Appendix A[1] to the simplified modalities and procedures for small-scale CDM project activities

CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL SCALE PROJECT ACTIVITIES (SSC-PDD)
Version 01 (21 January, 2003)

Sahabat Empty Fruit Bunch Biomass Project

APRIL 2005

[1] This appendix has been developed in accordance with the simplified modalities and procedures for small-scale CDM project activities (contained in annex II to decision 21/CP.8, see document FCCC/CP/2002/7/Add.3) and it constitutes appendix A to that document. For the full text of the annex II to decision 21/CP.8 please see http://unfccc.int/cdm/ssc.htm).

CONTENTS

A. General description of project activity

A.1. Title of the project activity:

Sahabat Empty Fruit Bunch Biomass Project, (referred to as "the project")

A.2. Description of the project activity:

Research performed by Felda Palm Industries has indicated that oil palm Empty Fruit Bunches (EFB) has a moderate calorific value, comparable to palm mesocarp fibre and wood chips. Felda estimates that the EFB could become an important energy source based on the huge amount of EFB, approximately 500,000 tonnes, generated each year from their oil palm milling activities in Sahabat.

Currently the EFB poses a disposal problem, as most of the mills do not have an incinerator (sites built after 1992 are not allowed by law to use incineration as a waste management option). Consequently, on many sites the EFB has to be mulched or composted. During the peak crop months, the EFB becomes difficult to manage at several of the mills - factors such as access to labour and land topography conspire against mulching as a cost effective option. Waste is then disposed of in some mills' undersized dumping sites, and degrades anaerobically, releasing methane emissions to the atmosphere. Anecdotally this practice occurs at several of the mill sites, and dumping or landfilling is the only waste management practice currently employed at Mill J.

Felda Palm Industries are proposing to use the waste empty fruit bunches for electricity and steam generation. The project involves the construction of a 7.5 MW turbine generator equipped with auxiliary facilities such as boilers, water demineralisation plant, cooling tower, air pollution control devices and EFB storage yard. Currently, stand-alone diesel generators owned and operated by the CPO refineries themselves or through Felda Engineering Services and Sahabat Bulkers supply the power generated for industrial and domestic use at the Sahabat Complex. The project is estimated to produce 54,915 (t CO_2/year) of emissions reductions.

The two main processes and major power consumers, located at the Sahabat Complex, are the two palm oil production sites, Sahabat Oil Products (SOP – the crude palm oil refinery) and Sahabat Kernel Crushing Plant (SKCP- the palm kernel crushing plant). Sahabat Bulkers (SBI) consumes large amounts of electricity only when there is a shipment of crude palm oil. All these plants are currently generating their own electricity through diesel generators.

Sahabat Bulkers was generating electricity for Bandar Sahabat Resort and the staff quarters until July 2001. The electricity generation and distribution is currently carried out and managed by Felda Engineering Services Sdn Bhd (FESS). FESS generates its own electricity to supply the Bandar D settlement and Bandar C Township. Because of an increase in demand from both commercial and domestic customers FESS has installed an additional two diesel generators 500kW each at the Sahabat Complex. Electricity demand is not expected to increase significantly in the future, as any increases will be attributable primarily to residential consumers. There are no plans for expansion of capacity by industrial consumers therefore this demand is expected to remain stable.

The Sahabat Oil Products refinery (SOP) also requires steam for its operations, which it currently generates through two oil-fired boilers. The maximum steam demand for the refinery is 16 tonnes per hour at a pressure of 12.5 bar. The steam will be supplied by the power plant and the cost of the steam will be charged to the refinery based on the cost of steam production. There are no plans for further expansion of the SOP plant and therefore future demand is expected to be stable and manageable by the new biomass power plant.

The development of this biomass plant will have a positive effect on the waste disposal problems facing mills at the Sahabat Complex, diverting waste away from incineration, reducing the stress on composting capacity, and significantly reducing the amount of EFB currently landfilled. A biomass utilisation scheme, such as the Felda project, also presents an opportunity to promote alternative waste management strategies.

Other expected benefits from the project include:

- The multiplier effect of this investment is likely to bring additional benefits such as increased employment opportunities, in the area where the project is located;
- It increases diversity and security of electricity supply;
- It contributes towards a decrease in fuel imports;
- The project will act as a clean technology demonstration project, encouraging development of biomass facilities throughout Malaysia which could be replicated across the region;
- It contributes towards meeting Government renewable energy targets and therefore qualifies for tax exemptions on the importation of renewable energy technology.

A.3. Project participants:

Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

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 wished to be considered as project participant**
The Government of Malaysia (host)	Felda Palm Industries Sdn. Bhd.	Yes
	EcoSecurities Ltd.	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.

Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.

A.4. Technical description of the project activity:

The Sahabat complex generates large quantities of EFB, over half a million tonnes per year. Currently the EFB poses a disposal problem, as most of the mills do not have an incinerator (sites built after 1992 are not allowed by law to use incineration as a waste management option). Consequently, on many sites the EFB is mulched or composted, or landfilled. While this decomposition activity in the current baseline activity does produce some methane, the savings from diminishing this activity are not being claimed within the project scenario.

Felda Palm Industries are proposing to use the waste empty fruit bunches for electricity and steam generation in a biomass energy electricity generation facility. The biomass plant will directly replace the current use of diesel for electricity and steam production in the complex.

The proposed site is vacant land area of 16,000 m^2 sited within Bandar Sahabat. . The project involves the construction of a 7.5 MW turbine generator equipped with auxiliary facilities such as boilers, water demineralisation plant, cooling tower, air pollution control devices and EFB storage yard.

Currently, power generated for industrial and domestic use at the Sahabat Complex is supplied by stand-alone diesel generators owned/operated by the CPO refineries, or through Felda Engineering Services and Sahabat Bulkers. The two palm oil production sites, Sahabat Oil Products (SOP - the crude palm oil refinery) and Sahabat Kernel Crushing Plant (SKCP- the palm kernel crushing plant) represent the main processors and major power consumers, in the Sahabat Complex. Electricity generation and distribution is currently carried out and managed by Felda Engineering Services Sdn Bhd (FESS). FESS generates electricity to supply the Bandar D settlement and Bandar C Township. Due to an increase in demand from both commercial and domestic customers, FESS has installed an additional two diesel generators at the Sahabat Complex.

Electricity demand is not expected to increase significantly in the future, as any increases will be attributable primarily to residential consumers. There are no plans for expansion of capacity by industrial consumers therefore this demand is expected to remain stable.

SOP also requires steam for its operations, which it currently generates through two oil-fired boilers. Currently the maximum steam demand for the refinery is 16 tonnes per hour at a pressure of 12.5 bar. In the project scenario steam will be supplied by the EFB power plant and the cost of the steam will be charged to the refinery based on the cost of steam production. There are no plans for further expansion of the SOP plant. Therefore future demand for steam is expected to be stable and manageable by the new biomass power plant.

In view of the projections and the forecast of maximum demand, the capacity of the intended power plant will be rated at 7.5 MW electrical. This is believed to be sufficient to cater for the future needs of the complex, its surrounding areas, the refinery and storage facilities' internal needs. The steam CPO refinery, or SOP, demands have been designed into the electrical rating of the plant. The project will see extraction from the turbine of the required steam, which will act to reduce the electrical power output of the plant. Electricity output is still expected to exceed the requirements of the complex as a whole.

A.4.1. Location of the project activity:

A.4.1.1 Host country Party(ies):

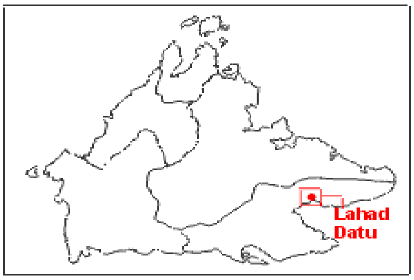
Malaysia

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

The state of Sabah, in East Malaysia

A.4.1.3. City/Town/Community etc:

Lahad Datu, a town of 120,000 people on the Eastern Coast of the State of Sabah is situated in the Tawau Division on the East coast of Sabah, where the interior mountain ranges stand on its west and the Celebes Sea borders it from the east:



A.4.1.4. Detailed description of the physical location, including information allowing the unique identification of this project activity.

The project is located within a plantation complex belonging to Felda Palm Industries named Felda Sahabat. The plant is located about 80km northeast of the town Lahad Datu and southeast of Sandakan. Lahad Datu is located in the Tawau Division of Sabah, which stretches from north to Lahad Datu and south to Tawau. Tawau Division occupies a total of 14,905 Sq. km or 20% of Sabah territory and in 1991 it housed approximately 26% of Sabah's total population (1991 census, Sabah Yearbook of Statistics, 1998). Lahad Datu hosts one of the major regional airports, the third one after Tawau and Kota Kinabalu. The nearest village to the site is Kampog Tungku which is approximately 5.25° north of the equator and 119.2° longitudinal east. The site is in an industrial zone within the Sahabat complex that supports the plantations downstream.

A.4.2. Type and category(ies) and technology of project activity

Displacement of diesel through the use of waste biomass: biomass, renewable energy (Project type I.C. under the Appendix B of the simplified modalities and procedures for small-scale CDM project activities)

The EFB power plant will be a closed loop steam driven heat and power plant operating in conjunction with medium pressure boilers and multi stage condensing cum extraction turbines. The main features of the project technology are outlined below.

The use of EFB for a biomass project is relatively novel, particularly in Southeast Asia. Historically, palm oil industry projects utilised the palm mesocarp fibre and kernel shells, which have a higher calorific value and lower moisture content. However, availability of new technology means that the higher moisture content of the EFB is no longer an impediment to use of this waste product as a biomass fuel.

EFB fuel characteristics are as follows;

- it has a very high volatile matter content of approximately 68%;
- a reasonably high heating value of 4,890 kCal/kg (oven dried);
- and a reasonably low ash content of 7.3% on a moisture free basis.

Due to its physical nature and high moisture content (60-70%), the EFB needs to undergo some pre-treatment, or drying, in order to enhance flame stability in the combustion chamber when burnt on its own without assistance from high calorific value fuels such as palm shells.

Based on the selected turbine, operating at 5 kg of steam per kWh in extraction condensing mode, a boiler efficiency of 75% and generator operating at 7.5 MW with steam extraction at 18 tonnes per hour, the amount of EFB required at 65% moisture is approximately 30,000 kg per hour or 246,240 tonnes per year (although arrangements are in place for 313,837 tonnes).

Image 1: Palm Oil Full Fruit Bunches (FFB)

In the production of palm oil, Full Fruit Bunches (FFB), as shown in the image above, are transported to the closest mill and steam treated to soften and condition the bunch before the threshing process to dislodge the 'fruitlet' from the bunch. The FFB are then processed to produce crude palm oil (CPO). For each tonne of fruit bunch that is processed by a mill, 23% of the full fruit bunch (FFB) mass will be left as empty fruit bunches (EFB). This presents a waste management problem for many of mills, with most of them producing in the order of 50,000 tonnes of EFB per annum. The complete list of mills, the amount of EFB produced by each site and the current waste management strategies employed by each mill are displayed in Table 1 below. For further details about current waste management strategies please refer to Section B3.

Table 1: The Felda mills

Mill	EFB Produced (tonnes)	Distance to project site (km)	Current waste management strategy
A	48,752	25	Incineration
B	42,900	15	Incineration

C	44,854	30	Incineration & composting
D	39,002	19	Incineration & composting
E	46,024	46	Composting
F	43,294	59	Composting
G	53,046	31	Composting
H	33,546	60	Incineration & composting
I	46,804	53	Composting
J	44,850	27	Landfill

The current plan is to source fuel supply from six palm oil mills within the Sahabat Complex. The main criteria for mill selection is the relative proximity to the power plant, however whether the mill is equipped with an incinerator is also a consideration. The six selected mills are Mills A, B, C, D, E and J. The amount of EFB available from the selected mills based on forecasts over a ten-year period demonstrates sufficient supply for the planned annual power output. However, due to the seasonal fluctuation of crops throughout the year there may be a need for the other oil mills (i.e. Mills F, G, H and I) to provide EFB should there be any shortfall in supply.

The power plant will be equipped with 5 x 1 MW diesel generators as backup during breakdowns as well as to supply power during boiler inspections. It is anticipated that the plant will use these diesel gensets for 2 weeks per annum during annual O&M of the EFB facility. Emissions from the use of these diesel gensets will be captured within the monitoring plan.

Industrial Power Technology Prt Ltd, Singapore, utilising German and Japanese components, will implement the project technology. The boiler will be sourced from Erkroch Kessel, the fire grate from Kablitz, the fuel preparation equipment from Haas, and the turbine from Shin Nippon Machinery.

A.4.3. Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

The proposed activity, with its 7.5 MW installed capacity with additional boilers, will directly reduce greenhouse gas emissions from existing and future generation of electricity and steam production that use fossil fuels for thermal generation. Under the baseline scenario there would be continued use of diesel generation to provide both electricity and steam to industrial, commercial and residential consumers within the Sahabat complex. The project will displace the use of diesel for electricity and steam generation with a carbon neutral alternative, use of EFB. The project will result in some emissions from the use of diesel generators during an annual maintenance period.

A.4.3.1. Estimated amount of emission reductions over the chosen crediting period:

Pleas indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emissions reductions shall be indicated using the following tabular format. For type (iii) small-scale projects the estimation of project emissions is also required.	
Years	**Annual estimation of emission reductions in tonnes of CO2e**
Year 2004	54,915
Year 2005	54,915
Year 2006	54,915
Year 2007	54,915
Year 2008	54,915
Year 2009	54,915
Year 2010	54,915
*After the initial 7-year crediting period, the baseline will be reassessed, generating a new estimate of emissions reductions yet to be determined.	
Total estimated reductions (tonnes of CO2e)	384,405
Total number of crediting years	7 (renewable up to 21 years)
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	384,405

A.4.4. Public funding of the project activity:

No public funding will be used for this project from either domestic or international sources.

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

Based on the information provided in Appendix C of the simplified modalities and procedures for small-scale CDM activities the proposed Felda Sahabat Palm Oil Empty Fruit Bunch Power Plant project is not a debundled component of a larger project activity. The project participants do not have a CDM project registered with the same project participants within the last 2 years or operate another project in the region surrounding the project boundary.

B. Baseline methodology

B.1. Title and reference of the project category applicable to the project activity:

Category I.C., “Thermal Energy for the User”.

B.2. Project category applicable to the project activity:

According to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the Felda EFB biomass project falls under the category I.C., “Thermal Energy for the User”.

The baseline methodology adopted for the Felda project is based on the Section I.C. of the aforementioned Appendix B of the simplified modalities and procedures for a small-scale CDM project activities: “Thermal Energy for the User” (Sections 18):

“ 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 emissions coefficient for the fossil fuel displacement. IPCC default values for emission coefficients may be used.”

B.3. Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity

The approach chosen here to determine the baseline and demonstrate additionality is approach **a)** ***Existing actual or historical emissions, as applicable***. This approach is designed to test whether the continuation of current practices and historic practices (and emissions) on the site, or similar sites, would continue in the absence of the project activity, or if an alternative baseline scenario is identifiable. This methodology could support baseline determination of a range of project activities, including the production and use of biomass for on site energy use.

The key to determining additionality of the whole project is to determine the baseline of energy provision to the facility and – related to that – the baseline management of the EFB that will be used to power the prospective facility.

The baseline determination methodology consists of a five-step process in order to define the baseline:

1. Listing a range of potential baseline options;
2. Narrow the potential baseline option(s) most likely in the absence the project (where possible);
3. Select the barriers from the range of potential barriers that can be demonstrated to be the most significant in the context of the particular project under consideration;
4. Score the barrier. This can be done by addressing a range of potential questions, as set out in Annex Table 1 below. Where a barrier exists Select Y, Where a barrier does not exit select N, where the question is not relevant select NA;
5. Compare, through assessment of the barriers results, which is the most plausible baseline option and determine whether, on balance, it can be shown that particular barriers drive a particular baseline option. Where the most likely option shown to be the baseline is not the project, then the project is shown to be additional.

Annex Table 1: Barrier Test Framework

Plausible Baseline Alternative Barrier Tested	Alternative 1	Alternative 2	Alternative 3
Legal			
• Is this practice regulated by Host Nation law or regulation and therefore legally allowed?			
Technical			
• Is this technology option currently available through local equipment suppliers?			
• Are there sufficient skills and labour to operationalise and maintain this technology in country?			
• Is this technology a regional or global standard, or technology of choice?			
• Can performance certainty be guaranteed within tolerance limits?			
• Is there real, or perceived, technology risk associated with this technology?			
Financial			
• Is this technology intervention financially attractive in comparison to other technologies?			
• Is this the most financially viable option?			
• Is equity participation easy to find locally?			
• Is equity participation easy to find internationally?			
• Are site owners/ project beneficiaries carrying any risk?			
• Is technology currency (country) denomination a risk?			
Institutional			
• Are subsidies available?			
• Does the host nation have an active programme for technology support in the			

industry?			
Business and Cultural			
• Is this considered a well understood and accepted technology in the Host Nation and among local constituencies?			
• Is there a willingness to change to alternative management practice in the absence of regulation?			
• Is technology changeover considered a high management priority			

Using the Barriers Matrix - Notes

- This matrix is meant to be a flexible tool. It is not designed to presuppose what the relevant barriers are in a project specific context. Therefore, the developer is encouraged to identify and justify what barriers are believed to be the most significant;
- The list of potential questions is not exhaustive, and the project developer is encouraged to identify other potential barriers not identified here.

Alternative Scenarios Tested

- o **Alternative 1 - Maintaining current practice of On-Site Diesel generation for the Sahabat Site**
- o **Alternative 2 - Use of biomass for energy on the Sahabat Site**
- o **Alternative 3 – Connecting the Sahabat Site to the regional Electricity Grid**

Barriers Test Application

COMPONENT 1 - LEGAL QUESTIONS

- ➢ ***Is this practice regulated by Host Nation law or regulation and therefore legally allowed?***

Description

The current practice of using diesel to power off-grid facilities is legal at Sahabat. There are no specific legal barriers to the use of biomass generation for onsite power. The only relevant legal requirements in regards to managing the flow of EFB is that it is not allowed to be open burned in the field.

Alternatives Assessment

- **Alternative 1 - Current practice of On-Site Diesel: No**. This activity is not regulated by national law, and is therefore legal, providing that all relevant air and water quality emission standards are met, which has been the case throughout the operational history of the existing plant.
- **Alternative 2 - Use of biomass for energy: No**. There are basic requirements of having Environmental Impact Statements for this type of facility – however, these requirements have been undertaken. Using EFB will not impact any legal requirements for managing the EFB – indeed, it will make it easier to meet the non open burning requirement
- **Alternative 3 - Connection to the regional Electricity Grid – No**. There are no legal barriers against this activity

COMPONENT 2 - TECHNICAL QUESTIONS

- ***Is this technology option currently available through local equipment suppliers?***
- ***Are there sufficient skills and labour to operationalise and maintain this technology in country?***
- ***Is this technology a regional or global standard, or technology of choice?***
- ***Can performance certainty be guaranteed within tolerance limits?***
- ***Can real, or perceived technology risk associated with this technology be discounted?***

Description

Diesel based energy systems are extremely low tech and represent the lowest common denominator practice for off grid CHP applications through the developing world. The skills for facility maintenance are easily obtainable from existing local populations and there is little performance risk from the technology.

The use of EFB for a biomass project is relatively novel, particularly in Southeast Asia. Historically projects related to the palm oil industry have utilised the **palm kernel shells**, which have a higher calorific value and lower moisture content. However, new technology means that the higher moisture content of the EFB is less of an impediment to use of the waste product as a biomass fuel. Due to its physical nature and high moisture content (60-70%), the EFB needs to undergo some pre-treatment, or drying, in order to enhance flame stability in the combustion chamber when burnt on its own without assistance from high calorific value fuels such as palm shells. In terms of pre-treatment, the EFB also has components such as potassium and chloride that need to be addressed in the design of the furnace such that the temperature profile of the furnace does not exceed the fusion temperature of the ashes. This is of great importance as two plants (Kwantas Biomass plant in Lahad Datu and a glove factory's heat plant) that tried to use EFB are facing the problem of severe fouling of the boiler tube surface whereby the full generation load could not be achieved. Technical skills of local maintenance will also need to be upgraded.

There is a real and significant technology risk in performance in choosing this path. One of the most critical components in technology risk is in selecting and designing the pre-treatment, conveying and combustor equipment so that the efficiency of the plant is maximized. This is demonstrated by the fact that Felda has chosen to keep its existing gensets onsite as back up, rather than sell them to a 3rd party.

Furthermore, from the perspective of the EFB management, there is the barrier of getting local contractors to treat what has originally been a waste stream into a commodity. Some degree of logistics will be required to collect and deliver the EFB to the centralized facility.

Connecting the Sahabat complex to the local Sabah grid would potentially be a partial solution to the energy requirements. However, the local grid is not perfectly stable – there are regular disruptions in power supply, which would potentially have significant impact on Felda's operations. Moreover, grid connection would not solve the need for heat. This partially explains why Felda has traditionally chosen to be self sufficient for power rather than reliant on the grid.

Alternatives Assessment

- **Alternative 1 - Current practice of On-Site Diesel: No**. This activity is standard for the industry and for off grid applications around the world
- **Alternative 2 - Use of biomass for energy: Yes** Use of EFB biomass for energy and electricity provision represents an unproven technological leap forward for Malaysia's palm oil sector. There is furthermore the challenging logistics requirements of developing a transport network for centralizing the EFB at the Sahabat complex
- **Alternative 3 - Connection to the regional Electricity Grid: Yes**. Connection to the grid would solve the need for electricity – however, a significant portion of the energy needs from the Sahabat complex are for heat, which would mean the continued need for some form of on-site combustion

COMPONENT 3 – FINANCIAL QUESTIONS

- ***Is this technology intervention financially attractive in comparison to other technologies?***
- ***Is this the most financially viable option?***
- ***Is equity participation easy to find internationally?***
- ***Is equity participation easy to find locally?***
- ***Are site owners/ project beneficiaries carrying any risk?***
- ***Is technology currency (country) denomination a risk?***

Description

On an installed basis, diesel gensets are among the cheapest form of power available in the market today. Diesel is readily available in both local and global markets and there is little threat of supply interruption. Felda, moreover, already has such gensets on the Sahabat site, where they have been powering the facility for many years. There is some threat from the potential impact of shifts in fossil fuel pricing (a 27% increase in diesel prices from the draft PDD, with further short term hikes expected) – however, given the utter preponderance of diesel and bunker fuel in these types of applications, such a shift would presumably impact all parties across a relevant sector equally, meaning that none would gain a relative competitive advantage.

The biomass power option is not the most attractive financial option. Refitting the facility to accept biomass represents a significant outlay of hard currency for industrial national technology. Moreover, there are the costs of collecting, transporting, delivering and treating the EFB. While here are a high number of EFB plants in development in Malaysia, few – if any – have been able to source sufficient equity capital to move forward to completions. Felda has overcome this barrier by undertaking the project with its own equity and assuming the operational risk of the project by guaranteeing debt repayments with its overall corporate balance sheet.

Interconnect with the grid is, of course, technically possible. However, the Sabah grid is approximately 80km's away and, as cost of the connection would be born by the project developer, the transmission line infrastructure cost is uneconomical. Based on an estimate of RM100,000/km the cost of the interconnection would be RM8,000,000. Moreover, grid connection would not solve the need for heat. Extension of the grid to the Sahabat complex would be a prohibitive capital outlay, given the fact that Felda would also bear the addtitional costs of purchasing electricity from the local utility into the future

Alternatives Assessment

- **Alternative 1 - Current practice of On-Site Diesel: No**. This technology, is currently installed, requires no further financing.
- **Alternative 2 - Use of biomass for energy: Yes**. This is perceived as a high risk, novel project, due to the technical challenges of efficiently combusting high moisture EFB. Felda has accepted a lower rate of return on capital that its conventional business practices dictate in order to execute the project
- **Alternative 3 - Connection to the regional Electricity Grid – Yes**. Extension of the grid approximately 100 km would be fully Felda's financial responsibility and would still leave Felda liable for the long term costs of purchases from the local electricity supplier

COMPONENT 4 – INSTITUTIONAL QUESTIONS

- ***Are subsidies available?***
- ***Does the host nation have an active programme for technology support in the industry?***

Description

Industrial Diesel prices in Malaysia are partially subsidized by the government, meaning that there is little incentive to investigate alternatives. To our knowledge, there is no significant technology support programme for diesel, as it is not needed

Green power provision to the grid has a variety of subsidies and other forms of encouragement in Malaysia. The Small Scale Renewable Energy Programme (SREP) provides a guaranteed tariff for clean energy projects that provide electricity to the grid. However, as an inside the fence project, Felda will not be selling to the grid and will therefore not have access to those specific subsidies. Even so, it would be difficult to describe the SREP programme as particularly successful to date, as less than five projects (all, by definition, under 10 MW) have been successfully accepted in the programme as of mid 2004.

For Sahabat, there will be an accelerated capital allowance on related equipment to be fully written off within a period of 3 years. Sahabat does enjoy import and sales tax exemption from Malaysians Customs because its application through MIDA as a renewable energy categorized project. The Malaysian government under the 5th fuel policy in the 8th Malaysian Plan supports this.

The Malaysia Palm Oil Board (MPOB) supports a wide variety of initiatives to increase the overall value stream of palm-based commodities. However, MPOB is principally a research organization and does not provide direct support for implementing activities

There would be no subsidy for Sahabat to extend the grid to its location.

Alternatives Assessment

- **Alternative 1 - Current practice of On-Site Diesel: No**. Ongoing subsidy of conventional fossil fuel means that there is little incentive to change from the current practice
- **Alternative 2 - Use of biomass for energy: Yes/No -** While there are low levels government support for renewable energy projects, these are substantially weighted in favour of producers that are selling to the grid.
- **Alternative 3 - Connection to the regional Electricity Grid – Yes**. Felda/Sahabat would be responsible for the extension of grid electricity to the site, as there would be no significant institutional support.

COMPONENT 5 – OTHER BUSINESS CULTURE BARRIERS QUESTIONS

- ***Is this considered a well understood and accepted technology in the Host Nation and among local constituencies?***
- ***Is there a willingness to change to alternative management practice in the absence of regulation?***
- ***Is technology changeover considered a high management priority***

Description

As the outputs of the project – heat and electricity – do not differ between any of the scenarios, we can ignore on-site business practices (or at least consider all scenarios to be fairly equal). The one business culture practice that will be impacted is fuel supply, specifically the transformation of a useless waste product (currently viewed as a waste management problem for palm oil mills both in Malaysia and across the wider South East Asian region) into an energy source. Three approaches to this problem are currently employed:

1. EFB are composted;
2. EFB are incinerated on site;
3. EFB are dumped or landfilled on site.

Incineration is currently the cheapest and therefore, most widely used waste management option. However, evidence suggests that the Malaysian policy directive - which currently prevents incinerators being installed in new mills - may be expanded in the coming years to ban incineration altogether. This would result in much greater volumes of EFB having to be composted or dumped.

At some sites, EFB is transported back to the plantations for composting. However, the cost of removal and management of EFB *on flat land* (i.e. where bulldozers are used to spread EFB) is on the order of RM14/tonne. If the terrain does not allow for this kind of treatment then it must be spread manually, incurring higher costs. This cost of disposal equals approximately 1-2% of total FFB value. Further problems arise in areas where the available workforce is limited and therefore there is limited labour available for composting. This can increase the cost of labour and therefore encourage dumping or landfilling of the EFB.

The lack of recourse to the two previous options means mills stockpile - then landfill - EFB on-site. Prior to landfilling a large amount of EFB may be stockpiled, as shown in Image 2. This option results in the anaerobic breakdown of the EFB and uncontrolled emissions of methane, a potent greenhouse gas, to the atmosphere. This additional emission of GHG's is not being claimed within the baseline scenario of the project document.

Image 2: Stockpiled EFB

Use of EFB as a fuel in biomass projects - and as an alternative waste management strategy - has not occurred anywhere in Malaysia to date. It is hoped that this project will play an important role as a demonstration project and encourage other palm oil mills to also consider this as an alternative option for disposing of EFB.

Technology shifts are not considered a high priority for Felda, which does not have previous experience in this technology

Alternatives Assessment

- **Alternative 1 - Current practice of On-Site Diesel: <u>No</u>**. This technology is an accepted technology, and continued operation of existing facilities presents no real social barriers.
- **Alternative 2 - Use of biomass for energy: <u>Yes/No</u>.** While the traditional use of biomass for composting will be impacted, the attempts to stop current incineration will create incentives to find useful applications for EFB
- **Alternative 3 - Connection to the regional Electricity Grid – <u>No</u>**. There would be no cultural barrier to the Sahabat complex connecting to the grid

Barriers Analysis Summary

The barriers analysis above has clearly shown that the most plausible baseline scenario is the prevailing practice use of diesel energy systems and waste management of the EFB in the current manner. The third alternative to the baseline and project scenario – the extension of grid power to the facility, would be expensive and would not serve the needs of the Sahabat complex, as it would not provide heat. For the alternative of biomass-based power, while Malaysian policy has been encouraging of that end, few projects have actually been implemented, as they require fairly high tariffs to the grid generally to be cost effective. Diesel is capital cost-effective and represents proven and mission critical technology.

Therefore, in this context, the continuation of current diesel based energy system is defined as the baseline.

Plausible Baseline Alternative Barrier Tested	**Alternative 1**	**Alternative 2**	**Alternative 3**
Legal	N	N	N
Technical	N	Y	N
Financial	N	Y	Y
Institutional	N	Y/N	Y
Business and Social Culture	N	Y/N	N

B.4. Description of the project boundary for the project activity:

As defined in Appendix B for small-scale project activities, the project boundary for small-scale renewable energy project is delineated by the physical, geographical site of the renewable energy generation. A brief description of all sources of baseline and project emissions appears below:

The direct on-site GHG emission sources can be divided into activities prior to the operation of the project and activities during the operation period. The main activity of the Felda project- once it becomes operational - is the generation of electricity and steam. This activity is under the control of the project developer and has to be included in the project boundary.

The emissions related to biomass electricity and steam production are zero, as the fuel source is a renewable source of waste biomass. However, the use of diesel generators and oil boilers during the anticipated maintenance period of 2 weeks per annum will lead to direct on-site greenhouse gas emissions. During the operation phase of the project, no other direct on-site GHG emission sources have been identified.

Emissions arising from construction of the project have been excluded from the project boundary. It is assumed that similar activities and related emissions -- for example, installation of new diesel gensets as older existing gensets are retired -- would also occur in the baseline scenario. It is also extremely difficult to accurately estimate the emissions arising from construction, especially transportation of materials therefore they have been excluded.

B.5.1. Details of the baseline and its development:

The Felda EFB biomass project methodology was developed in accordance with Appendix B of the simplified modalities and procedures for small-scale CDM project, specifically Section I.C., paragraphs 5 and 7. The following section elucidates the detailed procedures that guided the development of baseline methodology.

Diesel for electricity generation

Felda Palm Industries provided historical data and future projections for past and expected electricity and diesel consumption for the following sites:

- Sahabat Kernel Crushing Plant (SKCP);
- Sahabat Oil Products (SOP);
- Sahabat Bulking Installation (SBI);
- Diesel generator house of Felda Engineering Services;
- Sahabat Complex (powered by Felda Engineering Services);
- Desa Kencana or Kampung D (powered by Felda Engineering Services);
- Cendrawasih Township or Bandar D (powered by Felda Engineering Services);

- Water Treatment Plant at Complex B;
- Booster pump at BH1.

The Project Proponent has collected full data regarding fossil fule use for 2002 and 2003 for both the electricity and the steam applications across all the facilties. These numbers are provided

Within the project boundaries, electricity demand is not expected to significantly increase in the future, as industrial capacity is not expected to grow without major refurbishment works. Small increases are predicted in electricity consumption at the residential complexes, but Felda indicates these increases will be insignificant compared to the industrial power requirements.

Felda anticipates that additional plant capacity will potentially be required after 2013 -- that is, after the current baseline-crediting period. Therefore, the electricity portion of the baseline scenario is the extrapolation of historical diesel consumption for electricity generation trends for the crediting period, taking account of the limited expected increase in electricity demand.

Under these assumptions, and following the guidelines of Appendix B of the simplified modalities and procedures for small-scale CDM, the baseline methodology was computed by multiplying the fuel consumption of the technologies used in the absence of the project activity by the emissions coefficient of diesel.

In the Sahabat complex, diesel consumption fluctuates significantly throughout the year due to seasonal variances, changing production loads and variances in operating hours. Average monthly diesel consumption figures for electricity generation, for each site, are displayed in the table below:[2]

Table 3: Average diesel requirements for electricity production at each site

Sahabat Complex Diesel
Consumption for Electricity
Average 2002-2003

	Sahabat Kernel Crushing Plant	**Sahabat Complex 16**	**Sahabat Oil Products**	**Booster Pump**	**Bandar Cendrawasih**	**Desa Kencana**	**Water Treatment Plant**	**All sites**
Month	**(L)**	**(L)**	**(L)**	**(L)**	**(L)**	**(L)**	**(L)**	**(L)**
JAN	297,032	106,650	238,041	5,618	47,488	26,505	4,275	725,607
FEB	251,930	95,732	208,506	8,548	41,204	21,337	3,480	630,736
MAR	269,917	107,208	284,202	11,868	41,353	22,762	3,781	741,090
APR	284,253	100,890	237,283	13,871	54,619	23,009	2,844	716,768

[2] Data supplied by Felda Palm Industries Sdn Bhd.

MAY	298,262	101,517	223,226	14,140	66,131	27,907	4,868	736,050
JUNE	327,686	101,973	213,250	9,285	42,880	34,200	5,781	735,054
JULY	325,228	110,293	261,679	6,504	51,899	28,310	4,372	788,284
AUG	312,653	109,839	250,384	8,514	72,730	26,429	5,011	785,560
SEPT	321,299	109,497	219,407	7,020	68,799	27,018	4,243	757,281
OCT	383,834	106,362	258,823	7,276	47,926	34,124	5,498	843,842
NOV	314,672	98,420	220,535	12,767	67,257	32,623	3,998	750,271
DEC	310,969	98,146	206,259	13,072	55,731	37,772	5,091	727,038
TOTAL	**3,697,732**	**1,246,525**	**2,821,593**	**118,480**	**658,015**	**341,996**	**53,240**	**8,937,580**

Annual emissions arising from diesel consumption can be estimated by multiplying with a diesel CEF of 2.68 kgCO_2/L, sourced from the UK DETR, Environmental Reporting Guidelines for Company Reporting on Greenhouse Gas Emissions, June 1999[3].

Felda Palm Industries anticipates that the project will not supply electricity to Bandar Cendrawasih, the Booster Pump House and the Water Treatment Plant until 2006. Hence, these three sites will continue to rely on diesel generators for the first two years of project operation. This will be taken into account when tallying the total emission reductions attributable to the project.

Diesel for steam production

Sahabat Oil Products, the crude palm oil refinery, also requires stable steam production. Current steam production is 16 tonnes per hour. Steam has historically been generated using diesel or medium fuel oil, although the experimental use of a diesel/sludge oil mixture is being trialled. Since 2000 the refinery team have been experimenting with a mixture of mineral oil and the residual palm sludge oil for steam production at the refinery. Palm sludge oil is a residue left after oil milling and is left as a weak emulsion with wastewater from the milling process. The wastewater settles and cools in a series of ponds, where the sludge oil separates from the water layer and can be scooped off and used elsewhere.

Currently a mix of diesel and palm sludge oil is used for steam production. Felda Palm Industries have indicated however that, for a number of reasons, the use of palm sludge oil will be decreased in the next few years and the diesel component of the diesel/sludge oil mix would increase. Reasons for the decrease in use of palm sludge oil for steam production include:

- Increased processing efficiency at the mills will reduce the percentage of Free Fatty Acids (FFA) contained in the sludge oil. Sludge oil with FFA lower than 40% can not be utilised by the boiler;
- Increased processing efficiency will also reduce the quantity of sludge oil available from approximately 0.20-0.25% of total Fresh Fruit Bunches processed to the widely accepted Malaysian standard of 0.15-0.20% of total Fresh Fruit Bunches processed. This will reduce the amount of sludge oil physically available for steam production;

[3] This figure is comparable to the IPCC Guidelines, simply presented in different units.

- The quality of the sludge oil is lower than that of mineral oil or diesel oil previously used, and highly variable (as a result of many factors including water content). This has significantly increased the frequency of boiler maintenance and cleaning required from once every six months to once every week;
- Anecdotal evidence from Felda engineers also suggests the use of sludge oil may reduce the operational life of parts of the boilers, in particular the burner nozzle which needs to be replaced much more often, therefore increasing costs;
- Burning sludge oil leaves deposits on the burners, reducing their efficiency, and increasing the frequency with which they need to be cleaned and the efficiency of using all fuels (including mineral fuels);
- Sludge oil can not be stored for too long, otherwise it solidifies rendering it impractical for use in the boilers;
- Sludge oil may be sold for commercial purposes for use in higher value products such as soap production. This will compete with sludge oil used for steam production;
- The cost of sludge oil is also expected to increase. Currently the mills sell the sludge oil to the refinery at a subsidised rate as each business unit still operates under the Felda Palm Industries umbrella. However each business unit is supposed to operate as an independent business, therefore real costs will eventually be transferred to the refinery affecting its ability to compete with mineral oils.

Historical diesel, medium fuel oil and sludge oil consumption figures for the years 1997-2001 are shown in Table 4 below.

Table 4: Historical steam production fuel consumption at the Sahabat Oil Products refinery

	2002	**2002**	**2003**	**2003**
Month	**LFO (L)**	**Diesel**	**LFO (L)**	**Diesel (L)**
Jan	55,338	355,337	0	851,209
Feb	25,218	163,322	0	790,283
Mar	0	269,726	0	875,584
Apr	0	290,272	0	707,538
May	0	248,838	0	731,827
Jun	0	274,119	0	640,698
July	0	781,545	0	688,642
Aug	0	585,405	0	663,694
Sept	0	776,098	0	667,423
Oct	0	853,338	0	702,525
Nov	0	752,307	0	584,765
Dec	0	631,915	0	560,003
TOTAL	80,556	5,982,222	0	8,464,191
ANNUAL TOTAL		6,062,778		8,464,191
Average fuel oil consumption (L)	7,263,485			

As the table shows the consumption of fossil fuel during the sludge oil trial in 2000 is significantly higher than the amount of fossil fuel used in preceding years, and in 2001. Felda Palm Industries attribute the variance to difficulties in the implementation of the sludge oil/diesel fuel mix. Previous paragraphs set out a number of points that would result in the sludge oil trial being discontinued. Taking this into account fuel consumption data from the sludge oil trial (i.e. 2000 and 2001) will be excluded from the data set. This also increases the conservatism of the baseline. It has therefore been assumed that the project will displace an average of the medium fuel oil consumption from the years 1997 to 1999 (i.e. 6,464,881 L).

B.5.2. Date of completing the final draft of this baseline section

May 2004

B.5.3. Name of person/entity determining the baseline:

Marc Stuart
EcoSecurities, Ltd

EcoSecurities are Felda Palm Industries CDM advisors for this project activity.

C. Duration of the project activity and crediting period

C.1. Duration of the project activity:

C.1.1 Starting date of the project activity:

Q3, 2004

C.1.2 Expected operational lifetime of the project activity: ***(in years and months, e.g. two years and four months would be shown as: 2y-4m.)***

25y-0m

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

C.2.1. Renewable crediting period ***(at most seven (7) years per crediting period)***

C.2.1.1. Starting date of the first crediting period

30/06/2004

C.2.1.2. Length of the first crediting period

*7*y-0m

C.2.2. Fixed crediting period ***(at most ten (10) years)*****:**

C.2.2.1. Starting date

C.2.2.2. Length (max 10 years):

D. Monitoring methodology and plan

D.1. Name and reference of approved methodology applied to the project activity:

Appendix B of the simplified modalities and procedures, I.C. "Thermal Energy for the User" project: "Monitoring shall consist of metering the thermal *and* electrical energy generated for co-generation projects".

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

This methodology has been selected due to its simplicity, reliability and compatibility with the standard procedures and equipment used in thermal energy projects. It is based on the continuous measurements and analysis of real time records, which are stored on a regular basis to comply with regulations. These records offer a high degree of reliability (low margin error, easy validation and quality assurance) and enable us to compute and measure the emissions reduction with great accuracy.

D.3. Table 5: Data to be monitored

ID number ***(Please use numbers to ease cross-referencing to table D.6)***	**Data type**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**For how long is archived data to be kept?**	**Commen**
D3-1	Electricity delivered	Mwh	m	Continuous	100%	Electronic (spreadsheet)	2 years	
D3-2	Steam delivered	tonnes	m	Continuous	100%	Electronic (spreadsheet)	2 years	
D3-3	Project diesel consumption during maintenance period	L	m	Monthly	100%	Electronic (spreadsheet)	2 years	

Data to be monitored	Data Acquisition Source
Empty Fruit Bunch (EFB)	From oil mill weighting machines. The lorry will be

	weighed before exiting the mill premises. Units of measurement are in tonnes.
Steam used	The steam output to the Sahabat Oil Products will be measured at the oil refinery and the power plant steam export line. The units of measurement will be in kilograms measured by a totaliser
Power used	The daily power plant output will be measured in Kwhr by meter and totalised by power management recording equipment for export line users
Diesel used	The diesel used at the plant for startup and for emergency operation will be measured in litres and recorded daily. A totaliser flow meter will be installed at the diesel engine fuel input line.

D. 4. Name of person/entity determining the monitoring methodology:

Marc Stuart

EcoSecurities are Felda Palm Industries CDM advisors for this project activity.

E. Calculation of GHG emission reductions by sources

E.1. Formulae used:

E.1.1. Selected formulae as provided in appendix B:

The baseline emissions for the project are calculated using Appendix B, section I.C "Thermal Energy for the User," paragraphs 5 and 7 of the simplified modalities and procedures for a small-scale CDM project activities:

Paragraph 5 states:
"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 emissions coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used."

This will be used for determining emissions reductions from steam generation.

Paragraph 7 states:
"For renewable energy technologies that displace electricity the simplified baseline is the electricity consumption times the relevant emission factor calculated as described in category I.D, paragraphs 6 and 7."

For the project, I.D. paragraph 6 is applicable, and states: "For a system where all generators use exclusively fuel oil and/or diesel fuel, the baseline is the annual kWh generated by the renewable unit times and emissions coefficient for a modern diesel generating unit of relevant capacity operating at optimal load as given in Table I.D.1."

This will be used for determining emissions reductions from electricity generation.

Since Appendix B does not provide a formula, the two GHG estimation options above will be used to determine the total emissions avoided by the project.

E.1.2. Description of formulae when not provided in appendix B:

E.1.2.1. Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: ***(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)***

The IPCC Guidelines[4] state that biomass combustion is equal to its regrowth, therefore there are zero net emissions from the combustion of EFB in the project activity. With transportation emissions excluded from the estimations, the only source of emissions from the project is the use of diesel during an annual two-week maintenance period. Five 1 MW generators will be retained by Felda Engineering Services to be operated during an annual two week cleaning and maintenance programme.

The actual amount of diesel used (L) during the maintenance period will be captured within the monitoring plan. However an estimate of project emissions is calculated below:

Emissions from diesel use during maintenance period (t CO_2/year)	=	Average diesel requirement for 2 weeks of electricity generation (litre)	+	Average diesel requirement for 2 weeks of steam generation (litre)	**x**	Diesel carbon emissions factor (kgCO_2/ litre)
	=	[2/52 x Annual requirement for electricity generation (litre)	+	2/52 x Annual requirement for steam generation (litre)]	**x**	2.68 (kgCO_2/ litre)
	=	[2/52 x 8,937,580 (litre)	+	2/52 x 7,263,485 (litre)]	**x**	2.68 (kgCO_2/ litre)
	=	[535,921	+			

[4] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories

248,649] (litre) **x** 2.68 ($kgCO_2$/ litre)

= 1670 t CO_2/year

E.1.2.2. Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities (for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)

According to Appendix B, I.C., paragraph 8, leakage is to be considered only if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity. Since there is no transfer in this project, there are no sources of leakage expected from the project.

E.1.2.3. The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

Project emissions (t CO_2/year) = Emissions from diesel use during maintenance period (1670 t CO_2/year) + leakage (0 tCO_2/year) = 1670 (tCO_2/year)

E.1.2.4. Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: ***(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)***

Baseline emissions from electricity generation

For the electricity baseline, I.C. paragraph 7 states to use I.D. paragraph 6 or 7. Paragraph 6 is applicable for the project and states:

"For a system where all generators use exclusively fuel oil and/or diesel fuel, the baseline is the annual kWh generated by the renewable unit times and emissions coefficient for a modern diesel generating unit of relevant capacity operating at optimal load as given in Table I.D.1." The emissions coefficient for the project is 0.8 kg CO_2e/kWh (or 0.8 t CO_2/MWh). The formula is shown below:

Baseline emissions for electricity production, $EP_{baseline}$, are given by:

$$EP_{baseline}\ (t\ CO_2/yr) = S\ (MWh/yr) * \langle EP \rangle_{baseline}\ (t\ CO_2/MWh)$$

Where *S* stands for the project's electricity generation; and
<*EP*>$_{baseline}$ is the provided standard emission coefficient 0.80.

$EP_{baseline}$ (t CO_2/year)	=	S (MWh/yr)	X	<*EP*>$_{baseline}$ (t CO_2/MWh)
	=	45,964 (MWh/yr)[5]	X	0.8 (t CO_2/MWh)
	=	36,771 (t CO_2/year)		

Baseline emissions from steam generation using historical data

For steam generation, I.C. paragraph 5 states:

"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 and emissions coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used."

Baseline emissions for steam production, $ES_{baseline}$, are given by:

$$ES_{baseline} \text{ (t } CO_2\text{/yr)} = ADC \text{ (litre/year)} * \langle ES \rangle_{baseline} \text{ (t } CO_2\text{/litre)}$$

Where ADC stands for average diesel consumption per year; and
<*ES*>$_{baseline}$ is the emission coefficient for diesel fuel (0.0027279 t CO_2/litre)[6].

Baseline emissions from steam generation using historical data

$ES_{baseline}$ (t CO_2/year)	=	Historical average diesel consumption for steam generation (litre)	X	Emission coefficient for diesel fuel (t CO_2/litre)
	=	7,263,485 (litre)	X	0. 0027279 (t CO_2/litre)
	=	19,814 t CO_2		

Therefore total baseline emissions per year equals

Total Baseline Emissions (t CO_2/year)	=	Baseline emissions from electricity generation	+	Baseline emissions from steam generation

[5] Assumes that the generator runs 24 hrs/day for 90% of the year, with a capacity of 5.83 MW (taking into account the parasitic load).

[6] t CO_2/litre was calculated as follows with figures from the IPCC for diesel fuel: 20.2 (t C/TJ) * 44/12 (t CO_2/t C)* 43.33 (TJ/kilotonne) * 0.000001 * 0.85 (kg/litre) = 0.0027279 (t CO_2/litre).

	=	36,771 (t CO_2/year)	+	19,814 t CO_2
	=	56,585 (t CO_2/year)		

E.1.2.5. Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Annual Emission Reductions (tCO_2)	=	Estimated baseline emissions ((t CO_2/year)	-	Estimated project emissions (t CO_2/year)
	=	56,585 (t CO_2/year)	-	1670 (t CO_2/year)
	=	54,915 (t CO_2/year)		

E.2. Table providing values obtained when applying formulae above:

	2002	**2002**	**2003**	**2003**
Month	**LFO (L)**	**Diesel**	**LFO (L)**	**Diesel (L)**
Jan	55,338	355,337	0	851,209
Feb	25,218	163,322	0	790,283
Mar	0	269,726	0	875,584
Apr	0	290,272	0	707,538
May	0	248,838	0	731,827
Jun	0	274,119	0	640,698
July	0	781,545	0	688,642
Aug	0	585,405	0	663,694
Sept	0	776,098	0	667,423
Oct	0	853,338	0	702,525
Nov	0	752,307	0	584,765
Dec	0	631,915	0	560,003
TOTAL	80,556	5,982,222	0	8,464,191
ANNUAL TOTAL		6,062,778		8,464,191
Average fossil fuel consumption	7,263,485			

F. Environmental impacts

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

F.1.1. Documentation on the analysis of the environmental impacts

The Felda project does not require an Environmental Impact Assessment (EIA) as the proposed generating capacity is less than 10 MW. However an Environmental Impact Study is required, and has been approved by the relevant authority.

The EIS conducted found that construction would have a minimal effect on the environment. The majority of the construction is in an industrial area, not a residential zone and it is anticipated that noise, dust and traffic impacts will be localised and insignificant. Further, the equipment supplier provides a noise guarantee, which meets the requirements of the Malaysian department of Environment. Noise at the source will not exceed 85dB, noise at the project perimeter will not exceed 65dB. All shredding and trucking of fuel will be done during the day to minimise noise impact. The EFB fuel supply will also be stored in a shed to minimise any odour impacts.

During the operational phase of the project the potential impacts identified include air pollution associated with boiler operation and the discharge of cooling water into local water bodies. Both of these impacts will be monitored but are anticipated to be insignificant.

F.1.2. If impacts are considered significant by the project participants or the host Party:

The Felda project does not require an Environmental Impact Assessment (EIA) as the proposed generating capacity is less than 10 MW. However an Environmental Impact Study is required, and has been prepared and approved by the relevant authority. It concludes that there are **no** significant negative environmental impacts from the project. A hard copy of the EIA is available on request.

G. Stakeholders comments

G.1. Brief description of the process by which comments by local stakeholders have been invited and compiled:

The process followed to collect stakeholders' comments was a public brief session organized by Felda Palm Industries Sdn. Bhd. (FPISB) and EcoSecurities Ltd. A meeting was advertised in the local newspaper, "Borneo Post", and also posters were used to inform all potential stakeholders of the consultation event. The event was held on 18 December 2002, at the Sahabat Beach Resort.

Eric Chan gave the presentations from EcoSecurities and Ahmad Nor Azman Jamin and M. Salihin Sadimon, from FPISB.

Format for the event

The consultation event entailed:

- A presentation with an introduction with an explanation of the project and its objectives;
- A presentation with a description of the benefits of the project;
- A presentation on environmental issues and actions taken in this regard;
- A session of questions and answers with participation of the audience.

Annex 3 contains additional information regarding stakeholders' consultation the list of participants, and questions and answers.

G.2. Summary of the comments received:

The stakeholders raised no major concerns or objections. A summary of the questions and responses made by local stakeholders is included in the additional information regarding stakeholders' consultation, attached as Annex 3. The only concerns raised during the meeting include:

1. Impacts: if the project results on major impacts to the water supply for the consumer.
2. Complying issues: if FPISB will comply with the Department of Environment (DOE) requirements.

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

As stated under G.2 the stakeholders raised no major concerns or objections. The answers provided by FPISB and EcoSecurities in relation to impacts and complying issues satisfied the participants.

Please refer to "Additional information regarding stakeholders' consultation" in Annex 3.

Annex 1

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	EcoSecurities, Ltd.
Street/P.O.Box:	206 W. Bonita Ave.
Building:	Harvard Square
City:	Claremont
State/Region:	CA
Postcode/ZIP:	91711
Country:	USA
Telephone:	(909) 621 1358
FAX:	(909) 621 7438
E-Mail:	marc@ecosecurities.com
URL:	www.ecosecurities.com
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Stuart
Middle Name:	
First Name:	Marc
Department:	LA Office/US
Mobile:	(909) 489 5668
Direct FAX:	(909) 621 7438
Direct tel:	(909) 621 1358
Personal E-Mail:	marc@ecosecurities.com

Organization:	Felda Palm Industries Sdn. Bhd
Street/P.O.Box:	4th Floor, Balai Felda, Jalan Gurney Satu
Building:	
City:	Kuala Lumpur
State/Region:	
Postcode/ZIP:	54000
Country:	Malaysia
Telephone:	603 2697 1070.
FAX:	603 26939130
E-Mail:	s.subash@felda.net.my
URL:	www.felda.net.my

Represented by:	
Title:	General Manager of Eng. & Special Project
Salutation:	
Last Name:	Sunderaj
Middle Name:	
First Name:	Subash
Department:	Department of Eng. & Special Project
Mobile:	019-38063120
Direct FAX:	603 26939130
Direct tel:	603 26971070
Personal E-Mail:	s.subash@felda.net.my

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

N/A

- - - - -

Annex 3

ADDITIONAL INFORMATION REGARDING STAKEHOLDERS' CONSULTATION

The participants are listed in the table below:

Names:	Company:
1. Soh Kim Yaw	FPISB-RGM
2. Md Yusof Abdullah	FPISB
3. Ali Ahmad	FPISB
4. MD Yusof MD Idris	Aneka Asia
5. Rasakh Abdullah	Bell Plantation
6. MD Zulkifli Md Ariffin	SOP
7. Bensar ABD Hamid	Bulkers
8. Ruslan Bin Sulai	Felda Settler
9. Edmund Samunting	Felda Settler
10. Zamin Sinkoi	Felda Settler
11. Md Khairudin Ali	KCP
12. Danny Justin	Felda Regional
13. Albert Lim	Jab Haiwan
14. Mustapha Epit	FESSB
15. Putra Mahmood	Angkut
16. Zakaria Latif	FESSB
17. Abd Halim Hamid	FASSB
18. Christain Awing	Felda Settler
19. Abd Razak Chulli	Bengkel Sabah
20. Samsudun Karim	Angkut
21. Fauzi Sahat	Felda Settler
22. Md Salihin Sadimon	FPISB – HQ
23. Ahmad Nor Azman Jamin	FPISB – HQ
24. Eric Chan	EcoSecurities

Questions raised and answered during the event include the following:

QUESTION	ANSWER
1. What is the total investment of this project? By: Md. Zulkifli Ariffin – SOP	The total cost of this project is about RM.37 million
2. When the project will be completed and be fully operational?	The project is expected to be completed and fully operational in December 2003

By: Bensar Abd Hamid --Bulkers	
3. Is there any similar project for the biomass (100% empty bunch) power plant initiated by private sectors? By: Md Yusof Md Idris –Anika Asia	Not Yet. This project is a pioneer project for a biomass (100% empty bunch) power plant in Malaysia/world.
4. What is the technology to be employed in this project, what is the difference compared to conventional palm oil boiler system? By: Md. Khairudin Ali - KCP	The power plant will be a closed loop steam driven heat and power plant operating with combination of medium pressure boilers and multistage condensing cum extraction turbines.
5. Who is the main contractor for this project? By: Abd Razak Chulli – Bengkel Sabah	The main contractor for this project is Industrial Power Technology (IPT) Ltd. from Singapore.
6. What is the selling price of the electricity and steam supply? By: Rasakh Abdulla – Bell Plantation	The selling price is RM 0.21 / KWhr and RM.0.27 / kg of steam.
7. What is the pay back period of this project? By: Albert Lim – Jabatan Haiwan	The Payback period (Return of Investment) is 7.7 years.
8. Is there any consequence of this project to the water supply for the consumers in Sahabat Complex? By: Zamin Sinkoi – Felda Settler	There is no major impact to the water supply for the consumer. FPISB will ensure all infra structures for the water supply (pumps) will be upgraded.
9. What is the guarantee from FPISB that the project will comply with the Department of Environment (DOE) requirements? By: Md Sulkifli Ariffin - SOP	The machinery selection for this power plant project is done strictly and the contractor / vendor is to guarantee that the requirement of DOE can be achieved.
10. What are the benefits of the projects to the settler? By: Christain Awing – Felda Settler	Consistency in electricity supply, employment and healthy environment.