

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

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Revision history of this document

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

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SECTION A. General description of small-scale project activity**A.1 Title of the small-scale project activity:**

Environmentally Friendly Development by Multiple Use of *Jatropha curcas* in Indonesia

Version 1: 08/03/10

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

The purpose of the Project is to displace fossil fuel based electricity generation by producing and using Purified *Jatropha* Oil (PJO).

In the Project, Yayasan Dian Desa (YDD), an Indonesian NGO together with the local residents of Flores Island, will install PJO production plant on Flores, Indonesia in collaboration with the Asian People's Exchange (APEX), an NGO based in Japan. The PJO will be used to displace diesel oil currently being used in one of the existing power plants on the island leading to the reduction of greenhouse gas (GHG) emissions from the fossil-fuel fired power station.

The Project is part of a wider project that involves (a) reforestation of degraded lands by *Jatropha*, (b) extraction of fatty oil from harvested seeds and production of *Jatropha* oil through purification, (c) using *Jatropha* oil to displace diesel oil used in electricity generation, (d) electricity generation by gasification of biomass waste generated in the process leading to extraction of fatty oil, (e) composting of biomass waste generated in the *Jatropha* oil production, and (f) using waste heat generated by electricity generation for desalination of seawater.

The CDM project focuses on electricity generation using PJO as fuel and contributes to the sustainable development of Flores in the following ways.

1. Economic Dimension

Although Indonesia has its own petroleum reserve, it has become a net importer since 2004 due to rising domestic demand. By promoting indigenous and renewable energy production, the Project will reduce the country's dependence on expensive fossil fuel imports and reliance on foreign exchange. It will also enable energy production to become more economic and reliable by eliminating the risks associated with oil price fluctuation.

Moreover, the Project will create employment in the local community in the various processes of *Jatropha* cultivation and PJO production which results in sustainable increase in household income in one of the poorest regions in Indonesia.

2. Social Dimension

The Project will be implemented with proactive participation by local residents and will be set up in such a way that they can participate in a wide ranging manner. Not only will the Project improve the access of the local population to reliable renewable energy, but it will also bring substantial training and employment for the local community. In the end, the Project aims to improve quality of living by

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increasing household income and through community development.

3. Environmental Dimension

The Project will reduce current uncontrolled GHG emissions emitted from diesel powered electricity generation. Jatropha cultivation will also lead to reforestation of unused degraded land.

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)
Indonesia (host)	Yayasan Dian Desa (YDD)	No
Japan	Asian People's Exchange (APEX)	No

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):

Indonesia

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

East Nusa Tenggara Province
Sikka Regency

A.4.1.3. City/Town/Community etc:

Jatropha Cultivation

Reroroja Village
Magepanda Subdistrict, Sikka Regency, Nusa Tenggara Timur Province

PJO Production (Jatropha Center)

Wairbleler Village
Waigete Subdistrict, Sikka Regency, Nusa Tenggara Timur Province

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

Flores, an island located approximately 750 km east of Bali, is one of the islands including East Timor that constitute East Nusa Tenggara Province. Sikka Regency is situated in the eastern part of Flores that includes its capital Maumere. The geographical coordinates of Sikka Regency are between Latitude 8°22' to 8°50' and Longitude 121°55'40" to 122°41'30".

Reroroja Village where *Jatropha* cultivation will take place is located approximately 25 km northwest of Maumere while Wairbleler Village where the *Jatropha* Center will be built is located approximately 12 km east of Maumere.



Figure 1: Map of Flores

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

(1) Types and categories of the small-scale project activity

In accordance with Appendix B of the simplified modalities and procedures for small-scale CDM project

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activities (“SSC M&P”), the proposed project falls under the following types and categories:

AMS-I.A.

Type I: Renewal Energy Projects

Category A: Electricity generation by the user

Reference: Version 13, Scope 1 (in effect of 26 September 2008)

(2) Technology of the small-scale project activity

As stated in Section A.2., the purpose of the project activity is to reduce CO₂ emissions currently emitted into the atmosphere by the use of diesel oil in an existing power plant. The Project involves the following technical processes.

- Cultivation of Jatropha
- Harvesting of Jatropha seeds
- Oil pressing
- Purification leading to the production of PJO
- Supplying PJO and use of PJO at the power plant

The PJO production volume is forecast as follows.

Table 1: Forecast PJO production volume

	Volume of Jatropha seeds (tons)	Amount of PJO production (tons)
2010	192	50
2011	1,225	300
2012 onwards	1,575	400

The new equipments to be installed are a screw press for oil pressing and a purification unit. For oil pressing, a screw-press is chosen over a ram press or solvent extraction as the scale of oil production is not large enough to make the solvent extraction method economic and also as the screw press has a higher efficiency compared to the ram press. For purification of oil, the processes involved are solids removal by oil precipitation and filtering by a filter press, followed by de-gumming, de-acidification and cleansing. The purification process will be carried out so the produced PJO meets the DIN 51605 standard, a German quality standard adopted for the use of rapeseed oil as a fuel and also recommended for application in the Jatropha oil industry by the FACT Foundation.¹

The project participants have chosen to utilize PJO as it is produced instead of employing the esterification process to produce biodiesel as they want to make the Project as simple as possible so that the local community can independently operate the Project and also to conserve the energy input and costs involved in the production of the final product. PJO is proven to be an excellent diesel engine fuel

¹ FACT Foundation, 2009, Jatropha handbook 2nd edition, Chapter 4: Oil Pressing and Purification

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whereby any diesel engine can run on 100% PJO as long as the engine is heated sufficiently². Therefore, there will be no technical alteration required for the existing power generators.

The Project is a green-field activity where the abovementioned technologies will be newly installed. There are no similar facilities prior to the start of the project activity which is the same as the baseline scenario in this case.

The technologies to be introduced will be state-of-the-art technologies that are environmentally safe and sound. There will be significant technology transfer at all stages of project implementation including installation, operation and maintenance.

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

Table 2: Ex-ante estimation of emission reductions

Year	Estimation of overall emission reductions (tCO ₂)
2010	136.96
2011	852.96
2012	1,137.29
2013	1,137.29
2014	1,137.29
2015	1,137.29
2016	1,137.29
2017	1,137.29
2018	1,137.29
2019	1,137.29
Total estimated reductions (tonnes of CO ₂)	10,088.24
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period	1,008.82

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

The Project received approximately JPY25 million (TBC) from Ministry of Foreign Affairs of Japan as Grant Assistance for Japanese NGO Projects. However, this does not result in the diversion of Official Development Assistance as this grant is separate from and not counted towards the financial ODA obligations of Japan. Relevant documents will be submitted to verify this.

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

² Anso N., 2009. Direct fuel for cars and driving engines for shaft power or electricity generation—PPO. FACT Foundation, Jatropa Handbook 2nd edition, Chapter 5

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As defined in paragraph 2 of Appendix C of the SSC M&P, 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 a request for registration by another small-scale project activity:

- By the same project participants;
- In the same project category and technology/measure;
- Registered within the previous two 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 any larger project activity as there is no other small-scale project activity that fulfils the abovementioned criteria.

SECTION B. Application of a baseline and monitoring methodology

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

AMS-I.A.

Type I : Renewal Energy Projects

Category A: Electricity generation by the user

Reference : Version 13, Scope 1, in effect of 26 September 2008

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

The Project meets the following applicability conditions of AMS-I.A as it is a renewable energy generation project that supplies a group of households or users with electricity and the households and users under the Project currently received their electricity supply through an isolated mini-grid where the capacity of the generating units is under the 15 MW threshold set forth by AMS-I.A. (Capacity of the generating unit will be defined after the power plant is specified.) The renewable biofuel produced in the Project will replace existing fossil-fuel-fired generation and the generation capacity will remain the same.

It is noted that the Small-Scale Working Group of the CDM Executive Board has confirmed through SSC Clarification Number 302 that plant oil is indeed biomass that can be used in Type 1 activities as long as the plant oil can be defined as renewable biomass in accordance with the “Definition of Renewable Biomass” provided by the CDM Executive Board.³

The Jatropha seeds used in the Project, non-woody biomass originating from cropland, meet the requirements set forth under Paragraph 3 of the “Definition of Renewable Biomass” in the following manner:

Table 3: Requirements under “Definition of Renewable Biomass”

³ Report of Executive Board Meeting 23, Annex 18

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Requirements	Project activity
The land area remains cropland and/or grasslands or is reverted to forest.	Jatropha plantation is cropland and will remain so.
Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting).	Sustainable management practice will be ensured in cultivation and harvesting of Jatropha seeds so that the level of carbon stocks on these lands will not decrease. The level of carbon stock will in fact increase due to the project activity as the land area prior to Project implementation is seriously degraded.
Any national or regional forestry, agriculture and nature conservation regulations are complied with.	All national and regional forestry, agriculture and nature conservations regulations will be strictly adhered to.

In accordance with SSC Clarification Number 302, the plant production component of the Project is to be considered using AMS III.T. “Plant oil production and use for transport applications”.

B.3. Description of the project boundary:

The aforementioned SSC Clarification Number 302 indicates the need to include within the project boundary the area where cultivation of crop, production and processing of plant oil takes place in accordance with AMS III.T while AMS I.A. prescribes that the project boundary consists of the physical, geographical site of the renewable energy generating unit and the equipment that uses the electricity produced.

Combining the two, the project boundary includes the Jatropha plantation, the oil pressing and purification units and the supply and use of PJO as a fuel in the existing diesel electricity generator as demonstrated in the following diagram:

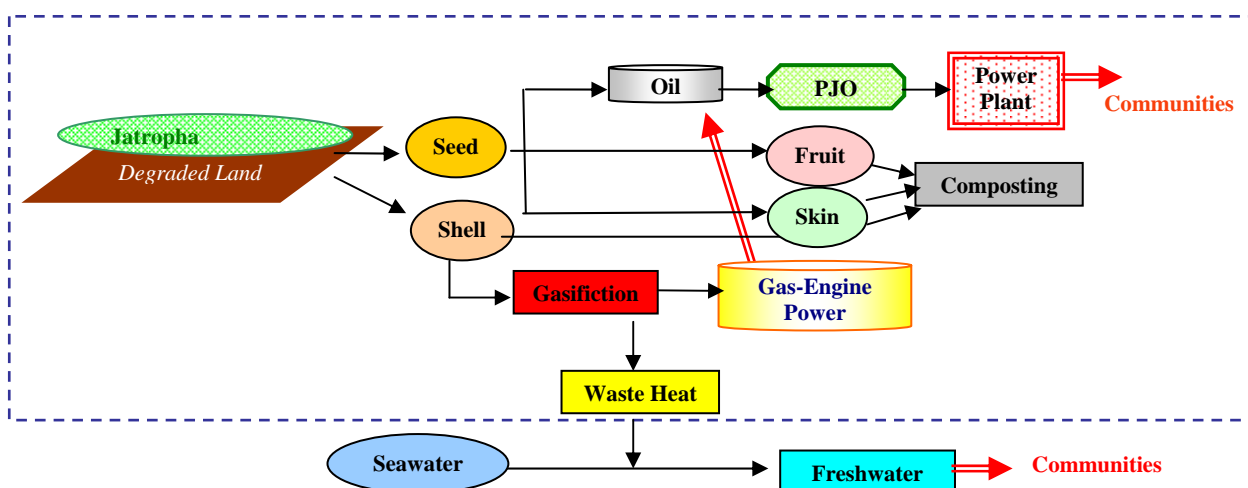


Figure 2: Project Boundary

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B.4. Description of baseline and its development:

In accordance with AMS I.A., the energy baseline is determined as “the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy”. In the case of the project activity where the current situation is the same as the scenario in the absence of the project activity, it would be the amount of diesel oil currently consumed in the existing power plant to produce the amount electricity that would be displaced by the PJO.

Of the three options provided by AMS I.A. to calculate the energy baseline, Option 3, where the baseline is a trend-adjusted projection of historic fuel consumption in situations where an existing technology is replaced.

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:

In line with the Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the Project is deemed to be additional if it faces at least one of the following barriers:

- (a) Investment barriers
- (b) Technological barriers
- (c) Barrier due to prevailing practice
- (d) Other barriers

The Project faces the following three barriers and therefore is additional.

Investment barrier

The Project is not intended to generate a profit. Although 80~90 % of the initial investment cost will be provided by the Japanese Ministry of Foreign Affairs, there is still not enough incentive for the local residents to continue the Project due to extremely low economic feasibility as a business operation considering the current fuel price. Income from CER sales is essential in continuing the Project.

Technological barrier

Although Jatropha has attracted much attention recently as an alternative fuel source, there have been very few success stories. The reasons are related to the fact that forming a consistent system of Jatropha cultivation starting from selection of good quality seedlings and their cultivation to planting, maintenance, harvesting, pressing and purification is not easy and associated technologies are not fully established. Moreover, the Project is not limited to cultivation of Jatropha and pressing and purification of the fatty oil. The Project will aim to effectively utilise waste materials generated from the production process in a multi-dimensional manner. Since it is a new endeavour, there are no established technologies for waste material utilization at each stage of production starting from seedling rearing to fatty oil utilization.

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As explained, the Project faces a significant technological barrier and the Project cannot take place without the technical support, education and training provided by the project participants, APEX and YDD who will not be able to operate the Project without financial gain through the sale of CERs.

Barrier due to prevailing practice

The slash-and-burn method is typically attempted to increase crop yields in East Nusa Tenggara Province, including Reroroja Village, the project location, as most farmers cannot afford to buy fertilizer to compensate for low crop yields due to the poor condition of the soil. Although slash-and-burn is illegal in the project areas, the situation has not been rectified. In the absence of the Project the local residents would undoubtedly continue the slash-and-burn practice. APEX and YDD will provide support for the greening of degraded land and multiple usage of *Jatropha* through the incentives provided by CDM.

B.6. Emission reductions:**B.6.1. Explanation of methodological choices:**

The baseline scenario of the Project is the continued generation of electricity through a diesel-fuelled power plant. AMS-I.A. is applied in calculating baseline emissions while AMS-III.T. is partially applied in calculating project emissions as previously discussed in Section B.2.

Baseline Emissions

Baseline emissions are calculated using Option 3 provided in AMS-I.A. based on the historic fuel consumption of the existing technology. Calculations are carried out in the following manner.

$$\begin{aligned}
 BE_y &= \sum FC_{j,y} \times NCV_j \times EF_{CO_2,j} \\
 &= \sum FC_{k,y} \times NCV_k \times EF_{CO_2,j}
 \end{aligned}
 \tag{Equation 1}$$

Where:

Parameter	Description	Unit	Value	Source
BE_y	Emissions in the baseline in year y	tCO ₂		
$FC_{j,y}$	Amount of fuel consumption of fuel type j mass or volume unit in year y	tons		
NCV_j	Net calorific value of fuel type j	GJ/ton		
$EF_{CO_2,j}$	CO ₂ emission factor of fuel type j	tCO ₂ /GJ	0.0741	IPCC 2006
$FC_{k,y}$	Amount of fuel consumption of fuel type k mass or volume unit in year y	tons	Year 1: 50 Year 2: 300 Year 3	Project participants

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			onwards: 400	
NCV_k	Net calorific value of fuel type k	GJ/ton	39.77 ⁴	
j	Existing fuel replaced by the Project (diesel oil)			
k	Fuel type of the Project (PJO)			

Project Emissions

AMS-I.A. does not provide for any source of project emissions. However, as SSC Clarification Number 302 specifies, projects that involve renewable biomass as a fuel source shall include cultivation of crops and production and processing of plant oil within the project boundary. Project emissions from these sources are to be accounted for in accordance with AMS-III.T.

Estimation of project emission is carried out as follows.

$$PE_y = PE_{FA,k,y} + PE_{OFP,k,y} \quad \text{Equation 2}$$

Parameter	Description	Unit	Value	Source
PE_y	Total project emissions from plant oil production (tCO _{2e} /ton plant oil produced) in year y	tCO ₂		
$PE_{OFP,k,y}$	Project emissions from energy use for oil-seed processing (e.g. pressing and filtering) of crop k in year y	tCO ₂	Year 1: 10.38 Year 2: 31.12 Year 3 onwards: 41.49	Equation 3
$PE_{FA,k,y}$	Project emissions of N ₂ O in cultivation of crop k in year y	tCO _{2e}	0	Equation 4
k	Fuel type of the Project (PJO)			

Project emissions from energy use for processing (e.g. pressing and filtering) of plant oil

$$PE_{OFP,k,y} = EC_{OFP,k,y} \times EF_{CO_2,ELEC} + \sum_i (FC_{OFP,j,k,y} \times NCV_j \times EF_{CO_2,j}) \quad \text{Equation 3}$$

Parameter	Description	Unit	Value	Source
$PE_{OFP,k,y}$	Project emissions from energy use for oil-seed processing (e.g. pressing and filtering) of crop k in year y	tCO ₂	Year 1: 10.38 Year 2: 31.12 Year 3 onwards:	Calculated

⁴ Kumar, A., Sharma, S., 2008. An evaluation of multipurpose oil seed crop for industrial uses (Jatropha curcas L.): A review. Industrial Crops and Products 28, 1-10

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			41.49	
$EC_{OFF,k,y}$	Electricity consumption in processing (e.g. pressing and filtering) for crop k in year y	MWh	0	Project participants
$EF_{CO_2,ELEC}$	Emissions factor for grid electricity supplied to the project plant using the calculation methods of AMS I.D	tCO ₂ e/MWh	-	
$FC_{OFF,j,k,y}$	Consumption of diesel oil for filtering and pressing for crop k in year y	tons	Year 1: 3.26 Year 2: 9.77 Year 3 onwards: 13.02	Project participants
NCV_j	Net calorific value of diesel oil	GJ/ton	43	IPCC
$EF_{CO_2,j}$	Emissions factor of diesel oil	tCO ₂ /GJ fuel	0.0741	IPCC

The Project will not import any electricity from grid. On the other hand, the Project will install a biomass gasification power plant to supply in-house electricity for processing of Jatropha oil. The power plant will co-fire diesel oil and gaseous fuel produced from gasification of Jatropha shells. Only diesel oil is considered in calculating the project emissions as gaseous fuel from gasification process, which is biomass origin, is carbon-neutral.

N₂O emissions resulting from either from fertilizer application and/or from nitrogen in crop residues (above-ground and below-ground)

$$PE_{FA,k,y} = \left[(F_{ON,k,y} + F_{SN,k,y} + F_{CR,k,y}) \times EF_{N_2O_direct} \right] \times \frac{44}{28} \times GWP_{N_2O} \quad \text{Equation 4}$$

Parameter	Description	Unit	Value	Source
$PE_{FA,k,y}$	Project emissions of N ₂ O in cultivation of crop k in year y	tCO ₂ e	0	Calculated
$F_{ON,k,y}$	Amount of organic fertilizer nitrogen applied in crop k in year y	ton N	0	Project participants
$F_{SN,k,y}$	Amount of synthetic fertilizer nitrogen applied in crop k in year y	ton N	0	Project participants
$F_{CR,k,y}$	Amount of N in residues of crop k in year y . For N-fixing crops like soybean F _{CR} shall be taken into account. For other types of crops F _{CR} can be ignored. F _{CR} shall be calculated in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol 4, chapter 11	ton N	0	Project participants
$EF_{N_2O_direct}$	N ₂ O emission factor for emissions	ton N ₂ O-	0.01	IPCC

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	from N inputs. A default value of 0.01 can be taken in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol 4, Table 11.1 p.11.26	N/ton N input		
GWP_{N_2O}	Global warming potential of N ₂ O	tCO _{2e} /tN ₂ O	310	IPCC

The Project will only use compost produced from fruit and seed husks collected through the pressing and purification process and will not use any organic or synthetic fertilizer. Therefore, the Project, without any external nitrogen input, will not generate any N₂O. N₂O emission is zero.

Leakage

AMS-I.A. states that leakage is to be considered when the power plant used in the Project is transferred from another activity or if the existing equipment is transferred to another activity. Since this is not the case in the Project, leakage attributed to equipment transfer is zero.

AMS-III.T. provides three following cases where leakage shall be considered:

- (1) If equipment is transferred from another activity or if the existing equipment is transferred to another activity.
- (2) In case there is a shift of pre-project activities.
- (3) In case plant oil is produced in the baseline situation in the area of land where plant oil is cultivated in the project situation, the competing use of biomass shall be taken into account.

(2) and (3) above are to be considered in accordance with “the general guidance on leakage in biomass project activities” for small scale projects.

Transfer of equipment

As for (1), the Project will use an existing power plant that currently supplies electricity to the same households to which the Project will supply electricity; therefore, there is no transfer of equipment either from or to another activity. Therefore, there is no leakage from the transfer of equipment.

Shift of pre-project activities

With regards to (2), Paragraph 7 of “the general guidance on leakage in biomass project activities” states that leakage effects due to shifts in pre-project activities may be neglected where the land would not be used in the absence of the project activity. The land used for cultivation of Jatropha seeds in the Project has not been used for many years due to its degraded condition. There is no incentive to develop the land without the financial merits provided by the CDM framework. As such, leakage related to the shift of project activities is zero.

Competing use of biomass

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For (3), Paragraph 17 of “the general guidance on leakage in biomass project activities” indicates that competing uses for biomass are not relevant where the biomass is generated as part of the project activity, such as new forests or cultivations.

In summary, there is no leakage as a result of the Project.

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

(Copy this table for each data and parameter)

Data / Parameter:	$EF_{CO_2,j}$
Data unit:	tCO ₂ /GJ
Description:	CO ₂ emission factor of diesel oil
Source of data used:	IPCC 2006
Value applied:	0.0741
Justification of the choice of data or description of measurement methods and procedures actually applied :	No reliable national, regional or local data are available; therefore the IPCC default value is used.
Any comment:	

Data / Parameter:	NCV_j
Data unit:	GJ/ton
Description:	Net calorific value of diesel oil
Source of data used:	IPCC 2006
Value applied:	43
Justification of the choice of data or description of measurement methods and procedures actually applied :	No reliable national, regional or local data are available; therefore the IPCC default value is used.
Any comment:	

Data / Parameter:	-
Data unit:	tons/kWh
Description:	Specific fuel consumption of biomass fuel used in the Project power plant (Amount of fuel consumption per unit of electricity generated)
Source of data used:	Specific fuel consumption of PJO will be calculated.
Value applied:	
Justification of the	Specific fuel consumption should be specified ex-ante.

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choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	-
Data unit:	ton/kWh
Description:	Specific fuel consumption of fossil fuel used in the Project power plant. (Amount of fuel consumption per unit of electricity generated)
Source of data used:	Specific fuel consumption of diesel oil will be calculated.
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Specific fuel consumption should be specified ex-ante.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline Emissions

As per Equation 1 and input data as shown in the baseline emissions calculations under Section B.6.1, baseline emissions are calculated as follows:

Year 1

$$\begin{aligned}
 BE_y &= \sum FC_{j,y} \times NCV_j \times EF_{CO_2,j} \\
 &= \sum FC_{k,y} \times NCV_k \times EF_{CO_2,j} \\
 &= 50 \text{ tons} \times 39.77 \text{ GJ/ton} \times 0.0741 \text{ tCO}_2 / \text{GJ} \\
 &= 147.34 \text{ tCO}_2\text{e}
 \end{aligned}$$

Year 2

$$\begin{aligned}
 BE_{CO_2,y} &= 300 \text{ tons} \times 39.77 \text{ GJ/ton} \times 0.0741 \text{ tCO}_2 / \text{GJ} \\
 &= 884.08 \text{ tCO}_2\text{e}
 \end{aligned}$$

Year 3~10

$$BE_{CO_2,y} = 400 \text{ tons} \times 39.77 \text{ GJ/ton} \times 0.0741 \text{ tCO}_2 / \text{GJ}$$

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$$= 1,178.78 \text{ tCO}_2\text{e}$$

Project Emissions

As per Equation 2 and input data listed in project emissions calculation under Section B.6.1, emissions from the project activities are calculated as follows.

Year 1:

$$PE_y = PE_{FA,k,y} + PE_{OFP,k,y}$$

$$= 0 + 10.38$$

$$= 10.38 \text{ tCO}_2\text{e}$$

Year 2:

$$PE_y = PE_{FA,k,y} + PE_{OFP,k,y}$$

$$= 0 + 31.12$$

$$= 31.12 \text{ tCO}_2\text{e}$$

Year 3~10:

$$PE_y = PE_{FA,k,y} + PE_{OFP,k,y}$$

$$= 0 + 41.49$$

$$= 41.49 \text{ tCO}_2\text{e}$$

Emissions Reduction

Year 1:

$$ER_y = BE_y - PE_y - LE_y$$

$$= 147.34 - 10.38 - 0$$

$$= 136.96 \text{ tCO}_2\text{e}$$

Year 2:

$$ER_y = BE_y - PE_y - LE_y$$

$$= 884.08 - 31.12 - 0$$

$$= 852.976 \text{ tCO}_2\text{e}$$

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Year 3~10:

$$ER_y = BE_y - PE_y - LE_y$$

$$= 1,178.78 - 41.49 - 0$$

$$= 1,137.29 \text{ tCO}_2\text{e}$$

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

	Baseline emissions	Project emissions	Leakage	Emissions Reduction
2010	147.34	10.38	0	136.96
2011	884.08	31.12	0	852.96
2012	1,178.78	41.49	0	1,137.29
2013	1,178.78	41.49	0	1,137.29
2014	1,178.78	41.49	0	1,137.29
2015	1,178.78	41.49	0	1,137.29
2016	1,178.78	41.49	0	1,137.29
2017	1,178.78	41.49	0	1,137.29
2018	1,178.78	41.49	0	1,137.29
2019	1,178.78	41.49	0	1,137.29
Total (tonnes of CO₂e)	10,461.66	373.42	0	10,088.24

B.7 Application of a monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:***(Copy this table for each data and parameter)***Data/Parameters to be monitored in accordance with AMS-IA.**

Data / Parameter:	-
Data unit:	kWh/year
Description:	Annual output of electricity generated by the Project power plant
Source of data used:	Amount of electricity generated at the power plant will be continuously monitored by electricity meters by the project participants.
Value of data	n/a
Description of measurement methods and procedures to be applied:	Measured continuously using electricity meters.

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QA/QC procedures to be applied:	Electricity meters will undergo maintenance/calibration in accordance with appropriate industry standards.
Any comment:	

Data / Parameter:	$FC_{k,y}$
Data unit:	tons/year
Description:	Amount of fuel consumption of fuel type k mass or volume unit in year y
Source of data to be used:	Amount of PJO input in the power plant will be continuously monitored by the project participants.
Value of data	Year 1: 50 Year 2: 300 Year 3 onwards: 400
Description of measurement methods and procedures to be applied:	Continuously measured.
QA/QC procedures to be applied:	The meter will undergo maintenance/calibration in accordance with appropriate industry standards.
Any comment:	

Data / Parameter:	-
Data unit:	tons/year
Description:	Amount of fuel consumption of fuel type j mass or volume unit in year y
Source of data to be used:	Amount of diesel oil input in the power plant will be continuously monitored by the project participants.
Value of data	n/a
Description of measurement methods and procedures to be applied:	Measured continuously using a flow meter.
QA/QC procedures to be applied:	The meter will undergo maintenance/calibration in accordance with appropriate industry standards.
Any comment:	

Data/Parameters to be monitored in accordance with AMS-III.T.

Data / Parameter:	NCV_k
Data unit:	GJ/ton
Description:	Net calorific value of PJO
Source of data to be used:	Sample of PJO produced at the Project site will be measured
Value of data	39.7 (Kumar, A., Sharma, S., 2008. An evaluation of multipurpose oil seed crop for industrial uses (<i>Jatropha curcas</i> L.): A review. Industrial Crops and Products 28,

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	1-10)
Description of measurement methods and procedures to be applied:	Laboratory measurement will be conducted per production lot.
QA/QC procedures to be applied:	Comparison of measurement result with literature source.
Any comment:	

Data / Parameter:	-
Data unit:	tons/year
Description:	Crop harvest per crop source per production location
Source of data used:	Amount of Jatropha seeds harvested at the Project site will be weighed by scale per harvest.
Value of data	Year 1: 192 Year 2: 1,225 Year 3 onwards: 1,575
Description of measurement methods and procedures to be applied:	Measured at each harvest and aggregated annually.
QA/QC procedures to be applied:	The scale will undergo maintenance/calibration in accordance with appropriate industry standards.
Any comment:	

Data / Parameter:	-
Data unit:	%
Description:	Oil content of oil seeds
Source of data used:	Fraction of oil content of Jatropha seeds cultivated in the Project
Value of data	25
Description of measurement methods and procedures to be applied:	Oil content will be determined by random sampling taken monthly and averaged annually
QA/QC procedures to be applied:	Samples are processed by a qualified technician according to the recognized international standards.
Any comment:	

Data / Parameter:	-
Data unit:	tons/year
Description:	Amount of purified Jatropha oil produced per year
Source of data used:	Amount of PJO produced will be monitored continuously by flow meter.

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Value of data	Year 1: 50 Year 2: 300 Year 3 onwards: 400
Description of measurement methods and procedures to be applied:	Measured continuously by a meter
QA/QC procedures to be applied:	The meter will undergo maintenance/calibration in accordance with appropriate industry standards.
Any comment:	Ex-ante estimation is based on projected production

Data / Parameter:	-
Data unit:	ha
Description:	Area of plant oil production
Source of data used:	Area of Jatropha seeds cultivation will be monitored by land survey ever year.
Value of data	Year 1: 80 ha Year 2 onwards: 200 ha
Description of measurement methods and procedures to be applied:	Field survey
QA/QC procedures to be applied:	The flow meter will undergo maintenance/calibration in accordance with appropriate industry standards.
Any comment:	Ex-ante estimation is based on projected production

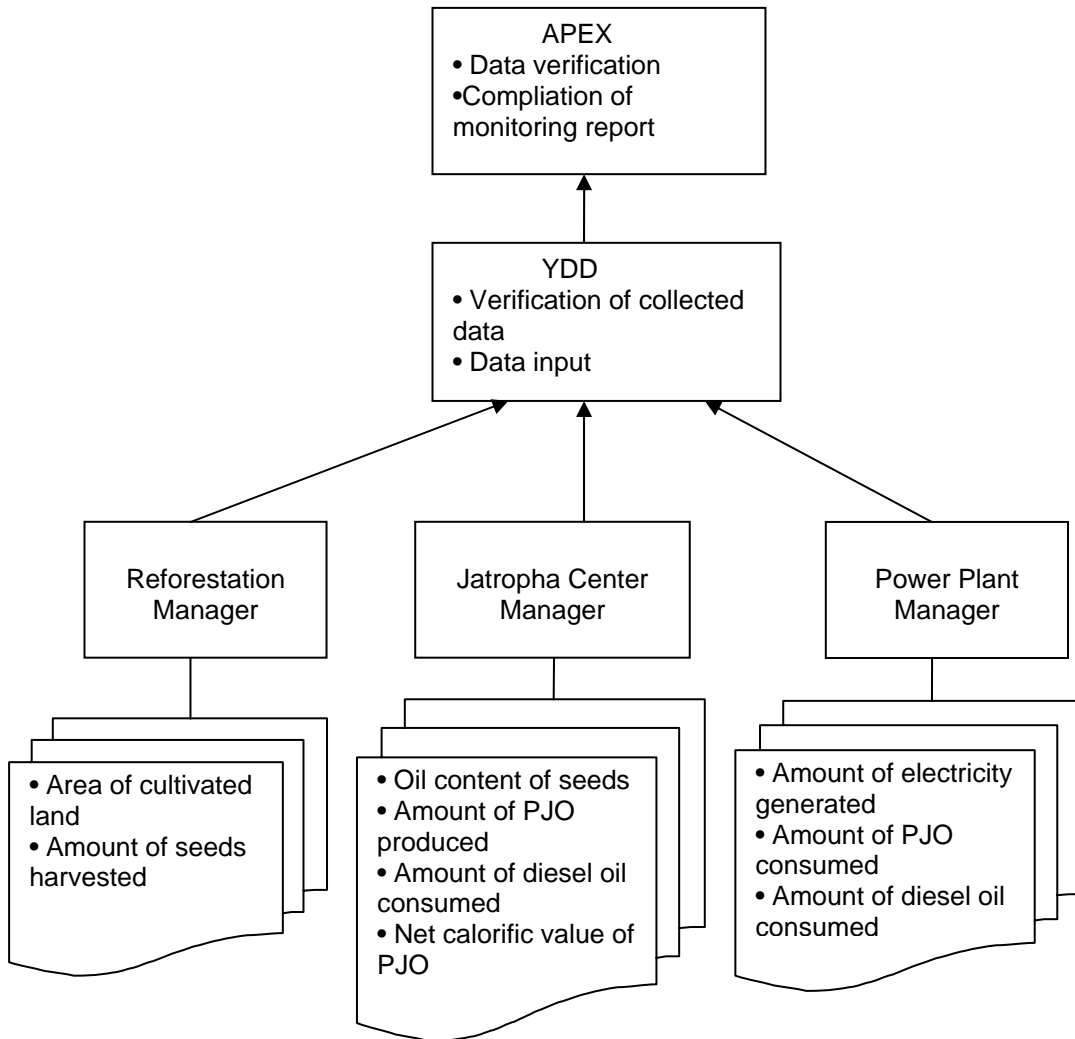
Data / Parameter:	$FC_{OFP,j,k,y}$
Data unit:	tons/year
Description:	Consumption of fossil diesel oil for filtering and pressing for crop k in year y
Source of data used:	Amount of diesel oil used for filtering and pressing of Jatropha seeds will be monitored continuously by a flow meter.
Value of data	Year 1: 3.26 Year 2: 9.77 Year 3 onwards: 13.02
Description of measurement methods and procedures to be applied:	Measured continuously by a meter
QA/QC procedures to be applied:	The meter will undergo maintenance/calibration in accordance with appropriate industry standards.
Any comment:	Ex-ante estimation based on projected electricity consumption, required amount of diesel oil, power plant efficiency and heat value of diesel. Details are found

in Annex 4.

B.7.2 Description of the monitoring plan:

All monitoring equipment will be installed by experts and regularly calibrated to the highest standards by YDD and fully supported by APEX. YDD and APEX will form a team to maintain and operate the project activity and to monitor the parameters required by the two applicable methodologies. YDD and APEX will provide staff training in cooperation with experts concerning the operation of all monitoring equipment. The management will supervise all readings to be taken and recorded in a systematic and transparent manner. The monitoring plan will be developed outlining which quality control and assurance procedures are to be undertaken for data monitoring.

The monitoring team will consist of the members as described in the following diagram. Each manager will oversee one to two staff members who are responsible for regular collection of monitoring data. Managers will compile the data and report to YDD. YDD, after data verification and entry of the data into the database, will report to APEX. APEX will hold the final responsibility for the contents of data verification and monitoring reports.



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Figure 3: Monitoring Structure

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

The baseline and monitoring study was completed in 22/01/10 by:

Clean Energy Finance Committee
Mitsubishi UFJ Securities Co., Ltd. (MUS)
2nd Floor, KR Toyosu Building,
5-4-9, Koto-ku, Tokyo 135-0061, Japan
watanabe-hajime@sc.mufg.jp

MUS is not a project participant.

SECTION C. Duration of the project activity / crediting period**C.1 Duration of the project activity:****C.1.1. Starting date of the project activity:**

dd/mm/yyyy

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

10 years

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

Fixed crediting period is chosen for the project activity.

C.2.1. Renewable crediting period

N/A

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

N/A

C.2.1.2. Length of the first crediting period:

N/A

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C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

dd/mm/yyyy

C.2.2.2. Length:

10 years

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

In Indonesia, where the Project is located, the environmental impact assessment system (AMDAL) set forth in Government Ordinance No. 27 is enforced in order to include major environmental impacts in the decision making of businesses and other activities. However, AMDAL is not required for the Project due to the following factors:

- The area required for the Jatropha plantation is 200 ha, below the threshold of 3,000 ha for agricultural product cultivation outside forest areas.
- The area required for Jatropha processing (pressing and purification) is 0.9 ha, below the 30 ha threshold for other industry categories under which the Project is classified.
- The capacity of electricity generation will be less than 10 MW, the threshold for electricity generation projects.

Instead of ADMAL, submissions of an Environmental Management Plan (UKL: Upaya Pengelolaan Lingkungan Hidup) and Environmental Monitoring Plan (UPL: Upaya Pemantauan Lingkungan Hidup) with more simplified procedures are required. UKL and UPL are prerequisites for obtaining the project operation license. UKL and UPL include the following contents.

- Information concerning the project developer and/or project owner
- Outline of the project plan
- Environmental impacts of the project
- Environmental management and environmental monitoring plans
- Signature and seal

Preliminary assessments have been made by the project participants with regards to the impacts on air quality, water quality and noise, vibration and odour. Details are as follows:

Air quality and emission standards of exhaust gases

The only exhaust gas emission foreseen in the Project is exhaust gas from that diesel power generator that will supply power to pressing and purification processes. The amount of exhaust gas emission will be small and is expected to come below the maximum exhaust gas emission allowed for industry category

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(“other industry”) under which the Project is classified as set forth by Environment Minister’s Decree Number 13 of 1995 concerning emission standards for stationary sources.

Water quality and effluent standards

Standards for industrial effluents are set forth by Environment Minister’s Decree Number 51 of 1995 concerning the effluent standards of industries. The effluent from the Jatropha processing plant will be treated biologically and applied to soil. The Project is expected to meet the effluent standards for the soap, chemical detergent and plant oil industry.

Noise, vibration and odour

Environmental standards for noise, vibration and odour are set forth by Environment Minister’s Decree Number 48 of 1996 concerning noise standards, Environment Minister’s Decree Number 49 of 1996 concerning vibration standards and Environment Minister’s Decree Number 50 of 1996 concerning odour standards respectively.

The Project will not generate much noise or vibration, however consideration needs to be made in relation to odour as compost will be produced using waste materials generated from the pressing process.

Details of all standards mentioned are listed in Annex 5.

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:

SECTION E. Stakeholders’ comments

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

Comments from local stakeholders were invited in the following three separate meetings.

- (1) Meeting with local residents represented by the heads of Magepanda Subdistrict and Reroroja Village where the Project will be located.
- (2) Meeting with the Government of Sikka Regency
- (3) Meeting with East Flores Branch of PLN, a power company

Meeting with local residents represented by the heads of Magepanda Subdistrict and Reroroja Village

A meeting with was held on 26 August 2009 at the temporary healthcare office of Duri District, Reroroja Village. The meeting was announced by the heads of the villages and the villagers were invited to the meeting.

The meeting was attended by the following people:

- Mr. Silvestor Saka, Head of Magepanda Subdistrict

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- Mr. Cirylianus Badjo, Chief of Reroroja Village
- 60 Reroroja Village residents
- Staff members of APEX (project participant)

After statements were made by the two heads of local municipalities, local residents were invited to express their opinions and ask questions freely.

Meeting with the Government of Sikka Regency

A meeting was held on 27 August 2009 at the Office of the Sikka Regency Government and was attended by the following people in addition to staff members from APEX:

Table 4: List of participants at the meeting with Sikka Regency

No	Names of participant	Title
1	Sosimus MITANG	Governor of Sikka Regency
6	Cyprianus DA COSTA	Assistant, Economic Development Department
7	LUKMAN	Head of Natural Resources Division Department
8	Herman BELA	Director-General, Land Management Department
9	Elkana M. HALE	Staff, Land Management Department
10	Rodja a. NATSIR	Director-General, Forest Department
11	Blasius P. PARERA	Head of Regional Development and Investment Agency
12	Kornelis NGGALA	Head of Welfare and National Policy Office, Head of Regional Social Security Office
13	Simon SUBSIDI	Head of Local Resident Development Commission
14	Yakobus REGANG	Staff, Public Works Department
15	Silvester SAKA	Head, Magepanda Subdistrict
16	Lodovikus LOTAK	Director, Social Department, Regional Office of Sikka Regency
17	A.A.G. CONTERIUS	Director, Development Department, Regional Office of Sikka Regency
18	Endang SRI	Director, Economic Department, Regional Office of Sikka Regency
19	Valerianus SAMADOR	Director, Food Security and Research Division
20	Ferdinandus FLORIANUS	Director-General, Farms and Livestock Department
21	A.B. SATRIO	Director, Mines and Energy Division, Public Works Department
22	Mauritz DA CUNHA	Director, Environment Division, Public Works Department
23	G.K. UBA	Director-General, Industry and Commerce Department

Meeting with East Flores Branch of PLN

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A meeting was held on 9 October 2009 and was attended by the following people in addition to staff members of APEX and CDM consultants:

- Robert Rumapea, Head of East Flores Branch, PLN and 6 other staff members

E.2. Summary of the comments received:

Summary of the comments received are as follows.

Meeting with local residents represented by heads of Magepanda Subdistrict and Reroroja Village

Table 5: List of participants and comments at the meeting in Reroroja Village

Participant	Comments
Mr Silvester Saka, Head of Magepanda Subdistrict	<ul style="list-style-type: none"> - Magepanda Subdistrict strongly supports the Project. - Jatropha is a suitable plant for the region and the Project will contribute to the economic development of the village - Expect similar projects will be developed in other villages
Mr Cirylianus Badjo, Chief of Reroroja Village	<ul style="list-style-type: none"> - Expect the Project will bring improved income and quality of life to the villages - Should place an inspector to prevent animals from harming the seedlings and watch for bushfires. - The perimeter of the plantation area should be removed of weeds by herbicides to prevent fire spreading. - Recommends a small reservoir for watering the plantation during the dry seasons. - The purchase price of cultivated Jatropha seeds should be clearly proposed. - Wants local labour used for the Project. - The Village will provide land for the Project. - The Village is ready to assist the Project until it succeeds - Residents welcome the Project - Wants more explanation be given to the local residents as clear understanding of the Project will motivate the residents to contribute even more to the Project.
Local Residents	<ul style="list-style-type: none"> - Welcome the Project. - Want to be paid for labour in plantation and cutting weeds. - The Project should not replace crops currently being harvested. - Want high purchasing price for Jatropha seeds so residents have more motivation and the local economy will improve. - A small reservoir should be made to be used for watering during dry seasons. - Security posts should be placed in each plantation so residents in each area can inspect and ensure proper growth of Jatropha. - Suggest children be taught about the Project in schools so they understand the meaning and objective of the Project and will not harm the seedlings.

Meeting with the government of Sikka Regency

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Table 6: List of participants and comments at the meeting with Sikka Regency

Participant	Comments
Sosimus Mitang, Governor of Sikka Regency	<ul style="list-style-type: none"> - Sikka Regency supports the Project. All departments related to the Project should give support. - Wants similar projects in other parts of the regency. - Wants pressing and purification conducted inside the Regency. - Usage and stable sales of the oil are important for the Project to continue. - Certificate concerning land ownership should be issued to clarify plantation land ownership and prevent ownership problems.
Blasius P. PARERA, Head of Sikka Regency Regional Development and Investment Agency	<ul style="list-style-type: none"> - Please liaise with regional government bodies throughout the course of project development
Mauritz DA CUNHA, Director of Environment Division, Public Works Department	<ul style="list-style-type: none"> - It is important that local residents can earn income through Jatropha cultivation in order for the Project to continue. A secure supply of seeds must be purchased by APEX and YDD. The purchasing price should be set as to ensure the continuation of the Project as well as meet the needs of residents. - It is necessary to sort out the land ownership certificate issue

Meeting with East Flores Branch of PLN**Table 7: List of participants and comments at the meeting with PLN**

Participant	Comments
Robert Rumapea, Head, East Flores Branch, PLN	<ul style="list-style-type: none"> - Think highly of the Project. - PLN welcomes any supply of Jatropha oil however small. - It is important to secure the buyer of the seeds and user of the oil.
PLN technical staff	<ul style="list-style-type: none"> - Wants to know if any modification to the existing power station is required. (There is no need for requirement)

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

The statements made at all aforementioned meetings were duly acknowledged and the project participants will continue to follow through with concerns raised by the stakeholders by closely liaising with all parties involved in the Project.

Responses by project participants given to individual concerns raised by local residents of Magepanda Subdistrict and Reroroja Village are as follows:

Table 8: List of comments and responses at the meeting in Reroroja Village

Comment	Response
<ul style="list-style-type: none"> - Want to be paid for labour in plantation and cutting weeds. 	APEX will ensure that all seeds harvested will be purchased. Plantation, cultivation and harvesting will be carried out by residents voluntarily.

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<ul style="list-style-type: none"> - The Project should not replace crops currently being harvested. 	<p>The Project will be located in unused, degraded land; therefore, will not replace any existing crop.</p>
<ul style="list-style-type: none"> - Want high purchasing price for Jatropha seeds so residents have more motivation and the local economy will improve. 	<p>Want to seek a suitable price for both parties as the purchasing price is important. Should be balanced with the price of diesel.</p>
<ul style="list-style-type: none"> - A small reservoir should be made to be used for watering during dry seasons. 	<p>Will consider it if necessary. Labour and water tank will be required to store water. Will wait for the rainy season before deciding.</p>
<ul style="list-style-type: none"> - Security posts should be placed in each plantation so residents in each area can inspect and ensure proper growth of Jatropha. 	<p>Inspection is already being carried out.</p>
<ul style="list-style-type: none"> - Suggest children be taught about the Project in schools so they understand the meaning and objective of the Project and will not harm the seedlings. 	<p>Agree and will be conducted.</p>

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Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	APEX
Street/P.O.Box:	1-5-12 Taitou-ku, Negishi
Building:	Inoume Building
City:	
State/Region:	Tokyo
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Country:	Japan
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FAX:	+81-3-3875-9306
E-Mail:	tokyo-office@apex-ngo.org
URL:	http://www.apex-ngo.org/
Represented by:	
Title:	Executive Director
Salutation:	
Last Name:	Inoue
Middle Name:	
First Name:	Hitoshi
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Yayasan Dian Desa
Street/P.O.Box:	Jl. Kaliurang Km.7
Building:	Jurugsari IV/19
City:	Yogyakarta
State/Region:	
Postfix/ZIP:	55281
Country:	Indonesia
Telephone:	+62-274-885423
FAX:	+62-274-885423
E-Mail:	
URL:	
Represented by:	
Title:	Director
Salutation:	
Last Name:	Soejarwo
Middle Name:	
First Name:	Anton
Department:	

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Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2**INFORMATION REGARDING PUBLIC FUNDING**

The Project received approximately JPY25 million (TBC) from Ministry of Foreign Affairs of Japan as Grant Assistance for Japanese NGO Projects. However, this does not result in the diversion of Official Development Assistance as this grant is separate from and not counted towards the financial ODA obligations of Japan. Relevant documents will be submitted to verify this.

Annex 3**BASELINE INFORMATION**

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Annex 4**MONITORING INFORMATION**

The amount of diesel oil used for filtering and pressing of Jatropha seeds, the data required for monitoring, is estimated *ex-ante* in the following manner for the purpose of calculating project emissions.

Table 1: Electricity required for production of 400 tons of PJO

Process	Equipment	Capacity (kW)	Number of Units (unit)	Operating Hours (hr/year)	Electricity Consumption (kWh)
Shelling	Shelling Machine	2.25	3	1,575	10,631
Pressing	Screw Press	18.5	3	1,575	87,413
Purification	Filter Press	2.25	2	1,575	7,088
	Mixer	1.5	1	412	618
	Oil Pump	0.75	3	75	169
	Boiler	0.75	1	1,575	1,181
	Lighting	2	1	1,575	3,150
Total					110,250

The electricity demand listed above will be met by in-house electricity generation using diesel oil and electricity generation through gasification of Jatropha shells. The expected output of electricity generation by fixed-bed gasification is projected at 60-140 kW. As gaseous fuel is expected to be co-fired with the diesel oil and is expected to take approximately two (2) hours to reach normal operation, electricity will be supplied by gasification for 5 hours out of 7 hours of daily operation. At the same time, gaseous fuel and diesel oil will be co-fired at a ratio of 7:3. In other words, it is estimated that 50% of electricity consumption ($5/7 \times 0.7 = 0.5$) will be displaced by gaseous fuel. As electricity generation through gasification will only be implemented from the second year of project operation, annual electricity consumption, the amount of electricity displaced by gaseous fuel and the amount of diesel consumption are estimated as described in Table 8.

Table 8: Calculation of the amount of diesel oil consumed for the pressing and purification process of Jatropha oil

	PJO Production (ton)	Electricity Consumption (kWh)	Electricity generated by diesel oil fuel (kWh)	Efficiency (%)	Calorific Value (MJ)	Amount of diesel oil consumed (ton)
Year 1	50	13,781	13,781	35.45	139,951	3.26
Year 2	300	82,688	41,344	35.45	419,852	9.77
Year 3-10	400	110,250	55,125	35.45	559,803	13.02

Annex 5**ENVIRONMENTAL STANDARDS****Table 1: Exhaust gas standards for other industries**

Other Industry	
Item	Maximum (mg/m ³)
NH ₃	0.5
Cl ₂	10
HCl	5
HF	10
NO ₂	1000
Opacity	35%
Dust	350
SO ₂	800
H ₂ S	35
Hg	5
As	8
Sb	8
Cd	8
Zn	50
Pb	12

(Source: Environment Minister's Decree Number 13 of 1995)

Note: The amount of exhaust gas is measured as dry gas in standard conditions (25°C, 1 atm)

Table 2: Effluent standards for the soap, chemical detergent and plant oil industry**(a) In case of large amount of effluent per unit of production**

Item	Maximum (mg/L)	Maximum discharge allowed for pollutants (kg/t)		
		Soap	Plant Oil	Chemical Detergent
BOD	125	2.5	7.50	0.75
COD	300	6.0	18.0	1.8
TSS	100	2.0	6.0	0.6
Oil content	25	0.50	1.5	0.15
Phosphate (PO ₄ form)	3	0.06	0.18	0.018
MBAS	5	0.1	0.3	0.03
pH	6.0-9.0			

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Maximum effluent volume	20m ³ / 1t Product	60m ³ / 1t Product	60m ³ / 1t Product
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(b) In case of small amount of effluent per unit of production

Item	Maximum (mg/L)	Maximum discharge allowed for pollutants (kg/t)		
		Soap	Plant Oil	Chemical Detergent
BOD	75	0.60	1.88	0.075
COD	180	1.44	4.50	0.180
TSS	60	0.48	1.50	0.06
Oil content	15	0.12	0.375	0.015
Phosphate (PO4 form)	2	0.016	0.05	0.002
MBAS	3	0.024	0.075	0.003
pH	6.0-9.0			
Maximum effluent volume	8m ³ / 1t Product	25m ³ / 1t Product	1m ³ / 1t Product	

1) Maximum values for each item is the amount in mg per 1L of effluent.

2) Maximum discharge allowed for pollutants for each item is the amount in kg per 1 t of production.

Table 3: Environmental standards for noise

Land use/ activity type	Noise level dB (A)
a. Land use	
1. Residence	55
2. Commerce	70
3. Business	65
4. Greenery	50
5. Industry	70
6. Public facilities and government	60
7. Recreational facilities	70
8. Other	
• Airport	
• Train stations	60
• Ports	70
• Cultural assets	
b. Activity	
1. Hospital	55
2. School	55
3. Places of worship	55

(Source: Environment Minister's Decree Number 48 of 1996)

Table 4: Environmental standards for vibration

Spectrum (Hz)	Vibration level ($10^{-6}m$)			
	Impact	Little impact	Uncomfortable	Disturbing
4	<100	100-500	500-1000	>1000
5	<80	80-350	350-1000	>1000
6.3	<70	70-275	275-1000	>1000
8	<50	50-160	160-500	>500
10	<37	37-120	120-300	>300
12.5	<32	32-90	90-220	>220
16	<25	25-60	60-120	>120
20	<20	20-40	40-85	>85
25	<17	17-30	30-50	>50
31.5	<12	12-20	20-30	>30
40	<9	9-15	15-20	>20
50	<8	8-12	12-15	>15
63	<6	6-9	9-12	>12

(Source: Environment Minister's Decree Number 49 of 1996)

Table 5: Environmental standards for odours

No.	Item	Unit	Maximum
1	Ammonia	ppm	2.0
2	CH ₃ SH	ppm	0.002
3	H ₂ S	ppm	0.02
4	(CH ₃) ₂ S	ppm	0.01
5	H ₈ CHCH ₂	ppm	0.1

(Source: Environment Minister's Decree Number 50 of 1996)