Chantaburi Starch Wastewater Treatment and Biogas Utilization Project

Additional PDD Annex as required for Gold Standard validation version 1

GS Annex Version: 1.0
Date: January 29th, 2009
Contact person: Patrick Bürgi, South Pole Carbon Asset Management Ltd.
p.buergi@southpolecarbon.com, +41.44.633 78 76

Introductory Notes

This document contains the PDD Annex to validate the 1.9 MW Wastewater Treatment and Biogas Utilization 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 up-flow anaerobic sludge blanket technology (UASB) biogas reactor to generate biogas which shall be used to replace fossil fuel usage and generate renewable electricity at an existing starch plant. The project activity implies a series of sustainable development aspects including technology transfer, environmental and social benefits.

The project replaces the existing wastewater treatment practice by adding UASB system into the existing treatment system. The project activity avoids the release of methane into the atmosphere, which would occur due to the anaerobic digestion of the organic content in the open lagoon based wastewater treatment system (anaerobic conditions, leading to methane generation within the lagoon are the result of a lagoon depth greater than 1m and an average atmospheric temperature of about 28°C). Furthermore, the biogas reactor produces sufficient quantities of biogas to fuel a boiler for the production of process steam for the starch manufacturing plant, thus replacing the use of heavy fuel oil, and to fuel a gas engine for the production of power for the starch plant's own use and sale to the Thai electricity grid. The replacement of heavy fuel oil in the thermal oil boilers, the replacement of diesel from the generators and the displacement of electricity from the national grid, which is generated by fossil fuel fired power plants from the Thai national grid to a large extent, will lead to further reductions of greenhouse gases. 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 tapioca-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.

UNFCCC Additionality Tool "Tool for the demonstration of additionality" (EB 39 Report Annex 10, Version 05)

GS Manual for CDM Project Developers: **Section 3.3.2**

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:

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

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 for effluent treatment. Therefore, alternative 1, 2, 3 and 5 do not face any legal barriers.

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. Prevailing 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 practice to handle wastewater from tapioca starch production in Thailand. Most of the tapioca starch production facilities in the project region utilize open lagoon 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.

When considering *Alternative 2*, it is implied that project operators will need to acquire by themselves - through contracting or in-sourcing - the skills and labour to properly operate and maintain such a facility. 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 shown that this technology has 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 demand 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, high 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. For more details related to this argument please refer to the financial analysis provided in the PDD.

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, as it is at odds with Thai law.

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 some social barriers due to the technology complexity. Technical understanding of the involved processes (biological, chemical and physical) in the technology is poorly understood and therefore decision-making is confused, slowing the uptake of this technology. Furthermore, it is of general knowledge that many biogas projects in Thailand did not perform as expected, while some even failed[1].
With the increased availability of operational experience, this barrier is however likely to become less relevant in the future. Given the lack of studies to confirm this barrier and in order to be on the conservative side, it was decided to judge this barrier as non-existing for Alternative 2.

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 are relevant due to existing and future lack of regulatory pressure to adopt *Alternative 2*. For more information on this barrier please refer to the "common practice analysis" provided below.

Alternatives 3 to 5 have been excluded already.

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 as there are neither commercial nor regulatory incentives.

Since only *Alternative 1* - continuation of the current open lagoon based wastewater treatment system - does not face any barriers and since, as discussed above, there are no arguments other than CDM

[1] 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.

revenues to pick the solution under *Alternative 2*, *Alternative 1* would be considered as 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

Since the proposed CDM project is not a "first-of-its-kind", 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 additionality, projects are considered "similar" in case

- they are located in the "same country/region",
- they are of "similar scale", and
- they "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 8[2] million of rais[3] of cassava cultivation areas in Thailand, most of which are located in the eastern (where the project is located) and northeastern regions. In total, there are 85 native starch factories[4], 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[5], which require little investment, have low operation and maintenance costs and fulfill the national regulations for wastewater discharge. Out of 85 starch factories, 26 have installed anaerobic digesters (29.4%). Thus, the proposed project needs to be compared with 26 projects.

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

From the 26 projects, eight projects have received the letter of approval from Thai DNA and are either registered (Table A.1), under registration (Table A.2) or review (Table A.3), or under validation (Table A.4). The remaining eight projects have all made requests recently to receive the letter of approval from Thai DNA and are initiating the CDM application process, in Table A5.

One project has sold its carbon credits to the voluntary carbon market and another five are currently undergoing validation and initial verification under VER standards[6] as shown in Table B.1. These projects intended 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.

Thus, none of the 26 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.

[2] Source: http://www.thaitapiocastarch.org/crop.asp
[3] A rai is an area unit, which is equal to 1,600 square meters (40 m x 40m). It is commonly used in TH used for measuring land area. It is commonly used in Thailand.
[4] Source: http://www.thaitapiocastarch.org/article05.asp
[5] Source: http://www.thaitapiocastarch.org/article01.asp
[6] Source: South Pole Carbon Asset Management Ltd

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

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

Table A.2: Projects requesting registration by the CDM EB

No.	Project Title	Project Developer
1	CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand [8]	CYY Bio Power Co Ltd
2	Cassava Waste To Energy Project, Kalasin, Thailand (CWTE project)[9]	Asia Modified Starch Co., Ltd. (AMSCO)

Table A.3: Projects undergoing review requests

No.	Project Title	Project Developer
1	Siam Quality Starch Wastewater Treatment and Energy Generation Project in Chaiyaphum, Thailand[10]	Siam Quality Starch Co.,Ltd
2	Jiratpattana Biogas Energy Project[11]	Thai Biogas Energy Company
3	Chao Khun Agro Biogas Energy Project[12]	Thai Biogas Energy Company

Table A.4: Projects available for public comments on the UNFCCC CDM website

No.	Project Title	Project Developer
1	ES Bio Energy Wastewater Treatment and Energy Generation Project at Srakaew[13]	Eastern Sugar Power Co., Ltd.
2	Biogas from Ethanol Wastewater for Electricity Generation	Pornvilai International Group Trading Co., Ltd. (PVL)

Table A.5: Projects having requested LoA

No.	Project Title	Project Developer
1	Wastewater treatment with Biogas System in a Starch Plant for Energy and Environment Conservation in Nakorn Ratchasima	Sima Interproduct Co.,Ltd.
2	Wastewater treatment with Biogas System in a Starch Plant for Energy and Environment Conservation in Chachoengsao	Sima Interproduct Co.,Ltd.
3	Northeastern Starch (1987) CO.,Ltd. -- LPG Fuel Switching Project[14]	Northeastern Starch (1987) Co. Ltd.
4	Khon Kaen Fuel Ethanol Project	Khon Kaen alocohol Co.,Ltd

[7] Source: http://cdm.unfccc.int/Projects/DB/KPMG1175141470.89/view
[8] Source: http://cdm.unfccc.int/Projects/DB/RWTUV1218617500.62/view
[9] Source: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1218551520.16/view
[10] Source: http://cdm.unfccc.int/Projects/DB/SGS-UKL1217944948.76/view
[11] Source: http://cdm.unfccc.int/Projects/DB/DNV-CUK1218619436.44/view
[12] Source: http://cdm.unfccc.int/Projects/DB/DNV-CUK1218616482.16/view
[13] Source: http://cdm.unfccc.int/Projects/Validation/DB/DEEQYPX12PF7ARJFO65LN7UQTNK873/view.html
[14] Source: http://www.tgo.or.th/english/index.php?option=com_content&task=view&id=17&Itemid=29

5	Avoidance of methane emission from the wastewater treatment facility in K.S. Bio-Plus Co. Ltd., Thailand	K.S. Bio-Plus Co. Ltd.
6	Advanced wastewater management at Rajburi Ethanol Plant	Rajburi Ethanol Co., Ltd.
7	Blue Fire Bio wastewater treatment and biogas utilization project	Blue Fire Bio Co.,Ltd
8	Biogas project, Cargill Siam Borabu	Cargill Siam Ltd.

Table B.1: The projects applying for VER

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

ODA Additionality Screen

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

Project financing for this project activity will not use any Official Development Assistance (ODA) funds as defined in the Gold Standard Manual for Project Developers. No loans or grants have been provided by International Finance Institutions.

A detailed financial plan can be provided during validation of the project.

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 (AMS-III.H-Version 10 “Methane Recovery in Wastewater Treatment) in order to determine the baseline scenario and calculate emission reductions.
- Likely baseline scenarios have been developed and assessed using guidance provided by methodology AMS-III.H. 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 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 especially to an under-developed and rural region of the country.

Geographically, transfer of technology and know-how has occurred mainly 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 Chantaburi Starch 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 thanks to the newly installed concrete treatment building.
• Air quality (emissions other than GHG)	+2	By replacing the open anaerobic lagoon with an enclosed bio-digester, 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 bio-digester 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)	+1	The project leads to employment generation in the power plant itself and in the operation and maintenance of the biogas system. Seven 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	**+2**	
Economic and Technological Development		
• Employment (numbers)	+2	Seven 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 will contribute to improving 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)	+1	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)	+1	The project showcases an innovative way to treat wastewater, generate clean and renewable electricity and improve the cost efficiency of agro industry. The project and has a great replication potential in the starch sector in Thailand and other countries and also contributes to technology transfer.
Sub Total	**+4**	
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. As the project scores +11, 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 of 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 within the Chantaburi Starch factory on 22 august 2008. 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 on 22 August 2008 at a meeting room in the Chantaburi Starch factory, which is located 400m away from the wastewater treatment plant. This meeting was attended by representatives from the starch factory, representatives of the local government, local residents, rural entrepreneurs, media representatives and farmers.

The overall response to the project, from all invited stakeholders, was encouraging. Most of the questions from the participant regarded potential environmental impacts such as dust production and landscape impacts, and project's safety. These questions were clarified during the meeting.

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

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
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 of the Project which could affect human health (explosion risks due to biogas leakage)	The wastewater treatment plant has all provisions for a safe handling of 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.	There are no evident monitoring parameters, apart 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 Chemical Oxygen Demand (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 Chantaburi Starch 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.	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.

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

Chantaburi Starch wastewater treatment and biogas utilization project

Soidao, Chantaburi, Thailand

Procedure followed to invite stakeholder comments

A. Public hearing for local stakeholders:

Invitation procedure

The Gold Standard Initial Stakeholder Consultation has been conducted by the project owner Chantaburi Starch Power Limited with assistance from South Pole Carbon Asset Management Limited (Switzerland based company responsible for CDM project development) and Papop Limited (Thai engineering company response for implementation of the wastewater treatment plant).

Stakeholder groups as defined in the Gold Standard procedures have been identified and informed through oral and written means about the meeting. The invitation letter was sent by fax to participants located a long distance from the project, by regular mail to participants without access to a fax and there was an announcement of this meeting posted at the community hall for people who had not received an invitation letter. This invitation process was done 2 weeks before the meeting date. An example of the invitation letter can be seen in annex I.

Place and date of the meeting

The initial stakeholder consultation was held on August 22nd, 2008 at a meeting room within the Chantaburi Starch factory, which is located 400m away from the wastewater treatment plant.

Meeting Participants

The mentioned meeting was attended by local residents and representatives from the following stakeholder categories:

1. Local residents
2. Local government representatives
3. Local entrepreneurs
4. Employees
5. Local farmers

From the overall participants of 104 people, there are only 67 participants have followed the invitation, attended the meeting and returned the questionnaire. The following list shows only the participants who returned their questionnaires after this consultation.

Participation	Occupation/Organization
Nuanchan Tongdaeng	Local resident
Samnaeng Pansuwan	Local resident
Kanittha phapim	Local resident
Pannipa Saengthong	Local resident
Boonyuth Saoyod	Local resident

Sukij Thawinthong	Local resident
Mathee Klunmunkong	Local resident
Kongsak Jaipasert	Local resident
Nikom Thanuwat	Local resident
Suthin Narongsorn	Vice-Mayor
Sangud Narongsorn	Local resident
Boonchan Saorod	Local resident
Surasak Srisawaek	Local resident
Kitti Saenruayngaen	Local resident
Jai Moonpak	Farmer
Orasa Muentiang	Farmer
Sangam Kebpak	Farmer
Boontarn Luadee	Local resident
Warissara Jaiharn	Local resident
Pichitpong Yodpikul	police officer
Sanit Sritakul	Farmer
Panom Thamniam	Farmer
Wipada Pholbumroong	Civil engineer, government officer
Boonsong Sopakhun	Head of the village
Pratheep Preepan	Farmer
Sompoje Julthai	Farmer
Kanung Yaenarom	Farmer
Noppadol Preamprasit	Farmer
Wimol Suato	Farmer
Supap Jumpa	Farmer
Sompong Pannala	Merchant
Ampol Kaewkam	Farmer
Sompoj Wongsiri	Local resident
Wicharnchai Srimala	Farmer
Cholticha Phadungsat	Local resident
Jittra Moonpat	Local resident
Chanmanee Tongtawin	Local resident
Amnaj Larbtawee	Local resident
Jantee Kumjul	Local resident
Auan Moonpat	Local resident
Lai Koeytong	Local resident
Wilai Yodklang	Local resident
Boonchuay Sripa	Mechanic
Boonlaew Sripa	Local resident
Lek Kongkaew	Self-employed
Boonchan Luadee	Laborer
Nukul Attano	Mechanic
Somporn Moonpat	Farmer
Wan Thamsathien	Farmer
Pranee Boonta	Local resident

Saichon Moonwan	Local resident
Pitsamai Saenarsa	Farmer
Swat Chantachote	Farmer
Polkrit Suriyong	Farmer
Laddawan Moonpat	Farmer
Somsri Waree	Self-employed
Somkieat Chaewwong	Farmer
Nattanan Kaisuban	Local resident
Tian Wandee	Farmer
Sompong Wirunya	Farmer
Jakkrit Suksamarn	Local resident
Kiangkai Sritakul	Farmer
Samai Pongsart	Farmer
Amnaj Noppornpitak	Government officer
Suthep Boondeelek	Local resident
Udomsak Rongkana	Local resident
Pongcharoen Rongkana	Local resident
Thitiwat Rattanathamcharoen	Government officer
Wicharn Sipaison	Police officer
Saitong Jaiprasert	Farmer
Boonlua Tongpen	Local resident
Suwat Luanam	Local resident
Narongsak chaewwong	Student
Rassamee Pinitka	Farmer
Preecha Wangsuppakijkosol	Local resident
tadtong Duangchan	Self-employed
somboon Jampa	Farmer
Wattana Kuseu	Government officer
Noppanan Prasawas	Government officer
Kwat Amangla	Government officer from Soidao
Sunwa Sukkasem	Government officer from Soidao
Charin Boonpeng	Farmer
Sombat Ladthong	Local resident
Boonsri Putthajan	Farmer
Tongsaeng Janyaban	Farmer
Pongpitsanu Lapan	Local resident
Winai Sila	Local newsman
Sanguan Wongpa	Local resident
Pattama Kaewkaew	Local resident
Lumkaen Pankaew	Local resident
Jittisorn Kittipongthikorn	Local resident
Jantra Boonyok	Local resident
Suparp Moonpak	Local resident
Prapas Putonglom	Government officer
Supat Janyatham	Local resident

Boonchan Saiboontang	Farmer
Jul Jampa	Farmer
Prajak Janwichit	Farmer
Yommana Sawasdipong	Farmer
Sompong Sopee	Farmer
Tongyoi Kaewauan	Farmer
Amnard Larptawee	Local resident
Chantee Kamjul	Local resident
Chanai Wongpitak	Local resident

Language

Documentation and meeting was held in Thai which is the local language.

Meetings procedure

- Opening (15 min)
- Purpose of the consultation (5 min)
- Description of the project and environmental impacts (20 min)
- Questions and Answers session (10 min)
- Completing checklists (Appendix E to the Gold Standard Project Deloper's Manual) (20 min)
- General feedback (15 min)

Meeting documents and protocols

On completion of the various meetings, the following documents were collected and attested by the signatures of the stakeholders that were present at the venue:

1. Presence list with name, address and occupation.(Annex II)
2. Non-technical description of the project (Annex III)
3. Documentation on environmental impacts of the project (Annex III)
4. Filled out Appendix E of Gold Standard (checklist) (Annex III)
5. Notes for additional comments on the project activity (part of checklist for gold standard (Annex III))

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

B. Email consultation for Gold Standard supporting organizations in Thailand:

Invitation procedure

An invitation was sent to representatives of Gold Standard supporting organizations in Thailand and international Gold Standard Supporters on August 8th 2008. The invitation included a short introduction of the project and the date and location of the scheduled initial stakeholder consultation. No reply was received.

Period of email consultation

From 8 August till 22 August 2008.

Compilation of comments received

A. Public hearing for local stakeholders:

The overall response to the Project, from 104 participating local stakeholders, was encouraging and positive. The greatest asset achieved by the project appears to be the positive effect on the environment. Stakeholders acknowledge that the improvement of the wastewater treatment technology will reduce odors released to the surrounding area, which previously was a major concern for the surrounding community like for other cases of tapioca starch factory. This project is viewed as a positive environmental plan that is important for local water resources and for the community's quality of life.
The project is considered to be one of the leading projects in developing covered lagoons for tapioca starch manufacture, where currently the wastewater is considered as a major odor and methane producer. This project is considered a financially risky plan due to the required investment and rate of return.

To sum up the sustainability of the project, the various benefits (as reported by local stakeholders) are listed below:

1. The installed technology contributes to a cleaner soil and water, and reduced odors;
2. Use of biogas represents a sustainable way for generating energy;
3. Since the system operates within strict environmental standards there will be no negative impacts to the environment due to the plant;
4. The project is well designed, returning clean water to the environment and not producing additional pollution;
5. The plant will create new jobs.

37 questionnaires were not returned. Some people declared that they could not read and write and other did not give their questionnaires back. No negative comments or reactions to the project have been received during the oral hearing.

Five participants left general comments and asked questions related to the project:

1. The village leader asked if there are any toxics contaminating the treated wastewater.

   The representative from Papop, project developer, explained that the Tapioca starch process does not contain any toxics because the tapioca starch is used as food and in the treatment process does not contain any toxic chemicals.

2. One local resident questioned the safety of the biogas system.

   Comment by project developer: "The nature of the biogas is lighter than the air so if it leaks from the system, it will flow upward to the sky. So in normal situation, it is difficult to cause fire. In addition, in order to sell CERs, the company is required to have a leak detector to protect gas leakage from system."

3. The Vice-Mayor asked how the methane would be used.

   The Plant manager explained that the methane in this plant would be used in the boiler and the Gas engine to produce electricity. The electricity is sold to the Local Electricity Authority. The amount of electricity generated by the plant will be enough to supply three villages around the factory.

4. A local resident raised the issue of dust caused by the plant operation

   The Project developer explained that no dust should be generated by the operation of the plant.

5. The last question was asked by another resident. He wondered where the UASB tower is located.

   The Plant manger explained that the UASB tower is located in the area next to the already existing wastewater treatment ponds. It is located behind the factory building. This location cannot be seen from outside the factory because it is quite far from the entrance of the factory.

The Gold Standard questionnaire (Appendix E to the Gold Standard Manual for CDM Project Developers) was presented in Thai. It consisted of 23 questions that were to be answered by the participants.

The following five questions were answered with "yes" by some of the participants:

1. Question 1: Will the construction, operation or decommissioning of the Project use or affect natural resources or ecosystems, such as land, water, forests, habitats, materials or, and especially any resources which are non-renewable or in short supply?

Two "yes"- answers. No specific comments.

Answer by the project owner: The aim of the project is to avoid any harm or threat to the environment or to the people. The construction of this project is under the supervision of a professional and experienced company, which has been working for this type of wastewater treatment system for over ten years. The construction was operated under international standards in order to ensure safety to both employees and local residents around the area.

2. Question 15: Will there be any risk of accidents during construction or operation of the Project which could affect human health?

Two "yes"- answers. No specific comments.

Answer by the project owner: 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.

3. Question 16: Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?

Seven "yes"- answers and all the people who answered "yes" commented that this plant needed to hire more local people for its operation.

Answer by the project owner: Given the overall very positive response to the project, it is assumed that the answers above highlight the beneficial social impacts of the project, as there was no explicit negative remark. However, the construction of this plant does not need a substantial number of people – which would have had an impact on a culture change. During the plant operation, more employees will be needed to operate this section. This aspect will lead to positive effects for the community.

4. Question 19: Is the project in a location where it is likely to be highly visible to many people?

20 "yes"- answers. No specific comments.

Answer by the project owner: The plant is located next to the factory building, which is one kilometre away from the local road, and three kilometres away from the closest communities around the factory area. The surrounding areas are used to plant cassava and longan. This

makes it very difficult for villagers to see the UASB and Biogas container. All the people who answered "yes" probably considered that this plant was visible to them when in the meeting room, which is located close to treatment plant.

6. **Question 20: Are there existing or planned land uses on or around the location e.g. homes, gardens, other private property, industry, commerce, recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be affected by the project?**

   Three "yes" - answers by participants.

   Answer by the project owner: This development uses only the area belonging to Chantaburi Starch Factory. The wastewater treatment plant is located next to the recent wastewater treatment ponds, which are in the middle of the factory area. The construction and operation of this plant would use only the area within the factory boundaries.

B. Email consultation for Gold Standard supporting organizations in Thailand:

Regarding the consultation meeting, the consultation document was sent two weeks prior to the meeting to the Gold Standard supporting organizations in Thailand, such as the Appropriate Technology Association (ATA), Dhammanart Foundation and Renewable Energy Institute of Thailand (REIT). No comments were received.

C. Changes to Project design based on comments received

As no major environmental concerns were raised during the entire initial stakeholder consultation process, it was neither necessary to make any changes to the Project design nor to incorporate any additional measures to limit or avoid negative environmental impacts. The same applies to socio-economic concerns, which have not been raised at all.

It is evident from the stakeholder consultation process, that the project is perceived as a positive example for the Tapioca starch factory in Thailand and that it contributes to sustainable development of the region.