CYY Biopower wastewater treatment plant Gold Standard PDD

Additional PDD Annex as required for Gold Standard validation

GS Annex Version: 1.0
Date: August 21st 2008
Contact person: Patrick Bürgi, South Pole Ltd., p.buergi@southpolecarbon.com, +41.44.633 78 76

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 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 process heat generation in the starch production process and the 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, increased capacity building and technology transfer, creation of employment opportunities and contribution to poverty alleviation in the project region.

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 lead to greenhouse gas emissions in open anaerobic lagoons in absence of the project.
- The biogas will reduce the use of fossil fuel by reusing the biogas in an existing boiler to generate steam, and the reuse of biogas for power generation.

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.

Prior to construction start in August 2006, the project activity signed a CDM service agreement in early 2006 (see Section B.5 of the PDD for more information). Further, 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, the project activity 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 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 waste water 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 law in Thailand, which allows 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 for effluent treatment. Therefore, alternative 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

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 has been a common practice of handling wastewater from tapioca starch production in Thailand. Most of the tapioca starch production facilities in the project region utilize open lagoon based systems for treating wastewater. The related technology, skills and labour are readily available in Thailand and there are few risks associated with this technology. Therefore, Alternative 1 does not face technical barriers.

Alternative 2. In the usual case, the 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.
The experience from CDM projects that use similar technology, where methane recovery and utilization for heat generation and flaring of remaining methane, has showed that this technology have faced substantial performance problems due to the inexperience with operation. Under baseline conditions, substantial technical barriers remain for the proposed activity 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 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 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 O&M costs and uncertain commercial returns (from the production and use of biogas). Prior to implementation of the project, the project owner assessed the costs, potential returns and the risks of the proposed activity and came to the conclusion that, given the high investment costs and insecure returns to due to technological risks, the company would not be able to implement the project without the 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 and 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 on 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 not surmountable and the alternative is excluded from further analysis.

Alternative 4 is already excluded.

Alternative 5 also entails high investment and O&M costs and no commercial return as the produced biogas is destroyed without use. The financial barriers are not surmountable and the 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 low understanding of the technology. While there is a lot of talk about the technology, technical understanding of the involved processes (biological, chemical and physical) are poorly understood and therefore decision-making is uninformed, slowing the uptake of this technology. Furthermore, it is known that many biogas projects in Thailand did not perform as expected and others even failed. However, 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 also likely to become less relevant in the future. Given the lack of studies to confirm this barrier, it was decided to judge this barrier as non-existing for Alternative 2 in order to be on the conservative side.

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 an alternative management practice is largely driven by the prospect to generate and use biogas in conjunction with the production of carbon credits. There is no foreseeable regulatory change that could stimulate such change as 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 not in compliance 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.

Only Alternative 1 does not face any barriers and 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 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". Currently, there is an average of 6.52[1] million of rais[2] of cassava cultivation areas in Thailand, most of which located in the eastern and northeastern regions, especially Nakorn Ratchasima (where the project is located), Chaiyaphum and Kalasin provinces. In total, there are 77 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[3]. 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 77 starch factories, 25 have installed an anaerobic digesters (32.5%). Thus, the proposed project needs to be compared with 25 projects.

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

From the 25 projects, 11 projects, including the proposed project, have received the letter of approval from Thai DNA, one project has sold its carbon credits to the voluntary carbon market and another 7 projects are currently undergoing validation and initial verification under VER standards[5] as shown in Table B.1. These projects had an intention to register under CDM; however, due to delays to establish 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.. The remaining 6 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.2.

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 on the existence of the same or similar barriers that avoid these projects from being successfully implemented without consideration of carbon credits.

Table B.1: The projects applying for VER

No.	Project Title	Project Developer
1	SD BioSupply wastewater treatment and biogas utilization project	SD Biosupply Co.,Ltd
2	VP BioSupply wastewater treatment and biogas utilization project	VP Biosupply Co.,Ltd

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

[2] 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.

[3] Source: biogas promotion report from Ministry of Energy.

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

[5] Source: South Pole Carbon Asset Management Ltd

3	Chol Charoen Group Wastewater Treatment with Biogas System (Chonburi)	Chol Chareon Co., Ltd.
4	Chol Charoen Group Wastewater Treatment with Biogas System (Srakaew)	Srakeaw Chareon Co., Ltd,
5	Chol Charoen Group Wastewater Treatment with Biogas System (Khon Kaen)	Kean Chareon Co., Ltd.,
6	Chol Charoen Group Wastewater Treatment with Biogas System (Leoi)	J.Charoen Marketing Co., Ltd.
7	Chol Charoen Group Wastewater Treatment with Biogas System (Chacheongsoa)	S.C. Industry Co., Ltd.,

Table B.2: The projects applying for CDM

No.	Project Title	Project Developer
1	Wastewater Treatment with Biogas Technology in a Tapioca processing plant at P.V.D. International Company Limited, Thailand	P.V.D. International Co.,Ltd
2	Wastewater Treatment with Biogas Technology in a Tapioca processing plant at Roi Et Flour International Company Limited, Thailand	Roi-Et Flour Co.,Ltd
3	Eiamburapa Campany Ltd. Tapioca Starch wastewater biogas extraction and utilization project, Sakaeo Province, Kingdom of Thailand	Eiamburapa Co.,Ltd
4	Bangna Starch wastewater treatment and biogas utilization project	P & Papop Renewable Co.,Ltd
5	Siam Quality Starch Wastewater Treatment and Energy Generation Project in Chaiyaphum, Thailand	Siam Quality Starch Co.,Ltd
6	Kalasin Wastewater Treatment to Energy	Kalasin Flour Co.,Ltd

ODA Additionality Screen

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

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 Finance Institutions, which include ODA.

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 has 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 norms than the Thai regulations.
- The technology applied in the project originates from a Belgian company, leading to know-how transfer. Core elements of the biogas reactor as well as the biogas engine to produce electricity are imported, leading to technology transfer.
- The anaerobic digester requires special training of skilled staff to operate and maintain the power plant, creating employment and leading to knowledge transfer to the host country and specially 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)	**Rational**
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 and 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.
• 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. Further, 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. .
• 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.
• Soil condition (quality and quantity)	+1	As compared to open lagoons, the biodigester allows for an easier handling of the produced sludge, which can be used as high quality organic fertilizer. However, the impact on soil condition is considered to be marginal.
• Biodiversity (species and habitat conservation)	0	As compared to the baseline, no significant change in biodiversity is expected.
Sub Total	**+5**	
Social Sustainability and Development		
• Employment (including job quality, fulfilment of labour standards)	+2	The project leads to employment generation in the power plant itself and in the operation and maintenance of the biogas system. Eight fulltime positions have been created within the plant. The employment of skilled staff has a significant impact on job quality in the rural context of the project.
• Livelihood of the poor (including poverty alleviation, distributional equity, and access to essential services)	0	As compared to the baseline, no significant change is expected.

• Access to energy services	+1	Since the project activity is a net exporter of electricity to the grid, it contributes to a better reliability of the local grid and helps adding renewable energy based capacity generation to the national grid.
• Human and institutional capacity (including empowerment, education, involvement, gender)	0	As compared to the baseline, no significant change is expected.
Sub Total	**+3**	
Economic and Technological Development		
• Employment (numbers)	+2	8 fulltime jobs are created for plant operation and maintenance. 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 tapioca roots and subsequently to more jobs and revenues in the rural sector.
• Balance of payments (sustainability)	+2	As previously mentioned, the project activity leads to a significant energy cost reduction by replacing fossil fuels for thermal energy and electricity generation. In addition, the project generates extra revenues by exporting electricity to the grid, contributing to the economic sustainability of the project. 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 foreign origin.
• 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 agro industry. The project contributes to technology transfer and has a great replication potential in the starch sector in Thailand and other countries.
Sub Total	**+6**	
Total	**+14**	

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. As the project scores +14, this project satisfies all 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.

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 Initial Stakeholder Consultation
   The Gold Standard Initial Stakeholder Consultation was held at Khamtalesor School on 26 July 2007. The results of the Gold Standard Initial 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

A description of environmental impacts of the project activity is featured under Section D in the PDD and will be validated by the DOE throughout the regular CDM validation process.

Public consultation procedures

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

Initial Stakeholder Consultation

The initial stakeholder consultation 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 participant are more concern on the environmental impact regarding the bad odour from the current open lagoon which was clarified during the meeting.

In all, no adverse reaction/comments/clarifications have been sought/received during the Initial 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 Initial Stakeholder Consultation is available in **Attachment 1** to this document.

Main Stakeholder Consultation

The Gold Standard Main Stakeholder Consultation is based on a set of additional criteria in addition to UNFCCC requirements. Full documentation of the project activity will be 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 the consultation period, stakeholders are invited to submit their comments and questions related to the project activity. For this purpose an online comment form is available at www.southpolecarbon.com/goldstandard.htm.

The report on the Main Stakeholder Consultation process will be made publicly available and sent to the DOE for validation.

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 stakeholder consultation meeting and the Sustainable Development Assessment conducted above. The Sustainable Development Assessment Matrix shows that there are no indicators, which would be critical for a positive contribution of the project to Sustainable Development or that are particularly sensitive since there is no indicator scoring below zero.
Local stakeholders have indicated issues of potentially significant importance. A detailed report of the issues raised and the answer provided by the project owner are provided in the Initial Stakeholder Consultation Report (Attachment 1 to this Annex). A summary of the raised issues and their implications on the monitoring requirements is provided in the table below:

Addressed Issue	Answer by project owner	Implications on monitoring requirements
Disturbance sound from the project	The noise level from the boilers will not change after implementation of the project and the biogas engine will not exceed the noise level of the starch production, which is substantial due to many centrifuges used in the process Furthermore, the plant is located six kilometres from any residents, hence the noise from the project is too far away to cause any disturbance..	Given the fact that the noise level from the boilers will not change after implementation of the project and the biogas engine will not exceed the noise level of the starch production and the distance to nearest residents is considerable, monitoring of noise levels would not add any value to the project. Hence, no specific noise monitoring procedure is proposed.
Potential 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, in the boilers and in the engine, which is constantly monitored, ensures that any environmental and health impacts can be excluded.	The wastewater treatment plant already includes safety and monitoring devices as well as safety and quality control procedures in order to avoid any release of biogas. The entire biogas handling system (including control of the entire biogas flow stream, functional capability and combustion efficiency of the flare, the boiler system and the engine) is already subject to continuous monitoring under CDM and periodic controls by environmental authorities. Hence, there is no need for additional monitoring parameters.
Accidents during construction or operation	The wastewater treatment plant has all provisions for a safe handling of	There are no evident monitoring parameters, apart

of the Project which could affect human health (explosion risks due to biogas leakage)	biogas, including an automated flaring system and a warning system in case of a significant pressure drop (indicating leakage) in the system. 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.	from standard regular safety procedures and the installed biogas handling equipment and procedures (flare, safety valves, safety sensors), which could significantly reduce accident risks during the operation of the project.
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, which will further reduce the COD load to a value, which is way below the 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 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	Contamination of local water streams or ground water is the most serious risk of the project. However, wastewater discharge quality after the reactor is already subject to continuous monitoring under CDM and periodic controls by environmental authorities. COD values, representing the main indicator for the quality of the wastewater prior to discharge, will be measured on a daily basis, with up to 3 samples per day prior to discharge into the lagoons. As mentioned above there is no effluent leaving the lagoon system since the water is kept in a closed loop. There is no need for additional monitoring parameters.

	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 closed and the biogas produced is utilized for electricity and heat generation. Any gases that would lead to odour emissions (mainly H2S and other sulphur compounds) are captured with the biogas and either destroyed in the boilers or removed in the desulphurization system prior to engine, without release of odour emissions to the atmosphere.	Given the fact that the new system makes a substantial contribution towards an improvement of odour emissions from the open anaerobic lagoons, there is no need for additional monitoring procedures.

None of the issues in the table above can be converted into additional monitoring requirements because:

- the CDM monitoring requirements already prescribe monitoring of all relevant parameters, or
- the indicated issues cannot be influenced by the project owner during the operation of the plant
- the indicated issues are not relevant or have rather a positive effect as compared to the baseline

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 monitoring method (including data registration, monitoring, measurement and calibration) and the equipment applied
- Quality assurance and control procedures for the monitoring process
- Documentation of all relevant monitoring steps

Attachment 1 - Initial Stakeholder Consultation Report

CYY Biopower wastewater treatment plant

Pongdeang District, Khamtalesor, Thailand

INITIAL STAKEHOLDER CONSULTATION REPORT

AIMS OF THE EVENT

The initial 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 to the community and global environment at large were also discussed.

INVITATION PROCEDURES AND LIST OF ATTENDEES

AEP and CYY send 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, are 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 was 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 step2 : 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 the CYY project is related to CDM and how the project can 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 process of treating wastewater 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 based on 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 allowed 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 forum:

The overall response to the project, from all invited stakeholders, was encouraging and positive. Most of the questions from the participant were regarding the environmental impact of 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. 5 persons refused to answer 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 general questions and answers are listed below:

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

Yes, it will. Because 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. Very little odour will be released trough the wastewater of the UASB system released to the open lagoon for the final treatment. 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 3 plants in Thailand which are working successfully.

B. Environmental and Social Impacts Checklist results:

After the presentation, the questionnaires were distributed to 43 participants (male participants 76.74%, female 23.26%; local government representatives 51.6%, private sector and local community representatives 48.84%).

The key findings from questionnaires as per Appendix E show below. Please note that only the issues with less than 90% approval rate are discussed below:

Environmental Impacts

- 71.05% of respondents agreed that the construction, operation or decommissioning of the Project will not affect natural resources or ecosystem.
- 76.32% of 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.
- 86.84% of respondents agreed that the Project will not release pollutants or any hazardous, toxic or noxious substances to air.
- 84.21% of 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

- 78.95% of respondents considered that there is a significant reduction on health risks, and in bad odour to the local communities.
- 78.95% of respondents considered that the project will improve air quality owning to the reduction of the fossil fuel combustions.

- 76.32% of respondents considered that the project will improve soil condition as compared to conventional practices.
- 78.95% of respondents considered that there is no impact in the social changes, for example, in demography, traditional lifestyles, and employment.

Overall, the participating stakeholders were satisfied with the outcome of consultation (84.62%) 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 some participants around 15.79% have raised some concerns related to the impacts of the project. The major concerns and the answer from the project owner are given below:

- Disturbance sound from the project

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

- The perceived risk that a gas leakages would create explosions

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, which will further reduce the COD load to a value, which is way below the 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 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 closed and the biogas produced is utilized for electricity and heat generation. Any gases that would lead to odour emissions (mainly H2S 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 are being addressed by the project owner or are monitored throughout the project's operation, it was not necessary to make any changes to the project design.

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