ADJUSTED WATER MANAGEMENT IN RICE CULTIVATION IN NORTHERN LUJIANG COUNTY

Document Prepared by Shanghai Libra Investment & Management Co., Ltd)

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project changing from continuously flooded to intermittent flooded condition during rice cultivation is conducted in Northern Lujiang. The living standard of farmers in Northern Lujiang is relatively low, and most of it is used to maintain the survival. In this case, they lacked funds to build ditches for applying intermittently flooded method. So, continuously flooded method was used in rice paddies, which means fields have standing water throughout the rice growing season and may only dry out for harvest. However, the organic matter in rice soil under flooded condition can emit a large amount of methane (CH_4) because of anaerobic decomposition. In contrast, there are at least once aeration period of more than three days, except for end-season drainage, during the cropping season by conducting intermittently flooded method after the cement ditches is built in this project activity. Since the CH_4 in rice paddies is produced by the anaerobic decomposition of organic matter after the flooding, allowing the field to drain halts CH_4 production, which happens in anaerobic condition, reducing the total quantity of CH_4 released during the cropping season. Moreover, the intermittently flooded method is more beneficial to water conservation, production increase and methane emission removal than the continuously flooded. 14,189 ha of rice paddies are changed to apply intermittently flooded method in Northern Lujiang, where the rice used to be cultivated under continuously flooded condition.

In this monitoring period (from 01-January-2021 to 31-December 2021), all the rice paddies of 14,189 ha have been planted with intermittent flooded water regime. In 2021, the ditches and reservoirs have been operating normally without any abnormality or damage so that the water could be irrigated and drained according to the needs of rice during different growth stages.

During the monitoring period, a training has been carried out to ensure the continuous and effective operation of the project. The technicians received annual training from the Anhui Academy of Agricultural Sciences on carbon emission reduction and intermittent flooded irrigation. Then, in February 2021, farmers received training from technicians to become more proficient in intermittent flooded irrigation.

The implementation schedule of this project is listed as follows:

Date	Milestone (s) in the project's development and implementation
29-May-2017	Hefei Luyu Agricultural Technology Co., Ltd held a general meeting of their stockholders and they decided to develop this project as a carbon trading project.

21-June-2017	The ex-ante investigation report in Lujiang County in 2017 from Anhui Academy of Social Sciences.
October-2017	Implementation Plan of Lujiang National Agricultural Comprehensive Development High Standard Farmland Construction Project in 2017 was completed by Lujiang Agricultural Bureau.
17-October-2017	The Approval of High Standard Farmland Construction Task in 2017 was issued by Hefei Agricultural Bureau[1]
08-November-2017	Construction of high standard rice fields was started
28- February -2018~02-March-2018	The construction of high standard rice fields was finished and all have passed the acceptance
09-February-2018	Farmer training was carried out in 2018
20-March-2018	The land preparation of early season was started, which means project activity was started in 2018
10-July-2018	The harvest of early season was started in 2018
13-July-2018	The land preparation of later season was started in 2018
25-October-2018	The harvest of later season was started in 2018
25-February-2019	Farmer training was carried out in 2019
09-March-2019	The land preparation of early season was started, which means project activity was started in 2019
05-July-2019	The harvest of early season was started in 2019
07-July-2019	The land preparation of later season was started in 2019
23-October-2019	The harvest of later season was started in 2019
03-March-2020	Farmer training was carried out in 2020
10-March-2020	The land preparation of early season was started, which means project activity was started in 2020
02-July-2020	The harvest of early season was started in 2020
05-July-2020	The land preparation of later season was started in 2020
20-October-2020	The harvest of later season was started in 2020
25-February-2021	Farmer training was carried out in 2021.
12-March-2021	The land preparation of early season was started, which means project activity was started in 2021
09-July-2021	The harvest of early season was started in 2021
12-July-2021	The land preparation of later season was started in 2021
24-October-2021	The harvest of later season was started in 2021
14-September-2021	Completed registration as a VCS project
16-March-2022	The draft MR for 2nd monitoring period was completed.

[1] Hefei Agricultural Bureau is the superior department in charge of Lujiang Agricultural Bureau

18- April-2022~19-April-2022	VVB on-site visit.

The GHG emissions reduction generated are 67,023 tCO_2e [2]from 01-January-2021 to 31-December-2021. However, the project proponent only claimed the 60,000 t CO2e annually as stated in registered PD since the net GHG emission reductions generated during this monitoring period have exceeded the threshold required in the small-scale methodology applied. Therefore, the number of GHG credits issued to the Project during this Monitoring period is 60,000 VCUs.

There are no changes in the Project Proponent, Project Owner, Land Owner and other entities.

1.2 Sectoral Scope and Project Type

The project is developed under VCS scope 14 "Agriculture, Forestry and Other Land Use (AFOLU)" with an activity category of Improved Cropland Management (ICM) under Agricultural Land Management (ALM). Although the AMS-III.AU methodology applied is approved under sectoral scope 15 (agriculture) of CDM, this project is categorized as sectoral scope 14 (AFOLU) under Verra. This is in accordance with the definitions of eligible AFOLU project categories set out in Appendix 1 of the VCS Standard, 4.0 and can be demonstrated from the following three points.

Requirements	Evidence
1. Eligible ALM activities are those that reduce net GHG emissions on croplands and grasslands by increasing carbon stocks and woody biomass and/or decreasing CO_2, N_2O and/or CH_4 emissions from soils.	This project reduces CH_4 emissions on croplands by replacing continuously flooded method by intermittent method. So, this project can be categorized as eligible ALM activity.
2. The project area shall not be cleared of native ecosystems within the 10-year period prior to the project start date.	The project area has not been cleared of native ecosystems since 2005[3].
3. Eligible ALM activities include:	This project practices intermittent flooded method on croplands, which is

[2] The annual emission reduction exceeded the threshold of 60,000 tCO_2e as required in the small-scale methodology applied, because the parameter of GWP CH_4 is different in PD and MR, which means that 25 t CO_2e/t CH_4 was used for ex-ante estimates in PD and 28 t CO_2e/t CH_4 was used for ex-post calculation in MR according to the updated version of VCS Standard (4.2). The project proponent only claimed the 60,000 tCO_2e for issuance as stated in registered PD.

[3] Evidence on Certificate of Eligibility for Land provided by Hefei Agricultural Bureau

Improved Cropland Management (ICM): This category includes practices that demonstrably reduce net GHG emissions of cropland systems by increasing soil carbon stocks, reducing soil N_2O emissions, and/or reducing CH_4 emissions.	demonstrated that can reduce net GHG emissions by reducing CH_4 emissions. So, this project is an eligible ICM activity.

The project is not a grouped project.

1.3 Project Proponent

Organization name	Hefei Luyu Agricultural Technology Co., Ltd
Contact person	Yiliang Chen
Title	Manager
Address	Room 2212, Building C, Xinhua International Square, No.320 Qianshan Road, Hefei City, Anhui Province, China
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Email	mail@luyunongye.com

Hefei Luyu Agricultural Technology Co., Ltd. (hereinafter referred to as Hefei Luyu or Luyu) is a private entity and its core business involves agricultural technology and agricultural project development.

1.4 Other Entities Involved in the Project

Organization name	Shanghai Libra Investment & Management Co., Ltd
Role in the Project	Consultant
Contact person	Shaohui Zhong
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Shanghai Libra Investment & Management Co., Ltd (hereinafter referred to as Shanghai Libra or Libra) is a company which has rich experience in developing the carbon reduction and

removal project. Shanghai Libra is leading the carbon project development and management, including compiling the Monitoring and Quality Control Manual[4], organizing the training, etc.

1.5 Project Start Date

According to VCS standard, the project start date is the date on which activities that lead to the generation of GHG emission reductions or removals are implemented (e.g., preparing land for seeding, planting, changing agricultural or forestry practices, rewetting, restoring hydrological functions, or implementing management or protection plans). For this project, according to the requirements of the AMS-III.AU methodology applied, an entire cropping season is started from land preparation and the emission reduction calculation is also started this day. So, the project start date is 20-March-2018[5] when the land preparation was started.

1.6 Project Crediting Period

The crediting period of this project will be using a 7-year, twice renewable crediting period, for a combined total project crediting period of 21 years from 20-March-2018 to 19-March-2039, and the first 7-year period is from 20-March-2018 to 19-March-2025. Also, the project lifetime is 30 years from 28-February-2018[6] to 27-February-2048.

This monitoring period is 1-January-2021 to 31-December-2021, which belongs to the first 7-year crediting period.

1.7 Project Location

The project is located in the north of Lujiang County of Hefei City in Anhui Province, China. In 2022, the project in the north of Lujiang has jurisdiction over 11 towns. The geographical coordinates of the project zone are between 117°4.882' and 117°33.34' east longitude and between 31°10.46' and 31°31.66'north latitude.

The project is located in the north of Lujiang County in Hefei City, as shown in Figure 1-2 and Figure 1-3. According to VCS standard, the north of Lujiang County is defined as the

[4] Source: Monitoring and Quality Control Manual is Compiled by Shanghai Libra Investment & Management Co., Ltd

[5] The earliest start date of rice cropping season within the whole 3,480 households which are recorded in the Farmers' database

[6] The project lifetime is calculated from the time when ditches and reservoirs, as the major construction, are put into use, while the start dates of the project and of the crediting period are the dates when the project begins to produce emission reductions. According to The Acceptance Report of Hefei City National Comprehensive Agricultural Development High-standard Farmland Construction Project in 2017, the ditches and reservoirs were put into use on 28 February 2018. Therefore, the project lifetime starts on 28 February 2018 instead of the project crediting period start date on 20 March 2018.

project zone, and the rice paddies applied intermittent flooded water regime in the north of Lujiang County is defined as the project area. The project zone is shown in Figure 1-4 and the boundaries of the project area and project zone are shown in Figure 1-5.

Figure 1-1 The map of China

Figure 1-2 The map of Anhui Province

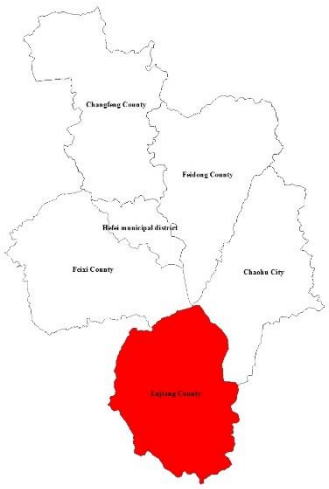

Figure 1-3 The map of Hefei City

Figure 1-4 The map of project zone – Northern Lujiang County

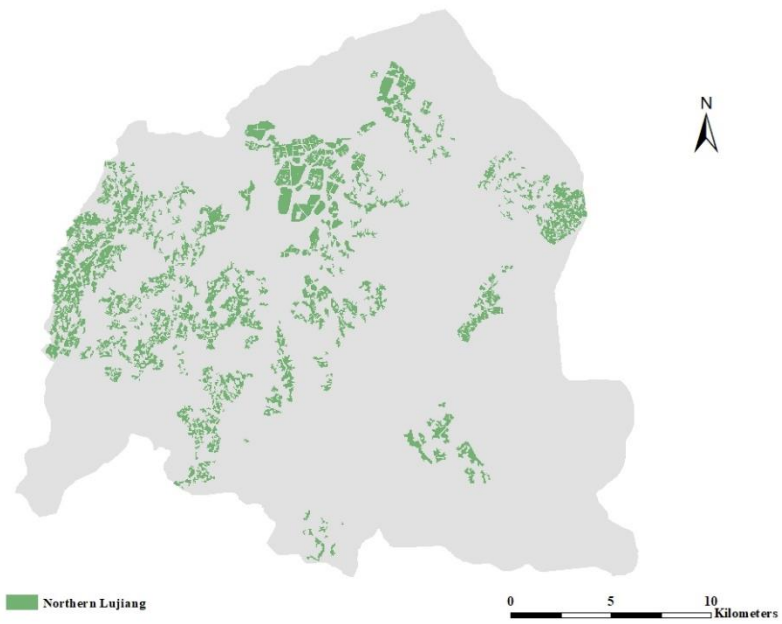

Figure 1-5 The boundary of project area

The dark yellow area marked in Figure 1-5 is the project area within the project zone, Northern Lujiang County. All the rice cultivated within the project boundary have been changed to intermittent flooded water regime.

According to section 3.9.3 of VCS Standard v4.2: “where applying a methodology with scale and/or capacity limits, it shall be demonstrated that the project is not a fragmented part of a larger project or activity that would otherwise exceed such limits. The project shall be considered a fragmented part of a larger project if within one kilometer of the project boundary there exists another project where:

1) The project proponents for both projects are the same.

2) The sectoral scope and project activity for both projects are the same.

3) The other project has been registered under the VCS Program or another GHG program within the previous two years.”

The project applied a small-scale methodology, according to the KML file of the project boundary and checking the areas within 1 km of the project boundary, there is no another project exists, hence the project is not a fragmented part of a larger project.

1.8 Title and Reference of Methodology

The small-scale methodology AMS-Ⅲ.AU: *Methane Emission Reduction by Adjusted Water Management Practice in Rice Cultivation/version 4.0* is used. Also, the project proponent shall apply the “General guidelines for SSC CDM methodologies/version 23.1”.

In addition, since the reporting and verification shall be done on the basis of samples of the log-books from the households, the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities/version 9.0* and the Guideline for *Sampling and Surveys for CDM Project Activities and Programme of Activities/version 4.0* are used.

1.9 Participation under other GHG Programs

The project has not been registered or is seeking registration under any other GHG programs.

1.10 Other Forms of Credit

According to China's national emissions trading scheme, only the high-emission industries are included, covering thermal power generation, petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation and other key emission industries that emitted at least 26,000 tCO_2e in any one year from 2013 to 2016, without renewable project[7]. Moreover, the project proponent, including this project activity, is except for mandatory emission control scheme[8]. Therefore, this project will not and cannot be double counted.

The project proponent declared and promised that this project is not involved in an emission trading program or any other mechanism that includes GHG allowance trading and also has not been rejected by other GHG program. Besides, GHG emission reductions and removals generated by the project during this monitoring period will not be used for compliance under any programs or mechanisms[9].

The project has not sought or received another form of GHG-related environmental credit.

1.11 Sustainable Development Contributions

In this monitoring period (from 01-January 2021 to 31-December 2021), all the rice paddies of 14,189 ha have been planted with intermittent flooded water regime. Since intermittent flooded water regime enables rice to be planted under the appropriate conditions, flooded or dry out, according to different stages of growth, this project increases rice yield, provides extra job opportunities and money by hiring farmers as technicians, contributes to gender equality by giving priority to women during job recruitment, improves education quality by donating stationary packs and reduces methane emissions from rice paddies.

The specific SDG Targets contributed by this project and it corresponding provisions for monitoring and reporting have been described detailed in Table 1 below.

[7] https://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

[8] https://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/W020210330581116693581.pdf

[9] The project proponent has made a Declaration of no double counting of the project.

The evidence for each contribution has been identified and provided as appendices to this project, since these are sensitive information and the project proponent is unwilling to disclose them. The corresponding evidences have been submitted to VVB and can also be submitted to Verra if required.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	2.4	The percentage of increase in rice yield	Implemented activities to increase	In this monitoring period, by replacing continuously flooded method with intermittent flooded method, rice yield has been increased by an average of 12%[10] since project start.	Since the project started operation, the rice yield increased from 400kg/mu in the baseline scenario to 444kg/mu in the project scenario (from 20-March-2018 to 31 December-2021), with an increase of 11%.
2)	4.1	The number of children who raised the reading accessibility in the project area by donating stationary packs.	Implemented activities to increase	During this monitoring period, a part of carbon profit from this project were used to donate about 6,320[11] sets of stationary packs, including books, pencils, pencil-case, etc., for the local boys and girls (49.4% are boys and 50.6% are girls), which raised their reading accessibility.	Since the project started operation, part of the carbon benefits from the project have been used to donate 12,640 school supplies and books to 12,640 boys and girls in the project area (49.8% are boys and 50.2% are girls).

[10] By comparing the yield recorded in the farmers' logbooks with that from the ex-ante investigation report in Northern Lujiang in 2017 from Anhui Academy of Social Sciences

[11] It can be proved by Photos of Donation Activity of Northern Lujiang Rice Carbon Emission Reduction Project.

3)	5.5	The percentage of women hired in this project.	Implemented activities to increase	In this monitoring period, 26 new job opportunities for technicians were created to do methane monitoring, maintenance of ditches and reservoirs, among which including 20 female workers, accounting for 76.9% are female workers[12].	Since the project started operation, this project provided equal job opportunities for women, and 20 of the technicians were hired in this project are women (76.9% of the total), which improves their social status, contributing to gender equality.
4)	8.5	The number of job opportunities provided by this project to local farmers	Implemented activities to increase	In this monitoring period, 26 new job opportunities for technicians with a salary of CNY 100 per month were created to do methane monitoring, maintenance of ditches and reservoirs[13].	Since the project started operation, this project provided extra job opportunities and increases the income for local farmers through hired these 26 farmers as technicians, with a monthly salary of CNY 100.

[12] Payroll of female workers.

[13] Technician Recruitment Appointment Contract signed by Hefei Luyu and Lujiang County Agricultural Technology Extension Center.

5)	13.0	Tons of greenhouse gas emissions avoided or removed	Implemented activities to increase	In this monitoring period the emissions reduce is 67,023 tCO_2e from 01-January-2021 to 31-December-2021 [14].	Since the project started operation, during the first and the second monitoring periods (from 20-March-2018 to 31 December-2021), the project actually reduced a total of 266,558 tCO_2e emissions.

[14] Since the amount of methane emissions reduced shall be calculated based on the parameters of $A_{s,g}$(area of project fields of group g in season s), $EF_{BL,s,g}$ and $EF_{P,s,g}$ (baseline and project emission factors of group g in season s), please refer to Section 5.4 of this monitoring report for more details.

2 SAFEGUARDS

2.1 No Net Harm

The potential negative environmental and socio-economic impacts and steps to mitigate them have been summarized in the following table:

Environmental		Socio-Economic	
Potential Negative Impacts	Actions	Potential Negative Impacts	Actions
During the operation, excessive use of fertilizer and pesticide could cause pollution to soil and surface water if farmers do not control the amount of fertilizer and pesticide well during cultivation.	During this monitoring period, technicians patrolled the rice paddies every week and instructed the farmers how to use the optimal amount of fertilizer according to the technical guidelines [15]. Therefore, there was no excessive use of fertilizer and pesticide during this monitoring period.	During the operation, if the cement ditches and reservoirs were badly damaged without long-term maintenance, the damaged parts could risk the life safety of farmers. In addition, if damaged ditches and reservoirs were not repaired in time, intermittent flooded water regime cannot be implemented, resulting in reduced rice production and thus reduced farmers' income	Since each technician is in charge of several villages, farmers could immediately call the technician if a ditch broke down in their fields. If it is a minor problem, including a blocked water outlet, the technician shall be on site within an hour to solve it. If the technician cannot solve the problem, they should immediately inform Shanghai Libra and contact the local agricultural bureau to activate the emergency mechanism and take corresponding measures. For

[15] The Technical Guidelines for Intermittently Flooded Rice Cultivation Method in Anhui Province issued by the Institute of Agricultural Engineering of Anhui Academy of Agricultural Sciences

			example, if the ditch is broken or leaking, the repair shall be arranged within 24 hours. There was no damage to the ditches and reservoirs during this monitoring period.

No net harm occurred in this monitoring period.

2.2 Local Stakeholder Consultation

Stakeholder consultations include questionnaires and stakeholder meetings, requiring stakeholders to present their opinions on the implementation of project and their willingness to participate.

Prior to the verification, the notice of meeting would be posted on the bulletin board in each village, and then, 55 villagers, the representatives of village committee, Agricultural bureau and government from 66 villages were organized by the project proponent and the agricultural bureau to attend the stakeholders' meeting at Lujiang Agricultural Bureau on 17 February 2022, in order to prepare for the project verification and collect the views of stakeholders before the project verification. Besides, in order to better understand the impact of the project on stakeholders after the implementation, Hefei Luyu conducted a questionnaire survey in 66 villages involved in the project from December 2021 to February in 2022. A total of 77 questionnaires were issued and collected. The background information of these 77 stakeholders is summarized in Table 2-1 below. In order to understand villagers' environment, life and socio-economic improvement, the questionnaire includes 'After the implementation of the project, what changes do you think the project has made to the surrounding environment?' 'Has it improved your standard of life?' 'Did you get job opportunities?' 'Has it made a positive contribution to local education?' and other relevant questions.

The feedback collected is summarized below:

- Most farmers have enjoyed benefits of adjusted water management during rice cultivation. The intermittently flooded method reduced methane emissions, saved water resource and increased the rice productivity.

- During this monitoring period, most local farmers have been trained in carbon trading, VCS and carbon credits. Now, they are looking forward to participating in the carbon trading market.
- Local farmers believe that the project has 1) created jobs; 2) got more benefits from selling carbon credits; 3) reduced methane emissions, saved water resource and increased the rice productivity; 4) improved the social status of women by hiring them to be technicians; and 5) made a positive contribution to local education by donating books.

Table 2-1 Background information of these 77 stakeholders

Categories	Proportion
Nationality	4% of them are Man, 3% of them are Zhuang, rest of them are Han.
Educational Level	10% and 19% are at the primary and high school levels, respectively, with the rest are all at the junior high school level.
Career	97% are farmers and3% are village officials.
Gender	69% are female and 31% are male.
Age-bracket	31~64 years old

<u>The mechanism for on-going communication with local stakeholders</u>

At the beginning of the project, the project proponent has identified a fixed contact person, which is referred to as a technician in this project. Besides, there is a Suggestion Book published with the phone number of contact person on the notice board in each of villages throughout the lifetime of the project. Stakeholders can write their comments or suggestions in the book anytime anonymously as they wish. During this monitoring period, a technician is responsible for the communication of 2 to 3 villages, collecting all the suggestions and problems from the villagers. The task of these technicians is not only to feedback the villagers' suggestions and problems directly to the project manager of Hefei Luyu, but also to enable the project manager of Hefei Luyu to communicate the progress of the project to all the villagers through the technicians, and timely post and distribute project materials. When the technicians passed the problems from villagers to the project proponent, project proponent positively responded and solved them. For example, during the planting process, when some villagers reported that their farming tools were old, the project proponent decided timely replaced them with new tools.

Once the project has been registered, the registered version of project description, monitoring manual and monitoring plan in both Chinese and English have been posted on every 66 village's notice board. A brief summary of project location, project registration date, expected annual emission reduction, monitoring period and expected verification date has

also been posted for stakeholders. After this monitoring report had been submitted to the VVB, the monitoring plan and manual were posted on these villages' notice board, too. Moreover, during the on-site verification period, and when the project proponent and Shanghai libra knew the specific time of on-site visit, the technicians started to invited the farmers to participate in the on-site stakeholder's interview by means of door-to-door announcements and meeting notice posted. The mobile phone number of contact person of the project were also published on the meeting notice so the villagers can directly reflect any problem about the project.

Stakeholders have no negative views on project implementation in this monitoring period.

On the other hand, the stakeholders have also been communicated on the followings during this monitoring period.

- The results of project implementation, including the results of monitoring.

  During this monitoring period from 1-January-2021 to 30-December-2021, 14,189 ha rice paddies have been equipped with reservoirs and cement ditches to conduct controllable drainage and irrigation, where water regime applied during rice cultivation has been changed from continuously flooded method to intermittent flooded method. In this case, the rice productivity has been increased by about 12% and 67,023 t CO_2e emission has been reduced. All the ditches and reservoirs were operating well without damages and farmers were familiar with the intermittent flooded water regime gradually because of the project.

  The progress of project implementation has also been informed to all stakeholders through village meetings, technicians and bulletin boards, which can be summarized as follows. a) the registration of the project was completed on 14 September 2021; 2) the carbon credit of the first monitoring period was issued in 2022 and 3) the actual quantity of issuance in the first monitoring period is 180,000 tCO_2e, among which 50% carbon profit has been distributed with all households involved in this project as signed in Rice Emission Reduction Project Cooperation Agreement between the farmers and Hefei Luyu. Since this project has brought job opportunities, carbon profits, gender equality, educational improvement and emission reductions as introduced at the start of the project, farmers are satisfied with this project and they are willing to support the implementation of this project.

- Any changes to risks, costs and benefits the project may bring to local stakeholders.

  In the stakeholders meeting before the project start, project proponent once explained the potential costs, risks, and benefits the project may bring to local stakeholders. During this monitoring period, there were not any changes to all the risks and costs that the project proponent has communicate with the stakeholders. Moreover, through the daily visits of technicians, the potential costs, risks and benefits of this project were

conveyed and explained to relevant villagers and stakeholders again for further feedback.

The changed benefits have been communicated with the stakeholders as below,

According to the Rice Emission Reduction Project Cooperation Agreement, 50% of carbon profit gained from the first-phase issuance has been distributed to all households involved in this project, which can be proved by the receipt from households. A proportion of benefit will be used to afford the costs of management and operation of ditches and reservoirs. After the project proponent gained the first-phase benefit, the project proponent can continuously manage and operate the project.

- Any changes to relevant laws and regulations covering workers' right in the host country

Also, in this monitoring period, there were no changes to the relevant laws and regulations which have been informed the stakeholders by the representative of Hefei Luyu, covering workers' rights in the host country.

- The process of VCS Program verification and the validation/verification body's site visit.

The on-site verification was from 18 April to 19 April, 2022. The VVB interviewed 32 people in total. Questions included: after the project was implemented 1) whether the paddy field was changed to intermittent irrigation; 2) whether they participated in relevant training every year; 3) whether the family income and living standards were increased; whether it was provided employment opportunities ;4) whether it was made a positive contribution to local education and so on.

The interview results showed that rice yields have increased by about 12% during this monitoring period. The additional job opportunities created during this monitoring period have also improved their economic level. Moreover, 20 female workers, accounting for 76.9% who have attended and they were pleasant that they were given priority to job recruitment. During this monitoring period, 6,320 stationary sets, including books, pens, pencil-cases and notebooks, had been donated by the project proponent to improve the quality of local education.

The interview results showed that all interviewees had no negative feedback on the project.

2.3 AFOLU-Specific Safeguards

- Activities implemented to mitigate risks local stakeholders due to project implementation

Potential risks to stakeholders	During the implementation of the project, since it is necessary to go to the field every day to observe the

	growth of rice and the change of water level, drainage and irrigation are carried out from time to time, which increases the chances of farmers encountering dangers, such as slipping while checking the rice in the field.
Measures to mitigate it	Firstly, all these potential risks were told to the stakeholders in advance and some simple first aid measures were taught to farmers during every training since 2018 to reduce the injuries. Secondly, working in extreme weather was strictly prohibited. In extreme weather conditions, farmers and technicians were not allowed to work outdoors in the fields. All the work must be carried out under the premise of safeguarding personal safety. Thirdly, the proponent has also equipped technicians and farmers with helmet, antiskid shoes, windbreakers and other equipment to ensure their safety. Lastly, once the injuries happen, the injured should be sent to the hospital for immediate treatment and all the medical expenses will be paid by the project proponent.

No risks occurred during this monitoring period.

- Property and land use rights

Prior to the project initiation, the ownership of the rice paddies of the agricultural land management project belongs to the farmers, which has been confirmed by the local government and agricultural bureau. In June 2017, the project participant and local Agricultural Bureau held a consultant meeting with local village committees before the project start. Stakeholders meeting collected stakeholders' opinions on project design and their willingness to participate. To make sure the successful development of the project, Hefei Luyu and the farmers which had the ownership of rice paddies had signed a carbon reduction project cooperation agreement, which clarifies the rice paddies rights by all parties during the project crediting period. According to the cooperation agreement, 50% of the carbon profits gained from the first-phase issuance has been distributed to all households in the project area, which can be proved by the receipt from households. Besides, the 14,189 ha of construction land within the project has been agricultural land since 2005, which has been proved by Hefei Agricultural Bureau[16]. So, the project did not infringe on private property, community property

[16] Evidence on Certificate of Eligibility for Land provided by Hefei Agricultural Bureau

or government property. There were no updates to the property and land use rights of the local stakeholders during this monitoring period.

Furthermore, this project activity only adjusts the water regime during rice cultivation but not changes the type of land use, therefore, the project would not impact local stakeholder's property rights without the free, prior and informed consent and no occupation involved so no compensation or return happened in this monitoring period.

The project documents on the information of the project such as the nature, size, pace, the scope of the project, the reason for it, and its duration were presented in the native language to villagers.

- Conflicts

As set out in registered PD, there is a Suggestion Book published with the phone number of contact person on the notice board in each of villages throughout the lifetime of the project. Stakeholders can write their comments or suggestions in the book anytime anonymously as they wish. The project proponent checked the book regularly and collected all the comments received. If there is a conflict of interest between the parties, the stakeholders can appeal to the local agricultural bureau through the village representative or directly, which is the most effective way to solve the problem. They appeal through the phone number of contact person or file a complaint during the meeting.

The project proponent has appointed a staff member to record and collect conflicts and dissatisfaction between local communities and individual villagers. Technicians' monthly inspection play an important role in dealing with conflicts and dissatisfaction and report to the agricultural bureau. Upon receipt of the technicians' report, the relevant management unit should contact and discuss with the relevant community or other stakeholders within 3 days. Based on the information collected by the relevant parties, the specific staff member shall propose a solution and mediation plan within one week and solve the conflict within 30 days.

No conflicts were arisen during this monitoring period.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

In this monitoring period (form 01-January-2021to 31-December 2021), all the rice paddies of 14,189 ha have been planted with intermittent flooded water regime. In 2021, the ditches and reservoirs have been operating normally without any abnormality or damage so that the water could be irrigated and drained according to the needs of rice during different growth stages.

During this monitoring period, the training was carried out to ensure the continuous and effective operation of the project. The technicians received annual training from the Anhui Academy of Agricultural Sciences on carbon emission reduction and intermittent flooded irrigation. Then, in February 2021, farmers received training from technicians to become more proficient in intermittent flooded irrigation. In addition, the technicians instructed the farmers and checked the famers' logbooks every month. The aggregated project area ($A_{s,g}$) were monitored by technicians every season while the $EF_{BL,s,g}$ and $EF_{P,s,g}$ were obtained from the calculation of the emission rate for baseline and project reference fields according to the requirements in the Appendix of methodology, so they also did the weekly gas sampling on baseline and project reference fields so that the emission rate $C_{CH4,t}$ (CH_4 concentration in chamber at time t) of weekly gas samplings could be derived from the laboratory analysis. In conclusion, no events that may impact the GHG emission reductions or removals and monitoring happened during this monitoring period.

During this monitoring period, no new activities that lead to the intended GHG benefit commenced. Prior to this monitoring period, high-standard rice paddies of 14,189ha involved in this project had been built and equipped with controllable drainage and irrigation ditches and reservoirs. Moreover, the 26 technicians employed in this project had been trained on 22 February 2021 to learn about intermittent flooded techniques, on-field gas sampling, etc. Then, farmers were trained by technicians within the next week to learn how to apply intermittent flooded water regime before the start of rice season. After the project started, the construction of high-standard farmland would no longer to be continued, while the trainings for technicians and farmers would continue to be implemented to ensure the successful and effective operation of the project activity. Besides, technicians were responsible to collect the logbooks from 308 farmers sampled in 2021 to determine whether the project fields are cultivated according to the project cultivation practice as defined by the project activity. According to the 308 copies of logbooks from sample fields collected by technicians during this monitoring period, the parameters that are part of the project cultivation practice, including the date of transplantation, fertilization (date, type and amount), water regime and yield, have been recorded by farmers as required. All the rice paddies of 14,189 ha have been planted with intermittent flooded water regime[17] in 2021.The GHG emissions reduction generated are 67,023 t CO_2e from 01-January-2021 to 31- December -

[17] It can be proved by the Rice Cultivation Fact Sheet from Lujiang Agricultural Bureau in 2021.

2021. However, the project proponent only claimed the 60,000 t CO_2e annually as stated in registered PD since the net GHG emission reductions generated during this monitoring period have exceeded the threshold required in the small-scale methodology applied. Therefore, the number of GHG credits claimed to issue during this Monitoring period is 60,000 VCUs.

According to the applied methodology AMS-Ⅲ.AU (version 4.0), any effects of the project activity on GHG emissions outside the project boundary are deemed to be negligible and do not be considered under this methodology. So, leakage does not need to be considered in this project.

As mentioned in the registered PD, during the construction period, Lujiang Agricultural Bureau was the main manager, with the cooperation and participation of Hefei Luyu, of the construction of ditches and reservoirs, while the local farmers were hired to build the ditches and reservoirs. During the operation period, Hefei Luyu is responsible for supervising technicians to patrol and maintain the ditches and reservoirs. Besides, Hefei Luyu has been fully authorized by all the farmers to act as the carbon project proponent. Also, Hefei Luyu has already sold the project development right to Shanghai Libra. So, Shanghai Libra is leading the carbon project development and management, including compiling the Monitoring and Quality Control Manual[18], organizing the training, etc. Moreover, the local agricultural bureau is responsible for technical training. Farmers are the main operators to practice intermittently flooded water regime and supposed to record the cultivation logbooks. The technicians should carry out monthly inspections according to the requirements of Monitoring and Quality Control Manual. The profit from this carbon reduction project is shared with farmers. There are no changes in the Project Proponent, Project Owner, Land Owner and other entities in this monitoring period.

3.2 Deviations

3.2.1 Methodology Deviations

N/A.

3.2.2 Project Description Deviations

N/A.

3.3 Grouped Projects

This is not a grouped project.

[18] Source: Monitoring and Quality Control Manual is Compiled by Shanghai Libra Investment & Management Co.,Ltd

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

According to the methodology, there is no pre-determined data, as long as the monitoring data, but the ex-ante calculation method was used in determining $EF_{BL,c}$, and the A_y used to calculate the ex-ante emission reduction is only used in the ex-ante calculation formula, so the relevant ex ante calculation data are listed in this section.

Data / Parameter	A_y
Data unit	ha
Description	Area of project fields in year y
Source of data	Determined by collecting the project field sizes in a project database. The size of project fields is determined by GPS or satellite data.
Value applied	The total area is 14,189ha
Justification of choice of data or description of measurement methods and procedures applied	The size of project field is determined through GPS by Lujiang Agricultural Bureau [19]
Purpose of Data	The parameter is used to calculate the ex-ante estimated net GHG removals.
Comments	N/A

Data / Parameter	GWP_{CH_4}
Data unit	t CO_2e/t CH_4
Description	Global warming potential of CH_4
Source of data	The number of GWP_{CH_4} is taken from the IPCC's Fifth Assessment report (AR5) and VCS standard (v4.2).
Value applied	25 was used for ex-ante estimates in PD and 28 was used for ex-post calculation in MR.

[19] Certificate of Land Ownership proved by Lujiang County Land and Resources Bureau

Justification of choice of data or description of measurement methods and procedures applied	As stated in Section 3.14.4 in the updated version of VCS-Standard (v4.2), the following requirements shall be followed. 1. For GHG emission reductions occurring on or after 1 January 2021, all ex-ante estimates and ex-post calculations shall be converted to CO_2e using GWP values from the IPCC Fifth Assessment Report (AR5), which is 28 t CO_2e/t CH_4. 2. For GHG emission reductions occurring on or before 31 December 2020, all ex-ante estimates and ex-post calculations may be converted to CO_2e using either the GWP value of 25 for CH_4 from AR4 or 28 from AR5. 3. Projects that complete validation on or before 31 July 2021 may use GWP value of 25 for CH_4 from AR4 for ex-ante emission reduction estimates, though such projects shall use that of 28 from AR5 for ex-post calculations. Therefore, since this project completed the validation before 31 July 2021, the value of 25 was use for ex-ante estimates and that of 28 was used for ex-post calculation in this monitoring period.
Purpose of Data	The parameter is used to calculate the estimated net GHG removals.
Comments	N/A

Data / Parameter	$EF_{BL,c}$
Data unit	kg CH_4/ha/day or kg CH_4/ha/season
Description	Seasonal baseline emission factor for continuously flooded fields without organic amendments
Source of data	The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies with Continuously Flooded Method by Closed Chamber in Northern Lujiang County in 2017.
Value applied	(1) 180.56 kg CH_4/ha/season for early season rice; (2) 167.61 kg CH_4/ha/season for later season rice;
Justification of choice of data or description of measurement methods and procedures applied	The methodology provides two kinds of methods, which are ex ante calculation and monitoring. The project proponent chose the ex-ante calculation method, and then conducted methane measurement according to the requirements in the Appendix according to the requirements of the ex-ante calculation

	method, and finally obtained the above value according to the calculation method in the Appendix of methodology.
Purpose of Data	The parameter was used to calculate the baseline emission factor $\mathrm{EF_{BL}}$ and ex-ante emission reduction calculation. It was not used for the ex-post emission reduction calculation during this monitoring period.
Comments	N/A

Data / Parameter	$SF_{BL,w}$
Data unit	N/A
Description	Baseline scaling factors to account for the differences in water regime during the cultivation period
Source of data	It is chosen from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	Since the rice is cultivated under continuously flooded condition in baseline scenario, the 1 of value is used.
Purpose of Data	The parameter was used to calculate the baseline emission factor $\mathrm{EF_{BL}}$ and ex ante emission reduction calculation. It was not used for the ex-post emission reduction calculation during this monitoring period.
Comments	N/A

Data / Parameter	$SF_{P,w}$
Data unit	N/A
Description	Project scaling factors to account for the differences in water regime during the cultivation period
Source of data	It is chosen from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied	0.52

Justification of choice of data or description of measurement methods and procedures applied	Since the rice is cultivated under intermittently flooded condition in project scenario, the 0.52 of value is used.
Purpose of Data	The parameter was used to calculate the project emission factor $\mathrm{EF_P}$ and ex ante emission reduction calculation. It was not used for the ex-post emission reduction calculation during this monitoring period.
Comments	N/A

Data / Parameter	$SF_{BL,p}$
Data unit	N/A
Description	Baseline scaling factors to account for the differences in water regime in the pre-season before the cultivation period.
Source of data	It is chosen from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	Since the cultivation mechanism in rice filed is double cropping in baseline scenario, the 1 of value is used.
Purpose of Data	The parameter was used to calculate the baseline emission factor $\mathrm{EF_{BL}}$ and ex ante emission reduction calculation. It was not used for the ex-post emission reduction calculation during this monitoring period.
Comments	N/A

Data / Parameter	$SF_{P,p}$
Data unit	N/A
Description	Project scaling factors to account for the differences in water regime in the pre-season before the cultivation period.

Source of data	It is chosen from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	Since the cultivation mechanism in rice filed is double cropping in project scenario, the 1 of value is used.
Purpose of Data	The parameter was used to calculate the baseline emission factor EF_P and ex ante emission reduction calculation. It was not used for the ex-post emission reduction calculation during this monitoring period.
Comments	N/A

Data / Parameter	$SF_{BL,o}$
Data unit	N/A
Description	Baseline scaling factors should vary for both type and amount of organic amendment applied
Source of data	It is calculated using equation below. $$SF_o = \left(1 + \sum_i ROA_i \times CFOA_i\right)^{0.59}$$ Where:

Parameters	Description
ROA_i	Application rate of organic amendment type i, in dry weight for straw and fresh weight for others, tonne ha^{-1}
$CFOA_i$	Conversion factor for organic amendment type i (in terms of its relative effect with respect of straw applied shortly before cultivation)

Value applied	1
Justification of choice of data or description of	Since no organic amendment was used in baseline scenario, which means the ROA_i=0, so $SF_{BL,o}$ is 1.

measurement methods and procedures applied	
Purpose of Data	The parameter was used to calculate the baseline emission factor EF_{BL} and ex ante emission reduction calculation. It was not used for the ex-post emission reduction calculation during this monitoring period.
Comments	N/A

Data / Parameter	$SF_{P,o}$
Data unit	N/A
Description	Project scaling factors should vary for both type and amount of organic amendment applied
Source of data	It is calculated using equation below. $$SF_o = \left(1 + \sum_i ROA_i \times CFOA_i\right)^{0.59}$$ Where:

Parameters	Description
ROA_i	Application rate of organic amendment type i, in dry weight for straw and fresh weight for others, tonne ha^{-1}
$CFOA_i$	Conversion factor for organic amendment type i (in terms of its relative effect with respect of straw applied shortly before cultivation)

Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	Since no organic amendment was used in project scenario, which means the ROA_i=0, so $SF_{P,o}$ is 1.
Purpose of Data	The parameter was used to calculate the baseline emission factor EF_P and ex ante emission reduction calculation. It was not used for the ex-post emission reduction calculation during this monitoring period.

Comments	N/A

4.2 Data and Parameters Monitored

Data / Parameter	$A_{s,g}$
Data unit	ha
Description	Aggregated project area in a given season s
Source of data	It was determined by collecting the project field sizes in the database set up by project proponent, which holds data and information that allow an unambiguous identification of participating rice farms, including the size of field. The technicians have submitted the Fact Sheets on Rice Cultivation in Lujiang County in 2021.
Description of measurement methods and procedures to be applied	The size of each household's rice field is determined by using GPS by Lujiang Agricultural Bureau provided to project proponent, which then makes a database. The technicians use this database to monitor and check each household in it. Every week, the technicians are required to check whether the project fields recorded in the database are cultivated by intermittent flooded method with the help of the logbooks. Finally, technicians should submit the Fact Sheets on Rice Cultivation in Lujiang County in 2021.
Frequency of monitoring/recording	Every season
Value applied	During this monitoring period in 2021, the planting area of early and later season rice in the project area is 14,189 ha.
Monitoring equipment	The information[20] of GPS measuring equipment used by Northern Lujiang Agricultural Bureau is shown as follows.

Parameters	Information
Model	GNSS handheld GPS measuring equipment of G1BD series

[20] Which is gained form The Instruction of GPS Measuring Equipment

Precision	Real-time display of the estimation accuracy of the current horizontal position in meters
Calibration	1. The compass was calibrated by placing the equipment horizontally and vertically before use 2. The automatic calibration of the barometer was turned on before use

Figure 4-1 GPS measuring equipment used by Lujiang Agricultural Bureau

QA/QC procedures to be applied

According to requirement described in Quality assurance/Quality control of General guidelines for SSC CDM methodologies, the monitoring of aggregated project area in a given season s ($A_{s,g}$) was divided into two sections. The first section is that the technicians checked whether the project fields recorded in the database are cultivated by intermittent flooded method with the help of the logbooks every week. Secondly, the size of each household's rice field is provided by Lujiang Agricultural Bureau to the project proponent, which then makes a database. The technicians used this database to monitor and check each household in it. At the end of each cropping season, the technicians submitted the Fact Sheets on Rice Cultivation in Lujiang County in 2021. In terms of the sampling of logbooks, 308 households were sampled as required (please refer to the relevant part in Section 4.3 for details).

Purpose of data	The parameter was used to calculate the baseline emissions from project fields in season s (BE_s) and the project emissions from project fields in season s (PE_s)
Calculation method	Sum of area of each compliant household's rice fields
Comments	Only compliant farms are considered. According to the Fact Sheets on Rice Cultivation in Lujiang County in 2021 submitted by technicians and the sampled cultivation logbooks collected from households, all the households cultivated double-cropping rice with intermittent flooded water regime in this monitoring period.

Data / Parameter	$EF_{BL,s,g}$
Data unit	kg CH_4/ha per season
Description	Baseline emission factor of group g in a given season s
Source of data	After the gas samples are gained from field measurements in baseline reference fields and analyzed in laboratory, the results were recorded in The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies with Different Water Regime by Closed Chamber in Northern Lujiang County in 2021.
Description of measurement methods and procedures to be applied	As per instructions in the appendix (Guidelines for measuring methane emissions from rice fields) and IPCC 2006, volume 4, chapter 5.5.
Frequency of monitoring/recording	It was obtained from the calculation of the emission rate for baseline reference fields according to the requirements in the Appendix of methodology (please refer to calculation of the emission rate for a plot (reference field) below for details), and the $C_{CH4,t}$ (CH_4 concentration in chamber at time t) of weekly gas samplings was derived from the laboratory analysis. Since there are only one group in this project, three baseline reference fields where rice is cultivated by continuously flooded method are needed to measure the gas samples. Three closed chambers should be placed in each field and samples should be measured three times a week from each closed chamber. Therefore, the number of gas samples gained during this monitoring period is summarized as follows.

Year	2021

Season	early	later
Times of gas sampling	18	16
Number of gas samples	486	432

Value applied

Categories	$EF_{BL,s,g}$ (kg CH_4/ha/season)
	2021
Early season	182.40
Later season	168.69

Monitoring equipment

There are two sets of monitoring equipment involved. Firstly, the gas samples were measured by using the closed chambers (shown as Figure 4-2 below). Then, all the samples should be analyzed in laboratory by FID (gas chromatography with flame ionization detector) (shown as Figure 4-3 below).

Figure 4-2 Closed Chamber for On-site Gas Sampling

The material and design of base and chamber used in the field measurement were chosen according the requirements of Appendix (please refer to Section 4.3 for details) in small-scale methodology applied. Moreover, depending on the design of the field measurement and the purpose of the equipment, no accuracy or calibration information is required for the closed chamber.

Figure 4-3 FID for Laboratory Analysis

The parameters of the FID used in laboratory analysis are shown in the table below.

Parameter	Information
Model	Agilent 7890B GS System
Injection	Direct injection
Column	Packed (Filling: 60/80,13X)
Calibration	With certified standard gas each day of analysis before and after the analyses are done (the concentration of the certified standard gas: 5.11ppm)[21]

QA/QC procedures to be applied

The technicians trained by expert from Anhui Academy of Agricultural Sciences should do gas sampling once a week. As mentioned above, three closed chambers were placed in each baseline reference field and each chamber was sampled three times at a time. Therefore, there were 27 gas samples a week. All these gas samples were stored in evacuated vial and then sent to laboratory for analysis by FID. Besides, the laboratory analysis was also conducted in this institution which owned an ISO/IEC 17025 certificate, which is issued by China National Accreditation Commission for Conformity Assessment. Also, the evacuated vial and the closed chamber used in this project have been judged to be qualified by the application requirement of CNAS-CL01 Accreditation Criteria for Testing and Calibrating Laboratory Competencies (CNAS-CL52_2014). All the technicians are rigorously trained by expert before they started gas sampling. Once the expert finds abnormal data, it is immediately verified with the technicians. If data is wrong, it will be discarded according to the actual

[21] Which is required by the small-scale methodology AMS-Ⅲ.AU: Methane Emission Reduction by Adjusted Water Management Practice in Rice Cultivation/version 4.0.

	situation. Thus, the quality of this data can be assured and controlled.
Purpose of data	The parameter was used to calculate the baseline emissions from project fields in season s (BE_s).
Calculation method	Please refer to the Equation (1) ~ (4) below for detailed calculation process
Comments	N/A

Data / Parameter	$EF_{P,s,g}$
Data unit	kg CH_4/ha per season
Description	Project emission factor of group g in a given season s
Source of data	After the gas samples are gained from field measurements in project reference fields and analyzed in laboratory, the results were record in The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies with Different Water Regime by Closed Chamber in Northern Lujiang County in 2021.
Description of measurement methods and procedures to be applied	As per instructions in the appendix (Guidelines for measuring methane emissions from rice fields) and IPCC 2006, volume 4, chapter 5.5.
Frequency of monitoring/recording	It was obtained from the calculation of the emission rate for p*roject* reference fields according to the requirements in the Appendix of methodology (please refer to Calculation Method of Parameter $EF_{BL,s,g}$ mentioned above for details), and the $C_{CH4,t}$ (CH_4 concentration in chamber at time t) of weekly gas samplings was derived from the laboratory analysis. Since there are only one group in this project, three project reference fields where rice is cultivated by intermittent flooded method are needed to measure the gas samples. Three closed chambers should be placed in each field and samples should be measured three times a week from each closed chamber. Therefore, the number of gas samples gained during this monitoring period is summarized as follows.

Year	2021	
Season	early	later

	Times of gas sampling	18	16
	Number of gas samples	486	432

Value applied

Categories	$EF_{P,s,g}$ (kg CH_4/ha/season)
	2021
Early season	94.75
Later season	87.64

Monitoring equipment

There are two sets of monitoring equipment involved. Firstly, the gas samples were measured by using the closed chambers (shown as Figure 4-2 above). Then, all the samples should be analyzed in laboratory by FID (gas chromatography with flame ionization detector) (shown as Figure 4-3 above). And the parameters of the FID used in laboratory analysis are shown in the table above (Please refer to Monitoring Equipment of Parameter $EF_{BL,s,g}$ for details).

QA/QC procedures to be applied

The technicians trained by expert from Anhui Academy of Agricultural Sciences should do gas sampling once a week. As mentioned above, three closed chambers were placed in each baseline reference field and each chamber was sampled three times at a time. Therefore, there were 27 gas samples a week. All these gas samples were stored in evacuated vial and then sent to laboratory for analysis by FID. Besides, the laboratory analysis was also conducted in this institution which owned an ISO/IEC 17025 certificate, which is issued by China National Accreditation Commission for Conformity Assessment. Also, the evacuated vial and the closed chamber used in this project have been judged to be qualified by the application requirement of CNAS-CL01 Accreditation Criteria for Testing and Calibrating Laboratory Competencies (CNAS-CL52_2014). All the technicians are rigorously trained by expert before they stated gas sampling. Once the expert finds abnormal data, it is immediately verified with the technicians. If data is wrong, it will be discarded according to the actual situation. Thus, the quality of this data can be assured and controlled.

Purpose of data

The parameter was used to calculate the project emissions from project fields in season s (PE_s).

Calculation method

Please refer to the Equation (1) ~ (4) below for detailed calculation process.

Comments	N/A

4.3 Monitoring Plan

Monitoring team

The monitoring team consisted of the project proponent, Shanghai Libra Investment Management Co., Ltd, technicians and expert from the agricultural bureau. Firstly, Shanghai Libra set the number of reference fields, and drafts cultivation logbooks template, tables, etc. Secondly, project proponent and Shanghai Libra confirmed the monitoring frequency and notified the technicians and the agricultural bureau. The technicians also need to instruct the farmers and check the logbooks every month. Finally, according to the requirements in the Appendix of methodology, the gas sampling on field should be conducted once a week in baseline and project reference fields, respectively. Then, the $EF_{BL,s,g}$ and $EF_{P,s,g}$ can be obtained from the calculation of the emission rate for baseline reference fields according to the requirements in the Appendix of methodology, and the $C_{CH4,t}$ (CH_4 concentration in chamber at time t) of weekly gas samplings was derived from the laboratory analysis. The implementation of methane measurement in both baseline and project reference fields was done by technicians trained by expert from Anhui Academy of Agricultural Sciences, which is an institution owned the certificate to do the laboratory analysis. The expert who is the leader of the experiment has a doctoral degree and her field of study is rice cultivation and GHG monitoring[22]. Therefore, the accuracy of monitoring results was guaranteed for this monitoring period.

[22] Which has been proved in the CV of the expert.

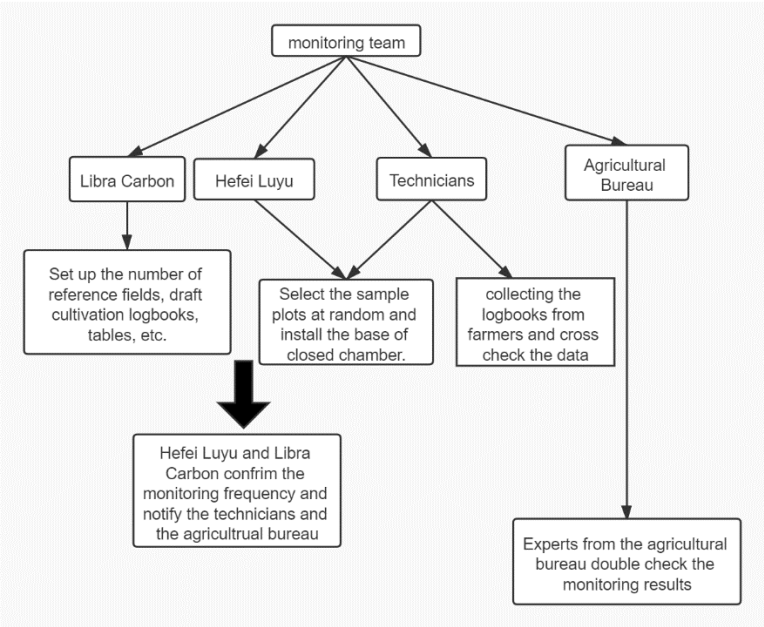

Figure 4-4 The figure of the monitoring team

Monitoring process

(1) Determine the reference fields

In this project, all the dynamic and statistic parameters of rice paddies within the project area are the same, according to the ex-ante investigation report[23], which can be summarized as follows:

No.	Parameter	Type	Conditions within the project area
1	Water regime – on-season	Dynamic	Continuously flooded
2	Water regime – pre-season		Flooded

[23] The ex-ante investigation report of Lujiang County in 2017 from Anhui Academy of Social Sciences

3	Organic amendment		No organic amendment
4	Soil pH	Static	The soil pH within project area is 5.6~7.4, which is in the range of larger than 5.5.
5	Soil organic carbon		The soil organic carbon is 0.98% which is in the range of less than 1%.
6	Climate		According to the Rice Almanac (Third Edition, 2002), the project zone, Lujiang County, lies in agroecological zones 7 (AEZs), which is warm/cool humid subtropics with summer rainfall.

Therefore, all fields within project area have the same cultivation pattern and there is only one group in this project. Then, in January 2018, before the cropping season started, 3 baseline reference fields and 3 project reference fields were set in Changfeng Village, Tongda Town, respectively, which are fixed rice paddies with area of around 0.4 ha[24] as shown in Table 4-1 below. The reason of choosing these reference fields is that the expert from Anhui Academy of Agricultural Science believed that these fields were representative of the baseline scenario and project scenario in all of the parameters mentioned above.

The measurements on project and baseline reference fields were carried out in an equal manner and simultaneously. The baseline reference fields were selected that they are representative of baseline scenario where double-cropping rice was planted by continuously flooded method without any organic amendments, while the project reference fields were selected that they are representative of project scenario where double-cropping rice was planted by intermittent flooded method without any organic amendments. During this

[24] According to the opinions of expert who is leading the on-site sampling and laboratory analysis and the general size of high-standard farmland, the experimental data is reliable and reasonable to select about 0.4 hectares of farmland as the reference fields.

monitoring period, these fields have been used as baseline and project reference fields and have not been changed.

Table 4-1 The information of baseline and project reference fields

Specific Information	Baseline Reference Fields			Project Reference Fields		
	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3
Area	0.37	0.42	0.41	0.36	0.40	0.39
Geological coordinates	117.306555°E, 31.472428°N	117.305531°E, 31.471637°N	117.305493°E, 31.471259°N	117.320577°E, 31.475752°N	117.320558°E, 31.477497°N	117.31833°E, 31.477261°N
Location	Changfeng Village, Tongda Town, Lujiang County			Changfeng Village, Tongda Town, Lujiang County		
The type of rice	Hybrid rice			Hybrid rice		
Climate	Subtropical humid monsoon climate			Subtropical humid monsoon climate		
Soil	pH5.6-7.5 and the soil organic carbon is0.98%			pH5.6-7.5 and the soil organic carbon is 0.98%		
Water management	Continuously flooded[25]			Intermittent flooded		
Fertilizer treatment	No any organic amendments, the amount of nitrogen fertilizer applied is at the range between 9 .0-10.5 kg/mu			No any organic amendments, the amount of nitrogen fertilizer applied is at the range between 9.0-10.5 kg/mu		

[25] Continuously flooded: fields have standing water throughout the rice growing season and may only dry out for harvest (end-season drainage)

(2) Monitoring of baseline and project emissions (determination of $EF_{BL,s,g}$ and $EF_{P,s,g}$)

According to the applied methodology AMS-III.AU (version 4.0), ex post-emission reduction shall be calculated by the formulas shown in Section 5.1, Section 5.2 and Section 5.4 below. So, $EF_{BL,s,g}$ and $EF_{P,s,g}$ shall be measured by technicians based on the requirements in the appendix (shown as follows) and IPCC 2006, volume 4, chapter 5.5.

1. The implementation of methane measurement in rice fields requires the involvement of experts in this field or at least experienced staff trained by experts (i.e. from research institutions). These guidelines cannot replace expertise in setting up chamber measurements. They rather set minimum requirements that serve for standardizing the conditions under which methane emissions are measured for projects under this methodology.

2. Project proponents prepared a detailed plan for the seasonal methane measurements before the start of the season. The plan included the schedule for the field and laboratory measurements, the logistics that are necessary to get the gas samples to the laboratory and a cropping calendar. The plan also included all reference field specific information regarding location and climate, soil, water management, plant characteristics, fertilizer treatment and organic amendments.

3. The following guidance is structured according to the steps from field measurement to emission factor calculation. Project proponents made sure that the measurements on project and baseline reference fields were carried out in an equal manner and simultaneously.

Table 4-2 On the field – technical options for the chamber design

Feature	Conditions	
Chamber material	Option 1: Non-transparent ● Commercially available PVC containers or manufactured chambers (e.g. using galvanized iron); ● Painted white or covered with reflective material (to prevent increasing inside temperature);	Option 2: Transparent ● Manufactured chambers using acrylic glass; ● Advantage of transparent chambers: could be placed for longer time spans on the field if equipped with a lid that remains open between measurements

	• Only suitable for short-term exposure (typically 30 min) followed by immediate removal from the field	and is only closed during measurements
Placement in soil	Option 1: Fixed base • Base made of non-corrosive material and remains in the field for the whole season; • Base should allow tight sealing of the chamber; • Base should have bores in the submerged section to allow water exchange between inside and outside; • Base should be installed at least 24 hours before the first sampling	Option 2: Without base • Chamber have to be placed on the soil with open lid to allow escape of eventual ebullition
Auxiliaries of chamber	• Thermometer for measuring the temperature inside the chamber; • Fan (battery operated) inside the chamber for mix the inside air during sampling; Sampling port (rubber stopper placed in a bore of the chamber)	
Basal area	Rectangular or rounded, but has to cover minimum of four rice hills (ca. 0.1m^2 minimum)	
Height	Option 1: Fixed height Total height (protruding base + chamber) should exceed plant height	Option 2: Flexible height • Adjustable to plant height; • Chambers with different heights or modular design

Table 4-3 On the field – air sampling

Feature	Conditions
Replicate chambers per plot	Minimum requirement: Three replicate chambers per plot
Number of air samples per exposure/data points per measurement	Minimum requirement: Three samples per exposure
Exposure time	30 minutes
Daytime of measurement	Morning
Measurement interval	Minimum requirement: once per week
Syringe	Suitability test (leak proof) before measurement Preferably equipped with a lock for ease of handling
Sample storage until analysis	● Storage < 24h: air samples can remain in syringe; Storage > 24h: transfer air samples into evacuated vial, store with slight overpressure

Table 4-4 Laboratory analysis

Feature	Conditions
Method	Gas Chromatography with flame ionization detector (FID)
Injection	Direct injection or with multi-port valve and sample loop
Column	Packed (e.g. molecular sieve) or capillary column
Calibration	With certified standard gas each day of analysis before and after the analyses are done

As mentioned above, three baseline reference fields and three project reference fields were selected in Changfeng Village, Tongda Town, and the project reference fields are 1.5km away from baseline reference fields. Besides, the measurements on project and baseline reference fields were carried out in an equal manner and simultaneously. Three replicate bases were placed in each reference fields just before rice transplanting (i.e. in March and please refer to Section 5.1 and Section 5.2 for details). The first gas sampling was conducted by technicians 24 hours after transplanting. Then, technicians conducted the gas sampling in both baseline and project reference fields once a week and the last sampling were taken

just before harvest (see details in Table 5-1 and Table 5-2). During every sampling, the technicians covered the chamber on the base for half an hour and took three samples from each chamber. Then, the technicians could gain 54 samples at a time from all baseline and project reference fields and took the gas samples to laboratory. After three times of sampling have been taken, all 162 gas samples would be analysed by FID in laboratory to obtain CH_4 concentration in chamber at time t ($c_{CH_{4,t}}$) that can be used to calculate average emission rate of a plot (reference field) in mg/h×m^2. After that, from the average emission rates per plot of each chamber measurement, the seasonally integrated emission factors were derived by integration of the measurement results over the season length, which means multiplying the emission rate with the number of hours of the measurement interval and accumulating the results of every measurement interval over the season. Finally, the seasonally integrated baseline emission factor $EF_{BL,s,g}$ and project emission factor $EF_{P,s,g}$ were derived as average value from the replicate three measurements for baseline reference fields and project reference fields. Please refer to Section 5.1 and Section 5.2 for detailed process of calculation.

Hefei Luyu, as the project proponent, prepared a detailed plan for the methane measurements before the start of the monitoring period. As mentioned above, the logics that are necessary to do field measurement and laboratory analysis as well as the cropping calendar are similar, so Hefei Luyu entrusted Anhui Academy of Agricultural Sciences to prepare a detailed plan[26] in January 2018 before the start of the project. The plan has included the schedule for the field and laboratory measurements, the logistics that are necessary to get the gas samples to laboratory and a cropping calendar. Please refer to the Table 4-1 above for all reference fields' specific information. The implementation of methane measurement in both baseline and project reference fields was conducted by technicians trained by expert from Anhui Academy of Agricultural Sciences which is an institution owned the certificate to do the laboratory analysis. The expert who is the leader of the experiment has a doctoral degree and her field of study is rice cultivation and GHG monitoring.

Table 4-5 On the field – technical options for the chamber design

Feature	Requirements	Conditions in the baseline reference fields	Conditions in the project reference fields
Chamber material	Option 1: Non-transparent ● Commercially available PVC	The chamber used in this project is made of PVC materials covered with reflective material to prevent the	The chamber used in this project is made of PVC materials

[26] The Test Plan for Measuring Methane Emission Rate in Rice Paddies with Different Water Regimes

	containers or manufactured chambers (e.g. using galvanized iron); ● Painted white or covered with reflective material (to prevent increasing inside temperature); ● Only suitable for short-term exposure (typically 30 min) followed by immediate removal from the field	increasing inside temperature. And it was only put just before the sampling and then is removed after 30 mins of sampling.	covered with reflective material to prevent the increasing inside temperature. And it was only put just before the sampling and then is removed after 30 mins of sampling.
Placement in soil	Option 1: Fixed base ● Base made of non-corrosive material and remains in the field for the whole season; ● Base should allow tight sealing of the chamber; ● Base should have bores in the submerged section to allow water exchange between inside and outside; ● Base should be installed at least 24 hours before the first sampling	The base used in this project is made of non-corrosive PVC material and was embedded before transplantation, remaining in the field for the whole season. Base allows tight sealing of the chamber and has bores in the submerged section to allow water exchange. The first sampling was taken 24 hours after the base installation (see details in Table 5-1 and Table 5-2 below).	The base used in this project is made of non-corrosive PVC material and was embedded before transplantation, remaining in the field for the whole season. Base allows tight sealing of the chamber and has bores in the submerged section to allow water exchange. The first sampling was taken 24

			hours after the base installation (see details in Table 5-1 and Table 5-2 below).
Auxiliaries of chamber	● Thermometer for measuring the temperature inside the chamber; ● Fan (battery operated) inside the chamber for mix the inside air during sampling; ● Sampling port (rubber stopper placed in a bore of the chamber)	There are a thermometer and a fan inside the chamber and the sampling port is set on the top of the chamber.	There are a thermometer and a fan inside the chamber and the sampling port is set on the top of the chamber.
Basal area	Rectangular or rounded, but has to cover minimum of four rice hills (ca. 0.1m^2 minimum)	The base is rectangular and installed covering four rice hills. According to The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies with Different Water Regime by Closed Chamber in the north of Lujiang County in 2021[27], the base covered the area of about 0.25m^2 which is meet the requirement of 0.1m^2 minimum.	The base is rectangular and installed covering four rice hills. According to The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies with Different Water Regime by Closed Chamber in Northern

[27] Which was completed by the expert from Anhui Academy of Agricultural Sciences

			Lujiang County in 2021[28], the base covered the area of about 0.25m^2 which is meet the requirement of 0.1m^2 minimum.
Height	Option 1: Fixed height Total height (protruding base + chamber) should exceed plant height	The total height of chamber and base is 1.5 meters which is higher than 1.2 meters, the largest height of the plant.	The total height of chamber and base is 1.5 meters which is higher than 1.2 meters, the largest height of the plant.

Table 4-6 On the field – air sampling

Feature	Requirements	Conditions in the baseline reference fields	Conditions in the project reference fields
Replicate chambers per plot	Minimum requirement: Three replicate chambers per plot	Three replicate chambers were placed in each of the three baseline reference fields, making a total of nine chambers.	Three replicate chambers were placed in each of the three baseline reference fields, making a total of nine chambers.
Number of air samples per exposure/data points per measurement	Minimum requirement: Three samples per exposure	Three samples for every exposure.	Three samples for every exposure.

[28] Which was completed by the expert from Anhui Academy of Agricultural Sciences

Exposure time	30 minutes	30 minutes	30 minutes
Daytime of measurement	Morning	9.30 – 10.00 a.m.	9.30 – 10.00 a.m.
Measurement interval	Minimum requirement: once per week	Once a week	Once a week
Syringe	Suitability test (leak proof) before measurement Preferably equipped with a lock for ease of handling	The syringe with a lock was used in this project and it is checked for leak proof before every measurement.	The syringe with a lock was used in this project and it is checked for leak proof before every measurement.
Sample storage until analysis	● Storage < 24h: air samples can remain in syringe; ● Storage > 24h: transfer air samples into evacuated vial, store with slight overpressure	Three samples were taken before a laboratory analysis was performed, so the samples were stored in the evacuated vials.	Three samples were taken before a laboratory analysis was performed, so the samples were stored in the evacuated vials.

Table 4-7 Laboratory analysis

Feature	Requirements	Conditions in the baseline reference fields	Conditions in the project reference fields
Method	Gas Chromatography with flame ionization detector (FID)	FID	FID
Injection	Direct injection or with multi-port valve and sample loop	Direct injection	Direct injection

Column	Packed (e.g. molecular sieve) or capillary column	Packed	Packed
Calibration	With certified standard gas each day of analysis before and after the analyses are done	With certified standard gas each day of analysis before and after the analyses are done	With certified standard gas each day of analysis before and after the analyses are done

During this monitoring period, the laboratory analysis was done in Anhui Academy of Agricultural Sciences, which has the laboratory accreditation certificate issued by China National Accreditation Service for Conformity Assessment[29]. Among them, FID has been judged to be qualified by the Regulations of Calibrate Metrological Verification (JJG 700-2016). The validity of this certificate is from 4-Febuary-2016 to 3-Febuary-2022. And the syringe, evacuated vial and the closed chamber used in this project have been judged to be qualified by the application requirement of CNAS-CL01 Accreditation Criteria for Testing and Calibrating Laboratory Competencies (CNAS-CL52_2014). The FID used in laboratory analysis were calibrated in accordance with the requirements in the Appendix of methodology (shown in Table 4-2~4-4 of Section 4.3 above) with certified standard gas each day of analysis before and after the analyses are done (the concentration of the certified standard gas: 5.11ppm)[30].

In combination with the experimental requirements and the area of the local high-standard farmland, the expert selected three baseline reference fields and three project reference fields in Changfeng Village, respectively, which represents the baseline and project scenario well in terms of the parameters listed above (shown in the Monitoring Process). Firstly, the technicians buried the base in the fields before transplanting, and plant 4 rice hills in the base area (as shown in the figure 4-5 below). The base size is 0.5m×0.5m, so the requirement of covering 0.1m^2 minimum was guaranteed. The first sampling was taken the next day after transplanting, and then once a week. At each sampling, the closed chamber was mounted on the base for 30 minutes and then three gas samples were gained by technicians. The gas samples were transferred into evacuated vial for storage. After the field sampling has been completed 3 times, all gas samples were sent to the laboratory for FID

[29] See more details in the Attachment of Laboratory Accreditation Certificate

[30] Which is required by the small-scale methodology applied and the results of calibration can be proved by The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies for Early Season and Later Season with Different Water Regime by Closed Chamber in Northern Lujiang County in 2021 from Anhui Academy of Agricultural Sciences

analysis. Finally, the expert calculated the final result by Equation (1) ~ (4), and then the report[31] was finished by expert at the end of each cropping season. Please refer to Section 4.2 for specific number of gas samples gained from field measurement.

Figure 4-5 The base buried in the reference fields (which covers 4 rice hills)

Taking early season rice of double cropping in 2021 as an example, the detailed process and final results of monitoring in both baseline and project reference fields are described as follows, including the schedule, personnel and equipment involved in field gas collection, laboratory analysis and report preparation.

Early season rice of double cropping in 2021			
Time	Activity	Equipment	Personnel
12 March	Land preparation	-----	Farmers
13 March	Base was buried and transplantation	Base	Technicians and Farmers
14 March	The first sampling	Closed chamber	Technicians
21 March	The second sampling		
28 March	The third sampling		
29 March	Laboratory Analysis	FID	Expert
04 April	The fourth sampling	Closed chamber	Technicians
11 April	The fifth sampling		
18 April	The sixth sampling		
19 April	Laboratory Analysis	FID	Expert

[31] The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies with Different Water Regime by Closed Chamber in Northern Lujiang County in 2021.

25 April	The seventh sampling	Closed chamber	Technicians
02May	The eighth sampling		
09May	The ninth sampling		
10 May	Laboratory Analysis	FID	Expert
17 May	The tenth sampling	Closed chamber	Technicians
23 May	The eleventh sampling		
30 May	The twelfth sampling		
31May	Laboratory Analysis	FID	Expert
06 June	The thirteenth sampling	Closed chamber	Technicians
13June	The fourth sampling		
20 June	The fifth sampling		
21 June	Laboratory Analysis	FID	Expert
27 June	The sixth sampling	Closed chamber	Technicians
04 July	The seventh sampling		
08 July	The last on-site sampling and then harvest		
09 July	Laboratory Analysis	FID	Expert
1 August	The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies with Different Water Regime by Closed Chamber in Northern Lujiang County in 2021	-----	Expert

Since the measurements on project and baseline reference fields were carried out in an equal manner and simultaneously, the schedule of measurements and laboratory analysis, and the number of gas samples collected from baseline and project reference fields were the same.

Calculation of the emission rate for a plot (reference field)

(1) For each gas analysis, calculate the mass of CH_4 emissions with the help of the following formula:

$$m_{CH_4} = c_{CH_{4,t}} \times V_{Chamber} \times M_{CH_4} \times \frac{1atm}{R \times T_t \times 1000} \quad (1)$$

Where:

Parameters	Description

m_{CH_4}	Mass of CH_4 in chamber at time t (mg)
t	Point of time of sample (e.g. 0,15,30 in case of three samples within 30 minutes)
$c_{CH_{4,t}}$	CH_4 concentration in chamber at time t, from gas analysis (ppm)
$V_{Chamber}$	Chamber volume (L)
M_{CH_4}	Molar mass of CH_4: 16g/mol
$1atm$	Assume constant pressure of 1atm, unless pressure measurement is installed
R	Universal gas constant: 0.08206 L atm/K^{-1}*mol^{-1}
T_t	Temperature at time t (K)

(2) Determine the slope of the line of best fit for the values of over time with the help of software (e.g. Excel):

$$s = \frac{\Delta m_{CH_4}}{\Delta t} \tag{2}$$

Where:

Parameters	Description
s	Slope of line of best fit (mg/min)

(3) Calculate the emission rate per hour for one chamber measurement:

$$RE_{ch} = s \times \frac{60min}{A_{chamber}} \tag{3}$$

Where:

Parameters	Description
RE_{ch}	Emission rate of chamber ch (mg/h*m^2)
ch	Index for replicate chamber on a plot
$A_{chamber}$	Chamber area (m^2)

(4) Calculate the average emission rate of a chamber measurement per plot:

$$RE_{plot} = \frac{\sum_{ch=1}^{Ch} RE_{ch}}{Ch} \quad (4)$$

Where:

Parameters	Description
RE_{plot}	Average emission rate of a plot (mg/h*m^2)
Ch	Number of replicate chambers per plot

(5) Further procedure: from the average emission rates per plot of each chamber measurement, derive the seasonally integrated emission factor by integration of the measurement results over the season length. The simplest way of integration is multiplying the emission rate with the number of hours of the measurement interval (e.g. one week) and accumulating the results of every measurement interval over the season. Convert from mg/m^2 to kg/ha by multiplying with 0.01. <u>Monitoring of farmers' compliance with project cultivation practice (determination of $A_{s,g}$)</u>

In order to determine whether the project fields are cultivated according to intermittent flooded cultivation practice, and thus assure that measurements on the reference fields are representative for the emissions from the project fields, a cultivation logbook has been maintained for all project fields. With the help of the logbook, all parameters, as following, that are part of the project cultivation practice have been documented by the farmers:

(a) Sowing date;

(b) Fertilizer, organic amendments, and crop protection application (date and amount);

(c) Water regime on the field (e.g. "dry/moist/flooded") and dates where the water regime is changed from one status to another;

(d) Yield.

In addition, farmers have stated whether they have followed fertilization recommendations [32] provided with the introduction of the adjusted water management practice.

Project proponent has established a database which holds data and information of these 3,480 households involved in this project activity, which contains the name, ID number,

[32] The Technical Guidelines for Intermittently Flooded Rice Cultivation Method in Anhui Province, later issued by the Institute of Agricultural Engineering of Anhui Academy of Agricultural Sciences, also emphasized that the optimal amount of nitrogen fertilizer used in Anhui rice paddy fields is 9-10.5kg/ Mu.

address of the head of the household, size of the field, completion date of construction, the starting date of rice season. Therefore, the sampling below is based on the database.

Since the reporting and verification shall be done on the basis of samples of the logbooks from the farmers, according to the latest version of the "*Standard for sampling and surveys for CDM project activities and programme of activities (version 9.0)*", the process of sampling is shown as follows:

- **Objectives and Reliability Requirements**

In this project, every farmers' household owning the paddy fields is regarded as an isolate unit. This sampling plan is for 3,480 households involved in this project. The project had applied intermittently flooded water regime with the same type, same category and same technology. After the implementation, this new water regime displaced the traditional continuously flooded method during rice cultivation in the project area. The households' logbooks were sampled for assuring the project activity. In this case, the project proponent used 90/10 confidence/precision according to the sampling standard mentioned above.

- **Target Population**

From the description, the target population is the related 3,480 households planting the rice.

Table 4-8 the number of households in each town of Northern Lujiang County

Name of Town	The number of households
Tongda Town	220
Baishan Town	553
Shengqiao Town	288
Guohe Town	396
Jinniu Town	389
Shitou Town	238
Lucheng Town	488
Yefushan Town	227
Tangchi Town	139
Wanshan Town	308
Baihu Town	234

Total	3,480

- **Sample Method**

Since the households are numerous and scattered, the water regime used during rice cultivation is identical, stratified random sampling is adopted in order that each one can be selected with equal probability. The strata should be mutually exclusive: every element in the population must be assigned to only one stratum. The stratification requires that information on the stratification variable, e.g. survey sample household will be changed once per year. Simple random sampling method have been taken in each stratum by using Microsoft Excel.

- **Sample Size**

According to the "*Standard for sampling and surveys for CDM project activities and programme of activities (version 9.0)*", the desired confidence level is 90% and the desired precision is 10%. Based on the statistical principles and sampling survey method, 308 samples should be sufficient to satisfy the desired confidence and precision. For mean value sampling, the required sampling quantity is calculated by the following steps:

$$n_1 = \frac{Z^2\sigma^2}{d^2} \tag{5}$$

Step1:

Where:

Parameters	Description
Z	The symbol used in general formula for confidence intervals. The validation team confirms it is to be 1.645 when confidence interval is 90%
σ	The population standard deviation, which is not available to PP
d	The maximum error of estimate

Step 2: Deformation of basic formula

$$n_1 = \frac{Z^2\sigma^2}{d^2} = \frac{Z^2(\frac{\sigma^2}{X^2})}{d^2/X^2} = Z^2V^2/e^2 \tag{6}$$

Where:

Parameters	Description

V	the coefficient of variation, and $V = \sigma/X$. As population standard deviation σ shall be smaller than the sample mean value X, hence from conservative consideration point of view, making V=1 can get the biggest sample size. It is conservative
e	the relative sampling error, and $e = d/X$, which is the precision. In this case, e=10% as discussed above

Consequently, $n_1 = \frac{Z^2V^2}{e^2} = \frac{1.645^2}{0.01} = 270.6$, and round up to 271.

Step 3: Correction based on population size

$$n_2 = \frac{n_1 N}{n_1 + N} \tag{7}$$

Where:

Parameters	Description
N	The population size, it is 3,480 under project context

Therefore,

$n_2 = \frac{n_1 N}{n_1 + N} = \frac{271 \times 3{,}480}{271 + 3{,}480}$ =251.42, and round up to be 252, it takes $n_2 = 252$ is preferable.

Step 4: Correction based on sampling approach

$$n_3 = Bn_2 \tag{8}$$

Where:

Parameters	Description
B	The survey design effect

As discussed in *Procedures for Administering Data Collection and Minimizing Non-Sampling Errors*. The project adopts multi-stage sampling approach. In this case, $B \leq 1$ as per Sampling Design and Methodology. It's conservative consideration.

Thus, $n_3 = Bn_2 = 1 \times n_2 = 252$

Step 5: Correction based on responding rate

$$n_4 = \frac{n_3}{r} \tag{9}$$

Where:

The responding rate is adopted to be less 90% according to investigation report.

Thus, $n_4 = \frac{n_3}{r} = \frac{252}{90\%} = 280$.

Step 6: Correction based on contingency consideration

$$n = 110\% \times n_4 \tag{10}$$

Where:

Consequently, the sample size $n = 110\% \times n_4 = 110\% \times 280 = 308$.

The calculation result for n is 308. Therefore, although all the households are required to complete the logbooks, only 308 sample logbooks from households were selected from the sampling frame according to stratified sampling method at the beginning during the crediting period in 2021. The template of logbook was compiled by Shanghai Libra in accordance with the requirements of methodology. An inclusion of 308 samples in total, the sample size of each township was decided on the method of proportional distribution.

- **Sampling Frame**

In the investigation, sampling frame is worked out independently by taking town as sampling unit. Sampled group have been changed in this monitoring period. Firstly, calculate the ratio of households in every administrative town to the total population of Northern Lujiang County. According to the ratio of every town, calculate the sampling size of every town, and then set the amount of sampling 308 households, the actual sampling size is the ratio of every town multiply by 308. Finally, according to the number of samples needed for each town, the random sampling function of Excel is used to extract from the database mentioned above.

Table 4-9. The sampling size of logbooks from households in each town of Northern Lujiang County

Name of Town	The number of households
Tongda Town	20
Baishan Town	49
Shengqiao town	25
Guohe town	35
Jinniu town	35
Shitou Town	21
Lucheng Town	43
Yefushan Town	20

Tangchi Town	12
Wanshan Town	27
Baihu Town	21
Total	308

After the sampling logbooks were collected by the technicians, the expert from Anhui Academy of Agricultural Sciences checked the contents in the logbooks first to confirm whether the nitrogen application amount and drainage and irrigation frequency recorded by the farmers meet the requirements of the project activity, and then hand it to Shanghai Libra for final check, and then complete the monitoring report.

Sampling monitoring results of this monitoring period

January 2021, the technicians gave out the blank cultivation logbooks to all the households. During the entire cropping season, farmers recorded the information required in the logbooks, including the date of transplanting, date of fertilization, the amount of fertilizer applied, water regime and yield. The technicians patrolled the fields every week and checked every household's logbooks. If the water management was inappropriate, the technician would instruct the farmer how to practice intermittent flooded water regime correctly and ask him to make adjustments. At the same time, if the records in logbooks were incorrect, the technicians would also ask the farmer to correct them immediately. At the end of each year, Shanghai Libra used Excel software to randomly select 308 households[33] from 3,480 households for inspection. After the 308 households are selected, Shanghai Libra informed the technicians to collect the corresponding logbooks. All cultivation logbooks collected have been reviewed by expert and the results were compiled into an excel sheet (which has been submitted to VVB for verification). According to the excel sheet, all the 308 households have applied intermittent flooded water regime as required during this monitoring period.

Besides, as mentioned above, the size of each household's rice field is provided by Lujiang Agricultural Bureau to the project proponent, which then makes a database before the project implementation. The technicians used this database to monitor and check each household in it. Every week, the technicians checked whether the project fields recorded in the database are cultivated by intermittent flooded method with the help of the logbooks. Finally, technicians submitted the *Fact Sheets on Rice Cultivation in Lujiang County in 2021*, which proved that all the rice paddies of 14,189 ha were cultivated by intermittent flooded water regime during this monitoring period. Thus, $A_{s,g} = 14{,}189\ ha.$

[33] The 308 households were randomly selected from 3,480 households in this monitoring period, then the 308 households in this monitoring period is verified as not the same group as the sampling group in the first monitoring period.

Monitoring frequency

The monitoring frequency of data and parameters set out in Section 4.2 (Data and Parameters Monitored) above have already been described in monitoring process. In terms of this project monitoring, it should be finished every year before verification.

Data management

All data collected as part of monitoring has been archived electronically. All information has been stored by the technology department of the project proponent and all the materials have physical copies for backup. All data collected have been archived at least two years after the end of the last crediting period of the project activity.

QA/QC

A systematic internal review and correction process have been used to assure/control the quality. The technicians collected the logbooks from households once a month and cross checked the data with expert. Similarly, the process of monitoring was also supervised by expert. When they find some unusual data, they will feed back to technicians and then correct the data before share it with Shanghai Libra. Shanghai Libra will draft the monitoring report based on the raw data and cross-check with the agricultural bureau expert. If there are not any further comments from the expert, Shanghai Libra will finalise the report. All parties are required to reply any questions raised within 30 days.

During this monitoring period, due to the systematic internal review and correction process, no data problems were found.

Emergency procedure

In this project, it is possible to cause equipment damage or missing data due to negligence and improper operation.

First of all, before the start of each growing season, Shanghai Libra should train technicians on how to check whether the equipment is working properly. After that, the technicians should check whether the equipment in the field is in good condition. Secondly, if there is any damage, the replacement should be completed before the land preparation, and the replacement should be recorded by Hefei Luyu and Shanghai Libra to ensure that the replaced equipment meets the requirements of this project. All the equipment should be in place before the start of growing season (land preparation). Thirdly, the technician should pay close attention to weather forecasts during rice planting. If extreme weather, such as heavy rain, is imminent, on-field gas sampling should be carried out before and after the extreme weather to ensure the monitoring frequency, at least once a week, required in the Appendix of methodology. Finally, if data loss or equipment damage occurs during the monitoring process, the corresponding emission reduction will be deducted in the most conservative way.

During this monitoring period, Shanghai Libra have trained the technicians to check that the base is in good condition before installation, and to check that the closed chamber can be used properly before each sampling. So far, no equipment damage has occurred, as well as the extreme weather.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As described in methodology AMS-Ⅲ.AU (version 4.0) mentioned above, the baseline scenario is the continuation of the current practice, e.g. continuously flooded rice cultivation in the project fields, the baseline emissions are estimated as follows:

$$BE_y = \sum_s BE_s \tag{11}$$

$$BE_s = \sum_{g=1}^{G} EF_{BL,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH_4} \tag{12}$$

Where:

Parameters	Description
BE_y	Baseline emissions in year y (tCO_2e)
BE_s	Baseline emissions from project fields in season s (tCO_2e)
$EF_{BL,s,g}$	Baseline emissions factor of group g in season s ($kgCH_4$/ha per season)
$A_{s,g}$	Area of project fields of group g in season s (ha)
GWP_{CH_4}	Global warming potential of CH_4 (tCO_2e/tCH_4)
g	Group g, covers all project fields with the same cultivation pattern (G = total number of groups)

Determination of baseline emission factor on baseline reference fields ($EF_{BL,s,g}$)

Baseline reference fields shall be set up in a way that they are representative of baseline emission in the project rice fields. Please refer to Section 4.3 for details of selecting baseline reference fields and the measurement of the seasonally integrated baseline emission factor $EF_{BL,s,g}$. And the specific information of baseline reference fields has been

summarized in Table 4-1 (Section 4.3). Besides, the plan for field measurement and laboratory analysis from baseline reference fields has been shown as Table 5-1 and Table 5-2 below.

Table 5-1 The plan for the seasonal methane measurements of the early season during this monitoring period in 2021

Activity	Gas Sampling	Laboratory Analysis
Land preparation	12 March	--
Base was buried and transplantation	13 March	--
The first sampling	14 March	29 March
The second sampling	21 March	
The third sampling	28 March	
The fourth sampling	04 April	19 April
The fifth sampling	11 April	
The sixth sampling	18 April	
The seventh sampling	25 April	10 May
The eighth sampling	02 May	
The ninth sampling	09 May	
The tenth sampling	16 May	31 May
The eleventh sampling	23 May	
The twelfth sampling	30 May	
The thirteenth sampling	06 June	21 June
The fourth sampling	13 June	
The fifth sampling	20 June	
The sixth sampling	27 June	09 July
The seventh sampling	04 July	
The last on-site sampling and then harvest	08 July	

Table 5-2 The plan for the seasonal methane measurements of the later season during this monitoring period in 2021

Activity	Gas Sampling	Laboratory Analysis
Land preparation	11 July	--
Base was buried and transplantation	14 July	--
The first sampling	15 July	30 July
The second sampling	22 July	
The third sampling	29 July	

The fourth sampling	05 August	20 August
The fifth sampling	12 August	
The sixth sampling	19 August	
The seventh sampling	26 August	10 September
The eighth sampling	02 September	
The ninth sampling	09 September	
The tenth sampling	16 September	01 October
The eleventh sampling	23 September	
The twelfth sampling	30 September	
The thirteenth sampling	07 October	28 October
The fourth sampling	14 October	
The fifth sampling	21 October	
The last on-site sampling and then harvest	27 October	

It is demonstrated by The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies for Early Season and Later Season with Different Water Regime by Closed Chamber in Northern Lujiang County in 2021 from Anhui Academy of Agricultural Sciences that the baseline emissions factor of group g in season s ($EF_{BL,s,g}$) is shown as Table 5-3 below.

Table 5-3 The baseline emissions factor of group g in season s ($EF_{BL,s,g}$) in 2021

Season	$EF_{BL,s,g}$(kgCH4/season)
Early Season	182.40
Later Season	168.69

(1) Please refer to Section 4.3 for detailed calculation process. The final integrated results of RE_{plot} with the unit of (kg/season/ha) in the three reference fields is equal to $EF_{BL,s,g}$ (kgCH4/season/ha) which are summarized in Table 5-4 below.

Table 5-4 RE_{plot} (kg/season/ha) in baseline reference fields during this monitoring period in 2021

Category	Early Season			Later Season		
	RE_{plot} (mg/h x m^2)	Hours over the season	RE_{plot} (kg/season/ha)	RE_{plot} (mg/h x m^2)	Hours over the season	RE_{plot} (kg/season/ha)
Plot 1	6.34	2,880hours (120 days)	182.59	6.37	2,640 hours	168.17
Plot 2	6.29		181.15	6.41		169.22

Plot 3	6.37		183.46	6.39	(110 days)	168.70
Average	6.33		182.40	6.39		168.69

Therefore, the baseline emission factors of group g in season s ($EF_{BL,s,g}$) are summarized as follows:

Table 5-5 $EF_{BL,s,g}$ (kg CH_4/season/ha) in baseline reference fields during this monitoring period in 2021

Season	$EF_{BL,s,g}$(kgCH_4/season)
Early Season	182.40
Later Season	168.69

Calculation of the baseline emissions in year y BE_y (tCO_2e)

Taking all the information above, the table below can be reached.

Season	Early Season	Later Season
$EF_{BL,s,g}$ (kgCH_4/season/ha)	182.40	168.69
GWP_{CH_4} (t CO_2e/t CH_4)	28	
$A_{s.g}$ (ha)	14,189	
P.S. 1. The GWP_{CH_4} is taken from the IPCC's Fifth Assessment report, GHG Protocol 2. The number of $A_{s,g}$ is obtained from the Fact Sheets[34] of the monitoring results submitted by technicians		

Since there are two seasons in one year and one group in the project, the baseline emissions BE_y (tCO_2e) during the period in 2021 are calculated as follows:

(1) For early season,

$$BE_s = \sum_{g=1}^{G} EF_{BL,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH_4}$$

$$= 182.40\ kgCH_4/season/ha \times 14{,}189ha \times 10^{-3} \times 28t\ CO_2e/t\ CH_4$$

[34] Fact Sheets on Rice Cultivation in Lujiang County in 2021 submitted by technicians

$= 72{,}466.06 tCO_2e$

(2) For later season,

$$BE_s = \sum_{g=1}^{G} EF_{BL,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH_4}$$

$$= 168.69\ kgCH_4/season/ha \times 14{,}189ha \times 10^{-3} \times 28t\ CO_2e/t\ CH_4$$

$$= 67{,}019.19tCO_2e$$

Thus, in 2021,

$$BE_y = \sum_{s} BE_s = 72{,}466.06tCO_2e + 67{,}019.19tCO_2e = 139{,}485\ tCO_2e$$

Overall, the baseline emissions BE_y (tCO_2e) during the period in 2021 are summarized as follows:

Table 5-6 BE_y (tCO_2e) in baseline reference fields during this monitoring period in 2021

Season	Early Season	Later Season
BE_s(tCO_2e)	72,466.06	67,019.19
BE_y (tCO_2e)	139,485	

5.2 Project Emissions

According to the applied methodology AMS-III.AU (version 4.0), the project emissions within the project boundary are calculated as follows:

$$PE_y = \sum_{s} PE_s \tag{13}$$

$$PE_s = \sum_{g=1}^{G} EF_{P,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH_4} \tag{14}$$

Where:

Parameters	Description
PE_y	Project emissions in year y (tCO_2e)
PE_s	Project emissions from project fields in season s (tCO_2e)

$EF_{P,s,g}$	Project emission factor of group g in season s (kgCH4/ha per season

Determination of project emission factor on reference fields ($EF_{P,s,g}$)

The seasonally integrated project emission factor $PE_{P,s,g}$ shall be determined using measurements on at least three project reference fields that fulfil the same conditions as the baseline reference fields, with the difference that they are cultivated according to the defined project cultivation practice. Project reference fields shall be established close to the baseline reference fields and begin with the growing season at the same time. $EF_{P,s,g}$ is the average of the measurement results from the three reference fields.

There is only one group for all rice paddies in this project, so a total of three project reference fields were established about 2km away from the baseline reference fields and began with the growing season at the same time. Please refer to Section 4.3 for details of selecting project reference fields and the measurement of the seasonally integrated project emission factor $EF_{P,s,g}$. And the specific information of project reference fields has been summarized in Table 4-1 (Section 4.3). Besides, the plan for field measurement and laboratory analysis from project reference fields has been shown as Table 5-1 and Table 5-2 above, since all the practice in project reference fields including the timeline of sampling should be consistent with that in baseline reference field except for water regime.

It is demonstrated by *The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies for Early Season and Later Season with Different Water Regime by Closed Chamber in Northern Lujiang County in 2021* from Anhui Academy of Agricultural Sciences that the project emissions factor of group g in season s ($EF_{P,s,g}$) is shown as Table 5-7 below.

Table 5-7 The project emissions factor of group g in season s ($EF_{P,s,g}$) in 2021

Season	$EF_{BL,s,g}$(kgCH4/season)
Early Season	94.75
Later Season	87.64

The process of calculation is shown as follow.

(2) Please refer to Section 4.3 above for detailed calculation process. The final integrated results of RE_{plot} with the unit of (kg/season/ha) in the three reference fields is equal to $EF_{P,s,g}$ (kgCH4/season/ha) which are summarized in Table 5-8 below.

Table 5-8 RE_{plot} (kg/season/ha) in project reference fields during this monitoring period in 2021

Category	Early Season	Later Season

	RE_{plot} (mg/h x m^2)	Hours over the season	RE_{plot} (kg/season/ha)	RE_{plot} (mg/h x m^2)	Hours over the season	RE_{plot} (kg/season/ha)
Plot 1	3.32	2,880hours (120 days)	95.62	3.36	2,640 hours (110 days)	88.70
Plot 2	3.30		95.04	3.29		86.86
Plot 3	3.25		93.60	3.31		87.38
Average	3.29		94.75	3.32		87.64

Therefore, the project emission factors of group g in season s ($EF_{P,s,g}$) are summarized as follows:

Table 5-9 $EF_{P,s,g}$ (kg CH_4/season/ha) in project reference fields during this monitoring period in 2021

Season	$EF_{BL,s,g}$(kgCH_4/season)
Early Season	94.75
Later Season	87.64

Calculation of the project emissions in year y PE_y (tCO_2e)

Taking all the information above, the table below can be reached.

Season	Early Season	Later Season
$EF_{P,s,g}$ (kgCH_4/season/ha)	94.75	87.64
GWP_{CH_4} (t CO_2e/t CH_4)	28	
$A_{s.g}$ (ha)	14,189	
P.S. 1. The GWP_{CH_4} is taken from the IPCC's Fifth Assessment report, GHG Protocol 2. The number of $A_{s,g}$ is obtained from the Fact Sheets[35] of the monitoring results submitted by technicians		

[35] Fact Sheets on Rice Cultivation in Lujiang County in 2021 submitted by technicians

Since there are two seasons in one year and one group in the project, the project emissions PE_y (tCO_2e) during the period in 2021 are calculated as follows:

(1) For early season,

$$PE_s = \sum_{g=1}^{G} EF_{P,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH_4}$$

$$= 94.75\ kgCH_4/season/ha \times 14{,}189ha \times 10^{-3} \times 28t\ CO_2e/t\ CH_4$$

$$= 37{,}643.42tCO_2e$$

(2) For later season,

$$PE_s = \sum_{g=1}^{G} EF_{P,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH_4}$$

$$= 87.64\ kgCH_4/season/ha \times 14{,}189ha \times 10^{-3} \times 28t\ CO_2e/t\ CH_4$$

$$= 34{,}818.67tCO_2e$$

Thus, in 2021,

$$PE_y = \sum_{s} PE_s = 37{,}643.42\ tCO_2e + 34{,}818.67\ tCO_2e = 72{,}462\ tCO_2e$$

Overall, the baseline emissions PE_y (tCO_2e) during the period in 2021 are summarized as follows:

Table 5-10 PE_y (tCO_2e) in baseline reference fields during this monitoring period in 2021

Season	Early Season	Later Season
PE_s(tCO_2e)	37,643.42	34,818.67
PE_y (tCO_2e)	72,462	

5.3 Leakage

According to the applied methodology AMS-Ⅲ.AU (version 4.0), any effects of the project activity on GHG emissions outside the project boundary are deemed to be negligible and do not considered under this methodology. So, leakage does not need to be considered in this project.

5.4 Net GHG Emission Reductions and Removals

The emission reductions achieved by the project activity shall be calculated as the difference between the baseline and the project emissions, which is shown as follows:

$$ER_s = BE_s - PE_s \tag{15}$$

Where:

Parameters	Description
ER_s	Emission reductions in season s (tCO_2e)

Under this methodology, any effects of the project activity on GHG emissions outside the project boundary are deemed to be negligible and do not have to be considered, so the leakage of this project activity is zero.

Thus, the emission reduction during this monitoring period in 2021 should be calculated as follows:

(1) For early season,

$$ER_s = BE_s - PE_s = 72{,}466.06\ tCO_2e\ - 37{,}643.42\ tCO_2e = 34{,}822.64\ tCO_2e$$

(2) For later season,

$$ER_s = BE_s - PE_s = 67{,}019.19\ tCO_2e\ - 34{,}818.67\ tCO_2e = 32{,}200.52\ tCO_2e$$

In general, the emission reductions achieved by this project during this monitoring period in 2021 can be summarized as follows.

Season	Early Season	Later Season
ER_s(tCO_2e)	34,822.64	32,200.52
ER_y (tCO_2e)	67,023	

All the information above can be summarized as follows.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	VCUs eligible for issuance
01-January-2021~31 -	139,485	72,462	0	67,023	60,000

December-2021[36]					
Total	139,485	72,462	0	67,023	60,000

The net GHG emission reductions generated during this monitoring period have exceeded the threshold required in the small-scale methodology applied, which is the 60,000 tCO_2e per year, therefore, the project proponent only claimed the 60,000 t CO_2e annually as stated in registered PD. According to the Section 3.14.4 of updated VCS Standard (v4.2), for GHG emission reductions occurring on or before 31 December 2020, all ex-ante estimates and ex-post calculations may be converted to CO_2e using either the GWP value of 25 for CH_4 from the IPCC Fourth Assessment Report (AR4) or that of 28 from AR5. Besides, projects that complete validation on or before 31 July 2021 may use GWP value of 25 for CH_4 from AR4 for ex-ante emission reduction estimates, though such projects shall use GWP value of 28 for CH_4 from AR5 for ex-post calculations. Since this project has registered on 14 September 2021, the GWP value of 28 shall be used during this monitoring period while that of 25 was used for ex-ante estimates in registered PD. That is why the ex-post emission reduction calculation in this monitoring report exceeded the threshold of 60,000 tCO_2e per year.

Then, the final results of this monitoring period should be summarized as follows.

Year	Net GHG emission reductions or removals (tCO_2e) claimed during this monitoring period
01-January-2021~31 - December-2021	60,000
Total	60,000

The number of GHG credits issued to the Project during this Monitoring period is 60,000 VCUs.

[36] Section 3.8 of the VCS Standard v4.2 states that “The project crediting period is the time period for which GHG emission reductions or removals generated by the project are eligible for issuance as VCUs.” According to the Methodology of Methane emission reduction by adjusted water management practice in rice cultivation, the time when the project produces emission reductions is the start time of land preparation. And the land preparation means the start of a rice season. The main activity of this project is emission reduction due to adjusted water regime during rice cultivation, which means emission reduction for each year, for this period from 01-January-2021 to 31-December-2021, only occurred in the rice growing season. So, this crediting period in 2021 does start from 1st January, it has already included the whole rice growing season in a year.

APPENDIX 1: EVIDENCE OF SD CONTRIBUTIONS

No.	SD Contributions	Evidences
1)	1.4 The number of community members who have been provided extra job opportunities and gain higher income	1. Technician recruitment appointment contract signed by Hefei Luyu and Lujiang County Agricultural Technology Extension Center 2. These technicians' payrolls
2)	2.4 The percentage of increase in rice yield	1. The yield recorded in the farmers' logbooks 2. The yield from the the ex-ante investigation report in Northern Lujiang in 2017 from Anhui Academy of Social Sciences
3)	4.1 The number of stationary packs donated by this project	The photo of donation activity in Northern Lujiang
4)	5.5 The percentage of women hired in this project	Payroll of these women workers.
5)	8.5 The number of job opportunities provided by this project to local farmers	Technician recruitment appointment contract signed by Hefei Luyu and Lujiang County Agricultural Technology Extension Center
6)	13.0 Tons of greenhouse gas emissions avoided or removed.	Since the amount of methane emissions reduced shall be calculated based on the parameters of $A_{s,g}$(area of project fields of group g in season s), $EF_{BL,s,g}$ and $EF_{P,s,g}$ (baseline and project emission factors of group g in season s), the evidences are as follows. 1. The Report of Measuring Methane Emission Rate of Double-cropping Rice Paddies with Different Water Regime by Closed Chamber in Northern Lujiang in 2021 for $EF_{BL,s,g}$ and $EF_{P,s,g}$ (baseline and project emission factors of group g in season s) 2. Fact Sheets on Rice Cultivation in Northern Lujiang in 2021 for $A_{s,g}$(area of project fields of group g in season s).