WEIBEI PIPELINE ASSOCIATED GAS RECOVERY PROJECT

Document Prepared by

CNOOC Energy Conservation & Pollution Reduction Monitor Center CO.LTD.

Contact Information

Project Title	Weibei Pipeline Associated Gas Recovery Project
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1 PROJECT DETAILS

1.1 Summary Description of the Project

Weibei Pipeline Associated Gas Recovery Project is located in Beihai City, GuangXi Zhuang Autonomous Region, P.R. China. The project activity involves newly building processing and transport system, recover the associated gas produced by Weizhou offshore oilfield exploitation and send it to mainland for utilization.

After the project put into production, it is expected to process average 210 million Nm^3 associated gas annually.

In the absence of the project, the associated gas produced in the offshore oilfield would be flared to the atmosphere. The baseline scenario of the project is the same as the scenario existing prior to the start of implementation of the project. By recovering the associated gas, greenhouse gas (GHG) emission reductions will be generated by utilization of the recovered gas which displaces the use of other fossil fuel sources. It is expected to reduce an average amount of 423,049 tCO_2e annually.

The proposed project will contribute to the sustainable development of the local community and the host country in a series of ways:

- Avoiding waste of energy in the Oilfield;
- Reducing GHG emissions and air pollution from flaring of associated gas;
- Improving energy efficiency by recovery and utilization of the associated gas;
- Creating permanent jobs during operation period and short-term employment opportunities during the project construction.

1.2 Sectoral Scope and Project Type

Sectoral scope 01: Energy industries (renewable / non renewable sources)

Sectoral scope 10: Fugitive emissions from fuel (solid, oil and gas)

The project is not a grouped project.

1.3 Project Eligibility

As per section 2.1.1 of VCS Standard (version 4.4), the scope of the VCS Program include：

The six Kyoto Protocol greenhouse gases: The project is expected to avoid CO2 emissions from the flared associated gas in the baseline scenario, which will be recovered and processed in the project scenario. Thus, the project applies to this scope.

Ozone-depleting substances: N/A.

Project activities supported by a methodology approved under the VCS Program through the methodology approval process: N/A.

Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval : The applied methodology AM0009 (Version 7.0) of the project is a methodology approved under CDM Program, which is a VCS approved GHG program.

Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements: N/A.

The proposed project plans to recover the flared associated gas produced in the offshore oilfield. The associated gas is just a by-product during the exploitation of the offshore oilfield, which is apparently not a project that generates GHG emissions primarily for the purpose of their subsequent reduction, removal or destruction.

Meanwhile, the project does not belong to the projects excluded in Table 1 of VCS Standard v4.4. Thus, the project is eligible under the scope of VCS program.

1.4 Project Design

☐ The project includes a single location or installation only

☒ The project includes multiple locations or project activity instances, but is not being developed as a grouped project

☐ The project is a grouped project

Two stations are involved in the project. Therefor the project has multiple locations, but is not a grouper project.

Eligibility Criteria

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

1.5 Project Proponent

Organization name	CNOOC China Limited, Zhanjiang Branch
Contact person	LIU Peng
Title	Mr.
Address	South Diversion Road, Potou District, Zhanjiang City, Guangdong, P.R.China
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1.6 Other Entities Involved in the Project

Organization name	CNOOC Energy Conservation & Pollution Reduction Monitor Center CO.LTD.
Role in the project	Project Developer
Contact person	ZHANG Jingqi
Title	Mr.
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1.7 Ownership

The project owner of the project is CNOOC China Limited, Zhanjiang Branch who has the legal right to control and operate the project activities. The business license, approval of Environmental Impact Assessment (EIA) and the equipment purchasing contract are evidence for the ownership of the project and carbon credits generated.

1.8 Project Start Date

09/04/2023, the operation start date.

1.9 Project Crediting Period

This project adopts the fixed crediting period of 10 years, from 09/04/2023 to 08/04/2033 (the start and end dates included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

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

☐ <20,000 tCO_2e/year

☐ 20,000 – 100,000 tCO_2e/year

☒ 100,001 – 1,000,000 tCO_2e/year

☐ >1,000,000 tCO_2e/year

Project Scale	
Project	
Large project	√

Year	Estimated GHG emission reductions or removals (tCO_2e)
09/04/2023-08/04/2024	423,049
09/04/2024-08/04/2025	423,049
09/04/2025-08/04/2026	423,049
09/04/2026-08/04/2027	423,049
09/04/2027-08/04/2028	423,049
09/04/2028-08/04/2029	423,049
09/04/2029-08/04/2030	423,049
09/04/2030-08/04/2031	423,049
09/04/2031-08/04/2032	423,049
09/04/2032-08/04/2033	423,049
Total estimated ERs	4,230,490
Total number of crediting years	10
Average annual ERs	423,049

1.11 Description of the Project Activity

The project activity involves newly building processing and transport system, recover the associated gas produced by Weizhou offshore oilfield exploitation and send it to mainland for utilization.

The project involves two steps as follows:

1. In the Weizhou terminal station: the oil and gas compound will enter the Weizhou terminal station for dehydration and decarbonization, of which the heavy hydrocarbons will be loaded

and transported for end users. The associated gas will be furtherly processed. The electricity of the station will be supplied by the off-grid electricity.

2. In the Beihai first station: the treated associated gas will be transported through the newly built sea pipeline to the Beihai first station located in the Tieshangang district of Beihai city. In the first station the recovered gas will be filtered. After filtration, the treated gas will enter the metering skid and then be transported by pipeline for end users. The electricity of the station will be supplied by the grid.

The basic information of the project is listed in the following table:

Table 1-1 The basic information of the project

Items	Main Information
Laying of pipeline	A new submarine pipeline of about 70 kilometers will be constructed
Beihai first station	A newly built station which will have the functions to filtration and metering.
Weizhou terminal station	A new compression unit will be built to recover the associated gas
Design lifetime of new facilities	30 years

The figure 1-1 shows the arrangement of the main manufacturing technologies, system and equipment involved in the project activity.

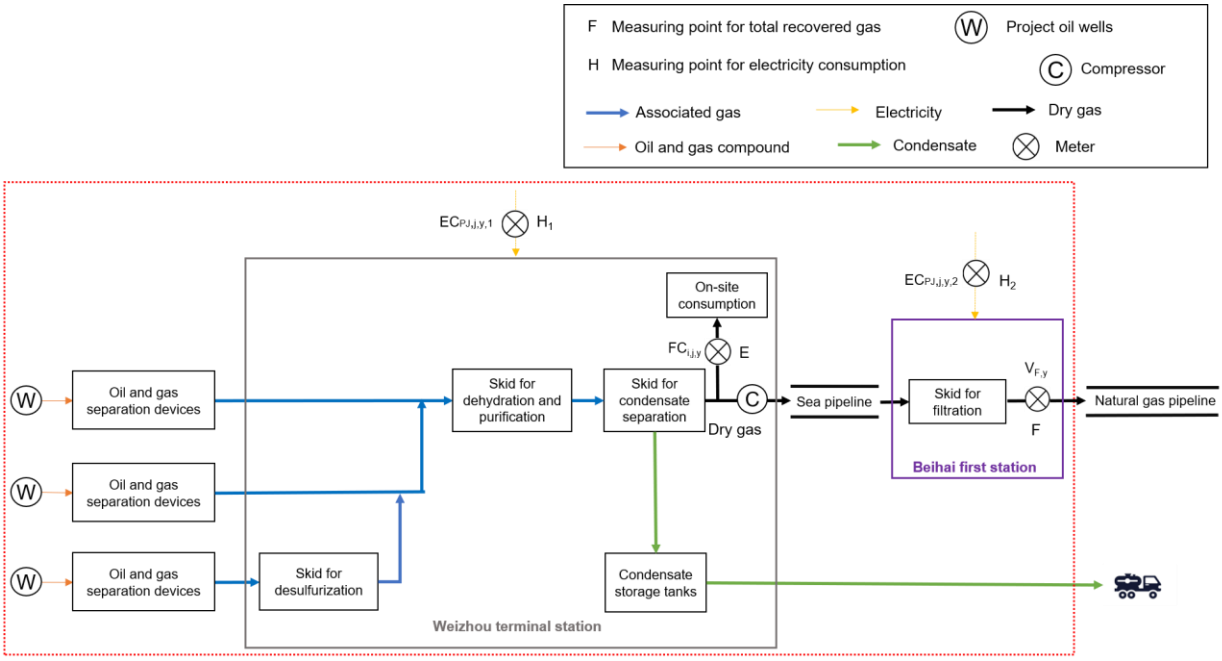

Figure 1-1 The arrangement of the project activity

The main equipment of the project activity has been provided in the Table 1-2.

Table 1-2 Main equipment list of the project

Station	Name	Model	Manufacturer's Specifications	Quantity
Weizhou terminal station	Compressor	RDSD704-3	Discharge volume: (24.87-62.85)*10^4Nm^3/d, Power: 2480.66 kW	2
Beihai first station	Skid for filtration	/	Design pressure: 4.45 MPa, Design temperature: 60°C	2

1.12 Project Location

The project locates at Beihai city, Guangxi province of China. Two stations are involved in the project. The geographical coordinates of the two stations are listed as below:

Table 1-3 Geographical coordinates of the two stations

Station	Coordinates
Weizhou terminal station	109.08E, 21.05N
Beihai first station	109.53E, 21.45N

Figure 1-2 The location of the project activity

1.13 Conditions Prior to Project Initiation

The scenario existing prior to the start of the implementation of the project is:

The associated gas produced in the offshore oilfield was flared to the atmosphere. The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity. Please refer to Section 3.4 (Baseline Scenario) for details.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

According to "Pollution prevention and control Technology policy for oil and gas exploitation industry" published by the Ministry of Ecology and Environment, PRC[1] and "Emission standard of air pollutants for onshore oil and gas exploitation and production industry (GB 39728-2020)", in the process of oilfield development, if the project does not have the conditions for associated gas recovery and utilization, the recovered gas should be fully flared. Moreover, the project has already approved by the National Ministry of Ecology and Environment on 10/05/2022. Hence, the project is in compliance with laws, status and other regulatory frameworks.

[1] http://www.mee.gov.cn/ywgz/fgbz/bz/bzwb/wrfzjszc/201203/t20120319_224789.htm

1.15 Participation under Other GHG Programs

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

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

1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

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

China has a national emissions trading program which covers the thermal power generation industry. And the project activity is not included the mandatory emission control scheme[2] and there is no emission cap enforced for the project owner according to the enforced company list[3] in public information. Hence, it is confirmed that the emission reductions will not be double counted.

1.16.2 Other Forms of Environmental Credit

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

Supply Chain (Scope 3) Emissions

The project is an associated gas recovery project, which reduces GHG emission reductions by avoiding GHG emission of CO_2 from flared associated gas. Therefore, the project's GHG emission reductions or removals are not in a supply chain, and thus the Supply Chain (Scope 3) Emissions are not applicable.

1.17 Sustainable Development Contributions

[2] http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/t20201230_815546.html

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

The project's goal is not only an energy saving project, but also an environmental, social, and financial solution to avoid flared gas (CO_2) release into the atmosphere. The project provides many benefits that helps achieve China's Sustainable Development Goals (SDG), a set of 17 universal goals covering the thematic areas of environmental, economic and social development.

The project contributes to achieving sustainable development in following ways:

- Affordable and clean energy. The project will reduce the consumption of the fossil fuels of the gas pipeline, which will contribute to increasing China's energy security. (SDG 7)
- Provide decent work. The project can provide job opportunities for local residents, which meets one of the China's action plans "Increase labour force participation rate through implementation of the classification policy. Vigorously enforce the Law on Promotion of Employment." (SDG 8)
- Reduce GHG emissions. The project avoids CO_2 emissions that would otherwise be released directly into the atmosphere, effectively reducing GHG emissions and air pollution. That means not only the project reduces GHG emissions to local environment, but also provide an environmentally sound solution to improve the surrounding air quality. The project is expected to achieve an annual emission reduction of 423,049 tCO_2e. This contributes to achieving one of China's stated sustainable development priorities "Actively adapt to climate change and strengthen resistance capacity to climate risks in agriculture, forestry, water resources and other key fields, as well as cities, coastal regions and ecologically vulnerable areas." (SDG 13)

1.18 Additional Information Relevant to the Project

Leakage Management

Not applicable.

Commercially Sensitive Information

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

Further Information

None.

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment Report for the project was compiled in November 2021. The EIA report for the project has been approved by National Ministry of Ecology and Environment on 10/05/2022. Every aspect of environmental impact has been considered in the EIA report with corresponding measures during project development, the construction of the project is in line with national policies and no net harm has been detected. Meanwhile, the implementation of the project will improve local-socio economic development through creating career opportunities.

2.2 Local Stakeholder Consultation

According to the Law of the People's Republic of China on Environmental Impact Assessment, the state encourages relevant units, experts and the public to participate in environmental impact assessment in an appropriate manner. Therefore, the project owner organized local stakeholder consultation in March and October 2021 respectively, publicly disclosing project related information to solicit public attitudes, concerns, and other information about the proposed project.

The main contents of the publicity include the project name, site selection, construction content and other basic information, the name and contact information of the construction unit, the preparation unit and name of the Environmental impact statement, the network link of the public opinion form, the way to submit the public opinion form and other relevant information.

No negative comments received during the local stakeholder consultation.

2.3 Environmental Impact

The Environmental Impacts Assessment Report has been prepared. The applied technology of the project is mature and reliable, and the applied pollution control measures are technically and economically feasible. As long as the environmental protection measures mentioned in the EIA

report are strictly implemented to ensure that the pollutants produced by the project meet the standard, and the preventive measures and emergency plans for environmental risks are seriously implemented, the project is feasible from the perspective of environmental protection. The main assessment conclusions of the EIA are provided below:

Air Pollution

The waste gas during the construction period mainly includes construction dust, welding smoke, construction machinery, and vehicle exhaust. The project owner will set up fences on the construction site to reduce the spread of construction dust, and take measures to sprinkle water to suppress dust. The main roads where transportation vehicles enter and exit will be regularly watered and cleaned, and measures such as covering with tarpaulin and controlling vehicle speed will be taken to reduce ground dust pollution.

The main sources of exhaust gas pollution during the project operation period are leakage from equipment sealing points. The project owner will use high-quality equipment, pipelines, and sealing components to strengthen the control of equipment installation quality, and strengthen the daily inspection and maintenance management of equipment, pipelines, and other equipment and facilities to reduce atmospheric pollution.

Water Pollution

The sewage generated during the construction period mainly includes production wastewater and domestic sewage. For the production wastewater generated during onshore construction, centralized collection will be carried out, and waste liquid tanks will be set up at the construction site for temporary storage, which will be regularly transported and treated by qualified units; The production wastewater generated at sea will be centrally treated by the oily production water treatment system in the factory area, and after meeting the first level standard limit requirements of the "Comprehensive Wastewater Discharge Standard" (GB 8978-1996), it will be discharged through deep-sea sewage outlets. The domestic sewage generated from road construction will be sent to the municipal sewage treatment plant for treatment; The domestic sewage generated from offshore construction will be pretreated in the septic tank, and then sent to the integrated processor for treatment. After meeting the requirements of Class I standard limit in the Integrated Wastewater Discharge Standard (GB 8978-1996), it will be discharged through the deep sea drain outlet.

The wastewater during the operation period of the project is mainly domestic sewage, which will enter the integrated domestic sewage treatment plant for treatment after primary treatment in the septic tank. The treated water quality reaches the Class B limit in the Water Quality Standard for Sewage Discharged into Urban Sewers (GB/T 31962-2015) and the relatively strict limit in the Class III standard in the Integrated Wastewater Discharge Standard (GB8978-1996).

Noise Pollution

The noise during the construction period mainly comes from construction machinery, equipment, vehicles, etc. The project owner will arrange the construction site reasonably to avoid arranging a large number of power machinery and equipment at the same construction site to prevent local sound levels from being too high. At the same time, the scheduling of high noise construction machinery operations will be optimized. Low noise equipment will be used as much as possible in equipment selection, and regular maintenance and upkeep of power machinery and equipment will be carried out; And set up protective barriers around the construction site to minimize the impact of equipment noise on the environment as much as possible.

The main noise during the operation period is the power noise of various valves, basket filters, and other equipment. This project plans to prioritize the selection of low-noise equipment and strengthen maintenance during operation. For equipment with noise exceeding the standard, measures such as sound absorption, insulation, noise reduction, and vibration reduction will be taken to minimize the frequency and intensity of noise generation and reduce the impact of operational noise during the operation period.

Solid Pollution

The solid wastes generated during the construction period mainly include formation cuttings and mud generated by directional drilling, construction waste, domestic waste and waste engine oil. Formation cuttings and mud generated by directional drilling and waste engine oil will be transported to qualified units for treatment, and domestic garbage will be collected uniformly and sent to the municipal sanitation department for cleaning and disposal.

The solid waste during the project operation period mainly consists of production solid waste and household waste. Production solid waste mainly includes hazardous waste such as waste oil and labor protection equipment generated during the maintenance and repair of newly added equipment. Production solid waste will be temporarily stored in the hazardous waste temporary storage warehouse and then handed over to qualified units for treatment; Oily labor protection equipment and household waste will be collected in a centralized manner and handed over to the environmental sanitation department for treatment.

Ecology

The ecological impact during the project construction period is mainly due to land occupation, vegetation, and damage to fish schools in the sea area. The project owner will strengthen on-site construction management and arrange the construction schedule reasonably. Offshore construction operations will try to avoid the peak spawning period of fish and the peak breeding period of coral, and minimize and mitigate the impact on the marine ecology of the nearby sea areas. In the later stage of construction, greening measures will be taken for the site, including planting grass, shrubs, and other trees.

The ecological impacts of the project activity during the operation period are primarily due to permanent land use or occupancy. However, the vegetation accounts for less than the evaluation area, thus the ecological impacts of the project activity will be very limited. The project owner will

strengthen greening and plant trees and grass around the installation, on both sides of the road, and between the living and auxiliary areas where greening can be achieved. And regular watering, fertilization, and other maintenance measures should be taken to ensure the survival rate of the green vegetation in the station and the green belt vegetation restored during pipeline construction.

2.4 Public Comments

All projects are subject to a 30-day public comment period. The date on which the project is listed on the project pipeline marks the beginning of the project's 30-day public comment period. This project will be open for public comment on the verra website. The project shall be listed, and comments shall be incorporated later.

2.5 AFOLU-Specific Safeguards

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

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The baseline methodology applied to the proposed project includes:

AM0009 "Recovery and utilization of gas from oil wells that would otherwise be flared or vented" (Version 07.0)

For more information, please refer to:

https://cdm.unfccc.int/methodologies/DB/ET4NXMVXFQ5C2EJ5L1OF8YZIEVLVDA

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

For more information, please refer to:

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

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

For more information, please refer to:

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

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

For more information, please refer to:

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf/history_view

"Combined tool to identify the baseline scenario and demonstrate additionality" (Version 07.0)

For more information, please refer to:

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

"Common practice" (Version 03.1)

For more information, please refer to:

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

3.2 Applicability of Methodology

The baseline and monitoring methodology AM0009 (Version 07.0) are applicable to the project, because the project meets all the applicability criteria as below:

Table 3.2-1 Justification of Methodology Applicable Conditions

No.	Applicability Condition	Project Activity compliance with Applicability condition	Whether satisfied
1	The methodology is applicable to project activities that recover and utilize the associated gas and/or gas-lift gas from oil fields that would have been either vented or flared in the absence of the project activity. The recovery may include the pre-treatment (compression and phase separation) in mobile or stationary equipment.	The proposed project will recover and utilize the associated gas from oil wells in Weizhou offshore oilfield that would have been flared in the absence of the project activity.	Yes
2	The methodology is applicable under the following conditions: (a) Under the project activity the recovered gas is transported to a gas pipeline with or without prior processing. Prior processing may include transportation to a processing plant where the recovered gas is processed into	The project activity meets the applicability conditions as description below: (a) Under the project activity, the recovered associated gas will be processed into dry gas and condensates. The dry gas will be separately transported via pipeline, and	Yes

	hydrocarbon products (e.g. dry gas, liquefied petroleum gas (LPG)). The dry natural gas is either: (i) transported to a gas pipeline directly; or (ii) compressed to CNG first, then transported by trailers/trucks/carriers and then decompressed again; and/or (b) All recovered gas comes from oil wells that are in operation and are producing oil at the time of the recovery of the associated gas and/or gas-lift gas; (c) Partial amount of the associated gas and/or gas-lift gas can be used on-site to meet on-site energy demands, i.e. to run auxiliary equipment prior to the implementation of the project activity and after the implementation of the project activity.	condensates will be transferred to storage tanks and then eventually transported by trailers. (b) All the involved oil wells are all in operation and are producing oil at the time of the recovery of the associated gas. The gas-lift technology is not involved in the project area. (c) In this project, there is no associated gas and/or gas-lift gas can be used on-site to meet on-site energy demands. Partial amount of the associated gas has been used on-site to meet on-site energy demands at the Weizhou terminal station.	
3	The methodology is only applicable if the application of the procedure to identify the baseline scenario and demonstrate additionality results in the venting and/or flaring of the associated gas and/or gas-lift gas at the oil production facility as the most plausible baseline scenario.	The identified baseline scenario of the project is the continuation of current practice of flaring of the associated gas at the oil production facility. The gas lift is not involved in the project.	Yes

Table 3.2-2 Compliance of the project activity regarding applicability conditions of mentioned tools

No.	Applicability Condition	Project Activity compliance with Applicability condition	Whether satisfied
1	The applicability conditions included in the tools referred "Baseline, project and/or leakage emissions from electricity consumption and monitoring of	Under the normal condition, the electricity consumption of Beihai first station is supplied only from the grid, so scenario (A) is applied. The electricity consumption of Weizhou	Yes

	electricity generation" is one of the following three scenarios applies to the sources of electricity consumption: (a) Scenario A: Electricity consumption from the grid. (b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). (c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities. This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage.	terminal station is from the off-grid fossil fuel fired captive power plants. Therefore, scenario B is also applied. The off-grid fossil fuel fired captive power plants also supply electricity to consumers/electricity consuming facilities in the Weizhou island. Therefore, scenario II is relevant with this project. This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario	

	The tool only accounts for CO_2 emissions.		
2	The applicability conditions included in the tools referred "Combined tool to identify the baseline scenario and demonstrate additionality". The tool is applicable to all types of proposed project activities. However, in some cases, methodologies referring to this tool may require adjustments or additional explanations as per the guidance in the respective methodologies. This could include, inter alia, a listing of relevant alternative scenarios that should be considered in Step 1, any relevant types of barriers other than those presented in this tool and guidance on how common practice should be established.	The project follows the requirements of methodology AM0009 to identify baseline scenarios and demonstrate additionality of the project. no adjustments or additional explanations are required, thus this tool can be applied. The detailed scenarios consideration will be described in section 3.4.	Yes
3	The applicability conditions included in the tools referred "Tool for the demonstration and assessment of additionality". The use of the methodological tool "Tool for the demonstration and assessment of additionality" is not mandatory for project owners when proposing new methodologies. Project owners may propose alternative methods to demonstrate additionality for consideration by the Executive Board. They may also submit revisions to approved methodologies using the additionality tool. Once the additionally tool is included in an approved methodology, its application by project owners	According to the methodology AM0009: when a benchmark analysis is applied, "Tool for the demonstration and assessment of additionality" should be followed. Therefore, the project follows the steps mentioned in the tool to assess a benchmark analysis. The detailed scenarios consideration will be described in section 3.4.	Yes

	using this methodology is mandatory.		
4	The applicability conditions included in the tools referred "Tool to calculate the emission factor for an electricity system". 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). 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 case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country. Under this tool, the value applied to the CO_2 emission factor of biofuels is zero	The electricity consumption of the Beihai first station will be supplied from the South Regional Power Grid (SRPG). The emission factor of SRPG for the electricity system should be calculated for the project emission according to this tool. According to the requirements of DNA of China, the calculation of emission factor of SRPG is based on the data from grid power plants. The project electricity system is located totally in China which is not an Annex I country. According to the calculation process of emission factor published by Chinese DNA, emissions from biofuels have not been considered, which is zero. Therefore, this tool is applicable for the proposed project.	
5	The applicability conditions included in the tools referred "Common practice". This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline	The methodological tools "Tool for the demonstration and assessment of additionality" and "Combined tool to identify the baseline scenario and demonstrate additionality" have been applied, so this tool can be applied. The detailed scenarios consideration will be described in section 3.5.	Yes

	scenario and demonstrate additionality", or baseline and monitoring methodologies that use the common practice test for the demonstration of additionality.		

3.3 Project Boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Combustion of fossil fuels at end-users that are produced from non-associated gas or other fossil sources	CO_2	Yes	Main source of emissions in the baseline
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project	Energy use for the recovery, pre-treatment, transportation, and if applicable, compression/ decompression, transportation of the recovered gas	CO_2	Yes	Main source of emissions in the project
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative

According to the methodology AM0009 (Version 07.0), the project boundary encompasses:

- The project oil field and oil wells where the associated gas is collected;
- The site where the associated gas would have been flared in the absence of the project activity;
- The gas recovery, pre-treatment, transportation infrastructure, including where applicable, compressors;
- The source of gas-lift gas: No gas-lift technology is involved in this project.

Figure 3-1 shows the baseline activity. In the baseline scenario, the associated gas is burned in the flaring system after being separated from the crude oil.

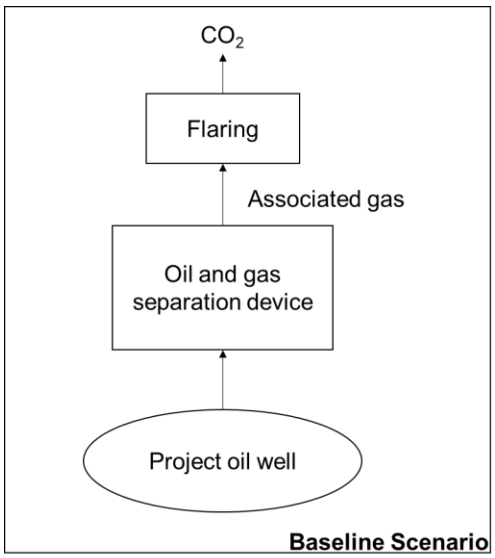

Figure 3-1: Schematic illustration of the baseline activity

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

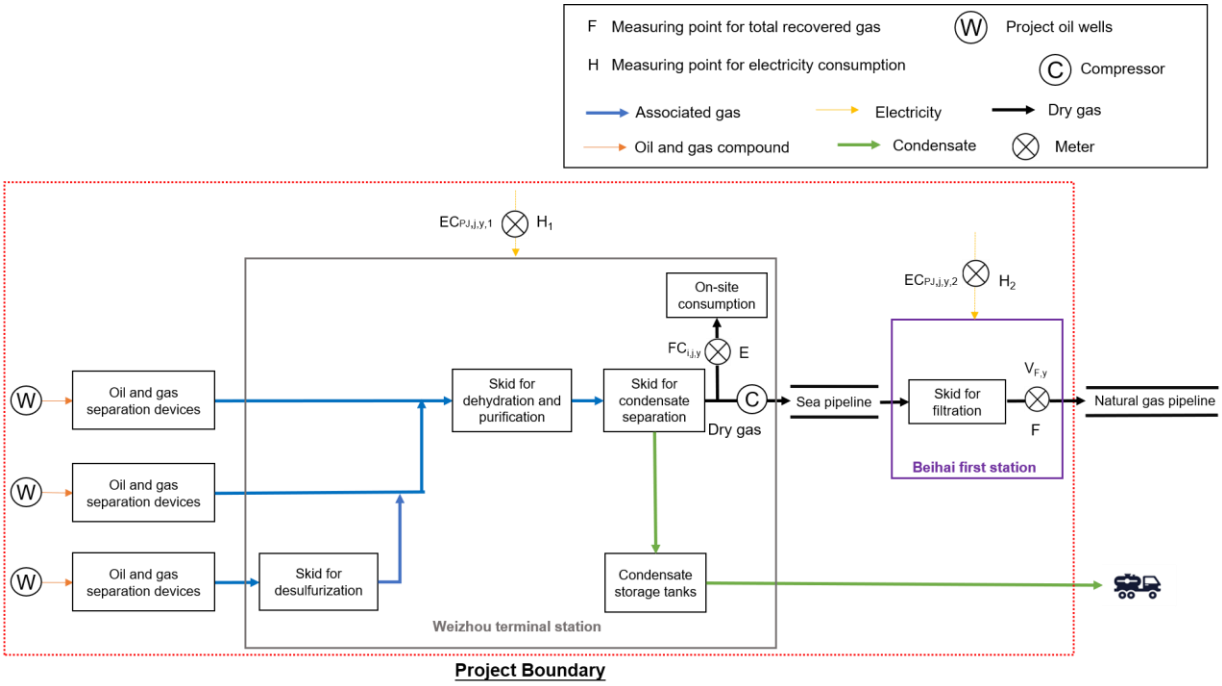

Figure 3-2: illustration of the project boundary

3.4 Baseline Scenario

According to the methodology AM0009 (Version 07.0), the baseline scenario is identified and description based on step 1 to 3 of the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 07.0) which is as follows:

Step 0: Demonstration that a proposed project activity is the first-of-its-kind

According to TOOL02, this step is not applied it shall be considered that the proposed project activity is not the first-of-its-kind. It proceeds to Step 1.

Step 1: Identification of alternative scenarios

This step serves to identify all alternative scenarios to the proposed project which can be the baseline scenario:

Step 1a: Define alternative scenarios to the proposed project

Alternative 1: The project activity not implemented as a VCS project

Alternative 2: Venting and/or flaring of the associated gas at the oil production facility

Alternative 3: Recovery and use of the associated gas in chemical industry

Alternative 4: Recovery and use of the associated gas to produce heat and/or electricity

Alternative 5: Recovery and use of the associated gas to use on-site

Step 1b: Consistency with mandatory applicable laws and regulations

According to the relevant laws and regulations of the People's Republic of China, the specific regulations and applicability of the alternatives are shown as follows:

In accordance with domestic laws and regulations, the alternative 2 is in line with applicable laws and regulations. According to "Pollution prevention and control Technology policy for oil and gas exploitation industry" published by the Ministry of Ecology and Environment, PRC[4] and "Emission standard of air pollutants for onshore oil and gas exploitation and production industry (GB 39728-2020)", in the process of oilfield development, if the project does not have the conditions for associated gas recovery and utilization, the recovered gas should be fully flared.

It is confirmed that Alternative 1 and 2 are both consistent with applicable laws and regulations.

"Policy on Natural gas Utilization"[5] published by National Development and Reform Commission, People's Republic of China, "taking into account the social, environmental and economic benefits of natural gas utilization and the characteristics of different users, natural gas projects are divided into priority, permitted, restricted, and prohibited."

Generally, natural gas chemical industry uses natural gas as a raw material to produce products such as methanol, acetylene, methyl chloride, or nitrogen fertilizer. According to "Policy on Natural gas Utilization", Article II-II-III "using natural gas as raw materials to produce synthetic

4 http://www.mee.gov.cn/ywgz/fgbz/bz/bzwb/wrfzjszc/201203/t20120319_224789.htm

5 http://www.gov.cn/gongbao/content/2013/content_2313190.htm

ammonia, using methane as raw materials to product chemicals such as acetylene and methyl chloride and the new nitrogen fertilizer are restricted". And Article II-II-IV, "newly build or expand methanol production equipment using natural gas as raw materials is prohibited". Therefore, it is not feasible to build a regular chemical plant here.

Thus alternative 3 is not consistent with applicable laws and regulations, and the recovering and using of associated gas and/or gas-lift gas to produce heat and/or electricity (alternative 4) or using on-site (alternative 5) are not prohibited from the related laws.

In a word, except alternative 3, the rest of alternatives are all in line with related laws in China. Therefore, these alternatives come to Step 2.

Step 2: Barrier analysis

Step 2a: Identify barriers that would prevent the implementation of alternative scenarios

For alternative 1, it faces investment barrier which will be demonstrated in step 3[6].

For alternative 2, it does not face any prohibitive barriers. It is the continuation of current situation and technically feasible. No additional investment or technology is required for the scenario.

For alternative 4: this alternative could face barriers as follows:

- There is no power demand for gas-fired power generation based on the situation that no other industrial facilities besides the oil field itself, and only limited resident's demand nearby, since the main project is in an island. If all the recovered associated gas will be used for electricity, it could only be supplied to the grid through transmission line. While existing power transmission line is used for supply power to the existing oil producing facilities, it is required a newly built high voltage transmission line, which is very expensive and makes the project even less attractive. Thus, it is unattractive for project owner to recover associated gas to produce electricity.
- In addition, no industrial demand except the oilfield itself. In addition, the heating required by the oilfield is limited, which have been already completely satisfied before the project implementation. Heat produced from associated gas could only supply to the end-users at a long distance. Considering the investment and the heat loss during the transportation, use of the associated gas to produce heat is not economic comparable with the project scenario.

In a word, alternative 4 is less economically attractive, compared with alternative 1.

For alternative 5: this alternative could face barriers as follow:

[6] The investment analysis will be detailed described in Step 3. Therefore, alternative 1 is inappropriate eliminated in Step 2 Barrier analysis.

There are several approaches for using of associated gas on-site:

- 1. Using associated gas on-site for electricity supply: Firstly, there are only oil wells and some facility for exploration and pretreatment. All the electricity demand of the on-site equipment has already been satisfied. Secondly, additional investment for gas generators and auxiliary equipment is needed. If associated gas was recovered for on-site electricity supply, the supplied amount will far exceed the on-site demand, and make mostly all associated gas would still be flared. Moreover, as stated above, if the associated gas would be recovered for electricity generation, it should be treated. Therefore, it is less economic to use associated gas on-site for electricity generation.
- 2. Using associated gas on-site for heat supply: Similar as above, the on-site heat demand has already been satisfied. Also, if associated gas was used for on-site heat supply, additional investment will be needed to retrofit boilers or replace boilers. The on-site demand of heat cannot cover all the recovered gas. Under this situation, most associated gas will still be flared. Thus, it is also economically unattractive for project owner to use associated gas on-site for heat supply.
- 3. Reinjection associated gas on-site or apply of gas-lift gas technology: There is no gas-lift or reinjection applied for this project.

In a word, this alternative is not a possible alternative for the baseline scenario.

Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

After step 2a, there are still two alternatives remained, which are alternative 1 and alternative 2.

Step 3: Investment analysis

The purpose of this step is to determine whether the project activity is not (a) most economically or financially, (b) economically or financially feasible, without the revenue from the sale of VCS.

The investment analysis is conducted in the following steps:

Sub-step 3a. Determine appropriate analysis method

As recommended by the methodological tool "Tool for the demonstration and assessment of additionality" (version 07.0.0), demonstration of investment barrier following the "Non-binding best practice examples to demonstrate additionality for SSC project activities" (EB 35 Annex 34), the following options could be applied:

(Option I) Simple cost analysis This analysis method can be used if the carbon reduction mechanism project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than carbon reduction mechanism related income. However, this option is not applicable to the project because the project will generate LNG sales revenue.

(Option II) Investment comparison analysis This analysis method can only be used if the alternatives to the project are similar investment projects. However, this option is not applicable here as the alternative is not a new investment project.

(Option III) Benchmark analysis According to *Economic Assessment Parameters for Construction Projects of China National Petroleum Corporation* version 2010[7], the Internal Rate of Return (after tax) of total investment for oil industry project is 12%. Thus, the benchmark analysis is applicable to the project.

Hence, **Option III benchmark analysis** is chosen and the Internal Rate of Return (IRR) is used to assess the financial viability of the project.

According to the methodology AM0009 (Version 07.0), the Internal Rate of Return (IRR) is used to assess the financial viability of the project.

Sub-step 3b. Apply benchmark analysis

The benchmark of project IRR for the oil industry project is 12% (after tax) which is referred to the Economic Assessment Parameters for Construction Projects of China National Petroleum Corporation version 2010. Accordingly, 12% is regarded as criterion for assessing whether the project is economically attractive, if the IRR of the project less than 12% (after tax), it is economically unattractive and meets the requirement of additionality.

Sub-step 3c. Calculation and comparison of financial indicators

The analysis shows that without the revenue of VCUs, the IRR of the project will be much lower than the benchmark 12%. The project is not financial attractive. Considering the VCU revenues, the IRR of the project will be more financial attractive. Thus, the VCU revenues will help project overcome the investment barriers.

The investment analysis shows the conclusion that the Alternative 2 is the most plausible baseline scenario.

Step 4: Common practice analysis

In Section 3.5. of the PDD, the common practice analysis will be described.

The above steps show the conclusion that the Alternative 2 is the most plausible baseline scenario.

3.5 Additionality

The additionality of the project is demonstrated by using the Tool for the Demonstration and Assessment of Additionality (Version 07.0.0). The Tool for the Demonstration and Assessment of

[7] Economic Assessment Parameters for Construction Projects of China National Petroleum Corporation issued by China National Petroleum Corporation (CNPC) in 2010, which is widely applied in economic evaluation among petroleum industry, and the post-tax internal return rate of 12% is taken as benchmark. This version is so far still valid, and no updated version is available.

Additionality provides a step-wise approach to demonstrate and assess the additionality. These steps include:

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Define realistic and credible alternatives to the project activity(s) through the following Sub-steps:

Sub-step 1a: Define alternatives to the project activity

According to the procedure for selection of the most plausible baseline scenario described in Section 3.4, the flaring of the associated gas at the oil production facility is the most plausible baseline scenario. Investment analysis step is used to identify the baseline scenario. The sensitivity analysis confirms the result of the investment comparison analysis. The detail of the investment analysis please refer to the Section 3.4.

Sub-step 1b. Consistency with mandatory laws and regulations

Except alternative 3 identified in Step 1a, the others are all in line with all current applicable law and regulations in China, but doesn't belong to mandatory scope.

Step 2. Investment Analysis

For detail of the investment analysis please refer to the Section 3.4.

Step 3. Barrier Analysis

In this section, no barrier analysis has been applied.

Step 4. Common Practice Analysis

Since the project activity is involved in the applied measure(s) that are defined in the "Tool for the demonstration and assessment of additionality" (Version 07.0.0), to demonstrate the project activity is not common practice following measure is applied, corresponding with "Methodological tool Common practice" (Version 03.1):

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

As the Project is an Associated Gas Recovery and Utilization Project with a processing capacity of 600,000 Nm^3/d. Based on this indicator, thus projects for producing processed gas with daily treatment capacity of 300×10^3 Nm^3/d ~ 900×10^3 Nm^3/d are considered as similar size.

Step 2: identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

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

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

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

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

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

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

In accordance with the guideline, the applicable geographical area should be the whole of China. As for the project, applicable geographical area is within Guangxi.

China covers an extremely large area which is divided into 34 provinces (or regions), According to the "China Energy Statistical Yearbook 2020"[8], the investment circumstance, policies and regulations and natural sources of each province (or regions) are different. For example, investment in oil and natural gas extraction over preceding year differs by provinces or regions, which also stated in the "China Energy Statistical Yearbook 2020". The types of terrestrial large oilfields in China are very complex. Different types of basins and zones have different types and characteristics of reservoirs. The activity is only involved in the Beihai city which is located in Guangxi Province. Therefore, it is better to choose Guangxi Province as the geographical area for the common practice.

The project implemented associated gas recovery and processing technology to get dry gas and condensates product. So, it is defined that project which recover associated gas from oil field and get dry gas and condensates product to be same measure comparable good and service as the project activity.

Taken into consideration the above-mentioned factors, and further considering the project start date on 2023, the projects recover and process associated gas from oil field to produce dry gas and condensates, with the capacity ranging from 300×10^3 Nm^3/d ~ 900×10^3 Nm^3/d in Guangxi province which has been in operation before 2023, are considered for further discussion.

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

There is no associated gas recovery project which have been in operating and fulfill the above-mentioned criteria, so N_{all} = 0.

[8] *China Energy Statistical Yearbook* is an annual statistical publication, which covers very comprehensive data in energy construction, production, consumption, equilibrium of supply and demand in all-round way, edited by Department of Industry and Transport Statistics, National Bureau of Statistics.

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

There is no associated gas recovery project which have been in operating and fulfill the above-mentioned criteria, so $N_{diff} = 0$.

Step 5: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

Calculate $F= 1- N_{diff}/N_{all} = 0$ and $N_{all}-N_{diff} = 0$, so it can be concluded that the project is not a common practice.

In above, it can be demonstrated this project is additional.

3.6 Methodology Deviations

There is no methodology deviations applied for the project.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions are calculated as follows:

$$BE_y = V_{F,y} \times NCV_{RG,F,y} \times EF_{CO2,Methane} \quad \text{Equation (1)}$$

Where:

BE_y = Baseline emissions in year y, (tCO_2e)

$V_{F,y}$ = Volume of total recovered gas measured at point F in figure 3-2, in year y, (Nm^3)

$NCV_{RG,F,y}$ = Average net calorific value of recovered gas at point F in figure 3-2, in year y, (TJ/Nm^3)

$EF_{CO2,Methane}$ = CO_2 emission factor for methane (tCO_2/TJ)

According to Equation (1), ex-ante estimation of annual baseline emissions is calculated as follows

$$BE_y = V_{F,y} \times NCV_{RG,F,y} \times EF_{CO2,Methane} \quad \text{Equation (2)}$$
$$= 210{,}000{,}000\ Nm^3 \times 0.000041174 TJ/Nm^3 \times 54.834\ tCO_2/TJ$$
$$= 474{,}124\ tCO_2e$$

Where:

$V_{F,y}$ is the volume of the recovered gas measured at point F

$NCV_{RG,F,y}$ is the average net calorific value of recovered gas measured at point F

$EF_{CO2,methane}$ is CO_2 emission factor for methane. The value is 54.834 tCO_2/TJ sourced from the methodology AM0009.

4.2 Project Emissions

Project emissions are calculated as follows:

$$PE_y = PE_{CO2,fossil\ fuels,y} + PE_{CO2,elec,y} \quad \text{Equation (3)}$$

Where:

PE_y = Project emissions in year y, (tCO_2e)

$PE_{CO2,fossil\ fuels,y}$ = CO_2 emissions due to consumption of fossil fuels for the recovery, pre-treatment, transportation, and if applicable, compression of the recovered gas up to the point F in year y (tCO_2e)

$PE_{CO2,elec,y}$ = CO_2 emissions due to the use of electricity for recovery, pre-treatment, transportation and if applicable, compression of the recovered gas up to the point F in year y (tCO_2e)

Project emissions from the consumption of fossil fuels

According to the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", $PE_{CO2,fossil\ fuels,y}$ is calculated as follows:

$$PE_{CO2,fossilfules,y} = PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y} \quad \text{Equation (4)}$$

Where:

$PE_{CO2,fossil\ fuels,y}$ = CO_2 emissions due to consumption of fossil fuels for the recovery, pre-treatment, transportation, and compression of the recovered gas up to the point F in figure 3-2 in year y (tCO_2e)

$PE_{FC,j,y}$ = The CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr)

$FC_{i,j,y}$ = The quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr)

$COEF_{i,y}$ = The CO_2 emissions coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)

i = The fuel types combusted in process *j* during the year *y*

According to the tool, Option B is selected by the project activity since the chemical composition of the emission factor of the generated dry gas is not certain, and some composition will be likely omitted, the necessary data which involved in Option A is not available.

$$COEF_{i,y}=NCV_{i,y}\times EF_{CO2,i,y} \quad \text{Equation (5)}$$

Where:

$COEF_{i,y}$ = The CO_2 emissions coefficient of fuel type i in year y (tCO_2/mass or volume unit)

i = The fuel types combusted in process j during the year y

$NCV_{i,y}$ = The weighted net calorific value of the fuel type i in year y (GJ/mass or volume unit);

$EF_{CO2,i,y}$ = The weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ)

Ex-ante estimation of project emissions from the consumption of fossil fuels is only caused by the consumption of dry gas (fossil fuels) for on-site consumption in the Weizhou terminal station and is calculated as follows:

$$PE_{CO2,fossilfules,y} = \sum_i FC_{i,j,y}\times NCV_{i,y}\times EF_{CO2,i,y} \quad \text{Equation (6)}$$

$$= 5{,}100{,}000\ Nm^3\times 0.041174\ GJ/Nm^3\times 0.0583\ tCO_2/GJ$$

$$= 12{,}243\ tCO_2e$$

$FC_{i,j,y}$ is the volume of dry gas combusted in the on-site facilities of the project measured at point E in Figure 3-2.

$NCV_{i,y}$ is the weighted average net calorific value of dry gas.

$EF_{CO2,i,y}$ is the CO_2 emission factor of dry gas of the project at point E in figure 3-2. The fixed calculation value is 0.0583 tCO2/GJ sourced from Table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories, which is a default value at the upper limit of the uncertainty at a 95% confidence interval.

Project emissions from consumption of electricity

According to "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", $PE_{CO2,elec,y}$ is calculation as follows:

$$PE_{CO2,ele,y}=PE_{EC,y}=\sum_j EC_{PJ,j,y}\times EF_{EL,j,y}\times(1+TDL_{j,y}) \quad \text{Equation (7)}$$

Where:

$PE_{EC,y}$ = CO_2 emissions due to the use of electricity for the recovery, pre-treatment, transportation, and compression of the recovered gas up to the point F in year y (tCO_2e)

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

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

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

j = Sources of electricity consumption in the project.

The Weizhou terminal station of the project will consume the electricity from the off-grid fossil fuel fired captive power plants. Therefore, scenario B2 "Use the conservative default value 1.3 tCO_2/MWh" under the project "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is chosen for ex-ante project emissions calculation.

Calculation of $PE_{CO2,elec,y,1}$:

According to Equation (7), ex-ante estimation of annual project emissions from consumption of electricity is calculated as follows:

$$PE_{CO2,elec,y,1} = EC_{PJ,j,y,1} \times EF_{EL,j,y,1} \times (1+TDL_{j,y}) \quad \text{Equation (8)}$$

$$= 24{,}754.80 \text{ MWh} \times 1.3 \text{ } tCO_2\text{/ MWh} \times (1+0.20)$$

$$= 38{,}618 \text{ } tCO_2e$$

Where:

$EC_{PJ,j,y,1}$ is the quantity of electricity consumption measured at point H_1 in figure 3-2.

$EF_{EL,j,y,1}$ is the electricity emission factor. The ex-ante calculation value is 1.3 tCO_2/ MWh which is sourced from Tool 05 - *Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*. During the monitoring period, this value could be calculated based on instruction from the Tool 05 if the relevant values are available.

$TDL_{j,y}$ is the average technical transmission and distribution losses of electricity. The fixed calculation value is 20% which is sourced from Tool 05 - *Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*.

The Beihai first station of the project will consume the electricity from the grid. Therefore, scenario A under the project "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is chosen. $EF_{EL,j,y,2}$ will applied the "Tool to calculate the emission factor for an electricity system (Version 07.0)".

Calculation of $EF_{EL,j,y,2}$:

Option A1 is chosen - Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j,y,2} = EF_{grid,CM,y}$).

In order to maintain consistency with the applied methodology, in the following the same symbols are used as in the methodology instead of the tool: $EF_{EL,j,y,2}$ (same as $EF_{grid,CM,y}$), $EF_{OM,y}$ (same as $EF_{grid,OM,y}$) and $EF_{BM,y}$ (same as $EF_{grid,BM,y}$).

The combined margin CO_2 emission factor for grid connected power generation in year y is calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (version 07.0).

The combined margin emission factor ($EF_{EL,j,y,2}$) consists of the weighted average of the OM emission factor ($EF_{OM,y}$) and the BM emission factor ($EF_{BM,y}$), as detailed below.

According to the "Tool to calculate the emission factor for an electricity system" (Version 07.0), the six steps below is to determine $EF_{EL,j,y,2}$.

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

For determining the electricity emission factors, identify the relevant project electricity system. The Option 1 provided in the methodology tool is applied, which is: A delineation of the project electricity system and connected electricity systems published by the DNA of the host country.

The Chinese DNA has published a delineation of the project electricity system and connected electricity system, therefore these delineations are used in accordance with the tool:

The project electricity system is the South Regional Power Grid ("SRPG"). The grid consists of independent province-level electricity systems including Guangdong Province, Guangxi Province, Yun'nan Province, Guizhou Province and Hai'nan Province grids that are physically connected through transmission and distribution lines. In accordance with the tool, SRPG has been selected as the relevant electric power system.

The detail of the calculation from ***Step 2 to Step 5***, please refer to the bulletin issued by Chinese DNA on 29/12/2020[9], in which $EF_{grid,OM,y}$ is 0.8042 tCO_2/MWh and $EF_{grid,BM,y}$ is 0.2135 tCO_2/MWh.

Step 6. Calculate the Combined Margin emissions factor

The Combined Margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM} \quad \text{Equation (9)}$$

Where

$EF_{grid,CM,y}$ = Combined Margin CO_2 emission factor in year y (tCO_2/MWh)

[9] http://www.mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/t20201229_815386.shtml

W_{OM} = Weighting of Operating Margin emissions factor (%)

W_{BM} = Weighting of Build Margin emissions factor (%).

According to "Tool to calculate the emission factor for an electricity system", the proposed project belongs to (b): all other projects. Therefore, W_{OM}=0.5, W_{BM}=0.5, $EF_{EL,j,y} = EF_{grid,CM,y}$ = 0.5*0.8042 tCO_2e /MWh +0.5*0.2135 tCO_2e /MWh = 0.50885 tCO_2e /MWh.

Calculation of $PE_{CO2,elec,y,2}$:

According to Equation (7) and (9), ex-ante estimation of annual project emissions from consumption of electricity in the Beihai first station is calculated as follows:

$$PE_{CO2,elec,y,2} = EC_{PJ,j,y,2} \times EF_{EL,j,y,2} \times (1+TDL_{j,y}) \quad \text{Equation (10)}$$

$$= 350\ MWh \times 0.50885\ tCO_2/\ MWh \times (1+0.20)$$

$$= 214\ tCO_2e$$

Where:

$EC_{PJ,j,y,2}$ is the quantity of electricity consumption measured at point H_2 in figure 3-2.

$EF_{EL,j,y,2}$ is the electricity emission factor of SRPG. The value is 0.50885 tCO_2/ MWh which is calculated per the "Tool to calculate the emission factor for an electricity system". The calculation details have been described as above.

$TDL_{j.y}$ is the average technical transmission and distribution losses of electricity. The fixed calculation value is 20% which is sourced from Tool 05 - *Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*.

In summary:

$$PE_y = PE_{CO2,fossilfules,y} + PE_{CO2,elec,y} \quad \text{Equation (11)}$$

$$= 12,243\ tCO_2e + 38,618\ tCO_2e + 214\ tCO_2e$$

$$= 51,075\ tCO_2e$$

4.3 Leakage

According to the methodology AM0009, leakage emissions shall be accounted for project activities where the recovered gas is transported to a processing plant where it is processed into hydrocarbon products (e.g. dry gas, LPG and condensates) and the dry gas is compressed to CNG first, then transported by trailers/trucks/carriers and then decompressed again, before it finally enters the gas pipeline. For other types of project activities, leakage emissions need not to be considered.

However, for this project the above-described situation that recovered gas is transported to a processing plant where it is processed into hydrocarbon products has already been accounted in the project emissions.

In summary, no leakage emission should be considered in this project.

4.4 Net GHG Emission Reductions and Removals

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (12)}$$

Where:

ER_y = Emission reductions in year y, (tCO_2e)

BE_y = Baseline emissions in year y, (tCO_2e)

PE_y = Project emissions in year y, (tCO_2e)

LE_y = Leakage emissions in year y, (tCO_2e)

Emission reductions calculation :

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (13)}$$
$$= 474{,}124\ tCO_2e - 51{,}075\ tCO_2e - 0\ tCO_2e$$
$$= 423{,}049\ tCO_2e$$

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)
09/04/2023-08/04/2024	474,124	51,075	0	423,049
09/04/2024-08/04/2025	474,124	51,075	0	423,049
09/04/2025-08/04/2026	474,124	51,075	0	423,049
09/04/2026-08/04/2027	474,124	51,075	0	423,049
09/04/2027-08/04/2028	474,124	51,075	0	423,049
09/04/2028-08/04/2029	474,124	51,075	0	423,049
09/04/2029-08/04/2030	474,124	51,075	0	423,049
09/04/2030-08/04/2031	474,124	51,075	0	423,049
09/04/2031-08/04/2032	474,124	51,075	0	423,049

09/04/2032-08/04/2033	474,124	51,075	0	423,049
Total	**4,741,240**	**510,750**	**0**	**4,230,490**

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{CO2,Methane}$
Data unit	tCO_2/TJ
Description	CO_2 emission factor for methane
Source of data	Calculated in line with procedures and data presented in ISO 6976: Unit / Value / Source Carbon Content of Methane / 12.011 kg/kmol / ISO 6976: Table 1 CO2 Emission Factor for Methane / 44.01 kg/kmol / ISO 6976: Table 1 NCV of Methane (at 25˚C) / 802.60 kJ/mol / ISO 6976: Table 3
Value applied	54.834
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{CO2,i,y}$
Data unit	tCO_2/GJ
Description	The weighted average CO_2 emission factor of dry gas at point E in year y;
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories

Value applied	0.0583
Justification of choice of data or description of measurement methods and procedures applied	The weighted average CO_2 emission factor of dry gas is obtained in accordance with the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". As option (a) is not available since the fuel supplier does not provide the values in invoices for each fuel delivery, option (d) "IPCC default values" is chosen: IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Purpose of Data	Calculation of project emissions from the consumption of fossil fuels
Comments	Review appropriateness of the values annually

Data / Parameter	$TDL_{j,y}$
Data unit	%
Description	Average technical transmission and distribution losses for providing electricity to source j in year y;
Source of data	Tool 05 - *Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation,* Data/ Parameter Table 3 default value 20% is applied
Value applied	20
Justification of choice of data or description of measurement methods and procedures applied	Default value of Data/ Parameter Table 3 was chosen only to project and/or leakage electricity consumption sources but not to baseline electricity consumption sources, and the electricity consumption of the project is greater than the electricity consumption of the baseline sources. Therefore, the conservative default value of CO_2 emission factor could be adopted from "Option A2: Use the following conservative default values" of *"Tool 05- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation".*
Purpose of Data	Calculation of project emissions from consumption of electricity
Comments	-

5.2 Data and Parameters Monitored

Data / Parameter	$V_{F,y}$

Data unit	Nm^3
Description	Volume of the total recovered gas measured at point F in year y.
Source of data	On-site measurement by using flowmeters.
Description of measurement methods and procedures to be applied	Data should be measured using calibrated flowmeters. Measurements should be taken at the point F in figure 3-2.
Frequency of monitoring/recording	Continuously
Value applied	210,000,000
Monitoring equipment	Flowmeters
QA/QC procedures to be applied	Volume of gas should be completely metered with regularly calibrated metering equipment as per relevant industry standard. The measured volume should be converted to the volume at normal temperature and pressure using the temperature and pressure at the time of measurement. The flowmeters will be calibrated by a third party regularly strictly following the relevant standard of host country. The flowmeter will be strictly equipped in accordance with relevant regulation. The data will be recorded in the computer, and paper record sheet will also be saved as a backup.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	$NCV_{RG,F,y}$
Data unit	TJ/Nm^3
Description	Average net calorific value of recovered gas at point F in figure 3-2 in year y
Source of data	Chemical analysis of gas samples by third party laboratory to measure $NCV_{RG,F,y}$
Description of measurement methods and procedures to be applied	Gas samples should regularly be taken at point F in figure 3-2 and the molar composition of each gas sample should be determined through chemical analysis following the procedures for QA/QC. Based on the molar composition, the Net Calorific Value on a

	volumetric basis should be determined for each sample in line with ISO 6976 and the same metering reference condition used for parameter $V_{F,y}$. The average NCV during the period y is defined as the arithmetic average of NCVs for the samples taken during the same period.
Frequency of monitoring/recording	Monthly
Value applied	41.174×10^{-6} TJ/Nm^3
Monitoring equipment	Chemical analysis of recovered gas samples
QA/QC procedures to be applied	Sampling will be carried out in accordance with GB/T 13609 which is equivalent to ISO10715. Composition analysis will be carried out in accordance with ISO 6974 or equivalent standard. The project owner will entrust a third-party laboratory which has an ISO 17025 accreditation to carry out the Composition analysis.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	$FC_{i,j,y}$
Data unit	Nm^3
Description	Volume of dry gas consumed on-site at point E in figure 3-2 in year y.
Source of data	On-site measurement by using flowmeters. If the measured data is not available during the monitoring period, the volume of dry gas consumed on-site will be calculated based on the rated power of facilities and the full operation hours.
Description of measurement methods and procedures to be applied	Data should be measured using calibrated flowmeters. Measurements should be taken at the point E in figure 3-2.
Frequency of monitoring/recording	Continuously
Value applied	5,100,000
Monitoring equipment	Flowmeters

QA/QC procedures to be applied	Volume of gas should be completely metered with regularly calibrated metering equipment as per relevant industry standard. The measured volume should be converted to the volume at normal temperature and pressure using the temperature and pressure at the time of measurement. The flowmeters will be calibrated by a third party regularly strictly following the relevant standard of host country. The flowmeter will be strictly equipped in accordance with relevant regulation. The data will be recorded in the computer, and paper record sheet will also be saved as a backup.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	$NCV_{i,y} = NCV_{RG,F,y}$
Data unit	GJ/Nm^3
Description	The weighted average net calorific value of dry gas consumed on-site, measured at point F in year y. Since there is no composition difference between the on-site consumed gas at point E and the recovered gas at point F. The $NCV_{RG,F,y}$ will be applied as the net calorific value of dry gas consumed on-site.
Source of data	Chemical analysis of gas samples by third party laboratory
Description of measurement methods and procedures to be applied	Gas samples should regularly be taken at point F and the molar composition of each gas sample should be determined through chemical analysis following the procedures for QA/QC. Based on the molar composition, the Net Calorific Value on a volumetric basis should be determined for each sample in line with ISO 6976 and the same metering reference condition used for parameter $V_{F,y}$. The average NCV during the period y is defined as the arithmetic average of NCVs for the samples taken during the same period.
Frequency of monitoring/recording	Monthly
Value applied	41.174×10^{-3} GJ/Nm^3
Monitoring equipment	Chemical analysis of recovered gas samples
QA/QC procedures to be applied	Sampling will be carried out in accordance with GB/T 13609 which is equivalent to ISO10715. Composition analysis will be

	carried out in accordance with ISO 6974 or equivalent standard. The project owner will entrust a third-party laboratory which has an ISO 17025 accreditation to carry out the Composition analysis.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	$EC_{PJ,j,y,1}$
Data unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source j measured at point H_1 at Weizhou terminal station in year y
Source of data	On-site measurement by using electricity meters. If the measured data is unavailable during the monitoring period, the quantity of electricity consumed at Weizhou terminal station will be calculated based on the rated power of facilities and the full operation hours.
Description of measurement methods and procedures to be applied	On site measurement by using electricity meters
Frequency of monitoring/recording	Continuously
Value applied	24,754.80
Monitoring equipment	Electricity meters
QA/QC procedures to be applied	The accuracy class of the meters should be in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements.
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$EC_{PJ,j,y,2}$

Data unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source j measured at point H_2 at Beihai first station in year y
Source of data	On-site measurement by using electricity meters
Description of measurement methods and procedures to be applied	On site measurement by using electricity meters
Frequency of monitoring/recording	Continuously
Value applied	350
Monitoring equipment	Electricity meters
QA/QC procedures to be applied	The accuracy class of the meters should be in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements.
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$EF_{EL,j,y,1}$
Data unit	tCO_2/MWh
Description	Emission factor for electricity generation for source j (Weizhou terminal station) in year y
Source of data	The ex-ante calculation value is from the conservative default value sourced from Tool 05 - *Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation* During the monitoring period, this value could be calculated based on the instruction from the Tool 05 if the relevant values are obtained. However, if the relevant values are not available the default value will be applied during the verification stage.
Description of measurement methods	If the calculated value could be applied, the quantity of fossil fuel fired in the captive power plant and the quantity of electricity

and procedures to be applied	generated in captive power plant during the monitoring period should be measured in line with the requirements in the Tool 05.
Frequency of monitoring/recording	Continuously, if the calculated value will be applied.
Value applied	1.3
Monitoring equipment	If the calculated value will be applied: Use either mass or volume meters to monitor the quantity of fossil fuel fired in the captive power plant. Use electricity meters to monitor the quantity of electricity generated in captive power plant.
QA/QC procedures to be applied	The consistency of metered fuel consumption quantities should be cross-checked with an annual energy balance that is based on purchased quantities and stock changes. Cross check measurement results with records for sold electricity where relevant
Purpose of data	Calculation of project emissions
Calculation method	If the calculated value applied, the equation (4) from the Tool 05 will be used to calculate the emission factor for electricity generation.
Comments	-

Data / Parameter	$EF_{OM,y}$
Data unit	tCO_2/MWh
Description	CO_2 operating margin emission factor of the SRPG
Source of data	Calculated value published by Chinese DNA
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	Yearly
Value applied	0.8042
Monitoring equipment	-
QA/QC procedures to be applied	-

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

Data / Parameter	$EF_{BM,y}$
Data unit	tCO_2/MWh
Description	CO_2 build margin emission factor of the SRPG
Source of data	Calculated value published by Chinese DNA
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	Yearly
Value applied	0.2135
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$EF_{EL,j,y,2} = EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Emission factor for electricity generation for source j (Beihai first sation) in year y / Combined margin emission factor for the grid in year y
Source of data	Scenario A of Tool 05 (Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation): Electricity consumption from the grid is applied. Option A1 is chosen, therefore, calculate the combined margin emission factor, using the procedures in the latest approved

	version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j,y} = EF_{grid,CM,y}$)
Description of measurement methods and procedures to be applied	Calculated as per the "Tool to calculate the emission factor for an electricity system". $EF_{grid,CM,y}=EF_{grid,OM,y}\times W_{OM}+EF_{grid,BM,y}\times W_{BM}$
Frequency of monitoring/recording	Yearly
Value applied	0.50885
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	Calculated as indicated in "Tool to calculate emission factor for an electricity system"

5.3 Monitoring Plan

1. Monitoring structure

Monitoring Manager

Responsible for monitoring management

Monitoring Staff

Responsible for monitoring works including:

- Data collection
- Maintenance of monitoring equipment
- Calculation of emission reductions
- Reporting of monitoring results

Figure 5-1 Management structure of monitoring

The required monitoring equipment will be installed by the project owner. The project will be operated by trained monitoring staffs that also collect data under the supervision of the monitoring manager who is in charge of filing and processing data and calculates the emission reductions. Following figure shows the management structure of the project.

The monitoring staffs are responsible for the installation and maintenance of monitoring equipment, recording and collecting monitoring results and monitoring data. The staffs will be trained and supervised by the monitoring manager. The monitoring manager will take the responsibility for calculation of the emission reductions and completion of the monitoring report.

2. Monitoring Equipment and Installation Positions

In the following figure indicates the monitoring points in the stations of the project:

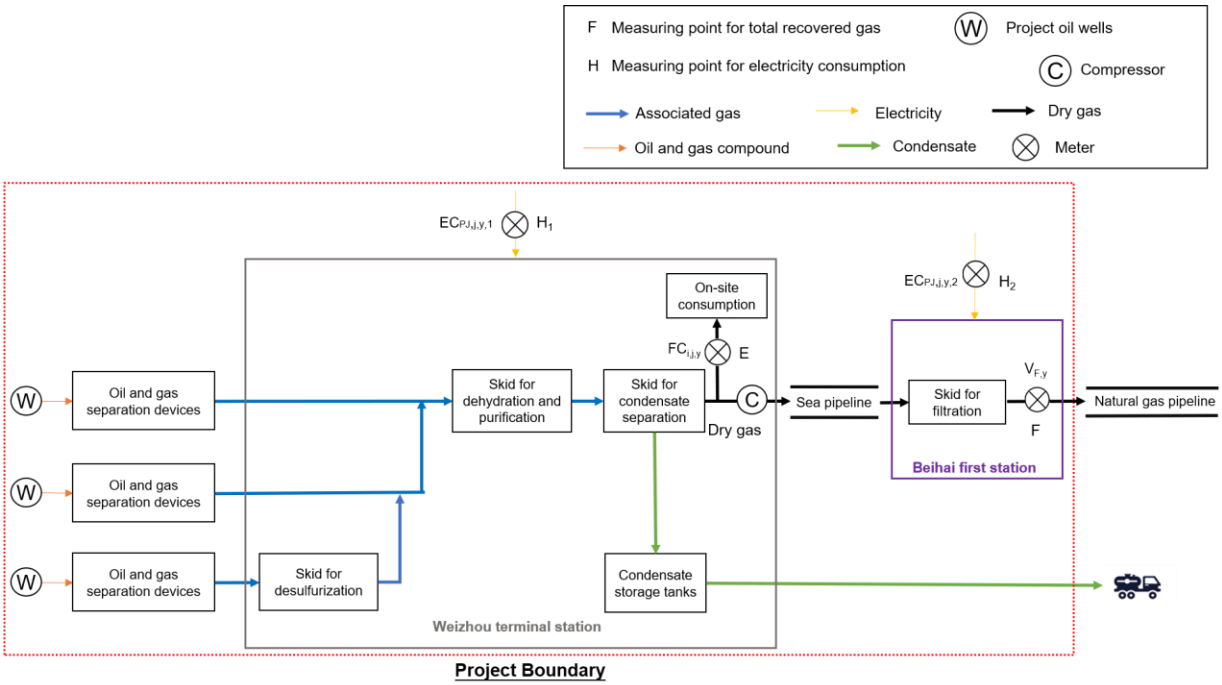

Figure 5-2 Schematic illustration of monitoring points in the stations

The monitoring equipment for project can be categorized into three types: the flowmeter for monitoring recovered gas, at point F, the flowmeters for monitoring on-site gas consumption at point E and the electricity meters at point H to measure the electricity consumption.

3. Quality Assurance, Quality Control

a) The project monitoring manager shall be responsible for the overall supervision of the operation of the project and takes the training and monitoring process carried out by staff. The monitoring staff will be in charge of collection of monitoring data and maintenance of relevant equipment to ensure the collected data is reliable and accurate.

b) All monitoring staff will obtain appropriate training to perform their activities in conformity with the requirements of the monitoring plan prior to take their job.

c) All data will be archived only after being checked by the monitoring manager.

d) The NCV measurement entity and instrument calibration entity will be both accredited as required.

e) All data will be backed up. When the equipment is in troubleshooting, monitoring data will be omitted from emission reductions.

f) Data should be recorded from readings of monitoring instruments regularly, and be archived by means of electronic and paper backup.

g) The project owner should entrust the third-party to regularly calibrate the flowmeter and electricity meter according to the relevant industry standards. The accuracy of flowmeters and the flowmeters will be strictly equipped in accordance with relevant regulation. The accuracy of electricity meters will be strictly equipped in accordance with relevant regulation.

4. Data Storage and Filling

All monitoring data will be recorded and stored by paper. An electronic copy will be saved as the backup document as well.

5. Measures to take in case of malfunction in major meters and equipment

In case of any erroneous measurement or malfunction in gas flowmeter or electricity meter, the project owner will take actions to maintain or displace the broken meter.

All of emergency event and meters displacement action will be recorded in the event report and worksheet. And all data are backed up. When the equipment is in troubleshooting, monitoring data are omitted from emission reduction calculations.

6. Monitoring report

Emission reductions will be calculated based on amount of recovered associated gas, the on-site consumption of dry gas and the electricity for associated gas processing. The monitoring report will be completed by the monitoring manager with the content of the monitoring data, calibration records, and process flowchart of processing station for reference, in which the locations of monitoring equipment will be clearly indicated.

APPENDIX

Use appendices for supporting information. Delete this appendix (title and instructions) where no appendix is required.