Country Presentation
on Status of Bioenergy Development
In Malaysia

by
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Malaysian Palm Oil Board
Energy situation in the country

Primary Energy Supply 2012
- Hydropower: 3%
- Coal: 19%
- Natural gas: 46%
- Crude oil: 32%

Total: 83939 ktoe

Final Energy Consumption 2012 (Fuels)
- Petroleum: 53%
- Natural gas: 22%
- Electricity: 21%
- Coal: 4%

Total: 46710 ktoe

Final Energy Consumption 2012 (by Sectors)
- Industry: 30%
- Transport: 37%
- Agriculture: 2%
- Residential & commercial: 15%
- Non-Energy Use: 16%

Overview of the Malaysian Palm Oil Industry

- World’s second largest CPO producer
- World’s second largest exporter of palm oil products.
- Crude Palm Oil production in 2013: 19.23 mil. tonnes (94.92 mill. Tonnes FFB)
- Export earnings in 2013: RM 61.36 billion

Palm oil, oil palm biomass and biogas are major feedstocks for Biofuel & RE development in Malaysia
1) Use of mesocarp fibre and shell in palm oil mills for combined heat & power generation

2) First Generation Biofuels using Palm Oil & Waste Palm Oil - as liquified fuel for transportation and industrial sectors

3) Off & On-grid of Renewable Energy – in solid (in particular EFB) and gaseous (POME biogas) for heat and power generation

4) Second Generation Biofuels using Oil Palm Biomass (Thermo-Chemical & Bio process conversion for multi-forms fuel)
As of May 2014, a total of 55 biodiesel manufacturing licenses with a total annual capacity of 6.18 million tonnes were approved under the Malaysian Biofuel Industry Act, 2007.

From the total, 20 biodiesel plants were in commercial production (since 2006 – not all in active production) with production capacity of 2.65 million tonnes/year.

In addition, there were 11 plants with production capacity of 1.03 million tonnes per year that have completed construction but yet to commence production.

### Status of Approved Biodiesel Licencees (as at May 2014)

<table>
<thead>
<tr>
<th>Implementation Phase</th>
<th>No.</th>
<th>Production Capacity (Mil. T/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Production *</td>
<td>20</td>
<td>2.65</td>
</tr>
<tr>
<td>Completed Construction **</td>
<td>11</td>
<td>1.03</td>
</tr>
<tr>
<td>Under Construction</td>
<td>5</td>
<td>0.81</td>
</tr>
<tr>
<td>Pre-Construction / Planning</td>
<td>19</td>
<td>1.69</td>
</tr>
<tr>
<td>Total Approved</td>
<td>55</td>
<td>6.18</td>
</tr>
</tbody>
</table>

* On and off

** Not in commercial operation
Palm Oil Mill – Waste Section

- Palm Shell
- Mesocarp Fibre
- Palm Oil Mill Effluent
- Empty Fruit Bunch
### Oil Palm Biomass from Palm Oil Mills

<table>
<thead>
<tr>
<th>Biomass (wt% to FFB)</th>
<th>Quantity, Million tonnes</th>
<th>Moisture Content, %</th>
<th>Calorific Value, MJ/kg (dry basis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibre (13%)</td>
<td>12.34</td>
<td>37.00</td>
<td>18.8</td>
</tr>
<tr>
<td>Shell (6%)</td>
<td>5.69</td>
<td>12.00</td>
<td>20.1</td>
</tr>
<tr>
<td>EFB (23%)</td>
<td>22.88</td>
<td>67.00</td>
<td>18.9</td>
</tr>
<tr>
<td>POME (65%) (biogas)</td>
<td>61.70 (1728 mill m³)</td>
<td>-</td>
<td>20.0 MJ/m³</td>
</tr>
</tbody>
</table>

- Off-grid energy generated from shell and fibre used in POMs in year 2013 (based on 428 mills, 92.33 million tonnes of FFB processed at 20 kwh/tonne) was **1898.4 GWh or 396 MW**
## Potential Electricity from Oil Palm Biomass

<table>
<thead>
<tr>
<th>BIOMASS &amp; Biogas</th>
<th>Availability (mill. tonnes)</th>
<th>Lower CV, kJ/kg</th>
<th>Estimated Energy, MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFB (65% moist @ 100 % and 50% excess)</td>
<td>21.37 (10.69)</td>
<td>6,000 - 7000</td>
<td>1236 (@ 25% eff)</td>
</tr>
<tr>
<td>Palm Oil Mill Effluent (Biogas)</td>
<td>61.70 (1728 mill m³ biogas)</td>
<td>20 MJ/m³</td>
<td>533 (@ 40% eff)</td>
</tr>
</tbody>
</table>
EPP5: Building Biogas Facilities at Palm Oil Mills

- All palm oil mills to install biogas facilities (or methane avoidance) by 2020
- To encourage use as energy source for internal use and to supply to national electricity grid
- GNI – RM2.9 billion (~ USD 1 billion)

<table>
<thead>
<tr>
<th>Status</th>
<th>As of 16 July 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed Biogas Plants</td>
<td>66</td>
</tr>
<tr>
<td>Under Construction</td>
<td>11</td>
</tr>
<tr>
<td>Under Planning</td>
<td>150</td>
</tr>
</tbody>
</table>
Renewable Energy Development in Malaysia

8th Malaysia Plan (2001 – 2005)
- RE as the 5th fuel
- 5% RE in energy mix

9th Malaysia Plan (2006 – 2010)
- Targeted RE capacity to be connected to power utility grid:
  - 300 MW - Peninsular Malaysia;
  - 50 MW - Sabah
- Targeted power generation mix:
  - 56% natural gas, 36% coal, 6% hydro, 0.2% oil, 1.8% Renewable Energy
- Carbon intensity reduction target: 40% lower than 2005 levels by 2020

RE as of 31 Dec. 2013
- Connected to the utility grid (as of 2013): 149.78 MW
- Off-grid: >430MW (private palm oil millers and solar hybrid)

Source: Datuk Loo GT, 2nd ISES 2013
Policy Statement:

- Enhancing the utilisation of indigenous renewable energy resources to contribute towards national electricity supply security and sustainable socio-economic development

Objectives:

- To increase RE contribution in the national power generation mix;
- To facilitate the growth of the RE industry;
- To ensure reasonable RE generation costs;
- To conserve the environment for future generation; and
- To enhance awareness on the role and importance of RE.

RE Act 2011

- Enabled the establishment of SEDA Malaysia
- Launched the Feed-in Tariff Mechanism (FiT)
- Establish the RE Fund to finance the FiT.
- Came into force on 1st December 2011
### National RE Target

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative RE Capacity</th>
<th>RE Power Mix (vs Peak Demand)</th>
<th>Cumulative CO2 avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>73 MW</td>
<td>0.5 %</td>
<td>0.3 mt</td>
</tr>
<tr>
<td>2015</td>
<td>985 MW</td>
<td>6%</td>
<td>11.1 mt</td>
</tr>
<tr>
<td>2020</td>
<td>2,080 MW</td>
<td>11%</td>
<td>42.2 mt</td>
</tr>
<tr>
<td>2030</td>
<td>4,000 MW</td>
<td>17%</td>
<td>145.1 mt</td>
</tr>
</tbody>
</table>

### FiT Status as of January 2014

<table>
<thead>
<tr>
<th>No.</th>
<th>Renewable Energy Sources</th>
<th>Approved (MW)</th>
<th>FiTCD (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biogas</td>
<td>29.53</td>
<td>11.73</td>
</tr>
<tr>
<td>2</td>
<td>Biomass</td>
<td>166.49</td>
<td>50.40</td>
</tr>
<tr>
<td>3</td>
<td>Small Hydro</td>
<td>130.99</td>
<td>15.70</td>
</tr>
<tr>
<td>4</td>
<td>Solar Photovoltaic (PV)</td>
<td>209.06</td>
<td>85.36</td>
</tr>
<tr>
<td></td>
<td>• Individual</td>
<td>26.28</td>
<td>20.82</td>
</tr>
<tr>
<td></td>
<td>• Non-Individual</td>
<td>182.78</td>
<td>64.54</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>536.07</td>
<td>163.19</td>
</tr>
</tbody>
</table>

Source: seda.gov.my & Datuk Loo GT, 2nd ISES 2014
Issues & Challenges of Palm Biomass / Biogas based Renewable Energy

- Competitiveness uses of biomass / POME for non-energy products
- Interconnection issue / load demand – location of the power plants (for grid connected power plant)
- Uncertainties of long terms biomass supply & pricing mechanism, logistic and transportation cost
- Need for more financial support and incentives
- Inconsistency of biomass fuel quality – EFB pre-treatment plant
- Inconsistency of biogas yield – due to low crop season and weather that may affect the microbes activity
- High capital investment - digester tank technology/grid connection
Recommendation & Conclusion

- To enhance Government’s initiatives/ policy and industry support / participation

- Promotes the use of RE for additional revenue from power generated, saving on the operational cost etc

- Promotes the green image of industry through the use of RE, thus lower carbon footprint and better market access to competitive markets.

- Diversify the use and potential market of RE from oil palm biomass and biogas ( grid connection, rural electrification, industrial use ,etc)