CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

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PT. WIRA Tapioca Starch Factory Methane Collection And On-site Use Project in Lampung Province, Republic of Indonesia
("The Project" or "the Project activity")

A.2. Description of the project activity:

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The Project activity involves the installation of a closed anaerobic wastewater treatment and biogas extraction system at an existing tapioca starch manufacturing plant and its auxiliary facilities for treatment of organic wastewater, which is currently treated at an open lagoon based system. The collected biogas will be utilized to generate electricity that will be used on-site. By extracting and utilizing biogas, the Project activity will reduce the CH_4 emissions that would have otherwise been emitted from the existing open lagoons. The electricity generated with biogas by the Project activity will displace the diesel based captive generation and will additionally reduce GHG emissions.

The project developer, PT. WIRAKENCANA ADIPERDANA (PT. WIRA), is a big tapioca starch producer in Indonesia. PT. WIRA plans to install "Short HRT (Hydraulic Retention Time) Bio Immobilised Methane Fermentation Process Digesters (Dome Digesters)" in its Kedaton tapioca starch factory located in Lampung Province in the southern part of the Sumatera Island in Republic of Indonesia.

The factory is currently capable of producing 92 tons of tapioca starch daily. The operation of this facility results in approximately 1,661m^3/day of wastewater with high organic content. All wastewater from the production process is currently treated at an open anaerobic lagoon system prior to its release into the adjacent river system. The existing system meets the effluent regulatory standards for the tapioca industry in Indonesia.

In the Project activity, the organic wastewater from Kedaton plant is sent to anaerobic digesters prior to being discharged into the existing open anaerobic lagoon treatment system. Anaerobic digestion consistently generates methane-rich biogas. Generated biogas is collected and utilized as fuel for electricity generation and surplus biogas is flared in the Project.

The generated electricity will satisfy Kedaton plant's electricity demand, replacing the diesel based captive power generation. The Project plans to install one biogas engine generator with capacity of 1 MW.

The amount of greenhouse gas (GHG) emission reduction resulting from the Project activity is expected to be approximately 29,000tCO_2e per annum.

The Project activity will directly contribute to sustainable development of Indonesia in several ways as shown below.

Environmental benefits
- Mitigation of uncontrolled GHG emission from the lagoons
- Mitigation of unpleasant odour caused by treatment of high strength organic wastewater at open lagoons
- Improvement of the quality of the wastewater released to the river system

- Reduction of air pollutant emissions due to cleaner emissions from the new methane gas engine
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Economical benefits
- Utilization of biogas as a new indigenous fuel source in Indonesia
- Access to foreign expertise and training to facilitate smooth technology transfer
- Cost saving for tapioca industry in the region

Social benefits
- Creation of new jobs for local population.
- Staff training to improve their technical skills.

A.3. Project participants:

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Table 1 Project participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No).
Party/country: Indonesia (host)	PT. WIRAKENCANA ADIPERDANA	No
Party/country: Indonesia (host)	UNIVERSITAS LAMPUNG (UNILA)	No
Party/country: Japan	JFE TECHNO-RESEARCH Corporation (JFE-TEC)	No
Party/country: Japan	KAJIMA Corporation	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

JFE Techno-Research Corporation, who is a project participant, is the contact for this Project activity (See Annex 1 for contact details).

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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Republic of Indonesia

A.4.1.2. Region/State/Province etc.:

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Lampung Province, Sumatera Island

A.4.1.3. City/Town/Community etc:

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Headquarters: 1 Jl.Soekarno-Hatta Km.6 Ketapang, Panjang Teluk Betung Bandar Lampung, Indonesia
Factory: Ds. Kedaton Kec.Sukadana Kab.Lampung Timur

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The Project activity will be located on the premises of Kedaton Factory, located in Kedaton, East Lampung Regency of Lampung Province, Sumatera, Indonesia.

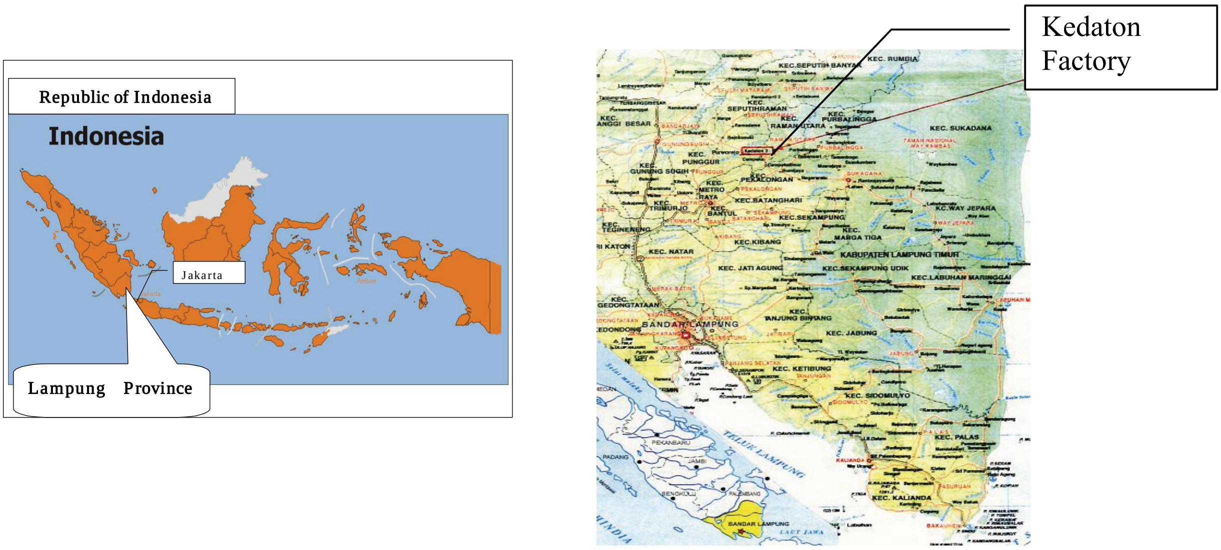

Fig.1 Location map of proposed project activity

A.4.2. Category(ies) of project activity:

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Sectoral scope 13: Waste handling and disposal

A.4.3. Technology to be employed by the project activity:

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The technology to be implemented by the Project activity is a Short HRT Bio Immobilised Methane Fermentation Process (Dome Digester System). Wastewater from the plant will first flow into the digesters before going into the existing lagoons. The tank will be sealed with special sheets that are resistant against deterioration due to ultra-violet rays. A highly efficient submerged pump will be provided in the digesting tank for (a) mixture of the fermenting wastewater in a uniform manner, and (b) stable and active methane fermentation by securing contact of the fermenting wastewater and Bio Immobiliser. In this process, HRT will be reduced by half in comparison with the conventional process by using Onggok as a Bio Immobiliser, to which methane bacteria will attach for growth. Methane fermentation will be stably secured even when the load fluctuates.

This process is a cutting edge technology that best fits for methane fermentation from cassava wastewater where cassava crop level cannot be steady. When wastewater comes in contact with the Onggok, anaerobic decomposition of the organic material contained in the wastewater takes place, resulting in the generation of methane-rich biogas.

Through the utilization of this advanced technology, the Project will be able to achieve approximately 85% removal of COD, significantly reducing the COD load on the open lagoons, which subsequently receive effluent from the Dome Digester. Dome Digester will be covered by ultra-violet ray proof materials and extracted biogas will be forwarded from a gasholder to a biogas engine generator for electricity generation. The project developer plans to install one gas engine supplied by a widely recognized supplier for biogas applications. The planned treatment system is illustrated in the flow chart shown in Figure 2 below.

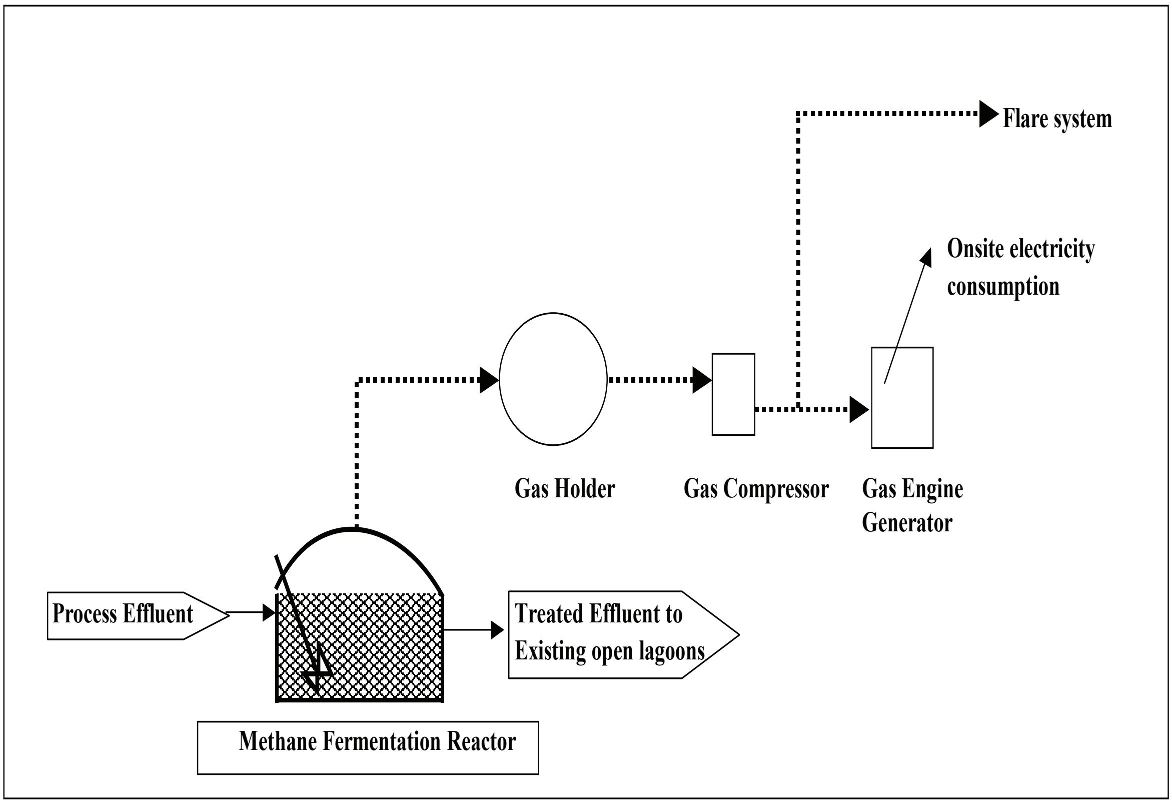

Figure 2: Process Flow Diagram

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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Table 2 Estimated amount of emission reduction of GHG

Year	Estimation of project activity emissions	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emissions reductions (tonnes of CO_2e)
Year 1(Mar. 2010-Feb. 2011)	1,545	30,206	0	28,661
Year 2(Mar. 2011-Feb. 2012)	1,545	30,206	0	28,661
Year 3(Mar. 2012-Feb. 2013)	1,545	30,206	0	28,661
Year 4(Mar. 2013-Feb. 2014)	1,545	30,206	0	28,661
Year 5(Mar. 2014-Feb. 2015)	1,545	30,206	0	28,661
Year 6(Mar. 2015-Feb. 2016)	1,545	30,206	0	28,661
Year 7(Mar. 2016-Feb. 2017)	1,545	30,206	0	28,661
Total estimated reductions (tonnesof CO_2e)				200,627
Total number of crediting years				7
Annual average over the crediting period of estimated reductions(tonnesof CO2e)				28,661

A.4.5. Public funding of the project activity:

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No public funding is planned for this project.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Avoided methane emissions from wastewater treatment (ACM0014/Version01)
It is hereafter referred to as the baseline methodology.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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ACM0014 is a new methodology that combines AM0013 and AM0022 in EB36. ACM0014/ version 01 has been chosen because the Project activity involves the installation of an anaerobic treatment system in an existing open lagoon-based wastewater treatment facility and meets all the applicability conditions stated in the baseline methodology as follows:

Scenario 1 of the said methodology will apply because this Project activity does not involve sludge treatment. Study result for scenario 1 is shown in Table 3 below.

Table 3 scenarios applicable to the methodology

Scenario	Description of the historical situation	Description of the project activity
1	The wastewater is not treated, but directed to open lagoons that have clearly anaerobic conditions.	The wastewater is treated in a new anaerobic digester. The biogas extracted from the anaerobic digester is flared and/or used to generate electricity and/or heat. The residual from the anaerobic digester after treatment is directed to open lagoons.

- * The average depth of the open lagoons or sludge pits is at least 1 m.
- * Heat and electricity requirements per unit input of the water treatment facility remain largely unchanged before and after the Project activity start.
- * Data requirements as laid out in this methodology are fulfilled.
- * The residence time of the organic matter in the open lagoon system should be at least 30 days.
- * Local regulations do not prevent discharge of wastewater in open lagoons.

Present method of wastewater treatment in open lagoons is shown in Figure 3. Method of wastewater treatment in the proposed Project is shown in Figure 4.

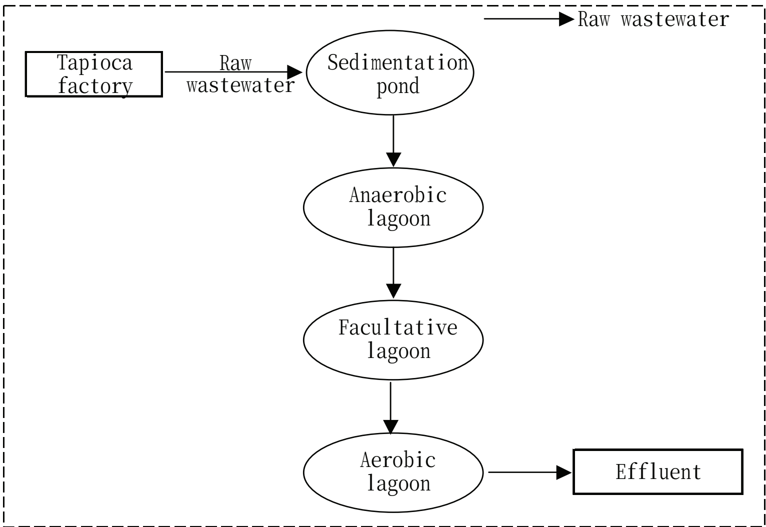

Figure 3 Present Method of Wastewater Treatment

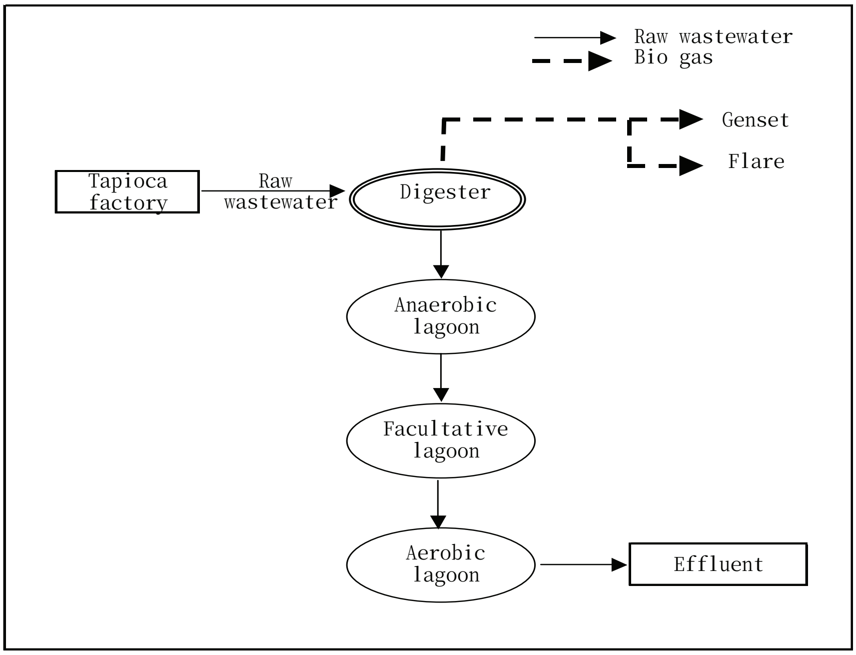

Figure 4 Wastewater Treatment in the Project

As described in section B. 4 below, the baseline is the utilization of the current lagoon system for managing wastewater. Also, the current lagoon based system is in full compliance with existing rules and regulations of the Republic of Indonesia.

The Project utilizes the biogas recovered from the Dome Digester System for power generation and surplus biogas is flared.

As described in Section B.7 below, data requirements will be fulfilled. Organic materials flow into and out of the considered lagoon based treatment system and the contribution of different removal processes will be measured and quantified.

B.3. Description of the sources and gases included in the project boundary

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Table 4 Description of sources and gases

	Source	Gas		Justification/ Explanation
Baseline	Wastewater treatment	CH_4	Included	The major source of emissions in the baseline from open lagoons (scenario 1)
		N_2O	Excluded	Excluded for simplification. This is conservative.
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for.
	Electricity consumption / generation	CO_2	Included	Electricity may be consumed for the operation of the wastewater or sludge treatment system in the baseline scenario. If electricity is generated with biogas from an anaerobic digester under the Project activity, electricity generation in the grid or on-site is displaced by the Project activity.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Thermal energy generation	CO_2	Excluded	Thermal energy generation is not planned in this Project.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project Activity	Wastewater treatment processes or sludge treatment process	CH_4	Included	The treatment of wastewater or sludge under the Project activity may cause different emissions: (i) Methane emissions from the lagoons (if effluent from the treatment under the Project activity is directed to lagoons); (ii) Physical leakage of methane from the digester system; and (iii) Methane emissions from flaring (if biogas from the digester is flared).
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for.
		N_2O	Excluded	This is excluded as land application of sludge is not planned in the Project.
	On-site electricity use	CO_2	Included	May be an important emission source. If electricity is generated with biogas from an anaerobic digester, these emissions are not accounted for. Any on-site electricity consumption should be subtracted from the electricity generation of the digester.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	On-site fossil fuel consumption	CO_2	Included	May be an important emission source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

The baseline methodology will be used in conjunction with the approved monitoring methodology, ACM0014/ version01. Figure 5 shows the boundary of the project.

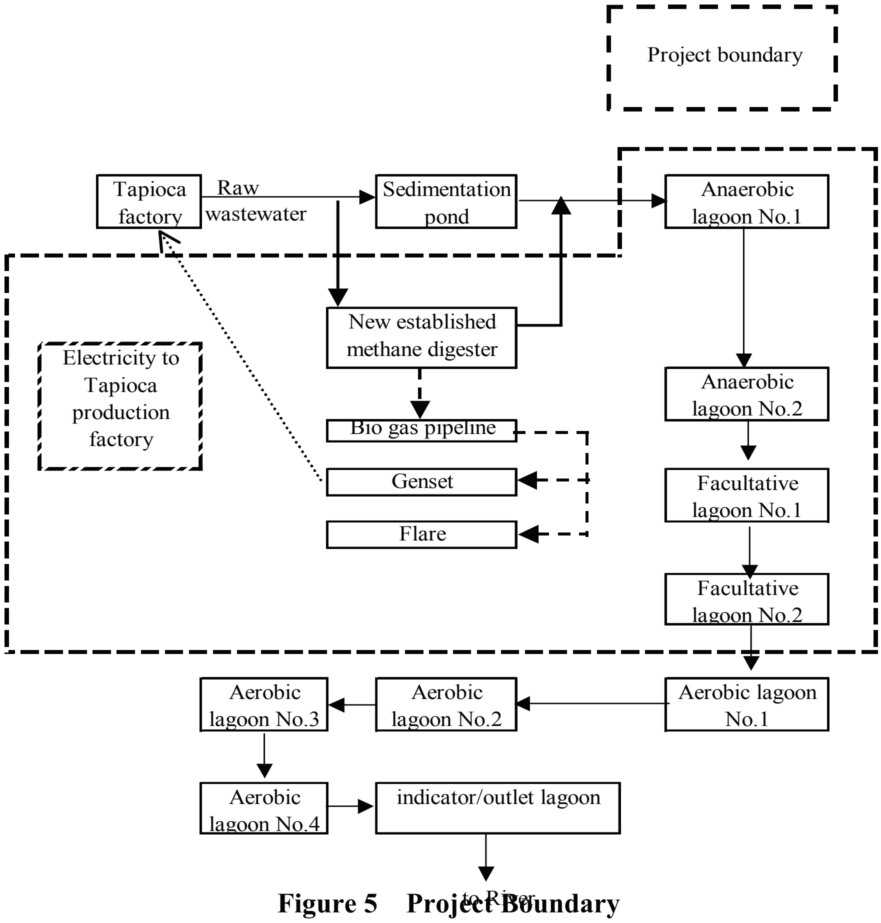

Figure 5 Project Boundary

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The baseline scenario is identified according to the procedure for identification of the most plausible baseline scenario as stated in ACM0014 that consists of four steps.

Step 1: Identification of alternative scenarios
Step 2: Eliminate alternatives that are not complying with applicable laws and regulations
Step 3: Eliminate alternatives that face prohibitive barriers
Step 4: Compare economic attractiveness of remaining alternatives

Step 1: Identification of alternative scenarios

The following is a list of potential alternatives identified for the treatment of wastewater (W).

W1: The use of open lagoons for the treatment of wastewater (Continuation of the current situation)
W2: Direct release of wastewaters to a nearby water body
W3: Aerobic wastewater treatment facilities (activated sludge or filter bed type treatment)

W4: Covered anaerobic lagoon with methane recovery and utilization for electricity generation (the proposed project undertaken without CDM assistance)

Since the Project activity includes electricity generation with biogas from a covered anaerobic lagoon, potential alternatives for the generation of electricity (E) identified are:

E1: Power generation using fossil fuels in a captive power plant
E2: Electricity using renewable resources

With regard to these alternatives, the realistic and credible alternatives of the Project activity include alternatives for wastewater treatment (W) and the combination of the alternatives for wastewater treatment and electricity generation (W and E). The alternatives are:

Alternative 1: W4 (Anaerobic digester with methane recovery and utilization for electricity generation, the proposed project undertaken without CDM assistance)
Alternative 2: Combination of W1 and E1
Alternative 3: Combination of W1 and E2
Alternative 4: Combination of W2 and E1
Alternative 5: Combination of W2 and E2
Alternative 6: Combination of W3 and E1
Alternative 7: Combination of W3 and E2

Step 2: Eliminate alternatives that are not complying with applicable laws and regulations

Alternative 1

Alternative 1 (or W4) considers wastewater treatment from tapioca starch industry using a covered anaerobic lagoon system from which methane is recovered and used for electricity generation. Either methane recovery from biogas or its utilization (as renewable energy) for electricity generation does not violate the applicable regulation of the host government, the Decree of the Minister of Environment No. 3 of 1998, regarding liquid waste standard for industrial sector.

The main Indonesian prevailing law related to electricity is the Law of the Republic of Indonesia Number 15 of 1985 which states that PLN (Persahaan Listrik Negara = National Electricity Energy Corporation) holds the mandate for electricity provision in the country, including areas where there is increasing demand. However, power generation (electricity) using renewable energy for a captive power plant such as in a tapioca starch processing plant is not prohibited by any applicable laws or regulations in Indonesia. Thus alternative 1 does not face legal barriers.

Alternative 2 (Combination of W1 and E1)

Alternative 2 considers the use of open lagoons for the treatment of wastewater (W1). Current practice of PT. WIRA is performing wastewater treatment using anaerobic open lagoons in order to comply with the effluent discharge standard to the water bodies as set by the government, the Decree of the Minister of Environment No. 3 of 1998. The applicable Indonesian laws or regulations do not prevent such treatment and discharge of wastewater into open lagoons as long as the effluent is released to the water bodies within the allowed effluent discharge standard.

Also, there are no laws or regulations that prohibit electricity generation in industries, such as in a tapioca starch processing plant using fossil fuels (E1) for a captive power in the plant. Considering the above, alternative 2 does not face legal barriers.

Alternative 3 (Combination of W1 and E2)

Wastewater treatment in tapioca starch industry using anaerobic open lagoons (W1) is not forbidden by laws or regulations. Similarly, power generation from renewable energy is not prohibited either. In view of this, alternative 3 complies with the prevailing laws. This alternative does not face legal barriers.

Alternative 4 (Combination of W2 and E1)
Wastewater from a tapioca starch processing production such as at PT. WIRA, generally would have high organic content. Therefore, direct release of wastewater from tapioca starch processing (without any treatment) will violate the regulations as set by the government of Indonesia due to its content. The allowable effluent to be discharged to the environment must be in compliance with the Decree of the Minister of Environment No.3 of 1998. W2 is eliminated as an alternative to the Project activity, and thus its combination with E1.
Accordingly, alternative 4 is eliminated from further consideration for identification of the baseline scenario.

Alternative 5 (Combination of W2 and E2)
As described above, in the alternative 4, W2 is eliminated from further consideration for identification of the baseline scenario and assessment of additionality and thus its combination with E2.

Alternative 6 (Combination of W3 and E1)
Alternative 6 implies the use of an aerobic treatment system using activated sludge or filter bed type (W3). This treatment system will reduce the content of wastewater to an allowed standard of effluent to be discharged to the environment. With regard to this, alternative 6 is a system that improves the wastewater system for acceptable effluent. There is no particular regulation that requires a certain technology for the treatment of wastewater from tapioca starch processing industry. The wastewater released after an aerobic treatment system would comply with the effluent standard according to the Ministerial Decree of the Ministry of Environment No. 3 of 1998. W3 is not violating the applicable Indonesian laws and regulations.

There are no Indonesian prevailing laws or regulations that prohibit electricity generation using fossil fuel (E1) in the industry. Therefore, the combination of W3 and E1 is not violating the applicable laws and regulation. Alternative 6 does not face legal barrier.
Alternative 7 (Combination of W3 and E2)
The combination of W3 and E2 complies with the prevailing Indonesian laws and regulations. Alternative 7 does not face legal barrier.

After screening the alternatives for its compliance with the applicable laws and regulations, the remaining realistic and credible alternatives to the Project activity are:

Alternative 1: W4 (Covered anaerobic lagoon with methane recovery and utilization for electricity generation, the proposed project undertaken without CDM assistance)
Alternative 2: Combination of W1 and E1
Alternative 3: Combination of W1 and E2
Alternative 6: Combination of W3 and E1
Alternative 7: Combination of W3 and E2

These alternatives do not violate the applicable Indonesian laws and regulations.
Step 3: Eliminate alternatives that face prohibitive barriers

At this step, the proposed Project activity is further assessed for potential barriers that prevent the implementation of this type of proposed Project activity and do not prevent the implementation of at least one of the alternatives, by applying step 3 of the latest version of the “Tool for the demonstration and assessment of additionality”, Version 04.

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

The followings are identified realistic and credible barriers that would prevent the implementation of the proposed Project activity if the Project activity was not registered as a CDM activity:

a. Investment barrier
b. Technological barrier
c. Barriers due to prevailing practices
d. Social barrier
e. Business culture barrier

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

a. Investment barriers

PT. WIRA is now applying anaerobic open lagoons for the treatment of wastewater from the tapioca starch processing. Alternative 2 does not face financial barriers. Alternative 1 would require high capital investment due to the cost for the modification of existing anaerobic open lagoon to covered anaerobic lagoon. Similarly, alternative 6 and 7 would also require new investment for the application of an aerobic treatment system and its operation and maintenance (O&M) cost.

Alternative 3 would require a new method, technology and new investment to recover biogas from anaerobic open lagoons (as in the existing condition at PT. WIRA) in order to be able to generate electricity from recovered methane in biogas. Therefore, PT. WIRA neither applies covered anaerobic lagoons to treat the wastewater nor biogas recovery for electricity generation. Moreover, the current wastewater system has already met the existing regulatory requirements for industrial wastewater discharge in Indonesia.

At present, PT. WIRA is generating electricity and heat using fossil fuels in a captive power plant. If the electricity is generated using renewable resources, there will be new investment regarding the equipment converting renewable energy (recovered biogas from covered anaerobic lagoon system) into electricity. With regard to this, PT. WIRA does not plan to switch the fuel for generating electricity from fossil fuel to renewable resources due to the costly investment associated with it. Therefore, alternative 1, 3, 6 and 7 face financial barrier.

b. Technological barriers

Alternative 1, 6 and 7 are not a common method for managing wastewater in tapioca starch processing plants in Indonesia. Qualified labour (skilled and/or properly trained labour) for operating and maintaining the introduced wastewater system is not readily available. The skilled labour will only be available after proper training.

Unskilled and/or inappropriately trained labour may lead to unacceptably high risk of equipment disrepair and malfunctioning or other underperformance.

The Project activity is proposing wastewater treatment using covered anaerobic lagoon system where methane recovered from anaerobic digestion is used for electricity generation. Alternative 3 would also require a new system and technology for electricity generation from renewable energy source. To date the technology used for electricity generation in tapioca starch processing plants is the one that commonly uses fossil fuel. So far, the technology is widely accepted and applied. Switching fossil fuel to renewable energy for electricity generation would mean introducing a new system. This may give a view that the new system is associated with risks of the mastery of the new technology to be applied. Due to this statement, alternative 1, 3, 6 and 7 face technical barrier.

c. Social barrier

At present, alternative 2 is applied at the project site. The method use as in alternative 2 is widely accepted in the host country. Therefore, it is regarded that this method has no social barrier.

Alternative 1, 3, 6 and 7 would face social barriers ~~which~~ that are related to the technology to be introduced.

d. Business culture barrier
Pertaining to the prevailing practice and investment barriers, alternative 1, 3, 6 and 7 would face business culture barrier if there are no incentives for its application or no enforcement of regulation to change to the alternatives.

Table 5 Summary of Barrier Analysis

Plausible Baseline Alternative / Barrier Tested	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Legal	N	N	N	Y	Y	N	N
Investment	Y	N	Y			Y	Y
Technological	Y	N	Y			Y	Y
Prevailing practices	Y	N	Y			Y	Y
Social	Y	N	Y			Y	Y
Business Culture	Y	N	Y			Y	Y

Key - Y: barrier exists; N: barrier does not exist

Step 4: Compare economic attractiveness of remaining alternatives

Since there is only one baseline option regarding the wastewater treatment and one baseline option regarding electricity generation using fossil fuel in a captive power plant, assessment regarding the comparison of economic attractiveness of remaining alternatives is not required by the baseline methodology.

<u>Conclusion</u>
Through the above assessment, it is determined that the most plausible baseline option is the use of open lagoons for the treatment of the wastewater and electricity generation using fossil fuels in a captive power plant (Alternative 2).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

B.5 Additionality of the proposed project will be demonstrated and assessed using the "Tool for the demonstration and assessment of additionality" (version 04).

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations
Sub-step 1a. Define alternatives to the project activity:
As stated in B.4, the alternative scenarios to the Project activity are the following.

Alternative 1: W4
Alternative 2: Combination of W1 and E1

Alternative 3:	Combination of W1 and E2
Alternative 4:	Combination of W2 and E1
Alternative 5:	Combination of W2 and E2
Alternative 6:	Combination of W3 and E1
Alternative 7:	Combination of W3 and E2

Where:

Alternatives for the treatment methods for wastewater (W) are the following.

W1:	The use of open lagoons for the treatment of wastewater (Continuation of the current situation)
W2:	Direct release of wastewaters to a nearby water body
W3:	Aerobic wastewater treatment facilities (activated sludge or filter bed type treatment)
W4:	Covered anaerobic lagoon with methane recovery and utilization for electricity and/or heat generation (the proposed project undertaken without CDM assistance)

Alternatives for the generation of electricity (E) are the following.

E1:	Power generation using fossil fuels in a captive power plant
E2:	Electricity generation using renewable resources

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

From the reasons stated in Step 2 of B.4, the realistic and credible alternative scenarios to the Project activity that are in compliance with mandatory legislation and regulations are as follows.

Alternative 1:	W4
Alternative 2:	Combination of W1 and E1
Alternative 3:	Combination of W1 and E2
Alternative 6:	Combination of W3 and E1
Alternative 7:	Combination of W3 and E2

Step 3. Barrier analysis

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

As stated in B.4, the barriers that would prevent the implementation of the proposed CDM Project activity are the following.

1. Investment barriers
2. Technological barriers

Through the assessment, it is shown that the barriers above do not prevent the use of open lagoons for the treatment of the wastewater and electricity generation using fossil fuels in a captive power plant (Alternative 2), but prevent the implementation of the proposed Project activity.

Step 4. Common practice analysis

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

Current practice in tapioca starch processing plants is the application of wastewater treatment system in anaerobic open lagoons, and it resulted in still allowable effluent discharged to water bodies as set by the prevailing Indonesian regulations. The system requires relatively low capital investment causing many tapioca industries to apply. Moreover, the technology and skilled labour for this type of system is already available in the host country.

In Lampung Province, there are currently more than 40 tapioca starch processing plants. Application of a covered anaerobic lagoon system or a bio digester that requires additional investment and technical skills for operation is not a common practice in the tapioca starch processing plant in the host country.
Therefore, similar activities cannot be found in the proposed project region.

Conclusion
Through the discussions above, it is concluded that the proposed Project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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In order to quantify emission reductions achieved by the Project activity, procedures to calculate project emissions, baseline emissions, leakage and emission reductions set out in the methodology are applied as follows.

Baseline emissions
Baseline emissions are calculated according to the Organic Removal Ratio Method as below.

Total estimated baseline emissions are the sum of Methane emissions from anaerobic treatment of the wastewater in open lagoon and CO_2 emissions from the generation of power on site.

Baseline emissions: $$BE_{y} = BE_{CH4,y} + BE_{EL,y} + BE_{HG,y} \quad (1)$$

Where:

BE_y	Baseline emissions in year *y* (tCO_2e/yr)
BE_{CH4}	Methane emissions from anaerobic treatment of the wastewater in open lagoons (scenario 1) in the absence of the Project activity in year *y* (tCO_2e/yr)
$BE_{EL,y}$	CO_2 emissions associated with electricity generation that is displaced by the Project activity and/or electricity consumption in the absence of the Project activity in year *y* (tCO_2/yr)
$BE_{HG,y}$	CO_2 emissions associated with fossil fuel combustion for heating equipment that is displaced by the project in year *y* (tCO_2/yr)

Baseline emissions are calculated in two steps as follows:
Step 1: Calculation of baseline emissions from anaerobic treatment of the wastewater or sludge
Step 2: Calculation of baseline emissions from generation and consumption of electricity

Step 1: Calculation of baseline emissions from anaerobic treatment of the wastewater

$$BE_{CH4,y} = GWP_{CH4} \times B_o \times (COD_{BL,y} - COD_{aerobic,BL} - COD_{OX,BL,y} - COD_{sedim,BL,y})$$

Where:

$BE_{CH4,y}$	Methane emissions from anaerobic treatment of the wastewater in open lagoons (scenario 1) in the absence of the Project activity in year *y* (tCO_2e/yr)
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4) Default value of GWP_{CH4} is 21 tCO_2e/tCH_4 according to the IPCC Guideline.
B_o	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand ($tCH_4/tCOD$)

Default value of B_o is 0.25 $kgCH_4/kgCOD$ according to the IPPC Guideline. For the implementation of the project, however, the Guideline stipulates that a conservative value of 0.21 $kgCH_4/kgCOD$ should be adopted for B_o. In case the subject wastewater does not contain mono-saccharides, the Guideline instructs the default value shall be separately established. In case of this project, the wastewater is produced in the process of starch separation and it contains saccharides including poly-saccharides, which are easy to be digested Therefore the wastewater of this project can be regarded as containing mono-saccharides, and the conservative figure of 0.21 $kgCH_4/kgCOD$ is adopted as B_o in the calculation.

$COD_{BL,y}$	Quantity of chemical oxygen demand that would be treated in open lagoons (scenario 1) in the absence of the Project activity in year *y* (t COD/yr)
$COD_{aerobic,BL}$	Annual quantity of chemical oxygen demand that would degrade aerobically in the lagoon (t COD/yr)
$COD_{OX,BL,y}$	Annual quantity of chemical oxygen demand that would be chemically oxidised through sulphate in the wastewater (t COD/yr)
$COD_{sedim,BL,y}$	Amount of chemical oxygen demand lost through sedimentation in the lagoon (t COD/yr)

$COD_{BL,y}$ is determined as per following equations (3), (4) and (5) for the methane conversion factor method.

$$\mathbf{COD_{BL,y} = AD_{BL} \times COD_{PJ,y}} \quad \text{------------ (3)}$$

$$\mathbf{AD_{BL} = 1 - COD_{out,x} / COD_{in,x}} \quad \text{------------ (4)}$$

$$\mathbf{COD_{PJ,y} = \sum^{12} F_{PJ,dig,m} \times W_{COD\ dig,m}} \quad \text{------------ (5)}$$

Where:

$COD_{PJ,y}$	Quantity of chemical oxygen demand that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in year y (t COD / yr)
AD_{BL}	Effluent adjustment factor expression the percentage of COD that is degraded in open lagoons in the absence of the project activity
$COD_{out,x}$	COD of the effluent in the period x (t COD) measured at the outlet of the Facultative Lagoon No.2 as indicated in Figure 5 for the Project Boundary.
$COD_{in,x}$	COD directed to the open lagoons in the period x (t COD) measured at the outlet of wastewater from the factory
x	Representative historical reference period (at least one year)
$COD_{PJ,y}$	Quantity of chemical oxygen demand that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in year y (t COD / yr)
$F_{PJ,dig,m}$	Quantity of wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month m (m^3 / month)
$w_{COD,dig,m}$	Average chemical oxygen demand in the wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month (t COD / m^3)
m	Months of year y of the crediting period

The organic removal ratio method measures the reduction of chemical oxygen demand (COD) in a wastewater between its entry into and exit from the treatment system (the open lagoon). In this method, $COD_{in,x}$ is the value at the outlet of wastewater from the factory and $COD_{out,x}$ is at the outlet of the Facultative Lagoon No.2 as indicated in Figure 5 for the Project Boundary.

Determination of $COD_{aerobic,BL}$

$COD_{aerobic,BL}$ is calculated based on the surface of the lagoon or sludge pit and a default value for the amount of COD per hectare that degrades under aerobic conditions as follows:

$$COD_{aerobic,BL} = A \times f_{COD,aerobic} \qquad \text{------------ (13)}$$

Where:

$COD_{aerobic,BL}$ Annual quantity of chemical oxygen demand that would degrade aerobically in the lagoon (tCOD/yr)

A Surface of the lagoon or sludge pit (ha) Surface area of the open lagoon.

$f_{COD,aerobic}$ Quantity of chemical oxygen demand degraded to CO_2 under aerobic conditions per surface area of the lagoon or sludge pit (t COD / ha yr).

The default value is stipulated as 92.7 tCOD/ha/y in the ORR Method.

Determination of $COD_{OX,BL,y}$

The determination of this parameter is relevant if the wastewater contains chemical substances that chemically oxidize organic matter in the wastewater.

$$COD_{OX,BL,y} = F_{PJ,y} \times \Sigma W_{s,y} \times Rs \times 0.001 \qquad \text{------------ (14)}$$

In the subject plant, no chemically oxidizing organic matters like sulphuric acid are used. Therefore it can be considered that no chemical substances like sulphate ion are contained in the wastewater.

Determination of $COD_{sedim,BL}$

$COD_{sedim,BL,y}$

How to determine this value is described in Appendix II. As indicated in Figure 5, sediment has been removed in the wastewater before flowing into the Project Boundary. Therefore it is assumed that there will be no sediment of organic substances and that the value here is 0.

Step 2: Baseline emissions from generation and/or consumption of electricity

- Baseline emissions from consumption of electricity associated with the treatment of wastewater (scenario 1) are estimated as follows.

$$(1) \quad BE_{EL,y} = (EC_{BL,y} + EG_{PJ,y}) \times EF_{BL,EL,y} \qquad \text{------------ (15)}$$

Where:

$BE_{EL,y}$ CO_2 emissions associated with electricity generation that is displaced by the Project activity and/or electricity consumption in the absence of the Project activity in year *y*(tCO_2/yr)

EC_{BL} Annual quantity of electricity that would be consumed in the absence of the Project activity for the treatment of the wastewater (scenario 1) (MWh/yr) This can be considered as nil because the wastewater presently flows through the existing open lagoons by itself or by natural force.

$EG_{PJ,y}$ Net quantity of electricity generated in year *y* with biogas from the new anaerobic bio digester (MWh/yr) The planned quantity of annual electricity generation is 5,375MWh/year based on the planned capacity of 1,024kW. Electricity consumed for the Project activity itself must be deducted to obtain the net quantity.

(v) Project emissions from electricity consumption and combustion of fossil fuels in the project

$EF_{BL,EL,y}$ Baseline emission factor for electricity generated and/or consumed in the absence of the Project activity in year *y* (tCO_2/MWh)
All electricity required for operating the existing tapioca factory is supplied by its captive power plant with six diesel engine generators, and there is no need for power purchase from the grid. Also in consideration that the power plant capacity is over 200kW, the default value of 0.8(tCO_2/MWh) described in AMS Ⅰ-D.1 is used as the emission factor.

Step 3: Baseline emissions from the generation of heat

This step is applicable if the biogas captured from the new anaerobic digester is utilized in the project scenario for heat generation.

There is no heat utilisation in the existing system. There will be no heat utilisation in the project either.

Project emissions

Project emissions described in B.3 are estimated as follows.

$$PE_y = PE_{CH4,effluent,y} + PE_{CH4,digest,y} + PE_{flare,y} + PE_{sludge.LA,y} + PE_{EC,y} + PE_{FC,y} \quad \text{------------ (19)}$$

Where:

PE_y	Project emissions in year *y* (tCO_2e/yr)
$PE_{CH4,effluent,y}$	Project emissions from treatment of wastewater effluent from the anaerobic digester in year *y* (tCO_2e/yr)
$PE_{CH4,digest,y}$	Project emissions from physical leakage of methane from the anaerobic digester in year *y* (tCO_2e/yr)
$PE_{flare,y}$	Project emissions from flaring of biogas generated in the anaerobic digester in year *y* (tCO_2e/yr)
$PE_{sludge,LA,y}$	Project emissions from land application of sludge in year *y* (tCO_2e/yr)
$PE_{EC,y}$	Project emissions from electricity consumption in year *y* (tCO_2e/yr)
$PE_{FC,y}$	Project emissions from fossil fuel consumption in year *y* (tCO_2e/yr)

(i) Project methane emissions from effluent from the digester

This step is applicable if a new digester is installed under the Project activity and if the effluent from this digester is directed to open lagoons.

$$PE_{CH4,\ effluent,y} = GWP_{CH4} \times B_o \times (COD_{PJ,effl,dig,y} - COD_{PJ,aerobic} - COD_{PJ,OX,y} - COD_{PJ,sedim,y} - COD_{PJ,effl,lag,\ y}) \quad \text{------------ (28)}$$

Where:

$PE_{CH4,effluent,y}$	Project emissions from treatment of wastewater effluent from the anaerobic digester in year *y* (tCO_2e/yr)
$COD_{PJ,effl,dig,y}$	Quantity of chemical oxygen demand in the effluent from the digester in year *y* (tCOD/yr)
$COD_{PJ,aerobic}$	Annual quantity of chemical oxygen demand that degrades aerobically in the lagoon under the Project activity (t COD/yr)
$COD_{PJ,OX,y}$	Annual quantity of chemical oxygen demand that is chemically oxidised through oxidizing substances in the effluent from the digester in year *y* (t COD/yr) This is as already reviewed above.
$COD_{PJ,sedim,y}$	Amount of chemical oxygen demand lost through sedimentation in the lagoon under the Project activity (t COD/yr) This is as already reviewed above.

$COD_{PJ,effl,lag,}$	Quantity of chemical oxygen demand in the effluent of the open lagoon facility in which the effluent from the digester is treated in year *y* (t COD/yr)

(ii) Project emissions related to physical leakage from the digester

This step is applicable if the Project activity includes the construction of a new anaerobic digester. The emissions directly associated with the operation of digesters involve the physical leakage of methane from the digester system. Methane emissions from the new digester are calculated as follows

$$PE_{CH4,digest,y} = F_{biogas,y} \times EF_{CH4,digest} \times w_{CH4,biogas,y} \times GWP_{CH4} \times 0.001 \quad \text{------------ (30)}$$

Where:

$PE_{CH4,digest}$	Project emissions from physical leakage of methane from the anaerobic digester (tCO_2e/yr)
$F_{biogas,y}$	Amount of biogas collected in the outlet of the new digester in year *y* (m^3/yr)
$EF_{CH4,digest}$	Fraction of biogas that leaks from the digester (m^3 biogas leaked / m^3 biogas produced) Value applied here is 1%, which is the guarantee value by the supplier of the covering material. Test report of the supplier will be provided for the implementation of the project.
$w_{CH4,biogas,y}$	Concentration of methane in the biogas in the outlet of the new digester (kg CH_4/m^3)

(iii) Methane emissions from flaring

This step is applicable if under the Project activity biogas is generated in a new anaerobic digester and if all or a part of the biogas is flared. Methane may be released as a result of incomplete combustion in the flare. To calculate project emissions from flaring of the biogas (PE_{flare}), apply the latest approved version of the "Tool to determine project emissions from flaring gases containing methane".

Where:

PE_{flare}=	Project emissions that are not flare-burned
$\Sigma\ TM_{RG,h}$	Amount of flare-burned biogas
$\eta_{flare,h}$	The flare efficiency of 90%, which is the default value, is used in the calculation. The flare system for the project is of the closed type that can always maintain the burning temperature of 500℃ or more.

(iv) Project emissions from land application of sludge

$$PE_{sludge.LA,y} = COD_{sludge,LA,y} \times B_o \times MCF_{sludge,LA} \times GWP_{CH4} + S_{LA,y} \times w_{N,sludge,y} \times EF_{N2O,A,sludge} \quad \text{------------ (31)}$$

As mentioned in <u>*Determination of $COD_{sedim,BL,}$*</u>, there will be no sludge production in the project.

(v) Project emissions from electricity consumption and combustion of fossil fuels in the project

This emission source includes CO_2 emissions from the consumption of electricity or combustion of fossil fuels for the operation of the Project activity.

$PE_{EC,y}$	Amount of CO_2 emissions from following for this project: 1. Electricity required for operation of the methane fermentation facility, and

2. Electricity required for operation of the gas engine generation system

Above two factors are deducted in the calculation of $EG_{PJ,y}$ as described in Step 2 for the study of baseline emissions.

Leakage

No leakage is estimated.

Emission Reductions

Emission reductions for any given year of the crediting period are obtained by subtracting project emissions from baseline emissions:

Emission Reductions： $ER_y = BE_y - PE_y$ ------------ **(32)**

Where:

ER_y = Emissions reductions of the Project activity in year *y* (tCO_2e/year)

BE_y = Baseline emissions in year *y* (tCO_2e/year)

PE_y = Project emissions in year *y* (tCO_2e/year)

B.6.2. Data and parameters that are available at validation:

Table 6 Data and parameters

Parameter:	B_o
Data unit:	tCH_4/tCOD
Description:	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand (COD)
Source of data:	2006 IPCC Guidelines
Value to be applied:	The main components of wastewater from tapioca factories are easily digestible poly-saccharides that are akin to simple sugars. Therefore, the methane emission factor of 0.21kgCH4/kg COD can be applied as a conservative value.
Any comment:	

Parameter:	$f_{COD, aerobic}$
Data unit:	t COD / ha yr
Description:	Quantity of chemical oxygen demand degraded to CO_2 under aerobic conditions per surface area of the lagoon or sludge pit
Source of data:	Experiments have to be conducted
Value to be applied:	92.7 t COD / ha yr (= 254 kg COD / ha day)
Any comment:	Applicable to the organic removal ratio method

Parameter:	EC_{BL}
Data unit:	MWh/yr

Description:	Annual quantity of electricity that would be consumed in the absence of the Project activity for the treatment of the wastewater (scenario 1)
Source of data:	Historical records
Measurement procedures (if any):	Based on three years of historical data
Any comment:	Estimation is based on three-year data prior to start of the project. Electricity meters will undergo maintenance/calibration subject to appropriate industry standards. The accuracy of the meter readings will be verified by receipts issued by the purchasing power company. Uncertainty of the meters to be obtained from the manufacturer. In this project, no electricity is generated as the wastewater is treated without using any power or electricity.

Parameter:	$EF_{BL,EL,y}$
Data unit:	tCO_2/MWh
Description:	-Baseline emission factor for electricity generated and/or consumed in the absence of the Project activity in year y (tCO_2/MWh)
Any comment:	$EF_{BL,EL,y}$ shall be 0.8 t CO_2/MWh because diesel generators of 200kW or more are used on-site.

Parameter:	$EF_{CH4,digest,y}$
Data unit:	m³ biogas leaked / m³ biogas produced
Description:	Fraction of biogas that leaks from the digester
Source of data:	Either use a default value of 0.15 (based on the 2006) IPCC guidelines or undertake measurements
Value to be applied:	Value applied here is 1%, which is the guarantee value by the supplier of the covering material. Test report of the supplier will be provided for the implementation of the project.
Any comment:	Applicable if a new digester is installed under the Project activity

Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential for CH4
Source of data:	IPCC
Measurement procedures (if any):	Default to be applied 21 for the first commitment period.
Any comment:	Shall be updated according to any future COP/MOP decisions.

Parameter:	-$\eta_{EL,captive}$
Data unit:	%
Description:	Flare efficiency
Source of data:	IPCC
Any comment:	To increase the flare efficiency, a flare of enclosed type with the efficiency of 90% will be used. Increasing the efficiency over 90% is not considered because

	flow rate and composition of the emissions must be always monitored for analysis.

B.6.3 Ex-ante calculation of emission reductions:

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Baseline emissions

Total estimated baseline emissions are the sum of Methane emissions from anaerobic treatment of the wastewater in open lagoon and CO_2 emissions from the generation of power on site.

$$BE_{y} = BE_{CH4,y} + BE_{EL,y} + BE_{HG,y}$$
$$= 25{,}618\ (tCO_2e/y) + 4{,}588\ (tCO_2e/y) + 0(tCO_2e/y)$$
$$= 30{,}206\ (tCO_2e/y)$$

Step 1: Calculation of baseline emissions from anaerobic treatment of the wastewater Organic removal ratio (ORR) method

$$BE_{CH4,y} = GWP_{CH4} \times Bo \times (COD_{BL,y} - COD_{aerobic,BL} - COD_{OX,BL,y} - COD_{sedim,BL,y})$$
$$= 21(\ tCO_2e/tCH_4\ ) \times 0.21 kgCH_4/kgCOD \times (6{,}180 - 371)(tCOD/y)$$
$$= 25{,}618\ tCO_2e/y$$

Determination of COD,BL,y

$$COD_{BL,y} = AD_{BL} \times COD_{PJ,y}$$
$$= 0.954(-) \times 6{,}478\ (tCOD/y) = 6{,}180\ (tCOD/y)$$

Determination of CODaerobic,BL

$$COD_{aerobic,BL} = A \times f_{COD,aerobic}$$
$$= 4.0(ha) \times 92.7(tCOD/ha/y) = 371\ (tCOD/y)$$

Determination of CODOX,BL,y

In the subject plant, no oxidizing chemicals like sulphuric acid are used. Therefore it can be considered that no chemical substances like sulphate ion are contained in the wastewater.

Determination of CODsedim,BL

How to determine this value is described in Appendix II. As indicated in Figure 5, sediment has been eliminated in the wastewater before flowing into the Project Boundary. Therefore it is assumed that there will be no sediment of organic substances and that the value here is 0.

Step 2: Baseline emissions from generation and/or consumption of electricity

$$BE_{EL,y} = (EC_{BL,y} + EG_{PJ,y}) \times EF_{BL,EL,y}$$
$$= 5{,}735\ (MWh/y) \times 0.8(tCO2/MWh) = 4{,}588\ tCO_2e/y$$

$EC_{BL,y}$ This can be considered as nil, or $EC_{BL,y}$＝0 MWh/y in case the project is not implemented because the wastewater presently flows through the existing open lagoons by itself or without using any other power or electricity.

$EG_{PJ,y}$ Expected electricity generated per year is 6,390MWh/year, while expected electricity consumed for the plant is 655MWh/year. Therefore the net electricity available from this project will be 5,735MWh/year.

$EG_{PJ,y}$ = 6,390 (MWh/yr) - 655(MWh/yr) = 5,735 (MWh/yr)

Project emissions

Total estimated project emissions are the sum of the followings below.

(i) Methane emissions from the lagoons
(ii) Physical leakage of methane from the digester system;
(iii) Methane emissions from flaring
(iv) CO_2 emissions from consumption of electricity and or fossil fuels in the Project activity.

$$PE_y = PE_{CH4,effluent,y} + PE_{CH4,digest,y} + PE_{flare,y} + PE_{sludge.LA,y} + PE_{EC,y} + PE_{FC,y}$$
$$= 1{,}054\ (tCO_2e/y) + 266\ (tCO_2e/y) + 225\ (tCO_2e/y) = 1{,}545\ (tCO_2e/y)$$

(i) Project methane emissions from effluent from the digester

$$PE_{CH4,\ effluent,y} = GWP_{CH4} \times B_o \times (COD_{PJ,effl,dig,y} - COD_{PJ,aerobic} - COD_{PJ,OX,y} - COD_{PJ,sedim,y} - COD_{PJ,effl,lag,y})$$
$$= 21(\ tCO_2e/tCH_4\ ) \times 0.21(kgCH_4/kgCO_2) \times ((907\ (tCOD/y) - 371\ (tCOD/y) - 297(tCOD/y)) = 1{,}054\ (tCO_2e/y)$$

$$COD_{PJ,effl,dig,y} = \Sigma\ F_{PJ,effl.dig,m} \times W_{COD\ effl.dig,m} = 431{,}860(m^3/yr) \times 0.0021(tCOD/m^3) = 907\ tCOD/y$$
$$COD_{PJ,aerobic} = 4.0(ha) \times 92.7(tCOD/ha/y) = 371\ tCOD/y$$
$$COD_{PJ,effl,lag,\ y} = 431{,}860(m^3/yr) \times 0.00068(tCOD/m^3) = 297\ tCOD/y$$

$COD_{PJ,OX,y}$ and $COD_{PJ,sedim,y}$ are both zero as seen in the study of the baseline emissions.

(ii) Project emissions related to physical leakage from the digester

$$PE_{CH4,digest,y} = F_{biogas,y} \times EF_{CH4,digest} \times w_{CH4,biogas,y} \times GWP_{CH4} \times 0.001$$
$$= 3{,}169{,}679(m^3/y) \times 0.01 \times 0.400(kgCH_4/m^3) \times 21\ (\ tCO_2e/tCH_4\ ) \times 0.001$$
$$= 266\ (tCO_2e/y)$$

$F_{biogas,}$ = 3,169,679 (m^3/y)

$EF_{CH4,digest}$ = 0.01

$w_{CH4,biogas,y}$ = 0.400 ($kgCH_4/m^3$)

(iii) Methane emissions from flaring

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times GPW_{CH4}/1000$$
$$= 107{,}000(m^3/y) \times (1-0.9) \times 21(tCO_2e/y)/1000 = 225\ (tCO_2e/y)$$

$\Sigma\ TM_{RG,h}$ = 107,000 m^3/y

$\eta_{flare,h}$ = 90 %

(iv) Project emissions from land application of sludge

Project emissions are zero as already mentioned above.

(v) Project emissions from electricity consumption and combustion of fossil fuels in the project

$PE_{EC,y}$ CO_2 emissions from this project are based on following.

1. Electricity required for operation of the methane fermentation facility, and
2. Electricity required for operation of the auxiliary equipment of the gas engine

Above two factors are deducted in the calculation of the existing baseline emissions as $EG_{PJ,y}$.

$PE_{FC,y}$ Utilisation of heat is not planned in the project.

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Table 7 Summary of the ex-ante estimation of emission reductions

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emissions reductions (tonnes of CO_2e)
Year 1(Mar. 2010-Feb. 2011)	1,545	30,206	0	28,661
Year 2(Mar. 2011-Feb. 2012)	1,545	30,206	0	28,661
Year 3(Mar. 2012-Feb. 2013)	1,545	30,206	0	28,661
Year 4(Mar. 2013-Feb. 2014)	1,545	30,206	0	28,661
Year 5(Mar. 2014-Feb. 2015)	1,545	30,206	0	28,661
Year 6(Mar. 2015-Feb. 2016)	1,545	30,206	0	28,661
Year 7(Mar. 2016-Feb. 2017)	1,545	30,206	0	28,661
Total estimated reductions (tonnesof CO_2e)				200,627
Total number of crediting years				7
Annual average over the crediting period of estimated reductions(tonnesof CO2e)				28,661

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Table 8 Parameters used for determination of baseline emissions

Data/Parameter	ID-1_{a-f} -$COD_{BL,y}$ -$COD_{PJ,y}$ -$COD_{out,x}$ -$COD_{in,x}$ -$COD_{BL,m}$ -$COD_{PJ,m}$
Data unit:	ton COD/year,month
Description	- COD that would be treated in open lagoons (scenario 1) in the absence of the Project activity in year y - COD that is treated under the Project activity - COD of the effluent in the period x - COD directed to the open lagoons (scenario 1) in the period x - Quantity of chemical oxygen demand that would be treated in open lagoons (scenario 1) in the absence of the Project activity

	In month m - COD that is treated in the anaerobic digester or under clearly aerobic conditions in the Project activity in month
Source of data	Measured
Measurement procedure	COD concentration is to be measured monthly using sampling techniques and flow rate is to be measured continuously. Sampling to be carried out adhering to internationally recognized procedures.
Monitoring frequency	Monthly
QA/QC procedure	Flow and COD meters undergo maintenance/calibration subject to appropriate industry standards.

Data/Parameter	ID-2 $F_{PJ,dig,m}$
Data unit:	m³/month
Description:	Quantity of wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the Project activity in month m
Source of data:	Measured
Measurement procedure	Electromagnetic Flow meter
Monitoring frequency:	Parameter monitored continuously but aggregated annually for calculations

Data/Parameter:	ID-3 $w_{COD,dig,m}$
Data unit:	t COD / m³
Description:	Average chemical oxygen demand in the wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the Project activity in month m
Source of data:	Measurements
Measurement procedure	Measure the COD according to national or international standards
Monitoring frequency:	Regularly, calculate average monthly and annual values

Data/ Parameter:	ID-4 $w_{S,y}$
Data unit:	t COD / m³
Description:	Average chemical oxygen demand in the wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the Project activity in month m
Source of data:	Measurements
Measurement procedure	Measure the COD according to national or international standards
Monitoring frequency:	Regularly, calculate average monthly and annual values

Data/Parameter:	ID-5 $\mathbf{T_{2,m}}$
Data unit:	K

Description:	Average temperature at the project site in month *m*
Source of data:	National or regional weather statistics
Measurement procedure	-
Monitoring frequency:	Continuously, aggregated in monthly average values
Any comment:	Applicable for the methane conversion factor method

Data/Parameter:	ID-6 $EG_{PJ,y}$
Data unit:	MWh/year
Description:	Net quantity of electricity generated in year y with biogas from the new anaerobic Digester.
Source of data:	Calculated based on the measurement of the amount of biogas captured used for heat generation, the methane content of the gas and the NCV of the methane or directly measured from the heat received by the heated process
Measurement procedure	
Monitoring frequency:	Monitored daily
QA/QC procedures:	Wattmeter will be subject to maintenance/calibration according to appropriate industry standards.

Table 9 Parameters applied for determination of project emissions

Data / Parameter:	ID-7a-e - $COD_{PJ,effl,dig,y}$ - $COD_{PJ,effl,lag,y}$ - $COD_{PJ,effl,dig,m}$ - $COD_{PJ,effl,lag,m}$ - $COD_{sludge,LA,y}$
Data unit:	ton COD/unit of time (year, month)
Description:	- COD in the effluent from the digester in year y - COD in the effluent of the open lagoon in which the effluent from the digester is treated in year y - COD in the effluent from the digester in month m - COD in the effluent of the open in which the effluent from the digester is treated in month m - COD of the sludge applied to land after the dewatering process in year y
Source of data:	Measured
Measurement procedure	COD concentration is to be measured monthly using sampling techniques and flow rate is to be measured continuously. Sampling to be carried out adhering to internationally recognized procedures.
Monitoring frequency:	Monthly
QA/QC procedures:	Flow & COD meters undergo maintenance/calibration subject to appropriate industry standards.

Any comment:	y = Year of the Project activity m = Months of year *y* of the crediting period Note: annual values are derived from the monthly measures(m)

Data/Parameter	ID-8 a, b $F_{PJ,dig,m}$
Data unit:	m³/month
Description:	Quantity of wastewater that is treated in the anaerobic digester or under clearly aerobic conditions in the Project activity in month m
Source of data:	Measured
Measurement procedure	Electromagnetic Flow meter
Monitoring frequency:	Parameter monitored continuously but aggregated annually for calculations

Data/ Parameter:	ID-9 a, b $W_{COD,effl.dig,m}$ $W_{COD,effl.lag.m}$
Data unit:	t COD / m³
Description:	Average COD in the wastewater in the anaerobic digester or in the effluent from the open lagoon in month m
Source of data:	Measurements
Measurement procedure	COD concentration is to be measured monthly using sampling techniques and flow rate is to be measured continuously. Sampling to be carried out adhering to internationally recognized procedures
Monitoring frequency:	Internationally recognized procedures.
QA/QC procedures:	Flow & COD meters undergo maintenance/calibration subject to appropriate industry standards.

Data/ Parameter:	ID-10 $w_{S,eff,y}$
Data unit:	Kg / m³
Description:	Average concentration of chemical oxidative substance s in the effluent from the digester in year y
Source of data:	Measurements
Measurement procedures	Measure according to national or international standards
Monitoring frequency:	Regularly, calculate average monthly and annual values

Data/ Parameter:	ID-11a,b $F_{biogas,y}$
Data unit:	m^3/yr
Description:	Biogas recovered from anaerobic digestion system: respective measurement of (a) annual total recovered volume and (b) annual flared volume
Source of data:	Measured
Measurement procedures	Using calibrated portable gas meters. To be measured at wet basis Wet Gas meter
Monitoring frequency:	Parameter monitored continuously but aggregated annually for calculations

QA/QC procedures:	Gas meters will be subject to maintenance and calibration according to the appropriate industrial standards.
Any comment:	Applied to estimate emissions associated with physical leakage from the digester

Data/ Parameter:	ID-12 $P_{CH4,bio}$
Data unit:	m³ biogas leaked / m³ biogas produced
Description:	Fraction of biogas that leaks from the digester
Source of data:	Measured
Measurement procedures	Portable Gas Detector To check leakage from connections of covering materials over the digestion lagoons and those of biogas pipelines during the operation
Monitoring frequency:	Either with continuous analyser or alternatively with periodical measurement at 95% confidence level
QA/QC procedures:	Meter undergoes maintenance/calibration subject to appropriate industry standards.
Any comment:	The project envisages no leakage from the plant. Because of existing neighbouring lagoons, detection of gas leakage from the plant in the atmosphere is not appropriate. Leakage will be checked at each connection that can be a point of leakage.

Data / Parameter:	ID-13 T_{lag}
Data unit:	K
Description:	Temperature of lagoon
Source of data:	Measured
Monitoring frequency:	Daily average is monitored but monthly average is used in the calculations

Data / Parameter:	ID-14 CH_4
Data unit:	%
Description:	Concentration of CH_4 in the biogas
Source of data:	Measured
Monitoring frequency:	Daily average is monitored but monthly average is used in the calculations
QA/QC procedures:	Meter undergoes maintenance/calibration subject to appropriate industry standards.

Data / Parameter: (Project Emissions)	ID-15 T_{Flare}
Data unit:	K
Description:	Burning temperature of flare
Source of data:	Measured
Equipment:	Thermometer
Monitoring frequency:	Continuous measurement for each year

B.7.2 Description of the monitoring plan:

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All monitoring equipment will be installed by experts and regularly calibrated to the highest standards by UNILA. PT. WIRA's staff at the site will be trained in the operation of all monitoring equipment. All reading will be taken under the supervision of management. PT. WIRA will appoint an executive to be responsible for all data monitoring / acquisition and recording for CDM purposes. UNILA will advise on the data monitoring and acquisition, and periodically review the data to check its appropriateness.Figure 6 shows the monitoring plan.

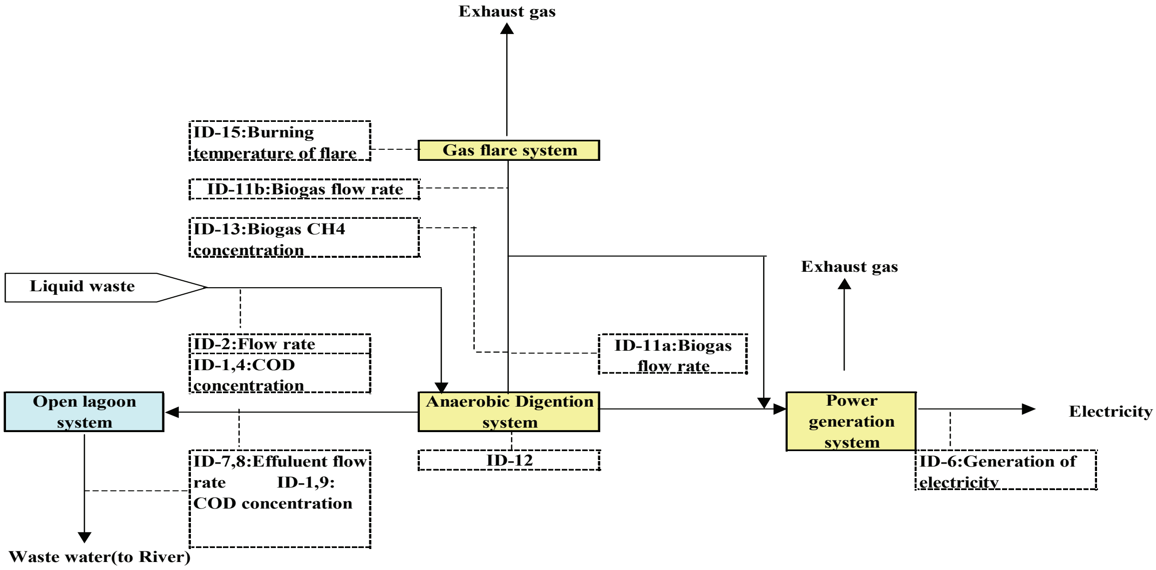

Figure 6 Monitoring Plan

MONITORING PLAN

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

1. Responsibility of the Project Management

PT. WIRA will be responsible for the execution of the monitoring plan. It will collect and store relevant data in a systematic and reliable way, evaluate them regularly, and ensure the availability of pertinent information for verification. An electronic spreadsheet file will be kept to record and manage all monitored variables and will be regularly presented to the DOE for verification.

2. Quality Assurance and Quality Control

The quality assurance and quality control for recording, maintaining and archiving data shall be maintained by PT. WIRA.UNILA will advise on the data monitoring and acquisition, and periodically review the data to check its appropriateness.

PT. WIRA will also make sure that it provides the staff in charge of data collection and monitoring with necessary training opportunities to enhance efficiency of their work.

3. On-site Procedures

Operation and Maintenance Logs

Daily O&M logs will be maintained by each shift leader on a real time basis. They will provide detailed on-the-spot information about the operation of the plant. Any event of significance will be reported and recorded in a special log.

Operation and Maintenance Report

This report will be developed every month.
The report will include the following topics:

- Summary
- Accidents, malfunctions and remedial measures taken
- Safety and environment
- Plant performance and availability
- Meter records
- Fuel report
- Personnel changes

Procedures for Calibration of Equipment

UNILA will supervise calibration of each equipment according to the pre-determined schedule.

4. Data Storage and Filing – Electric Workbook
All relevant data will be monitored and electronically stored.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

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Date of completion of the application of the baseline study and monitoring methodology

28th Feb.2008

Atsuo Inokawa
Technical Survey & Research Dept.
JFE Techno-Research Corporation
Tokyo, Japan
Phone: +81-3-3510-3430 Fax: +81-3-3510-3476
E-mail: inokawa@jfe-tec.co.jp

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity :

C.1.1. Starting date of the project activity:

>>

01 September 2008

C.1.2. Expected operational lifetime of the project activity:

>>

7 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
01 March 2010

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

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D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>
The project activity will result in a positive environmental benefit. First, the project will result in the reduction of greenhouse gases (GHG) helping to reduce global environmental issue of climate change and global warming. The project will reduce GHG emissions through capturing methane which is currently emitted from anaerobic open lagoons to which wastewater is digested. Methane has a potent GHG 21 times that of carbon dioxide. The project will also reduce GHG emissions by displacing diesel fuel used in current diesel engines.

Second, the project will reduce local odour pollution (air quality). The use of onggok (a fine biomass waste product from tapioca process) of less than 0.5% will be added to keep the system in balance. The sludge, which is primarily bacterial biomass, will be used as organic fertilizer for cassava plantations. The sludge will reduce the amount of fertilizer used for the plantations. The use of onggok less than 0.5% will not influence onggok's local demand.

The environmental impacts of the project activity are perceived to be positive, and the project activity would deliver measurable improvements in the wastewater management, discharged effluent and air quality in the region.

According to the Decree of the Minister of Environment No. 11 of 2006, construction of a biogas extraction system at an existing tapioca starch processing plant including auxiliary facilities for organic wastewater treatment and development of a power plant such as the project activity up to 10 MW does not require a full

Environmental Impact Assessment (Analysis Mengenai Dampak Lingkungan/AMDAL), but it does require a preparation of environmental management and environmental monitoring plan (Upaya Pengelolaan Lingkungan/UKL and Upaya Pemantauan Lingkungan/UPL).

In order to comply with the Decree, UKL and UPL of the existing tapioca starch manufacturing plant have been completed by PT WIRA. However, the UKL and UPL of existing tapioca processing plant will be adjusted to include electricity generation for a captive power in the plant. An amendment of the UKL/UPL will still be required for the project activity that utilizes biogas extracted from wastewater treatment system for electricity generation.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

No significant negative environmental impacts have been identified, apart from the utilization of onggok, which requires about 5% of the onggok produced. This impact is not considered significant, and does not require an EIA preparation. Beside the impact associated with the utilization of onggok, no other impacts (e.g., on ground water) or other environmental emissions are identified. The project activity will bring positive impact to the environment because it will improve either water quality as well as air quality.

SECTION E. Stakeholders' comments

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E.1. Brief description how comments by local stakeholders have been invited and compiled:

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Since the project activity is still at the stage of study, comments received from local stakeholders have not been requested yet. However, personnel from PT WIRA, University of Lampung (UNILA), Local Environmental Office (BAPEDALDA) have been visited on 28th August 2007,27th August 2007, and 29th August 2007.Presentation and discussion with them regarding the project activity has been performed during the visit.

E.2. Summary of the comments received:

>>

It was confirmed through the conversation with the President and the personnel of UNILA and also from local government personnel that they welcome the project activity and would provide their support in arranging a meeting with local stakeholders when the decision to implement the project activity is made.

The comment regarding a lack of information in the EIA was addressed. EIAs are not required for biogas projects of less than 10 MW but an amendment to the environmental management and monitoring plan of the tapioca processing plant must be completed and obtained an approval.

A representative of Bapedalda suggested that utilization of onggok at about 0.5% as stabilizer in the anaerobic treatment system would not influence local demand. It is also suggested that the project activity should be communicated to the surrounding villages. The personnel reminded the project developer to record the result of wastewater analysis and to report it to the Bapedalda on a regularly basis. The Bapedalda showed their intention to involve in the project activity, particularly for the training of personnel regarding environmental care.

E.3. Report on how due account was taken of any comments received:

>>

No account is necessary

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	PT. WIRA Kencana Adiperdana
Street/P.O.Box:	Jl. Soekarno-Hatta Km.6 No.1
Building:	
City:	Kec. Telubetung selatan
State/Region:	Bandar Lampung
Postfix/ZIP:	35244
Country:	Indonesia
Telephone:	+62-721-342345
FAX:	+62-721-342222
E-Mail:	wirapg@yahoo.com
URL:	
Represented by:	Bayu Minarto
Title:	Technical Advisor
Salutation:	Mr.
Last Name:	Minarto
Middle Name:	
First Name:	Bayu
Department:	Technical Advisor
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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Annex 3

BASELINE INFORMATION

Table 1：Wastewater characteristics

COD removal Efficiency of Dome Digester System	0.86
COD (before Dome Digester System)	15,000 mg/litre
COD (after Dome Digester System)	2,100 mg/litre
Effluent flow	1,661 m^3/day
Annual COD load to lagoons before Dome Digester System implementation	6,478,000 kgCOD/yr
Annual COD load to lagoons after Dome Digester System implementation	907,000 kgCOD/yr
Plant operation	260 days/year

Data source: PT. WIRA & UNILA

Table 2：Lagoon condition

Lagoon Depth	4 m (Anaerobic lagoon) 3 m (Facultative lagoon)
Area	4.0 ha
Minimum Lagoon Temperature	27 ℃
Minimum Ambient Temperature	34 ℃

Data source: PT. WIRA & UNILA

Table 3: Organic material removal ratio for lagoons based on the historical Lagoon COD data

Average COD into the lagoon	15,000 mg/litre
Average COD out from the lagoon	688 mg/litre
Average COD removal ratio	95.4 %

Data source: PT. WIRA & UNILA

Table 4: Expected production and electricity consumption

	Expected production (Tonnes/year)
Tapioca	23,998
Total	23,998

Data source: PT. WIRA

Table 5: Fuel specification

	(A)	(B)
Fuel Type	Density [kg/kl]	Net Calorific value [TJ/kt]
Data Source	PERTAMINA	IPCC
HSD	850	43033

HSD: High speed diesel

Annex 4

MONITORING INFORMATION

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