MPOB Side Event

The Malaysian Approach: Climate Change Mitigation and Adaptation Measures by the Oil Palm Industry

Pitaya Room, 1 December 2010

Cancunmesse, Cancun, Mexico

# Life Cycle Assessment of Palm Biodiesel

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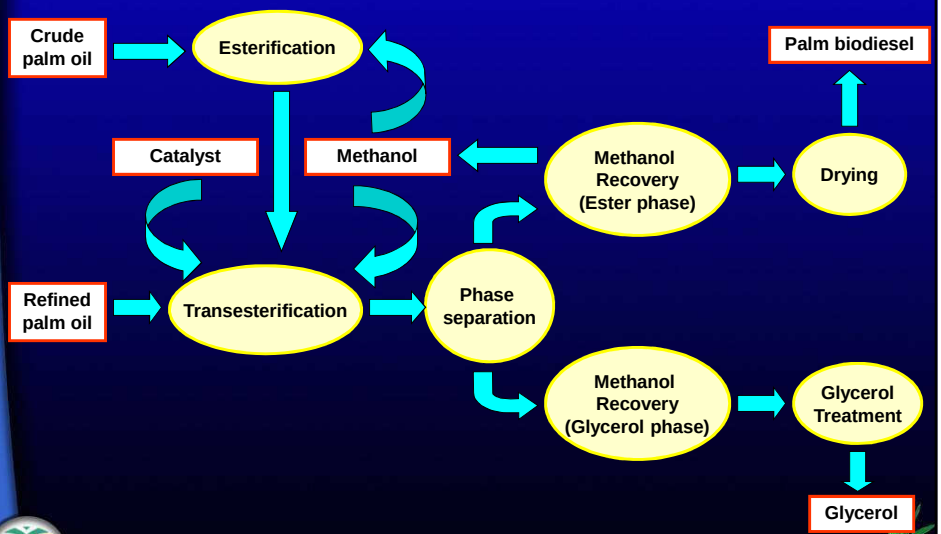
# Development of Biodiesel Industry in Malaysia

- Malaysia has undertaken R&D on palm-based biofuels since 1982
- Home-grown palm biodiesel production technologies, including winter grade biodiesel have been successfully commercialised
- Both summer and winter grades biodiesel are exported to EU, USA, Taiwan, Kenya and India
- Palm biodiesel meets the international standards (EN 14214 and ASTM D6751)

# MPOB Palm Biodiesel Process

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# Biodiesel Plant, Malaysia

Normal-grade Palm Biodiesel Plant 60,000 TPA

Winter-grade Palm Biodiesel Plant 30,000 TPA

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# Palm Biodiesel


Summer-Grade
Palm Biodiesel

Pour point +15° C


Winter-Grade
Palm Biodiesel

Pour point –21° C



# Mitigation Benefits

- Bioenergy produces mitigation benefits by displacing fossil fuel use
- However, the production and use of bioenergy raises some concerns on environmental issues
- This study provides a quantifiable measures to show that palm biodiesel is environmental friendly

## Life Cycle Assessment (LCA)

Tool to comprehensively quantify and interpret the flows to and from the environment over the entire life cycle of a product or process: *cradle to grave*



## Objectives

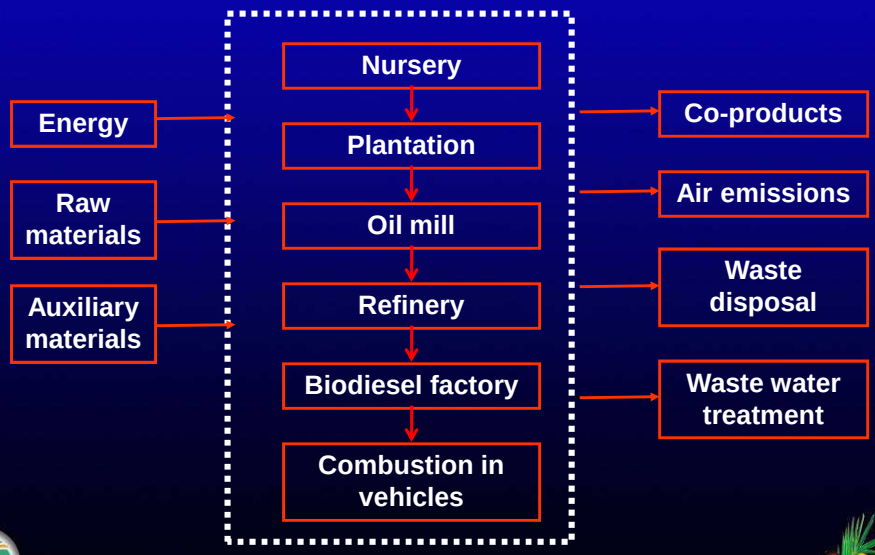
- To conduct LCA to quantify the comprehensive sets of environmental flows (to and from the environment) associated with palm biodiesel, beginning from the nursery
- To provide the necessary yardstick for stakeholders of the Malaysian oil palm industry for improvement of environmental performance

# LCA Methodology

1. Goal and scope definition
2. Inventory analysis
3. Impact assessment
4. Interpretation



# System Boundary: LCA of Palm Biodiesel



## Life Cycle Inventory

| | Inventory |
|---|---|
| Nursery | 21 |
| Plantation | 102 |
| Oil Mill | 12 |
| Refinery/Fractionation | 11 |
| Biodiesel factory | 4 |



## Life Cycle Inventory

- Data validation through on-site visits, interviews and discussion
- Inventory data reviewed by stakeholders of the Malaysian oil palm industry
- Weighted averaged data used

# Life Cycle Impact Assessment of Palm Biodiesel



## Life Cycle Impact Assessment

- LCA software SimaPro 7.1
- The Eco-Indicator 99 methodology
- SimaPro software used is based on European database
- Malaysian database on input/output data is limited and is used wherever possible

# Life Cycle Impact Assessment

- **Allocation of co-products:**
  - **Palm fatty acid distillate**
  - **Palm kernel**
  - **Glycerine**

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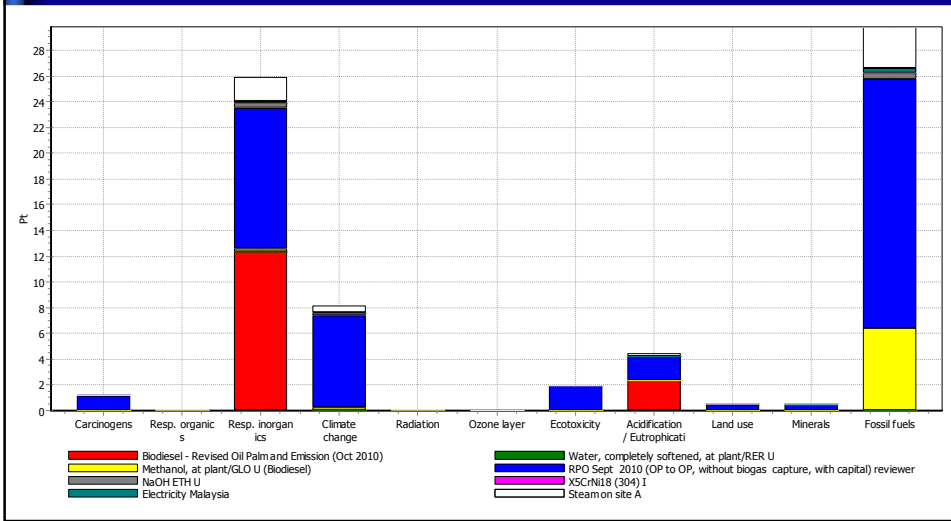
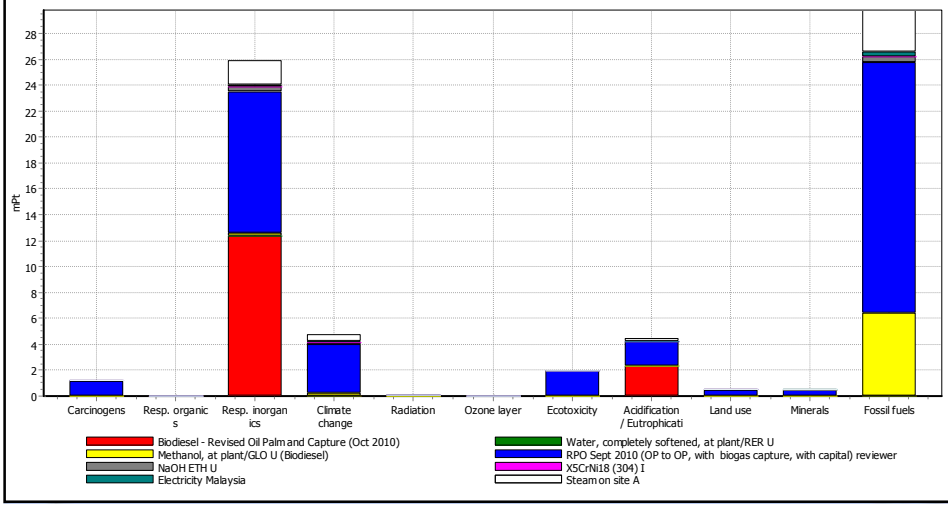
# Weighted LCIA: Cradle to Grave Study Palm Oil Mills with Biogas Emission



# Weighted LCIA:
# Cradle to Grave Study
# Palm Oil Mills with Biogas Capture




# MPOB LCA Study

- MPOB LCA study for the production of palm biodiesel has been accepted by international external reviewers' panel
- The results of the study will be published by MPOB

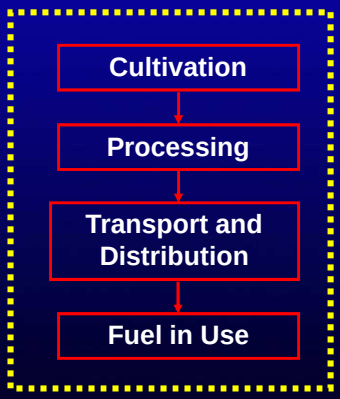
## Possible Mitigation Measures

| Impact category: Fossil fuels | Possible approach |
|---|---|
| Boiler and transportation fuel | Palm biodiesel |
| Methanol | Bioethanol (from biomass) |
| Fertilisers production | Biofertilisers |

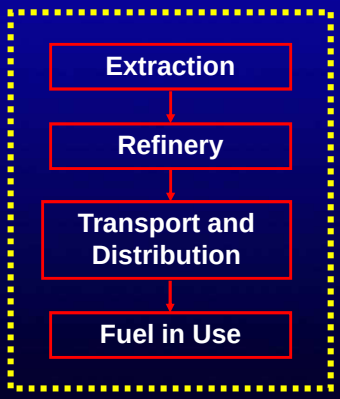


## Directive of the European Parliament and of the Council on the Promotion of the Use of Energy from Renewable Sources (2009/28/EC)

# Comparative LCA Study: Palm Biodiesel and Petroleum Diesel




LCA of Palm Biodiesel




LCA of Petroleum Diesel



# Calculation of GHG emissions

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{ccs} - e_{ccr} - e_{ee}$$

| | |
|---|---|
| $E$ | total emissions |
| $e_{ec}$ | emissions from the extraction/cultivation of raw materials |
| $e_l$ | annualized emissions from C stock changes caused by land use change |
| $e_p$ | emissions from processing |
| $e_{td}$ | emissions from transport and distribution |
| $e_u$ | emissions from the fuel in use |
| $e_{ccs}$ | emission savings from C capture and sequestration |
| $e_{ccr}$ | emission savings from C capture and replacement |
| $e_{ee}$ | emission savings from excess electricity from cogeneration |

## Calculation of GHG savings

GHG savings = $(E_F - E_B) / E_F$

$E_B$ = total emissions from biofuel or other bioliquid

$E_F$ = total emissions from the fossil fuel comparator (83.8 g $CO_{2eq}$/MJ)



## GHG Emission Savings from Selected Biofuels

| Biofuel Feedstock | GHG emission savings (%) | |
|---|---|---|
| | Typical | Default |
| Palm oil biodiesel (process not specified) | 36 | 19 |
| Palm oil biodiesel (process with methane capture at oil mill) | 62 | 56 |
| Soybean oil biodiesel | 40 | 31 |
| Rapeseed oil biodiesel | 45 | 38 |
| Sunflower seed oil biodiesel | 58 | 51 |

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# Calculation of GHG emission savings based on Malaysian Data



## GHG Emission Savings* (Based on MPOB Data)

| Palm biodiesel pathway | GHG emission savings (%) |
|---|---|
| Palm oil biodiesel (Without biogas capture) | 50 |
| Palm oil biodiesel (With biogas capture) | 71 |

* Based on methodology as stipulated under EU Directive on the Promotion of the Use of Energy from Renewable Sources (2009/28/EC)

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## Current Status

- MPOB provided the LCA data to Joint Research Centre (JRC) for their consideration after consultations with the stakeholders of the oil palm industry.
- However, JRC is considering using LCA data for palm biodiesel based on global producers and not from Malaysia only.
- MPOB continues to engage with JRC to ensure that the market access of palm biofuels is not affected.



## Public Consultations on EU Directive

- MPOB had provided comments for public consultations by European Commission:
  - Indirect land use change, biofuels and bioliquids – pre-consultation (July 2009)
  - Biodiverse grassland, biofuels and bioliquids (February 2010)
  - Impact of biofuels on indirect land use change (October 2010)
- The comments can be viewed at http://ec.europa.eu/energy/renewables/consultations/index_en.htm

# Renewable Fuel Standard Program (RFS 2)



## Life Cycle GHG Thresholds Specified in EISA (*Percent reduction from 2005 baseline*)

| Fuel Category | GHG threshold (%) |
|---|---|
| Renewable fuel* | 20 |
| Advanced biofuel | 50 |
| Biomass-based diesel | 50 |
| Cellulosic biofuel | 60 |

*Source: Office of Transportation and Air Quality; EPA-420-F-10-007, February 2010*

** Note: The 20% criterion generally applies to renewable fuel from new facilities that commenced construction after 19 December 2007*

## Current Status

- Palm biodiesel has not been approved as a feedstock for biodiesel but EPA is evaluating LCA for palm-based biodiesel.
- MPOB has provided data required by EPA for the evaluation of palm-based biodiesel (early June 2010).
- MPOB continues to communicate with EPA through MPOB Regional Office in Washington and monitor the development of RFS 2.
- MPOB responded to two public consultations for RFS 2



## Importance of LCA to the Oil Palm Industry

- Advantage in the market for environmental friendly products
- A sector backed by an LCA study has a competitive edge in the global market
- Engaging in LCA is a key element for gaining credibility on sustainable claims

## Conclusion

- Palm biodiesel contributes to GHG emission reduction
- The environmental impact due to fossil fuels can be reduced with the use of energy from renewable sources such as oil palm biomass
- Use of Malaysian palm biodiesel helps to mitigate climate change