



**Verified Carbon
Standard**

DONGYANG WASTEWATER TREATMENT PLANT PROJECT



盈碳
Profit Carbon

*Document Prepared by Profit Carbon Environmental Energy Technology
(Shanghai) Co., Ltd.*

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Dongyang Wastewater Treatment Plant Project is located in Dongyang City, Zhejiang Province, China. The project owner is CSD Water Service Co., Ltd. The whole aerobic process includes pre-treatment process, secondary biological treatment process, tertiary deep treatment process and sludge treatment process, with a maximum design influent flow of 109,000 m³/d, the influent and effluent COD concentration are 750 mg/L and 40 mg/L, separately. The wastewater is composed of industrial wastewater and some domestic wastewater within the service area. The project can reduce environmental pollution and destroy methane emissions from the open anaerobic lagoons in baseline scenario.

In the baseline scenario, rural industrial wastewater and some domestic wastewater within the service area would have been treated through a deep open anaerobic lagoon. The open lagoon is the best available low-cost operation solution for wastewater treatment, which is also in compliance with the environmental regulations. However, open anaerobic lagoon would have been released into methane directly to the atmosphere when treating wastewater. In the project scenario, the wastewater will be treated through aerobic biological treatment technology, which includes pre-treatment process, secondary biological treatment process, tertiary deep treatment process and sludge treatment process. Aerobic wastewater treatment plants produce essentially no methane emissions during the entire process of wastewater treatment, and the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)".

Emission reductions of this project are generated by reducing methane emissions of the open anaerobic lagoon in baseline scenario. The project began construction on 06-September-2019, and the construction of the wastewater plant was completed in 15-October-2020 and put into test run from 15-October-2020 to 24-October-2020. The wastewater plant began commercial operation on 25-October-2020. Annual average estimation of GHG emission reductions from the project activity is 64,548 tCO₂e/year, the total GHG emission reductions are 645,480 t CO₂e during the fixed 10 years crediting period.

This monitoring period for the project is 25-October-2020 to 31-August-2022, which is the first monitoring period. The total emission reductions achieved in this monitoring period is 112,638 tCO₂e.

1.2 Sectoral Scope and Project Type

The project is not AFOLU project and not a grouped project

Sectoral Scope 13: Waste handling and disposal.

Project type: According to the Section 3.9.1 of VCS standard v4.3, the annual emission reduction of this project is Less than 300,000 tonnes of CO₂e per year, which belongs to “project”.

Project Methodology: AM0080 Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants (Version 01).

1.3 Project Eligibility

As per section 2.1.1 of VCS Standard (version 4.3), the scope of the VCS Program include :

- 1) The six Kyoto Protocol greenhouse gases:
- 2) Ozone-depleting substances.
- 3) Project activities supported by a methodology approved under the VCS Program through the methodology approval process.
- 4) Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval.
- 5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements.

The project activity reduces methane emissions by replacing open anaerobic ponds in the baseline scenario with the aerobic wastewater treatment plant. Meanwhile, the project is not belonged to the projects excluded in Table 1 of VCS Standard 4.3. Therefore, the project is eligible under the scope of VCS program.

According to section 3.1 of the VCS-Standard (version 4.3), establishing a consistent and standardized certification process is critical to ensuring the integrity of VCS projects. Accordingly, certain high-level requirements must be met by all projects, as set out below:

Reference to VCS Standard (Version 4.3)	Requirement	Justification
3.1.1	Projects shall meet all applicable rules and requirements set out under the VCS Program, including this document. Projects shall be guided by the principles set out in Section 2.2.	The project meets all applicable rules and requirements as set out under the VCS Program.
3.1.2	Projects shall apply methodologies eligible under the VCS Program.	The project applies CDM approved methodology

	Methodologies shall be applied in full, including the full application of any tools or modules referred to by a methodology, noting the exception set out in Section 3.13.1. The list of methodologies and their validity periods is available on the Verra website.	AM0080 (Version 01) which is an eligible VCS methodology along with tool or modules as applicable. Refer to section 3.1 and 3.2 of the PD below for more details.
3.1.3	Projects and the implementation of project activities shall not lead to the violation of any applicable law, regardless of whether or not the law is enforced.	Projects are in compliance with currently applicable laws. According to the environmental impact assessment report (EIA) of the project, the project complies with all Chinese relevant laws and regulations. Refer to section 1.14 of the PD below for more details.
3.1.4	Where projects apply methodologies that permit the project proponent its own choice of model (see the VCS Program document <i>Program Definitions</i> for definition of model), such model shall meet with the requirements set out in the VCS Program document <i>VCS Methodology Requirements</i> and it shall be demonstrated at validation that the model is appropriate to the project circumstances (i.e., use of the model will lead to an appropriate quantification of GHG emission reductions or removals).	Not applicable. There is no model needs to be chosen by the project proponent as per the applied methodology AM0080 (Version 01).
3.1.5	Where projects apply methodologies that permit the project proponent its own choice of third party default factor or standard to ascertain GHG emission data and any supporting data for establishing baseline scenarios and demonstrating additionality, such default factor or standard shall meet	Not applicable. There are no third party default factor or standard need to be chosen by the project proponent as per the applied methodology AM0080 (Version 01).

	with the requirements set out in the VCS Program document <i>VCS Methodology Requirements</i>	
3.1.6	Projects shall preferentially apply methodologies that use performance methods (see the VCS Program document <i>VCS Methodology Requirements</i> for further information on performance methods) where a methodology is applicable to the project that uses a performance method for determining both additionality and the crediting baseline (i.e., a project shall not apply a methodology that uses a project method where such a performance method is applicable to the project). Methodologies approved under the VCS Program that use performance methods provide a list of similar methodologies that use project methods (that were approved under the VCS Program or an approved GHG program at the time the performance method was developed). Such lists are not necessarily exhaustive but can serve as the starting point for determining whether a performance method is applicable to the project. Following the approval of a methodology that uses a performance method, projects may use any applicable pre-existing methodology that uses a project method for a six-month grace period.	Baseline scenario and additionality have been analysed as per the applied methodology AM0080 (Version 01) and tool 02 (Version 07). Refer to section 3.4 and 3.5 of the PD for more details.
3.1.7	Where the rules and requirements under an approved GHG program conflict with the rules and requirements of the VCS Program, the	Not applicable.

	rules and requirements of the VCS Program shall take precedence.	
3.1.8	Where projects apply methodologies from approved GHG programs, they shall comply with any specified capacity limits (see the VCS Program document <i>Program Definitions</i> for definition of capacity limit) and any other relevant requirements set out with respect to the application of the methodology and/or tools referenced by the methodology under those programs.	Not applicable. There is no specified capacity limits and any other relevant requirements set out as per the applied methodology and tools.
3.1.9	Where Verra issues new requirements relating to projects, registered projects do not need to adhere to the new requirements for the remainder of their project crediting periods (i.e., such projects remain eligible to issue VCU's through to the end of their project crediting period without revalidation against the new requirements). The new requirements shall be adhered to at project crediting period renewal, as set out in Section 3.8.9.	This is the first crediting period of the project, and it has followed all the latest requirements of Verra.

1.4 Project Design

The project activity involves the construction and operation of an aerobic wastewater treatment plant with the wastewater treatment capacity of 109,000 m³ per day. It has been designed to include a single installation of an activity. The proposed project has been designed to include a single installation of an activity as per the proposed project description in Section 1.1 and the detail of installed technology in Section 1.11. The proposed project location is described in Section 1.12.

Eligibility Criteria

The project is not a grouped project. Thus, this section is not applicable.

1.5 Project Proponent

Organization name	CSD Water Service Co., Ltd.
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1.6 Other Entities Involved in the Project

Organization name	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.
Role in the project	VCS Consultant
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Title	Project Manager
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1.7 Ownership

The project owner of the project is CSD Water Service Co., Ltd., who has the legal right to control and operate the project activities. The business license, approval of Environmental Impact Assessment (EIA), Feasibility Study Report (FSR), and project investment license are evidences for the ownership of the project and carbon credits generated.

1.8 Project Start Date

As per section 3.7 of VCS Standard (Version 4.3), the project start date of a non-AFOLU project is the date on which the project began generating GHG emission reductions or removals. The project activity is a non-AFOLU project, the project began construction on 06-September-2019, and the construction of the wastewater plant was completed in 15-October-2020 and put into

test run from 15-October-2020 to 24-October-2020, and it began commercial operation on 25-October-2020. Thus, the project start date is 25-October-2020.

1.9 Project Crediting Period

This project adopts fixed crediting periods of 10 years. The crediting period is 10 years from 25-October-2020 to 24-October-2030 (both days included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated volume of emission reduction from the project activity is 64,548 tCO₂e, which is less than 300,000 tonnes of CO₂e per year. As per section 3.9.1 of the VCS Standard (Version 4.2), the scale of the project activity is under “Project” category.

Project Scale	
Project	✓
Large project	

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
25-October-2020-31-December-2020	12,026 ¹
01-January-2021-31-December-2021	64,548
01-January-2022-31-December-2022	64,548
01-January-2023-31-December-2023	64,548
01-January-2024-31-December-2024	64,548
01-January-2025-31-December-2025	64,548
01-January-2026-31-December-2026	64,548
01-January-2027-31-December-2027	64,548
01-January-2028-31-December-2028	64,548
01-January-2029-31-December-2029	64,548
01-January-2030-24-October-2030	52,525

¹ The estimated annual emission reduction from the project activity is 64,548 tCO₂e, there are 68 days from 25-October-2020 to 31-December-2020, so emission reduction from 25-October-2020 to 31-December-2020 can be calculated as 64,548 tCO₂e × 68d/365d=12,026 tCO₂e.

Total estimated ERs	645,480
Total number of crediting years	10
Average annual ERs	64,548

1.11 Description of the Project Activity

The project activity is to replace the traditional existing open anaerobic lagoon by build a new aerobic wastewater treatment plant in Dongyang City, where the aerobic treatment process can significantly reduce greenhouse gas emissions. The wastewater is composed of industrial wastewater and some domestic wastewater within the service area. The project began construction on 06-September-2019, and the construction of the wastewater plant was completed in 15-October-2020 and put into test run from 15-October-2020 to 24-October-2020, and it began commercial operation on 25-October-2020.

Baseline scenario

Before the implementation of the project, the wastewater from the area in Dongyang City was treated by local one open anaerobic lagoon, and the methane was directly discharged into the atmosphere. There was no methane recovery and destruction facilities, and the sludge generated by the anaerobic lagoon was dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery. After the implementation of the project, the original open anaerobic lagoon has been removed.

Project activities mainly include pre-treatment process, secondary biological treatment process, tertiary deep treatment process and sludge treatment process. The process flow diagram of this project activity is shown in Figure 1-1.

- **Pre-treatment process**

The pre-treatment process includes water distribution wells, coarse grating, lifting pump pond, fine grating, aeration, and sedimentation tank.

- **Secondary biological treatment process**

The secondary biological treatment process includes A²O biological treatment stage and secondary sedimentation tank treatment stage, where the A²O treatment includes pre-anoxic tank, anaerobic tank, anoxic tank, aerobic tank, combined as a reinforced concrete tank; and the secondary sedimentation tank treatment stage is designed as four spoke-flow sedimentation tanks operating in parallel. The COD is basically removed in the aerobic stage.

- **Tertiary deep treatment process**

The deep treatment stage includes two stages. The first stage is used to remove SS (Suspended Solid), including deep bed denitrification filter; the second stage is the disinfection process of wastewater, including ozone contact tank.

- **sludge treatment process**

The sludge treatment process includes a sludge thickening tank and a sludge dewatering plant, where the sludge is dewatered to 60% moisture content under controlled conditions and finally transported to a controlled landfill for landfill.

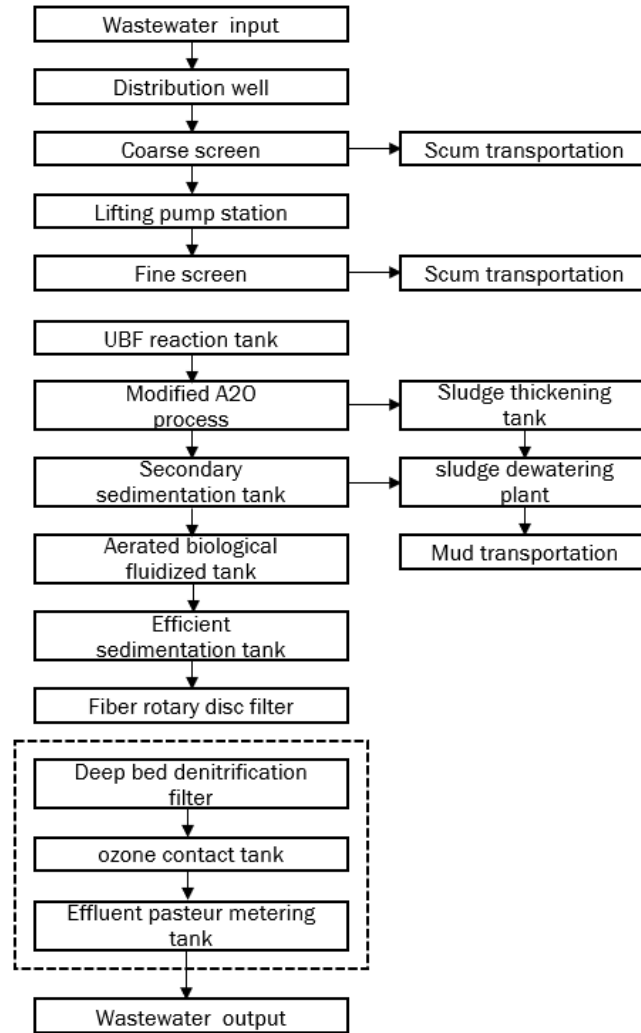


Figure 1-1 Process flow diagram of the project activity

Table 1 Parameters of the main structures and Equipments of the wastewater plant

Main structures		Quantity	Parameters	Design flow
Distribution wells		1	B×L×H=14.0m×6.4m×8.0m	$Q_{\max} = 5,000\text{m}^3/\text{h}$
coarse screen		1	B×L×H=16.8m×8.6m×6.1m	$Q_{\max} = 5,000\text{m}^3/\text{h}$
(1)	Rotary screen decontamination machine	2	B=900mm, N=2.2kw, B0=800mm, b=20mm, h=1,000mm, v=0.8m/s, $\Delta h_{\max}=200\text{mm}$, N=2.2kw	—
(2)	Sluice	4	800mm×1,000mm	—
(3)	Shaftless screw conveyor	1	W=2.5m ³ /h, D=260mm, N=1.1kw	—

(4)	Screw press	1	W=1.0m ³ /h, D=260mm, N=1.1kw	—
Lifting pump station		1	B×L×H=22.6m×8.6m×8.5m	Q _{max} =5,000m ³ /h
(1)	Submersible centrifugal pump	18	Q _{max} =420m ³ /h, H=14m, N=22kw	—
(2)	Flap valve	18	DN400	Q _{max} =420m ³ /h
Fine screen		1	B×L×H=13.6m×8.4m×2.0m	Q _{max} =5,000m ³ /h
(1)	Rotary screen decontamination machine	8	V=0.8m/s, B=1,100mm, B0=1,000mm, b=5mm, h=1,000mm, α=75°, △h _{max} =200mm, N=2.2kw	—
(2)	Shaftless screw conveyor	4	W=2.5m ³ /h, D=260mm, N=1.1kw	—
(3)	Screw presses	4	W=1.0m ³ /h, D=260mm, N=1.1kw	—
(4)	Sluice	16	W×H=4.0m×1.5m	—
UBF reaction tank		1	L×B×H =120m×20m × 8.4m	—
Modified A ² O process Pre-anoxic tank and anaerobic tank		2	L×B×H = 36.0m×16.3m×7.5m HRT=2.0 h	—
(1)	Submersible mixer	8	D=500mm, n=344rpm, N=2.5kw	—
Modified A ² O process Anoxic tank		2	L×B×H = 49.2m×18.3m×7.5m HRT=4h, SRT=4.4d	—
(1)	Submersible mixer	48	D=500mm, n=371rpm, N=2.5kw	—
Modified A ² O process Aerobic tank		2	L×B×H = 152m×27.6m×7.5m HRT=14.22h, SRT=10d	—
(1)	Internal return pump	16	Q=420m ³ /h, H=1.0m, N=4.0kw	—
(2)	Microporous aerator	5200	D=300mm, Q=3m ³ /h-piece	—
Secondary sedimentation tank		4	3×Φ36×5m 1×Φ50×5m	—
(1)	sludge suction machine	8	N=0.55kw	—
(2)	Nitrate return pump	6	Q=625m ³ /h, H=1.0m, N=5.5kw	—

(3)	sludge pump	4	$Q=100\text{m}^3/\text{h}$, $H=8.8\text{m}$, $N=4\text{kw}$	—
	efficient sedimentation tank	1	$L\times B\times H=40\text{m}\times 10\text{m}\times 6.9\text{m}$	—
	Fiber rotary disc filter	1	$L\times B\times H=7.4\text{m}\times 8\text{m}\times 4.7\text{m}$	—
	Deep bed denitrification filter	1	$L\times B\times H=61.8\text{m}\times 41.4\text{m}\times 6.5\text{m}$	—
(1)	Inlet weir plate	12	$L=20\text{m}$, $H=0.3\text{m}$, $\delta=3\text{mm}$	—
(2)	Backwash blower	3	$Q=62\text{m}^3/\text{min}$, $H=7\text{m}$, $N=132\text{kw}$	—
(3)	Backwash water pump	3	$Q=650\text{m}^3/\text{h}$, $H=15\text{m}$, $N=45\text{kw}$	—
(4)	Air compressor	2	$Q=0.67\text{m}^3/\text{min}$, $H=0.8\text{MPa}$, $N=5.5\text{KW}$	—
(5)	gas tank	1	$V=1\text{m}^3/\text{min}$, $H=0.8\text{MPa}$	—
(6)	pit pump	2	$Q=10\text{m}^3/\text{min}$, $H=10\text{m}$, $N=0.55\text{KW}$	—
	Ozone contact tank	1	$L\times B\times H=21.0\text{m}\times 18.0\text{m}\times 4.5\text{m}$	—
(1)	Ozone generator	3	$20\text{kg}/\text{h}$, $195\text{Nm}^3/\text{h}$, $N=180\text{kw}$	—
(2)	Internal circulating water pump	3	$Q=45\text{m}^3/\text{h}$, $H=25\text{m}$, $N=5.5\text{kw}$	—
(3)	Air storage tank	1	$V=0.3\text{m}^3$, $H=0.8\text{MPa}$	—
(4)	External circulating water pump	3	$Q=45\text{m}^3/\text{h}$, $H=15\text{m}$, $N=4\text{kw}$	—
	Sludge dewatering room	1	$L\times B\times H=33.6\text{m}\times 16.0\text{m}\times 4.5\text{m}$	—
(1)	Stacked snail sludge dewatering machine	6	$300\text{-}600\text{kg.DS}/\text{h}$; $N=3.2\text{kW}$;	—
(2)	Axial Fan	18	$Q=6,000\text{m}^3/\text{h}$; $N=0.55\text{kw}$	—
	sludge thickening tank	1	$B\times L\times H=13.9\text{m}\times 24.0\text{m}\times 4.5\text{m}$ $t=12\text{h}$	—
(1)	Cleaning the water pump	6	$Q=25\text{m}^3/\text{h}$, $H=50\text{m}$, $N=11\text{kw}$	—
(2)	PAM integrated dissolving machine	4	$2000\text{L}/\text{h}$, $N=3.2\text{kw}$	—
(3)	PAM dosing pump	6	$Q=1\text{m}^3/\text{h}$, $H=30\text{m}$, $N=0.75\text{kw}$	—
	Effluent Pasteur metering tank	1	$L\times B\times H=21.3\text{m}\times 2.5\text{m}\times 2.9\text{m}$	—

As per equipment purchase contract of the project, the lifetime of the equipment mentioned above is no less than 10 years.

Some of the main monitoring parameters, such as the influent flow and influent COD, effluent flow and effluent COD, volume of sludge transportation, and the electricity consumption of the wastewater plant, are monitored normally, and there is no missing data.

1.12 Project Location

The project is located in Dongyang City, Zhejiang Province, China. The geographic location of the project is shown in Figure 1-2. Project coordinates of the wastewater plant is 29°17'38.8"N, 120°12'30.4"E.

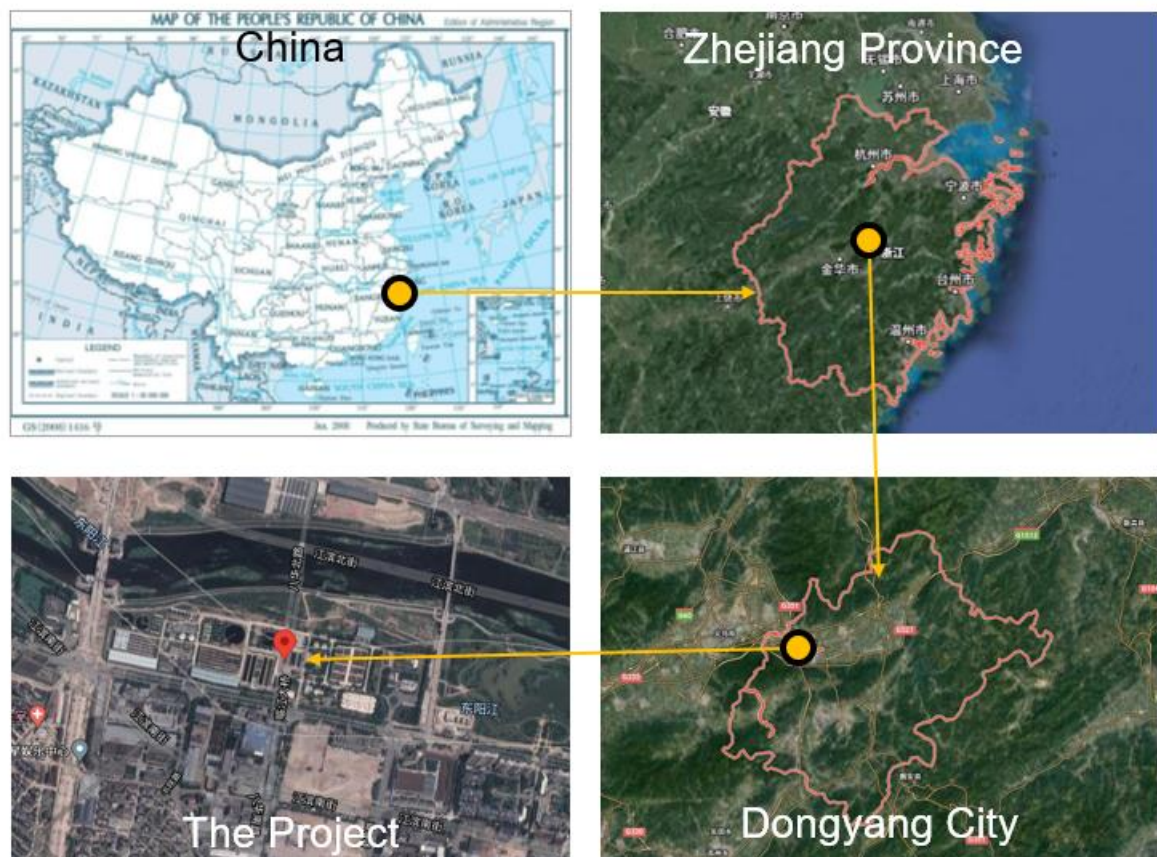


Figure 1-2 Location of the project

1.13 Conditions Prior to Project Initiation

The project is a Greenfield project. Thus, there are no project activity at the project sites before the construction of the proposed project activity. Before the implementation of the project, the rural industrial wastewater and some domestic wastewater in the project site is treated by the existing local open anaerobic lagoon.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

According to the environmental impact assessment report (EIA) of the project, the project complies with all Chinese relevant laws and regulations. Mainly include:

1. Environmental Protection Law of the People's Republic of China;
2. Water Pollution Prevention and Control Law of the People's Republic of China;
3. Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes;
4. Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution;
5. Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise;
6. Law of the People's Republic of China on Environmental Impact Assessment.

The project obtained the project approval and EIA approval from governmental authorities: Dongyang Development and Reform Bureau, Jinhua Environmental Protection Bureau. Dongyang Water Affairs Bureau and the project owner also signed a Dongyang Wastewater Treatment Plant Project Contract . These approvals well demonstrate that local government permits the construction of the project. Consequently, the project is compliance with laws, status, and other regulatory frameworks.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program.

1.15.2 Projects Rejected by Other GHG Programs

The project activity is not participating in other environment credits, other GHG programs and has not been rejected by any other GHG Programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The project owner has signed the Declaration of No Double Counting Statement and Declaration of not involved in other GHG scheme on 18-May-2020. And then there is a cap & trade scheme in China. However, the project activity is not included in the mandatory emission control scheme since the scheme only cover the high-emission industries, such as power generation sector that

emitted at least 26,000² tons of CO₂e/year. So there is no emission cap enforced for the project owner.

The project proponent is not part of any emission trading program. The net GHG emission reductions from the project will not be used for compliance with emission trading programs or to meet binding limits on GHG emissions. The project activity has not participated under any other GHG programs.

1.16.2 Other Forms of Environmental Credit

The project hasn't sought or received another form of environmental credits.

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The project activity implemented by the project owner can contribute to sustainable development as defined by and tracked against the United Nations Sustainable Development Goals (SDGs). The specific analysis is as follows:

SDG6

The project activity treats wastewater by building one aerobic wastewater treatment plant in Dongyang City, and the project can reduce water pollution and increase the proportion of wastewater treatment nationwide. So, it can ensure availability and sustainable management of water and sanitation for more people.

SDG8

The project activity provides temporary and long-term employment to the local community during construction of the project activity as well as during operation. During construction, employment was offered for a lot of local labors contributing to social wellbeing and economic wellbeing. The involvement of local employees in the project activity helps to enhance the skills of the labour in the region by training them in different technical areas. As well, regional economic development can foster through contracts to local firms.

SDG13

The project activity is designed to introduce one aerobic wastewater treatment plant to treat wastewater to avoid methane emissions of the open anaerobic lagoon in baseline scenario. Annual average estimation of GHG emission reductions from the project activity is 64,5480 tCO₂e/year, the total GHG emission reductions are 645,480 t CO₂e during the fixed 10 years crediting period.

² https://www.mee.gov.cn/xxgk/xxgk06/202203/t20220315_971468.html

1.17.2 Sustainable Development Contributions Activity Monitoring

For this monitoring period covering 676 days³, the actual emission reduction is 112,638 tCO₂e generated by the project, the cumulative wastewater treatment of the project reached 65,589,938.40⁴ m³, total 10 jobs for local people were created (including 5 females and 5 males). Please see below Table 1-5 for details⁵.

³ From 25/10/2020 to 31/08/2022

⁴ In the current crediting period, the total wastewater treatment volume in the crediting period in 2020 (03-October-2020-31-August-2020) is 6,414,859.1 m³, the wastewater treatment volume in 2021(01-January-2021-31-December-2021) is 35,001,164.5 m³, and the wastewater treatment volume in 2022 (01-January-2022-31-August-2022) is 24,173,914.8 m³, so the wastewater treatment volume in the current crediting period is 65,589,938.40 m³. Please refer to Flow rate operation statistics of wastewater from Dongyang Wastewater Treatment Plant Project for detailed.

⁵ See Appendix 1 for supplementary evidence

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	6.3	6.3.1 Proportion of domestic and industrial wastewater flows safely treated	Implemented activities to decrease	During this monitoring period, the cumulative wastewater treatment of the project reached 65,589,938.40 m ³ .	From the operation start date of this project activity to the end of this monitoring period, the cumulative wastewater treatment of the project reached 65,589,938.40 m ³ .
2)	8.5	8.5.2 Unemployment rate, by sex, age and persons with disabilities	Implemented activities to decrease	During this monitoring period, 40 people including 20 females and 20 males were employed for operation, and maintenance of this project.	From the operation start date of this project activity to the end of this monitoring period, 40 people were employed including 20 females and 20 males.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	During this monitoring period, the project has achieved GHG emission reductions of 112,638 tCO ₂ e.	From the operation start date of this project activity to the end of this monitoring period, the project has achieved GHG emission reductions of 112,638 tCO ₂ e.

1.18 Additional Information Relevant to the Project

Leakage Management

According to paragraph 35 of approved baseline and monitoring methodology AM0080” Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants” (Version 01), no leakage is considered in this methodology.

Commercially Sensitive Information

There is no information deemed as commercially sensitive for this project activity.

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report for the Project has been approved by Jinhua Environmental Protection Bureau on 30-June-2019. Every aspect of environmental impact has been considered in the EIA report with corresponding measures during project development, the construction of the project is in line with national policies and has a good emission reduction effect, and no net harm has been detected. Meanwhile, the implementation of the project will improve local-socio economic development through creating career opportunities.

2.2 Local Stakeholder Consultation

Local stakeholder consultation was conducted by project owner before the construction of the project and during the monitoring period through the means of meeting and questionnaire.

Local stakeholder consultation before the construction of the project

Invitation procedure

The stakeholder consultation was conducted by CSD Water Service Co., Ltd. with assistance from Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd. Stakeholder groups were identified and they were informed through oral and written means about the meeting. The invitation letter was sent by email to local authorities. This invitation email was done 2 weeks before the meeting date. And Invitation notice were put on the bulletin of local villages and in person to participants nearby the project site.

Place and date of the meeting

The stakeholder consultation was held at a meeting room of CSD Water Service Co., Ltd. on 06-July-2019.

Meeting Participants

The meeting was attended by local residents and representatives from the following stakeholder categories:

1. Local residents/farmers
2. Local government representatives
3. Representative of the project owner

There were 30 participants who accepted the invitation, attended the meeting and returned the questionnaire.

Table 2-1 Information of stakeholder attending the meeting

Items		Amount
Gender	Male	15
	female	15
Age	<25	5
	25-55	25
	>55	5
Education	Junior high school or below	5
	Senior high school	24
	College or above	6
Occupation	Worker	12
	Farmer	20
	Management personnel	1
	Civil servant	2

Meeting procedure

- Registration (30 min)
- Opening (15 min)
- Introduction by CSD Water Service Co., Ltd. (15 min)
- Description of the project and environmental impacts (30 min)
- Purpose of VCS, and relation of the project and VCS (30 min)
- Questions and Answers session (10 min)
- Completing questionnaire (20 min)

In the stakeholder consultation, all attendees were invited to express their comments. All attendees agreed the construction of the project and believed that the implementation of the

project is beneficial. Only some feedback and comments were received, however, these feedbacks mainly focus on the questions of project technology, project mechanism operation and the environmental impact. Prompt response was made by PP during the meeting and the feedback and response were summarized as below table. There were no comments on project design and monitoring methods. The minutes of stakeholder meeting was recorded by PP.

Table 2-2 Feedback and response during the meeting

No.	Stakeholder feedback	Response by PP
1	How does this project generate emission reductions?	If there is no project activity using the aerobic wastewater treatment technology, the rural wastewater will continue to be treated by the existing open anaerobic pond, and the anaerobic will produce a large amount of greenhouse gas methane, while the aerobic treatment technology will only produce very low emissions. Thus generating a reduction in emissions.
2	What are the current emission reduction mechanisms?	GS, VCS or CCER.
3	Can I apply for the job in this project?	Everyone can apply as long as they meet our recruitment requirements.
4	If there is no proposed project activity, how is the wastewater generated in the rural areas treated?	The wastewater will be treated through open anaerobic lagoon.
5	What is the wastewater treatment technology used in the project?	A2O, it is an aerobic wastewater treatment technology

Local stakeholder consultation during the monitoring period

During this monitoring period, mean of a questionnaire survey was adopted for stakeholder consultation. From 15-November-2020 to 20-November-2020, the project proponent put up public announcements at the villages near the project site; also, the project proponent contacted the local authorities (mainly the Department of ecological environment, Development and Reform Commission) by phone. The general information about the introduction of project, the date and the purpose of the questionnaire survey as well as the project proponent's phone number and email address were clearly conveyed via these public announcements and phone calls. A questionnaire survey was conducted by project proponent from 16-December-2020 to 26-December-2020. Total 100 questionnaires were distributed and all questionnaires have been recollected. The basic information about the survey respondents is listed in Table 2-3. Responses and comments from these questionnaires are summarized in Table 2-4.

Table 2-3 Structure of stakeholder survey

Items		Amount
Gender	Male	50

	female	50
Age	<25	15
	25-55	70
	>55	15
Education	Junior high school or below	25
	Senior high school	50
	College or above	25
Occupation	Worker	45
	Farmer	15
	Management personnel	10
	Civil servant	20

Table 2-4 Summary of the survey results in monitoring period

No	Question	Response	Amount	Percentage
1	Do you know the purpose of this project?	Very much	93	93%
		A little	7	7%
		Not at all	0	0%
2	Do you think the project is good for the local environment?	Yes	80	80%
		I don't know	20	6%
		No	0	0%
3	What impact do you think the implementation of this project will have on your life?	Reduce surrounding wastewater pollution	60	60%
		Provide employment	5	5%
		Improve the surrounding environment	35	35%
4	Whether the project has a negative impact on the surroundings during operation?	Yes	0	0%
		No	100	100%
		I don't know	0	0%
5	Do you know the aerobic wastewater treatment technology used in the project?	Yes	30	30%
		No	40	40%
		I don't know	30	30%
6	Are you willing to make positive comments on this project?	Yes	320	100%
		No	0	0%
		I don't know	0	0%
		No idea	15	15%

In summary, all the villagers and local government that attending the meeting and filling out questionnaires are all supportive of the project and to date there has been no need to modify the due to the comments received.

Continuous Input / Grievance Expression Process Book

A grievance book is put in the communication room at the main door of the wastewater treatment plant. The local stakeholders can provide feedbacks there as well. The village head will reach project owner if any comments are received.

2.3 Environmental Impact

The Environmental Impact Assessment (EIA) Report for the project has been approved by local governmental authorities. The environmental impacts and mitigation measures during the construction period and the operation period are summarized as follows.

Construction period

Air Quality

The treatment facilities emitting odor in the wastewater treatment plant are closed units, and the odor is collected and then enters the deodorization system through the fan. According to the environmental impact assessment report, after treatment, the odor emission can reach the emission standard of odorous pollutants and will not affect the air quality.

Water Quality

The wastewater treatment plant treats a mixture of residential sewage and industrial wastewater, and the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants". Therefore, the project's effluent discharge meets national discharge standards and does not cause water pollution problems.

Noise

According to the environmental impact assessment report, the sound generated by the project after it is put into operation can meet the third category of the national sound environment quality standard, and will not produce noise pollution to the surrounding environment.

Solid Waste

Solid waste is disposed of in accordance with methods that comply with national environmental regulations, so there is no environmental risk.

Operation period

Air Quality

The treatment facilities emitting odor in the wastewater treatment plant are closed units, and the odor is collected and then enters the deodorization system through the fan. According to the

environmental impact assessment report, after treatment, the odor emission can reach the emission standard of odorous pollutants and will not affect the air quality.

Water Quality

The wastewater treatment plant treats a mixture of residential sewage and industrial wastewater, and the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)". Therefore, the project's effluent discharge meets national discharge standards and does not cause water pollution problems.

Noise

According to the environmental impact assessment report, the sound generated by the project after it is put into operation can meet the third category of the national sound environment quality standard, and will not produce noise pollution to the surrounding environment.

Solid Waste

Solid waste is disposed of in accordance with methods that comply with national environmental regulations, the sludge generated by the daily operation of the wastewater treatment plant will be dehydrated under aerobic conditions and then transported to the landfill for landfill treatment, so there is no environmental risk.

Jinhua Ecological Environment Bureau believed that the construction of the project is in line with national industrial policy, and has a emission reduction effect as well as during operation. From the perspective of environmental protection, the project will not cause any environmental impact, and therefore agreed to the construction of Dongyang Wastewater Treatment Plant. The above description can be proved by the EIA approval issued by Jinhua Environmental Protection Bureau.

2.4 Public Comments

Besides, as per section 3.16.5 of the VCS Standard (Version 4.3), all projects are subject to a 30-day public comment period. The date on which the project is listed on the project pipeline marks the beginning of the project's 30-day public comment period. This project was open for public comment from 22-April -2022 to 22-May-2022⁶. No comments were received for the Project.

2.5 AFOLU-Specific Safeguards

Not applicable.

⁶ <https://registry.terra.org/app/projectDetail/VCS/3020>

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The following methodologies are applicable to the project activity:

AM0080 Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants (Version 01.0)⁷

The latest version of the following tools will also be used in this Project activity:

Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)⁸

Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)⁹

Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0)¹⁰

Tool 24 Common practice (Version 03.1)¹¹

3.2 Applicability of Methodology

Justification for the choice of the selected methodology is shown in the following table:

AM0080 Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants (Version 01)	
Eligibility Criteria	Justification for the Project Activity
This methodology is applicable to project activities that implement a new aerobic wastewater treatment plant for the treatment of domestic and/or industrial wastewater. The sludge produced in the aerobic wastewater treatment plant in the project activity is either: (1) Treated in the same way as the sludge that would have been produced in the anaerobic open lagoons system in the baseline scenario would have been treated. This includes one of the	The project activity is a new aerobic wastewater treatment plant in Dongyang city to treat industrial wastewater and some domestic wastewater. The sludge generated from the aerobic wastewater treatment plant in the project activity is dried under controlled and aerobic conditions and subsequently sent to a landfill for disposal. According to Sludge Disposal Letter issued by Jinhua Housing and Urban-Rural Development Bureau, and the

⁷https://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_5FZ9GOW3ZKWF7Y8X3F07T11YNQIDQR/EB47_repan02_AM0080_NM0250.pdf?t=RTJ8cXpjemxsfDC0044xil_J65OfshjSTUAF

⁸ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf>

⁹ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf>

¹⁰ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

¹¹ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf>

following two options: (i) the sludge is dumped or left to decay; or (ii) the sludge is dried under controlled and aerobic conditions, and then disposed to a landfill with methane recovery or used in soil application (2) Treated in a new anaerobic digester, with the biogas extracted from the anaerobic digester being flared and/or used to generate electricity and/or heat. The residues from the anaerobic digester are dehydrated, limed and stored before final disposal in a controlled landfill.	sludge will be transported to the landfill, which has a methane recovery device. In addition, according to the baseline survey report, the sludge produced by the local anaerobic lagoon is also treated under controlled and aerobic conditions, and then transported to the landfill with methane recovery for landfill. So the sludge produced by the aerobic wastewater treatment plant in the project activity is treated in the same way as the sludge produced by the anaerobic open lagoon system. The treatment method is drying under controlled and aerobic conditions, and then transported to the landfill with methane recovery for landfill. The treatment scenario belongs to (1) (ii). Therefore, this condition is applicable.
The project activity either replaces an existing anaerobic open lagoons system, with or without conversion of the sludge treatment system, or is an alternative to a new to be built anaerobic open lagoons system;	The project activity is an alternative to a new to existing anaerobic open lagoon system. Therefore, this condition is applicable.
Loading in the wastewater streams has to be high enough to ensure that the existing or new to be built anaerobic open lagoons system develops an anaerobic bottom layer and that algal oxygen production can be ruled out;	As per the baseline survey report, the localexisting anaerobic open lagoon system in the baseline scenario are open anaerobic lagoon with a depth greater than 5 m. According to the stabilization lagoon design specification, the entire open pond is completely in an anaerobic environment at this depth level, anaerobic open lagoon system can develop an anaerobic bottom layer and that algal oxygen production can be ruled out¹². Therefore, this condition is applicable.
The average depth of the existing or new to be built anaerobic open lagoons system is at least 1 meter. In case of an existing anaerobic open lagoons system in the baseline scenario, the depth of the lagoons should be verified based on historical data available for one year before the implementation of the project activity. In case of a new to be built anaerobic open lagoons system, the depth of the lagoons should be determined following the guidance provided in Step 1 of the section “Procedure for the identification of the	As established in section 1.1, the project activity is an alternative to existing anaerobic open lagoon system. As per the baseline survey report issued by Jinhua Environmental Protection Bureau, from 01-January-2018 to 31-December-2018, the depth of the local open anaerobic lagoon is more than 5m, so the lagoon depth can be verified based on the historical data reported in this baseline survey report.

¹²<http://shigongdaquan.max.book118.com/%E5%BB%BA%E7%AD%91%E8%A7%84%E8%8C%83/%E5%BB%BA%E7%AD%91%E8%A7%84%E8%8C%83CJJ/CJJ54T-1993%E6%B1%A1%E6%B0%B4%E7%A8%B3%E5%AE%9A%E5%A1%98%E8%AE%BE%E8%AE%A1%E8%A7%84%E8%8C%83.pdf>

most plausible baseline scenario and assessment of additionality”;	Therefore, this condition is applicable.
The residence time of the organic matter in the anaerobic open lagoons system is at least 30 days. In case of an existing anaerobic open lagoons system in the baseline scenario, the residence time of the organic matter in the lagoon should be verified based on historical data available for one year before the implementation of the project activity. In case of a new to be built anaerobic open lagoons system, the residence time of organic matter in the lagoons should be determined following the guidance provided in Step 1 of the section “Procedure for the identification of the most plausible baseline scenario and assessment of additionality”.	As established in section 1.1, the project activity is an alternative to existing anaerobic open lagoon system. As per to tool 02 <i>Combined tool to identify the baseline scenario and demonstrate additionality</i> and the document “Guideline on Project Construction and Investment for Rural Sewage Treatment”, describing the baseline, residence time of organic matter is at least 30 days. As per the baseline survey report issued by Jinhua Environmental Protection Bureau, from 01-January-2018 to 31-December-2018, residence time of organic matter in the existing open anaerobic lagoon at the project site is generally one year, so the residence time of organic matter can be verified based on the historical data reported in this baseline survey report. Therefore, this condition is applicable.
The wastewater would have been treated in an existing (W3) or new to be built (W6) anaerobic open lagoons system under clearly anaerobic conditions and without methane recovery and flaring;	As established in section 1.1 of the JPM, the wastewater would have been treated in one existing (W3) anaerobic open lagoon system under clearly anaerobic conditions and without methane recovery and flaring. Therefore, this condition is applicable.
The sludge that would have been produced in the baseline lagoons system would have been dumped or left to decay (S1), or dried under controlled and aerobic conditions and then disposed to a landfill with methane recovery or used in soil application (S2);	As per the baseline survey report and Feasibility Study Report, the sludge generated in this baseline scenario is treated in the same way as in the project scenario, where it is dried under controlled conditions and then sent to a landfill with methane recovery for disposal (S2). Therefore, this condition is applicable.
The electricity produced with biogas in the project scenario, if any, would have been produced using fossil fuels in a captive power plant (E1), or obtained from the grid (E2);	As per Feasibility Study Report, biogas power generation does not exist in the project scenario. Therefore, this condition is not applicable.
The heat produced with biogas in the project scenario, if any, would have been produced using fossil fuels in a captive cogeneration power plant (H1), or using fossil fuels in a boiler (H2).	As per Feasibility Study Report, there is no biogas for heat production in the project scenario. Therefore, this condition is not applicable.
Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)	
The tool is applicable to all types of proposed project activities. However, in some cases, methodologies referring to this tool may require adjustments or	Alternative scenarios, barrier analysis, investment analysis and common practice analysis will be carried out based on Tool 02.

additional explanations as per the guidance in the respective methodologies. This could include, inter alia, a listing of relevant alternative scenarios that should be considered in Step 1, any relevant types of barriers other than those presented in this tool and guidance on how common practice should be established.	Refer to section 3.4 and 3.5 of the PD for more details.
Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)	
If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: (a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer; (b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or (c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.	The project activity will use electricity from grid (the Project is connected to the East China Power Grid (ECPG), which falls under scenario A of Tool 05 (Version 03.0). Therefore, emissions related to electricity consumption need to be calculated. Electricity bill were provided as evidence.
This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	This methodological tool is applied for calculating for emission by electricity consumption in project activity. Therefore, this criterion is not applicable.

This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO₂ emissions.	The project activity introduced an aerobic wastewater treatment plant in Dongyang city to replace the existing open anaerobic lagoon. No captive renewable power generation technologies will be installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. Tool 05 is used for calculating project emissions of CO₂. This criterion is not applicable.
Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0)	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	Baseline scenario is an open anaerobic lagoon. No electricity will be used, this criterion is not applicable.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in “Appendix 1: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	The electricity used by the project activity comes only from the East China Power Grid (ECPG). Electricity bill were provided as evidence. Emission factor for the project electricity system will be calculated for grid power plants only as per Tool 07.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project electricity system is located totally in Zhejiang Province of China, which is not an Annex I country.
Under this tool, the value applied to the CO₂ emission factor of biofuels is zero.	The electricity used by the project activity comes only from the East China Power Grid (ECPG). As per requirements of this criterion, the value applied to the CO₂ emission factor of biofuels were zero. The latest available emission factor of ECPG issued by China DNA on 29- December-2020 was used to calculate emissions factor.
Tool 24 Common practice (Version 03.1)	

This methodological tool is applicable to project activities that apply the methodological tool “Tool for the demonstration and assessment of additionality”, the methodological tool “Combined tool to identify the baseline scenario and demonstrate additionality”, or baseline and monitoring methodologies that use the common practice test for the demonstration of additionality.	The project applies the methodological tool “Combined tool to identify the baseline scenario and demonstrate additionality” that use the common practice test for the demonstration of additionality.
In case the applied approved baseline and monitoring methodology defines approaches for the conduction of the common practice test that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	It is consistent of Tool 24 (Version 03.1) and AM0080 (Version 01.0) on approaches for the conduction of the common practice test.

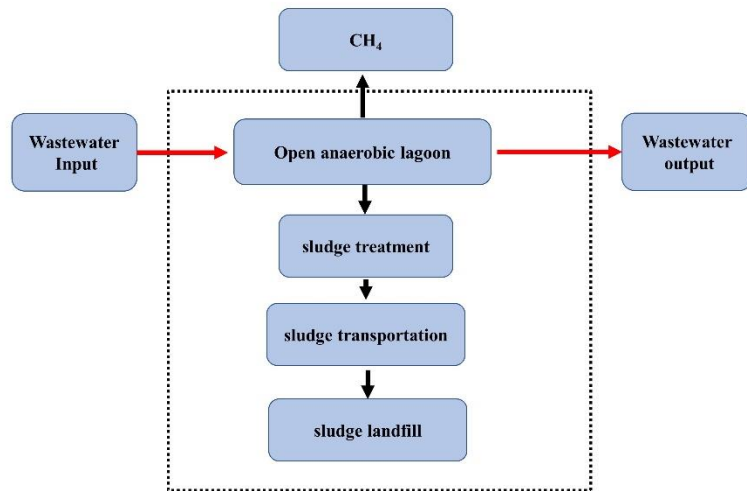
3.3 Project Boundary

According to the methodology AM0080, the spatial extent of the project boundary includes:

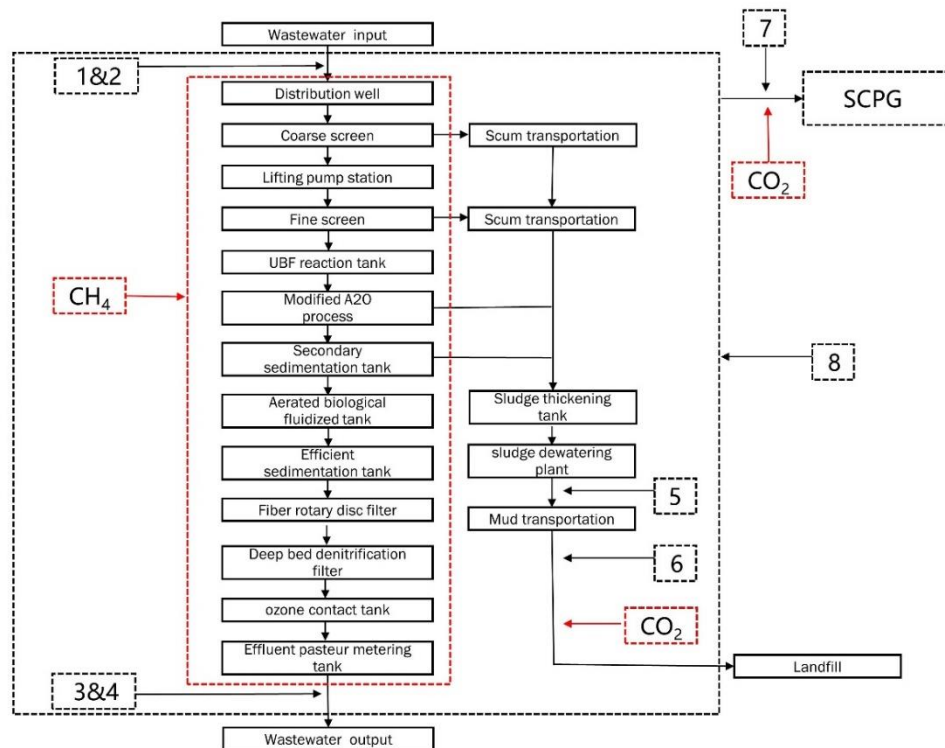
- 1) The site and facilities where the wastewater and sludge are treated in both the baseline and the project scenario;
- 2) Any on-site power plants that supply electricity to the wastewater and sludge treatment systems;
- 3) Any on-site facilities that generate heat used by the wastewater and sludge treatment systems;
- 4) If applicable, the anaerobic digester, the power and/or heat generation equipment and/or the flare installed under the project activity;
- 5) If grid electricity is displaced from electricity generation with biogas from an aerobic digester: the power plants connected to the grid, with the geographical boundary as specified in the latest approved version of the “Tool to calculate the emission factor for an electricity system”.

So the project boundary includes the existing baseline open lagoon, the physical and geographic boundary of the one wastewater treatment plant, which mainly includes the site and facilities for wastewater and sludge, sludge transportation, landfill for sludge landfill, the power plant connected to the grid (ECPG).

The baseline situation is shown in Figure 3-1 below.



The project activity boundary is defined as Figure 3-2 below.



1: Electromagnetic flowmeter converter. Monitoring parameters: $Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$;

2: COD_{cr} water quality online automatic monitor. Monitoring parameters: $W_{PJ,COD,ww,m}$ and $W_{PJ,COD,ww,i}$;

- 3: Electromagnetic flowmeter converter. Monitoring parameters: $Q_{PJ,effl,i}$ and $Q_{PJ,effl,m}$;
4. COD_{cr} water quality online automatic monitor. Monitoring parameters: $W_{PJ,COD,effl,i}$ and $W_{PJ,COD,effl,m}$;
5. Weighbridge. Monitoring parameters: $Q_{PJ,sl,y}$;
6. Online On-Board Diagnostics installed in sludge transport vehicle. Monitoring parameters: $D_{PJ,i,y}$ and $F_{PJ,i}$;
7. Electricity meters. Monitoring parameters: $EC_{PJ,j,y}$;
8. China Meteorological Administration regularly calibrates and maintains the temperature monitoring equipment according to the national specifications. Monitoring parameters: $T_{2,m}$;

Figure 3-2 Diagram of the project boundary

The emission sources included in the project boundary are described in Table 3-3 below:

Table 3-3 Emission sources included in or excluded from the project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Wastewater and sludge treatment	CO ₂	Excluded	CO ₂ emissions from the decomposition of organic waste are not accounted for.
		CH ₄	Included	Major source of emissions in the baseline.
		N ₂ O	Excluded	Excluded for simplification. This is conservative.
	Electricity and thermal energy generation	CO ₂	Excluded	For the project, the emissions from power generation / thermal energy in the baseline scenario do not exist, so it can be excluded.
		CH ₄	Excluded	Excluded for simplification. This is conservative.
		N ₂ O	Excluded	Excluded for simplification. This is conservative.
	Transportation of sludge	CO ₂	Included	Emissions from transportation of sludge is included
		CH ₄	Excluded	Excluded for simplification. This is conservative.
		N ₂ O	Excluded	Excluded for simplification. This is conservative.
Project	Wastewater and sludge treatment	CH ₄	Included	Major source of emissions in the project.
		CO ₂	Excluded	CO ₂ emissions from the decomposition of organic waste are not accounted for.
		N ₂ O	Excluded	In case of projects that involve land application of sludge this is an important emission source. However, the sludge was sent to the landfill for sanitary landfill, and there is no land use. Therefore, N ₂ O emission is 0.
	On-site use of electricity and	CO ₂	Included	May be an important emission source.
		CH ₄	Excluded	Excluded for simplification. This emission source is

Source	Gas	Included?	Justification/Explanation
	fossil fuels		assumed to be very small.
	N ₂ O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	CO ₂	Included	Emissions from transportation of sludge may be included.
	CH ₄	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	N ₂ O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

3.4 Baseline Scenario

As per section of AM0080 Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants (Version 01.0), the most plausible baseline scenario shall be determined through the use of Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0) by the application of the following steps:

The most plausible baseline scenario is identified in the following steps:

Step 0. Demonstration that a proposed project activity is the First-of-its-kind;

Step 1. Identification of alternative scenarios;

Step 2. Barrier analysis;

Step 3. Investment analysis (if applicable);

Step 4. Common practice analysis.

Step 0: As per Tool 02“Combined tool to identify the baseline scenario and demonstrate additionality” (Version 07.0), this step is optional. So this step can be skipped.

Step 1: Identification of alternative scenarios

Step 1a: Define alternative scenarios to the proposed project activity

The identification of alternative baseline scenario should include all realistic and credible alternatives to the project activity that are consistent with current laws and regulations of the host country and that provide output or service (i.e. wastewater treatment capacity) with comparable quality as the proposed project activity. To identifying relevant alternative scenarios, provide an overview of other technologies or practices used for wastewater treatment that have been implemented prior to the start of the project activity or are currently underway in the

relevant geographical area. The realistic and credible alternative(s) for the implementation of a new wastewater treatment may include

Identification of alternative scenarios – Wastewater			
Option	Description	Credibility	Conclusion
W1	Direct release of wastewaters to a nearby water body;	This option cannot be considered an alternative in the absence of the project activity as the direct release of wastewater to nearby water body is prohibited according to national legislation. This violates the Environmental Protection Law of the People's Republic of China ¹³ . Therefore, W1 cannot be considered as an alternative.	No
W2	Aerobic wastewater treatment facilities (e.g., activated sludge or filter bed type treatment);	Aerobic treatment processes such as activated sludge and biofilm comply with national government legislation on water quality and water discharge ¹⁴ . Therefore, W2 can therefore be considered as an alternative.	Yes
W3	Existing anaerobic open lagoons system without methane recovery and flaring;	According to the local baseline survey report, the anaerobic lagoon is open without methane recovery and flaring system. Therefore, W3 can therefore be considered as an alternative.	Yes
W4	Existing anaerobic open lagoons system with methane recovery and flaring;	According to the local baseline survey report, the anaerobic lagoon is open without methane recovery and flaring system. Therefore, W4 can therefore not be considered as an alternative.	No
W5	Existing anaerobic open lagoons system with methane recovery and utilization for energy generation;	According to the local baseline survey report, the local anaerobic lagoon in the project site is open without methane recovery and flaring system. Therefore, W5 can therefore not be considered as an alternative.	No
W6	New to be built anaerobic open lagoons system without methane recovery and flaring;	The construction and operation of the open anaerobic lagoons comply with laws and regulation. However, before the construction of the project, the residents' domestic	No

¹³ http://www.gov.cn/zhengce/2014-04/25/content_2666434.htm

¹⁴ <https://baijiahao.baidu.com/s?id=1727515723531310380&wfr=spider&for=pc>

		wastewater and some industrial wastewater within the service area is treated by the existing open anaerobic lagoon without methane recovery and flaring, so it is not necessary to build anaerobic open lagoon system. Therefore, W6 cannot be considered as an alternative.	
W7	New to be built anaerobic open lagoons system with methane recovery and flaring;	The construction and operation of the open anaerobic lagoons comply with laws and regulation ¹⁵ . However, before the construction of the project, the residents' domestic wastewater and some industrial wastewater within the service area is treated by the existing open anaerobic lagoon without methane recovery and flaring, so it is not necessary to build anaerobic open lagoon system. Therefore, W7 can therefore not be considered as an alternative.	No
W8	New to be built anaerobic open lagoons system with methane recovery and utilization for energy generation;	The construction and operation of the open anaerobic lagoons comply with laws and regulation ¹⁶ . However, before the construction of the project, the residents' domestic wastewater and some industrial wastewater within the service area is treated by the existing open anaerobic lagoon without methane recovery and flaring, so it is not necessary to build anaerobic open lagoon system. Therefore, W8 can therefore not be considered as an alternative.	No
W9	Anaerobic digester without methane recovery and flaring;	Compared with the open anaerobic lagoons and aerobic treatment process, the anaerobic digester has the following characteristics: The aerobic treatment is generally suitable for the treatment of low concentration organic wastewater, while the anaerobic digester is usually suitable for the treatment of medium	No

¹⁵ http://www.moa.gov.cn/nybgf/2019/201907/202001/t20200103_6334298.htm
¹⁶ http://www.moa.gov.cn/nybgf/2019/201907/202001/t20200103_6334298.htm

		to high concentration and difficult to degrade organic wastewater (medium to high concentration wastewater usually refers to wastewater with a COD concentration greater than 1000mg/L). The maximum designed influent COD concentration for this project's wastewater is 750mg/L, so anaerobic digester is not applicable; In addition, the COD concentration of the designed effluent of this project can reach below 40mg/L, the degradation efficiency of Anaerobic digestion to COD is generally about 80%, so the anaerobic digester cannot meets the effluent requirements $(750\text{mg/L} \times (1-80\%))=150\text{mg/L} > 40\text{mg/L}$. Therefore, W9 cannot be considered as an alternative.	
W10	Anaerobic digester with methane recovery and flaring;	Compared with the open anaerobic lagoons and aerobic treatment process, the anaerobic digester has the following characteristics: The aerobic treatment is generally suitable for the treatment of low concentration organic wastewater, while the anaerobic digester is usually suitable for the treatment of medium to high concentration and difficult to degrade organic wastewater (medium to high concentration wastewater usually refers to wastewater with a COD concentration greater than 1000mg/L). The maximum designed influent COD concentration for this project's wastewater is 750mg/L, so anaerobic digester is not applicable; In addition, the COD concentration of the designed effluent of this project can reach below 40mg/L, the degradation efficiency of Anaerobic digester to COD is generally about 80%, so the anaerobic digester cannot meets the effluent	No

		requirements (750mg/L *(1-80%))=150mg/L >40mg/L). Therefore, W10 cannot be considered as an alternative.	
W11	Anaerobic digester with methane recovery and utilization for electricity or heat generation.	Compared with the open anaerobic lagoons and aerobic treatment process, the anaerobic digester has the following characteristics: The aerobic treatment is generally suitable for the treatment of low concentration organic wastewater, while the anaerobic digester is usually suitable for the treatment of medium to high concentration and difficult to degrade organic wastewater (medium to high concentration wastewater usually refers to wastewater with a COD concentration greater than 1000mg/L). The maximum designed influent COD concentration for this project's wastewater is 750mg/L, so anaerobic digester is not applicable; In addition, the COD concentration of the designed effluent of this project can reach below 40mg/L, the degradation efficiency of Anaerobic digester to COD is generally about 80%, so the anaerobic digester cannot meets the effluent requirements (750mg/L *(1-80%))=150mg/L >40mg/L). Therefore, W11 cannot be considered as an alternative.	No

Identification of alternative scenarios – Sludge			
Option	Description	Credibility	Conclusion
S1	The sludge would have been dumped or left to decay	According to national legislation, sludge is a waste product and must therefore be treated in a manner that prevents the waste to have a nocuous impact on the environment and the	No

		quality of life ¹⁷ . Therefore, S1 cannot be considered as an alternative.	
S2	The sludge would have been dried under controlled and aerobic conditions, with disposal in a landfill with methane recovery or with use in soil application	According to the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste, the activities of solid waste eventually placed in landfills that meet the requirements of environmental protection regulations are in accordance with the requirements of laws and regulations¹⁷. As per to <i>Feasibility Study Report</i>, in the project activities, sludge would be treated by means of controlled drying under aerobic conditions and then disposed to a landfill with methane recovery. And as per the Sludge Disposal Letter issued by Jinhua Housing and Urban Rural Development Bureau, the sludge would will be transported to the local landfill, which has a methane recovery device. Therefore, S2 can therefore be considered as an alternative.	Yes
S3	Disposal of sludge in sludge pits under clearly anaerobic conditions	According to national legislation, sludge is a waste product and must therefore be treated in a manner that prevents the waste to have a nocuous impact on the environment and the quality of life ¹⁷ . In addition, the anaerobic treatment of sludge in the sludge pits is actually an incomplete treatment method. Therefore, S3 cannot be considered as an alternative.	No
S4	Land application of the sludge	According to national legislation, sludge is a waste product and must therefore be treated in a manner that prevents the waste to have a nocuous impact on the environment and the quality of life ¹⁷ . Considering the COD concentration of the wastewater influent and some of its industrial characteristics, the land	No

¹⁷ https://www.mee.gov.cn/ywgz/fgbz/fl/202004/t20200430_777580.shtml

		use of sludge cannot be considered. Therefore, S4 cannot be considered as an alternative.	
S5	Composting	At present, the sludge composting technology has some disadvantages, such as large land area, long treatment period, easy enrichment of heavy metals, emission of greenhouse gases and odor, which restrict the promotion of the technology. Therefore, S5 cannot be considered as an alternative	No
S6	Mineralization	The option complies with the national legislation, and might be considered for W2 and W6 in absence of the project activity. However, the sludge mineralization technology developed both domestically and internationally is not mature and expensive enough to be used industrially. Therefore, S6 cannot be considered as an alternative.	No
S7	Disposal of sludge in a landfill without landfill gas capture	This option does not comply with national legislation. The Technical Specifications for Sludge Treatment of Municipal Wastewater Treatment Plant stipulates that when sludge from municipal wastewater treatment plants enters a domestic waste landfill, its sludge moisture content should be less than 60% ¹⁸ . However, S7 scenario does not specify reducing the moisture content of the sludge to below 60% before sending it to the landfill. Therefore, the sludge needs to be dewatered before entering the landfill for landfill treatment. Therefore, S7 cannot be considered as an alternative.	No
S8	Disposal of sludge in a landfill with landfill gas capture and flare	This option does not comply with national legislation. The technical specification for sanitary landfill treatment of domestic waste in China stipulates that when sludge from	No

¹⁸ <http://www.mee.gov.cn/gkml/hbb/bgth/201004/W020100401574292358556.pdf>

		municipal wastewater treatment plants enters a domestic waste landfill, its sludge moisture content should be less than 60% above¹⁸. However, S8 scenario does not specify reducing the moisture content of the sludge to below 60% before sending it to the landfill. Therefore, the sludge needs to be dewatered before entering the landfill for landfill treatment. Therefore, S8 cannot be considered as an alternative.	
S9	Disposal of sludge in a landfill with landfill gas capture and utilization for energy generation	This option does not comply with national legislation. The technical specification for sanitary landfill treatment of domestic waste in China stipulates that when sludge from municipal wastewater treatment plants enters a domestic waste landfill, its sludge moisture content should be less than 60%¹⁸. However, S9 scenario does not specify reducing the moisture content of the sludge to below 60% before sending it to the landfill. Therefore, the sludge needs to be dewatered before entering the landfill for landfill treatment. Therefore, S9 cannot be considered as an alternative.	No
S10	Anaerobic digestion with methane recovery and utilization for energy generation	Sludge from wastewater treatment plants has the characteristics of high sand content and low organic matter in China, in which the organic matter content of sludge is only 30%-60%, much lower than 60%-75% in foreign countries. Therefore, the lower organic matter content often results in adverse effects on the operation of the anaerobic digestion process, such as reduced biogas production and decreased project benefits. These impacts are often challenging to support the stable operation of the project; In addition, the high sand content will also cause a certain degree of damage to the anaerobic digestion equipment¹⁹.	No

¹⁹ <http://qikan.cqvip.com/Qikan/Article/Detail?id=7105351862>

		Currently, landfilling remains the primary disposal method for sludge from urban wastewater treatment plants in China. Therefore, S10 can not be considered as an alternative.	
S11	Anaerobic digestion with methane recovery and flaring;	Sludge from wastewater treatment plants has the characteristics of high sand content and low organic matter in China, in which the organic matter content of sludge is only 30%-60%, much lower than 60%-75% in foreign countries. Therefore, the lower organic matter content often results in adverse effects on the operation of the anaerobic digestion process, such as reduced biogas production and decreased project benefits. These impacts are often challenging to support the stable operation of the project; In addition, the high sand content will also cause a certain degree of damage to the anaerobic digestion equipment¹⁹. Currently, landfilling remains the primary disposal method for sludge from urban wastewater treatment plants in China. Therefore, S11 can not be considered as an alternative.	No
S12	Anaerobic digestion with methane recovery and utilization for energy generation and following disposal in a landfill without further methane recovery.	Sludge from wastewater treatment plants has the characteristics of high sand content and low organic matter in China, in which the organic matter content of sludge is only 30%-60%, much lower than 60%-75% in foreign countries. Therefore, the lower organic matter content often results in adverse effects on the operation of the anaerobic digestion process, such as reduced biogas production and decreased project benefits. These impacts are often challenging to support the stable operation of the project; in addition, the high sand content will also cause a certain degree of damage to the anaerobic digestion equipment¹⁹.	No

		Currently, landfilling remains the primary disposal method for sludge from urban wastewater treatment plants in China. Therefore, S12 can not be considered as an alternative.	
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Identification of alternative scenarios – Electricity			
Option	Description	Credibility	Conclusion
E1	Power generation using fossil fuels in a captive power plant;	Open anaerobic lagoon in the baseline scenario do not consume electricity. Therefore, E1 cannot be considered as an alternative.	No
E2	Electricity generation in the grid;	Open anaerobic lagoon in the baseline scenario do not consume electricity. Therefore, E2 cannot be considered as an alternative.	No
E3	Electricity generation using renewable sources of energy.	Open anaerobic lagoon in the baseline scenario do not consume electricity. Therefore, E3 cannot be considered as an alternative.	No

Identification of alternative scenarios – Heat			
Option	Description	Credibility	Conclusion
H1	Heat generation using fossil fuels in a captive cogeneration plant;	Neither aerobic wastewater treatment plants nor open anaerobic ponds use fossil fuels to generate heat in a captive cogeneration plant. Therefore, H1 cannot be considered as an alternative.	No
H2	Heat generation using fossil fuels in a boiler;	Neither aerobic wastewater treatment plants nor open anaerobic ponds use fossil fuels to generate heat in a captive cogeneration plant. . Therefore, H2 cannot be considered as an alternative.	No

H3	Heat generation using renewable sources of energy.	Neither aerobic wastewater treatment plants nor open anaerobic ponds use fossil fuels to generate heat in a captive cogeneration plant. . Therefore, H3 cannot be considered as an alternative.	No
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In summary, the remaining realistic and credible alternative scenarios for wastewater treatment processes are:

Alternative	Wastewater/Sludge /Electricity/Heat	Description
1	W2-S2	Aerobic wastewater treatment facilities (e.g. activated sludge or filter bed type treatment) with sludge being dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery. This scenario is same to the project but is not a VCS project activity
2	W3-S2	Existing anaerobic open lagoon system without methane recovery and flaring with sludge being dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery. This scenario continue adopts best available and commonly used low-cost operation solution for wastewater treatment.

3.5 Additionality

Additionality for the project activity is demonstrated using Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0).

Step 1b: Consistency with mandatory laws and regulations

The above options are all considered to follow all mandatory applicable legal and regulatory requirements:

As per “Technical specifications for Anaerobic-Anoxic-Oxic activated sludge process” issued by Ministry of Ecology and Environment of the People’s Republic of China, So aerobic sewage treatment technology is a typical sewage treatment method at present, which conforms to Chinese laws and regulations and can effectively prevent and control sewage pollution.

According to “Guideline on Best Available Technologies of Pollution Prevention and Control for Township-villages” issued by Ministry of environmental protection of the people's Republic of China, the open anaerobic lagoon is a kind of wastewater treatment method recognized by the

state, which need minimum financial cost and is compliance with laws and regulations. Therefore, it is the most economic, viable and reasonable for project owners²⁰. As per “Guiding opinions on promoting rural domestic sewage treatment”²¹ issued by Ministry of agriculture and rural affairs of the people's Republic of China, the state actively promotes low-cost, low energy consumption, easy maintenance and high-efficiency sewage treatment technologies, oxidation lagoons (including anaerobic lagoons) and other ecological treatment modes.

And then as per overview of sludge treatment industry in China²², at present, the treatment of sludge is still mainly landfill.

Therefore, the Scenario W2-S2: “Aerobic wastewater treatment facilities with sludge being dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery” and Scenario W3-S2: Existing anaerobic open lagoon system without methane recovery and flaring with sludge being dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery” are all consistency with mandatory laws and regulations. So, the outcome of Step 1b is unchanged from Step 1a.

The outcome of Step 1b is unchanged from Step 1a.

Step 2: Barrier analysis

There are no technology barriers, acceptability barriers and financial barriers that may prevent these two alternative scenarios to occur. As per Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0), go to Step 3 investment analysis.

Step 3: Investment analysis

As per paragraph 25 in section 4.4 of Tool 02 of Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0). Identify the financial indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g., levelized cost of electricity production in \$/kWh or levelized cost of delivered heat in \$/GJ) most suitable for the project type and decision-making context. The unit cost of wastewater treatment (UCWT) has been used as the most meaningful indicator for the investment comparison analysis. The unit cost of service is calculated taking into consideration costs defined in the methodology: Land cost, Engineering, procurement and construction cost, operation and maintenance cost, administration cost, fuel cost, capital cost and interest, revenue from electricity and/or heat sales, all other costs of implementing the technology of each alternative option and all revenues generated by the implementation of the proposed technology except for carbon credits revenues.

Inputs to the financial analysis

²⁰ <https://www.mee.gov.cn/gkml/hbb/bgg/201307/W020130726461701943622.pdf>

²¹ http://www.moa.gov.cn/nybggb/2019/201907/202001/t20200103_6334298.htm

²² http://pdf.dfcfw.com/pdf/H3_AP202008131398231167_1.pdf

The parameters required in calculating UCWT for the two remaining alternatives after step 2 are listed in Table 3-4 below

Table 3-4 Calculating UCWT for the two remaining alternatives

Financial analysis		
Parameters \ Alternatives	Value ²³	
	Alternative 1 (W2-S2)	Alternative 2 (W3-S2)
Construction Investment (10,000 RMB)	18,973.46	
1 Annual Operation Cost (10,000 RMB):	3,510.61	1989.25 ²⁴
1.1 Raw materials and power (10,000 RMB)	1,951.51	—
1.2 Salary and welfare (10,000 RMB)	280.00	—
1.3 Maintenance (10,000 RMB)	543.88	—
1.4 Other management (10,000 RMB)	735.22	—
Average Annual Total Cost (10,000 RMB)	4,246.94	1,894.52
Amount of Wastewater Treated (10,000 RMB)	3,978.50	3,978.50
UCWT (10,000 RMB)	1.07	0.69

The comparison of the two alternatives lead to the conclusion that based on the chosen parameters, anaerobic open lagoons system with sludge dried under controlled and aerobic conditions, with disposal in a landfill with methane recovery, is the financially most attractive scenario.

Sensitivity analysis

A sensitivity analysis of +/- 10% on the following parameters was conducted:

- Construction Investment;
- Annual Operation Cost; and
- Wastewater Treated.

Table 3-5 Sensitivity Analysis of UCWT on Construction Investment (Unit: RMB/m³)

²³ The data source for Alternative 1 is from FSR, the data source for Alternative 2 is from baseline survey report.

²⁴ According to the "baseline survey report", the annual operation cost of anaerobic open lagoon is 0.5 RMB/m³, so the operating cost is 109,000m³/d×0.5RMB/m³×365d=19,892,500 RMB/year.

Construction Investment	-10%	-5%	0%	5%	10%	Critical point
Alternative 1 (W2-S2)	1.04	1.06	1.07	1.08	1.09	-258%
Alternative 2 (W3-S2)	0.48	0.48	0.48	0.48	0.48	

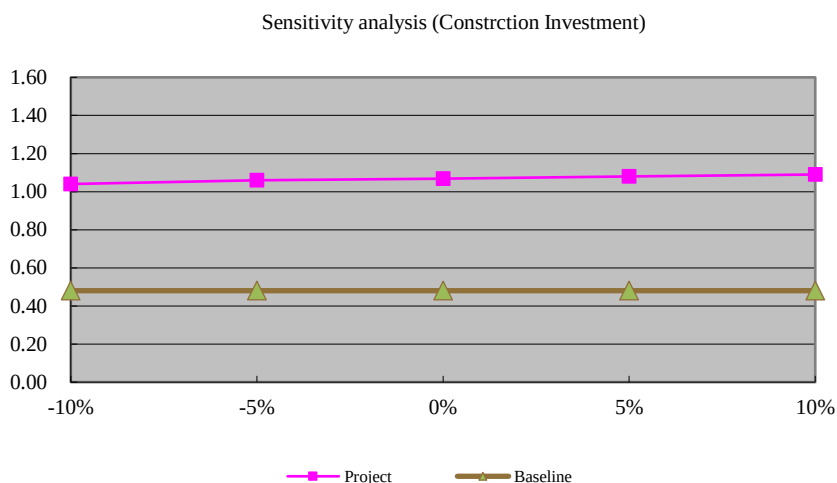


Figure 3-2 Sensitivity Analysis (Construction Investment)

According to Table 3-4, Alternative 2 is the most economical attractive alternative. The unit wastewater treatment cost of Alternative 1 becomes the same as Alternative 2 only when the construction cost of Alternative 1 decreases by 258%. The price index of investment in fixed asset for Zhejiang Province has continued increased in recent years²⁵. Therefore, it is not likely to implement the project activity with the Construction Investment reducing by 258%.

Table 3-6 Sensitivity Analysis of UCWT on Annual Operation Cost (Unit: RMB/m³)

Annual Operation Cost	-10%	-5%	0%	5%	10%	Critical point
Alternative 1 (W2-S2)	0.98	1.03	1.07	1.11	1.15	-70%
Alternative 2 (W3-S2)	0.43	0.45	0.48	0.50	0.52	

²⁵ <https://wenku.baidu.com/view/aa64ea0714fc700abb68a98271fe910ef12dae35.html>

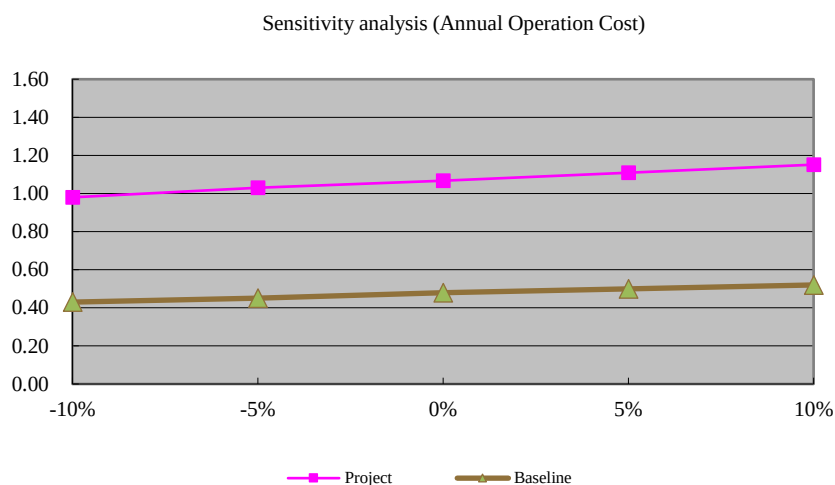


Figure 3-3 Sensitivity Analysis (Annual Operation Cost)

When the Annual Operation Cost decreases 70%, the unit wastewater treatment cost of Alternative 1 becomes the same as Alternative 2. The Annual Operation Cost mainly consist of raw materials and power cost, salary and welfare cost, maintenance cost and other management cost. According to the Feasibility Study Report, the above costs remain basically stable, so, it is not likely to decrease the Annual Operation Cost by 70%.

Table 3-7 Sensitivity Analysis of UCWT on Wastewater Treated (Unit: RMB/m³)

Wastewater Treated	-10%	-5%	0%	5%	10%	Critical point
Alternative 1 (W6-S2)	1.19	1.12	1.07	1.02	0.97	124%
Alternative 2 (W6-S2)	0.53	0.50	0.48	0.45	0.43	

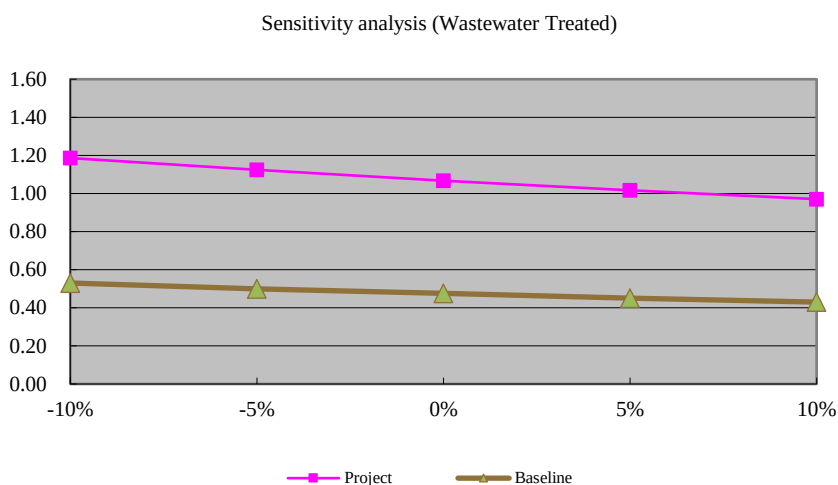


Figure 3-5 Sensitivity Analysis (Wastewater Treated)

When the Wastewater Treated increased by 124.00%, the unit wastewater treatment cost of Alternative 1 becomes the same as Alternative 2. However, from the Feasibility Study Report of the project, the amount of wastewater treated is fixed. A further 124% increase in the amount of wastewater to be treated is not possible. So, the increase in amount of wastewater treated by 124.00% is unrealistic.

The sensitivity analysis further confirms that construction of alternative 2 is the most economically attractive option. Compared with the proposed project activity under taken without being registered as a VCS project activity, existing open anaerobic lagoon in Dongyang City is the lowest cost operation option and is selected as the most economically attractive alternative.

According to the unit cost of wastewater treatment, alternative 2 is the most economically attractive option. Furthermore, the sensitivity analysis is conclusive and confirms the result of the investment comparison analysis.

Therefore, the lowest unit cost of wastewater treatment (alternative 2) is considered as the baseline scenario.

Investment analysis has been conducted in section B.4. As per Tool 24 Common practice (Version 03.1), Step 4 common practice analysis will be conducted as follows:

Step 4: Common practice analysis

The proposed project will achieve significant greenhouse gas (GHG) reductions by replacing open anaerobic lagoon in the baseline scenario with one aerobic wastewater plant. Therefore, according to the Tool 24“Common practice (version 03.1), the measure of the proposed project belongs to “Methane formation avoidance”. Thus, sub-steps are adopted to take the common practice analysis

Sub-step 4a. The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above.

The proposed project is belonged to type (D) measure listed in the latest version of the Tool 24 common practice (version 03.1), i.e., Methane formation avoidance (example: use of biomass that would have been left to decay in a solid waste disposal site resulting in the formation and emission of methane, for energy generation). As per additionality tool, the Tool 24 common practice (version 03.1) available on the UNFCCC website is applied as below:

Sub-step 4a.1: calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

As described in section 1.1 of this JPM, the total design treatment capacity of wastewater treatment plant of the project is 109,000 m³/d, so treatment capacity of wastewater treatment projects between 54,500 m³/d -163,500m³/d are included in the range of similar projects.

Sub-step 4a.2: identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area;

Zhejiang Province is selected as the applicable geographical area for the common practice, and the reasons are detailed as follows:

- Due to the differences of economic development level, population size, industrial structure, fundamental infrastructure, strategic planning etc, the investment environment of each province in China varies widely. Therefore, a project in the same province as the proposed project (i.e. Zhejiang Province) was selected as a similar project.;

In summary, the waste water treatment projects within the same province are selected for the common practice analysis.

(b) The projects apply the same measure as the proposed project activity;

Projects using aerobic biological treatment technology for wastewater treatment should be used.

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

The project is an aerobic wastewater treatment process, the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)", sludge would be dried under controlled and aerobic conditions, with disposal in a landfill with methane recovery;

Besides, the following conditions should also be fulfilled:

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

- (e) If similar projects can use the aerobic wastewater treatment process, and the sludge produced by the project is dried under controlled and aerobic conditions, and then transported to the landfills with methane recovery for landfill treatment, it shall be considered as a comparable service. The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

Based on the calculation in Sub-step 4a.1, the treatment capacity ranges of similar project are that can treat wastewater from 54,500 m³/d -163,500m³/d.

- (f) The projects started commercial operation before the project design document is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project act.

The similar project started commercial operation before the start date of the project at 25-October-2020, which is earlier date.

Based on the above analysis, it can be concluded that the project belongs to "avoiding methane formation" with treatment of wastewater treatment before 25-October-2020, the aerobic wastewater treatment process is used, the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)", and the sludge is dried under controlled and aerobic conditions, and then transported to the landfills with methane recovery for landfill treatment, the wastewater treatment capacity is 54,500 m³/d -163,500m³/d in Zhejiang Province, which is similar to the proposed project activities.

Sub-step 4a.3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all} .

By searching the website of Department of Ecology and Environment of Zhejiang Province, which is responsible for EIA approval. the identified keywords were used to search for conditions related to similar projects such as "wastewater treatment plants operated before 25-October-2020" treatment of wastewater from 54,500 m³/d -163,500m³/d, "treated effluent meets the standard", "produced sludge will be dried under controlled and aerobic conditions" and searched the results. Via the source, it confirmed that there are no similar projects identified in Zhejiang Province based on the above criteria. Therefore, there is no aerobic wastewater treatment plant that can meet all the above conditions at the same time.

So there are no similar projects, therefore $N_{all}=0$

Sub-step 4a.4: within similar projects identified in Step 3, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff} .

$N_{diff}=0$

Sub-step 4a.5: calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the

measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

According to the analysis above, $N_{all} = N_{diff}$, and the factor $F = 1 - N_{diff}/N_{all} = 1 - 1 = 0 < 0.2$. Therefore, the result of common practice assessment is: $N_{all} - N_{diff} = 0 < 3$. Therefore, the proposed activity is not a common practice in the region.

Conclusion of the assessment and demonstration of additionality

As per paragraph 18 of Tool 24 Common practice (Version 03.1), the proposed project activity is not a “common practice” within a sector in the applicable geographical area.

As per paragraph 40 of Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0), the project activity is additional.

3.6 Methodology Deviations

There is no methodology deviation for the project.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

This section details the applicable formulas from the methodologies applied to the project Activity. The baseline emission of the project may have consisted of the following emission sources in water treatment, sludge treatment, transport, and energy consumption:

- i) Baseline methane emissions from anaerobic treatment of the wastewater in open lagoons;
- ii) Baseline emissions on account of decomposition of final sludge;
- iii) Baseline emissions associated with electricity generation avoided, equivalent to electricity generated with biogas recovery in project activity;
- iv) Baseline carbon dioxide emissions on account of heat consumption in water and sludge treatment processes;

Therefore, baseline emissions can be calculated as:

$$BE_y = BE_{CH_4,ww,y} + BE_{CH_4,sl,y} + BE_{EL,y} + BE_{HG,y} + BE_{TR,sl,y} \quad (1)$$

Where:

$$BE_y = \text{Baseline emissions in year y (tCO}_2\text{e/year)}$$

$BE_{CH_4,ww,y}$	=	Methane emissions from anaerobic treatment of the wastewater in the baseline scenario in year y (tCO ₂ e/year)
$BE_{CH_4,sl,y}$	=	Methane emissions from treatment of sludge in the baseline scenario in year y (tCO ₂ e/year)
$BE_{EL,y}$	=	CO ₂ emissions associated with electricity generation that is displaced by the project activity and/or electricity consumption in the baseline scenario in year y (tCO ₂ /year)
$BE_{HG,y}$	=	CO ₂ emissions associated with fossil fuel combustion for heating equipment that is displaced by the project in year y (tCO ₂ /year)
$BE_{TR,sl,y}$	=	CO ₂ emissions associated with transportation of sludge in the baseline scenario in year y (tCO ₂ /year)

i). Calculation of baseline emissions from treatment of wastewater ($BE_{CH_4,ww,y}$):

$$BE_{CH_4,ww,y} = GWP_{CH_4} \times B_o \times COD_{BL,ww,y} \times MCF_{BL,ww,y} \quad (2)$$

Where:

$BE_{CH_4,ww,y}$	=	Methane emissions from anaerobic treatment of the wastewater in the baseline scenario in year y (tCO ₂ e/year)
GWP_{CH_4}	=	Global Warming Potential of methane valid for the commitment period (tCO ₂ e/tCH ₄)
B_o	=	Quantity of chemical oxygen demand that would have been treated in the baseline scenario in year y (tCOD/year)
$COD_{BL,ww,y}$	=	Quantity of chemical oxygen demand that would have been treated in the baseline scenario in year y (tCOD/year)
$MCF_{BL,ww,y}$	=	Average baseline methane conversion factor in year y, representing the fraction of organic load that would be degraded to CH ₄ in the baseline scenario (fraction)

$$COD_{BL,ww,y} = AD_{BL} \times COD_{PJ,ww,y}^{26} \quad (3)$$

Where:

²⁶ According to page 10 of methodology, if there would be an effluent from the lagoons in the baseline, $COD_{BL,ww,y}$ should be adjusted by an effluent adjustment factor which relates the COD supplied to the lagoon with the COD in the effluent. In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoon instead of the newly-build anaerobic lagoon, so the calculation formula of $COD_{BL,ww,y}$ should be the formula (4) of page 10 in methodology.

$COD_{BL,ww,y}$	=	Quantity of chemical oxygen demand that would have been treated in the baseline scenario in year y (tCOD/year)
AD_{BL}	=	Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the baseline scenario (fraction)
$COD_{PJ,ww,y}$	=	Quantity of chemical oxygen demand that is treated in the aerobic wastewater treatment plant in the project activity in year y (tCOD/year)

$$\text{With } COD_{PJ,ww,y} = \sum Q_{PJ,ww,y} \times W_{PJ,COD,ww,m} \quad (4)$$

Where:

$Q_{PJ,ww,y}$	=	Quantity of wastewater that is treated in the aerobic wastewater plant in the project activity in month m
$W_{PJ,COD,ww,m}$	=	Average Chemical Oxygen Demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m
m	=	Months of year y of the crediting period

$$\text{With } AD_{BL} = (1 - (COD_{BL,out,x} / COD_{BL,in,x}))^{27} \quad (5)$$

Where:

AD_{BL}	=	Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the baseline scenario (fraction)
$COD_{BL,out,x}$	=	COD of the effluent of open lagoons in the baseline scenario in the period x (tCOD)

²⁷ In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoon. Before the construction of the project, in order to investigate the influent COD and flow, effluent COD and flow, quantity of sludge transportation, the local government conducted a complete monitoring process on the influent COD and flow, effluent COD and flow, quantity of sludge transportation of the anaerobic lagoon in 2018 (From 01-January-2018 to 31-December-2018). Please see the feasibility study report for more details. Therefore, according to page 9 of methodology, AD_{BL} should be calculated according to the Option A of page 9 in the methodology.

$COD_{BL,in,x}$ = COD directed to the open lagoons in the baseline scenario in the period x (tCOD)

x = Representative historical reference period (at least one year)

Determination of $MCF_{BL,ww,y}$

The quantity of methane generated from COD disposed to the open lagoon depends mainly on the temperature and the depth of the lagoon. Accordingly, the methane conversion factor is calculated based on a factor $f_{BL,d}$, expressing the influence of the depth of the lagoon on methane generation, and a factor $f_{BL,T,y}$ expressing the influence of the temperature on the methane generation. In addition, a conservativeness factor of 0.89 is applied to account for the considerable uncertainty associated with this approach. For the purpose of ex ante estimations, $f_{BL,d}$ and $f_{BL,T,y}$ will be calculated by referring to the local historical temperature data from the Meteorological Bureau. $MCF_{BL,ww,y}$ is calculated as follows:

$$\text{With } MCF_{BL,ww,y} = f_{BL,d} \times f_{BL,T,y} \times 0.89 \quad (6)$$

Where:

$MCF_{BL,ww,y}$ = Average baseline methane conversion factor in year y, representing the fraction of organic load that would be degraded to CH₄ in the baseline scenario (fraction)

$f_{BL,d}$ = Factor expressing the influence of the depth of the lagoon on methane generation (fraction)

$f_{BL,T,y}$ = Factor expressing the influence of the temperature on the methane generation in year y (fraction)

0.89 = Conservativeness factor

For the purpose of ex ante estimations, IPCC default values of methane conversion factors ($MCF_{BL,ww,y}$) for different treatment types and conditions should be used as per IPCC Guidelines. As per baseline survey report, the depth of the local anaerobic lagoon system of the project is more than 5 m, and then as per table 6.3 of chapter 6 in IPCC 2006, when the depth of anaerobic system is greater than 5m, the default value of MCF is 0.8. Referring to the local historical average temperature of the project²⁸, the calculation results of $MCF_{BL,ww,y}$ are all lower than 0.8 (See the calculation results shown in the following table). Therefore, if the calculation value is used, the results will be more conservative. Therefore, $MCF_{BL,ww,y}$ will use the calculated value instead of the default value of IPCC.

Determination of $f_{BL,T,y}$

²⁸ <https://m.tianqi.com/qiwen/city/>

$f_{BL,T,y}$ will be calculated by formula (8) on page 10 of methodology, for ex-ante calculation, the local historical temperature data will be used²⁸. The calculation formula is as follows:

$$\text{With } f_{BL,T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{BL,available,m}}{\sum_{m=1}^{12} AD_{BL} \times Q_{PJ,ww,m} \times W_{PJ,ww,COD,m}} \quad (7)$$

Where:

$f_{BL,T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year y(fraction)
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m(fraction)
$COD_{BL,available,m}$	=	Quantity of chemical oxygen demand available for degradation in month m (tCOD)
AD_{BL}	=	Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the baseline scenario (fraction)
$Q_{PJ,ww,m}$	=	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m (m ³)
$W_{PJ,ww,COD,m}$	=	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m (tCOD/m ³)
m	=	Months of year y of the crediting period

$$\text{With } f_{T,m} = \begin{cases} 0 & \text{if } T_{2,m} < 283K \\ \exp\left(\frac{E \times (T_{2,m} - T_1)}{R \times T_1 \times T_{2,m}}\right) & \text{if } 283K < T_{2,m} < 303K \\ 1 & \text{if } T_{2,m} > 303K \end{cases} \quad (8)$$

Where:

$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m(fraction)
E	=	Activation energy constant (15,175 cal/mol)
T1	=	303.16 K (273.16 K + 30 K)
R	=	Ideal gasconstant (1.987 cal/K.mol)
$T_{2,m}$	=	Average temperature at the project site in month m (K)

m = Months of year y of the crediting period

As indicated in the equation above, the value of $f_{T,m}$ cannot exceed 1 and should be assumed to be zero if the ambient temperature is below 10°C.

Determination of $COD_{BL,available,m}$

The quantity of chemical oxygen demand available for degradation in the open lagoon for each month m , is given by the balance of the quantities of wastewater directed to the lagoon, the quantity of organic compounds that decay in the lagoons, and the quantity of any effluent water from the lagoon. Therefore, $COD_{BL,available,m}$ is assumed to be equal to the amount of organic matter directed to the open lagoon, less any effluent, plus the COD that may have remained in the lagoon from previous months.

The baseline scenario of the project is that the wastewater continues to be treated by the open anaerobic lagoon, as per the baseline survey report, the retention time of organic matter in the local anaerobic lagoon of the project is 1 year. The calculation formula is as follows:

$$\text{With } COD_{BL,available,m} = AD_{BL} \times Q_{PJ,ww,m} \times w_{PJ,ww,m} \times (1 - f_{T,m}) \times COD_{BL,available,m-1} \quad (9)$$

Where:

$COD_{BL,available,m}$ = Quantity of chemical oxygen demand available for degradation in month m (tCOD)

AD_{BL} = Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the baseline scenario (fraction)

$Q_{PJ,ww,m}$ = Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m (m³)

$w_{PJ,ww,m}$ = Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m (tCOD/m³)

$f_{T,m}$ = Factor expressing the influence of the temperature on the methane generation in month m (fraction)

$COD_{BL,available,m-1}$ = Months of year y of the crediting period

m = Months of year y of the crediting period

The parameters and calculation involved in the above equation are shown in the following table:

Parameter	Value	Unit	source
GWP_{CH_4}	28	tCO ₂ /tCH ₄	IPCC Fifth Assessment Report - Climate Change 2014
B_0	0.21	tCH ₄ /tCOD	2006 IPCC Vol5 Ch6 table 6.2 & AM0080 v.1 p.28

E	15175	cal/mol	As per AM0080 v.1 p.11, it is activation energy constant.
$COD_{BL,ww,y}$	Ex-ante ER spreadsheet	tCOD/year	Calculated The parameter is calculated using equation (4) based on parameters $COD_{PJ,ww,y}$ and AD_{BL}
$COD_{PJ,ww,y}$	Ex-ante ER spreadsheet	tCOD/year	Calculated The parameter is calculated using equation (4) based on parameters $Q_{PJ,ww,m}$ and WPJ,COD,ww,m
Maximum design influent flow	109,000	m ³ /d	FSR
$Q_{PJ,ww,m}$	Ex-ante ER spreadsheet	m ³	Calculated Multiply daily design influent flow by days in month
Influent COD concentration	750	mg/L	FSR
Effluent COD concentration	40	mg/L	FSR
WPJ,COD,ww,m	0.000750	tCOD/m ³	Calculated Convert the influent COD concentration in mg/l to tCOD/m ³
Effluent COD concentration	0.000040	tCOD/m ³	Calculated Convert the effluent COD concentration in mg/l to tCOD/m ³
AD_{BL}	Ex-ante ER spreadsheet	Fraction	Calculated The parameter is calculated by equation (6) based on parameters $COD_{BL,out,x}$ and $COD_{BL,in,x}$
$COD_{BL,out,x}$	Ex-ante ER spreadsheet	tCOD	Historical data on site in the FSR
$COD_{BL,in,x}$	Ex-ante ER spreadsheet	tCOD	Historical data on site in the FSR
$MCF_{BL,ww,y}$	Ex-ante ER spreadsheet	Fraction	Calculated The parameter is calculated using equation (7) based on parameters $f_{BL,T,y}$, $f_{BL,d,y}$.
$f_{BL,T,y}$	Ex-ante ER spreadsheet	Fraction	Calculated The parameter is calculated using equation (8) based on the monthly values of the parameters of $f_{T,m}$.

			$COD_{BL,available,m}$, $Q_{PJ,ww,m}$, AD_{BL} , and WPJ,COD,ww,m .
$f_{BL,d,y}$	70%	Fraction	As per the baseline survey report, the baseline scenario is one existing anaerobic lagoon system with depth greater than 5m, so the value is taken as 70%.
$f_{T,m}$	Ex-ante ER spreadsheet	Fraction	Calculated The value listed in this table is yearly average which is calculated based on monthly value calculated using equation (9) based on parameters $T_{2,m}$, T_1 , E , and R .
T_1	303.16	K	As per AM0080 v.1 p.11, it is a temperature constant.
$T_{2,m}$	Ex-ante ER spreadsheet	K	https://m.tianqi.com/qiwen/city-dongyang
R	1.987	cal/K.mol	As per AM0080 v.1.p.11, it is a ideal gas constant
$COD_{BL,available,m}$	Ex-ante ER spreadsheet	tCOD	Calculated The parameter is calculated using equation (10) based on monthly value of parameters AD_{BL} , $Q_{PJ,ww,m}$, WPJ,COD,ww,m and $f_{T,m}$.
$BE_{CH_4,ww,y}$	72,757	tCO ₂ e/year	The parameter is calculated using equation (2) based on parameters GWP_{CH_4} , B_o , $COD_{BL,ww,y}$, and $MCF_{BL,ww,y}$

The ex-ante baseline emissions from treatment of wastewater are calculated as:

$$BE_{CH_4,ww,y} = 72,757 \text{ tCO}_2\text{e/year}$$

Please refer to the **ex-ante ER spreadsheet** for the more detailed calculation process and parameters for calculation.

ii). Calculation of baseline emissions from treatment of sludge ($BE_{CH_4,sl,y}$)

Based on the analysis of the baseline scenario in Section 3.4, the sludge that produced in the baseline scenario from the treatment of wastewater in the open lagoons system would have been treated by means of controlled drying under aerobic conditions and then disposed to a landfill with methane recovery (S2), the corresponding methane emissions ($BE_{CH_4,sl,y}$) are considered to be negligible and are not accounted for.

Therefore, the baseline emissions from treatment of sludge are calculated as:

$$BE_{CH_4,sl,y}=0 \text{ tCO}_2\text{e/year}$$

iii). Calculation of baseline emissions from consumption of electricity ($BE_{EL,y}$)

There is no power consumption in this baseline scenario, therefore, the baseline emissions from treatment of sludge are calculated as:

$$BE_{EL,y}=0 \text{ tCO}_2\text{e/year}$$

iv). Baseline emissions from the generation of heat ($BE_{HG,y}$)

There are no emissions from the generation of heat in this baseline scenario, therefore, the baseline emissions from the generation of heat are calculated as:

$$BE_{HG,y}=0 \text{ tCO}_2\text{e/year}$$

v). Baseline emissions from transportation of sludge ($BE_{TR,sl,y}$)

The baseline emissions resulting from transportation of sludge that would have been produced in the baseline scenario should be calculated as:

$$BE_{TR,sl,y} = \sum_i N_{BL,i,y} \times D_{BL,i} \times F_{BL,i} \times NCV_{BL,j} \times EF_{BL,j} \quad (10)$$

Where:

$BE_{TR,sl,y}$	CO ₂ emissions associated with transportation of sludge in the baseline scenario in year y (tCO ₂ /year)
$N_{BL,i,y}$	Number of trips (vehicle of type i with similar loading capacity) for transportation of the sludge that would have been produced in the baseline scenario in year y (trips)
$D_{BL,i}$	Average distance per trip, that would have been travelled by the transportation vehicle of type i, for transportation of sludge in the baseline scenario (km)
$F_{BL,i}$	Specific fuel consumption of the transportation vehicle of type i (mass or volume units of fuel/km)
$NCV_{BL,j}$	Net calorific value of the transportation fuel j (TJ/mass or volume units)
$EF_{BL,j}$	CO ₂ emission factor of the transportation fuel j (tCO ₂ /TJ)
i	Vehicle type
j	Fuel type used in vehicles
y	Year of the crediting period

If the emissions associated with transportation of sludge in the baseline scenario and in the project scenario are found to be comparable (i.e. within +1% range) or emissions in the project scenario are lower, then both can be excluded in the calculation of baseline emissions and project emissions as

a simplification. According to Section 4.1 and 4.2 of Chapter 4, the ex-ante calculated values of project emissions and baseline emissions due to sludge transportation are: $BE_{TR,sl,y} = 32.80$ tCO₂e/year; $PE_{TR,sl,y} = 37.06$ tCO₂e/year. Since $PE_{TR,sl,y} > BE_{TR,sl,y}$ and $(PE_{TR,sl,y} / BE_{TR,sl,y} - 1) = 12.99\% > 1\%$, so the emissions associated with transportation of sludge in the baseline scenario and in the project scenario cannot be simplified.

Determination of $N_{BL,i,y}$

$$N_{BL,i,y} = \frac{Q_{BL,sl,y}}{q_{BL,i}} \quad (11)$$

Where:

$N_{BL,i,y}$	=	Number of trips (vehicle of type i with similar loading capacity) for transportation of final sludge generated by the waste water treatment system in the baseline scenario in the year y (trips)
$Q_{BL,sl,y}$	=	Quantity of sludge that would have been produced and treated in the baseline scenario in the year y (tonnes)
$q_{BL,i}$	=	Average vehicular capacity of the transportation vehicle of type i (tonnes/trip)
y	=	Year of the crediting period

Parameter	value	Unit	source
$N_{PJ,i,y}$	813	trips	Calculated The parameter is calculated using equation (12) based on parameters $Q_{BL,sl,y}$ and $q_{BL,i}$.
$Q_{PJ,sl,y}$	4,069.55	tonnes	Historical data on site in the FSR (It was calculated with conservative value)
$q_{PJ,i}$	5	tonnes/trip	Historical data on site in baseline survey report
$D_{PJ,i,y}$	59.6	km	Historical data on site in baseline survey report
$F_{PJ,i,y}$	0.251	Liter/km	As per baseline survey report, historical data available on-site was also from the Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, > 4 tonne < 8 tonne) https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf
Density of diesel	0.00084	t/L	As per baseline survey report, historical data available on-site was also from Page 15 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf)

NCV _{PJ,y}	0.04333	TJ/tonne	As per baseline survey report, historical data available on-sit was also from Table 2 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel) (https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf)
EF _{PJ,y}	74.1	tCO ₂ /TJ	As per baseline survey report, historical data available on-sit was also from Table 3.2.1 of Chapter 3 in Volume 2 of IPCC

The baseline emissions from transportation of sludge are calculated as:

$$BE_{TR,sl,y} = (813 \times 59.6 \times 0.251 \times 0.00084 \times 0.04333 \times 0.251 \times 74.1) \text{ tCO}_2\text{e/year} = 32.80$$

tCO₂e/year

Therefore, baseline emissions can be calculated as:

$$BE_y = BE_{CH_4,ww,y} + BE_{CH_4,sl,y} + BE_{EL,y} + BE_{HG,y} + BE_{TR,sl,y}$$

$$= BE_{CH_4,ww,y} + BE_{TR,sl,y}$$

$$= 72,757 \text{ tCO}_2\text{e/year} + 32.80 \text{ tCO}_2\text{e/year} = 72,789 \text{ tCO}_2\text{e/year}$$

Please refer to the ex-ante ER spreadsheet for the detailed calculation process and parameters for calculation.

4.2 Project Emissions

The project emissions associated with project wastewater and sludge treatment systems may consist of the following emissions sources;

- Methane emissions on account of inefficiency of the wastewater treatment system;
- Project emissions from physical leakage of methane from anaerobic digesters and flare system;
- Project N₂O emissions on account of energy final sludge land application;
- Project emissions on account of energy consumption (electrical and/or thermal) of the wastewater and sludge treatment systems;
- Project emissions from fossil fuel consumption in the project activity;
- Project emissions on account of transportation of final sludge produced.

Project emissions are calculated as follows:

$$PE_y = PE_{CH_4,ww,y} + PE_{CH_4,sl,y} + PE_{N_2O,sl,y} + PE_{EC,y} + PE_{FC,y} + PE_{TR,sl,y} \quad (12)$$

Where:

PE_y	=	Project emissions in the year y (tCO ₂ e/year)
$PE_{CH_4,ww,y}$	=	Project emissions from inefficiency of the wastewater treatment system and presence of degradable organic carbon in the treated wastewater.
$PE_{CH_4,sl,y}$	=	Methane emissions from treatment of sludge in the project activity in year y (tCO ₂ /year).
$PE_{N_2O,sl,y}$	=	Project N ₂ O emissions on account of energy final sludge land application.
$PE_{EC,y}$	=	Project emissions associated with electricity consumption in the project activity.
$PE_{FC,y}$	=	Project emissions associated with fossil fuel consumption in the project activity.
$PE_{TR,sl,y}$	=	Project emissions on account of transportation of final sludge produced in the year y(tCO ₂ /annum).

i) Methane emissions from treatment of wastewater ($PE_{CH_4,ww,y}$)

Project emissions due to wastewater treatment comprise two components, emissions from the aerobic wastewater treatment plant due to inadequate operation and/or overloading, and emissions due to the presence of degradable organic carbon in the treated wastewater after leaving the aerobic wastewater treatment plant:

$$PE_{CH_4,ww,y} = PE_{CH_4,wwtp,y} + PE_{CH_4,effl,y} \quad (13)$$

Methane emissions from the aerobic wastewater treatment plant $PE_{CH_4,wwtp,y}$:

Due to the highly site specific nature of the factors leading to the development of anaerobic conditions in aerobic wastewater treatment plants, it is difficult to provide a clear-cut procedure and monitoring parameters to determine CH₄ emissions for plants under inadequate operational conditions. This methodology applies a proxy parameter, the oxidisation ratio (OR) described further below. In order to conservatively account for emissions, the higher value (MCF=0.4) of the IPCC MCF range for aerobic treatment plant should be used if the oxidisation ratio (OR) is out of an acceptable range. If the oxidisation ratio is within the acceptable range, emissions should be considered zero.

Therefore, methane emissions from the aerobic wastewater treatment plant in year y due to inadequate operation and/or overloading should be calculated as follows:

$$\text{If } OR_i \geq 0.8, PE_{CH_4,wwtp,y} = 0 \quad (14)$$

$$\text{If } OR_i < 0.8, PE_{CH_4,wwtp,y} = \sum_{i=1}^{365} GWP_{CH_4} \times B_{0,ww} \times 0.4 \times (COD_{PJ,ww,i} - COD_{PJ,effl,i}) \quad (15)$$

Where:

$PE_{CH_4,wwtp,y}$	=	Methane emissions from the aerobic wastewater treatment plant in year y due to inadequate operation and/or overloading (tCO ₂ e/year);
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$PE_{CH_4,effl,y}$	=	Methane emissions due to the presence of degradable organic carbon in the effluent from the aerobic wastewater treatment plant in year y (tCO ₂ e/year);
OR_i	=	Oxidisation ratio, representing the ratio between organic matter in the output and organicmatter in the input of the aerobic wastewater treatment plant in day i of year y (fraction);
GWP_{CH_4}	=	Global Warming Potential of CH ₄ . (tCO ₂ /tCH ₄);
$B_{0,ww}$	=	Maximum methane producing capacity of the wastewater treated in the year y.(Faction)
0.4	=	Default methane conversion factor (MCF) for not well managed plants (fraction);
$COD_{PJ,ww,i}$	=	Quantity of chemical oxygen demand that enters the aerobic wastewater treatment plant in the project activity in the day i of year y (tCOD);
$COD_{PJ,effl,i}$	=	Quantity of chemical oxygen demand in the effluent of the wastewater treatment plant in the project activity in the day i of year y (tCOD).

The quantities of chemical oxygen demands in the wastewater and effluent are calculated as follows:

$$COD_{PJ,ww,i} = Q_{PJ,ww,i} \times w_{PJ,COD,ww,i} \quad (16)$$

$$COD_{PJ,effl,i} = Q_{PJ,effl,i} \times w_{PJ,COD,effl,i} \quad (17)$$

Where:

$COD_{PJ,ww,i}$	=	Quantity of chemical oxygen demand that enters the aerobic wastewater treatment plant in the project activity in the day i of year y (tCOD)
$Q_{PJ,ww,i}$	=	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in day i of year y (m ³)
$w_{PJ,COD,ww,i}$	=	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in day i of year y (tCOD/m ³)
$COD_{PJ,effl,i}$	=	Quantity of chemical oxygen demand in the effluent of the wastewater treatment plant in the project activity in the day i of year y (tCOD)
$Q_{PJ,effl,i}$	=	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in day i of year y (m ³)
$w_{PJ,COD,effl,i}$	=	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in day i of year y (tCOD/m ³)

Determination of the oxidisation ratio (OR_i)

The determination of whether the aerobic wastewater treatment system is well operated (managed) or not is made by monitoring the quality of the wastewater at the outlet of the treatment plant to make sure it meets the target specified in the design of the project activity. If it does meet this requirement it can be trusted to be a well-managed facility with little to no CH₄ emissions during the project implementation. In many developing countries the urban areas either do not have separate storm water drain systems or the storm water drain systems do not work properly. Due to this reason, during rainy seasons, the wastewater gets diluted from the ingress of rainwater before reaching the treatment plant.

Because of the dilution effect, the COD in the wastewater decreases and can appear within the acceptable range even if the treatment plant is not in operation;

The legislation in many of the developing countries specifies the maximum limit for wastewater COD, but the legislation generally does not specify the particular wastewater treatment technology which should be used to achieve the objective. It is possible to achieve an acceptable level of COD in the final effluent by diluting it (directly mixing water to it) just before it is discharged into the final receiving body (mostly fresh water streams).

In fact, according to the feasibility study report, the project does not have the above two problems.

To address these two issues, the following approach is suggested:

$$OR_i = \frac{COD_{PJ,ww,i} - COD_{PJ,effl,i}}{COD_{PJ,ww,i}} \quad (18)$$

Where:

OR_i = Oxidisation ratio, representing the ratio between organic matter in the output and organic matter in the input of the aerobic wastewater treatment plant in day i of year y (fraction)

$COD_{PJ,ww,i}$ = Quantity of chemical oxygen demand that enters the aerobic wastewater treatment plant in the project activity in the day i of year y (tCOD)

$COD_{PJ,effl,i}$ = Quantity of chemical oxygen demand in the effluent of the wastewater treatment plant in the project activity in the day i of year y (tCOD)

The project emissions from the aerobic wastewater treatment due to inadequate operation and/or overloading are calculated as:

Parameter	Value	Unit	Source
$COD_{PJ,ww,i}$	81.75	tCOD	The parameter is calculated using equation (16) based on parameters $Q_{PJ,ww,i}$ and $W_{PJ,COD,ww,i}$. As per FSR, $Q_{PJ,ww,i} = 109,000 \text{ m}^3$, and $W_{PJ,COD,ww,i} = 0.00075 \text{ tCOD/m}^3$.
$COD_{PJ,effl,i}$	4.36	tCOD	The parameter is calculated using equation (17) based on parameters $Q_{PJ,effl,i}$ and $W_{PJ,COD,effl,i}$. As per FSR, the monthly average value of $Q_{PJ,effl,i} = 109,000 \text{ m}^3$, and $W_{PJ,COD,effl,i} = 0.00004 \text{ tCOD/m}^3$.
OR_i	0.947	Fraction	The parameter is calculated using equation (18) based on parameters $COD_{PJ,ww,i}$ and $COD_{PJ,effl,i}$. $OR_i = (COD_{PJ,ww,i} - COD_{PJ,effl,i}) / COD_{PJ,ww,i}$ $= (81.75 - 4.36) / 81.75 = 0.947$, which is greater than 0.8

$PE_{CH_4,wwtp,y}$	0	tCOD/year	As per equation (14), if $OR_i \geq 0.8$, $PE_{CH_4,wwtp,y} = 0$.
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$$PE_{CH_4,wwtp,y} = 0 \text{ tCO}_2\text{e/year}$$

Please refer to the ex-ante ER spreadsheet for the more detailed calculation process and parameters for calculation.

Methane emissions from the aerobic wastewater treatment plant: $PE_{CH_4,effl,y}$

The methane emissions due to the presence of degradable organic carbon in the effluent from the aerobic wastewater treatment plant are calculated as:

$$PE_{CH_4,effl,y} = GWP_{CH_4} \times MCF_{PJ,effl,y} \times \sum_{i=1}^{365} COD_{PJ,effl,i} \times B_0 \quad (19)$$

Where:

$PE_{CH_4,effl,y}$ = Methane emissions due to the presence of degradable organic carbon in the effluent from the aerobic wastewater treatment plant in year y (tCO₂e/year)

GWP_{CH_4} = Global Warming Potential of methane valid for the commitment period (tCO₂e/tCH₄)

$MCF_{PJ,effl,y}$ = Average methane conversion factor in year y, representing the fraction of organic load in the effluent that is degraded to CH₄ in year y. The factor is based on the type of treatment and discharge pathway of the effluent of the aerobic wastewater treatment plant (fraction)

B_0 = Maximum methane producing capacity of wastewater treated in the year y, expressing the maximum amount of CH₄ that can be produced from a given quantity of chemical oxygen demand (tCH₄/tCOD)

$COD_{PJ,effl,i}$ = Quantity of chemical oxygen demand in the effluent of the wastewater treatment plant in the project activity in the day i of year y (tCOD)

y = Year of the crediting period

Determination of $MCF_{PJ,effl,y}$

$$MCF_{PJ,effl,y} = f_{PJ,d,y} \times f_{PJ,T,y} \times 0.89 \quad (20)$$

Where:

$MCF_{PJ,effl,y}$ = Average baseline methane conversion factor in year y, representing the fraction of organic load in the effluent that is degraded to CH₄ in year y. The factor is based on the type of treatment and discharge pathway of the effluent of the aerobic wastewater treatment plant (fraction)

$f_{PJ,d,y}$ = Factor expressing the influence of the depth on methane generation in year y

$f_{PJ,T,y}$ = Factor expressing the influence of the temperature on the methane generation in year y

0.89 = Conservativeness factor

As per the methodology, for the purpose of ex ante estimations, IPCC default values of methane conversion factors (MCF) for different treatment types and conditions should be used as per IPCC Guidelines.

As per the equation (20), $MCF_{PJ,effl,y} = f_{PJ,d,y} \times f_{PJ,T,y} \times 0.89$. As per FSR, the effluent channels of the wastewater treatment plant is not more than 1m. As per the page 34 in the methodology, when Depth < 1 m: $f_{PJ,d,y}$ is selected as 0%. So the $MCF_{PJ,effl,y} = 0$; Please refer to the following table and ER spreadsheet for detailed data calculation.

The calculation results of $MCF_{PJ,effl,y}$ is 0 (See the calculation results shown in the following table). Therefore, the IPCC value is actually the same as the calculated value. In order to maintain the integrity of the calculation process, the calculated value is still used this time.

Determination of $f_{PJ,T,y}$

$$f_{PJ,T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{PJ,available,m}}{\sum_{m=1}^{12} Q_{PJ,effl,m} \times W_{PJ,COD,effl,m}} \quad (21)$$

Where:

$f_{PJ,T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year y
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m
$COD_{PJ,available,m}$	=	Quantity of chemical oxygen demand in the effluent from the aerobic wastewater treatment plant available for degradation in month m (tCOD)
$Q_{PJ,effl,m}$	=	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in month m of year y (m ³)
$W_{PJ,COD,effl,m}$	=	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in month m of year y (tCOD/m ³)
m	=	Months of year y of the crediting period

$$\text{With } f_{T,m} = \begin{cases} 0 & \text{if } T_{2,m} < 283K \\ \exp\left(\frac{E \times (T_{2,m} - T_1)}{R \times T_1 \times T_{2,m}}\right) & \text{if } 283K < T_{2,m} < 303K \\ 1 & \text{if } T_{2,m} > 303K \end{cases} \quad (22)$$

Where:

$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m (fraction)
E	=	Activation energy constant (15,175 cal/mol)
T ₁	=	303.16 K (273.16 K + 30 K)
R	=	Ideal gas constant (1.987 cal/K.mol)

$T_{2,m}$ = Average temperature at the project site in month m (K)

m = Months of year y of the crediting period

As indicated in the equation above, the value of $f_{T,m}$ cannot exceed 1 and should be assumed to be zero if the ambient temperature is below 10°C.

$$COD_{PJ,available,m} = Q_{PJ,effl,m} \times w_{PJ,COD,effl,m} + (1 - f_{T,m}) \times COD_{PJ,available,m-1} \quad (23)$$

Where:

$COD_{PJ,available,m}$ = Quantity of chemical oxygen demand available for degradation in the effluent from the aerobic wastewater treatment plant in month m (tCOD)

$Q_{PJ,effl,m}$ = Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in month m of year y (m³)

$w_{PJ,COD,effl,m}$ = Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in month m of year y (tCOD/m³)

$f_{T,m}$ = Factor expressing the influence of the temperature on the methane generation in month m

$COD_{PJ,available,m-1}$ = Quantity of chemical oxygen demand available for degradation in the effluent from the aerobic wastewater treatment plant in month m-1 (tCOD)

m = Months of year y of the crediting period

Methane emissions due to the presence of degradable organic carbon in the effluent are calculated as:

Parameter	Value	Unit	Source
$COD_{PJ,effl,i}$	4.36	tCOD	The parameter is calculated using equation (17) based on parameters $Q_{PJ,effl,i}$, $w_{PJ,COD,effl,i}$
$MCF_{PJ,effl,y}$	0	Fraction	The parameter is calculated using equation (20) based on parameters $f_{PJ,d,y}$ and $f_{PJ,T,y}$.
$f_{PJ,d,y}$	0	Fraction	The effluent from the wastewater treatment plant is discharged through the effluent channel, and the depth of the effluent channel is less than 1 m (The data is from FSR). Therefore, Depth < 1 m: 0%. As per AM00080 version 01, apply the following values for the corresponding average depth: Depth > 5 m: 70% Depth 1 – 5 m: 50%

			Depth < 1 m: 0% Therefore, $f_{PJ,d,y} = 0$.
$f_{PJ,T,y}$	0.4470	Fraction	The parameter is calculated using equation (21) based on parameters $f_{T,m}$, $COD_{PJ,available,m}$, $Q_{PJ,effl,m}$, $W_{PJ,COD,effl,m}$ and m .
$f_{T,m}$	Ex-ante ER spreadsheet	Fraction	The parameter is calculated using equation (9) based on parameters $T_{2,m}$, T_1 , E , R
E	15175	cal/mol	Page 11, AM0080 (version 01)
T_1	303.16	K	Page 11, AM0080 (version 01)
R	1.987	cal/K.mol	Page 11, AM0080 (version 01)
$T_{2,m}$	ER	K	https://m.tianqi.com/qiwen/city-dongyang
$COD_{PJ,available,m}$	See in ex-ante ER spreadsheet	tCOD	The parameter is calculated using equation (23) based on $Q_{PJ,effl,m}$, $W_{PJ,COD,effl,m}$, $f_{T,m}$ and m .
$Q_{PJ,effl,m}$	See in section 5.2	m^3	$Q_{PJ,effl,i}=109,000.00m^3$, $Q_{PJ,effl,m}$ is obtained by multiplying $Q_{PJ,effl,i}$ by the number of days in the corresponding month.
$W_{PJ,COD,effl,m}$	0.000040	tCOD/ m^3	$W_{PJ,COD,effl,i}=W_{PJ,COD,effl,m}=0.000040$ t COD/ m^3
$PE_{CH_4,effl,y}$	0	tCO ₂ e/year	The parameter is calculated using equation (19) based on parameters $COD_{PJ,effl,i}$, GW_{PCH_4} , $MCF_{PJ,effl,y}$ and B_0 . Since $MCF_{PJ,effl,y}=0$, So $PE_{CH_4,effl,y}=0$.

$PE_{CH_4,effl,y}=0$ tCO₂e/year

Please refer to the ex-ante ER spreadsheet for the detailed calculation process and parameters for calculation.

So the methane emissions from treatment of wastewater ($PE_{CH_4,ww,y}$) can be calculated as:

$$PE_{CH_4,ww,y} = PE_{CH_4,wwtp,y} + PE_{CH_4,effl,y} = 0 \text{ tCO}_2\text{e/year} + 0 \text{ tCO}_2\text{e/year} = 0 \text{ tCO}_2\text{e/year}$$

ii). Methane emissions from treatment of sludge in the project activity in year y ($PE_{CH_4,sl,y}$)

Sludge in this project activity is dried under controlled and aerobic conditions, and then disposed to a landfill with methane recovery or used in soil application, corresponding project emissions are considered to be negligible and should not be accounted for. Therefore:

$$PE_{CH_4,sl,y} = 0 \text{ tCO}_2\text{e/year}$$

iii). N₂O emissions from treatment of sludge in the project activity in year y (PE_{N₂O,sl,y})

Nitrous oxide emissions are assumed to be negligible and need not be accounted for if the sludge is:

- Dried under controlled and aerobic conditions, and then disposed to a landfill; or,
- Treated in a new anaerobic digester and the residues from the anaerobic digester are dehydrated, limed, and stored before final disposal in a controlled landfill.

As per FSR of the project activity, sludge generated by the project activity will be dried under controlled and aerobic conditions, with disposal in Landfill Site with methane recovery. Therefore:

$$PE_{N_2O,sl,y} = 0 \text{ tCO}_2\text{e/year}$$

iv). Project emissions associated with electricity consumption in the project activity (PE_{EC,y})

Project emissions from electricity consumption (PEEC) used to run the entire aerobic wastewater treatment plant shall be calculated using Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0). Electricity consumption from each relevant source should be monitored and summed up to EC_y

As per paragraph 16 of Tool 05 (Version 03.0), project emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

$$PE_{EC,y} = \sum j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad (24)$$

Where:

$PE_{EC,y}$	=	Project emissions from electricity consumption in year y (t CO ₂ /yr).
$EC_{PJ,j,y}$	=	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr).
$EF_{EL,j,y}$	=	Emission factor for electricity generation for source j in year y (t CO ₂ /MWh).
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source j in year y.

The electricity consumed by facilities of the geothermal system is sourced from local power grid connected to East China Power Grid (ECPG). Scenario A: Electricity consumption from the grid is applied to the proposed project. For project electricity consumption sources, a default value of 20% is used for TD_{Lj,y}.

Determination of the emission factor for electricity generation (EF_{EL,j,y})

For the project, the actual electricity consumption of the wastewater treatment plant during the operation period is sourced from the local grid company. “Scenario A: electricity consumption from the grid “is consistent with the situation of the project. So “Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the “Tool to calculate the emission factor for an electricity system” ((EF_{EF,j,y})=(EF_{grid,CM,y})(version 07.0) is applied.

For project electricity consumption sources, a default value of 20% is used for $TDL_{j,y}$.

Step 1. Identify the relevant electricity system

According to the Tool, project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity. The Chinese DNA has published a delineation of the project electricity system and connected electricity system. According to the delineation, the project electricity system of the local grid to which the Project activity is connected is ECPG.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

For the operating margin, “Option I: only grid power plants are included in the calculation” was selected.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on the following methods:

- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch Data Analysis OM, or
- (d) Average OM.

Detailed information to carry out a dispatch data analysis is not publicly available; therefore, method (b) and method (c) is not suitable for the project.

As annual data from each power plant on power generation, fuel type and fuel consumption are available, and low-cost/must-run resources constitute 19.54%, which is less than 50% of total grid generation. Therefore, the simple OM method is chosen for the calculation of the OM emission factor $EF_{grid,OM,y}$.

The Simple OM can be calculated using either of the two following data vintages for years(s) y :

(a) (Ex-ante option): If the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

(b) (Ex-post option): If the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring.

Here ex-ante vintage is chosen, and the $EF_{grid,OM,y}$ is fixed during the second crediting period.

Step 4. Calculate the operating margin emission factor according to the selected method.

The Simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. The simple OM may be calculated:

Option A: Based on the net electricity generation and a CO₂ emission factor of each power unit, or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the project activity, the required data for the exercise of Option A is not available and those of Option B can be obtained from official sources, and off-grid power plants are not included in the calculation, therefore, Option B is chosen to calculate the operating margin emission factor:

For Option B, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimpl,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_m EG_y} \quad (25)$$

Where:

$EF_{grid,OMsimpl,y}$ = simply operating margin CO₂ emission factor in year y (tCO₂/MWh)

$FC_{i,y}$ = Amount of fuel type i consumed in the project electricity system in year y (mass or volume unit).

$NCV_{i,y}$ = Net calorific value (energy content) of fuel type i in year y (GJ/mass or volume unit)

$EF_{CO_2,i,y}$ = CO₂ emission factor of fuel type i in year y (tCO₂/GJ)

EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)

i = All fuel types combusted in power sources in the project electricity system in year y

y = The relevant year as per the data vintage chosen in Step 3

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO_2,i,y}$ should be used where available. If no such values are available, IPCC world-wide default values are preferable. In this JPM, the Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistical Yearbook 2016-2018. Emission factors ($EF_{CO_2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

The Simple OM Emission Factor ($EF_{grid,OMsimpl,y}$) of the project is calculated based on the fuel consumption data for electricity generation of the ECPG, not including those of low-operating cost and must-run power plants, such as wind power, hydropower and nuclear etc. These data are obtained from the China Electric Power Yearbook (2016~2018, published annually) and China Energy Statistical Yearbook (2016~2018).

Based on these data, the Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the ECPG is calculated as 0.7921 tCO₂e/MWh.

STEP 5. Calculate the build margin emission factor

In terms of vintages of data, project participants can choose between one of the following two options:

Option 1 For the first crediting period, calculate the build margin emission factor, ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the second crediting period should be used. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2 For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The JPM chooses Option 1, which requires the project participant to calculate the Build Margin Emission Factor $EF_{grid,BM,y}$, ex-ante based on the most recent information available on units already built for sample group m at the time of JPM submission.

According to the “Tool to calculate the emission factor for an electricity system”, the build margin emissions factor ($EF_{grid,BM,y}$) is calculated as the generation-weighted average emission factor (tCO₂e/MWh) of all power units m during the most recent year y for which power generation data is available. The calculation equation is as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (26)$$

Where:

$EF_{grid,BM,y}$ =Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EG_{m,y}$ =Net quantity of electricity generated and delivered to the grid by power unit m in year y (tCO₂/MWh)

$EF_{EL,m,y}$ =CO₂ emission factor of power unit m in year y (tCO₂/MWh)

m =Power units included in the build margin

y =Most recent historical year for which electricity generation data is available

As it is difficult to obtain the detailed data on the power generation, fuel consumption and thermal efficiency of each newly built power unit from public documents. According to “Tool to calculate the emission factor for an electricity system” (version 07.0). The BM emission factor is calculated as follows:

- (1) Using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin.
- (2) Use of capacity additions during last 1 ~ 3 years for estimating the build margin emission factor for grid electricity.
- (3) Use of weights estimated using installed capacity in place of annual electricity generation.

The newly built power plants in the past few years are bundled into “grouped new power plant” according to their construction year, their province and their fuel type. The annual net electricity generation in the year y of each “grouped new power plant” is estimated according to their total capacity and the average utilization hours, as the following equation:

$$EG_{m,y} = CAP_m \times H_{m,y} \quad (27)$$

where:

$EG_{m,y}$	=	Annual net electricity generation the unit m in year y (MWh)
CAP_m	=	Installed capacity of the unit m (MW)
$H_{m,y}$	=	Utilization hour of the unit m in the year y (h), determined according to the average utilization hour of the same type of unit in the same province
y	=	The most recent year for which the generation data is available. For the calculation of BM in 2019, $y = 2017$
m	=	grouped new power plant

Since the newly built power plants in the same province (A), in the same year (t) and using the same fuel type (k) are grouped into “a grouped new power plant”, CAP_m represents the total installed capacity of fuel type k power plants located in the province A and in the year t :

$$CAP_m = CAP_{A,t,k} \quad (28)$$

where:

CAP_m	=	Installed capacity of the unit m (MW), with m representing the specified combination of A , t , and k
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- $CAP_{A,t,k}$ = Total installed capacity of fuel type k power plants located in the province A and in the year t
- A = Provinces covered by the NWPG, namely, Shaanxi Province, Gansu Province, Qinghai Province, Ningxia Autonomous Region, Xinjiang Autonomous Region
- t = Years related to the grouped new power plants, for the 2019 calculation, t represents 2017, 2016, 2015.... Until the aggregated electricity generation of the grouped new power plants reaches 20% of the total electricity generation of the NWPG
- k = Fuel type of the grouped new power plants, including hydro, thermal (coal, gas, oil, waste incineration, other thermal), nuclear, wind, solar and others.

Figure 3 shows the procedure to determine the sample group of power units m .

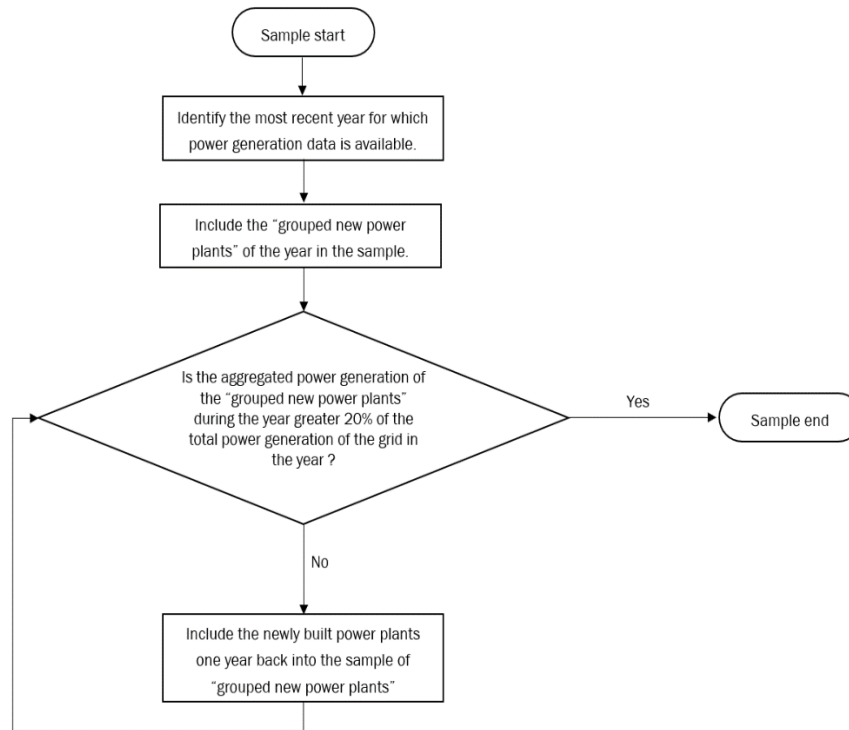


Figure 3 Procedure to determine the sample group of power units m used for the BM emission factor calculation

The emission factors of each fuel type $EF_{EL,m,y}$ are determined according to the Option A2 in the TOOL07, as the following equation:

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}} \quad (29)$$

Where:

$EF_{EL,m,y}$	=	CO ₂ emission factor of power unit m in year y (t CO ₂ /MWh)
$EF_{CO2,m,i,y}$	=	Average CO ₂ emission factor of fuel type i used in power unit m in year y (t CO ₂ /GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit m in year y (ratio)
m	=	All power units serving the grid in year y except low-cost / must-run power units
3.6	=	Conversion factor (GJ/MWh)

Among the fuel types, the emission factors of hydro, nuclear, wind, solar, other thermal and others are 0. Concerning the emission factors of coal, gas, oil and waste incineration, Equation (22) takes the following form due to conservativeness:

$$EF_{best,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{best,y}} \quad (30)$$

Where:

$EF_{best,m,y}$	=	Emission factor of power unit m with the best technology commercially available in year y (t CO ₂ /MWh)
$\eta_{best,y}$	=	Power generation efficiency of the best technology commercially available in year y
m	=	Power units serving the grid with coal, gas, oil or waste incineration in year y

According to the latest and available data at the time of this JPM submission, $EF_{grid,BM,y}$ is calculated to be 0.3870 tCO₂e/MWh.

Step 6. Calculate the combined margin emission factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

- (a) Weighted average CM; or
- (b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option. And the JPM choose option A.

The combined margin emissions factor ($EF_{grid,CM,y}$) is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM} \quad (31)$$

Where:

$EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y, tCO₂/MWh

ω_{OM} = Weighting of operating margin emissions factor

$EF_{grid,BM,y}$ = Building margin CO₂ emission factor in year y, tCO₂/MWh.

ω_{BM} = Weighting of build margin emissions factor.

As per 2019 China regional power grid carbon dioxide baseline emission factor OM calculation instructions published by Ministry of Ecology and Environment of the People's Republic of China, $EF_{grid,OM,y}$ of East China Power Grid (ECPG) is 0.7921 tCO₂/MWh. $EF_{grid,BM,y}$ of East China Power Grid (ECPG) is 0.3870 tCO₂/MWh.

Some of the parameters involved in the above equation are shown in the following table :

Parameter	value	Unit	source
$EC_{PJ,j,y}$	11,595.60	MWh	FSR
$TDL_{j,y}$	20%	ratio	Tool 05 P15
ω_{OM}	0.5	Fraction	Tool 07 P28, ω_{OM} = 0.5 for the first crediting period
ω_{BM}	0.5	Fraction	Tool 07 P28, ω_{BM} = 0.5 for the first crediting period

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM} =$$

$$0.7921 \text{ tCO}_2/\text{MWh} \times 0.5 + 0.3870 \text{ tCO}_2/\text{MWh} \times 0.5 =$$

So $EF_{EF,j,y} = 0.5896 \text{ tCO}_2/\text{MWh}$

$$PE_{EC,y} = 11,595.60 \text{ MWh/year} \times 0.5896 \text{ tCO}_2/\text{MWh} \times (1+20\%) = 8,203.42 \text{ tCO}_2\text{e/year}$$

v). Project emissions from transportation of sludge ($PE_{TR,sl,y}$)

The project emissions resulting from transportation of final sludge produced in the project activity should be calculated as:

$$PE_{TR,sl,y} = \sum_i N_{PJ,i,y} \times D_{PJ,i,y} \times F_{PJ,i,y} \times NCV_{PJ,j,y} \times EF_{PJ,j,y} \quad (32)$$

Where:

$PE_{TR,sl,y}$ = CO₂ emissions associated with transportation of sludge in the project activity in year y (tCO₂/year)

$N_{PJ,i,y}$ = Number of trips (vehicle of type i with similar loading capacity) for transportation of the sludge produced in the project activity in the year y (trips)

$D_{PJ,i,y}$ = Average distance per trip travelled by the transportation vehicle of type i for transportation of sludge generated by the wastewater treatment system in the project activity in the year y (km)

$F_{PJ,i,y}$	=	Specific fuel consumption of the transportation vehicle of type i in the year y (mass or volume units of fuel/km)
$NCV_{PJ,j,y}$	=	Net calorific value of the transportation fuel j in the year y (TJ/mass or volume units)
$EF_{PJ,j,y}$	=	CO ₂ emission factor of the transportation fuel j in the year y (tCO ₂ /TJ)
i	=	Type of vehicle
j	=	Year of the crediting period
y	=	Year of the crediting period

As per the methodology, if the emissions associated with transportation of sludge in the baseline scenario and in the project scenario are found to be comparable (i.e., within +1% range) or emissions in the project scenario are lower, then both can be excluded in the calculation of baseline emissions and project emissions as a simplification. According to Section 4.1 and 4.2 of Chapter 4, the ex-ante calculated values of project emissions and baseline emissions due to sludge transportation are: $BE_{TR,sl,y} = 32.80$ tCO₂e/year; $PE_{TR,sl,y} = 37.06$ tCO₂e/year. Since $PE_{TR,sl,y} > BE_{TR,sl,y}$ and $(PE_{TR,sl,y} / BE_{TR,sl,y} - 1) = 12.99\% > 1\%$, so the emissions associated with transportation of sludge in the baseline scenario and in the project scenario cannot be simplified.

Determination of $N_{PJ,i,y}$

$$N_{PJ,i,y} = \frac{Q_{PJ,sl,y}}{q_{PJ,i}} \quad (33)$$

Where:

$Q_{PJ,sl,y}$	=	Quantity of sludge produced in the project activity in the year y (tonnes)
$q_{PJ,i}$	=	Average vehicular capacity of the transportation vehicle of type i (tonnes/trip)

Some of the parameters involved in the above equation are shown in the following table :

Parameter	value	Unit	source
$N_{PJ,i,y}$	1,825	trips	AM0080 Version 01 Equation 34
$Q_{PJ,sl,y}$	9,125	tonnes	FSR
$q_{PJ,i}$	5	tonnes/trip	On-site measurements available in FSR
$D_{PJ,i,y}$	30	km	On-site measurements available in FSR
$F_{PJ,i,y}$	0.251	Liter/km	Table 1 Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, >4 tonne <8 tonne) https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf
Density of diesel	0.00084	t/L	Page15, https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf

			The fuel for the transport vehicle here is diesel, and the actual monitoring will select the data according to the fuel type
NCV _{PJ,j,y}	0.04333	TJ/tonne	Table 2 Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel) (https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf)
EF _{PJ,j,y}	74.1	tCO ₂ /TJ	Table 2 Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel) (https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf)

$$PE_{TR,sl,y} = (1,825.00 \text{ trips} \times 30 \text{ km} \times 0.251 \text{ Liter/km} \times 0.00084 \text{ t/L} \times 0.04333 \text{ TJ/tonne} \times 74.1 \text{ tCO}_2/\text{TJ}) \text{tCO}_2/\text{year} = 37.06 \text{ tCO}_2/\text{year}$$

So Project emissions are calculated as follows:

$$PE_y = PE_{CH_4,ww,y} + PE_{CH_4,sl,y} + PE_{N_2O,sl,y} + PE_{EC,y} + PE_{FC,y} + PE_{TR,sl,y} =$$

$$0 \text{ tCO}_2/\text{year} + 0 \text{ tCO}_2/\text{year} + 0 \text{ tCO}_2/\text{year} + 8,203.42 \text{ tCO}_2/\text{year} + 37.06 \text{ tCO}_2/\text{year} =$$

$$8,241 \text{ tCO}_2/\text{year}$$

4.3 Leakage

The used technology is not equipment transferred from another activity, So no leakage is considered in this methodology.

$$LE_y = 0$$

4.4 Estimated Net GHG Emission Reductions and Removals

Emission reductions for any given year of the crediting period are obtained by subtracting project emissions and leakage from baseline emissions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$$ER_y = \text{Emissions reductions of the project activity in year } y \text{ (tCO}_2/\text{year)}$$

$$BE_y = \text{Baseline emissions in year } y \text{ (tCO}_2/\text{year)}$$

$$PE_y = \text{Project emissions in year } y \text{ (tCO}_2/\text{year)}$$

$$LE_y = \text{Leakage emissions in year } y \text{ (tCO}_2/\text{year)}$$

As per Section 4.1, Section 4.2 and Section 4.3:

$$BE_y = 72,789 \text{ tCO}_2/\text{year}; PE_y = 8,241 \text{ tCO}_2/\text{year}; LE_y = 0 \text{ tCO}_2/\text{year}$$

Emissions reductions are calculated as:

$$ER_y = 72,789 \text{ tCO}_2\text{e/year} - 8,241 \text{ tCO}_2\text{e/year} - 0 \text{ tCO}_2\text{e/year} = 64,548 \text{ tCO}_2\text{e/year}$$

The emission reductions can be obtained as below:

Table 4-1 The estimation of ER_y

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
25-October-2020-31-December-2020	13,561	1,535	0	12,026
01-January-2021-31-December-2021	72,789	8,241	0	64,548
01-January-2022-31-December-2022	72,789	8,241	0	64,548
01-January-2023-31-December-2023	72,789	8,241	0	64,548
01-January-2024-31-December-2024	72,789	8,241	0	64,548
01-January-2025-31-December-2025	72,789	8,241	0	64,548
01-January-2026-31-December-2026	72,789	8,241	0	64,548
01-January-2027-31-December-2027	72,789	8,241	0	64,548
01-January-2028-31-December-2028	72,789	8,241	0	64,548
01-January-2029-31-December-2029	72,789	8,241	0	64,548
01-January-2030-24-October-2031	59,228	6,706	0	52,522

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	GWP _{CH4}
Data unit	tCO ₂ /tCH ₄
Description	Global Warming Potential of methane valid for the commitment period
Source of data	IPCC Fifth Assessment Report - Climate Change 2014 and VCS Standard Version 4.3
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	Default IPCC value applied.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

Data / Parameter	EF _{EL,j,y} (EF _{grid,CM,y})
Data unit	tCO ₂ /MWh
Description	Combined margin emission factor for the grid in year y
Source of data	Calculate the combined margin emission factor, using the procedures in Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0). The data of EF _{grid,OM,y} and EF _{grid,BM,y} are from Baseline emission factors of China's regional power grid for emission reduction projects in 2019 published by Ministry of Ecology and Environment of the People's Republic of China.
Value applied	0.5896 tCO ₂ /MWh (0.7921 tCO ₂ /MWh*0.5+0.3870 tCO ₂ /MWh*0.5)
Justification of choice of data or description of measurement methods and procedures applied	As per Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0).
Purpose of Data	Calculation of project emissions

Comments	N/A
Data / Parameter	B_0
Data unit	tCH ₄ /tCOD
Description	Maximum methane producing capacity of wastewater, expressing the maximum amount of CH ₄ that can be produced from a given quantity of chemical oxygen demand
Source of data	2006 IPCC Vol5 Ch6 table 6.2 & AM0080 Version 01 p.28
Value applied	0.21
Justification of choice of data or description of measurement methods and procedures applied	Default IPCC value applied. The default IPCC value for B_0 is 0.25 kg CH ₄ /kg COD. However, taking into account the uncertainty of this estimate, project participants should use a value of 0.21 kg CH ₄ /kg COD as a conservative assumption for B_0 .
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

Data / Parameter	COD _{BL,in,x} and COD _{BL,out,x}
Data unit	tCOD/year
Description	Respectively, COD directed to the open lagoons in the baseline scenario in the period x, and COD of the effluent of open lagoons in the baseline scenario in the period x.
Source of data	The data is from the feasibility study report. In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoon. Before the construction of the project, in order to investigate the influent COD and flow, effluent COD and flow, quantity of sludge transportation, the local government conducted a complete monitoring process on the influent COD and flow, effluent COD and flow, quantity of sludge transportation of the anaerobic lagoon in 2018 (From 01-January-2018 to 31-December-2018).
Value applied	COD _{BL,in,x} = 24,918.30 tCOD/year; COD _{BL,out,x} = 613.83 tCOD/year
Justification of choice of data or description of	In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoon. Before the construction

measurement methods and procedures applied	of the project, in order to investigate the influent COD and flow, effluent COD and flow, quantity of sludge transportation, the local government conducted a complete monitoring process on the influent COD and flow, effluent COD and flow, quantity of sludge transportation of the anaerobic lagoon in 2018(From 01-January-2018 to 31-December-2018). The data is from the feasibility study report. Therefore, the data is reasonable.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$f_{BL,d}$
Data unit	fraction
Description	Factor expressing the influence of the depth of the lagoon on methane generation
Source of data	Apply the following values for the corresponding average depth of the open lagoon: Depth > 5 m: 70% Depth 1 – 5 m: 50% Depth < 1 m: 0%
Value applied	70% (Depth > 5 m)
Justification of choice of data or description of measurement methods and procedures applied	As per the baseline survey report, the baseline scenario is one existing anaerobic lagoon system with depth greater than 5m, so the value is taken as 70%.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$Q_{BL,sl,y}$
Data unit	t
Description	Quantity of sludge that would have been produced and treated in the baseline scenario in the year y

Source of data	In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoon. Before the construction of the project, in order to investigate the influent COD and flow, effluent COD and flow, quantity of sludge transportation, the local government conducted a complete monitoring process on the influent COD and flow, effluent COD and flow, quantity of sludge transportation of the anaerobic lagoon in 2018(From 01-January-2018 to 31-December-2018), and the data is from the feasibility study report. And then in order to ensure a conservative computation of baseline emissions, the lowest amongst the monthly values was considered and multiplied by the quantity of wastewater treated to estimate the sludge that would have been produced.
Value applied	4,069.55t
Justification of choice of data or description of measurement methods and procedures applied	The data is investigated by the official department, and the final data is from the feasibility study report
Purpose of Data	Calculation of baseline emissions from treatment of sludge
Comments	-

Data / Parameter	DBL _i
Data unit	km
Description	Average distance per trip, that would have been travelled by the transportation vehicle of type i, for transportation of sludge in the baseline scenario
Source of data	Historical data available on-site, the distance of sludge transportation between open anaerobic lagoon and landfills can be determined by baseline survey report.
Value applied	59.6
Justification of choice of data or description of measurement methods and procedures applied	–
Purpose of Data	Calculation of baseline emissions
Comments	–

Data / Parameter	$F_{BL,i}$
Data unit	Liter/km
Description	Specific fuel consumption of the transportation vehicle of type i
Source of data	As per historical data available on-site in baseline survey report, the fuel used by the local sludge transport vehicle is diesel, the fuel consumption per kilometer is also from the Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, >4 tonne <8 tonne) ²⁹ .
Value applied	0.251
Justification of choice of data or description of measurement methods and procedures applied	–
Purpose of Data	Calculation of baseline emissions
Comments	–

Data / Parameter	$NCV_{BL,j}$ and $EF_{BL,j}$
Data unit	Respectively: TJ/tonne, and tCO_2/TJ
Description	Respectively: net calorific value of the transportation fuel j , and CO_2 emission factor of the transportation fuel j
Source of data	As per historical data available on-site in baseline survey report, the fuel used by the local sludge transport vehicle is diesel, historical data available on-site of $NCV_{BL,j,y}$ was also from Table 2 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel) ³⁰ , historical data available on-site of $EF_{BL,j,y}$ was also from Table 3.2.1 of Chapter III in Volume 2 of IPCC.
Value applied	$NCV_{BL,j,y} = 0.04333$ TJ/tonne; $EF_{BL,j,y} = 74.1$ tCO_2/TJ
Justification of choice of data or description of	–

²⁹ <https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf>

³⁰ <https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf>

measurement methods and procedures applied	
Purpose of Data	Calculation of baseline emissions
Comments	–

Data / Parameter	$Q_{BL,i}$
Data unit	tonnes/trip
Description	Average vehicular capacity of the transportation vehicle of type i
Source of data	5, The local sludge transport vehicle specifications have historical data, which can be easily obtained by the project participants in the baseline survey report.
Value applied	5
Justification of choice of data or description of measurement methods and procedures applied	–
Purpose of Data	Calculation of baseline emissions
Comments	–

5.2 Data and Parameters Monitored

Data / Parameter	$Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$
Data unit	m^3
Description	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m and in day i, respectively
Source of data	Flow operation statistics of wastewater from Dongyang Wastewater Treatment Plant Project
Description of measurement methods and procedures to be applied	$Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$ was measured by the electromagnetic flowmeter converter. The monitoring team of the wastewater treatment plants will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	Monitoring frequency is once every two hours. Parameter monitored continuously and aggregated daily and monthly for calculations

Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual flow will be monitored. $Q_{PJ,ww,i}=109,000.00$, $Q_{PJ,ww,m}$ is obtained by multiplying $Q_{PJ,ww,i}$ by the number of days in the corresponding month.																																							
	<table><tr><th>Month</th><th>Days</th><th>$Q/m^3/m$</th></tr><tr><td>Jan</td><td>31</td><td>3,379,000</td></tr><tr><td>Feb</td><td>28</td><td>3,052,000</td></tr><tr><td>Mar</td><td>31</td><td>3,379,000</td></tr><tr><td>Apr</td><td>30</td><td>3,270,000</td></tr><tr><td>May</td><td>31</td><td>3,379,000</td></tr><tr><td>June</td><td>30</td><td>3,270,000</td></tr><tr><td>July</td><td>31</td><td>3,379,000</td></tr><tr><td>Aug</td><td>31</td><td>3,379,000</td></tr><tr><td>Sept</td><td>30</td><td>3,270,000</td></tr><tr><td>Oct</td><td>31</td><td>3,379,000</td></tr><tr><td>Nov</td><td>30</td><td>3,270,000</td></tr><tr><td>Dec</td><td>31</td><td>3,379,000</td></tr></table>	Month	Days	$Q/m^3/m$	Jan	31	3,379,000	Feb	28	3,052,000	Mar	31	3,379,000	Apr	30	3,270,000	May	31	3,379,000	June	30	3,270,000	July	31	3,379,000	Aug	31	3,379,000	Sept	30	3,270,000	Oct	31	3,379,000	Nov	30	3,270,000	Dec	31	3,379,000
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Nov	30	3,270,000																																						
Dec	31	3,379,000																																						
Monitoring equipment	$Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$ was monitored by the electromagnetic flowmeter converter, it was installed in front of pre-treatment process of the wastewater plant.																																							
QA/QC procedures to be applied	The electromagnetic flowmeter converter, including the frequency of calibration, should be done once three years in accordance with national standards or requirements.																																							
Purpose of data	Calculation of project emissions																																							
Calculation method	-																																							
Comments	The data will be stored for the crediting period + 2 years																																							
Data / Parameter	$W_{PJ,COD,ww,m}$ and $W_{PJ,COD,ww,i}$																																							
Data unit	tCOD/m ³																																							

Description	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m and in day i, respectively
Source of data	COD operation statistics of wastewater from Dongyang Wastewater Treatment Plant Project
Description of measurement methods and procedures to be applied	Influent COD concentration of Dongyang wastewater Treatment plant was measured by one COD _{cr} water quality online automatic monitors. The unit of Influent COD concentration is mg/L, the unit of $W_{PJ,COD,ww,i}$ is t/m ³ , so $W_{PJ,COD,ww,i}$ can be obtained by dividing Influent COD concentration by 1,000,000 through unit conversion, The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	COD monitoring frequency is once every two hours ³¹ , the average daily COD was calculated based on the 24-hourly data, the average monthly COD was calculated based on all the daily data of this month, the average monthly values will be used for calculations.
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual COD concentration will be monitored. $W_{PJ,COD,ww,m} = W_{PJ,COD,ww,i} = 0.000750 \text{ tCOD/m}^3$
Monitoring equipment	COD _{cr} water quality online automatic monitor
QA/QC procedures to be applied	The COD _{cr} water quality online automatic monitor, including the frequency of calibration, should be done once a year in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions
Calculation method	The average monthly values will be used for calculations.
Comments	The data will be stored for the crediting period + 2 years.
Data / Parameter	$T_{2,m}$
Data unit	K

³¹ According to the requirements of methodology, the monitoring and evaluation rate of this parameter is once a day, and the actual monitoring is once every two hours, so the actual monitoring frequency is higher.

Description	Average temperature at the project site in month m																										
Source of data	Data from the website at https://m.tianqi.com/qiwen/city-dongyang/ , the data of this website comes from the China Meteorological Administration, which has conducted by on-site measurements, and the data is the historical monthly average, so the data is reliable.																										
Description of measurement methods and procedures to be applied	The temperature is obtained from the Meteorological Bureau website: https://m.tianqi.com/qiwen/city-dongyang/																										
Frequency of monitoring/recording	Continuously, aggregated in monthly average values																										
Value applied	The temperature is obtained from the Meteorological Bureau website: https://m.tianqi.com/qiwen/city-dongyang/ <table border="1"> <thead> <tr> <th>Month</th><th>Average temperature/K</th></tr> </thead> <tbody> <tr><td>Jan</td><td>280.15</td></tr> <tr><td>Feb</td><td>281.15</td></tr> <tr><td>Mar</td><td>286.15</td></tr> <tr><td>Apr</td><td>292.15</td></tr> <tr><td>May</td><td>297.15</td></tr> <tr><td>June</td><td>299.15</td></tr> <tr><td>July</td><td>304.15</td></tr> <tr><td>Aug</td><td>304.15</td></tr> <tr><td>Sept</td><td>299.15</td></tr> <tr><td>Oct</td><td>293.15</td></tr> <tr><td>Nov</td><td>288.15</td></tr> <tr><td>Dec</td><td>281.15</td></tr> </tbody> </table>	Month	Average temperature/K	Jan	280.15	Feb	281.15	Mar	286.15	Apr	292.15	May	297.15	June	299.15	July	304.15	Aug	304.15	Sept	299.15	Oct	293.15	Nov	288.15	Dec	281.15
Month	Average temperature/K																										
Jan	280.15																										
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July	304.15																										
Aug	304.15																										
Sept	299.15																										
Oct	293.15																										
Nov	288.15																										
Dec	281.15																										
Monitoring equipment	Temperatures are monitored by the local weather bureau Data from the website at https://m.tianqi.com/qiwen/city-dongyang/, the data of this website comes from the China Meteorological Administration, which has conducted on-site measurements, and the data from this website is the historical monthly average. So the data is reliable.																										

QA/QC procedures to be applied	The data source used in the ex-ante calculation is the historical monthly average data of the project site. The website is: https://m.tianqi.com/qiwen/city-dongyang/ The data source of this website is China Meteorological Administration, the China Meteorological Administration is the authority, and the China Meteorological Administration regularly calibrates and maintains the temperature monitoring equipment according to the national specifications.
Purpose of data	Calculation of baseline emissions and project emissions
Calculation method	-
Comments	The data will be stored for the crediting period +2 years.

Data / Parameter	Q _{PJ,effl,i} and Q _{PJ,effl,m}		
Data unit	m ³		
Description	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in day i and month m, respectively		
Source of data	Flow operation statistics of wastewater from Dongyang Wastewater Treatment Plant Project		
Description of measurement methods and procedures to be applied	Q _{PJ,ww,m} and Q _{PJ,ww,i} was measured by the electromagnetic flowmeter converter. The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.		
Frequency of monitoring/recording	Parameter monitored continuously and aggregated daily and monthly for calculations		
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual flow rate will be monitored. Q _{PJ,effl,i} =109,000.00 m ³ , Q _{PJ,effl,m} is obtained by multiplying Q _{PJ,effl,i} by the number of days in the corresponding month.		
	Month	Days	Q _{PJ,effl,m}
	Jan	31	3,379,000
	Feb	28	3,052,000
	Mar	31	3,379,000
	Apr	30	3,270,000

	May	31	3,379,000
	June	30	3,270,000
	July	31	3,379,000
	Aug	31	3,379,000
	Sept	30	3,270,000
	Oct	31	3,379,000
	Nov	30	3,270,000
	Dec	31	3,379,000
Monitoring equipment	Q _{PJ,ww,m} and Q _{PJ,ww,i} was measured by the electromagnetic flowmeter converter, it was installed after tertiary deep treatment process of the wastewater plant..		
QA/QC procedures to be applied	The electromagnetic flowmeter converter, including the frequency of calibration, should be done once three years in accordance with national standards or requirements.		
Purpose of data	Calculation of baseline emissions and project emissions.		
Calculation method	-		
Comments	The data will be stored for the crediting period + 2 years		

Data / Parameter	W _{PJ,COD,effl,i} and W _{PJ,COD,effl,m}
Data unit	t COD/m ³
Description	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in day i and month m, respectively
Source of data	COD operation statistics of wastewater from Dongyang Wastewater Treatment Plant Project
Description of measurement methods and procedures to be applied	Effluent COD concentration of wastewater treatment plant was measured by the one COD _{cr} water quality online automatic monitor. The unit of effluent COD concentration is mg/L, the unit of W _{PJ,COD,effl,i} is t/m ³ , so W _{PJ,COD,effl,m} can be obtained by dividing effluent COD concentration by 1,000,000 through unit conversion,

	The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	COD monitoring frequency is once every two hours ³² , the average daily COD was calculated based on the 24-hourly data, the average monthly COD was calculated based on all the daily data of this month, the average monthly values will be used for calculations.
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual COD concentration will be monitored $W_{PJ,COD,effl,i} = W_{PJ,COD,effl,m} = 0.000040 \text{ t COD/m}^3$
Monitoring equipment	COD _{cr} water quality online automatic monitor
QA/QC procedures to be applied	The COD _{cr} water quality online automatic monitor, including the frequency of calibration, should be done once a year in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$f_{PJ,d,y}$
Data unit	fraction
Description	Factor expressing the influence of the depth on methane generation in year y
Source of data	Apply the following values for the corresponding average depth: Depth > 5 m: 70% Depth 1 – 5 m: 50% Depth < 1 m: 0% The effluent from the wastewater treatment plant is discharged through the effluent channel, and the depth of the effluent channel is less than 1 m (The data is from FSR). Therefore, Depth < 1 m: 0%
Description of measurement methods	

³² According to the requirements of methodology, the monitoring and evaluation rate of this parameter is once a day, and the actual monitoring is once every two hours, so the actual monitoring frequency is higher.

and procedures to be applied	As per FSR, the design depth of the effluent channel of the wastewater treatment plant is not more than 1m, so there is no need for monitoring equipment for the effluent channel, The monitoring team of the wastewater treatment plant will not need to monitor and record this data.
Frequency of monitoring/recording	Conduct monthly measurements of depth and take the annual average value for calculation
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual depth will be monitored. 0% (Depth < 1 m)
Monitoring equipment	The depth of the effluent channel is monitored once a month. As per FSR, the design depth of the effluent channel of the wastewater treatment plant is not more than 1m, so there is no need for monitoring equipment for the effluent channel.
QA/QC procedures to be applied	The design depth of the effluent channels of the wastewater treatment plant is not more than 1m, so there is no need for monitoring equipment for the effluent channel, so the QA/QC procedures is not applicable.
Purpose of data	Calculation of project emissions
Calculation method	Conduct monthly measurements of depth under normal operating conditions and take the annual average value for calculations
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$Q_{PJ,sl,y}$
Data unit	tonnes
Description	Quantity of sludge produced in the project activity in the year y
Source of data	Sludge statistics of wastewater from Dongyang Wastewater Treatment Plant Project
Description of measurement methods and procedures to be applied	The amount of sludge produced by the wastewater treatment plant is weighed by weighbridge. The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	Record the total sludge once a day, and aggregated yearly for calculations.

Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual COD concentration will be monitored. $Q_{PJ,sl,y}=9,125.00 \text{ t}$
Monitoring equipment	Weighbridge, it was installed after the sludge treatment process of the wastewater plant.
QA/QC procedures to be applied	The weighbridge, including the frequency of calibration, should be done once a year in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions
Calculation method	–
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$D_{PJ,i,y}$
Data unit	km
Description	Average distance per trip travelled by the transportation vehicle of type i for transportation of sludge generated by the wastewater treatment system in the project activity in the year y
Source of data	The ex-ante data can be available in the feasibility study report. The local government conducted on-site measurements on the distance between the wastewater treatment plant and the landfill, and the data in the feasibility study report also comes from the on-site measurements of the government. Ex-post data will be monitored.
Description of measurement methods and procedures to be applied	The distance of sludge transportation between the wastewater treatment plants and landfills will be determined by online On-Board Diagnostics installed in sludge transport vehicle. The monitoring team of the wastewater treatment plant will be responsible for exporting and recording the data from online On-Board Diagnostics every year, this data will be recorded in the Data Record of Sludge Transport Vehicle.
Frequency of monitoring/recording	Once a year

Value applied	30 (For ex ante estimation, the data is from Feasibility Study Report of the project. The actual average distance will be monitored)
Monitoring equipment	Determination by online On-Board Diagnostics installed in sludge transport vehicle
QA/QC procedures to be applied	The ex-post distance of sludge transportation between the wastewater treatment plants and landfills will be determined by online On-Board Diagnostics installed in sludge transport vehicle, and it will be cross-check with the Google Maps. Finally, the larger value will be selected because the calculation result is more conservative
Purpose of data	Calculation of project emissions.
Calculation method	–
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$F_{PJ,i}$
Data unit	Liter/km
Description	Specific fuel consumption of the transportation vehicle of type i
Source of data	For ex-ante calculation, the data was obtained from the Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, >4 tonne < 8 tonne). The ex-post data will be monitored.
Description of measurement methods and procedures to be applied	Fuel consumption of the transportation vehicle of one wastewater plant will be measured by the online On-Board Diagnostics installed in sludge transport vehicle. The monitoring team of the wastewater treatment plant will be responsible for exporting and recording the data from the online On-Board Diagnostics installed in sludge transport vehicle, this data will be recorded in the Data Record of Sludge Transport Vehicle .
Frequency of monitoring/recording	Once a year

Value applied	0.251 (For ex ante estimation, the data is from Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, >4 tonne < 8 tonne))
Monitoring equipment	Online On-Board Diagnostics installed in sludge transport vehicle
QA/QC procedures to be applied	The ex-post data will be monitored by Online On-Board Diagnostics installed in sludge transport vehicle, it will be cross-check with the data which comes from the guideline for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, >4 tonne <8 tonne) ³³ . The larger data will be used as an ex-post calculation because it is more conservative.
Purpose of data	Calculation of project emissions.
Calculation method	–
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$NCV_{PJ,j,y}$ and $EF_{PJ,j,y}$
Data unit	Respectively: TJ/mass or volume units, and tCO_2/T
Description	Respectively: net calorific value of the transportation fuel j, and CO_2 emission factor of the transportation fuel j in the year
Source of data	$NCV_{PJ,j,y}$: Table 2 Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel) $EF_{PJ,j,y}$: IPCC Vol2 Ch3 table 3.2.1
Description of measurement methods and procedures to be applied	The Net Calorific Value of the transportation fuel is taken from default value in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises. The CO_2 emission factor of the transportation fuel is taken from IPCC default value.
Frequency of monitoring/recording	Once a year
Value applied	$NCV_{PJ,j,y} = 0.04333$ TJ/tonne; $EF_{PJ,j,y} = 74.1$ tCO_2/TJ (For ex ante estimation, $NCV_{PJ,j,y}$ is from Table 2 Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of

³³ <https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf>

	Transportation Enterprises (Diesel), $EF_{PJ,j,y}$ is from IPCC Vol2 Ch3 table 3.2.1)
Monitoring equipment	–
QA/QC procedures to be applied	No QA/QC procedure will be required for the parameter
Purpose of data	Calculation of project emissions.
Calculation method	–
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$Q_{PJ,i}$
Data unit	tonnes/trip
Description	Average vehicular capacity of the transportation vehicle of type i
Source of data	Dongyang wastewater treatment plant sludge amount statistics
Description of measurement methods and procedures to be applied	Manual records. The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	Once a day
Value applied	5 (For ex ante estimation, the data is from Feasibility Study Report of the project. The actual average vehicular capacity will be monitored)
Monitoring equipment	Manual records
QA/QC procedures to be applied	–
Purpose of data	Calculation of project emissions.
Calculation method	Manual records
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$EC_{PJ,j,y}$
Data unit	MWh

Description	Electricity consumption for the year y in operating the wastewater plant.
Source of data	Electricity meter.
Description of measurement methods and procedures to be applied	Electricity meters will be installed at the wastewater plant. Readings will be done monthly.
Frequency of monitoring/recording	The data is monitored continuously and recorded once a month
Value applied	11,595.60 MWh. For ex ante estimation, the data is from Feasibility Study Report of the project. The actual electricity consumption will be monitored.
Monitoring equipment	Electricity meter installed in the wastewater plant
QA/QC procedures to be applied	Readings will be verified using monthly electricity bills. Calibration of the electricity meters will be done according to national standard by qualified organizations. Readings will be cross-checked using monthly electricity bills of the wastewater plant. For missing data, average monthly electricity consumption in the JPM or average electricity consumption of the previous months whichever is higher will be used. This is the most conservative approach.
Purpose of data	To calculate project emissions
Calculation method	Electricity bill
Comments	N/A

Data / Parameter	$TDL_{j,y}$
Data unit	–
Description	Average technical transmission and distribution losses for providing electricity to source j in year y.
Source of data	As per the Methodological Tool 05 (V3.0) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" In case of scenario B and scenario C, case C.II, assume $TDL_{j,y}=0$ as a simplification. In case of other scenarios (scenario A and

	scenario C, cases C.I and C.III), choose one of the following options: 1. Use annual average value based on the most recent data available within the host country. 2. Use as default values of 20% for: (a) project or leakage electricity consumption sources; (b) baseline electricity consumption sources if the electricity consumption by all project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies. 3. Use as default values of 3% for: (a) baseline electricity consumption sources. (b) project and leakage electricity consumption sources if the electricity consumption by all project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is smaller than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies.
Description of measurement methods and procedures to be applied	Scenario A: Electricity consumption from the grid is applied to the proposed project. For project electricity consumption sources, a default value of 20% is used for $TDL_{j,y}$.
Frequency of monitoring/recording	Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
Value applied	20%
Monitoring equipment	-
QA/QC procedures to be applied	–
Purpose of data	To calculate project emissions
Calculation method	–
Comments	For (a): $TDL_{j,y}$ should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed project activity is connected to. The technical distribution losses should not contain other types of grid losses (e.g. commercial losses/theft). The distribution losses can either be calculated by the project participants or be based on references from utilities, network operators or other official documentation.

5.3 Monitoring Plan

The monitoring plan presented in this PD assures that real, measurable, long term GHG emission reductions can be monitored, recorded and reported. It is a crucial procedure to identify the final VCU of the project. This monitoring plan will be implemented by the project owner during the project operation. The details of the monitoring plan are specified as follows:

Monitoring framework

Figure 5-1 below outlines the organization structure of the monitoring system for the related three parameters. The project owner will be responsible for the whole monitoring work. The VCS monitoring team will be responsible for the monitoring of all the parameters to be monitored. All the data will be reviewed by the project developer and VVB

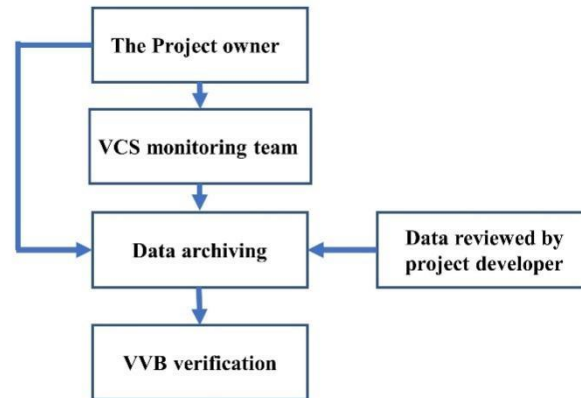
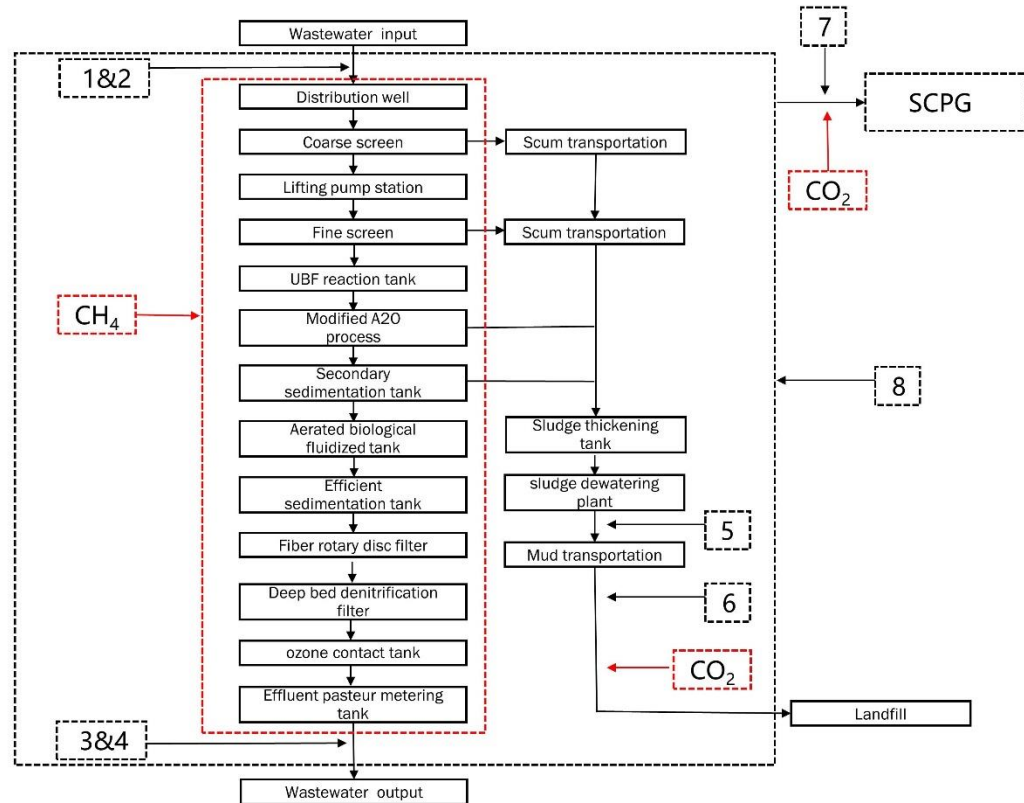


Figure 5-1 Organization Structure of the Monitoring Team

Monitoring equipment and installation

Installation and configuration of meters are shown as Figure 5-2. In order to ensure measurements with a low degree of uncertainty, the data metering equipment and gauges was calibrated and checked by an appropriately qualified third party according to an appropriate national standard. The calibration records will be appropriately maintained and made available for review by VVB.



- 1: Electromagnetic flowmeter converter. Monitoring parameters: $Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$;
- 2: COD_{cr} water quality online automatic monitor. Monitoring parameters: $W_{PJ,COD,ww,m}$ and $W_{PJ,COD,ww,i}$;
- 3: Electromagnetic flowmeter converter. Monitoring parameters: $Q_{PJ,effl,i}$ and $Q_{PJ,effl,m}$;
- 4: COD_{cr} water quality online automatic monitor. Monitoring parameters: $W_{PJ,COD,effl,i}$ and $W_{PJ,COD,effl,m}$;
- 5: Weighbridge. Monitoring parameters: $Q_{PJ,sl,y}$;
- 6: Online On-Board Diagnostics installed in sludge transport vehicle. Monitoring parameters: $D_{PJ,i,y}$ and $F_{PJ,i}$;
- 7: Electricity meters. Monitoring parameters: $EC_{PJ,j,y}$;
- 8: China Meteorological Administration regularly calibrates and maintains the temperature monitoring equipment according to the national specifications. Monitoring parameters: $T_{2,m}$;

Figure 5-2 Installation and Configuration of Meters

Quality control and quality assurance procedures

A quality management system will be established, which ensures the quality and accuracy of the measured data.

Training

For all members involved in the project, necessary trainings will be provided by the project owner. Besides, the project owner should ensure that only skilled employees are allowed to undertake the monitoring work. The training contents should be regard to the general and technical aspects of the project to the extent appropriate, as well as basic understandings of VCS Standard and climate change.

Data management

All data collected as part of monitoring plan should be saved with at least 1 backup copy until the end of the crediting period. After the crediting period ends, the data should be archived electronically on hard disks and be kept at least 2 years after the end of the last crediting period.

Corrective actions

The project will sign an agreement that it will not participate in other environment credits, other GHG programs and has not been rejected by any other GHG Programs. The whole VCS monitoring team will follow recognized standard data evaluation methods to guarantee that the data is reliable and accurate. The quality control and quality assurance procedures include the handling and correction of nonconformities in the implementation of the project or the monitoring plan. In case such nonconformities are observed:

- An analysis of the nonconformity and its causes will be carried out immediately by the project owner, with the help of external experts if necessary.
- A corrective action plan should then be developed to eliminate the non-conformity and its causes to prevent its recurrence.
- Corrective actions are implemented and reported back to the VCS monitoring team.
- Relative information will be included in the monitoring report and reported to VVB during the verification.

If the data record is missing or damaged during the monitoring periods, the following makeup process will be conducted:

-The general principle is that zero value will be used for the missing or damaged data. This is most conservative approach. The monitoring personnel will be trained before the starting of the project operation to ensure that each team member is fully aware of and able to strictly follow this conservative principle. During the monitoring process, the monitoring personnel will be required to strictly abide by the above conservative principle in data recording, i.e., use zero values for all the missing or damaged data.

-If this is due to the working error of the monitoring personnel, further train the person until he or she can perform the job properly. And in the meantime, use zero value for the missing or damaged data;

-If this is due to the inability or attitude of a particular worker in monitoring team, dismiss such worker and re-hire those with proper ability and attitude. And in the meantime, use zero value for the missing or damaged data;

-If some data recorded are significantly higher than the normal range, the monitoring personnel should ask for the reason. If the measurement is high due to the damage of measurement equipment, zero value will be used for that day's data. And need to calibrate and maintain the measuring equipment immediately and avoid this situation in the future.

If the monitoring results are satisfactory in terms of correct reporting, data completeness and correct analysis, the data will be accepted for the monitoring report.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	$Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$			
Data unit	m^3			
Description	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m and in day i, respectively			
Value applied:	Month	Days	$Q_{PJ,ww,i}$ (m^3/d)	$Q_{PJ,ww,m}$ (m^3/m)
	25-October-2020-31-October-2020	7	99,799.3	698,595.1
	01-November-2020-30-November-2020	30	82,643.8	2,479,314.0
	01-December-2020-31-December-2020	31	104,417.7	3,236,948.7
	01-January-2021-31-January-2021	31	87,900.1	2,724,903.1
	01-February-2021-28-February-2021	28	92,892.8	2,600,998.4
	01-March-2021-31-March-2021	31	104,402.9	3,236,489.9
	01-April-2021-30-April-2021	30	104,421.0	3,132,630.0
	01-May-2021-31-May-2021	31	92,902.3	2,879,971.3
	01-June-2021-30-June-2021	30	90,349.5	2,710,485.0

	01-July-2021-31-July-2021	31	104,421.2	3,237,057.2
	01-August-2021-31-August-2021	31	104,439.4	3,237,621.4
	01-September-2021-30-September-2021	30	92,860.6	2,785,818.0
	01-October-2021-31-October-2021	31	104,409.3	3,236,688.3
	01-November-2021-30-November-2021	30	90,350.1	2,710,503.0
	01-December-2021-31-December-2021	31	92,885.2	2,879,441.2
	01-January-2022-31-January-2022	31	104,421.8	3,237,075.8
	01-February-2022-28-February-2022	28	104,455.3	2,924,748.4
	01-March-2022-31-March-2022	31	92,909.1	2,880,182.1
	01-April-2022-30-April-2022	30	90,355.6	2,710,668.0
	01-May-2022-31-May-2022	31	104,399.1	3,236,372.1
	01-June-2022-30-June-2022	30	90,345.4	2,710,362.0
	01-July-2022-31-July-2022	31	104,429.3	3,237,308.3
	01-August-2022-31-August-2022	31	104,425.9	3,237,202.9
	Please refer to the ER spreadsheet for the detailed applied value.			
Comments	The data will be stored for the crediting period + 2 years $Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$ was monitored by the electromagnetic flowmeter converter, it was installed in front of pre-treatment process of the wastewater plant. And it can monitor the influent flow continuously and record it per hour. All the hourly influent flow data were exported by the monitoring team to form the daily and monthly record at the beginning of the next month. The average daily influent flow was calculated based on the 24-hourly data. The average monthly influent flow was calculated based on all the daily data of this month. The manufacturer of the electromagnetic flowmeter converter is Shanghai Foxboro Co., Ltd, it was calibrated by an officially accredited entity (Zhejiang Institute of Metrology) in compliance with JJG1033-2007" Verification Regulation of electromagnetic flowmeter converter" in China. The measure range of electromagnetic flowmeter converter is 0.1~10,000 m³/h, and the serial No., model, accuracy, the			

	calibration date and validity date of the electromagnetic flowmeter converter are shown in the following table:				
	Type	Accuracy	Series number	Calibration date	Validity
	FOXBORO IMT25	0.1m ³ /h	20201012	18-October-2020 17-October-2021	17-October-2021 16-October-2022

Data / Parameter	Q _{PJ,effl,i} and Q _{PJ,effl,m}			
Data unit	m ³			
Description	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in day i and month m, respectively.			
Value applied:	Month	Days	Q _{PJ,effl,i} (m ³ /d)	Q _{PJ,effl,m} (m ³ /m)
	25-October-2020-31-October-2020	7	98,862.2	692,035.4
	01-November-2020-30-November-2020	30	81,813.3	2,454,399.0
	01-December-2020-31-December-2020	31	103,401.9	3,205,458.9
	01-January-2021-31-January-2021	31	87,058.7	2,698,819.7
	01-February-2021-28-February-2021	28	91,958.4	2,574,835.2
	01-March-2021-31-March-2021	31	103,355.0	3,204,005.0
	01-April-2021-30-April-2021	30	103,386.4	3,101,592.0
	01-May-2021-31-May-2021	31	91,991.9	2,851,748.9
	01-June-2021-30-June-2021	30	89,454.6	2,683,638.0
	01-July-2021-31-July-2021	31	103,400.5	3,205,415.5
	01-August-2021-31-August-2021	31	103,383.7	3,204,894.7
	01-September-2021-30-September-2021	30	91,981.5	2,759,445.0
	01-October-2021-31-October-2021	31	103,373.5	3,204,578.5
	01-November-2021-30-November-2021	30	89,433.4	2,683,002.0
	01-December-2021-31-December-2021	31	91,964.6	2,850,902.6
	01-January-2022-31-January-2022	31	103,366.7	3,204,367.7

01-February-2022-28-February-2022	28	103,377.8	2,894,578.4
01-March-2022-31-March-2022	31	91,975.5	2,851,240.5
01-April-2022-30-April-2022	30	89,449.0	2,683,470.0
01-May-2022-31-May-2022	31	103,346.1	3,203,729.1
01-June-2022-30-June-2022	30	89,426.2	2,682,786.0
01-July-2022-31-July-2022	31	103,359.2	3,204,135.2
01-August-2022-31-August-2022	31	103,404.7	3,205,545.7

Please refer to the ER spreadsheet for the detailed applied value.

Comments

The data will be stored for the crediting period + 2 years

$Q_{PJ,effl,i}$ and $Q_{PJ,effl,m}$ was monitored by the electromagnetic flowmeter converter, it was installed at the effluent channel of the wastewater plant. And it can monitor the effluent flow continuously and record it per hour. All the hourly effluent flow data were exported by the monitoring team to form the daily and monthly record at the beginning of the next month. The average daily effluent flow was calculated based on the 24-hourly data. The average monthly influent flow was calculated based on all the daily data of this month.

The manufacturer of the electromagnetic flowmeter converter is Siemens (China) Co., Ltd, it was calibrated by an officially accredited entity (Zhejiang Institute of Metrology) in compliance with JJG1033-2007" Verification Regulation of electromagnetic flowmeter converter" in China.

The measure range of electromagnetic flowmeter converter is 0.1~10,000m³/h, and the serial No., model, accuracy, the calibration date and validity date of the electromagnetic flowmeter converter are shown in the following table:

Type	Accuracy	Series number	Calibration date	Validity
FM MAG 6000 SV	0.1m ³ /h	20201013	18-October-2020	17-October-2021
			17-October-2021	16-October-2022

Data / Parameter

$W_{PJ,COD,ww,m}$ and $W_{PJ,COD,ww,i}$

Data unit

tCOD/m³

Description	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m and in day i, respectively			
Value applied:	Month	Days	W _{PJ,COD,ww,m} (tCOD/m ³)	W _{PJ,COD,ww,i} (tCOD/m ³)
	25-October-2020-31-October-2020	7	0.00070922	0.00070922
	01-November-2020-30-November-2020	30	0.00070881	0.00070881
	01-December-2020-31-December-2020	31	0.00070877	0.00070877
	01-January-2021-31-January-2021	31	0.00070868	0.00070868
	01-February-2021-28-February-2021	28	0.00070876	0.00070876
	01-March-2021-31-March-2021	31	0.00070893	0.00070893
	01-April-2021-30-April-2021	30	0.00070873	0.00070873
	01-May-2021-31-May-2021	31	0.00070861	0.00070861
	01-June-2021-30-June-2021	30	0.00068873	0.00068873
	01-July-2021-31-July-2021	31	0.00068864	0.00068864
	01-August-2021-31-August-2021	31	0.00068868	0.00068868
	01-September-2021-30-September-2021	30	0.00070877	0.00070877
	01-October-2021-31-October-2021	31	0.00070888	0.00070888
	01-November-2021-30-November-2021	30	0.00070901	0.00070901
	01-December-2021-31-December-2021	31	0.00070889	0.00070889
	01-January-2022-31-January-2022	31	0.00070870	0.00070870
	01-February-2022-28-February-2022	28	0.00070905	0.00070905
	01-March-2022-31-March-2022	31	0.00070882	0.00070882
	01-April-2022-30-April-2022	30	0.00070890	0.00070890
	01-May-2022-31-May-2022	31	0.00070889	0.00070889
	01-June-2022-30-June-2022	30	0.00068894	0.00068894
	01-July-2022-31-July-2022	31	0.00068860	0.00068860
	01-August-2022-31-August-2022	31	0.00068881	0.00068881
	Please refer to the ER spreadsheet for the detailed applied value.			

Comments

The data will be stored for the crediting period + 2 years

$W_{PJ,COD,ww,i}$ and $W_{PJ,COD,ww,m}$ was monitored by the COD_{cr} water quality online automatic monitor, it was installed in front of pre-treatment process of the wastewater plant.

The COD water quality online automatic monitor COD every two hours. All the COD data were exported by the monitoring team to form the daily and monthly record aggregated at the beginning of the next month. The average daily COD concentration was calculated based on the 24-hourly data. The average monthly COD concentration was calculated based on all the daily data of this month.

The manufacturer of the COD_{cr} water quality online automatic monitor is Shimadzu (China) Co., Ltd., it was calibrated by an officially accredited entity (Zhejiang Institute of Metrology) in compliance with JJG1012-2019" Verification Regulation of COD_{cr} water quality online automatic monitor" in China.

The measure range of COD water quality online automatic monitors is 0~20,000 mg/L, and the serial No., model, accuracy, the calibration date and validity date of the flowmeter are shown in the following table:

Type	Accuracy	Series number	Calibration date	Validity
TOC4200	0.01 mg/L	20201014	19-October-2020	18-October-2021
			18-October-2021	17-October-2022

Data / Parameter	$T_{2,m}$																				
Data unit	K																				
Description	Average temperature at the project site in month m																				
Value applied:	<table border="1"> <thead> <tr> <th>Month</th><th>$T_{2,m}$ (K)</th></tr> </thead> <tbody> <tr> <td>25-October-2020-31-October-2020</td><td>292.15</td></tr> <tr> <td>01-November-2020-30-November-2020</td><td>288.65</td></tr> <tr> <td>01-December-2020-31-December-2020</td><td>281.15</td></tr> <tr> <td>01-January-2021-31-January-2021</td><td>280.65</td></tr> <tr> <td>01-February-2021-28-February-2021</td><td>285.15</td></tr> <tr> <td>01-March-2021-31-March-2021</td><td>287.15</td></tr> <tr> <td>01-April-2021-30-April-2021</td><td>290.65</td></tr> <tr> <td>01-May-2021-31-May-2021</td><td>297.15</td></tr> <tr> <td>01-June-2021-30-June-2021</td><td>299.65</td></tr> </tbody> </table>	Month	$T_{2,m}$ (K)	25-October-2020-31-October-2020	292.15	01-November-2020-30-November-2020	288.65	01-December-2020-31-December-2020	281.15	01-January-2021-31-January-2021	280.65	01-February-2021-28-February-2021	285.15	01-March-2021-31-March-2021	287.15	01-April-2021-30-April-2021	290.65	01-May-2021-31-May-2021	297.15	01-June-2021-30-June-2021	299.65
Month	$T_{2,m}$ (K)																				
25-October-2020-31-October-2020	292.15																				
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01-December-2020-31-December-2020	281.15																				
01-January-2021-31-January-2021	280.65																				
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01-March-2021-31-March-2021	287.15																				
01-April-2021-30-April-2021	290.65																				
01-May-2021-31-May-2021	297.15																				
01-June-2021-30-June-2021	299.65																				

	01-July-2021-31-July-2021	303.15
	01-August-2021-31-August-2021	302.15
	01-September-2021-30-September-2021	301.15
	01-October-2021-31-October-2021	293.65
	01-November-2021-30-November-2021	286.15
	01-December-2021-31-December-2021	282.15
	01-January-2022-31-January-2022	279.65
	01-February-2022-28-February-2022	278.65
	01-March-2022-31-March-2022	288.15
	01-April-2022-30-April-2022	291.65
	01-May-2022-31-May-2022	293.65
	01-June-2022-30-June-2022	299.65
	01-July-2022-31-July-2022	306.15
	01-August-2022-31-August-2022	305.65
	Please refer to the ER spreadsheet for the detailed applied value, and the data comes from this website: https://www.tianqi24.com/dongyang/history202010.html	
Comments	The data will be stored for the crediting period + 2 years The data source of this website is China Meteorological Administration, the China Meteorological Administration is the authority, and the China Meteorological Administration regularly calibrates and maintains the temperature monitoring equipment according to the national specifications. The website of data monitoring source is: https://www.tianqi24.com/dongyang/history202010.html	

Data / Parameter	$W_{PJ,COD,effl,i}$ and $W_{PJ,COD,effl,m}$			
Data unit	t COD/m ³			
Description	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in day i and month m, respectively			
Value applied:	Month	Days	$W_{PJ,COD,effl,i}$ (tCOD/m ³)	$W_{PJ,COD,effl,m}$ (tCOD/m ³)
	25-October-2020-31-October-2020	7	0.00001813	0.00001813
	01-November-2020-30-November-2020	30	0.00001851	0.00001851
	01-December-2020-31-December-2020	31	0.00001823	0.00001823
	01-January-2021-31-January-2021	31	0.00001851	0.00001851

	01-February-2021-28-February-2021	28	0.00001862	0.00001862
	01-March-2021-31-March-2021	31	0.00001841	0.00001841
	01-April-2021-30-April-2021	30	0.00001865	0.00001865
	01-May-2021-31-May-2021	31	0.00001831	0.00001831
	01-June-2021-30-June-2021	30	0.00001478	0.00001478
	01-July-2021-31-July-2021	31	0.00001495	0.00001495
	01-August-2021-31-August-2021	31	0.00001457	0.00001457
	01-September-2021-30-September-2021	30	0.00001833	0.00001833
	01-October-2021-31-October-2021	31	0.00001839	0.00001839
	01-November-2021-30-November-2021	30	0.00001807	0.00001807
	01-December-2021-31-December-2021	31	0.00001862	0.00001862
	01-January-2022-31-January-2022	31	0.00001841	0.00001841
	01-February-2022-28-February-2022	28	0.00001832	0.00001832
	01-March-2022-31-March-2022	31	0.00001843	0.00001843
	01-April-2022-30-April-2022	30	0.00001798	0.00001798
	01-May-2022-31-May-2022	31	0.00001869	0.00001869
	01-June-2022-30-June-2022	30	0.00001473	0.00001473
	01-July-2022-31-July-2022	31	0.00001509	0.00001509
	01-August-2022-31-August-2022	31	0.00001473	0.00001473
	Please refer to the ER spreadsheet for the detailed applied value.			
Comments	The data will be stored for the crediting period + 2 years $W_{PJ,COD,eff,i}$ and $W_{PJ,COD,eff,m}$ was monitored by the COD_{cr} water quality online automatic monitor, it was installed at the end of the tertiary deep treatment process. The COD water quality online automatic monitor COD every two hours. All the COD data were exported by the monitoring team to form the daily and monthly record aggregated at the beginning of the next month. The average daily COD concentration was calculated based on the 24-hourly data. The average monthly COD concentration was calculated based on all the daily data of this month.			

The measure range of COD_{cr} water quality online automatic monitor is 0~20,000mg/L, and the manufacturer of the COD_{cr} water quality online automatic monitor is Shimadzu (China) Co., Ltd., it was calibrated by an officially accredited entity (Zhejiang Institute of Metrology) in compliance with JG1012-2019" Verification Regulation of COD_{cr} water quality online automatic monitor" in China.

The serial No., model, accuracy, the calibration date and validity date of the COD_{cr} water quality online automatic monitor are shown in the following table:

Type	Accuracy	Series number	Calibration date	Validity
TOC4200	0.01 mg/L	20201015	19-October-2020	18-October-2021
			18-October-2021	17-October-2022

Data / Parameter	$f_{PJ,d,y}$
Data unit	fraction
Description	Factor expressing the influence of the depth on methane generation in year y
Value applied:	0% (Depth < 1 m)
Comments	The data will be stored for the crediting period + 2 years. The effluent channels of the one wastewater treatment plant is not more than 1m, so there is no need for monitoring equipment for the effluent channels, In the current monitoring period, the depth of the effluent channels does not exceed 1m.

Data / Parameter	$Q_{PJ,sl,y}$
Data unit	tonnes
Description	Quantity of sludge produced in the project activity in the year y

Value applied:	Month	Q _{PJ,sl,y} (t)									
	25-October-2020-31-October-2020	207.56									
	01-November-2020-30-November-2020	1002.98									
	01-December-2020-31-December-2020	987.36									
	01-January-2021-31-January-2021	896.76									
	01-February-2021-28-February-2021	884.94									
	01-March-2021-31-March-2021	955.66									
	01-April-2021-30-April-2021	930.48									
	01-May-2021-31-May-2021	884.66									
	01-June-2021-30-June-2021	949.18									
	01-July-2021-31-July-2021	1052.16									
	01-August-2021-31-August-2021	915.56									
	01-September-2021-30-September-2021	841.78									
	01-October-2021-31-October-2021	953.26									
	01-November-2021-30-November-2021	921.38									
	01-December-2021-31-December-2021	904.36									
	01-January-2022-31-January-2022	867.96									
	01-February-2022-28-February-2022	836.44									
	01-March-2022-31-March-2022	778.26									
	01-April-2022-30-April-2022	905.78									
	01-May-2022-31-May-2022	981.56									
	01-June-2022-30-June-2022	905.88									
	01-July-2022-31-July-2022	985.26									
	01-August-2022-31-August-2022	973.76									
	Please refer to the ER spreadsheet for the detailed applied value.										
Comments	The data will be stored for the crediting period + 2 years										
	Q _{PJ,sl,y} was monitored by one weighbridge, it was installed at the end of the sludge treatment process, then the sludge is transported to the landfill. The weighbridge continuously weighs the dried sludge produced by the wastewater plants every day, and then transports it to the landfill for landfill treatment. The monitoring team records the total quality of sludge produced every day to form a monthly record at the beginning of the next month, and calculates the annual total sludge weight according to the monthly sludge data.										
	The measure range of weighbridge is 0~100t, and the manufacturer of the weighbridge is Shuoheng Industry (Shanghai) Co., Ltd., it was calibrated by an officially accredited entity (Zhejiang Institute of Metrology) in compliance with JJG 539-2016" Verification Regulation of weighbridge" in China.										
	The serial No., model, accuracy, the calibration date and validity date of the flowmeter are shown in the following table:										
	<table><tr><th>Type</th><th>Accuracy</th><th>Series number</th><th>Calibration date</th><th>Validity</th></tr><tr><td>SCS-100t/20kg</td><td>20kg</td><td>20201008</td><td>15-October-2020</td><td>14-October-2021</td></tr></table>		Type	Accuracy	Series number	Calibration date	Validity	SCS-100t/20kg	20kg	20201008	15-October-2020
Type	Accuracy	Series number	Calibration date	Validity							
SCS-100t/20kg	20kg	20201008	15-October-2020	14-October-2021							

				14-October-2021	13-October-2022
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Data / Parameter	$D_{PJ,i,y}$
Data unit	Km
Description	Average distance per trip travelled by the transportation vehicle of type i for transportation of sludge generated by the wastewater treatment system in the project activity in the year y
Value applied:	$D_{PJ,i,y}$—Dongyang Wastewater Treatment Plant The distance of sludge transportation between the wastewater treatment plants and landfills was determined by online On-Board Diagnostics installed in sludge transport vehicle, and it was cross-check with the Screenshot of Google Maps. Finally, the larger value was selected because the calculation result is more conservative. The data monitored by the On-Board Diagnostics installed in sludge transport vehicle is 15.4 km, 15.3 km and 15.2km, and the data Determined by the Google Maps is 15.1 km. Therefore, 15.4 km, 15.3 km and 15.2km were selected for calculation from 2020 to 2022. So one trip distance is can be calculated as: 25-October-2020-31-December-2020: 15.4 km*2=30.8 km 01-January-2021-31-December-2021 15.3 km*2=30.6 km 01-January-2022-31-August-2021 15.2 km*2=30.4km
Comments	The data will be stored for the crediting period + 2 years. The distance of sludge transportation between the wastewater treatment plant and landfill was determined by online On-Board Diagnostics installed in sludge transport vehicles, and it was cross-check with the Screenshot of Google Maps, the larger value

	was selected because the calculation result is more conservative. This data is monitored once a year.
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Data / Parameter	$F_{PJ,i}$
Data unit	Liter/km
Description	Specific fuel consumption of the transportation vehicle of type i
Value applied:	0.251
Comments	The data will be stored for the crediting period + 2 years. In this monitoring period, the fuel used by transport vehicles is diesel, fuel consumption of the transportation vehicle of wastewater plant was measured by the online On-Board Diagnostics installed in sludge transport vehicle, the monitoring data of this parameter are all lower than 0.251 Liter/km, and the detailed monitoring results can be found in the Data Record of Sludge Transport Vehicle. 25-October-2020-31-December-2020: $F_{PJ,i}=0.201$ Liter/km 01- January-2021-31-December-2021 $F_{PJ,i}=0.203$ Liter/km 01- January-2022-31-August-2021 $F_{PJ,i}= 0.198$ Liter/km According to the Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel >4 tonne <8 tonne), the default value of this parameter is 0.251 Liter/km. Therefore, the data in this monitoring period are all taken as 0.251 for calculation, so the results are more conservative.

Data / Parameter	$NCV_{PJ,j,y}$ and $EF_{PJ,j,y}$
Data unit	Respectively: TJ/mass or volume units, and tCO_2/T

Description	Respectively: net calorific value of the transportation fuel j , and CO_2 emission factor of the transportation fuel j in the year
Value applied:	$\text{NCV}_{\text{PJ},j,y} = 0.04333 \text{ TJ/tonne}$; $\text{EF}_{\text{PJ},j,y} = 74.1 \text{ tCO}_2/\text{TJ}$ ($\text{NCV}_{\text{PJ},j,y}$ is from Table 2 Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel), $\text{EF}_{\text{PJ},j,y}$ is from IPCC Vol2 Ch3 table 3.2.1, this data in this guidelines was not updated throughout the monitoring period)
Comments	The data will be stored for the crediting period + 2 years. In this monitoring period, the fuel used by transport vehicles is diesel, according to the methodology, this data needs on-site measurements, but at present, due to the technical conditions, this data cannot be monitored, so the official default value will be used, this data in this guideline was not updated throughout the monitoring period.

Data / Parameter	$q_{\text{PJ},i}$
Data unit	tonnes/trip
Description	Average vehicular capacity of the transportation vehicle of type i
Value applied:	5
Comments	The data will be stored for the crediting period + 2 years. During the actual monitoring process, the types of sludge transportation vehicles was easily obtained, and the data was recorded in the Sludge statistics of wastewater from Dongyang Wastewater Treatment Plant Project.

Data / Parameter	$\text{EC}_{\text{PJ},j,y}$
Data unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr).
Value applied:	$\text{EC}_{\text{PJ},j,y}$ —Dongyang Wastewater Treatment Plant

	Period	Electricity consumption/MWh
	25-October-2020-31-October-2020	466.41022
	01-November-2020-30-November-2020	728.97031
	01-December-2020-31-December-2020	834.72764
	01-January-2021-31-January-2021	886.61512
	01-February-2021-28-February-2021	668.78042
	01-March-2021-31-March-2021	765.80565
	01-April-2021-30-April-2021	733.63587
	01-May-2021-31-May-2021	954.28589
	01-June-2021-30-June-2021	945.59028
	01-July-2021-31-July-2021	935.92541
	01-August-2021-31-August-2021	898.27535
	01-September-2021-30-September-2021	888.93046
	01-October-2021-31-October-2021	984.28532
	01-November-2021-30-November-2021	844.66522
	01-December-2021-31-December-2021	976.24544

	01-January-2022-31-January-2022	975.27644
	01-February-2022-28-February-2022	735.65856
	01-March-2022-31-March-2022	842.38573
	01-April-2022-30-April-2022	806.99828
	01-May-2022-31-May-2022	789.71324
	01-June-2022-30-June-2022	758.78042
	01-July-2022-31-July-2022	865.82334
	01-August-2022-31-August-2022	763.17842
Comments	The data will be stored for the crediting period + 2 years. The project owner signed a power purchase agreement with the local grid company, and the reading of the meter is recorded on time every month. At the end of each month, all electricity bills are settled by the project owner and the local grid company, and all electricity consumption data are confirmed by the electricity bill provided by the grid company. The electricity bill includes the power supply period, meter information (location, accuracy, maximum range), electricity consumption, and electricity costs. According to the monitoring plan, there is no missing data in this monitoring period. The manufacturer of the electricity meters is Wasion Group Limited, the model and accuracy are DTSK341-Z and 0.5S respectively, and it was calibrated by an officially accredited entity (Zhejiang Institute of Metrology) in compliance with JJG 596-2012" Electrical Meters for Measuring Alternating-current Electrical Energy" in China. The serial No., the calibration date and validity date of the electricity meters are shown in the following table:	

Series number	Calibration date	Validity
00010010834475	14-October-2020	13-October-2025

Data / Parameter	$TDL_{j,y}$
Data unit	–
Description	Average technical transmission and distribution losses for providing electricity to source j in year y.
Value applied:	20%
Comments	The value of this parameter sourced from Tool 05 “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) and this tool is not updated in this monitoring period.

6.2 Baseline Emissions

In this section, the detailed calculation formula and its description are also described in section 4.1

i). Calculation of baseline emissions from treatment of wastewater ($BE_{CH_4,ww,y}$):

The parameters and calculations are listed in the following table:

Parameter	value	Unit	source
GWP_{CH_4}	28	tCO_2/tCH_4	IPCC Fifth Assessment Report - Climate Change 2014
B_0	0.21	$tCH_4/tCOD$	2006 IPCC Vol5 Ch6 table 6.2 & AM0080 v.1 p.28
AD_{BL} (25-October-2020-31-December-2020)	0.9742	Fraction	AM0080 v.1 Equation 6
AD_{BL} (01-January-2021-31-December-2021)	0.9754	Fraction	AM0080 v.1 Equation 6
AD_{BL} (01-January-2022-31-August-2022)	0.9759	Fraction	AM0080 v.1 Equation 6
$MCF_{BL,ww,y}$ (25-October-2020-31-December-2020)	0.1079	Fraction	AM0080 v.1 Equation 7

MCF _{BL,ww,y} (01-January-2021-31-December-2021)	0.4804	Fraction	AM0080 v.1 Equation 7
MCF _{BL,ww,y} (01-January-2022-31-August-2022)	0.5704	Fraction	AM0080 v.1 Equation 7
f _{BL,d,y}	70%	Fraction	AM0080 v.1 p.29 (Depth > 5 m)
f _{BL,T,y} (25-October-2020-31-December-2020)	0.1732	Fraction	AM0080 v.1 Equation 8
f _{BL,T,y} (01-January-2021-31-December-2021)	0.7711	Fraction	AM0080 v.1 Equation 8
f _{BL,T,y} (01-January-2022-31-August-2022)	0.9156	Fraction	AM0080 v.1 Equation 8
E	15,175	cal/mol	AM0080 v.1
T1	303.16	K	AM0080 v.1
R	1.987	cal/K.mol	AM0080 v.1

Monitoring period	Influent COD concentration (mg/L)	Effluent COD concentration (mg/L)	WPJ,COD,ww,m (tCOD/m ³)	T _{2,m} (K)
25-October-2020-31-October-2020	709.22	18.13	0.00070922	292.15
01-November-2020-30-November-2020	708.81	18.51	0.00070881	288.65
01-December-2020-31-December-2020	708.77	18.23	0.00070877	281.15
01-January-2021-31-January-2021	708.68	18.51	0.00070868	280.65
01-February-2021-28-February-2021	708.76	18.62	0.00070876	285.15
01-March-2021-31-March-2021	708.93	18.41	0.00070893	287.15
01-April-2021-30-April-2021	708.73	18.65	0.00070873	290.65
01-May-2021-31-May-2021	708.61	18.31	0.00070861	297.15
01-June-2021-30-June-2021	688.73	14.78	0.00068873	299.65
01-July-2021-31-July-2021	688.64	14.95	0.00068864	303.15
01-August-2021-31-August-2021	688.68	14.57	0.00068868	302.15
01-September-2021-30-September-2021	708.77	18.33	0.00070877	301.15
01-October-2021-31-October-2021	708.88	18.39	0.00070888	293.65
01-November-2021-30-November-2021	709.01	18.07	0.00070901	286.15
01-December-2021-31-December-2021	708.89	18.62	0.00070889	282.15
01-January-2022-31-January-2022	708.70	18.41	0.00070870	279.65

01-February-2022-28-February-2022	709.05	18.32	0.00070905	278.65
01-March-2022-31-March-2022	708.82	18.43	0.00070882	288.15
01-April-2022-30-April-2022	708.90	17.98	0.00070890	291.65
01-May-2022-31-May-2022	708.89	18.69	0.00070889	293.65
01-June-2022-30-June-2022	688.94	14.73	0.00068894	299.65
01-July-2022-31-July-2022	688.60	15.09	0.00068860	306.15
01-August-2022-31-August-2022	688.81	14.73	0.00068881	305.65

Monitoring period	Influent flow (m ³ /d)	Q _{PJ,ww,m} (m ³)	COD _{PJ,ww,y} (tCOD/year)	COD _{BL,ww,y} (tCOD/year)
25-October-2020-31-October-2020	99799.3	698595.3	495.46	482.66
01-November-2020-30-November-2020	82643.8	2479314.9	1757.37	1711.98
01-December-2020-31-December-2020	104417.7	3236948.9	2294.26	2235.00
01-January-2021-31-January-2021	87900.1	2724904.5	1931.08	1883.51
01-February-2021-28-February-2021	92892.8	2600997.0	1843.47	1798.06
01-March-2021-31-March-2021	104402.9	3236490.7	2294.44	2237.92
01-April-2021-30-April-2021	104421.0	3132628.6	2220.19	2165.50
01-May-2021-31-May-2021	92902.3	2879970.3	2040.77	1990.50
01-June-2021-30-June-2021	90349.5	2710483.9	1866.79	1820.80
01-July-2021-31-July-2021	104421.2	3237058.2	2229.16	2174.25
01-August-2021-31-August-2021	104439.4	3237622.1	2229.69	2174.76
01-September-2021-30-September-2021	92860.6	2414376.1	1711.23	1669.08
01-October-2021-31-October-2021	104409.3	3236688.1	2294.44	2237.91
01-November-2021-30-November-2021	90350.1	2710503.2	1921.77	1874.43
01-December-2021-31-December-2021	92885.2	2879441.8	2041.22	1990.94
01-January-2022-31-January-2022	104421.8	3237075.2	2294.11	2238.92
01-February-2022-28-February-2022	104455.3	2924747.5	2073.80	2023.90
01-March-2022-31-March-2022	92909.1	2880181.4	2041.54	1992.42
01-April-2022-30-April-2022	90355.6	2710667.4	1921.59	1875.36
01-May-2022-31-May-2022	104399.1	3236372.8	2294.22	2239.02
01-June-2022-30-June-2022	90345.4	2710362.2	1867.29	1822.36
01-July-2022-31-July-2022	104429.3	3237306.9	2229.21	2175.58
01-August-2022-31-August-2022	104425.9	3237201.4	2229.82	2176.17

Monitoring period	COD _{BL,available,m} (tCOD)	f _{t,m} (Fraction)	COD _{BL,out,x} (tCOD)	COD _{BL,in,x} (tCOD)
25-October-2020-31-October-2020	482.66	0.3870	58.25	2295.54
01-November-2020-30-November-2020	2058.60	0.2819	51.65	1975.45
01-December-2020-31-December-2020	4293.59	0.0000	53.13	2040.47
01-January-2021-31-January-2021	6177.10	0.0000	47.33	1854.89
01-February-2021-28-February-2021	6716.89	0.2037	47.21	1843.37

01-March-2021-31-March-2021	7305.99	0.2455	58.96	2294.97
01-April-2021-30-April-2021	7001.03	0.3381	56.68	2220.75
01-May-2021-31-May-2021	4785.41	0.6008	52.39	2040.79
01-June-2021-30-June-2021	3043.64	0.7445	41.14	1918.80
01-July-2021-31-July-2021	2174.25	1.0000	48.12	2229.14
01-August-2021-31-August-2021	2350.35	0.9192	48.33	2228.92
01-September-2021-30-September-2021	2032.83	0.8452	50.65	1975.22
01-October-2021-31-October-2021	2237.91	0.4423	58.25	2295.54
01-November-2021-30-November-2021	3611.76	0.2237	51.65	1975.45
01-December-2021-31-December-2021	5602.69	0.0000	53.13	2040.47
01-January-2022-31-January-2022	7841.61	0.0000	47.33	1854.89
01-February-2022-28-February-2022	9865.51	0.0000	47.21	1843.37
01-March-2022-31-March-2022	9202.04	0.2692	58.96	2294.97
01-April-2022-30-April-2022	7672.45	0.3700	56.68	2220.75
01-May-2022-31-May-2022	6518.23	0.4423	52.39	2040.79
01-June-2022-30-June-2022	3487.99	0.7445	41.14	1918.80
01-July-2022-31-July-2022	2175.58	1.0000	48.12	2229.14
01-August-2022-31-August-2022	2176.17	1.0000	48.33	2228.92

The baseline emissions from treatment of wastewater are calculated as:

Monitoring period	BE _{CH4,ww,y} (tCO _{2e})
25-October-2020-31-October-2020	306
01-November-2020-30-November-2020	1,086
01-December-2020-31-December-2020	1,418
01-January-2021-31-January-2021	5,321
01-February-2021-28-February-2021	5,079
01-March-2021-31-March-2021	6,322
01-April-2021-30-April-2021	6,117
01-May-2021-31-May-2021	5,623
01-June-2021-30-June-2021	5,143
01-July-2021-31-July-2021	6,142
01-August-2021-31-August-2021	6,143
01-September-2021-30-September-2021	4,715
01-October-2021-31-October-2021	6,322
01-November-2021-30-November-2021	5,295
01-December-2021-31-December-2021	5,624
01-January-2022-31-January-2022	7,509
01-February-2022-28-February-2022	6,788
01-March-2022-31-March-2022	6,683
01-April-2022-30-April-2022	6,290
01-May-2022-31-May-2022	7,510
01-June-2022-30-June-2022	6,112
01-July-2022-31-July-2022	7,297
01-August-2022-31-August-2022	7,299
Total	126,144

During this monitoring period, BE_{CH4,ww,y} is 126,144 tCO_{2e}, the results of wastewater treatment plant are summarized as the following table. Please refer to the ER spreadsheet for the detailed calculation process.

BE _{CH4,ww,y} (tCO _{2e})			
25-October-2020 to 31-December-2020	01-January-2021 to 31-December-2021	01-January-2022 to 31-August-2022	1 st Monitoring Period

2,810	67,845	55,489	126,144
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ii). Calculation of baseline emissions from treatment of sludge ($BE_{CH_4,sl,y}$)

The sludge that produced in the baseline scenario from the treatment of wastewater in the open lagoons system was treated by means of controlled drying under aerobic conditions and then disposed to a landfill with methane recovery (S2), the corresponding methane emissions ($BE_{CH_4,sl,y}$) are considered to be negligible and are not accounted for. Therefore:

$$BE_{CH_4,sl,y}=0 \text{ tCO}_2\text{e/year}$$

iii). Calculation of baseline emissions from consumption of electricity ($BE_{EL,y}$)

There is no power consumption in this baseline scenario, therefore:

$$BE_{EL,y}=0 \text{ tCO}_2\text{e/year}$$

iv). Baseline emissions from the generation of heat ($BE_{HG,y}$)

There are no emissions from the generation of heat in this baseline scenario, therefore:

$$BE_{HG,y}=0 \text{ tCO}_2\text{e/year}$$

v). Baseline emissions from transportation of sludge ($BE_{TR,sl,y}$)

The parameters and calculations are listed in the following table:

Parameter	value	Unit	source
$N_{BL,i,y}$ (25-October-2020 to 31-December-2020)	147	trips	AM0080 v.1 Equation 17
$N_{BL,i,y}$ (01-January-2021 to 31-December-2021)	804	trips	AM0080 v.1 Equation 17
$N_{BL,i,y}$ (01-January-2022 to 31-August-2022)	556	trips	AM0080 v.1 Equation 17
$Q_{BL,sl,y}$ (25-October-2020 to 31-December-2020)	737.07	tonnes	Historical data on site in the FSR (It was calculated with conservative value)
$Q_{BL,sl,y}$ (01-January-2021 to 31-December-2021)	4,021.63	tonnes	Historical data on site in the FSR (It was calculated with conservative value)
$Q_{BL,sl,y}$ (01-January-2022 to 31-August-2022)	2,777.58	tonnes	Historical data on site in the FSR (It was calculated with conservative value)
$q_{BL,i}$	5	tonnes/trip	Historical data on site in baseline survey report
$D_{BL,i,y}$	59.6	km	Historical data on site in baseline survey report
$F_{BL,i,y}$	0.251	Liter/km	As per baseline survey report, historical data available on-site was also from the Table 1 in Guidelines for Accounting Methods and

			Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, >4 tonne <8 tonne) (https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf)
Density of diesel	0.00084	t/L	As per baseline survey report, historical data available on-sit was also from Page15 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf)
NCV _{BL,j,y}	0.04333	TJ/tonne	As per baseline survey report, historical data available on-sit was also from Table 2 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel) (https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf)
EF _{BL,j,y}	74.1	tCO ₂ /TJ	As per baseline survey report, historical data available on-sit was also from Table 3.2.1 of Chapter 3 in Volume 2 of IPCC

The baseline emissions from transportation of sludge are calculated as:

25-October-2020 to 31-December-2020

$$BE_{TR,sl,y} = (147 \times 59.6 \times 0.251 \times 0.00084 \times 0.04333 \times 74.1) \text{ tCO}_2\text{e/year} = 5.95 \text{ tCO}_2\text{e}$$

01-Janurary-2021 to 31-December-2021

$$BE_{TR,sl,y} = (804 \times 59.6 \times 0.251 \times 0.00084 \times 0.04333 \times 74.1) \text{ tCO}_2\text{e/year} = 32.45 \text{ tCO}_2\text{e}$$

01-Janurary-2022 to 31-August-2022

$$BE_{TR,sl,y} = (556 \times 59.6 \times 0.251 \times 0.00084 \times 0.04333 \times 74.1) \text{ tCO}_2\text{e/year} = 22.41 \text{ tCO}_2\text{e}$$

During this monitoring period, BE_{TR,sl,y} is 60.81 tCO₂e, the results of one wastewater treatment plant are summarized as the following table. **Please refer to the ER spreadsheet for the detailed calculation process.**

<i>BE_{TR,sl,y}</i> (tCO ₂ e)			
25-October-2020 to 31-December-2020	01-Janurary-2021 to 31-December-2021	01-Janurary-2022 to 31-August-2022	1 st Monitoring Period

5.95	32.45	22.41	60.81
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Therefore, baseline emissions can be calculated as:

$$BE_y = BE_{CH_4,ww,y} + BE_{CH_4,sl,y} + BE_{EL,y} + BE_{HG,y} + BE_{TR,sl,y}$$

$$= BE_{CH_4,ww,y} + BE_{TR,sl,y}$$

Year	$BE_{CH_4,ww,y}$ (tCO ₂ e)	$BE_{TR,sl,y}$ (tCO ₂ e)	BE_y (tCO ₂ e)
	A	B	C=A+B
25-October-2020 to 31-December-2020	2,810	5.95	2,815
01-Janurary-2021 to 31-December-2021	67,845	32.45	67,877
01-Janurary-2022 to 31-August-2022	55,489	22.41	55,511
1st Monitoring Period	126,144	61	126,203

6.3 Project Emissions

In this section, the detailed calculation formula and its description are also described in section 4.1. Therefore, please refer to section 4.1 for the detailed calculation formula.

i) Methane emissions from treatment of wastewater ($PE_{CH_4,ww,y}$)

$$PE_{CH_4,ww,y} = PE_{CH_4,wwtp,y} + PE_{CH_4,effl,y}$$

Methane emissions from the aerobic wastewater treatment plant $PE_{CH_4,wwtp,y}$:

The parameters for this monitoring are listed in the table below:

Parameter	value	Unit	source
GWP_{CH_4}	28	tCO ₂ /tCH ₄	IPCC Fifth Assessment Report - Climate Change 2014
B_0	0.21	tCH ₄ /tCOD	2006 IPCC Vol5 Ch6 table 6.2 & AM0080 v.1 p.28
E	15175	cal/mol	AM0080 v.1
T1	303.16	K	AM0080 v.1
R	1.987	cal/K.mol	AM0080 v.1

Monitoring period	$Q_{PJ,ww,i}$ (m ³ /d)	$W_{PJ,COD,ww,i}$ (tCOD/m ³)	$Q_{PJ,eff,i}$ ((m ³ /d)	$W_{PJ,COD,eff,i}$ (tCOD/m ³)
25-October-2020-31-October-2020	99799.3	0.00070922	98862.2	0.00001813
01-November-2020-30-November-2020	82643.8	0.00070881	81813.3	0.00001851
01-December-2020-31-December-2020	104417.7	0.00070877	103401.9	0.00001823
01-January-2021-31-January-2021	87900.1	0.00070868	87058.7	0.00001851
01-February-2021-28-February-2021	92892.8	0.00070876	91958.4	0.00001862
01-March-2021-31-March-2021	104402.9	0.00070893	103355.0	0.00001841
01-April-2021-30-April-2021	104421.0	0.00070873	103386.4	0.00001865
01-May-2021-31-May-2021	92902.3	0.00070861	91991.9	0.00001831
01-June-2021-30-June-2021	90349.5	0.00068873	89454.6	0.00001478
01-July-2021-31-July-2021	104421.2	0.00068864	103400.5	0.00001495
01-August-2021-31-August-2021	104439.4	0.00068868	103383.7	0.00001457
01-September-2021-30-September-2021	92860.6	0.00070877	91981.5	0.00001833
01-October-2021-31-October-2021	104409.3	0.00070888	103373.5	0.00001839
01-November-2021-30-November-2021	90350.1	0.00070901	89433.4	0.00001807
01-December-2021-31-December-2021	92885.2	0.00070889	91964.6	0.00001862
01-January-2022-31-January-2022	104421.8	0.00070870	103366.7	0.00001841
01-February-2022-28-February-2022	104455.3	0.00070905	103377.8	0.00001832
01-March-2022-31-March-2022	92909.1	0.00070882	91975.5	0.00001843
01-April-2022-30-April-2022	90355.6	0.00070890	89449.0	0.00001798
01-May-2022-31-May-2022	104399.1	0.00070889	103346.1	0.00001869
01-June-2022-30-June-2022	90345.4	0.00068894	89426.2	0.00001473
01-July-2022-31-July-2022	104429.3	0.00068860	103359.2	0.00001509
01-August-2022-31-August-2022	104425.9	0.00068881	103404.7	0.00001473

Monitoring period	$COD_{PJ,ww,i}$ (tCOD)	$COD_{PJ,eff,i}$ (tCOD)	OR_i (Fraction)
25-October-2020-31-October-2020	70.78	1.79	0.9747
01-November-2020-30-November-2020	58.58	1.51	0.9741
01-December-2020-31-December-2020	74.01	1.89	0.9745
01-January-2021-31-January-2021	62.29	1.61	0.9741
01-February-2021-28-February-2021	65.84	1.71	0.9740
01-March-2021-31-March-2021	74.01	1.90	0.9743
01-April-2021-30-April-2021	74.01	1.93	0.9740
01-May-2021-31-May-2021	65.83	1.68	0.9744
01-June-2021-30-June-2021	62.23	1.32	0.9788
01-July-2021-31-July-2021	71.91	1.55	0.9785
01-August-2021-31-August-2021	71.93	1.51	0.9791
01-September-2021-30-September-2021	65.82	1.69	0.9744
01-October-2021-31-October-2021	74.01	1.90	0.9743

01-November-2021-30-November-2021	64.06	1.62	0.9748
01-December-2021-31-December-2021	65.85	1.71	0.9740
01-January-2022-31-January-2022	74.00	1.90	0.9743
01-February-2022-28-February-2022	74.06	1.89	0.9744
01-March-2022-31-March-2022	65.86	1.70	0.9743
01-April-2022-30-April-2022	64.05	1.61	0.9749
01-May-2022-31-May-2022	74.01	1.93	0.9739
01-June-2022-30-June-2022	62.24	1.32	0.9788
01-July-2022-31-July-2022	71.91	1.56	0.9783
01-August-2022-31-August-2022	71.93	1.52	0.9788

The designed effluent COD concentration of this project is 40mg/L(Through unit conversion, the designed effluent concentration is 0.00040 t/m³). According to the $W_{PJ,COD,effl,i}$ in the above table, the effluent COD concentration during this monitoring period is lower than the design value, so it meet the COD effluent requirements. Therefore, by monitoring the quality of wastewater at the outlet of the treatment plant, it can be preliminarily determined that the aerobic wastewater treatment system is well operated (managed)

As per equation (14) in section 4.2, if $OR_i \geq 0.8$, $PE_{CH_4,wwtp,y} = 0$. According to the calculation results in the above table, all OR_i during this monitoring period are greater than 0.8, so the aerobic wastewater treatment plant of the project is well managed. Therefore:

$$PE_{CH_4,wwtp,y} = 0 \text{ tCO}_2\text{e/year};$$

Methane emissions from the aerobic wastewater treatment plant: $PE_{CH_4,effl,y}$

The parameters for this monitoring are listed in the table below:

Parameter	value	Unit	source
GWP_{CH_4}	28	tCO ₂ /tCH ₄	IPCC Fifth Assessment Report - Climate Change 2014
B_0	0.21	tCH ₄ /tCOD	2006 IPCC Vol5 Ch6 table 6.2 & AM0080 v.1 p.28
E	15175	cal/mol	AM0080 v.1
T_1	303.16	K	AM0080 v.1
R	1.987	cal/K.mol	AM0080 v.1
$f_{pj,T,y}$ (25-October-2020-31-December-2020)	0.1517	Fraction	AM0080 v.1 Equation 25
$f_{pj,T,y}$ (01-January-2021-31-December-2021)	0.4495	Fraction	AM0080 v.1 Equation 25
$f_{pj,T,y}$	0.4478	Fraction	AM0080 v.1 Equation 25

(01-January-2022-31-August-2022)			
$f_{PJ,d,y}$	0	Fraction	AM0080 v.1. p.29 (Depth < 1 m)

Monitoring period	$f_{T,m}$ (Fraction)	$T_{2,m}$ (K)	$COD_{PJ,available,m}$ (tCOD)	$MCF_{PJ,effl,y}$ (Fraction)
25-October-2020-31-October-2020	0.3870	292.15	12.54	0
01-November-2020-30-November-2020	0.2819	288.65	45.44	0
01-December-2020-31-December-2020	0.0000	281.15	58.45	0
01-January-2021-31-January-2021	0.0000	280.65	49.96	0
01-February-2021-28-February-2021	0.2037	285.15	47.95	0
01-March-2021-31-March-2021	0.2455	287.15	59.00	0
01-April-2021-30-April-2021	0.3381	290.65	57.84	0
01-May-2021-31-May-2021	0.6008	297.15	52.23	0
01-June-2021-30-June-2021	0.7445	299.65	39.66	0
01-July-2021-31-July-2021	1.0000	303.15	47.93	0
01-August-2021-31-August-2021	0.9192	302.15	46.71	0
01-September-2021-30-September-2021	0.8452	301.15	50.58	0
01-October-2021-31-October-2021	0.4423	293.65	58.92	0
01-November-2021-30-November-2021	0.2237	286.15	48.47	0
01-December-2021-31-December-2021	0.0000	282.15	53.08	0
01-January-2022-31-January-2022	0.0000	279.65	58.98	0
01-February-2022-28-February-2022	0.0000	278.65	54.91	0
01-March-2022-31-March-2022	0.2692	288.15	52.56	0
01-April-2022-30-April-2022	0.3700	291.65	48.25	0
01-May-2022-31-May-2022	0.4423	293.65	59.89	0
01-June-2022-30-June-2022	0.7445	299.65	39.51	0
01-July-2022-31-July-2022	1.0000	306.15	48.35	0
01-August-2022-31-August-2022	1.0000	305.65	47.20	0

As per the equation (20), $MCF_{PJ,effl,y} = f_{PJ,d,y} \times f_{PJ,T,y} \times 0.89$. And during this monitoring period, the effluent channels of the one wastewater treatment plant is not more than 1m. As per the page 34 in the methodology, when Depth < 1 m: $f_{PJ,d,y}$ is selected as 0%. So the $MCF_{PJ,effl,y}=0$;

The calculation result of $MCF_{PJ,effl,y}$ during this monitoring period is 0, as per equation (19) in section 4.2, $PE_{CH_4,effl,y}=0$ tCO₂e/year.

So $PE_{CH_4,effl,y}=0$ tCO₂e/year

$$PE_{CH_4,ww,y} = PE_{CH_4,wwtp,y} + PE_{CH_4,effl,y} = 0 \text{ tCO}_2\text{e/year}$$

Please refer to the ex-post ER spreadsheet for the more detailed calculation process.

ii). Methane emissions from treatment of sludge in the project activity in year y ($PE_{CH_4,sl,y}$)

Sludge in this project activity is dried under controlled and aerobic conditions, and then disposed to a landfill with methane recovery, corresponding project emissions are considered to be negligible and should not be accounted for. Therefore:

$$PE_{CH_4,sl,y} = 0 \text{ tCO}_2\text{e/year}$$

iv). N_2O emissions from treatment of sludge in the project activity in year y ($PE_{N_2O,sl,y}$)

Nitrous oxide emissions are assumed to be negligible and need not be accounted for if the sludge is:

- Dried under controlled and aerobic conditions, and then disposed to a landfill; or,
- Treated in a new anaerobic digester and the residues from the anaerobic digester are dehydrated, limed and stored before final disposal in a controlled landfill.

Sludge generated by the project activity was dried under controlled and aerobic conditions, with disposal in Landfill with methane recovery. Therefore:

$$PE_{N_2O,sl,y} = 0 \text{ tCO}_2\text{e/year}$$

v). Project emissions associated with electricity consumption in the project activity ($PE_{EC,y}$)

The parameters and calculations are listed in the following table::

Parameter	value	Unit	source
$EC_{PJ,j,y}$ (25-October-2020 to 31-December-2020)	2,030.11	MWh	Electricity bill
$EC_{PJ,j,y}$ (01-January-2021 to 31-December-2021)	10,483.04	MWh	Electricity bill
$EC_{PJ,j,y}$ (01-January-2022 to 31-August-2022)	6,537.81	MWh	Electricity bill
$TDL_{j,y}$	20%	ratio	Tool 05 P15
$EF_{EF,j,y}$	0.5896	tCO ₂ /MWh	https://www.mee.gov.cn/ywgz/ycqhbh/wsqtzk/202012/W020201229610353340851.pdf

25-October-2020 to 31-December-2020

$$PE_{EC,y} = 2,030.11 \text{ MWh/year} \times 0.5896 \text{ tCO}_2/\text{MWh} \times (1+20\%) = 1,436.22 \text{ tCO}_2\text{e/year}$$

01-January-2021 to 31-December-2021

$$PE_{EC,y} = 10,483.04 \text{ MWh/year} \times 0.5896 \text{ tCO}_2/\text{MWh} \times (1+20\%) = 7,416.33 \text{ tCO}_2\text{e/year}$$

01-January-2022 to 31-August-2022

$PE_{EC,y} = 6,537.81 \text{ MWh/year} \times 0.5896 \text{ tCO}_2/\text{MWh} \times (1+20\%) = 4,625.24 \text{ tCO}_2\text{e/year}$ During this monitoring period, $PE_{EC,y}$ is 21,754.51 tCO₂e, the results of each wastewater treatment plant are summarized as the following table. **Please refer to the ER spreadsheet for the detailed calculation process.**

$PE_{EC,y} \text{ (tCO}_2\text{e)}$			
25-October-2020 to 31-December-2020	01-January-2021 to 31-December-2021	01-January-2022 to 31-August-2022	1 st Monitoring Period
1,436.22	7,416.33	4,625.24	13,477.79

vi). Project emissions from transportation of sludge ($PE_{TR,sl,y}$)

Parameter	value	Unit	source
$N_{PJ,i,y}$ (25-October-2020 to 31-December-2020)	439.0	trips	AM0080 Version 01 Equation 34
$N_{PJ,i,y}$ (01-January-2021 to 31-December-2021)	2,218	trips	AM0080 Version 01 Equation 34
$N_{PJ,i,y}$ (01-January-2022 to 31-August-2022)	1,446	trips	AM0080 Version 01 Equation 34
$Q_{PJ,sl,y}$ (25-October-2020 to 31-December-2020)	2,197.90	tonnes	Sludge statistics of wastewater from Dongyang Wastewater Treatment Plant Project
$Q_{PJ,sl,y}$ (1-January-2021 to 31-December-2021)	11,090.18	tonnes	Sludge statistics of wastewater from Dongyang Wastewater Treatment Plant Project
$Q_{PJ,sl,y}$ (01-January-2022 to 31-August-2022)	7,234.90	tonnes	Sludge statistics of wastewater from Dongyang Wastewater Treatment Plant Project
$q_{PJ,i}$	5	tonnes/trip	Sludge statistics of wastewater from Dongyang Wastewater Treatment Plant Project
$D_{PJ,i,y}$ (25-October-2020 to 31-December-2020)	30.8	km	The distance of sludge transportation between the wastewater treatment plants and landfills was determined by online On-Board Diagnostics installed in sludge transport vehicle, and it was cross-check with the Screenshot of Google Maps. Finally, the larger value was selected because the calculation result is more conservative.
$D_{PJ,i,y}$ (01-January-2021 to 31-December-2021)	30.6	km	The distance of sludge transportation between the wastewater treatment plants and landfills was determined by online On-Board Diagnostics installed in sludge transport vehicle, and it was cross-check with the Screenshot of Google Maps.

			Finally, the larger value was selected because the calculation result is more conservative.
$D_{PJ,i,y}$ (01-January-2022 to 31-August-2022)	30.4	km	The distance of sludge transportation between the wastewater treatment plants and landfills was determined by online On-Board Diagnostics installed in sludge transport vehicle, and it was cross-check with the Screenshot of Google Maps. Finally, the larger value was selected because the calculation result is more conservative.
$F_{PJ,i,y}$	0.251	Liter/km	Source from fuel consumption record book of sludge transport vehicle , cross-checked with the Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel > 4 tonne < 8 tonne), the larger value was used for calculation
Density of diesel	0.00084	t/L	Page15, https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf
$NCV_{PJ,j,y}$	0.04333	TJ/tonne	Table 2 Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel) (https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf)
$EF_{PJ,j,y}$	74.1	tCO ₂ /TJ	IPCC Vol2 Ch3 table 3.2.1

25-October-2020 to 31-December-2020

$$PE_{TR,sl,y} = (439 \times 30.8 \times 0.251 \times 0.00084 \times 0.04333 \times 74.1) \text{tCO}_2\text{e/year} = 9.15 \text{ tCO}_2\text{e/year}$$

01-January-2021 to 31-December-2021

$$PE_{TR,sl,y} = (2,218 \times 30.6 \times 0.251 \times 0.00084 \times 0.04333 \times 74.1) \text{tCO}_2\text{e/year} = 45.95 \text{ tCO}_2\text{e/year}$$

01-January-2022 to 31-August-2022

$$PE_{TR,sl,y} = (1,446 \times 30.4 \times 0.251 \times 0.00084 \times 0.04333 \times 74.1) \text{tCO}_2\text{e/year} = 29.76 \text{ tCO}_2\text{e/year}$$

$PE_{TR,sl,y}$ (tCO ₂ e)			
25-October-2020 to 31-December-2020	01-January-2021 to 31-December-2021	01-January-2022 to 31-August-2022	1 st Monitoring Period
9.15	45.95	29.76	84.86

So the project emissions can be calculated:

$$PE_y = PE_{CH_4,ww,y} + PE_{CH_4,sl,y} + PE_{N_2O,sl,y} + PE_{EC,y} + PE_{FC,y} + PE_{TR,sl,y}$$

$$= PE_{EC,y} + PE_{TR,sl,y}$$

Year	PE _{EC,y} (tCO ₂ e)	PE _{TR,sl,y} (tCO ₂ e)	PE _y (tCO ₂ e)
	A	B	C=A+B
25-October-2020 to 31-December-2020	1,436.22	9.15	1,446
01-Janurary-2021 to 31-December-2021	7,416.33	45.95	7,463
01-Janurary-2022 to 31-August-2022	4,625.24	29.76	4,656
1st Monitoring Period	13,477.79	84.86	13,565

6.4 Leakage

The used technology is not equipment transferred from another activity, So no leakage is considered in this methodology.

$$LE_y = 0$$

6.5 Net GHG Emission Reductions and Removals

Emission reductions for any given year of the crediting period are obtained by subtracting project emissions and leakage from baseline emissions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$$ER_y = \text{Emissions reductions of the project activity in year } y \text{ (tCO}_2\text{e/year)}$$

$$BE_y = \text{Baseline emissions in year } y \text{ (tCO}_2\text{e/year)}$$

$$PE_y = \text{Project emissions in year } y \text{ (tCO}_2\text{e/year)}$$

$$LE_y = \text{Leakage emissions in year } y \text{ (tCO}_2\text{e/year)}$$

As per Section 6.2, Section 6.3 and Section 6.4:

Year	BE _y (tCO ₂ e)	PE _y (tCO ₂ e)	LE _y (tCO ₂ e)
	A	B	C

25-October-2020 to 31-December-2020	2,815	1,446	0
01-Janurary-2021 to 31-December-2021	67,877	7,463	0
01-Janurary-2022 to 31-August-2022	55,511	4,656	0
1st Monitoring Period	126,203	13,565	0

Emissions reductions are calculated as:

Table 5-1 The estimation of ER_y

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
25-October-2020 to 31-December-2020	2,815	1,446	0	1,369
01-Janurary-2021 to 31-December-2021	67,877	7,463	0	60,414
01-Janurary-2022 to 31-August-2022	55,511	4,656	0	50,855
Total	126,203	13,565	0	112,638

APPENDIX I:

Supporting evidence for contribution to SDG 6.0 Proportion of domestic and industrial wastewater flows safely treated

Evidence 1: It is estimated that the annual wastewater treatment capacity of the project is 73,684,000 m³ and wastewater treatment capacity of the project of first monitoring period is 65,589,938.40 m³ (25-October-2020 to 31-August-2022). annual wastewater treatment capacity of the project was measured by the electromagnetic flowmeter converter. The monitoring team of the wastewater treatment plants will be responsible for monitoring and recording the data.

Evidence 2: Flow operation statistics of wastewater from Dongyang Wastewater Treatment Plant Project

Supporting evidence for contribution to SDG 8.5 Unemployment rate, by sex, age and persons with disabilities

Evidence1: 40 local residents (20 females and 20 males) are employed permanently during the operation period of the project during project implementation and monitoring activities.

Image showing the roster of all staff members:

东阳污水处理厂项目员工花名册

序号	职位名称	姓名	性别	入职日期	工作状态	所属污水厂	家庭住址	身份证号	年龄
1	厂长	孙问旋	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199208013010	28
2	污水厂运营	姜珠星	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199508019629	25
3	污水厂运营	郝觅荷	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199608015831	24
4	污水厂运营	龙从筠	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199108011365	29
5	污水厂运营	卢雅丹	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199008016615	30
6	污水厂运营	蒋淑萍	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783198908014482	31
7	污水厂运营	萧正巧	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199008011611	30
8	污水厂运营	田绮菱	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199108012647	29
9	污水厂运营	叶翼瑞	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199608013879	24
10	污水厂运营	冯玮奇	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199708014426	23
11	污水厂运营	马绮怀	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199208016252	28
12	污水厂运营	石茜欢	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199008013962	30
13	污水厂运营	武融雪	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199208017458	28
14	污水厂运营	胡静秀	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199208016285	28
15	污水厂运营	黄雅容	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783198908013932	31
16	污水厂运营	薛好慕	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783198808017384	32
17	污水厂运营	姚尔白	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199108015911	29
18	污水厂运营	张梓露	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199308015462	27
19	污水厂运营	程芝英	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199408015911	26
20	污水厂运营	孟杰秀	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199508012029	25
21	污水厂运营	李慧语	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199608013510	24
22	污水厂运营	彭柯拉	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199208015429	28
23	污水厂运营	丁紫南	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199108018813	29
24	污水厂运营	尹梦曼	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199008013746	30
25	污水厂运营	康诗文	男	2020.10.8	正常	东阳污水处理厂	东阳市	341323199103208478	29
26	污水厂运营	吴莹莉	女	2020.10.8	正常	东阳污水处理厂	东阳市	341323198209132188	38
27	污水厂运营	邵郑哲	男	2020.10.8	正常	东阳污水处理厂	东阳市	341323198708186077	33
28	污水厂运营	熊墨玉	女	2020.10.8	正常	东阳污水处理厂	东阳市	341323199304129882	27
29	污水厂运营	王静美	男	2020.10.8	正常	东阳污水处理厂	东阳市	341323199008147690	30

30	污水厂运营	尹顺秀	女	2020.10.8	正常	东阳污水处理厂	东阳市	341323199310158622	27
31	污水厂运营	蔡专霞	男	2020.10.8	正常	东阳污水处理厂	东阳市	341323199209077232	28
32	污水厂运营	杨朗然	女	2020.10.8	正常	东阳污水处理厂	东阳市	341323199009158425	30
33	污水厂运营	彭雪冰	男	2020.10.8	正常	东阳污水处理厂	东阳市	341323198909177596	31
34	污水厂运营	叶雨竹	女	2020.10.8	正常	东阳污水处理厂	东阳市	341323199409209061	26
35	污水厂运营	黎清晖	男	2020.10.8	正常	东阳污水处理厂	东阳市	341323199509207650	25
36	污水厂运营	薛沈思	女	2020.10.8	正常	东阳污水处理厂	东阳市	341323199209197205	28
37	污水厂运营	姜芸姝	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199108018070	29
38	污水厂运营	史书慧	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199008014000	30
39	污水厂运营	康紫霜	男	2020.10.8	正常	东阳污水处理厂	东阳市	330783199108014391	29
40	污水厂运营	戴浩文	女	2020.10.8	正常	东阳污水处理厂	东阳市	330783199008019256	30

Supporting evidence for contribution to SDG 13.0 Tons of greenhouse gas emissions avoided or removed

Evidence 1: The project design document has estimated 64,548 tCO₂e emission reductions, the emission reductions of first monitoring period is 112,638 tCO₂e.

Evidence 2: Emission reductions achieved during the First Monitoring Period

Below Table showing the emission reductions during the first monitoring period:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
25-October-2020 to 31-August-2022	126,203	13,565	0	112,638