The Truth about Palm Oil | Palm Oil Milling Initiatives

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Research & Development, Sime Darby Plantation Berhad

June 17, 2019
OUTLINE

The Company

- Sime Darby Plantation – An Integrated Plantation Company

The Truth about Palm Oil

- Current Scenario & Challenges
- Facts about Palm Oil

Palm Oil Milling Initiatives

- Overview on Milling Processes & Performance
- Current Challenges & Research Prospect
- Technological Development
The Company

Sime Darby Plantation
An Integrated Plantation Company
Business Overview

Integrated Plantation Company

**Upstream**
- Oil palm estate
- Mill

**Oil palm, rubber & sugarcane estates**
- Developing, cultivating and managing oil palm, rubber and sugarcane plantation estates

**Milling of FFB and processing & sales**
- Milling of FFB into CPO and PK
- Processing and sales of rubber and sugarcane

**Others**
- Cattle rearing and beef production

**Downstream**
- Refinery
- Food application

**Bulk and refined oils & fats**
- Production and sales of refined oils and fats (which includes specialty and end-user oils and fats)

**Oleochemicals, biodiesel products & derivatives**
- Production and sales of oleochemicals, biodiesel products and derivatives

**Others**
- High-yielding genome seeds
- Renewables

**R&D**
- Focused on yield and productivity improvements, increasing revenue streams and developing sustainable practices while pursuing innovative strategies

**Renewables business**
- Development of green technology and renewable energy which includes bio-based chemicals, biogas and composting

**Agribusiness**
- Provision of agriculture products and services
Sime Darby Plantation R&D Centre

Units & Roles

**Plantation Research & Advisory**
Provide technical support to maximize yield & productivity:
- Continuous improvement in agro-management practices
- Reduction in chemical inputs through IPM, biofertilisers & biopesticides
- Improve nutrient & water use efficiency

**Biotechnology & Breeding**
Breeding for continuous improvement in yield & other desirable economic traits:
- Marker assisted breeding program
- Optimisation production & performance of oil palm clones

**Advanced Agricultural Tech**
Developing new technologies to support R&D and Plantation operations:
- Labour reduction through mechanisation & automation
- Precision Agriculture Data analytics

**Processing Technology**
Audit & Advisory to maximise mill & refinery product recovery:
- Continuous improvement in processing technology to improve efficiency & cost
- Towards zero waste
- Waste to wealth initiatives

**Sime Darby Seeds & Agricultural Services**
Production & sale of elite planting materials
Agro-technology and management services to external parties

**Innovation Centres**
Provide technical service to all global customers, develop new products and provide technical support to refineries

**Minamas Research Centre**
Liberia Research Centre
OPRS Dami
Regional research centres providing similar functions as PRA & Breeding for the local estates.
Upstream Portfolio Spread Across 5 Countries

- **Landbank**: 1 mil ha
- **Planted area**: ~631,000 ha

- **Oil Palm**: 96%
- **Rubber & Sugarcane**: 4%
- **Cattle**

- **Estates**: 250
- **Mills**: 71

- **Crude Palm Oil**: 2.5 mil MT (Own Production)
- **Palm Kernel**: 0.6 mil MT (Own Production)

SDP accounts for:
- ~4% of total world CPO production
- ~20% of total world certified sustainable palm oil

Excludes Plasma/Outgrowers’ scheme (~100,000 ha)
Snapshot – Downstream Operation

~4 million MT Refining Capacity

10* Refineries

73%* Average Refinery Utilisation

Key Products

Note: ○ Bulk Processing  ● Differentiated Food
* Excluding Industrial Enterprises (IE) Soya in Thailand and GH Nhabe in Vietnam
Figures as at 31 June 2018

Refined bulk products produced by the Group’s bulk refineries: RBD Olein, RBD Stearin, CPKO, RBD PKO, etc.
Ingredients produced by the Group’s refineries: Bakery fats, specialty oils, confectionery fats
Non-food products produced by the Group’s biodiesel, oleochemicals and nutrition plants
The Truth about Palm Oil

Current Scenario & Challenges

Facts of Oil Palm
Rang-tan, the story of dirty palm oil

Facts about palm oil?
Negative Perception: Anti-Palm Oil Campaign
Changing Perception : Love MY Palm Oil

Malaysia launches “Love MY Palm Oil” campaign in the face of Europe’s anti-palm oil stand

By Anna Maria Romero - January 11, 2019

24 March 2019 at Sime Darby Plantation, Carey Island, Selangor.

MAHB, Malaysia Airlines, AirAsia and Malindo to help promote palm oil

Indonesia and Malaysia unite to fight EU’s ban on palm oil
The Truth

THE PALM OIL STORY
THE MOST WIDELY USED VEGETABLE OIL IN THE WORLD

From the fruits of a palm oil tree
Each fruit contains 30-35% oil
Harvested every 10 days
Use in food dates back 5,000 years

From a tropical climate
A palm tree produces 40 kg of oil every year

STIMULATES LOCAL ECONOMIES
Palm oil creates jobs: 1 worker per 8ha
Indonesia & Malaysia provide 85% of the world production
Grows best around the equator

SUSTAINABLE PRODUCTION
No cultivation in primary forests
Low pesticides usage
Education for boys and girls
Annual sustainable production
Environmental and social responsibility for future generations

A HIGHLY EFFICIENT CROP

3.8
0.8
0.7
0.5

tons per hectare
Palm
Rape
Sunflower
Soy

2011
2013
2015

5.6
9.8
12.9

million tons

GROWING GLOBAL DEMAND

Global Oilseed Harvested Area (mln ha)

Soya Bean Oil

Source: European Palm Oil Alliance

Source: FAO, Oil World 17/18

Source: European Palm Oil Alliance

Figure 1:
World Oils & Fats Production, 2017
219.97 million tonnes

Soya Oil 24.47%
Rapeseed Oil 11.50%
Sunflower Oil 8.67%
Coconut Oil 1.11%
Animal Fats 8.65%
Others 11.84%
Palm Oil 30.50%
Palm Kernel Oil 3.25%

Source: Oil World & MPOC estimates

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Immense Health Benefits of Palm Oil

A healthier, high-carotene & trans-fat free alternative

Source: MPOC

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Global Vegetable Oil Demand & Supply

Population Growth is a Key Driver

Vegetable Oil Demand & Supply vs Population

Oil World ISTA Mielke GmbH, Hamburg www.oilworld.biz

Note: Europe consumption per capita for EU-28 only, excludes Russia & Eastern Europe countries

Growing population (9.7 bil by 2050) + increased life expectancy, raising concerns over Food Security, Food Safety and Sustainability

- Global oils and fats consumption expected to increase
  - From 180 mil MT to 250 mil MT in the future

- Dr. James Fry’s study in 2013 – that the world will lose 145 million Ha of Forest land by the year 2050 to feed the 9.7 billion people if it uses other edible oils such as Soya, Sunflower, Rapeseed etc.

- With Oil Palm it will be less than 10 – 14 million Ha.

145 millions hectare is equivalent to?

| 145 millions Ha | = | 2x the size of France | or | 43x the size of Netherlands | or | 2,111x the size of Singapore |

Source: James Fry (2016). What are the implications of a halt to all expansion in oil palm areas? PAC Seminar, Malaysian Palm Oil Board.
Immense Opportunities Await…

- Palm Oil plays a critical role in helping to feed 3 billion people in more than 150 countries worldwide
- Feeding another 2 billion people by the year 2050 is NO small feat
- Palm Oil will remain relevant as it is now an Irreplaceable part of the Global Food Supply Chain
- Palm Oil is expected to account for 55% of the Global Edible Oil Consumption in the next 35 years!

(Source: Global Oils & Fats. June 2017)
Palm Oil Milling Initiatives

Overview on Milling Processes & Performance

Current Challenges & Research Prospect

Technological Development
Oils Processing
From Oil Palm Tree to Edible Palm Oil

1. **Planting**
2. **Harvesting**
3. **Collecting**
4. **Weighing**
5. **Milling**
6. **Sterilizing**
7. **Threshing & Digesting** (Oil extraction)
8. **Clarifying**
9. **Quality Inspection**
10. **Storage**
11. **Reception**
12. **Refining**
13. **Quality Inspection**
14. **Packaging / Drumming**
15. **Shipping / Delivery**

**Estate**
- Palm Tree
- Nursery

**Mill**
- Milling
- Quality Inspection

**Refinery**
- Refining process
- Packaging / Drumming
- Shipping / Delivery

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Palm Oil Milling

Oil Extraction Rate (OER) = 20-22%
Oil Losses = 1.40-1.60%
## Today’s Mill Challenges

| Stagnant process          | • Same process for the past 30-40 years  
|                          | • Stagnant oil extraction and mill efficiency  
|                          | • Increase of operational cost  |
| Additional New Requirement | • New parameter such as 3-MCPD and GE  |
| High Energy Utilisation and Carbon Footprint | • Solid waste as fuel – tendency for low boiler efficiency  
|                          | • Malaysian commitment for 40% Carbon Emission reduction by year 2020  |
| Stricter Emission and Discharge Limit | • More stringent effluent and boiler emission standard  
|                          | • More CAPEX and OPEX utilisation  |
| Perception               | • Consumer perception on non-hygienic means of oil palm fruits handling and processing during milling  
|                          | • GMP, HACCP, HALAL Certifications, etc  |
| Weather                  | • El Nino affected the production of palm oil in Malaysia, reduce productivity and increase cost of production  |
| Labour Issue             | • Increase in wages  
|                          | • Human error  |
Research/Improvement Opportunities

**Economic**
- **High Efficiency**
  - 93% Oil
  - 96% Kernel
- **Low Processing Cost**
  - RM20-25/FFB
- **High Value Products**
  - CPO, Kernel

**Environmental**
- **Green Mill**
  - Power 25-30kW
  - POME 0.7-0.75/FFB
- **Environmental Friendly**
  - DOE compliance
- **Zero Discharge**
  - Liquid waste
  - Solid waste

**Technology Advancement**
- **Automation/Mechanization**
  - Manpower, human error, hazard
- **Compact Mill**
  - Multiple unit operation
  - Large footprint
- **Minimal Labour**
  - 70-80 pax/mill

**Standard**
- **High Safety Standard**
  - LTIFR
- **Food Grade Factory**
Example:
High Efficiency Improvement
High Efficiency Improvement

- OER is Oil Extraction Rate.

**Oil Input = OER + Oil Losses**

$$OER = \frac{\text{Weight of Oil Produced}}{\text{Weight of FFB Processed}}$$

<table>
<thead>
<tr>
<th>Loss Type</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil loss in press fibre</td>
<td>0.60%</td>
</tr>
<tr>
<td>Oil loss in final effluent</td>
<td>0.40%</td>
</tr>
<tr>
<td>Oil loss in empty bunch</td>
<td>0.30%</td>
</tr>
<tr>
<td>Oil loss in decanter cake</td>
<td>0.10%</td>
</tr>
<tr>
<td><strong>Total oil loss</strong></td>
<td>&lt;1.40%</td>
</tr>
</tbody>
</table>
High Efficiency Improvement

Separate Mesocarp Extraction

Screw Press-continuous process
## High Efficiency Improvement

### Inorganic Enhancer

<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>Author</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Surfactant for Oil Recovery</td>
<td>G.P. Ahearn</td>
<td>Usage of surfactant as support for the current water injection system for oil recovery</td>
</tr>
<tr>
<td>2</td>
<td>Improved Oil Recovery by Surfactant and Polymer Flooding</td>
<td>L.A. Wilson, Jr.</td>
<td>Usage of surfactant and type of water are influence by the type of oil, pH, temperature and fluid composition</td>
</tr>
<tr>
<td>3</td>
<td>Biosurfactant Production by Bacillus Subtilis B20 using Date Molasses and its possible application in enhanced oil recovery</td>
<td>S.N. Al Bahry</td>
<td>Biosurfactant can reduce the surface tension and allow for additional 9.7% oil recovery</td>
</tr>
<tr>
<td>4</td>
<td>Treatment of Cutting Oil/Water Emulsion by Coupling Coagulation and DAF</td>
<td>K.Bensadok</td>
<td>Usage of sulphuric acid, ferric chloride and calcium chloride can destabilize the emulsion thus assist in turbidity removal and oil recovery</td>
</tr>
<tr>
<td>5</td>
<td>Coagulation of Residue Oil and Suspended Solid in POME by Chitosan, Alum and PAC</td>
<td>A.L. Ahmad</td>
<td>Usage of chitosan, Alum and PAC will assist in removal of oil together with suspended solid from POME. Therefore, it cannot be used to recover oil from POME</td>
</tr>
</tbody>
</table>

- Evaluation conducted in 4-months period
- Results illustrates a 95% confident internal for a mean difference of 1% increase for oil recovery rate

### Regression Analysis: %ORR versus Dosing, Day, Line

**Method**

Categorical predictor coding (1, 0)

**Analysis of Variance**

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Seq SS</th>
<th>SS</th>
<th>Contribution</th>
<th>Adj SS</th>
<th>Adj MS</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>38</td>
<td>1238.83</td>
<td>97.94%</td>
<td>1238.83</td>
<td>32.6009</td>
<td>43.74</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td>36</td>
<td>1166.47</td>
<td>92.37%</td>
<td>1169.11</td>
<td>32.4752</td>
<td>43.57</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>Line</td>
<td>1</td>
<td>52.69</td>
<td>4.17%</td>
<td>52.69</td>
<td>52.6927</td>
<td>70.70</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>Dosing</td>
<td>1</td>
<td>17.67</td>
<td>1.40%</td>
<td>17.67</td>
<td>17.6721</td>
<td>23.71</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>35</td>
<td>26.09</td>
<td>2.06%</td>
<td>26.09</td>
<td>0.7453</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td>1264.92</td>
<td>100.00%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Model Summary**

<table>
<thead>
<tr>
<th>S</th>
<th>R-sq</th>
<th>R-sq(adj)</th>
<th>PRESS</th>
<th>R-sq(pred)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.863335</td>
<td>97.94%</td>
<td>95.70%</td>
<td>115.464</td>
<td>90.87%</td>
</tr>
</tbody>
</table>
High Efficiency Improvement

Membrane Oil Recovery System

- Maximising oil recovery/minimising oil losses
- To reduce biological load of raw POME i.e BOD, COD, SS, etc.
- 50-60% BOD & COD reduction
- To ease and reduce effluent treatment plant cost.
- To support compliance to the new DOE effluent discharge limit.

Raw POME
SS – 2-5%
Oil – 0.5-1.2%

Membrane Oil & Biosolid Recovery System

Filtered POME
Biosolid recovery before effluent treatment plant (ETP)
Example:
Environmental Friendly
Environmental Friendly

Department of Environment (DoE) has circulated new draft in 2015:

- More stringent on treated effluent discharge
- Proposed to be enforced by July, 2016 but deferred after hearing comments from industries.
Environmental Friendly

Steriliser condensate

Empty Fruits Bunch (EFB)

Decanter solid

Kernel

Fibre: 12-13% to FFB

Shell: 6-8% to FFB

POME: 60-75% to FFB

EFB: 22-23% to FFB

Hydrocyclone/claybath waste

Shell

Excess fibre

Excess shell

Boiler ash/clinker

Anaerobic solid

Aerobic solid

Final Discharge Water

CPO

Kernel

Sterilisation

Threshing

Digestion/Pressing

Oil Room

Clarification/Oil Purification & Sludge Separation

Kernel Recovery Plant

Depericarping Nut Cracking Kernel/Shell Separation

Power House

Boiler & Power Generation

Effluent Treatment Plant

Fresh Fruit Bunches (FFB)
Environmental Friendly

Fresh Fruit Bunches (FFB)

Sterilisation

Threshing

Digestion/Pressing

Oil Room
Clarification/Oil Purification & Sludge Separation

Kernel Recovery Plant
Depericarping Nut Cracking Kernel/Shell Separation

Power House
Boiler & Power Generation

Effluent Treatment Plant

Kernel

CPO

Steriliser condensate

Centr.waste/ decanter h.phase

Hydrocyclone/ claybath waste

Fibre

Shell

Empty Fruits Bunch (EFB)

Decanter solid

Excess fibre

Excess shell

Anaerobic solid

Aerobic solid

Final Discharge Water

Biogas

Compost

Mulching in oil palm plantation

Surface landfill/compost

Organic fertilizer

Road surface

Recycled as process Water or boiler water feed

Compost

Organic fertilizer

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Environmental Friendly
Effluent Treatment System

FFB

Oil Mill

Composting Plant

Polishing Plant

EFB

Aerobic

Cooling Pond

Anaerobic

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Example:
High Value Products - Oil Quality Improvement
Palm Oil Washing with Bio-based Solution

- Improve the CPO quality (FFA, 3-MCPD)
- Highly Commended for Palm Oil Award, IChemE 2018
  PI 2018702151 (Malaysia)  
  P00 2017 03656 (Indonesia)
Separate Loose Fruits Processing

- Improve the CPO quality
- Reduce Steam Consumption
- Reduce Oil Loss in EFB
- Patent filing: PI 2018000689 (Malaysia)
Example:
Technology Advancement Improvement
Experimental Plant

Pilot Plant

• Carey Island
• Fundamental Study
• Control Trials
• Laboratory to pilot scale trials

Experimental Station

• Bestari Jaya
• Pilot to commercial study
• 200+ sensors
• Pilot to commercial trial
• Mill optimization
THANK YOU
mervin.chew.chienlye@simedarbyplantation.com
Appendix
The Truth

Global Oilseed Harvested Area (mil ha)

- **Soya Bean Oil**: 33
- **Rapeseed Oil**: 27
- **Sunflower Oil**: 82
- **Oil Palm**: 126
- **Others**: 20

Source: FAO, Oil World 17/18

**Green cover for 97% of the total oil palm areas**

**The oil palm industry is a net carbon sink**

**Oil Palm plantations are capable of removing as much CO2 as tropical forests**


**Emits 8–10x more O₂**

**Absorbs 10x more CO₂**

Per ha/year compared to other crops

Global Demand Scenarios and Impact on Malaysian Palm Oil

**Figure 1:**
World Oils & Fats Production, 2017

<table>
<thead>
<tr>
<th>Oil Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soyabean Oil</td>
<td>24.47%</td>
</tr>
<tr>
<td>Rapeseed Oil</td>
<td>11.50%</td>
</tr>
<tr>
<td>Sunflower Oil</td>
<td>8.67%</td>
</tr>
<tr>
<td>Coconut Oil</td>
<td>1.11%</td>
</tr>
<tr>
<td>Animal Fats</td>
<td>8.65%</td>
</tr>
<tr>
<td>Others</td>
<td>11.84%</td>
</tr>
<tr>
<td>Palm Oil</td>
<td>30.50%</td>
</tr>
<tr>
<td>Palm Kernel Oil</td>
<td>3.25%</td>
</tr>
</tbody>
</table>

Source: Oil World & MPOC estimates

Source: MPOC Annual Report 2017
Behind beef, soy is the second largest agricultural driver of deforestation worldwide.

Source: WWF 2018
The company initiative

NEW PLANTING

Our New Planting Policy takes into account not only local laws and the Principles and Criteria of the Roundtable of Sustainable Palm Oil (RSPO), but also the traditions and practices of the local communities living in the areas of our operations.

Social & Environmental Impact Assessments (SEIA)

Sime Darby Plantation undertakes Social & Environmental Impact Assessments (SEIA) as a standard operating procedure before any development begins. The company does not plant on High Conservation Value (HCV) ground.

As a founding members of RSPO, Sime Darby Plantation respects and fulfils the principles and criteria set. The company has strict policies against the clearing of HCV forests and virgin jungles, graveyards, identified buffer and riparian zones. All of these commitments have been discussed at the RSPO’s RTS-7 summits and have been endorsed by the Board of Directors of Sime Darby Berhad, the parent of Sime Darby Plantation.

Sime Darby Plantation’s commitment towards sustainable plantation practices includes maintaining High Conservation Value (HCV) areas in its estates. The following areas will be considered to be maintained as HCV:

- Natural forests within the estates.
- Wetland areas
- River boundaries
- Water catchments and effluent pond areas
- Marginal soil areas
- Areas with slopes of more than 20 degrees gradient
- Land belonging to local indigenous peoples

As per RSPO’s requirement, we shall only use HCV assessors accredited by the HCVRN Assessor Licensing Scheme (ALS) in conducting assessments.

http://www.simedarbyplantation.com/sustainability/beliefs-progress/practices-key-initiatives/good-agricultural-practices/new-planting
‘Crosscheck’ is Sime Darby Plantation’s major step forward in our journey to creating a deforestation-free supply chain. It is an open source online tool that is available to everyone.

We believe the frontier to halting deforestation is traceability. ‘Crosscheck’ allows us to trace to supply back to its source, making it possible to identify where problems exist - and take action.

http://www.simedarbyplantation.com/sustainability/crosscheck
Sime Darby Plantation: Roadmap to No Deforestation

Our Approach and Progress to No Deforestation in our Supply Chain

Guiding Principles: New York Declaration on Forests
The Declaration pledges to halve the rate of deforestation by 2020, to end it by 2030, and to restore hundreds of millions of acres of degraded land.

Pre 2014
- No new development on peat regardless of depth
- Application of RSPO New Planting Procedures which include FPIC, HCV and SEIA Assessments prior to planting
- Conservation of HCV areas identified
- Conservation, Restoration and Biodiversity projects
- Transparency through sustainability reports, annual reports, website, FTSE4Good, DISL, ACOP, CDP

2014
- Nov 2014 - Commitment to New York Declaration on Forests
- Zero Burn Policy since 1990’s, 24 hour Hotspot Monitoring

2015
- Phase 1 - Forest Protection
- Initial focus on internal operations
- Moratorium on any new palm oil development
- Rollout of SDP Responsible Sourcing Guidelines to Outside Crop Purchase & 3rd Party Suppliers

2016
- Phase 2 - Forest Enhancement
- Commerce engagement with direct suppliers
- Launch of Responsible Agriculture Charter (Sept 2016)

2017
- Phase 3 - Forest Restoration
- Deeper dive into indirect supply chain
- Launch of Human Rights Charter (Feb 2017)
- Develop Innovation and Productivity Charter

2018
- Inclusion of HCSA requirements into RSPO PBC Review 2018 onwards

2019
- Ongoing commitment to the High Carbon Stock Approach (HCSA)
- Participation in Tropical Forest Alliance (TFA 2020)

2020
- Participation in Fire Free Alliance (FFA)
- Participation in Sabah RSPO Jurisdictional Approach
- Formation of PONCO Alliance
- Inclusion in SPOTT Assessments
- Disclosure of Supply Chain Traceability via Open Palm Dashboard
- Disclosure of Hotspots via Online Hotspot Dashboard
- Disclose Global Mill List

http://www.simedarbyplantation.com/sustainability/responsible-agriculture-charter
GenomeSelect™

100 ha
2016

1000 ha pa

Full replant
2022

16% yield improvement = feed 15 million people without any extra land