Oil Palm Based Resources for Bioenergy: Sustainability and Challenges
Contents:

1. About Felda
2. ‘Waste’ Resources & Management
4. Sustainability, Issues & Challenges
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FELDA DEVELOPMENT SCHEME

Background: Poverty Eradication
- 103,156 settlers in 317 schemes
- 70% in oil palm sector

Development of FELDA projects:
- Established 1st July 1956
  - Land for landless families
  - Uplift socio-economic status
- Total land 811,140 & 703,932 oil palm (05)
- 4 & 0.1 hec plantation land & housing land
- Each project: Central area for housing and businesses
- Development of townships to provide wide range of services
- Opportunity for settlers to participate in business activities
- Current, FELDA’s development focus:
  - Provide good public amenities
  - Urbanization of rural areas
  - Sustainable development
Palm Based Biomass Resources Within Felda: 2014

CPO (20.50%)
POME 9.94 mt (65-70%)
PK (5.40%)
FFB 15.3 mt (22-24%)
EFB 3.36 mt (22-24%)
Shell 0.76 mt (5.0-5.5%)
Mesocarp Fibre 1.83 mt (12.0-13%)

Biomass / By-Product

Edible Oil, Fat
PKO: Oleo-chemicals

Note:
Million mt

OPF
Replanting = 308,196 mt
Harvesting = 6,131,725 mt

OPT = 3,099,702
Sustainable waste/byproduct management: Good Agricultural Practices (GAP)

Field Application - Zero burning

Empty Fruit Bunch + Mill Effluent > Compost

Grass for cattle rearing
## THE VISION AND STRATEGIES

### VISION

Optimisation of biomass recovery and revenue generation

### THE STRATEGIES

1. Optimisation of biomass recovery from mill’s operation
2. Coordinated Empty Fruit Bunches (EFB) utilisation activities.
3. Enhancement of Biomass related sales activities (Focus on low hanging fruit projects)
4. Continuous Improvement of biomass based projects/products
5. Comprehensive Biogas trapping activities and applications.

### MAIN TRUST

**TARGET BY 2020**

- Zero incinerator’s operation through fresh and/or treated EFB sales
- To increase shell excess recovery yield to 2%
- All mills with biogas trapping facilities and potential applications
1) 1998: R&D Collaboration with MPOB
2) 1999: Designed, built & patented EFB processing equipment

1) 2002: BOD approved 1st EFB based power plant in Sahabat Complex in 2002
2) Continuous operation from 2005 till now
3) 1st Clean Development Mechanism (CDM) Project in Malaysia

1) 2006: CDM strongly promoted for biogas capture
2) 2008: Build, Own, Operate,& Transfer (BOOT) for 10 mills signed with AES, USA.
3) 2008: Concurrently award to 4 biogas capture projects to single company; encountered many technical problems.
4) EFB compost facilities installed: targeted for internal consumption, utilising POME thus eligible as CDM projects
5) CER market collapsed due to low interest to CDM from developed countries

1) 2002: SEDA was created & Feed-in-Tariff established – selling electricity to National Grid: potentially revenue generating endeavor without depending on CDM
2) 2013: EFB Pelleting Plant successfully operated
3) FPI continue to build more biogas projects in mills
4) New Reactor design for Biogas where yield increased to > 1500 m3/hour, displaying confidence in design scale up
5) 1st Biogas Plant (Serting Hilir) successfully connected to the grid

1) 2012: SEDA was created & Feed-in-Tariff established – selling electricity to National Grid: potentially revenue generating endeavor without depending on CDM
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1) 2013: Collaboration with MIGHT & Sime Darby, a SPV created to explore opportunities of palm based bio-refinery producing high value bio-chemicals
2) 2014: 11 biogas capture plants successfully operated
3) To build 600 m3/hr the 1st BioCNG Plant; collaboration with MPOB, showcase project for the industry
4) MPOB directive: all mills to be fitted with biogas capture facilities by 2020
BioMASS based initiatives
## Brief walk through on Phase 1 of renewable energy initiatives executed by FPISB

**Sahabat Biomass Power plant**

- Project developed to utilise EFBs produced by 5 mills in Sahabat to generate heat & power for demands within the Group – CPO refining, kernel crushing plant, hotel, office and residential.
  - 1\textsuperscript{st} large scale co-generation plant in the world to utilise solely treated EFB combustion fuel.
  - Project was developed & commissioned in 2005 to substitute fossil fuel.
  - 2012: New boiler is added.
  - Project was designed to benefit from Clean Development Mechanism (CDM)
  - Cost saving to consumers of about RM10 million yearly

**Bio-Compost**

- Compost was produced for internal consumption and application in the palm plantation:
  - 6 sites were developed by FPISB employing multitude of composting technology and knowhow through open tender exercises.
<table>
<thead>
<tr>
<th>Brief walk through on Phase 1 of renewable energy initiatives executed by FPISB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sahabat Renewable Fuel Ventures Sdn Bhd (SRFV)</strong></td>
</tr>
<tr>
<td>SPV company established to produce bio-oil from EFB.</td>
</tr>
<tr>
<td><strong>a) Registered as an EPP7 Project</strong></td>
</tr>
<tr>
<td>b) Pyrolysis technology developed by Ensyn, Canada patented as Rapid Thermal Process (RTP)</td>
</tr>
<tr>
<td>c) Site location: Sahabat, Lahad Datu, Sabah</td>
</tr>
<tr>
<td>d) Raw EFB supply from 4 mills in Sahabat area &amp; others</td>
</tr>
<tr>
<td>e) Capacity: <strong>Downsize to 150 BDT treated EFB/day</strong></td>
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<tr>
<td><strong>FNI Biofuel Sdn Bhd</strong></td>
</tr>
<tr>
<td>SPV company established undertake pellet making project based on EFB.</td>
</tr>
<tr>
<td>a) Initial master plan to involve 4 similar pellet plants.</td>
</tr>
<tr>
<td>b) Itochu withdrew from project in 2012 after sales commitment cannot be achieved, due to tsunami in Japan &amp; market constrains</td>
</tr>
<tr>
<td>c) Encountered technical &amp; market hiccups: barrier for growth.</td>
</tr>
<tr>
<td>d) FNI currently servicing export (75%) and local sales.</td>
</tr>
</tbody>
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New Initiative: Biomass to Electricity

Background:
- FTJ Bio Power is a JV-co between Felda Palm Industries (60%) and TNB (40%)
- Support the government’s Small and Renewable Energy Programme (SREP)
- To manage 12.5MW(gross) empty fruit bunch (EFB) based power generation plant.
- EFB from 7 adjacent mills.
- With Feed-in-Tariff (FIT) being endorsed: tariff of RM0.30 per kWh for 16 years.
- Financial Support: RM125 Million.
- Target operation: August 2014.

Plant Profile:

<table>
<thead>
<tr>
<th>Operational parameters</th>
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<tbody>
<tr>
<td>Power generation capacity</td>
<td>10MW(net)</td>
</tr>
<tr>
<td>*EFB required</td>
<td>350,000MT</td>
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Biogas based initiatives
BIOGAS UTILIZATION: Strategic Options

- **CLEAN DEVELOPMENT MECHANISM (CDM)**

- **BIOGAS FOR ELECTRICITY GENERATION & GRID CONNECTED PROJECT**
  - **POWER STABILITY STUDY (PSS) BY TNB**
    - Determine the capacity acceptable by TNB at the project area & Interconnection Point.
    - Distance of Interconnection Point from the biogas plant within 5 km away.
    - High cost if interconnection point far away from biogas plant (>5km).
  - **FEED-IN TARIFF QUOTA**
    - Subject to quota opening by SEDA (FPI successfully registered 10 new projects).

- **Bio Compressed Natural Gas (Bio-CNG) or Bio-Methane**
  - Another option of biogas utilization based on location of mill rather far from grid and availability of potential buyer.

- **BIOGAS AS BOILER FUEL**
  - No load demand based on Power System Study by TNB.
  - Interconnection Point determined by TNB too far from biogas plant (>5 km)
Biogas Trapping for Grid-Connected Electricity Generation:

- Under EPP5: FPISB has pledged to equip all palm oil mill with biogas capturing facility.
- Main focus is for electricity generation for rural electrification & as Small Power Producer.

### BIOGAS PROJECT STATUS AS OF JANUARY 2014

<table>
<thead>
<tr>
<th>FPISB’S EQUITY</th>
<th>BOOT (CDM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Status</strong></td>
<td><strong>No.</strong></td>
</tr>
<tr>
<td>Completed</td>
<td>11</td>
</tr>
<tr>
<td>Under construction</td>
<td>11</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>22</strong></td>
</tr>
</tbody>
</table>

#### Economic Analysis on Grid Connection Project

<table>
<thead>
<tr>
<th>Capacity</th>
<th>1.5MW</th>
<th>2.0MW</th>
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<tr>
<td>Capex (RM)</td>
<td>16 mil</td>
<td>20 mil</td>
</tr>
<tr>
<td>FIT Tariff (RM/Kwh) (16 years)</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Total Power Generation Per Year (Kwh/year)</td>
<td>11 mil</td>
<td>15 mil</td>
</tr>
<tr>
<td>Revenue per year (RM/year)</td>
<td>4.0 mil</td>
<td>5.2 mil</td>
</tr>
<tr>
<td>IRR (%)</td>
<td>13.6</td>
<td>16.12</td>
</tr>
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**Bio-Methane Compression System from Biogas**

**Background:** diversifying biogas utilization to expand the revenue stream. BioMethane Compression System is a process of turning raw biogas to industrial grade bio-Compressed Natural Gas (Bio-CNG), through biogas cleaning, drying, separation & compress to required pressure demanded by customers.

<table>
<thead>
<tr>
<th><strong>Project Cost</strong> : MYR --</th>
<th><strong>Potential Off-takers</strong> : NGC Energy, several private industrial purchasers</th>
</tr>
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<tbody>
<tr>
<td><strong>Location</strong> : FPISB; Sg Tengi Mill</td>
<td><strong>Project Design Capacity</strong> : 8,208 m³/day, app. 2,462,400 m³/year or 79,760 MMBTU/year</td>
</tr>
</tbody>
</table>
| **Financial Details (Independent)** : | **Current Status** :
| Total Revenue (MYR)/yr : 3.58 mil | • Expected completion November, 2014.  
• Ongoing discussion with MPOB to secure special fund.  
• MPOB to promote BioCNG Plant as national showcase for palm oil industry.  |
| IRR (%) at 10 years : 13.5 |
Biogas based initiatives

RURAL ELECTRIFICATION
RURAL ELECTRIFICATION FROM BIOGAS

- Location: UMAS PALM OIL MILL, TAWAU, SABAH.
- Design Biogas Output: 1,200 m³/HOUR
- Gas Engine Capacity: 1.2 MW
- Point of Electricity Injection: Existing FELDA distribution facility
- Electricity Supply Areas: UMAS’S COMPLEX (3,000 Houses, Offices & Commercial Premises)
  - SETTLER FAMILY: 2,500 HOUSES
  - STAFF QUARTERS: 500 HOUSES
- GHG Emission Reduction: 27,000 mt CO₂ / yr (Methane Avoidance) exclude Displacement of Diesel based electricity Generation
REDUCTION IN DIESEL CONSUMPTION

![Graph showing the reduction in diesel consumption]

- **Jumlah penggunaan di Perumahan (kWh)**
- **Jumlah Penggunaan Diesel oleh FESSB (L)**

![Bar chart showing the percentage of electricity generation through biogas engine]

- **PERATUSAN BEKALAN TENAGA ELEKTRIK (%)**
  - Jan-13: 20%
  - Feb-13: 25%
  - Mar-13: 30%
  - Apr-13: 35%
  - May-13: 40%
  - Jun-13: 45%
  - Jul-13: 50%
  - Aug-13: 55%
  - Sep-13: 60%
  - Oct-13: 65%
  - Nov-13: 70%
  - Dec-13: 75%
  - Jan-14: 80%
  - Feb-14: 85%
  - Mar-14: 90%

- **Bekalan Tenaga Elektrik Melalui Enjin Biogas (%)**
  - Jan-13: 0%
  - Feb-13: 5%
  - Mar-13: 10%
  - Apr-13: 15%
  - May-13: 20%
  - Jun-13: 25%
  - Jul-13: 30%
  - Aug-13: 35%
  - Sep-13: 40%
  - Oct-13: 45%
  - Nov-13: 50%
  - Dec-13: 55%
  - Jan-14: 60%
  - Feb-14: 65%
  - Mar-14: 70%
**DIESEL REPLACEMENT FOR RURAL ELECTRIFICATION PROJECT, SABAH**

- **Kalabakan**
  - Output = 1.0MW
  - Status = Construction

- **Biogas Plant Uma**
  - Output = 1.2MW
  - Status = Operating

- **Baiduri Ayu**
  - Potential = 1.8MW
  - Target = End 2014

- **Merchu Puspita**
  - Design = 1.2MW
  - Target = Oct 2014

- Meeting Organisation’s sustainable strategy
- No more dependence on petro-diesel.
- Able to meet local power demand
- Support local industries through reliable power supply.
Challenges

- Approval from Authorities e.g Department of Environment (DOE)
  - No specific guidelines for RE projects: for installation of boiler, chimney, generating set and particulate control system.
  - New DOE emission requirement for 150ppm when regulations have stipulated for 400ppm and EPC contractor has committed for 200ppm

- Single Line Diagram Endorsement from Tenaga Nasional Berhad (TNB)
  - Uncertainty for interconnection requirements
  - Utility company requested for special long lead time equipment (33kV switchgears)

- Financing
  - Able to obtain full financing support, but require corporate guarantees
  - Disbursement: rather challenging and difficult.
  - Rather tight requirements imposed.
What is the values?

Investors: USD50 / BDT
Owner: USD80 / BDT

- Palm Kernel Shell
- Palm Kernel Cake
- Empty Fruit Bunch
- Oil Palm Fronds (Basal Part)
- Oil Palm Trunks
- Mesocarp Fibers
CONCLUSIONS: The Benefits

Local Communities:
- Permanent jobs; 50-70
- Job opportunities during construction; 100-150
- Cleaner environment (Avoid incinerator’s usage)
- Avoid open disposal of EFB & no un-control open burning
- Support the development of SMEs.
- Electricity generated: enough to support local demand.

- Support the country initiatives; ETP
- Reduce the use and reliance on fossil fuel.
- 5th Fuel Policy: Clean energy.
- Support Kyoto Protocol; a CDM project.
- Country image to clean sustainable energy.

Malaysia:
- RM230 million PBT by 2020
- 2.25 mt mil/yr CER

The World:
- In-line with United Nations Initiatives
- Exporting clean air to the rest of the world
THANK YOU

TERIMA KASIH

FELDA PALM INDUSTRIES SDN BHD