XINGNING TOKZIN PET RECYCLING PROJECT

Document Prepared by BAINENG NEW ENERGY (SHENZHEN) CO., LTD

Project Title	**Xingning Tokzin PET Recycling Project**
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1 PROJECT DETAILS

1.1 Summary Description of the Project

"Xingning Tokzin PET Recycling Project" (hereafter referred to as "the project") aims to produce the PET chips by reprocessing the waste PET products (like consumed package and bottled drink, used cable, etc.) and to replace the same PET product produced from the raw materials. The total production capacity is about 55,000 tons of recycled polyester (PET) chips per year, and the project factory will recycle 65,000 tons waste plastic PET per year. The Project located in Dongguan Shijie(Xingning) Industrial Transfer Area, Xingning, Meizhou, Guangdong, China and is developed and operated by Xingning Tokzin Yinghui Resources Co., Ltd. (hereinafter called "the Project Owner").

Prior to the project implementation, the same amount of PET flakes was produced from raw materials (crude oil and natural gas); the baseline scenario is the same as the condition prior to project initiation. The Project achieves GHG emission reductions by avoiding the consumption of the equivalent raw materials and by reducing related energy consumption as well.

The first crediting period of the project is from 06-April-2022 to 05-April -2029. The estimated annual average GHG emission reductions are 59,201 tCO_2e and the total estimated GHG emission reductions over the first crediting period are 414,407 tCO_2e.

1.2 Sectoral Scope and Project Type

Sectoral Scope: 13. Waste Handling and Disposal

The project is not a Grouped Project.

1.3 Project Eligibility

Section 2.1.1 of VCS Standard version 4.5 is discussed as follows:

The scope of the VCS Program includes seven Kyoto Protocol greenhouse gases. The Project reduces emissions of CO_2 which is a Kyoto Protocol greenhouse gas.

The Project applies the methodology AMS-III.AJ.: Recovery and recycling of materials from solid wastes (Version 09.0), which is a CDM methodology and CDM is an approved GHG program.

Section 2.1.2 of VCS Standard version 4.5 states that "the scope of the VCS Program excludes projects that can reasonably be assumed to have generated GHG emissions primarily for the purpose of their subsequent reduction, removal, or destruction". The Project avoids GHG emissions by displacing the production of virgin PET materials with recycled PET flakes; the GHG emissions generated by PET production from fossil fuel are not generated primarily for the

purpose of their subsequent reduction, removal, or destruction. Therefore, the Project is not excluded under the scope of the VCS program.

Meanwhile, the Project does not fall into any project type shown in Table 1 (Excluded Project Activities), Section 2.1.3 of *VCS Standard* version 4.5.

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

1.4 Project Design

The project includes a single location or installation only.

Eligibility Criteria

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

1.5 Project Proponent

Organization name	Xingning Tokzin Yinghui Resources Co., Ltd.
Contact person	Yupeng Liu
Title	General Manager
Address	Dongguan Shijie(Xingning) Industrial Transfer Area, Xingning, Meizhou, Guangdong, China
Telephone	+86 0753-3836668
Email	office@tzyhgd.com

1.6 Other Entities Involved in the Project

Organization name	Baineng New Energy (Shenzhen) Co., Ltd.
Role in the project	Consultant
Contact person	Zexu Zhang
Title	General Manager
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1.7 Ownership

The ownership of Xingning Tokzin Yinghui Resources Co., Ltd. over the Project arises under the project approval issued by a competent authority in compliance with laws; the ownership also arises by virtue of property rights in the plant and equipment that generate GHG emission reductions, as shown in Table 1.1.

Table 1.1 Evidence establishing project ownership accorded to the project proponent

Evidence types of project ownership	Condition of the Project and the project proponent
1) Project ownership arising or granted under statute, regulation or decree by a competent authority.	The project proponent has obtained the approval from the Bureau of the Development and Reform Bureau of Xingning City for the construction and operation of the Project. The Approval is a competent authority, and the approval demonstrates that the project proponent has been granted the project ownership in compliance with relevant laws and regulations in China.
2) Project ownership arising under law.	
3) Project ownership arising by virtue of a statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions and/or removals (where the project proponent has not been divested of such project ownership).	The project proponent has signed equipment purchase contracts with suppliers and signed the construction contract with contractors. Therefore, the project proponent has property rights in the plant and its equipment that generate GHG emission reductions.

1.8 Project Start Date

Project start date: 6-April-2022.

1.9 Project Crediting Period

The Project adopts the 3*7 renewable crediting period, totally 21 years. The project's first crediting period is from 6-April-2022 to 5-April-2029.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale

Project	✓
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
6-April-2022 to 31-December-2022	43,791[1]
01-January-2023 to 31-December-2023	59,201
01-January-2024 to 31-Decembe -2024	59,201
01-January-2025 to 31-December-2025	59,201
01-January-2026 to 31-December -2026	59,201
01-January-2027 to 31-December -2027	59,201
01-January-2028 to 31-December -2028	59,201
01-January-2029 to 05-April-2029	15,410[2]
Total estimated ERs	**405,994**
Total number of crediting years	**7**
Average annual ERs	59,201

1.11 Description of the Project Activity

The Project activity, under the premise of ensuring the quality of the product, will recycle and process the waste plastic PET instead of using the raw material (crude oil and natural gas) to produce the PET flakes. Therefore, the GHG emission reductions will be generated through the implementation of the project by avoiding the consumption of the equivalent raw materials and reducing related energy consumption as well.

[1] The estimated annual ERs are59,201 tCO_2e, the period from 6-April-2022 to 31-December-2022 accounts for 0.7397 year, thus the estimated ERs during 6-April-2022 to 31-December-2022 are calculated as 59,201 tCO_2e/yr × 0.7397 yr = 43,791 tCO_2e. Detailed calculation process is included in the ER spreadsheet

[2] The estimated annual ERs are 59,201 tCO_2e, the period from 01-January-2029 to 05-April-2029 accounts for 0.2603 year, thus the estimated ERs during 01-January-2029 to 05-April-2029 are calculated as 59,201 tCO_2e/yr × 0.2603 yr = 15,410 tCO_2e. Detailed calculation process is included in the ER spreadsheet

The project is owned by Xingning Tokzin Yinghui Resources Co., Ltd. Its annual productivity is 55,000 tons PET flakes, and the Project will recycle 65,000 tons waste plastic PET. The estimated annual emission reductions are 59,201 tons CO_2e.

The existing scenario prior to the implementation of the project is the product being produced by using the raw material, and the baseline scenario of the project is the same as the existing scenario.

Technology description

The Project installs series of product equipment and system. The Project aims to recycle the waste plastic PET, and the production processes don't involve the chemical reaction and there are only a little waste gas and wastewater. The electricity for production is supplied by the South China Power Grid (SCPG).

The project production processes are shown in the Figure 1-1, and the main production technologies are described in below paragraph:

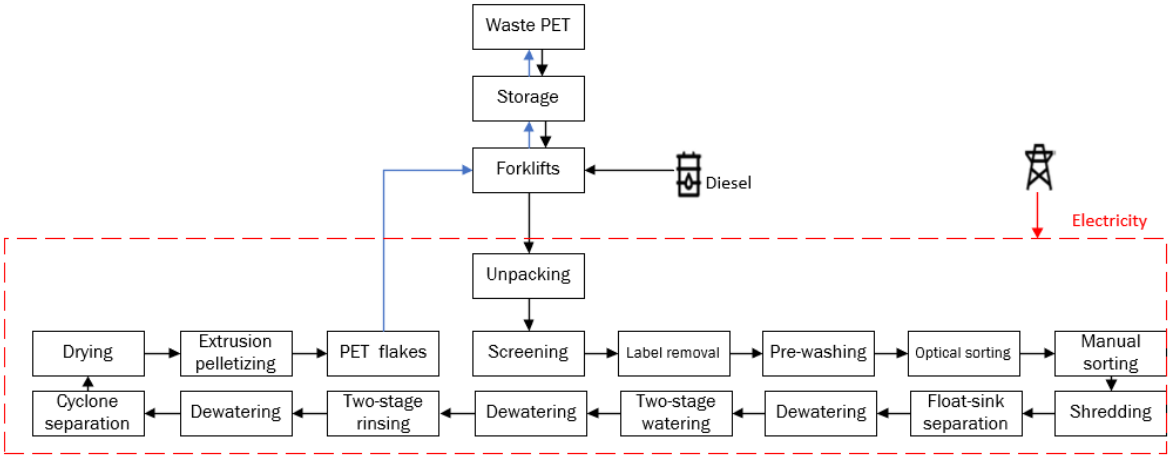


Figure 1.1 Project production processes

(1) Unpacking

The waste PET bottle bricks recycling material enters the unpacking machine for unpacking.

(2) Screening

The metal inside the plastic is removed by a magnetic separator.

(3) Laber removal

The label on the outer surface of the raw material is removed by the de-labeling machine, and the removed label is blown into the net bag by the fan.

(4) Pre-washing

After the removal of impurities, the raw material is washed on the surface of the bottle brick by the whole bottle hot washing machine, and the cleaning temperature is between 20 and 60℃. NaOH is added to the water, and the hydrolysis and saponification reaction occurs between NaOH and the oil on the surface of the bottle brick. After the oil and other objects are surrounded by soap molecules and water molecules, the adhesion between them and the surface of the bottle brick is reduced, once washed, the oil dust and other particles of the bottle brick are easily removed from the surface of the bottle brick and go with the water.

(5) Optical sorting

Bottle bricks of different materials and colors have different spectrums. The automatic sorting machine detects the spectrum of the bottle bricks to separate the bottle bricks of other materials mixed in PET bottle bricks and to separate different colors of PET bottle bricks.

(6) Shredding

The bottle brick is broken by crusher into 25mm coarse bottle pieces.

(7) Float-sink separation

The lids and paper float on the water surface in the rinsing tank, while the coarse PET bottle flakes sink to the bottom, thus separating the lids and paper from the raw material. The rinsing water flows back to the previous cleaning process.

(8) Dewatering

The centrifugal dewatering technology was used to dehydrate the raw materials, and the dewatering rate reached 95%.

(9) Two-stage watering

NaOH (sodium hydroxide) is added to the clean water, and the cleaning temperature is maintained between 20-60°C to perform two rounds of cleaning on the PET bottle flakes.

(10) Cyclone separation

Using an air classifier machine to further remove moisture from the surface of the bottle flakes, they become loose PET flakes, which are then funneled into packaging bags.

(11) Extrusion pelletizing

After the clean PET flakes are added to the hopper, they smoothly fall onto the screw and are gripped by the screw threads. As the screw rotates, the flakes are forcibly pushed towards the machine head, forming a mechanical conveying process. As the plastic moves from the feeding port towards the machine head, the decreasing depth of the screw threads and the presence of resistance from the filter screen, distributor plate, and machine head create high pressure during the plasticization process, compacting the material and improving its thermal conductivity,

facilitating rapid melting of the plastic. Simultaneously, the increasing pressure allows gases trapped within the plastic to be expelled through the venting holes.

As the pressure increases, the plastic is heated externally and also generates a significant amount of heat due to compression, shearing, and mixing processes, resulting in temperature rise and changes in physical state from glassy to highly elastic to viscous flow. Generally, in the feeding stage, the plastic is mainly in a glassy state, while in the compression section where the screw threads gradually decrease, the material is in a partially elastic state, gradually melting, and finally fully plasticized. The plasticized material is continuously extruded from the machine head under the pushing action of the screw, maintaining constant pressure, quantity, and uniformity, and forming uniform particles.

1.12 Project Location

The Project located in Dongguan Shijie(Xingning) Industrial Transfer Area, Xingning, Meizhou, Guangdong, China. As shown in Figure 1.2. The geographic coordinates of the project site are 115° 40’42’’ E，24° 11’11’’N.

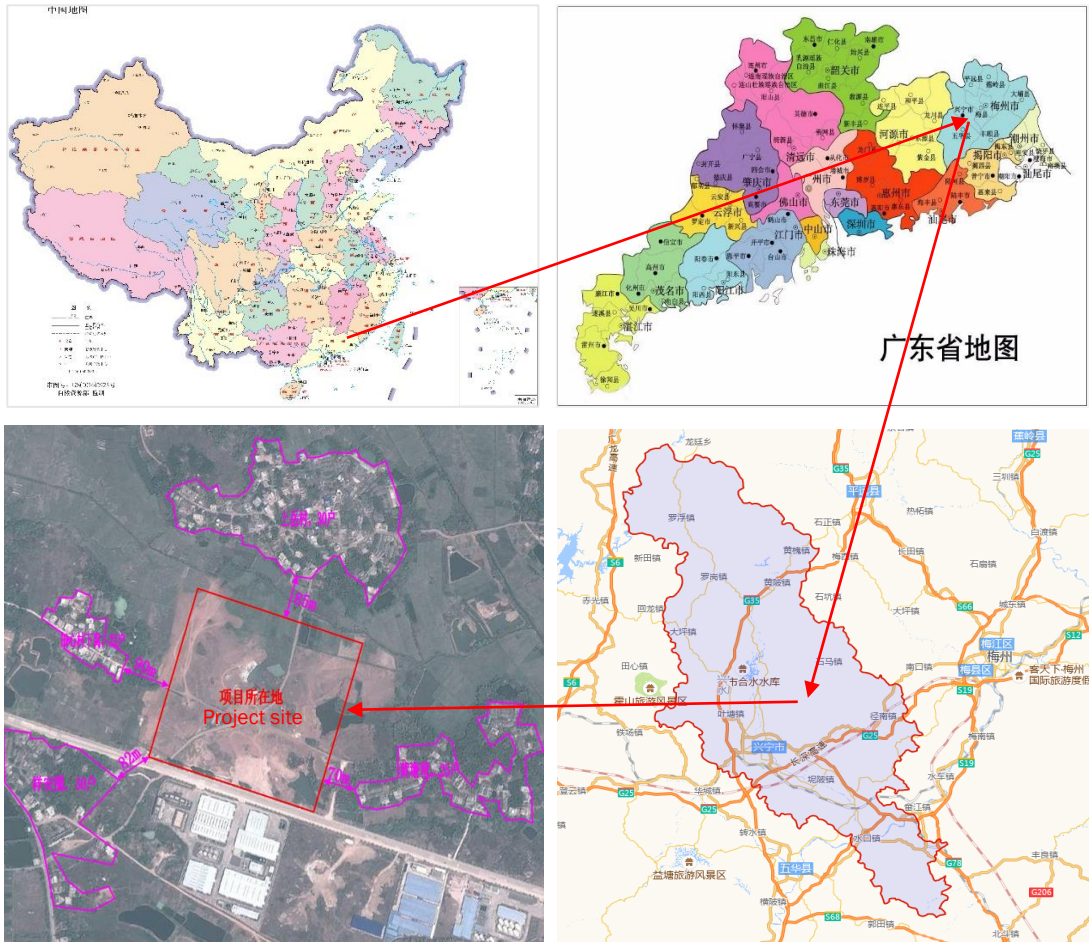


Figure 1.2 Location of the project

1.13 Conditions Prior to Project Initiation

The project activity recycles post-consumer PET daily necessities and processes them into recycled PET flakes which will then be further processed downstream into final products.

Prior to project initiation, the post-consumer PET daily necessities were disposed in the landfill without being recovered; the PET flakes were produced by using virgin raw material, i.e., crude oil and natural gas obtained from oil and gas exploitation. The baseline scenario is the same as the condition prior to project initiation; please refer to Section 3.4 for details.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project complies with all relevant laws and regulations in China, as shown in **Table 1.2**.

Table 1.2 Compliance with relevant laws and regulations

Laws and regulations	The Project
Regulations on the Approval and Recordation of Enterprise Investment Projects [3], Administrative Measures on the Approval and Recordation of Enterprise Investment Projects[4], which sets out the procedures of project approval and recordation.	The Project has obtained the approval and has been recorded by the Development and Reform Bureau of Xingning City in compliance with the regulation and the administrative measure.
According to Environmental Protection Law of the People's Republic of China[5], enterprises, public institutions and other producers and business operators that discharge pollutants shall take measures to prevent and control the environmental pollution caused by waste gas, waste water, waste residues, dust, malodorous gases, radioactive substances and noise, vibration and electromagnetic radiation generated during production, construction or other activities.	The project proponent takes measures to prevent and control the pollution including waste gas, waste water, dust and noise, etc. The measures have been described in the EIA report. In addition, the local Ecology and Environment Bureau is responsible for ensuring that the measures are in place and that the project proponent complies with laws and regulations on pollution prevention and control.
Law of People's Republic of China on Environmental Impact Assessment [6], Regulations on Environmental Protection	The EIA report of the Project has been completed and then approved by the Environmental Protection Bureau of Xingning

[3] http://www.gov.cn/zhengce/content/2016-12/14/content_5147959.htm

[4] http://www.gov.cn/zhengce/2020-12/27/content_5574475.htm

[5] https://www.mee.gov.cn/ywgz/fgbz/fl/201404/t20140425_271040.shtml

[6] https://www.mee.gov.cn/ywgz/fgbz/fl/201901/t20190111_689247.shtml

Management for Construction Projects [7], Classified Administration Catalogue of Environmental Impact Assessments for Construction Projects [8], which set out the requirements on the completion and approval of the environmental impact assessment (EIA) report/form of construction projects.	City, which is in compliance with the provisions in the law, the regulation and the catalogue.
Construction Law of the People's Republic of China[9], which sets out the requirements on application and approval of the construction permit prior to the project construction.	The Project obtained the construction permit prior to the construction in compliance with the provisions in the law.
Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste [10], in effect since September 2020, which encourages recycling of waste materials.	The Project is a PET recycling and reproduction project, and thus complies with the law.
Law of the People's Republic of China on the Prevention and Control of Air Pollution[11] Law of the People's Republic of China on Prevention and Control of Water Pollution[12] Law of the People's Republic of China on Prevention and Control of Noise Pollution[13]	The impacts on air, water and noise during the construction and operation of the Project comply with the requirements set out in these laws.
Catalogue for the Guidance of Industrial Structure Adjustment[14], which lists projects in three categories: encouragement category, restriction category and elimination category.	The Project belongs to the encouragement category of the Catalogue.
Recycled Polypropylene (PET) flakes (GB/T 40006.9-2021)[15], the industry standard for PP recycling and processing	The PET flakes produced in the project activity meet the requirements set out in the industry standard.

[7] http://www.gov.cn/zhengce/2020-12/26/content_5574290.htm

[8] https://www.mee.gov.cn/xxgk2018/xxgk/xxgk02/202012/t20201202_811053.html

[9] http://www.npc.gov.cn/npc/c30834/201905/0b21ae7bd82343dead2c5cdb2b65ea4f.shtml

[10] https://www.mee.gov.cn/ywgz/fgbz/fl/202004/t20200430_777580.shtml

[11] https://mee.gov.cn/ywgz/fgbz/fl/201811/t20181113_673567.shtml

[12] https://www.mee.gov.cn/ywgz/fgbz/fl/200802/t20080229_118802.shtml

[13] https://www.mee.gov.cn/ywgz/fgbz/fl/202112/t20211225_965275.shtml

[14] http://www.gov.cn/xinwen/2019-11/06/5449193/files/26c9d25f713f4ed5b8dc51ae40ef37af.pdf

[15] https://openstd.samr.gov.cn/bzgk/gb/newGbInfo?hcno=A64C04FB7292A20022602620FF5407DD

1.15 Participation under Other GHG Programs

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

The project has neither been registered nor seeking registration under any other GHG programs.

1.15.2 Projects Rejected by Other GHG Programs

The Project hasn't been rejected by other GHG Programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading. In fact, China's national emissions trading scheme (ETS) only includes 2,225 fossil fuel-fired power plants in the power sector[16], and the project proponent is not included in the list. China's ETS is expected to further expand to include emission-intensive companies in other seven industries (petrochemicals, chemicals, building materials, non-ferrous metals, papermaking, steel and aviation)[17]. The project proponent and the project activity will not be included in the national ETS; no emission cap will be enforced on the project proponent or the project activity, nor can the project proponent participate in carbon transactions in the national ETS. Therefore, the net GHG emission reductions from the Project will not be used for compliance with emission trading programs or to meet binding limits on GHG emissions.

1.16.2 Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related credit, including renewable energy certificates.

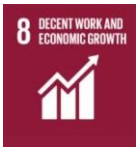
1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The project activity recycles post-consumer PET daily necessities to process them into PET flakes that will be further processed downstream into final products. The Project achieves GHG emission reductions by avoiding the consumption of the equivalent raw materials and by reducing related energy consumption. The Project contributes to achieving the United Nations' Sustainable Development Goals (SDG) in the following aspects:

[16] http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf

[17] http://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

	**SDG 8 Decent Work and Economic Growth:** "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all": The project activity will need manpower to operation, management and maintenance, which will directly increase the employment opportunities for local residents or for migrant workers. This contributes to one of the China's actions for promoting sustainable developing, "Fully implement the policy of Employment Priority, and promote more productive and high-quality employment through multiple channels".
	**Goal 12 Responsible consumption and Production:** "Ensure sustainable consumption and production patterns": The project activity produces recycled PET flakes by utilizing waste PET daily necessities. which replaces the same PET products produced from the raw materials to avoid the consumption of the equivalent raw materials, to reduce the related energy consumption, MSW (Municipal Solid Waste) disposal and accumulation. This contributes to one of China's actions for promoting sustainable developing, "achieve carbon peaks in 2030, and achieve carbon neutralization before 2060, accelerating the establishment and improvement of green low-carbon circulation economic systems, and promoting the comprehensive green transformation of economic and social development".
	**Goal 13 Climate Action:** "Take urgent action to combat climate change and its impacts": GHG emission reductions will be generated through the implementation of the project activity by avoiding the consumption of the equivalent raw materials and reducing related electricity and fossil fuel consumption. This contributes to achieve one of China's stated sustainable development priorities "Promote the implementation of the national strategy to actively respond to climate change and achieve the carbon intensity reduction target ahead of schedule".

1.18 Additional Information Relevant to the Project

Leakage Management

As per AMS-III.AJ. (Version 09.0), "if it is demonstrated that organic biogenic waste segregated in the recycling facility would otherwise have been deposited in a landfill without methane recovery in the baseline scenario, or if the baseline scenario is the incineration of the wastes, then no leakage calculation is required."

For the project, no organic biogenic waste is involved, the waste recycled is only plastic, and they would be incinerated in the incineration, therefore, in the project situation, no leakage calculation is required.

Commercially Sensitive Information

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

Further Information

No further information is required.

2 SAFEGUARDS

2.1 No Net Harm

The environmental impacts during the construction and operation of the Project have been carefully and strictly assessed; measures have been taken to minimize the potential negative impacts and to ensure that there is no net harm. Refer to Section 2.3 for details.

There are no negative socio-economic impacts related to the Project. Instead. The project activity offers long-term job opportunities and contributes to local economic prosperity.

In summary, the construction and operation of the Project has no net harm environmentally or socio-economically.

2.2 Local Stakeholder Consultation

The procedures or methods used for engaging local stakeholders

Prior to the project start, the project proponent identified people living or working around the project site and government officials as local stakeholders. The project proponent also decided that the local stakeholder consultation would be conducted by means of a questionnaire survey. The project proponent put up public announcements on bulletin boards at neighbourhoods near the project site; to contact the local government and the Ecology and Environment Bureau, the project proponent made direct phone calls. The introduction 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 conveyed via these public announcements and phone calls. On 05-January-2019, stakeholders from local government gathered at a conference room of the project proponent to participate in the questionnaire survey; on the other hand, the project proponent visited the neighbourhoods near the project site from 06-January-2019 to 07-January-2019 and directly distributed printed questionnaires to people and workers there.

The procedures or methods used to document the local stakeholder consultation outcomes

The project proponent conducted the local stakeholder consultation by distributing questionnaires prior to the project construction. The questionnaire was designed to ask people's

opinions about various aspects of the Project. A total number of 100 questionnaires were distributed. The surveyed stakeholders varied in age, gender, occupation and educational background, as shown in **Table 2.1**. The survey results are summarized in **Table 2.2**.

Table 2.1 Basic information of the stakeholders surveyed

Item \ Distribution		Number	Percentage
Gender	Male	46	46%
	Female	54	54%
Age	<30	20	20%
	31-40	35	35%
	41-50	30	30%
	>50	15	15%
1Education	Junior high school or below	57	57%
	Senior high school	17	17%
	College or above	26	26%
Occupation	Employee	37	37%
	Self-employed	33	33%
	Civil servant	7	7%
	Unspecified	23	23%

Table 2.2 Summary of the survey results

No.	Questions	Response	Number	Percentage
1	Are you satisfied with the local environmental quality?	Very satisfied	20	20%
		Satisfied	77	77%
		Not satisfied	3	3%
2	Are you aware of the proposed projects in the area?	No	10	10%
		A little	80	80%
		Yes	10	10%
3	What do you think are the major environmental impacts of the Project? (multiple choices possible)	None	78	78%
		Air pollution	2	2%
		Water pollution	0	0%
		Noise pollution	1	1%

		Harm to animals and plants	0	0%
		No idea	19	19%
4	From the perspective of environmental protection, what is your attitude towards the project?	Positive	80	80%
		Negative	0	0%
		No idea	20	20%
5	Will the project have a negative impact on the ecosystem?	Yes	1	1%
		No	90	90%
		Indifferent	9	9%
6	Do you think the Project will have promotion in local economic development?	Positive	97	97%
		None	3	3%
		Negative	0	0%
7	Do you have any concerns about the project?	Yes	3	3%
		No	97	97%

The survey shows that the Project was well known by local residents. All respondents had learnt heard about the Project. Most of them were supportive of the project construction and believed that the Project would bring more benefit than harm. Most of the respondents support the construction and operation of the project.

The majority of the respondents believed that the Project would not have any environmental impact, but a few respondents were concerned about the potential negative environmental impacts. Almost all of them believed that the Project would contribute to local economic development.

In conclusion, the implementation of the Project is regarded as beneficial by most of the local stakeholders. Regarding the concerns that several respondents expressed over air pollution, water pollution, noise and harm to animals and plants, the project proponent explained the requirements of national and industry standards that have to be followed as well as the mitigation measures taken.

The mechanism for ongoing communication with local stakeholders

During the project operation, questionnaire surveys took place in the same manner on a regularly basis. Besides questionnaire surveys, local stakeholders also raised their concerns and opinions directly by making a phone call to the project proponent. In addition, the project proponent informs the local authorities of key implementation events or changes to the project, then the local authorities inform the residents around the project site, and the comments and suggestions from residents are collected by the local authorities; the local government agencies also conduct

spot checks on the project implementation on a regular basis and give suggestions on potential issues.

How due account of all and any input received during the consultation has been taken

As described earlier, when some of the stakeholders expressed their concerns in the questionnaire surveys, the project proponent explained related issues including the measures to be taken. The project proponent also organizes internal meetings to ensure that the project operation complies with requirements in the EIA report and applicable laws, regulations and national standards. During two stakeholder consultations conducted so far (described previously), no significant negative comments were received.

2.3 Environmental Impact

The project proponent has entrusted a qualified third party (Guangdong Senhai Environmental Protection Equipment Engineering Co., LTD.) to conduct the environmental impact assessment (EIA) on the Project. The EIA report, completed by the third party, was approved by the the Environmental Protection Bureau of Xingning City. The environmental impacts during the project construction and project operation and associated mitigation measures are summarized as following.

Air quality

During the construction of the project, the construction site is regularly cleaned and sprayed with water, and the transport vehicle is covered with tarpaulin and cleaned to reduce the generation of dust.

The organic waste gases generated during operation are connected to the ventilation duct through the exhaust outlet of the machine, collected and directed to an activated carbon adsorption device for treatment. The smoke and dust are introduced into a vacuum sintering furnace with a supporting spray device for treatment. The dust waste gas is directly sucked into a central bag filter through the duct for treatment. By reasonably setting up corresponding treatment facilities for each pollution source, all types of waste gases are treated to meet the second stage, level two standards of "Emission Limits of Atmospheric Pollutants in Guangdong Province" (DB44/27-2001) and are discharged at high altitude in compliance with regulations. The project includes one 10t/h biomass fuel-fired boiler, its waste gas is treated by a "bag filter + limestone water film desulfurization and dedusting tower" system to meet the requirements of "Emission Standard of Atmospheric Pollutants for Boilers in Guangdong Province" (DB44/765-2010), and is discharged at high altitude in compliance with regulations

Water quality

The project implements rainwater and sewage diversion. The production wastewater generated during operation is treated using the "air flotation + hydrolysis acidification + contact oxidation+ sedimentation tank+ biofilter" process. After being treated by a 1500-ton wastewater treatment

system on a daily basis, it meets the requirements of Table 1 of "Water Quality for Urban Wastewater Recycling - Industrial Water Use" (GB/T19923-2005). The treated wastewater is fully reused for cleaning processes, and the concentrated liquid is returned to the wastewater treatment plant for further treatment without being discharged. Domestic wastewater is treated by a three-stage septic tank, and oily wastewater from kitchens is treated by a three-stage oil and residue separator, meeting the third stage standards of "Emission Limits of Water Pollutants in Guangdong Province" (DB44/26-2001), it is discharged into the sewage pipe network and eventually enters the Ye Tong sewage treatment plant for further treatment.

Noise

The project selects low-noise equipment, adopts new construction techniques, arranges high-noise equipment reasonably, and performs regular maintenance on the equipment. Soundproof walls should be installed around sensitive areas to minimize environmental impact. Construction is prohibited during the nighttime period of 22:00-6:00 and the midday period of 12:00-14:00. The project strictly complies with the relevant provisions of “Environmental Noise Emission Standards for Construction Sites” (GB12523-2011) to minimize noise impact. During the operation phase, measures such as soundproofing, sound absorption, shock absorption, and greening are implemented to handle the noise, ensuring that it meets the requirements of Category 3 or 4 of “Environmental Noise Emission Standards for Industrial Enterprises” (GB12348-2008).

Solid waste

Solid waste is managed through classification, and construction waste is disposed of according to regulations. After segregating household waste, impurities, and sediment, they are collected and handed over to the sanitation department for processing. Dust collected from reusable plastics, trimmings, and bag filters is directly sold to external parties. Boiler slag, smoke, and sediment are sold to specialized companies as raw materials for agricultural organic fertilizers, and waste packaging bags are purchased by waste recycling companies. Waste grease is treated and disposed of by qualified units. Hazardous waste such as spent activated carbon, chemical packaging waste, waste oil, and oily rags are temporarily stored in qualified hazardous waste warehouses according to regulations, and they are regularly collected by qualified organizations for treatment. Sludge generated during the wastewater treatment process is pressed and transported by qualified organizations for further processing.

2.4 Public Comments

The Project will be open for public comments for a month on the Verra Registry.

2.5 AFOLU-Specific Safeguards

The project is non-AFOLU project.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Methodology

AMS-III.AJ.: Recovery and recycling of materials from solid wastes (Version 09.0) is used for the project.

https://cdm.unfccc.int/methodologies/DB/L0WIXM9S6DV07DGXB21DPVLE8N3VB9

Tools used for the Project activity:

TOOL03: "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 03.0)"

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

TOOL07: "Tool to calculate the emission factor for an electricity system (Version 07.0)"

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

TOOL21: "Demonstration of additionality of small-scale project activities (Version 13.1)"

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v13.1.pdf

3.2 Applicability of Methodology

Section 2.1 of the methodology AMS-III.AJ. (Version 09.0) states that:

The methodology comprises activities for the recovery and recycling of materials in municipal solid waste (MSW) to process them into intermediate or finished products, displacing the production of virgin materials in dedicated facilities, thereby resulting in avoidance of energy use.

The methodology covers the emissions associated with:

(a) Production of virgin pellets of plastics consisting of either high density polyethylene (HDPE), low density polyethylene (LDPE), Polyethylene Terephthalate (PET) or Polypropylene (PP). For the sake of this methodology, "plastic" means HDPE, LDPE, PET and PP, unless otherwise specified;

(b) Production of container glass using virgin input ("container glass" hereafter) that is displaced by the recycled container glass ("container glass cullet" hereafter) due to the project activity;

(c) Production of metals (i.e., aluminium and steel)[18] from mined ore or virgin raw materials that is displaced by the recycled metals due to the project activity.

[18] Other metals are not covered under this methodology.

The project activity recycles post-consumer PET daily necessities to process them into PET flakes, displacing the production of PET plastic from virgin inputs, reducing energy consumption and hence GHG emissions. Therefore, the Project meets Case (a) thereof, and calculates the emissions associated with the production of virgin PET plastic.

The analysis of applicability is detailed in the Table 3-1:

Table 3-1 Applicability of AMS-III.AJ. (Version 09.0)

Applicability	Project situation
Case A: Project activities that target the participation of the informal Waste sector. Case B: Greenfield facility and/or capacity addition to existing facilities with formal sector. Participation.	Applicable. After checking the project proponent background, reviewing the public information, the project factory is not planned, sponsored, financed, carried out nor regulated and/or recognized by the local authorities or their agents. The project is run by individual, who is not formal sector. Therefore, the project belongs Case A.
Case A (a) The recycling facility may be an existing facility, or a newly implemented facility.	Applicable. The production lines that can process the waste plastic are new built.
Case A (b) It is possible to directly measure and record the final output of the recycling facility, that is the weight of materials leaving the recycling facility (on a dry basis), segregated by type.	Applicable. PET flakes produced by the same production line are of the same type, the performance can be different according to the client's demand, they can be segregated by type. The project activity directly measures and records the weight of PET flakes leaving the recycling facility (on a dry basis) with equipped truck scale.
Case A (c) Each type of recycled material is sold directly to a processing/manufacturing facility, or to a chain of intermediary retailers that are able to transfer the materials to final identifiable processing/	Applicable. The recycled PET flakes are partly used directly by a manufacturing facility, which belongs to the Project owner, partly are sold to processing/

manufacturing facilities that process the segregated fractions.	manufacturing facilities to be processed into final products.
Case A (d) The Project Design Document (PDD) shall explain the procedures such as contractual agreements proposed to eliminate double counting of emission reductions, for example due to the formal waste sector or the processing/ manufacturing facility, or other parties possibly claiming credits for emission reductions. Similarly, through contractual agreement and other means such as survey/ analysis undertaken by a third party, credible proof shall be provided to show that the materials supplied from the recycling facility are used for processing/ manufacturing and not for other purposes such as a source of fuel or disposal PET .	Applicable. The project proponent will provide contractual agreements with their upstream and downstream partners to prove that double counting of emission reductions will not occur. Also, contractual agreements between the project proponent and the downstream facilities will be provided to prove the materials supplied from the recycling facility are used for manufacturing final products instead of fuel or disposal. As described in Section 1.16.1, this project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner according to the enforced company list in public information. Hence, it is confirmed that the emission reductions will not be double counted.
Case A (e) Emission reductions can be claimed for the difference in energy use for the production of materials from virgin inputs versus production from recycled material. In the case of paper or cardboards, emission reductions due to the avoidance of methane formation in anaerobic decay may be claimed if the baseline scenario is the waste disposal in a disposal site without methane recovery.	Applicable. the Project's emission reductions can be claimed for the difference in energy use for the two kinds of products. The product is not paper, the other case is not considered.
In any of the above cases the project proponent shall be able to demonstrate, using three years[19] historic data (market data, official statistics etc.)	Applicable. The three years (2019, 2020 and 2021) historic data of China's imports and

[19] A minimum of one-year data would be required if the facility is less than three years old.

prior to the start date[20] of the project activity, that the finished products (HDPE, LDPE, PET, PP, steel aluminium, paper and cardboard and glass) were manufactured in the host country of the CDM project using either virgin raw materials produced in country or virgin raw materials imported from another non-Annex I country. This analysis may be limited to only those finished products where recycled materials have proven to be a technically viable option, that is those types of products that are expected to be the end products produced from materials recycled as part of the project activity.	exports of PET have been consulted via UN Comtrade (International Trade Statistics Database)[21]. It is found out that China exported 8.1 times, 4.3 times and 3.5 times PET more than it imported in 2019, 2020 and 2021, respectively. In addition, the domestic PET production was always higher than domestic PET consumption and 2~3 times of exports during these years[22]. It can hence be reasonably assumed that all the PET was manufactured in China. PDD will adjust the baseline emissions by using the baseline correction factor (Bi) as described in the methodology.
As an alternative to the requirement stipulated in paragraph 8 of the methodology, the project proponents may choose to adjust the baseline emissions by using the baseline correction factor (Bi) as described under the baseline section below.	Not applicable. Because, through the demonstration mentioned above, prior to the start date of the project activity, the finished product, the recycled PET chip, were manufactured in China by using virgin raw materials produced in China.
The recycling facility shall source its materials from MSW; materials from an unknown source are not eligible under this methodology. The project activity consists of separation of the recyclables from bulk MSW by means of manual or magnetic or mechanical separations. If the project activity involves the collection of wastes on a door-to-door basis, or collection at recipient's containers for the voluntary dispensing of wastes by the local community, all recyclables (paper, plastics, glass, etc.) processed by the recycling plant shall be	Applicable. The PET daily necessities are collected from MSW, which will be demonstrated by the agreement signed between the project proponent and the supplier. The project activity consists of mechanical and manual separations to obtain purified PET, and does not consist of separation of the recyclables from bulk MSW.

[20] As per the definition of start date provided in the EB 41 report, paragraph 67.

[21] https://comtrade.un.org/

[22] https://www.163.com/dy/article/GKTS8D4R051480KF.html

collected together, selective collection of metals or any other wastes is excluded. As a consequence, wastes not pertaining to the identified baseline waste collection and destination stream that would not be delivered to the baseline disposal site and/or treatment plant (e.g. incineration) are not eligible.	The waste PET suppliers only supply the waste PET daily necessities to project proponent, there are no wastes pertaining to the identified baseline waste collection. The waste PET daily necessities would have otherwise been disposed of either by incineration or landfill under the baseline scenario; therefore, they are eligible under this methodology.
In the specific case of metals, the methodology excludes collection of the scraps generated from the production process of primary/secondary/ finished metal and materials or in the processing of the finished metal and materials into final products, and it covers only postconsumer obsolete wastes. Project proponents shall provide evidence that the materials recycled under the project activity are recovered only from end-of-life-wastes and project activity does not divert waste from any historically existing informal or formal recycling activity.	Not applicable. The project activity is reprocessing the plastic PET, not metal.
The amount of fuel and electricity consumed by the recycling facility can be measured and recorded.	Applicable. Applicable, the project proponent has installed the meter in the facility to measure the consumption of electricity during the crediting period. Therefore, the amount of the fuel and electricity consumed by the recycling facility can be measured and recorded.
Project proponents shall demonstrate that the properties of the materials produced from waste recycling are the same as those from virgin materials. For example, if the waste materials such as recycled plastic bottles are converted into building blocks or roof tiles, the emission reductions based on displacement of original virgin materials cannot be claimed under this methodology. For recycled materials, project	The project proponent has provided documents which show that the properties of PET flakes produced from the project activity are the same as those from virgin materials.

proponents shall provide documentation proving that the properties of the materials produced are comparable according to standard testing methods for each material.	
Measure are limited to those that result in aggregate emission reductions of less than or equal to 60ktCO_2 equivalent annually.	Applicable. The project activity results in annual emission reductions less than 60 kt CO_2e.

Through the analysis above, the methodology AMS-III.AJ.: Recovery and recycling of materials from solid wastes (Version 09.0) is applicable to the project.

Table 3.2 Applicability of the applied methodological tools

Applicability Criteria	Project situation
TOOL03	
It can be used in the cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.	Applicable. The quantity of fossil fuel combusted and its properties are recorded in order to calculate project emissions.
TOOL07	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	Applicable. The use of waste PET daily necessities to produce PET flakes in the project scenario will use less electricity than in the baseline scenario where PET flakes are produced directly from raw materials. Thus, the project activity results in savings of electricity that would have been provided by the grid. Therefore, this tool is applied to estimate the OM, BM and CM for baseline emissions.
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.,	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 calculated only for the grid power plants.

option II a and option II b. If option II a is chosen, the conditions specified in "Appendix 1: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	
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.	Applicable. The project electricity system is totally located in China, a non-Annex I country.
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero	Applicable. The value applied to the emission factor of biofuels is zero.
TOOL21	
The use of the methodological tool "Demonstration of additionality of small-scale project activities" is not mandatory for project participants when proposing new methodologies. Project participants and coordinating/managing entities may propose alternative methods to demonstrate additionality for consideration by the Executive Board.	Applicable. Refer to Section 3.5 for the demonstration of additionality.
Project participants and coordinating/ managing entities may also apply "TOOL19: Demonstration of additionality	

of microscale project activities" as applicable.	

3.3 Project Boundary

According to the methodology, the project boundary includes the physical geographical sites of:

(a) Waste collection sites;

(b) The recycling facility;

(c) Processing/manufacturing facility;

(d) Virgin material production[23];

(e) MSW disposal site or treatment plant in the baseline scenario.

The Figure 3-1 presents the project boundary and the process involved.

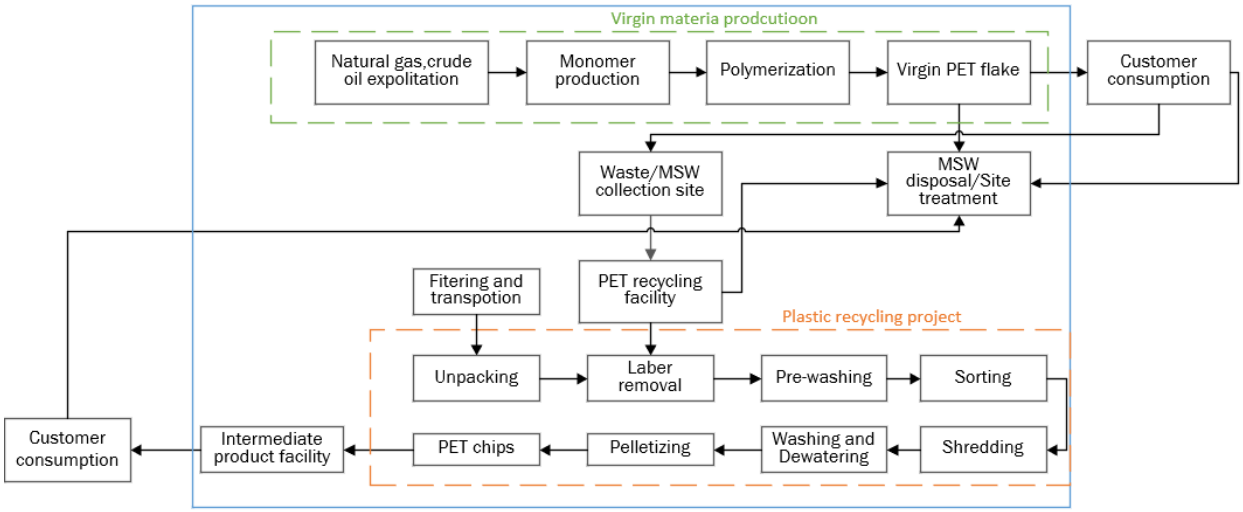


Figure 3.1 Project boundary

The following table present the carbon pool considered within the project boundary:

Source		Gas	Included?	Justification/Explanation
Baseline	Electricity consumption	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.

[23] Virgin material production is included in the project boundary, even if it is not an identifiable site, because the emission factor for virgin material production for baseline calculation is based on the assumptions on the typical conditions for the virgin

Source		Gas	Included?	Justification/Explanation
		Other	No	Minor emission source.
	Fuel consumption	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
		Other	No	Minor emission source.
Project	Electricity consumption	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
		Other	No	Minor emission source.
	Diesel and natural gas consumption	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
		Other	No	Minor emission source.

3.4 Baseline Scenario

The identified credible alternatives are:

a) implementation of the project activity without VCS;

b) continuation of current business-as-usual scenario, i.e., the PET products would be produced by using crude oil and nature gas from the oil exploitation as raw material.

The alternative (a) faces the investment barrier, which is elaborated in Section 3.5. The alternative (b) faces no barrier as it is the common situation.

Therefore, the identified baseline scenario would be alternative (b): continuation of current business-as-usual scenario, i.e., the PET products would be produced by using crude oil and nature gas from the oil exploitation as raw material.

3.5 Additionality

The additionality of the Project is demonstrated as per TOOL21 “Demonstration of additionality of small-scale project activities” (Version 13.1), in line with the methodology AMS-III.AJ. (Version 09.0).

Figure 1 (Criteria for automatic additionality using provisions of small-scale (SSC) or microscale (MSC) additionally tools) in the Appendix of TOOL21 (Version 13.1) has been applied. The project activity aggregate size is less than SSC thresholds (60 $ktCO_2e/y$); the project activity is not comprised of any technologies from the positive list under TOOL32; the aggregate size is greater than MSC thresholds (20 $ktCO_2e/y$). Due to these facts, the project shall use the regular additionality procedure to demonstrate the additionality.

As per TOOL21 (Version 13.1), project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

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

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

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

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

It will be demonstrated that the project activity would not have occurred anyway due to the investment barrier, as elaborated below.

Investment barrier

Two alternatives have been identified previously (refer to Section 3.4). Alternative (b) is the continuation of current business-as-usual scenario, which does not involve an investment from the project participants, hence not requiring an investment analysis.

Alternative (a) is the implementation of the project activity without VCS. As the project activity generates financial and economic benefits other than VCS-related income by selling PET flakes, a benchmark analysis has been chosen and conducted for the investment analysis of Alternative (a); the financial indicator equity IRR (post-tax) has been chosen.

According to Notice issued by National Development and Reform Commission and the Ministry of Housing and Urban-Rural Development on Adjusting the Financial Benchmark Rate of Construction Projects in some Industries[24], the project belongs to “Manufacture of plastics and synthetic resins in primary form” in the “Petrochemical industry”; the benchmark equity IRR (post-tax) for this category is 16%.

[24] https://www.ndrc.gov.cn/fggz/gdzctz/tzfg/201907/W020191104862129391071.pdf

The equity IRR of the project is calculated according to the basic parameters from feasibility study report (FSR) of the proposed project, and the comparison of the proposed project IRR with and without VCUs are shown below:

Table 3.3 Comparison of IRR values with and without revenue from carbon credits

Scenario	Equity IRR (%)
Without VCUs income	6.46%
With VCUs income	8.37%

From the calculation, it can be seen that without VCUs revenue, the equity IRR of the project is below the benchmark 16%, and the financial status with VCUs revenue will be significantly improved.

Outcome: according to the tool, the project activity has a lower IRR than the benchmark, then the project activity cannot be considered as financial attractive.

Sensitivity analysis

Subsequently, the sensitivity analysis is conducted to show whether the conclusion regarding to the financial attractiveness is robust to reasonable variation under the critical assumptions. The static total investment and annual O&M costs[25] are important components of the project costs and are thus considered. The variable that most significantly impact the project revenues is annual PET sales revenues, i.e., the product of annual PET production and reproduced PET price, which are taken into account as two separate variables. Another variable, purchased waste PET cost (waste PET consumption × waste PET cost), is also an important part of the project costs, but it is not separately considered in the sensitivity analysis. This is because the IRR calculation already correlates PET production with waste PET consumption, and correlates reproduced PET price with waste PET cost. By taking into account annual PET production and reproduced PET price in the analysis, waste PET consumption and waste PET cost are also implicitly considered.

In summary, the variables to be considered in the sensitivity analysis are:

- Static total investment,

- Annual PET production,

- Annual O&M cost,

- Reproduced PET price.

The sensitivity analysis results are shown in the table below.

[25] Annual O&M costs do not include waste PET costs. The reason why waste PET costs are not specifically included in the sensitivity analysis is explained in the same paragraph.

Variation	-10%	-5%	0	5%	10%
Static total investment	7.83%	7.12%	6.46%	5.84%	5.26%
Annual PET production	4.58%	5.53%	6.46%	7.36%	8.23%
Annual O&M cost	8.64%	7.57%	6.46%	5.31%	4.12%
Reproduced PET price	2.99%	4.78%	6.46%	8.05%	9.58%

The results show that the IRR remains below the benchmark value in the variations of all the four variables within the range of ±10%, which shows the robustness of the conclusion that the Project is unlikely to be financially/economically attractive.

The detailed analysis of four variables is as follows.

Static total investment

With a decrease in the static total investment by 10%, the IRR is 7.83% which is still lower than the benchmark. Only if the static total investment decreases by 48.24% will the IRR reach the benchmark. Such a massive reduction in investment is impossible to occur. Therefore, it is impossible to improve the financial attractiveness by reducing static total investment.

Annual PET production

If annual PET production increases by 58.93%, the IRR would reach the benchmark. The production capacity was approved by the government and was estimated based on the capacity of the equipment and facilities installed. Therefore, even considering the design margin, an increase in PET production by 58.93% is almost impossible to achieve.

Annual O&M costs

If annual O&M costs decrease 47.37%, the IRR would reach the benchmark. However, according to data from the National Bureau of Statistics, the indices of urban employees' wages were 106.4, 109.1, 108.9, 108.2 and 107.2 (the value of the previous year taken as 100) for the last five years from 2016 to 2020, all higher than 100, indicating a continuous increase for these years. It is reasonable to assume that the increasing trend will continue; a 47.37% decrease in O&M costs is unlikely to occur.

Reproduced PET price

When an increase of 32.71% is assumed in reproduced PET price, the IRR would reach the benchmark. Although the PET price might fluctuate within a certain range, it normally remains at a stable level. Moreover, according to the current actual sales price of the factory, the price of PET flakes is around 6,000 CNY/t, which is lower than the expected price of 7,200 CNY/t. Not

only that, according to current market analysis[26], the price of PET flakes in Hunan Province during the recent years is showing a downward trend. Therefore, it is not credible to improve the economic attraction due to the increase in production.

Therefore, the project activity would not have occurred anyway due to the investment barrier.

In conclusion, the Project is additional.

3.6 Methodology Deviations

The project does not involve any methodology deviation.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

According to the methodology, the baseline emission include:

(a) For the production of the plastic, the emissions associated with energy consumption for the production of plastic pellets from virgin plastic materials;

(b) For paper and cardboard, the emissions associated with the anaerobic decay within a disposal site may be claimed;

(c) For the production of glass, emissions associated with the energy consumption for the production of virgin container glass corresponding to the preparation and mixing of raw materials before the melting stage;

(d) For the production of metals, emissions associated with energy consumption for the production from virgin materials.

Baseline emission shall be determined as

$$BE_y = BE_{plastic,y} + BE_{glass,y} + BE_{paper,y} + BE_{metal,y} \quad (1)$$

Where:

BE_y	Baseline emissions in year y (tCO_2e)
$BE_{plastic,y}$	Baseline emissions in year y associated with the recycling of plastic (tCO_2e)

[26] http://jiage.zz91.com/detail/1287203.html

$BE_{glass,y}$	Baseline emissions in year y associated with the recycling of glass (tCO_2e)
$BE_{paper,y}$	Baseline emissions in year y associated with the recycling of paper (tCO_2e)
$BE_{metal,y}$	Baseline emissions in year y associated with the recycling of metal (tCO_2e)

The Project only recycled and fabricated the plastic product (PET flakes), the baseline emissions associated with the other materials are equal to 0, therefore:

$$BE_y = BE_{plastic,y} \quad (2)$$

Baseline emissions associated with the recycling of plastic type i from virgin inputs are calculated based on the consumption of plastic type i is produced in the host country as well as imported, using the equation below:

$$BE_{plastic,y} = \sum_i \left[Q_{i,y} \times L_i \times \left(SE_{i,in-country,y} \times w_{i,in-country,y} + SE_{i,imported,y} \times w_{i,imported,y} \right) \right] \quad (3)$$

Where:

$BE_{plastic,y}$	Baseline emissions in year y associated with the recycling of plastic (tCO_2e).
i	Indices for material type i (i = 1,2,3,4 for HDPE, LDPE, PET and PP).
$Q_{i,y}$	Quantity of plastic type i recycled in year y (t/y).
L_i	Net to gross adjustment factor to cover degradation in material quality and material loss in the production process of the final product using the recycled material (use 0.75).
$w_{i,in-country,y}$	Percentage of plastics produced in the host Country out of total plastic consumed in year y (%)
$SE_{i,in-country,y}$	Specific emissions in the baseline for the production of virgin plastics type i in the host Country in year y (tCO_2/t_i)
$w_{i,imported,y}$	Percentage of imported plastics out of total plastic consumed in year y (%)
$SE_{i,imported,y}$	Specific emissions in the baseline for virgin plastics type i imported in year y (tCO_2/t_i)

Specific emissions in the baseline for the production of virgin plastics type i in the host country ($SE_{i,in-country,y}$) are determined based on the equation below:

$$SE_{i,in-country,y} = \left(SEC_{BL,i} \times EF_{BL,el,y} + SFC_{BL,i} \times EF_{BL,FF,CO2} \right) \quad (4)$$

Where:

$SEC_{BL,i}$	Specific electricity consumption for the production of virgin material type i (MWh/ti).

$EF_{BL,el,y}$	Emission factor for the baseline electricity consumption for virgin plastic production in the host party (tCO_2/MWh)
$SFC_{BL,i}$	Specific fuel consumption for the production of virgin material type i (GJ/t).
$EF_{BL,FF,CO2}$	CO_2 emission factor for fossil fuel (tCO_2/GJ). Project participants shall assume that the baseline fuel is natural gas when it's not possible to identify the type of fuel consumed for the production of plastics from virgin materials

For the plastic PET imported from the foreign country, according to the public information[27], the host country's (China) production of PET has always exceeded the consumption; it's a net exporter of PET flakes, so the percentage of imported plastics ($w_{i,imported,y}$) is 0.

$$w_{i,imported,y} = 0 \; and \; w_{i,in-country,y} = 1$$

$$SE_{i,imported,y} = B_i \times \left(SEC_{BL,i} \times EF_{el,imported} + SFC_{BL,i} \times EF_{FF,imported,CO2}\right)$$

B_i	Correction factor based on share of production in non-Annex I countries, as specified in Table 2.
$EF_{el,imported}$	Emission factor for the baseline electricity consumption for the portion of plastic that is imported (tCO_2/MWh). Apply a default value of 0.24 (tCO_2/MWh)
$EF_{FF,imported,CO2}$	CO2 emission factor for fossil fuel (tCO2/GJ). Assume that natural gas supplies the energy needed to produce the virgin plastic imported if it is not possible to identify the fuel type.

Therefore, the calculation of emission for the plastic imported is out of the consideration, so,

$$BE_{plastic,y} = Q_{i,y} \times L_i \times \left(SEC_{BL,i} \times EF_{BL,el,y} + SFC_{BL,i} \times EF_{BL,FF,CO2}\right) \quad (5)$$

For the virgin plastic type i = PET, the values of related parameters are:

$SEC_{BL,i}$ = 1.11 MWh/t_i;

$SFC_{BL,i}$ = 15 GJ/t_i.

The following conservative assumptions were made to derive the default values above:

1. The energy needed for the production of the virgin monomers Ethylene, Propylene, Ethylene Glycol and Terephthalic Acid through thermal cracking of olefins is supplied by natural gas; A conservative value of 15 GJ/tons of energy needed to produce ethylene was selected from Table 4.3 of the report "Tracking Industrial Energy Efficiency and CO_2 emissions" published by the International Energy Agency (IEA, 2007);

[27] https://baijiahao.baidu.com/s?id=1709866061485175719&wfr=spider&for=pc; https://www.chyxx.com/industry/202006/872079.html

2. The energy needed for the production of the polymers is supplied by electricity: For PET, a conservative value of 4.0 GJ/t (divided by 3.6 to convert MWh/t) was sourced from Table 1 of SAYGIN et al (2011).

3. The remaining steps of virgin pellet production (melting and shaping, pelletizing, compounding) require relatively negligible amounts of energy and hence are ignored.

1. Calculation of fossil fuel emission factor EF_{BL,FF,CO_2} and $EF_{FF,imported,CO2}$

For the production of PET, it's hard to identify the type of fuel consumed for the production, as per the methodology, the baseline fuel is natural gas.

$EF_{FF,CO2} = EF_{natural\ gas}$ =56,100 kgCO_2/TJ=0.0561 tCO_2/GJ

2.Calculation of grid electricity emission factor $EF_{BL,el,y}$

The emission factor for the baseline electricity consumption for virgin plastic production in the host party (parameter$EF_{BL,el,y}$) shall be determined based on the weighted average consumption of electricity from the electric grid(s) and from captive power plant(s) as indicated in the equation below. Project participants may choose to fix this parameter ex-ante and update it at the renewal of the crediting period or monitor this parameter ex-post. If the parameter is fixed ex-ante, it shall be calculated using the most recent data available.

$$EF_{BL,el,y} = \frac{\sum_k \left(EF_{BL,grid,k,y} \times EC_{BL,grid,k,y}\right) + \sum_i \left(EF_{BL,captive,k,y} \times EC_{BL,captive,k,y}\right)}{\sum_k EC_{BL,grid,k,y} + \sum_j EC_{BL,captive,j,y}} \quad (6)$$

Where:

$EF_{BL,grid,k,y}$	Emission factor of the grid k supplying electricity to produce virgin plastics in the host party in year y (tCO_2/MWh)
$EC_{BL,grid,k,y}$	Electricity consumed from the grid k to produce virgin plastics in the host country in year y (MWh)
$EF_{BL,captive,k,y}$	Emission factor of the captive power plant j supplying electricity to produce virgin plastics in the host party in year y (tCO_2/MWh)
$EC_{BL,captive,k,y}$	Electricity consumed from the captive power plant j to produce virgin plastics Identify the relevant electricity systems; in the host country in year y (MWh)

In the Chinese plastic industry, all the electricity used for producing the plastic is supplied by the grid, it doesn't exist the energy supplied by the captive power plant, therefore, the equation (6) will be simplified as:

$$EF_{BL,el,y} = EF_{BL,grid,k,y} \quad (7)$$

The grid electricity emission factor $EF_{BL,grid,k,y}$ is calculated through the TOOL07: Tool to calculate the emission factor for an electricity system (version 07.0).

Step 1: Identify the relevant electricity systems;

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

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

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

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

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

Step 1: Identify the relevant electricity systems.

The delineation of the electricity systems in China is provided by the Chinese DNA. Guangdong Province is covered by South China Regional Power Grid (SCPG) .

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

Only grid power plants are included in the calculation.

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

The tool offers four options for the calculation of the OM emission factor. A flow chart is used to determine the calculation method, as per the Section 6.3 of TOOL07 (version 07.0). As annual data from each power plant on power generation, fuel type and fuel consumption are available, the low-cost / must-run resources constitute for 17.7% of total grid generation of the SCPG (excluding electricity generated by off-grid power plants) in average of the five most recent years, which is less than 50% of total grid generation, the calculation method of simple OM is suitable for the project activity.

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

(a) Ex ante option: if the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the 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.

(b) Ex post option: if the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y–1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y–2 may be used. The same data vintage (y, y–1 or y–2) should be used throughout all crediting periods.

Based on the most recent data available at the time of this project description submission, the first option (ex-ante) for the calculation of the OM emission factor is chosen for the project, in line with BEF 2019 published by the Chinese DNA.

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

The simple OM method is applied to calculate the OM emission factor. As per TOOL07 (Version 07.0), the simple OM method is applicable because the following requirement is satisfied:

Low-cost/must-run resources constitute 17.7% (less than 50%) of total grid generation of the SCPG (excluding electricity generated by off-grid power plants) in average of the five most recent years.

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated by one of the two following options:

Option A: Based on the net electricity generation and a CO_2 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:

1) The necessary data for Option A is not available; and

2) 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

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

The data of each power plant serving the system is difficult to obtain. In this case, Option A is not preferred. In addition, according to the China Energy Statistical Yearbook, 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. Therefore, Option B is chosen to calculate the OM emission factor.

Under this option, 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 the following equation:

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}\right)}{EG_y} \qquad (8)$$

If available, values of $NCV_{i,y}$ and $EF_{CO2,i,y}$ provided by the fuel supplier of the power plants in invoices may be used; otherwise, regional or national average default values may be used. For the Project, the values of $NCV_{i,y}$ for each type of fuel are obtained from China Energy Statistical Yearbook 2018, and the emission factors $EF_{CO2,i,y}$ for each type of fossil fuel come from default values in 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Fuel consumption data and electricity generation data are obtained from China Electric Power Yearbook 2016~2018 and China Energy Statistical Yearbook 2016~2018.

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year y (t CO_2/MWh)
$FC_{i,y}$	Amount of fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fuel type i in year y (GJ/mass or volume unit
$EF_{CO2,i,y}$	CO_2 emission factor of fuel type i in year y tCO_2/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

The above simple OM calculation is derived from the notification '2019 Baseline Emission Factors for Regional Power Grids in China' published by China's DNA, which is the only most recent available official statistics at the time of submission for the crediting renewal request. Therefore, based on the most latest data published by China DNA, the Simple OM Emission Factor ($EF_{grid,OM,simple,y}$) of SCPG is 0.8042 tCO_2/MWh.

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

As per Section 6.5 of TOOL07 (version 07.0), in terms of vintage of data, project participants can choose between one of the following two options:

(a) Option 1 - for the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of 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;

(b) Option 2 - For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build

margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

In line with BEF 2019 published by the Chinese DNA, Option 1 is chosen for the project; the BM emission factor is calculated ex ante for the first crediting period 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:

(a) 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 ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the proposed 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% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\geq 20\%}$, in MWh);

(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ 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 (d), (e) and (f).

Otherwise

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as 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% of the annual electricity generation of the proposed project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh); If the annual electricity generation of that set comprises at least 20% of the annual electricity generation of the proposed project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise

(e) Include in the sample group $SET_{sample\text{-}CDM}$ 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% of the annual electricity generation of the proposed project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

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

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

$$EF_{grid,BM,y} = \frac{\sum_m (EG_{m,y} \times EF_{EL,m,y})}{\sum_m EG_{m,y}} \qquad (9)$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y ($t\ CO_2/MWh$)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power units m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y ($t\ CO_2/MWh$)
m	Power units included in the build margin
y	The most recent year for which the generation data is available

As it is difficult to obtain the detailed data on the power generation, fuel consumption and thermal efficiency of each newly built power unit from public documents, a deviation of TOOL07 (version 07.0) is adopted following the clarifications[14] given by the CDM EB concerning the BM emission factor calculation:

(1) The CDM EB suggested using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin.

(2) The EB agreed the use of capacity additions during last 1 ~ 3 years for estimating the build margin emission factor for grid electricity.

(3) The EB also agreed to use of weights estimated using installed capacity in place of annual electricity generation.

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

$$EG_{m,y} = CAP_m \times H_{m,y} \qquad (10)$$

Where:

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

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

$$CAP_m = CAP_{A,t,k} \quad (11)$$

Where:

CAP_m	Installed capacity of the unit m (MW), with m representing the specified combination of A, t, and k
$CAP_{A,t,k}$	Installed capacity of the unit m (MW)
A	Provinces covered by the SCPG, namely, Guangdong Province, Yunan Province, Guizhou Province, Hainan Province and Guangxi Autonomous Region.
t	Years related to the grouped new power plants, for the 2019 calculation, t represents 2017, 2016, 2015…. Until the aggregated electricity generation of the grouped new power plants reaches 20% of the total electricity generation of the SCPG
k	Fuel type of the grouped new power plants, including hydro, thermal (coal, gas, oil, waste incineration, other thermal), nuclear, wind, solar and others.

Figure 4.1 shows the procedure applied to determine the sample group of power units m.

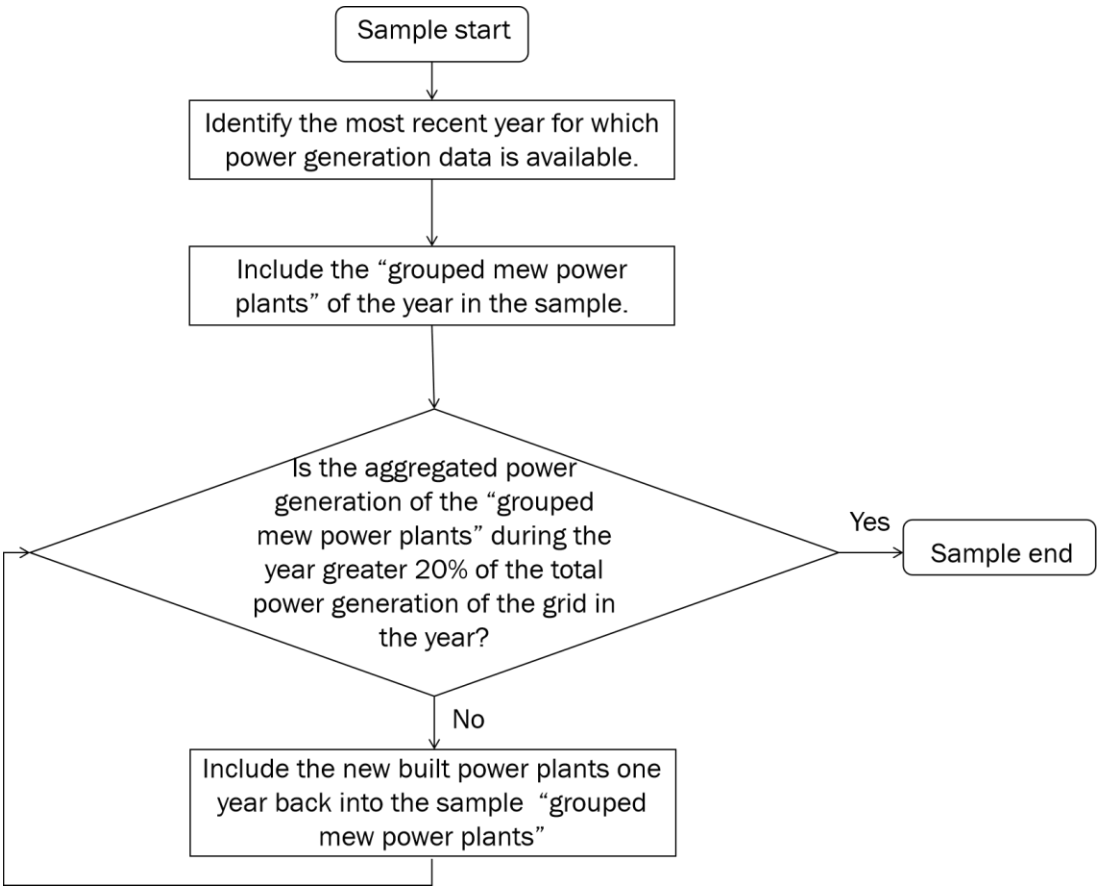


Figure 5.1 Procedure to determine the sample group of power units m

The emission factors of each fuel type are determined according to the Option A2 in the TOOL07, as the following equation:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \qquad (12)$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (t CO_2/MWh)
$EF_{CO2,m,i,y}$	Average CO_2 emission factor of fuel type *i* used in power unit m in year y (t CO_2/GJ)
$\eta_{m,y}$	Average net energy conversion efficiency of power unit m in year y (ratio)
m	All power units serving the grid in year y except low-cost / must-run power units
3.6	Conversion factor (GJ/MWh)

Among the fuel types, the emission factors of hydro, nuclear, wind, solar, other thermal and others are 0. Concerning the emission factors of coal, gas, oil and waste incineration, the formula (13) takes the following form due to conservativeness:

$$EF_{best,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{best,y}} \quad (13)$$

Where:

$EF_{best,m,y}$	Emission factor of power unit m with the best technology commercially available in year y (t CO_2/MWh)
$\eta_{best,y}$	Power generation efficiency of the best technology commercially
m	Power units serving the grid with coal, gas, oil or waste incineration in year y

The emission factors of coal, natural gas, fuel oil and municipal solid waste (MSW) are sourced from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, and the lower values of the 95% confidence interval are applied to be conservative.

According to *Compilation of Statistics of the Electric Power Industry* in 2017 published by China Electricity Council, newly built coal-fired power projects of 600 MW and above totalled 19.58 GW in 2017, of which 7 units each with a capacity of 1,000 MW accounted for 35.75%, and 19 units each with a capacity between 600 MW and 1,000 MW accounted for 64.25%. Among these 26 new units, the power generation and coal consumption data for 16 units are available. The 10 units with the lowest coal consumption for power supply are selected as the best commercial technology cases, and their weighted-average coal consumption is 297.59 gce/kWh, equivalent to a power generation efficiency of 41.33%.

According to Compilation of Statistics of the Electric Power Industry in 2017 published by China Electricity Council, 59 newly built MSW power units totalled to 1,147.5 MW in 2017, of which the power generation and MSW consumption data for 25 units are available. Their weighted-average power generation efficiency is 516.41 gce/kWh, equivalent to 23.82%.

According to Compilation of Statistics of the Electric Power Industry in 2017 published by China Electricity Council, 32 newly built natural gas power units totalled to 5,658.1 MW in 2017, of which the power generation and gas consumption data for 18 units are available. Their weighted-average power generation efficiency is 223.41 gce/kWh, equivalent to 55.05%.

No fuel oil power units were constructed in 2017. The power generation efficiency of the best technology commercially available for fuel oil units comes from Baseline Emission Factors for Regional Grids in China of previous years, i.e., 232.3 gce/kWh or 52.9%.

BM is calculated based on the composition of each power generation technology and the emission factors with the best technology commercially available.

The above BM calculation is derived from the notification '2019 Baseline Emission Factors for Regional Power Grids in China' published by China's DNA, which is the only most recent available official statistics at the time of submission for the registration request. Therefore, based on the

most recent data published by China DNA, $EF_{grid,BM,y}$ for SCPG is calculated to be 0.2135 tCO_2/MWh.

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

The combined margin (CM) emission factor of the baseline scenario is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (14)$$

Where:

$EF_{grid,OM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,BM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of build margin emissions factor (%)
w_{BM}	Weighting of operating margin emissions factor (%)

As per TOOL07, and are both 50% during the crediting period. Therefore, the baseline CM emission factor:

$$EF_{grid,CM,y} = 0.8042 \times 50\% + 0.2135 \times 50\% = 0.50885\ tCO_2/MWh$$

Therefore:

$$EF_{el,PJ,y} = EF_{BL,grid,k,y} = EF_{grid,CM,y} = 0.50885\ tCO_2/MWh$$

4.2 Project Emissions

Project emissions include emissions associated with the energy use at recycling facility and at the processing facility, and are calculated based on the equation below.

According to Methodology AMS-III.AJ, for project activities where the recycling facility includes both waste sorting and processing, project emissions are calculated using equation below:

$$PE_y = EC_{PJ,y} \times EF_{el,PJ,y} + \sum_f \left(EC_{f,PJ,y} \times NCV_{f,y} \times EF_{f,CO2,y}\right) \quad (15)$$

Where:

PE_y	Project emissions in year y (t CO_2/y)
$EC_{PJ,y}$	Electricity consumed by the recycling facility in year y (MWh/t)
$EC_{f,PJ,y}$	Fuel type f consumed by the recycling facility in year y (unit mass or volume/t)
$NCV_{f,y}$	Net calorific value of the fossil fuel type y consumed in the recycling facility in year y (GJ/unit mass or volume)

$EF_{f,CO2,y}$ CO_2 emission factor of the fossil fuel type y consumed at the recycling facility in year y (tCO_2/GJ)

For project activities that fall under Case A, the parameters $EC_{PJ,y}$ and $FC_{f,PJ,y}$ may be estimated based on the nameplate specific energy consumption of the equipment used and the average time of operation and level of service delivered, or based on measurement campaigns of the energy consumption under typical operation conditions.

The project activity falls under Case A and the electricity consumption and diesel consumption calculation for the Project activity ($EC_{PJ,y}$, $FC_{diesel,PJ,y}$) is determined by direct measurement.

4.3 Leakage

As per AMS-III.AJ. (Version 09.0), "if it is demonstrated that organic biogenic waste segregated in the recycling facility would otherwise have been deposited in a landfill without methane recovery in the baseline scenario, or if the baseline scenario is the incineration of the wastes, then no leakage calculation is required."

For the project, no organic biogenic waste is involved, the waste recycled is only plastic, and they would be incinerated in the incineration, therefore, in the project situation, no leakage calculation is required.

4.4 Net GHG Emission Reductions and Removals

Emission reduction due to the project activity during the year y are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (16)$$

Baseline Emissions (BE_y)

It was planned that the project would recycle 65,000 tons of post-consumer PET daily necessities and produce 55,000 tons of recycled PET flakes each year.

Based on the equation (5), the baseline emissions for plastic recycling are:

$$BE_{plastic,y} = Q_{i,y} \times L_i \times \left(SEC_{BL,i} \times EF_{BL,el,y} + SFC_{BL,i} \times EF_{BL,FF,CO2}\right)$$

$$= 65{,}000 \times 0.75 \times (1.11\ MWh/t \times 0.50885\ tCO_2/MWh + 15\ GJ/t \times 0.0561\ tCO_2/GJ)$$

$$= 68{,}558\ tCO_2e$$

Project Emissions (PE_y)

It was estimated that the project would consume 15,500 MWh electricity, 630,000 Nm^3 natural gas and 30 tons of diesel each year.

$$PE_y = EC_{PJ,y} \times EF_{el,PJ,y} + \sum_f \left(EC_{f,PJ,y} \times NCV_{f,y} \times EF_{f,CO2,y} \right) = 15{,}500 \text{ MWh} \times 0.50885 \frac{tCO_2}{MWh} +$$
$$630{,}000 \times 38{,}931 \times 0.0561 \times 10^{-6} \frac{tCO_2}{GJ} \times 30 \text{ t} \times 42{,}652 \times 10^{-3} \frac{GJ}{t} \times 0.0726 \frac{tCO_2}{GJ} = 9{,}357 \ CO_2e$$

Leakage (LE_y)

As discussed before, LE_y=0.

Emission Reductions (ER_y)

The emission reductions (ER_y) of the project activity are calculated as:

$ER_y = BE_y - PE_y - LE_y$ = 68,558 tCO_2e – 9,357 tCO_2e - 0 tCO_2e =59,201 tCO_2e

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
06-April-2022 to 31-December-2022	50,712	6,921	0	43,791
2023	68,558	9,357	0	59,201
2024	68,558	9,357	0	59,201
2025	68,558	9,357	0	59,201
2026	68,558	9,357	0	59,201
2027	68,558	9,357	0	59,201
2028	68,558	9,357	0	59,201
01-January-2029 to 05-April -2029	17,846	2,436	0	15,410
Total	479,906	65,499	0	414,407
Annual average	68,558	9,357	0	59,201

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	L_i

Data unit	-
Description	Net to gross adjustment factor to cover degradation in material quality and material loss in the production process of the final product using the recycled material
Source of data	AMS-III.AJ.: Recovery and recycling of materials from solid wastes (Version 09.0)
Value applied:	0.75
Justification of choice of data or description of measurement methods and procedures applied	Default value from AMS-III.AJ.: Recovery and recycling of materials from solid wastes (Version 09.0)
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$w_{i,in-country,y}$
Data unit	%
Description	Percentage of plastics produced in the host party out of total plastic consumed in year y
Source of data	Public information
Value applied:	100%
Justification of choice of data or description of measurement methods and procedures applied	Refer to Section 3.2 for the justifications for assuming that all the PET was manufactured in China.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$w_{i,imported,y}$
Data unit	%
Description	Percentage of imported plastics out of total plastic consumed in year y
Source of data	Public information
Value applied:	0%
Justification of choice of data or description of measurement methods and procedures applied	Refer to Section 3.2 for the justifications for assuming that all the PET was manufactured in China.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$SEC_{BL,i}$
Data unit	MWh/t_i
Description	Specific electricity consumption in the production of virgin material type i
Source of data	AMS-III.AJ.: Recovery and recycling of materials from solid wastes (Version 09.0)
Value applied:	1.11
Justification of choice of data or description of measurement methods and procedures applied	Default value for PET from the methodology AMS-III.AJ., Recovery and recycling of materials from solid wastes (Version 09.0)
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$SFC_{BL,i}$
Data unit	GJ/t_i
Description	Specific fuel consumption in the production of virgin material type i
Source of data	AMS-III.AJ.: Recovery and recycling of materials from solid wastes (Version 09.0)
Value applied:	15
Justification of choice of data or description of measurement methods and procedures applied	Default value for PET from the methodology AMS-III.AJ.: Recovery and recycling of materials from solid wastes (Version 09.0)
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$EF_{BL,FF,CO2}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor of the baseline fossil fuel.
Source of data	The natural gas was assumed to supply the energy, and according to IPCC, this parameter is converted into 0.0561tCO2/GJ (IPCC default value is 15.3 tC/TJ).
Value applied:	0.0561(for natural gas)
Justification of choice of data or description of measurement methods and procedures applied	It is assumed that the baseline fossil fuel involved in the production of PET is natural gas, which is in line with the methodology. The emission factor of natural gas is from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.4
Purpose of Data	Calculation of baseline emissions

Comments	-
Data / Parameter	$EF_{grid,OMsimple,y}$
Data unit	tCO_2/MWh
Description	Operating margin emission factor of the grid connected (SCPG)
Source of data	1. 2019 Baseline Emission Factors for Regional Power Grids in China, and Calculation Instructions for 2019 Baseline OM Emission Factors for Regional Power Grids in China published by the Ministry of Ecology and Environment of China; 2. TOOL07: "Tool to calculate the emission factor for an electricity system" (version 07.0)
Value applied:	0.8042
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per TOOL07 (version 07.0) based on official data published by the Ministry of Ecology and Environment of China
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	The value is calculated ex ante and fixed during the crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build margin emission factor of the grid connected (SCPG)
Source of data	1. 2019 Baseline Emission Factors for Regional Power Grids in China [28], and Calculation Instructions for 2019 Baseline BM Emission Factors for Regional Power Grids in China[29] published by the Ministry of Ecology and Environment of China;

[28] http://mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/W020201229610353340851.pdf

[29] http://mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/W020201229610354442145.pdf

	2. TOOL07: "Tool to calculate the emission factor for an electricity system" (version 07.0)
Value applied:	0.2135
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per TOOL07 (version 07.0) based on official data published by the Ministry of Ecology and Environment of China
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	The value is calculated ex ante and fixed during the crediting period.

Data / Parameter	$\boldsymbol{EF_{grid,CM,y}}$ $(EF_{BL,el,y}, EF_{el,PJ,y})$
Data unit	tCO_2/MWh
Description	Combined margin emission factor for the grid (SCPG) in year y
Source of data	1. 2019 Baseline Emission Factors for Regional Power Grids in China[30], Calculation Instructions for 2019 Baseline OM Emission Factors for Regional Power Grids in China[31] and Calculation Instructions for 2019 Baseline BM Emission Factors for Regional Power Grids in China[32] published by the Ministry of Ecology and Environment of China; 2. TOOL07: "Tool to calculate the emission factor for an electricity system" (version 07.0)
Value applied:	0.50885
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per TOOL07 (version 07.0) based on official data published by the Ministry of Ecology and Environment of China

[30] http://mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/W020201229610353340851.pdf

[31] http://mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/W020201229610353816665.pdf

[32] http://mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/W020201229610354442145.pdf

Purpose of Data	Calculation of baseline emissions and project emissions
Comments	The ex-ante option is selected to calculate $EF_{grid,OM,y}$ and $EF_{grid,BM,y,}$ and hence $EF_{grid,CM,y}$, which will be fixed throughout the crediting period; therefore, both parameters $EF_{BL,el,y}$ and $EF_{el,PJ,y}$ are fixed throughout the crediting period.

Data / Parameter	w_{OM}
Data unit	-
Description	Weighting of operating margin emission 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	Default value
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	N/A

Data / Parameter	w_{BM}
Data unit	-
Description	Weighting of build margin emission 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	Default value

measurement methods and procedures applied	
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	N/A

Data / Parameter	$NCV_{diesel,y}$
Data unit	MJ/t
Description	Net calorific value of diesel consumed in the recycling facility in year *y*
Source of data	China Energy Statistical Yearbook
Value applied:	42,652
Justification of choice of data or description of measurement methods and procedures applied	Official, publicly accessible and reliable data source
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	$EF_{diesel,CO2,y}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor of diesel consumed at the recycling facility in year y
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.0726
Justification of choice of data or description of measurement methods and procedures applied	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.4
Purpose of Data	Calculation of project emissions
Comments	-

5.2 Data and Parameters Monitored

Data / Parameter	$Q_{i,y}$
Data unit	t/y
Description	Quantity of waste PET daily necessities recycled in year y
Source of data	Truck scale installed at the project site
Description of measurement methods and procedures applied	The weight of vehicles with and without PET flakes are weighed by the truck scale, so that the load carried by the vehicle can be calculated and recorded.
Frequency of monitoring/recording	Recorded at the time of receiving each consignment of waste PET daily necessities entering the project site.
Value applied:	**65,000** (ex-ante estimated value)
Monitoring equipment	Truck scale with the following technical information: Monitoring instrument: **Truck scale** Equipment type: XK3910-DS10 Serial No.: 1609002201 Accuracy: 20 kg Manufacturer: Shenzhen Shuxing Xinghengqi Technology Co. LTD.
QA/QC procedures applied	The truck scale is regularly maintained and calibrated every year. The recorded weight of PET flakes will be cross-checked with waste PET purchase invoices or other payment documents, and conservative values will be applied in calculation.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	$EC_{PJ,y}$
Data unit	MWh
Description	Electricity consumed by the recycling facility in year y

Source of data	Electricity meter's reading records
Description of measurement methods and procedures applied	Measured by an electricity meter
Frequency of monitoring/recording	Measured continuously and recorded monthly
Value applied:	15,500 (ex-ante estimated value)
Monitoring equipment	Electricity meter with the following technical information:
QA/QC procedures applied	The monitored values will be cross checked with electricity purchase receipts, and conservative values will be applied in calculation. The electricity meter is to be calibrated regularly in compliance with relevant standards. The calibration reports, recorded data files and sales receipts will be archived for two years following the end of the crediting period.
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$FC_{gas,PJ,y}$
Data unit	Nm^3
Description	Quantity of natural gas consumption of the recycling facility in year y
Source of data	Flow meter
Description of measurement methods and procedures applied	Measured by a flow meter
Frequency of monitoring/recording	Monitored continuously and recorded regularly
Value applied:	630,000 (ex-ante estimated value)
Monitoring equipment	Flow meter

QA/QC procedures applied	The monitored values will be cross checked with natural gas purchase receipts, and conservative values will be applied in calculation. The flow meter is to be calibrated regularly in compliance with relevant standards. The calibration reports, recorded data files and sales receipts will be archived for two years following the end of the crediting period.
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$FC_{diesel,PJ,y}$
Data unit	t
Description	Diesel consumption of the recycling facility in year y
Source of data	Diesel purchase receipts
Description of measurement methods and procedures applied	Diesel purchase receipts will be collected to record the diesel consumption.
Frequency of monitoring/recording	Monitored continuously and recorded *continuously*
Value applied:	30 (ex-ante estimated value)
Monitoring equipment	Diesel used for transportation by vehicles within the recycling facility is purchased directly from the filling stations and no metering equipment is available in the recycling facility, the Project uses diesel purchase receipts for recording the amount of diesel consumption.
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

5.3 Monitoring Plan

This section describes the process and schedule for obtaining, recording, and analysing the monitored data set out in Section 5.2 above.

1) Data and parameters monitored

As stated in Section 5.2, quantity of waste PET bottles recycled in year y ($Q_{i,y}$), electricity consumed by the recycling facility in year y ($EC_{PJ,y}$), diesel and natural gas consumed by the recycling facility in year y ($FC_{gas,PJ,y}$ and $FC_{diesel,PJ,y}$) are the parameters to be monitored.

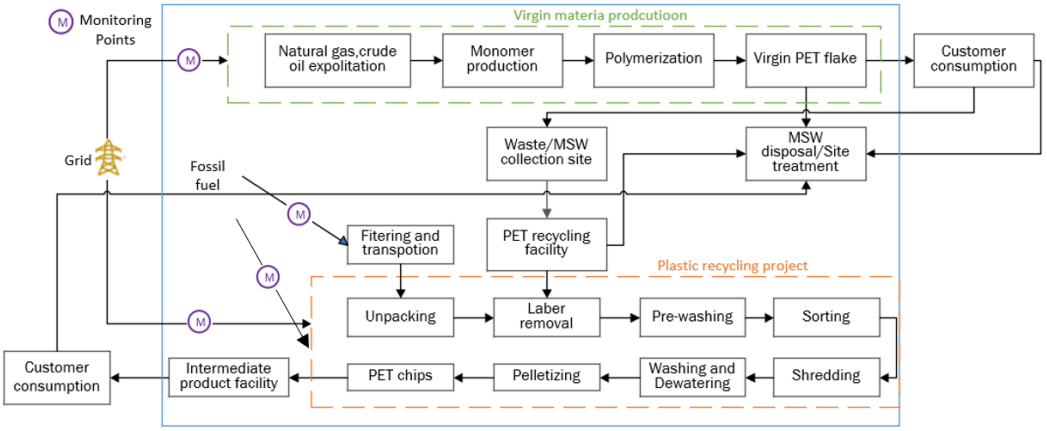


Figure 5.1 Diagram of the project boundary showing the monitoring instruments

2) Management of the monitoring plan

The project proponent has established a VCS monitoring team in charge of measuring and recording of the parameter values, collecting relevant documents (such as sales/purchase receipts) as well as calculating emission reductions.

Figure 5.2 shows the operation and management structure of the monitoring team. The VCS manager takes full responsibility for the overall implementation of the monitoring plan. The monitoring activities, including recording and document collecting, are carried out by a team of monitoring officers. In addition, the internal verifiers are in charge of internal check of the data and files as well as calculation of emission reductions. A monitoring manual regarding the project, which stipulates detailed duties and responsibilities of all members of the monitoring team, has been developed and serves as the basis of the monitoring plan.

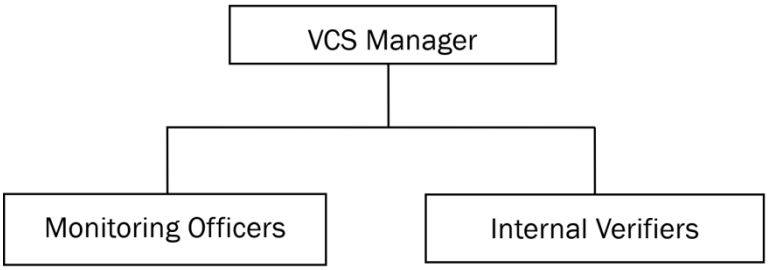


Figure 5.2 Management structure of the monitoring team

All the relevant data files will be kept by the project proponent during the crediting period and at least for two years after the end of the last crediting period.

3) Quality assurance and quality control

The monitoring data will be cross checked with corresponding sales/purchase receipts to ensure the data quality.

Calibration of the monitoring instruments should be conducted in compliance with relevant national or industry standards and rules, and all the calibration records should be documented and archived by the project proponent for verification.

4) Procedures of exception handling and reporting

The monitoring staff will continuously monitor the operation status of the measuring instruments to ensure that any abnormity could be detected as soon as possible and that the corresponding trouble-shooting measures will be taken in time. The measuring instrument will be repaired immediately and must be calibrated by a qualified third-party before being put into use again.

Problem that occurred in monitoring and measurement process will be recorded and reported to company administrator or supervisor; measures will be adopted to avoid the same problem reoccurring in the future.

5) Emergency procedure

In case of any failure or malfunction of any monitoring instrument, the project participant and the equipment suppliers will repair or displace it as soon as possible, and the emission reductions achieved during the troubleshooting period will be calculated conservatively.

During the reported monitoring period, no emergency occurred, and on event, which might impact the monitoring plan, the applied methodology or the calculation of emission reductions, occurred.