National Biomass Strategy 2020: New wealth creation for the palm oil industry

Presentation document
1 Nov, 2012
Objectives of the National Biomass Strategy 2020

Create a national strategy on how to use biomass for **high-value downstream activities** (e.g., bioenergy, biofuel, biochemicals), starting with palm oil biomass.

Primary objective: **maximize sustainable GNI impact** from oil palm biomass in the 2020 time frame.

Other considerations:
- **Downstream** value creation
- High value **job creation**
- “**Indigenous technology**” creation within Malaysia
- **Sustainability** impact and emissions impact

Design principles:
- **Private sector led**
- No specific technology recommendations
Inclusive stakeholder effort: 300+ interactions

Stakeholder involvement
Advisory panel
Stakeholder labs
Survey with ~170 plantations and ~70 mills
Malaysia generates 80 m tonnes of dry palm biomass per year

<table>
<thead>
<tr>
<th>Biomass Type</th>
<th>Site of production</th>
<th>Annual availability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per ha (tonnes of dry biomass)</td>
<td>National total (m tonnes of dry biomass)</td>
</tr>
<tr>
<td>Fronds</td>
<td>Plantation 9.6</td>
<td>46.4</td>
</tr>
<tr>
<td>Trunks</td>
<td>Plantation 3.0</td>
<td>14.4</td>
</tr>
<tr>
<td>EFB</td>
<td>Mill 1.4</td>
<td>6.7</td>
</tr>
<tr>
<td>Shells (PKS)</td>
<td>Mill 0.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Fiber (MF)</td>
<td>Mill 1.4</td>
<td>6.9</td>
</tr>
<tr>
<td>POME</td>
<td>Mill 12.2 (wet weight)</td>
<td>59.3 (wet weight)</td>
</tr>
</tbody>
</table>
Harvesting the basal portion of the frond will provide 50% of the weight, allowing most of the fertilizer nutrients to stay on field.

<table>
<thead>
<tr>
<th>In percent</th>
<th>Top + middle (2/3rd of frond)</th>
<th>Basal (1/3rd of frond)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient content</td>
<td>66</td>
<td>34</td>
</tr>
<tr>
<td>Cellulose content</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Sugar content</td>
<td>34</td>
<td>66</td>
</tr>
</tbody>
</table>

- More than 50% of desired carbohydrate is found in the basal portion.
- Leaving the top and middle third of the frond ensures that the majority of the fertilizer value remains in the plantation.

1 NFC: Non fiber carbohydrate (sugars, starches, pectins, b-glucans, fructans)

## Detailed biomass costing methodology

<table>
<thead>
<tr>
<th>Biomass types (USD per tonne dry weight)</th>
<th>Fronds</th>
<th>Trunks</th>
<th>EFB</th>
<th>PKS</th>
<th>Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting &amp; collection</td>
<td>5 - 21</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pre-processing</td>
<td>19</td>
<td>26</td>
<td>31</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>(chipping)</td>
<td></td>
<td>(chipping)</td>
<td>(shredding + compacting)</td>
<td></td>
<td>(compacting)</td>
</tr>
<tr>
<td>Transportation</td>
<td>9 - 80</td>
<td>8 - 81</td>
<td>0 - 113</td>
<td>0 - 40</td>
<td>0 - 97</td>
</tr>
<tr>
<td>Substitution</td>
<td>11 + 5</td>
<td>24 + 3</td>
<td>29</td>
<td>41</td>
<td>13</td>
</tr>
<tr>
<td>(fertilizer)</td>
<td></td>
<td>(fertilizer)</td>
<td>(fertilizer), no application cost</td>
<td>(2010 price)</td>
<td>(2010 price)</td>
</tr>
</tbody>
</table>
The 2010 national biomass cost curve (fully-loaded cost methodology)

Cost of biomass in 2010
USD per tonne (dry weight)

- 13 m tonnes below USD 60 at fully-loaded cost
- 2 m tonnes below USD 40 at fully-loaded cost
- 25 m tonnes below USD 80 at fully-loaded cost

Biomass available
Million tonnes

1. Harvesting and collection cost
2. Substitution, harvesting and collection cost
3. Pre-processing cost
4. Transport cost
25m tonnes of biomass could potentially be mobilised across Malaysia at competitive cost.
Case example of Lahad Datu in Sabah

Lahad Datu is the port based bulking installation in Sabah with the 2nd largest biomass potential.

Biomass available (incremental)
- Million tonnes
  - 2.4
  - 2.2
  - 5.0

Cost, USD / tonne
- 40
- 60
- 80
- Total Cost
Wide range of downstream uses for oil palm biomass

SOLID BIOMASS

Lignocellulosic biomass

Fertilizer  Wood industry  Bioenergy  Pellets  Biofuels  Biobased chemicals  Other

Bioenergy to grid  Co-firing at mills  Petrol substitutes  Bioplastics  Diesel/jet-fuel substitutes  Neutra-ceuticals  Other

NON-EXHAUSTIVE
Biobased chemicals should offer highest value-add in the future

Revenue generated per tonne of lignocellulosic biomass input (dry weight)

- **Fertilizer**: 24-78 RM
- **Bioenergy**: 215-390 RM
- **Wood industry/Pellets**: 430-1,100 RM
- **Biofuels**: 380-1,250 RM
- **Biobased-chemicals**: 1,100-3,515 RM

Existing revenue per tonne today: 24-78 RM

Upper range
Lower range
Biobased chemicals to reach commercial scale between 2015-2020
Additional 20% biomass shift towards higher value uses by 2020

Use of biomass by type of end-product

Biomass used
Million tonnes, dry weight

- **Bio-chemicals**: Uncertain, but very high value
- **Bio-fuels**: Requires blending mandate
- **Pellets**: Possible today, enables mobilization

Share of total biomass available in given year

- **Biobased chemicals**
- **Fuels**
- **Pellets**
- **Wood products**
- **Energy**

Biomass to wealth

Business as usual

**2011**

<table>
<thead>
<tr>
<th>Year</th>
<th>Bio-chemicals</th>
<th>Bio-fuels</th>
<th>Pellets</th>
<th>Wood products</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>2015</td>
<td>3%</td>
<td>1%</td>
<td>3%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>2020</td>
<td>9%</td>
<td>4%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
</tbody>
</table>

**Total:**

- **2011**: 11%
- **2015**: 11%
- **2020**: 31%
Incremental GNI impact of ~RM 30 billion

Average revenue per tonne of biomass

- Business as usual:
  - Today: RM 1
  - 2015: RM 2-3
  - 2020: RM 6-7

- 2020 Biomass to wealth scenario:
  - 2015: RM 11-12
  - 2020: RM 35-39

Cumulative impacts:
- Cumulative RM 28-35 bn investment
- Cumulative RM 8-10 bn investment

- ~2% additional GNI impact
- ~66,000 new jobs
- ~12% CO₂e abatement
Private sector initiative to mobilize the biomass with targeted government support

**Challenges**
- Disproportionate focus on fertilizer
- Understanding of downstream opportunities and technology options
- Short-term monetization focus

**Government role**
- Funding (private sector led primarily through EPP mechanism)
- Capabilities
- Orchestration
Potential mobilization structure in 2015

**Plantations and mills**
- Large corp.
- Large corp.
- Mid size
- Mid size
- Small holder
- Small holder
- Small holder
- Independent mill
- Independent mill
- Independent mill

**Cooperatives**
- Full play portfolio cooperative
- Specialized biochemical cooperative
- Regional pellet cooperative
- Regional portfolio cooperative
- National wood pellet cooperative
- Specialized energy cooperative

**Technology players**
- Input to engineered wood player
- Input to ethanol intermediate producer
- Input to specialized chemicals player

**Downstream players**
- Part-owned biorefineries
- Fully owned pellet plant
- Input to independent bio-energy plants

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**Question areas to answer**
1. % of biomass off take
2. % of biomass off take
3. % of biomass off take
4. % of biomass off take
5. % of biomass off take

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**ILLUSTRATIVE**
The National Biomass Strategy was launched by Tan Sri Bernard Dompok at BioMalaysia in November 2011

“Given that Malaysia is the world’s largest exporter of palm oil, its waste alone holds tremendous potential for the creation of high value industrial applications…”

- Prime Minister Datuk Seri Najib Tun Razak, at the launch of the strategy at the opening of BioMalaysia 2011

SOURCE: Press articles
The 1MBAS initiative was launched on 22 March 2012 by PM at Parliament to ensure a synthesized approach to all Biomass related initiatives

1MBAS:
- A broader initiative to ensure Malaysia will become a leader in biomass utilisation and the Nation and its people will benefit from the opportunities
- To develop strategies for all Malaysian Biomass utilization opportunities (Palm Oil, Forestry, municipal waste etc.)
- To ensure and support delivery of National Biomass Strategy objectives:
  - Create new high value industries
  - Create jobs for Malaysians
  - Create additional GNI for the country

"1MBAS will focus on driving new sources of income generation, driving inclusiveness through job creation at all levels including in most remote parts of Malaysia and enhance development of new industries through the utilisation of biomass" – Prime Minister Dato’ Seri Najib Tun Razak at the launch of 1MBAS
On the same day 18 organisations committed to set up OPBC

- OPBC is a consortium made up of Malaysian upstream plantation companies, international downstream chemicals companies and Malaysian and International Academia and scientists
- The Oil Palm Biomass Center will focus on expediting the scaling up of technologies to convert biomass to high value chemicals in Malaysia
1MBAS taskforce – A cross-agency unit to ensure delivery of Biomass initiatives, while contributing to each respective agency’s KPIs

**FOCUS ON AND STRENGTHEN DELIVERY** of Malaysia’s National Biomass Strategy

**ALIGN STAKEHOLDERS**, public and private sector, towards a common goal and aspiration

**ATTRACT PARTNERS** to JV with or invest in high-value added biomass uses by providing a united front

**MOBILIZE BIOMASS** to facilitate effective usage towards high-value added applications

**DELIVERY MANAGEMENT** of EPPs with regular reporting and updates to Palm Oil NKEA

The government's principal agency for the promotion of the manufacturing and services sectors in Malaysia.

Custodian of Palm oil industry to enhance the well-being of the Malaysian oil palm industry through research, development and services

Responsible for the development of plantation industries namely palm oil, rubber, timber, cocoa, tobacco, kenaf, pepper and sago.

- Drive implementation of policy or government initiatives as lab result
- Reporting to Palm Oil NKEA (monthly)
- Tracking and monitoring of EPPs and initiative status
- Identify willing plantation owners and facilitate formation of cooperatives
- Assist coops in developing biomass portfolio strategy

- Conduct technology scanning to identify latest trends, opportunities
- Develop knowledge platform to share findings

- Develop investment opportunities / incentive packages
- Conduct international and domestic roadshow to attract
- Facilitate introduction of international players into Malaysia

- Nurture and accelerate growth of Malaysian companies, promote FDI and Create conducive environment for biotechnology

Others

Task Force
TaskForce process flow

Alert  >  Inform  >  Facilitate