CYY Biopower wastewater treatment plant Gold Standard PDD

Additional PDD Annex as required for Gold Standard validation (GS v. 1)

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Introductory Notes

This document contains the PDD Annex to validate the 2.72 MW CYY Biopower Captive Energy Project against the Gold Standard. Gold Standard validation shall be carried out in parallel with regular CDM validation.

The proposed project entails the installation of an upflow anaerobic sludge blanket technology (UASB) biogas reactor for treatment of wastewater and up to 2.72 MWel gas engine at an existing starch production plant for steam and power generation. The project activity implies a series of sustainable development aspects including technology transfer and innovation, environmental and social benefits.

The biogas produced in the anaerobic digester will be captured and sent to biogas boilers and generators to generate heat and electricity. In the absence of the project activity, the wastewater from the starch production would be treated in an open anaerobic lagoon releasing methane from the anaerobic decay of the organic content in the wastewater into the atmosphere. The biogas replaces heavy fuel oil for heat generation in the starch production process. Electricity that is generated with biogas by the project activity will displace fossil fuel based electricity generation from the grid, further contributing to greenhouse gas emission reductions. Other benefits from the project include a significant reduction of odour emissions from the previously used lagoon system, technology transfer, and creation of employment opportunities.

Project Type Eligibility Screen

GS Manual for CDM Project Developers: **Section 3.2**

The project activity falls under category "A.1. Renewable Energy (Electricity/Heat)", sub-category "A.1.1.2. Biogas", which applies to methane recovery from wastewater treatment, as specified in Appendix A of the Gold Standard Manual for CDM Project Developers.

The project activity fulfils the eligibility requirements of the Gold Standard for biogas projects as follows:

- Biogas used in the project activity is derived from wastewater coming from a cassava based starch production process;
- Biomass resources (wastewater) used for the project would have led to greenhouse gas emissions in open anaerobic lagoons in the absence of the project;
- The biogas will reduce the use of fossil fuel by using the biogas in an existing boiler to generate steam, and the use of the biogas for power generation;

- All biogas will be used for electricity and thermal generation. A flare will only be used in the case of emergency. Therefore, the project complies with the minimum 65% biogas usage threshold defined by the Gold Standard to deliver energy services from biogas projects[1].

Gold Standard Additionality Screen

Previously announced projects screen

GS Manual for CDM Project Developers: **Section 3.3.1**

There has been no public announcement of the project going ahead without the CDM, prior to any payment being made for the implementation of the project.

In early 2006, prior to construction start in August 2006, the project activity signed a CDM service agreement (see Section B.5 of the PDD for more information). Furthermore, in order to attract the necessary financial investments, the project developer entered negotiations with the Austrian JI/CDM Programme prior to the implementation of the project. Upfront payments provided by the Austrian JI/CDM Programme have played an essential role in reaching financial closure of the project. Therefore, as explained in detail below, the project activity was not announced without CDM consideration and would not have happened without CDM.

UNFCCC Additionality Tool (EB 39 Report Annex 10, Version 05)

GS Manual for CDM Project Developers: **Section 3.3.2 "Tool for the demonstration and assessment of additionality" (version 05)**

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

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

1. Status-quo: open anaerobic lagoon based wastewater treatment system
2. Proposed project activity undertaken without being registered as CDM project activity
3. Aerobic wastewater treatment
4. Direct discharge
5. Methane recovery and flaring

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

Alternatives 1, 2, 3 and 5 are in compliance with current regulations in Thailand, which allow the use of open lagoon systems and other waste treatment technologies that meet effluent standards for the discharge of treated wastewater into the environment. There is no other regulatory requirement for the implementation of a specific wastewater treatment technology such as anaerobic digester or aerobic treatment system to cassava processing plants. Therefore, Alternatives 1, 2, 3 and 5 do not face any legal barriers.

Alternative 4 would violate effluent discharge standards set by the laws and regulations of Thailand. Therefore, Alternative 4 cannot be considered the baseline and is excluded from further assessment.

Step 2. Investment Analysis
The additionality tool requires either an investment analysis or a barrier analysis. A barrier analysis has been conducted for the proposed project.

Step 3. Barrier Analysis

[1] For reference, a calculation has been made to demonstrate that biogas requirement for energy service delivery amounts to 14,609,808 Nm^3 per year, whereas the biogas generation potential at the plant only amounts to 9,648,990 Nm^3. Therefore the standard operating intent is that the project will use all the generated biogas to deliver energy services.

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM activity

1. Technical barriers
2. Investment barriers
3. Social barriers
4. Prevailaing practice barriers

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project alternative):

Technical barriers

Alternative 1 is a common wastewater handling practice in tapioca starch production sites in Thailand. Most of the tapioca starch production facilities in the project region are either utilizing open lagoon based systems for treating wastewater or used to have such systems prior to implementation of CDM project activities (see common practice analysis below for more details). The related technology, skills and labour to build and operate open anaerobic lagoon systems are readily available in Thailand and there are few risks associated with this technology. Therefore, Alternative 1 does not face technical barriers.

For *Alternative 2*, project operators have to acquire (through contracting or in-sourcing) the skills and labour to operate and maintain such a facility properly. Personnel for the operation of these plants need to go through extensive training. Experience from CDM projects that use similar technology (where methane is recovered and utilized for heat generation while the remaining methane is flared), has shown that this technology has faced substantial performance problems due to the inexperience in operating and monitoring. Under baseline conditions, substantial technical barriers remain for the proposed activity being undertaken without being registered as CDM project activity.

Alternative 3 is well established and commonly used for both domestic and industrial wastewater treatment in many parts of the world. However, there is no experience with this type of technology in the tapioca starch industry in Thailand and no starch factory operator considers the use of this technology a viable option at this point in time. This is mainly due to commercial reasons since aerobic systems would lead to extremely high operational costs due to high electricity consumption and high sludge production, and the associated disposal costs. Considering the lack of interest and lack of commercial viability of this technology for starch effluent treatment, technical barriers are deemed irrelevant.

Project operators do not consider *Alternative 5* due to commercial reasons as it creates no income streams and is not required by law. Technical reasons are deemed irrelevant.

Investment barriers

Alternative 1 is currently in operation and creates acceptable operational costs to achieve compliance with domestic effluent regulation. It does not face any financial barrier.

Alternative 2 entails high investment and Operation and Maintenance (O&M) costs and uncertain commercial returns (from the production and use of biogas). Prior to project implementation, the project owner assessed the costs, potential returns and risks of the proposed activity and came to the conclusion that given the high investment costs and insecure returns due to technological risks, the company would not be able to implement the project without long-term financial returns linked to CERs and potential investment from CER buyers. The proposed project activity could only reach financial closure due to upfront CER payments released from the CER buyer to CYY Biopower Co. Ltd. The owners of CYY Biopower faced difficulties to attract both equity and debt to finance the project. The credit line of the company with its commercial bank was exhausted. The project owners saw no other way to finance the project except with the upfront CDM payment provided by Kommunalkredit GmbH on behalf of the Austrian government. Evidence of the upfront payment and the financial background of the project has been provided to the DOE.

Alternative 3 entails high investment and very high O&M costs. The major reason for high O&M costs for treating wastewater with high organic content in aerobic systems is the very high electricity demand for forced aeration and high costs associated to sludge disposal as compared to anaerobic treatment systems. Due to high investment and O&M costs and the lack of commercial returns from energy production or energy saving (as no biogas is produced), the financial barrier for this type of technology is insurmountable and therefore this alternative is excluded from further analysis.

Alternative 4 is already excluded.

Alternative 5 also entails high investment and O&M costs along with no commercial return as the produced biogas is destroyed without use. The financial barriers are insurmountable and this alternative is excluded from further analysis.

Social barriers

Alternative 1 is currently used at the Project site and is common practice in Thailand, no social barriers are identified.

Alternative 2 faces certain social barriers associated with the lack of understanding of the technology. Whilst there are a lot of discussions taking place about the technology, technical understanding of the involved processes (biological, chemical and physical) is poor., Therefore decision-making is uninformed and slowing the uptake of this technology. Furthermore, it is known that many biogas projects in Thailand have not performed as expected and some have failed. There is no market study, which could provide an accurate analysis of the status quo of installed projects and the perception of the technology in Thailand. With the increased availability of operational experience, this barrier is likely to become less relevant in the future. Given the lack of studies to confirm this barrier, a decision was made to determine this barrier as being non-existing for Alternative 2 in order to be conservative.

Alternatives 3 to 5 have been excluded already.

Prevailing practice barriers

Alternative 1 is currently used for wastewater treatment and meets all regulatory requirements of Thailand. Therefore there is no prevailing practice barrier for this alternative.

Interest in *Alternative 2* as a substitute is largely driven by the prospect of the generation and use biogas, in conjunction with the production of carbon credits. There is no foreseeable regulatory change that would mandate treatment standards to this level and despite this Alternative 1 usually exceeds regulatory requirements for water effluent discharge. Therefore, prevailing practice barriers exist due to existing and future lack of regulatory pressure to adopt Alternative 2.

Conclusion of Barrier Analysis:

As discussed above, *Alternative 1* - continuation of the current situation - does not face any significant barriers while *Alternative 2* - anaerobic digestion system - and *Alternative 3* - aerobic treatment system - face a number of technical, financial and prevailing practice barriers, which prevent the implementation of these alternatives under baseline conditions. *Alternative 4* is non-compliant with the law and *Alternative 5* is not considered by project operators due to commercial reasons as it creates no income streams and is not required by law.

Alternative 1 is the only alternative that does not face any barriers. Based on the above arguments it can be concluded that in the absence of CDM, Alternative 1 (continuation of the current open lagoon based wastewater treatment system) would be considered the baseline scenario. It can also be concluded that it would not be possible to overcome the barriers that *Alternative 2* faces without CDM.

Step 4. Common practice analysis

The proposed CDM project is not the first-of-its-kind. Hence, a common practice analysis is conducted.

Sub-step 4a. Analyze other activities similar to the proposed project activity

According to the Tool for the demonstration and assessment of additionally, projects are considered "similar" in case where they;

- are located in the "same country/region",
- are of "similar scale", and
- "take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc".

The common practice analysis is conducted based on data that reflects the situation in Thailand around the time of investment decision for this particular project activity.

Based on data in 2007, there was an average of 6.52[2] million of rais[3] of cassava cultivation areas in Thailand, most of which is located in the Eastern and Northeastern regions, especially Nakorn Ratchasima (where the project is located), Chaiyaphum and Kalasin provinces. In total, there are 85 native starch factories, mostly located in the Northeastern (46%) and in the Eastern region (33%) of the country, followed by the Central (14%) and the Northern region (7%), respectively[1]. The starch factories are normally closely distributed in the cassava cultivation areas. Furthermore, cassava cultivation and starch production practices do not vary significantly throughout the country. Thus, Thailand is chosen as the common practice comparison region.

In Thailand, most of the wastewater management systems for starch production plants are open anaerobic lagoons[4], which require little investment, have low operation and maintenance costs and fulfill the national regulations for wastewater discharge. From 85 starch factories 25[5] have installed anaerobic digesters (29.4%) around 2007, when the investment decision for the proposed project activity was made. Thus, the proposed project needs to be compared with a total of 25 projects.

Sub-step 4b. Discuss any similar options that are occurring

From the 25 projects, one project has been registered by the CDM Executive Board as in Table B.1, another 13 projects, including the proposed project, have received the letter of approval from Thai DNA, and have made details available for public comment on the UNFCCC CDM website as in Table B.2. Four projects have all made requests recently to receive the letter of approval from Thai DNA and are initiating the CDM application process including the proposed project as in Table B.3. The remaining 7 projects are currently undergoing validation and initial verification under VER standards as in Table C.1[6]. These projects had an intention to register under CDM; however, due to delays in establishing the Thai DNA and the subsequent standstill of the DNA's work during the political turmoil surrounding the military coup (and the interim government from 2006/2007), these projects could not apply for CDM and opted for the voluntary carbon market.

Thus, none of the 25 installed biogas reactor projects are being implemented without taking additional revenues from carbon credits into account, which reinforces the credibility of the existence of similar barriers that avoid these projects from being successfully implemented without consideration of carbon credits.

Table B.1: Project registered by the CDM Executive Board

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[2] Source: http://www.thaitapiocastarch.org/article05.asp

[3] A rai is a unit of area, which is equal to 1,600 square meters (40 m x 40m), used for measuring land area. It is commonly used in Thailand.

[4] Source: http://www.thaitapiocastarch.org/article01.asp

[5] Source: Biogas promotion report from Ministry of Energy.
http://cdm.unfccc.int/UserManagement/FileStorage/S1XU6WGJZ7L98IFKRNBC3E0AHDT4Q2

[6] Source: South Pole Carbon Asset Management's projects. A copy of the company's project management tool is enclosed in Attachment 2.

No.	Project Title	Project Developer
1	Korat Waste to Energy (KWTE)[7]	Korat Waste to Energy Company Ltd.

Table B.2: Projects available for public comments on the UNFCCC CDM website

No.	Project Title	Project Developer
1	Eiamburapa Campany Ltd. Tapioca Starch wastewater biogas extraction and utilization project, Sakaeo Province, Kingdom of Thailand[8]	Eiamburapa Co.,Ltd
2	Siam Quality Starch Wastewater Treatment and Energy Generation Project in Chaiyaphum, Thailand[9]	Siam Quality Starch Co.,Ltd
3	C.P.A.T tapioca processing wastewater biogas extraction and utilization project, Nakhonratchasima Province, Kingdom of Thailand[10]	Corn Product Amardass (Thailand) Ltd.
4	Wastewater treatment with Biogas System in a Starch Plant for Energy and Environment Conservation in Nakorn Ratchasima[11]	Sima Interproduct Co.,Ltd.
5	Chok Chai Starch Wastewater Treatment and Energy Generation Project in Uthai Thani, Thailand (the Project)[12]	Chok Chai Starch Co.,Ltd.
6	Kalasin Wastewater Treatment to Energy[13]	Kalasin Waste to Energy Ltd
7	Northeastern Starch (1987) Co.,Ltd. – LPF Fuel Switching Project[14]	Northeastern Starch (1987) Co., Ltd.
8	Jiratpattana Biogas Energy Project[15]	Thai Biogas Energy Company
9	Kitroongruang Biogas Energy Project[16]	Thai Biogas Energy Company
10	Chao Khun Agro Biogas Energy Project[17]	Thai Biogas Energy Company
11	Cassava Waste To Energy Project, Kalasin, Thailand (CWTE project)[18]	Cassava Waste To Energy Co., Ltd.
12	Wastewater Treatment with Biogas System (AFFR) in a Starch Plant for Energy & Environment Conservation at Chachoengsao[19]	Sima Interproduct Co.,Ltd.

[7] Source: http://cdm.unfccc.int/Projects/DB/KPMG1175141470.89/view
[8] Source: http://cdm.unfccc.int/Projects/Validation/DB/A8JT0K03JKGLSDSV1O1Y0JISTYYNHN/view.html
[9] Source: http://cdm.unfccc.int/Projects/DB/SGS-UKL1217944948.76/view
[10] Source: https://cdm.unfccc.int/Projects/Validation/DB/577FGXFHP9SZENI4QQNQS4I51GPWV0/view.html
[11] Source: http://cdm.unfccc.int/Projects/Validation/DB/STKRYOPZAL8SQYQUSJDJ3SFZRFBWEI/view.html
[12] Source: http://cdm.unfccc.int/Projects/Validation/DB/LQTJF5681NVDBMDZ353AK88VQOJ0YS/view.html
[13] Source: http://cdm.unfccc.int/Projects/Validation/DB/D7GX65CTGLH8Y7WW6EQSD567Q6TYNJ/view.html
[14] Source: http://cdm.unfccc.int/Projects/Validation/DB/W6LK3QZGNWBK541V7XOM5ZUK7PJA63/view.html
[15] Source: http://cdm.unfccc.int/Projects/DB/DNV-CUK1218619436.44/view
[16] Source: http://cdm.unfccc.int/Projects/Validation/DB/EMVWWRZQUBBJ97FX1D3I9SA6CWJEP2/view.html
[17] Source: http://cdm.unfccc.int/Projects/DB/DNV-CUK1218616482.16/view
[18] Source: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1218551520.16/view

13	CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand[20]	CYY Bio Power Co Ltd

Table B.3: Projects having requested LoA

No.	Project Title	Project Developer
1	Wastewater Treatment with Biogas Technology in a Tapioca processing plant at Roi Et Flour Company Limited, Thailand[21]	Roi-Et Flour Co., Ltd.
2	Wastewater Treatment with Biogas Technology in a Tapioca processing plant at P.V.D. International Company Limited, Thailand[22]	P.V.D International Co.,Ltd
3	Eiamheng Tapioca Starch Industry Co., Ltd. Tapioca starch wastewater biogas exatraction and utilization project, Nakornratchasima Province, Kingdom of Thailand[23]	Eiamheng Tapioca Starch Industry Co.,Ltd.

Table C.1: Projects applying for VER[24]

No.	Project Title	Project Developer
1	Banpong Tapioca Flour Industrial wastewater treatment and biogas utilisation project	Banpong Tapioca Flour Industrial Co.,Ltd
2	SD BioSupply wastewater treatment and biogas utilization project	SD Biosupply Co.,Ltd
3	VP BioSupply wastewater treatment and biogas utilization project	VP Biosupply Co.,Ltd
4	Chol Charoen Group Wastewater Treatment with Biogas System (Chonburi)	Chol Chareon Co., Ltd.
5	Chol Charoen Group Wastewater Treatment with Biogas System (Srakaew)	Srakeaw Chareon Co., Ltd,
6	Chol Charoen Group Wastewater Treatment with Biogas System (Khon Kaen)	Kean Chareon Co., Ltd.,
7	Chol Charoen Group Wastewater Treatment with Biogas System (Kampangpet)	Kean Chareon (II) Co., Ltd.
8	Chol Charoen Group Wastewater Treatment with Biogas System (Chacheongsoa)	S.C. Industry Co., Ltd.,

ODA Additionality Screen

GS Manual for CDM Project Developers: **Section 3.3.3**

[19] Source: http://cdm.unfccc.int/Projects/Validation/DB/PGE32ZZPYJSAJ4ACZ6ER89YSSI59M7/view.html

[20] Source: http://cdm.unfccc.int/Projects/DB/RWTUV1218617500.62/view

[21] Source: http://www.tgo.or.th/english/index.php?option=com_content&task=view&id=17&Itemid=29 The Danish Government has entered a CER purchase agreement with the project (see http://www.danishcarbon.dk/OurProjects/cdmprojects/Thailand/RoiEtFlourCompany/)

[22] Source: http://www.tgo.or.th/english/index.php?option=com_content&task=view&id=17&Itemid=29

[23] Source: http://www.tgo.or.th/english/index.php?option=com_content&task=view&id=17&Itemid=29

[24] Source: South Pole Carbon Asset Management's projects. A copy of the company's project management tool in enclosed in Attachment 2.

Project financing for this project activity will not use Official Development Assistance (ODA) Funds as defined in the Gold Standard Manual for Project Developers. There are no loans or grants being provided by International Financial Institutions, which include ODA. For clarification, the tables below summarise the financing plan of the project activity:

Investment in the project activity	**Total (EUR)**
Contract for UASB system (excluding civil work)	1,157,894
Gas engines (x 2)	1,166,220

Source of Investment	**Total (EUR)**	**Share (%)**
Equity funding	446,220	**19%**
Debt funding (THB 55,000,000)	1,157,894	**50%**
Upfront CDM payment	720,000	**31%**
Total	**2,324,114**	**100%**

To confirm the same, a written document from the project owner, along with the financing plan, demonstrating that no ODA was used for financing the project is provided to the DOE.

Conservative Approach

GS Manual for CDM Project Developers: **Section 3.3.4**

The baseline scenario selection and the calculation of green house gas emission reductions have been carried out in a conservative manner:

- Project proponents have used an approved methodology by CDM Executive Board (AM0022 – Avoided Wastewater and On-site Energy Use Emissions in the Industrial Sector, Version 04) in order to determine the baseline scenario and calculate emission reductions.
- Likely baseline scenarios have been developed and assessed using guidance provided by the methodology AM0022. A set of quantified scenarios have been described and the most conservative baseline scenario has been selected.
- Calculations have been done in a transparent manner providing full documentation and references to data sources to the DOE.

Please refer to the PDD Sections B.3, B.4, B.5 and B.6 for more details on project boundary definition, baseline scenario selection and emission reductions calculation.

Technology Transfer and Knowledge Innovation

GS Manual for CDM Project Developers: **Section 3.3.5**

The project activity results in technology and knowledge innovation related to:

- Implementation of an advanced biogas reactor system, reusing biogas as fuel for heat and electricity production. As compared to the baseline scenario, the installed wastewater treatment system consists of a highly efficient process for wastewater treatment based on state

of the art technology from one of the leading anaerobic reactor suppliers in the world, which comply with stricter wastewater discharge standards than the Thai regulations;

- The technology applied in the project originates from a Belgian company, leading to knowledge transfer. Core elements of the biogas reactor as well as the biogas engine to produce electricity are imported, also leading to technology transfer;
- The anaerobic digester requires specially trained skilled staff to operate and maintain the power plant, creating employment and leading to knowledge transfer to the host country and furthermore, to an under developed and rural region of the country.
- Geographically, transfer of technology and know-how has occurred mainly from North to South and from urban to rural areas.

Sustainable Development

Sustainable Development Assessment

GS Manual for CDM Project Developers: **Section 3.4.1**

The sustainable development assessment matrix presented in the table below is based on a comparison of the project activity versus an anaerobic lagoon as the baseline.

Any project seeking to obtain the Gold Standard must demonstrate clear benefits in terms of sustainable development. The contribution of the proposed project activity to the sustainable development of the country is based on indicators of three broad **components**:

- Local/global environment sustainability;
- Social sustainability and development;
- Economic and technological development.

The indicators within these three components are set out in the Sustainable Development Assessment Matrix (see Box 3 below). They do not provide "yes" or "no" answers, but a rating of how the project performs against a series of parameters, based on quantitative and/or qualitative assessment. The project's performance must be assessed using the following **scoring system**:

-2:	major negative impacts, i.e. where there is significant damage to ecological, social and/or economic systems that cannot be mitigated through preventive (not remedial) measures.
-1:	minor negative impacts, i.e. where there is a measurable impact but not one that is considered by stakeholders to mitigate against the implementation of the project activity or cause significant damage to ecological, social and/or economic systems.
0:	no, or negligible impacts, i.e. there is no impact or the impact is considered insignificant by stakeholders.
+1:	minor positive impacts
+2:	major positive impacts

For each indicator in the matrix, a score between -2 and +2 has been assigned.

The sustainable development assessment matrix is applied to the CYY Biopower wastewater treatment plant as follows:

Component Indicators	**Score** (-2 to +2)	**Rationale (and reference)**
Local / Regional / Global Environment		
• Water quality and quantity *	+2	There is a significant improvement in water quality due to the implementation of a more efficient and reliable effluent treatment system. The wastewater discharged after the effluent treatment process will

		meet the standards and requirements of national regulation. Some of the treated wastewater will be reused in the process (Zero Discharge), which contributes to a significant improvement in terms of water quantity. Risks of groundwater contamination due to leakage of organic pollutants from the bottom of the lagoons into the groundwater are also reduced[25].
• Air quality (emissions other than GHG) *	+2	By replacing the open anaerobic lagoon with an enclosed biodigester, the project significantly contributes to an improvement of odour emissions, which has a substantial impact on quality of life for the employees at the starch plant and residents living in the area close to the lagoons. Furthermore, air quality is improved substantially compared to emission levels (SO_x and NO_x) related to fossil fuel combustion, which is displaced by the use of biogas from the project activity for thermal energy generation. Emissions from the project will be reduced thanks to the enclosed bio-digester and controlled combustion of the biogas[26].
• Other pollutants (including, where relevant, toxicity, radioactivity, POPs, stratospheric ozone layer depleting gases)	0	Apart from water, soil and air pollutants mentioned in this matrix, no other relevant pollutants have been identified[27].
• Soil condition (quality and quantity)	0	There is no significant difference relative to the baseline scenario. However, it can be argued that compared to open lagoons, the biodigester allows for an easier handling of the produced sludge[28]. Furthermore, this sludge can reduce the need for synthetic fertilisers, thus improving the soil quality[29]. To be conservative, a neutral score is given for this indicator.
• Biodiversity (species and habitat conservation)	0	As compared to the baseline, no significant change in biodiversity is expected (although a reduction of pathogens due to the improvement in the overall effluent treatment system might be observed, with a potential benefit on plant, animal and human health)[30].
Sub Total	**+4**	
Social Sustainability and Development		
• Employment (including job quality, fulfilment of labour standards)	+1	The project leads to employment generation in the power plant itself and in the operation and maintenance of the biogas system, with the creation of

[25] The details, including explanation on the zero discharge, are available in the IEE, section 8.2.1, page 28. Risks of groundwater are explained in IEE section 6.3.3, page 20.

[26] Please see the Air Pollution Certificate under Attachment 4 and the IEE, section 4, page 7.

[27] This point is substantiated through information in the IEE.

[28] Please see the IEE, section 6, page 21.

[29] Source: NREC, *"Anaerobic Digestion Of farm and food Processing residues"*, p.52 (http://www.mrec.org/biogas/adgpg.pdf)

[30] Source: NREC, *"Anaerobic Digestion Of farm and food Processing residues"*, p.10 (http://www.mrec.org/biogas/adgpg.pdf)

		eleven fulltime positions. During the first year of operation the employees will receive training from the technology provider, GWE, to learn to skilfully and safely operate the project. If further persons are employed at a later stage, the project owner will also organise formal training[31]. The activity thus leads to improved skills of local staff, more jobs and safer working conditions than currently seen in this rural region.
• Livelihood of the poor (including poverty alleviation, distributional equity, and access to essential services)	0	On top of creating additional employment (see above), the project will improve the livelihood of those hired through income and national social security[32]. However, because of its limited impact, the indicator is scored neutrally.
• Access to energy services	+1	Since the project activity is a net exporter of electricity to the grid[33], it contributes to the reliability of the local grid and helps add renewable energy based capacity generation to the national grid. Since Thailand shares a common grid, delivering power to the grid will improve the overall access to energy in the grid and help to overcome the ever increasing demand for power in the country in a sustainable manner.
• Human and institutional capacity (including empowerment, education, involvement, gender)	0	Although the project will improve the human and institutional capacity through involvement of local population in the stakeholder meetings[34], the overall benefits are not significant. In practice, only the employees working on the project can be considered as the main beneficiaries.
Sub Total	**+2**	
Economic and Technological Development		
• Employment (numbers) *	+2	11 fulltime jobs are created for plant operation and maintenance (seven employees of Q.C. department, three of wastewater, plant operation monitoring department and maintenance, and one electrical engineer).[35] Per MWh of electricity produced, more jobs are created by this small biogas power production plant as compared to conventional power plants. Indirect benefit: The project contributes to an improvement of the cost efficiency of the starch production (due to reduced energy costs), which makes the starch industry more competitive. An increased competitiveness usually leads to growth of the sector, which leads to an increased demand for

[31] Annex 4 in the PDD shows that training of client's personnel will be the responsibility of CYY, with GWE being accountable for the content and performance of the training.

[32] As per Thai labour law.

[33] The project owner plans to export electricity to grid via a power purchase agreement with the Provincial Electricity Authority (PEA).

[34] Reference can be made to Attachment 1 and 6 in this GS Annex with regard to Stakeholder Consultation meetings.

[35] Organisation chart has been submitted upon CDM-validation showing that 11 full-time employees will be involved in the operation of the project (excludes the managing director and her advisor, whose roles may be seen as not directly attributable to the project acitivity).

		tapioca roots and subsequently to more jobs and revenues in the rural sector.
• Balance of payments (sustainability)	+1	As previously mentioned, the project activity leads to a significant energy cost reduction by replacing fossil fuels for thermal energy and electricity generation[36]. From a macro-economic perspective, the project will have an impact on net foreign currency savings related to fossil fuel import since most of the fossil fuel used in the baseline is from a foreign origin. Since the impact will be small in macro-economic terms, a scoring of +1 is given to represent the magnitude of the impact.
• Technological self reliance (including project replicability, hard currency liability, institutional capacity, technology transfer) *	+2	The project showcases an innovative way to treat wastewater, generate clean and renewable electricity and improve the cost efficiency of agricultural industry. The project contributes to technology transfer and has a great replication potential in the starch sector in Thailand and other countries. The technology provider for this particular project, Global Water Engineering (GWE), has more than 30 years experience in designing and implementing anaerobic wastewater treatment systems[37]. In Thailand, GWE implements the technology together with training operators at the project site. The project activity therefore improves institutional capacity and contributes to technology transfer in the host country[38].
Sub Total	**+5**	
Total	**+11**	

To meet the requirements of the Gold Standard, each of the above three components must have a positive sub-total score, the total score must be positive, and none of the indicators should score –2. Since all these conditions are met, the project activity satisfies the requirements to meet the Gold Standard.

EIA requirements

GS Manual for CDM Project Developers: **Section 3.4.2**

EIA Gold Standard Requirements according to section 3.4.2 in the Gold Standard Manual apply to the project activity as follows:

1. Host country EIA requirements
   The project does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Natural Resources and Environment (MONRE), Government of Thailand with the approval of National Environment Board (NEB). As per information from the Ministry of Natural Resources and Environment, no EIA is required for the proposed project activity (http://www.onep.go.th/eia/).

[36] Please refer to Section B.6 in the registered PDD (see http://cdm.unfccc.int/Projects/DB/RWTUV1218617500.62/view)

[37] http://www.globalwaterengineering.com/asp/asp/pagina.asp?level1=28

[38] Please see IEE section 4.1, page 8.

2. CDM Executive Board EIA requirements
   The CDM Executive Board does not pose extra requirements for biogas power projects related to the EIA.
3. Gold Standard Stakeholder Consultation
   The Stakeholder Consultation, which followed the Gold Standard's rules and principles, was held at Khamtalesor School on 26 July 2007. The results of the Stakeholders Consultation did not show any significant environmental and/or social impact.
4. None of the indicators in the Sustainable Development Assessment Matrix scores -1.
5. None of the above steps shows a requirement to conduct an EIA.

Although the project is not required to undertake an EIA, under the rules of the Thai Designated National Authority (DNA), an Initial Environmental Evaluation (IEE) has to be conducted. Such IEEs represent a simplified EIA, addressing potential environmental and social impacts of CDM projects in Thailand. The IEE for the proposed project activity was submitted to and approved by the Thai DNA; which is confirmed by the CDM Letter of Approval (LoA). Based on the outcome from the IEE, a summary of environmental impacts of the project activity is featured under Section D in the PDD.

Public consultation procedures

GS Manual for CDM Project Developers: **Section 3.4.3**

Stakeholder Consultation

A stakeholder consultation, which followed the Gold Standard's rules and principles, was held at at Khamtalesor School on 26 July 2007. This meeting was attended by representatives from the CYY Biopower, the local government, local villagers, farmers, educational institution, rural entrepreneurs, and NGOs.

The overall response to the project, from all invited stakeholders, was encouraging and positive. Most of the questions from the participants regarded the environmental impacts, such as the bad odour from the current open lagoon, and could be clarified during the meeting.

In all, no adverse reactions/comments/clarifications were received during the Stakeholder Consultation process. The participants of the meetings and Gold Standard supporting NGOs have not raised any significant concerns related to potential impacts of the project.

A detailed report on the Stakeholder Consultation is available in **Attachment 1** to this document.

Second Round ('Main') Stakeholder Consultation[39]

Since the first consultation took place on-site and allowed for the collection of opinions, photographs and so on, this second round was carried out electronically. Full documentation of the project activity was made publicly available for two months prior to conclusion of the Gold Standard validation at www.southpolecarbon.com/goldstandard.htm, including:

- The original and complete PDD;
- A non-technical summary of the project design document (in appropriate local language);
- Relevant supporting information.

During this consultation period, stakeholders were invited via emails[40] to submit their comments and questions related to the project activity. For this purpose, an online comment form was made available on the above-mentioned website.

No comments were received during the consultation period. The information regarding the 'Main' Stakeholder Consultation process was made publicly available and sent to the DOE for validation.

[39] Please see Attachment 6: Second Round ('Main') Stakeholder Consultation Report

[40] Sent to the local municipality for information to the stakeholders (tesssaban@khamtalayso.com), the Thai Tapioca Starch Association, the GS Supporters and GS Secretariat Members and the Thai DNA, on September 5th, 2008.

Gold Standard Monitoring

GS Manual for CDM Project Developers: **Section 3.5.1**

According to the Gold Standard Manual for CDM Project Developers, Gold Standard monitoring requirements in addition to regular CDM monitoring procedures are defined based on the outcomes of the Sustainable Development Assessment conducted above and of the Stakeholder consultation meeting[41]. The outcomes are as follows:

- The Sustainable Development Assessment Matrix shows that several indicators are crucial, either because they strongly contribute to an overall positive score and/or because they were specifically pointed out by the stakeholders during the consultation process. The crucial indicators are thus examined in the table below. It should be noted that there is no indicator with a negative score;
- There is no sensitive indicator which is likely to change over the crediting period due to changes in the boundary conditions.

No		1
Indicator		Water quality and quantity*
Chosen parameter		COD concentration in wastewater at the outlet of the UASB reactor (in kg COD / m^3)
Implications on monitoring requirements and justification		The aim of the project is to improve the current wastewater treatment facilities and avoid any harm or threat to the environment or people. The installed wastewater treatment system is more efficient and robust (from a process control perspective) than the open anaerobic lagoon system (baseline scenario). The biogas reactor system will reduce 90% to 98% of the COD load in the wastewater [42]. The effluent from the biogas reactor is still diverted to the old lagoon system, for a final treatment, which will further reduce the COD load to a value well below the Thai wastewater discharge limits. The lagoon system at CYY is designed in such a way that there is no effluent leaving the lagoon system. Most of the produced wastewater is constantly re-circulated as wash water for the starch production process. The rest is stored in the aerobic lagoons at the end of the cascading lagoon system, where part of the water evaporates, keeping a hydrological balance. The wastewater treatment plant includes safety and monitoring devices as well as safety and quality control procedures in order to avoid abnormal operating conditions, which could lead to abnormal wastewater discharges. Wastewater quality format the outlet of the reactor is already subject to continuous monitoring under CDM and periodic controls by environmental authorities. Given the fact that the treated wastewater cannot be discharged and is constantly re-circulated and re-used in the starch plant, which was already done prior to the project, the project activity does not have a significant impact on water quantity, From this, it is evident that the impact on the water quality is the only crucial for an overall positive impact of sustainable development and its monitoring would thus be required in the verification period.
Way of monitoring	How	The Reactor Digestion Method is applied for wastewater analysis.
	When	Daily (up to three samples per day)
	By who	CYY plant operator
QA/QC procedures to be applied		The Standard Solution Method is used for accuracy check of the on-site measurements. Periodic tests will be carried out by accredited

[41] Please see Attachment 1 to this document.

[42] Please refer to the PDD, parameters ID 3 and 4 (p.44), and ID 18 (p.49).

	laboratory (ISO/IEC 17025) in order to provide quality assurance.

No		2
Indicator		Air quality: *Odour from the wastewater treatment plant**
Chosen parameter		Volume of biogas production and combustion (Nm^3)
Implications on monitoring requirements and justification		As explained by the project owner during the public consultation, the odour will be reduced as a result of the project activity, because the new system is a closed system and the biogas produced is utilized for electricity and heat generation. Any gases that would lead to odour emissions (mainly H_2S and other sulphur compounds) are captured with the biogas and either destroyed in the boilers or removed in the desulphurization system (gas scrubber) prior to reaching the engine, without release of odour emissions to the atmosphere. Given this fact, monitoring of biogas production and utilization would be sufficient to demonstrate a reduction in odour emissions from the project.
Way of monitoring	How	Measured using gas flow meters at the reactor outlet and at the inlet of the boiler, engine/generator sets and flare system. Combustion of the biogas, and consequently the destruction of any gases that would lead to odour emissions, is monitored through measurement of the energy output of the boiler and engine/generator systems as well as the flame detection period of the flare system. More details about all these parameters are provided in the monitoring plan (Section B.7) of the registered PDD[43].
	When	Continuously using totalised meters
	By who	CYY plant operator
QA/QC procedures to be applied		Meters will undergo maintenance / calibration subject to appropriate industry standards. In the event of technical problems with a biogas flowmeter, the value can be calculated based on a mass balance using the other installed gas meters (e.g. biogas sent to boilers = total biogas produced – biogas sent to flare – biogas sent to engine).

No		3
Indicator		Employment (numbers)*
Chosen parameter		Number of employed staffs and the level of income generation
Implications on monitoring requirements and justification		To date the job creation has been in the higher end of the range and the owner expects it to increase. Reference to the organisation chart is also made available[44].
Way of monitoring	How	Number of employees and the level of income generation will be recorded through salary payment records.
	When	Monthly
	By who	CYY management
QA/QC procedures to be applied		NA. Careful monitoring of salary payments and expenditures is a general practice of the company required for financial accounting as per Thai regulations.

No		4
Indicator		Technological self reliance *
Chosen parameter		Training records
Implications on monitoring requirements and justification		The project contributes to technology transfer and has a great replication potential in the starch sector in Thailand and other countries. In Thailand, GWE, the technology provider for this particular project, implements the technology along with a special training for operators at the project site.
Way of monitoring	How	Training records shall be archived at the end of each training
	When	Periodical (depending of the frequency of training)
	By who	CYY management

[43] http://cdm.unfccc.int/Projects/DB/RWTUV1218617500.62/view

[44] Please see the Organization chart provided under Attachment 5.

QA/QC procedures to be applied	All training plans shall be approved by the plant manager prior to implementation.

In addition to the above monitoring plan, regular CDM monitoring procedures as specified in the PDD of the project activity account for:

- Determination of project emissions and emission reductions during the crediting period
- Determination of the monitoring method (including measurement and calculation procedures, data registration and storage as well as calibration requirements) and the equipment applied
- Quality assurance and control procedures for the monitoring process
- Documentation of all relevant monitoring steps

Attachment 1 - Stakeholder Consultation Report

CYY Biopower wastewater treatment plant

Pongdeang District, Khamtalesor, Thailand

STAKEHOLDER CONSULTATION REPORT

AIMS OF THE EVENT

The stakeholder consultation was held on July 26, 2007 at Khamthaleso Wittaya School, Nakorn Ratchasima near by the project activity. Stakeholder groups as defined by the Gold Standard procedures was identified an invited to the meeting by written invitation letters. The event, organized by Advance Energy Plus Co., Ltd. (AEP) and CYY Bio Power Co., Ltd. (CYY) had the following aims:

1. To explain the stakeholders about Green House Gas effect, Kyoto protocol and the CDM process.
2. To present the project to the local stakeholders.
3. To describe what the CDM means for this project.
4. To describe the environmental impacts from this project.
5. To allow the stakeholders an opportunity to express their concerns regarding the project, to ask questions and to clarify issues if any.

EVENT VENUE

Khamthaleso Wittaya School, Nakornratchasima Province, Thailand
July 26, 2007

In the public consultation meeting, detailed information about the project and its benefits were presented by the project advisor and the project owner to the participants who attended the meeting. The event provided a forum for all stakeholders to raise questions about pollution, safety and any other issues regarding the project and to share opinions. The tapioca-based starch production plant and brief of existing wastewater treatment, was represented by the factory. Advance Energy Plus Co., Ltd. represented the CDM project advisor. The technology supplier was also present to answer questions regarding the UASB technology and CDM-related issues respectively**.**

BRIEF INTRODUCTION OF THE PROJECT

In its introductory presentation, AEP explained the Green House Gas effect, Kyoto protocol, project in detail, and illustrated the UASB technology through several photographs and figures. The advantages and key features of the technology over existing methods of wastewater treatment were highlighted. The impact of the new technology on the community and global environment at large were also discussed.

INVITATION PROCEDURES AND LIST OF ATTENDEES

AEP and CYY sent invitation letters to a number of stakeholders to attend the Public Consultation event. The invited stakeholders included representatives of the government, local officials, NGOs (including NGOs that support Gold Standard), academic institutions, members from the local community living in the project area and others, as listed below:

- **Thai Government Entities**
  - National Science and Technology Development Agency (NSTDA)
  - Office of Natural Resources and Environmental Policy and Planning
  - IIEC (International Institute for Energy Conservation)
  - Sheriff of Amphur Khamthaleso
  - Director of Police station
  - Subdistric Administrative Organization
  - Leader of Thambol Khamthaleso
  - Leader of Subdistric Administrative Organization Thambol Pongdang
  - Leader of Subdistric Administrative Organization Thambol Pandung
  - Leader of Subdistric Administrative Organization Thambol Bungao
  - Ministry of Agriculture and Co-operative
  - Lord Mayor of Thambol Khamthaleso
  - Leader of Ban Moo 3
  - Leader of Ban Moo 4
  - Leader of Ban Moo 5
  - Leader of Ban Bungao
  - Leader of Thumbol Pongdang
  - Leader of Thambol Bungao
  - Leader of Thambol Pandung
  - Leader of Thambol Hangsong
- **NGOs**
  - Green Leaf Foundation
  - Green World Foundation (GWF)
  - IIEC (International Institute for Energy Conservation)
  - WWF Thailand
  - Thailand Development Research Institute (TDRI)
  - Appropriate Technology Association
  - Environmental Engineering Association of Thailand
  - Thai Environmental and Community Development
  - Thailand Environment Institute (TEI)
- **Academia**
  - Faculty of Engineering, Khon Kaen University
  - Faculty of Engineering, Chulalongkorn University
  - Faculty of Engineering, King Mongkut's University of Technology Thonburi
  - Faculty of Engineering, Suranaree University of Technology
  - Faculty of Engineering, Thammasat University
  - Faculty of Engineering, Kasetsart University
  - Faculty of Engineering, Dhurakijpundit University
  - Faculty of Environment and Resource Studies, Mahidol University
- **Others**
  - South Pole Carbon Asset Management Ltd.
  - Retech Energy Co., Ltd

Following is the list of stakeholders from the above entities, who attended the meeting:

1.	Mr. Pitsawong Sanprasert	Subdistric Administrative Organization Thambol Pongdang
2.	Mr. Shob Sherdsungnern	Leader of Thumbol Pongdang
3.	Mr. Shoosak Shunkao	Bailiff of Amphur Khamthaleso Officer
4.	Mr. Somporn Srichumnong	Manager of Electricity Officer
5.	Mr. Trachak Kisantera	Subdistric Administrative Organization Thambol Pondung
6.	Mr. Ingo Puhl	South Pole Carbon Asset Management Ltd.
7.	Mr. Le Than Tung	South Pole Carbon Asset Management Ltd.
8.	Mr. Suvit Kakhuntod	Subdistric Administrative Organization Thambol Khamthaleso
9.	Mr. Somkeach Patcharasuntorn	Subdistric Administrative Organization of Thambol Bungao
10.	Mr. Manoch Marikhaow	Lord Mayor of Thambol Khamthaleso Officer
11.	Mr. Samart Shoonsantea	Subdistric Administrative Organization of Thambol Bungao
12.	Mr. Tavee Mathawirat	Subdistric Administrative Organization of Thambol Bungao
13.	Ms. Supawadee Phothikamoon	Managing Director of Retech Energy Co., Ltd.
14.	Mr. Tuchsanai Poksantea	Leader of Ban Moo 3
15.	Mr. Po Rodpandung	Leader of Thambol Bungao
16.	Mr. Saychoon Kisantea	Leader of Ban Moo 4
17.	Mr. Sungwan Chapandung	Leader of Thambol Pandung
18.	Mr. Chumnong Ponsantea	Prolocutor of Subdistric Administrative Organization
19.	Mr.Anan Poomkokrak	Subdistric Administrative Organization of Thambol Bungao
20.	Mr. Way Khumsantea	Leader of Ban Moo
21.	Ms. Naruchoon Sirirodchanakul	Villager of Ban Khamthaleso
22.	Ms. Natthinich Pongsuwan	Villager of Changwat Nakhonrachasrima
23.	Ms. Samaree Wachon	Villager of Ban Khamthaleso
24.	Ms. Uncharee Chitsuk	Villager of Ban Khamthaleso
25.	Ms. Phatcharaporn Boonru	Villager of Changwat Nakhonrachasrima
26.	Ms. Noppharath Reabthavee	Villager of Ban Bungao
27.	Ms. Khanittha Aorsantea	Villager of Ban Bungao
28.	Mr. Boonsom Deemarerng	Villager of Ban Bungao
29.	Mr. Yuthapong Trithong	Villager of Ban Bungao
30.	Mr. Wisuth Maneethong	Villager of Ban Khamthaleso
31.	Mr. Wisan Phromnasath	Subdistric Administrative Organization Thambol Khamthaleso
32.	Mr. Sanith Booranapiyasakhul	Leader of Thambol Hangsong
33.	Mr. Sirichai Phiboon	Subdistric Administrative Organization Thambol Bungao
34.	Mr. Sukhol Wongvilai	Villager of Ban Khamthaleso
35.	Mr. Somphan Trithong	Asst. of Leader of Thambol Bungao
36.	Ms. Khanyarath Peasantea	Villager of Ban Bungao

37.	Ms. Wanchai Nasri	Villager of Ban Bungao
38.	Mr. Khunthung Kansakool	Villager of Ban Bungao
39.	Mr. Pramoch Putharaksa	Villager of Ban Bungao
40.	Mr. Dong Chapandung	Leader of Ban Moo 5
41.	Mr. Withaya Niziyok	Director of Police station
42.	Mr. Manop Yunyong	Director of CYY Biopower Co,.Ltd
43.	Mr. Surasak Charuthavai	CYY Industry

LANGUAGE

Documentation and meeting were held in Thai (local language) and English.

MEETING PROCEDURES

- Opening (5 min)
- Purpose of the consultation (5 min)
- Global warming and Clean Development Mechanism (10 min)
- Project descriptions (10 min)
- Impacts of the project (10 min)
- Answering of questions (20 min)
- Completing checklists (40 min)
- General feedback (20 min)

MEETING PROTOCOLS

On completion of the meeting, the following documentation was collected and attested by the signatures of the stakeholders that were present:

1. Invitation letters and acceptance letter.
2. Presence list with name, position, sector, address, e-mail address and signatures.
3. Filled out Appendix E of Gold Standard (checklist)
4. Examples of completed Appendix E in Thai.
5. Thai (local language) version of Appendix E.
6. Notes for additional comments on the project activity.
7. Photographs of the meeting(s).

These documents are available as hardcopies and will be handed over to the designated operational entity (DOE) conducting the Gold Standard validation process.

THE MINUTES

At the start of the event, the project advisor, technology suppliers and project advisors were introduced. Then two presentations were made by the project advisors, namely Mr.Jetsada Falert, Manager, AEP and project owner, namely Mr. Thawatchai Yoenyong, Managing Director, CYY. All presentations were made in Thai language.

The presentation can be divided into three sections;

(i) Greenhouse gases and Clean Development Mechanism
(ii) CYY project introduction
(iii) How the CYY project is related to CDM and how the project can reduce greenhouse gases?

Summary of presentation by Mr. Jetsada Fahlert

(i) Greenhouse gases and Clean Development Mechanism

What is Green House Gas effect and what is CDM or Clean Development Mechanism? In our daily life, people have many activities that produce Carbon Dioxide (CO_2). The CO_2 which is released to the atmosphere causes the atmospheric temperature to rise, which is called the greenhouse effect. In the 1997 Kyoto Protocol (a part of the United Nations agreement), a number of nations reached an agreement to reduce the emissions of greenhouse gases in to the atmosphere. As per the agreement, some countries are obliged to reduce the emission of greenhouse gases over the coming several years. These are called Annex I countries, which include Europe, North America, other OECD nations, the former Soviet Union and Eastern Europe. To allow them to do this, a flexible mechanism called Clean Development Mechanism (CDM) was introduced. CDM permits the activities to be undertaken in non-Annex I countries. The CDM will allow Annex 1 countries to develop projects in non-Annex 1 countries, which will reduce greenhouse gas emission. CYY project is developed as one of such projects in Thailand. The gases that are defined as greenhouse gases are:

- Carbon Dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Hydro fluorocarbons (HFCs)
- Per fluorocarbons (PFCs) and
- Sulphur Hexafluoride (SF_6)

The actual issuance of the credits or CERs (Certified Emission Reductions) is made by the CDM Executive Committee of the United Nations.

The steps involved in implementing a CDM project are as follows:

Step1. Preparation of Project Idea Note (PIN)
Step2. Project Design Document (PDD) development
Step3. Host Country Approval
Step4. Validation
Step5. Registration
Step6. Monitoring
Step7. Verification and Certification
Step8. CERs issuance

Now we are in step 2: Project Design Document (PDD) development

Summary of presentation by Mr. Thawatchai Yoenyong

(ii) CYY project introduction

CYY Biopower Co., Ltd. (CYY) was registered on March 28, 2006 to produce biogas from wastewater of Chokeyoenyong Industries Co.Ltd. located at Thambol Pong Dang, Amphur Khamtalesor, Nakornrachasima Province. Chokeyoenyong Industries Co.Ltd. has been operating the starch production plant since 2003. The approximated production capacity is 250 tonnes of native starch per day. The processing generates about 2.4 million litres of wastewater every day. The energy sources for Chokeyoenyong Industries Co.Ltd. are electricity, supplied by PEA and the thermal energy that generated in-house from fuel oil boiler.

CYY Biopower Co., Ltd. will treat wastewater from Chokeyoenyong Industries Co.Ltd. and produce biogas. The biogas produced will be utilized for electricity generation and replace fuel oil at boiler for heat generation to starch plant.

Summary of presentation by Mr. Jetsada Fahlert

(iii) How is the CYY project related to CDM and how can the project reduce greenhouse gases?

What will happen when the wastewater flows through the open lagoon? The bacteria in the lagoon act upon and digest the organic materials in the wastewater. Aerobic digestion takes place on the surface of the lagoon while anaerobic digestion takes place beneath the surface. Anaerobic digestion reaction will generate biogas, which is composed of methane (CH_4), carbon dioxide (CO_2) and Hydrogen Sulphide (H_2S) gases. The biogas has a heating value of approximately 9,000 kcal/ m^3; therefore 1 m^3 of biogas can generate electricity 1.85 kWh or replace 0.6 litre of bunker oil, 0.5 litre of gasoline, 0.6 kg of LPG, 1.9 kg of rice husk as fuel. In the wastewater treatment process through the open lagoons, there are two issues: one is the natural discharge of biogas from the pond system, which will be considered as GHGs, into the atmosphere. This is a naturally occurring by-product of organic decomposition. The second is the odour from the biogas that is immediately apparent as a result of aeration.

To tackle the above issues, Chokeyoenyong Industries Co.Ltd. and CYY Biopower Co, Ltd. have decided to construct a new wastewater treatment system with an Upflow Anaerobic Sludge Blanket (UASB) system. This technology will use anaerobic bacteria to digest the organic materials in the wastewater. The system will use bacteria that already exist in the wastewater in a natural biological process. We can see this process occurring in all wastewater ponds, animal farms and kitchens where food is left to decay. The UASB system is a closed system where the gas generated in the process is not allowed to escape. Biogas is collected and then used as a fuel to generate electrical energy in a gas engine-generator system and replace fuel oil at boiler.

The UASB system has a number of benefits: it reduces the release of methane (which is one of the GHGs) into the atmosphere; generates biogas as a by product (which can be used as a fuel in the plant); and maximizes the conversion of organic material into biogas, thereby accelerating the digestion process. The technology has a high reliability and requires low maintenance.

The environmental effects of the UASB system are very beneficial: cleaner wastewater within a shorter period of time; no odour; no leakage of wastewater to the ground water.

Thank you everyone and if anybody has any questions, please feel free to ask.

Compilation of comments received

A. Oral hearing for local stakeholders:

Summary of comments received during the forum:

The overall response to the project, from all invited stakeholders, was encouraging and positive. Most of the questions from the participants regarded the bad odour from the current open lagoon. These questions could be clarified during the meeting.

Out of the 43 participants at the stakeholder consultation, 38 persons answered the questionnaire. The answers and general comments submitted in the Gold Standard questionnaires show that 84.62% of the total participant agreed that the project would reduce

the bad odour from the wastewater and thereby improve local quality of life. The results of the GS questionnaire are summarized in the subsequent section.

A general Questions & Answers session was also conducted during the event, where questions were invited from the present stakeholders. The questions were basically answered by the AEP, CYY owner, with additional explanation on technical details by the technology supplier Re-Tech.
The questions and answers are listed below:

- *After the project is implemented, will the odour reduce?*

Yes, it will, thanks to the new system: UASB is a closed system and the biogas produced is utilized for electricity and heat generation, so neither biogas nor odour emissions are released to the environment, hence the odour is reduced. The odour will be much less than in the past because the COD in the wastewater flowing into the open lagoon is only 10% of the wastewater input before implementation of the project.

- *How can we be confident in the performance of the Biogas system? Are there any site references for this technology?*

The biogas system has been developed and implemented for more than 10 years in many sectors. This specifc technology has been installed in three plants in Thailand, which are all working successfully.

B. Environmental and Social Impacts Checklist results:

After the presentation, the questionnaires were distributed to 43 participants (male participants 76.7%, female 23.3%; local government representatives 51.6%, private sector and local community representatives 48.8%).

The key findings from questionnaires can be found in Appendix E below. Please note that only the issues with less than 90% approval rate are discussed below.

Environmental Impacts

- 71.1% of the respondents agreed that the construction, operation or decommissioning of the Project will not affect natural resources or ecosystem.
- 76.3% of the respondents agreed that the Project will not involve use, storage, transport, handling, production or release of substances or materials (including solid waste) which could be harmful to the environment.
- 86.8% of the respondents agreed that the Project will not release pollutants or any hazardous, toxic or noxious substances to air.
- 84.2% of the respondents agreed that the Project will not lead to risks of contamination into ground or into surface waters, groundwater, coastal wasters or the sea.

Socioeconomic and Health Impacts

- 79% of the respondents considered that there is a significant reduction on health risks, and in bad odour to the local communities.
- 79% of the respondents considered that the project will improve air quality owing to the reduction of fossil fuel combustion.
- 76.3% of the respondents considered that the project will improve soil condition as compared to conventional practices.

- 79% of the respondents considered that the project will not lead to social changes, such as demography, traditional lifestyles and employment.

Overall, the participating stakeholders were satisfied with the outcome of consultation (84.6%) and congratulated CYY Biopower for their efforts to implement this project which they recognized would benefit the local and community environment and contribute to sustainable development; however about 15.8% of the participants raised some concerns related to the impacts of the project, as reported below:

- Sound disturbance from the project

The plant is located six kilometers away from any residences so the noise from the project will not cause disturbance.

- Air quality problems

Biogas is a mixture of carbon dioxide and methane, which are not toxic gases. However, biogas is inflammable and should be handled with care. As mentioned above, the wastewater treatment plant has all provisions for a safe handling of biogas. Emissions from biogas combustion are subject to environmental regulation. An efficient combustion process at the flare and in the boilers, which is constantly monitored, ensures that any environmental and health impacts can be excluded.

- Safety issues

As mentioned above, the wastewater treatment plant has all provisions for a safe handling of biogas. The construction and operation of the plant is carried out in accordance with relevant safety standards and procedures. Accident risks are mitigated to the extent that can be influenced by the project owner.

- Natural resource contamination

The aim of the project is to improve the current wastewater treatment facilities and avoid any harm or threat to the environment or people. The installed wastewater treatment system is more efficient and robust (from a process control perspective) than the open anaerobic lagoon system (baseline scenario). It should be noted that the biogas reactor system will reduce 90% to 98% of the COD load in the wastewater (replacing all the work that was previously done by the lagoon system). Nevertheless, the effluent from the biogas reactor is still diverted to the old lagoon system for a final treatment, further reducing the COD load to a value way below Thai wastewater discharge limits. The lagoon system at CYY is designed in such a way that there is no discharge of water. Most of the produced wastewater is constantly re-circulated as wash water for the starch production process. The rest is stored in the aerobic lagoons at the end of the cascading lagoon system, where part of the water evaporates, keeping a hydrological balance. If the plant is not operated as it should, the project activity might lead to a release of untreated water or release of methane to the atmosphere. However, the wastewater treatment plant includes safety and monitoring devices as well as safety and quality control procedures in order to avoid abnormal operating conditions, which could lead to biogas leakage or abnormal wastewater discharges. The quality of the treated wastewater is constantly monitored and periodically checked by environmental authorities in order avoid any contamination. Biogas production, its use as a fuel in the boilers or its combustion in the flare systems is also constantly monitored. The project fully complies with safety and health regulations and any threats to human health are being avoided to the extent that can be influenced by the project owner.

- Odour from the wastewater treatment plant

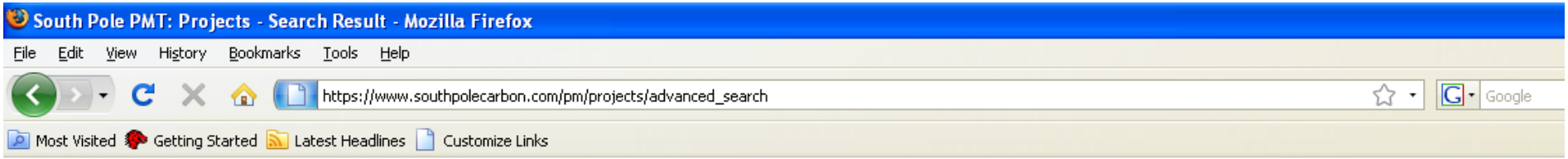
The odour will be reduced because the new system is capturing the biogas produced and then utilizing it for electricity and heat generation. Any gases that would lead to odour emissions (mainly H_2S and other sulphur compounds) are captured with the biogas and either destroyed in the boilers or removed in the desulphurization system prior to the engine, without release of odour emissions to the atmosphere.

Changes to Project design based on comments received

Given the fact that most of the concerns raised were rather clarifications and were thereafter addressed by the project owner or were monitored throughout the project's operation, it was not necessary to make any changes to the project design.

Additionally, the stakeholder consultation demonstrated that it is not required to conduct an Environmental Impact Assessment of the Project, which is not requested by the Thai government or the CDM Executive Board.

Attachment 2 – VER projects from South Pole's Project Management Tool



Projects - Search Result -

advanced search

Emission Reduction Projects

Search Criteria search

Projects Overview - 8 Projects

Note that by default only active projects are shown. Use the advanced search option to view all projects. You can sort projects by clicking on the arrows. Use shift key for multiple sorting parameters. See all information of a project by clicking on its name, mark a project by clicking on its number.

Project No	Name	Host	Type	GS	Scope	tCO2e12	Start ER	Last Milestone	PM	!
300136	SD BioSupply WWT	Thailand	VER		Waste handling and	176652	2006-03-28	Stakeholder Cons	kk	!
300137	VP Biosupply WWT	Thailand	VER		Waste handling and	179643	2006-03-28	Stakeholder Cons	kk	!
300141	Banpong WWT	Thailand	VER		Waste handling and	136305	2006-03-28	Due Diligence	kk	!!
300283	Chol Charoen I (Chonburi)	Thailand	VER		Waste handling and	133764	2007-01-01	Initial Due Dili	sap	!!
300284	Chol Charoen I (Srakaew)	Thailand	VER		Waste handling and	93243	2009-09-30	Initial Due Dili	sap	!!
300285	Chol Charoen I (Khon Kaen)	Thailand	VER		Waste handling and	73824	2009-06-01	Initial Due Dili	sap	!!
300286	Chol Charoen I (Kampangpet)	Thailand	VER		Waste handling and	74290	2009-10-01	Initial Due Dili	sap	!!
300288	Chol Charoen I (Chachengsao)	Thailand	VER		Waste handling and	59497	2009-06-01	Initial Due Dili	sap	!!

Attachment 3 - Time schedule of the project

Date	Event	Comment
3 July 2003	Chokyuenyong Company is registered as starch factory	Company affidavit
1 February 2006	Global Water Engineering (GWE) proposal	Proposal
21 February 2006	Chokyuenyong Company is received the operating license	Operating license
25 February 2006	Board Meeting to discuss the biogas project and take decision on same.	Minutes of Meeting
28 March 2006	CYY Bio Power company is registered as biogas production	Company affidavit
4 August 2006	First payment being paid as consider as construction start	Purchase order
8 September 2006	Loan approval from TMB Bank	Loan approval
12 September 2006	Purchase of biogas between CYY Bio Power (seller) and Chokyuenyong (buyer)	Biogas Purchase Contract
26 July 2007	CDM stakeholder consultation	Cooperation between CYY Bio Power and Advance Energy Plus company
20 August 2007	Finishing Initial Environmental Evaluation and draft PDD	
10 October 2007	Submission the Letter of Approval (LoA) request to the Thai DNA (Host)	
14 July 2008	Reception of the Letter of Approval (LoA) from the Thai DNA	

Attachment 4 – Air pollution certificate

Pro2 Anlagentechnik GmbH
Schmelzerstraße 25
D-47877 Willich
Telefon: +49 / 2154 / 488-0
Telefax: +49 / 2154 / 488-105

Internet: http://www.pro2.eu

Pro2 Anlagentechnik GmbH, Schmelzerstraße 25, D-47877 Willich

CYY BIO Power Co., Ltd.
Mrs. Parinthorn Yuenyong
100 MOO 5
Pangdaeng, Khamataleso
Nakornratcharisma 30280
Thailand

your reference	our reference	phone +49 / 2154 / 488	Date
	PSt *CYY thai emission standard.doc*	**460**	**03.06.2008**

Emission Standards in Thailand

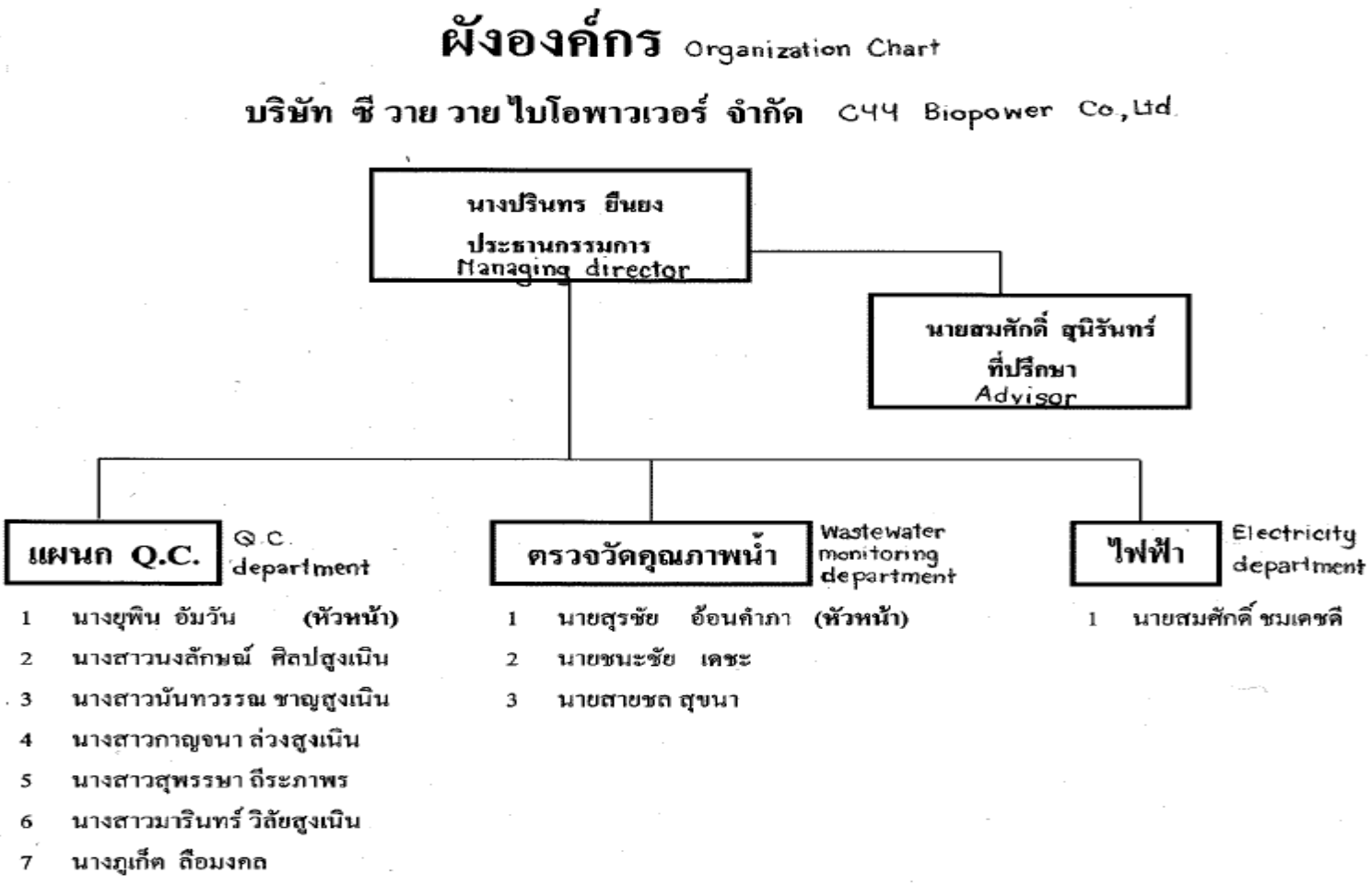
Pro2 confirms that NOx < 200 ppm and SOx < 60 ppm can be achieved at 7% O2 in the exhaust gas. However the SOx depends upon the inlet H2S in the biogas and this condition can be met up to a max. of 900 ppm of H2S in the biogas. No other sulphur compounds or elemental sulphur may be introduced to the engine. CO emission of 690 ppm at 7% O2 can be achieved.
To meet above mentioned emission standards the gas consistence has to be in accordance to the TI2012 " Minimum characteristics of combustibles for gas engine plants" which is attached to this document.

Yours faithfully

Pro2 Anlagentechnik GmbH

i. A. Philipp Stolzenburg

Attachment 5 – Organisation Chart



Attachment 6 –Second Round ('Main') Stakeholder Consultation Report

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Report based on GS Manual for CDM Project Developers: Section 3.4.3

The Gold Standard 'Main' Stakeholder Consultation for *CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand* was launched on 5 September 2008, in order to allow stakeholders to consult the Project Design Document (PDD).

South Pole Carbon Asset Management Ltd. provided full documentation of the project activity and made it publicly available for two months, prior to conclusion of the Gold Standard validation at www.southpolecarbon.com/goldstandard.htm.

This documentation included:

- The original and complete PDD;
- A non-technical summary of the project design document (in Thai).

The PDD was also published for public consultation on the UNFCCC website, in accordance with UNFCCC requirements.

Invitation procedure

To inform stakeholders of the start of the Consultation, emails (copies enclosed in Annex) were sent to :

- local policy makers and local people directly impacted by the project;
- local NGOs;
- Local and national NGOs that have endorsed the Gold Standard.

During the consultation period, stakeholders were invited to submit their comments and questions related to the project activity. For this purpose, an online comment form was made available on the above-mentioned website.

Stakeholders' comments

No comments were received during the consultation period.

Copies of the emails sent to the stakeholders and the GS supporters and secretariat members

Invitation

From: Rukvongtrakul Suwipa Sent: Fri 9/5/2008 2:23
To: 'joshharris@theclimategroup.org'; 'chaowarat@ata.or.th'; 'indhukarns@hotmail.com'; 'steve.sawyer@diala.greenpeace.org'; 'dmcintosh@uk.mercycorps.org'; 'lsalter@wwf.org.hk'
Cc: Tonsuwonnont Pathathai; Knill Angela; Bürgi Patrick
Subject: Invitation to Gold Standard Main Stakeholder Consultation for CYY Biopower Wastewater treatment Project, Thailand

Message | CYY PDD summary_final.pdf (100 KB) | CYY_GS_Annex_final.pdf (301 KB) | CYY_PDD_final.pdf (4 MB)

Dear Gold Standard Secretariat Members,
Dear Supporters of the Gold Standard in Thailand,

We kindly invite you to participate in the Gold Standard Main Stakeholder Consultation of the CDM project "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand". The project, being developed as a Gold Standard CDM project, is currently undergoing validation. Please find attached the CDM Project Design Document (PDD) and the additional Gold Standard Annexes of the project, which include a report on the Initial Stakeholder Consultation.

You are invited to provide comments on above mentioned documentation by replying to this email or submitting comments through our web interface (http://www.southpolecarbon.com/goldstandard_consultations.htm). The commenting period will be open for 2 months starting from today.

With best regards,
Suwipa Rukvongtrakul
CDM Project Associate

From: Rukvongtrakul Suwipa Sent: Fri 9/5/2008 2:39 PM
To: 'Thai-dna@tgo.or.th'; 'contact@thaitapiocastarch.org'; 'tesssaban@khamtalayso.com'; 'info@cdmgoldstandard.org'
Cc: Tonsuwonnont Pathathai; Knill Angela; Bürgi Patrick
Subject: Invitation to Gold Standard Main Stakeholder Consultation for CYY Biopower Wastewater treatment Project, Thailand

Message | CYY PDD summary_final.pdf (100 KB) | CYY_GS_Annex_final.pdf (301 KB) | CYY_PDD_final.pdf (4 MB)

To whomever the main concern,

We kindly invite you to participate in the Gold Standard Main Stakeholder Consultation of the CDM project "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand". The project, being developed as a Gold Standard CDM project, is currently undergoing validation. Please find attached the CDM Project Design Document (PDD) and the additional Gold Standard Annexes of the project, which include a report on the Initial Stakeholder Consultation.

You are invited to provide comments on above mentioned documentation by replying to this email or submitting comments through our web interface (http://www.southpolecarbon.com/goldstandard_consultations.htm). The commenting period will be open for 2 months starting from today.

Best regards,
Suwipa Rukvongtrakul
CDM Project Associate

Closure notice

From: Rukvongtrakul Suwipa Sent: Thu 1/29/2009 6:24 PM
To: Thai-dna@tgo.or.th; contact@thaitapiocastarch.org; tesssaban@khamtalayso.com; info@cdmgoldstandard.org
Cc: Bürgi Patrick; Donceel Hermine; Singh Harshpreet; Knill Angela; Tonsuwonnont Pathathai
Subject: Closure of Gold Standard Main Stakeholder Consultation for CYY Biopower Wastewater treatment Project, Thailand

To whom it may concern,

We would like to kindly inform you that the Gold Standard Main Stakeholder Consultation for CYY Biopower Wastewater treatment Project, Thailand is now over.
Full documentation of the project activity was made publicly available for two months prior to conclusion of the Gold Standard validation at http://www.southpolecarbon.com/goldstandard_consultations.htm, including:

- The original and complete PDD;
- A non-technical summary of the project design document (in Thai);
- Relevant supporting information.

During this consultation period, stakeholders were invited via emails to submit their comments and questions related to the project activity. To inform local stakeholders, emails were sent to the local municipality (tesssaban@khamtalayso.com), the Thai Tapioca Starch Association and the Thai DNA on September 5th, 2008.

For this purpose, an online comment form was made available on the above-mentioned website.

No comments were received during the consultation period.

Best regards,
Suwipa Rukvongtrakul
CDM Project Associate

From: Rukvongtrakul Suwipa Sent: Thu 1/29/2009 5:01 PM
To: 'joshharris@theclimategroup.org'; 'chaowarat@ata.or.th'; 'indhukarns@hotmail.com'; 'steve.sawyer@diala.greenpeace.org'; 'dmcintosh@uk.mercycorps.org'; 'lsalter@wwf.org.hk'
Cc: Bürgi Patrick; Donceel Hermine; Knill Angela; Singh Harshpreet; Tonsuwonnont Pathathai
Subject: Closure of Gold Standard Main Stakeholder Consultation for CYY Biopower Wastewater treatment Project, Thailand

Dear Gold Standard Secretariat Members,
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Best regards,
Suwipa Rukvongtrakul
CDM Project Associate
