

Technical Assistance Closure Report Template

Objective of the technical assistance (TA) Closure Report:

- To communicate publicly in one document a summary of progress made and lessons learned during the TA towards the anticipated impact (sections 1-4).
- To document qualitative and quantitative data collected during TA, for use in donor and UN reporting (Annex 1).

Steps for completing the TA closure report:

1. The lead TA implementer submits the closure report at the end of the technical assistance as a final deliverable. The TA closure report will capture outputs, outcomes and impacts of all activities conducted under the TA. Please copy and summarise relevant material from previous TA outputs/deliverables and the Response Plan, as relevant.
2. A CTCN Manager will review and revise the closure report before final approval by the CTCN Deputy Director.

Important note on public and internal use of the closure report:

Once approved by the CTCN Deputy Director, the TA closure report will be a public document available on the CTCN website www.ctc-n.org. Selected content will be used for targeted communication activities. Annex 2 is for internal use only and will not be publicly available.

Closure Report for CTCN Technical Assistance

1. Basic information

Title of response plan	Feasibility study of 'Waste to Energy (Livestock Manure to Biogas and Organic Fertilizer)' for rural communities in Vietnam, using anaerobic digestion technology
Technical assistance reference number	Ref.2023000008
Country / countries	Vietnam
NDE organisation	Department of Climate Change (DCC), Ministry of Natural Resources and Environment (MONRE)
NDE focal point	Dr. Chu Thi Thanh Huong Deputy Head, GHG Emission Reduction and Ozone layer protection
NDE contact information	chuthanhhuong@gmail.com
Proponent focal point and organisation	Duong Tat Thang General director Department of Livestock Production, Ministry of Agriculture and Rural Development (MARD) thangdt.cn@mard.gov.vn
Designer of the response plan	Huynsu Yoon Head of division Ecosian Ltd. yoonhs@ecosian.com

Implementer(s) of technical assistance	<p>Implementer: Ecosian Ltd.</p> <p>Partners:</p> <ul style="list-style-type: none"> • Ministry of Agriculture and Rural Development • BKT Vietnam Ltd.
Beneficiaries	<p>The direct beneficiaries of this TA project can be calculated as those who can benefit from the by-product produced by the introduction of the biogas plant. It can be defined as the agricultural population expected to use renewable energy and use organic fertilizer to improve crop productivity. As of 2021, the number of agricultural producers in Thai Nguyen City is expected to be 117,681.</p> <p>The indirect beneficiaries of this TA project can be defined as the population expected to be affected by the unauthorized discharge of livestock manure wastewater if the biogas plant is not introduced. By treating livestock manure through the biogas plant, it is possible to prevent water pollution in Thai Nguyen City. It is expected that there will be no impact on the water system that supplies drinking water to the city, which will indirectly benefit the entire population of Thai Nguyen City. With an annual average growth rate of 1.3%, the population of Thai Nguyen City is projected to reach 1,323,150 individuals. Consequently, the number of indirect beneficiaries is expected to grow accordingly.</p>
Sector(s) addressed	<ul style="list-style-type: none"> • Renewable Energy • Waste Management
Technologies supported	<ul style="list-style-type: none"> • Bioenergy - Energy supply from waste • Bioenergy - Biogas power • Wastewater management - Manure management
Implementation start date	
Implementation end date	
Total budget for implementation	USD 182,100
Description of delivered outputs and products as well as the activities undertaken to achieve them. In doing so, review the log frame of the original response plan and refer to it as appropriate	<p>The objective of this TA is to support the rural area of Vietnam to improve environmental and greenhouse gas reduction through the spread of livestock manure energy (biogas) technology.</p> <p>The main outcomes of the TA are: 1) Improvement of the institutional system for strengthening the management of livestock manure, 2) Improvement of awareness and understanding of livestock manure energy technology, 3) Diffusion of livestock manure energy technology.</p> <p>Output 1. Site Selection for the Establishment of a Biogas Generation Pilot Complex</p> <p>To select the most feasible site, the team conducted the following activities:</p> <ol style="list-style-type: none"> 1) Development of criteria for site selection within a kick-off meeting with stakeholders and literature review, 2) Field research/investigation of the target sites against

	<p>the criteria developed, 3) Selection of final target site based on the results of the field research.</p> <p>Following reports were delivered as outputs:</p> <ul style="list-style-type: none"> - Site Selection Criteria for Establishment of a Pilot Complex - Field Research/Investigation and Final target site selection report <p>Output 2. Central, Local Government and affiliated Institutions Analysis and Network Building for Establishment of a Pilot Complex</p> <p>To develop corporation basis for pilot complex establishment, the team conducted following activities: 1) identification of central, local governments and affiliated institutions, 2) built network, 3) literature review of currently on-going governmental support programs, and 4) development of an improvement proposal in context of livestock management in Vietnam. For sharing a proposal of government support program, the capacity building program was held and involving 47 relevant stakeholders including government officials, researchers, and experts.</p> <p>As a result of these activities, the following deliverables were produced:</p> <ul style="list-style-type: none"> - Governmental Stakeholder Analysis and Networking Result - Governmental Support Program Review Result and Improvement Proposal - Communication/Knowledge Products for the Capacity Building - Letter for Interest (LoI) for the project from central and local government <p>Output 3. Pre-Feasibility Study (Economic Feasibility, Environmental Impact Analysis, Risk Analysis) on the Biogas Generation Plant</p> <p>The biogas expert conducted the following activities: 1) Technical-Economic Feasibility Study, 2) Develop a Draft Plan to Establish a Pilot Complex & Conduct Environmental Impact Analysis, etc. As a result of these activities, the following deliverable were produced:</p> <ul style="list-style-type: none"> - Pre-Feasibility Study Report (Technical, Economic) - Draft Plan to Establish a Pilot Complex - Result of Environmental Impact Analysis <p>Output 4. Local Community Stakeholder Analysis & Network Building</p> <p>Based on the identified technology solutions, a training workshop was held in Hanoi involving 71 relevant stakeholders including government officials, researchers, experts and technicians, local communities, etc. As a result of these activities, the following deliverable were produced:</p> <ul style="list-style-type: none"> - Result of Local Community Stakeholder Analysis and Network Building
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	<ul style="list-style-type: none"> - Capacity Building Program (Program and Implementation of the Program) - Communication/Knowledge Products for the Capacity Building
Methodologies applied to produce outputs and products	<ul style="list-style-type: none"> • Literature review and Data collection • Interviews and meetings with key stakeholders • Field visit and survey • Technical and Economic feasibility study • Stakeholders training workshop
Reference to knowledge resources	-
Deviations	<p>During the promotion of the TA, the initial design of the pilot project changed within the stakeholder's discussion.</p> <p>During the implementation of the pilot project, government stakeholders emphasized the importance of incorporating a biogas plant in newly established farms as a best practice.</p> <p>As a result, when determining the project's target location, a government official suggested an area where new farms had been constructed with strong support from the local government. The selection process focused on identifying suitable sites within this area.</p> <p>Additionally, considering the size of the newly constructed farms, the project scope was adjusted to incorporate a large-scale biogas plant in a single farmhouse.</p>
Anticipated follow-up activities and next steps	<ul style="list-style-type: none"> • Conducting feasibility study and constructing a biogas plant with experts and local stakeholders • Provide capacity building programs to train the O&M workforce • Support organizing local communities to communicate capacity-building needs • Follow-up and prepare a draft funding proposal

2. Lessons learned

	Lessons learned	Recommendations
Lessons learned from the CTCN TA process	<p>During the document submission process for the TA business, challenges manifested in the form of decision-making and the requirement for intervention among the project implementers.</p> <p>There was a limited time, the information that able to get is limited.</p>	<p>Finalizing the response plan prior to project implementation involves an ongoing exchange of information among project implementers by maintaining communication with stakeholders.</p> <p>Thorough research and investigation and close engagement with the local stakeholders are necessary to collecting the information.</p>
Lessons learned related to climate technology transfer	<p>The problem of lack of livestock manure treatment system is no limited to water and soil pollution but also related to resident's public health and hygiene.</p> <p>The absence of the source of financing to cover the operating and maintenance (O&M) cost; capacity and experience to conduct the O&M; risk of low social acceptance to new technology; and low public awareness on livestock manure management.</p>	<p>Addressing climate change through proposed solutions yields co-benefits that directly impact vital aspects of livelihood, including public health. Consideration with other sectors is essential for deploy of the technology, leading to co-benefits.</p> <p>It is important to design the project in a way that it could be sustainable after the implementation period of the TA. From that perspective, Capacity building and raising awareness are key. The local stakeholders who will operate the biogas plant are better positioned to provide the capacity building in the long-term and carry out event to raise awareness of the people.</p>

3. Illustration of the TA and photos



01 CTCN TA Overview

Title	<ul style="list-style-type: none"> Feasibility study of 'Waste to Energy (Livestock Manure to Biogas and Organic Fertilizer)' for rural communities in Vietnam, using anaerobic digestion technology
Implementer	<ul style="list-style-type: none"> Ecosian Ltd.
Duration	<ul style="list-style-type: none"> July. 2022–June. 2023
Objectives	<ul style="list-style-type: none"> Strengthening the institutional and policy framework to promote the application of transferred technology for Organic Fertilizer production by Livestock Production Waste for farm and household scale in Vietnam. Increase stakeholder awareness and capacity on using Organic Fertilizer by Livestock Production Waste for agricultural production, living improvement, environmental protection, and responding to climate change. Establish the institutional basis for the technical support of Organic fertilizer and Biofuel technology using livestock waste. Improving sustainability through increased productivity and disposal /management of agricultural by-products. Enhancing the capacity of stakeholders in agriculture sector, improving the awareness to understand the project concept, and expected effect.
Stakeholders	
Barriers & opportunities	
<ul style="list-style-type: none"> It was difficult to get residents' consent It was difficult to find a suitable target site There was no precedent of establishing a large-scale biogas plant in Vietnam before Ministry of Agriculture and Rural Development(MARD) shows a high level of interest in relevant policies and is actively formulating them 	

02 Brief result of the TA project

	Output 1	Output 2
Output	Site Selection for the Establishment of a Biogas Generation Pilot Complex	Central, Local Government and affiliated Institutions Analysis and Network Building for Establishment of a Pilot Complex
Activities	<p style="text-align: center;">Development of criteria for Site Selection</p> <ul style="list-style-type: none"> Criteria developed considering technical suitability, access to input materials(manures), securing demand and sales potential for outputs <p style="text-align: center;">↓</p> <p style="text-align: center;">Selection of the final target sites based on field research/investigation</p> <ul style="list-style-type: none"> Site investigation is conducted for each target sites in order to identify the optimal candidate sites and the final candidate sites were selected Considering determined criteria (the number of livestock farms, the number of livestock heads per farm, the amount of manure, etc.) 	<p style="text-align: center;">Governmental Stakeholder analysis and Network building</p> <p style="text-align: center;">↓</p> <p style="text-align: center;">Review of governmental support programs and Development of an Improvement Proposal</p> <ul style="list-style-type: none"> Review relevant governmental support programs, legislations and roadmap in Vietnam and countries to benchmark <p style="text-align: center;">↓</p> <p style="text-align: center;">Communicate the proposal with the relevant stakeholders</p> <ul style="list-style-type: none"> The Improvement Proposal communicated with relevant stakeholders through kick-off meeting, experts meeting, and Capacity building events Capacity building event with 47 relevant stakeholder including central and local government officials
Deliverable	<ul style="list-style-type: none"> Site Selection Criteria for Establishment of a Pilot Complex Field Research/Investigation Report Final target site <p style="text-align: center; color: red;">Deliverable 1</p>	<p style="text-align: center; color: red;">Capacity building program Deliverable 2 LOI from local government</p> <ul style="list-style-type: none"> Governmental Stakeholder Analysis and Networking Result Governmental Support Program Review Result and Improvement Proposal Letter for Interest(LoI) of the project from local government

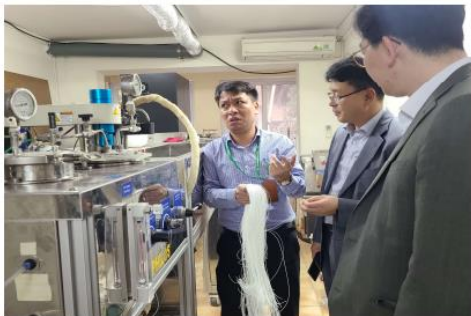
02 Brief result of the TA project

	Output 3	Output 4
Output	Pre-Feasibility Study on the Biogas Generation Plant	Local Community Stakeholder Analysis & Network Building
Activities	<p>Technical-Economic Feasibility Study</p> <ul style="list-style-type: none"> • Technical feasibility of implementing anaerobic digestion technology with technology expert team • Economic feasibility to the pilot complex, expected expenses and revenue streams <p>▼</p> <p>Develop a Draft Plan to Establish a Pilot Complex & Conduct Environmental Impact Analysis</p> <ul style="list-style-type: none"> • Established draft plan to a pilot complex • Analyzed environmental impact of developing pilot complex in target area within local regulations and laws, benefits of the TA, and other environmental impact factors 	<p>Local Community Stakeholder Analysis & Network Building</p> <p>▼</p> <p>Development of Capacity Building Program to Improve Awareness</p> <ul style="list-style-type: none"> • Capacity building program developed to improve awareness and understanding of the technology and to make a chance to communicate the importance • Described biogas technology in Vietnam and introduced technology through pilot project • Capacity building event with 71 relevant stakeholder including local government officials, local communities, researchers, experts and technicians, etc
Deliverable	 <ul style="list-style-type: none"> • Pre-Feasibility Study Report (Technical, Economic) • Draft Plan to Establish a Pilot Complex • Result of Environmental Impact Analysis <p>Deliverable 3</p>	 <p>Capacity building program LOI from local company Deliverable 4</p> <ul style="list-style-type: none"> • Result of Local Community Stakeholder Analysis and Network Building • Communication/Knowledge Products for the Capacity Building • Letter for Interest(Loi) of the project from local company

03 Photos of the TA project (Kick-off meeting & Field Study)



03 Photos of the TA project (Stakeholder meeting & Expert meeting)



03 Photos of the TA project (Training workshop)



4. Impact Statement

The information in the table below will be used to communicate results and anticipated impacts of this technical assistance publicly. Please copy information from impact statement developed in the M&E Plan and update as relevant.

<p>Challenge</p>	<p>Most of livestock in Vietnam identified that 47% of the household raising livestock do not take any treatment measures before discharging the livestock manure. Discharged waste treated improperly would occur to contamination of soil and a threat to resident's public health and hygiene. But most of the husbandry in Vietnam is small and not concentrated, and lack of awareness of biogas plant put in place to discourage the management and recycling of livestock.</p>
<p>CTCN Assistance</p>	<ul style="list-style-type: none"> • Identify pilot project possible sites to implement the proposed technology. • Suggested implementing institutional incentives to promote the adoption of the proposed technology. • Technical and economic feasibility study for introducing the proposed technology into the pilot project site • Improving stakeholder awareness and strengthening capabilities for the introduction of biogas plants
<p>Anticipated impact</p>	<ul style="list-style-type: none"> • Diffusion of understanding on policy necessity through RD&D event on the necessity of introducing a proposed support program and policy to strengthen the institutional system. • Technology is expected to spread beyond the pilot program in Vietnam through a pilot program to strengthen awareness of the importance of livestock manure management and awareness of technical benefits such as energy generation through biogas plants. • Through the implementation of the pilot biogas plant, a substantial reduction of 51,745 tCO₂e per year is anticipated. This reduction is in comparison to the scenario where unauthorized discharge of livestock manure occurs. The pilot program offers an effective solution to

	<p>mitigate carbon dioxide equivalent emissions and address environmental concerns.</p>
<p>Co-benefits: Achieved or anticipated co-benefits from the TA</p>	<p>The key co-benefits from this TA include deployment of the selected technology.</p> <p>Provide new stream of revenue to local governments (from selling heat, electricity and organic fertilizer produced from the plant) It is expected that by establishing an incentive system and establishing a policy basis for introducing a government-led biogas plant, it is possible to establish a profitable environment by utilizing heat, electricity, and organic compost, which are by-products of the biogas plant.</p> <p>Provide clean, locally sourced energy and organic fertilizer to the residents. According to the pilot project, 100 tons of livestock manure are treated daily through a biogas plant, producing 3.1 MW/day of electricity, 95 m³/day of liquid fertilizer, and 5 m³/day of organic fertilizer. The power, liquid fertilizer and organic fertilizer produced are expected to be sold to nearby farms and used as clean resources.</p> <p>Improve settlement environment, hygiene of the community. If the technology transfer and incentive system are spread through this TA project, soil and water pollution caused by livestock manure that was released without treatment is expected to be improved.</p>
<p>Gender aspects of the TA</p>	<p>The introduction of supporting technologies has facilitated the active involvement of women in stakeholder capacity building activities. Consequently, throughout the implementation of the entire technical assistance project, there were 135 primary attendees, out of which 55 were women, accounting for approximately 40% of the total participants.</p>
<p>Anticipated contribution to NDC</p>	<ul style="list-style-type: none"> • Utilizing Biogas Plant Power as Renewable Energy in terms of Energy Supply • Reducing methane emissions and utilizing biogas in the agricultural sector • Expansion of Organic Compost Utilization Using Agricultural Waste

<p>The narrative story</p>	<p>The expansion of the livestock industry in Vietnam has resulted in a significant increase in waste generation, leading to various environmental challenges. The management of livestock manure has emerged as a prominent issue in the country. According to estimates from 2018, the total solid waste produced by the livestock industry amounted to approximately 62.07 million tons, with an additional 63 million cubic meters of liquid waste. Alarming, it has been observed that 47% of households engaged in livestock rearing do not undertake any measures to treat the manure before its discharge. The improper treatment and disposal of livestock waste pose a clear threat to public health and hygiene, as it leads to the contamination of soil and water. Furthermore, the recent outbreak of African Swine Fever (ASF) in Vietnam has heightened the demand for safer and cleaner livestock products. This urgency underscores the critical need to enhance and enforce livestock manure management practices to ensure the health and well-being of both residents and livestock in the country. This TA project has the potential to make a significant contribution to climate change mitigation by effectively managing methane emissions derived from livestock manure. Additionally, it can contribute to the development of sustainable energy sources.</p>
<p>Contribution to SDGs</p> <p>A complete list of SDGs and their targets is available here: https://sustainabledevelopment.un.org/partnership/register/</p>	<p>SDG 6. Ensure availability and sustainable management of water and sanitation for all</p> <p>The protection of water and sanitation in the surrounding area is prioritized by implementing proper manure management practices to reduce mishandling or unauthorized discharge of livestock manure.</p> <p>SDG 7. Ensure access of affordable, reliable, sustainable, and modern energy for all</p> <p>The utilization of renewable energy sources is made possible through the generation of power using methane derived from livestock manure.</p>

	<p>SDG 13. Take urgent action to combat climate change and its impacts Raising awareness of climate change issues, raising awareness of the need for livestock manure management and management response, and strengthening expert and institutional capabilities</p>
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Annex 1 Technical assistance data collection

Please add quantitative and qualitative values for the indicators selected in the M&E plan and monitored throughout the technical assistance in the tables below. Indicators which have been monitored in addition to the proposed indicators below may be added at the end of table A. Non-relevant indicators should be left blank.

A. Output and outcome indicators

Indicator	Quantitative value <i>Numerals only; disaggregates must sum to the total</i>	Qualitative description <i>List the various elements corresponding to the quantitative value as well as timelines and responsible institutions</i>
Please note indicators below highlighted as anticipated		
Total number of events organized by proponents and implementing partners	135	<ul style="list-style-type: none"> • Kick-off event: 8 • Expert event: 9 • Policy capacity building program: 47 • Technology capacity building program: 71
Number of participants in events organized by proponents and implementing partners	17	<ul style="list-style-type: none"> • Kick-off event: 8 • Expert event: 9
a) Number of men	9	
b) Number of women	8	
Number of climate technology RD&D related events	1	<ul style="list-style-type: none"> • Biogas plant policy in Korea
Number of participants in climate technology RD&D events	47	
a) Number of men	29	
b) Number of women	18	
Number of training organized by proponents and implementing partners	1	<ul style="list-style-type: none"> • Composting of livestock manure and biogas power generation
Number of participants in trainings organized by proponents and implementing partners	71	
a) Number of men	42	
b) Number of women	29	
Total number of institutions trained	15	
a) Governmental (national or subnational)	4	<ul style="list-style-type: none"> • Department of Livestock Production, Ministry of Agriculture and Rural Development (MARD) • Thai Nguyen Animal Husbandry, Veterinary and Fisheries Sub-department • Viện Chăn Nuôi

		<ul style="list-style-type: none"> Lien Hiep HTQT VN Châu Phi
b) Private sector (bank, corporation, etc.)	9	<ul style="list-style-type: none"> Trong Khoi Company Ltd. Sunjin Vina Hansung Cleantech GK Inter Nam Hai LSA Consulting Company Ltd. BKT Vietnam ODIN Ltd. Chi cuc Chan Nuoi, Thu y va Thuy san Thai Nguyen
c) Nongovernmental (NGO, University, etc.)	2	<ul style="list-style-type: none"> Hanoi University of natural Resources and Environment Vietnam National University of Agriculture
Percentage of participants reporting satisfaction with CTCN training (from CTCN training feedback form)	90.3%	Satisfied= 4+ on 5-pt scale
Percentage of participants reporting increased knowledge, capacity and/or understanding as a result of CTCN training (from CTCN training feedback form)	90.1%	Increased knowledge, capacity and/or = 4+ on 5-pt scale
a) Percentage of men	62%	
b) Percentage of women	38%	
Total number of deliverables produced during the assistance (excluding mission, progress and internal reports)	5	
a) Number of communication materials, including news releases, newsletters, articles, presentations, social media postings, etc.	1	<p>News : 1</p> <ul style="list-style-type: none"> <u>“Việt Nam – Hàn Quốc trao đổi kỹ thuật, công nghệ sản xuất khí sinh học và phân bón hữu cơ”</u>
b) Number of tools and technical documents strengthened, revised or developed		
c) Number of other information materials strengthened, revised or created (For example training and workshop reports, Power Points, exercise docs etc.)	4	<p>4 Power points on training session</p> <ul style="list-style-type: none"> Biogas Plant Policy in Korea Anaerobic Digestion and biogas technology in Korea Biogas technology in Vietnam Introduction to Industrial/home odor removal technology
Total number of policies, strategies, plans, laws, agreements or regulations supported by the assistance		
a) Adaptation related		
b) Mitigation related		
c) Both adaptation- and mitigation related		
Anticipated number of policies, strategies, plans, laws, agreements or regulations proposed, adopted or implemented as a result of the TA		
a) Adaptation related		
b) Mitigation related		

c) Both adaptation- and mitigation related	1	
Anticipated number of technologies transferred or deployed as a result of CTCN support	3	<ul style="list-style-type: none"> • Bioenergy - Energy supply from waste • Bioenergy - Biogas power • Waste water management - Manure management
Anticipated number of collaborations facilitated or enabled as a result of technical assistance	1	
a) Number of South-South collaborations		
b) Number of RD&D collaborations	1	<ul style="list-style-type: none"> • Center for Advanced Materials and Environment Technology
c) Number of private sector collaborations		
Number of countries with strengthened National System of Innovation as a result of CTCN support	1	Vietnam
Insert any additional indicators here		

B. Core impact indicators

Please fill in the tables for anticipated impacts of the CTCN assistance. Every technical assistance should contribute to at least one of the indicators below. For guidance on how to report on core indicators see the [‘M&E Guidance Document for TA Implementers’](#).

Core indicator 1	Anticipated metric tons of CO₂ equivalent (CO₂e) emissions reduced or avoided as a result of CTCN TA	
	<i>Please add your calculations in word or excel format as an Annex to this Closure Report, where applicable.</i>	
	Anticipated metric tons of CO₂e reduced or avoided as a result of the TA on annual basis	Anticipated metric tons of CO₂e reduced or avoided as a result of the TA in total
Quantitative value <i>(emissions reductions)</i>	4,532	45,320
Unit	tCO ₂ e	tCO ₂ e
GHG assessment boundary (project emissions) Identify expected post-TA activities, associated effects and assess boundary for quantification of GHG emission reductions	<p>These are estimated GHG emissions, actual GHG emission will be calculated after feasibility study.</p> <p>The anaerobic manure management system used in the project will enable the combustion of biogas. Field testing carried out on-site indicates that the facility capacity is 100 ton/day and it can generate 3,000 m³ of biogas per day.</p> <p>Anaerobic manure management system emits practically no GHGs. Thus, conversion to the facility with this advanced system has the potential to avoid a significant number of GHGs.</p> <p>The mitigation potential could be around 4,532t CO₂-equivalent per year.</p>	The mitigation potential could be around 45,328 t CO ₂ e for 10 years.
Baseline emissions Describe baseline scenario, baseline candidates, emission factors and emissions calculated	<p>Baseline scenario: Methane gas is naturally released into the atmosphere as a result of anaerobic digestion of livestock manure.</p> <p>Baseline candidates: Most of the farms in Vietnam have collected and buried most of the livestock manure. Otherwise, Wastewater from livestock has been discharged untreated into streams, rivers.</p> <p>Emission factors for baseline emissions:</p> <ul style="list-style-type: none"> - Annual average number of animals per year. - Volatile solids production/excretion per animal per year. 	Emissions calculated for 10 years could be 64,086tCO ₂ e

	<ul style="list-style-type: none"> - Fraction of manure handled in the baseline animal manure management system. <p>Emissions calculated: 6,408.6tCO₂e</p>	
Methodology Explain the method or process of verifying the indicator and how data was gathered	The indicators were primarily collected through interviews with relevant stakeholders at the target site, and in cases that this was not possible, it was collected through literature research.	-
Assumptions Describe assumptions made during calculation and quantification of GHG reductions	<p>Since the manure treatment facility has not been installed yet, it is not possible to conduct on-site verification of the use of fossil fuel and electricity. Therefore, instead of using Equation 'ER_{y,ex post}=MD_y-PE_{power,y,ex post}', only 'ER_{y,ex post}=BE_{y,ex post}-PE_{y,ex post}' was employed to calculate the emission reduction.</p> <p>Factors for Baseline emissions:</p> <ul style="list-style-type: none"> - Annual average number of animals per year: 19,608 - Volatile solids production/excretion per animal per year: 109.5 kg-dm/animal/year - Fraction of manure handled in the baseline animal manure management system: 100% <p>Factors for Project activity emissions:</p> <ul style="list-style-type: none"> - Emissions due to physical leakage of biogas in year y: 862.9 tCO₂e - Emissions from flaring or combustion of the biogas stream per year: There's no emission from flaring or combustion of the biogas stream - Emissions from the use of fossil fuel or electricity for the operation of the installed facilities per year: 1,013 tCO₂e - Emissions from incremental transportation per year: Underground pipelines will be installed underground instead of using transportation. - Emissions from the storage of manure: The livestock is immediately transferred to the anaerobic manage facility after storing it for about a day. 	10 years of project activity emissions could be 18750 t CO ₂ e. The mitigation potential could be around 45,328 t CO ₂ e for 10 years.

	<p>GHG reductions = Baseline emission per year – Project activity emissions per year = 6,408.6tCO₂e – 1,875tCO₂e = 4532.8 tCO₂e</p> <p>The mitigation potential could be around 4532.8 t CO₂-equivalent per year.</p>	
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<p>Core indicator 2</p>	<p>Anticipated increased economic, health, well-being, infrastructure and built environment, and ecosystems resilience to climate change impacts as a result of technical assistance</p> <p><i>Please provide a qualitative description of the anticipated impacts on the categories below</i></p>
<p>Infrastructure and built environment Anticipated increased infrastructure resilience (avoided/mitigated climate induced damages and strengthened physical assets)</p>	<ul style="list-style-type: none"> Expansion of livestock manure treatment facilities in rural areas
<p>Ecosystems and biodiversity Anticipated increased ecosystem resilience (areas with increased resistance to climate-induced disturbances and with improved recovery rates)</p>	<ul style="list-style-type: none"> Prevention of ecosystem contamination by livestock manure in Thai Nguyen province
<p>Economic Anticipated increased economic resilience (e.g. less reliance on vulnerable economic sectors or diversification of livelihood)</p>	<p>The biogas plant yields valuable by-products, including electricity, liquid manure, and organic fertilizer, which bring about significant economic benefits to the farmhouse and local residents.</p> <ul style="list-style-type: none"> Job creation for biogas plant operation Increase crop productivity through the sale of organic fertilizer
<p>Health and wellbeing Anticipated increased health and wellbeing of target group (e.g. improved basic health, water and food security)</p>	<ul style="list-style-type: none"> Improving drinking water stability through water quality improvement Minimize damages suffered by local residents from bad odor of livestock manure

Core indicator 3	Anticipated number of direct and indirect beneficiaries as a result of the TA	
	Quantitative value	Means of verification
Total beneficiaries	1,323,150	
Number of adaptation beneficiaries	1,323,150	<p>By introducing biogas plants, indirectly adaptability to climate change is improved in terms of water quality management. Treating livestock manure through the biogas plant, it is possible to prevent water pollution in the city. It is expected that there will be no impact on the water system that supplies drinking water to the city, which will indirectly benefit the entire population of Thai Nguyen City. With an annual average growth rate of 1.3%, the population of Thai Nguyen City is projected to reach 1,323,150 individuals. From this point of view, it can indirectly benefit the citizens of Thai Nguyen city in enhancing their capacity to adapt to climate change.</p>
Number of mitigation beneficiaries	117,681	<p>The beneficiaries from the by-product produced by the introduction of the biogas plant.</p> <p>It can be defined as the agricultural population expected to improve crop productivity through the use of renewable energy, production, and use of organic fertilizer. The implementing of the pilot project is expected to result in the distribution of its outputs to nearby farms. This distribution entails the production of</p>

		3.1MW/day of electricity, 5m ³ /day of organic fertilizer, and 95m ³ /day of liquid fertilizer. In 2021, the number of agricultural producers in Thai Nguyen City is expected to be 117,681.
Number of adaptation-and mitigation beneficiaries		<i>Describe calculation n methods and assumptions made</i>

Core indicator 4	Anticipated amount of funding/investment leveraged (USD) as a result of TA (disaggregated by public, private, national, and international sources, as well as between anticipated/confirmed funding)			
	Quantitative value confirmed in USD	Quantitative value anticipated in USD	Qualitative description <i>List the institutions, timelines, and description or title of the investment</i>	Methods <i>Describe methods used for quantification of funds leveraged</i>
Total funding	<i>Total number in USD (numerals only, no rounding or abbreviations)</i>	300,000		
Anticipated amount of public funding mobilised from national/domestic sources				
Anticipated amount of public funding mobilised from international/ regional sources		300,000	<i>Name of institutions: Korea Eximbank The title of the investment: Greenhouse Gas International Reduction Project Feasibility Study Support Project</i>	<i>A series of costs for feasibility study, licensing, basic design of the business, and financial/ tax analysis</i>
Anticipated amount of private funding mobilised from national/domestic sources				
Anticipated amount of private funds mobilised from international/regional sources				

Annex 2 (for internal use – to be filled in by the CTCN)

CTCN evaluation

This section will be completed by the relevant CTCN Technology Manager.

- Evaluation of the timeliness of the TA implementation as measured against the timeline included in the response plan;
- Evaluation of TA quality as defined in the response plan;
- Overall performance of the Implementers;
- Overall engagement of the NDE and Proponent;
- Lessons learned on the CTCN process and steps taken by the CTCN to improve.