBARD and Co-op Bank.

2.3. ICMD funds are fully channeled into 36,050 accounts of beneficiaries by 2017	Number	2017	36050		Financial incentives are being disbursed through the post office or provincial bank systems .

Recent Development

The credit facility under the project is slow-functional. The participating financial intermediaries (PFIs) view the scope of the credit as being restrictive. Efforts to better assess the demand and current constraints of the existing credit facility is being initiated. CPMU has recruited and mobilized a national credit consultant for this purpose. The consultant has finalized and submitted to CPMU the inception report. The credit market evaluation report is expectedly submitted in May 2016.

No.	Activities	Target Completion Date	Completed	Progress/ Status
1	2.1 Encourage the selected two financial intermediaries to provide credit lines by 2018	Q2 2013	Y	The 2 financial intermediaries participated in Project are VBARD and Co-op Bank.
2	2.2 Encourage other financial intermediaries to finance BVC management infrastructure by 2016	Q2 2013	N	A national credit consultant has been mobilized to evaluate the credit situation and then provide solutions which are not excluding the participation of other financial intermediaries.
3	2.3 Coordinate training program between CPMUs, PPMUs and financial intermediaries by 2017	Q2 2013	N	CPMU and FIs have organized 02 training courses on credit lending procedure for 115 participants
4	2.4 Monitor the disbursement of incentive for carbon market development through financial intermediaries by 2018	Q2 2013	N	Financial incentives are being disbursed through the post office or provincial bank systems.

Outputs

3. Enhanced Climate Smart Agriculture Waste Management Practices (CSAWMP) technology transfer

Project Specific Indicators	Unit of Measurement	Target Year	Target Value	Cumulative Achievements	Progress/ Status
3.1 Well-established CSAWMP packages are disseminated in 10 participating provinces by 2016	Y/N	2016	Y		- CPMU, LIC consultants and PPMUs proposed lists of demonstration models in line with the needs of the Province. CPMU has also submitted to ADB the demonstration models selection procedure, demonstration models content and implementing plans and waiting for no objection. - The proposal of e-library which will be used for disseminating CSAWMP information packages into 10 provinces, has been submitted to ADB and now waiting for the no objection. - The Project has organized training courses for extension staffs and farmers on CSAWMP. - The project conducted domestic study tours to share experiences of livestock waste management technologies.
3.2 One long-term, community-based CSAWMP technology transfer and research strategy is elaborated by 2014, and includes communication,	Y/N	2014	Y		A research strategy and detailed implementation plan for CSAWMP has been drafted by the CPMU and is being reviewed by MARD and ADB.

dissemination, and mainstreaming plans					ADB recently requested CPMU and LIC consultants to assist 10 PPMUs to develop detailed provincial plans which consist of needed research activities and pilot demonstrations under component 3. These provincial plans will replace the research strategy, which is not needed to be developed.
3.3 Critical CSAWMP knowledge gaps are identified and at least 21 research, dissemination, and mainstreaming packages carried out according to a priority list, by 2018; 30% of research projects will include gender issues by 2016	Number	2018	21		- CPMU and LIC consultants developed a list of 21 research topics and the implementing method in accordance with the ADB's consultant selection procedures. CSAWMP packages will be developed and disseminated based on the provincial demands. - CPMU has conducted upgrading map sets for 7 agro-ecological regions to forecast potentiality and current situation of agricultural waste use for producing renewable energy and organic fertilizer, to include support for agricultural waste management planning.
Recent Developments Activities for Output 3 (enhancing climate-smart agriculture waste management practices through R&D) must follow on from a research and demonstration strategy to be developed by the Project. ADB has provided comments to a draft earlier shared and suggested revisions in certain areas, in particular, to identify gaps vis-a-					

vis ongoing research and practices, expand the range of proposed interventions to cover low carbon agricultural practices across the value chain and to include evaluation criteria for selecting activities. The CPMU was also advised to formulate, in consultation with ADB, an appropriate set of investment packages (i.e., consulting services, goods, works) and a corresponding procurement plan to undertake Output 3 activities. By end of Quarter 4, 2015, ADB agreed that the Research Strategy is not needed; instead, CPMU and LIC consultants will assist PPMUs to prepare provincial plans, which identify research activities and pilot demonstrations to be implemented under component 3. To date, lists of research topics and demonstration models have been submitted to ADB and show their relevance based on ADB's reply.
CPMU and ADB agreed to select the research implementing units in accordance with the ADB's consultant selection procedures. CPMU, LIC consultants and PPMUs developed selection procedure, implementing plan and submitted to ADB and now waiting for no objection.

No.	Activities	Target Completion Date	Completed	Progress/ Status
1	3.1 Organize farmer-based research including using biochar and other agricultural wastes as organic fertilizers; applying other efficient low greenhouse gas emission agricultural practices which generate bioenergy; managing waste treatments in aquaculture and other CSAWMP by 2018	Q2 2013	N	- The CPMU and LIC consultants assisted 10 PPMUs to develop detailed provincial plans which consist of needed research activities and pilot demonstrations under component 3. - ADB suggested CPMU to have fewer packages of research.
2	3.2 Establish an information system, e-library, journals, and database for sharing CSAWMP research and training by 2018	Q2 2013	N	The CPMU and LIC consultants have finalized the proposal of e-library system which will be used for disseminating CSAWMP information packages in 10 provinces. The proposal has been submitted to ADB and now waiting for ADB's no objection.
3	3.3 Train staff in efficient, CSAWMP, including organizing overseas study tours by 2018	Q2 2013	N	- CPMU in collaboration with VAAS in selecting training topics on

				CSAWMP for research staffs. - The proposal for a overseas study tour to Japan has been submitted to ADB. Another proposal for a study tour to China is now preparing and be submitted ADB by Q3/2016
4	3.4 Develop training programs, textbooks, and syllabus for training farmers on appropriate techniques for CSAWMP; provide vocational training for farmers by 2015	Q2 2013	N	CPMU and LIC consultants have developed 8 vocational training programs on CSAWMP in livestock, crops and aquaculture. Theses training programs are expected to be implemented by Q2/2016.
5	3.5 Upgrade CSAWMP-based map sets for 7 agro-ecological regions to forecast the direct impact of climate change (sea level rise, salt sea intrusion, flood, drought) and provide support for agricultural planning by 2014	Q2 2013	N	CPMU recruited a service provider to implement this activity in early March 2016.
6	3.6 Develop livestock waste management models for agricultural production and greenhouse gas emission reductions by 2016	Q2 2013	N	The CPMU and LIC consultants have finalized and submitted 02 sample pilot demonstrations to ADB. As suggested by ADB, CPMU has finalized a guideline for demonstration models submitted to ADB and now waiting for ADB's no objection.

7	3.7 Train extension staff and farmers in low carbon agricultural production technologies to promote application of the technologies in agricultural production by 2018	Q2 2013	N	Being implemented. As of Q1/2016, the Project has organized 39 training courses for 1449 extension staffs and farmers in CSAWMP technologies

Outputs					
4. Effective project management					
Project Specific Indicators	Unit of Measurement	Target Year	Target Value	Cumulative Achievements	Progress/ Status
4.1. A CPMU and 10 PPMUs established and operational with adequately skilled staff and facilities in MARD by first quarter of 2013. At least 30% of staff are women and a gender focal point will be appointed by 2014	Y/N	2014	Y		MARD appointed Dr. Nguyen The Hinh as the Project Director to lead project implementation and to supervise the Project's CPMU. He will be supported by two Project Deputy Directors, Mr. Hoang Thai Ninh and Mr. Vu Tien Dung; and approximately 25 staff in the CPMU office. Each PPMU is led by a project manager. Key PPMU staff have been selected based on their qualifications and experience in the management of similar projects. To date, approximately 44% of staff is women.
4.2. PPMS with sex-disaggregated and	Y/N	2015	Y		Monitoring and Evaluation

ethnicity data collected and reported operating effectively in 10 provinces by 2015					consultant has been mobilized and conducted M&E tools for DMF, GAP, Loan covenant, and Training data. A consultancy provider to gather baseline data has been recruited. Its inception report has been conducted and sent to CPMU and LIC for comments. The gender consultant will be mobilized on 14/4/2016 and support all gender related activities.
4.3. Carbon market coordinator and 36,000 biogas owners are organized through associations by 2014	Y/N	2014	Y		Being implemented. NBDP will be formulated as a carbon market coordinator for all biogas plants supported under MARD's biogas projects
Recent Developments The CPMU's ability to support project implementation is strengthened by the mobilization of Loan Implementation Consultants (LIC consultants) and two individual consultants (a biogas value chain credit market specialist and a commercial business planner specialist).					

No.	Activities	Target Completion Date	Completed	Progress/ Status
1	4.1 Establish CPMU and PPMUs to be operational by 2013	Q2 2013	Y	CPMU and 10 PPMUs were established and being operating since 2013. Key CPMU and PPMU staff have been selected based on their qualifications

				and experience in the management of similar projects
2	4.2 Engage consultants for start-up and auditing, and to develop the PPMS, with sex- and ethnicity-disaggregated data and including gender action plan monitoring by 2013	Q2 2013	N	Individual start up consultants for PIM development, training, and agribusiness have been mobilized. The recruitment of the Project auditor is completed. LIC consultants have been mobilized in December 2015.
3	4.3 Explore all potential carbon markets by 2014	Q2 2013	N	Being implemented with cooperation of NBDP supported by SNV.
4	4.4 Undertake baseline surveys in all project provinces with collection and analysis of sex- and ethnicity-disaggregated data by 2014	Q2 2013	N	A consultancy provider to gather baseline data has been recruited. Its inception report has been conducted and send to CPMU and LIC for comments
5	4.5 Conduct a gender awareness raising workshop for PMUs by 2016	Q2 2013	N	A gender awareness workshop is planned to be implemented at the beginning of Q2/2016.
6	4.6 Organize biogas owners and CSAWMP participants through relevant agencies	Q2 2013	N	The Project has also proposed a fund to support NBDP to become a carbon market coordinator for all biogas plants supported

				under MARD's biogas projects.
7	4.7 Prepare progress reports and submit to ADB on a regular basis by 2018	Q2 2013	N	Progress reporting being complied with.

Source:CPMU:12-04-2016

APPENDIX F DEMONSTRATION ECONOMIC AND TECHNICAL DOSSIERS

1. **Demonstration of Comprehensive Management of Industrial Scale Pig Farming Waste.**
   Prepared by Mrs. Thi Lan Huong
   Case study: one industrial scale farm with a total of 3,000 head of fattening pigs in Nam Dinh

2. **Demonstration of Shared Biogas for Energy Supply to One Centralized Cluster Combined with** Organic Fertilizer Production.
   Prepared by Mrs. Thi Lan Huong
   Case of one residential cluster in the plain of Tien Giang province

3. **Demonstration of Utilizing Digested Effluent as Organic Fertilizer Source for Agricultural and Industrial Crops.**
   Prepared by Mr.Bui Van Chinh

   Case of 2 – 3 communes with over 150 biogas plants and each participating household gets biogas plant of 8 – 12m3 constructed and has industrial and agricultural crop cultivation area of more than 500 m2 in Phu Tho

4. **Demonstration of model of collecting bio slurry from biogas plant & livestock waste from farm households**
   Prepared by Mr.Bui Van Chinh
   Case of a cluster of 5 – 6 communes with 6,000 fattening pigs & 250 biogas plants in Bac Giang

5. **Demonstration of Model of Pig Farming Waste Treatment (via Separation of Solid-Waste from Slurry) for Organic Fertilizer Production.**
   Prepared by Mr.Bui Van Chinh
   Case of a farm with 2,000 head of fattening pigs in Ha Tinh

6. **Demonstration model of Utilizing Organic Manure for Red Worm** Raise
   Prepared by Mr.Nguyen Van Bo
   Case of Binh Dinh

F.1 DEMONSTRATION OF COMPREHENSIVE MANAGEMENT OF INDUSTRIAL SCALE PIG FARMING WASTE

Prepared by Mrs. Thi Lan Huong

Case study: one industrial scale farm with a total of 3,000 head of fattening pigs in Nam Dinh

Abstract

Demonstration of livestock waste comprehensive management includes 3 main components: i) Effective livestock waste management system for the environmental pollution reduction and high quality organic fertilizer production, ii) Equipment system for treating the wastewater meeting the environmental and biogas production standards and iii) Power generation system for the effective utilization of biogas source for the production and daily activities of the farm.

The demonstration is to be implemented at the farm with a size of 3,000 head of fattening pigs or an equivalent livestock quantity. Part of manure quantity produced shall be dehydrated for producing 350 ton of organic fertilizer/year. The rest shall be used for producing the biogas for a power generator with a capacity of 60kVA. Total investment for the equipment and construction of the demonstration is 3.64 billion VND, of which 1.01 billion VND (27.34%) is supported by the project and the remaining 2.124 billion VND (72.66%) is from the farm owner. The demonstration is expected to produce high economic efficiency with two key financial indicators: rate of return/total investment of 14.53% and rate of return/sales turnover of 39.43%

1. Rationale of pilot development

Practice of the centralized industrial scale farming is popular in almost all the project provinces such as Nam Dinh, Bac Giang, Son La, Ha Tinh, Binh Dinh, Tien Giang, Ben Tre, etc. For example, there are a total of 175 farms of medium and large scale (centralized livestock farms) in Nam Dinh, 30 of which is of the industrial scale mainly located in Hai Hau, Xuan Truong and Y Yen districts.

A typical industrial scale farm often possesses between 2,000 and 3,000 head of pigs. With the farm of 3,000 head of pigs, total estimated daily waste quantity as follows:

i) Solid waste (manure): 5.8 ton;

ii) Wastewater (urine and animal house cleansing water): 50 m3

The waste produced from the livestock production activities include pig house cleansing water, pig-bathing water, manure and pig urine. The daily waste quantity of each farm shall be subject to the type of livestock production technology, which has been applying. The current prevailing livestock production technology is of CP group as well as of some domestic livestock production groups (such as DAFACO) or of pig breeders themselves. In general, status of solid waste treatment of the farm is as described in diagram No.1.

The advantage of industrial scale livestock production is that it is possible to collect the big amount of manure for producing the commercial organic fertilizer. In addition, high-energy demand for production entails investment into the necessary energy forms such as electricity for lighting, cooling or warming. Therefore, solution of livestock waste comprehensive management implies; the dehydration of manure for producing the commercial organic fertilizer and the rest shall be treated via a biogas plant (HDPE

covered lagoon) for producing biogas as fuel for a power generator with a capacity suiting the electricity need of the farm.

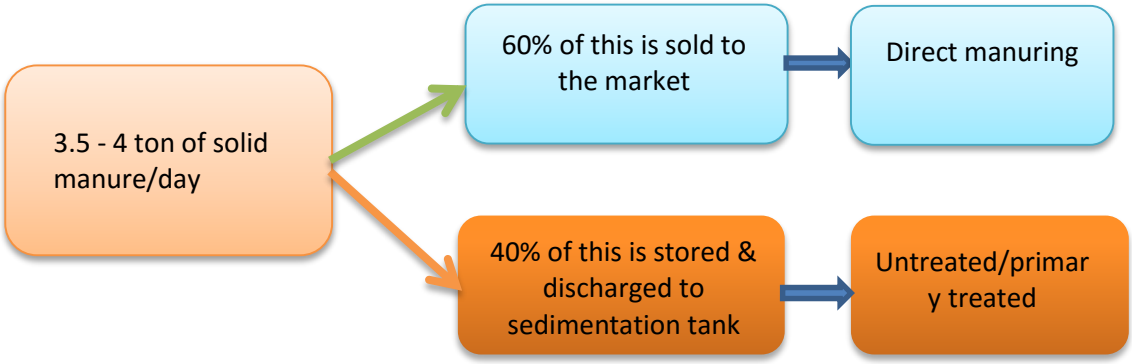


Diagram No.1 – status of livestock waste treatment of the farm

2. Objective of the demonstration

2.1 General objective:

In view of the foregoing, the main objective of the pilot is to manage in a comprehensive and effective manner the livestock waste to produce high quality organic fertilizer and energy supply as well as to create a practical foundation for training and scaling out of the model to the livestock farms with similar conditions.

2.2 Specific objective:

i) Install a system of manure collection and separation for producing high quality organic fertilizer, contributing to the effective management of waste in the pig farming, enhancing the economic efficiency, environmental protection and greenhouse gas emission reduction.

ii) Construct large biogas plants for treating the livestock solid waste and wastewater to serve the demand for fuel and power generation of the farm.

iii) Install a power generation system with a capacity of 60kW to save on grid electricity costs and improve the efficiency of using biogas.

3. Technological solution

3.1. Technological diagram:

The key technology of the demonstration is for the collection of solid waste to produce organic fertilizer. The construction of biogas system is to treat all the wastewater of the farm and part of solid waste from the area of fattening pig farming. The biogas produced shall replace the whole LPG as fuel and for power generation to serve the production of the farm. The technological diagram is summarized as follows:

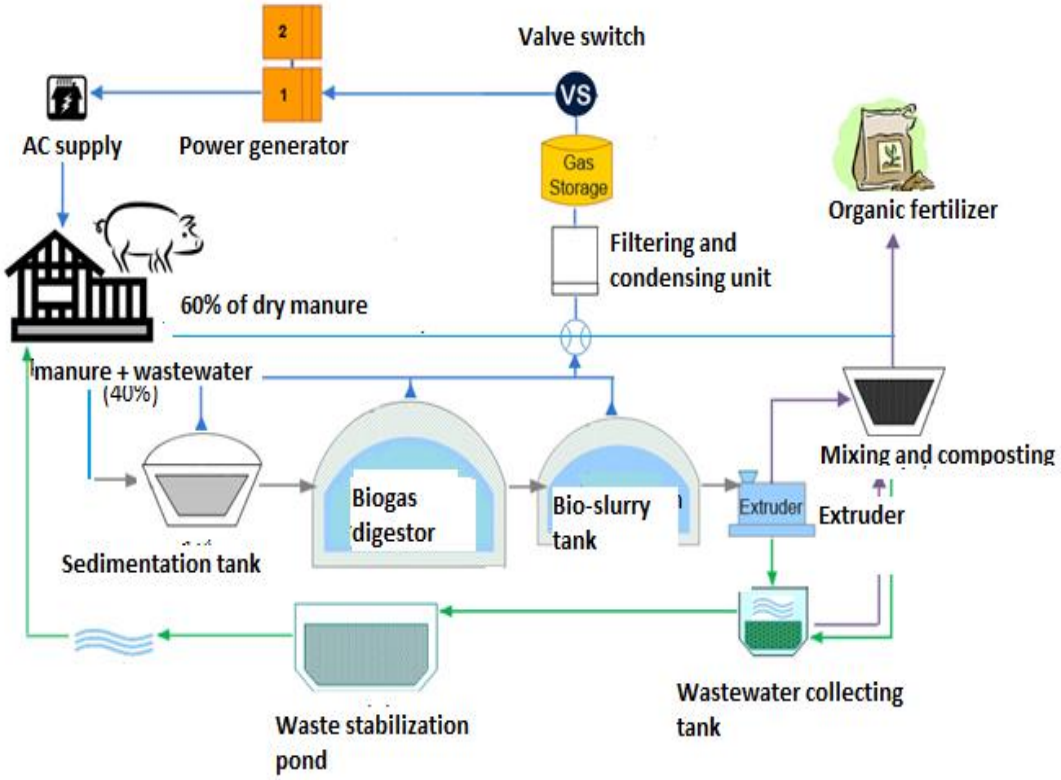


Diagram 1 – schematic diagram of comprehensive management solution of livestock waste into energy and organic fertilizer

Design parameters and ability of the model to meet the demands of the market and farm are as follows:

a) Production of organic fertilizer:

Total estimated solid waste quantity: 5.8 ton/day

- 60% of the raw solid waste quantity for fertilizer production: 3.5 ton/day
- Quantity of commercial organic fertilizers: 350 ton/year
- Expected selling price: 3.0 million VND/ton (market price of bio-organic fertilizer and micro-biological organic fertilizer of good quality is between 5 and 5.5 million VND/ton)

b) Biogas system:

Technology: HDPE covered lagoon together the sedimentation tanks and wetland system for treating the digested effluent to be used for cleaning.

Design data of biogas system:

- Total quantity of wastewater: 50m^3/day
- 40% of solid waste quantity of the farm: 2.3 ton/day
- Volume of biogas digester: 2,500m^3
- Daily biogas output: 200m^3/day

c) Power generation system:

- Capacity of power generator: 60kW
- Working mechanism of the power generator: operated regularly for between 4 and 6 hours per day or 2,200 hours per year at peak time to save on electricity cost and as the standby-power- supply-source in case of power cut.

3.2 Quantity of construction and installation

Quantity of construction and installation and list of materials and equipment of the demonstration are summarized in the following table 1:

Table 1 – List and quantity of materials and equipment of the demonstration

No.	Description	Technical parameter	Unit	Quantity	Remarks
A	**Equipment**				
1	**Biogas plant**				
1.1	HDPE Covered lagoon 2500m^3	Canvas with a thickness of 0.5mm for lining and 1mm for covering	m^2	3,000	
1.2	Manure collecting tank	Built of brick (underground)	m^3	50	
1.3	Bio-slurry storage tank	Built of brick (underground)	m^3	50	
1.4	Waste stabilization pond	Unlined pond with embankment where the hyacinth are raised	m^2	700	
1.5	Ditch for collecting manure	Built of brick	linear meter	1,000	
1.6	Biogas pipe system	Using PVC plastic, type of φ34mm and φ21mm	linear meter	150	
1.7	Valves, connectors	complete with pipeline	Set	10	
1.8	Sludge pump	Capacity of 15m^3/h with a low head	Unit	1	
2	**Fertilizer production system**				
2.1	Manure extruder	Imported, with a capacity of 15-20m3/h	Unit	1	
2.2	Slicer of agricultural by-products	Slicing capacity: 1,500kg/hour	Unit	1	
2.3	Manure turner (with conveyor belt)	Engine of 1 phase, 3kW	Unit	1	
3	**Power generation system**				
3.1	Biogas meter	Measuring range 35-50m^3/h	Unit	1	
3.2	Biogas bag	LDPE material with a thickness of 0,75mm, V=80m3	Unit	1	
3.3	Condenser, filter	Filtration rate: 35-40m^3/h, filtration efficiency: 90%	Set	1	
3.4	Control panel		Set	1	
3.5	Power generator	60 kW,3 phases, able to run on 2 types of fuel	Unit	1	

Total investment and financial mechanism of the demonstration are summarized in table 2 below (for detail, please find the appendix)

Table 2 – Total investment cost and financial mechanism

No.	Item	Amount (x10³VND)	Financial mechanism			
			Project		Owner/hhs	
			Capital	Rate (%)	Capital	Rate (%)
I	**EQUIPMENT, MACHINERY, WORKSHOP/WAREHOUSE & PRODUCTION COSTS OF DEMONSTRATION:**					
A	Machinery, equipment:	2,541,250	1,010,000	40	1,531,250	60
B	Labor cost:	592,750	0	0	592,750	100
	TOTAL (A+B)	**3,134,000**	**1,010,000**	**32.2**	**2,124,000**	**67.8**
C	Production costs of demonstration comprise:	560,000	0	0	560,000	100
	TOTAL I (A+B+C)	**3,694,000**	**1,010,000**	**27.34**	**2,684,000**	**72.66**
II	**TECHNICAL SERVICE OF DEMONSTRATION**					
1	Training	80,000	80,000	100	0	0
2	Technical expert	200,000	200,000	100	0	0
3	Technical design and construction	40,000	40,000	100	0	0
4	Adjustment to shop drawing based on the actual conditions	24,000	24,000	100	0	0
5	Commercial promotion workshop	50,000	50,000	100	0	0
6	Dissemination and advertisement	50,000	50,000	100	0	0
7	Review of demonstration and replication	200,000	200,000	100	0	0
	TOTAL II	**644,000**	**644,000**	**100**	**0**	**0**

4. Economic efficiency analysis of the demonstration

The economic efficiency of the demonstration is analyzed and assessed based the costs and benefits of the demonstration. Production cost is calculated for one production cycle (presumably one year) and following are the main products of the demonstration:

1) Organic fertilizer production: 350 ton/year
2) In place of LPG (as fuel): 600,000 VND/month
3) Savings on cost for electricity: 22 million VND/month
4) Environmental fee: 40 million VND/year

The results of cost calculation of the model are shown in the following table:

Production costs	Amount (10³VND)

1	Loan (if any)	
2	Depreciation of assets, equipment, etc.	264,489
3	Raw materials/fuels and labor	560,000
Total production costs		**824,489**

Business results of the demonstration and its efficiency are shown in the following table:

Table 4 – TOTAL REVENUE FROM THE COMMERCIAL PRODUCTS OF THE DEMONSTRATION

Unit: thousand VND

No.	Item	Unit	Quantity	Selling price	Amount
1	Organic fertilizer	ton/year	350	3,000	1,050,000
2	Biogas as fuel	VND/month	12	600	7,200
3	Power-saving	VND/month	12	22,000	264,000
4	Others (environmental fee, etc.)	Times of penalty	2	20,000	40,000
	TOTAL				**1,361,200**

	Net income of the demonstration:	**536,711**	**thousand VND**	

From the result of analyzing the costs and benefits of the demonstration, the economic efficiency is calculated according to the following indicators:

Rate of return/total investment (capital)	***14.53%***
Rate of return/investment capital of owner	***20.00%***
Rate of return/sales turnover	***39.43%***

5. Analysis of market demand

a) Demand of the market for the organic fertilizer

Nam Dinh is an agriculture-based province with a total agricultural land of 103,480ha. Total harvesting rice area (2013) is 155,354ha; for vegetables: 16,665ha; for groundnut: 6,287 and maize: 4,151ha, not including thousands of ha of fruits, flowers and ornamental trees. With the application rate of 8 – 10 tons of organic fertilizer per crop, Nam Dinh province needs a minimum of 1.5 – 2 million tons of organic fertilizer each year. At present, only 30 – 40% of the above demand is satisfied; however, the quality of processed organic fertilizer is quite low due to its main raw material is peat.

It is expected that Nam Dinh province shall complete the new rural development plan with the priorities are as follows: i) establishment of 150 large field production with aromatic specialty rice varieties for the domestic consumption and export, ii) 14,530 ha reserved for growing vegetables and other cash crops with 300 ha for growing the organic vegetables, iii) 2,000ha for planting flowers and ornamental trees which are the long-standing traditional trade of the province.

b) Demand for energy of the farm

Pig farming requires much energy for pumping water for animal house cleaning, lighting, fan and cooling system in summer and heating in winter, etc. At present, the farm has been equipped with the system of lighting, heating, pumping, electric fans, cooling and other machines with a total capacity of 60kVA and the power consumption cost is between 30 and 40 million VND per month (the power price for the production is 1,600 VND/kWh at off-peak time and 2,600 VND/kWh at peak time).

Status of the grid electricity of the farm area: frequency of power cuts for the priority purposes (at times of flooding and storms in summer season and drought in winter season) is from 2 to 3 times per month and the power supply is unstable (low voltage). Therefore, though already connected to the grid electricity, the farm still uses a diesel run generator (with a capacity of 60kVA) to meet its power demand as well as to ensure the continuous power supply for the sows which are pregnant or just give birth with a monthly petroleum consumption of around 550 liters. At present, the price of diesel oil is 16,000 VND per liter; therefore, the power generator shall need an amount of 8.8 million VND for its monthly operation.

Besides, the energy demand for cooking and daily activities (such as the preparation of meals for the workers, hot water for hygienic purpose, etc.) is quite high. On average, the family uses 2 cylinders of LPG for cooking each month. The market price of LPG is 35,000 VND/kg.

6. Implementation schedule

No.	Activity	2016				2017			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Activity 1**: organization of bidding								
	Prepare the bidding document								
	Organization of bidding								
	Signing of the contract								
2	**Activity 2**: Model of fertilizer production								
	Procurement of equipment								
	Construction of workshop								
	Installation of equipment								
	Training and commissioning								
3	**Activity 3**: Development of biogas demonstration								
	Development and installation of biogas system								
	Guidance and transfer of O & M techniques								
	Construction of pre and post treatment auxiliary systems								
	Analysis of environmental indicators								

4	**Activity 4**: Installation of power generation system								
	Procurement of equipment								
	Setting up room for keeping machine								
	Installation of equipment								
	Training and commissioning								
	Transfer of O & M techniques								
5	**Activity 5**: Training and Information/communication								
	Making and broadcasting the programs on mass media								
	Making, printing and distributing the technical documents and leaflets								
	Making the video tapes about the activities of the model								
6	**Activity 6**: Commercialization of the product								
7	**Activity 7**: Management and implementation of model								
	Kick-off workshop								
	FFS (farmer field school) for exchanging the experience in the organization of activities								
	Review workshop on the demonstration								

APPENDIX 1

Table 1a - Total investment for procurement and installation

Unit: thousand VND

No.	Description	Unit	Quantity	Unit price	Amount
A	**Equipment**				**2,541,250**
1	**Biogas plant**				**1,453,250**
1.1	Covered HDPE lagoon 2500m^3	m^2	3,000	400	1,200,000
1.2	Manure collecting tank	m^3	50	850	42,500
1.3	Bio-slurry storage tank	m^3	50	850	42,500
1.4	Waste stabilization pond	m^2	700	100	70,000
1.5	Ditch for collecting manure	linear meter	1,000	50	50,000
1.6	Biogas pipe system	linear meter	150	75	11,250
1.7	Valve, coupler	Set	10	300	3,000
1.8	Sludge pump	Unit	2	17,000	34,000
2	**Fertilizer production system**				**640,000**
2.1	Manure extruder	Unit	1	500,000	500,000
2.2	Slicer of agricultural by-products	Unit	1	90,000	90,000
2.3	Manure turner (with conveyor belt)	Unit	1	50,000	50,000
3	**Power generation system**				**448,000**
3.1	Biogas meter	Unit	1	3,000	3,000
3.2	Biogas bag	Unit	1	20,000	20,000
3.3	Condenser, filter	Set	1	50,000	50,000
3.4	Control panel	Set	1	25,000	25,000
3.5	Power generator	Unit	1	350,000	350,000

Table 1b - Cost of labor for construction and installation

Unit: thousand VND

No.	Description	Unit	Quantity	Unit price	Amount
A	**Equipment**				**592,750**
1	**Biogas plant**				**542,750**
1.1	Covered HDPE lagoon 2500m^3	m^2	3,000	150	450,000
1.2	Manure collecting tank	m^3	50	150	7,500
1.3	Bio-slurry storage tank	m^3	50	150	7,500
1.4	Waste stabilization pond	m^2	700	70	49,000
1.5	Ditch for collecting manure	linear meter	1,000	25	25,000
1.6	Biogas pipe system	linear meter	150	25	3,750
1.7	Valve, coupler	Set	10		0
1.8	Sludge pump	Unit	2		0
2	**Fertilizer production system**				**0**
2.1	Manure extruder	Unit	1	0	0
2.2	Slicer of agricultural by-products	Unit	1	0	0
2.3	Manure turner (with conveyor belt)	Unit	1	0	0
3	**Power generation system**				**50,000**
3.1	Biogas meter	Unit	1	0	0
3.2	Biogas bag	Unit	1	0	0
3.3	Condenser, filter	Set	1	0	0
3.4	Control panel	Set	1	0	0
3.5	Power generator	Unit	1	50,000	50,000

APPENDIX 2

Table 1C - Total investment cost and financial mechanism

No.	Item	Amount (x10³VND)	Financial mechanism			
			Project		Owner/hhs	
			Capital	Rate (%)	Capital	Rate (%)
I	EQUIPMENT, MACHINERY, WORKSHOP/WAREHOUSE AND PRODUCTION COSTS OF DEMONSTRATION:					
A	**Machinery, equipment:**					
1	System of biogas lakes	1,453,250	20,000	1.4	1,433,250	98.6
2	Fertilizer production system	640,000	640,000	100	0	0
3	Power generation system	448,000	350,000	78.1	98,000	21.9
	SUBTOTAL A	**2,541,250**	**1,010,000**	**40**	**1,531,250**	**60**
B	**Labor cost:**					
1	Cost of construction and installation of biogas plant	542,750	0		542,750	100
2	Cost of earthworks (soil excavation and backfilling)	50,000	0		50,000	100
	SUBTOTAL B	**592,750**	**0**	**0**	**592,750**	**100**
	TOTAL (A+B)	**3,134,000**	**1,010,000**	**32.2**	**2,124,000**	**67.8**
C	**Production costs of demonstration comprise:**					
1	Raw materials	150,000		0	150,000	100
2	Labor (workers for system operation and maintenance)	240,000		0	240,000	100
3	Utilities (electricity, water)	20,000		0	20,000	100
4	Others (contingency, transaction, packing, printing, etc.)	150,000		0	150,000	100
	SUBTOTAL C	**560,000**	0	0	**560,000**	100
	TOTAL I (A+B+C)	**3,694,000**	**1,010,000**	**27.34**	**2,684,000**	**72.66**
II	TECHNICAL SERVICE OF DEMONSTRATION					
1	Training	100,000	100,000	100	0	0
2	Technical expert	400,000	400,000	100	0	0
3	Sample analysis	50,000	50,000	100	0	0
4	Commercial promotion workshop	50,000	50,000	100	0	0
5	Dissemination and advertisement	50,000	50,000	100	0	0
6	Review of demonstration- replication	200,000	200,000	100	0	0
	TOTAL II	**850,000**	**850,000**	**100**	**0**	**0**

	TOTAL (I + II)	4,544,000	1,860,000	40.9	2,684,000	59.1

APPENDIX 3:

Table 1D - Estimated depreciation of equipment and assets of the demonstration

No.	Description	Initial asset value (10^3VND)	*Quantity of asset*	*Expected deprecation time/year*	*Depreciation rate (10^3VND)*
A	**Machinery, equipment:**				
1	**Biogas plant system**	**1,453,250**			**109,539**
1.1	Covered HDPE lagoon 2500m3	1,200,000	1	15	80,000
1.2	Manure collecting tank	42,500	1	15	2,833
1.3	Bio-slurry storage tank	42,500	1	15	2,833
1.4	Waste stabilization pond	70,000	1	15	4,667
1.5	Ditch for collecting manure	50,000	1	7	7,143
1.6	Biogas pipe system	11,250	1	4	2,813
1.7	Valve, coupler	3,000	1	4	750
1.8	Sludge pump	34,000	1	4	8,500
2	**Fertilizer production system**	**640,000**			**48,333**
2.1	Manure extruder	500,000	1	20	25,000
2.2	Slicer of agricultural by-products	90,000	1	6	15,000
2.3	Manure turner (with conveyor belt)	50,000	1	6	8,333
3	**Power generation system**	**448,000**			**57,933**
3.1	Biogas meter	3,000	1	5	600
3.2	Biogas bag	20,000	1	5	4,000
3.3	Condenser, filter	50,000	1	5	10,000
3.4	Control panel	25,000	1	3	8,333
3.5	Power generator	350,000	1	10	35,000
	SUB-TOTAL A	**2,541,250**			**215,805**
B	**Cost of labor**				
1	Cost for civil works of biogas plant	542,750		15	36,183
2	Cost of installation and adjustment of power generator	50,000		4	12,500
	SUB-TOTAL b	**592,750**			**48,683**
	TOTAL (A+B)	**3,134,000**			**264,489**

APPENDIX 4

Table 1E : Estimation of production cost of demonstration

No.	Description	Unit	Quantity	Unit price (10^3VND)	Amount (10^3VND)
1	**Raw materials**				**150,000**
1.1	Main materials	VND/month	10	10,000	100,000
1.2	Auxiliary materials	VND/month	10	5,000	50,000
2	**Utilities (electricity, water)**	VND/month	10	2,000	**20,000**
3	Labor				**240,000**
3.1	Main labor	person/month	48	5,000	240,000
3.2	Supporting labor				
4	**Costs of sales** (packaging, printing, transportation, etc.)	VND/month	10	10,000	**100,000**
5	**Other costs**				**50,000**
	TOTAL:				**560,000**

F.2 DEMONSTRATION OF SHARED BIOGAS FOR ENERGY SUPPLY TO ONE CENTRALISED RESIDENTIAL CLUSER COMBINED WITH ORGANIC FERTILISER PRODUCTION

Prepared by Mrs. Thi Lan Huong

Case of one residential cluster in the plain of Tien Giang province

Introduction to the model

The common status of the pig farms is that if the whole quantity of manure is used for biogas production, then such amount of biogas shall be in excess of the farm's demand. Moreover, the farm also has to invest more to raise the capacity of the biogas plant. This is a waste of energy and can cause the secondary pollution. Therefore, the objective of the demonstration is to produce the biogas at the community level and try to promote the utilization of biogas amount produced via the supply of the biogas to the households who have the demand for biogas but do not involve in the livestock production. On the other hand, solid manure portion is also separated for organic fertilizer production in a sustainable manner, contributing to the higher income generation for the breeders and GHG emission reduction. Demonstration includes the following components: i) A biogas system of 1,000m3 and complete auxiliary system to ensure the effective treatment of the farm's waste, ii) A system of biogas distribution and supply to 20 – 30 hhs who live within a radius of 1.5 – 2 km from the farm, iii) A manure separation system with a capacity of 10 – 15 ton/hour for fertilizer production and surplus manure amount treatment in order to ensure the environmental hygiene and GHS emission reduction.

Total cost of model implementation is 3.858 billion VND, including both direct cost (for civil works and equipment) and indirect cost (for technical consultancy services). The demonstration is expected to produce high economic efficiency and its economic criteria are analyzed and assesses as follows:

1. Rationale of model development

At present, mode of household based livestock production toward bio-safety is being encouraged. The number of household based livestock producers is different from province to province; however, the area of household based livestock production has been planned, namely the household based livestock producers are often concentrated in some districts of province and in each district, these are concentrated in some communes.

As to the provinces in the midland and plain area, the households often lives in a centralized manner and the household based livestock producers still lies not so far from or scattered within the residential area. 100% of the residents in the area have the access to the national electricity grid; however, the quality of electricity source and frequency of power failure are different from locality to locality. Popular energy sources for cooking and production of the households are LGP, honeycomb coal briquette and firewood contributing to the higher GHG emission and deforestation.

The following are some problems about waste management in the household based livestock producers and environmental pollution from livestock waste:

- The quantity of manure from the household based livestock producers is not enough to produce the commercial fertilizer.

- If the whole manure quantity is loaded into the biogas plant for processing, the quantity of biogas generated is too big to use within the household and its production activities.

In view of the foregoing, the following methods are mapped out:

- The quantity of solid manure shall be separated in each household-based livestock producer to sell to the organic fertilizer producer. As such, the household based livestock producers shall have an additional income source from sale of solid manure. Separating the solid manure from the waste contributes to reducing the quantity of feedstock to the biogas plant. The biogas quantity produced shall

match with the demand for biogas of the households and no need to discharge the excess amount into the air, resulting in the green house effect.

- The quantity of remaining manure for loading onto the biogas plant shall be calculated based on the demand for biogas utilization. As such, the scale of biogas plant should be suitable so that the amount of biogas produced shall be used up, contributing to the environmental hygiene assurance and GHG emission reduction.

2. Objective of the demonstration

2.1. General objective

Enhancing the effective utilization of biogas energy source in order to ensure the environmental hygiene and contribute to GHG emission reduction.

2.2. Specific objective

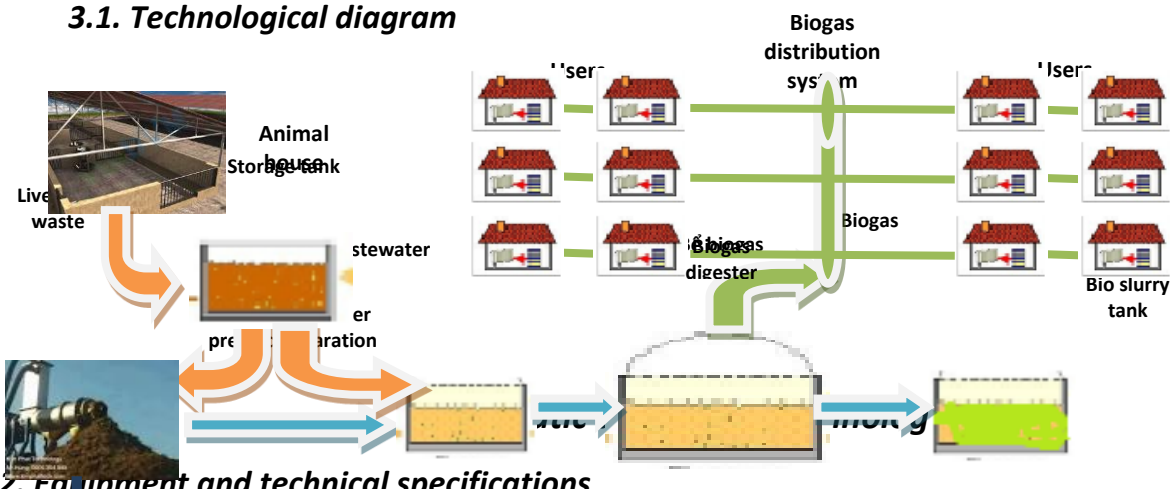
- Set up the biogas plant of suitable scale and supply the biogas to 20 – 30 hhs who live within a radius of 1.5 – 2 km from the farm.

- Set up one synchronous system of biogas distribution and supply for the residential cluster suiting to the demand and habit of the locality.

- Contribute to reducing the production costs and improving the investment opportunities of the breeders via the commercialization of the separated solid manure quantity and sale of biogas to the users in place of traditional fuels as well as contribute to the environmental protection, lower GHG emission and decreased deforestation.

3. Technological solution

3.1. Technological diagram



3.2. Equipment and technical specifications

Table 1 - Raw materials, equipment, technical specifications, types and requirement on quantity

	em	Material	Quantity	Life-span (years)
	r V=100m3	HDPE canvas (made in Thailand) – Thickness of 0.5mm for lining - Thickness of 1mm for covering	1,200m^2 2,200m^2	10
2	Manure collecting tank V = 10m^3	Built of brick	1	10
3	Feedstock and mixing tank V = 2m^3	Built of brick	1	10
4	Bio slurry lake 6m x 6m x 2m	Bottom and walls of lake lined with HDPE (made in Vietnam) of 0.3mm thick	200m^2	10

5	Ditch for collecting manure	Built of brick	1,000m	7
	Pipe for channeling the wastewater into the tanks	Tien Phong plastic, class 1, φ160mm	200m	4
6	Main biogas pipeline system	Tien Phong plastic, class 1, φ34mm	4,000m	3
	Biogas delivery system to the users	Tien Phong plastic, class 1, φ21mm	2,500m	3
7	Condenser, biogas filter	Locally made	1 set	3
8	Biogas meter	Q= 0.5-1m^3/h	30 pieces	3
9	Biogas force pump	Q=	1 unit	3
10	Biogas bag (V=2m^3)	LDPE canvas of Thai Land; with a thickness of 0.5mm	30 pieces	5
11	Valve and spare parts	Plastic valve, complete with biogas pipeline	100 sets	5
12	Manure separator	Separation capacity of 10 ton/hour, imported	1	15

4. Total investment and financial mechanism

			Project	Owner
A	Cost of equipment	1,482,700,000	707,500,000	775,200,000
B	Cost of labor	882,300,000		882,300,000
	Total (A+B)	*2,365,000,000*		
C	Cost of technical service	664,000,000	664,000,000	
	Total (A+B+C)	**3,029,000,000**	**1,371,500,000**	**1,657,500,000**

5. Benefit analysis of the demonstration

5.1. Economic benefit

a) Benefit from sale of solid manure to fertilizer producer

1	**Revenue from solid manure**	**1,400,000,000 VND**
	Selling price of solid manure	350,000 VND/ton
	Output of solid manure	4,000 ton/year
2	**Cost of production**	**1,070,475,000 VND**
	Depreciation of equipment	193,170,000
	Workers for construction & operation	882,300,000
3	**Income from sale of solid manure**	**1,143,160,000 VND**

The economic efficiency of the demonstration

Rate of return/sales turnover	23%
Rate of return/capital of owner	20%
Rate of return/total investment (including LCASP + counterpart)	14%

b) Benefit from the new energy source in place of traditional fuels

- Annual biogas yield: 120,000 m^3/year
- Income from sale of biogas from biogas plant: 75.6 million VND/year

c) Environmental benefit: a saving of 180 million VND/year (penalty for environmental pollution in case of violation).

d) Benefit for the community: not causing the pollution (bad odor), preventing the discharge of wastewater into the environment, utilizing the source of excess biogas helping reduce GHG effect.

6. The current consumption market

The provinces in the midland and plain areas are strong in the agricultural production; therefore, the demands of fertilizer for the crops such as staple crops, vegetables of various types, fruit trees, industrial crops and production forests are high. The demand for organic fertilizer in Tien Giang ranges from 1.5 to 2 million ton per year. Of which, the supply source from the fertilizer producers and local people can only meet 30 – 35% of total demand. In addition, the crops that are cultivated according to good agricultural practices are more and more highly appreciated; therefore, demand for organic fertilizer is also higher.

The shared biogas market is full of potential, especially the plain provinces such as Tien Giang where the centralized livestock production is popular and there is a increasing demand for shared biogas system for daily life in rural areas. Shared biogas demonstration both meets the requirement on waste treatment of the farm and helps deal with the surplus biogas amount via making a clean and civilized energy source available to the community.

Appendix A: Cost estimate of the equipment of demonstration

Description	Quantity	Unit price (VND)	Amount (VND)	Financial mechanism		
				Project	Rate	Owner
A. Cost of equipment			**1,482,700,000**	**707,500,000**	**48%**	**775,200,000**
System of biogas lake			**704,700,000**	**20,000,000**	**3%**	**684,700,000**
Covered HDPE lagoon (m^3)	1000	500,000	500,000,000	20,000,000	4%	480,000,000
Manure collecting tank ($10m^3$)	10	850,000	8,500,000	0		8,500,000
Feedstock and mixing tank (m^3)	2	850,000	1,700,000	0		1,700,000
Bio slurry lake (m^3)	700	150,000	105,000,000	0		105,000,000
Ditch for collecting manure (0,2m x 0,35m x 1,000m) (m^3)	70	850,000	59,500,000	0		59,500,000
Pipe for channeling the wastewater into the tanks, dy=m	200	150,000	30,000,000	0		30,000,000
Biogas distribution system			**266,000,000**	**175,500,000**	**66%**	**90,500,000**
Main biogas pipeline system, dy=m	4000	14,000	56,000,000	56,000,000	100%	0
Biogas delivery system to the users, dy=m	2500	8,000	20,000,000	0		20,000,000
Condenser, biogas filter	1	40,000,000	40,000,000	40,000,000		0
Biogas meter	30	1,500,000	45,000,000	27,000,000	60%	18,000,000
Biogas bag	30	3,500,000	105,000,000	52,500,000	50%	52,500,000
Biogas force pump	**1**	**3,000,000**	**3,000,000**	**3,000,000**	**100%**	**0**
Biogas valve (general valve, distribution valve & spare parts)	**36**	**250,000**	**9,000,000**	**9,000,000**	**100%**	**0**

Mobile liquid/solid waste separator	**1**	**500,000,000**	**500,000,000**	**500,000,000**	**100%**	**0**

Appendix B – Depreciation of equipment

Description	Quantity	Unit price (VND)	Amount (VND)	Depreciation	
				Time of depreciation (years)	Rate of depreciation (VND)
A. Cost of equipment			**1,482,700,000**		
1. System of biogas lake			**704,700,000**		
Covered HDPE lagoon (m^3)	1000	500,000	500,000,000	10	50,000,000
Manure collecting tank ($10m^3$)	10	850,000	8,500,000	10	850,000
Feedstock and mixing tank (m^3)	2	850,000	1,700,000	10	170,000
Bio slurry lake (m^3)	700	150,000	105,000,000	10	10,500,000
Ditch for collecting manure (0,2m x 0,35m x 1,000m) (m^3)	70	850,000	59,500,000	7	8,500,000
Pipe for channeling the wastewater into the tanks, dy=m	200	150,000	30,000,000	4	7,500,000
Sub-total 1					**77,520,000**

2. Biogas distribution system			**266,000,000**		
Main biogas pipeline system, dy=m	4000	14,000	56,000,000	3	18,666,667
Biogas delivery system to the users, dy=m	2500	8,000	20,000,000	3	6,666,667
Condenser, biogas filter	1	40,000,000	40,000,000	3	13,333,333
Biogas meter	30	1,500,000	45,000,000	3	15,000,000
Biogas bag	30	3,500,000	105,000,000	4	26,250,000
Sub-total 2					**79,916,667**
3. Biogas force pump	**1**	**3,000,000**	**3,000,000**	**5**	**600,000**
4. Biogas valve (general valve, distribution valve and spare parts)	**36**	**250,000**	**9,000,000**	**5**	**1,800,000**
5. Mobile liquid/solid waste separator	**1**	**500,000,000**	**500,000,000**	**15**	**33,333,333**
TOTAL COST OF EQUIPMENT DEPRECIATION					**193,170,000**

Appendix C – Cost of Labor

Unit: year

No.	Description	Quantity	Unit price	Amount	Financial mechanism	
					Project	Owner
B	**Cost of labor**			**670,000,000**	**0**	**670,000,000**
1	Labor for installation of biogas plant	7	50,000,000	350,000,000	0	350,000,000
2	Labor for earthworks (soil excavation and backfilling)	2	25,000,000	50,000,000	0	50,000,000
3	Labor for constructing storage tank, mixing tank, outlet tank and ditch for collecting the manure.	9	20,000,000	180,000,000	0	180,000,000
4	Labor for installing the pipeline system	9	10,000,000	90,000,000	0	90,000,000
C	**Cost of technical service**			**964,000,000**	**964,000,000**	
1	Technical expert	15	20,000,000	300,000,000	300,000,000	-
2	Technical design and construction	2	40,000,000	80,000,000	80,000,000	
3	Adjustment to shop drawing based on the actual conditions	7	12,000,000	84,000,000	84,000,000	
4	Training	1	200,000,000	200,000,000	200,000,000	-
5	Communication Information & dissemination	1	50,000,000	50,000,000	50,000,000	-
6	Workshop for commercial promotion	1	50,000,000	50,000,000	50,000,000	-

7	Review for replication	1	200,000,000	200,000,000	200,000,000	-
Total (A+B+C)				**3,858,200,000**	**2,017,500,000**	**1,840,700,000**

F.3 DEMONSTRATION OF UTILIZING DIGESTED EFFLUENT AS ORGANIC FERTILIZER SOURCE FOR AGRICULTURAL AND INDUSTRIAL CROPS

Prepared by Mr.Bui Van Chinh

Case of 2 – 3 communes with over 150 biogas plants and each participating household gets biogas plant of 8 – 12m3 constructed and has industrial and agricultural crop cultivation area of more than 500 m2 in Phu Tho

General information about the demonstration

Location:

Duration: 18 – 24 months

Technology: Applying the technology of aerobic treatment to the digested effluent; arranging utilization of the digested effluent of the community and each individual household to water the industrial and agricultural crops for the sake of reducing environmental pollution because a certain amount of nutrient still exists in the digested effluent, which shall replace the organic fertilizer, helping economize on the costs of the participating households.

Total investment cost:	**2,760,750,000 VND**	
Of which:		
Support of LCASP project:	**729,150,000 VND**	26.41%
Contribution (counterpart fund) of farm owner/hhs:	**2,031,600,000 VND**	73.59%

1. **Rational of the demonstration development**

- Livestock production sector of Phu Tho mountainous province has been developing with a total of 177,000 head of cattle and buffalos (ranked second in the midland and northern mountainous provinces), 815,800 head of pigs and 11,700,000 head of poultry (according to the statistical data in 2015). The quantity of livestock waste is estimated at 1.5 million ton per year in Phu Tho province. More than 20,000 small size biogas plants (8 – 10m3) were constructed. As such, it is estimated that the volume of digested effluent from biogas plants is significant (amounting to 1.46 million m^3 per year). However, almost all of this is being directly discharged into the environment, polluting the water sources.

Digested effluent from the biogas plant abounds in nutrients that are good for the crops. The content of nitrogen in the digested effluent ranges from 0.5 to 1.0 g/liter while that of P_2O_5 ranges between 0.1 and 0.36 g/liter (as per biogas program for livestock production sub-sector, 2011; Zheng, 2014). As such, the quantity of nutrient contained in 12 – 15m3 of digested effluent shall be equivalent to that of 1 ton of organic fertilizer.

2. **Quantity of farms and potential of replicating the demonstration in Phu Tho**

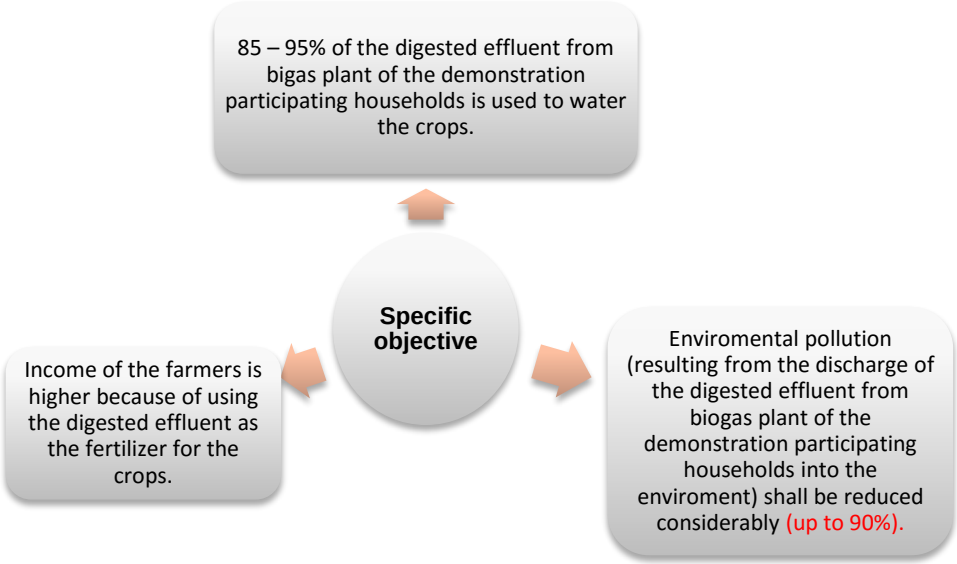
Total number of farming hhs of the whole province	114,400
Of which:	
The number of farming households from 6 to 9 head of pigs (or 3 – 4 head of cattle or buffalos)	12,000
The number of farming households from 10 to 49 head of pigs	16,500
The number of farming households from 100 to 1,000 head of pigs	> 113
The number of farming households of more than 1,000 head of pigs	> 11

Therefore, Phu Tho province has a lot of potential to replicate the demonstrations of the project.

3. Objective of the demonstration:

General objective of the model is to set up a demonstration of digested effluent effective utilization to water the fruit tree, tea plant and grass, contributing to the environmental pollution reduction and income improvement of the farmers (also for a potential replication to other areas of the same conditions).

Specific objective:



4. Technological solution

This sub-project shall help set up 2 demonstrations of digested effluent utilization: (i) set up the system of digested effluent utilization for the community and (ii) set up the system of digested effluent utilization system for the individual households.

4.1 Set up the system of digested effluent utilization for the community (1 group of households)

(a) 15 – 20 livestock households, who are voluntary to participate in the implementation of the demonstration, shall be selected. The land plots of these hhs (for cultivating industrial and agricultural crops) shall be located near to each other. Over 60% of them have the biogas plant constructed.

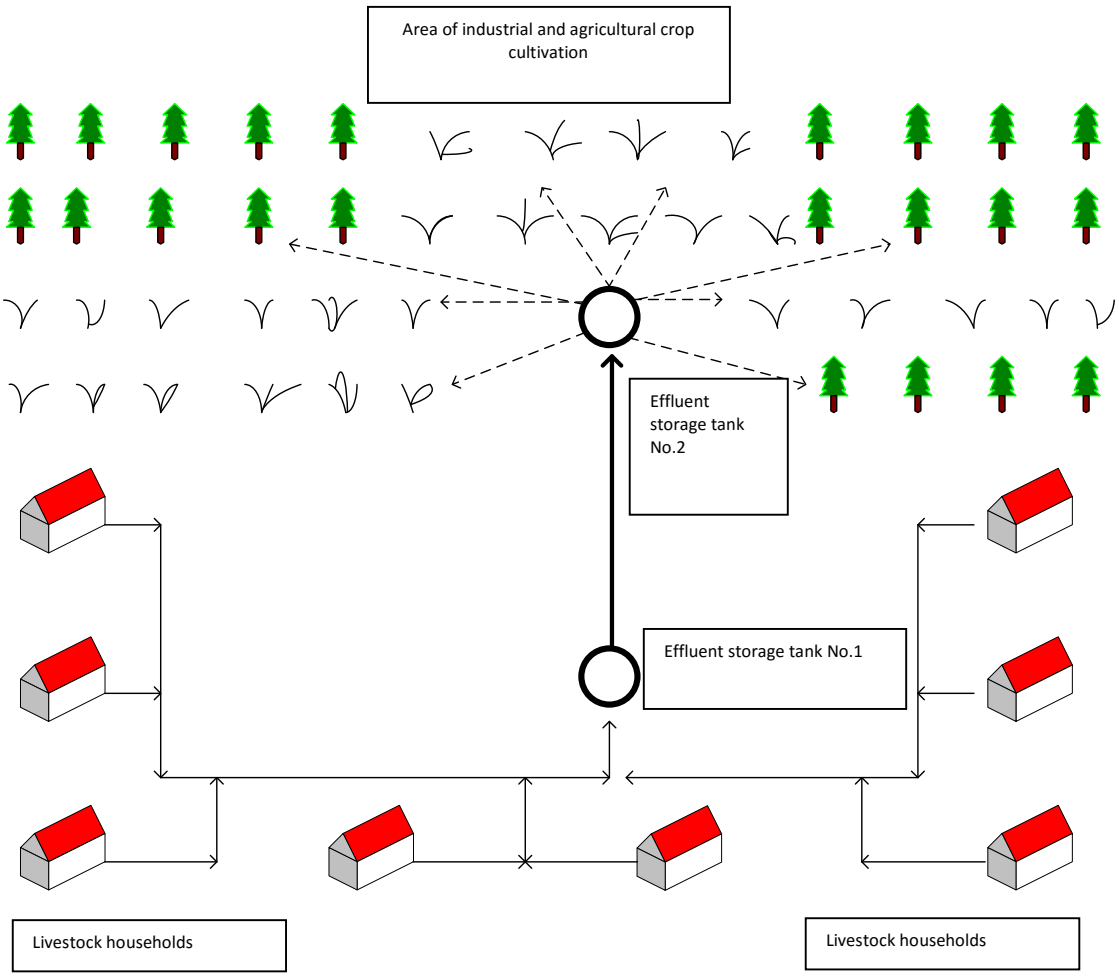
(b) 1 public digested effluent tank with a capacity of 15 – 20m3 shall be constructed within the residential area for aerobic treatment of digested effluent aiming at removing types of pathogenic anaerobic microbes. This tank is also the place of storing the digested effluent before being pumped to other tanks located in the areas of industrial and agricultural crop cultivation. The tank is equipped with a storm-water-proof cover but needs the air contact, to the maximum, to create the aerobic condition for the digested effluent treatment.

(c) For the households where the pipeline system cannot be set up for channeling the digested effluent to the public big tank, one more digested effluent tank with a volume of $2m^3$ (located next to biogas plant) shall be constructed. At the same time, one small pump with a capacity of 4 – 5m3/hour shall be set up for pumping the digested effluent to the public tank.

(d) 1 digested effluent tank with a volume of 15 – $20m^3$ shall be constructed within the area of industrial and agricultural crop cultivation. This tank shall be located at a high position so that the digested effluent can follow the gravity pipe to the areas of industrial and agricultural crop cultivation.

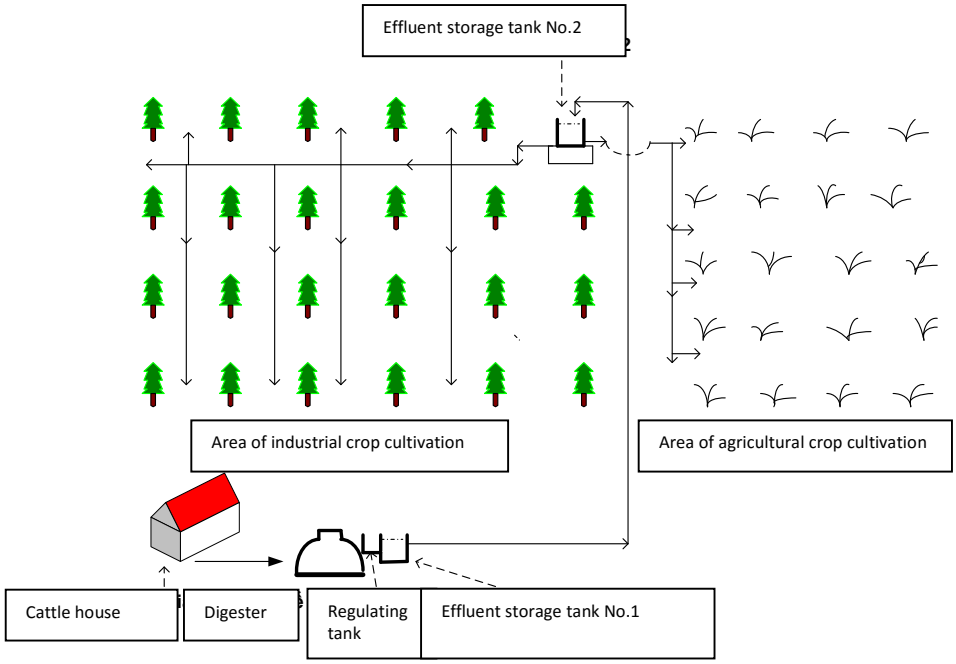
(e) The digested effluent delivery pipeline to the industrial and agricultural crop cultivation areas shall be installed to facilitate the watering of crops.
(g) The group of the households who participate in the demonstration implementation shall elect 1 leader and 1 vice leader who shall be responsible for system management and economic accounting (calculating the cost of operating the system, power consumption of the pump, cost of repair, etc.)
(h) The households shall pay the electricity and management costs based on the actual expenses and their cultivation area

Diagram 1: Digested effluent delivery system from biogas plant to cultivation area of industrial and agricultural crop for the community



4.2 Set up the system of digested effluent utilization for the individual households

Diagram 2: Digested effluent delivery system from biogas plant to cultivation area of industrial and agricultural crop of the individual households



(i) 15 – 20 livestock households, who are voluntary to participate in the implementation of the demonstration, shall be selected. Criteria of selecting these households are that they have the biogas plant constructed, have the land for cultivating industrial and agricultural crops and have the demand for utilizing the digested effluent in place of organic fertilizer.

(ii) Construct one more digested effluent storage tank (near regulating tank) with a volume of 2 m^3 for aerobic treatment of digested effluent and removal of types of pathogenic aerobic microbes

(iii) Install the pumping system to pump the digested effluent to the cultivation area of industrial and agricultural crops

(iv) Construct one storage tank of 2 m^3 in the crop cultivation area. This tank shall be located at a high position so that the digested effluent can follow the gravity pipe to the area of crop cultivation.

(v) Install the effluent delivery pipeline to facilitate the watering of the crops.

If, on average, each participating household possesses 500m^2 land for industrial and agricultural crop cultivation and each month they water the crops 6 times (4 liters of effluent each for 1m^2 land) for a duration of 9 months (not including 3 months with considerable rainfall); as such, each household shall use an effluent amount of 54m^3 (500m^2 x 2 liters x 6 times x 9 months) of effluent per year. This means that 40 participating households shall use 2,160m^3 of effluent (54m^3 x 40), equivalent to 144 ton of organic fertilizer. This implied they save an amount of 432,000,000 VND per year on the fertilizer (144 ton x 3 million VND/ton).

5. Equipment and technical specifications

Table 1 – Raw materials, equipment, technical specifications, types and requirement on quantity

No.	Item	Technical specification	Quantity
I	**Equipment, machinery, material facilities***		
1	Pump for pumping effluent from tank No.1 of the shared system to tank No.2 in crop cultivation area.	Specialized type (with a capacity of 8 - 10 m^3/hour)	1
2	Pump for pumping the effluent from the aerobic tanks of the farm households	Specialized type (with a capacity of 3 - 4 m^3/hour)	25 units
3	Tank for storing effluent of biogas digester	Built of brick and cement with a volume of 15 – 20 m^3, covered to prevent the storm-water	2 tanks
4	System for channeling effluent from households to the shared tank within the residential area	Plastic pipe with a minimum diameter of 110mm	600m
5	System of community effluent pumping pipeline	Pumping pipeline from storage tank No.1 to storage tank No.2 (type of Tien Phong branded plastic pile or C2 or equivalent) with a minimum diameter of 65mm	450m
6	System of effluent pumping pipeline for individual farm household model	Pumping pipeline from aerobic storage tank of the farm household to storage tank in crop cultivation area (type of Tien Phong branded plastic pile or C2 or equivalent) with a minimum diameter of 45mm	5,500m
7	System of effluent delivery pipeline to water the crops in shared model and individual farm household model	Delivery pipeline from storage tank to crop cultivation areas (type of Tien Phong branded plastic pipe or C2 or equivalent) with a minimum diameter of 27mm	4,500m
8	Types of valve	Solid plastic valve, suiting to the pipe of various kinds	1,250 pieces

6. Important equipment, requirements on guarantee and after-sale service

The important equipment for this demonstration is the water pump for emptying the biogas digester. The equipment supplier shall offer a guarantee period of at least 1 year and provide the technicians to guide the installation, operation and maintenance of the machines. They also have to commit to providing the spare parts for 5 years.

7. Tentative budget for implementing pilot/demonstration:

Table 2: Tentative budget for implementing demonstration

No.	Item	Amount (VND)	
		Project	**Owner**
A	**Cost of equipment and civil works**		
1	Pump for channeling digested effluent from tank No.1 to tank No.2 in the crop cultivation area (for the community system) (1 unit x 25,500,000 VND per unit)	25.500.000	

2	Pump for pumping digested effluent (small type) of each hhs (250 units x 2,400,000 VN per unit)	60.000.000	
3	Digested effluent storage tank for the community (2 tanks x 20,000,000 VND per tank)	40.000.000	
4	System for channeling effluent from households to the shared tank within the residential area (600 m x 65,000 VND per meter)	39.000.000	
5	System of community effluent pumping pipeline (450 m x 25,000 VND per meter)	11.250.000	
6	System of effluent pumping pipeline for individual farm household model (5500 m x 22,000 VND per meter)	121.000.000	
7	System of effluent delivery pipeline to water the crops in shared model and individual farm household model (4,500m x 9,200 VND/meter)	41.400.000	
8	Valve of various kinds (1,250 pieces x 34,500 VND per valve)	43.125.000	
	Sub-total (A)	**381.275.000**	
B	Cost of technical service		
7	Training, product promotion, sample analysis, etc.	150.000.000	
8	Expert (1person x 6 months x 20 million VND per month)	120.000.000	
	Sub-total (B)	**270.000.000**	
	Total (A+B)	**651.275.000**	
C	**Energy and manpower (for a duration of 1 year)**		
9	Electricity for pump each year (25 units x 1 hour/day x 2.5 Kw x 365 days/year x 1,500 VND/Kw x 2 years)		68.400.000
10	Electricity for community pump each year (1 unit x 4 hours/day x 8.5 Kw x 365 days/year x 1,500 VND/Kw x 2 years)		37.200.000
11	Manpower (40 hhs x 8 working days/month x 12 months x 200,000 VND/working day x 2 years)		1.536.000.000
20	Other expenses (contingency accounting for 5%)		**10.000.000**
21	Bank loan interest charge		100.000.000
	Sub-total (C) (raw materials, labor, etc.)		**1.075.167.000**
	Total counterpart fund		**925.800.000**
	Total project fund		**651.270.000**
	Grand total (project and counterpart)		**1.307.075.000**

8. Estimated economic efficiency of the mode (for a duration of 1 year)

Table 3: Estimated economic efficiency

Total production cost of one year, *of which:*	**1,075,496,167**
Equipment depreciation	*39,669,167*
Bank loan principal repayment	*110,000,000*
Cost of labor, electricity/water	*925,800,000*
Total turnover	**1,200,000,000**
Convert the effluent (which is used for watering crops) into organic fertilizer (144 ton x 3 million VND/ton)	*432,000,000*

Savings on labor (using the digested effluent pipeline system, instead of manpower and water like before, to water the crops)	*768,000,000*
Profit/year	**124,530,833**

Given the detailed financial data of the demonstration, the following is its investment efficiency:

Table 4: Analysis of economic efficiency

Investment efficiency analysis of the demonstration	
Rate of return/turnover	10.4%
Rate of return/total investment of demonstration (including direct cost of LCASP and owner)	10%
Rate of return/counterpart fund (owner)[22]	13%

9. Potential of digested effluent utilization in Phu Tho

Total annual crop cultivation area (rice, vegetable and subsidiary crops) of Phu Tho is 98,280 ha, including around 5,000 ha for growing fruit trees, 16,500 ha for growing tea plant and about 2,200 ha for growing grass (as per the statistical data in 2014). More than 20,000 small biogas plants (size of 8 – 10m^3) were constructed. It is estimated that the quantity of digested effluent from biogas plant reaches 1.46 million m3/year (equivalent to 108,000 ton of organic fertilizer) while Phu Tho province needs an estimated 2.5 million ton of organic fertilizer per year (for the crops).

Digested effluent from the biogas plant abounds in nutrients, which are good for the crops. The content of Nitrogen in the digested effluent ranges from 0.5 to 1.0 g/liter while that of P_2O_5 ranges between 0.1 and 0.36 g/liter (as per biogas program for livestock production sector, 2011; Zheng, 2014). Therefore, there is a high potential of using the digested effluent from the biogas plant to water the fruit trees, tea plants and grass in Phu Tho province.

[22] *Of which: cost of labor is paid according to demonstration*

10. Implementation schedule

Table 5: implementation schedule

No.	Description	2016										2017						
		T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T1	T2	T3	T4	T5	T6	
1	Development of method statement																	
2	Establishment of steering board, technical unit																	
3	Investigation and survey for household selection, bidding organization																	
4	Training and transfer of technology																	
5	Equipment procurement																	
6	Utilization of digested effluent for the crops																	
7	Preliminary wrap-up review																	
8	Final review																	
9	Workshop & dissemination for demonstration replication																	

F.4 DEMONSTRATION OF MODEL OF COLLECTING BIO SLURRY FROM BIOGAS PLANT & LIVESTOCK WASTE FROM FARM HOUSEHOLDS

Case of a cluster of 5 – 6 communes with 6,000 fattening pigs & 250 biogas plants in Bac Giang

(Prepared by Mr.Bui Van Chinh)

General information about the model:

Location: Bac Giang
Duration: 18 – 24 months
Technology: Arranging the collection of bio slurry and livestock waste from the small-scale livestock hhs (8 – 15 head of pigs) and applying the new technology of aerobic fermentation of livestock waste to the high quality organic fertilizer production.

Total investment cost:	**8,662,250,000 VND**	
Of which:		
Support of LCASP project:	**1,160,000,000 VND**	**13.39%**
Contribution (counterpart fund) of farm owner/hhs:	**7,502,250,000 VND**	**86.61%**

1. Rationale of model development

Livestock production sector of Bac Giang province has been developing with a total of more than 1.2 million head of pigs (ranked third in the whole country) and 16.5 million head of poultry. The quantity of livestock waste is estimated at 1,350,000 ton per year in Bac Giang province. The organic fertilizer source is very good for the agricultural crops but only around 55% of this is used for the crops. A considerable quantity of livestock waste is being discharged into the environment, polluting the water sources and increasing GHG emission.

According to the survey results (in 2015), Bac Giang had a total of 24,700 biogas plants with a volume of 8 – 12m^3, which can only treat around 12% of the livestock waste. In fact, the quantity of livestock at household scale normally increases thanks to the rising price of livestock products (meat, egg). However, the biogas plant volume is fixed and too small to the new livestock scale. Most farmers have the habit of discharging all livestock waste into the biogas plant, making biogas plant overloaded. For these reasons, the fully untreated waste is released from biogas plant into environment causing water source contamination. It is estimated that biogas plants in Bac Giang release annually 19,800 m^3 of slurry (the sediment is normally pumped out every 4 - 5 years).

There are 53,890 households with a livestock size of 10 – 20 head of pigs or 3 – 6 head of cattle, which is quite popular in Bac Giang province. These livestock households often lie scattered within the residential areas, polluting the air and water source. On the other hand, it is quite difficult to do the composing at household scale. Therefore, collection of livestock waste and bio slurry of biogas plant for organic fertilizer production shall contribute to the environmental protection and higher income of the farmers.

2. Quantity of farms and potential of replicating the model in Bac Giang

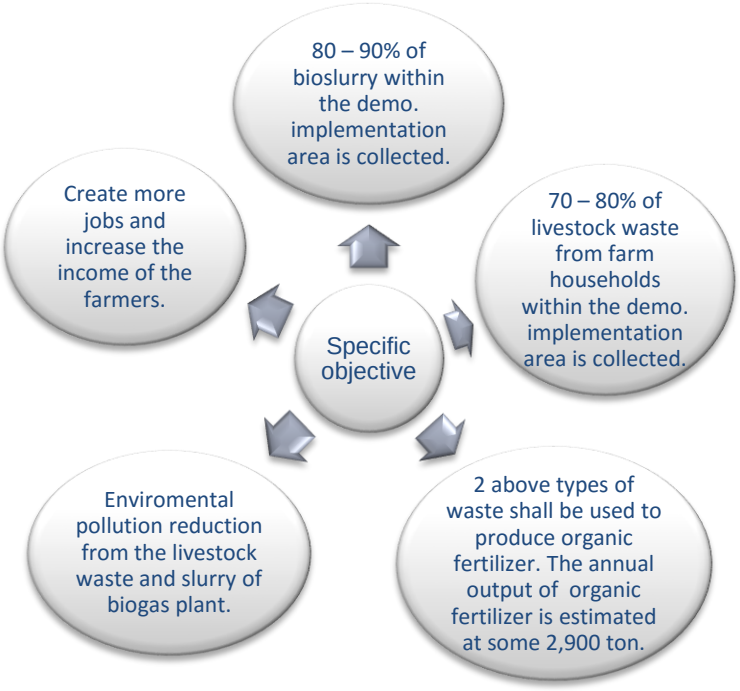
Size	No. of hhs
Total number of livestock hhs of the whole province	177,330
Of which:	
from 6 to 9 head of pigs (or 3 – 4 head of cattle)	35,500
from 10 to 20 head of pigs	18,400
from 21 to 99 head of pigs	5,670
more than 100 head of pigs	230

Therefore, Bac Giang province has a lot of potential to replicate the models of the project.

3. Objective of the demonstration:

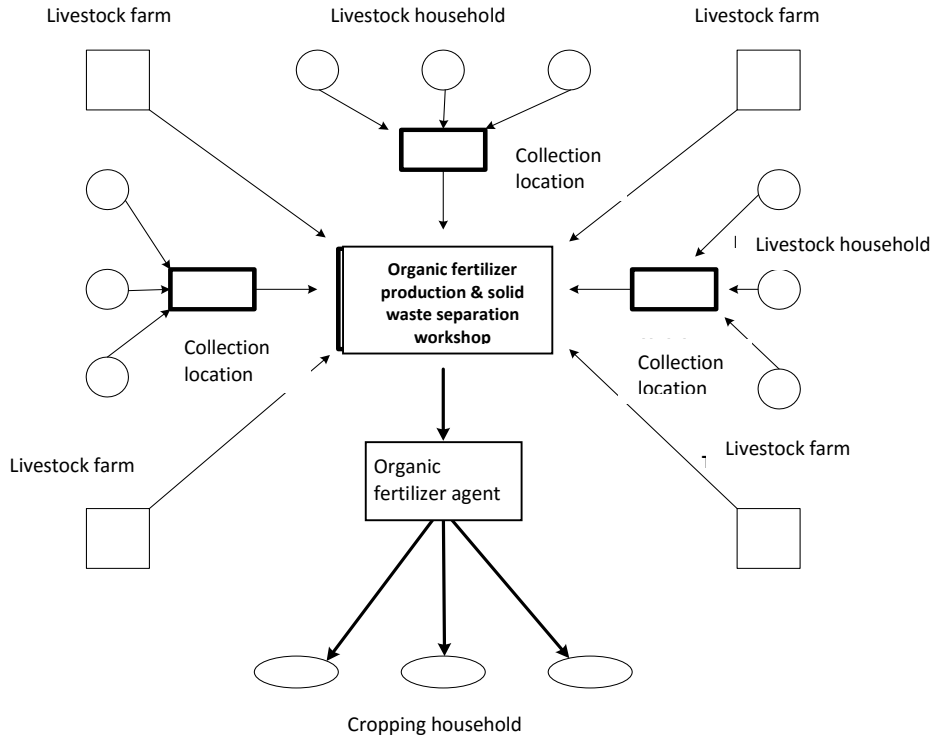
General objective of the model is to map out a solution to the collection and production organization of the quality organic fertilizer for the crops (for a potential replication to other areas of the same conditions).

Specific objective



6. Technological solution

Diagram of organizing the waste collection and separation for organic fertilizer production



(i) Organize the system of slurry collection from the biogas plant and livestock waste from the farm households in 5 – 6 adjacent communes (within the radius of around 15 – 18 km from organic fertilizer production area); set up 2 – 3 groups of slurry and livestock waste collection and map out the working regulation.

(ii) Separate the solid waste from the slurry using the clarifier; utilize the solid waste and livestock waste to produce organic fertilizer.

(iii) The remaining liquid matter (after the dry matter separation) shall be treated by aerobic pond and waste stabilization pond.

(iv) The method of aerobic fermentation shall be applied to the organic fertilizer production from the livestock waste and solid waste. The organic fertilizer shall meet the requirements on quality and hygienic standards as regulated by MARD.

(v) It is estimated that the quantity of slurry from the biogas plants is 750m^3 of slurry and the quantity of waste from the farm households is 2,200 ton each year. Therefore, the expected output of organic fertilizer is 3,200 ton/year.

(vi) Link with the organic fertilizer distributors to supply this fertilizer source to the consumer (the crop production household).

5. Equipment and technical specifications

Table 1 – Raw materials, equipment, technical specifications, types and requirement on quantity

No.	Item	Technical specification	Quantity	Remarks
I	**Equipment, machinery, material facilities***			
1	Mobile bio slurry suction pump	Specialized type (with a capacity of 10 - 5 m^3/hour)	2	
2	Waste tank (able to mount on the small truck)	4-5 m^3, as a separate unit with inlet and outlet	1	
3	Small truck	4-6 ton with the tipping system	2	
4	Rice straw slicer	Capacity of 2-2.5 ton/hour	1	
5	Crusher	Capacity of 3-4 ton/hour	1	
6	Compost turner	Capacity of 15-20 ton/hour	1	
7	Bascule balance	Type of 100 kg	1	
8	System of workshop and warehouse	Flat-roofed house with solid cement foundation and wide door for the truck of 5 – 6 ton to easily access	300 m^2	
9	System of liquid lakes	2 systems, each includes 2 connected tanks; total volume: 50 m^3	50m^3,	
10	Wastewater sewer system	Built of brick and cement, 250mm wide and 200mm deep with rain-proof cover	200m	
11	Wastewater stabilization pond	Pond with firm earth embankment, dimensions of 15m long, 4m wide and 2.5m deep	2 ponds x 150 m^3 = 300 m^3,	
12	Lighting system	For the workshop with a total area of 400 m^2,		

***** The warrantee of the equipment is as agreed between the purchaser and seller.

6. Important equipment, requirements on guarantee and after-sale service

The important equipment for this demonstration is the pump for emptying the biogas digester. The equipment supplier shall offer a guarantee period of at least 1 year and provide the technicians to guide the installation, operation and maintenance of the machines. They also have to commit to providing the spare parts for 5 years.

7. Tentative budget for implementing pilot/demonstration:

Table 2: tentative budget for implementing model

No.	Item	Amount (VND)	
		Project	Owner
A	**Cost of equipment**		

1	Mobile bio slurry suction pump (capacity of 10-15 m^3/hour) 2 x 50,000,000 VND	100,000,000	
2	Rice straw slicer, capacity of 2-2.5 ton/hour	150,000,000	
3	Crusher, capacity of 3-4 ton/hour	120,000,000	
4	Compost turner, capacity of 15-20 ton/hour	80,000,000	
5	Tank for containing the liquid, capacity of 4-5 m^3,	60,000,000	
6	Bascule balance, type of 100 kg		3,000,000
7	Small truck (5-6 ton) 2 x 290,000,000		580,000,000
8	Bagging equipment		30,000,000
	Total cost of equipment (sub-total A)	**510,000,000**	**613,000,000**
B	**Cost of construction, warehouse, workshop**		
9	System of liquid lake (50 m^3 x 1,500,000 VND)		75,000,000
10	System of workshop and warehouse (350 m^2 x 2,000,000 VND)		700,000,000
11	Wastewater sewer system (200m x 600,000 VND)		120,000,000
12	Wastewater stabilization pond (300 m^3 x 35,000 VND)		10,500,000
	Sub-total (B)		**905,500,000**
C	**Cost of technical service**		
	Training, product promotion, sample analysis, etc.	250,000,000	
	Expert (2 persons x 10 months x 20 million VND per month)	400,000,000	
	Sub-total (C)	**650,000,000**	
C	**Raw materials**		
15	Cost of feedstock (rice straw) for organic fertilizer production (2,300 ton/year x 400,000 VND/ton)		920,000,000
16	Livestock waste, 2,200 ton x 450,000 VND/ton)		990,000,000
17	Labor (14 persons x 5,000,000 VND/month x 24 months)		1,680,000,000
18	Petroleum		590,000,000
19	Electricity		385,000,000
20	Cost of packaging (printing) (3,200 ton x 250,000)		800,000,000
21	Other costs (contingency: 5% of production cost)		238,750,000
22	Bank loan interest charge		380,000,000
	Sub-total D		**5,983,750.000**
	Total counterpart fund		**7,502,250,000**
	Total project fund		**1,160,000,000**
	Grand total (project and counterpart)		**8,662,250,000**

Economic efficiency of the model (based on the profit gained):

Table 3: Estimation of income (balance sheet – for a period of 1 year):

No.	Item	Unit	Quantity	Price	Amount (thousand VND)
A	**Revenue : organic fertilizer**	Ton	1600	2,300,000	3,680,000,000

	Earning from suction pumping of bio slurry	Unit	125	250,000	31,250,000
	Total revenue				**3,711,250,000**
B	**Cost for production cycle/year**				
1	Cost of depreciation (results taken from table 2)				338,000,000
2	Raw materials, labor, bank loan interest charge				2,991,880,000
	Total cost				**3,329,880,000**
C	**INCOME before tax**				**381,370,000**
	Deducting tax and other charges (If any)				
D	**Net income (production cycle/year)**				**381,370,000**

Table 4: Economic efficiency analysis of the model

Economic efficiency	**Rate (%)**
Rate of return/investment capital	11.45%
Rate of return/sales turnover	10.28%

8. Potential of organic fertilizer consumption in Bac Giang province

Bac Giang has a total rice cultivation area of 155,000 ha, area of vegetable and subsidiary crop cultivation of 33,900ha, area of fruit tree cultivation of 33,500 ha (according to the statistical data in 2014). If an average of 20 ton of organic fertilizer is needed for each crop cultivation hectare (ha), the demand for organic fertilizer in Bac Giang is around 4.3 million ton per year. As such, the quantity of organic fertilizer, which is processed from the livestock waste of the province, can just only meet 40% of its demand for the crops in Bac Giang. In addition, in Bac Giang province, there is only one organic fertilizer producer with an annual productivity of 1,500 ton/year. If the organic fertilizer (from the livestock waste) is produced within the province, this shall help reduce the cost of transportation and therefore can compete with other kinds of organic fertilizer that are transported from other provinces. As such, the potential of organic fertilizer consumption market is still huge.

9. Model implementation schedule

Table 5: Model implementation schedule

		2016	**2017**

No.	Activity	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Activity 1**: Formation of collection groups of bio slurry and livestock waste								
	Investigate and select suitable households								
	Set up working regulation								
	Form collection groups								
2	**Activity 2**: organization of bio slurry and livestock waste collection								
	Site preparation and infrastructure								
	Preparation of collection equipment								
	Organization of collection								
3	**Activity 3**: Separation of waste and waste treatment after separation								
	Building warehouse/workshop, procurement and installation of waste separation equipment								
	Guide and transfer waste separation and treatment								
	Construction of stabilization lake to treat liquid waste after separation								
	Analyze and test the product after separation								
4	**Activity 4**: Using separated solid waste and livestock waste to produce organic fertilizer								
5	**Activity 6**: Training and communication information								
	Construction and broadcast programs on mass media (radio and television)								
	Construction, printing and publishing technical documents and leaflets								
	Building DVD on model activity								
	Training on method of waste collection and treatment								
	Training in techniques of organic fertilizer production from solid waste and new organic fertilizer utilization for crops								
6	**Activity 7**: Commercialization of products								
	Introduce and promote products								
	Signing contracts with partners								
7	**Activity 8**: Model management and implementation								
	Inception workshop								
	Field farmer workshop on experience exchange on organizing activities								
	Review workshop								

F.5 MODEL OF PIG FARMING WASTE TREATMENT (VIA SEPARATING SOLID WASTE FROM SLURRY) FOR ORGANIC FERTILIZER PRODUCTION

Prepared by Mr.Bui Van Chinh

Case of a farm with 2,000 head of fattening pigs in Ha Tinh

General information about the model:

Location:
Duration: 18 – 24 months
Technology: the new and modern technology applied, separator of solid waste from the livestock waste with low dry matter content (2 – 3%) used, the solid waste with the dry matter content of 30 – 35% collected. In addition, the new technology for composting solid waste with crop by-products applied to produce high quality organic fertilizer.

Total investment cost:	**4,629,500,000 VND**	
Of which:		
Support of LCASP project:	**1,165,000,000 VND**	**25.17%**
Contribution (counterpart fund) of farm owner/hhs:	**3,464,500,000 VND**	**74.83%**

1. **Rational of the model development**

According to the statistical data in 2015, Ha Tinh has a total of 473,000 head of pigs and 204,000 head of cattle. Amount of livestock waste is estimated at 1.3 million ton per year. 60% of this has not been managed properly, namely, the untreated fresh manure is often applied directly to the crops, causing the environmental pollution and spread of the infectious diseases to the animals and human.

Ha Tinh has a hot climatic condition, especially in summer when the temperature can reach 39-43^{0}C; therefore, the fattening pig farms (with a size of 500 head of pigs) often apply the kind of enclosed pig house (equipped with a cooling system) with a water container to receive the manure and urine. All of the livestock waste is mixed together in the form of slurry, causing the difficulty to the solid waste collection. In view of the forgoing, the solution of using screw press separator for separating solid waste is highly efficient.

Post-separation solid waste shall be used to produce organic fertilizer, contributing to raising the income of the farmers and making the rural environment cleaner.

Quantity of farms and potential of replicating the model in Ha Tinh

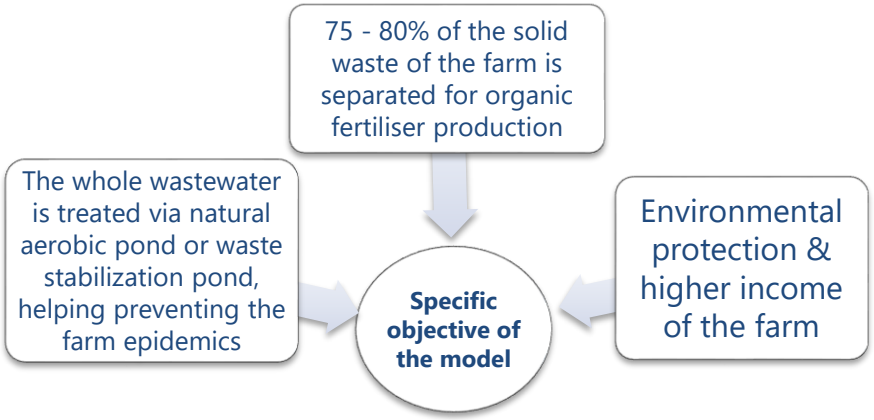
Size	No. of hhs
Total number of pig farming hhs, of which	88,980
6 - 9 head	5,100
10 - 49 head	4,860
Over 1,000 head	100
Total number of cattle raising hhs (over 5 head of cattle)	805
Total number of poultry keeping hhs (5,000 head of poultry)	15

In view of the foregoing, it can be assured that the potential of replicating the project's model is quite high in Ha Tinh province.

2. Objective

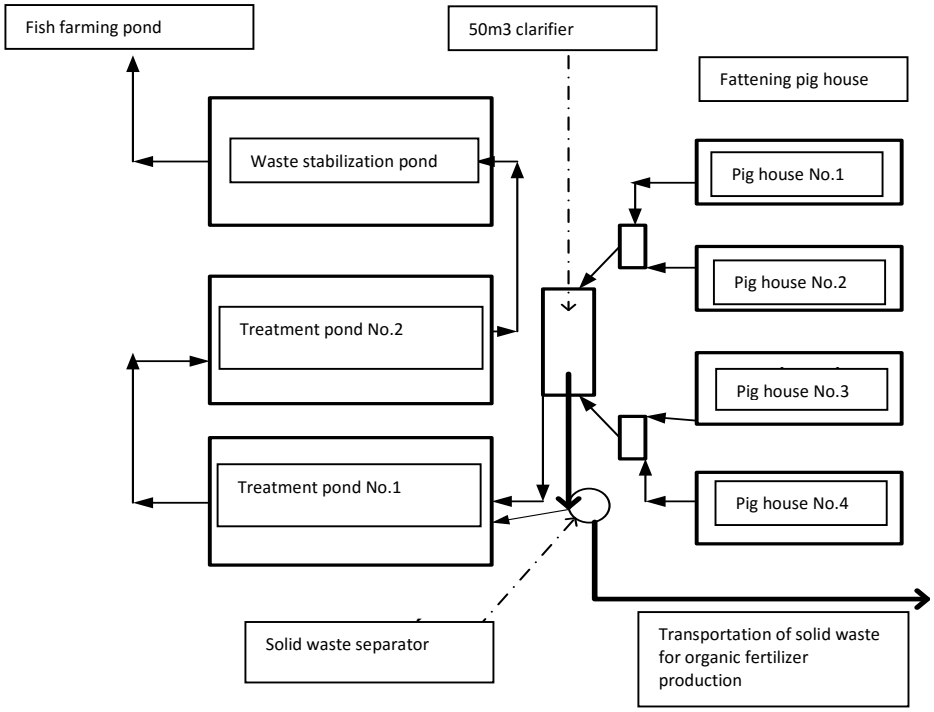
General objective of the model is to map out one effective waste management solution for the sake of producing the high quality organic fertilizer for the crops (for a potential replication to the farms of the same conditions).

Specific objective:



3. Technological solution

Diagram of livestock waste treatment technology of fattening pig farm (2,000 head of pigs)



- Renovate and renew a centralized wastewater collection system to one clarifier with a volume of 50m^3. In the clarifier, the solid waste shall be settled down while a part of liquid matter shall flow to the waste stabilization ponds.
- Apply the advanced technology to separating the solid waste from slurry with a low dry matter content of 2 – 3% (using the solid waste screw- press- separator). The solid waste which settled down in the clarifier shall be pumped into screw press separator (for solid waste separation) on a daily basis (this machine shall work 4 – 5 hours/day)
- Tentatively, 70 – 80% of the solid waste shall be recovered; as such, 1.3 ton of solid waste shall be recovered each day (content of dry matter is 30%) and 400 ton of solid waste shall be recovered each year for organic fertilizer production.
- Form the cooperation relationship between the livestock farm and an organic fertilizer production facility or one establishment of the similar condition to apply the advanced technical solutions to the organic fertilizer production. As estimated, 600 ton of good quality organic fertilizer shall be produced each year.

Wastewater from the livestock and after separating the dry matter shall be treated in the clarifier and waste stabilization pond before flowing to fish farming pond. 22,000 m^3 of wastewater from the farms shall be treated each year. **Equipment and technical specifications**

Table 1 – Materials, equipment, technical specifications, types and requirement on quantity

No.	Item	Technical specification	Quantity
1	***System of collection, dry matter separation and wastewater treatment***		
1.1	System of wastewater collection sewer	Constructed by brick, cement; covered for preventing the storm-water	300 m
1.2	Clarifier (for collecting the settled portion of the waste)	Built of brick with a volume of 50m^3, covered for preventing the storm-water	1
1.3	2 Natural aerobic treatment ponds for treating the remaining organic matter and removing the germs.	Earth embankment to prevent erosion (volume of 1,300m3 per pond, the pond's depth of 3 – 3.5m)	2
1.4	Waste stabilization pond (for treating the remaining organic matter)	Earth embankment, water-fern /aquatic plant floating (650m^2, 2m deep, 1,300m^3)	1
1.5	Sewage sludge pump (dedicated lift and force type)	Capacity of 15-20m^3/h, high head, with automatic shut-off	1
1.6	Dry matter separator (for collecting solid waste)[23]	Imported, capacity of 10-15m^3/h	1
1.7	House for keeping dry matter separator (including the machine platform, system of transporting the wastewater to the treatment pond, etc.)	The house is built high and on a solid cement foundation, allowing the access of the truck for loading the waste	170 m^2
1.8	Repair the access road for transporting solid waste from the farm	Compact to prevent settlement, cover with gravel, install the drainage system, etc.	250 m
2	***Organic fertilizer production system***		
2.1	Truck for transporting solid waste	4-5 ton with the automatic tip system	1
2.2	Slicer of rice straw/other by-products (rice straw slicing for composting with solid waste)	1 phase engine, 3kW Slicing capacity: 0.5-1 ton/hour, length: 2-5 cm	1
2.3	Manure turner when composting (to create an aerobic environment for microorganism)	- Capacity: 15-20 ton/hour - Wheeled and mobile	1
2.4	Bagging equipment	- Capacity of 500 kg/h	1
2.5	Construction of organic fertilizer production workshop and warehouse	- The house is built high and on a solid cement foundation, allowing the access of the truck for loading the waste	350 m^2
2.6	Repair of existing workshop for organic fertilizer production	- The workshop's foundation is heightened using solid cement, allowing the access of the truck for loading the waste	320m^2

4. Important equipment, requirements on guarantee and after-sale service

The important equipment is screw press separator (for dry matter separation) which has just recently been popular in Vietnam. The dry matter separator and attached accessories should be procured from the prestigious/well-known foreign companies. The equipment supplier shall offer a guarantee period of at least

[23] Equipment guarantee:

1 year and provide the technicians to guide the installation, operation and maintenance of the machines. They also have to commit to providing the spare parts for 10 years.

5. Potential of organic fertilizer consumption in Ha Tinh province

Ha Tinh is an agricultural province with total rice cultivation area of 98,000ha, groundnuts- 18,000ha, fruit trees - 3,000ha and rubber trees of 19,700 ha. If an average of 20 ton of organic fertilizer is needed for each crop cultivation hectare (ha), the demand of fertilizer for industrial crops in Ha Tinh is around 2.8 million ton per year. As such, the quantity of organic fertilizer, which is processed from the whole livestock waste (cattle and poultry) of the province, can just only meet 50% of its demand for the crops in Ha Tinh. Moreover, the price of organic fertilizer is 9 – 10 times higher than that of fresh manure (untreated waste). In addition, in Ha Tinh province, there is only one organic fertilizer producer (from municipal waste) with an annual productivity of 6,000 ton/year. If the organic fertilizer (from the livestock waste) is produced within the province, this shall help reduce the cost of transportation and therefore can compete with other kinds of organic fertilizer, which are transported from other provinces. As such the potential of organic fertilizer consumption market is still huge.

6. Total initial investment, financial mechanism and tentative income from the model:

Table 2 – Total cost estimate and supporting mechanism

No.	Item	Amount ($x10^3$VND)	Supporting mechanism	
			Project	Owner
A	**Cost of equipment**			
1	Clarifier (50 m^3)	75,000	75,000	
2	Manure separator (including the spare parts such as dedicated pump and agitator)	520,000	520,000	
3	Rice straw slicer	90,000	90,000	
4	Manure turner	60,000	60,000	
5	Bagging equipment	30,000	30,000	
6	Small truck (5-6 ton)	290,000		290,000
	Sub-total (A)	**1,065,000**	**775,000**	**290,000**
B	**Cost of technical service**			
7	Training, product promotion, sample analysis, etc.	150,000	150,000	
8	Expert (2 persons x 6 months x 20 million VND per month)	240,000	240,000	
	Sub-total (B)	**390,000**	**390,000**	
	Total (A + B) (of project)	**1,455,000**	**1,165,000**	
C	**Investment of infrastructure & workshop (counterpart fund)**			

9	House for keeping dry matter separator24	340,000		340,000
10	System of wastewater collection sewer (300m x 600,000)	180,000		180,000
11	Repair the access road for transporting solid waste from the farm: 250m x 1,600,000	400,000		400.000
12	Repair of workshop for organic fertilizer production and warehouse: 320m x 1,000,000	320,000		320,000
13	(New) construction of workshop and warehouse: 350 m x 2,000,000	700,000		700,000
13	Aerobic treatment pond (2 ponds): 1,300 m3 x 37,500 x 2	98,000		98,000
14	Waste stabilization pond: 1,300 m3 x 47,500	49,000		49,000
	Total construction investment (workshop, treatment pond, etc.)	**2,087,000**		**2,087,000**
D	**Raw materials (counterpart fund)**			
15	Cost of auxiliary feedstock (rice straw, sawdust,etc.) for organic fertilizer production (400 ton/year x 300,000 VND/ton)	120,000		120,000
16	Solid waste (separated) 400 ton x 400,000 VND/ton)	160,000		160,000
17	Labor (4 persons x 5,000,000 VND/month x 12 months)	240,000		240,000
18	Petroleum	80,000		80,000
19	Electricity	75,000		75,000
20	Other costs	100,000		100,000
21	Loan interest charge	312,500		312,500
	Sub-total D (raw materials, labor, etc.)	**1,087,500**		**1,087,500**
	Total counterpart fund			**3,464,500**
	Total project fund			**1,165,000**
	Total investment (project & counterpart fund)			**4,629,500**

[24] including the machine platform, area of solid waste storage, system of transporting the wastewater to the treatment pond, etc.): 170m2 x 2,000,000 VND/m^2

Table 3: initial investment, financial mechanism and tentative income

Description	Amount (VND)
A- initial investment of the model/financial mechanism as detailed below:	4,629,500,000
1)- Fund from the project:	1,165,000,000
Machine, equipment (direct support)	1,065,000,000
Services and technical support (indirect support)	390,000,000
2)- Counterpart fund/contribution of owner (of which the *loan accounting for 9% of the self-financing fund of owner*), including:	3,464,500,000
Infrastructure, workshop	2,087,000,000
Initial investment cost (minimum) of model[25]	3,152,000
B- Direct production costs *(raw material, asset depreciation, labor, electricity, water, bank loan repayments, etc.)*	1,087,500,000
C-Total turnover *(600 ton/year x 3,000,000 VND/ton)*	1,800,000,000
D- Income (annual) from the model:	187,200,000
Income (from the model) per quarter	46,800,000

PPMU shall support the farm to connect with an organic fertilizer producer for using the solid waste (the benefits of the parties shall be discussed and specified in the contract)

9. Estimated economic efficiency of the model (for a duration of 1 year)

Total expenses (depreciation, labor, material, loan interest charge, etc.): 1,270,550,000 VND
Total income (600 ton x 3,000,000): 1,800,000,000 VND
Net income 529,450,000 VND

Rate of return/model product sale turnover:	29%
Rate of return/investment of the owner/enterprise:	15.3%
Rate of return/total investment (owner + LCASP)	11.4%

10. Model implementation schedule

No.	Activity	2016				2017			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Activity No.1**:								
	Model survey and design								
	Prepare the bidding document								

[25] ***Note:*** Initial investment cost of the model should only cover the first production period because after that, earning from the sale of the model products (in cash) shall be added to the working capital (production capital)

	Organization of bidding, signing of the contracts								
2	**Activity No.2**:								
	Site preparation and material facilities								
	Workshop construction, procurement and installation of waste separation equipment								
	Guide on and transfer of waste separation and treatment								
	Construction of aerobic pond, waste stabilization pond to treat liquid waste after separation								
	Analyze and test the product after separation								
3	**Activity No.3**:								
	Using separated solid waste to produce organic fertilizers								
4	**Activity No.4**:								
	Training and communication information								
	Construction, printing and publishing technical documents and leaflets								
5	**Activity No.5**: Model management & implementation								
	Inception workshop								
	FFS (farmer field school) for exchanging the experience in the organization of activities								
	Review workshop on the model								

F.6 DEMONSTRATION OF MODEL OF UTILIZING ORGANIC MANURE FOR RED WORM RAISING (Case of Binh Dinh)

Executive Summary

The model include 3 main components: i)utilizing cattle dung for red worm raising to produce the high quality organic fertilizer; ii) utilizing the by-products from the red-worm raising as the bio-organic fertilizer; iii) utilizing the red worm as the additional feed for the chicken.

The model is implemented at either an agricultural cooperative with a size of 30 red worm raising households on an area of 1,500m2 (50m^2/hhs) or a farm of equivalent size (1,500m^2); rice cultivation on an area of 10ha according to VietGAP standard (or 5ha of vegetables), raising of 1,600 head of fattening chickens using the red worm as the additional feed. Total investment of the model is 1,232 million VND. Of which, an amount of 450 million VND as the cost of purchasing the machines, breed of red worm and other technical services such as consultancy, training, workshop, information dissemination and communication shall be invested by the project and the rest is the contribution of the farm owner (1,333 million VND, accounting for 63% of the total investment).

The model is expected to produce high economic efficiency with two key products of red worm meat and its manure. With an area of red worm raising of 1,500m^2, 240 ton of cattle dung shall be treated and 60 ton of red worm manure shall be produced to implement the intensive farming model of high quality crops. In addition, an amount of 9.6 ton of commercial red worm, which is used as the additional feed of 1,600 head of fattening chickens, shall bring about the economic efficiency to the breeders.

The expected model implementation duration is 18 months, starting from the third quarter of 2016.

Part 1. CONTENT OF THE MODEL

1.1. Title of the model *(Sub-Category):* Utilizing cattle dung and bio-slurry for red worm raising (*Perionyx excavatus)* in Binh Dinh

1.2. Objectives of the model:

i) Establish the model of utilizing the cattle dung as the feed for red worm raising on an area of 1,500m^2.

ii) Set up the model of utilizing the red worm manure for the intensive cultivation of 10 ha of high quality rice or 5 ha of vegetables according to VietGAP standard

iii) Set up the model of utilizing red worm as the additional feed for raising 1,600 head of chickens.

iv) Provide the training for the farmers and extension staff on the techniques of red worm raising, organic fertilizer production and processing of red worm into the additional feed for the livestock farming.

1.3. Rationale *(*problem statement in relation to project targets and environmental issues)

Animal husbandry sector of Binh Dinh province has been developing, especially the cow raising with 266,031 head of cattle (until 1 October 2015). As planned, by 2020, Binh Dinh province shall have 320,000 head of cattle (rate of crossbred cattle is 90%), raising the cattle production output to around 25% of total production output of animal husbandry sub-sector. In addition, Binh Dinh province is also home to one million head of pigs and 5.5 million head of chickens[26].

The more the livestock sector develops, the heavier the environmental pollution is. In addition, the livestock waste treatment is more pressing. On average, 1 cow produces around 10 kg of manure, 1 pig around 2.5kg of manure/day[27]; therefore, the above amount of livestock and poultry in Binh Dinh will produce around 1 million ton of cattle dung and over 900,000 tons of pig manure. The majority of cattle dung is mainly dried for selling to the coffee planters in the Central Highlands and the remainder is composted for application to the

[26] Binh Dinh Statistics Department, 2015

[27] Proceedings of 10 years of the Vietnam Livestock Sector, 2015

crops within the area. The processing of pig manure to produce the biogas is currently the most common method (14,046 biogas plants have been constructed). However, the utilization of biogas slurry has not been promoted yet.

The latest study revealed that the cattle dung and biogas slurry can be the good feedstock to the red worm raising. The products of this model are diversified: i) Fresh red worm can be used directly for the poultry raising and aquaculture; ii) Red worm is processed into the feed of the cattle; iii) Juice extracted from the red worm can be used as the foliar feed and iv) the red worm manure is a kind of bio-organic fertilizer of highly decomposed and nutrient-rich characteristic.

In terms of nutrition: The grown-up red worm is often 10 – 15 cm long with a dry matter rate of 15 – 20%. The content of the substances (based on the amount of dry matter): protein (68 – 70%), lipid (7 – 8%), sugar (12 – 14%) and ash (11 – 12%). The raw protein content of the red worm is equivalent to that of fishmeal. The red worm meat contains 12 types of amino acids, abounds in necessary vitamins, mineral substances for the cattle, poultry and aquatic products[28]. Especially, the red worm itself contains various kinds of natural growth hormone, which cannot be found in fishmeal. The cattle feed, which was mixed with the red worm powder, are attractive to the livestock because of having no the fishy and burnt smell (like that of fish and fish oil).

Besides the main products such as meat and juice of the red worm, another product from the red worm raising is its manure, a type of high quality organic fertilizer. The main composition of the red worm manure is as shown in the following table:

Table 1: Composition of red worm manure (based on the dry matter content)

No.	Parameter	Unit	Farmyard manure	Red worm manure
1	pH	-	7.80	6.80
2	EC	mmhos/cm	3.60	11.70
3	Nts	%	0.80	1.94
4	NO_3^-	Ppm	156.5	902.2
5	P2O5	%	0.35	0.47
6	K2O	%	0.48	0.70
7	CaO	%	2.27	4.40
8	MgO	%	0.57	0.46
9	Fe	Ppm	11,690	7,563
10	ZnO	Ppm	128	278
11	CuO	Ppm	17	27
12	B	Ppm	25	34

Source: http://trongraulamvuon.com/kinh-nghiem-lam-vuon/5-yeu-to-giup-phan-biet-phan-trun-que-cao-cap/

As such, the content of nutrients of the red worm manure is higher than that of compost because it is "treated" by the red worm. This type of manure is quite suitable for the kinds of vegetables, fruit trees and industrial crops, which are cultivated organically, or according to VietGAP standard. Besides the micronutrients, median nutrients and macronutrients, as revealed by some studies, the red worm manure also contains some useful microorganisms and auxin (IAA, IBA). The red worm manure can be dried under the sun for immediate use or packing.

In view of the foregoing, LCASP proposes the implementation of model "utilizing the cattle dung and biogas slurry for red worm raising to produce the bio-organic fertilizer and additional livestock feed in Binh Dinh" for the sake of environmental pollution reduction, value enhancement of livestock waste and contribution to the sustainably agricultural production.

[28] National Institute of Animal Sciences, 2003

1.4. Technical Feasibility

Technology of utilizing the cattle dung and biogas slurry[29] for red worm raising as the additional feed for the livestock and fertilizer production is developed from the research results of the test topics/models and some of which were implemented right in Binh Dinh province.

Process of red worm raising: the cattle dung is the main feedstock to this model, including the following steps: i)Prepare the breeding facilities and covering materials; ii)Prepare the substrate/cattle dung and treat (compost); iii) Spread the substrate onto the beds; iv) Prepare the red worm breed and spread them onto the beds (20kg/m^2); v)Tend and feed red worm and spray water to maintain the soil moisture; vi) Harvest.

The most important step of red worm raising process is the selection of breed. The fact is that it is difficult for the red worm to recover after being separated from their living environment for a long time. Therefore, as for the breed of red worm, which is to be bought from a far place, shall be in the form of biomass, namely including mother/father red worm, young red worm, egg and cocoon. With this biomass, red worm can adapt to the new environment quickly. The mother/farther red worm shall continue produce young while the young red worm shall grow up and the egg shall continue hatch.

Normally, each day the red worm consumes an amount of feed equivalent to their body weight. Therefore, we can spread from 20 to 30 kg of biomass per m^2 of breeding facilities.

The first harvest often takes longer than the succeeding ones (about 2 months) because the fresh-bought red worms need some time to adapt themselves and recover. The subsequent harvest shall be shorter (around 1 month). As such, an average of 8 liters of red worm can be harvested each year, subject to the care regime of the owner.

In order to ensure the economic efficiency of the model, at the beginning, only one fourth of total expected breeding red worm amount is needed. For the first multiplication period, because the biomass is still low, half of existing biomass area shall be moved to the other breeding area while the remaining half shall be evenly re-distributed.

Model of cement breeding facilities (split into many cells) with the thatched roof often produces a higher output than that of canvas covered and lined breeding facilities. To economize on the costs, instead of only using the cattle dung (as the feed for the red worm), the farmers can make use of other suitable inputs such as rice straw, vegetables, fruit peel or any degradable materials. Red worm shall be fed with both the cattle dung and litter (the cattle dung layer shall be spread onto the surface of the litter layer) once per week. This method shall help improve the economic efficiency and quicken the litter decomposition.

In order to get the red worm manure with the good quality, it takes at least 3 months (preferably 4 – 6 months) so that 100% of raw organic substance is decomposed. 1 ha of rice needs from 2 to 3 ton of red worm manure.

With the red worm meat as feed for safe chicken raising: the chicken's feed ration shall be added with 10% of fresh red worm meat or 2% of dried red worm meat.

In summary, model of "utilizing cattle dung and biogas slurry for red worm raising" have the advantages of simple technology, small investment amount and being easy to apply. The supply of the feed for red worm, namely cattle dung and biogas slurry is abundant. This kind of job does not demand much labor and hard work

[29]According to Mr.Nguyen Van Sang (Cu Chi Red Worm JS Co.), in Cu Chi area, red worm can be fed with un-composted fresh cattle dung with a frequency of 2 – 3 days/times. The fresh manure of pig can be used as the feed for the red worm after being composted. The treated pig manure (by biogas digester) can be used for red worm raising. According to Nguyen Phan Hong Phuong (2010), biogas slurry can be mixed with cattle dung and other organic substances to feed the red worm. The digested effluent from the biogas digester can also be used to spray the breeding area of red worm once per day (instead of using ordinary water), supporting the soil moisture maintenance and nutrition improvement for the red worm. However, this shall be further tested.

and is suited to many subjects (children, women and elderly). The products from red worm (manure and meat) are full of potential and can be consumed in the whole country.

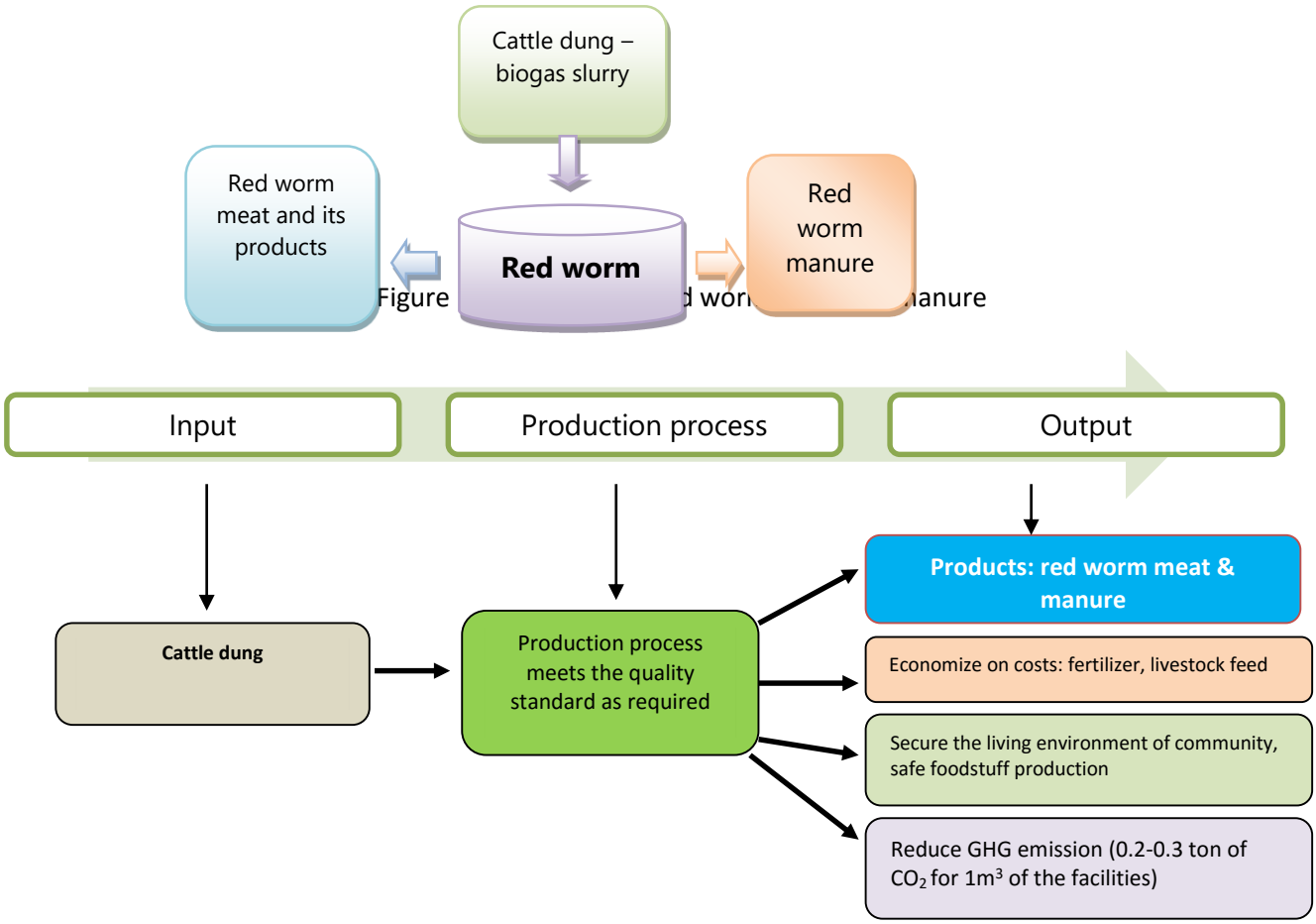


Figure 2: Diagram of livestock waste management model according to biogas value chain

Model of utilizing the cattle dung for red worm raising can be implemented in each farm or can apply the method of cattle dung collection from the small scale livestock households or from each hhs on the basis of linkage in terms of breed, processing of red worm manure and red worm meat as well as the establishment of consumption network. A village/commune, with more than 3,000 head of buffalos and cattle (on average, 1 – 3 head per hhs) is sufficient to supply the inputs for the implementation of red worm raising model.

The quantity of hhs who can join the model: 30 – 50hhs or 1 farm with a minimum scale of 1,500m^2 (the red worm raising area). The potential of replication is high because the high demand of the market, simple technology, small investment and high efficiency.

1.5. Proposed equipment and machinery

a) Equipment (more details in table 2)

- Water pump and drip irrigation system
- Manure mixer (for feeding red worm and for producing manure)
- Lighting system

b) Output capacity:

- Power-run water pumping motor of 1 phase (capacity of 1 HP)
- Drip irrigation pipe (made of soft net plastic with a diameter of 27mm) and a sprinkler with a length of 100m/set
- Compost turner of capacity 1.5-2.0 ton/hour

c) Regime of after sales, guarantee, maintenance and repair (Indicative after sales service):

Pump and drip irrigation system are sold widely in the market. The repair service is available and guarantee period is of 6-12 months.

d) Depreciation of machinery and equipment (Outline schedule of spare parts required over the normal life of the equipment): Table 3.

1.6 Indicative market for the product

Red worm manure is high quality organic fertilizer and suitable for growing organic products, especially for safe vegetable and VietGap farming. In Binh Dinh now, there are 2 cooperatives growing VietGap vegetable with an area of 50ha each. Besides, the hhs also wants to grow the clean vegetables, especially in the urban areas such as An Nhon town and Quy Nhon city. Therefore, the market for Red worm manure is potential. Agricultural enterprises and agents in Binh Dinh have to buy Red worm manure from Ho Chi Minh city of 3-5 tons per week with an average price of 5,000 – 6,000VND/kg. High quality rice of 300ha for export also need worm manure as main sources of nutrient. Only Hoai My Agricultural Cooperative needs a big amount of red worm manure for its 300 ha of rice/crop. In addition, extract from red worm is an excellent foliar fertilizer. Demand of red worm for livestock is also high because of its high efficiency, including for chicken, shrimps (2,500ha/crop).

1. 7 Economic analysis

At present, the dried cattle dung is sold at 400 VND/kg (3kg of fresh cattle dung is equivalent to 1 kg of dried cattle dung). The red worm manure is collected from the red worm raising using the fresh cattle dung (5 kg of fresh cattle dung can produce 1kg of red worm manure). The cost of red worm manure production is estimated at 1,000 VND/kg. The quality of red worm manure is equivalent to that of bio-organic manure and better than that of farmyard manure (table 1). Therefore, if the model of red worm raising is implemented, the farmers can both treat the livestock waste and biogas slurry and contribute to the organic product enhancement, soil fertility improvement and GHG emission reduction.

At present, the red worm manure, which is being used by several models of rice and vegetable production according to VietGAP standard in Binh Dinh, is sold at 4,000 VND/kg. Using this for high quality rice-production is obligatory. Selling the red worm manure at 2,000 VND/kg means that the breeder gets a profit of 1,000 VND/kg. If the cooperatives for collecting, pre-processing and packaging are set up, it can be sold at 3,000 VND/kg. When the red worm manure is used for the rice production, the selling price of rice shall be 20 – 25% higher than that of the rice, which does not use the red worm manure[30].

To supply the enough feed for red worm raising (2 cows) and sufficient amount of organic fertilizer (100 kg of red worm manure, after 1 month of livestock production) for application to the 500m^2 of rice cultivation, the households shall reserve an area of 20m^2 for the red worm raising, have some cows raised. The above scale

[30] Report on the high quality rice production model implementation results according to VietGAP standard in 2014 – Hoai My Agricultural Cooperative

can be expanded if more cows are raised and area of rice cultivation is larger. Only 1 worker is needed for this kind of work. When the households, household groups or cooperatives implement the model or work together to implement on a large scale, they can produce the red worm breeds and construct the production workshops; as a result, a new trade shall be set up in the locality.

Part 2: ANALYSIS OF MODEL EFFICIENCY

Table 2: model investment

(Estimated for 1,500m2 of red worm raising)

No	Item	Total, mil. VND	LCASP		Farm owner/household	
			mil. VND	%	mil. VND	%
I	**Invested assets and equipment**					
A	**Machinery and equipment**					
1	Water pump and drip irrigation system	30	30	100		
2	Manure mixer	60	60	100		
3	Platform scales, 100kg range	3	3	100		
4	Small truck (5-6 tons)	300			300	100
5	Bag packing and sewing machine	50	50	100		
6	Worm container	5			5	100
7	Shading net (70% of the light)	30	30	100		
8	Net for cocoon separating	30	30	100		
	Sub-total A	**508**	**203**	**40.0**	**305**	**60.0**
B	**Workshop, production site and warehouse**					
1	Worm raising house (1,500m^2)	500			500	100
2	Workshop for processing manure into worm feed (300m^2)	150			150	100
3	Workshop for processing and bagging worm manure (150m^2)	100	50	50	50	50
4	Worm manure store (200m^2)	50	25	50	25	50
5	Worm meat processing house (100m^2)	100	50	50	50	50
	Sub-total B	900	125	13.9	775	86.1
	Sub-total (A+B)	**1,408**	**328**	**23.0**	**1,080**	**77.0**
II	**Production cost (Working Capital)**					
C	Raw material	**146**				
1	Red worm breed (biomass)	50	50	100		
2	Cattle dung	96			96	100
D	Labor (3 persons)	27			27	100
E	Facilities (water and electricity)	30			30	100
G	Others (transaction, etc.)	50			50	100
	Total working capital (C+D+E+G)	**253**	**50**	**19.8**	**203**	**80.2**
	Total direct investment capital (A+B+C+D+E+G)	**1,661**	**378**	**22.8**	**1,283**	**77.2**
III	**Cost of technical service**					

1	Technical experts	250	250	100		
2	Training	100	100	100		
3	Information and communication	50	50	100		
4	Contingency (5 % of the total investment)	50			50	100
	Total technical service	**450**	**400**	**89.0**	**50**	**11.0**
	TOTAL INVESTMENT (I + II +III)	**2,111**	**778**	**37.0**	**1,333**	**63.0**

Table 3. Estimated depreciation of assets, machinery and equipment

No	Items	Initial asset value (VND)	Depreciation time (years)	Annual depreciation rate[31], Mil. VND
A	**Equipment and machinery**			
1	Water pump	30	6	5.0
2	Manure mixer	80	10	8.0
3	Platform scales, 100kg range	3	5	0.6
4	Small truck (5-6 tons)	300	15	20.0
5	Bag packing and sewing machine	50	5	10.0
6	Worm container	5	5	1.0
7	Shading net (70% of the light)	30	3	10.0
8	Net for cocoon separating	30	3	10.0
	Sub-total A	**528**		**64.6**
B	**Workshop, production site and store**			
1	Worm raising house	500	20	25.0
2	Workshop for processing manure into worm feed	150	20	7.5
3	Workshop for processing and bagging worm manure	100	20	5.0
4	Worm manure store	50	20	2.5
5	Worm meat processing house	100	20	5.0
	Sub-total B	**900**		**45.0**
	Total (A+B)	**1,428**		**109.6**

Table 4: Estimated income of the model

(Calculated for 1,500m^2 of worm raising)

TT	Item	Value, mil VND/year
A	**Revenue/year**	**528**
1	Sale of worm meat: 9.6 ton/year x 30 mil VND/ton	288

[31] *Total initial asset value divided by depreciation time*

2	Sale of worm manure: 60 ton/year x 4 mil. VND/ton	240
B	**Cost/year**	**362.6**
1	Depreciation cost (taken from table 2)	109.6
2	Raw material and fuels	146.0
3	Labor (9 mil. VND/year/person)	27.0
4	Other costs (water, electricity, packaging, cheap production tools, etc.)	80.0
C	**Income before tax**	165.4
	Deduct tax and other charges (if any)[32]	0
D	**Net income/year**	**165.4**

Table 5. Economic Efficiency Analysis

No	Item	%
1	Rate of return/sales turnover[33]	31.3
2	Rate of return/total direct investment (enterprise + LCASP)[34]	9.9
3	Rate of return/total investment of the enterprise[35]	12.9

Note: *The equipment such as water pump is the project's asset, which shall be depreciated, as regulated, upon the project completion and shall be either sold to the farm owner (as top priority) or transferred for use to other models.*

Implementation arrangement

- 100% of the technical service shall be supported by the project.
- The mode of bidding shall be applied to the acquisition of the machines and technology for use within the model, which are invested by the project. The farm owner shall hold responsible for the investment of red worm raising farm.
- Client: PPMU of Binh Dinh

The above result shows that utilizing the cow's waste for red worm raising generates more employment (a turnover of 528 million VND/year) and an income of 82.9 million VND/year. In addition we can get benefit from utilizing the red worm manure, instead of organic fertilizer, for rice cultivation (an estimated 20% income increase compared to farmer's rice cultivation practice). Benefit from utilizing red worm meat as the additional feed for chicken raising also increase in profit of chicken raising (a total of 1,600 head) compared to not using the red worm as the additional feed: 28 million VND.

[32] According to the Sscience and Technology Law, the model like LCASP doesn't pay any tax (Law No.29/2013 dated 18/6/2013, Article 3 and 64 (point 2) on tax policy)
[33] Net profit/total product sale turnover
[34] Net profit/total investment (including investment of hhs and project), excluding technical service
[35] Net profit/direct investment of owner

Model implementation schedule

No.	Description	2016			2017			
		Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Activity 1:** Organization of bidding							
	Prepare the bidding document							
	Organization of bidding							
	Signing of the contract							
2	**Activity 2:** Model utilizing the bio slurry							
	Procurement of equipment							
	Installation of equipment							
	Training and commissioning							
	Assessment on efficiency, training							
3	**Activity 3:** Development of biogas model							
	Development/ installation of biogas system							
	Guidance and transfer of O & M techniques							
	Construction of pre and post treatment auxiliary systems							
	Analysis of environmental indicators							
4	**Activity 4:** Installation of manure press separator system							
	Procurement of equipment							
	Setting up room for keeping machine							
	Installation of equipment							
	Training and commissioning							
	Transfer of O & M techniques							
5	**Activity 5:** Training and IEC							
	Making and broadcasting the programs on mass media							
	Making, printing and distributing the technical documents and leaflets							
	Making the video tapes about the activities of the model							
6	**Activity 6:** Commercialization of the product							
7	**Activity 7:** Management and implementation of model							
	Kick-off workshop							
	FFS (farmer field school) for exchanging experiences							
	Review workshop on the model							

Reference materials

1. Association of Binh Dinh Gardeners, 2003. Report on the results of topic "research on the raising of industrial red worm as the additional cattle feed at the hhs level and the utilization of red worm manure as the crop fertilizer."
2. National Institute of Animal Sciences. The Vietnam animal feed, Agricultural Publishing House, 2003.
3. Nguyen Thi Be, 2009. Report on the results of topic "Raise the red worm utilizing the fresh pig manure for organic fertilizer and protein production." Nong Lam University – HCM City, August 2009.
4. Hoang Khac Hai, 2012. Research on the utilization of biogas slurry for red worm raising in Tho Xuan district, Thanh Hoa province. Report on the topic under Thanh Hoa Biogas Project.
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6. Nguyen Phan Hong Phuong, 2010. Utilization of biogas slurry for red worm raising. Report of Go Dong Dong district
7. Ho Hong Quyen and others, 2010. Research on organic production process from the waste with the participation of red worm. Da Nang University.
8. Nguyen Van Sang, 2015. i) Harvest of red worm meat: 2kg/m^2/month; ii) How long does it take us to harvest the red worm(http://trunquecuchi.co)
9. Vu Dinh Ton and others, 2009. Red worm (Perionyx excavatus) as the additional feed for fattening chicken (Ho Lai chicken and Luong Phuong chicken) of 4 – 10 weeks of age. Science and Development Magazine, 2009,Vol.7, Issue.2, pages 186 – 191

APPENDIX G E-LIBRARY FEASIBILITY STUDY

Executive summary

1. Objective

- Set up an e-library for information sharing
- Transfer the low carbon agricultural technologies into the production to 10 provinces

2. Current Status

As for the farmers and agricultural extension system in the provinces

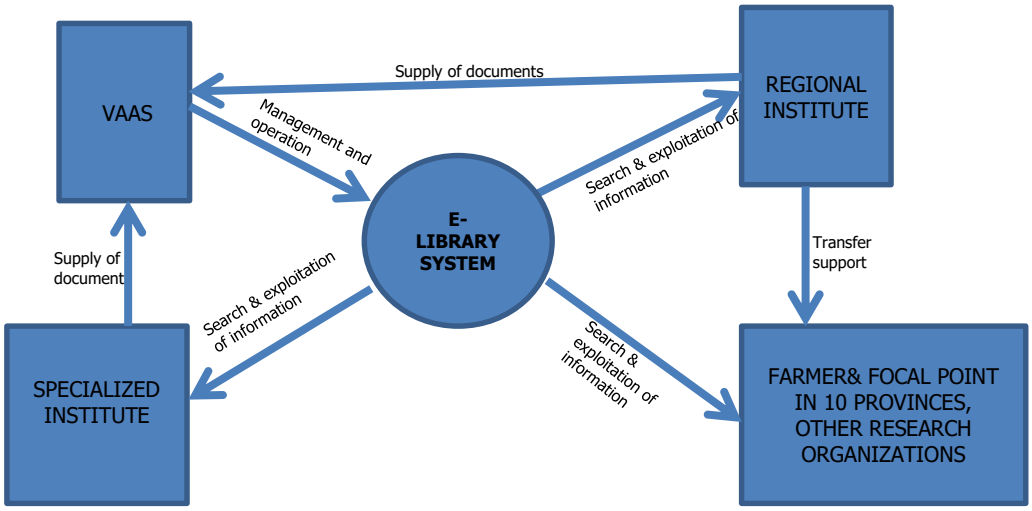
- Difficulties in accessing reliable and up-to-date information.
- There have been no Units supporting the application of the agricultural waste production technologies.

Supporting and research entities

- Most of the information needing to be disseminated mainly lies within the specialized institutes: Agricultural Environment Institute, Field Crops Research Institute, Cuu Long Delta Rice Research Institute and Soils and Fertilizers Research Institute.

- The regional institutes are assigned with the task of technical support for 10 participating provinces: Northern Mountainous Agriculture and Forestry Science Institute, Soils and Fertilizers Research Institute, Agricultural Science Institute of Northern Central Vietnam, Agricultural Science Institute for Southern Coastal Central of Vietnam, Southern Horticultural Research Institute.

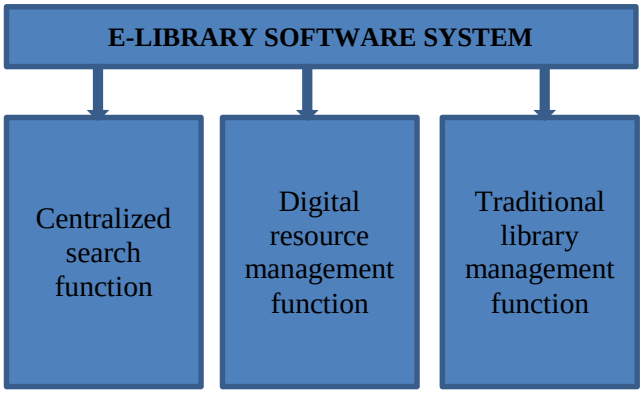
3. Model



- Farmers and enterprises in 10 provinces: get the information via the provincial system or internet.
- Focal points in 10 provinces: support farmers in getting the information and partly guide them.

- Specialized research institute: collect and appraise the materials
- Regional institute: guide the farmers and enterprises; collect and appraise the materials.
- VAAS: collect, select, edit the materials; manage and operate the e-library.
- Other research organizations: exchange or supply the materials

3. Function of e-library software



The establishment of e-library software system shall be web-based and open.

With the main functions: centralized search function, digital resource management and traditional resource management.

4. Plan

No.	Activity	2016			2017	
		Q2	Q3	Q4	Q1	Q2
1	Collection of materials from specialized and regional institutes					
2	Bidding (software and hardware system)					
3	Installation and transfer (hardware and software system and book digitalization)					
4	Data entry and conversion					
	Descriptive information entry					
	Material digitalization					
	Convert the forms (into word or pdf files)					
5	Training on utilization for provincial focal points					

5. Estimated cost

No.	Institution	Amount (VNĐ)
1	VAAS – Lead management entity for the e-library system	8,380,148,000

2	10 participating provinces – information access entities	1,508,100,000
3	Regional and specialized institutes – information supply and exploitation entity	1,206,480,000
Total		**11,094,728,000**

G.1 LEGAL BASIS

1.1 Basis for establishing the e-library

Loan Agreement:

Item ii, part 3, schedule 1 of Loan Agreement said: "Establishing an information system for sharing CSAWMP"

RRP

Para. 15 of RRP said: "The project will improve the skills and knowledge of stakeholders for managing agricultural wastes through dissemination campaigns, commune pilot demonstrations, short training courses, study tours, e-libraries, radio and television programs, DVDs and information posters. Additionally agro-ecological maps will be updated"

Section 3.2: Activities with Milestone under RRP said: "Establish an information system, e-library, journals, and database for sharing CSAWMP research and training by 2018"

1.2 Basis related to the beneficiaries of e-library

DMF and RRP said: "Well-established CSAWMP packages are disseminated in 10 participating provinces by 2016".

1.3 Basis related to the subjects of e-library

DMF said that "At least 70% bio-slurry is converted to organic fertilizers; At least 80% energy produced by BVCs is utilized; Daily workload of women and children is reduced by 1.8-2 hours, on average".

Para. 16, part 3, RRP concerning low carbon agricultural sectors of the project said: "Research activities may include use of non-livestock agricultural wastes for producing bioenergy and organic fertilizers, and application of low GHG emission practices in agriculture (including aquaculture)".

As such the project documents all require the establishment of 1 e-library system for the purpose of disseminating the information on the low carbon agriculture to 10 participating provinces. The subjects related to low carbon agriculture of the project include: utilization of agricultural wastes as the organic fertilizers, bio-energy and agricultural production technologies for reducing GHS emissions.

G2. CURRENT STATUS

The farmers, enterprises and agricultural extension system of the province meet with many difficulties in accessing the reliable information; there have been no units supporting the application of low carbon agricultural waste technologies:

+ Difficulties of the provinces in accessing information: the provinces either have no documents on this or have some, but scattered somewhere. Almost the information searched on the internet is unofficial.

+ Difficulties in utilization of information: The information is complicated and not easy for the users (farmers and extension units of the province) to understand.
In order to fully and officially disseminate the information to the farmers and enterprises about the application to the production within the provinces, the following solutions are needed:

+ The experts and research units are needed to support the farmers and enterprises in applying the technologies to the production.

Most of the information related to low carbon production of the project, which need to be disseminated, lies in the specialized institutes: the main function of the Agricultural Environment Institute is to research the agricultural environment in general and bio-energy from the crop and livestock wastes in particular; the main function of the Field Crops Research Institute is to research crop by-products as the fertilizer and farming techniques; the main function of Cuu Long Delta Rice Research Institute is to research about the rice and farming techniques to reduce GHS emission – this is a leading unit in researching into rice and wet rice which emit most in the agricultural sector; the main function of Soils and Fertilizers Research Institute is to conduct the basic research and application in terms of soil science, fertilizers and crop nutrients. The remainder lies in a scattered manner within the regional institutes.

The regional institutes: Northern Mountainous Agriculture and Forestry Science Institute with its headquarter in Phu Tho in charge of supporting the provinces of Lao Cai, Son La, Phu Tho; Soils and Fertilizers Research Institute with its headquarter in Ha Noi in charge of supporting the provinces of Bac Giang, Nam Dinh; The Agricultural Science Institute of Northern Central Vietnam with its headquarter in Nghe An in charge of supporting Ha Tinh province; Agricultural Science Institute for Southern Coastal Central of Vietnam with its headquarter in Binh Dinh in charge of supporting Binh Dinh province; Southern Horticultural Research Institute with its headquarter in Tien Giang in charge of supporting Ben Tre, Tien Giang and Soc Trang provinces) are assigned with the task of technical support for the participating provinces in terms of agricultural production in general and application of low carbon agricultural production technologies in particular. The institutes shall appoint the

experts in agricultural production to support the farmers, enterprises and extension system of the province.

In summary, to be able to convey in a sufficient and effective manner the information related to low carbon agricultural production as well as to support the farmers and enterprises in the participating provinces in utilization of the information about the low carbon agricultural production, the project shall set up en e-library system with the participation of the specialized institutes, regional institutes and extension system of the province.

G3. OBJECTIVES

- Set up an e-library for information sharing on research and training in low carbon agriculture with the farmers, enterprises and extension system in 10 provinces.

- Transfer the low carbon agricultural technologies into the production to 10 provinces.

G4. CONTENT

- Set up the e-library system to link the specialized institutes/regional institutes with the farmers, enterprises and extension system in 10 participating provinces for the sake of information sharing in a sufficient and official manner on the low carbon agricultural production technologies.

- Support the research staff, farmers, enterprises, extension system in 10 provinces in transferring the low carbon agricultural technologies into the production.

G5. SUBJECT OF E-LIBRARY SYSTEM

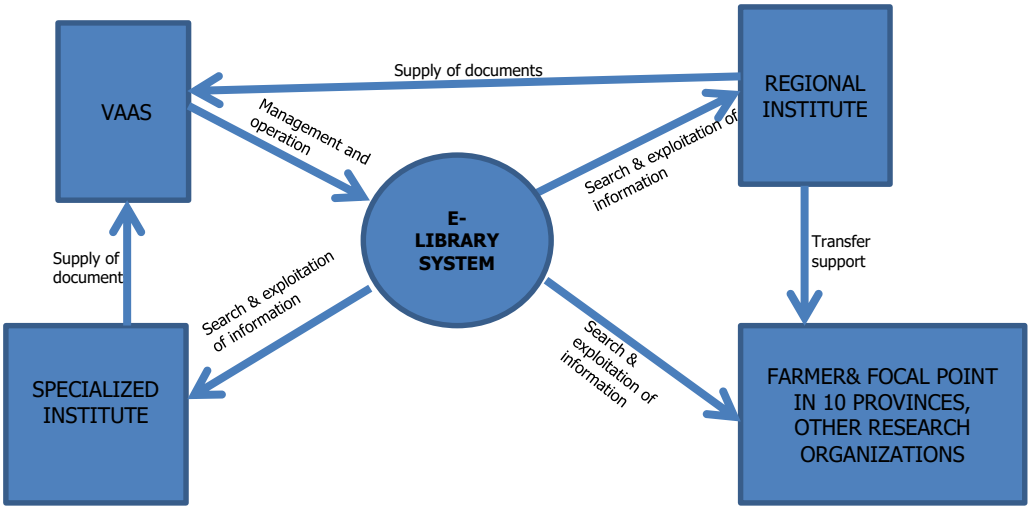
5.1 The subjects who benefit from the e-library system about the low carbon agriculture are the farmers, enterprises, and staff under the extension system in 10 participating provinces and research staff.

5.2 The subjects who supply the information and technical support: Specialized institutes, regional institutes, provincial extension staff

5.3 The subject (agency) of e-library system management is VAAS (Vietnam Academy of Agricultural Sciences): as the focal point to manage and operate the e-library that has a lot of research on the low carbon agriculture in Viet Nam. It is also the managing entity of regional/specialized institutes within the project.

G6. MODEL AND OPERATIONAL SYSTEM

6.1 Model



- Farmers and enterprises in 10 provinces: approaching DARDs in the provinces for collecting the information to serve their work. If connected to the internet, the farmers and enterprises can access the information free of charge.

- Focal points in 10 provinces: DARD is the agency which helps farmers and enterprises in accessing the information and disseminating the low carbon agricultural technologies suiting to that province.

- Specialized research institute: Collect and appraise the information related to low carbon agriculture before uploading onto the e-library system

- Regional institute: Guide, collect and appraise the information related to low carbon agriculture before uploading onto the e-library system

- VAAS: is the managing and operating agency of the e-library that shall collect, select, edit the information from the provinces, research institutes, regional institutes as well as other research units within or outside MARD for uploading onto the e-library system.

- Other research organizations: able to exchange or supply the materials to the project (free of charge).

6.2 Expected operational plan of the system

Considering its scale, the project shall be deployed in the following stages:

- Stage 1: Deployment

No.	Activity	2016			2017	
		Q2	Q3	Q4	Q1	Q2
1	Collection of materials from specialized and regional institutes					
2	Bidding (software and hardware system)					
3	Installation and transfer (hardware and software system and book digitalization)					
4	Data entry and conversion					
	Descriptive information entry					
	Material digitalization					
	Convert the formats (into word or pdf files)					
5	Training on utilization for provincial focal points					

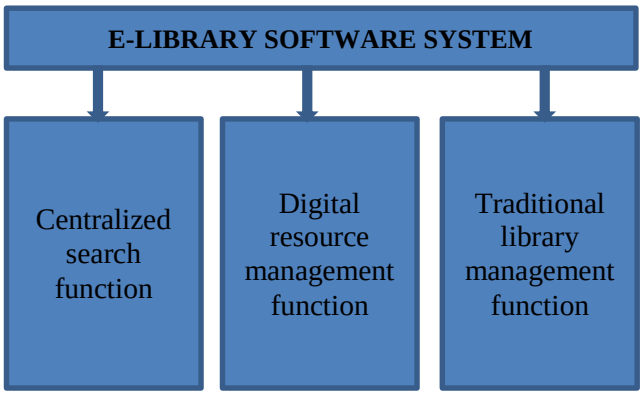
- Stage 2: After the project ends

The beneficiaries can still access the information free of charge 5 years after the project completion. The next 5 years (after that period), the information which is procured by VAAS shall be in accordance with its regulations.

G7. TECHNOLOGY AND EQUIPMENT SELECTION

7.1 Selection of software solution

Since the internet technology is more and more developed and universalized to all the regions/sub-regions in Vietnam, the establishment of e-library software system shall be web-based and open. The web-based platform enables the internet users to access and use the e-library system conveniently. The software system shall help manage the digital resources and traditional resources, fully meet the standards on the library's operations: bibliographic standard of MARC21, inter-library extended connection standard of Z39.50. The library software shall be equipped with the feature of searching and detecting the digital resource and metadata searching, with an interface which is user-friendly and suitable with the habits and customs of Vietnam.



Centralized search function: Allow searching the different data sources on a sole interface.

Digital resource management function: allow managing the formats of digital resources: pictures, videos, word/pdf files, etc.
Traditional library management function: allow the online exploitation, cataloguing, document circulation, reporting, and user administration.

7.2 Selection of hardware solution

Main technological solutions for setting up the low carbon agricultural e-library system:

+ Software and deployment of the cloud computing software
+ Software and deployment on physical server system and hiring the location to house the server
+ Software and deployment on physical server system which is housed in VAAS

Comparative table of solutions

No.	Evaluation criteria	Cloud computing	Procurement of physical server & hiring the location	Procurement of physical server & housing in VAAS
1	Ensuring the safety of the system: - Network attack prevention - Illegal access detection	Good	Good	Good
2	Operational stability: - Stable transmission line - Standby power system	Good	Good	Good
3	Readiness of the system at time of failure - Data backup capability - Physical level access	Good	Good	Good
5	Administration right	Poor (Administration right shared with third party)	Good	Good

6	Popularity (in the application)	Not yet applied in Vietnam (related to e-library system)		Being implemented in many big libraries in Viet Nam (National Library, Ta Quang Buu Library, Library of Hanoi National University, Ho Chi Minh national university library, etc.)
7	Total cost of initial installation	3,850,200,000 VND (for a period of 18 months)	2,198,680,000 VND	2,449,628,000 VND
7.1	Cost of server procurement	2,566,800,000 VND (for a period of 18 months)	902,000,000 VND	902,000,000 VND
7.2	Cost of storage system procurement	1,238,400,000 VND (for a period of 18 months)	1,296,680,000 VND	1,296,680,000 VND
7.3	Cost of firewall procurement	No need	No need	161,920,000 VND
7.4	Cost of cabinet procurement (for keeping server)	No need	No need	No need
7.5	Cost of air conditioner procurement (1 unit)	No need	No need	30,800,000 VND
7.6	Cost of initial installation of high speed internet transmission line	No need	No need	1,000,000 VND
7.7	Installation cost	No need	No need	No need
7.8	Cost of UPS procurement (2 units)	No need	No need	52,228,000 VND
7.9	Cost of training support	No training	No training	5,000,000 VND
8	Monthly overall cost	28,000,000 VND/month	13,200,000 VND/month	9,800,000 VND/month

8.1	Cost of electricity	No need (included in the maintenance cost)	No need (included in the maintenance cost)	6,000,000 VND/month
8.2	Cost of transmission line	No need (included in the maintenance cost)	No need (included in the maintenance cost)	3,800,000 VND/month
8.3	Cost of maintenance	28,000,000 VND/month	13,200,000 VND/month	No need

Based on the above analysis, the option of procuring the physical server and physical storage equipment costs less than the option of using cloud (the monthly overall cost is also lower). The option of procuring the physical server and hiring the location costs less than the option of housing the server in VAAS (however, the monthly overall cost is higher). To ensure the sustainable operation of the e-library, it is proposed that the e-library system should be located in VAAS. As such, VAAS can master the technologies related to e-library system and ensure long-term operation of the system after the project ends.

Based on the selected technology and composition of e-library system participation, the proposed solution of equipment and manpower is as follows:

Tentative list of equipment and personnel No.	**Equipment and personnel**	**Description**
A	**10 participating provinces**	
	Equipment	
1	PC	Supplied to staff in 10 provinces to access and exploit the information for the farmers.
2	Printer, photocopier	Allow the staff in 10 provinces to transfer the materials of e-library to the farmers who have no computer to access to the e-library. Printing and copying the materials from e-library to transfer to the farmer via the communication activities or training courses.

3	Scanner	Enable the staff in 10 provinces to digitalize their materials for the e-library system
4	Switch, network cable, jack, network equipment (duct, electric wire, etc.), desk/chair, UPS for PC.	
	Personnel	
1	The staff for guiding how to access and get the information from e-library	Guide on using and getting the information for the farmers and enterprises in 10 provinces.
B	**VAAS**	
	Equipment	
1	E-library software system	Supply of information, management of digital resources, management of users, material circulation, management of catalogue, allowance of on-line exploitation, management of statistic reports.
2	Physical server system	Allow the establishment of operating system, database administration system, e-library software system: 1 server for software, 1 server for database administration system.
3	Digital resource storage equipment	Store the digital resources, mainly the materials which are converted from the printed format into the digital format.
4	UPS system for server	Stabilize the power source for the server, store the backup power source
5	Book scanners (A4 size) (for digitalizing the documents)	Used for converting most of resources from the printed format into the digital format.
6	Hard firewall	Help protect the e-library from the network attacks
7	PC	Enable the library staff and IT staff to manage and operate the e-library continuously.
8	Laptop	Used for the professional training on the e-library for the provinces and institute
9	Printer	
10	Camera, projector	Used for training and guiding on the use of e-library
11	High speed internet transmission line	Allow the e-library to operate stably at time of heavy traffic

12	Switch, network cable, jack, network equipment (duct, wire, etc.), desk/chair, UPS for PC.	
	Personnel	
1	Library staff	Operate and manage e-library; operate and manage the machine for digitalizing the documents.
2	IT staff	Ensure the stable operation of the server system, e-library system, digital resource storage system; prevention and detection of network attacks; ensuring the data backup.
C	**Research institute, regional institute**	
	Equipment	
1	PC	Supplied to the staff in 10 provinces to access and exploit the information for the farmers
2	Printer, photocopier	Allow the staff in 10 provinces to transfer the materials of e-library to the farmers who have no computer to access to the e-library.
3	Scanner	Enable the staff in 10 provinces to digitalize their materials for the e-library system
4	Switch, network cable, jack, network equipment (duct, electric wire, etc.), desk/chair, UPS for PC.	
	Personnel	
1	Staff in charge of collection, classification, access, exploitation of information.	Guide on using the e-library in their agency; collect, classify and digitalize the materials for sending to VAAS

Current status of provinces, institutes and VAAS:

Province: In general, the computer system of the province is old, the photocopiers and printers are often broken down. The extension units are all equipped with the network system and internet transmission line. The staff in charge of supporting the farmers in their production is available but there is no staff to support the information searching on the e-library.

Institute: Computers and information equipment are available but there is no equipment for library. Basically, the network system and internet transmission line are not; however, the speed of transmission line in some units is still low. The contingent of the leading experts in low carbon agriculture is available. The staff in charge of storing and preserving the books and research topics are available but they have no the expertise in the e-library.

Managing entity (VAAS):

To date, an information section has been set up to manage the information and operate the website and manage the traditional library of the institute. A scientific section is also in place to manage the scientific research topics of VAAS and its member institutes. The institute has also assigned 2 staff to manage a considerable quantity of books of its library about low carbon agriculture in the printed format. The system of network and internet in VAAS has been established with a speed of 30Mbp/s to serve its staff. 1 IT staff has been assigned to ensure the stable operation of its network and internet system; however, this staff has not been trained profoundly on the information safety and network attack prevention as well as has had little knowledge about the e-library software system.

Detail list of equipment and personnel for operating and accessing information of e-library:

Considering the current status of the e-library system participating units and selected technologies, the following equipment and personnel are proposed for the e-library system:

No.	Description	Unit	Quantity	Remarks
A	**10 participating provinces - beneficiary**			
	Equipment			
1	Scanner A4 size	Piece	10	Focal point of province: 1 piece per province
2	PC	Set	20	Focal point of province: 2 sets per province
3	UPS	Set	20	Focal point of province: 2 sets per province
4	Chairs/desks (for PC)	Set	20	Focal point of province: 2 sets per province
5	(Black and white) Laser printer A4 size	Piece	10	Focal point of province: 1 piece per province
6	Photocopier	Piece	10	Focal point of province: 1 piece per province
7	Switch	Piece	10	Focal point of province: 1 piece per province

8	Network cable	Roll	10	Focal point of province: 1 roll per province
9	Cable jack	Box	10	Focal point of province: 1 box per province
10	Other accessories for network system (including: ducts, screws, fasteners, tape, electric wire, etc.)	Package	10	Focal point of province: 1 set per province
	Personnel			
1	Support staff to get and supply the information	Person	20	2 persons per province
B	**VAAS – Managing and operating unit**			
	Equipment			
1	E-library software system	Package	01	
2	Blade Server	Set	02	Set up e-library software system and database
3	UPS system for server	Set	02	Stabilize and store the power source
4	Data storage system, together with the server frame	System	1	Digital resource storage
5	Firewall system	Set	1	Ensure the information safety
6	High speed internet transmission line	Month	24	For accessing e-library
7	Hire and maintain the domain name	Year	24	E-library's address on internet
8	Dedicated book scanner A4 size	Set	01	Digitalize and convert printed materials into digital materials
9	Scanner A3 size	Piece	01	For digitalizing materials of big size
10	PC	Set	03	For the staff who manages, operates and administers e-library
11	UPS	Set	03	
12	Chairs/desks (for PC)	Set	03	
13	Laptop	Piece	02	For the library's training
14	(Black and white) Laser printer A4 size	Piece	01	
15	Photocopier	Piece	01	
16	Camera	Piece	01	

17	AC	Set	02	1 for server room and 1 for book digitalizing machine room
18	Multi-functional projector, electric screen	Piece	01	For the training work
19	Switch	Piece	01	
20	Network cable	Roll	01	
21	Cable jack	Box	01	
22	Other accessories for network system (including: ducts, screws, fasteners, tape, electric wire, etc.)	Package	01	
	Personnel			
1	Staff for managing and operating e-library	Person	02	
2	IT staff for operating e-library system	Person	02	
C	**Research institute, regional institute - entity for exploiting, supporting and transferring**			
	Equipment			
1	Scanner A4 size	Piece	08	Specialized institute: 1 per institute Regional institute: 1 per institute
2	PC	Set	16	Specialized institute: 2 per institute Regional institute: 2 per institute
3	UPS	Set	16	Specialized institute: 2 per institute Regional institute: 2 per institute
4	Chairs/desks (for PC)	Set	16	Specialized institute: 2 per institute Regional institute: 2 per institute
5	(Black and white) Laser printer A4 size	Piece	8	Specialized institute: 1 per institute Regional institute: 1 per institute
6	Photocopier	Piece	8	Specialized institute: 1 per institute Regional institute: 1 per institute
7	Switch	Piece	8	Specialized institute: 1 per institute Regional institute: 1 per institute
8	Network cable	Roll	8	Specialized institute: 1 per institute Regional institute: 1 per institute

9	Cable jack	Box	8	Specialized institute: 1 per institute Regional institute: 1 per institute
10	Other accessories for network system (including: ducts, screws, fasteners, tape, electric wire, etc.)	Package	8	
	Personnel			
1	The staff for guiding on use of e-library and information supply for e-library	Person	16	Specialized institute: 2 per institute Regional institute: 2 per institute

Commitment of system participating entities:

No.	Description	Farmer, enterprise, other research entities	DARD	Specialized research institute	Regional institute	VAAS	CPMU
A	**During the project implementation**						
1	Equipment	Benefit	Benefit	Benefit	Benefit	Benefit	Investment
2	Internet transmission line	Invest	Invest	Invest	Invest	Invest (by **CPMU**)	
3	Digital resource	Benefit	Benefit, supply	Benefit, supply	Benefit, supply	Benefit, supply	
4	Personnel		2 staff per province	2 staff per institute	2 staff per institute	4 staff	Support training
B	**After the project completion**						
1	Cost of internet transmission line maintenance	Pay	Pay	Pay	Pay	Pay	

2	Digital resource	Benefit	Benefit, supply	Benefit, supply	Benefit, supply	Benefit, supply	
3	Personnel		2 staff per province	2 staff per institute	2 staff per institute	4 staff	
4	Cost of maintenance		Pay	Pay	Pay	Pay	

G8. CONCLUSION

In order to set up the system of e-library as mentioned above, the following equipment shall be needed:

Equipment needed for the e-library:

No.	Description	Unit	Unit price (VND)	Quantity	Amount (VND)	Remarks
A	**Managing entity**				**8,380,148,000**	
1	E-library software system	Package	3,930,000,000	01	3,930,000,000	
2	Blade Server	Set	451,000,000	2	902,000,000	Set up e-library software system and database
3	UPS system for server	Set	26,114,000	02	52,228,000	Stabilize and store the power source
4	Data storage system, together with the server frame	System	1,296,680,000	1	1,296,680,000	Digital resource storage
5	Firewall system	Set	161,920,000	1	161,920,000	Ensure the information safety
6	High speed internet transmission line	Month	3,800,000	24	91,200,000	For accessing e-library
7	Hire and maintain the domain name	Year	1,100,000	02	2,200,000	E-library's address on internet
8	Dedicated book scanner A4 size	Set	1,413,500,000	1	1,413,500,000	Digitalize and convert printed materials into digital materials

No.	Description	Unit	Unit price (VND)	Quanti ty	Amount (VND)	Remarks
9	Scanner A3 size	Piece	110,000,000	1	110,000,000	For digitalizing materials of big size
10	Laptop	Piece	31,900,000	02	63,800,000	
11	PC	Set	20,900,000	03	62,700,000	For the staff who manages, operates and administers e-library
12	UPS	Set	1,320,000	03	3,960,000	
13	Chairs/desks (for PC)	Set	4,620,000	03	13,860,000	
14	(Black and white) Laser printer A4 size	Piece	9,350,000	01	9,350,000	
15	Photocopier	Piece	49,500,000	01	49,500,000	
16	Camera	Piece	70,070,000	1	70,070,000	
17	AC	Set	30,800,000	2	61,600,000	1 for server room and 1 for book scanner room
18	Multi-functional projector, electric screen	Piece	74,800,000	1	74,800,000	For the training work
19	Switch	Piece	4,400,000	1	4,400,000	
20	Network cable	Roll	3,025,000	1	3,025,000	
21	Cable jack	Box	825,000	1	825,000	
22	Other accessories for network system (including: ducts, screws, fasteners, tape, electric wire, etc.)	Package	2,530,000	1	2,530,000	
B	**Research institute, regional institute**				**1,206,480,000**	
1	Scanner A4 size	Piece	27,500,000	08	220,000,000	Specialized institute: 1 per institute Regional institute: 1 per institute
2	PC	Set	20,900,000	16	334,400,000	Specialized institute: 2 per institute

No.	Description	Unit	Unit price (VND)	Quanti ty	Amount (VND)	Remarks
						Regional institute: 2 per institute
3	UPS	Set	1,320,000	16	21,120,000	Specialized institute: 2 per institute Regional institute: 2 per institute
4	Chairs/desks (for PC)	Set	4,620,000	16	73,920,000	Specialized institute: 2 per institute Regional institute: 2 per institute
5	(Black and white) Laser printer A4 size	Piece	9,350,000	8	74,800,000	Specialized institute: 1 per institute Regional institute: 1 per institute
6	Photocopier	Piece	49,500,000	8	396,000,000	Specialized institute: 1 per institute Regional institute: 1 per institute
7	Switch	Piece	4,400,000	8	35,200,000	Specialized institute: 1 per institute Regional institute: 1 per institute
8	Network cable	Roll	3,025,000	8	24,200,000	Specialized institute: 1 per institute Regional institute: 1 per institute
9	Cable jack	Box	825,000	8	6,600,000	Specialized institute: 1 per institute Regional institute: 1 per institute
10	Other accessories for network system (including: ducts, screws, fasteners, tape, electric wire, etc.)	Set	2,530,000	8	20,240,000	Specialized institute: 1 per institute Regional institute: 1 per institute
C	**In 10 participating provinces**				**1,508,100,000**	
1	Scanner A4 size	Piece	27,500,000	10	275,000,000	Focal point of province: 1 piece per province

No.	Description	Unit	Unit price (VND)	Quanti ty	Amount (VND)	Remarks
2	PC	Set	20,900,000	20	418,000,000	Focal point of province: 2 sets per province
3	UPS	Set	1,320,000	20	26,400,000	Focal point of province: 2 sets per province
4	Chairs/desks (for PC)	Set	4,620,000	20	92,400,000	Focal point of province: 2 sets per province
5	(Black and white) Laser printer A4 size	Piece	9,350,000	10	93,500,000	Focal point of province: 1 piece per province
6	Photocopier	Piece	49,500,000	10	495,000,000	Focal point of province: 1 piece per province
7	Switch	Piece	4,400,000	10	44,000,000	Focal point of province: 1 piece per province
8	Network cable	Roll	3,025,000	10	30,025,000	Focal point of province: 1 roll per province
9	Cable jack	Box	825,000	10	8,250,000	Focal point of province: 1 box per province
10	Other accessories for network system (including: ducts, screws, fasteners, tape, electric wire, etc.)	Package	2,530,000	10	25,300,000	Focal point of province: 1 set per province

Procedure of operation:

The e-library system is to be housed in VAAS, which has a high speed internet transmission line. VAAS is the central management entity which has the function of operating and managing the e-library system as well as administering the infrastructure system, ensuring the security of the e-library, collecting, selecting and evaluating the materials of VAAS affiliated institutes which are digitalized and converted in the format for uploading onto the e-library.

VAAS shall set up a council of scientists that is responsible for evaluating the materials (sent by its member institutes) before uploading onto the e-library. The information shall be added to the e-library later after it is put into operation. VAAS shall the entity which collects and procures the information. The information in English shall be translated into Vietnamese by the experts of VAAS.

The farmers and enterprises in the province can access directly from their house for exploiting the information if the internet connection is available or approaching DARDs to extract and print out the needed information on the e-library. The information can also be printed out and copied for the dissemination in the workshops and training courses.

The specialized research institutes and regional institutes are responsible for collecting, classifying the documents and digitalizing (if possible) for sending to VAAS for uploading on the e-library. The institutes can also access the e-library for the information needed for their work.

Appendix 1: Comparison with initial proposal

Compared with the previous proposal, the changes are as follows:

No.	Description	Unit	Initial quantity	Proposal by consultant	Reduction	Increase
A	**Managing entity**					
1	E-library software system	Package	01	01		
2	Server	Set	05	02	03	
3	UPS system for server	Set		02		02
4	Data storage system, together with the server frame	System	01	01		
5	Hiring the location to house the server	Month	36	0	36	
6	Firewall system	Set	0	01		01
7	High speed internet transmission line	Month	0	24		24
8	Hire and maintain the domain name	Year	3	2	1	
9	Dedicated book scanner A4 size	Set	01	01		
10	Scanner A3 size	Piece	01	01		
11	Color scanner A4 size	Piece	19	18	01	
12	PC	Set	41	39	02	
13	UPS	Set	41	39	02	
14	Chairs/desks (for PC)	Set	41	39	02	
15	Laptop	Piece	05	02	03	
16	(Black and white) Laser printer A4 size	Piece	23	19	04	
17	Photocopier	Piece	19	19		
18	Camera	Piece	1	1		
19	AC	Set	1	2		01

20	Multi-functional projector, electric screen	Piece	2	1	1	
21	Switch	Piece	19	19		
22	Network cable	Roll	19	19		
23	Cable jack	Box	19	19		
24	Other accessories for network system (including: ducts, screws, fasteners, tape, electric wire, etc.)	Package	19	19		

APPENDIX H GUIDELINES PROCEDURES FOR THE SELECTION AND IMPLEMENTATION OF DEMONSTRATION PILOTS OF LCASP

H1. Introduction and Overview

This document notes the recommended principles and procedural steps for the identification, selection, procurement and implementation for the demonstration pilot sub-projects. This is done in the context of the procedural steps recommended by the LIC to the CMPU and utilized in the process to identify and select sub-projects that commenced immediately after TET on15th February. This chapter conceptualizes overall project cycle procedures from identification through to procurement and implementation. We then explain how the procedures have been used to date combined intended course of action and necessary steps that will take each sub-project through to implementation. This is backed-up appendices with related templates, pro-forma and checklists, as well as an example of the consultation process and a pre-feasibility dossier that comprises six categories of demonstration project.

1.1 General Principles

The principles recommended to guide the overall process are for a strongly participatory and 'bottoms up' consultation process through the PPMUs and local communities; and the transparent criteria based selection of eligible sub-projects.

- The concept notes and list of demonstration were proposed by the province (bottom up consultation process)
- Selection of the locations and participants of the demonstration was made in an open, transparent and equitable manner.

1.2 Consultation

This works at two levels.

1.2.1 CPMU/LIC coordinators with Provincial Project Management Units (PPMU)

In the first instance the CPMU and LIC Provincial coordinators support local PPMUs to assess need and determine local priorities in the context of LCASP criteria. Once a sub-project type (based upon six categories – table 1c) has been selected local communities are informed and a process of consultation commences – which allows local households (hh) or enterprises to express an interest in participating in the sub-project activities.

1.2.2 Community consultations

This process must be guided by local regulation and preferably initiated through mass media advertising. PPMU will additionally write to local district and commune Divisions and sections to identify 'qualifying' households to be notified of the project by a combination of information posted on local notice board and/or letters directly to the household. Extension officers will also assist with disseminating the information as part of their day-to-day work in the communities.

The process for selecting participating households and businesses must be open and transparent and with signed minutes of meetings on file and available for inspection.

1.3 Criteria for selecting the participating household/farm enterprise

Core Criteria

- Are the circumstances for the proposed sub-project representative of local farming conditions and problems with waste treatment and capable of replication in the province
- Is the proposed technology or approach to address climate smart agricultural waste management economically viable[36] and capable of commercial application – but, as yet, not well known or practiced?
- Is the sub-project economically and technically viable as well as environmentally suitable.
- Is the selected demonstration site easily accessible and reasonably close to comparable households/enterprise in the district/province?
- Other key criteria include gender/ethnic minority group consideration as well as the prioritization of funding allocated to each province.

Personal and contractual

- Has the selected household/enterprise committed to a partnership agreement with the PPMU on the investment share and associated obligations such as assuring access to the site during normal working hours. (specimen partnership agreement to follow)

(*In advance of this PPMU must determine what is a reasonable share (up to a 40% maximum for the project) between the project and the participant for the initial investment; and the basis for calculating the depreciated value project owned equipment at the end of the demonstration period. Depreciation calculation of the project-supported assets/equipment is based on the following documents: Article 65 regulating the credit policy for investment under Law on Science and Technology Ref.No.29/2013; ii) Circular No.45/2013 dated 25 April 2013 issued by MoF stipulating the way of calculating the depreciation of special equipment in the agricultural sector. It is envisaged that the famer/enterprise will commit to purchase at the agreed depreciated price but facility for open sale, if the farmer /enterprise decides not to proceed needs to be incorporated into the agreement.)*

A template with scoring methodology for the assessment of provincial proposals is contained in Appendix 2C. The above factors are then assessed and analyzed through in the form laid out and completed for pre-feasibility assessment. Please refer to appendix 3 for an example)

1.4 Stages of the Selection Process of demonstration type

Stages of the Selection process

- In the first instance, PPMU's with the support of LIC provincial coordinator utilize survey data to make an overall situation and needs analysis from which an initial list of possible sub-projects are drawn up.
- All proposals subject to a preliminary review by a panel of LIC project coordinators and CPMU representatives - approximately one hour of detailed scrutiny per proposal. Through this process - based upon scoring criteria – sub-projects are provisionally recommended for approval, rejection or requiring further work.

[36] Product or project designs may be economically viable on paper but may lack the scope for commercial application. The LIC visited a community based biogas project in Thai Binh and observed that the medium scale plant that had been established with government/donor support would have been economically viable if the biogas was not being sold at a social rather than commercial price to the local community.

- These are then batched up and sent to a formal selection panel of PPMU and CPMU officials to determine whether to accept the recommendations or take an alternative course of action. Initially this list comprised 29 demonstration sub-projects but has since been increased to 32. (Table 1c refers.)

1.5 Consolidation into Category Types and Pre-feasibility Assessment

Following approval by the CPMU/PPMU selection panel each assessment is subjected to a further stress test by being compared to one of the six category types of demonstration types prepared by the LICs as an indicative measure of technical, economic and operational viability. Table 1C below refers and is in process.

1.6 Procurement Arrangement

i. Preparation of the TOR and Draft of Request for Quotation (RFQW) will be done by PPMU with support of CPMU and the LIC team.
ii. Method of procurement suggested is (i) Shopping for works: for package under $100,000 (based on real design from PPMUs), and (ii) NCB: for package over $100,000 (based on real design from PPMUs).
iii. PPMU submits RFQW (including TOR, cost estimate) to CPMU for review with support of LIC consultants. CPMU may, then, request PPMU to modify the first draft of RFQW submits the RFQW to ADB for no objection.
iv. Review the RFQW: ADB reviews the RFQW and issues letter of no objection. For packages of shopping for works: it is suggested that the ADB applies the prior review of the first two or three demonstration/pilots – to be determined. For the remaining packages of demonstration/pilots, ADB applies the post review method. For packages of NCB: ADB applies the prior review to all.
v. Approve the bidding documents: PPMU submits RFQW to DARD for approval after receiving the no-objection of ADB through CPMU.
vi. PPMU advertises for bidding followed by ADB procurement guideline and Vietnamese laws and receives proposal of providers/contractors.
vii. PPMU evaluates the bids with support of An independent evaluation committee consist of independent experts and representatives of DARD/PPMU.
viii. Approve the bid's results: Follow initial review by the CPMU, ADB reviews the bid evaluation submitted by PPMU though CPMU and issues no-objection letter. For packages of shopping for works, ADB applies the prior review of the bid evaluation of the first three above demonstration/pilots (i, ii, iii). The remaining packages of demonstration/pilots: ADB applies the post review of the bid evaluation. For packages of NCB, ADB applies the prior review to all. DARD will approve the bid results after receiving the no-objection of ADB through CPMU.
ix. PPMU awards contracts to bid's winners after receiving the no-objection of bid evaluation from ADB through CPMU and approval of DARD.
x. Contractors/ Providers will implement the demonstrations/pilots as contracted. PPMU/ DARD/CPMU (with support of consultants) will periodically monitor the implementation process.
xi. Acceptance of the demonstrations/pilots results: DARD/PPMU will be responsible to accept the demonstrations/pilots results with support of independent acceptance committee consisting of independent experts and representatives of DARD/PPMU.
xii. PPMU does the contract liquidation and asset disposal as regulated.

NB: All contents of the TOR will be consistent to governmental regulations in terms of categories of investment items, specifications, cost norms. All assets under TOR belong to the project. The Project invests to

demonstrate/pilot CSAWMP to proper locations. Upon the completion of the demonstration contract the project's assets will be sold back to farmers or handled over as regulated by Vietnamese laws.

1.7 Demonstration Period

The demonstration period will be fixed at the outset at 18 months or 24 months depending on negotiations between the PPMU and the partner household(s)/enterprises.

H2. Procedure for Selection and Implementation of demonstration sub-projects

This chapter covers the selection process as being followed to date along with the overall approach as the sub-projects move to procurement and implementations stages.

2.1. Selection Procedure

i. General survey on the status of production and waste treatment, especially the fattening pig farming waste (conducting the survey of 10 hhs/commune, 3 communes/district and 3 districts/province; the number of provinces surveyed: 10 participating provinces), was done between June and December 2014. The results of the above survey shall be basis for identifying the sub-projects and making a list of potential households and/or enterprises who meet the criteria as stated in appendix 2a for participating into the sub-projects.

ii. Secondary information collection (from the reports of DARD and DoNRE of the provinces and the relevant departments under MARD) was conducted between June and December 2014.

iii. Consolidation of actual status evaluation report of each province (the evaluation was completed in May 2015)

iv. Based on the problems identified in the survey report, PPMU recommended the pilots and submitted to CPMU for consolidation in February 2016.

v. Based on the proposals of PPMU, CPMU together LIC team and provincial coordinators selected the suitable pilots for each province (this activity was done on 26 and 27 February 2016).

vi. Based upon criteria (reference) developed LIC team and CPMU 6 demonstration category types have been developed for the 32 pilots.

vii. CPMU consulted 10 participating provinces at the meeting on 2 March 2016 in Binh Dinh province and agreed final list.

2.2 Overall Implementation Arrangement

As recommended by the LIC team, the implementation of pilots should cover three stages:

Stage 1:

Implement 1 sample demonstrations package in of 4 sub-projects in Nam Dinh respectively, including the following steps:

- Deepen and repeat the community consultation process to select participating households/enterprises so as to incorporate mass media advertising as instructed by ADB;
- The content of the advertising will include information on each stage of the procedure and the detailed criteria used for selection. Furthermore, a deadline e for expressions of interest will be noted as well as a date for publication of the results of the 'partner selection committee' deliberations stating the results of the criteria assessment.

(One of the features of the process is that the LCASP has a general principle of supporting demonstrations sub-project with an investment of 30-40%. Those HH/communities and/or enterprises interested in 'partnering with the project will be asked to confirm their maximum stake in the project, which shall be no less than 60%. In order to assist interested parties, an economic and technical feasibility type document will be made available upon request.)

- Results of farm/household selection are widely announced on the mass media of the locality and by direct mail or the letters on the results of farm/household selection are sent to the households who submitted their applications for demonstration participation.
- Sign participating and partnership agreement with co-operating household/enterprise;
- PPMU prepares bidding documents on the basis of the design developed by LIC team;
- Organize the bidding;
- Review of tender submissions and selection;
- Negotiate, sign and implementation contract.

Stage 2

Implement in 10 provinces, one demonstration per province with a view to covering each of the 6 categories). This is tentatively estimated at 3 months after the implementation of stage 1.

Stage 3

Implement the remaining demonstrations, tentatively about 3 months after the implementation of stage 2.

2.3 Procedure of implementing and developing the bidding packages

The bidding packages shall be categorized according to the applied technologies; therefore, each province shall implement 2 packages as a maximum.

The implementation steps are detailed in the following table:

No.	Steps of implementation	Implementing partners		Remarks
		Consulting/implementing agency	Monitoring/approving agency	
1	**Making the list of demonstrations**			
1.1	Survey and evaluation on agricultural waste management and treatment status in the whole province	Provincial coordinators and PPMU (supported by central LIC team)	PPMU shall finalize upon the comments by CPMU and LIC team	Appendix 1a – form of status survey and evaluation
1.2	Propose types of demonstration	PPMU (supported by provincial coordinator)		Appendix 1b– List of demonstrations
1.3	Consolidate and make the list of demonstrations of the whole project	CPMU with the support of LIC team	ADB gives their no-objection	Appendix 1c – categorization of demonstrations
2	**Selection of hhs/farm**			
2.1	Development of hhs/farm selection criteria	PPMU + provincial coordinator	Comments of CPMU + LIC team	Appendix 2a – hhs/farm selection criteria
2.2	Making the list of the livestock farms based on the scale	District agriculture section + provincial coordinator	PPMU	Appendix 2b – List of livestock farms based on the scale
2.3	Inform on the media/send the letter to the districts	PPMU		
2.4	Guide the hhs/farm to fill in the form and submit the application for demonstration implementation	District agriculture section		Appendix 2c – Sample of application for demonstration implementation
2.5	Minutes on evaluation and selection of participating hhs/farm	PPMU as the process leader and provincial coordinator as the participant		Appendix 2d – sample of meeting's minutes for application evaluation
2.6	Widely announced on the mass media of the	PPMU		

	locality or the letters on the results of farm/household selection are sent to the households who submitted their applications for demonstration participation			
2.7	Financial and technical support contract for hhs/farm			Appendix 2e- Sample of support contract
3	**Detail design of sample demonstration and proposal of package**			
3.1	Making the design dossier and cost estimate for bid/procurement of 6 sample demonstration categories	LIC team	CPMU shall consolidate and get the comments of ADB	Appendix 3a – Sample of design dossier
3.2	Making the design dossier and cost estimate based on the list of demonstration implementation hhs in 10 provinces	Suitable design consulting agency + support of provincial coordinator	PPMU shall finalize upon the comments by CPMU and LIC team	*Demonstration with a cost estimate of >2billion VND: applying competitive bidding procedure <2 billion VND: applying shopping procedure*
3.3	Approval and appraisal of demonstration design dossier		PPMU + support of LCI	
3.4	Development of ToR and proposal of bidding			Appendix 3b-TOR
3.5	Inform of contractor selection on mass media			*As per the procurement practices of ADB and Vietnam*
3.6	Selection of contractors			
3.7	Negotiate and sign the contract with bid winner			
3.8	Selection and contract signing with technical consultancy experts of the package			*Qualification and experience requirements on the experts are as mentioned in the detailed*

				design of the demonstration
4	**Implementation of demonstration with items of civil works and installation**			
4.1	Detail design of shop drawing and cost estimate	The selected consulting agency		*LIC team and CPMU shall monitor and support directly at request by the provinces*
4.2	Verification and appraisal of design and cost estimate		PPMU + LIC	
4.3	Civil works and installation	The selected consulting agency		
4.4	Quality control and certification	Technical consultant of package + provincial coordinator and PPMU		
4.5	Training for users	The selected consulting agency in coordination with PPMU + provincial coordinator		
4.6	Acceptance and handing-over			
4.7	Impact assessment	M & E specialist + provincial M & E staff + provincial coordinator		
5	**Implementation of technology transfer demonstration**			
5.1	Submission of solution to technical transfer	The selected consulting agency		*LIC team and CPMU shall monitor and support directly at request by the provinces*
5.2	Approve and implement		PPMU	
5.3	Quality control and certification	Technical consultant of package + provincial coordinator and PPMU		
5.4	Training for users	The selected consulting agency in coordination with PPMU + provincial coordinator		
5.5	Acceptance and handing-over			
5.6	Impact assessment	M & E specialist + provincial M & E staff + provincial coordinator		
6	**Checking and assessment**			
7	**Workshop for dissemination & information about demonstration implementation results**			

APPENDIX 1

Table1a – Form of status survey

Sheet 1: LIST OF LIVESTOCK FARMS
WHICH ARE ELIBIGLE FOR APPLYING WASTE TREAMENT MODEL

Province: .....

No.	Name of farm	Location (commune/ district/town)	As-designed quantity of livestock (head)	Existing quantity of livestock (head)	Available area (ha/m2)	Current waste treatment status	Farm's demand for energy and fertilizer	Ability of financial contribution to demonstration implementation	Remarks
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
1									
2									
3									
4									
5									
6									

Notes: The additional contents to the sheet
Farm N:……
Farm M:……
Attention shall be paid to the survey of integrated or linked demonstrations with the establishments which produce or trade in the organic fertilizer within the area or in the locality.

Table 1b – List of demonstration sub-projects per province

1. Bac Giang province

No.	Title of demonstration	Objective	Expected output
1.	Demonstration of community biogas (shared biogas)	(i) Exploit, to the maximum, biogas source (ii) Reduce environmental pollution (iii) Contribute to the new rural development via the supply of biogas energy as fuel for even the households which do not involve in the livestock farming. (iv) Create the linkage and share benefits in the residential community	i) install one system of medium scale biogas with a biogas distribution system for the community (15 – 30 households) ii) Model of effective management and operation at the community level.
2	Processing the organic fertilizer from bio-slurry and mushroom cultivating medium for the safe vegetables, contributing to the environmental pollution reduction.	(i) Production of organic fertilizer from the bio-slurry and mushroom planting waste for safe and organic vegetables. (ii) Improve the crop productivity and the fertility of agricultural land. (iii) Create more jobs and improve the income of farmers	i) Process of organic fertilizer production from bio slurry and mushroom cultivating medium ii) The results of experimentation on a typical crop of the province iii) Contribute to raising the income of participating households
3	Demonstration/pilot on the collection of biogas slurry and livestock waste from the farm households and farms for organic manure production	- Contribute to the establishment of one sustainable, effective and environment-friendly agriculture (i) Apply the advanced technology and science to the production of organic fertilizer from biogas slurry and livestock waste (ii) Reduce environmental pollution (iii) Improve the crop productivity and the fertility of agricultural land. (iv) Create more jobs and improve the income of farmers.	i) 1 effective collection model of slurry from small biogas plants to produce fertilizer.

2.Ben Tre province

No.	Title of demonstration	Objective	Expected output
4	Comprehensive management of pig farming waste (medium and large scale) in Ben Tre province	(i) Install the system of collecting and separating the manure for high quality organic fertilizer production, contributing to the effective management of waste in pig farming, improving the economic efficiency, protecting the environment and reducing the GHG emission.	i) 1 manure separation system ii) Establish 1 medium scale biogas system

		(ii) Construct the medium biogas plant to treat the livestock wastewater, produce the energy and power to serve the demands of the farm.	
5	Separate the fresh manure from the pig farms for producing the bio-organic fertilizer for: i) Intensive farming of Da Xanh pomelo (green skin pomelo) ii) Coconut cultivation	1. Set up the teams which support linking production with the product consumption 2. 2 types of crops (green skin pomelo and coconut) shall be tested. 3. Transfer the technique of composting, growing and tending the crops to the farmers and relevant subjects. 4. Set up cooperative team/production linking team, linkages among 4 entities, linking production with consumption.	i) Pig manure separation system as the feedstock for organic fertilizer production. ii) Process of testing on 2 kinds of crops (green skin pomelo and coconut) iii) Effective organizational and management model

3. Binh Dinh province

No.	Title of demonstration	Objective	Expected output
6	Demo: Separate the fresh manure from the medium and large scale pig farms for producing the bio-organic fertilizer for crops	+ Apply the manure separating technology to produce the feedstock in place of peat to as inputs for the organic fertilizer production enterprises. + Generate more income from the sale of solid waste (pig manure).	+ 1 fresh manure separation system + Generate more income for breeders
7	Comprehensive management of livestock waste, application of technologies, utilization of biogas for running power generator to serve the industrial scale pig farming.	+ Power generation from the biogas source, partly replacing the grid electricity. + Exploit and make full use of the biogas from biogas plants, prevent the environmental pollution.	+ 2 power generator systems from biogas + Utilize 100% of the biogas amount produced from the installed biogas plants.
8	Use the cow dung and biogas slurry for raising red worm or as organic fertilizer for the rice or as additional feed for chicken in Hoai My commune, Hoai Nhon district, Binh Dinh province.	- Livestock waste treatment helps reduce environmental pollution. - Use cow dung and biogas slurry as livestock feed - Evaluate the efficiency of utilizing red worm manure as the organic fertilizer for high quality rice cultivation as per the VietGap standard. - Evaluate the efficiency of utilizing red worm as the additional feed for chicken. - Technical training for the farmers on red worm raising and product utilization from red worm	+ At least 80% of the bio slurry amount from the biogas plants of 30 cow raising households shall be used for red worm raising. + Evaluation report on the effectiveness of using red worm as the fertilizer and the feed for the chicken
9	"Utilizing bio slurry for high quality grass planting to serve the cow raising"	+ Utilize the bio slurry as the fertilizer + Reduce the environmental pollution from the livestock households who do not know where to discharge their waste.	+ Model on the effective utilization of bio slurry to plant grass as the feed for cow.

		+ Utilize effectively the area under cultivation and improve the soil fertility. + Reduce costs for fertilizer + Supply the high quality green feed source for cow + Generate more income for the farmers who plant grass for cow raising.	+ At least 70% of the chemical fertilizer amount shall be replaced.
10	Production of bio-organic fertilizer from biological bedding in chicken raising in combination with trichoderma for safe vegetables in Phuoc Hiep commune, Tuy Phuoc district, Binh Dinh province.	+ Treat chicken manure by biological bedding in combination with organic matter decomposition, etc. + Produce bio-organic fertilizer from biological bedding for chicken raising in combination with Trichoderma. + Use organic manure from chicken raising bedding to produce the fertilizer for safe vegetables.	

4. Ha Tinh province

No.	Title of demonstration	Objective	Expected output
11	Utilize all the effluent and bio-slurry waste from the biogas plant for fruit trees and biogas for producing power at one pig farm in Ha Tinh.	(i) Treat all the livestock waste and wastewater using HDPE lagoon to produce biogas for running power generator, contributing to power with a yearly saving (125.9 MW/h) for the farm. (ii) Utilize the whole water discharged from biogas lagoon as the fertilizer for the fruit trees and rubber tree; protect the watershed water source	i) Construct one HDPE lagoon to produce 125.9 MW/h per year ii) Replace 525 ton of organic fertilizer per year
12	Produce the organic fertilizer from industrial scale fattening pig farming waste	(i)Re-establish the system of liquid matter collection system, (ii) Separate the dry matter from liquid matter to reduce environmental pollution (iii) Work with 1 cooperative to produce 1,350 ton of organic fertilizer, treat 78,800 m3 of wastewater.	i) Treat 78,800 m3 of wastewater. ii) Produce 1,350 ton of organic fertilizer

5. Lao Cai province

No.	Title of demonstration	Objective	Expected output
13	Comprehensive management of waste from medium and large pig farm to produce the electricity and bio-organic fertilizer.	i) Produce high quality organic fertilizer from the pig manure, contributing to waste management in pig farming, improving the economic efficiency, protecting the environment and reducing GHG emission. ii) Construct large scale biogas plant to treat waste and install one power generation system to meet the demands for biogas and electricity of the farm.	+ 1 manure separation system as the feedstock for organic fertilizer production + 1 large scale biogas system + 1 power generation system from biogas
14	"Establishment of integrated system of farm	- Set up livestock waste management team	+ 1 treatment and collection system of

	household scale livestock waste treatment for the sparsely populated mountainous area.	- Provide the training and dissemination to the farm households - Support the local people with materials, equipment, tapes/disks, etc. - Form the bio-organic fertilizer production teams to meet the high demand of the market.	scattered waste with the participation of ethnic group people.

6. Nam Dinh province

No.	Title of demonstration	Objective	Expected output
15	Separate the fresh manure from medium and large fattening pig farm to produce organic fertilizer and power generation.	Comprehensive and effective management of livestock waste to produce high quality organic fertilizer and provide the energy.	+ 3 manure separation systems + 3 large scale biogas plants + 3 power generation systems from biogas
16	"Formation of system of collecting and separating slurry from biogas plants to process organic fertilizer	- Environmental pollution reduction in the livestock sector - Waste collection for processing into the organo-mineral and microbiological organic fertilizer, etc.	+ 1 model of collecting and separating slurry from scattered biogas plants to produce organic fertilizer

7. Phu Tho province

No.	Title of demonstration	Objective	Expected output
17	Demonstration on the application of biogas technology to treat the waste from pig farm and share the biogas benefits in Thanh Thuy district and Phu Tho town in Phu Tho province.	+ Manage and utilize effectively the quantity of biogas produced from the medium biogas plants to reduce the environmental pollution and lower GHG emission. + The successful implementation of demonstration is a good lesson for others to follow and replicate in the whole province with the different livestock scales.	1 model of shared biogas
18	Demonstration on the utilization of cow dung to raise red worm as the feed (protein supplementation) for the hill chicken in Huong Non commune, Tam Nong district and the whole city of Viet Tri of Phu Tho province.	- Livestock waste treatment helps reduce environmental pollution. - Use cow dung and biogas slurry as feed for red worm - Evaluate the efficiency of utilizing red worm as the additional feed for chicken. - Technical training for the farmers on red worm raising and product utilization from red worm	+ At least 80% of the bio slurry amount from the biogas plants of 30 cow raising households is used for red worm raising. + Evaluation report on the effectiveness of using red worm as the fertilizer and the feed for the chicken
19	Separate the fresh manure from medium and large fattening pig farm to	- Apply the manure separation and post-separation solid waste treatment technology as the substrate for organic fertilizer production.	+ 1 manure separation system as the feedstock for organic fertilizer production

	produce bio-organic fertilizer for the	- Generate more income for the local people.	
20	Utilize the biogas slurry for high quality grass planting to serve the cow raising	+ Utilize the bio slurry as the fertilizer for high quality grass planting + Reduce the environmental pollution from the livestock households who do not know where to discharge their waste. + Utilize effectively the area under cultivation and improve the soil fertility. + Reduce costs for grass planting fertilizer + Generate more income for the farmers who plant grass for cow raising.	+ Model on the effective utilization of bio slurry to plant grass as the feed for cow. + At least 70% of the chemical fertilizer amount shall be replaced.

8. Soc Trang province

No.	Title of demonstration	Objective	Expected output
21	Demonstration development of separating the fresh manure from pig farm as the feedstock for bio-organic fertilizer production for the crops.	- Separate the solid matter from pig farming waste as the feedstock for producing organic fertilizer; minimize the quantity of waste to be treated via biogas technology. + Improve the organic fertilizer production via composting technology. + Generate more income for livestock households.	+ 1 manure separation system + Process of composting
22	Demonstration development of separating the biogas slurry from pig farm as feedstock for producing organic fertilizer for the crops and power generation.	- Separate the solid matter from biogas slurry and the sediment of biogas system as the feedstock for producing organic fertilizer. + Improve the biogas run power system in the farm.	+ 1 manure separation system as the feedstock for organic fertilizer production. + 1 biogas system + 1 power generation system from biogas
23	Utilize the biogas slurry for high quality grass planting to serve the cow raising	+ Utilize the bio slurry as the fertilizer for high quality grass planting + Reduce the environmental pollution from the livestock households who do not know where to discharge their waste. + Utilize effectively the area under cultivation and improve the soil fertility. + Reduce costs for grass planting fertilizer + Generate more income for the farmers who plant grass for cow raising.	+ Model on the effective utilization of bio slurry to plant grass as the feed for cow. + At least 70% of the chemical fertilizer amount shall be replaced.
24	Development of slurry separation demonstration from small biogas plant to produce organic fertilizer for the subsidiary crops as per Global GAP standard	+ Separate solid matter from biogas slurry and sediment of the biogas system as the feedstock for organic fertilizer production + Improve the power system used the biogas in the farm	+ System of collecting and separating the slurry of scattered small biogas plants to produce the fertilizer.

9. Son La province

No.	Title of demonstration	Objective	Expected output

25	Development of comprehensive management demo. of industrial scale dairy cow raising waste	Set up the effective and comprehensive management demo. of dairy cow raising waste for producing bio-organic fertilizer for the crops right in Moc Chau district, supplying the energy and forming the practical basis for training on and replicating the demo. to the farms of the similar scale.	+ 1 cow dung separation system for organic fertilizer production. + 1 large biogas system + 1 power generation system from biogas
26	Development of comprehensive management demo. of industrial scale pig raising waste	Set up the effective and comprehensive management demo. of raising waste for producing high quality organic fertilizer, renewable energy and forming the practical basis for training on and replicating the demo. to the farms of the similar scale.	+ 1 pig manure separation system for organic fertilizer production. + 1 large biogas system + 1 power generation system from biogas

10. Tien Giang province

No.	Title of demonstration	Objective	Expected output
27	Comprehensive management demo. of livestock waste applying the manure separation and power generation technology from the biogas for the medium and large livestock farms	Manage the livestock waste, inclusive of manure and wastewater, to reduce environmental pollution and produce energy for the production.	+ 1 pig manure separation system for organic fertilizer production. + 1 large biogas system + 1 power generation system from biogas
28	Demonstration of separating the slurry from small biogas plant to produce bio-organic fertilizer to serve the planting of durian as per the Global Gap standard	Control the waste from the small biogas plant to produce bio-organic fertilizer to serve the planting of durian as per the Global Gap standard; generate more income for the local people and reduce environmental pollution.	+ System of collecting and separating the slurry of scattered small biogas plants to produce the fertilizer.
29	Demonstration of shared biogas supply and production of organic fertilizer from medium biogas plant	Enhancing the use of biogas energy via the community sharing, contributing to the lower environmental pollution.	+ 1 effective shared biogas model

***** Three additional proposals are currently under consideration making 32 in total.

Table 1c – Categorization of demonstration sub-projects

	Demonstration Categories By Technology Type	Participating provinces										Total
		BG	BT	BD	HT	LC	ND	PT	ST	SL	TG	
1	Comprehensive management of livestock waste (for biogas production, power generation, organic fertilizer)		1	2	1	1	3			2	1	**11**
	Size of 2000-3000 head of pigs (equivalently converted)		*1*	*1*	*1*	*1*	*1*			*1*	*1*	
	Size of 3001-5000 head of pigs (equivalently converted)			*1*			*1*			*1*		
	Size of >5000 head of pigs (equivalently converted)						*1*					
2	Separating slurry of biogas digester – scattered collection system for organic fertilizer production	2		1			1		2		1	**7**
	Small scale (family)	*1*		*1*					*1*		*1*	
	Medium scale (household-based livestock producer)	*1*					*1*		*1*			
3	Shared biogas and linkage in organic fertilizer production from livestock waste	1				1		1			1	**4**
4	Utilization of digested effluent as the fertilizer of the crops and grass			1				1	1			**3**
5	Utilization of cattle dung as the feedstock for red worm raising			1				1				**2**
6	Separating the pig manure for organic fertilizer production		1	1	1			1	1			**5**
	No. of selected demonstrations	**3**	**2**	**6**	**2**	**2**	**4**	**4**	**4**	**2**	**3**	**32**
	Total no. of project demonstrations	**32**										

APPENDIX 2: Forms and Templates

Appendix 2a: Criteria for hhs/enterprise selection

General principle:
These criteria are the basis for the demonstration implementation hhs selection and they shall be customized given the features of each model.
General criteria:

1) Representative for the farming status and problems with waste treatment in the livestock and crop production
2) Voluntary (willing) to participate in the project
    - Counterpart fund contribution to the demonstration development
    - Support of facilities and labor
3) Ability to arrange the implementation
    - Capability to receive the technology or operate the plant according to the guidelines
    - Sufficient area (site) for model development and available facilities and labor,
    - No financial difficulties such as bad debt of bank, land dispute, etc.
4) Ease of access to the demonstration site and associated information and training activities.
5) Farm owner and majority of its labor are women or ethnic minority people

Appendix 2b – List of livestock farms based on the scale

No	Name of hhs/farm owner	Address/contact telephone	< 100 head of pigs or 5 head of cattle	100-1500 head of pigs or < 100 head of cattle	>1,500 head of pigs >100 head of cattle	Remarks
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*

Appendix 2C – Summary Form for Panel Scoring Against Criteria

Sub-project investment proposal	Title - Description	Summary of rating/cost								
		Criteria								
		Typical	Agree to join the project	Farm location	Enough resource to take the tech and project	Priority given to farm owner being female or ethnic group people	Technical design	Econ Viability / Cost estimate	HH/Enterprise Commitment % of Investment	General rating
Applicant 1										
Applicant 2										
Applicant 3.										
Applicant 4.										

Criteria and scoring scale (100 points) for identifying pilot implementation hhs/farm

Representative for the farming status and problems with waste treatment**: 20 points**

Willingness to participate and help facilitate the demonstration: **30 points,** including: fund contribution (10 points), support of facilities (5 points) and labor (5 points), Ability to arrange the implementation: expertise, total area (site), available facilities and labor: 10 points

Ease to access (convenience) to the activities of training, **visit: 5 points**

Farm owner being female or most of the labor are women or ethnic minority people**: 5 points**.

The allocation of the remaining points **(40 points**): i) according to the suitability of the technical design: 20 points and ii) economic viability :20 points

NB If the proposal fails an economic viability assessment i.e. has a rate of return of return of less than 12%, then this is considered a 'killing assumption.' Meaning the proposal fails and is rejected.

Appendix 2D –Sample of demonstration implementation application A

THE SOCIALIST REPUBLIC OF VIETNAM

Independence - Freedom - Happiness

APPLICATION FOR DEMONSTRATION IMPLEMENTATION

To: PPMU of LCASP in…….

My name is: ……..
Year of Birth: ……
ID number: …… issued by police of ..... dated ....
Resident in Commune: .....District..... :……. Province:.....

Via the information from mass media and the dissemination of PPMU of Low Carbon Agricultural Support Project in ....., I strongly believe that my household is eligible for and can meet the requirements for the demonstration implementation of the project as detailed below:

- The current quantity of livestock:
- Outstanding problems of the farm/household (indicating the main problems faced require the support for the demonstration implementation).
- Our household has not been received any funding from the state or other projects to deal with the above problems.

If supported to implement the demonstration of …. (name of demonstration), I promise to actively cooperate with PMU to implement the demonstration at our farm, strictly comply with technical requirements on the demonstration, contribute counterpart funds in a timely manner and create the favorable conditions for the contractors to implement their work (technical items of the demonstration) at our farm. We will welcome and guide the groups/missions which come to our farm for visiting, studying and exchanging the experience and information related to the demonstration (according to the requirements of PPMU).

We commit to operating and maintaining LCASP equipment to required high standards and to follow the plan for this. At the end of the project we shall purchase LCASP equipment at the agreed depreciated price (according to prescribed regulation) of xxxxxxxxxxx – to insert

I look forward to the support from PPMU.

Yours Sincerely,

…. ....., Date…….

Confirmation of CPC	The applicant
Mr. (Ms.)	*(Sign, write full name)*
Resident at:	
(Signature, name, stamp)	

Table 2d: Sample of meeting's minutes for application evaluation

DARD....	THE SOCIALIST REPUBLIC OF VIETNAM
PPMU of LCASP	Independence – Freedom - Happiness

MINUTES OF MEETING

Sub.: Selection of farm/hhs for implementing demonstration (Name of demonstration)

-Pursuant to: ……

-Pursuant to: ……..

Today, ...2016, PPMU of .....organized the meeting for evaluating and selecting the demonstration implementation hhs in the province.

Participants:

Mr./Mrs.: - position:

Mr./Mrs.: - position:

Mr./Mr.: - provincial coordinator

Chairperson:

Secretary:

Contents of meeting:

- The quantity and contents of the demonstrations to be implemented
- List of hhs/farms which submitted the applications for demonstration implementation
- Criteria of evaluation and selection

Conclusion:

- List of selected hhs/farms together with the demonstrations to be implemented, the reasons why these were selected.
- The contents of the meeting were agreed by all the parties. The meeting was wrapped up at ..... of the even day.
- Director of PPMU is kindly requested to approve this for implementation.

CHAIRPERSON **SECRETARY**

Table2e: Sample of support contract

DARD....	THE SOCIALIST REPUBLIC OF VIETNAM
PPMU of LCASP	Independence – Freedom - Happiness

FINANCIAL AND TECHNICAL SUPPORT CONTRACT
FOR DEMONSTRATION IMPLEMENTATION HHS/FARM
Title of demonstration

- Pursuant to…..
- Pursuant to the application for demonstration implementation of the farm……which was approved by PPMU and main partners of the project.
- Based on the results of evaluating and selecting the demonstration implementation hhs/farm of PPMU dated…..
Today, date……in……We are:

1. **Financial and technical support entity (party A)**: PPMU of LCASP in…….
Address: ..... …. Tel:
Represented by: Position: Director

2. **Financial and technical support recipient (party B)**:
Name of farm:……
Address: Province/city.....District..... Commune.....
Tel.: ..... Fax……
Represented by: .....Position: Farm owner
Mobile phone:……..email……

Two parties came to an agreement about the implementation of demonstration of ……..(name of demonstration) with the terms as follows:

Article 1: Contents of cooperation

+ Technical content
+ Other contents and activities

Article 2: Responsibility of the parties

Party A:

+ Technical support*{indicating the technical items to be supported}*;
+ Financial support *{supporting mechanism and amount}*

Party B:

+ Contribute the fund to the construction of facilities/equipment installation, etc.
+ Prepare the site for civil works and installation of the demonstration
+ Together with Party A to supervise the construction and equipment installation as per the technical requirements specified in the design dossier of the demonstration.

+ Together check the commissioning and the whole demonstration before conducting the acceptance and handing-over.
+ Involve in the acceptance and receive the handing-over of the demonstration.
+ Organize the operation, exploitation and maintenance of the demonstration in accordance with the guidelines supplied by Party B.
+ Utilize and maintain the equipment of the demonstration during the project lifetime.
+ Disseminate and introduce the demonstration in the locality, allow the missions/delegations to come to visit and study the demonstration (as introduced by PPMU).
+ Assign the individual(s), who are capable and knowledgeable, to be responsible for the demonstration. Such person(s) shall participate in all the training courses recommended by PPMU.

Article 3: Necessary conditions to get the financial and technical support:

Financial support via the subsidy for the biogas plant (only supporting the demonstration with the item of biogas plant)

+ The subsidy is provided as per the regulations of the project on the subsidy level and condition specified in the document of…..
+ The quality requirements were met at time of the acceptance
+ The farm owner participated in the training courses for the users.

Financial support via the lending of equipment and technology transfer

As to the biogas demonstration for power generation

+ The biogas plant was put into operation stably and produced the quality biogas (the fire burn well on the biogas cooker)
+ The other infrastructural items such as the workshops and the operators are available and accepted by party A.

As to the demonstration for organic fertilizer production and technology transfer:

+ The other infrastructural items such as the workshops and the operators are available and accepted by party A.

Article 4:Unilateral contract suspension and damage compensation:

+ One party has the right to unilaterally suspend the contract performance and demands the compensation from the other party for its grave violation to the articles in the contract.
+ In case where no other consensus is reached, the offending party shall compensate for the whole cost incurred by the other party.

Article 5: Settlement of complaint and dispute

+ The complaint and dispute shall be discussed for a joint solution. In case no joint solution is mapped out, these shall be brought to the civil court for settlement.

This contract is made on…….2016 into 2 copies of equally authentic value, each keeps 1 copy and shall become effective as of its signing until ……2018.

.

Party A	**Party B**
(Sign and write full name)	*(Sign, write full name and stamp)*

APPENDIX 3: Checklists and Specimen Samples

This covers essential pre-feasibility based information. A specimen example follows on along with the checklist from which the information was derived.

Table 3a – Sample of design dossier of demonstration

Short summary/overview of the demonstration

- Main contents and activities of the demonstration
- Products of the demonstration
- Total investment and economic efficiency
- Time frame and implementation mechanism
-

1. Rationale of demonstration development
   1.1 Current status and outstanding problems
   1.2 Potential of demonstration replication within the province

2. Objective of the demonstration

3. Technological solution

4. Equipment and technical parameters

5. Total investment

6. Analysis of economic efficiency

7. Potential market

8. Implementation plan and schedule

Appendix 3b checklist for Dossier Preparation

Information for each categorization of demonstration sub-projects

Sub-Category (Determine type	Province X
1.Problem statement (in relation to project targets and environmental issues **(Provincial coordinator with PPMU**	
2. No of farms/HH/Enterprises with potential to replicate - Provincial coordinators with PPMU **Specify plus narrative** ➢ **10** ➢ **11-30** ➢ **31-50** ➢ **>50**	
3. Technical Feasibility of the proposed design type (Ms. Huong, Mr.Chinh and Mr. Bo)	
4 Proposed equipment (Mr.Chinh and Ms Huong) - **Name and purpose** - **Output capacity** - **Cost** **Also indicatively** - **Indicative after sales service** - **Operations and maintenance requirements** - **Outline schedule of spare parts required over the normal life (10 years) of the equipment**	
5 Indicative market for the end product **Who and number of entities will buy the product?** **provincial coordinators with PPMU**	
6.Economic Analysis **Modal-formula per Ms Hanh-Economic and Business Specialist**	

Appendix 3C Specimen Dossier for Shared Biogas Model

Community biogas model for organic fertilizer production & biogas supply to one centralized residential cluster in midland or plain area.

Prepared by Mrs.Ho Thi Lan Huong

Case of one farm cluster from 200 to 1,000 fattening pigs in Phu Tho

Short introduction to the model:

Shared biogas model uses the biogas technology to treat the livestock waste and other organic waste for energy and fertilizer production at the community level.

The model consists of one and several medium size biogas plants with the biogas pipeline system to supply the energy even to the households which do not involve the livestock production. The solid waste portion is separated as the feedstock for organic fertilizer production.

Total cost of model implementation is 3.858 billion VND, including both direct cost (for civil works and equipment) and indirect cost (for technical consultancy services).

1. Rationale of model development

At present, mode of household based livestock production toward bio-safety is being encouraged. The number of household based livestock producers is different from province to province; however, the area of household based livestock production has been planned, namely the household based livestock producers are often concentrated in some districts of province and in each district, these are concentrated in some communes.

As to the provinces in the midland and plain area, the households often lives in a centralized manner and the household based livestock producers still lies not so far from or scattered within the residential area. 100% of the residential area herein have the access to the national electric grid; however, the quality of electricity source and frequency of power failure are different from locality to locality. Popular energy sources for cooking and production of the households are LGP, honeycomb coal briquette and firewood contributing to the higher GHG emission and deforestation.

The following are some problems about waste management in the household based livestock producers and environmental pollution from livestock waste :

- The quantity of manure from the household based livestock producers is not enough to produce the commercial fertilizer.

- If the whole manure quantity is loaded into the biogas plant for processing, the quantity of biogas generated is too big to use within the household and its production activities.

In view of the foregoing, the following methods are mapped out :

- The quantity of solid manure shall be separated in each household-based livestock producer to sell to the organic fertilizer producer. As such, the household based livestock producers shall have an additional income source from sale of solid manure. Separating the

solid manure from the waste contributes to reducing the quantity of feedstock to the biogas plant. The biogas quantity produced shall basically match with the demand for biogas of the households and no need to discharge the excess amount into the air, resulting in the green house effect.

- Connecting the biogas plants together shall help deal with the problem of how to make full use of the biogas generated, namely sharing the biogas with the adjacent households who do not involve the livestock production but have the demands for biogas utilization.

2. Objective of the model:

2.1. General objective

Enhancing the green production by improving the efficiency of waste generation management process and utilizing effectively the recycled energy source from the waste.

2.2. Specific objective

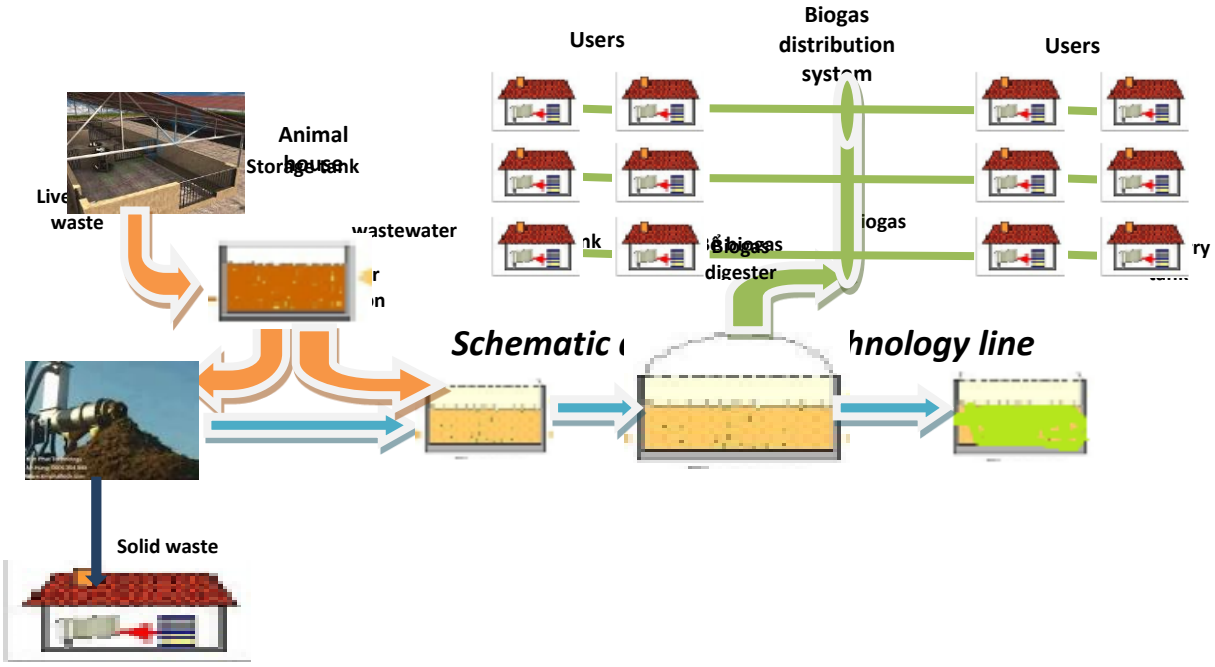
- Medium size biogas technology shall be applied to the livestock waste treatment and biogas production, matching with the demands for biogas utilization.

- Set up and install the system of biogas distribution which is synchronous and suitable for the demands of the households.

- The income of the livestock households shall be higher through commercialization of the separated solid manure quantity and sale of biogas to the users in place of traditional fuels, contributing to the environmental protection, lower GHG emission and decreased deforestation.

3. Technological Solution

3.1. Technological diagram



3.2. Equipment and technical specifications

Table 1 – Raw materials, equipment, technical specifications, types and requirement on quantity

No.	Item	Technical specification	Quantity	Remarks
1	Tubular biogas plug flow digester V=100m^3	Brick, cement, sand	7	
	Biogas digester (model KT1) V = 50m^3	Brick, cement, sand	2	
2	Tank for collecting manure V = 7-10m^3	Built of brick	9	
3	Mixing tank V = 2m^3	Built of brick	9	
4	Bio slurry tank V= 7-10m^3	Built of brick	8	
5	Ditch for collecting manure	Built of brick	1,000m	
	Pipe for channeling the wastewater into the tanks	Tien Phong plastic, class 1, φ160mm	500m	
6	Main biogas pipeline system	Tien Phong plastic, class 1, φ34mm	6,000m	
	Biogas delivery system to the users	Tien Phong plastic, class 1, φ21mm	2,500m	

7	General filter		9 sets	
8	Biogas meter	Q= 0.5-1m^3/h	90 units	
9	Biogas force pump	Q=	9 units	
10	Biogas bag (V=5m^3)	LDPE canvas of Thai Land; with a thickness of 0.5mm	90 pieces	
11	Valve and spare parts	Plastic valve, complete with biogas pipeline	100 sets	

4. Total investment and financial mechanism

No.	Item	Amount (đ)	Financial mechanism	
			Project	Owner
A	Cost of equipment	2,224,200,000	1,053,500,000	1,170,700,000
B	Cost of labor	670,000,000	0	670,000,000
C	Cost of technical service	964,000,000	964,000,000	-
Total (A+B+C)		3,858,200,000	2,017,500,000	1,840,700,000

6. Benefit analysis of the model [37]

6.1. Economic benefit

a) Benefit from sale of solid manure to fertilizer producer

- Output of solid manure: 4,000 ton/year
- Selling price of solid manure: 350,000 VND per ton
- Turnover from solid manure: 1,400,000,000 VND/year
- Income from sale of solid manure : 705,000,000 VND/year

The economic efficiency of the model is analyzed as follows:

Contribution of the project to pilot demo.:	**47%**
Contribution of the owner to pilot demo.:	53%
Rate of return/investment of the project to pilot demo.:	67%
Rate of return/investment of the owner/enterprise:	60 %
Rate of return/turnover of sale of products from pilot demo:	50%

b) Benefit from the new energy source in place of traditional fuels

- Annual biogas yield : 120,000 m^3/year
- Income from sale of biogas from biogas plant : 75.6 million VND/year

c) Environmental benefit : a saving of 180 million VND/year (penalty for environmental pollution in case of violation).

d) Benefit for the community: not causing the pollution (bad odor), preventing the discharge of wastewater into the environment, utilizing the source of excess biogas helping reduce GHG effect.

7. The current consumption market

The provinces in the midland and plain areas are strong in the agricultural production; therefore, the demands of fertilizer for the crops such as staple crops, vegetables of various types, fruit trees, industrial crops and production forests are high. The demand for organic

[37] Ms. Hanh to verify and provide formula.

fertilizer in Phu Tho ranges from 1.5 to 2 million ton per year. Of which, the supply source from the fertilizer producers and local people can only meet 30 – 35% of total demand. Two biggest organic fertilizer trading and production enterprises in the province are Bai Bang Trade Union JS Company and Phu Tho Technical Consultancy and Service Company.

In the midland and plain provinces (like Phu Tho province), there is a high potential for shared biogas system because the centralized medium scale livestock production is popular and there is a considerable quantity of households living near these livestock farms. The biogas application for treating waste is quite popular; however, the quantity of biogas generated often is much higher than the demand for the energy of these farms. The plants of the scale of 50 – 100m^3 can meet the demand for the biogas of 10 – 30 households. Also the households which do not involve in the livestock production can access to the biogas as a clean energy source to ensure a civilized society

Appendix: Cost estimate of model implementation

No.	Item	Quantity	Unit price (VND)	Amount (VND)	Financial mechanism	
					Project	Owner
A	**Cost of equipment**			**2,224,200,000**	**1,053,500,000**	**1,170,700,000**
1	Tubular biogas plug flow digester (built of brick, V=100m^3	7	70,000,000	490,000,000	70,000,000	420,000,000
	Biogas digester (model KT1, built of brick) V = 50m^3	2	35,000,000	70,000,000	20,000,000	50,000,000
2	Tank for collecting manure (V = 7-10m^3)	84	850,000	71,400,000	0	71,400,000
3	Mixing tank (V = 2m^3)	18	850,000	15,300,000	0	15,300,000
4	Bio slurry tank (V= 10m^3)	9	8,000,000	72,000,000	0	72,000,000
5	Ditch for collecting manure (0.2 x 0.35 x 1.000m) m^3	70	900,000	63,000,000	0	63,000,000
	Pipe for channeling the wastewater into the tanks, dy=m	500	150,000	75,000,000	0	75,000,000
6	Main biogas pipeline system, dy=m	6000	14,000	84,000,000	0	84,000,000
	Biogas delivery system to the users, dy=m	2500	8,000	20,000,000	0	20,000,000
7	Filter	9	15,000,000	135,000,000	81,000,000	54,000,000
8	Biogas meter	90	1,500,000	135,000,000	81,000,000	54,000,000
9	Biogas bag	90	5,000,000	450,000,000	270,000,000	180,000,000
10	Biogas force pump	9	1,500,000	13,500,000	13,500,000	0

11	Set of biogas valve (general valve, distribution valve and spare parts)	100	300,000	30,000,000	18,000,000	12,000,000
12	Mobile solid/liquid matter separator)	1	500,000,000	500,000,000	500,000,000	0

No.	Item	Quantity	Unit price (VND)	Amount (VND)	Financial mechanism	
					Project	Owner
B	**Cost of labor**			**670,000,000**	**0**	**670,000,000**
1	Labor for constructing biogas plant of 100m3	7	50,000,000	350,000,000	0	350,000,000
2	Labor for constructing biogas plant of 100m3	2	25,000,000	50,000,000	0	50,000,000
3	Labor for constructing storage tank, mixing tank, outlet tank and ditch for collecting the manure.	9	20,000,000	180,000,000	0	180,000,000
4	Labor for installing the pipeline system	9	10,000,000	90,000,000	0	90,000,000
C	**Cost of technical service**			**964,000,000**	**964,000,000**	**0**
1	Technical expert (man month)	15	20,000,000	300,000,000	300,000,000	-
2	Technical design and construction (man month)	2	40,000,000	80,000,000	80,000,000	
3	Adjustment to shop drawing based actual conditions	7	12,000,000	84,000,000	84,000,000	
4	Training	1	200,000,000	200,000,000	200,000,000	-

5	Communication Information & dissemination	1	50,000,000	50,000,000	50,000,000	-
6	Workshop for commercial promotion	1	50,000,000	50,000,000	50,000,000	-
7	Review for replication	1	200,000,000	200,000,000	200,000,000	-
Total (A+B+C)				**3,858,200,000**	**2,017,500,000**	**1,840,700,000**

APPENDIX I: INCEPTION ACTIVITIES AND LIST OF OUTPUTS (DOCUMENTS SUBMITTED) By M&E SPECIALIST

1. Activities

Dec 2015

No.	Description of Activity according to TOR	Expected outputs	Outputs achieved Notes/Comments
1	**TOR tasks (PM, iii, iv, viii, ix)** LIC Meetings with CPMU, ADB and Province Coordinators. **TOR tasks (PM, iii, iv)** Collected all main documents of the project. **TOR tasks (PM, iii, iv)** Read project documents and the related documents.	LIC Meetings with CPMU, ADB and Province Coordinators conducted. All main project documents are collected. Project documents and the related documents are read. Specialist the market aware of the project situation.	LIC Meetings with CPMU, ADB and Province Coordinators conducted. All main project documents are collected. Project documents and the related documents are read. Specialist the market aware of the project situation.
2	**TOR tasks (PM, iii)** Reviewing the implementation of the project in period from starting to December 2015. **TOR tasks (PM, iii)** Determine the status of the current M&E activities of the project. **TOR tasks (PM, iii, iv, viii, ix)** Prepare to establish the M&E Plan in 2016. **TOR tasks (PM, iii, iv, viii, ix)** Meeting with M&E Staff of Project. TA Meeting on New technology for waste treatment. **TOR tasks (PM, iii)** Identify the Indicators in Project Design and Monitoring Framework and Data base.	The implementation of the project in period from starting to December 2015 is reviewed deeply. Status of the current Project M&E activities are determined. M&E Plan in 2016 is prepared to establish. Meeting with M&E Staff of Project and TA Meeting on New technology for waste treatment are conducted. Indicators in Project Design and Monitoring Framework and Data base are identified.	The implementation of the project in period from starting to December 2015 is reviewed deeply. Status of the current Project M&E activities are determined. M&E Plan in 2016 is prepared to establish. Meeting with M&E Staff of Project and TA Meeting on New technology for waste treatment are conducted. Indicators in Project Design and Monitoring Framework and Data base are identified.
3	**TOR tasks (PM, iii)** Identify the Indicators in Gender Action Plan Framework and Data base. **TOR tasks (PM, iii)** Reviewed Current data base system of Project.	Indicators in Gender Action Plan Framework and Data base are identified. Current Data Base System of Project reviewed.	Indicators in Gender Action Plan Framework and Data base are identified. Current Data Base System of Project reviewed.

No.	Description of Activity according to TOR	Expected outputs	Outputs achieved Notes/Comments
	TOR tasks (PM, iii) Prepare to develop the PPMS. **TOR tasks (PM, iii, iv, viii, ix)** TA meeting to coordinate the deployment plan of TA.	PPMS's development are prepared. TA meeting to coordinate the deployment plan of TA is conducted.	PPMS's development are prepared. TA meeting to coordinate the deployment plan of TA is conducted.

Jan 2016

No.	Description of Activity according to TOR	Expected outputs	Outputs achieved Notes/Comments
1	**TOR tasks (PM, iii, iv, v, vi, vii, viii, ix)** Develop M&E Plan in 3 years and in 2016 EN VN. **TOR tasks (PM, viii)** Develop the form of Quick survey table selecting the demonstration pilot VN. **TOR tasks (PM, iii, iv, v)** Develop the Form of DMF updated EN VN. **TOR tasks (PM, iii, iv, v)** Develop the Tool aggregating data to update DMF VN.	M&E Plan in 3 years and in 2016 developed EN VN. Form of Quick survey table selecting the demonstration pilot developed VN. Form of updated DMF developed EN VN. Tool aggregating data to update DMF developed VN.	M&E Plan in 3 years and in 2016 developed EN VN. Form of Quick survey table selecting the demonstration pilot developed VN. Form of updated DMF developed EN VN. Tool aggregating data to update DMF developed VN.
2	**TOR tasks (PM, iii, iv, v)** Develop the Tool aggregating data to update DMF VN. **TOR tasks (PM, iii, v, vi)** Meeting with the Project M&E staff. **TOR tasks (PM, iv, ix)** Field trip in Bac Giang Province. Meeting with Bac Giang PPMU. **TOR tasks (PM, iii, vi)** Develop the Form of LCASP Quarterly Report under the TT01 VN. **TOR tasks (PM, iii, vi)** Develop the Form of CPMU Quarterly Report submitting to ADB VN.	Tool aggregating data to update DMF developed VN. Meeting with the Project M&E staff is conducted. Field trip in Bac Giang Province and Meeting with Bac Giang PPMU are conducted. Form of LCASP Quarterly Report under the TT01 VN developed. Form of CPMU Quarterly Report submitting to ADB developed VN.	Tool aggregating data to update DMF developed VN. Meeting with the Project M&E staff was conducted. Field trip in Bac Giang Province and Meeting with Bac Giang PPMU were conducted. Form of LCASP Quarterly Report under the TT01 VN developed. Form of CPMU Quarterly Report submitting to ADB developed VN.
3	**TOR tasks (PM, iii, vi)** Developed the Form of PPMU Quarterly Report submitting to CPMU VN. **TOR tasks (PM, iii, vi)** Perfect the Form of Gender Action Plan EN VN.	Form of PPMU Quarterly Report submitting to CPMU developed VN. Form of Gender Action Plan is perfected EN VN.	Form of PPMU Quarterly Report submitting to CPMU developed VN. Form of Gender Action Plan was perfected EN VN.

	TOR tasks (PM, iii, iv, v, vi) Develop the Form of Monitoring in GAP implementation updated EN VN. **TOR tasks (PM, iii, iv, v, vi)** Develop the Tool aggregating data to update Monitoring of GAP implementation VN.	Form of Monitoring in GAP updated implementation developed EN VN. Tool aggregating data to update Monitoring of GAP implementation developed VN.	Form of Monitoring in GAP updated implementation developed EN VN. Tool aggregating data to update Monitoring of GAP implementation developed VN.
4	**TOR tasks (PM, iii, iv, v, vi)** Develop the Tool aggregating data to update Monitoring of GAP implementation VN. **TOR tasks (PM, viii)** Develop the Form of Monthly Results Report - Coordinator VN. **TOR tasks (PM, viii)** Develop the Form of Work Progress Report on direct demand of CPMU - Coordinator VN. **TOR tasks (PM, viii)** Develop the Form of Monthly Progress Report - Specialist and Coordinator EN. **TOR tasks (PM, iii, vi, viii, ix)** Develop the Monthly Progress Report EN. **TOR tasks (PM, vii, viii, ix)** TA Meeting.	Tool aggregating data to update Monitoring of GAP implementation developed VN. Form of Monthly Results Report - Coordinator developed VN. Form of Work Progress Report on direct demand of CPMU - Coordinator developed VN. Form of Monthly Progress Report - Specialist and Coordinator developed EN. Monthly Progress Report developed EN. TA Meeting is conducted.	Tool aggregating data to update Monitoring of GAP implementation developed VN. Form of Monthly Results Report - Coordinator developed VN. Form of Work Progress Report on direct demand of CPMU - Coordinator developed VN. Form of Monthly Progress Report - Specialist and Coordinator developed EN. Monthly Progress Report developed EN. TA Meeting was conducted.
5	**TOR tasks (PM, ix)** Undertook other tasks as requested by Team Leader.	As arises - completed.	As arises - completed.

Feb 2016

No.	Description of Activity according to TOR	Expected outputs	Outputs achieved Notes/Comments
1	**TOR tasks (PM, ix)** Meeting with the Specialists, Team Leader and Agrifood Consulting International. **TOR tasks (PM, iii,v)** Developed the Tool aggregating data of Training monitoring VN. **TOR tasks (PM, ix)** Supported the Team Leader to develop the Inception Report. **TOR tasks (PM, viii)** Meetings with CPMU, Team Leader and Specialists on	Working regulations of specialists agreed. Tool aggregating data of Training monitoring developed VN. M&E content in Inception Report completed. Meeting with CPMU, Team Leader and Specialists on	Working regulations of specialists agreed. Tool aggregating data of Training monitoring developed VN. M&E content in Inception Report completed. Meeting with CPMU, Team Leader and Specialists on demonstration pilot deployment conducted.

No.	Description of Activity according to TOR	Expected outputs	Outputs achieved Notes/Comments
	demonstration pilot deployment.	demonstration pilot deployment conducted.	
2	**TOR tasks (PM, iii, v)** Developed the Tool aggregating data of Training monitoring VN. **TOR tasks (PM, viii)** Meeting with the CPMU, TL and Specialists to review work, product and project progress. **TOR tasks (PM, iii, vi)** Meeting with the CPMU's staffs about M&E Tools, Forms of Tables and Forms of Reports. **TOR tasks (PM, ix)** Supported the Team Leader to develop the Inception Report. **TOR tasks (PM, iii)** Developed the Table monitoring implement of Loan agreement VN.	Tool aggregating data of Training monitoring developed VN. Meeting with the CPMU, TL and Specialists to review work, product and project progress conducted. Meeting with the CPMU's staffs about M&E Tools, Forms of Tables and Forms of Reports conducted. M&E content in Inception Report completed. Table monitoring implement of Loan agreement developed VN.	Tool aggregating data of Training monitoring developed VN. Meeting with the CPMU, TL and Specialists to review work, product and project progress conducted. Meeting with the CPMU's staffs about M&E Tools, Forms of Tables and Forms of Reports conducted. M&E content in Inception Report completed. Table monitoring implement of Loan agreement developed VN.
3	**TOR tasks (PM, vi)** Meeting with M&E Staff of LCASP on data collection for ADB Mid Term Review Mission. **TOR tasks (PM, viii)** Meeting on Specialist management and Methods of planning, establishment demonstration pilot. **TOR tasks (PM, iii)** Developed the Table monitoring implement of Loan agreement. **TOR tasks (PM, iii)** Reviewed and revised the Table monitoring implement of LA outlined by ADB EN VN. **TOR tasks (PM, viii)** Coordinated with the Provincial coordinators to develop plan for Component 3 of Provinces.	Meeting with M&E Staff of LCASP on data collection for ADB Mid Term Review Mission conducted. Meeting on Specialist management and Methods of planning, establishment demonstration pilot conducted. Table monitoring implement of Loan agreement developed. Table monitoring implement of LA outlined by ADB reviewed and revised EN VN. Plan for Component 3 of Provinces developed.	Meeting with M&E Staff of LCASP on data collection for ADB Mid Term Review Mission conducted. Meeting on Specialist management and Methods of planning, establishment demonstration pilot conducted. Table monitoring implement of Loan agreement developed. Table monitoring implement of LA outlined by ADB reviewed and revised EN VN. Plan for Component 3 of Provinces developed.
4	**TOR tasks (PM, iii, vi)** Developed the Form of LCASP Annual Report under the TT01 VN.	Form of LCASP Annual Report under the TT01 developed VN.	Form of LCASP Annual Report under the TT01 developed VN.
5	**TOR tasks (PM, ix)** Undertook other tasks as requested by Team Leader.	As arises - completed.	As arises - completed.

Mar 2016

No.	Description of Activity according to TOR	Expected outputs	Outputs achieved Notes/Comments
1	**TOR tasks (PM, iv, ix)** Worked with ICT Specialist and Evaluated the Database of Project. **TOR tasks (PM, iii, iv, v, viii)** Developed Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants. **TOR tasks (PM, iv, ix)** Evaluated the Database of Project.	Project Database Evaluated Report is submitted. Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants is completed. Project Database Evaluated Report is submitted.	Project Database Evaluated Report was submitted. Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants was completed. Project Database Evaluated Report was submitted.
2	**TOR tasks (PM, iii, iv, v)** Supported Provincial Coordinator and Provincial M&E Staff to update data into DMF. **TOR tasks (PM, iii, iv, v)** Supported Provincial Coordinator and Provincial M&E Staff to update data into GAPIF. **TOR tasks (PM, iii, iv, v)** Supported the Provincial Coordinator and Provincial M&E Staff to update training data.	PPMU's data is updated into DMF. PPMU's data is updated into GAPIF. PPMU's training data is updated.	PPMU's data was updated into DMF. PPMU's data was updated into GAPIF. PPMU's training data was updated.
3	**TOR tasks (PM, iii, iv, v)** Supported the Provincial Coordinator and Provincial M&E Staff to update training data. **TOR tasks (PM, iii)** Reviewed information in Table monitoring implement of Loan Agreement EN VN. **TOR tasks (PM, iii, iv, v)** Worked with Bac Giang PPMU on M&E activities and M&E data update.	PPMU's training data is updated. Information in Table monitoring implement of Loan Agreement is reviewed EN VN. Meeting with Bac Giang PPMU on M&E activities and M&E data update are conducted.	PPMU's training data was updated. Information in Table monitoring implement of Loan Agreement was reviewed EN VN. Meeting with Bac Giang PPMU on M&E activities and M&E data update were conducted.
4	**TOR tasks (PM, iii, iv, v, viii)** Developed Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants.	Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants is completed.	Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants was completed.
5	**TOR tasks (PM, ix)** Undertook other tasks as requested by Team Leader.	As arises - completed.	As arises - was completed.

April 2016

No.	Description of Activity according to TOR	Expected outputs	Outputs achieved Notes/Comments
1	**TOR tasks (PM, iii, viii)** Meeting with Baseline survey consultants. **TOR tasks (PM, iii, viii)** Worked with National Social, Gender and Ethnic Minority Specialist on preparation to develop GAP. **TOR tasks (PM, iii, iv, vii, viii)** Reviewed and commented Guideline procedure for the selection and implementation of demonstration. **TOR tasks (PM, iii, viii)** Worked with National Environment Safeguard Specialist on preparation to develop the EMP.	Plan and technical measures are agreed. GAP is prepared to develop. Guideline procedure for the selection and implementation of demonstration is reviewed and commented. EMP is prepared to develop.	Plan and technical measures were agreed. GAP was prepared to develop. Guideline procedure for the selection and implementation of demonstration was reviewed and commented. EMP was prepared to develop.
2	**TOR tasks (PM, iii, viii)** Meeting with specialists to discuss the list of research topics package. **TOR tasks (PM, iii, iv, v, viii)** Guide to use Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas Plants. **TOR tasks (PM, iii, iv, v)** Review the updated information of the entire project for Design and Monitoring Framework. **TOR tasks (PM, iii, iv, v)** Update the progress achieved to reporting time into the Monitoring Framework.	List of research topics package is completed. Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas Plants is guided. Updated information of the entire project for Design and Monitoring Framework is reviewed. Progress achieved to reporting time into the Monitoring Framework is updated.	List of research topics package was completed. Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas Plants was guided. Updated information of the entire project for Design and Monitoring Framework was reviewed. Progress achieved to reporting time into the Monitoring Framework was updated.
3	**TOR tasks (PM, ix)** Undertook other tasks as requested by Team Leader.	As arises - completed.	As arises - was completed.

2. Outputs (Documents Submitted)

No	Report/ Product on Outputs	Code (Filename)	Version		Total of Pages	Submissions	
			EN	VN		2015	2016
1	Project documentation system for TA's use.					Dec-15	
2	M&E WP for Dec 2015 EN.	WP for Dec 2015 M&E Pham Van Binh EN.doc	x		2	Dec-15	
3	M&E WP for Dec 2015 VN.	WP for Dec 2015 M&E Pham Van Binh VN.doc		x	2	Dec-15	
4	M&E Monthly Report for Dec 2015 EN.	M&E Monthly Report for Dec 2015 EN.doc	x		2	Dec-15	
5	M&E Monthly Report for Dec 2015 VN.	M&E Monthly Report for Dec 2015 VN.doc		x	2	Dec-15	
6	Monitoring and Evaluation Plan in 3 years EN VN.	Workplan for 3 years - M&E Consultant EN VN.xls	x	x	4		Jan-16
7	Monitoring and Evaluation Plan in 2016 EN VN.	Workplan for 2016 M&E Consultant EN VN	x	x	4		Jan-16
8	M&E WP for Jan 2016 EN.	WP for Jan 2016 M&E Pham Van Binh EN.doc	x		2		Jan-16
9	M&E WP for Jan 2016 VN.	WP for Jan 2016 M&E Pham Van Binh VN.doc		x	2		Jan-16
10	M&E Monthly Report for Jan 2016 EN.	M&E Monthly Report for Jan 2016 EN.doc	x		2		Jan-16
11	M&E Monthly Report for Jan 2016 VN.	M&E Monthly Report for Jan 2016 EN.doc		x	2		Jan-16
12	Form of Monthly Results Report - Coordinator VN.	BC ket qua cong viec thang BG Bui The Hung Form.docx		x	1		Jan-16
13	Form of Work Progress Report on direct demand of CPMU - Coordinator VN.	BC tien do cong viec thang BG Bui The Hung Form.docx		x	1		Jan-16
14	Form of Weekly Progress Report - Coordinator VN.	BC tien do cong viec tuan BG Bui The Hung Form.docx		x	1		Jan-16
15	Form of Monthly Progress Report - Specialist and Coordinator EN.	MONTHLY PROGRESS REPORT 01.16 M&E Specialist EN Draft.docx	x		5		Jan-16
16	Form of DMF from PAM EN.	DMF of PAM EN.docx	x		4		Jan-16
17	Form of DMF from PAM VN.	DMF of PAM VN.docx		x	5		Jan-16
18	Form of DMF from PIM EN.	DMF of PIM EN.docx	x		4		Jan-16
19	Form of DMF from PIM VN.	DMF of PIM VN.docx		x	4		Jan-16
20	Form of DMF updated EN.	DMF updated to Month 16 EN.docx	x		4		Jan-16
21	Form of DMF updated VN.	DMF updated to Month 16 VN.docx		x	4		Jan-16
22	Tool aggregating data to update DMF VN.	DMF updated to Month 16 VN.xlsx		x	39		Jan-16

No	Report/ Product on Outputs	Code (Filename)	Version		Total of Pages	Submissions	
			EN	VN		2015	2016
23	Tool aggregating data to update DMF - Example VN.	DMF updated to Month 16 VN thi du.xlsx		x	39		Jan-16
24	Form of Gender Action Plan EN.	GAP EN.docx	x		1		Jan-16
25	Form of Gender Action Plan VN.	GAP VN.docx		x	1		Jan-16
26	Form of Monitoring in GAP implementation updated EN.	GAPI Monitoring updated to Month 16 EN.docx	x		2		Jan-16
27	Form of Monitoring in GAP implementation updated VN.	GAPI Monitoring updated to Month 16 VN.docx		x	2		Jan-16
28	Tool aggregating data to update Monitoring of GAP implementation VN.	GAPI Monitoring updated to Month 16 VN.xlsx		x	26		Jan-16
29	Tool aggregating data to update Monitoring of GAP implementation - Example VN.	GAPI Monitoring updated to Month 16 VN thi du.xlsx		x	26		Jan-16
30	Form of LCASP Quarterly Report under the TT01 VN.	Phu dinh GSDG 2 LCASP.doc		x	1		Jan-16
31	Form of LCASP Quarterly Report under the TT01 VN.	Phu dinh GSDG 2 LCASP.xls		x	23		Jan-16
32	Form of CPMU Quarterly Report submitting to ADB VN.	Mau Bao cao CPMU to ADB.docx		x	11		Jan-16
33	Form of PPMU Quarterly Report submitting to CPMU VN.	Mau Bao cao PPMU to CPMU.docx		x	11		Jan-16
34	Form of quick survey table selecting the demonstration pilot VN.	Bieu mau khao sat nhanh chon mo hinh Final.doc		x	5		Jan-16
35	M&E WP for Feb 2016 EN.	WP for Feb 2016 M&E Pham Van Binh EN.doc	x		2		Feb-16
36	M&E WP for Feb 2016 VN.	WP for Feb 2016 M&E Pham Van Binh VN.doc		x	2		Feb-16
37	M&E Monthly Report for Feb 2016 EN.	M&E Monthly Report for Feb 2016 EN.doc	x		2		Feb-16
38	M&E Monthly Report for Feb 2016 VN.	M&E Monthly Report for Feb 2016 EN.doc		x	2		Feb-16
39	Tool aggregating data of Training monitoring VN	Training VN updated to Month 16 VN.xlsx	x		166		Feb-16
40	Tool aggregating data of Training monitoring - Example VN.	Training VN updated to Month 16 VN thi du.xlsx		x	166		Feb-16
41	Table monitoring implement of Loan agreement VN.	LOAN COVENANT LCASP Status 01.16 VN.doc		x	12		Feb-16
42	Table monitoring implement of LA outlined by ADB updated EN VN.	Loan 2968_loan covenants Reviewed.xls	x	x	10		Feb-16
43	Form of LCASP Annual Report under the TT01 VN.	Phu dinh GSDG 3 LCASP.doc		x	2		Feb-16

No	Report/ Product on Outputs	Code (Filename)	Version		Total of Pages	Submissions	
			EN	VN		2015	2016
44	Form of LCASP Annual Report under the TT01 VN.	Phu dinh GSDG 3 LCASP.xls		x	5		Feb-16
45	M&E WP for Mar 2016 EN.	WP for Mar 2016 M&E Pham Van Binh EN.doc	x		2		Mar-16
46	M&E WP for Mar 2016 VN.	WP for Mar 2016 M&E Pham Van Binh VN.doc		x	2		Mar-16
47	M&E Monthly Report for Mar 2016 EN.	M&E Monthly Report for Mar 2016 EN.doc	x		2		Mar-16
48	M&E Monthly Report for Mar 2016 VN.	M&E Monthly Report for Mar 2016 EN.doc		x	2		Mar-16
49	Developed Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants VN.	Cach tinh luong phat thai giam do CT KSH.xlsx		x	1		Mar-16
50	Developed Table calculating reduction of GHGE (tons of CO2) annually on 1 m3 of Biogas plants - Example VN.	Cach tinh luong phat thai giam do CT KSH Thi du.xlsx		x	1		Mar-16
51	Report evaluating the Database of Project EN VN.		x	x	3		Mar-16
52	Monitoring Evaluation Inception Report of LCASP EN.doc	Monitoring Evaluation Inception Report LCASP EN.doc	x		31		Mar-16
53	Monitoring Evaluation Inception Report of LCASP - Version 2 EN.doc	Monitoring Evaluation Inception Report LCASP Vr2 EN.doc	x		4		Mar-16
54	Monitoring Evaluation Inception Report of LCASP - Version 2 VN.doc	Monitoring Evaluation Inception Report LCASP Vr2 VN.doc		x	4		Mar-16
55	M&E WP for Apr 2016 EN.	WP for Apr 2016 M&E Pham Van Binh EN.doc	x		2		Apr-16
56	M&E WP for Apr 2016 VN.	WP for Apr 2016 M&E Pham Van Binh VN.doc		x	2		Apr-16
57	M&E Monthly Report for Apr 2016 EN.	M&E Monthly Report for Apr 2016 EN.doc	x		2		Apr-16
58	M&E Monthly Report for Apr 2016 VN.	M&E Monthly Report for Apr 2016 EN.doc		x	2		Apr-16
	Sum	**56**	**23**	**38**	**673**	**5**	**53**

APPENDIX J: TRAINING FIGURES

Unit	Technical training course		Training course for mason		Training course for engineers, HDPE contractor	
	Quantity of courses	Quantity of participant	Quantity of courses	Quantity of participant	Quantity of courses	Quantity of participant
CPMU	12	626			2	59
PPMUs	14	459	14	531		

Source: CPMU