T@W Good Practice Form: Thailand

Chumporn Applied Biogas Technology for advanced Waste water management

Setting:

Title:	Chumporn applied biogas technology for advanced wastewater management project
Country:	Thailand
Location:	Salui Sub-district, Tasae District, Chumporn Province
Start date:	2006
End date:	2017
Technology keyword(s):	Industrial Waste
Host sector:	The project sectoral scope, as defined by the UNFCCC, is Waste handling and disposal.

General description:

Summary:

The project activity is the introduction of anaerobic wastewater treatment with biogas collection and utilisation in Thai palm oil industry. Up to now, traditional anaerobic open pond systems are commonly applied in Thai palm oil industry. The tank-reactor technology commonly applied in industrialised countries has been adapted for Thai conditions – the result is the A-CSTR ("Appropriate - Complete Stirred Tank Reactor") – in co-operation with the University of Wageningen, Netherlands. Thus, the envisaged project uses state of the art technology that results in a significantly better performance than commonly used technologies in palm oil industry in Thailand.

Biogas generated from project activity approximately 20,700 m^3 of biogas per day will be used for replacement of fuel oil and oil palm shell which is currently used to generate steam in Refinery plant.

The "Chumporn applied biogas technology for advanced waste water management" project will reduce GHG-emissions in two following ways, which has total GHG emission reduction of 45,749 tons CO_2-equivalent per year:

1. The reduction of methane emissions released to the atmosphere by the existing anaerobic open pond treatment system, and

2. The reduction of CO_2 emissions resulting from the burning of fossil fuels within the production process of the facility.

Aims:

The purpose of the Chumporn applied biogas technology for advanced wastewater management is to shift from traditional wastewater treatment in open, anaerobic ponds with uncontrolled release of methane to the atmosphere to a closed tank digester system with biogas capture and utilization and thus to contribute to an economically, environmentally and socially sustainable development of Thai palm oil industry.

Summary of Results:

Biogas produced from A-CSTR palm oil wastewater treatment system approximately 20,700 m^3 per day shall be used to replace fuel oil and oil palm shell, for steam generation, shell approximately 530,363 litres/year and 7,650 tons/year respectively. Biogas will be utilised in two steam boilers; a high pressure boiler (90 bars) and a low pressure boiler (30 bars).

Operation Time:

Expected plant's life time is 12.5 years. (10 years as pessimistic, 15 years as optimistic scenario)

Feasibility Study:

The project activity will provide FIRR (base case) 10.45% with the project's payback period of 8 years and 3 months. Fuel prices constitute the major parameter influencing the project's economic attractiveness. As a sensitivity analysis reveals, the payback period is reduced to be 6 years and 6 months, if fuel prices increase by 20% and the FIRR would be increased to be 15.66%. On the contrary, if fuel prices decrease by 20%, the payback period increases to be 11 years and 6 months, and FIRR shall be decrease to be 4.49%.

Technical details:

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A modern wastewater treatment technology will be implemented at the pal oil plant in Chumporn, Thailand. Wastewater generated through palm oil processing averages 0.5 m^3/ton of fresh fruit bunches (FFB). The palm oil mill processes about 450,000 t FFB and thus 210,000 m^3 wastewater per year.

The existing simple wastewater treatment system in open, anaerobic lagoons will be replaced by a closed tank digester system to recover methane and produce biogas. The A-CSTR tank reactor system

has been chosen as this seems best suited for the underlying case. Since the wastewater is characterized not only by a high COD, but also by a high load of suspended soils with low separation ability, an adoption of traditional tank reactors to the specific site characteristics is necessary. Thus, a A-CSTR system will be established, which has been developed in co-operation between Thai experts and the University of Wageningen, Netherlands.

The planned utilizable volume of the digesters is 6,000 m^3, which will allow handling the daily load of about 700 m^3 waste water. The system will produce approximately 20,700 m^3 of biogas per day, which will substitute the utilization of heavy oil in a high pressure boiler, and palm shells in a low pressure boiler for heat generation in the refinery plant. The digested effluent will be used for irrigation purposes at surrounding palm plantations.

Next to the tank reactor as the central element of the improved treatment process, the following components will be installed:

- Collection and equalization tank
- Screening and sand trap
- Distribution Tank
- Sand Bed Filter
- Post Treatment and storage pond
- Biogas Filter; retained gas stored will first be channeled through a biogas filter in order to remove hydrogen sulfide (H2S)
- Biogas combustion system in two boilers

Energy data:

Energy data:

Biogas produced from the project activities is approximately 20,700 m^3 per day. The produced biogas shall be used to replace fuel oil and oil palm shell approximately 530,363 litres/year and 7,650 tonne/year respectively for producing high & low pressure steam. Biogas will be utilized in two steam boilers; a high pressure boiler (90 bars) which is currently used fuel oil and a low pressure boiler (30 bars) which is currently used palm shell.

Energy saved/generated:

The project will save fuel oil approximately 18,616 GJ/year, which is equivalent to fuel oil 530,363 litres/year (calorific value of fuel oil 35.1 MJ/litre).

Palm shell saving is approximately 105,570 GJ/year which is equivalent to palm shell 7,650 tonne/year (calorific value of palm shell 13.8 MJ/kg).

Monitoring:

The monitoring methodology AM0013/Version 02 "Forced methane extraction for grid-connected electricity supply and/or heat production" as of May 13th, 2005 is applied to the project activity. The Monitoring Plan (MP) has been provided for the necessary methodological, data collection, and auditing needs and procedures for recording the project variables as follows:

- COD concentration of effluent
- Flow rate of effluent
- Mass of fossil fuel used onsite
- Biogas flow rate at digester outlet
- Biogas CH4 content at digester outlet or heating equipment inlet
- Biogas flow rate at heating equipment inlet
- Stack gas flow rate
- Stack gas CH4 content
- Electricity consumed by digester processes

Environmental data:

Environmental data:

According to the Regulations of the Kingdom of Thailand, a comprehensive EIA is not required. Anyway, the Thai DNA has adopted standards and requirements on Sustainable Development and Environmental Impact screening which the project has covered all requirements. Otherwise, the project causes the positive benefit to environment as follows:

- The project will serve self-supply of thermal power in the agro-industry in Thailand and also, will help to decrease the level of fossil fuel and biomass derived air-borne particles;
- The project Improves efficiency in the use of energy resources;
- The utilization of the existing ponds as post-treatment facilities, thus achieving higher treatment efficiency and contributing to protecting the environment;
- Regarding the methane gas thermal generating plant, no smoke or soot will be produced; and
- The current release of fugitive methane from the existing anaerobic open pond system will be

eliminated; odor recently deriving from the ponds will be avoided.

Project GHG-emissions: Project GHG emission which is included methane emissions from post-treatment lagoons, leakage from the biogas digester, and CO_2 emissions associated with the digester auxiliary equipment (electricity consumption) is approximately 24,039 tonnes CO_2 equivalent/year

GHG-emission reductions: GHG emission reduction of the project is approximately 45,749 tonnes CO_2 equivalent/year

"EAU, CER, ERU, AAU": CER

Methodology: AM0013/Version 02 "Forced methane extraction from organic waste-water treatment plants for grid connected electricity supply and/or heat production" as of May 13th, 2005 is applied to the project.

Baseline Baseline emissions are methane emissions from existing open lagoons and the utilization of fossil fuels for heat generation for the industrial processes in the palm oil plant. It is currently not planned to generate electricity through the project activity. Consequently, baseline emissions related to electricity supply are not considered in the following.

Monitoring: The monitoring methodology AM0013/Version 02 "Forced methane extraction for grid-connected electricity supply and/or heat production" as of May 13th, 2005 is applied to the project activity. The necessary monitoring data and parameters shall be recorded as above.

Contribution to Sustainable Development: The project will contribute to the sustainable development as follows:

Produced biogas can be used to substitute 530,363 litres/year of fuel oil and 7,650 tons/year of palm shells;

The utilised biogas will reduce methane emission and thus decrease the impact on the global warming;

Sludge and treated effluent can be used for fertilizing farm land without polluting the groundwater;

Factory operation becomes more efficient and stable. Additional fossil fuel consumption will be

avoided; Substitution of fossil fuels will reduce air pollution caused by the combustion process;

The problem of bad odours and insects caused by the wastewater treatment system will be reduced;

Natural water resources, supplying the community will be improved through better treated effluent that can be used for agricultural purpose without harming the groundwater;

Employment opportunities will increase, especially during the construction and installation of the system, and also for the long-term maintenance of the biogas technology and related systems; and

A macroeconomic benefit is generated by the reduction of imports of fossil fuel; Moreover, the project will reduce the government's outlays for power production infrastructure.

Economic data:

Economic data: The project activity will provide FIRR (base case) 10.45% with the project's payback period of 8 years and 3 months.

Financing: The financing will be realized by Chumporn Palm Oil Industry (CPI) with own capital, a bank loan, and the sale of generated CERs to private investors.

Capital cost: 40.8 million baht

Operational Costs: 4.88 million baht per year
Payback: 8 years and 3 months

Additional Information:

Printed or electronic reports or other literature available:

Title Chumporn applied biogas technology for advanced waste water management, version 1, September 9th 2005 (ver. 2)

Methodology AMOO13 Ver 2

Address for download of electronic document:

http://cdm.unfccc.int/methodologies/DB/YA5AG3R9IBXSES5YNPTBJUA5347HZK/view.html

Project Document: Address for download of electronic document:

http://www.netinform.de/KE/files/pdf/CPI_PDD_V1.pdf

Project Web site: www.cpi-th.com

Photo Library:

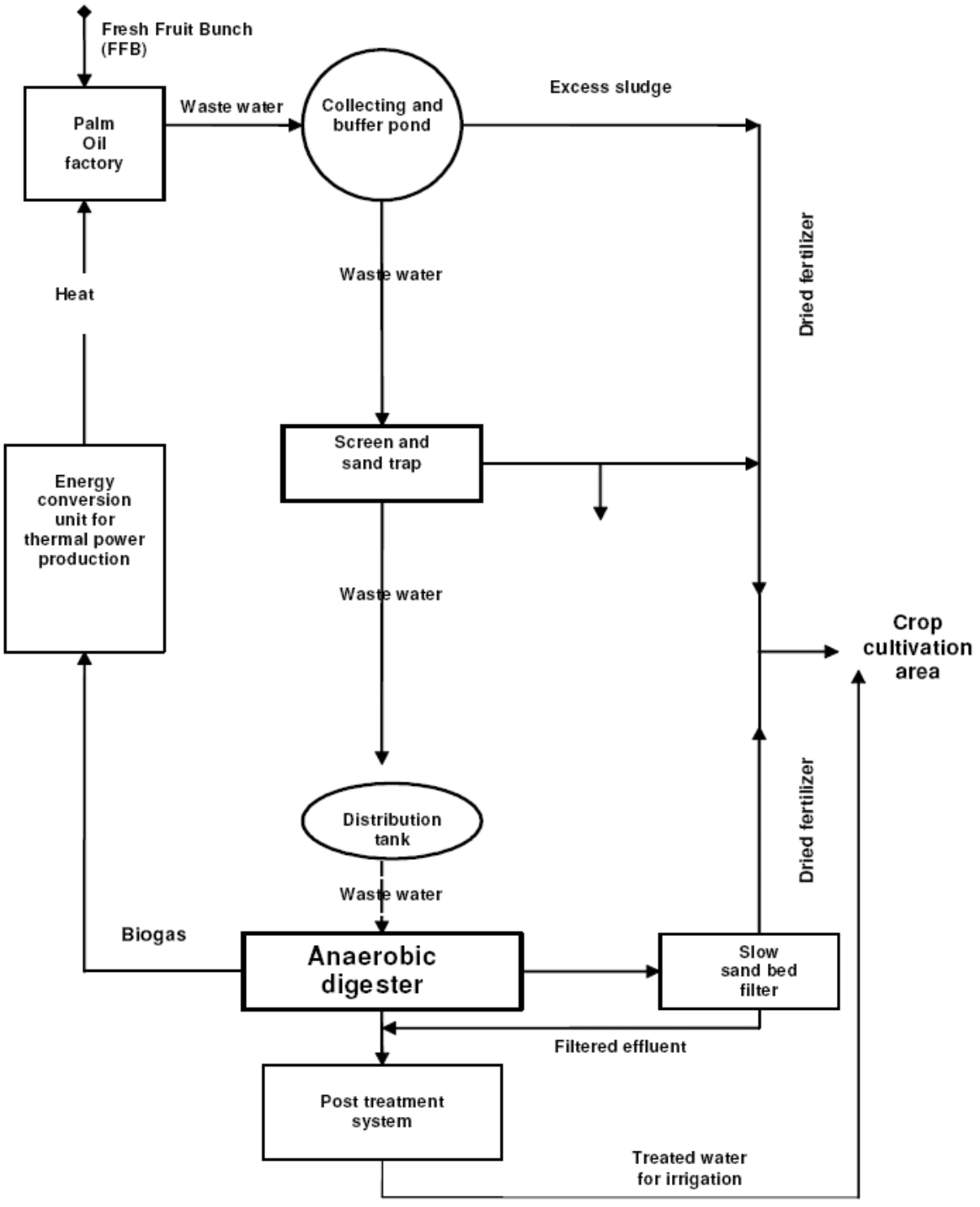

Figure 1 Flow diagram of improved waste water management system

(Source: CDM-PDD of Chumporn applied biogas technology for advanced wastewater management project)

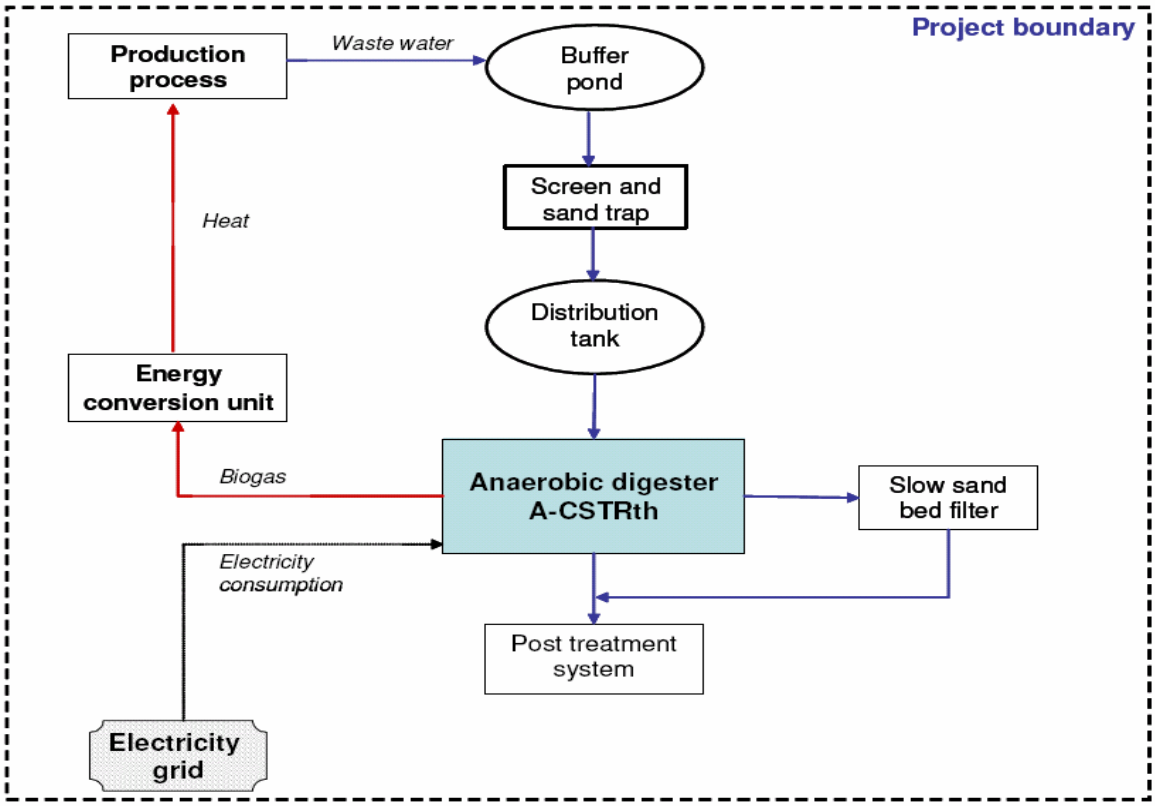

Figure 2 Project Boundary

(Source: CDM-PDD of Chumporn applied biogas technology for advanced wastewater management project)

Contact information:

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