Feasibility Studies with the Aim of Developing a Bilateral Offset Credit Mechanism FY2011

Studies for Project Exploration and Planning

Program Exploration Research of Indonesian State Palm-oil Factory’s Industrial Waste Biomass Boiler Power Generation Project

New Energy and Industrial Technology Development Organization (NEDO)
Shimizu Corporation
Program Exploration Research of Indonesian State Palm-oil Factory’s Industrial Waste Biomass Boiler Power Generation Project

Shimizu Corporation
GHG Project Department
Genichiro Sawamura
Amount of Palm-oil Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount (×1000t)</th>
<th>Other</th>
<th>Malaysia</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>30000</td>
<td></td>
<td>10000</td>
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</tr>
<tr>
<td>2006</td>
<td>35000</td>
<td></td>
<td>15000</td>
<td>20000</td>
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<tr>
<td>2007</td>
<td>40000</td>
<td></td>
<td>20000</td>
<td>20000</td>
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<tr>
<td>2008</td>
<td>45000</td>
<td></td>
<td>25000</td>
<td>20000</td>
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<td>2009</td>
<td>50000</td>
<td></td>
<td>30000</td>
<td>20000</td>
</tr>
<tr>
<td>2010</td>
<td>55000</td>
<td></td>
<td>35000</td>
<td>20000</td>
</tr>
<tr>
<td>2011</td>
<td>60000</td>
<td></td>
<td>40000</td>
<td>20000</td>
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<td>2012</td>
<td>65000</td>
<td></td>
<td>45000</td>
<td>20000</td>
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Industrial Waste from Palm-oil Mill

FFB
- EFB: 0%
- Shell: 30~40%
- Fiber: 100%

Use Rate

Water Content 75%

Treatment
50%
LHV 7.75MJ/kg

Product
FFB
EFB
Shell
Fiber

FFB: Fresh Fruit Bunch
EFB: Empty Fruit Bunch
CPO: Crude Palm Oil
PKO: Palm Kernel Oil
Content of F/S

- Situation of State Palm-oil Factory
- Data Collection in All State Palm-oil Factory
- Data Analysis (Potential)
- Case Study
- Cost Study
Framework of Survey

NEDO

Shimizu Corp.

BPPT

KBUMN

PTPN

Palm-oil Mill


BPPT : Agency for the Assessment and Application of Technology
KBUMN : Ministry of State Owned Enterprises
PTPN : State Owned Enterprises(SOE's)
Challenge for EFB Combustion

• High Potassium (K) Content
  Maximum 2～3%

• High Water Content
  70～75% (After treatment 50%)

• Large Size
CFB Boiler over Grate Boiler

- **Applicable Fuel**
  - EFB100% Applicable
  - EFB + Coal Applicable
  - Not Applicable (Only for Mix with Other Biomass)

- **Combustion Efficiency**
  - 86%
  - 70%

- **EFB Consumption**
  - 30t/h / 12MWg
  - 36t/h / 12MWg

- **Annual Operation**
  - 7500-8000h/Y
  - <7000h/Y

- **Ash Fouling**
  - No Clinker formation Due to the Low Combustion temperature
  - Severe Clinker formation due to un-uniformed Combustion and Hot (Heat) Spot on Grate

- **Maintenance**
  - No Moving Mechanism In Furnace
  - No Clinker Trouble
  - Required to stop operation and maintenance
  - Non continuous operation

CFB : Circulating Fluidized Bed
Baseline Scenario: BAU

- Almost of all POM (Palm Oil Mill) is utilizing all Fiber and a part of Shell for their own use of power and steam by stoker type furnace and boiler, and EFB in general is return to Palm plantation by its high water and Potassium (K) contents.
- Composting and/or waste to energy project for EFB with Shell has commenced in some POMs, but EFB(100%)-CFB Boiler is not introduced into POM.

Project Activities

- ALT-A: EFB will be collected from several POMs to one site/core POM, and then CFB Boiler Plant will supply power to Grid for public use.
- ALT-B: In a POM, all of EFB/Fiber/Shell will be utilized by CFB and surplus power will be supplied to Grid for public use.
- By increasing of POM production, distance between POMs, its road condition, distance between POM and Grid, choice of ALT-A or -B will be done and project will be implementing one by one in PTPN(n).
- Emission Reduction (ER) of the Project equal to the reduction of fossil fuel combustion in the Grid system by selling power by the Plant minus fuel use for EFB transportation.
Alternative-A and -B

<table>
<thead>
<tr>
<th>ALT-</th>
<th>Project Name</th>
<th>Fuel</th>
<th>AMOUNT</th>
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<tbody>
<tr>
<td>A</td>
<td>EFB Boiler Power Plant</td>
<td>EFB(100%)</td>
<td>&gt;305,000t-EB</td>
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</table>
Case Study of ALT-A

<table>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Generating Capacity</td>
<td>35MW</td>
<td>30MW</td>
<td>50MW</td>
<td>115MW</td>
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<tr>
<td>Emission Reduction</td>
<td>214,000 t–CO₂/y</td>
<td>183,000 t–CO₂/y</td>
<td>301,000 t–CO₂/y</td>
<td>698,000 t–CO₂/y</td>
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</tbody>
</table>

Excluding own consumption
Case Study in Potential Area

P3B Sumatera Unit Pematang Siantar (150/20kV)

South of the MEDAN CITY: PTPN IV (PKS403-410)
Plan of PKS Bah Jambi & BM Boiler

Water Sources: Springs (River)

Power Plant
A=1.3Ha

Reservoir
Pipeline L=700m

To Grid (14km)

Asahan-Pematangsiantar Road

Residential Zone

POME Treatment Zone

Residential Zone

Residential Zone

Residential Zone
12MW Power Plant Layout
Plant side view
Example of CFB Biomass Power Plant in Singapore

Start Up: Dec 2012
Steam Flow: 450 t/h
Steam Pressure: 105 bar
Steam Temp.: 510 °C
Power Output: 100 MWe & Steam
Fuel: PalmWaste (PKS) & Coal
Service: Grid Power Supply
Steam Supply to Industrial Estate

<Outstanding Features>
1. largest size CFB Biomass firing
2. Flexible Operation
Monitoring Plan for the Project

<table>
<thead>
<tr>
<th>Formula</th>
<th>Monitoring Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ELPJ,y  Project Generation of Electric Power(MWh)</td>
</tr>
<tr>
<td>2</td>
<td>FFag,y  Fossil Fuel Use of Stand-by Diesel Engine Generator(ton)</td>
</tr>
<tr>
<td>3</td>
<td>FFaux,y Fossil Fuel Use for Boiler Start-up(ton)</td>
</tr>
<tr>
<td>4</td>
<td>QEFB,y  Transportation Volume for EFB(ton)</td>
</tr>
</tbody>
</table>
Cost Study

Condition:
- Initial Cost: 33,200,000 US$
- Maintenance Cost: 4,500,000 US$/Year
- Income:
  - Power Sales: 7,360,000 US$/Year (975Rp/kWh)
  - Carbon Credit: 804,000 US$/Year (10Euro/t-CO2)
- Corporate Tax: (25%)

Result:
- IRR:
  - without Credit: 8.78% -> Not Feasible
  - with Credit: 11.48% -> Feasible
Rationale and Issues for Project Development Further

- Contribution of Realization of Energy Mix (vision25/25)
- Contribution of Bilateral Offset Credit Mechanism Target: Indonesia NAMA (ER:-26/41% in 2020)
  Japanese Export of Low Carbon Technology
- Model Supply to Private POM by SOEs

- Inter-POM Road Improvement in the Rural Area
- Higher Priority on the Project in both Government
- Application of IIGF (Indonesian Infrastructure Guarantee Fund)
How to Contact Us

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