JINGHAI LEACHATE ANAEROBIC BIOGAS UTILIZATION PROJECT

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Jinghai Leachate Anaerobic Biogas Utilization Project (hereafter referred to as the project) is located at Jinghai New Energy Environmental Protection Power Generation Project, in Chenguantun Town, Jinghai District, Tianjin City, P.R. China. The project is constructed and operated by Tianjin BCCY New Energy Co., Ltd.

Before the implementation of this project, Jinghai New Energy Environmental Protection Power Generation Project invested by Tianjin Gaoneng Environmental Protection Energy Co., Ltd. incinerates domestic waste with a daily treatment capacity of 1,000t /d. Leachate will be produced during the storage and fermentation process in the garbage bin. The supporting treatment system of the factory is " Anaerobic (UASB) + membrane bioreactor (MBR) + nanofiltration system (NF)+reverse osmosis system (RO)" treatment process. A large amount of biogas is produced in the anaerobic treatment section of UASB. The Jinghai New Energy Environmental Protection Power Generation Project started to construct in 04/2019[1] and started operation in 28/12/2020[2], Because it was difficult to collect and treat biogas, the biogas generated by the UASB was emitted to the atmosphere directly without any recovery and utilization. The biogas was being vented to the atmosphere in 28/12/2020 when the Jinghai New Energy Environmental Protection Power Generation Project started operation.

This project collects the biogas generated by the anaerobic treatment section of leachate to generate electricity and connect to the grid, which can effectively utilize biogas resources.

The project started to construct on 13/12/2021 and started operation on 12/07/2022. The project has a total designed capacity 1MW (2*500KW) and combusts the leachate biogas, which contains nearly 65% of methane, to generate electricity and export it to the North China Power Grid (NCPG). Total electricity supplied to the grid in the crediting period will be 6,630MWh. VCUs will be claimed from the methane destroyed and the grid electricity displaced. The estimated average GHG emission reductions of the project are 33,937tCO_2e and the total GHG emission reductions and removals are 339,370tCO_2e during the fixed 10 years crediting period.

Scenario existing prior to the implementation of the project (the same as baseline scenario):

Leachate biogas from Jinghai New Energy Environmental Protection Power Generation Project wastewater treatment is emitted to the atmosphere directly.

Equivalent electricity generated by the project is supplied by the NCPG, which is dominated by

[1] https://www.sohu.com/a/386224071_213821

[2] https://xueqiu.com/3093244593/174631274

fossil fuel based power plants.

1.2 Sectoral Scope and Project Type

Sector scope 1: energy industries (renewable-/non-renewable sources)

Sector scope 13: waste handling and disposal

The project is not a grouped project.

1.3 Project Eligibility

The project is a leachate biogas power generation project, utilizing leachate biogas, which consists mainly of methane, for electricity generation, which is eligible under the scope of the VCS program.

1.4 Project Design

The project has been designed to include a single installation of an activity.

Eligibility Criteria

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

1.5 Project Proponent

Organization name	Henan BCCY Environmental Energy Co., Ltd.
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Address	8/F, Hengmei Business Building, 22 Dongfeng Road, Zhengzhou, China
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1.6 Other Entities Involved in the Project

Organization name	Tianjin BCCY New Energy Co., Ltd
Role in the project	Project Operation Entity
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1.7 Ownership

Tianjin BCCY New Energy Co., Ltd. is the sole project owner of the project. The approval of Feasibility Study Report (FSR) and Environmental Impact Assessment (EIA) and the Business License of the project owner are the evidences for legislative right. Henan BCCY Environmental Energy Co., Ltd. is the mother company of Tianjin BCCY New Energy Co., Ltd., and Tianjin BCCY New Energy Co., Ltd authorized Henan BCCY Environmental Energy Co., Ltd. as the Project Proponent.

1.8 Project Start Date

12/07/2022 (commercial operation started date)

1.9 Project Crediting Period

The project crediting period runs from 12/07/2022 through 11/07/2032 for 10 years fixed.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

☐ <20,000 tCO_2e/year

☒ 20,000 – 100,000 tCO_2e/year

☐ 100,001 – 1,000,000 tCO_2e/year

☐ >1,000,000 tCO_2e/year

Project Scale	
Project	√
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
12/07/2022-31/12/2022	16,085
2023	33,937
2024	33,937
2025	33,937
2026	33,937
2027	33,937
2028	33,937
2029	33,937
2030	33,937
2031	33,937
01/01/2032-11/07/2032	17,852
Total estimated ERs	339,370
Total number of crediting years	10
Average annual ERs	33,937

1.11 Description of the Project Activity

The GHG emission reductions will be achieved through combustion of the recovered methane gas by gas engines, which would be otherwise emitted to the atmosphere, and the generation of electricity from leachate biogas, which is supplied by the NCPG prior to the implementation of the project.

The leachate biogas collection system and treatment system will emit the biogas to the atmosphere directly. The electricity generation and grid connection system will generate electricity to the NCPG.

Description of the technology in the project

The project consists in leachate biogas collection, transmission and treatment system, with subsequent electricity generation and grid connection system.

Leachate biogas collection system

Leachate biogas is extracted from UASB anaerobic biochemical system by the top set gas pipe collection into the storage tank. The pipeline is connected to the biogas storage tank through

Roots fan to extract and transport biogas into the biogas pretreatment unit. Flow rate of the leachate biogas is regulated at the collection points in order to always fit with the consumption capacity of the generation engines.

Leachate biogas treatment system

Prior to electricity generation, leachate biogas is treated to remove impurities and moisture, to avoid corrosion in the engines. The treatment consists of filtration, de-moisturing, cooling and pressurization.

Electricity generation and grid connection system

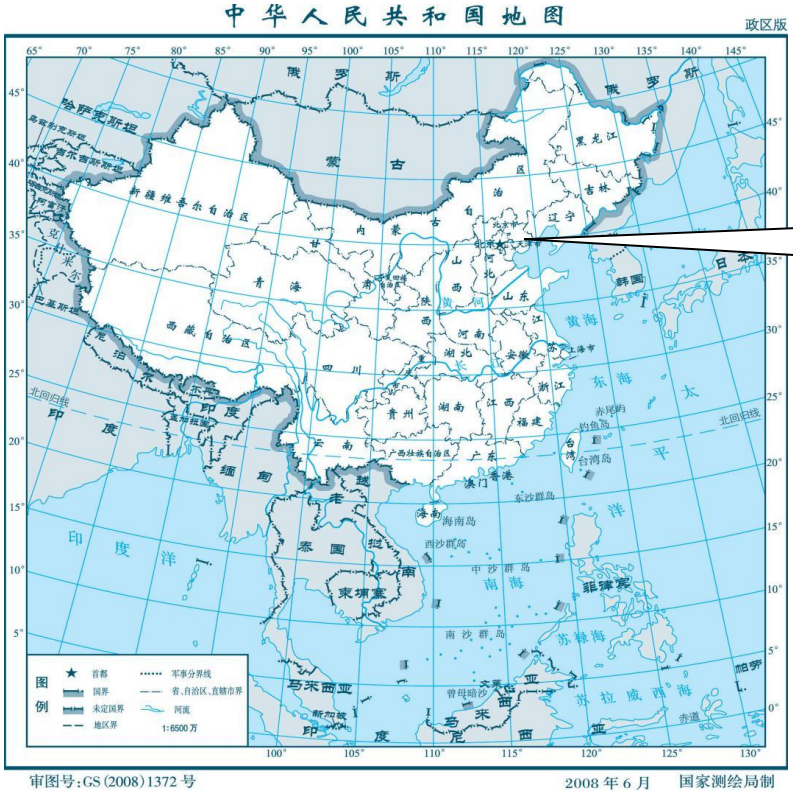
2 gas engines of 500KW rated power each are fed with the leachate biogas and generate electricity, which is then exported to the grid.

Table 1.1 Equipment technical parameters

Main Equipment	Parameter	Value
Gas engine	Type	500GF-NK
	Manufacturer	JINAN DIESEL ENGINE CO.,LTD.
	Rated capacity	500 kW
	Rated rotation speed	1000 r/min
	Lifetime	15 years
Gas engine	Type	500GF-N1
	Manufacturer	JINAN DIESEL ENGINE CO.,LTD.
	Rated capacity	500 kW
	Rated rotation speed	1000 r/min
	Lifetime	15 years

1.12 Project Location

The project is located in Jinghai New Energy Environmental Protection Power Generation Project, Chenguantun Town, Jinghai District, Tianjin City, P.R. China. The geographical coordinates of the project site are longitude 116.56°E and latitude 38.49°N. Figure 1.1 shows the location of the project.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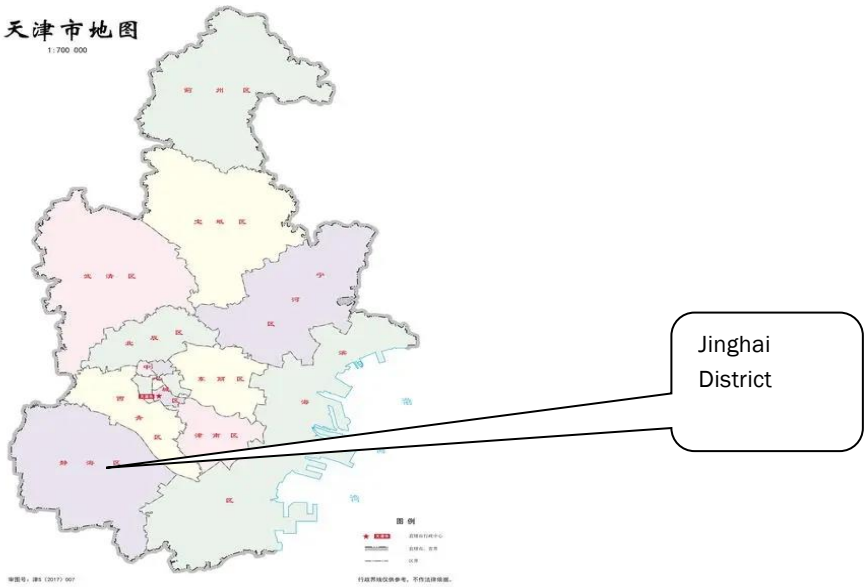
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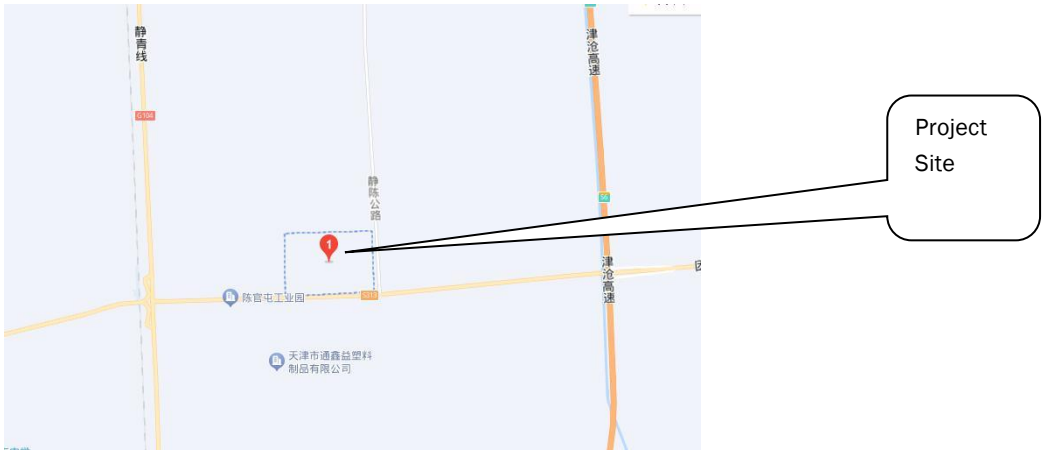

Figure 1.1 Location of the project

1.13 Conditions Prior to Project Initiation

The scenario existing prior to the start of the implementation of the project activity (the same as baseline scenario)

- Leachate biogas from Jinghai New Energy Environmental Protection Power Generation Project is released into the atmosphere.
- Equivalent electricity generated by the project is supplied by the NCPG, which is dominated by fossil fuel based power plants.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project complies with all Chinese relevant laws and regulations. Mainly include:

1. Renewable Energy Law of the People's Republic of China;

2. National Action plan for the collection and Utilization of municipal leachate biogas;

3. Catalogue for the Guidance of Industrial Structure Adjustment (2011 version).

The project obtained the approval letters from local governmental authorities: Investment Supervisory Department, as well as Environment Protection Agency (EPA). The two approvals well demonstrate that local governments permit the construction of the project. Hence, the project is in 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 is not registered or is seeking registration under other GHG Programs.

1.15.2 Projects Rejected by Other GHG Programs

The project 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

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

1.16.2 Other Forms of Environmental Credit

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

☐ Yes ☒ No

Supply Chain (Scope 3) Emissions

The proposed project is to capture and utilize the leachate biogas which otherwise will be released to atmosphere, and it will not impact the emissions of goods and services in a supply chain, i.e. Scope 3 emissions.

1.17 Sustainable Development Contributions

The project is located in Chenguantun Town, Jinghai District, Tianjin City, P.R. China. The project captures leachate biogas and generates electricity, which is fed into the NCPG, displacing energy that would otherwise be generated by fossil fuels.

The primary objective of the project is to avoid greenhouse gases emission through leachate biogas capture, purification, and injection in a grid connection system, while contributing to the environmental, social, and economic sustainability by minimizing global climate changes and local air pollution. Additional benefits include the increase of employment opportunities through full-time and permanent positions, etc.

The Project will contribute to sustainable development in the following ways:

- Reduce CH_4 emission. The project will recover and destroy leachate biogas that consists mainly of greenhouse gas methane and would otherwise be released directly into the atmosphere, effectively reducing greenhouse gas emissions, which contributes to the China's commitment to peak carbon dioxide emissions before 2030;

- Increase electricity production from renewable sources, which will certainly reduce the consumption of fossil fuel in Central China Power Grid and further help to achieve the national action to promote renewable energy development;
- Improve the operational safety of the waste incineration plant. The project reduces the potential safety hazards of leachate biogas explosion by recycling leachate biogas and improves the safety of waste incineration plant operation;
- The project will also provide new jobs opportunities and increase tax revenue, which will have a positive effect on the local economy.

1.18 Additional Information Relevant to the Project

Leakage Management

Not applicable as not AFOLO project.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Further Information

No further information available.

2 SAFEGUARDS

2.1 No Net Harm

The Environment Impact Assessment (EIA) was compiled by Tianjin Donghai Environmental Monitoring Co., Ltd. in December, 2021 and approved by Tianjin Jinghai district administrative examination and approval Bureau on 29/01/2022. Every aspect of environmental impact has been considered in the EIA report with corresponding measures during project development. The environmental impacts, treatment and effect arising from the Project during operation has been analysed in section 4 of this report below. And no net harm has been detected.

Meanwhile, the implementation of the project will improve local socio-economic development and contribute to the sustainable development as described in section 1 of this report above.

In conclusion, the project has no negative impacts on local environment and socio-economy. No net harm on local environment and social community has been detected for the project.

2.2 Local Stakeholder Consultation

The project owner distributed questionnaires to local residents who may be impacted by the project in order to collect advice for the project. The aim of these questionnaires was to collect opinions concerning the influence the project would have on the local society, environment, economy, daily life etc.

The following questions are from the questionnaires and stakeholder consultancy meeting:

- What do you think about the environment of surrounding areas?
- Do you support the construction of this leachate biogas power station?
- Do you think the implementation of the project will cause positive effect on living of local residents?
- Do you think the implementation of the project will cause negative effect?

The stakeholders were informed about the stakeholder meeting through posters on 10/04/2022. In the bulletin, the company invited the potential stakeholders to get to know their opinions and/or suggestions about the implementation of the project and VCS application of the project. The stakeholder consultancy meeting for the parties interested in the project was organized at Jinghai New Energy Environmental Protection Power Generation Project on 22/04/2022 to collect opinions from all stakeholders, such as representatives of local residents, Jinghai New Energy Environmental Protection Power Generation Project, the project owner and so on. The project owner appointed one person to make a meeting minute.

30 questionnaires were distributed, and 30 questionnaires were returned. The age range of questioned people was 23-65 years old.

- About 20% of questioned people think the environment of surrounding areas is bad, and others think it is acceptable and good.
- 100% of questioned people support the construction of the project.
- 96% and 83% of questioned people think the implementation of the project will mitigate air pollution and lack of electricity, respectively.
- 60% of questioned people think the noise of implementation of the project will affect the living of local resident surround.

There are 15 stakeholders attended the stakeholder consultation meeting and the project owner had taken meeting minute.

During the stakeholder consultancy meeting, some stakeholders worried that the project will bring noise, land occupying and pollution on employees and local residents' living. For these

issues, the project owner will offer some measures: i.e. installation of sound proof devices and plating of green isolation belts are used for mitigating noise; the area the project built on only will not occupy farms of local residents; at the project site, waste recycling will be carried out reduce emit of waste, and the project site meanwhile will be far from the residential area, so the effect of the noise from the plant is little to local residents. All attendances to the meeting were satisfied to the measures.

Expect for introducing the project information, grievance mechanism was also explained during the local stakeholder consultation meeting. A grievance expression book will be put in the office of the project, which is used to collect stakeholders' views about the project. Project Participant will be checking the comments in the book on a regular basis, and record responses. The project information with contact information has also been posted on the bulletins at and nearby the project site. Every stakeholder can make comments by grievance expression book or contact information. Project Participant will be respectful to the views of stakeholders and suggest alternative solutions or compromises wherever possible.

As a whole, the impacts of construction of the project are basically positive. All stakeholders were pleased with the development of the project. The project would actually facilitate the development of the local economy and increase the income of local residents.

2.3 Environmental Impact

In December 2021, an environmental impact assessment (EIA) was completed in accordance with Chinese regulation by Tianjin Donghai Environmental Monitoring Co., Ltd. and was approved by Tianjin Jinghai district administrative examination and approval Bureau on 29/01/2022. The objective of this EIA was to identify the effects of the project activities on both the biophysical components of the environment and socio-economical aspects of local community and to provide measures and procedures to mitigate the possible effects.

The outcome of the EIA was favourable and the project was found to have no significant environmental impacts. The project not only reduces the danger caused by uncontrolled release of leachate biogas, but also reduces the pollution caused by the leachate biogas to the air, soil and water quality in the local area. From environmental protection perspectives, the project is in compliance with national industry policy, promoting sustainable development and utilisation of waste.

During construction phase, the raise dust, noise, waste water and solid wastes caused by project construction will be treated according to the measures in EIA report, and there will be no significant impact on the environment.

During the operation period, all the mitigation measures proposed by EIA report will be implemented and the following key aspects will be addressed:

Waste water

The wastewater discharged in this project mainly consists of domestic sewage, catering wastewater, ion exchange resin backwashing water, and biogas condensate. After pretreatment in the grease trap and settled in the septic tank, the wastewater is regularly cleared and transported to the leachate treatment system of Tianjin High-energy Environmental Protection Energy Co., Ltd. for treatment. Therefore, it can meet the standards of "The reuse of urban recycling water- Waste quality standard for industrial uses"(GB/T19923-2005).

Waste Gas

The exhaust gas produced by this project is mainly the exhaust gas of the generators and catering oil fume. The concentration of the exhaust gas (mainly SO_2, NO_x and particulate matter) after combustion in gas-generator sets and processed by the SCR denitration system is discharged through the 15m high cylinder exhaust. The catering oil fume is purified by the oil fume purification device and discharged through the 8m high cylinder exhaust. According to the analysis, the emission meets the requirements of the Comprehensive Emission Standard for Air Pollutants (GB16297-1996).

Noise pollution

According to the prediction results, the acoustic environment quality of the project equipment noise transmitted to the boundary of project can meet the Class 2 Zone standards of "Environmental Noise Emission Standard of Industrial Enterprise Boundary" (GB12348-2008).

Solid waste

The solid waste of the project is mainly waste desulphurization products, waste oil, waste oil barrel, waste denitration catalyst, household garbage and kitchen waste. The waste desulphurization products are collected centrally and transferred to the recycling department for recycling. The waste oil, waste oil barrels and waste denitration catalyst are stored in the hazardous waste room of the factory, and regularly handed over to qualified units for recycling and processing. The construction standard of hazardous waste room shall meet the requirements of "Standard for pollution control on hazardous waste storage" (GB18597-2001). After sorting and collecting the household garbage, it will be transferred to the Urban Management Commission. Kitchen waste shall be disposed of by the corresponding qualified unites.

As mentioned above, the project was considered not causing significant environmental impacts.

2.4 Public Comments

NA

2.5 AFOLU-Specific Safeguards

For non-AFOLU projects, this section is not required.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Title: AMS-III.H. Methane recovery in wastewater treatment --- Version 19.0

AMS-I.D. Grid connected renewable electricity generation---Version 18.0

Reference: https://cdm.unfccc.int/methodologies/index.html

The methodology also refers to the latest approved versions of the following tools:

"Tool to calculate the emission factor for an electricity system" (Version 07.0);

"Tool for the demonstration and assessment of additionality" (version 07.0.0);

"Demonstration of additionality of small-scale project activities" (version 13.1);

"Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 3.0)

3.2 Applicability of Methodology

The selected methodology AMS-III.H. (version 19.0) and AMS-I.D. (version 18.0) are appropriate to leachate biogas project activities, where the baseline scenario is the atmospheric release of the leachate biogas, and that all or part of the electricity exported to the grid is the electricity generation in existing and/or new grid-connected power plants. In this case, the leachate biogas is released to atmosphere prior to the implementation of the project, and electricity generated by the project is exported to North China Power Grid (NCPG).

The project fulfils the following applicability conditions of the methodology:

Applicability conditions for AMS-III.H.	Justifications
2.This methodology comprises measures that recover biogas from biogenic organic matter in wastewater by means of one, or a combination, of the following options: a) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion; b) Introduction of anaerobic sludge treatment system with biogas recovery and combustion to a wastewater treatment plant without sludge treatment;	Applicable. This project collects the biogas generated by the anaerobic treatment section of leachate to generate electricity and connect to the grid. The simplified baseline methodology is applicable to this project activity because without the project activity, methane from the existing anaerobic treatment system would continue to be emitted into the atmosphere. As such, paragraph 2(f) of the methodology applies "Introduction of a sequential stage of wastewater treatment with biogas

c) Introduction of biogas recovery and combustion to a sludge treatment system; d) Introduction of biogas recovery and combustion to an anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on-site industrial plant; e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream; f) Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).	recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery)"
3.In cases where baseline system is anaerobic lagoon the methodology is applicable if: (a) The lagoons are ponds with a depth greater than two meters, without aeration. The value for depth is obtained from engineering design documents, or through direct measurement, or by dividing the surface area by the total volume. If the lagoon filling level varies seasonally, the average of the highest and lowest levels may be taken; (b) Ambient temperature above 15°C, at least during part of the year, on a monthly average basis; (c) The minimum interval between two consecutive sludge removal events shall be 30 days.	Applicable. a) The baseline system is anaerobic lagoons with the minimum depth of 2 m; b) The average atmospheric temperature in the region is above 15°C from April to October[3]; c) The sludge is incinerated in the incineration system of this project. There was no sludge generation in the baseline scenario. Therefore, the project activity is applicable f or this criterion.
4.The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring:	Applicable.

[3] https://www.tianqi24.com/tianjin/history.html

a) Thermal or mechanical, electrical energy generation directly; b) Thermal or mechanical, electrical energy generation after bottling of upgraded biogas, in this case additional guidance provided in the appendix shall be followed; or c) Thermal or mechanical, electrical energy generation after upgrading and distribution, in this case additional guidance provided in the appendix shall be followed: i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or iii) Upgrading and transportation of biogas (e.g. by trucks) to distribution points for end users; d) Hydrogen production; e) Use as fuel in transportation applications after upgrading.	The recovered biogas will be utilized to generate electrical energy directly. As such, paragraph 4 (a) applies.
5.If the recovered biogas is used for project activities covered under paragraph 4(a), that component of the project activity can use a corresponding methodology under Type I.	Applicable. Since the biogas captured will be used for electrical energy generation directly for this project activity, methodology under Type I should be used for the electricity generation components. Therefore, AMS.I.D is applied for the project activity.
6.For project activities covered under paragraph 4(b), if bottles with upgraded biogas are sold outside the project boundary, the end-use of the biogas shall be ensured via a contract between the bottled biogas vendor and the end-user. No emission reductions may be claimed from the displacement of fuels from the end use of bottled biogas in such situations. If, however, the end use of the bottled biogas is included in the project boundary and is monitored during the crediting period CO_2 emissions avoided by the displacement of fossil fuel can be claimed under the corresponding Type I methodology,	Not applicable.

e.g. "AMS-I.C.: Thermal energy production with or without electricity"	
7.For project activities covered under paragraph 4(c)(i), emission reductions from the displacement of the use of natural gas are eligible under this methodology, provided the geographical extent of the natural gas distribution grid is within the host country boundaries.	Not applicable.
8.For project activities covered under paragraph 4(c)(ii), emission reductions for the displacement of the use of fuels can be claimed following the provision in the corresponding Type I methodology, e.g. AMS-I.C.	Not applicable.
9.In particular, for the case of paragraph 4(b) and (c)(iii), the physical leakage during storage and transportation of upgraded biogas, as well as the emissions from fossil fuel consumed by vehicles for transporting biogas shall be considered. Relevant procedures in paragraph 18 of the appendix of "AMS-III.H.: Methane recovery in wastewater treatment" shall be followed in this regard.	Not applicable.
10.For project activities covered under paragraph 4(b) and (c), this methodology is applicable if the upgraded methane content of the biogas is in accordance with relevant national regulations (where these exist) or, in the absence of national regulations, a minimum of 96 per cent (by volume).	Not applicable.
11.If the recovered is utilized for the production of hydrogen (project activities covered under paragraph 3(d)), that component of the project activity shall use the corresponding methodology "AMS-III.O.: Hydrogen production using methane extracted from biogas".	Not applicable.
12.If the recovered biogas is used for project activities covered under paragraph 4(e), that component of the project activity shall use corresponding methodology "AMS-III.AQ.: Introduction of Bio-CNG in transportation applications".	Not applicable.
13.New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity of the	Not applicable.

baseline treatment system are only eligible to apply this methodology if they comply with the relevant requirements in the "General guidelines for SSC CDM methodologies". In addition, the requirements for demonstrating the remaining lifetime of the equipment replaced, as described in the general guidelines shall be followed.	
14.The location of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the PDD.	Applicable. The location of the wastewater treatment plants is uniquely defined in the factory site of Jinghai New Energy Environmental Protection Power Generation Project. The source generating the wastewater is from production water and domestic sewage from waste incineration plant, and the wastewater is being imported to the leachate treatment station treatment through channels.
15.Measures are limited to those that result in aggregate emissions reductions of less than or equal to 60 kt CO_2 equivalent annually from all Type III components of the project activity.	Applicable. The estimated annual ERs are less than the 60,000 tCO_2 limit for Type III components. The project activity estimated annual ERs are 29,218 tCO_2 for AMS-III.H.

Applicability conditions for AMS-I.D.	Justifications
4.This methodology is applicable to project activities that: (a) Install a Greenfield plant; (b) Involve a capacity addition in (an) existing plant (s); (c) Involve a retrofit of (an) existing plant (s); (d) Involve a rehabilitation of (an) existing plant (s)/unit (s) or; (e) Involve a replacement of (an) existing plant(s).	Applicable. The project installs a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project, which corresponds to point (a).

5.Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: (a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir; (b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4W/m^2; (c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4W/m^2.	Not applicable. The project is not a hydro power plant.
6. If the new unit has both renewable and non-renewable components (e.g. a wind/ diesel unit), the eligibility limit of 15 MW for a small-scale VCS project activity applies only to the renewable component. If the new unit co-fires fossil fuel. The capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable. The project does not use non-renewable components nor co-fires fossil fuels. Anyway, the total installed capacity is below 15MW.
7. Combined heat and power (co-generation) systems are not eligible under this category.	Not applicable. The project only involves electricity generation.
8. In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable. The project does not involve addition of renewable energy generation units at an existing renewable power generation facility.
9.In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project the total output of the retrofitted, rehabilitated	Not applicable.

or replacement power plant / unit shall not exceed the limit of 15 MW.	
10. In the case of leachate biogas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as AMS-L.C. Thermal energy production with or without electricity shall be explored.	Applicable. The project installed 2 engines to combusted leachate biogas of Jinghai New Energy Environmental Protection Power Generation Project, which mainly contains 65% methane.
11.In case biomass Is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass "shall apply.	Not applicable.

Regarding to tool— "Tool to calculate the emission factor for an electricity system" (Version 07.0)：

Applicable conditions	Justifications
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).	Applicable. This tool is applied to estimate the OM, BM and/or CM.
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"	Applicable. The emission factor for the project electricity system is calculated for grid power plants only.

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.	
In case of VCS projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Not applicable. The project electricity system is located in China.
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	Not applicable.

Regarding to tool— "Positive lists of technologies" (Version 04.0):

Applicable conditions	Justifications
The use of this methodological tool is not mandatory for the project participants of a VCS project activity or VCS POA for demonstrating their additionality.	Applicable.
This methodological tool shall be applied in conjunction with a small-scale or large-scale methodology which refers to this tool.	Applicable. This tool is applied in conjunction with small-scale methodology AMS-III.H. （version 19.0）.

Regarding to tool— "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 03.0):

Applicable conditions	Justifications
5.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:	Applicable. (a) Scenario A: Electricity consumption from the grid.

(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.	
6. 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.	Applicable. (a) Scenario I: Electricity is supplied to the North China Power Grid (NCPG);
7. 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	Not applicable.

or to sources of leakage. The tool only accounts for CO_2 emissions.	

3.3 Project Boundary

Define the project boundary and identify the relevant GHG sources, sinks and reservoirs for the project and baseline scenarios (including leakage if applicable). The project boundary is the site of the project activity, Jinghai New Energy Environmental Protection Power Generation Project, where the leachate biogas is captured and used, and also includes all the power sources connected to the NCPG, which expands throughout Beijing City, Tianjin City, Hebei Province, Shanxi Province, Shandong Province and Inner Mongolia Autonomous Region.

The treatment systems not affected by the project activity, i.e. sections operating in the project scenario under the same operational conditions as in the baseline scenario. The water treatment system of the factory is " Anaerobic (UASB) + membrane bioreactor (MBR) + nanofiltration system (NF)+reverse osmosis system (RO)" treatment process. The project adds biogas collection, transmission and treatment system, with subsequent electricity generation and grid connection system. The wastewater inflow and COD content, temperature, retention time, etc. are not affected by the biogas collection.

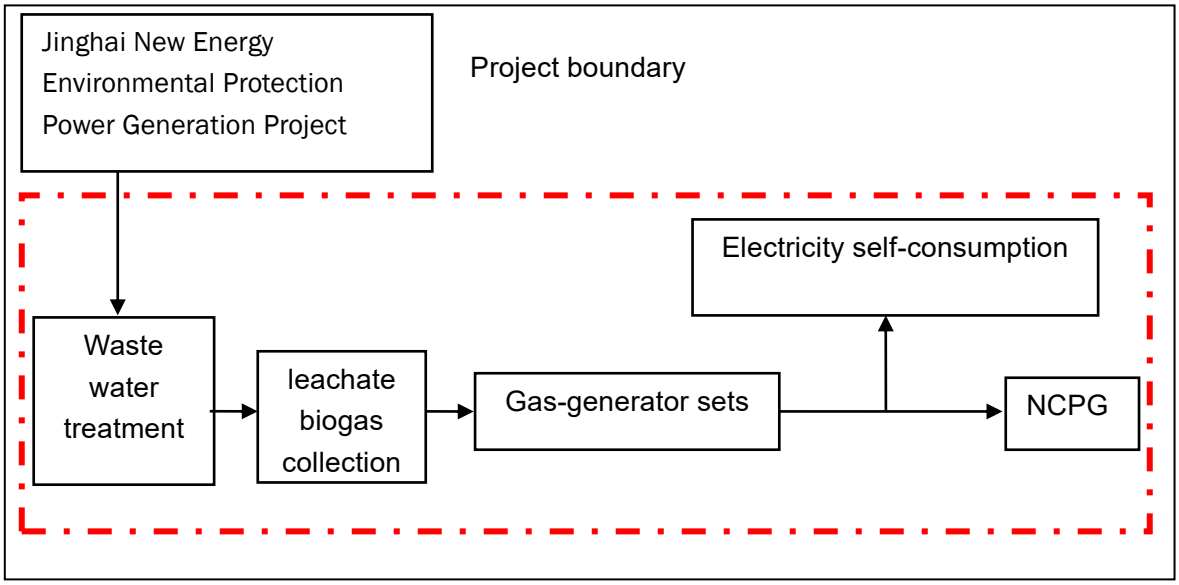

Figure 3.1 the Diagram of Project Boundary

Table 3.1 Summary of greenhouse gases and sources included in and excluded from the project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Emission from wastewater treatment system	CH_4	Yes	The major source of emissions in the baseline.
		N_2O	No	Excluded for simplification.
		CO_2	No	CO_2 emissions from the decomposition of organic waste in the wastewater are not accounted for.
	Emission from electricity generation	CO_2	Yes	The major source of emissions in the baseline.
		CH_4	No	Excluded for simplification, this is conservative.
		N_2O	No	Excluded for simplification, this is conservative.
	Emissions from heat generation	CO_2	No	No heat generation is included in the project.
		CH_4	No	No thermal energy generation is included in the project.
		N_2O	No	No thermal energy generation is included in the project.
	Emissions from the use of natural gas	CO_2	No	Excluded for simplification. This is conservative
		CH_4	No	No supply of leachate biogas is included in the project.
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	No	Excluded because there is no fossil fuel consumption.
		CH_4	No	Excluded because there is no fossil fuel consumption.
		N_2O	No	Excluded because there is no fossil fuel consumption.
	Emission from electricity consumption due to project activity	CO_2	Yes	Main emission source.
		CH_4	No	Excluded for simplification. This emission source is very small compared to CO_2 emissions.
		N_2O	No	Excluded for simplification. This emission source is very small compared to CO_2 emissions.
	Emissions from flaring	CO_2	No	Excluded because there is no flaring in the project.

Source		Gas	Included?	Justification/Explanation
		CH_4	No	Excluded because there is no flaring in the project
		N_2O	No	Excluded because there is no flaring in the project
	Emissions from project wastewater treatment system	CO_2	No	CO_2 emissions from the decomposition of organic waste in the wastewater are not accounted for.
		CH_4	Yes	CH_4 is the major component in the biogas produced during anaerobic wastewater treatment.
		N_2O	No	Excluded for simplification.

3.4 Baseline Scenario

Leachate biogas: In the absence of the project, Leachate biogas of Jinghai New Energy Environmental Protection Power Generation Project is left to decay within the project boundary, and methane is emitted to the atmosphere directly without any recovery and utilization.

Electricity: The project is a new grid-connected renewable power unit.

According to the section 5.3 of the methodology AMS-III.H. and 5.2 of methodology AMS-I.D., the baseline scenario is:

Leachate biogas from Jinghai New Energy Environmental Protection Power Generation Project is emitted to the atmosphere directly.

Equivalent electricity generated by the project is supplied by the NCPG, which is dominated by fossil fuel based power plants.

3.5 Additionality

As per "Demonstration of additionality of small-scale project activities" Version 13.1, additionality of the project shall be demonstrated by providing an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

In line with the above guidance, the additionality is demonstrated using option (a) Investment barrier. The tool available in "Tool for the demonstration and assessment of additionality, version 07.0.0" is used to conduct the investment analysis and determine appropriate analytical methods.

Option I. Apply simple cost analysis

Applicable to situations where the proposed project does not generate financial or economic benefits other than those related to emission reduction mechanisms. In addition to VCUs revenue, this project also includes electricity sales revenue, so Option I is not applicable to this project.

Option II. Apply investment comparison analysis

Suitable for alternative projects as well as investment projects. Providing equal power supply from Central China Power Grid is not a specific investment project, and the project participants do not participate in investment related to the construction of the power grid. Therefore, Option II is not applicable to this project.

Option III. Apply benchmark analysis

Applicable to situations where alternative projects are not investment projects.

Therefore, the benchmark analysis (Option III) option has been applied. This project adopts a benchmark rate of return analysis to analyze the investment obstacles of the project. According to the "Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects"[4], the post tax benchmark rate of return for the full investment of landfill gas power generation projects is 8%.

Based on the Feasibility Study Report of the proposed project, basic parameters for calculation of financial indicators are as follows:

Table 3.2 Main parameters used in the calculation of the after-tax project IRR

Parameters	Unit	Value	Source
Total static investment	Million RMB	8.9	FSR
Installed capacity	MW	1	FSR
Net electricity supplied to the grid	MWh	6,630	FSR
Electricity Tariff (with VAT)	RMB/kWh	0.3655	FSR

[4] "Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects", issued by State Power Corporation on 10/09/2002.

VAT for electricity	%	17	FSR
Urban maintenance and construction tax	%	7	FSR
Education additional tax	%	3	FSR
Income tax	%	25	FSR
Lifetime	Year	10	FSR
Residual value rate of fixed assets	%	5	FSR
Annual operation & maintenance costs in a normal year	Million RMB	1.43	FSR
Expected VCUs price	RMB /tCO_2e	20	Assumption
Plant load factor (PLF)	%	75.68[5]	Calculated

Comment: The FSR refers only to the biogas capture and electricity generation investment and O&M costs.

The benchmark analysis compares the after-tax project IRR with the benchmark. The main results of the financial analysis are presented in Table 3.2, where the project IRR with and without VCS revenues are compared to the benchmark.

Table 3.3 Comparison of calculated Project IRR and the benchmark

Project IRR	Benchmark	Project IRR
Without VCS	Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects	With VCS
1.33%	8%	13.47%

It is clear from the table above that without VCS revenue the project IRR is far below the benchmark, in others words, it is financially unattractive, while with VCS revenue the project IRR is negative.

According to the financial analysis, after the implementation of the project with the expected input-output effect, the financial internal rate of return of all investment of the project is 1.33%. The economic benefit of the project is poor and lower than benchmark 8%. After the transaction of VCS project is included, the financial internal rate of return after income tax increases to 13.47%. The financial profitability of the project is good, and the income target can be reached. Therefore, after applying for VCS project, the project income can be increased.

[5] PLF=6,630/ (1*8,760) =75.68%.

A sensitivity analysis is conducted with the purpose of checking whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the assumptions. The investment analysis provides a valid argument in favor of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive or is unlikely to be financially attractive. The following financial parameters were identified as the main variable factors for sensitivity analysis of financial attractiveness:

- Total static investment

- Electricity tariff

- Net electricity supplied to the grid

- Annual O&M cost

Table 3.3 presents the results of the sensitivity analysis for the four main parameters. Financial analyses were performed to assess the impact on the project profitability by altering each of these parameters by ±10% as conservative consideration. The impact on the project IRR is as follows:

Table 3.4 sensitivity of Project IRR to different financial parameter

	-10%	-5%	0%	5%	10%
Total static investment	3.05%	2.16%	1.33%	0.56%	-0.15%
Electricity tariff	-2.87%	-0.72%	1.33%	3.31%	5.20%
Net electricity supplied to the grid	-2.87%	-0.72%	1.33%	3.31%	5.20%
Annual O&M cost	1.62%	1.47%	1.33%	1.19%	1.05%

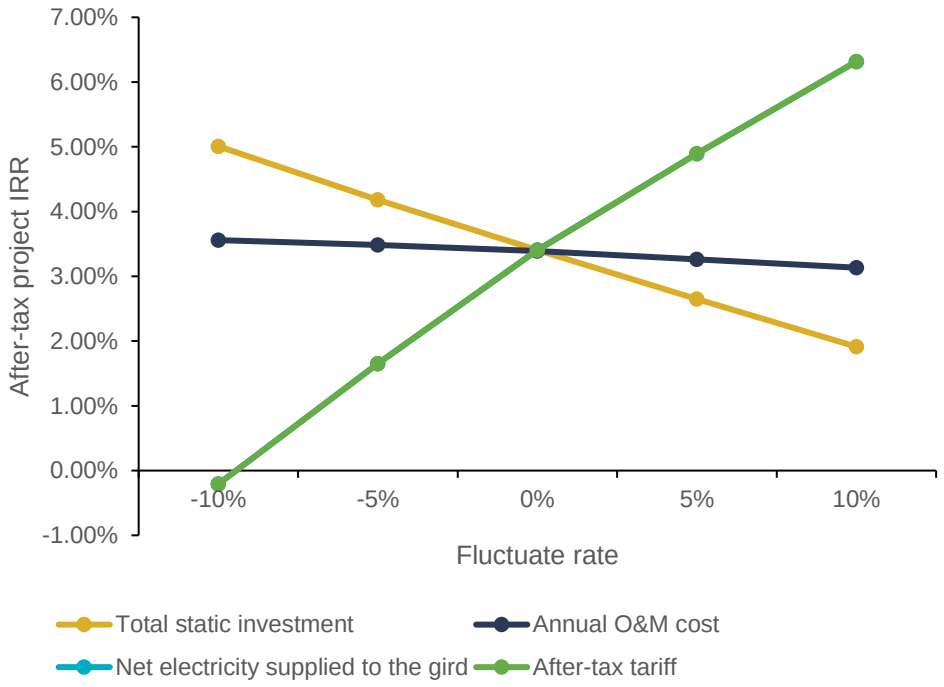

Figure 3.2 Sensitivity analysis of after-tax project IRR with changes of key parameters

Total static investment: With a decrease in the total static investment by 10%, the after-tax Project IRR is 3.05% still less than 8.0%. Even when the total static investment reduced by 33.43% (decrease to 5,590,000 RMB), the after-tax project IRR will reach benchmark. According to the fixed asset investment price index of National Bureau of Statistics[6], the fixed asset investment price index from 2017 to 2019 was respectively is 101.0, 101.2 and 103.5 and It's always growing. Therefore, the static total investment of the project cannot be reduced by 33.43%. According to the audit of financial accounts, the total cost has been 8,459,579.70 RMB, which exceeds the sensitive point of the sensitivity analysis of the project. Therefore, it is not possible to increase the economic attractiveness of the project by reducing the total static investment.

Annual O&M cost: With a decrease in the annual O&M cost by 10%, the after-tax Project IRR would only rise to 1.62% which is much lower than the benchmark of 8.0%. When the O&M cost decreases to 0 RMB, the IRR will not reach benchmark, however such great decrease is unlikely happen due to the increasing CPI in China[7].

Electricity tariff: With an increase in the electricity tariff by 10%, the after-tax Project IRR of the project is 5.20%, less than 8.0%. When the electricity tariff increases to 0.4388 RMB/kWh the after-tax Project IRR of the project can reach benchmark of 8.0%. However, the approval of

[6] https://data.stats.gov.cn/easyquery.htm?cn=C01&zb=A0901&sj=2022

[7] http://sousuo.www.gov.cn/sousuo/search.shtml?code=17da70961a7&dataTypeId=107&searchWord=CPI

electricity tariff of a power generation project is set by the government[8]. The actual electricity tariff of the project is 0.3655RMB/kWh[9]（As indicated in the electricity purchase and sale contract）, as per the approval of electricity tariff. Therefore, it cannot be expected that the after-tax Project IRR will improve due to an increase in the electricity tariff.

Net electricity supplied to the grid: With an increase in net electricity supplied to the grid by 10%, the after-tax Project IRR of the project is 5.20%, less than 8.0%. When the net electricity supplied to the grid increases by 18.90%, the after-tax Project IRR of the project can reach benchmark of 8.0%. Even when the generators will supply all generated electricity to the grid (Rate of electricity consumption by plant is assumed to be 0%) during the crediting period, the annual average electricity supplied to the grid will only reach 6,630[10] MWh (according to EIA). Moreover, the net electricity supplied to the grid is calculated based on captured biogas, which is estimated conservatively. Therefore, it is very unlikely for the project to become commercially attractive through an increase of the electricity generation.

In conclusion, the above sensitivity analysis provides valid argument that the financial attractiveness of the proposed project is robust to reasonable variations in the critical assumptions, and consistently supports that without VCUs revenue, the proposed project is not financially attractive.

3.6 Methodology Deviations

No methodology deviation is applied in the project.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The project utilizes the leachate biogas for generation to substitute the equivalent electricity supplied by the grid, resulting in CH_4 and CO_2 emissions, which will be calculated as follows according to the methodology AMS-III.H. and AMS-I.D.

[8] http://www.gov.cn/ztzl/2006-01/20/content_165910.htm

[9] https://www.tj.gov.cn/zwgk/szfgb/szfbawjSite/202007/t20200710_2783325.html

[10] According to the invoice for 2022, the net electricity supplied to the grid of 2022 is 2,173 MWh. The difference between 2,173 MWh and 2,762 MWh (6,630/12*5=2,762) is within reasonable range, since power generator 1# was started operation on 12/07/2022 and power generator 2# was started operation on 17/07/2022. In addition, 2022 is the first operation year of the project, and the net electricity supplied to the grid will increase with the improvement of operational capacity.So the annual net electricity supplied to the grid of 6,630 MWh is reasonable.

Baseline emissions associated with wastewater treatment:

$$BE_{y,1} = BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}$$

Equation (1)

Where:

$BE_{y,1}$	=	Baseline emissions associated with wastewater treatment in year y (t CO_2e)
$BE_{power,y}$	=	Baseline emissions from electricity or fuel consumption in year y (t CO_2e)
$BE_{ww,treatment,y}$	=	Baseline emissions of the wastewater treatment systems affected by the project activity in year y (t CO_2e)
$BE_{s,treatment,y}$	=	Baseline emissions of the sludge treatment systems affected by the project activity in year y (t CO_2e)
$BE_{ww,discharge,y}$	=	Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (t CO_2e). The value of this term is zero for the case 1(b)
$BE_{s,final,y}$	=	Baseline methane emissions from anaerobic decay of the final sludge produced in year y (t CO_2e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected

There is no electricity consumption. Therefore, $BE_{power,y}$ is not applicable .

In the baseline scenario, treated wastewater is used for factory reusing and is not discharged into sea/lake/river, therefore methane emissions from degradable organic carbon in treated wastewater discharged ($BE_{ww,\ discharge,\ y}$) in e.g. a river, sea or lake in the baseline situation is assumed to be zero. Therefore, $BE_{ww,\ discharge,\ y} = 0$

The sludge is controlled combusted by sent to incinerator. Therefore, $BE_{s,final,y}$ and $BE_{s,treatment,y}$ is not applicable to calculations.

Therefore, the baseline emissions equation is simplified to:

$$BE_{y,1} = BE_{ww,treatment,y}$$

Equation (2)

Methane emissions from the baseline wastewater treatment systems affected by the project ($BE_{ww,treatment,y}$) are determined using the COD removal efficiency of the baseline plant:

$$BE_{ww,treatment,y} = \sum_i \left(Q_{ww,i,y} \times COD_{inflow,i,y} \times \eta_{COD,BL,i} \times MCF_{ww,treatment,BL,i}\right) \times B_{o,ww} \times UF_{BL} \times GWP_{CH4}$$

Equation (3)

Where:

$Q_{ww,i,y}$	=	Volume of wastewater treated in baseline wastewater treatment system i in year y (m^3).

$COD_{inflow,i,y}$	=	Chemical oxygen demand of the wastewater inflow to the baseline treatment system i in year y (t/m³). Average value may be used through sampling with the confidence/precision level 90/10
$\eta_{COD,BL,i}$	=	COD removal efficiency of the baseline treatment system i, determined as per the paragraphs 35,36 or 37
$MCF_{ww,treatment,BL,i}$	=	Methane correction factor for baseline wastewater treatment systems i
$B_{o,ww}$	=	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)
UF_{BL}	=	Model correction factor to account for model uncertainties (0.89)[11]
GWP_{CH4}	=	Global Warming Potential for methane

According to the EIA, the Volume of treated wastewater is 417.6 m³/d.

$Q_{ww,i,y}$=417.6*365=152,424 m³/yr

The Methane Correction Factor (MCF) shall be determined based on the following table:

Table 4.1. IPCC default values 7 for Methane Correction Factor (MCF)

Type of wastewater treatment and discharge pathway or system	***MCF* value**
Discharge of wastewater to sea, river or lake	0.1
Land application	0.1
Aerobic treatment, well managed	0.0
Aerobic treatment, poorly managed or overloaded	0.3
Anaerobic digester for sludge without methane recovery	0.8
Anaerobic reactor without methane recovery	0.8
Anaerobic shallow lagoon (depth less than 2 metres)	0.2
Anaerobic deep lagoon (depth more than 2 metres)	0.8
Septic system	0.5
Land application[(a)]	0.1

$$MCF_{ww,treatment,BL,i} = 0.8$$

Baseline emissions associated with electricity generation ($BE_{EC,y}$)

$$BE_{y,2} = EG_{PJ,y} \times EF_{grid,y}$$ Equation (4)

$BE_{y,2}$ = Baseline emissions associated with electricity generation in year y (t CO_2)

[11] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year y(MWh)

$EF_{grid,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

Calculation of $EG_{PJ,y}$

The project is the installation of a greenfield power plant, therefore:

$$EG_{PJ,y} = EG_{PJ,facility,y}$$ Equation (5)

Where:

$EG_{PJ,facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y(MWh)

Calculation of $EF_{grid,y}$

According to the AMS-III.G., $EF_{grid,y}$ is calculated using the "Tool to calculate the emission factor for an electricity system"($EF_{grid,y}$=$EF_{grid,CM,y}$).

Project participants shall apply the following six steps:

Step 1: Identify the relevant electricity systems;

Step 2: Choose whether to include off-grid power plants in the project

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

Step 4: Calculate the operating margin emission factor according to the

Step 5: Calculate the build margin (BM) emission factor;

Step 6: Calculate the combined margin (CM) emission factor.

Step 1: Identity the relevant electricity systems

Ministry of Ecology and Environment of the People's Republic of China has published a delineation of the project electricity system and connected electricity systems, so the project adopts the delineation of project electricity system and connected electricity system published by Ministry of Ecology and Environment of the People's Republic of China. The power generated by the project displaces the equivalent electricity generated by the East China Power Grid. The East China Power Grid is a larger regional grid, which consists of six sub-grids: Shanghai City, Jiangsu Province, Zhejiang Province, Anhui Province, Fujian Province.

In addition, there is net imported power to the East China Power Grid from the North China Power Grid, Northwest China Power Grid and Central China Power Grid. According to the "Tool to calculate

the emission factor for an electricity system", use one of the following options to determine the CO_2 emission factor for net electricity imports from a connected electricity system:
(a) 0tCO_2/MWh; or

(b) The simple operating margin emission rate of the exporting grid, determined as described in Step 4 section 6.4.1, if the conditions for this method, as described in Step 3 below, apply to the exporting grid; or

(c) The simple adjusted operating margin emission rate of the exporting grid, determined as described in Step 4 section 6.4.2 below; or

(d) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in Step 4 section 6.4.4 below.

The PD will choose option (b) to calculate the CO_2 emission factor for net electricity imports from the East China Power Grid.

According to the available data of 2016-2018, the corresponding marginal emission factors of electricity are calculated, and weighted average is carried out to obtain the marginal emission factors of electricity.

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

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.

Following the calculation of the Ministry of Ecology and Environment of the People's Republic of China, and statistical data is available, Option I is chosen.

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

"Tool to calculate the emission factor for an electricity system (Version 7.0)" offers four methods for the calculation of the operating margin emission factor(s) ($EF_{grid,OM,y}$):

(a) Simple OM; or

(b) Simple adjusted OM; or

(c) Dispatch data analysis OM; or

(d) Average OM.

Method (a) -Simple OM is chosen for calculation and low-cost/must-run resources constitute less than 50% of the total grid generation in average of the five most recent years[12].

[12] 2019 Bulletin on the Baseline Emission Factors of the China Grids

For simple OM, the emission factor can be calculated using either of the two following data vintages:

(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 mission 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 VCS-PD to the DOE for validation. For off-grid power plants, use a single calendar year within the 5 most recent calendar years prior to the time of submission of the VCS-PD 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 emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods

Project participant employs ex ante option for its operation margin calculation.

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 CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units.

The simple OM may be calculated by one of the following two options:

(a) Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

(b) 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. Option B can only be used if:

(i) The necessary data for Option A is not available: and

(ii) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and

(iii) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

Since the data of each power plant/unit is unavailable, Option A is not applicable to the project. The project adopts Option B to calculate the operating margin emission factor ($EF_{grid,OM,y}$) of NCPG.

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$ Equation (6)

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/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)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2e/GJ), 2006 IPCC Guidelines for default values
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 dta vintage chosen in Step 3

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO2,i,y}$ should be used where available. If no such values are available, IPCC default values are preferable. The Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistic Yearbook 2018. Emission factor ($EF_{CO2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

The operating margin emission factor for 2016, 2017 and 2018 are calculated based on the data above. The three-year average is calculated as a weighted average of the emission factors. The Operational Margin Emission Factor is $0.9419tCO_2/MWh$.

Step 5. Calculate the build margin emission factor

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

(a) 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 VCS PD 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 crediting period to the DOE. 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.

(b) 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 the 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 project applies option 1 to calculate the build margin emission factor ex-ante.

According to the "Tool to calculate the emission factor for an electricity system", the sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as VCS project activities, that started to supply electricity to the grid most recently ($SET_{5\ units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as VCS project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as VCS project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

(c) From $SET_{5\text{-}units}$ and $SE_{T\geq 20\ percent}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use $SE_{Tsample}$ to calculate the build margin. Ignore steps (d), (e) and (f).

Otherwise:

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as VCS project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set (SET_{sample}) the annual electricity generation ($AEG_{SET\text{-}sample}$, in MWh);

If the annual electricity generation of that set is comprised at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample} \geq 0.2 \times AEG_{total}$), then use the sample group SET_{sample} to calculate the build margin. Ignore steps (e) and (f).

(e) Include in the sample group SET_{sample} the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set (SET_{sample}>10yrs)

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \text{Equation (7)}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (t CO_2/MWh)

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

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (t CO_2/MWh)

m = Power units included in the build margin

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

According to the tools, the generation capacity of and the proportions of different generating technologies used in the mostly recent capacity additions would be calculated at first. The weight of each generating technology used in capacity additions can then be worked out and finally the Build Margin emission factor would be calculated with the commercial optimal efficiencies of the generating technologies.

The following method is adopted for the BM calculation. The first step is to use the most recently available data on the energy balance to calculate the proportion of CO_2 emissions from solid, liquid, and gas fuels used for power generation in total CO_2 emissions for the NCPG in 2019. Then this proportion is applied as a weight and combined with the emission factors of the best commercially available technologies to calculate the thermal emission factor of the NCPG. Finally, the BM factor of the NCPG can be determined by multiplying its thermal emission factor by the capacity-weighted share of thermal power in the newly added 20% of the installed capacity

(1) Calculate the proportion of CO_2 emissions from solid, liquid, and gas fuels used for power generation in total CO_2 emissions for the NCPG in the base year (2015)

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad \text{Equation (8)}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in Oil,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}$$ Equation (9)

$$\lambda_{Gas,y} = \frac{\sum_{i \in Gas,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}$$ Equation (10)

Where:

$F_{i,j,y}$	=	The amount of fuel i (in a mass or volume unit) consumed by province
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i(GJ/mass or volume unit)
COAL,OIL&GAS	=	The aggregation of various kinds of coal, oil, and gas as fossil fuels.

(2) Calculate the corresponding emission factor for fossil fuel fired power generation.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{GAS} \times EF_{Gas,Adv}$$ Equation (11)

Where:

$EF_{Coal,adv}$, $EF_{OIL,adv}$, $EF_{Gas,adv}$ are the emission factors of coal, oil and gas-fired power generation with efficiency levels of the best commercially available technology in China in the previous three years.

(3) Calculate the Building Margin emission factor

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$$ Equation (12)

Where:

$CAP_{Thermal}$	=	Total capacity additions while
CAP_{Total}	=	Capacity additions of thermal power

Following the four steps above, the build margin emission factor, $EF_{grid,BM,y}$ of the NCPG is calculated to be 0.4819 tCO_2/MWh.

Step 6. Calculate the combined margin emission factor

Combined Margin emission factor ($EF_{grid,CM,y}$) is calculated as the weighted average of the operating margin emission factor($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$),where the weights ω_{OM} and ω_{BM} ,by default, are 0.5 and 0.5 in the first crediting period, and $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are calculated as described above and are expressed in tCO_2/MWh.

$$EF_{grid,CM,y} = \omega_{OM} \times EF_{grid,OM,y} + \omega_{BM} \times EF_{grid,BM,y}$$ Equation (13)

$EF_{grid,CM,y}$=0.5×0.9419+0.5×0.4819=0.7119 (tCO_2/MWh)

The $EF_{OM,y}$, $EF_{BM,y}$ and $EF_{grid,CM,y}$ are ex-ante calculation and are fixed during the credit period.

By combining all the above equations,the ex-ante estimate of the emission reduction is :

$$BE_y = \sum_i \left(Q_{ww,i,y} \times COD_{inflow,i,y} \times \eta_{COD,BL,i} \times MCF_{ww,treatment,BL,i}\right) \times B_{o,ww} \times UF_{BL} \times GWP_{CH4} + EG_{PJ,y} \times EF_{grid,y}$$

Equation (14)

BE_y=152,424m³*0.056498t/m³*77.89%*0.25t CH_4/t COD*0.89*28+6.630MWh*0.7119tCO_2e/MWh

=33,431 tCO_2e +4,720 tCO_2e =38,150 tCO_2e

4.2 Project Emissions

$$PE_y = PE_{BR,y} + PE_{EC,y}$$

Equation (15)

Where:

PE_y	=	Project emissions in the year y (t CO_2e)
$PE_{BR,y}$	=	Project emissions from biogas recovery in the year *y* (t CO_2e).
$PE_{EC,y}$	=	Project emissions from electricity consumption in the year *y* (t CO_2e).

Project emissions from biogas recovery calculation:

$$PE_{BR,y} = PE_{power,y} + PE_{ww,treatment,y} + PE_{fugative,y} + PE_{ww,discharge,y} + PE_{s,treatment,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y}$$

Equation (16)

Where:

$PE_{BR,y}$	=	Project emissions from biogas recovery in the year y (t CO_2e)
$PE_{power,y}$	=	Emissions from electricity or fuel consumption in the year *y* (t CO_2e).
$PE_{ww,treatment,y}$	=	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (t CO_2e).
$PE_{ww,discharge}$	=	Methane emissions from degradable organic carbon in treated wastewater in year *y* (tCO_2e).
$PE_{fugitive,y}$	=	Methane emissions from biogas release in capture systems in year *y*, calculated as per paragraph 40 (t CO_2e).
$PE_{s,treatment,y}$	=	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (t CO_2e).
$PE_{s,final,y}$	=	Methane emissions from anaerobic decay of the final sludge produced in year *y* (t CO_2e).
$PE_{fugitive,y}$	=	Methane emissions from biogas release in capture systems in year *y* (t CO_2e).
$PE_{biomass,y}$	=	Methane emissions from biogas stored under anaerobic conditions.
$PE_{flaring,y}$	=	Methane emissions due to incomplete flaring in year y (t CO_2e).

There is no flare used to destroy the leachate biogas, therefore, $PE_{flaring,y}$ Is equal to 0.

The sludge is controlled combusted by sent to incinerator. Project activity does not involve sludge treatment, therefore, $PE_{s,treatment,y}$ *and* $PE_{s,final,y}$ is equal to 0.

These emissions shall be calculated as per paragraph 26 of the methodology, If recovered biogas in the baseline is used to power auxiliary equipment it should be taken into account accordingly, using zero as its emission factor. The electricity used by project activity will be firstly supplied by the gas engines which use biogas as fuel, to import electricity from the grid is the second option when the gas engines does not operate. The project deliver the electricity to the project activity before delivery to the grid. Then the chance that the project activity will use electricity from grid is very low. Therefore, $PE_{power,y}$ can be considered as zero.

Only when the biogas plant need to import the electricity from grid the $PE_{power,y}$ will be taken into account , which can be calculated from the same equation (4) of the baseline calculation formula for AMS I.D.

$$PE_{\text{power,y}} = EG_{PJ,y} \times EF_{grid,y} \quad \text{Equation (17)}$$

The water treatment system remains unchanged, and only methane capture system was installed. Therefore, $PE_{ww,treatment,y}$,$\text{PE}_{\text{biomass,y}}$ and $\text{PE}_{\text{ww,discharge,y}}$is equal to 0.

Therefore, the baseline emissions equation is simplified to:

$$PE_{BR,y} = PE_{fugitive,y} \quad \text{Equation (18)}$$

$$PE_{fugitive,ww,y} = (1 - CFE_{ww}) \times MEP_{ww,treatment,y} \times GWP_{CH4} \quad \text{Equation (19)}$$

Where:

CFE_{ww}	=	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 shall be used)
$MEP_{ww,treatment,y}$	=	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year *y* (t)

$$MEP_{ww,treatment,y} = Q_{ww,y} \times B_{o,ww} \times UF_{PJ} \times \sum_k COD_{removed,PJ,k,y} \times MCF_{ww,treatment,PJ,k} \quad \text{Equation (20)}$$

Where:

$COD_{removed,PJ,k,y}$	=	The chemical oxygen demand removed[13] by the treatment system *k* of the project activity equipped with biogas recovery in the year *y* (t/m^3)
$MCF_{ww,treatment,PJ,k}$	=	Methane correction factor for the project wastewater treatment system *k* equipped with biogas recovery equipment (*MCF* values as per Table 2 above)
UF_{PJ}	=	Model correction factor to account for model uncertainties (1.12)

[13] Difference between the inflow COD and the outflow COD.

The Methane Correction Factor (MCF) shall be determined based on the table 4.1. IPCC default values 7 for Methane Correction Factor (MCF).

$$MCF_{ww,treatment,PJ,k} = 0.8$$

$MEP_{ww,treatment,y}$ =152,424*0.044061*0.25*0.8*1.12
=1,504 tCH_4/yr

$PE_{BR,y} = (1 - 0.9) * 1{,}504 * 28$
=4,213 tCO_2e/yr

Project emissions from electricity consumption calculation:

$PE_{EC,y}$ is determined by "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 3.0) as follow:

$PE_{EC,y}$=Σ$EC_{PJ,j,y}$*$EF_{EF,j,y}$*(1+$TDL_{j,y}$) Equation(21)

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption in year y (tCO_2/yr)

$EC_{PJ,j,y}$ = Quantity of electricity consumed by the project electricity consumption source j in year y(MWh/yr)

$EF_{EF,j,y}$ = Emission factor for electricity generation for source j in year y(tCO_2/MWh)

$TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source j in year y

The ""Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" provides 3 scenarios for different sources of electricity consumption. Since the electricity generated through the project is consumed solely from grid (NCPG), scenario A is applicable. In the case of applying scenario A, two options are available for determining emission factor. For this project, Option A1($EF_{EF,j,y}$=$EF_{grid,CM,y}$) is chosen.

For simplification, $PE_{EC,y}$ will be 0 in the ex-ante calculation.

4.3 Leakage

There is no equipment transferred in the project, no leakage effects need to be accounted under AMS-III.H. and AMS-I.D.

4.4 Net GHG Emission Reductions and Removals

According to AMS-III.H., the emission reduction achieved by the project activity can be estimated ex-ante in the PD by:

$$ER_{y,estimated} = BE_y - PE_y - LE_y \quad \text{Equation (22)}$$

By combining all the above equations, the ex-ante estimate of the emission reduction is:

$$ER_{y,estimated} = \sum_i \left(Q_{ww,i,y} \times COD_{inflow,i,y} \times \eta_{COD,BL,i} \times MCF_{ww,treatment,BL,i}\right) \times B_{o,ww} \times UF_{BL} \times GWP_{CH4} + EG_{PJ,y} \times EF_{grid,y} - PE_y - LE_y$$

Equation (23)

The data used for calculation is from Environmental Impact Assessment and project operation daily.

$ER_{y,estimated}$ =152,424*0.056498*77.89%*0.8*0.25*0.89*28+6,630*0.7119-4,213-0

=33,431+4,720-4,213-0

=33,937 tCO_2/yr

Emission reductions (ex-post)

According to AMS-III.H., The actual emission reduction achieved by the project activity during the crediting period will be calculated as:

$$ER_{y,ex,post} = min((BE_{y,ex,post} - PE_{y,expost} - LE_{y,expost})(MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,expost})) \quad \text{Equation (24)}$$

Where:

$ER_{y,ex\ post}$	=	Emission reductions achieved by the project activity based on monitored values for year y (t CO_2e)
$BE_{y,ex\ post}$	=	Baseline emissions calculated as per paragraph 25 using ex post monitored values
$PE_{y,ex\ post}$	=	Project emissions calculated as per paragraph 39 using ex post monitored values
MD_y	=	Methane captured and destroyed/gainfully used by the project activity in the year y (t CO_2e)

In the case of flaring/combustion MD_y will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} \times W_{CH4,y} \times D_{CH4} \times FE \times GWP_{CH4} \quad \text{Equation (25)}$$

Where:

$BG_{burnt,y}$	=	Biogas[14] combusted in year y (m^3)
$w_{CH4,y}$	=	Methane content[13] of the biogas in the year y (volume fraction)
D_{CH4}	=	Density of methane at the temperature and pressure of the biogas in the year y (t/m^3)

[14] Biogas volume and methane content measurements shall be on the same basis (wet or dry).

FE = Flare efficiency in year y (fraction). If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100 per cent may be applied

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
12/07/2022-31/12/2022	18,082	1,997	0	16,085
2023	38,150	4,213	0	33,937
2024	38,150	4,213	0	33,937
2025	38,150	4,213	0	33,937
2026	38,150	4,213	0	33,937
2027	38,150	4,213	0	33,937
2028	38,150	4,213	0	33,937
2029	38,150	4,213	0	33,937
2030	38,150	4,213	0	33,937
2031	38,150	4,213	0	33,937
01/01/2032-11/07/2032	20,068	2,216	0	17,852
Total	**381,500**	**42,130**	**0**	**339,370**

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$MCF_{ww,treatment,BL,i}$
Data unit	-

Description	Methane correction factor for baseline wastewater treatment systems i
Source of data	MCF values as per Table 2 of AMS-III.H. V.19
Value applied	0.8
Justification of choice of data or description of measurement methods and procedures applied	Default values from chapter 6 of volume 5. Waste in 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$\eta_{COD,BL,i}$
Data unit	%
Description	COD removal efficiency of the baseline treatment system
Source of data	Operation report
Value applied	77.89%
Justification of choice of data or description of measurement methods and procedures applied	The COD removal efficiency is based on COD values for baseline system before implementation of project activity. Detailed data is shown in APPENDIX Table 5.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$B_{o,ww}$
Data unit	kg CH_4/kg COD
Description	Methane producing capacity of the wastewater
Source of data	Paragraph 29 of AMS-III.H V.19
Value applied	0.25
Justification of choice of data or description of	IPCC default value applies in line with Equation 2 of AMS-III.H V.19

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

Data / Parameter	UF_{BL}
Data unit	-
Description	Model correction factor to account for model uncertainties
Source of data	Paragraph 29 of AMS-III.H V.19
Value applied	0.89
Justification of choice of data or description of measurement methods and procedures applied	As specified in Paragraph 29 of AMS-III.H *V.19*
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	UF_{PJ}
Data unit	-
Description	Model correction factor to account for model uncertainties
Source of data	AMS-III.H V.19
Value applied	1.12
Justification of choice of data or description of measurement methods and procedures applied	As specified in methodology AMS-III.H V.19
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	$MCF_{ww,treatment,PJ,k}$
Data unit	-
Description	Methane correction factor for project wastewater treatment system k
Source of data	Table 2 of AMS-III.H V.19
Value applied	0.8
Justification of choice of data or description of measurement methods and procedures applied	As specified in methodology AMS-III.H V.19
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	GWP_{CH4}
Data unit	$tCO_2e/t\ CH_4$
Description	Global warming potential of CH_4
Source of data	IPCC
Value applied	Default value of 28. Shall be updated according to any future COP/CMP decisions
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	CFE_{ww}
Data unit	-
Description	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems
Source of data	Default value as per paragraph 40 Eq 10 of AMS-III.H V.19

Value applied	0.9
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operation margin emission factor of NCPG
Source of data	2019 Bulletin on the Baseline Emission Factors of the China Grids
Value applied	0.9419
Justification of choice of data or description of measurement methods and procedures applied	The value is published by Ministry of Ecology and Environment of the People's Republic of China, based on China Electric Yearbook (2016-2018), Electricity Industry Statistics (2015-2017), China Energy Statistic Yearbook (2016-2018) and IPCC data.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build margin emission factor of NCPG
Source of data	2019 Bulletin on the Baseline Emission Factors of the China Grids
Value applied	0.4819
Justification of choice of data or description of measurement methods and procedures applied	The value is published by Ministry of Ecology and Environment of the People's Republic of China, based on China Electric Yearbook (2016-2018), Electricity Industry Statistics (2015-2017), China Energy Statistic Yearbook (2016-2018) and IPCC data.
Purpose of Data	Calculation of baseline emissions

Comments	-

Data / Parameter	$TDL_{j,y}$
Data unit	%
Description	Average technical transmission and distribution losses for providing electricity to source j,k in year y
Source of data	Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0)
Value applied	20%
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	D_{CH4}
Data unit	Tonnes /m^3
Description	Methane density
Source of data	Tool 08 “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0)
Value applied	0.0007156
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	At the normal conditions (273.15 K and 101,325 Pa)

Data / Parameter	FE

Data unit	%
Description	Flare efficiency in year y
Source of data	Default value as per paragraph 45 Eq 10 of AMS-III.H V.19
Value applied	100
Justification of choice of data or description of measurement methods and procedures applied	If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100 per cent may be applied
Purpose of Data	Calculation of baseline emissions
Comments	-

5.2 Data and Parameters Monitored

Data / Parameter	$Q_{ww,i,y}$
Data unit	m^3/month
Description	The flow of wastewater
Source of data	Continuous flow meter F1
Description of measurement methods and procedures to be applied	Measured continuously by flow meters installed before entering the treatment system.
Frequency of monitoring/recording	Parameter monitored continuously but aggregated monthly and annually for calculations.
Value applied	12,528
Monitoring equipment	Continuous Flow Meter
QA/QC procedures to be applied	Tianjin Gaoneng Environmental Protection Energy Co., Ltd. employs an internal QA audit process that ensures monitoring activities are conducted in accordance with the monitoring plan

	Accuracy	Serial Number
Flow Meter F1	0.5	PAOCF018000

	and verifies the accuracy of data reported. The flow meter will be operated and calibrated according to manufacturer's specifications but no less than every 3 years). A calibration/service log will be maintained for the flow meter.
Purpose of data	Calculation of baseline and project emissions
Calculation method	-
Comments	-

Data / Parameter	$BG_{burnt,y}$
Data unit	Nm^3
Description	Biogas volume in year y
Source of data	Daily records of the flow meter F2
Description of measurement methods and procedures to be applied	Measured continuously by flow meters installed before entering the treatment system.
Frequency of monitoring/recording	Measured continuously by a flow meter, and recorded at least once per hour. Data to be aggregated monthly and yearly.
Value applied	2,922,400(based on EIA and all biogas is combusted in gas engines)
Monitoring equipment	Continuous Flow Meter
QA/QC procedures to be applied	The calibration is being done once a year.
Purpose of data	Calculation of baseline emissions
Calculation method	-

	Accuracy	Serial Number
Flow Meter F2	1.5	T1030d02000

Comments	Flow meters automatically measure temperature and pressure, expressing LFG volumes in Normalized cubic meters (Nm^3). Data are archived during the crediting period and kept until two years after.

Data / Parameter	$w_{CH4,y}$
Data unit	%
Description	Methane content in biogas in the year y
Source of data	Daily records of the gas analyzer meter
Description of measurement methods and procedures to be applied	Measured directly by continuous gas analyzer.
Frequency of monitoring/recording	Measurements are recorded electronically at least once per day. The data are measured and archived electronically.
Value applied	65% (assumed based on feasibility study report)
Monitoring equipment	Gas analyzer
QA/QC procedures to be applied	Gas analyzer is calibrated once a year.
Purpose of data	Calculation of baseline and project emissions
Calculation method	-
Comments	-

Name	Type	Accuracy class	Serial number
Gas analyzer	BIOGAS 5000	0.5%	G505030

Data / Parameter	$COD_{ww,untreated,y}$
Data unit	t COD/m^3
Description	The chemical oxygen demand of the wastewater before the treatment system affected by the project activity

Source of data	Sampling analysis
Description of measurement methods and procedures to be applied	The COD content will be analyzed using a spectrophotometric method. The results will be logged in the plant operation report on a daily basis.
Frequency of monitoring/recording	Measured and recorded every day. The confidence/precision level of 90/10 shall be attained.
Value applied	The data below are calculated ex-ante. Detailed data is shown in APPENDIX Table 5.
Monitoring equipment	UV-1500 spectrophotometer
QA/QC procedures to be applied	Measure the COD in accordance with Technical requirement and test procedures for rapid COD photometric analyzer (HJ924-2017).
Purpose of data	Calculation of baseline and project emissions
Calculation method	-
Comments	-

Data / Parameter	$COD_{ww,treated,y}$
Data unit	t COD/m^3
Description	The chemical oxygen demand of the wastewater after the treatment system affected by the project activity
Source of data	Sampling analysis
Description of measurement methods and procedures to be applied	The COD content will be analyzed using a spectrophotometric method. The results will be logged in the plant operation report on a daily basis.
Frequency of monitoring/recording	Measured and recorded every day. The confidence/precision level of 90/10 shall be attained.

Value applied	The data below are calculated ex-ante. Detailed data is shown in APPENDIX Table 5.
Monitoring equipment	UV-1500 spectrophotometer
QA/QC procedures to be applied	Measure the COD in accordance with Technical requirement and test procedures for rapid COD photometric analyzer (HJ924-2017).
Purpose of data	Calculation of baseline and project emissions
Calculation method	-
Comments	-

Data / Parameter	$EG_{PJ,facility,y}$
Data unit	MWh
Description	Quantity of net electricity generated supplied by the project plant/unit in year y
Source of data	Electricity meter E
Description of measurement methods and procedures to be applied	Measured continuously by electricity meter (bi-directional) installed at the project site. All data will be monitored and archived electronically. Double check by receipt of electricity sales.
Frequency of monitoring/recording	The recording frequency will be hourly measured and record and monthly aggregated.
Value applied	The data below are calculated ex-ante.

Year	Quantity of net electricity generated supplied by the project plant (MWh)
12/07/2022-31/12/2022	3,142
2023	6,630
2024	6,630
2025	6,630

	2026	6,630
	2027	6,630
	2028	6,630
	2029	6,630
	2030	6,630
	2031	6,630
	01/01/2032-11/07/2032	3,488
Monitoring equipment	Electricity meter E shown in the monitoring system as below.	
QA/QC procedures to be applied	The calibration should be done once a year by a qualified third party.	
Purpose of data	Calculation of baseline emissions	
Calculation method	-	
Comments	-	

Data / Parameter	$EC_{PJ,y}$
Data unit	MWh
Description	Amount of electricity consumed by the project activity in year y
Source of data	Electricity meter E
Description of measurement methods and procedures to be applied	Sources of consumption include electricity consumed for the operation of the biogas capture system, for any processing and upgrading of the biogas, for transportation of the biogas to the flare or power generators, etc.
Frequency of monitoring/recording	The recording frequency will be hourly measured and record and monthly aggregated.
Value applied	For simplification, the data used in ex ante calculation is 0.
Monitoring equipment	Electricity meter E shown in the monitoring system as below.
QA/QC procedures to be applied	The calibration should be done once a year by a qualified third party.

Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	P
Data unit	Pa
Description	Pressure of the biogas
Source of data	-
Description of measurement methods and procedures to be applied	The pressure of the gas is required to determine the density of the methane combusted. If the biogas flow meter employed measures flow, pressure and temperature and displays or outputs the normalised flow of biogas, then there is no need for separate monitoring of pressure and temperature of the biogas.
Frequency of monitoring/recording	-
Value applied	-
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	-
Calculation method	-
Comments	-

Data / Parameter	T
Data unit	℃
Description	Temperature of the biogas
Source of data	-
Description of measurement methods and procedures to be applied	The temperature of the gas is required to determine the density of the methane combusted. If the biogas flow meter employed measures flow, pressure and temperature and displays or outputs

	the normalised flow of biogas, then there is no need for separate monitoring of pressure and temperature of the biogas
Frequency of monitoring/recording	-
Value applied	-
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	-
Calculation method	-
Comments	-

5.3 Monitoring Plan

1. The requirement of monitoring plan

The project participants will monitor the emission reductions by methods, indicators, and frequency required by Monitoring Methodology AMS-III.H. (Version 19.0) and AMS-I.D (Version 18.0) to ensure project ERs are measurable and real. The monitoring methodology is based on direct measurement of the amount of leachate biogas captured and destroyed by the project and electricity generating units.

2. Responsibilities of operational and management structure

The project participant will implement this monitoring plan. The plan could be revised according to suggestions from VVB and the practical circumstances, in order to keep it consistent, transparent and conservative during the monitoring process.

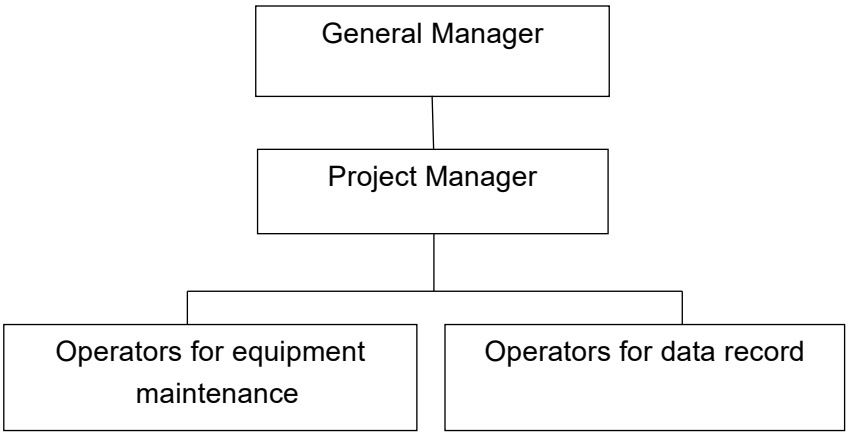

Figure 5.1 Operational and management structure

(1) Principal of the monitoring procedure

The general manager of the project is the leader of the monitoring tasks: he sets out the responsibility of everyone in the monitoring system, and establishes the related documents. The general manager ensures that staff in the monitoring system has the ability to deal with the assigned tasks.

(2) Executive person of the monitoring procedure

Project Manager: a Project Manager is appointed, specifically responsible for training, checking the daily operation, reporting forms and archiving emergency situation reports. The VCS Manager reports monthly to the General Manager (GM) about the project performance and monitored data. In the event that non-conformance in the performance to the mentioned procedures and/or functioning problems of the monitoring equipment are identified, the VCS manager will inform the GM about the situation and work out relevant measures to be taken. The VCS manager will also be responsible for aggregating the monitored data monthly and yearly, archiving and keeping data during the crediting period and two years after.

(3) Operators of the monitoring procedure

Operators will take turns to work in the control center 24 hours a day. They will be in charge of data supervision, filling operation report forms and, checking and inspecting the system. If necessary, they will have the responsibility for executing the emergency plan and drafting emergency situation reports.

3. Monitoring system

-

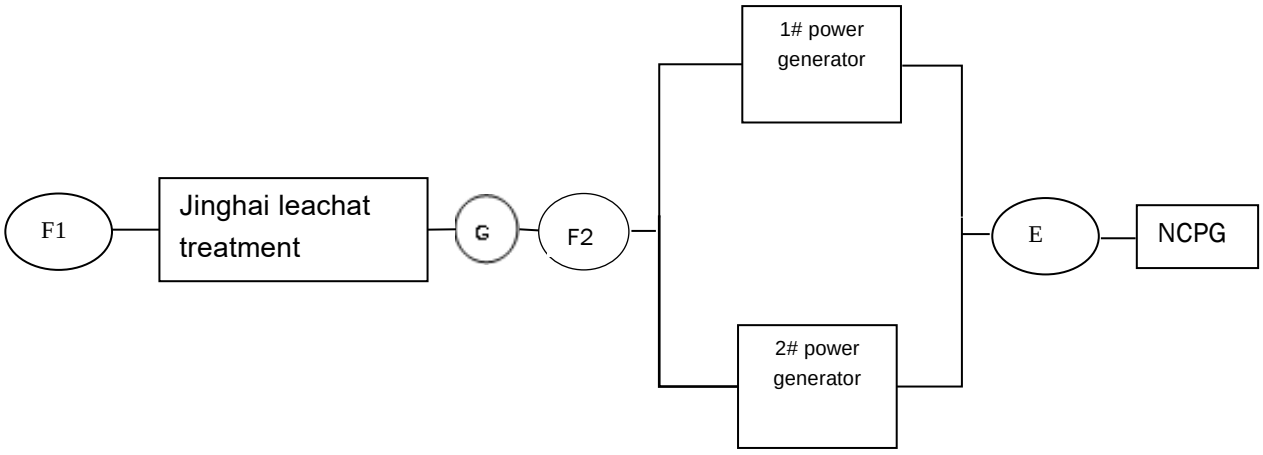

Figure 5.2 Monitoring system

Main parameters:

E	Electricity meter (main meter, bi-directional) to continuously measure the electricity supplied to the NCPG and the electricity supplied by the grid
F1	Flow meter to continuously measure the flow of wastewater before entering the treatment system.
F2	Flow meter to continuously measure flow rate of total biogas, with automatic measure adjustment for temperature and pressure.
G	Gas analyzer to continuously measure methane fraction in biogas (W_{CH4}).

Net electricity exported to the grid:

Electricity meter E is the main meter for monitoring the net electricity supplied to and imported from the grid. Therefore, the net electricity supplied to the grid is calculated as: EG_{OUT} - EG_{IN}.

The meter E is installed at the project site and sends data to the DCS. The data was checked daily and totalized monthly. Electricity receipts and invoices was used as cross check during verification. E was calibrated by a qualified third party according to the industry standards and applicable regulations.

4. QA/QC

In order to ensure monitoring plan with high quality, QA/QC measures are carried out in monitoring data recording and checking, equipment calibrating and staff training.

Data recording: all data collected are recorded in electronic files which are regularly backed up. The data are checked by the specific staff every day and reported to General Manger by Project manager monthly.

Equipment calibration and maintenance: Project equipment are subject to regular maintenance and testing according to technical specifications from the manufactures to ensure accuracy and good performance.

If there is a problem with the project's monitoring equipment, the relevant data will be discarded during this period.

5. Emergency procedures

Once a meter in fault, it shall be immediately repaired or replaced with another calibrated meter by a professional engineer, and the biogas or electricity generated during the period of erroneous measurement and replacement of the fault meter shall not be accounted for conservative consideration.

APPENDIX

Table 5: Additional information for ex-ante estimation

Date	$COD_{ww,untreated,y}$ (mg/L)	$COD_{ww,treated,y}$ (mg/L)	$COD_{ww,untreated,y}$ (t/m^3)	$COD_{ww,treated,y}$ (t/m^3)	$\eta_{COD,BL,i}$ (%)
01-Jul-22	59,618	11,773	0.059618	0.011773	80.25%
02-Jul-22	60,588	11,397	0.060588	0.011397	81.19%
03-Jul-22	59,929	11,384	0.059929	0.011384	81.00%
04-Jul-22	57,420	12,970	0.057420	0.012970	77.41%
05-Jul-22	58,701	12,285	0.058701	0.012285	79.07%
06-Jul-22	56,191	12,593	0.056191	0.012593	77.59%
07-Jul-22	57,438	12,701	0.057438	0.012701	77.89%
08-Jul-22	56,846	12,819	0.056846	0.012819	77.45%
09-Jul-22	57,065	11,577	0.057065	0.011577	79.71%
10-Jul-22	57,040	11,920	0.057040	0.011920	79.10%
11-Jul-22	55,905	11,630	0.055905	0.011630	79.20%
12-Jul-22	60,984	11,125	0.060984	0.011125	81.76%
13-Jul-22	/	/	/	/	/
14-Jul-22	55,124	12,662	0.055124	0.012662	77.03%
15-Jul-22	56,289	12,646	0.056289	0.012646	77.53%
16-Jul-22	58,470	12,895	0.058470	0.012895	77.95%
17-Jul-22	56,520	12,504	0.056520	0.012504	77.88%
18-Jul-22	59,125	12,912	0.059125	0.012912	78.16%
19-Jul-22	57,690	12,172	0.057690	0.012172	78.90%
20-Jul-22	57,316	12,314	0.057316	0.012314	78.52%
21-Jul-22	57,014	12,237	0.057014	0.012237	78.54%
22-Jul-22	59,408	12,377	0.059408	0.012377	79.17%
23-Jul-22	55,940	12,149	0.055940	0.012149	78.28%
24-Jul-22	59,437	12,692	0.059437	0.012692	78.65%
25-Jul-22	59,091	12,683	0.059091	0.012683	78.54%
26-Jul-22	57,364	12,638	0.057364	0.012638	77.97%

27-Jul-22	60,756	12,765	0.060756	0.012765	78.99%
28-Jul-22	60,551	11,983	0.060551	0.011983	80.21%
29-Jul-22	55,695	12,959	0.055695	0.012959	76.73%
30-Jul-22	58,534	12,931	0.058534	0.012931	77.91%
31-Jul-22	/	/	/	/	/
01-Aug-22	55,907	12,382	0.055907	0.012382	77.85%
02-Aug-22	59,059	12,148	0.059059	0.012148	79.43%
03-Aug-22	57,539	12,883	0.057539	0.012883	77.61%
04-Aug-22	/	/	/	/	/
05-Aug-22	/	/	/	/	/
06-Aug-22	/	/	/	/	/
07-Aug-22	60,549	12,970	0.060549	0.012970	78.58%
08-Aug-22	58,465	12,834	0.058465	0.012834	78.05%
09-Aug-22	58,539	12,086	0.058539	0.012086	79.35%
10-Aug-22	56,767	12,915	0.056767	0.012915	77.25%
11-Aug-22	58,748	12,480	0.058748	0.012480	78.76%
12-Aug-22	56,167	12,594	0.056167	0.012594	77.58%
13-Aug-22	56,545	12,344	0.056545	0.012344	78.17%
14-Aug-22	56,026	12,922	0.056026	0.012922	76.94%
15-Aug-22	59,711	12,123	0.059711	0.012123	79.70%
16-Aug-22	59,691	12,130	0.059691	0.012130	79.68%
17-Aug-22	60,804	12,474	0.060804	0.012474	79.48%
18-Aug-22	55,936	12,470	0.055936	0.012470	77.71%
19-Aug-22	55,476	12,005	0.055476	0.012005	78.36%
20-Aug-22	60,206	12,209	0.060206	0.012209	79.72%
21-Aug-22	56,432	12,841	0.056432	0.012841	77.25%
22-Aug-22	60,945	12,831	0.060945	0.012831	78.95%
23-Aug-22	55,981	12,245	0.055981	0.012245	78.13%
24-Aug-22	58,584	12,628	0.058584	0.012628	78.44%
25-Aug-22	59,610	12,268	0.059610	0.012268	79.42%
26-Aug-22	56,063	12,722	0.056063	0.012722	77.31%
27-Aug-22	59,816	12,063	0.059816	0.012063	79.83%
28-Aug-22	57,516	12,516	0.057516	0.012516	78.24%
29-Aug-22	55,861	12,631	0.055861	0.012631	77.39%
30-Aug-22	57,095	12,775	0.057095	0.012775	77.63%

31-Aug-22	60,086	11,919	0.060086	0.011919	80.16%
01-Sep-22	59,088	12,088	0.059088	0.012088	79.54%
02-Sep-22	57,012	12,232	0.057012	0.012232	78.54%
03-Sep-22	55,243	12,757	0.055243	0.012757	76.91%
04-Sep-22	55,652	12,179	0.055652	0.012179	78.12%
05-Sep-22	55,216	11,989	0.055216	0.011989	78.29%
06-Sep-22	58,786	12,606	0.058786	0.012606	78.56%
07-Sep-22	55,620	12,510	0.055620	0.012510	77.51%
08-Sep-22	/	/	/	/	/
09-Sep-22	/	/	/	/	/
10-Sep-22	/	/	/	/	/
11-Sep-22	60,760	12,951	0.060760	0.012951	78.68%
12-Sep-22	57,880	12,859	0.057880	0.012859	77.78%
13-Sep-22	57,450	11,931	0.057450	0.011931	79.23%
14-Sep-22	60,286	12,964	0.060286	0.012964	78.50%
15-Sep-22	57,125	12,963	0.057125	0.012963	77.31%
16-Sep-22	59,582	12,277	0.059582	0.012277	79.39%
17-Sep-22	59,432	12,842	0.059432	0.012842	78.39%
18-Sep-22	60,551	12,785	0.060551	0.012785	78.89%
19-Sep-22	56,683	12,509	0.056683	0.012509	77.93%
20-Sep-22	55,691	12,168	0.055691	0.012168	78.15%
21-Sep-22	58,015	12,050	0.058015	0.012050	79.23%
22-Sep-22	56,166	12,683	0.056166	0.012683	77.42%
23-Sep-22	57,559	12,731	0.057559	0.012731	77.88%
24-Sep-22	60,227	12,917	0.060227	0.012917	78.55%
25-Sep-22	59,133	12,110	0.059133	0.012110	79.52%
26-Sep-22	56,438	12,627	0.056438	0.012627	77.63%
27-Sep-22	58,261	12,700	0.058261	0.012700	78.20%
28-Sep-22	56,681	12,984	0.056681	0.012984	77.09%
29-Sep-22	59,601	12,337	0.059601	0.012337	79.30%
30-Sep-22	59,864	12,929	0.059864	0.012929	78.40%
01-Oct-22	57,725	12,750	0.057725	0.012750	77.91%
02-Oct-22	58,234	11,950	0.058234	0.011950	79.48%
03-Oct-22	58,857	12,696	0.058857	0.012696	78.43%
04-Oct-22	57,375	12,088	0.057375	0.012088	78.93%

05-Oct-22	60,766	12,825	0.060766	0.012825	78.89%
06-Oct-22	56,245	12,292	0.056245	0.012292	78.15%
07-Oct-22	57,812	12,107	0.057812	0.012107	79.06%
08-Oct-22	59,915	12,704	0.059915	0.012704	78.80%
09-Oct-22	58,224	12,104	0.058224	0.012104	79.21%
10-Oct-22	57,367	12,176	0.057367	0.012176	78.78%
11-Oct-22	59,200	12,359	0.059200	0.012359	79.12%
12-Oct-22	56,255	12,557	0.056255	0.012557	77.68%
13-Oct-22	57,559	12,906	0.057559	0.012906	77.58%
14-Oct-22	55,772	12,332	0.055772	0.012332	77.89%
15-Oct-22	55,610	12,368	0.055610	0.012368	77.76%
16-Oct-22	55,827	11,970	0.055827	0.011970	78.56%
17-Oct-22	58,390	11,938	0.058390	0.011938	79.55%
18-Oct-22	56,147	12,451	0.056147	0.012451	77.82%
19-Oct-22	58,026	12,750	0.058026	0.012750	78.03%
20-Oct-22	56,796	12,728	0.056796	0.012728	77.59%
21-Oct-22	57,252	12,144	0.057252	0.012144	78.79%
22-Oct-22	56,289	12,470	0.056289	0.012470	77.85%
23-Oct-22	57,468	12,697	0.057468	0.012697	77.91%
24-Oct-22	57,625	12,144	0.057625	0.012144	78.93%
25-Oct-22	55,109	12,436	0.055109	0.012436	77.43%
26-Oct-22	58,089	12,536	0.058089	0.012536	78.42%
27-Oct-22	56,550	12,162	0.056550	0.012162	78.49%
28-Oct-22	56,511	12,237	0.056511	0.012237	78.35%
29-Oct-22	50,655	12,942	0.050655	0.012942	74.45%
30-Oct-22	47,215	11,949	0.047215	0.011949	74.69%
31-Oct-22	50,491	12,373	0.050491	0.012373	75.49%
01-Nov-22	46,935	12,074	0.046935	0.012074	74.28%
02-Nov-22	46,443	12,943	0.046443	0.012943	72.13%
03-Nov-22	48,575	12,921	0.048575	0.012921	73.40%
04-Nov-22	46,361	12,285	0.046361	0.012285	73.50%
05-Nov-22	47,425	12,943	0.047425	0.012943	72.71%
06-Nov-22	46,189	11,918	0.046189	0.011918	74.20%
07-Nov-22	48,795	12,922	0.048795	0.012922	73.52%
08-Nov-22	49,348	12,279	0.049348	0.012279	75.12%

09-Nov-22	49,926	12,309	0.049926	0.012309	75.35%
10-Nov-22	46,657	12,600	0.046657	0.012600	72.99%
11-Nov-22	49,075	12,114	0.049075	0.012114	75.32%
12-Nov-22	49,935	11,936	0.049935	0.011936	76.10%
13-Nov-22	46,968	12,669	0.046968	0.012669	73.03%
14-Nov-22	48,651	12,046	0.048651	0.012046	75.24%
15-Nov-22	46,866	11,953	0.046866	0.011953	74.50%
16-Nov-22	45,712	12,157	0.045712	0.012157	73.41%
17-Nov-22	48,761	12,585	0.048761	0.012585	74.19%
18-Nov-22	45,339	12,288	0.045339	0.012288	72.90%
19-Nov-22	49,715	12,426	0.049715	0.012426	75.01%
20-Nov-22	48,107	12,297	0.048107	0.012297	74.44%
21-Nov-22	48,084	12,818	0.048084	0.012818	73.34%
22-Nov-22	48,530	12,013	0.048530	0.012013	75.25%
23-Nov-22	45,790	12,451	0.045790	0.012451	72.81%
24-Nov-22	47,196	12,261	0.047196	0.012261	74.02%
25-Nov-22	45,470	12,278	0.045470	0.012278	73.00%
26-Nov-22	45,535	12,059	0.045535	0.012059	73.52%
27-Nov-22	49,557	12,229	0.049557	0.012229	75.32%
28-Nov-22	49,071	12,237	0.049071	0.012237	75.06%
29-Nov-22	47,917	12,338	0.047917	0.012338	74.25%
30-Nov-22	60,642	12,348	0.060642	0.012348	79.64%
01-Dec-22	56,475	12,638	0.056475	0.012638	77.62%
02-Dec-22	55,629	12,215	0.055629	0.012215	78.04%
03-Dec-22	55,401	12,808	0.055401	0.012808	76.88%
04-Dec-22	59,272	12,439	0.059272	0.012439	79.01%
05-Dec-22	58,257	12,066	0.058257	0.012066	79.29%
06-Dec-22	60,739	12,577	0.060739	0.012577	79.29%
07-Dec-22	59,188	12,800	0.059188	0.012800	78.37%
08-Dec-22	59,411	12,142	0.059411	0.012142	79.56%
09-Dec-22	58,715	11,989	0.058715	0.011989	79.58%
10-Dec-22	59,587	12,107	0.059587	0.012107	79.68%
11-Dec-22	58,203	11,985	0.058203	0.011985	79.41%
12-Dec-22	59,694	12,020	0.059694	0.012020	79.86%
13-Dec-22	/	/	/	/	/

14-Dec-22	/	/	/	/	/
15-Dec-22	58,956	12,763	0.058956	0.012763	78.35%
16-Dec-22	56,700	12,508	0.056700	0.012508	77.94%
17-Dec-22	59,878	12,636	0.059878	0.012636	78.90%
18-Dec-22	53,875	12,848	0.053875	0.012848	76.15%
19-Dec-22	54,610	12,444	0.054610	0.012444	77.21%
20-Dec-22	52,250	12,994	0.052250	0.012994	75.13%
21-Dec-22	52,296	12,172	0.052296	0.012172	76.72%
22-Dec-22	51,926	12,179	0.051926	0.012179	76.55%
23-Dec-22	53,154	12,052	0.053154	0.012052	77.33%
24-Dec-22	54,909	11,984	0.054909	0.011984	78.17%
25-Dec-22	53,909	12,035	0.053909	0.012035	77.68%
26-Dec-22	52,928	12,539	0.052928	0.012539	76.31%
27-Dec-22	54,270	12,054	0.054270	0.012054	77.79%
28-Dec-22	51,626	12,515	0.051626	0.012515	75.76%
29-Dec-22	52,602	12,670	0.052602	0.012670	75.91%
30-Dec-22	54,468	12,234	0.054468	0.012234	77.54%
31-Dec-22	54,361	12,413	0.054361	0.012413	77.17%
01-Jan-23	52,183	12,476	0.052183	0.012476	76.09%
02-Jan-23	53,221	11,991	0.053221	0.011991	77.47%
03-Jan-23	52,988	12,966	0.052988	0.012966	75.53%
04-Jan-23	52,140	12,401	0.052140	0.012401	76.22%
05-Jan-23	51,690	12,749	0.051690	0.012749	75.34%
06-Jan-23	53,454	11,956	0.053454	0.011956	77.63%
07-Jan-23	51,525	12,186	0.051525	0.012186	76.35%
08-Jan-23	52,586	12,616	0.052586	0.012616	76.01%
09-Jan-23	51,831	12,472	0.051831	0.012472	75.94%
10-Jan-23	53,009	12,699	0.053009	0.012699	76.04%
11-Jan-23	53,177	12,929	0.053177	0.012929	75.69%
12-Jan-23	/	/	/	/	/
13-Jan-23	54,794	11,900	0.054794	0.011900	78.28%
14-Jan-23	53,796	12,974	0.053796	0.012974	75.88%
15-Jan-23	53,485	12,574	0.053485	0.012574	76.49%
16-Jan-23	57,538	11,999	0.057538	0.011999	79.15%
17-Jan-23	55,915	12,208	0.055915	0.012208	78.17%

18-Jan-23	59,582	12,261	0.059582	0.012261	79.42%
19-Jan-23	58,330	12,095	0.058330	0.012095	79.26%
20-Jan-23	58,169	12,920	0.058169	0.012920	77.79%
21-Jan-23	57,223	12,582	0.057223	0.012582	78.01%
22-Jan-23	57,100	12,601	0.057100	0.012601	77.93%
23-Jan-23	59,947	12,182	0.059947	0.012182	79.68%
24-Jan-23	58,646	12,767	0.058646	0.012767	78.23%
25-Jan-23	58,366	12,979	0.058366	0.012979	77.76%
26-Jan-23	60,337	12,295	0.060337	0.012295	79.62%
27-Jan-23	56,082	12,915	0.056082	0.012915	76.97%
28-Jan-23	57,375	12,922	0.057375	0.012922	77.48%
29-Jan-23	59,061	11,926	0.059061	0.011926	79.81%
30-Jan-23	55,685	11,907	0.055685	0.011907	78.62%
31-Jan-23	58,077	12,572	0.058077	0.012572	78.35%
01-Feb-23	60,294	12,573	0.060294	0.012573	79.15%
02-Feb-23	57,134	12,902	0.057134	0.012902	77.42%
03-Feb-23	57,499	12,285	0.057499	0.012285	78.63%
04-Feb-23	60,237	11,948	0.060237	0.011948	80.17%
05-Feb-23	59,935	12,749	0.059935	0.012749	78.73%
06-Feb-23	/	/	/	/	/
07-Feb-23	56,775	12,622	0.056775	0.012622	77.77%
08-Feb-23	58,892	12,741	0.058892	0.012741	78.37%
09-Feb-23	60,298	12,867	0.060298	0.012867	78.66%
10-Feb-23	60,160	12,459	0.060160	0.012459	79.29%
11-Feb-23	55,917	12,949	0.055917	0.012949	76.84%
12-Feb-23	55,709	12,508	0.055709	0.012508	77.55%
13-Feb-23	57,129	12,680	0.057129	0.012680	77.80%
14-Feb-23	57,235	12,745	0.057235	0.012745	77.73%
15-Feb-23	57,535	12,348	0.057535	0.012348	78.54%
16-Feb-23	56,075	12,769	0.056075	0.012769	77.23%
17-Feb-23	56,488	12,992	0.056488	0.012992	77.00%
18-Feb-23	55,695	12,437	0.055695	0.012437	77.67%
19-Feb-23	55,198	12,539	0.055198	0.012539	77.28%
20-Feb-23	55,417	12,844	0.055417	0.012844	76.82%
21-Feb-23	55,022	12,982	0.055022	0.012982	76.41%

22-Feb-23	57,068	12,007	0.057068	0.012007	78.96%
23-Feb-23	57,409	12,044	0.057409	0.012044	79.02%
24-Feb-23	57,593	12,602	0.057593	0.012602	78.12%
25-Feb-23	59,308	12,417	0.059308	0.012417	79.06%
26-Feb-23	56,737	12,943	0.056737	0.012943	77.19%
27-Feb-23	58,032	12,819	0.058032	0.012819	77.91%
28-Feb-23	56,834	12,720	0.056834	0.012720	77.62%
01-Mar-23	59,399	12,442	0.059399	0.012442	79.05%
02-Mar-23	55,885	12,774	0.055885	0.012774	77.14%
03-Mar-23	58,996	12,061	0.058996	0.012061	79.56%
04-Mar-23	58,942	12,072	0.058942	0.012072	79.52%
05-Mar-23	55,760	12,959	0.055760	0.012959	76.76%
06-Mar-23	58,400	12,666	0.058400	0.012666	78.31%
07-Mar-23	60,527	12,097	0.060527	0.012097	80.01%
08-Mar-23	55,024	12,087	0.055024	0.012087	78.03%
09-Mar-23	60,735	12,716	0.060735	0.012716	79.06%
10-Mar-23	59,036	12,338	0.059036	0.012338	79.10%
11-Mar-23	57,307	12,833	0.057307	0.012833	77.61%
12-Mar-23	55,254	12,574	0.055254	0.012574	77.24%
13-Mar-23	55,820	12,559	0.055820	0.012559	77.50%
14-Mar-23	58,301	12,553	0.058301	0.012553	78.47%
15-Mar-23	56,586	12,462	0.056586	0.012462	77.98%
16-Mar-23	58,751	12,436	0.058751	0.012436	78.83%
17-Mar-23	59,521	12,830	0.059521	0.012830	78.44%
18-Mar-23	/	/	/	/	/
19-Mar-23	/	/	/	/	/
20-Mar-23	/	/	/	/	/
21-Mar-23	57,878	12,161	0.057878	0.012161	78.99%
22-Mar-23	59,368	12,543	0.059368	0.012543	78.87%
23-Mar-23	58,465	12,552	0.058465	0.012552	78.53%
24-Mar-23	58,873	11,932	0.058873	0.011932	79.73%
25-Mar-23	59,874	12,104	0.059874	0.012104	79.78%
26-Mar-23	55,840	12,710	0.055840	0.012710	77.24%
27-Mar-23	56,264	12,555	0.056264	0.012555	77.69%
28-Mar-23	56,948	12,366	0.056948	0.012366	78.29%

29-Mar-23	57,774	12,682	0.057774	0.012682	78.05%
30-Mar-23	56,270	12,898	0.056270	0.012898	77.08%
31-Mar-23	57,853	12,525	0.057853	0.012525	78.35%
01-Apr-23	55,031	12,420	0.055031	0.012420	77.43%
02-Apr-23	57,223	12,060	0.057223	0.012060	78.92%
03-Apr-23	56,249	12,098	0.056249	0.012098	78.49%
04-Apr-23	57,039	12,191	0.057039	0.012191	78.63%
05-Apr-23	57,948	12,096	0.057948	0.012096	79.13%
06-Apr-23	55,596	12,184	0.055596	0.012184	78.08%
07-Apr-23	57,759	12,416	0.057759	0.012416	78.50%
08-Apr-23	57,921	11,959	0.057921	0.011959	79.35%
09-Apr-23	57,345	12,864	0.057345	0.012864	77.57%
10-Apr-23	57,047	12,628	0.057047	0.012628	77.86%
11-Apr-23	59,853	11,925	0.059853	0.011925	80.08%
12-Apr-23	58,037	12,881	0.058037	0.012881	77.81%
13-Apr-23	58,306	12,925	0.058306	0.012925	77.83%
14-Apr-23	57,642	12,464	0.057642	0.012464	78.38%
15-Apr-23	58,767	12,599	0.058767	0.012599	78.56%
16-Apr-23	58,991	12,076	0.058991	0.012076	79.53%
17-Apr-23	60,947	12,839	0.060947	0.012839	78.93%
18-Apr-23	60,135	12,108	0.060135	0.012108	79.87%
19-Apr-23	60,481	12,532	0.060481	0.012532	79.28%
20-Apr-23	56,805	12,123	0.056805	0.012123	78.66%
21-Apr-23	56,893	12,125	0.056893	0.012125	78.69%
22-Apr-23	59,337	12,624	0.059337	0.012624	78.72%
23-Apr-23	58,521	11,917	0.058521	0.011917	79.64%
24-Apr-23	55,126	12,902	0.055126	0.012902	76.60%
25-Apr-23	58,219	12,984	0.058219	0.012984	77.70%
26-Apr-23	59,776	12,710	0.059776	0.012710	78.74%
27-Apr-23	56,661	12,402	0.056661	0.012402	78.11%
28-Apr-23	58,255	12,549	0.058255	0.012549	78.46%
29-Apr-23	60,638	12,794	0.060638	0.012794	78.90%
30-Apr-23	56,609	12,262	0.056609	0.012262	78.34%
01-May-23	57,942	11,936	0.057942	0.011936	79.40%
02-May-23	56,425	12,466	0.056425	0.012466	77.91%

03-May-23	60,400	12,282	0.060400	0.012282	79.67%
04-May-23	/	/	/	/	/
05-May-23	/	/	/	/	/
06-May-23	/	/	/	/	/
07-May-23	/	/	/	/	/
08-May-23	/	/	/	/	/
09-May-23	/	/	/	/	/
10-May-23	/	/	/	/	/
11-May-23	/	/	/	/	/
12-May-23	/	/	/	/	/
13-May-23	/	/	/	/	/
14-May-23	/	/	/	/	/
15-May-23	/	/	/	/	/
16-May-23	/	/	/	/	/
17-May-23	/	/	/	/	/
18-May-23	/	/	/	/	/
19-May-23	/	/	/	/	/
20-May-23	/	/	/	/	/
21-May-23	/	/	/	/	/
22-May-23	60,288	12,947	0.060288	0.012947	78.52%
23-May-23	60,726	12,532	0.060726	0.012532	79.36%
24-May-23	55,978	12,960	0.055978	0.012960	76.85%
25-May-23	57,941	11,983	0.057941	0.011983	79.32%
26-May-23	56,739	11,914	0.056739	0.011914	79.00%
27-May-23	57,015	12,091	0.057015	0.012091	78.79%
28-May-23	57,354	12,919	0.057354	0.012919	77.47%
29-May-23	59,359	11,938	0.059359	0.011938	79.89%
30-May-23	56,568	11,958	0.056568	0.011958	78.86%
31-May-23	57,089	12,190	0.057089	0.012190	78.65%
01-Jun-23	59,163	12,465	0.059163	0.012465	78.93%
02-Jun-23	58,596	12,575	0.058596	0.012575	78.54%
03-Jun-23	55,872	12,670	0.055872	0.012670	77.32%
04-Jun-23	57,761	12,547	0.057761	0.012547	78.28%
05-Jun-23	59,866	12,215	0.059866	0.012215	79.60%
06-Jun-23	59,836	12,859	0.059836	0.012859	78.51%

07-Jun-23	58,152	12,206	0.058152	0.012206	79.01%
08-Jun-23	60,334	12,453	0.060334	0.012453	79.36%
09-Jun-23	60,612	12,820	0.060612	0.012820	78.85%
10-Jun-23	60,688	12,628	0.060688	0.012628	79.19%
11-Jun-23	56,216	12,946	0.056216	0.012946	76.97%
12-Jun-23	55,286	12,692	0.055286	0.012692	77.04%
13-Jun-23	58,861	12,514	0.058861	0.012514	78.74%
14-Jun-23	59,424	11,943	0.059424	0.011943	79.90%
15-Jun-23	55,881	12,526	0.055881	0.012526	77.58%
16-Jun-23	59,206	11,927	0.059206	0.011927	79.86%
17-Jun-23	57,360	12,023	0.057360	0.012023	79.04%
18-Jun-23	55,407	12,514	0.055407	0.012514	77.41%
19-Jun-23	56,166	12,072	0.056166	0.012072	78.51%
20-Jun-23	55,823	12,345	0.055823	0.012345	77.89%
21-Jun-23	/	/	/	/	/
22-Jun-23	/	/	/	/	/
23-Jun-23	/	/	/	/	/
24-Jun-23	/	/	/	/	/
25-Jun-23	55,808	12,924	0.055808	0.012924	76.84%
26-Jun-23	56,439	12,339	0.056439	0.012339	78.14%
27-Jun-23	60,910	12,037	0.060910	0.012037	80.24%
28-Jun-23	58,648	12,056	0.058648	0.012056	79.44%
29-Jun-23	55,432	12,625	0.055432	0.012625	77.22%
30-Jun-23	59,718	12,379	0.059718	0.012379	79.27%
Average	**56,498**	**12,438**	**0.056498**	**0.012438**	**77.89%**