BIOMASS DEPARTMENT,

FELDA PALM INDUSTRIES SDN BHD

Oil Palm Based Resources for Bioenergy: Sustainability and Challenges

IRENA: Bioenergy Forum 2014

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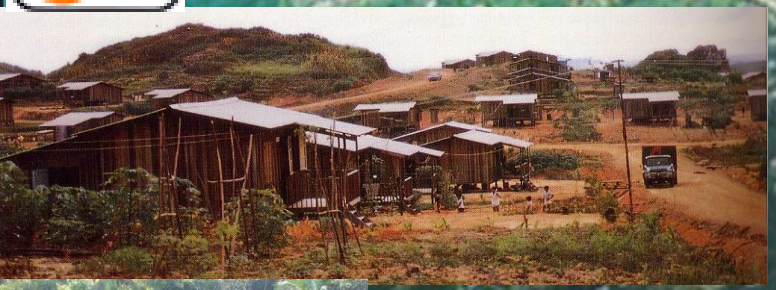
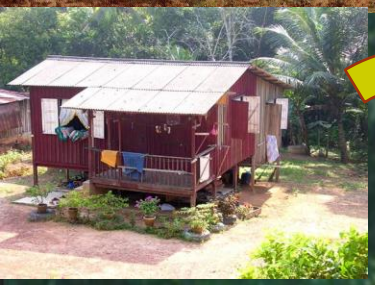
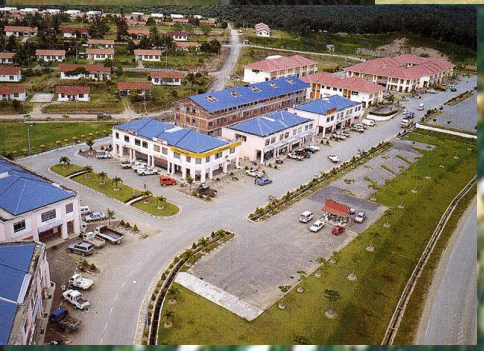
Contents:

1. About Felda
2. ‘Waste’ Resources & Management
3. Bio-Energy Initiatives Undertaken
4. Sustainability, Issues & Challenges
5. Conclusion

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

PKO : Oleo-chemicals

PK (5.40%)

Edible Oil, Fat

CPO (20.50%)

Main Product

FFB 15.3 mt

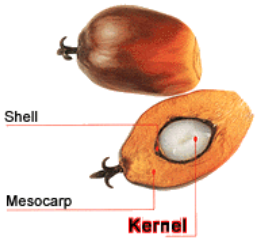
EFB 3.36 mt (22-24%)

POME 9.94 mt (65-70%)

Shell 0.76 mt (5.0-5.5%)

Mesocarp Fibre 1.83 mt (12.0-13%)

Biomass / By -Product



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

OPT = 3,099,702

Note:
Million mt

Sustainable Waste/Byproduct Management: Good Agricultural Practices (GAP)

ENVIRONMENT

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

i. Optimisation of biomass recovery from mill's operation

ii. Coordinated Empty Fruit Bunches (EFB) utilisation activities.

iii. Enhancement of Biomass related sales activities (Focus on low hanging fruit projects)

iv. Continuous Improvement of biomass based projects/products

v. 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

1990 - 2000 | 2000 - 2007 | 2008 - 2011 | 2011 - 2012 | 2012 - 2014

THE WALK THROUGH

FPISB BIOMASS DEPARTMENT

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

6) SRFV was formed to embark on Bio-oil production

1) 2012 : 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) 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 built 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

Projects Implemented

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. a) 1st large scale co-generation plant in the world to utilise solely treated EFB combustion fuel. b) Project was developed & commissioned in 2005 to substitute fossil fuel. c) 2012: New boiler is added. d) Project was designed to benefit from Clean Development Mechanism (CDM) e) Cost saving to consumers of about **RM10 million** yearly
Bio-Compost	Compost was produced for internal consumption and application in the palm plantation: a) 6 sites were developed by FPISB employing multitude of composting technology and knowhow through open tender exercises.

New Projects Undertaken

Brief walk through on Phase 1 of renewable energy initiatives executed by FPISB

Sahabat Renewable Fuel Ventures Sdn Bhd (SRFV) 	SPV company established to produce bio-oil from EFB. **a) Registered as an EPP7 Project** b) Pyrolysis technology developed by Ensyn, Canada patented as Rapid Thermal Process (RTP) c) Site location: Sahabat, Lahad Datu, Sabah d) Raw EFB supply from 4 mills in Sahabat area & others e) Capacity: Downsize to 150 BDT treated EFB/day
FNI Biofuel Sdn Bhd 	SPV company established undertake pellet making project based on EFB. a) Initial master plan to involve 4 similar pellet plants. b) Itochu withdrew from project in 2012 after sales commitment cannot be achieved, due to tsunami in Japan & market constrains c) Encountered technical & market hiccups: barrier for growth. d) FNI currently servicing export (75%) and local sales. e) Projected revenue for 2014: RM-- mil.

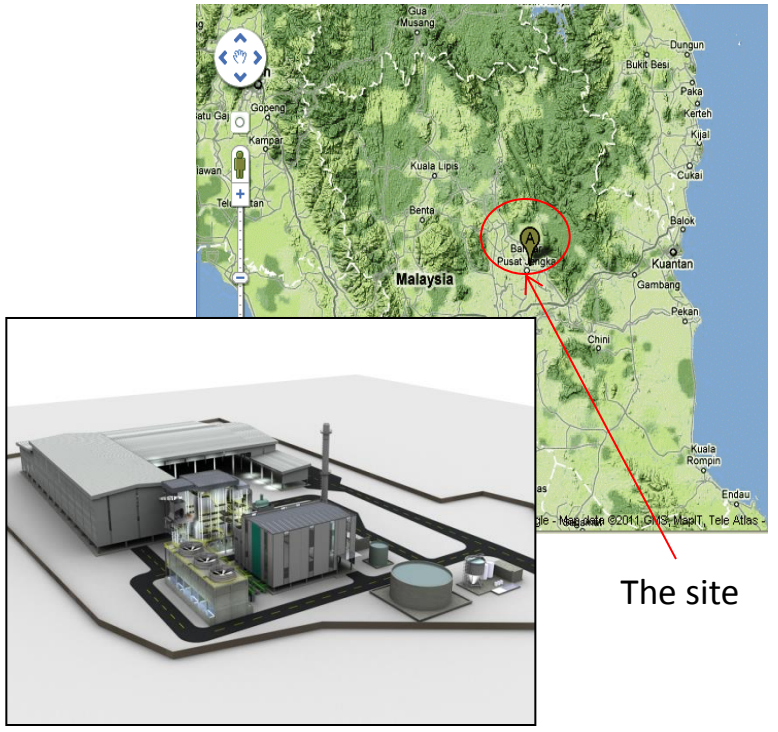
New Initiative : Biomass to Electricity

Background:

- FTJ Bio Power is a **JV-co between Felda Palm Industries (60%) and TNB (40%)**
- **S**upport 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.
- Under the Renewable Energy Power Purchasing Agreement (REPPA), TNB shall purchase price of 21sen/kWh for 21 years.
- 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:

Operational parameters	
Power generation capacity	10MW(net)
*EFB required	350,000MT



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			
FPISB'S EQUITY		**BOOT (CDM)**	
Status	No.	Status	No.
Completed	11	Completed	2
Under construction	11	Under construction	-
TOTAL	**22**	**TOTAL**	**2**

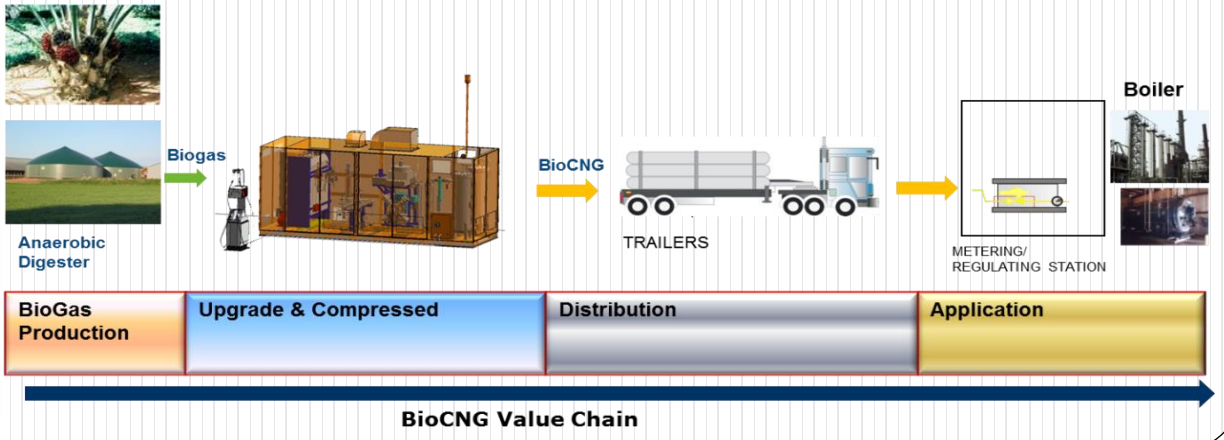
Economic Analysis on Grid Connection Project

Capacity	1.5MW	2.0MW
Capex (RM)	16 mil	20 mil
FIT Tariff (RM/Kwh) (16 years)	0.35	0.35
Total Power Generation Per Year (Kwh /year)	11 mil	15 mil
Revenue per year (RM/year)	4.0 mil	5.2 mil
IRR (%)	13.6	**16.12**

Bio-Methane Compression System from Biogas

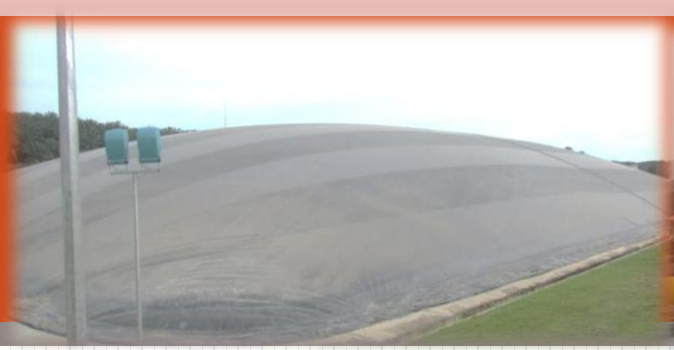
Background :
diversifying biogas utilization to expand the revenue stream. BioMethane Compression System is a process of turning raw biogas to industrial grade bio-Compressed Natural Gas (Bio-CNG), through biogas cleaning, drying, separation & compress to required pressure demanded by customers.

Project Cost : MYR --	**Potential Off-takers** : NGC Energy, several private industrial purchasers
Location : FPISB; Sg Tengi Mill	**Project Design Capacity** : 8,208 m^3/day, app. 2,462,400 m^3/year or 79,760 MMBTU/year
Financial Details (Independent) : Total Revenue (MYR)/yr : 3.58 mil IRR (%) at 10 years : 13.5	**Current Status :** • Expected completion November , 2014. • Ongoing discussion with MPOB to secure special fund. • MPOB to promote BioCNG Plant as national showcase for palm oil industry.



BIOGAS BASED INITIATIVES RURAL ELECTRIFICATION

RURAL ELECTRIFICATION FROM BIOGAS



- **Location: UMAS PALM OIL MILL, TAWAU, SABAH.**
- **Design Biogas Output: 1,200 m^3/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 CO_2 / yr (Methane Avoidance) exclude Displacement of Diesel based electricity Generation)**

PROCESS FLOW ELECTRICITY GENERATION FROM BIOGAS (UMAS PALM OIL MILL)

POME FROM THE PALM OIL MILL

ANAEROBICS DIGESTER

BIOGAS CAPTURED PIPING TO BIOSCRUBBER

BIOSCRUBBER FOR H2S REMOVAL

GAS ENGINE FOR ELECTRICITY GENERATION

KwH METER (ELECTRICITY GENERATION)

STEP UP TRANSFORMER 415V/11kV

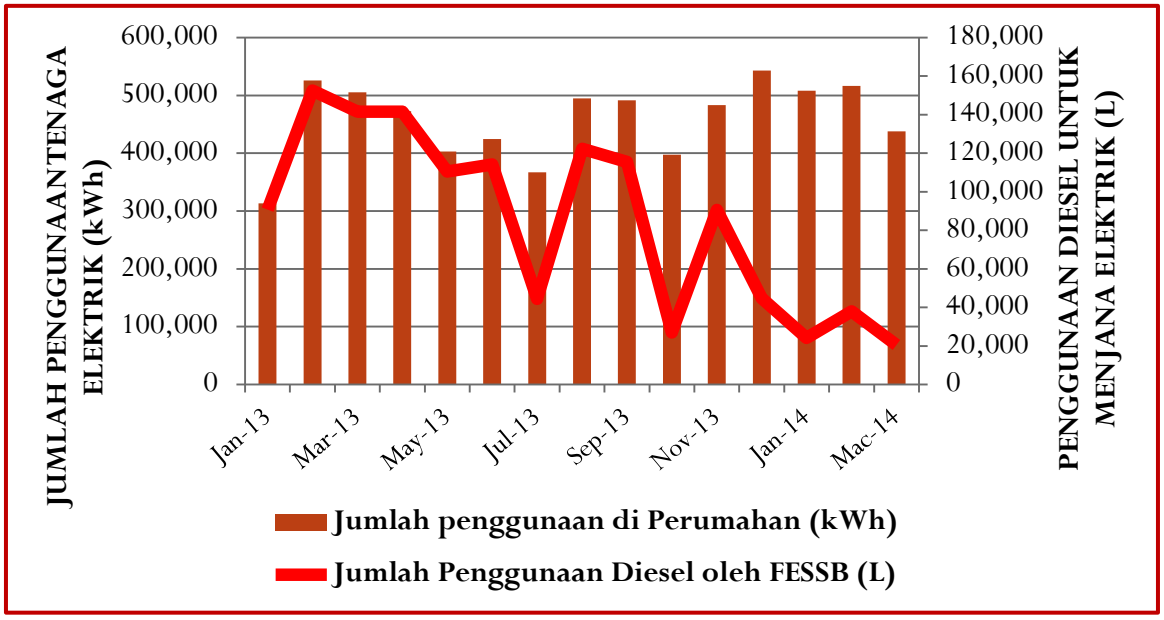
FELDA DISTRIBUTION LINE

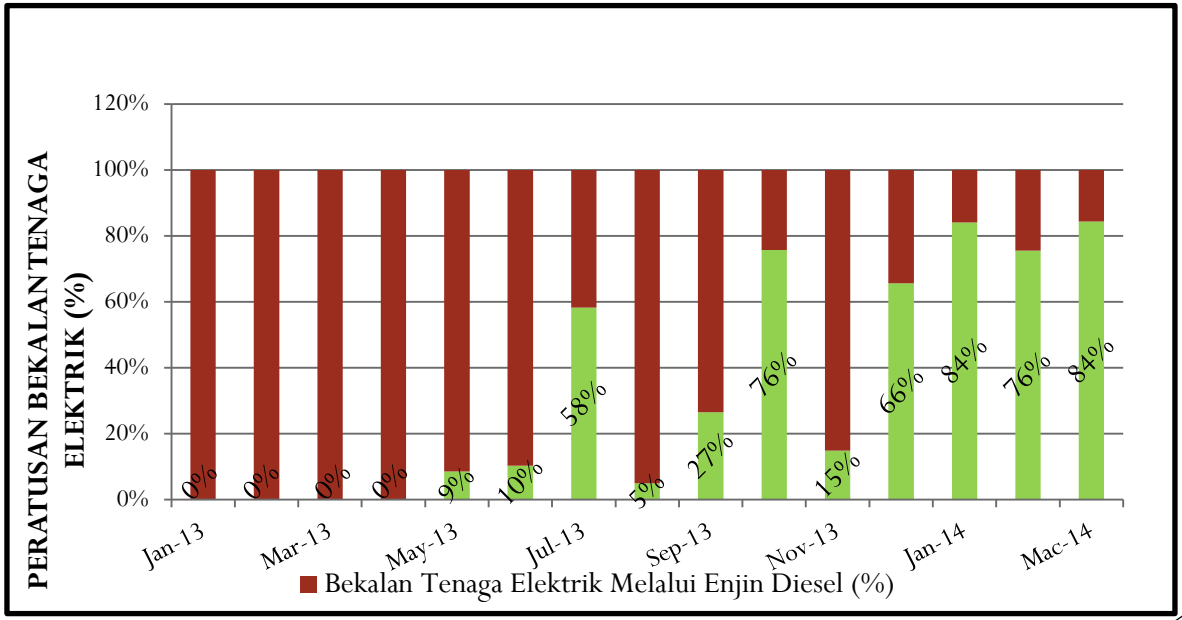
SETTLER HOUSES

STAFF QUARTERS

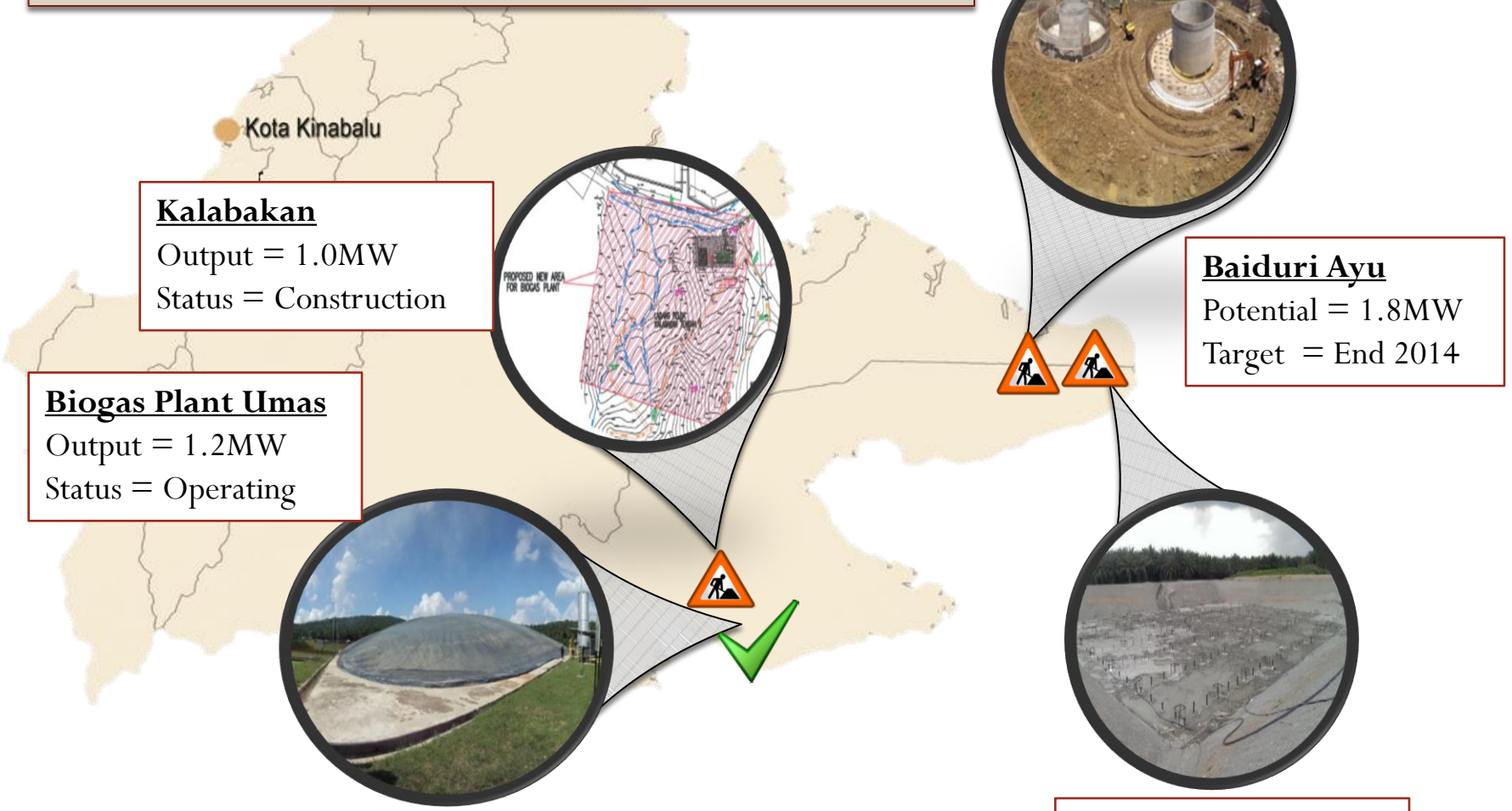
OFFICES & COMMERCIAL

REDUCTION IN DIESEL CONSUMPTION





DIESEL REPLACEMENT FOR RURAL ELECTRIFICATION PROJECT, SABAH



Kalabakan
Output = 1.0MW
Status = Construction

Biogas Plant Umas
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
- Low Quota given to biomass & biogas based RE provided by SEDA/KETHA

- **Single Line Diagram Endorsement from Tenaga Nasional Berhad (TNB)**

- Uncertainty for interconnection requirements
- Utility company requested for special long lead time equipment (33kV switchgears)
- Single line diagram endorsement might incur multiple changes

- **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

Mesocarp Fibers

Oil Palm Fronds
(Basal Part)

Palm Kernel Cake

Empty Fruit Bunch

Oil Palm Trunks

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.

Malaysia:

- 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.

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