The Development of Palm Based Biorefinery:
A New Approach to the Bio-Carbon Economy

INVESTMENT OPPORTUNITY IN PALM BASED BIOREFINERY IN SABAH, MALAYSIA

Dr. Pang Teck Wai & Rose Pun
13 May 2014
1) Introduction
2) Oil palm biomass availability in Sabah
3) Biomass supply issues and strategy
4) Roles of POIC Lahad Datu, Sabah
5) Concluding Remarks
INTRODUCTION
Introduction

• Sabah: the largest oil palm growing State in Malaysia.

• Apart from the production of palm oil, large amount of oil palm biomass are available as feedstock for downstream activities including bio-refinery.

• POIC Lahad Datu was established as a dedicated palm oil industrial cluster to tap the huge market opportunity of bio-based products for economic development in Sabah.

• This paper is to highlight the availability of oil palm biomass in Sabah, biomass supply issues and strategy, and the roles of POIC Lahad Datu.
OIL PALM BIOMASS AVAILABILITY IN SABAH
Sabah, Malaysia: Rich in Bioresources

- Vast Land Area (73,620 km²) (Agriculture/Forestry)
- Long Coastline (1,743 km) (Aquaculture)

Abundant Bio-feedstock

Development of Bio-economy through Industrial Biotechnology
Forestry & Agriculture Dominate the Land Use in Sabah

<table>
<thead>
<tr>
<th>Land use</th>
<th>(000' ha)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Forests &amp; State Land</td>
<td>4,091</td>
<td>55.6</td>
</tr>
<tr>
<td>Plantation Forest</td>
<td>214</td>
<td>2.9</td>
</tr>
<tr>
<td>Oil Palm Plantations</td>
<td>1,415</td>
<td>19.2</td>
</tr>
<tr>
<td>Rubber Holdings</td>
<td>87</td>
<td>1.2</td>
</tr>
<tr>
<td>Rice Fields</td>
<td>43</td>
<td>0.6</td>
</tr>
<tr>
<td>Coconut Farms</td>
<td>18</td>
<td>0.2</td>
</tr>
<tr>
<td>Cocoa Holdings</td>
<td>7</td>
<td>0.1</td>
</tr>
<tr>
<td>Other Crops</td>
<td>27</td>
<td>0.4</td>
</tr>
<tr>
<td>Other Land Uses</td>
<td>1,460</td>
<td>19.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7,362</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

*Source: Department of Statistics Malaysia (2012)*
# Oil Palm Industry in Sabah, Malaysia 2013

<table>
<thead>
<tr>
<th></th>
<th>Sabah</th>
<th>Malaysia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plantation Area (Mil. Ha)</strong></td>
<td>1.48 (28 %)*</td>
<td>5.23</td>
</tr>
<tr>
<td><strong>Palm Oil Mill (No.)</strong></td>
<td>124 (28.9%)</td>
<td>429</td>
</tr>
<tr>
<td>(Capacity: 3.26 Mil. MT/ Hr.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Refineries (No.)</strong></td>
<td>14 (27%)</td>
<td>52</td>
</tr>
<tr>
<td>(Capacity: 7.4 Mil. MT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Palm Kernel Crusher (No.)</strong></td>
<td>14 (30.4 %)</td>
<td>46</td>
</tr>
<tr>
<td>(Capacity: 2.3 Mil. MT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Crude Palm Oil Production</strong></td>
<td>5.78 (30%)</td>
<td>19.21</td>
</tr>
<tr>
<td>(Mil. Tonnes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Crude Palm Kernel Oil</strong></td>
<td>0.61 (27 %)</td>
<td>2.27</td>
</tr>
<tr>
<td>Production (Mil. Tonnes)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Malaysian Palm Oil Board (MPOB) website, 2013 Statistics
Basic Raw Materials From Oil Palm Tree

- Oil palm Tree
  - Fresh Fruit Bunches
    - Palm Kernel Oil
    - Crude Palm Oil
  - Biomass
    - Fronds
    - Trunks
    - Empty Fruit Bunches (EFB)
    - Palm Kernel Shells (PKS)
    - Mesocarp Fiber (MF)
    - Palm Oil Mill Effluent (POME)
## Oil Palm Biomass Resources in Sabah

<table>
<thead>
<tr>
<th>Biomass Type</th>
<th>Mil. Dry Tonnes/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Palm Fronds</td>
<td>16.4</td>
</tr>
<tr>
<td>Oil Palm Trunks</td>
<td>4.5</td>
</tr>
<tr>
<td>Empty Fruit Bunches</td>
<td>2.3</td>
</tr>
<tr>
<td>Mesocarp Fibres</td>
<td>2.5</td>
</tr>
<tr>
<td>Palm kernel Shells</td>
<td>1.4</td>
</tr>
<tr>
<td>Palm Oil Mill Effluent</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Estimated oil palm biomass* generated in Sabah (2012)**

<table>
<thead>
<tr>
<th></th>
<th>Total : 28.1</th>
</tr>
</thead>
</table>

*Computation Of Biomass Raw Materials Supplies based on MPOB formula.*
Value Adding Opportunities in Palm-based Biomass Downstream Industries

Feedstock Currently Underutilised

- **Oil Palm Fronds**: 16.4 mil dry tonnes
- **Oil Palm Trunks**: 4.5 mil dry tonnes
- **Empty Fruit Bunches**: 2.3 mil dry tonnes

Downstream Opportunities

- **Bioethanol**
- **Biobased Chemical**
- **Biofuels**
- **Pellets**
- **Furniture from Oil Palm Lumber**
- **Wood Plastic Composite**
- **Plywood**
- **Particle Board / Moulded Particle Board**
- **MDF**
- **Pulp & paper**
- **Finished Paper Product**
- **Compost**
- **Fibre**
- **Animal Feed from Oil Palm Fronds**

Our current focus:
- Bio-refinery
- Sugars
- Bio-fuels
- Bio-chem
- Bio-pellets

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BIOMASS ISSUES AND STRATEGY
Needs:

- Need to move biomass from sources to end users.

- Biorefinery industry requires long term, secured, supply of large amount of biomass feedstock at competitive cost.
Challenges:

- Plantation based biomass too costly to transport (*high moisture content and bulky*)
- Biomass per mill not sufficient for large scale downstream need (*each mill generates 20,000 dry MT Biomass per year*)
- Mills in one area belong to different owners
Government as facilitator to aggregate palm biomass: 2 models

- POIC Biomass Collection & Processing Centre Model
- Biomass Joint Venture (JV) Cluster Model
POIC Biomass Collection and Processing Centre Model

POIC Lahad Datu/ Govt
Invest in infrastructural
development of the centre

Biomass feedstock*
from palm oil mills,
plantations & other sources

* To start with Empty Fruit Bunches (EFB)

Biomass Collection & Processing Centre

Other biomass end users

Biomass investor
(purchaser & user)

Government as Facilitator:
Sabah State Govt initiative,
Malaysia
Distribution Pattern of Palm Oil Mills To POIC Biomass Collection Centre

Legend

- Palm Oil Mills
- 50km Radius
- 100km Radius
- 150km Radius

POIC Collection Centre

Distance of mill from collection centre

Numbers of CPO Mills from POIC Lahad Datu

<table>
<thead>
<tr>
<th>Distance</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50 km</td>
<td>37</td>
</tr>
<tr>
<td>50-100 km</td>
<td>48</td>
</tr>
<tr>
<td>100-150 km</td>
<td>28</td>
</tr>
<tr>
<td>&gt;150 km</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>124</td>
</tr>
</tbody>
</table>

Note:

a) Distance roughly to scale.
b) 85 mills within 100 km radius of POIC.
c) 113 mills within 150 km radius of POIC.
Biomass Joint Venture Cluster Model

**Biomass owners** (mills, plantations)

Contribution of biomass*

*B To start with Empty Fruit Bunches (EFB)*

**JV Cluster**
(Board of Director)
[Management team]

Biomass downstream investments
(biopellet, bioethanol, bio-chemicals etc)

Government as facilitator:
Agensi Inovasi Malaysia (AIM)
(Prime Minister’s Dept, Malaysia)

Government Agencies for support & advice
(e.g POIC Lahad Datu)
What Does a Biomass JV Cluster Look Like?

Mill owner #1
- Biomass supply: 120,000 MT
  - 20% stake

Mill owner #2
- Biomass supply: 240,000 MT
  - 40% stake

Mill owner #3
- Biomass supply: 240,000 MT
  - 40% stake

Portfolio JV
- Biomass supply: 600,000 MT (Dry)
  - 10% JV stake

Pellets
- Capacity: 100,000 MT
  - Feedstock required: 100,000 MT
    - 90% Partner stake

Partner #1

Capacity: 100,000 MT
Feedstock required: 100,000 MT

Bioethanol
- Capacity: 100,000 MT
  - Feedstock required: 500,000 MT
    - 85% Partner stake

Partner #2

Source: Agensi Inovasi Malaysia (AIM), 2013
Launch of Biomass JV Cluster in Lahad Datu, 10 June 2013

Five firms in biomass deal

Efa Rizan

LAHAD DATU: Five major plantation companies signed the Biomass Joint Venture (JV) cluster agreement, the first of its kind in the biomass manufacturing industry, here, Monday.

Many companies are expected to follow suit into the venture that is estimated to contribute an additional RM15 billion Gross National Income (GNI) to Sabah’s economy by 2020.

The Biomass Joint Venture (JV) cluster project is a concept by the Agensi Investasi Malaysia (AIM) aimed at aggregating sufficient volumes of biomass for a portfolio of downstream processing activities by having oil palm companies coming together to supply biomass.

Deputy Chief Minister and Minister of Industrial Development, Datuk Raymond Tan Shu Kiah said the agreement signing reflected the seriousness of the Federal Government in its transformation programmes.

In his speech delivered by Asst Minister Datuk Bolkiah Ismail, Tan said it also highlighted the important role that Sabah is expected to play in this national effort to make Malaysia a developed nation.

“This is a big deal as this is the first time since a number of years ago when I heard about the phrase biomass potential that something concrete is taking place. This is a crucial first step towards the materialisation of a biomass industry that can make significant contribution to economic growth in Sabah, creating jobs, and new wealth through development of small and medium industries.

“I hope other oil palm companies will participate in this joint venture so that we can take our industry to an unprecedented level as there are still many mills have the potential in this or similar biomass clusters,” he said.

See Page 2, Col. 1

RM15 bln annual income from biomass

Efa Rizan

Biomass cluster only: Pusap Sawit Grading and grading on the inscription of the National Biomass Exchange in Tenom.

Also present in the event were POIC Sabah chairman Shaik Abdullah, chief executive officer of oil palm giant, Bumitama, Datuk Dr Pung Teck Way, and his team.

Pung also cited that the biomass downstream industry was one of the programmes under the 11th Malaysia Plan (11MP) to grow Malaysia’s economic sector, which would make Malaysia a leading nation in the world.

POIC Sabah M&A & ECO chairman chairman Shaik Abdullah, said that POIC Lahad Datu was provided approximately 50 acres of land for halal industry development.

And for the oil palm industry, POIC also plans a key role in processing the raw material to be converted into high value-added products through integrated processing, and improving the value addition in the raw material.

He also said that JVC will be a major driving force to integrate more of the oil palm industry, adding that Sabah is the top oil palm-producing state in the country, and the foundation of the halal industry development were made possible due to the high potential that is knocking on our doors.”
ROLES OF POIC LAHAD DATU, SABAH
**Background:**

- Set-up in Jan 2005 as the first comprehensively developed (infrastructure) palm oil industrial cluster in the world.
- Owned by State Government of Sabah, Malaysia.

**Aim:**

- To value add to palm oil and palm biomass.
- Development of other related industries.
- To create jobs and business opportunities.
Located at the centre of oil palm growing belt in Sabah

**Availability of raw materials:**

- 1.48 million hectares oil palm planted area (28% of Malaysia’s total).
- 5.78 million tonnes of Crude Palm Oil production (30% of Malaysia’s total production).
- 124 palm oil mills in Sabah (27% of 429 palm oil mills in Malaysia).
- 14 refineries in Sabah – 2 in POIC (27% of 52 refineries in Malaysia).
- 14 Palm Kernel Crushing Plant in Sabah (30.4% of 46PKCP in Malaysia)
- 28 Mil tonnes (dried) palm biomass (empty fruit bunches, palm trunks and palm fronds, palm kernel shells and palm oil mill effluent).
Palm oil cluster & other clusters
Deep Sea Port & Large Industrial Area For Development

- 4,400 acres of industrial land for development
- 1,600 acres already developed
- Deep & sheltered harbour ~ depth up to 20-metre
- Strategic location – plentiful of supply source of PO & proximity to SE Asia
Master Plan

Bio-refinery Cluster Sites

Phase 1 (600 Acres)
Phase 2 (580 Acres)
Phase 3A (413 Acres)
Phase 3B
Phase 3 (3300 Acres)
Port & Industrial Infrastructure at POIC Lahad Datu

- Piperacks
- Interchange
- Electricity
- Water
- Liquid Bulk Terminal
- Dry Bulk Terminal
- Container Terminal Ready by 2016
- Bulking Facilities
MAJOR CLUSTER IN POIC LAHAD DATU
# Fertilizer Cluster

<table>
<thead>
<tr>
<th>No</th>
<th>Companies</th>
<th>Capacity (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CCM Agriculture (Sabah) Sdn Bhd</td>
<td>130,000</td>
</tr>
<tr>
<td>2</td>
<td>Behn Meyer &amp; Co (M) Sdn Bhd</td>
<td>150,000</td>
</tr>
<tr>
<td>3</td>
<td>FPM Sdn Bhd (Felda Group)</td>
<td>70,000</td>
</tr>
<tr>
<td>4</td>
<td>Taiko Fertiliser Sdn Bhd</td>
<td>200,000</td>
</tr>
<tr>
<td>5</td>
<td>Sabah Softwoods Hybrid Fertiliser Sdn Bhd</td>
<td>200,000</td>
</tr>
<tr>
<td>6</td>
<td>Agri Borneo Fertilizer Sdn Bhd</td>
<td>150,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>900,000</strong></td>
</tr>
</tbody>
</table>

**Planning For Construction**

1. Union Harvest (EM) Sdn Bhd, Capacity: 200,000 Mt/yr
2. Exelwin Biotech Sdn Bhd, Capacity: 50,000 Mt/yr
3. Sunnite Timur Sdn Bhd, Capacity: 25,000 Mt/yr

**Total**: 275,000

**Grand Total**: 1,175,000 Mt/yr
## Palm Oil Refinery Cluster

<table>
<thead>
<tr>
<th>No</th>
<th>Companies</th>
<th>Capacity (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mewah Datu Sdn Bhd (Mewah Singapore)</td>
<td>1,000,000</td>
</tr>
<tr>
<td>2</td>
<td>Zurex Corporation Sdn Bhd</td>
<td>200,000</td>
</tr>
<tr>
<td>3</td>
<td>Alfa Raya Development Sdn Bhd (Genting Group)</td>
<td>550,000</td>
</tr>
<tr>
<td>4</td>
<td>QL Bioenergy Sdn Bhd (QL Group)</td>
<td>175,750</td>
</tr>
<tr>
<td>5</td>
<td>Asia Oil Palm Sdn Bhd (JC Chang Group)</td>
<td>99,000</td>
</tr>
<tr>
<td>6</td>
<td>Sab Bio-Fuel Sdn Bhd (Southern Acids Group)</td>
<td>550,000</td>
</tr>
<tr>
<td>7</td>
<td>Reliance Synergy Sdn Bhd</td>
<td>150,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>2,725,750</strong></td>
</tr>
</tbody>
</table>

**Completed**

- **Mewah Datu Sdn Bhd**
- **Zurex Corporation Sdn Bhd**
Largest Palm Based Bio-Refinery Hub

Development of world’s largest integrated palm based biorefinery complex by Genting Group - utilize palm oil feedstock as high value added palm oil derivatives

- **Global Bio-Diesel Sdn Bhd** – 200,000 MT/Y Biodiesel
- **Alfa Raya Development Sdn Bhd** – 500,000 MT/Y RBD Palm Oil
- **SPC Biodiesel Sdn Bhd** – 100,000 MT/Y Biodiesel

Specialty chemicals

Oleochemical derivatives
# Biomass Industry

<table>
<thead>
<tr>
<th>No</th>
<th>Companies</th>
<th>Capacity (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Completed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>The Green Biomass Sdn Bhd (Oil Palm Pellet)</td>
<td>60,000</td>
</tr>
<tr>
<td>2</td>
<td>JS Biomass Resources Sdn Bhd (trading and processing of oil palm biomass)</td>
<td>200,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>260,000</strong></td>
</tr>
</tbody>
</table>

The Green Biomass Sdn Bhd

JS Biomass Resources Sdn Bhd
JFE Holding (Japan)
[Steel mill, Trading steel, machineries, chemicals, foods, 8th largest trading firm in Japan]
1. Being the largest oil palm growing State in Malaysia, no less than 28 million dry tonnes of palm-based biomass could be made available to sustain a healthy growth of bio-refinery industry in Sabah.

2. Two models facilitated by government are in place for aggregation and mobilization of palm-based biomass for industrial uses.

3. Being a dedicated oil palm-based industrial cluster, POIC Lahad Datu is well set to work with all stakeholders for the development of a vibrant bio-refinery industry in Sabah.
COME AND DISCOVER POIC
YOUR GLOBAL INVESTMENT HUB

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THANK YOU
Discover Sabah, Borneo

- South China Sea
- Sabah, Borneo Map with various locations and attractions.
- Kota Kinabalu
- Pulau Tiga
- Labuan F.T.
- Kota Klias
- Beaufort
- Tenom Cultural Centre
- Padang Rafting
- Agriculture Park
- Long Pa Sia
- Keningau
- Tambunan
- Batu Punggul
- Tawau Hills Park
- Tawau
- Lahad Datu
- Celebes Sea
- Sulu Sea
- Kota Marudu
- Kota Belud Tamu
- Kudat
- Kundasang
- Ranau
- Rungus Long House
- Tuaran
- Mount Kinabalu
- Poring Hot Springs
- Tunku Abdul Rahman Park
- North Borneo Railway
- Sepilok Orang Utan Sanctuary
- Danum Valley
- Gomantong Cave
- Sukau
- Tabin Wildlife Reserve
- Pulau Sipadan
- Pulau Kapalai
- Pulau Mabul
West Coast Division

Bunga Raya Island Resort

Layang Layang Island

Tunku Abdul Rahman Park

Mount Kinabalu & Kinabalu Park
East Coast Division

Sipadan Island

Mataking Island

Mabul Island

Kapalai Island

Lankayan Island

Turtle Island Parks
Danum Valley Conservation Area

Maliau Basin; Sabah’s lost world

Sepilok Orang Utan Sanctuary

Labuk Bay Proboscis Monkey Sanctuary