



# Verified Carbon Standard

## SHAORYANG XINNING LFG POWER GENERATION PROJECT



Climate Bridge

Document Prepared by Climate Bridge (Shanghai) Ltd.

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# 1 PROJECT DETAILS

## 1.1 Summary Description of the Project

The Shaoyang Xinning LFG Power Generation Project (hereinafter referred to as the Project) is a landfill gas (LFG) recovery and utilization project developed by Xinning Xinzhongshui Bio-energy Power Generation Co., Ltd. The project is located at the Laohutuo Landfill in Hengqiao Village, Wantang Town, Xinning County, Shaoyang City, Hu'nan Province, P.R. China.

The Laohutuo Landfill started operating on 27-June-2013. It has a design capacity of 4,800,000 m<sup>3</sup> and a design lifetime of 30 years. The municipal solid waste (MSW) deposition rate is estimated to be 400 tons/day. The landfill handles MSW from the urban area of Xinning County, the nearby townships, and the Langshan Scenic Area.

The Project aims to collect LFG from the Laohutuo Landfill and utilize it for power generation. The Project started construction on 30-December-2022. Two power generators of 1.067 MW each (2.134 MW in total) were installed and put into operation on 01-July-2023.

Before the implementation of the project activity, the LFG generated from the Laohutuo Landfill was released into the atmosphere; the equivalent amount of electricity generated by the project activity was supplied by the fossil-fuel-dominated Central China Power Grid (CCPG). The baseline scenario is the same as the conditions existing prior to the implementation of the project activity. Greenhouse gas (GHG) emissions will be reduced by avoiding CO<sub>2</sub> emissions from those fossil fuel-based power plants connected to the grid and by avoiding GHG emissions from releasing LFG into the atmosphere at the landfill site.

The Project is expected to supply a total of 86,994 MWh electricity to CCPG during the fixed 10-year crediting period (from 01-July 2023 to 30-June-2033), with an annual average amount of 8,699 MWh. It is estimated that the total GHG emission reductions will be 348,090 tCO<sub>2</sub>e during the 10-year crediting period, with annual emission reductions of 34,809 tCO<sub>2</sub>e.

## 1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	/	VCS	Carbon Check (India) Private Ltd.	/

## 1.3 Sectoral Scope and Project Type

<b>Sectoral scope</b>	1: Energy industries (renewable-/non-renewable sources) 13: Waste handling and disposal
<b>Project activity type</b>	LFG Power Generation Project

## 1.4 Project Eligibility

### 1.4.1 General eligibility

The scope of the VCS Program includes:

- 1) The seven Kyoto Protocol greenhouse gases.

The Project reduces CH<sub>4</sub> and CO<sub>2</sub> emissions. Both CH<sub>4</sub> and CO<sub>2</sub> are Kyoto Protocol GHGs.

- 2) Ozone-depleting substances (ODS).

The Project does not involve ozone-depleting substances.

- 3) Project activities supported by a methodology approved under the VCS Program through the methodology development and review process.

The project activity is not supported by a methodology approved under the VCS Program through the methodology development and review process.

- 4) Project activities supported by a methodology approved under an approved GHG program, unless explicitly excluded (see the Verra website for exclusions).

The Project is supported by methodologies AMS-III.G (version 10.0) and AMS-I.D (version 18.0) approved under the CDM program. The methodologies have been proven not to be excluded by checking the Verra website<sup>1</sup>. Also, the Project is not a fragmented part of a larger project or activity, thus within the scale and/or capacity limits of the methodologies. No single cluster of project activity instances exceeds the capacity limit.

- 5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the Jurisdictional and Nested REDD+ (JNR) Requirements.

The Project is not a jurisdictional REDD+ program or a nested REDD+ project.

Meanwhile, the Project does not belong to the projects excluded in Table 2.1 of VCS Standard 4.7.

According to requirements of VCS Standard 4.7, Non-AFOLU projects applying a standardized method shall complete validation within two years of the project start date. The validation deadline of the Project is 30-June-2025 since it started operation on 01-July-2023. The Project meets the timeline criteria. In addition, The Project follows the requirements that the project is listed on the project pipeline with a status of under validation before the opening meeting. Furthermore, validation does not begin until the 30-day public comment period has begun.

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<sup>1</sup> Methodologies - Verra

Therefore, the Project is eligible under the scope of the VCS Program.

#### 1.4.2 AFOLU project eligibility

The project is not an AFOLU project.

#### 1.4.3 Transfer project eligibility

The project is not a transfer project.

### 1.5 Project Design

- Single location or installation
- Multiple locations or project activity instances (but not a grouped project)
- Grouped project

#### 1.5.1 Grouped Project Design

The project is not a grouped project.

### 1.6 Project Proponent

<b>Organization name</b>	Xinning Xinzhongshui Bio-energy Power Generation Co., Ltd.
<b>Contact person</b>	TANG Sisi
<b>Title</b>	Project Manager
<b>Address</b>	Hengqiao Village, Wantang Town, Xinning County, Shaoyang City, Hu'nan Province, P.R. China
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<b>Email</b>	<a href="mailto:3542346576@qq.com">3542346576@qq.com</a>

### 1.7 Other Entities Involved in the Project

<b>Organization name</b>	Climate Bridge (Shanghai) Ltd.
<b>Role in the project</b>	Consultant
<b>Contact person</b>	GAO Zhiwen

<b>Title</b>	General Manager
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<b>Email</b>	<a href="mailto:gao.zhiwen@climatebridge.com">gao.zhiwen@climatebridge.com</a>

## 1.8 Ownership

The project owner is Xinning Xinzhongshui Bio-energy Power Generation Co., Ltd. Evidence of project ownership following the VCS Program requirements includes Project Approval issued by Shaoyang Development and Reform Commission, EIA approval issued by Shaoyang Municipal Bureau of Ecology and Environment, Power Purchase Agreement signed with the purchaser National Grid Hunan Electric Power Co., Ltd. Xinning County Power Supply Branch, and the *LFG Harmless Collection and Power Generation Agreement* signed with the Laohutuo landfill, etc.

## 1.9 Project Start Date

<b>Project start date</b>	01-July-2023
<b>Justification</b>	According to VCS standards, the project start date is when activities that lead to the generation of GHG emission reductions or removals are implemented. For this project, the project start date is 01-July-2023 when the LFG collection system, LFG pre-treatment system, and electricity generation system of the project operated.

## 1.10 Project Crediting Period

<b>Crediting period</b>	<input type="checkbox"/> Seven years, twice renewable <input checked="" type="checkbox"/> Ten years, fixed <input type="checkbox"/> Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)
<b>Start and end date of first or fixed crediting period</b>	01-July-2023 to 30-June-2033

## 1.11 Project Scale and Estimated GHG Emission Reductions or Removals

 < 300,000 tCO<sub>2</sub>e/year (project)

 ≥ 300,000 tCO<sub>2</sub>e/year (large project)

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO <sub>2</sub> e)
01-Jul-2023 to 31-Dec-2023	18,869
01-Jan-2024 to 31-Dec-2024	31,308
01-Jan-2025 to 31-Dec-2025	32,326
01-Jan-2026 to 31-Dec-2026	33,230
01-Jan-2027 to 31-Dec-2027	34,035
01-Jan-2028 to 31-Dec-2028	34,759
01-Jan-2029 to 31-Dec-2029	35,411
01-Jan-2030 to 31-Dec-2030	36,001
01-Jan-2031 to 31-Dec-2031	36,538
01-Jan-2032 to 31-Dec-2032	37,029
01-Jan-2033 to 30-Jun-2033	18,584
<b>Total estimated ERRs during the first or fixed crediting period</b>	<b>348,090</b>
<b>Total number of years</b>	<b>10</b>
<b>Average annual ERRs</b>	<b>34,809</b>

## 1.12 Description of the Project Activity

The project activity achieves emission reductions in two aspects: 1) it avoids methane emissions by capturing and destroying LFG which would have been directly vented into the atmosphere in the baseline scenario; 2) it reduces CO<sub>2</sub> emissions by displacing part of the electricity that would otherwise have been supplied by CCPG. Under the baseline scenario, the LFG generated from Laohutuo Landfill would have been totally released into the atmosphere; the equivalent amount of electricity supplied by the project activity would have been supplied by the fossil-fuel-dominated Central China Power Grid (CCPG).

The project activity, which collects LFG from the Laohutuo Landfill and utilizes it for power generation, includes the following installations:

- **Gas collection system**

The gas collection system includes wells, pipelines, and blowers. The blowers draw the LFG extracted from the gas wells, and then the LFG is transported via the pipelines to the pre-treatment system

- **Gas pre-treatment system**

Before entering the gas engines, the LFG is pre-treated so that impurities and moisture are removed to avoid corrosion of the electricity generation system. In addition, the pre-treatment system maintains the LFG in a continuously stable condition before the gas generator inlets. The pre-treatment includes filtration, dehumidification, cooling and pressurization

- **Power generation system**

Two gas generators with a rated capacity of 1.067 MW each have been installed and they are fed with the LFG to generate electricity, which is then exported to the grid. The service provided by the project is electricity. In the baseline scenario, the same amount of electricity would have been supplied by power plants connected to the grid. The technical parameters of the installed generators are shown in Table 1-1.

The technical parameters of the systems are shown in Table 1-1

**Table 1-1 Technical parameters of the systems**

System	Parameter	Value
Gas collection system	Type	Integrated system with impermeable cover and vertical wells
	Capture efficiency	50%
Gas pre-treatment system	Type	QC-02, QC-03
	Number	1
	Capacity	1100 – 1400 Nm <sup>3</sup> /h
Power generation system	Type	JGS 320 GS -L,L
	Number	2
	Rated capacity	1.067 MW
	Rated frequency	50 Hz
	Rated voltage	400 V
	Rated current	1540 A
	Lifetime	24 yr
Manufacturer	Jenbacher GmbH & Co OG	

### 1.13 Project Location

The Project is located in Hengqiao Village, Wantang Town, Xinning County, Shaoyang City, Hu'nan Province, P.R. China. The coordinates at the center of the project site are 26° 29'39.41"N, 110° 49'34.54"E.

The project location is shown in Figure 1-1.

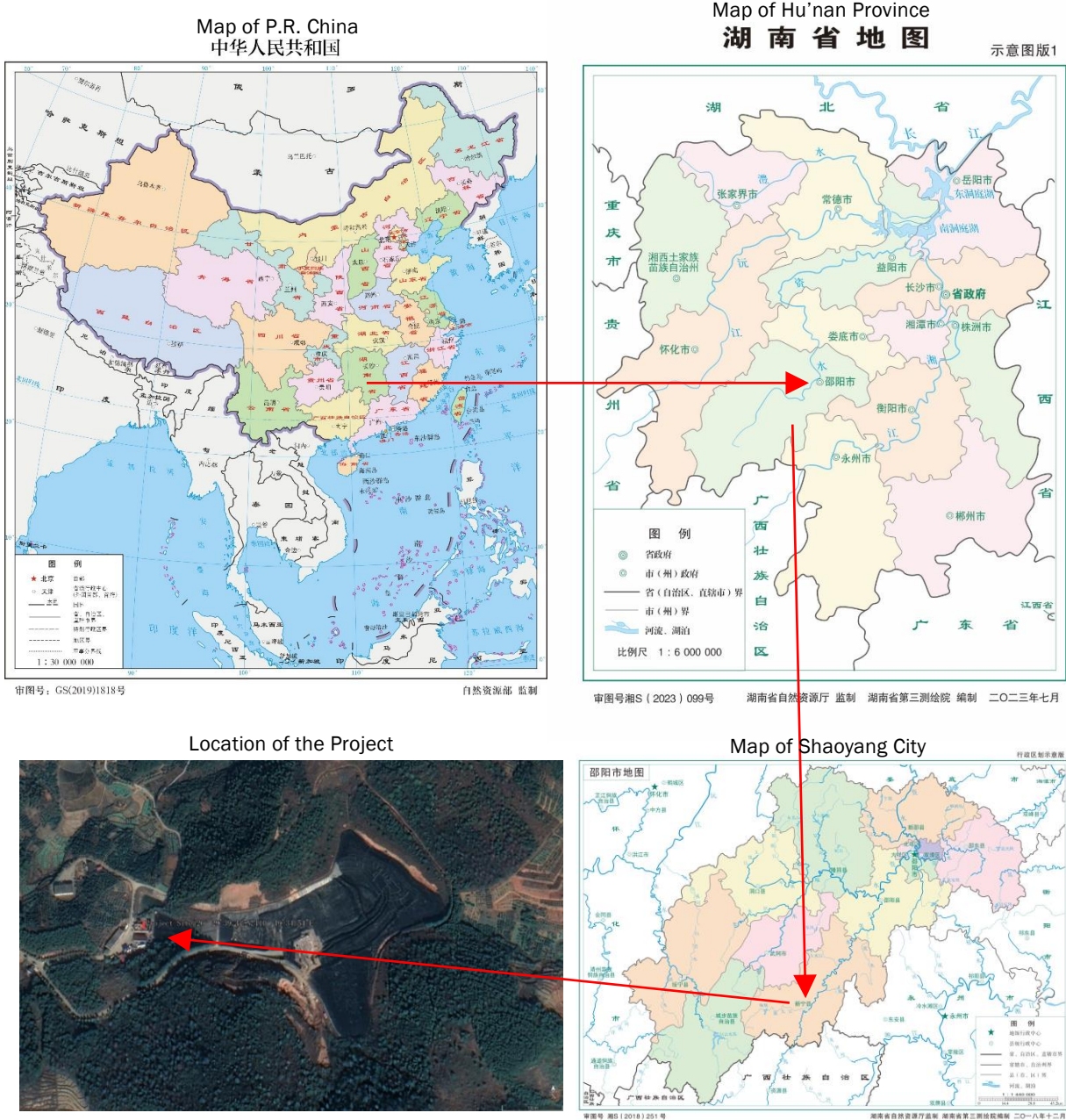


Figure 1-1 Location of the project

## 1.14 Conditions Prior to Project Initiation

Prior to the implementation of the project activity, the LFG generated from the Laohutuo landfill was released into the atmosphere; the equivalent amount of electricity supplied by the project activity was supplied by the fossil-fuel-dominated Central China Power Grid (CCPG).

The baseline scenario is the same as the conditions existing before the project initiation. Please refer to Section 3.4 (Baseline Scenario).

## 1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project complies with all Chinese relevant laws and regulations, mainly including:

1. Renewable Energy Law of the People's Republic of China;
2. National Action plan for the collection and Utilization of municipal landfill gas;
3. Catalogue for the Guidance of Industrial Structure Adjustment (2019 version);

The project has obtained the project approval and EIA approval from governmental authorities: Shaoyang Development and Reform Bureau and Shaoyang Municipal Bureau of Ecology and Environment. The two approvals well demonstrate that the local government permits the construction of the project.

Consequently, the project complies with laws, status, and other regulatory frameworks.

## 1.16 Double Counting and Participation under Other GHG Programs

### 1.16.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

- Yes  No

### 1.16.2 Registration in Other GHG Programs

Has the project registered under any other GHG programs?

- Yes  No

Is the project active under the other program?

- Yes  No

### 1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

- Yes  No

## 1.17 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

### 1.17.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit?

Yes  No

### 1.17.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system?

Yes  No


### 1.17.3 Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.12 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?



Yes  No

## 1.18 Sustainable Development Contributions

The Project contributes to achieving sustainable development goals (SDGs) in the following aspects:

SDG	Indicators	Chinese Sustainable Development Progress <sup>2</sup>	Project Activity Contribution
	SDG 7: Affordable and Clean Energy	By the end of 2015, China had fully solved the problem of providing electricity to all people without electricity and reached the goal of the Sustainable Development Agenda 15 years ahead of schedule. From 2015 to 2021, the share of non-fossil energy increased from 14.5 % to 20.6%, while the share of raw coal decreased from 72.2 % to 66.7%.	The project utilizes LFG for power generation and accordingly substitutes equivalent electricity from thermal power. This contributes to achieving China's stated sustainable development priorities "By 2030, the proportion of non-fossil energy consumption will reach about 25%".

<sup>2</sup> <https://www.cikd.org/ms/file/getimage/1726875869667008513>

	<p>SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</p>	<p>China has deeply implemented an innovation-driven development strategy, and small, medium and micro enterprises have developed rapidly. Adhering to the policy of giving priority to employment, the unemployment rate has remained at a low level. By coordinating epidemic prevention and control with economic and social development, China has become the only major economy to achieve positive growth in 2020 and has made positive contributions to global economic recovery.</p>	<p>The project activity can provide employment opportunities for local villagers. This contributes to one of China's actions for promoting sustainable development: "By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value".</p>
	<p>SDG 13: Take urgent action to combat climate change and its impacts</p>	<p>In 2022, China's energy consumption per unit of GDP was reduced by 35% compared with 2012; in 2020, carbon dioxide emissions per unit of GDP were reduced by 18.8% compared with 2015 and 48.4% compared with 2005, all of which have already fulfilled China's commitment to the international community in 2020 ahead of schedule.</p>	<p>The project is to utilize the LFG for electricity generation to avoid methane emissions and CO<sub>2</sub> emissions from the production of the equivalent amount of electricity replaced by the Project that would otherwise have been purchased from the CCPG. This contributes to achieving China's stated sustainable development priorities "China's carbon dioxide emissions would strive to peak by 2030 and strive to achieve carbon neutrality by 2060".</p>

## 1.19 Additional Information Relevant to the Project

### 1.19.1 Leakage Management

As per methodology AMS-I.D (Version 18.0), general guidance on leakage in biomass project activities shall be followed to quantify leakages pertaining to the use of biomass residues. The project activity does not involve utilizing biomass residue, no leakage emissions are produced.

As per methodology AMS-III.G (Version 10.0), if the methane recovery technology is equipment transferred from another activity, leakage effects are to be considered. The Project does not involve equipment transmission, so there are no leakage effects.

Therefore, leakage management does not apply to the Project.

### 1.19.2 Commercially Sensitive Information

The Project does not include commercially sensitive information in the project description to be excluded in the public version.

### 1.19.3 Further Information

There is no additional information that has a bearing on the eligibility of the Project, the GHG emission reductions or carbon dioxide removals, or the quantification of the Project’s reductions or removals.

# 2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

## 2.1 Stakeholder Engagement and Consultation

### 2.1.1 Stakeholder Identification

<b>Stakeholder Identification</b>	The stakeholder identification process for the project involved a step-by-step approach. Initially, the project owner performed a project scope analysis. This included evaluating the geographic boundary, potential environmental impacts, and the communities served by each subproject. Following this, the project owner engaged in a stakeholder mapping exercise, identifying individuals and organizations with a vested interest or potential influence over the project. Interviews and surveys were conducted with residents, businesses, and subject matter
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	<p>experts to gather various perspectives. In addition, the project owner reviewed regulatory standards and consulted with government entities to ensure compliance and to identify any legal stakeholders.</p> <p>The following people are considered as the stakeholders of this project during the implementation stage:</p> <ul style="list-style-type: none"> <li>• Residents of the nearby village.</li> <li>• Staff of the project.</li> <li>• Relevant administrative staff of the local government.</li> </ul>
<p><b>Legal or customary tenure/access rights</b></p>	<p>Applicable legal frameworks and existing agreements safeguard land use and access rights. The Shaoyang Development and Reform Commission has approved the project construction, and the Project was built in the reserved area of the Laohutuo landfill, which is state owned and managed by the local government. Therefore, the project activities do not involve conflicts on the existing legal or customary tenure/access rights of stakeholders, indigenous people (LPs), local communities (LCs), or customary rights holders, as the land is already designated for industrial purposes following relevant legal proceedings.</p>
<p><b>Stakeholder diversity and changes over time</b></p>	<p>Stakeholder groups encompass individuals from diverse social, economic, and cultural backgrounds. They represent various societal strata, including genders, age groups, education levels, and occupations. In general, residents of the nearby villages are mostly the elderly with an education background lower than junior high school. Many of them work as farmers or peasants and some take on temporary work in the landfill. The majority of the project staff has received a senior high school education or higher. Males are responsible for the most technical work, while females mainly support related administration work. The majority of relevant administrative staff of the local government is graduated from college or above. They have the highest social status and supervise the project overall. Different stakeholder group compositions change minimally over time due to the enduring nature of societal strata and slow changes in social factors.</p>
<p><b>Expected changes in well-being</b></p>	<p>The Project is expected to improve the local environment conditions by contributing to GHG reduction, provide clean electricity supply, and offer both long-term and temporary work opportunities.</p>

<p><b>Location of stakeholders</b></p>	<p>Residents of the nearby villages that may be influenced by the Project refer to communities around the project site, and most staff of the project live in urban area of Xinning County, southeast of the project site. The local government is located in the urban center of Xinning County in the southeast of the LFG power plant.</p>
<p><b>Location of resources</b></p>	<p>The project is in an existing landfill and no identified stakeholders own or have customary access to the land and resources occupied by the project.</p>

### 2.1.2 Stakeholder Consultation and Ongoing Communication

<p><b>Date of stakeholder consultation</b></p>	<p>27-September-2022 14-September-2023 24-September-2024</p>
<p><b>Stakeholder engagement process</b></p>	<p>Prior to the project construction, the project owner decided that the local stakeholder consultation would be conducted by means of a questionnaire survey. The project proponent will contact the local government and the Ecology and Environment Bureau by phone calls, informing them of the project site locations, the planned dates of construction and commissioning as well as the date and the purpose of the upcoming questionnaire survey two weeks in advance of the consultation.</p> <p>Meanwhile, the project proponent puts up public announcements on bulletin boards at the landfill and at neighborhoods near the project site on various dates two weeks ahead of the upcoming consultation. The general information about the project, the date and the purpose of the questionnaire survey as well as the project proponent’s phone number and email address are clearly conveyed via these public announcements and phone calls. During the consultation, the project proponent distributes questionnaires at a variety of places to collect the stakeholders’ opinions about the project in various aspects: they go to the landfill to distribute questionnaires to employees; they go to the neighborhoods nearby to distribute questionnaires to families living there; they also go to the office buildings of the local government and the Ecology and Environment Bureau. In addition, stakeholders are able to get the questionnaires at the locations communicated via public announcements and phone calls.</p>

	<p>Reports of the questionnaire survey are submitted to the company management department.</p>
<p><b>Consultation outcome</b></p>	<p>In general, the design and implementation of the project are regarded as beneficial by the majority of the local stakeholders. Most local stakeholders think the Project will help improve the lives of local people and promote local economic development with little adverse environmental impact. Almost all of the stakeholders believe that the Project will provide more employment opportunities, help local economic development, and increase local clean electricity supply. Several respondents expressed their concern over air pollution, water pollution and noise that the project might bring; faced with this, the project proponent explained the requirements of national and industry standards that have to be followed as well as the mitigation measures taken. Stakeholders are supportive of the free, prior, and informed consent (FPIC) process via questionnaire surveys and phone calls and the VCS validation and verification process to obtain emission reduction benefits.</p>
<p><b>Ongoing communication</b></p>	<p>The project owner implemented an ongoing communication mechanism, including holding stakeholder meetings, distributing questionnaires, or communicating with stakeholders by phone calls or other means regularly to collect the opinions of local stakeholders during the operation period. In addition, stakeholders can bring forward their opinions directly by phone calls, emails, and leaving comments on the project bulletin boards set up at the landfill gate and neighborhoods nearby. Residents can also give suggestions or complaints via village heads or resident staff taking on temporary or long-term work at the Project.</p>
<p><b>Stakeholder input</b></p>	<p>During the project operation, feedback from stakeholders through surveys, phone calls, etc., regarding the project are collected and regularly reported to company management. Considering environmental impacts or safety issues, the relevant responsible personnel is promptly notified for inspection and corrective action upon receiving the feedback, and an immediate report is required to be submitted to the company management.</p>

The landfill is located at least 500 m away from local neighborhoods and the power plant has had a scientific design of wastewater and other pollutants processing system strictly following the requirements of national and industry standards. Since no complaints were collected during the past consultations, there were no necessary or appropriate updates to the project design during the reporting period.

### 2.1.3 Free Prior and Informed Consent

<p><b>Obtaining consent</b></p>	<p>Prior to the project construction, the local stakeholder consultations were conducted by means of a questionnaire survey. The project proponent put up public announcements on bulletin boards at the landfill and at neighborhoods near the project site on various dates in advance; also, the project proponent contacted the local government and the Ecology and Environment Bureau by phone, informed them of the project site locations, the planned dates of construction and commissioning as well as the date and the purpose of the upcoming questionnaire survey. The general information about the project, the date and the purpose of the questionnaire survey as well as the project proponent’s phone number and email address were clearly conveyed via these public announcements and phone calls.</p> <p>Eventually, the project proponent obtained approval from the local government in accordance with laws and regulations prior to project construction. In addition, all stakeholders agreed and supported the construction and operation of the project. Residents of the nearby village and staff of the project have also well known the project and shown great consent. Therefore, the project complies with the relevant VCS regulations for FPIC. There are no ongoing or unresolved conflicts for this project.</p>
<p><b>Outcome of FPIC</b></p>	<p>All stakeholders agree with the construction and operation of the Project. Most respondents support the opinion that the Project improves regional economic development without adverse environmental impact. The project proponent disclosed the related information of the Project following the requirements of local government and relevant laws and regulations. Basic project information and updates are revealed via bulletin boards at the landfill and at</p>

neighborhoods nearby, phone calls, stakeholder meetings etc.

The Project strictly follows China's laws and regulations and has obtained legal land use rights before construction. No residents were relocated because the project site is in the reserve area of the Laohutuo landfill. Thus, the Project has not encroached on land, relocated people without consent, or forced physical or economic displacement, which are total bans, and the stakeholders are supportive of the project.

#### 2.1.4 Grievance Redress Procedure

<p><b>Development process</b></p>	<p>If any grievances are received during the project construction and operation, the project proponent will take on a series of reactions to resolve stakeholders' concerns. When stakeholders express their misgivings in the questionnaire survey, the project proponent will explain related issues including the corresponding measures on time. After collecting the questionnaires and analyzing the survey results, the project proponent will contact the stakeholders by phone calls to elaborate on the measures against the concerns raised within one week and ask for their feedback; the project proponent will also inform them how to contact the project and express opinions if they have any concerns in the future.</p> <p>Any grievances received by phone calls, emails, or direct communication will be explained within one week by phone calls or face-to-face conversations with the claimants. If updates of the Project are necessary, the project proponent will assess the problem seriously, formulate a scientific solution, timely update the progress with the complainants and ask for feedback until the grievance is resolved.</p>
<p><b>Grievance redress procedure</b></p>	<p>The project owner organized internal staff meetings to ensure that the project operation complies with requirements in the Environmental Impact Assessment (EIA) form and applicable laws, regulations and national standards and develop grievance redress procedures. The draft of the procedure was revealed to the public during the stakeholder consultations and agreed by all stakeholders. After full consideration and assessment, suggestions from</p>

stakeholders were included in the final grievance redress procedure.

### 2.1.5 Public Comments

Any Public Comments received during and after the public comment period will be reported, responded to, and recorded.

Comments received	Actions taken
To be updated	To be updated

## 2.2 Risks to Stakeholders and the Environment

### 2.2.1 Management Experience

Xinning Xinzhongshui Bio-energy Power Generation Co., Ltd. was established on May 20, 2022, and Xinzhongshui (Nanjing) Renewable Resources Investment Co., Ltd. (hereinafter referred to as the Xinzhongshui (Nanjing)) is its 100% controlling shareholder. The Xinzhongshui (Nanjing) specializes in the harmless, reduction, and resource recycling of municipal solid waste and the reclamation and recycling of land resources in landfills. The company provides project consulting, process design, product provision, engineering construction, operation management and other multi-faceted services. The company has owned rich management experience in construction and operation of landfill gas resource utilization projects.

### 2.2.2 Risk Assessment

	Risks identified	Mitigation or preventative measure taken
Natural and human-induced risks to stakeholders' wellbeing	No risk identified	Stakeholders' well-being is fully considered during the project operation. The Project is expected to improve the local environmental conditions by contributing to GHG reduction, providing a clean electricity supply, offering both long-term and temporary work opportunities, and bringing economic interest to the owner.
Risks to stakeholder participation	No risk identified	There were no risks identified including project design and consultation. The project was designed and implemented to avoid trade-offs including negative impacts on livelihoods and climate change adaptation.

		The mechanism for ongoing communication with local stakeholders has been set up.
<b>Working conditions</b>	No risk identified	Requirements for working conditions have been described in the project design and management manual. The project provides safety training and adequate labor protection supplies for the employees.
<b>Safety of women and girls</b>	No risk identified	There were no risks identified related to the safety of women and girls in the local community due to project activities. The project pays attention to the occupational health of female employees, providing regular health checkups and mental health support. The pay structure is reviewed regularly to ensure fair pay for both male and female employees.
<b>Safety of minority and marginalized groups, including children</b>	No risk identified	There were no risks identified related to safety of minority and marginalized groups, including children. At the project design and planning stage, the special needs of children, minorities and marginalized groups are fully considered to ensure the inclusiveness of project facilities and services. An effective feedback mechanism was established to ensure that community members can give feedback on their opinions and problems at any time.
<b>Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)</b>	No risk identified	Measures have been identified in the EIA of the project to mitigate environmental pollution caused by construction and operation, which were implemented per environment pollution-related laws and regulations and supervised by the local government.

## 2.3 Respect for Human Rights and Equity

### 2.3.1 Labor and Work

	Risks identified	Mitigation or preventative measure(s) taken
<b>Discrimination</b>	No risk identified	The project has well-established HR policies that strictly prohibit all forms of discrimination inclusive of staff and contracted workers employed by third parties. These policies ensure no discrimination on race, gender, disability, or any other characteristic occurring during the design or implementation phases. Workers, including women, are provided with equal pay for equal work under these regulations. Employees are provided with safe and effective reporting channels and procedures for handling reported information quickly.
<b>Sexual harassment</b>	No risk identified	The project has well-established HR policies that strictly prohibit all forms of sexual harassment inclusive of staff and contracted workers employed by third parties. Workers, especially women, are fully protected under these regulations. Employees are provided with safe and effective reporting channels and procedures for handling reported information quickly.
<b>Equal pay for equal work</b>	No risk identified	The project employees are paid equally for equal work. To ensure equity in pay for men and women employees, pay structures are regularly reviewed.
<b>Gender equity in labor and work</b>	No risk identified	The project-employed women are provided equal pay for equal work. No discrimination on gender is allowed due to the HR policy. Safe and effective reporting channels and procedures for handling gender discrimination are easily accessible to all workers inclusive of staff and contracted workers employed by third parties.
<b>Forced labor</b>	No risk identified	When overtime work is required, employees inclusive of staff and contracted workers employed by third parties are reasonably compensated and there is no forced labor. Employees are provided with safe and effective reporting channels and procedures for handling reported information quickly.
<b>Child labor</b>	No risk identified	HR policy of the project owner strictly follows the laws and regulations in China, child labor is totally prohibited. Furthermore, the operation of the project requires professional knowledge and skills that can't

		be found in children, thus there's no possibility of child labor used by the project.
<b>Human trafficking</b>	No risk identified	All employees inclusive of staff and contracted workers employed by third parties are employed voluntarily. HR policy of the project owner strictly follows the laws and regulations in China that human trafficking is prohibited.

### 2.3.2 Human Rights

Risks identified	Mitigation or preventative measure(s) taken
No risk identified	<p>The project is committed to upholding the rights of LPs, LCs, and customary rights holders by engaging in ongoing, informed consultations, obtaining FPIC for any activities, and ensuring that their cultural heritage and traditional knowledge are respected and preserved by international human rights law, the United Nations Declaration on the Rights of Indigenous Peoples, and ILO Convention 169.</p> <p>The project has obtained approval from the local government in accordance with laws and regulations before project construction. In addition, the project owner has conducted regular local stakeholder consultations and all stakeholders have agreed and supported the construction and operation of the project. The project proponent ensures that all employees' labor contracts are fair and equitable, specifying working conditions, wages and working hours. Any form of deposit, withholding of identity documents or restriction of employees' freedom is prohibited, ensuring all employees are preserved by international human rights law.</p>

### 2.3.3 Indigenous Peoples and Cultural Heritage

Risks identified	Mitigation(s) or preventative measure taken
No risk identified	No indigenous people residences and cultural heritages are located within the scope of the landfill and power plant, so the project had no negative impact on them.

### 2.3.4 Property Rights

Risks identified	Mitigation or preventative measure(s) taken
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No risk identified	<p>The project prioritizes protecting stakeholders' property rights by engaging in regular consultations, complying with legal standards, documenting rights, offering accessible conflict resolution, and ensuring fair benefit sharing and transparent monitoring. Applicable legal frameworks and existing agreements safeguard land use and access rights. The Project proponent has obtained land use rights before construction. The Project was built in the reserved area of the Laohutuo landfill, which is state owned and managed by the local government, and the Shaoyang Development and Reform Commission has approved the project construction. Therefore, the project activities do not involve any risks related to providing and preserving the property rights of indigenous people (LPs), local communities (LCs), or customary rights holders, as the land is already designated for industrial purposes following relevant legal proceedings.</p>
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### 2.3.5 Benefit Sharing

<b>Process used to design the benefit sharing plan</b>	Not applicable as the project does not impact property rights described in Section 2.3.4.
<b>Summary of the benefit sharing plan</b>	Not applicable as the project does not impact property rights described in Section 2.3.4.
<b>Approval and dissemination of benefit sharing plan</b>	Not applicable as the project does not impact property rights described in Section 2.3.4.
<b>Benefit sharing during the monitoring period</b>	Not applicable as the project does not impact property rights described in Section 2.3.4.

## 2.4 Ecosystem Health

Risks identified	Mitigation or preventative measure(s) taken
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Impacts on biodiversity and ecosystems	No risk identified	According to EIA of the project, there are no nature reserves in the project site, so the project has no further impact on biodiversity and ecosystems.
Soil degradation and soil erosion	No risk identified	According to EIA of the project, the project has no further impact on the soil.
Water consumption and stress	No risk identified	The wastewater mainly consists of domestic sewage and condensate. The condensate, which mainly contains BOD and COD, together with domestic sewage, enters the regulating tank for landfill leachate. After the biochemical treatment, the wastewater reaches the "Domestic Waste Landfill Pollution Control Standard" (GB16889-1997) "Domestic Waste Leachate" Level I standard before being discharged. According to the EIA, the project does not add wastewater stress and has little impact on the environment.

### 2.4.1 Rare, Threatened, and Endangered species

Is the project located in or adjacent to habitats for rare, threatened, or endangered species?

- Yes                       No

Species and habitat	There are no nature reserves or rare, threatened, or endangered species identified in the project site. As a result, no adverse impacts on habitats and areas needed for habitat connectivity for rare, threatened, or endangered species have been brought by the project during the monitoring period.
Areas needed for habitat connectivity	There are no nature reserves in the project site and the construction of the Project is within the reserve area of the Laohutuo landfill. According to the EIA, the Project has no adverse impact on areas needed for habitat connectivity.

Risks identified	Mitigation or preventative measure(s) taken
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Habitats for rare, threatened, and endangered species	No risk identified	According to the EIA of the project, the project has no impact on habitats and local rare, threatened, or endangered species.
Areas for habitat connectivity	No risk identified	According to the EIA of the project, the project has no adverse impact on areas needed for habitat connectivity.

### 2.4.2 Introduction of species

Species introduced	Classification	Justification for use	Adverse effects and mitigation
N/A	N/A	N/A	N/A

Existing invasive species	Mitigation measures to prevent the spread or continued existence of invasive species
N/A	N/A

	Risks identified	Mitigation or preventative measure(s) taken
Invasive species	No risk identified	According to the EIA of the project, no invasive species were existing in the project site before construction. In the project design, the Project does not involve the introduction of any plant or animal species.

### 2.4.3 Ecosystem conversion

	Risks identified	Mitigation or preventative measure(s) taken
Ecosystem conversion	No risk identified	Not applicable as the project is not an ARR, ALM, WRC or ACoGS project.

## 3 APPLICATION OF METHODOLOGY

### 3.1 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	AMS-I.D	Grid Connected Renewable Electricity Generation <sup>3</sup>	18.0
Methodology	AMS-III.G	Landfill Methane Recovery <sup>4</sup>	10.0
Tool	TOOL04	Emissions from Solid Waste Disposal Sites <sup>5</sup>	08.1
Tool	TOOL05	Baseline, Project and/or Leakage Emissions from Electricity Consumption and Monitoring of Electricity Generation <sup>6</sup>	03.0
Tool	TOOL07	Tool to Calculate the Emission Factor for an Electricity System <sup>7</sup>	07.0
Tool	TOOL32	Positive Lists of Technologies <sup>8</sup>	04.0

### 3.2 Applicability of Methodology

Methodology ID	Applicability condition	Justification of compliance
AMS-I.D	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).	4. Applicable. The Project is to install a new LFG capture system and power generation plant, meeting the applicability condition (a).

<sup>3</sup> <https://cdm.unfccc.int/UserManagement/FileStorage/2P7FS6ZQAR84LG3NMKYUH50WI9ODBC>

<sup>4</sup> <https://cdm.unfccc.int/UserManagement/FileStorage/HN2W3BMY6RKUQOZDCVXS08F9LT1AI7>

<sup>5</sup> <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v6.0.1.pdf>

<sup>6</sup> <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf>

<sup>7</sup> <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

<sup>8</sup> <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-32-v4.0.pdf>

	<p>5. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:</p> <p>(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 4 W/m<sup>2</sup>; (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 4 W/m<sup>2</sup>.</p>	<p>5. N/A. The Project is not a hydropower plant project.</p>
	<p>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 CDM 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.</p>	<p>6. N/A. The Project is not a renewable and non-renewable combined project.</p>
	<p>7. Combined heat and power (co-generation) systems are not eligible under this category.</p>	<p>7. N/A. The Project does not contain combined heat and power systems.</p>
	<p>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.</p>	<p>8. N/A. There were no existing renewable power generation facilities before the project construction.</p>
	<p>9. In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW.</p>	<p>9. N/A. The Project does not involve retrofit, rehabilitation or replacement.</p>
	<p>10. In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the</p>	<p>10. Applicable. The Project recovers LFG for electricity generation. The recovered methane</p>

	<p>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-I.C.: Thermal energy production with or without electricity” shall be explored.</p>	<p>emissions are eligible under a relevant Type III category. The baseline for the electrical component is in accordance with the procedure prescribed in AMS-I,D,</p>
	<p>11. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool “Project emissions from cultivation of biomass” shall apply.</p>	<p>11. N/A. The Project does not involve biomass sourced from dedicated plantations.</p>
<p>AMS-III.G</p>	<p>3. Different options to utilise the recovered landfill gas as detailed in paragraph 4 of “AMS-III.H.: Methane recovery in wastewater treatment” (version 19.0) are eligible for use under this methodology. The relevant procedures in AMS-III.H. shall be followed in this regard.</p> <p>4. Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO<sub>2</sub> equivalent annually from all Type III components of the project activity.</p> <p>5. The proposed project activity does not reduce the amount of organic waste that would have been recycled in the absence of the project activity.</p>	<p>3. Applicable. The project is to capture and utilize the landfill gas for electricity generation directly, which falls under 4(a) of para.4 of AMS-III.H. So, the LFG power generation component of the project shall apply methodology AMS-I.D.</p> <p>4. Applicable. Expected aggregate emission reductions from all type III components under the project activities are less than 60 kt CO<sub>2</sub> equivalent annually. The average annual emission reduction from methane recovery of the Project is 29,821 tCO<sub>2</sub>e, less than 60 kt CO<sub>2</sub>.</p> <p>5. Applicable. The project does not impact the management of the landfill, or reduce the amount of organic waste</p>

		that would have been recycled in the absence of the project activity.
	<p>6. This methodology is not applicable if the management of the solid waste disposal site (SWDS) in the project activity is deliberately changed in order to increase methane generation compared to the situation prior to the implementation of the project activity (e.g. other than to meet a technical or regulatory requirement). Such changes may include, for example, the addition of liquids to a SWDS, pre-treating waste to seed it with bacteria for the purpose of increasing the rate of anaerobic degradation of the SWDS or changing the shape of the SWDS to increase methane production.</p>	<p>6. N/A. The management of the SWDS in the project activity will not be deliberately changed to increase methane generation compared to the situation prior to the implementation of the Project.</p>
TOOL04	<p>3. The tool can be used to determine emissions for the following types of applications:</p> <p>(a) Application A: The CDM project activity mitigates methane emissions from a specific existing SWDS. Methane emissions are mitigated by capturing and flaring or combusting the methane (e.g. “ACM0001: Flaring or use of landfill gas”). The methane is generated from waste disposed in the past, including prior to the start of the CDM project activity. In these cases, the tool is only applied for an ex ante estimation of emissions in the project design document (CDM-PDD). The emissions will then be monitored during the crediting period using the applicable approaches in the relevant methodologies (e.g. measuring the amount of methane captured from the SWDS); (b) Application B: The CDM project activity avoids or involves the disposal of waste at a SWDS. An example of this application of the tool is ACM0022, in which municipal solid waste (MSW) is treated with an alternative option, such as composting or anaerobic digestion, and is then prevented from being disposed of in a SWDS. The methane is generated from waste disposed or avoided from disposal during the crediting period.</p>	<p>3. Applicable. The Project is to capture the LFG from an existing landfill and utilize the LFG to generate electricity, thus reducing the methane emission. Therefore, the Project meets the requirements of Application A.</p>

	<p>In these cases, the tool can be applied for both ex ante and ex post estimation of emissions. These project activities may apply the simplified approach detailed in 0 when calculating baseline emissions.</p>	
	<p>4. These two types of applications are referred to in the tool for determining parameters.</p>	<p>4. Applicable.</p>
	<p>5. In the case that: (a) different types of residual waste are disposed or prevented from disposal; or that (b) both MSW and residual waste(s) are prevented from disposal, then the tool should be applied separately to each residual waste and to the MSW.</p>	<p>5. Applicable. The Project meets the requirement of case (b) that both MSW and residual waste(s) are prevented from disposal, then the tool should be applied separately to each residual waste and to the MSW.</p>
<p>TOOL05</p>	<p>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:            (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</p>	<p>5. Applicable. The Project meets the requirement of Scenario A that the electricity consumption is from the grid.</p>

	<p>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.</p> <p>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.</p> <p>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 or to sources of leakage. The tool only accounts for CO<sub>2</sub> emissions.</p>	
TOOL07	<p>3. 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).</p> <p>4. 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,</p>	<p>6. Applicable. The Project meets the requirement of Scenario A and supply electricity to the grid - CCPG.</p> <p>7. Applicable. There were no captive renewable power generation technologies installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. Only CO<sub>2</sub> emissions are included in the Project.</p> <p>3. Applicable. The electricity generated by the Project is supplied to the grid - CCPG.</p> <p>4. Applicable. As off-grid power generation is an insignificant part of the national energy mix in China, the emission factor for the project electricity system is</p>

	<p>the conditions specified in “Appendix 1: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.</p>	<p>calculated only for the grid power plants.</p>
	<p>5. In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.</p>	<p>5. Applicable. The project's electricity system is totally located in China, which is not an Annex I country.</p>
	<p>6. Under this tool, the value applied to the CO<sub>2</sub> emission factor of biofuels is zero.</p>	<p>6. Applicable. The calculation of the emission factor considers the emission factor of biofuels as zero.</p>
TOOL32	<p>4. The use of this methodological tool is not mandatory for the project participants of a CDM project activity or CDM PoA for demonstrating their additionality.</p>	<p>4. Applicable. The project selects the use of the tool to demonstrate the additionality.</p>
	<p>5. This methodological tool shall be applied in conjunction with a small-scale or large-scale methodology which refers to this tool.</p>	<p>5. Applicable. The methodology AMS-III.G. (version 10.0) refers to the methodological tool.</p>
	<p>6. The positive lists as contained in section 5 of this tool are valid up to 10 March 2025. Notwithstanding the provisions on the validity of new, revised and previous versions of methodologies and methodological tools in the “Procedure: Development, revision and clarification of baseline and monitoring</p>	<p>6. Applicable. The validation is expected to be finished before March 2025. Thus, the tool is valid and applicable for the Project.</p>

methodologies and methodological tools”, there will be no grace period for the application of this tool and the validity of the positive list after this date, including in cases where further technologies are added to the positive list through revisions of this tool before this date.

### 3.3 Project Boundary

According to the methodology AMS-III.G, the project boundary is defined as the physical, geographical site of the landfill where the gas is captured and destroyed/used. As for methodology AMS-I.D, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

Considering the actual implementation of the Project, the project boundary includes the Laohutuo landfill, the whole LFG system (e.g. LFG collection, LFG pre-treatment system, LFG power generation system, etc.), and all grid-connected power plants in CCPG. The diagram of the project boundary is shown in Figure 3-1.

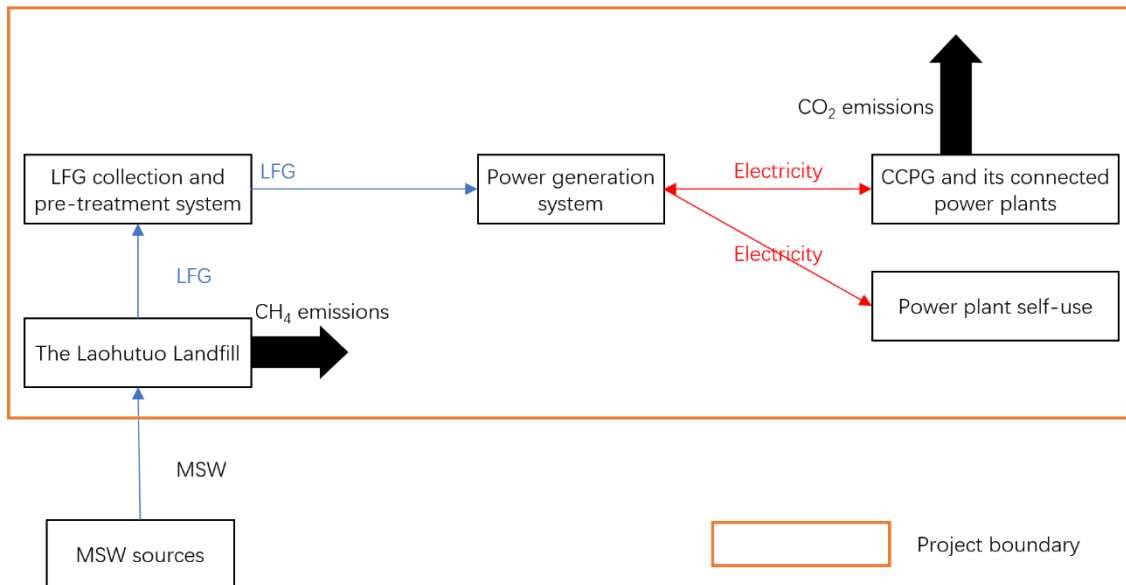


Figure 3-1 Diagram of the project boundary

Source	Gas	Included?	Justification/Explanation	
Baseline	Emission from decomposition of waste at the SWDS site	CO <sub>2</sub>	No	CO <sub>2</sub> emissions from decomposition of organic waste are not accounted for since CO <sub>2</sub> is also released under the project activity.

Source	Gas	Included?	Justification/Explanation	
Project	Emissions from electricity generation	CH <sub>4</sub>	Yes	The major source of emissions in the baseline scenario is CH <sub>4</sub> .
		N <sub>2</sub> O	No	N <sub>2</sub> O emissions are small compared to CH <sub>4</sub> emissions from SWDS. This is conservative.
		CO <sub>2</sub>	Yes	CO <sub>2</sub> is the major emission source, given that power generation is included in the project activity.
		CH <sub>4</sub>	No	CH <sub>4</sub> is excluded for simplification. This is conservative.
		N <sub>2</sub> O	No	N <sub>2</sub> O is excluded for simplification. This is conservative.
		Emission from heat generation	CO <sub>2</sub>	No
	CH <sub>4</sub>		No	The project does not involve heat generation.
	N <sub>2</sub> O		No	The project does not involve heat generation.
	Emissions from the use of natural gas	CO <sub>2</sub>	No	The project does not involve the use of natural gas.
		CH <sub>4</sub>	No	The project does not involve the use of natural gas.
N <sub>2</sub> O		No	The project does not involve the use of natural gas.	
Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO <sub>2</sub>	No	The project activity does not involve fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity.	
	CH <sub>4</sub>	No	The project activity does not involve fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity.	
	N <sub>2</sub> O	No	The project activity does not involve fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity.	

Source	Gas	Included?	Justification/Explanation
Emissions from electricity consumption due to the project activity	CO <sub>2</sub>	Yes	The project activity may use electricity from the CCPG, so CO <sub>2</sub> may be an important emission source.
	CH <sub>4</sub>	No	This emission source is assumed to be very small.
	N <sub>2</sub> O	No	This emission source is assumed to be very small.
Emissions from flaring	CO <sub>2</sub>	No	Not applicable
	CH <sub>4</sub>	No	Not applicable
	N <sub>2</sub> O	No	Not applicable
Emissions from distribution of LFG using trucks and dedicated pipelines	CO <sub>2</sub>	No	The project activity does not involve distribution of LFG using trucks or dedicated pipelines.
	CH <sub>4</sub>	No	The project activity does not involve distribution of LFG using trucks or dedicated pipelines.
	N <sub>2</sub> O	No	The project activity does not involve distribution of LFG using trucks or dedicated pipelines.

### 3.4 Baseline Scenario

As per AMS-III.G, the baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary, and methane is emitted to the atmosphere, possibly with capture of LFG and destruction through flaring to comply with regulations or contractual requirements.

As per AMS-I.D, the baseline scenario for Greenfield power plant is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

Therefore, the baseline scenario for the project activity is in the absence of the project activity, LFG from the Laohutuo landfill site is emitted directly into the atmosphere which complies with all national and local regulations and the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

### 3.5 Additionality

The project uses the following steps to demonstrate additionality. The project meets the additionality criteria as outlined in the VCS methodology as:

Step 1: Regulatory Surplus: the project is not mandated by any legal requirements. Please refer to section 3.5.1 below for details.

Step 2: Positive List: the project conforms to the positive list as stipulated in the applies the simplified procedures in Section 5.2 of the methodology AMS-III.G (version 10.0) and CDM “TOOL32: Positive lists of technologies” (version 04.0). Please refer to section 3.5.2 below for details.

#### 3.5.1 Regulatory Surplus

Is the project registered or seeking registration in an UNFCCC Annex 1 or Non-Annex 1 country?

- Annex 1 country                       Non-Annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

- Yes     No

If the project is located inside a Non-Annex 1 country and the project activities are mandated by a law, statute, or other regulatory framework, are such laws, statutes, or regulatory frameworks systematically enforced?

- Yes     No

#### 3.5.2 Additionality Methods

As per para.13(a) of Section 5.2 of the applied CDM methodology AMS-III.G (version 10.0), the simplified procedure in the methodology is applied by the project to demonstrate additionality. The methodological tool “TOOL32: Positive lists of technologies” (version 04.0) is applied in the project. According to the descriptions above, it is demonstrated that prior to the implementation of the project, the LFG was only vented but not for energy generation, and the LFG is used to generate electricity in one or several power plants with a total nameplate capacity that equals or is below 10 MW. The project meets the baseline scenario with a total nameplate capacity of 2.134 MW, below 10 MW. Therefore, the project is deemed automatically additional.

### 3.6 Methodology Deviations

Not applicable.

## 4 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

### 4.1 Baseline Emissions

The emission reductions are calculated in accordance with AMS-III.G (Version 10.0) and AMS-I.D (Version 18.0). The baseline emissions are determined according to equation (1) and comprise the following sources:

$$BE_y = BE_{CH_4,y} + BE_{EC,y} \quad \text{Equation 1}$$

Where:

$BE_y$	=	Baseline emissions in year $y$ (t CO <sub>2</sub> )
$BE_{CH_4,y}$	=	Baseline emissions of methane from the SWDS in year $y$ (t CO <sub>2</sub> )
$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year $y$ (t CO <sub>2</sub> )

- **Calculation of  $BE_{EC,y}$ :**

Based on AMS-I.D (version 18.0), the baseline emissions associated with electricity generation are to be calculated as below:

$$BE_{EC,y} = EG_{PJ,y} \times EF_{grid,y} \quad \text{Equation 2}$$

Where:

$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year $y$ (t CO <sub>2</sub> )
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year $y$ (MWh)
$EF_{grid,y}$	=	Combined margin CO <sub>2</sub> 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 <sub>2</sub> /MWh)

For Greenfield power plants,

$$EG_{PJ,y} = EG_{PJ,facility,y} \quad \text{Equation 3}$$

Where:

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

The value of  $EF_{grid,y}$  is determined as 0.57335 tCO<sub>2</sub>/MWh on the basis of Tool7: “Tool to Calculate the Emission Factor for an Electricity System” (Version 07.0), referring to Appendix 2 for the procedure.

- **Calculation of  $BE_{CH_4,y}$ :**

As per AMS-III.G (Version 10.0), baseline emissions of methane from the SWDS ( $BE_{CH_4,y}$ ) is calculated ex-ante using the equation below:

$$BE_{CH_4,y} = \eta_{PJ} \times BE_{CH_4,SWDS,y} - (1 - OX) \times F_{CH_4,BL,y} \times GWP_{CH_4} \quad \text{Equation 4}$$

Where:

$$BE_{CH_4,SWDS,y} = \text{Methane emission potential of a solid waste disposal site (in t CO}_2\text{e), calculated using the methodological tool “Emissions from solid waste disposal sites”. This tool may be used:}$$

- With the factor “f=0.0” because the amount of LFG that would have been captured and destroyed is already accounted for in this equation;
- With the definition of year x as ‘the year since the landfill started receiving wastes, x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)’.

The amount of waste type  $j$  deposited each year  $x$  ( $W_{j,x}$ ) shall be determined by sampling (as specified in the above-mentioned tool), in the case that waste is generated during the crediting period. Alternatively, for existing SWDS, if the pre-existing amount and composition of the wastes in the landfill are unknown, they can be estimated by using parameters related to the serviced population or industrial activity, or by comparison with other landfills with similar conditions at regional or national level

$$OX = \text{Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste) (dimensionless). A default value of 0.1 may be used}$$

$\eta_{PJ}$	=	Efficiency of the LFG capture system that will be installed in the project activity. It is used for ex ante estimation only. A default value of 50 per cent may be used
$F_{CH_4,BL,y}$	=	Methane emissions that would be captured and destroyed to comply with national or local safety requirement or legal regulations in the year y (t CH <sub>4</sub> ). The relevant procedures in “ACM0001: Flaring or use of landfill gas” may be followed, as well as taking into account the compliance with the relevant local laws and regulation if such laws and regulations exist
$GWP_{CH_4}$	=	Global Warming Potential for methane

$BE_{CH_4,SWDS,y}$  is determined using the tool “Emissions from solid waste disposal sites” (version 08.1) as follows:

$$\begin{aligned}
 BE_{CH_4,SWDS,y} = & \varphi_y \times (1 \\
 & - f_y) \times GWP_{CH_4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \times MCF_y \\
 & \times \sum_{x=1}^y \sum_j (W_{j,x} \times DOC_j \times e^{-k_j \times (y-x)} \times (1 - e^{-k_j}))
 \end{aligned}
 \tag{Equation 5}$$

Where, for the yearly model:

$BE_{CH_4,SWDS,y}$	=	Baseline, project or leakage methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (t CO <sub>2</sub> e/yr)
$x$	=	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period ( $x = 1$ ) to year y ( $x = y$ )
$y$	=	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)
$DOC_{f,y}$	=	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
$W_{j,x}$	=	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
$\varphi_y$	=	Model correction factor to account for model uncertainties for year y
$f_y$	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
$GWP_{CH_4}$	=	Global Warming Potential of methane
$OX$	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)

$F$	=	Fraction of methane in the SWDS gas (volume fraction)
$MCF_y$	=	Methane correction factor for year $y$
$DOC_j$	=	Fraction of degradable organic carbon in the waste type $j$ (weight fraction)
$k_j$	=	Decay rate for the waste type $j$ (1 / yr)
$j$	=	Type of residual waste or types of waste in the MSW

The model correction factor ( $\varphi_y$ ) depends on the uncertainty of the parameters used in the FOD model. For baseline emissions, project participants may choose between the following two options to calculate  $\varphi_y$ .

- **Option 1:** Use a default value. Use a default value:  $\varphi_y = \varphi_{default}$ . Default values for different applications and climatic conditions are provided in the section “Data and parameters not monitored” below.
- **Option 2:** Determine  $\varphi_y$  based on specific situation of the project activity

In the Project, option 1 is chosen to determine  $\varphi_y$  as 0.75 for both humid/wet and dry conditions.

According to the previous study in the Feasibility Study Report (FSR) of the Project and Tool04: “Emissions from solid waste disposal sites” (Version 08.1), the data of  $DOC_{f,y}$ ,  $W_{j,x}$ , and  $k_j$  are determined as follow:

**Table 4-1 Parameters of different waste types**

$j$	a	b	c	d	e
	Wood	Paper	Food	Textile	Other (rubber, plastic, glass, metal, etc.)
$DOC_j$	43%	40%	15%	24%	0
$k_j$ (1/yr)	0.03	0.06	0.185	0.06	0
$W_{j,x}$ (t)	9,680	8,483	76,796	1,913	49,129

For the Project meeting the requirements of Application A, the  $MCF$  should be selected as a default value ( $MCF_y = MCF_{default}$ ) provided in the section “Data and parameters not monitored”, where  $MCF_{default} = 1$  for anaerobic managed solid waste disposal sites.

The amount of LFG that would have been captured and destroyed is already accounted for when calculating  $F_{CH4,BL,y}$ , so the  $f_y$  in the tool shall be assigned a value of 0 according to the description of  $BE_{CH4,SWDS,y}$  in Equation 4. And since the start year of the landfill accepting wastes is 2013,  $x$  equals to 2013. According to Tool04: “Emissions from solid waste disposal sites” (Version 08.1), default  $OX$  is equal to 0.1, default  $DOC_{f,y}$  is determined as 0.5, and the

value of fraction of methane in the SWDS gas (volume fraction) ( $F$ ) is 0.5. Based on IPCC Fifth Assessment Report (AR5), the value of  $GWP_{CH_4}$  is equal to 28<sup>9</sup>.

The determination of  $F_{CH_4,BL,y}$  follows a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, to address safety and odour concerns, or for other reasons (collectively referred to as requirement in this section). The four cases in Table 4-2 are distinguished. The appropriate case should be identified, and the corresponding instructions followed:

**Table 4-2 Case for determining methane captured and destroyed in the baseline**

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture and destruction system
Case 1	No	No
Case 2	Yes	No
Case 3	No	Yes
Case 4	Yes	Yes

LFG recovery and destruction is recommended but not mandated for landfills, i.e., no requirement to destroy methane. However, to be conservative, it is assumed that methane destruction is required. The Laohutuo landfill was not equipped with an LFG capture and destruction system prior to the implementation of the Project. Based on these two conditions, Case 2 in the above table is applicable. In this situation:

$$F_{CH_4,BL,y} = F_{CH_4,BL,R,y} \quad \text{Equation 6}$$

Where:

$$F_{CH_4,BL,R,y} = \text{Amount of methane in the LFG which is flared in the baseline due to a requirement in year } y \text{ (t CH}_4\text{/yr)}$$

$F_{CH_4,BL,R,y}$  should be determined based on the information contained in the requirement to destroy methane, as follows:

- If the requirement specifies the amount of methane that must be flared then that amount is  $F_{CH_4,BL,R,y}$ ;
- If the requirement specifies a percentage of the captured LFG that is required to be flared, the amount shall be calculated as follows:

$$F_{CH_4,BL,R,y} = \rho_{reg,y} \times F_{CH_4,PJ,capt,y} \quad \text{Equation 7}$$

Where:

<sup>9</sup> Microsoft Word - Global-Warming-Potential-Values.docx (ghgprotocol.org)

$\rho_{reg,y}$	=	Fraction of LFG that is required to be flared due to a requirement in year $y$
$F_{CH_4,PJ,capt,y}$	=	Amount of methane in the LFG which is captured in the project activity in year $y$ (t CH <sub>4</sub> /yr)

Project participants may choose to calculate  $F_{CH_4,PJ,capt,y}$  by either of the two options:

- **Option 1:** Calculate using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, applying the following requirements:
  - (i) The gaseous stream tool shall be applied to the LFG pipeline immediately downstream of the LFG capture system and before any split in the gaseous flow to different uses or flares;
  - (ii) CH<sub>4</sub> is the greenhouse gases for which the mass flow should be determined;
  - (iii) The simplification offered for calculating the molecular mass of the gaseous stream is valid; and
  - (iv) The mass flow should be calculated on an hourly basis for each hour  $h$  in year  $y$
- **Option 2:** Calculate as the sum of the amount of methane that is sent to the flare, electricity generating or heat generating equipment in year  $y$  as measured in section 5.4.1.1 in Methodology ACM0001, however, not taking into account the working hours of the equipment;
  - (i) If the requirement does not specify the amount or percentage of LFG that should be destroyed but requires the installation of a capture system, without requiring the captured LFG to be flared then:

$$F_{CH_4,BL,R,y} = 0 \quad \text{Equation 8}$$

- (ii) If the requirement does not specify any amount or percentage of LFG that should be destroyed, but requires the installation of a system to capture and flare the LFG, then a typical destruction rate of 20 per cent is assumed<sup>10</sup>:

$$F_{CH_4,BL,R,y} = 0.2 \times F_{CH_4,PJ,capt,y} \quad \text{Equation 9}$$

There is no requirement specifying the amount or percentage of LFG that should be destroyed, and no requirement on the installation of a system to capture and flare the LFG. As a result, it is assumed a typical destruction rate of 20 per cent by Option 2 (ii) to calculate the required LFG destruction.

<sup>10</sup> This default value of 20 per cent is based on assuming a situation in which: the efficiency of the LFG capture system in the project is 50 per cent; the efficiency of the LFG capture system in the baseline is 20 per cent; and, the amount captured in the baseline is flared using an open flare with a destruction efficiency of 50 per cent (consistent with the default value provided in the tool “Project emissions from flaring”). Project participants may propose and justify an alternative default value as a request for revision to this methodology.

An ex ante estimate of  $F_{CH_4,PJ,capt,y}$  is equal to amount of methane in the LFG which is flared and/or used in the project activity,  $F_{CH_4,PJ,y}$ . It is required to estimate baseline emission of methane from the SWDS in order to estimate the emission reductions of the proposed project activity. It is determined as follows:

$$F_{CH_4,PJ,y} = \eta_{PJ} \times BE_{CH_4,SWDS,y} / GWP_{CH_4} \quad \text{Equation 10}$$

Where:

- $F_{CH_4,PJ,y}$  = Amount of methane in the LFG which is flared and/or used in the project activity in year  $y$  (t CH<sub>4</sub>/yr)
- $\eta_{PJ}$  = Methane emission potential of a solid waste disposal site (in t CO<sub>2</sub>e), calculated using the methodological tool “Emissions from solid waste disposal sites”. This tool may be used:
- With the factor “f=0.0” because the amount of LFG that would have been captured and destroyed is already accounted for in this equation;
  - With the definition of year  $x$  as ‘the year since the landfill started receiving wastes,  $x$  runs from the first year of landfill operation ( $x=1$ ) to the year for which emissions are calculated ( $x=y$ )’.

The amount of waste type  $j$  deposited each year  $x$  ( $W_{j,x}$ ) shall be determined by sampling (as specified in the above-mentioned tool), in the case that waste is generated during the crediting period. Alternatively, for existing SWDS, if the pre-existing amount and composition of the wastes in the landfill are unknown, they can be estimated by using parameters related to the serviced population or industrial activity, or by comparison with other landfills with similar conditions at regional or national level

- $BE_{CH_4,SWDS,y}$  = Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste) (dimensionless). A default value of 0.1 may be used

According to the Project Feasibility Study Report (FSR),  $\eta_{PJ}$  is determined as 60%.

## 4.2 Project Emissions

As per AMS-I.D. (Version 18.0), project emission of the project is zero.

As per AMS-III.G. (Version 10.0), project emission is calculated as per equation below

$$PE_y = PE_{power,y} + PE_{flare,y} + PE_{process,y} \quad \text{Equation 11}$$

Where:

$PE_y$	=	Project emissions in year $y$ (t CO <sub>2</sub> e)
$PE_{power,y}$	=	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year $y$ (t CO <sub>2</sub> e)
$PE_{flare,y}$	=	Emissions from flaring or combustion of the landfill gas stream in the year $y$ (t CO <sub>2</sub> e)
$PE_{process,y}$	=	Emissions from the landfill gas upgrading process in the year $y$ (t CO <sub>2</sub> e), determined by following the relevant procedures described in annex 1 of AMS-III.H.

The Project does not involve the emissions from the consumption of fossil fuels, only emissions from the use of electricity for the operation of the installed facilities are concerned. The Project will consume electricity delivered from the grid when the project is not in operation. And this part of electricity has already been deducted from the quantity of electricity supplied from the project plant/unit to the grid when calculating the net amount of electricity generation provided by the project plant/unit to the grid, which is then used to calculate the baseline emissions associated with electricity generation ( $BE_{EC,y}$ ), hence emissions from the use of electricity for the operation of the installed facilities are excluded, which means Emissions from the use of fossil fuel or electricity for the operation of the installed facilities equal to 0.

The Project does not involve emission reductions from flaring, hence project emissions from flaring or combustion of the landfill gas stream are excluded. The project does not involve a landfill gas upgrading process, hence the emissions from the landfill gas upgrading process are also excluded.

In conclusion, the project emission of the project activity is 0.

### 4.3 Leakage Emissions

As per applied CDM methodology AMS-I.D and AMS-III.G, leakage emissions ( $LE_y$ ) of the project are equal to 0.

### 4.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals

According to AMS-I.D and AMS-III.G, the emission reduction associated with methane recovery achieved by the project activity can be estimated ex ante in the project design document (PDD) by:

$$ER_{y,estimated} = BE_y - PE_y - LE_y \quad \text{Equation 12}$$

Where:

$$ER_{y,estimated} = \text{Emission reductions in year } y \text{ (t CO}_2\text{e)}$$

$BE_y$	=	Baseline emissions in year $y$ (t CO <sub>2</sub> e)
$PE_y$	=	Project emissions in year $y$ (t CO <sub>2</sub> e)
$LE_y$	=	Leakage emissions in year $y$ (t CO <sub>2</sub> e)

As per AMS-III.G, The actual emission reduction achieved by the project activity during the crediting period will be calculated using the amount of methane recovered and destroyed/gainfully used by the project activity, calculated as:

$$ER_{CH_4,y,calculated} = (1 - OX) \times (F_{CH_4,PJ,y} - F_{CH_4,BL,y}) \times GWP_{CH_4} - PE_y - LE_y \quad \text{Equation 13}$$

Where:

$F_{CH_4,PJ,y}$	=	Methane captured and destroyed/gainfully used by the project activity in the year $y$ (t CH <sub>4</sub> /yr)
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For project activities that utilize the recovered methane for power generation,  $F_{CH_4,PJ,y}$  may be calculated as follows, based on the amount of monitored electricity generation, without monitoring methane flow and concentration:

$$F_{CH_4,PJ,y} = \frac{EG_y \times 3600}{NCV_{CH_4} \times EE_y} \times D_{CH_4} \quad \text{Equation 14}$$

Where:

$EG_y$	=	Electricity generation in year $y$ (MWh)
3600	=	Conversion factor (1 MWh = 3600 MJ)
$NCV_{CH_4}$	=	NCV of methane (MJ/Nm <sup>3</sup> ) use default value: 35.9 MJ/Nm <sup>3</sup>
$EE_y$	=	Energy Conversion Efficiency of the project equipment determined from one of the following options: <ul style="list-style-type: none"> <li>• Specification provided by the equipment manufacturer specifically for biogas fuel only if the equipment is designed to utilize biogas as fuel. If the specification provides a range of efficiency values, the highest value of the range shall be used for the calculation</li> <li>• Default efficiency of 40 per cent</li> </ul>

As per section 4.2 and 4.3 above, project emission equals to zero, and no leakage is considered for the project. Therefore, the total emission reduction by the project (both Type I and Type III components) is calculated as follows:

$$ER_{y,calculated} = (1 - OX) \times (F_{CH_4,PJ,y} - F_{CH_4,BL,y}) \times GWP_{CH_4} + BE_{EC,y} \quad \text{Equation 15}$$

The estimated emission reductions ( $ER_{y,estimated}$ ) of the project is calculated as follows:

- **Calculation of estimated baseline emissions resulted from SWDS:**

In the PD, Equation 16-6 are applied to ex-ante estimate the baseline emissions resulted from methane recovery:

**Table 4-3 The ex-ante estimation of baseline emissions resulted from AMS-III.G.**

Year	$\eta_{PJ}$	$BE_{CH_4,SWDS,y}$ (tCO <sub>2e</sub> )	$OX$	$F_{CH_4,BL,y}$ (tCH <sub>4</sub> )	$GWP_{CH_4}$ (tCO <sub>2e</sub> /tCH <sub>4</sub> )	$BE_{CH_4,y}$ (tCO <sub>2e</sub> )
2023	0.5	80,594.91	0.1	287	28	33,065
2024	0.5	83,672.27	0.1	598	28	26,775
2025	0.5	86,391.91	0.1	617	28	27,645
2026	0.5	88,807.08	0.1	634	28	28,418
2027	0.5	90,962.37	0.1	650	28	29,107
2028	0.5	92,895.18	0.1	664	28	29,726
2029	0.5	94,636.91	0.1	676	28	30,283
2030	0.5	96,213.96	0.1	687	28	30,788
2031	0.5	97,648.54	0.1	697	28	31,247
2032	0.5	98,959.39	0.1	707	28	31,667
2033	0.5	100,162.33	0.1	715	28	32,051
<b>Total</b>						<b>330,772</b>

- **Calculation of estimated baseline emissions resulted from electricity generation:**

Baseline emissions resulting from AMS-I.D. are ex-ante estimated as follows:

**Table 4-4 The ex-ante estimation of baseline emissions resulted from AMS-I.D**

Year	$EG_{PJ,y}$ (MWh/y)	$EF_{grid,CM,y}$ (tCO <sub>2</sub> /MWh)	$BE_{EC,y}$ (tCO <sub>2</sub> )
2023	7,616.97	0.57335	4,367
2024	7,907.81	0.57335	4,533
2025	8,164.84	0.57335	4,681
2026	8,393.09	0.57335	4,812
2027	8,596.79	0.57335	4,928
2028	8,779.46	0.57335	5,033
2029	8,944.07	0.57335	5,128
2030	9,093.11	0.57335	5,213
2031	9,228.69	0.57335	5,291
2032	9,352.58	0.57335	5,362
2033	9,466.27	0.57335	5,427
<b>Total</b>			<b>54,775</b>

- **Calculation of estimated emissions reductions:**

Considering the project emissions and leakage emissions are 0 as described above, the estimated emission reductions are calculated as follows:

**Table 4-5 The ex-ante estimation of emissions reductions**

Year	$BE_{CH_4,y}$ (tCO <sub>2</sub> e)	$BE_{EC,y}$ (tCO <sub>2</sub> )	$BE_y$ (tCO <sub>2</sub> )	$PE_y$ (tCO <sub>2</sub> )	$LE_y$ (tCO <sub>2</sub> )	$ER_y$ (tCO <sub>2</sub> )
2023	33,065	4,367	37,432	0	0	37,432
2024	26,775	4,533	31,308	0	0	31,308
2025	27,645	4,681	32,326	0	0	32,326
2026	28,418	4,812	33,230	0	0	33,230
2027	29,107	4,928	34,035	0	0	34,035
2028	29,726	5,033	34,759	0	0	34,759
2029	30,283	5,128	35,411	0	0	35,411
2030	30,788	5,213	36,001	0	0	36,001
2031	31,247	5,291	36,538	0	0	36,538
2032	31,667	5,362	37,029	0	0	37,029
2033	32,051	5,427	37,478	0	0	37,478
<b>Total</b>	<b>330,772</b>	<b>54,775</b>	<b>385,547</b>	<b>0</b>	<b>0</b>	<b>385,547</b>

During the fixing 10-year crediting period from 01-July-2023 to 30-June-2033, the estimated emission reductions are calculated as follows:

Vintage period	Estimated baseline emissions (tCO <sub>2</sub> e)	Estimated project emissions (tCO <sub>2</sub> e)	Estimated leakage emissions (tCO <sub>2</sub> e)	Estimated reduction VCUs (tCO <sub>2</sub> e)	Estimated removal VCUs (tCO <sub>2</sub> e)	Estimated total VCUs (tCO <sub>2</sub> e)
07/01/2023-31/12/2023	18,869	0	0	18,869	0	18,869
01/01/2024-31/12/2024	31,308	0	0	31,308	0	31,308
01/01/2025-31/12/2025	32,326	0	0	32,326	0	32,326
01/01/2026-31/12/2026	33,230	0	0	33,230	0	33,230
01/01/2027-31/12/2027	34,035	0	0	34,035	0	34,035
01/01/2028-31/12/2028	34,759	0	0	34,759	0	34,759

01/01/2029-31/12/2029	35,411	0	0	35,411	0	35,411
01/01/2030-31/12/2030	36,001	0	0	36,001	0	36,001
01/01/2031-31/12/2031	36,538	0	0	36,538	0	36,538
01/01/2032-31/12/2032	37,029	0	0	37,029	0	37,029
01/01/2033-30/06/2033	18,584	0	0	18,584	0	18,584
<b>Total</b>	<b>348,090</b>	<b>0</b>	<b>0</b>	<b>348,090</b>	<b>0</b>	<b>348,090</b>

## 5 MONITORING

### 5.1 Data and Parameters Available at Validation

<b>Data / Parameter</b>	$NCV_{CH_4}$
<b>Data unit</b>	MJ/Nm <sup>3</sup>
<b>Description</b>	$NCV$ of methane (MJ/Nm <sup>3</sup> ) use default value: 35.9 MJ/Nm <sup>3</sup>
<b>Source of data</b>	AMS-III.G: "Landfill methane recovery" (Version 10.0)
<b>Value applied:</b>	35.9 MJ/Nm <sup>3</sup>
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	-
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	$EE_y$
<b>Data unit</b>	%
<b>Description</b>	Energy Conversion Efficiency of the project equipment

Source of data	AMS-III.G Landfill methane recovery (Version 10.0)
Value applied:	40.0%
Justification of choice of data or description of measurement methods and procedures applied	<p><math>EE_y</math> shall be determined from one of the following options:</p> <ul style="list-style-type: none"> <li>• Specification provided by the equipment manufacturer specifically for biogas fuel only if the equipment is designed to utilize biogas as fuel. If the specification provides a range of efficiency values, the highest value of the range shall be used for the calculation</li> <li>• Default efficiency of 40 per cent</li> </ul> <p>The default value of 40 per cent is used for the Project, and the latter option is applicable.</p>
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	$D_{CH_4}$
Data unit	tonnes/Nm <sup>3</sup>
Description	Density of methane at the temperature and pressure of the landfill gas
Source of data	TOOL06: "Project emissions from Flaring" (Version 04.0) <sup>11</sup>
Value applied:	0.000716 tonnes/ Nm <sup>3</sup>
Justification of choice of data or description of measurement methods and procedures applied	<p><math>LFG_{i,y}</math> is reported at normal conditions of temperature and pressure, so the density of methane is also determined as 0.000716 tonnes/Nm<sup>3</sup> at normal conditions.</p>
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	$GWP_{CH_4}$
Data unit	tCO <sub>2</sub> e/tCH <sub>4</sub>
Description	Global Warming Potential for methane
Source of data	IPCC AR5 <sup>12</sup>

<sup>11</sup> [EB113\\_repan10\\_TOOL06\\_ver04 \(unfccc.int\)](#)

<sup>12</sup> [Microsoft Word - Global-Warming-Potential-Values.docx \(ghgprotocol.org\)](#)

<b>Value applied:</b>	28 tCO <sub>2</sub> e/tCH <sub>4</sub>
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	-
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	$EF_{grid,OM,y}$
<b>Data unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Operating margin CO <sub>2</sub> emission factor r in year y
<b>Source of data</b>	“2023 Operating Margin Emission Factors for Regional Power Grids in China” <sup>13</sup> by DNA of China
<b>Value applied:</b>	0.8771 tCO <sub>2</sub> /MWh
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	Official and authoritative statistic data.
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	$EF_{grid,BM,y}$
<b>Data unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Build margin CO <sub>2</sub> emission factor
<b>Source of data</b>	“2023 Build Margin Emission Factors for Regional Power Grids in China” <sup>14</sup> by DNA of China
<b>Value applied:</b>	0.2696 tCO <sub>2</sub> /MWh
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	Official and authoritative statistic data.

<sup>13</sup> [W020240709709437370462.pdf \(ncsc.org.cn\)](https://www.ncsc.org.cn/W020240709709437370462.pdf)

<sup>14</sup> [W020240709709439048191.pdf \(ncsc.org.cn\)](https://www.ncsc.org.cn/W020240709709439048191.pdf)

Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	$w_{OM}$
Data unit	%
Description	Weighting of operating margin emissions factor
Source of data	Tool07: "Tool to calculate the emission factor for an electricity system" (version 07.0)
Value applied:	50%
Justification of choice of data or description of measurement methods and procedures applied	For projects other than wind and solar power generation project activities, $w_{OM} = 0.5$ for the first crediting period.
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	$w_{BM}$
Data unit	%
Description	Weighting of build margin emissions factor in year y
Source of data	Tool07: "Tool to calculate the emission factor for an electricity system" (version 07.0)
Value applied:	50%
Justification of choice of data or description of measurement methods and procedures applied	For projects other than wind and solar power generation project activities, $w_{BM} = 0.5$ for the first crediting period.
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO <sub>2</sub> /MWh

<b>Description</b>	Combined margin CO <sub>2</sub> emission factor in year y
<b>Source of data</b>	Calculated based on TOOL07: “Tool to calculate the emission factor for an electricity system” (Version 07.0)
<b>Value applied:</b>	0.57335 tCO <sub>2</sub> /MWh
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	$EF_{grid,CM,y}$ is calculated based on $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ as per the latest version of TOOL07
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	$OX$
<b>Data unit</b>	-
<b>Description</b>	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste) (dimensionless)
<b>Source of data</b>	AMS-III.G: “Landfill methane recovery” (Version 10.0)
<b>Value applied:</b>	0.1
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	A default value of 0.1 may be used.
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	$\eta_{PJ}$
<b>Data unit</b>	%
<b>Description</b>	Efficiency of the LFG capture system that will be installed in the project activity. It is used for ex ante estimation only.
<b>Source of data</b>	AMS-III.G Landfill methane recovery (Version 10.0)
<b>Value applied:</b>	50%
<b>Justification of choice of data or description of</b>	A default value of 50 per cent may be used.

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

Data / Parameter	$DOC_{f,y}$
Data unit	%
Description	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year $y$ (weight fraction)
Source of data	Tool04: "Emissions from solid waste disposal sites" (Version 08.1)
Value applied:	50%
Justification of choice of data or description of measurement methods and procedures applied	For methane calculation from MSW, the national value of $DOC_f$ is equal to 0.5.
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	$W_{j,x}$
Data unit	t
Description	Amount of solid waste type $j$ disposed or prevented from disposal in the SWDS in the year $x$
Source of data	Tool04: "Emissions from solid waste disposal sites" (Version 08.1)
Value applied:	Refer to the ER sheet
Justification of choice of data or description of measurement methods and procedures applied	It is calculated as total waste amount dumped in the landfill site in the year $x$ multiplied by organic waste type $j$ fraction on wet basis. Both total waste amount and waste type $j$ fraction are referred to FSR.
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	$\varphi_y$									
Data unit	-									
Description	Model correction factor to account for model uncertainties for year $y$									
Source of data	Tool04: "Emissions from solid waste disposal sites" (Version 08.1)									
Value applied:	0.75									
Justification of choice of data or description of measurement methods and procedures applied	<p>Option 1: use a default value is chosen to calculate <math>\varphi_y</math>.</p> <table border="1"> <thead> <tr> <th></th> <th>Humid/wet conditions</th> <th>Dry conditions</th> </tr> </thead> <tbody> <tr> <td>Application A</td> <td>0.75</td> <td>0.75</td> </tr> <tr> <td>Application B</td> <td>0.85</td> <td>0.80</td> </tr> </tbody> </table> <p>For the Project under Application A: The CDM project activity mitigates methane emissions from a specific existing SWDS, <math>\varphi_y = 0.75</math>.</p>		Humid/wet conditions	Dry conditions	Application A	0.75	0.75	Application B	0.85	0.80
	Humid/wet conditions	Dry conditions								
Application A	0.75	0.75								
Application B	0.85	0.80								
Purpose of data	Calculation of baseline emissions									
Comments	-									

Data / Parameter	$f_y$
Data unit	%
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year $y$
Source of data	AMS-III.G Landfill methane recovery (Version 10.0)
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied	<p>With the factor "f=0.0" because the amount of LFG that would have been captured and destroyed is already accounted for in Equation 4.</p> <p>For the Project, the amount of LFG that would have been captured and destroyed is already counted in the parameter <math>F_{CH_4,BL,y}</math> in the equation. Hence <math>f_y = 0</math>.</p>
Purpose of data	Calculation of baseline emissions
Comments	For Application A: $f_y$ is calculated once for the crediting period.

Data / Parameter	$F$
Data unit	%

<b>Description</b>	Fraction of methane in the SWDS gas (volume fraction)
<b>Source of data</b>	Tool04: "Emissions from solid waste disposal sites" (Version 08.1)
<b>Value applied:</b>	50%
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	The default value from the latest version of Tool04 is 0.5.
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	$MCF_y$
<b>Data unit</b>	-
<b>Description</b>	Methane correction factor for year $y$
<b>Source of data</b>	Tool04: "Emissions from solid waste disposal sites" (Version 08.1)
<b>Value applied:</b>	1.0
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	In case of Application A, $MCF_y = 1.0$ for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e.waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste.
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	$DOC_j$					
<b>Data unit</b>	%					
<b>Description</b>	Fraction of degradable organic carbon in the waste type $j$ (weight fraction)					
<b>Source of data</b>	Tool04: "Emissions from solid waste disposal sites" (Version 08.1)					
<b>Value applied:</b>		a	b	c	d	e
	$j$	Wood	Paper	Food	Textile	Others (rubber, plastic, glass, metal, etc.)
	$DOC_j$	43%	40%	15%	24%	0%

Justification of choice of data or description of measurement methods and procedures applied	Using default value provided by Tool04 (Version 08.1)
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	$k_j$					
Data unit	1 / yr					
Description	Decay rate for the waste type $j$					
Source of data	Tool04: "Emissions from solid waste disposal sites" (Version 08.1)					
Value applied:	$j$	a	b	c	d	e
		Wood	Paper	Kitchen	Textile	Others (rubber, plastic, glass, metal, etc.)
	$k_j$	0.03	0.06	0.185	0.06	0
Justification of choice of data or description of measurement methods and procedures applied	Using following default value for waste type $j$ :					
	Waste type $j$		Boreal and Temperate (MAT $\leq 20^\circ\text{C}$ )		Tropical (MAT $> 20^\circ\text{C}$ )	
			Dry (MAP/PE T $< 1$ )	Wet (MAP/PET $> 1$ )	Dry (MAP $< 1000$ mm)	Dry (MAP $> 1000$ mm)
	Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07
		Wood, wood product and straw	0.02	0.03	0.025	0.035
	Moderately degradable	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40	

	<p>Note: MAT – mean annual temperature, MAP – Mean annual precipitation, PET – potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration.</p> <p>For the project site in Shaoyang, Hu’nan, the climate zone is subtropical monsoon humid climate with an annual average temperature from 16.1 to 17.1 °C<sup>15</sup>, below 20°C. The average annual PET in Hu’nan province is about 819.22 mm/yr<sup>16</sup>. The annual average precipitation is about 1953 mm/yr<sup>17</sup>, thus MAP/PET &gt;1. Therefore, the values for Boreal and Temperate (MAT ≤ 20°C) and Wet (MAP/PET &gt; 1) are applicable.</p>
Purpose of data	Calculation of baseline emissions
Comments	-

## 5.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ, facility, y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Electricity meter
Description of measurement methods and procedures applied	Monitored by a bi-directional electricity meter M1 installed at the outlet of the onsite substation. Meter readings will be read and recorded by the project staff monthly. Sales receipts will be issued for electricity settlement monthly.
Frequency of monitoring/recording	Continuously measured and at least monthly recorded
Value applied:	Refer to ER sheet
Monitoring equipment	Electricity meter
QA/QC procedures applied	The data will be cross checked with sales receipts of electricity. The electricity meter is to be calibrated every year in compliance with the latest version of “ <i>Technical administrative code of electric energy metering</i> ”.
Purpose of data	Calculation of baseline emissions

<sup>15</sup> <https://www.shaoyang.gov.cn/shaoyang/szrdl/202207/7423a1198a4f4dd5b917e1330379ed92.shtml>

<sup>16</sup> Liu N, Jiang W, Huang L, Li Y, Zhang C, Xiao X, Huang Y. Evolution of Sustainable Water Resource Utilization in Hunan Province, China. *Water*. 2022; 14(16):2477. <https://doi.org/10.3390/w14162477>

<sup>17</sup> Liu N, Jiang W, Huang L, Li Y, Zhang C, Xiao X, Huang Y. Evolution of Sustainable Water Resource Utilization in Hunan Province, China. *Water*. 2022; 14(16):2477. <https://doi.org/10.3390/w14162477>

<b>Calculation method</b>	<p>This parameter should be calculated as difference between (a) the quantity of electricity supplied by the project to the grid (<math>EG_{export,y}</math>); and (b) the quantity of electricity the project from the grid (<math>EG_{import,y}</math>). The formula is as follows:</p> $EG_{PJ,y} = EG_{export,y} - EG_{import,y}$ $EG_{PJ,facility,y} = EG_{PJ,y}$ <p>The following parameters shall be measured:</p> <p>(a) The quantity of electricity supplied by the project to the grid; and</p> <p>(b) The quantity of electricity delivered to the project from the grid</p>
<b>Comments</b>	<p>This parameter is required for calculating baseline emissions associated with electricity generation (<math>BE_{EC,y}</math>) using the methodology AMS-I.D “Grid connected renewable electricity generation” (Version 18.0).</p>

<b>Data / Parameter</b>	$EG_y$
<b>Data unit</b>	MWh
<b>Description</b>	Electricity generation in year $y$
<b>Source of data</b>	Electricity meter
<b>Description of measurement methods and procedures applied</b>	Measured by a bi-directional electricity meter M2 installed at the outlet of gas generators. Meter readings will be read and recorded by the project staff monthly.
<b>Frequency of monitoring/recording</b>	Continuously measured and monthly recorded
<b>Value applied:</b>	Ex post calculation only
<b>Monitoring equipment</b>	Electricity meter
<b>QA/QC procedures applied</b>	The electricity meter is to be calibrated regularly in compliance with the latest version of “ <i>Technical administrative code of electric energy metering</i> ”.
<b>Purpose of data</b>	Calculation of emission reduction
<b>Calculation method</b>	-
<b>Comments</b>	This parameter is required for calculating baseline emissions.

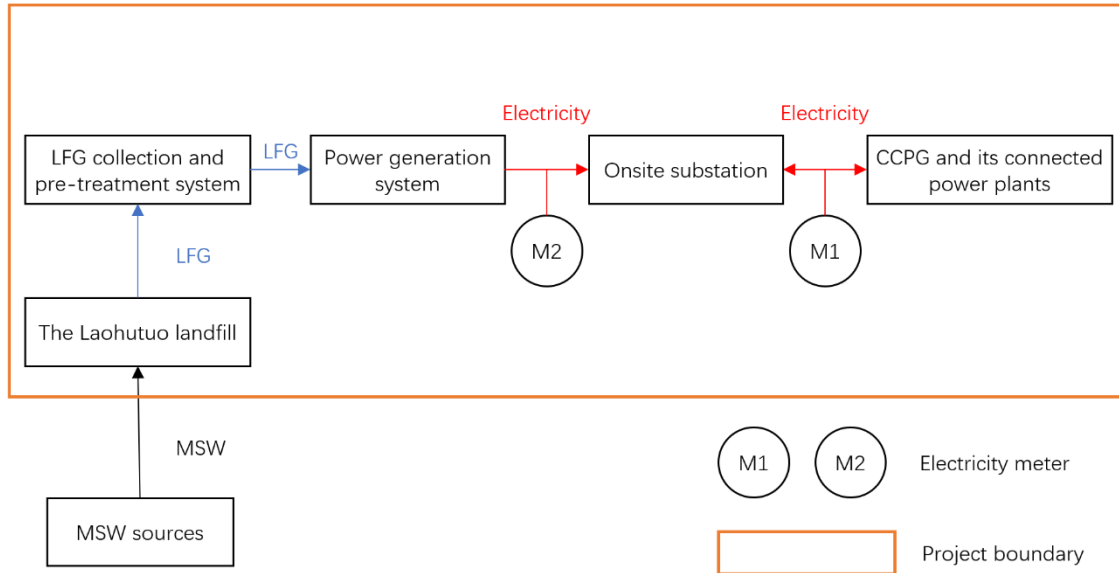
### 5.3 Monitoring Plan

The monitoring plan assures that real, measurable, long-term GHG emission reductions can be monitored, recorded and reported. It is a crucial procedure to identify the final VCUs of the project.

This monitoring plan is implemented by the project owner during the project operation. The details of the monitoring plan are specified as follows:

**(A) Data and parameters to be monitored**

Data and parameters to be monitored are listed below and show the positions of the monitoring instruments and Table 5-1 lists the corresponding parameters monitored.



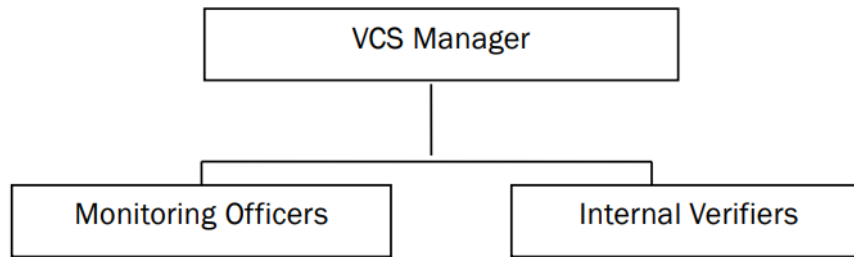
**Figure 5-1 Project monitoring diagram**

**Table 5-1 Corresponding parameters monitored**

Position	Monitoring Instrument	Parameter Monitored	Description
M1	Electricity meter	$EG_{PJ, facility, y}$ ( $EG_{PJ, y}$ )	Quantity of net electricity generation supplied by the project to the grid is continuously monitored by bi-directional electricity meter installed by outlet of onsite substation with the accuracy of $\pm 1\%$ .
M2	Electricity meter	$EG_y$	Amount of electricity generated using LFG by the project activity is continuously monitored by electricity meter installed at the outlet of gas generator with the accuracy of $\pm 1\%$ .

**(B) Management Structure**

The Project owner organizes a specific VCS team in project development department to be responsible for data collection, supervision and witness the whole process of data measuring and recording. A VCS manager is appointed to take full responsibility for the overall monitoring of the project. The monitoring and measurement of extracted gas, electricity generation and consumption etc. are carried out by a few designated monitoring officers. In addition, the Project developer appoints internal verifiers who is responsible for internal check of the measurement, collection of relevant receipts and invoices, and the calculation of the emission reductions. A monitoring and management manual of the project that identifies detailed duties and responsibilities of the relevant parties is developed and served as the basis of the project monitoring. Figure 5-2 shows the operation and management structure of the Project.



**Figure 5-2 Operation and management structure of the project**

**(C) Data collection**

Monitoring officers are responsible for data collection. Designated teams read and collect the monitored data regularly. The computer system automatically monitors and records relevant meter data. Automatic records serve as the main data source for emission reductions calculation. All data files, relevant purchase invoices and sales receipts is collected by a designated monitoring officer, who prepares backup in time and archive all documents properly.

**(D) Quality assurance**

All metering equipment for monitoring is chosen in accordance with VCS requirements and is calibrated regularly for accuracy by qualified party according to the national regulations. To assist in future verifications, the Project owner preserves the calibration records, along with the data files of project monitoring.

Error check routines is established on site and at the point of data storage to detect data measuring/transmission failures as well as malfunctions. In the case of malfunction of the meters, the meter supplier provides technical support to engage the problem promptly and emission reductions during this monitoring period are calculated conservatively.

The installation of the electricity metering equipment fulfills the requirements of “DL/T448 – 2016 Technical Administrative Code of Electric Energy Metering”. The accuracy of the installed meter is  $\pm 1\%$ . All the meters are checked and maintained periodically.

Internal audit procedure is initiated under any of the below circumstances:

- Modification of the monitoring system
- Two months prior to verification

Firstly, the monitoring system is checked on if the system functions properly and if the monitored results are correct. Secondly, a spot check of daily/monthly data report is undertaken. The internal audit report is submitted upon completion of the procedure.

#### **(E) Data file management**

All monitoring data is electronically filed by the end of each month and the electronic data files are archived in both disk copy and printed hard copy. All data collected as part of monitoring is archived electronically and will be kept at least for two years after the end of the crediting period.

#### **(F) Emergency**

The monitoring team members are in charge of identifying any emergency, such as failure or malfunction of a monitoring instrument, and then reporting it to the VCS Manager. The VCS Manager will promptly turn to professionals, such as technicians/engineers from the plant and/or equipment suppliers, to address the emergency. When the issue is successfully handled, the manager will inform the monitoring team members that the emergency is ended. Further, the manager will issue a written report to describe the procedures of emergency identification and intervention, followed by analyzing if the emergency impacts the ER calculation. If it does, the ER during the associated troubleshooting period will be calculated accordingly.

# APPENDIX 1: COMMERCIALLY SENSITIVE INFORMATION

The project does not include commercially sensitive information in the project description to be excluded in the public version.

Section	Information	Justification
N/A	N/A	N/A

# APPENDIX 2: CALCULATION OF BASELINE EMISSION FACTOR FOR CCPG

Evidence of  $EF_{grid,OM,y}$  calculation:

According to “Tool to calculate the emission factor for an electricity system” (version 07.0), the following six steps are applied to calculate the project baseline emission factor:

(a) **Step 1:** Identify the relevant electricity systems

Project participants may delineate the project electricity system using any of the following options:

- **Option 1.** A delineation of the project electricity system and connected electricity systems published by the DNA or the group of the DNAs of the host country(ies). In case a delineation is provided by a group of DNAs, the same delineation should be used by all the project participants applying the tool in these countries;
- **Option 2.** A delineation of the project electricity system defined by the dispatch area of the dispatch centre responsible for scheduling and dispatching electricity generated by the project activity. Where the dispatch area is controlled by more than one dispatch centre, i.e. layered dispatch area, the higher level area shall be used as a delineation of the project electricity system (e.g. where regional dispatch centres are required to comply with dispatch orders of the national dispatch centre then area controlled by the national dispatch centre shall be used);
- **Option 3.** A delineation of the project electricity system defined by more than one independent dispatch areas, e.g. multi-national power pools.

The Chinese DNA has published a delineation of the project's electricity system and connected electricity systems, Option 1 is applied for the project. According to the delineations, the Central China Power Grid (CCPG) is identified as the relevant electric power system of the project, which includes Henan Province, Hubei Province, Hunan Province, Jiangxi Province, Sichuan Province, and Chongqing City.

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

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

- **Optional I:** Only grid power plants are included in the calculation.
- **Optional II:** Both grid power plants and off-grid power plants are included in the calculation.

Based on China's real situation, only grid power plants are included in the calculation.

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

The calculation of the operating margin emission factor ( $EF_{grid,OM,y}$ ) is based on one of the following methods, which are described under Step 4:

- Simple OM; or
- Simple adjusted OM; or
- Dispatch data analysis OM; or
- Average OM.

According to the data from Electric Power Industry Statistical Data Compilation 2017 – 2021 and China Energy Statistical Yearbook 2018 – 2022, from 2017 to 2021, for the CCPG the project activity connected to, the low-cost/must-run resources (LCMR)<sup>18</sup> electric power resources generation accounting for the total grid total is 36.99%, 35.75%, 36.66%, 40.78%, and 41.27%, respectively, all lower than 50%.

On the grounds of Flow chart: Overview of the application of OM methods in “Tool to calculate the emission factor for an electricity system” (version 07.0) as shown in Figure 0-1, since the LCMR share is less than 50% of total grid generation in the average of the five most recent years, the simple OM method is chosen for the calculation of the OM emission factor  $EF$ .

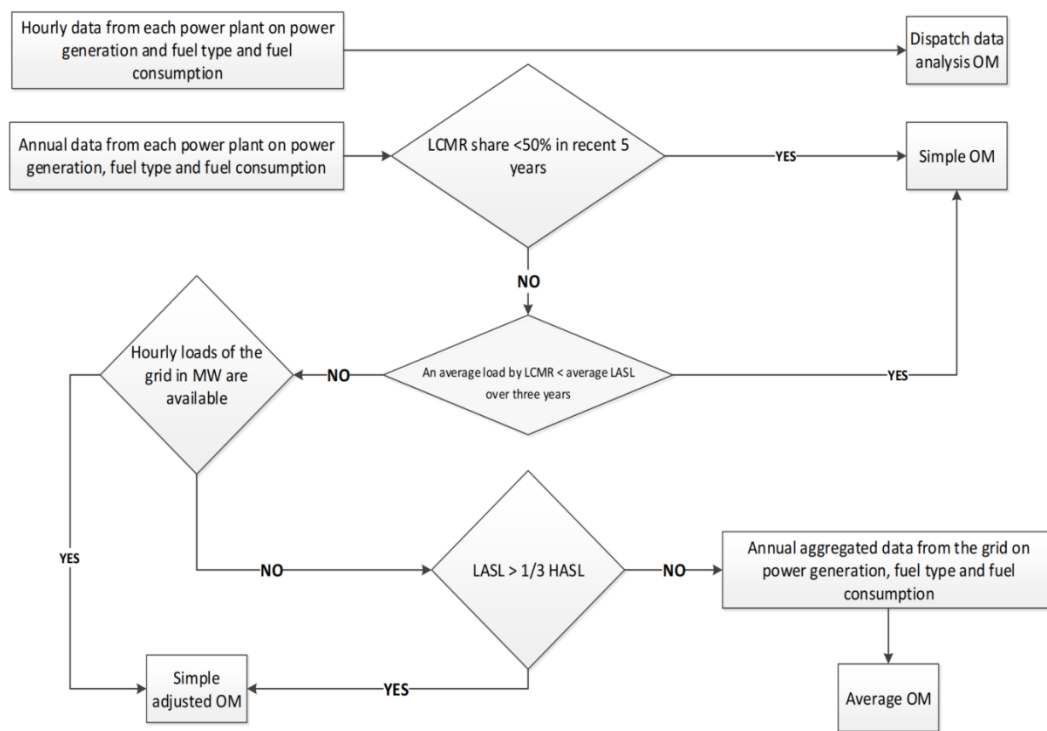


Figure 0-1 Flow chart: Overview of the application of OM methods

<sup>18</sup> Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list.

As per the latest version of “Tool to calculate the emission factor for an electricity system” (version 07.0), the emissions factor for the simple OM can be calculated using either of the two following data vintages:

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

The Ex ante option is selected, and the  $EF_{grid,OM}$  is fixed during the crediting period.

- (d) **Step 4:** Calculate the operating margin emission factor according to the selected method

Since the simple OM method is determined to calculate the CCPG OM emission factor in step 3, the simple OM emission factor is calculated as the generation-weighted average CO emissions per unit net electricity generation (t CO<sub>2</sub>/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:

- **Option A:** Based on the net electricity generation and a CO<sub>2</sub> emission factor of each power unit; or
- **Option B:** Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system. 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).

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

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

$$EG_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \quad \text{Equation 17}$$

Where:

- $EF_{grid,OMsimple,y}$  = Simple operating margin CO<sub>2</sub> emission factor in year  $y$  (t CO<sub>2</sub>/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<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (t CO<sub>2</sub>/GJ)
- $EG_y$  = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year  $y$  (MWh)
- $i$  = All fuel types combusted in power sources in the project electricity system in year  $y$
- $y$  = The relevant year as per the data vintage chosen in Step 3

For this approach (simple OM) to calculate the operating margin, the subscript  $m$  refers to the power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units.

Data such as  $EG_y$ ,  $FC_{i,y}$  and  $NCV_{i,y}$  used in the calculation of OM are derived from the China Energy Statistical Yearbook 2020 – 2022 and the Statistical Survey System of Energy Consumption of Public Institutions (formulated by the National Government Offices Administration and approved by the National Bureau of Statistics, August 2019). The data of plant electricity consumption rate are derived from the China Electricity Yearbook 2020 – 2022, the data of electricity exchange between grids are derived from the Statistical Data of the Electric Power Industry 2019 – 2021, and  $EF_{CO2,i,y}$  are derived from Table 1.4, Chapter 1 of the Energy volume of the 2006 IPCC Guidelines for the Preparation of National Inventories. The lower limit of 95% confidence interval for each fuel emission factor is obtained according to the conservative principle.

Based on these data, the latest Simple OM Emission Factor ( $EF_{grid,OMsimple,y}$ ) of the CCPG is 0.8771 tCO<sub>2</sub>/MWh in 2023<sup>19</sup>.

- (e) **Step 5:** Calculate the build margin (BM) emission factor

<sup>19</sup> [W020240709709437370462.pdf \(ncsc.org.cn\)](#)

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

- **Option 1:** for the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group  $m$  at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the 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;
- **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.

For the Project, Option 1 is chosen to calculate the ex ante BM emission factor based on the most recent information available on units already built for sample group  $m$  at the time of this project description submission.

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:

- (i) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ( $SET_{5-units}$ ) and determine their annual electricity generation ( $AEG_{SET-5-units}$ , in MWh);
- (ii) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities ( $AEG_{total}$ , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20 per cent of  $AEG_{total}$  (if 20 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ( $SET_{\geq 20 \text{ per cent}}$ ) and determine their annual electricity generation ( $AEG_{SET \geq 20 \text{ per cent}}$ , in MWh);
- (iii) From  $SET_{5-units}$  and  $SET_{\geq 20 \text{ per cent}}$  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  $SET_{sample}$  to calculate the build margin. In this case ignore Steps (iv), (v) and (vi).

Otherwise:

- (iv) 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 CDM project activities, starting with power units that started to supply electricity to the grid most

recently, until the electricity generation of the new set comprises 20 per cent of the annual electricity generation of the project electricity system (if 20 per cent 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 ( $SET_{sample-CDM}$ ) the annual electricity generation ( $AEG_{SET-sample-CDM}$ , in MWh);

If the annual electricity generation of that set is comprises at least 20 per cent of the annual electricity generation of the project electricity system (i.e.  $AEG_{SET-sample-CDM} \geq 0.2 \times AEG_{total}$ ), then use the sample group  $SET_{sample-CDM}$  to calculate the build margin. Ignore Steps (v) and (vi)

Otherwise:

- (v) Include in the sample group  $SET_{sample-CDM}$  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 per cent of the annual electricity generation of the project electricity system (if 20 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);
- (vi) The sample group of power units  $m$  used to calculate the build margin is the resulting set ( $SET_{sample-CDM->10yrs}$ )

The build margin emissions factor is the generation-weighted average emission factor (t CO<sub>2</sub>/MWh) of all power units  $m$  during the most recent year  $y$  for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \text{Equation 18}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO <sub>2</sub> emission factor in year $y$ (t CO <sub>2</sub> /MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit $m$ in year $y$ (mass or volume unit)
$EF_{EL,m,y}$	=	CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (t CO <sub>2</sub> /GJ)
$m$	=	Power units included in the build margin
$y$	=	Most recent historical year for which electricity generation data is available

According to the instructions of China DNA<sup>20</sup>, for the determination of the set of samples, a sample merging processing in some degree has been adopted due to that the power generation data, energy consumption data or thermal efficiency data of each plant cannot be consulted in the public statistical data. In this calculation, the newly-installed power units in the past years are classified by year, province and power generation technology, and the same type of newly-installed power units in the same province and in the same year are bundled as a "newly-installed power units".

<sup>20</sup> [W020240709709436742308.pdf \(ncsc.org.cn\)](#)

The power generation of each “newly-installed power units” in the most recent year  $y$  is estimated based on its installed capacity and the number of power generation utilization hours in year  $y$ . The formula is as follows:

$$EG_{m,y} = CAP_m \times H_{m,y} \quad \text{Equation 19}$$

Where:

$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit $m$ in year $y$ (MWh)
$CAP_m$	=	Installed capacity of electricity generated and delivered to the grid by power unit $m$ in year $y$ (MW)
$H_{m,y}$	=	The number of power utilization hours (h) of electricity generated and delivered to the grid by power unit $m$ in year $y$ . And it selects the average utilization hours of similar units in the province in which it is located in year $y$ ;
$m$	=	Power units included in the build margin
$y$	=	Most recent historical year for which electricity generation data is available

The power unit  $m$  is selected from the "newly-installed power plants" in the most recent year  $y$  (For the calculation of the grid BM in 2023, the  $y$  is equal to 2021) to the "newly-installed power plants" in the earlier year, until the cumulative power generation reaches 20% of the total power generation in the year  $y$  ( $y = 2021$ ).

Since the newly-installed power units of the same type ( $k$ ) in the same province ( $A$ ) and the same year ( $t$ ) are bundled into the “newly-installed power units”, the  $CAP_m$  is equal to the statistical data of recent installed capacity of a given unit type( $k$ ) in a given year( $t$ ) in a given province ( $A$ ):

$$CAP_m = CAP_m|_{m=(A,t,k)} = CAP_{A,t,k} \quad \text{Equation 20}$$

Where

$CAP_m$	=	Installed capacity of electricity generated and delivered to the grid by power unit $m$ in year $y$ (MW), and $m$ is equivalent to an established combination of ( $A$ , $t$ , $k$ )
$CAP_{A,t,k}$	=	Capacity of newly-installed power units of a given province ( $A$ ), given year ( $t$ ), and given unit type ( $k$ ) (MW)
$A$	=	It is the various provincial regions covered by the regional power grid
$t$	=	It is the sampling year of the "newly-installed power units". For the calculation of the grid BM in 2023, $t$ is equal to 2021, 2020, until the units that comprise at least 20 percent of the system generation in 2021.
$k$	=	It is the power generation technology classification of "newly-installed power units", which is divided into hydro-power, coal-

thermal power, gas-thermal power, oil-thermal power, Waste-thermal power plant, other thermal power, nuclear power, wind power, solar power, and others.

The CO<sub>2</sub> emission factor of each power unit  $m$  ( $EF_{EL,m,y}$ ) should be determined as per the guidance in Step 4 section 6.4.1 for the simple OM, using Options A1, A2 or A3, using for  $y$  the most recent historical year for which electricity generation data is available, and using for  $m$  the power units included in the build margin.

The emission factor of each power unit  $m$  should be determined as follows:

- **Option A1:** If for a power unit  $m$  data on fuel consumption and electricity generation is available, the emission factor ( $EF_{EL,m,y}$ ) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_{m,y}} \quad \text{Equation 21}$$

Where:

$EF_{EL,m,y}$	=	CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (t CO <sub>2</sub> /MWh)
$FC_{i,m,y}$	=	Amount of fuel type $i$ consumed in the project electricity system in year $y$ (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fuel type $i$ in year $y$ (GJ/mass or volume unit)
$EF_{CO_2,i,y}$	=	CO <sub>2</sub> emission factor of fuel type $i$ in year $y$ (t CO <sub>2</sub> /GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit $m$ in year $y$ (MWh)
$m$	=	All power units serving the grid in year $y$ except low-cost/must-run power units
$i$	=	All fuel types combusted in power unit $m$ in year $y$
$y$	=	The relevant year as per the data vintage chosen in Step 3

- **Option A2:** If for a power unit  $m$  only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO<sub>2</sub> emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EG_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}} \quad \text{Equation 22}$$

Where:

$EF_{EL,m,y}$	=	CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (t CO <sub>2</sub> /MWh)
$EF_{CO_2,m,i,y}$	=	CO <sub>2</sub> emission factor of fuel type $i$ in year $y$ (t CO <sub>2</sub> /GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit $m$ in year $y$ (ratio)
$m$	=	All power units serving the grid in year $y$ except low-cost/must-run power units

- $y$  = The relevant year as per the data vintage chosen in Step 3
- 3.6 = Conversion factor (GJ/MWh)

Where several fuel types are used in the power unit, use the fuel type with the lowest CO<sub>2</sub> emission factor for  $EF_{CO_2,m,i,y}$ .

- **Option A3:** If for a power unit  $m$  only data on electricity generation is available, an emission factor of 0 t CO<sub>2</sub>/MWh can be assumed as a simple and conservative approach.

Option A2 is selected to determine  $EG_{EL,m,y}$  because only data on electricity generation and the fuel types used is available.

If the power units included in the build margin  $m$  correspond to the sample group  $SET_{sample-CDM->10yrs}$ , then, as a conservative approach, only Option A2 from guidance in Step 4 section 6.4.1 can be used and the default values provided in Table 2, Appendix of TOOL09: "Determining the baseline efficiency of thermal or electric energy generation systems" shall be used to determine the parameter  $\eta_{m,y}$  for the power units that started to supply electricity to the grid more than 10 years ago.

The data of  $CAP_{A,t,k}$  and  $H_{m,y}$  used in the calculation of BM over the past years are mainly derived from the China Electricity Yearbook for 2017-2022, and the data of  $\eta_{m,y}$  are derived from the Statistical Data Collection of Electric Power Industry in 2019.

Based on these data, the latest Simple BM Emission Factor ( $EF_{grid,BM,y}$ ) of the CCPG is 0.2696 tCO<sub>2</sub>/MWh in 2023<sup>21</sup>.

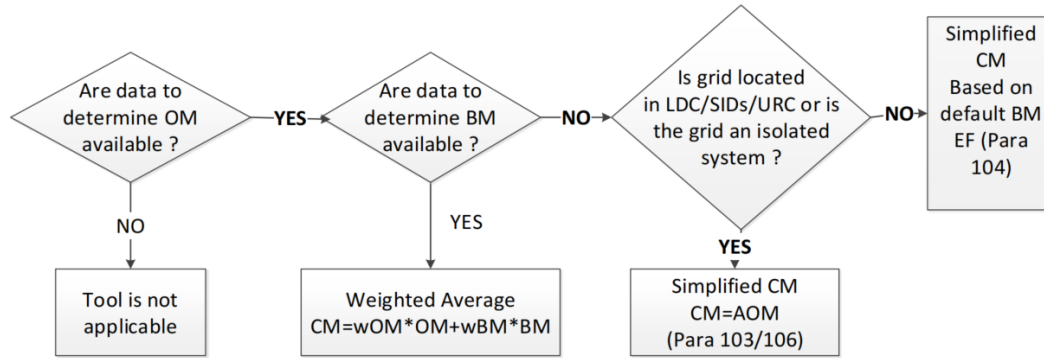
- (f) **Step 6:** Calculate the combined margin (CM) emission factor

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

- **Option a:** Weighted average CM; or
- **Option b:** Simplified CM

<sup>21</sup> [W020240709709439048191.pdf \(ncsc.org.cn\)](#)

According to the Flow chart: Determination of CM emission factor in Figure 0-2, the weighted average CM method is used since data to determine OM and BM are available, which also should be used as the preferred option.



**Figure 0-2 Flow chart: Determination of CM emission factor**

The combined margin emissions factor is calculated as follows:

$$EF_{grid,OM,y} = EF_{grid,CM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \text{Equation 23}$$

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year y (t CO<sub>2</sub>/MWh)
- $EF_{grid,OM,y}$  = Operating margin CO<sub>2</sub> emission factor in year y (t CO<sub>2</sub>/MWh)
- $w_{OM}$  = Weighting of operating margin emissions factor (per cent)
- $w_{BM}$  = Weighting of build margin emissions factor (per cent)

The following default values should be used for  $w_{OM}$  and  $w_{BM}$ :

- Wind and solar power generation project activities:  $w_{OM} = 0.75$  and  $w_{BM} = 0.25$  (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;
- All other projects:  $w_{OM} = 0.5$  and  $w_{BM} = 0.5$  for the first crediting period, and  $w_{OM} = 0.25$  and  $w_{BM} = 0.75$  for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

Considering that the Project is a LFG power generation project instead of wind and solar power generation projects,  $w_{OM} = 0.5$  and  $w_{BM} = 0.5$  for the first crediting period, and  $w_{OM} = 0.25$  and  $w_{BM} = 0.75$  for the second and third crediting period. Thus,

$$EF_{grid,OM,y} = 0.8771 \text{ tCO}_2/\text{MWh} \times 0.5 + 0.2696 \text{ tCO}_2/\text{MWh} \times 0.5 = 0.57335 \text{ tCO}_2/\text{MWh}$$