

**CLEAN DEVELOPMENT MECHANISM  
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)  
Version 03 - in effect as of: 22 December 2006**

**CONTENTS**

- A. General description of the small scale project activity
- B. Application of a baseline and monitoring methodology
- C. Duration of the project activity / crediting period
- D. Environmental impacts
- E. Stakeholders' comments

**Annexes**

Annex 1: Contact information on participants in the proposed small scale project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring Information

CDM – Executive Board

**Revision history of this document**

| <b>Version Number</b> | <b>Date</b>      | <b>Description and reason of revision</b>  |
|-----------------------|------------------|--|
| 01                    | 21 January 2003  | Initial adoption   |
| 02                    | 8 July 2005      | <ul style="list-style-type: none"><li>• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document.</li><li>• As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <a href="http://cdm.unfccc.int/Reference/Documents">http://cdm.unfccc.int/Reference/Documents</a>.</li></ul> |
| 03                    | 22 December 2006 | <ul style="list-style-type: none"><li>• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.</li></ul>   |

CDM – Executive Board

**SECTION A. General description of small-scale project activity****A.1 Title of the small-scale project activity:****Replacement of Fossil Fuel by Biomass in a Crude Palm Oil (CPO) Refinery at BIDCO's Thika facility in Kenya**

Version: 01  
Date: 28/05/2011

**A.2. Description of the small-scale project activity:****Background of the company:**

BIDCO, the largest edible oils refiner in East Africa, completed construction of its Crude Palm Oil (CPO) refinery in Thika, Kenya, in 1991. The facility is refining CPO imported from the Far East, to produce Palm oil, olein and stearin. The company also processes Corn Oils, Sunflower Oils and Soybean Oils.

**Purpose of the Project Activity:**

The purpose of the project activity is the thermal energy generation using agricultural residues for captive use. The project activity aims to avoid the use of fossil fuels; in particular "Heavy fuel oil" to produce the steam required during the refining process and instead switches over to Biomass to meet the steam requirements. In 2006 BIDCO's Thika refinery was re-designed to use biomass instead of heavy fuel oil. BIDCO replaced its Boilers to use primarily agricultural residues, specifically coffee, rice, macadamia and cashew husks and shells, as well as eucalyptus and acacia firewood. The project activity primarily involves installation of 16 TPH, 17.5kg/cm<sup>2</sup> biomass based boiler and associated accessories.

BIDCO's switch to Biomass to meet its steam requirement has resulted in carbon emission reductions due to replacement of fossil fuels. Biomass is considered to be a carbon-neutral fuel because emissions from combustion are taken to completely offset by carbon captured (during photosynthesis) by the growing biomass.

**Pre Project Scenario:**

The Thika refinery unit has existing two Boilers of 8 TPH Capacity each installed in 1999. The Boilers are operating on Furnace Oil. Steam demand for process was being met by running two numbers 8 TPH Furnace oil Boiler and Electrical demand from Kenya Power & Lighting Company (KPLC).

**Project Activity Scenario**

The project primarily involves installation of one new 16 TPH, 17.5kg/cm<sup>2</sup> Biomass based Boiler. Hence, the project activity aims to avoid the use of furnace oil to produce the steam required during the refining process and instead switches over to Biomass to meet the steam requirements.

---

CDM – Executive Board

### **Baseline Scenario:**

At the time of investment decision, PP evaluated continuation of Furnace oil based Boiler as an alternative to the project activity and found that this alternative is financially viable than the project activity. This alternative would not require any additional capital cost as the existing boilers were operational and had remaining life of 12 years. However, considering the fact that carbon revenue makes the project viable over the alternative, PP decided to go ahead with the implementation of the project activity.

Therefore, in the absence of the project activity, PP would have opted for Furnace oil based thermal energy generating system leading to CO<sub>2</sub> emissions.

### **Contribution of the Project Activity to Sustainable Development:**

As per the National Environment Management Authority (Govt of Kenya) the following five indicators viz. Environmental, Social, Economical, Energy and Technological well being are considered as indicators for the sustainable development in its approved guidelines for CDM<sup>1</sup>

The project proponent believes that the project activity has a beneficial effect on the surrounding community, rural industries and the employment in the region and thereby project improves the social, environmental and the economic status of the surrounding community.

### **Environmental Sustainability:**

- The project activity involves fuel switch from furnace oil to renewable biomass fuel which is considered as GHG neutral. Therefore in addition to reduced consumption of fossil fuel resources, the project activity leads to GHG emission reductions. The project activity neither impacts human health nor the biodiversity negatively.
- The use of agro residues as opposed to fuel oil from fossil sources results in a net reduction in particulate matter air pollution.
- On a broader spatial scale, if the use of biomass were to be replaced by its industry-standard petroleum-based substitute, fuel oil normally contains as much as 4% sulphur; replacement by biofuels reduces both SO<sub>2</sub> and NO<sub>x</sub> emissions, thereby mitigating local and long-range acid deposition

### **Social Well Being:**

- The project activity generates both skilled and unskilled employments opportunities, during the construction and operation of the plants.
- Manual firing and handling of biomass would require additional manpower compared to automated furnace oil boilers. This leads to employment generation in the local village

### **Economic Sustainability:**

---

<sup>1</sup> [http://www.nema.go.ke/index2.php?option=com\\_docman&task=doc\\_view&gid=76&Itemid=35](http://www.nema.go.ke/index2.php?option=com_docman&task=doc_view&gid=76&Itemid=35)

## CDM – Executive Board

- Act as a clean technology demonstration project, one – if not the first – of its kind in Kenya, encouraging development of modern and more efficient generation of steam using biomass fuel throughout the Country;
- As opposed to a fossil fuel-fired plant, the project does not lead to an outflow of foreign exchange capital, since the biomass waste does not have to be imported.
- The project activity will contribute to the general improvement in the living standards of local people by generating additional employment opportunities.

**Energy Sustainability:**

- Diversify the sources of steam generation;
- Use of clean and efficient technologies, and conserve natural resources;

**Technological well being:**

- The project activity uses environmentally safe and sound technology. The project will encourage the replication of the technology in the sector.

Thus the project activity meets all the requirements for the sustainable developments in the host country.

**A.3. 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) |
|--|--|---|
| Government of Kenya (Host)                             | BIDCO Oil Refineries Ltd. (a Private entity)                           | No  |

BIDCO Oil Refineries Ltd. will be the sole owner of the CERs generated from the project activity.

**A.4. Technical description of the small-scale project activity:****A.4.1. Location of the small-scale project activity:****A.4.1.1. Host Party(ies):**

Kenya

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

East Africa / Great Lakes region

**A.4.1.3. City/Town/Community etc:**

Thika

**A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :**

CDM – Executive Board

BIDCO Oil Refineries Ltd. is located in the industrial zone near the town of Thika, 35 km north of the Kenyan capital, Nairobi. The closest major airport is Jomo Kenyatta International Airport. This airport has international and domestic flights from Nairobi, Kenya and is about 35 km from the center of Thika, Kenya. The latitude/longitude coordinates of the project site are: 1°03'06.76" S, 37°05'09.00" E. elev. 4880ft. The location is shown in the satellite image, below.



**Figure 1: Location of the project activity**

**A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:**

The project activity replaces the use of furnace oil for steam generation by renewable biomass.

CDM – Executive Board

As per simplified modalities and procedures for small scale CDM project activities, the project activity qualifies under the

**Sectoral Scope** : 01 Energy Industries (Renewable/Non-Renewable Sources)  
**Type-I** : Renewable Energy Projects  
**Category C** : Thermal energy production with or without electricity

**Technical Specifications of the Project activity:**

BIDCO replaced its two existing furnace oil Boilers with the biomass based Boiler to be fired primarily by agricultural residues, specifically coffee, rice, macadamia and cashew husks and shells as well as eucalyptus and acacia firewood.

The project activity has commissioned a multi fuel fired boiler of 16TPH, 17.5kg/cm<sup>2</sup> and related machineries. The Main Boiler and the Balance of Plant (Auxiliaries) are manufactured by Thermax Ltd. and supplied by Spenomatic (K) Ltd., (SKL). The boiler will be operated by utilizing available agro-residues. The expected technical lifetime of the Boiler is 20 years and 0 months.

**Steam Boiler:**

| Parameter                                       | Remarks  |
|---|--|
| Steam generation Capacity                       | 16 TPH   |
| Model   | Combimax (CP 160)  |
| Boiler manufacturer (Make)                      | Thermax  |
| Type  | Multi fuel fired horizontal composite, (smoke tube and water tube), two pass, natural circulation Boiler |
| Pressure of the Boiler                          | 17.5 kg/cm <sup>2</sup>  |
| Temperature of the steam                        | Saturated  |
| Feed water temperature                          | 100°C  |
| Enthalpy of feed water                          | 419 kJ/kg  |
| Enthalpy of steam                               | 2795 kJ/kg   |
| Efficiency of the Boiler                        | 74 %   |
| Life time of the Boiler                         | 20 Years 0 months  |
| The date biomass fuel boiler become operational | August 15, 2006  |

Along with Boiler, other auxiliary machineries like Wood Chipper Machine, Air pre-heater, Draft fans, Motors, Ash handling system, Fuel handling system, Piping works, Electricals, Instrumentation & Control systems etc., are installed.

The biomasses for the project activity would be sourced from the nearby vendors. A total of 31,051 MT of the various fuels are to be combusted annually in 340 days of operation

The technology is environmentally safe and sound and it does not have negative impact on human health or biodiversity. No technology transfer is involved in the project activity from Annex I countries.



CDM – Executive Board

**A.4.3 Estimated amount of emission reductions over the chosen crediting period:**

| Years   | Estimation of annual emission reductions in tonnes of CO <sub>2</sub> e |
|---|---|
| 2012  | 23,827  |
| 2013  | 23,827  |
| 2014  | 23,827  |
| 2015  | 23,827  |
| 2016  | 23,827  |
| 2017  | 23,827  |
| 2018  | 23,827  |
| 2019  | 23,827  |
| 2020  | 23,827  |
| 2021  | 23,827  |
| <b>Total estimated reductions (tonnes of CO<sub>2</sub> e)</b>                                  | 238,270   |
| <b>Total number of crediting years</b>  | 10  |
| <b>Annual average of the estimated reductions over the crediting period (tCO<sub>2</sub> e)</b> | 23,827  |

**A.4.4. Public funding of the small-scale project activity:**

There is no public funding from the Annex I parties or diversion of Overseas Development Assistance (ODA) in the project activity. The total project cost is met by the project participant.

**A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:**

As per Appendix C, paragraph 2 of the Simplified Modalities and Procedures for Small-Scale CDM project activities states:

“A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point

The proposed project activity is not a debundled component of a large scale project activity as there is no registered project activity or an application for registration by the same project participant and in the same category.

**SECTION B. Application of a baseline and monitoring methodology**



CDM – Executive Board

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

As per the appendix B of simplified modalities and procedures for small scale project activities, the applied methodology for the CDM project activity is:

**Type** : AMS-I.C  
**Title** : Thermal energy production with or without electricity  
**Sectoral Scope** : 01  
**Version** : 18  
**EB** : 56

**Reference:** <http://cdm.unfccc.int/methodologies/DB/H2PMYUBPE9H1DP9S0WB470N5EKU1NP>

**B.2 Justification of the choice of the project category:**

This project falls under the "Type I: Renewable energy projects" and "Category I C: Thermal energy production with or without electricity" as it displaces fossil fuels with biomass for generation of thermal energy.

Requirements with respect to technology/measure under AMS I.C – Thermal Energy production with or without electricity (Version 18) and its comparison for justification with the project activity are explained in the table below.

| Sr. No | Applicability Criteria AMS I.C Version 18  | Project Status  | Remarks  |
|--------|--|---|--|
| 1      | This category comprises renewable energy technologies that supply users with thermal energy that displaces fossil fuel use. These units include technologies such as solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel. | The project activity comprises of renewable biomass (agricultural residues, specifically coffee husk, rice husk, macadamia, and cashew husks and shells, as well as eucalyptus and acacia firewood <sup>2</sup> ) based thermal energy generation by displacing the fuel oil. The steam generated in project activity is used for meeting the captive demand. In the absence of the project activity, the energy requirements would have been met by fuel oil based Boiler. | Since the project activity involves renewable biomass based thermal energy generation that displaces fuel oil, the applicability condition is met. |
| 2      | Biomass-based cogeneration systems consisting of steam generator(s) and steam turbine(s) are included in this category. For the purpose of this  | The project activity does not involve any cogeneration system.  | Since the project activity is not a cogeneration activity, this  |

<sup>2</sup> Since the biomasses being the byproducts of the industries agro industries, meet the definition of renewable biomass.

## CDM – Executive Board

|   |  |   |  |
|---|--|---|--|
|   | methodology cogeneration shall mean the simultaneous generation of thermal energy and electrical energy in one process. Project activities that produce heat and power in separate element processes (for example, heat from a boiler and electricity from biogas engine) do not fit under the definition of cogeneration project.   |   | condition is not relevant.   |
| 3 | Emission reductions from a biomass cogeneration system can accrue from one of the following activities:<br>(a) Electricity supply to a grid;<br>(b) Electricity and/or thermal energy (steam or heat) production for on-site consumption or for consumption by other facilities;<br>(c) Combination of (a) and (b).  | The project activity is not a cogeneration activity.  | Since the project activity is not a cogeneration system, this condition is not applicable.                             |
| 4 | The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal. (see paragraph 6 for the applicable limits for cogeneration project activities).   | Based on the manufacturer's rated thermal output, the total installed thermal generation capacity is 10.56 MW thermal (Calculations are provided under this table). | Since the total installed thermal generation capacity is less than 45 MW thermal, this applicability condition is met. |
| 5 | For co-fired systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel shall not exceed 45 MW thermal (see paragraph 6 for the applicable limits for cogeneration project activities).   | The project activity does not involve co-firing with fossil fuels.  | Since the project is not a co-fire system, this condition is not relevant.   |
| 6 | The following capacity limits apply for biomass cogeneration units.<br>a. If the project activity includes emission reduction from both the thermal and electrical energy components, the total installed energy generation capacity (thermal and electrical) of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating this capacity limit the conversion | The project activity does not involve cogeneration system.  | Since project is not a cogeneration activity, this condition does not apply.   |

CDM – Executive Board

|   |  |  |   |
|---|--|--|---|
|   | <p>factor of 1:3 shall be used for converting electrical energy to thermal energy ( i.e., for renewable project activities , the maximal limit of 15 MW(e) is equivalent to 45 MW thermal output of the equipment or the plant);</p> <p>b. If the emission reductions of the cogeneration project activity are solely on account of thermal energy production (i.e., no emission reductions accrue from electricity component), the total installed thermal energy production capacity of the project equipment of the cogeneration unit shall not exceed 45 MW thermal;</p> <p>c. If the emission reductions of the cogeneration project activity are solely on account of electrical energy production (i.e. no emission reductions accrue from thermal energy component), the total installed electrical energy generation capacity of the project equipment of the cogeneration unit shall not exceed 15 MW.</p> |  |   |
| 7 | <p>In case electricity and/or steam/heat produced by the project activity is delivered to another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into specifying that only the facility generating the energy can claim emission reductions from the energy displaced.</p>  | <p>The steam generated by the project activity is consumed onsite and not delivered to other facility.</p>   | <p>Since the steam generated is not transferred to a third party, this condition is not applicable.</p>           |
| 8 | <p>Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category.</p>  | <p>The proposed project activity has installed a new boiler and does not seek to retrofit or modify existing facility for renewable energy generation.</p> | <p>Since project activity does not retrofit or modify an existing facility, this condition is not applicable.</p> |

## CDM – Executive Board

|    |   |   |   |
|----|---|---|---|
| 9  | <p>The capacity limits specified in the above paragraphs apply to both new facilities and retrofit projects. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy facility, the total capacity of the units added by the project should comply with capacity limits in paragraphs 4 to 6 and should be physically distinct from the existing units.</p>  | <p>The project is a new facility and confirms to the capacity limits of 45MW thermal. The project does not involve retrofication or capacity addition of renewable energy units at an existing renewable energy facility.</p> | <p>Since the project being a new facility confirms to the 45MW thermal limit, the condition is met.</p> |
| 10 | <p>Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources provided:</p> <p>(a) Charcoal is produced in kilns equipped with methane recovery and destruction facility; or</p> <p>(b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered. These emissions shall be calculated as per the procedures defined in the approved methodology AMS - III.K. Alternatively, conservative emission factor values from peer reviewed literature or from a registered CDM project activity can be used, provided that it can be demonstrated that the parameters from these are comparable e.g., source of biomass, characteristics of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.</p> | <p>The proposed project activity uses agro-residues; it does not involve charcoal based biomass energy generation.</p>  | <p>Since the project does not intend to use charcoal, this condition is not relevant.</p>               |
| 11 | <p>If solid biomass fuel (e.g. briquette) is used, it shall be demonstrated that it has been produced using solely renewable biomass and all project or leakage emissions associated with its production shall be taken into account in emissions reduction calculation</p>   | <p>The project activity will use renewable biomass residues and does not intend to use solid biomass fuels.</p>   | <p>Since the project does not use solid biomass fuel, this condition is not relevant.</p>               |

CDM – Executive Board

**Small Scale Limit:**

Based on the manufacturer's rated output, the calculations for the total thermal energy generated by the project activity are as follows:

| S. No | Parameter                                    | Value  | Unit               | Remarks                                  |
|-------|--|--------|--------------------|--|
| 1     | Steam Quantity                               | 16     | TPH                | Technical specifications of Boiler       |
| 2     | Steam Pressure                               | 17.5   | kg/cm <sup>2</sup> | Technical specifications                 |
| 3     | Enthalpy of steam at 17.5kg/cm <sup>2</sup>  | 2795.2 | kJ/kg              | Estimated based on standard steam tables |
| 4     | Enthalpy of feed water at 100 <sup>0</sup> C | 419    | kJ/kg              | Estimated based on standard steam tables |
| 5     | Net energy output of the boiler              | 2376   | kJ/kg              | Calculated                               |

**At the Rated Capacity**

Total thermal output: 2376 kJ/kg \* 16 TPH= 38,018 MJ/h

Thermal output from the boiler: 38,018 MJ/h / 3600= 10.56 MW of thermal

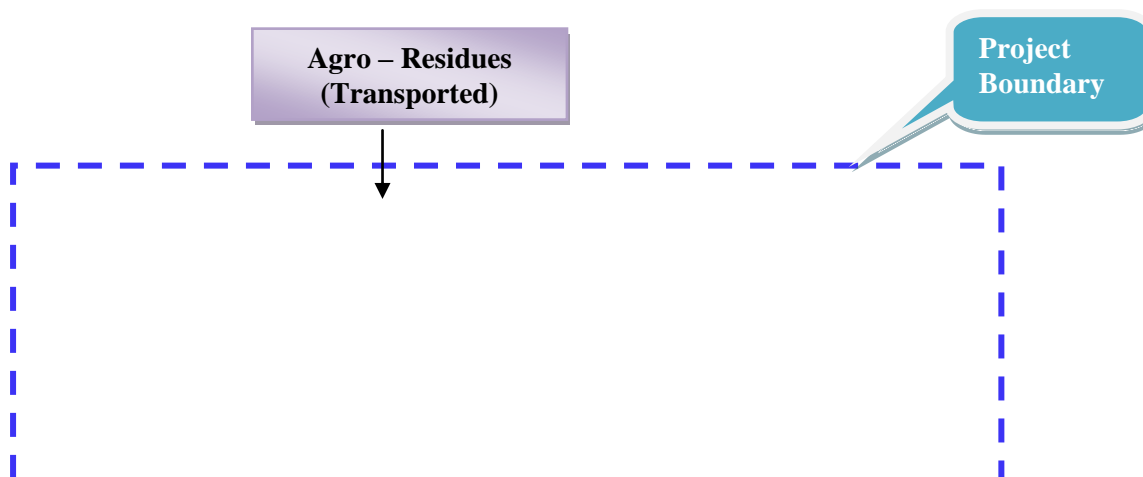
**Hence,** Total thermal output of Agro-Residues based Boiler: 10.56 MWth.

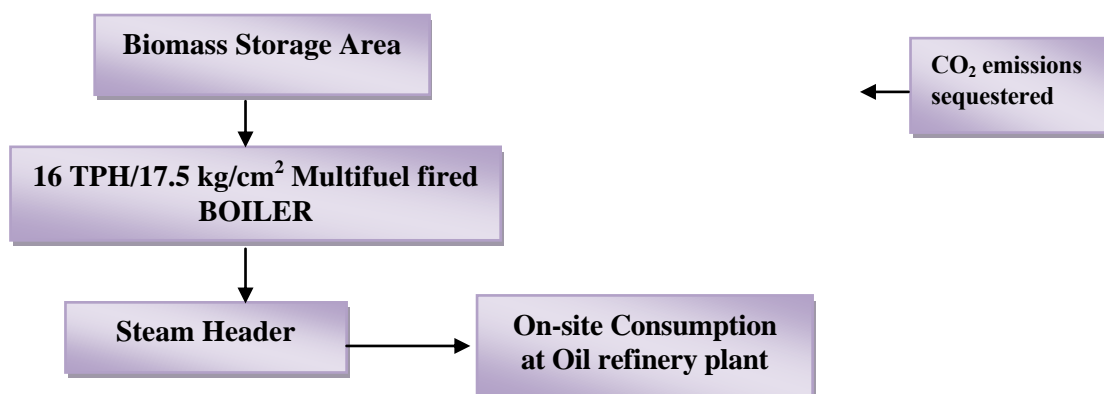
The chosen methodology for the project, AMS I C is justifiable since the project activity meets all the applicability conditions as discussed above. Thus, it is used in the following sections of the PDD.

**B.3. Description of the project boundary:**

As per AMS IC, Project boundary constitutes of “*the physical, geographical site of the project equipment producing the renewable energy delineates the project boundary. The boundary also extends to the industrial, commercial or residential facility, or facilities, consuming energy generated by the system and the processes or equipment that is affected by the project activity.*”

Therefore, project boundary includes Biomass storage area, Steam generation Boilers and related auxiliaries of the renewable energy generating system. The boundary extends to the refinery facility consuming the steam generated by the project.





**FIGURE 2: Project boundary**

#### **B.4. Description of baseline and its development:**

The project activity involves renewable biomass based thermal energy generation. The renewable biomasses used in the project activity are agricultural residues, specifically coffee husk, rice husk, macadamia and cashew husks and shells as well as eucalyptus and acacia firewood.

The identification of the baseline scenario has been carried out in line with the Para 13 of AMS IC Version 18 which states that:

*“For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission factor for the fossil fuel displaced. For calculating the emission factor, reliable local or national data shall be used. IPCC default values shall be used only when country or project specific data are not available or demonstrably difficult to obtain.”*

The project activity has come up to meet the steam demands of BIDCO’s crude palm oil (CPO) refining process plant. During the decision making, PP had evaluated continuation of fuel oil based thermal energy generation system of similar capacity as an alternative to the project activity. PP evaluated the financial viability (in terms of levelised cost) of both the systems and found that fuel oil based system is financially viable than the project activity.

Since PP had assessed an option of fuel oil based Boiler at the investment decision time, in the absence of project activity, fuel oil based Boiler of 16 TPH/17.5kg/cm<sup>2</sup> would have been installed to meet the additional steam demands. In line with the Para 48 (b) of Simplified modalities and procedures for small scale CDM projects, the baseline demonstration has been further strengthened by comparing the levelised cost of fuel oil and biomass based system in section B.5.

#### **Alternative 1: Fuel oil based thermal energy generation system (continuation of existing scenario)**

In the absence of the CDM project activity, the steam requirements would have been meet from fossil fuel (fuel oil) based plant. This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline.

CDM – Executive Board

**Alternative 2: Renewable Biomass based thermal energy generation system (i.e. project activity taken without CDM benefits)**

BIDCO shall utilise agro fuel like coffee husk, rice husk, etc., as a fuel to meet the steam requirements. This alternative is in compliance with all applicable legal and regulatory requirements. Hence this alternative is considered further for arriving at the baseline scenario.

The above real and credible alternative in the absence of project activity has been assessed in below table (refer Section B.5 of PDD and financial models for detailed calculations):

| Alternatives  | Levelised Cost of energy generation (USD/GJ) <sup>3</sup> |
|---|---|
| Fuel oil based thermal energy generation system   | 9.71  |
| Renewable Biomass based thermal energy generation system (i.e. project activity taken without CDM benefits) | 11.12   |

From the financial results presented above and in detailed analysis in section B.5, it becomes clear that the levelised cost of biomass based system is higher than the levelised cost of fuel oil based steam generation.

It can be concluded from the above results that alternative 2 i.e. “*Renewable Biomass based thermal energy generation system*” is not financially attractive as alternative scenario 1 i.e. “*Fuel oil based thermal energy generation system*”. The assumptions considered for both the alternatives financial analysis are detailed in section B.5.

**Hence, the most economically attractive course of action, i.e. fuel oil based thermal energy generating system has been considered as baseline scenario.**

Emission reduction is achieved by substituting heavy fuel oil with Biomass, specifically agricultural residues and plantation fuel wood. The baseline emission corresponding to thermal energy generation has been estimated using the emission coefficient for fuel oil. The baseline emissions have been computed on the basis of amount of fuel oil required to generate 16TPH of steam supplied to the process over 340 days.

As per equation 2 of AMS IC, the baseline emissions are calculated using the following formula:

$$BE_{\text{thermal, CO}_2, y} = (EG_{\text{thermal, y}} / \eta_{\text{BL, thermal}}) * EF_{\text{FF, CO}_2}$$

The following table illustrates the key parameters and assumptions used to determine the baseline emissions.

| Key Parameter   | Description             | Value             | Data Source                  |
|-----------------|-------------------------|-------------------|------------------------------|
| EG <sub>y</sub> | Total energy generation | 307.8<br>TJ/Annum | Estimated as discussed above |

<sup>3</sup> Relevant calculation and references are submitted to DOE



CDM – Executive Board

|                         |  |                             |  |
|-------------------------|--|-----------------------------|--|
| EF <sub>FF, CO2</sub>   | Emission Factor of Fuel oil              | 77.4 tCO <sub>2e</sub> / TJ | 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy; Table 2.2, Page Num 16 |
| NCV <sub>Fuel oil</sub> | Net Calorific Value of Fuel oil          | 9600 kCal/kg                | As per the quotes from Suppliers   |
| η <sub>BL,thermal</sub> | Efficiency of baseline (fuel oil) boiler | 100%                        | Default Efficiency as per Para 26c of the applied methodology  |

**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 small-scale CDM project activity:**

The project activity by BIDCO is substituting the use of heavy fuel oil by using renewable Biomass to meet the internal thermal requirements with the primary aim of reducing carbon dioxide emissions by fossil fuels.

For small-scale CDM project activities, additionality needs to be demonstrated using Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities. As per Attachment A to Appendix B, PP has to demonstrate additionality due to at least one of the following barriers:

1. Investment barrier
2. Technological barrier
3. Barrier due to prevailing practice
4. Other barriers

PP has chosen to prove the additionality using **investment barrier**.

**Investment Barrier:**

It is proposed to use Investment Comparison analysis as it derives economic benefits from the project activity by generation and use of thermal energy. The Investment comparison analysis has been carried out by calculating the levelized cost of energy generation (USD/GJ) for the alternatives

- 1) Renewable biomass based thermal energy generation system (without CDM)
- 2) Fuel oil based thermal energy generation system

As per Guideline 16 of Annex 58 (“Guidance on the Assessment of Investment Analysis-Version 03”) of EB 51 Report, the investment comparison analysis can be applied to those cases only if the baseline scenario leaves the project proponent no other choice than to make an investment to supply the same (or substitute) products or services. We, in view of the above, would like to submit that the investment in steam generation projects is necessary for PP to meet the thermal energy demand of the CPO refinery. Hence, the project proponent has the only option to invest in thermal energy generation project anyhow to meet the captive demands.

As per Guidance 16, “In cases where the alternative requires investment anyhow and baseline emissions are based on that alternative, the only means of determining that the project activity is less financially

## CDM – Executive Board

attractive than at least one alternative is to conduct an investment comparison analysis” As this condition is applicable to the project activity, the investment comparison approach is therefore suited for the proposed CDM project activity.

As explained above, PP has to make investment anyhow to generate thermal energy to meet its captive demands. Also, as there is no direct revenue source from the project activity in terms of sale of energy to third party, financial indicators like IRR, NPV and Cost benefit ratio are not applicable as the objective of BIDCO is to generate thermal energy that is reliable and economical to run its refinery. The cost of energy generation and other utilities directly reflect in the production cost of palm oil and hence objective is to keep these at minimum to be competitive in the market. The leveled cost of energy generation (USD/GJ of energy) is the most suitable financial indicator for this decision making context.

**List of assumptions used in the financial analysis for Project activity and Baseline alternative:**

| Parameter                                   | Unit               | Project activity | Baseline Scenario | Remarks  |
|---|--------------------|------------------|-------------------|--|
| <b>Technical Parameters:</b>                |                    |                  |                   |  |
| No. of operating days                       | Days               | 340              | 340               | Assumed  |
| Running Hours                               | hrs/annu<br>m      | 8160             | 8160              | Assumed for 340 days per annum   |
| Steam Rate                                  | TPH                | 16               | 16                | As per the offer letter and design parameters of the Boiler dated 14/10/2005 |
| Steam Pressure                              | kg/cm <sup>2</sup> | 17.5             | 17.5              | As per the Offer Letter dated 14/10/2005                                     |
| Enthalpy of feed water @ 100°C              | kJ/kg              | 419              | 419               | Estimated using steam table values for 100°C at inlet to boiler              |
| Enthalpy of steam @ 17.5 kg/cm <sup>2</sup> | kJ/kg              | 2795             | 2795              | Estimated using steam table values   |
| Efficiency of Furnace oil fired Boiler      | %                  | -                | 100%              | Default Efficiency as per Para 26c of the applied methodology                |
| Efficiency of Biomass based Boiler          | %                  | 74%              | -                 | As per the supplier quotation  |
| Life time                                   | Years              | 20               | 20                | As per the Offer Letter dated 14/10/2005                                     |
| <b>Fuel Parameters:</b>                     |                    |                  |                   |  |
| Furnace Oil Calorific value – NCV           | kCal/kg            | -                | 9600              | As per the supplier quotation  |
| Biomass Calorific value – NCV               | kCal/kg            | 3200             | -                 | As per the supplier quotation  |
| Fuel oil requirement                        | MT/Year            | -                | 7,659             | Estimated  |
| Biomass requirement                         | MT/Year            | 31,051           | -                 | Estimated  |
| Average Cost of Fuel oil                    | USD/ton            | -                | 303               | As per the supplier quotation  |
| Average Biomass Purchase cost               | USD/ton            | 85               | -                 | As per suppliers Quotations  |

CDM – Executive Board

| <b>Financial Parameters:</b>                  |     |         |                        |   |
|---|-----|---------|------------------------|---|
| Total Project Cost                            | USD | 1500000 | 10,50,000 <sup>4</sup> | As per the Offer Letter dated 14/10/2005                          |
| IT Depreciation                               | %   | 12.5    | 12.5                   | As per the Income tax Act, Chapter 470, Page Num 173 <sup>5</sup> |
| Income tax                                    | %   | 30      | 30                     | As per Income tax act   |
| Interest on Term Loan                         | %   | 12.88   | 12.88                  | As per rates prevailing at the time of investment decision        |
| Discount Factor (WACC)                        | %   | 12.88   | 12.88                  | As per rates prevailing at the time of investment decision        |
| Operation and Maintenance (% of Capital Cost) | %   | 3.5     | 3.5                    | As per Internal Memorandum  |
| Yearly Price Escalation on O & M              | %   | 5       | 5                      | As per Internal Memorandum  |

The levelized cost of energy generation calculated based on above assumptions is:

| <b>Alternatives</b>  | <b>Levelised Cost of energy generation (USD/GJ)<sup>6</sup></b> |
|--|---|
| <b>Fuel oil based thermal energy generation system</b>   | 9.71  |
| <b>Renewable Biomass based thermal energy generation system (i.e. project activity taken without CDM benefits)</b> | 11.12   |

From the above table it can be concluded that fuel oil based steam generation is financially attractive option than the renewable biomass based thermal energy generation. However, on consideration of CDM revenue and the environmental benefits the biomass based alternative becomes financially viable.

### **Sensitivity analysis:**

To substantiate the robustness of the results obtained above the sensitivity analysis has been conducted. As per “Guidelines on the assessment of investment analysis”, Version 03 Annex 58 of EB 51 meeting report, the criteria for choosing the sensitivity analysis parameter is:

**Guidance:** *Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude), and the results of this variation should be presented in the PDD and be reproducible in the associated spreadsheets.*

<sup>4</sup> Considered the residual value of 1999 commissioned F/O Boiler after depreciation

<sup>5</sup> <http://www.revenue.go.ke/incometax/pdf/IncomeTaxAct2004.pdf>

<sup>6</sup> Relevant calculation and references are submitted to DOE

## CDM – Executive Board

The most crucial parameters of the project activity like Capital cost, O&M cost, Fuel cost and Fuel calorific value that can affect the levelised cost are subjected to the sensitivity analysis. The reasons for subjecting the parameters to the sensitivity analysis are explained below:

The following parameters which can affect  $\pm 20\%$  of the project cost or Revenue is:

1. Capital cost
2. O&M Cost
3. Fuel Cost

***Range of variation of chosen parameters:***

The sensitivity analysis was carried on Levelised cost of energy generation varying the above selected parameters by  $\pm 10\%$  following the guideline provided by EB in meeting no. 41 annex 45.

The result of the project is presented in table 1 below.

**Table 1: Sensitivity analysis**

| Variable parameters | % Variation | Levelised Cost of energy generation for Biomass based system (USD/GJ) | Levelised Cost of energy generation for Fuel oil based system (USD/GJ) |
|---------------------|-------------|---|--|
| Capital cost        | -10%        | 11.08   | 9.68   |
|                     | +10%        | 11.06   | 9.74   |
| O&M Cost            | -10%        | 11.10   | 9.69   |
|                     | +10%        | 11.14   | 9.72   |
| Fuel Cost           | -10%        | 10.04   | 8.76   |
|                     | +10%        | 12.19   | 10.65  |

The levelised cost of energy generation from biomass based project as evident is quite high as compared to that from fuel oil based boiler. Hence, CDM revenues are very indispensable for the project activity and will help the project to become financially viable.

Therefore, it can be concluded that the proposed project activity without being registered as CDM project is financially not viable activity.

**Serious Consideration of CDM:**

*As per Para 6(a) of “guidelines on the demonstration and assessment of prior consideration of the CDM”, Annex 22 of EB 49 meeting report, the project participant must indicate awareness of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project. Evidence to support this would include, inter alia, minutes and/or notes related to the consideration of the decision by the Board of Directors, or equivalent, of the project participant, to undertake the project as a CDM project activity.*

## CDM – Executive Board

For the proposed project activity, the evidence to support awareness of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project is board resolution dated 21/01/2006 in which BIDCO has decided to implement the project activity considering CDM revenue.

*As per Para 6(b) of “guidelines on the demonstration and assessment of prior consideration of the CDM” Annex 22 of EB 49 meeting report, it has to indicate, by means of reliable evidence, that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.*

Below is the chronology referring to real and parallel action taken by BIDCO to secure the CDM status of the project, which clearly indicates that there is always a gap of less than 2 years between the real actions by BIDCO.

| Date            | Project Execution Step   | CDM registration efforts   | Evidence   |
|-----------------|--|--|--|
| 14/10/2005      | Offer letters received for Biomass based Boilers from Spenomatic (K) Limited       |  | Letters from equipment Suppliers dated 14/10/2005      |
| 21/01/2006      | BIDCO approves for the development of the biomass based energy generation project. | Board considered CDM revenue for financial viability                   | Extracts of the minutes of Board meeting               |
| 14/02/2006      | Initial Purchase order placed for the Boilers in the project activity.             | <b>CDM Starting Date</b>   | Letter from BIDCO to Boiler Suppliers dated 14/02/2006 |
| 15/08/2006      | Commissioned dates of the project activity plant                                   |  | Commissioning Certificates dated 15/08/2006            |
| Sep to Nov 2006 | --   | Local Stakeholders Survey for CDM conducted                            | Copy of Stakeholders survey forms                      |
| 15/03/2007      | -  | Contracted CDM Consultant for PDD services                             | Copy of the Agreement                                  |
| 08/05/2008      | -  | Agreement with DOE for validation services                             | Agreement with Validator                               |
| 19/11/2008      | -  | PDD submitted to Validator for Validation                              | Email Copy   |
| 11/11/2009      | -  | BIDCO signed an Emissions Reduction Purchase Agreement                 | Copy of ERPA   |
| 16/11/2010      | -  | Appointment of Consultants for providing the CDM Consultancy services. | Copy of the Agreement                                  |
| 28/04/2011      | -  | Proposal from DOE  | Copy of email  |

CDM – Executive Board

|            |   |  |                       |
|------------|---|--|-----------------------|
|            |   | for Validation services                    | communication         |
| 25/05/2011 | - | Agreement with DOE for validation services | Copy of the Agreement |
| 28/05/2011 | - | Submission of PDD for Webhosting           | Email Copy            |

As per Para 8(a) of “*guidelines on the demonstration and assessment of prior consideration of the CDM*” Annex 22 of EB 49 meeting report,

8. In validating proposed CDM project activities where:

(a) *there is less than 2 years of a gap between the documented evidence the DOE shall conclude that continuing and real actions were taken to secure CDM status for the project activity;*

From the above chronology table, it is clear that gap between two CDM related activities are not greater than two years. The PP has demonstrated the prior CDM awareness and within 2 years of the CDM starting date, CDM consultant was contracted and other CDM related activities also happened parallel with the implementation. The documented evidence for the same shall be provided to DOE.

Hence it can be concluded that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation and the gap between the CDM related activities is also less than 2 years.

**Thus, the project activity proves to be additional.**

## **B.6. Emission reductions:**

### **B.6.1. Explanation of methodological choices:**

The proposed project activity is the installation of biomass based Boiler uses renewable energy sources like rice husk, coffee Husk etc., that produces steam and displaces fossil fuel (Fuel Oil) used for thermal energy generation. Hence the baseline emissions is as per Para 18 of the methodology AMS I.C, Version 18, EB 56.

Emission reductions are calculated as follows:

#### **Emission reductions ( $ER_y$ ):**

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$ER_y$  Emission reductions in year y (t CO<sub>2</sub>e)  
 $BE_y$  Baseline emissions in year y (t CO<sub>2</sub>e)  
 $PE_y$  Project emissions in year y (t CO<sub>2</sub>)  
 $LE_y$  Leakage emissions in year y (t CO<sub>2</sub>)

### **Baseline Emissions:**

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

Where:

|                       |   |
|-----------------------|---|
| $BE_{thermal,CO_2,y}$ | The Baseline emission from steam / heat displaced by the project activity during the year y (tCO <sub>2</sub> )   |
| $EG_{thermal,y}$      | The net quantity of heat/steam supplied by the project activity during the year y (TJ). This has been calculated based on the manufacturer's rated output.  |
| $EF_{FF,CO_2}$        | The CO <sub>2</sub> emission factor of the fossil fuel (Fuel Oil) that would have been used in the baseline plant; tCO <sub>2</sub> /TJ, obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used. PP has used IPCC default value 77.4 tCO <sub>2</sub> /TJ. |
| $\eta_{BL,thermal}$   | The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity. As per Para 26 c, PP has used the default efficiency of 100%.   |

### **Project Emissions:**

As per para 43 of applied approved small scale methodology, AMS I.C, the project emissions include:

- CO<sub>2</sub> emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of 'Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion'.*
- CO<sub>2</sub> emissions from electricity consumption by the project activity using the latest version of Tool to calculate baseline, project and/or leakage emissions from electricity consumption;*
- Any other significant emissions associated with project activity within the project boundary;*
- For geothermal project activities, project participants shall account for the following emission sources, where applicable: fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam; and, carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant.*

For the proposed project activity, the project emission could be only from the on-site consumption of fossil fuels due to the project activity and emissions due to collection/processing/transportation of biomass residues to the project site will be considered as the project emissions since all the other conditions that are mentioned are not applicable.

The project emissions from fossil fuel combustion shall be calculated using the latest version of Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion. Also, the consumption of fossil fuels will be monitored whenever there is not adequate supply of renewable biomass/agro-residues.



## CDM – Executive Board

The project emissions would be calculated as per the below formula:

CO<sub>2</sub> emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO<sub>2</sub> emission coefficient of those fuels, as follows:

As per equation 1 of the “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion”;

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Where:

- PE<sub>FC,j,y</sub> = Are the CO<sub>2</sub> emissions from fossil fuel combustion in process j during the year y (tCO<sub>2</sub>/yr);
- FC<sub>i,j,y</sub> = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);
- COEF<sub>i,y</sub> = Is the CO<sub>2</sub> emission coefficient of fuel type i in year y (tCO<sub>2</sub>/mass or volume unit)
- i = Are the fuel types combusted in process j during the year y

The CO<sub>2</sub> emission coefficient COEF<sub>i,y</sub> can be calculated using one of the following two Options (A & B), depending on the availability of data on the fossil fuel type i, as follows:

PP has chosen option B

Option B: The CO<sub>2</sub> emission coefficient COEF<sub>i,y</sub> is calculated based on net calorific value and CO<sub>2</sub> emission factor of the fuel type i, as follows: Equation 4:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

- COEF<sub>i,y</sub> = Is the CO<sub>2</sub> emission coefficient of fuel type i in year y (tCO<sub>2</sub>/mass or volume unit)
- NCV<sub>i,y</sub> = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)
- EF<sub>CO2,i,y</sub> = Is the weighted average CO<sub>2</sub> emission factor of fuel type i in year y (tCO<sub>2</sub>/GJ)
- i = Are the fuel types combusted in process j during the year y

### **Leakage Emissions:**

As per Para 45 and 46 of the applied approved methodology AMS I.C., the leakage is to be considered:

- *If the energy generating equipment is transferred from another activity, leakage is to be considered.*

## CDM – Executive Board

There is no transfer of energy generating equipment from another activity, hence leakage is not considered and has been fixed ex-ante.

- *In case collection/processing/transportation<sup>7</sup> of biomass residues is outside the project boundary, CO<sub>2</sub> emissions from collection/processing/transportation of biomass residues to the project site.*

The project activity involves the transportation of biomass residues from outside the project boundary. As per para 46 of AMS I.C, Version 18, if biomass residues are transported over a distance of more than 200 kilometres due to the implementation of the project activity then this leakage source attributed to transportation shall be considered, otherwise it can be neglected. But the project activity involves the transportation of biomass residues within 200 kilometres and hence the leakage emissions are neglected.

|   |
|---|
| <b>B.6.2. Data and parameters that are available at validation:</b> |
|---|

|   |  |
|---|--|
| <b>Data / Parameter:</b>  | <b>EF<sub>FF,CO2</sub> - Fuel Oil</b>  |
| Data unit:  | tCO <sub>2</sub> /TJ   |
| Description:  | CO <sub>2</sub> emission factor of the fossil fuel type (Fuel oil) that has been identified as the most likely baseline scenario   |
| Source of data used:  | 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy; Table 2.2, Page Num 16   |
| Value applied:  | 77.4   |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The methodology allows (AMS I.C, Ver. 18, Para 13) that value can be obtained from reliable local or national data if available; otherwise IPCC default emission factors are used. Hence we have chosen to obtain the value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories. |
| Any comment:  | --   |

|   |   |
|---|---|
| <b>Data / Parameter:</b>  | <b>η<sub>BL,thermal</sub></b>   |
| Data unit:  | %   |
| Description:  | The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity.                   |
| Source of data used:  | Manufacturers specification   |
| Value applied:  | 100%  |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | As per Para 26 c of AMS I.C, Version 18 , default efficiency of 100% is used for ex-ante emission reduction calculation purposes. |

<sup>7</sup> If biomass residues are transported over a distance of more than 200 kilometres due to the implementation of the project activity then this leakage source attributed to transportation shall be considered, otherwise it can be neglected.

CDM – Executive Board

|              |    |
|--------------|----|
| Any comment: | -- |
|--------------|----|

|                            |  |
|----------------------------|--|
| Data / Parameter:          | <b>SEC<sub>biomass</sub></b>   |
| Data unit:                 | TJ of Biomass input energy /TJ of energy output  |
| Description:               | Specific fuel consumption of biomass   |
| Source of data to be used: | Calculated based on design parameters of biomass consumption and energy output   |
| Value of data              | 1.39   |
|                            | As per paragraph 40 of the Indicative simplified baseline and monitoring methodology I-C, Version 18, “ <i>In the case of project activity consuming biomass and fossil fuel to produce thermal and or electrical energy, specific energy consumption of each type of fuel (biomass or fossil) to be used shall be specified ex ante. The consumption of each type of fuel shall be monitored</i> ”. In accordance with the methodology, the specific fuel consumption of Biomass has been stated ex ante and the detailed calculation is provided in levelised cost analysis sheet. |
| Any comment:               | This data is calculated based on the total quantity of biomass consumed, calorific value and the enthalpy of steam (at both operating conditions). This data is provided ex-ante. The actual quantity of each type of biomass used will be monitored ex-post; details of which are provided in Section B.7.1.  |

|   |  |
|---|--|
| Data / Parameter:   | <b>Q<sub>Biomass available</sub></b>   |
| Data unit:  | Tonnes/Annum   |
| Description:  | Quantity of surplus biomass available in the region  |
| Source of data to be used:  | As per biomass assessment survey report  |
| Value of data   | --   |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Report prepared by the reputed third party consultant based on the Publicly available information on the annual generation of biomass. |
| Any comment:  | --   |

### B.6.3 Ex-ante calculation of emission reductions:

#### Emission reductions (ER<sub>y</sub>)

$$\begin{aligned}
 ER_y &= BE_y - PE_y - LE_y \\
 &= 23,827 - 0 - 0 \\
 &= 23,827 \text{ tCO}_2\text{e/year}
 \end{aligned}$$

#### Baseline Emissions:

## CDM – Executive Board

$$BE_{\text{thermal, CO}_2, y} = (EG_{\text{thermal, y}} / \eta_{\text{BL, thermal}}) * EF_{\text{FF, CO}_2}$$

$$EG_{\text{thermal, y}} = (2358 \text{ kJ/kg} * 16 \text{ TPH} * 1000 \text{ kg} * 8160 \text{ hrs})$$

$$\eta_{\text{BL, thermal}} = 100\%$$

$$EF_{\text{FF, CO}_2} = 77.4 \text{ tCO}_2/\text{TJ}$$

$$BE_{\text{thermal, CO}_2, y} = (2358 \text{ kJ/kg} * 16 \text{ TPH} * 1000 \text{ kg} * 8160 \text{ hrs}) / 100 \% * 77.4 \text{ tCO}_2/\text{TJ}$$

$$= 23,827 \text{ tCO}_2\text{e/ year}$$

**Project Emissions:**

For ex-ante emission reduction calculations, fossil fuel consumption in the project activity has been considered as zero. Also, the consumption of any fossil fuels would be monitored whenever there is not adequate supply of renewable biomass/agro-residues. The provision to monitor the same has been provided in section B.7.1 of the PDD.

$$PE_y = 0 \text{ tCO}_2\text{e/year}$$

**Leakage Emissions:**

$$LE_y = 0 \text{ tCO}_2\text{e/year}$$

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

| Year  | Estimation of project activity emissions (tCO <sub>2</sub> e) | Estimation of baseline emissions (tCO <sub>2</sub> e) | Estimation of leakage (tCO <sub>2</sub> e) | Estimation of overall emission reductions (tCO <sub>2</sub> e) |
|---|---|---|--|--|
| 2012  | 0   | 23,827  | 0  | 23,827   |
| 2013  | 0   | 23,827  | 0  | 23,827   |
| 2014  | 0   | 23,827  | 0  | 23,827   |
| 2015  | 0   | 23,827  | 0  | 23,827   |
| 2016  | 0   | 23,827  | 0  | 23,827   |
| 2017  | 0   | 23,827  | 0  | 23,827   |
| 2018  | 0   | 23,827  | 0  | 23,827   |
| 2019  | 0   | 23,827  | 0  | 23,827   |
| 2020  | 0   | 23,827  | 0  | 23,827   |
| 2021  | 0   | 23,827  | 0  | 23,827   |
| <b>Total</b><br>(tonnes of CO <sub>2</sub> e) | 0   | 238,270   | 0  | 238,270  |

**B.7 Application of a monitoring methodology and description of the monitoring plan:****B.7.1 Data and parameters monitored:**

CDM – Executive Board

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | <b>Continuous operation of the equipment/system</b>  |
| Data unit:   | --   |
| Description:   | Continuous operation of the equipment/system   |
| Source of data to be used:                                       | -  |
| Value of data  | --   |
| Description of measurement methods and procedures to be applied: | <u>Monitoring:</u> Manual inspection of the operation of the equipments to ensure that they are still operating.<br><u>Data type:</u> Monitored and Archived<br><u>Archiving Procedure:</u> Paper<br><u>Recording Frequency:</u> Annually<br><u>Responsibility:</u> Shift in charge. |
| QA/QC procedures to be applied:                                  | The senior manager would cross check the data.   |
| Any comment:   | Data archived will be kept 2 years beyond the crediting period   |

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | <b>Annual operating hours</b>  |
| Data unit:   | Hours  |
| Description:   | Number of hours of operation of the project activity in year y   |
| Source of data to be used:                                       | Plant records  |
| Value of data  | 8160   |
| Description of measurement methods and procedures to be applied: | <u>Monitoring:</u> The boiler operator will be recording the daily hour of operations. This will be aggregated annually<br><u>Data type:</u> Monitored and Archived<br><u>Archiving Procedure:</u> Paper<br><u>Recording Frequency:</u> Daily, aggregated annually<br><u>Responsibility:</u> Boiler operator |
| QA/QC procedures to be applied:                                  | Shift in-charge will cross check the data.   |
| Any comment:   | Data archived will be kept 2 years beyond the crediting period   |

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | <b>EG<sub>PJ,thermal</sub></b>   |
| Data unit:   | TJ   |
| Description:   | Net quantity of thermal energy supplied by the project activity  |
| Source of data to be used:                                       | Calculated   |
| Value of data  | 307  |
| Description of measurement methods and procedures to be applied: | <u>Calculation procedure:</u><br><br>Enthalpy of steam from Boiler is calculated from steam tables based on the corresponding pressure and quantity of steam. The net energy content of steam generated from the project activity (TJ) is then obtained as a product of the total steam generated and the enthalpy of steam.<br><br><u>Data type:</u> Calculate and archived |

## CDM – Executive Board

|                                 |   |
|---------------------------------|---|
|                                 | <u>Archiving procedure:</u> Paper and Electronic<br><u>Recording Frequency:</u> Hourly steam quantity and pressure to get monthly average enthalpy<br><u>Responsibility:</u> Boiler operator would be responsible for monitoring and checks for regular calibration of steam flow meters and pressure gauge and Shift in charge will be responsible for the calibration of steam flow meters. |
| QA/QC procedures to be applied: | QA/QC procedures will be ensured as the steam flow meters would be calibrated at regular intervals.   |
| Any comment:                    | Data archived will be kept 2 years beyond the Crediting period  |

|  |   |
|--|---|
| <b>Data / Parameter:</b>   | <b>Q<sub>Steam</sub></b>  |
| Data unit:   | TPH   |
| Description:   | Quantity of steam supplied by the Boiler  |
| Source of data to be used:                                       | Measured data at the plant site by Steam flow meter   |
| Value of data  | 16  |
| Description of measurement methods and procedures to be applied: | <p>Monitoring: Steam flow meters are installed at the boiler outlet will monitor the total quantity of steam supplied for process.</p> <p><u>Data type:</u> Measured and archived.<br/> <u>Archiving procedure:</u> Paper and Electronic<br/> <u>Meter:</u> Steam flow meter<br/> <u>Accuracy class:</u> 0.2%<br/> <u>Recording Frequency:</u> Hourly<br/> <u>Calibration Frequency:</u> Once in a year<br/> <u>Responsibility:</u> Boiler operator would be responsible for monitoring and checks for regular calibration of steam flow meters and Shift In-charge will be responsible for calibration of the steam flow meters.</p> |
| QA/QC procedures to be applied:                                  | QA/QC procedures will be ensured as the steam flow meters would be calibrated at regular intervals.   |
| Any comment:   | Data archived: Crediting period + 2 yrs   |

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | <b>Pressure</b>  |
| Data unit:   | kg/cm <sup>2</sup>   |
| Description:   | Pressure of steam at the outlet of boiler  |
| Source of data to be used:                                       | Pressure gauge   |
| Value of data  | 17.5   |
| Description of measurement methods and procedures to be applied: | <p><u>Monitoring:</u> Pressure gauge will measure the pressure of the steam at the boiler outlet</p> <p><u>Data type:</u> Measured and archived<br/> <u>Recording Frequency:</u> Hourly<br/> <u>Archiving procedure:</u> Paper and Electronic<br/> <u>Responsibility:</u> Boiler operator would be responsible for monitoring and checks for regular calibration of pressure gauge and Shift In-charge will be</p> |

## CDM – Executive Board

|                                 |  |
|---------------------------------|--|
|                                 | responsible for calibration of the pressure gauge.<br><u>Calibration Frequency:</u> Calibration will be carried out at regular intervals                               |
| QA/QC procedures to be applied: | QA/QC procedures will be ensured as the pressure gauge would be calibrated at regular intervals.   |
| Any comment:                    | The data will be daily monitored. The data is required to calculate enthalpy of steam at the Boiler.<br>Data archived will be kept 2 years beyond the Crediting period |

|  |  |
|--|--|
| Data / Parameter:  | <b>B</b> <u>Biomass.v</u>  |
| Data unit:   | MT/Annum   |
| Description:   | Quantity of Biomass used in the project activity per Annum   |
| Source of data to be used:                                       | 1. Invoices<br>2. Plant records  |
| Value of data  | 31,051   |
| Description of measurement methods and procedures to be applied: | <u>Monitoring:</u> Weigh bridge at plant entry would record the total quantity of different biomass residue to be used and the same would be confirmed with the invoices raised by the biomass suppliers<br><br><u>Data Type:</u> Measured and Archived<br><u>Archiving Procedure:</u> Electronic and Paper<br><u>Recording frequency:</u> Annually<br><u>Responsibility:</u> Plant head with Officer (Stores) would be responsible for monitoring and checks for regular calibration of the weigh bridge and maintaining the copy of invoices received on a regular basis |
| QA/QC procedures to be applied:                                  | QA/QC procedures will be ensured since the equipment would be calibrated at regular intervals.   |
| Any comment:   | Data archived will be kept 2 years beyond the Crediting period   |

|  |  |
|--|--|
| Data / Parameter:  | <b>NCV</b> <u>biomass</u>  |
| Data unit:   | kcal/kg  |
| Description:   | Net calorific value of biomass   |
| Source of data to be used:                                       | Third party lab records for monthly tests  |
| Value of data  | 3,200  |
| Description of measurement methods and procedures to be applied: | <u>Monitoring:</u> The calorific value analysis will be conducted by the competent third party and the same would be confirmed with the invoices raised by the biomass suppliers<br><br><u>Data Type:</u> Calculated and Archived<br><u>Archiving Procedure:</u> Paper<br><u>Recording frequency:</u> Monthly<br><u>Responsibility:</u> Plant head along with Officer (Stores) would be responsible for monitoring |
| QA/QC procedures to be applied:                                  | --   |
| Any comment:   | Data archived will be kept 2 years beyond the Crediting period   |



CDM – Executive Board

|  |   |
|--|---|
| Data / Parameter:  | <b>NCV<sub>i,v</sub> Fossil fuel</b>  |
| Data unit:   | kcal/kg   |
| Description:   | Net calorific value of fossil fuel type <i>i</i> used in the project activity   |
| Source of data to be used:                                       | Plant Records.  |
| Value of data  | --  |
| Description of measurement methods and procedures to be applied: | <p><u>Monitoring:</u> The calorific value of fossil fuel type <i>i</i> used in the boilers will be calculated and the same will be crosschecked with the purchased fossil fuel bills.</p> <p><u>Data Type:</u> Calculated and Archived<br/> <u>Archiving Procedure:</u> Paper<br/> <u>Recording frequency:</u> Monthly<br/> <u>Responsibility:</u> Plant head along with Officer (Stores) would be responsible for monitoring</p> |
| QA/QC procedures to be applied:                                  | --  |
| Any comment:   | Data archived will be kept 2 years beyond the Crediting period  |

|  |  |
|--|--|
| Data / Parameter:  | <b>Q<sub>fossil fuel i, v</sub></b>  |
| Data unit:   | Tonnes/Annum   |
| Description:   | Quantity of fossil fuel type <i>i</i> used in the project activity   |
| Source of data to be used:                                       | Plant records  |
| Value of data  | --   |
| Description of measurement methods and procedures to be applied: | <p><u>Monitoring:</u> The quantity of fossil fuel type <i>i</i> used in the project activity will be calculated and the same will be crosschecked with the purchased fossil fuel bills.</p> <p><u>Data Type:</u> Calculated and Archived<br/> <u>Archiving Procedure:</u> Paper<br/> <u>Recording frequency:</u> Monthly<br/> <u>Responsibility:</u> Plant head along with Officer (Stores) would be responsible for monitoring.</p> |
| QA/QC procedures to be applied:                                  | --   |
| Any comment:   | Data archived will be kept 2 years beyond the Crediting period   |

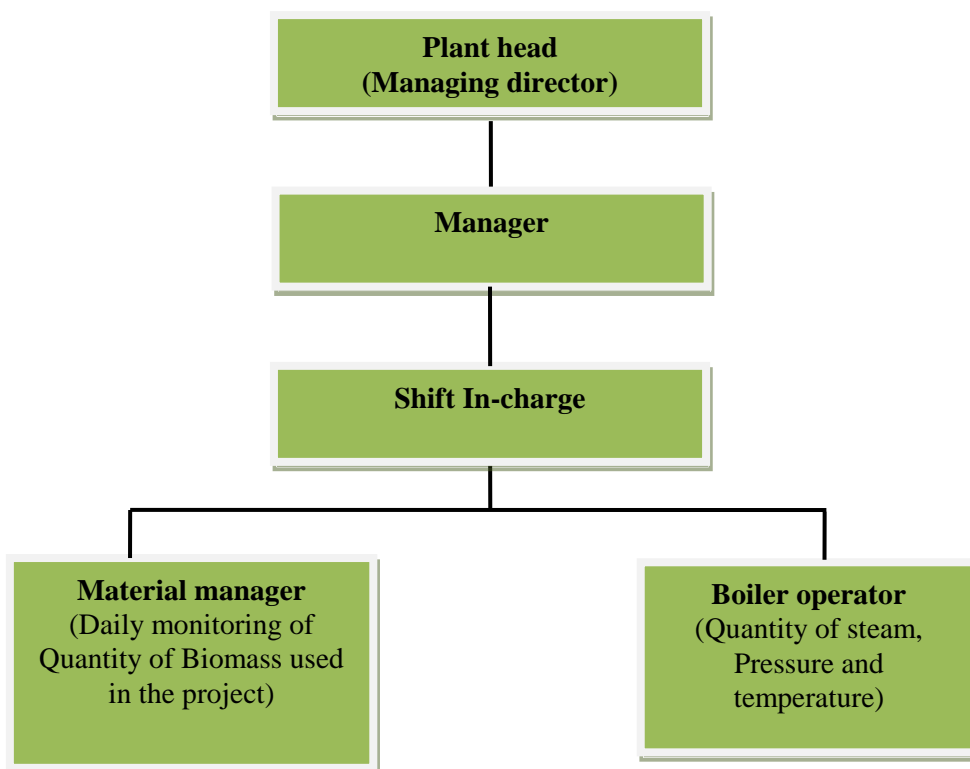
|                            |  |
|----------------------------|--|
| <b>Data / Parameter:</b>   | <b>Moisture Content<sub>biomass</sub></b>                                      |
| Data unit:                 | % water  |
| Description:               | Moisture content of the biomass residues                                       |
| Source of data to be used: | Moisture analysis in the in-house laboratory                                   |
| Value of data              | --   |
| Description of             | <u>Monitoring:</u> The moisture content of a batch of biomass residues will be |

CDM – Executive Board

|   |   |
|---|---|
| measurement methods and procedures to be applied: | measured in the in-house laboratory once in a month. Weighted average will be used for the calculations. Batch having homogenous quality will be selected.<br><br><u>Data Type:</u> Measured and archived<br><u>Archiving Procedure:</u> Paper<br><u>Recording Frequency:</u> Once in a month<br><u>Responsibility:</u> Lab technician will be analysing the moisture content of a batch of biomass residues using a standard method. |
| QA/QC procedures to be applied:                   | A sample of biomass residues from a batch having homogenous quality will be given in the external lab for moisture testing once in three months.  |
| Any comment:                                      | Data archived will be kept 2 years beyond the crediting period  |

**B.7.2 Description of the monitoring plan:**

The Managing Director (MD) of BIDCO has constituted the CDM project team, which is responsible for the project activity. The team is responsible for monitoring, verification and recording of the data.



**Roles and responsibilities:**

**Plant Head:**

- The Managing Director would head the CDM team and will be responsible for compliance with CDM related matters and ensure to follow the plan.

---

CDM – Executive Board

**Manager:**

- The Manager would manage the CDM team and will be responsible for compilation and checking of all the results.

**Shift In-charge:**

- Implementing the monitoring procedures lay down
- Ensure calibration of meter reading

**Material manager:**

- Daily recording of the biomass used in the project activity.

**Boiler operator:**

- Maintenance of the boiler and its metering equipments
- Daily recording of the meter equipments (like pressure, temperature, quantity of steam) in the log book

The detailed monitoring plan is provided in Annex 4.

|   |
|---|
| <b>B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)</b> |
|---|

Name of the responsible entity for applying baseline study and the monitoring methodology to the project activity and its contact information:

**BIDCO Oil Refineries Ltd, Kenya**

This is a project participant (contact details are given in Annex 1)

Date of completion of baseline Study: 05/12/2010

|   |
|---|
| <b>SECTION C. Duration of the <u>project activity</u> / <u>crediting period</u></b> |
|---|

|   |
|---|
| <b>C.1 Duration of the <u>project activity</u>:</b> |
|---|

|   |
|---|
| <b>C.1.1. <u>Starting date of the project activity</u>:</b> |
|---|

14/02/2006, (this start date is Purchase order date of major equipment i.e. Boiler for the proposed project activity)

|   |
|---|
| <b>C.1.2. <u>Expected operational lifetime of the project activity</u>:</b> |
|---|

CDM – Executive Board

20 years 0 Months

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

Fixed crediting period of 10 years is chosen

**C.2.1. Renewable crediting period**

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

Not Applicable

**C.2.1.2. Length of the first crediting period:**

Not Applicable

**C.2.2. Fixed crediting period:**

**C.2.2.1. Starting date:**

01/01/2012 or the date of registration (whichever is later)

**C.2.2.2. Length:**

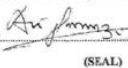
10 years 0 months

**SECTION D. Environmental impacts**

**D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:**

The National Environmental Management Authority, Kenya's DNA and the Host Party, has issued license number 523, shown below. All conditionality's attached to the permit have been complied with. In addition, the Company has been issued an ISO 14001 certificate (also shown below). As biomass waste will be used for energy generation with efficient combustion, there are no significant environmental impacts of the project activity.

## CDM – Executive Board

|  |  |
|--|--|
|  <p style="text-align: center;">NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)<br/>THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT<br/>ENVIRONMENTAL IMPACT ASSESSMENT LICENCE</p> <p style="text-align: right;">Application Reference No: PR/778<br/>Registration No: 000523<br/><small>For official use</small></p> <p>This is to certify that the Project Report/Environmental Impact Assessment Study Report received from<br/><u>BIDCO REFINERIES LIMITED</u> (name of individual/firm).....<u>P.O. BOX 239 - 0100, THIKA</u>.....(address) submitted to the National Environment Management Authority in accordance with the Environmental Impact Assessment &amp; Audit Regulations regarding.....<u>PROPOSED BIOMASS BOILER PLANT</u>.....(title of project) whose objective is to carry on.....<u>SUBSTITUTION OF MORE POLLUTING..... FOSSIL FUELS WITH BIO - FUELS IN THE PRODUCTION PROCESS</u>..... (briefly describe purpose) located at.....<u>BIDCO OIL REFINERIES LIMITED, THIKA</u>.....(locality and district) has been reviewed and a licence is hereby issued for implementation of the project, subject to attached conditions.</p> <p>Dated this <u>29TH</u> day <u>MAY</u> of 20.06..</p> <p>Signature: <br/>(SEAL)</p> <p style="text-align: center;"><i>Director General</i><br/>The National Environment Management Authority</p> <p><small>CONDITIONS OF LICENCE</small></p> <p>1. This licence is valid for a period of <u>24 MONTHS</u> time within which the project should commence from the date hereof.</p> <p>2. The Director-General shall be notified of any transfer/variation/surrender of this licence.<br/>P. T. O.</p> | <p style="text-align: right;">STA/15</p> <p style="text-align: center;"><b>KENYA BUREAU OF STANDARDS</b><br/>ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATION SCHEME<br/>CERTIFICATE OF REGISTRATION<br/>No: KEBS/SCS/ENV/08</p> <p style="text-align: center;"><i>Awarded to:</i></p> <p style="text-align: center;"><b>BIDCO OIL REFINERIES LIMITED</b><br/><b>P.O. BOX 239 - 01000, THIKA</b></p>  <p style="text-align: center;">This is to certify that the Environmental Management System of the above organization has been audited and found to be in accordance with the requirements of the Environmental System Standard: ISO 14001:2004</p> <p style="text-align: center;">The scope of the Certification is:</p> <p style="text-align: center;"><u>MANUFACTURING AND MARKETING OF EDIBLE OILS, FATS,</u><br/><u>MARGARINE AND HYGIENE PRODUCTS.</u></p> <p style="text-align: right;">Date of Issue: <u>1ST NOVEMBER 2005</u></p> <p style="text-align: right;">Managing Director/Authorised Officer:  Date of Expiry: <u>31ST OCTOBER 2008</u></p> <p style="text-align: center;"><small>Valid subject to the conditions of the scheme</small></p> |
|--|--|

**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:**

There was no significant environmental impacts assessed by the project participants and no trans-boundary effect was envisaged. This is in accordance with the local and country level pollution regulations.

However, the project activity has obtained all the necessary environmental, technical and legal clearances and has been regularly renewing the clearances whenever required.

### SECTION E. Stakeholders' comments

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

The local stakeholders are identified as the people living in the villages in vicinity of the BIDCO refinery. The comments are received by the survey through following questionnaire. The actual survey was conducted in local language as well as in English. The Local stakeholder's survey was carried out in the month of September to November 2006.

**Survey form for 16 TPH biomass based Boiler project at BIDCO refinery unit in Thika, Kenya**

CDM – Executive Board

You are aware of the BIDCO's oil refinery unit operating in your neighbouring area. The BIDCO Oil Refineries Ltd has implemented the renewable biomass based heat generation project at its Crude Palm Oil (CPO) refinery unit in Thika, Kenya. The renewable biomasses like coffee husk, firewood, etc., would be used in the project. The steam generated by the project will be consumed internally.

Through the implementation of this project, BIDCO Oil Refineries Ltd will be displacing the GHG emissions that would have occurred due to the Fuel oil combustion. Thus, the project is leading to CO<sub>2</sub> emission reductions generating environmental sustainability. BIDCO Oil Refineries Ltd has undertaken this project as Clean Development Mechanism project. This survey is a step towards the registration of the project under Clean Development Mechanism of the Kyoto Protocol. You are requested to fill your response in the following questionnaire.

Name: .....

Location: .....

Occupation: .....

Education: .....

| Sr. No. | Question  | Response |
|---------|---|----------|
| 1       | Is your environment affected by the project?  |          |
| 2       | Is there any environmental / social problem due to biomass collection and transportation to project site? |          |
| 3       | Does the project have any negative impact on human health or biodiversity?                                |          |
| 4       | Has the employment increased due to the project?  |          |
| 5       | Has your livelihood negatively affected by the project?   |          |
| 6       | What are the benefits from the project?   |          |
| 7       | Any other comments and suggestions?   |          |

Signature:

Date:

The responses are categorised as positive and negative based on the comments. The positive responses indicate that respondent feels that the project activity will lead to overall good of their own and the society.

### E.2. Summary of the comments received:

All of the individual respondents are of the view that the project activity is of good to them and the society. The renewable biomass based project activity has lead to the environmental sustainability without causing any pollution. Summary of detailed response is as follows:

| S. No | Question | Response |        |
|-------|----------|----------|--------|
|       |          | Yes (%)  | No (%) |

CDM – Executive Board

|   |   |       |       |
|---|---|-------|-------|
| 1 | Is your environment affected by the project?  | 0     | 100   |
| 2 | Is there any environmental / social problem due to biomass collection and transportation to project site? | 0     | 100   |
| 3 | Does the project have any negative impact on human health or biodiversity?                                | 0     | 100   |
| 4 | Has the employment increased due to the project?  | 100   | 0     |
| 5 | Has your livelihood negatively affected by the project?   | 0     | 100   |
| 6 | What are the benefits from the project?   | Below | Below |
| 7 | Any other comments and suggestions?   | Below | Below |

The other comments received were as follows:

- (a) Further increment in job opportunities among the local skilled & unskilled labours
- (b) Beneficiary for the local labours & local biomass producers as well.
- (c) Very good initiative by BIDCO towards sustainable development & environment friendliness.

The stakeholders viewed BIDCO as a reputed company contributing to the local economy. Overall there was view and agreement that the proposed project is a beneficial project from sustainability view-point

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

The comments received were positive for the project activity and did not required follow up action from the project proponent. There were no specific comments that required follow up action from CDM project activity point of view.

In general there was no adverse comment on the project activity by the local stakeholders. The stakeholders have given very positive feedback and thus no measures were required to be taken. However, project proponents assured that during the operation of the project activity any concerns regarding the project activity can be brought to their notice and quick action would be taken up to any negative impacts from the project activity affecting the stakeholders. The project proponent thanked the local stakeholders for their co-operation in installation and operation of the project activity.



---

 CDM – Executive Board

**Annex 1**

**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

|                 |                           |
|-----------------|---------------------------|
| Organization:   | BIDCO Oil Refineries Ltd. |
| Street/P.O.Box: | P.O. Box 239              |
| Building:       | --                        |
| City:           | Thika,                    |
| State/Region:   | --                        |
| Postfix/ZIP:    | 01000                     |
| Country:        | Kenya                     |
| Telephone:      | (+254) 67 282-1000        |
| FAX:            | +254-67-30103             |
| E-Mail:         | --                        |
| URL:            | --                        |
| Represented by: | --                        |
| Title:          | Director,                 |
| Salutation:     | Mr                        |
| Last Name:      | Shah                      |
| Middle Name:    | --                        |

---

CDM – Executive Board

|                  |  |
|------------------|--|
| First Name:      | Vimal  |
| Department:      | --   |
| Mobile:          | --   |
| Direct FAX:      | --   |
| Direct tel:      | --   |
| Personal E-Mail: | <a href="mailto:vimal@bidco-oil.com">vimal@bidco-oil.com</a> |

**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

Public funding from Annex I countries and diversion of official development assistance (ODA), is not involved in this project activity. The project cost is met by the project proponents through own sources and in part by debt financing from banks.

**Annex 3**

---

CDM – Executive Board

## **BASELINE INFORMATION**

Please refer section B.4 and B.6.1 of this document

**Annex 4**

## MONITORING INFORMATION

The monitoring plan is developed for developing suitable data collection methods to measure & collect each parameter and maintenance of records according to the monitoring methodology of AMS – I.C., ver. 18. The monitoring plan is project specific for which the project performance with all relevant criteria will be monitored. Proper training is being provided to concerned personnel and instruments used to monitor data are also calibrated.

### Overall Project Management and CDM Team:

A dedicated team responsible for the CDM project activity comprising of technical and management personnel from relevant departments will be responsible for monitoring of all the parameters mentioned in the section B.7.1. The CDM team will ensure the proper management of the CDM project activity. The team would be responsible for reviewing the data monitored & recorded, monthly report, annual report for emission reduction, the report on the operation and maintenance and timely calibration of monitoring equipment. The CDM team will prepare an annual report pertaining to the total quantity of steam generation by the project activity and hence total quantity of fossil fuel (fuel oil) that would be displaced against which the CDM benefit are to be claimed. The operation and maintenance team would be responsible for regular inspection of monitoring equipment functioning. The CDM team will be guided by CDM consultants.

**1. Director** - The Director will oversee all the monitoring requirements of the CDM project. He would review the half yearly and annual report pertaining to the emission reduction estimation. He will be responsible for Quality Assurance and ensure transparency in the monitoring system and data recording. The internal audit team will be headed by him.

**2. Manager:** The Manager will be responsible for compliance with CDM monitoring plan, reviewing monthly report prepared by the Shift In-charge (Steam Generation Unit) and based on that generating half yearly and yearly report pertaining to the total fuel oil consumption based on which the emission reduction would be estimated. He will organize & conduct the training program for CDM and related activities for the staffs and also carry out internal audit pertaining to the operation, monitoring and archiving of data.

**3. Shift In-charges** (Steam Generation Unit): The personnel will ensure proper monitoring of the data/parameters, completeness and quality assurance of data recorded by the Operators (Steam Generation Unit) and prepare of monthly report. The Shift In- charge of 1<sup>st</sup> shift will prepare daily report and submit to Shift In-charge.

**4. Operator** – Steam Generation Unit: The personnel will ensure proper running of the machines in terms of routine checks on daily basis, periodical maintenance. The personnel will also be entitled for biomass consumption data, steam generation data, steam temperature and pressure data recording on shift basis.

### Addressing Uncertainty of Data in Monitoring:

The steam generation data monitored will be cross-checked with the biomass consumption data and invoice of biomass procurement to ensure accurate data recording. For exceptional circumstances related to the failure of the metering system, immediate replacement would be carried out by the project

---

CDM – Executive Board

proponent. Under such exceptional condition the vendor invoice would be used for the monitoring purpose.

#### **Calibration of Measuring Equipments:**

The reliability of the monitoring system depends on the accuracy of the measuring system and the quality of the relevant equipment. Thus, measuring instruments would be calibrated as per manufacturers manual or at least once a year to ensure the reliability of the system and the accuracy of the readings. Once the meters are found to be malfunctioning or registering data outside the acceptable limits of accuracy, it shall be repaired, re-calibrated or replaced as soon as possible.

#### **Maintenance procedures:**

All the monitoring instruments (fixed and portable) e.g. pressure gauge, temperature meter, steam flow meter, weighing machine etc. should be inspected on weekly basis. Equipment should be checked and maintained in accordance with manufacturer's manual. The lifetime and accuracy of the equipments will be checked during internal audit process.

#### **Internal audit process:**

The Internal Energy Audit would give a positive orientation towards energy conservation, energy cost reduction, proper storing procedure, preventive maintenance and quality control programmes which are vital for production and utility activity compliances with CDM rule and the quality plan. Such an audit programme will help to keep focus on variations which occur in energy costs, availability and reliability of supply of energy, etc. Internal audit should be undertaken on annual basis one month before each CDM verification process. Manager (Plant) will be responsible for internal audit. He will review day to day recording procedure in the project, storing procedure practiced in the project, etc and suggest corrective measures wherever is required. CDM Consultant will be involved in internal audit process and guide on CDM requirements.

#### **Plant Energy Performance:**

Plant Energy Performance (PEP) is the measure and comparison of energy consumption for manufacture of products with the past practice. This will help in taking corrective actions whenever a plant will operate in inefficient mode and achieve optimum level of specific fuel consumption. Thus it will ensure minimum or no wastage of biomass in steam generation system.

#### **Training on Monitoring and Archiving of Data Related to Project Activity:**

Training will be provided to the staff members of the plant on the procedure of recording and archiving of data. The training pertaining to the monitoring and archiving of the data is to be carried out by Manager Plant along with other members of CDM team. CDM Consultants will provide training to the monitoring team for CDM project on procedure of baseline emission calculation and emission reduction estimation. The Director shall be reported on the progress of implementation of corrective actions by the team on half yearly basis. The non-conformities if any shall be closed within the stipulated time frame and approved by the Director.

-----