

Conversion of POME to Biogas

Energy from POME - Challenges and Opportunities -

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Malaysia and Palm Oil Industry



- **Population ~ 30 million, multi-cultural, truly Asia!**
- **Land area ~ 33 million hectares**
- **Oil palm ~ 5 million hectares (15% of land area)**
- **Palm oil mills ~ 400**
- **Economic Transformation Programme (2010)**
- **GNI per capita, from USD6700 to USD48000**
- **Towards a developed nation by 2020**
- **National Biomass Strategy 2020**

ETP, NKEA Palm Oil and EPPs

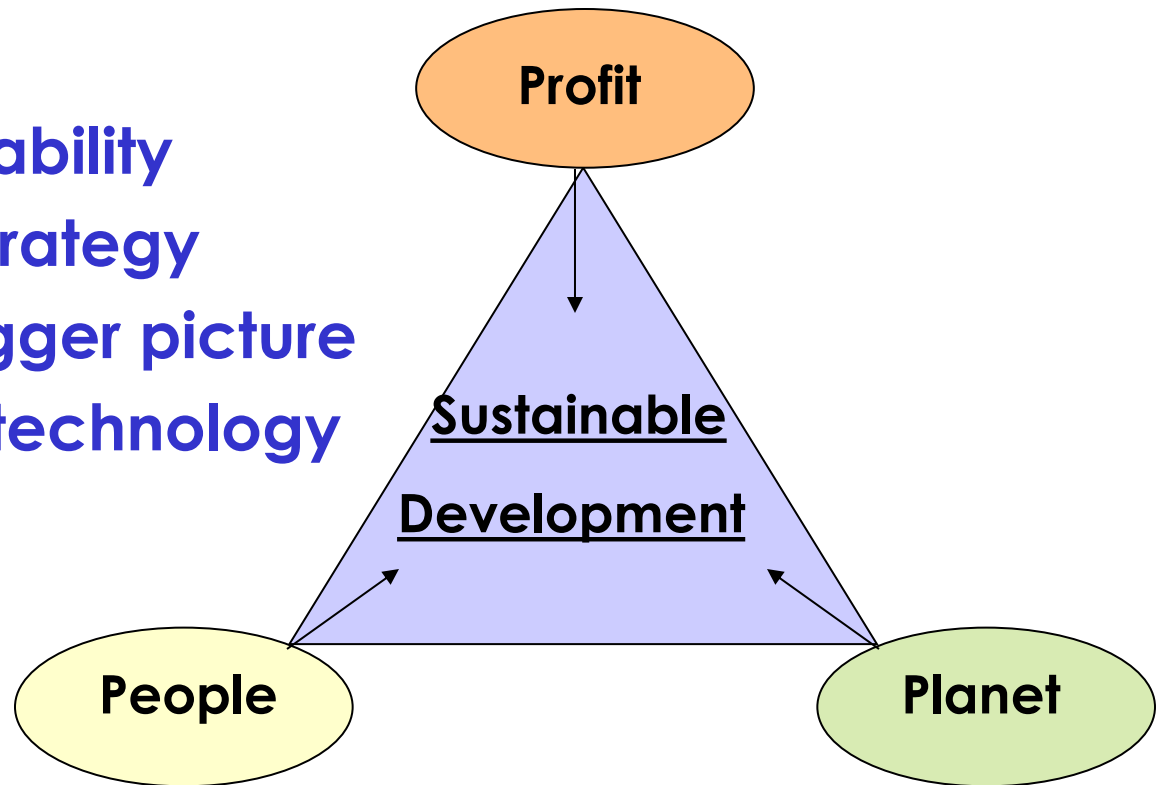


- ETP, NKEA Palm Oil and 8 EPPs (low hanging fruits)
- Focus on \uparrow GNI, \uparrow Jobs, \downarrow Carbon
- EPP#4 on OER (20.5% to 23% by 2020)
- EPP#5 on Biogas Capture (400 mills by 2020)
- 20mg/L BOD in POME discharged
- 0.15 g/Nm³ mill particulate emissions

Sustainability & Green Technology



- Merging the 3Ps
- Towards sustainability
- >>> **win-win-win** strategy
- Consider the bigger picture
- Develop green technology

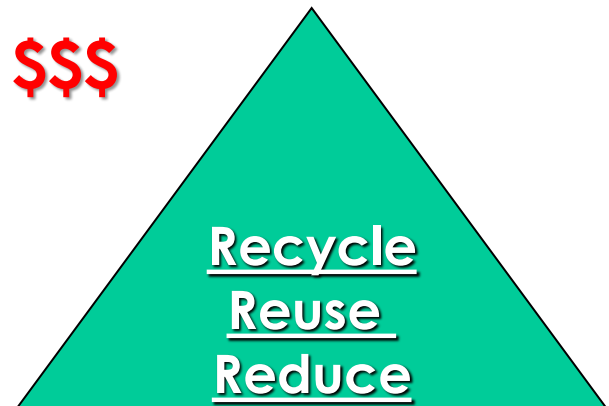


Biomass
~~Problem~~ → Profit

Waste Management and Utilisation



- The 3 stages of waste management
 - 1. treatment to meet discharge standards
 - 2. incorporate 3R strategies
 - 3. zero-emission (integration)
- 3Rs – reduce, reuse, recycle
- Concept of zero-emission
- w2w.. from waste to wealth \$\$\$
- b2b.. from biomass to business! \$\$\$



Oil Palm Tree and Fresh Fruit Bunch



Oil Palm Plantation Area in Malaysia \sim 5 million hectares

Oil yield: 3 – 5 tones/ (ha \cdot year)

Number of Palm Oil Mills: 400 (10,000 ha-plantation/mill)

30,000 tones CPO/(mill \cdot year)

Malaysian Palm Oil Industry



Palm Kernel Oil
2 million tonnes

Fresh Fruit Bunch
80 million tonnes

Oil Extraction

Crude Palm Oil
18 million tonnes



Renewable Resources

Fronds 83MT!
Trunks 15MT!

Fiber
8 million tonnes

Shell
4 million tonnes

Palm Oil Mill Effluent
50 million tonnes

Empty Fruit Bunch
17 million tonnes

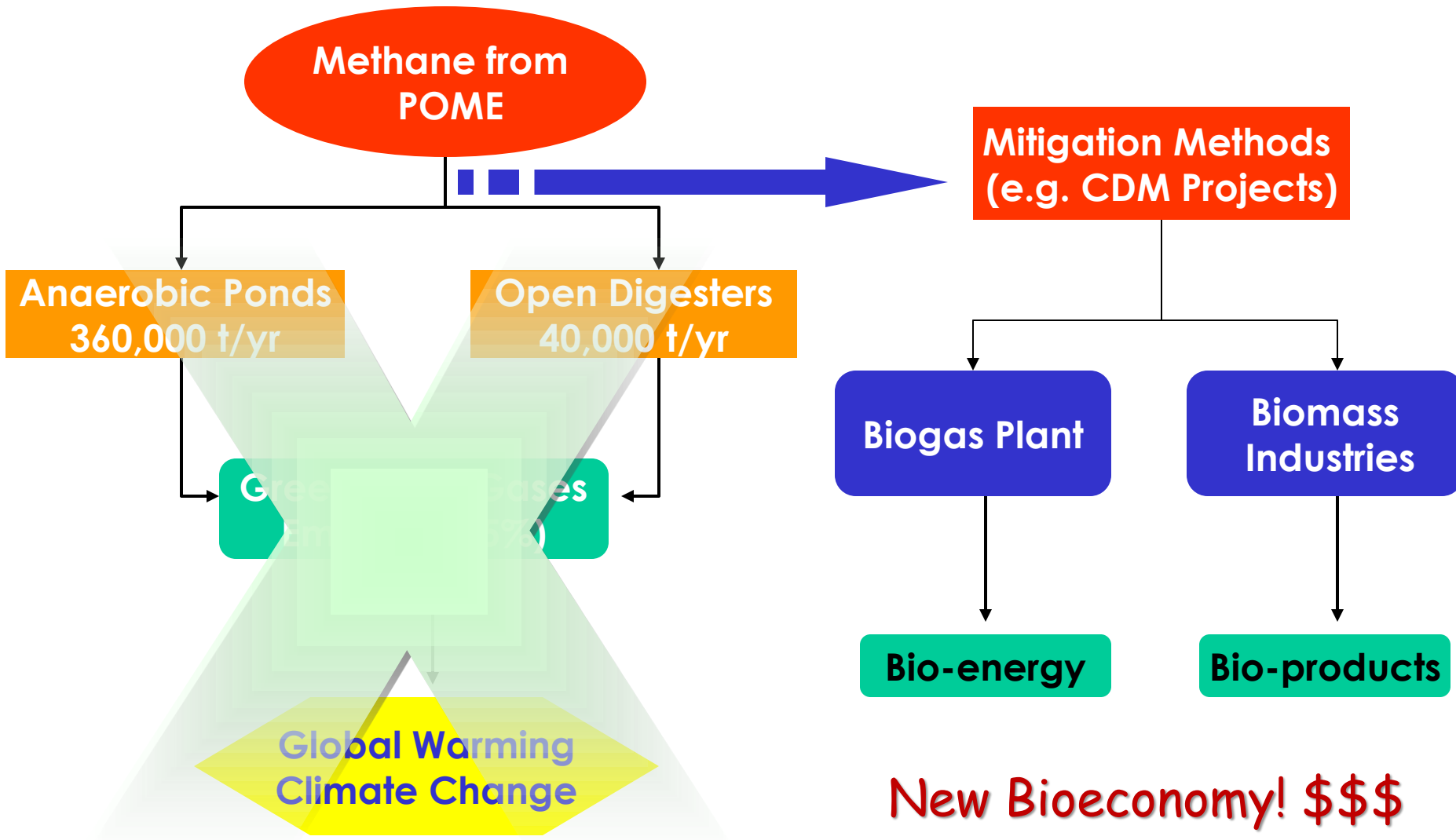


3 POME Lines



Sterilization of FFB

Methane Emission Mitigation



Serting Hilir Palm Oil Mill Biogas CDM Project



**380,000 tones
CO₂ reduced
for 10 years**



Approved by UN CDM
9th March 2009

Biogas Plant @ FELDA Serting Hilir Mill

EPP #5, Palm Oil

Commercialised!



Options for biogas:

1. grid connection
2. in-house usage
3. bottling

Renewable Energy (1 MW) to Grid



Estimated Costs, RM (million)	
Biogas capture (ponds or tanks)	1.8
Downstream processing (gas scrubber & gas storage)	2.0
Gas engine @ 1000 kW	1.2
Total plant cost	5.0
Yearly maintenance and operation cost	0.5

Benefits and revenues generated :

- Internal office use and external lighting (“24/7”)
>>> reduce diesel cost/usage during mill’s non-operating hours
- Sale of green electricity to TNB @ RM0.25/kWh ~ RM 1 million/yr
- Aeration system to remove remaining BOD
increased POME treatment efficiency >>> water re-use >>> zero emission!
+ reduced land requirement (~70% of total mill area)
- Estimated sale of CER @ € 10 per tonne CO₂ ~ RM 1 million/yr

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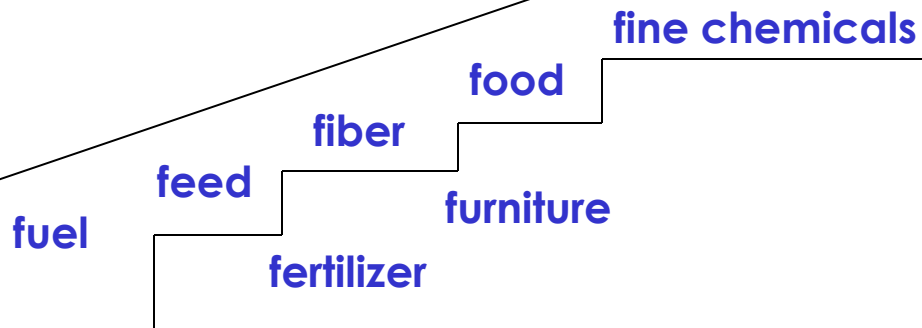
(Assumption: mill capacity of 60t FFB/hr and 320 days of operation)

Adding Value to Palm Biomass

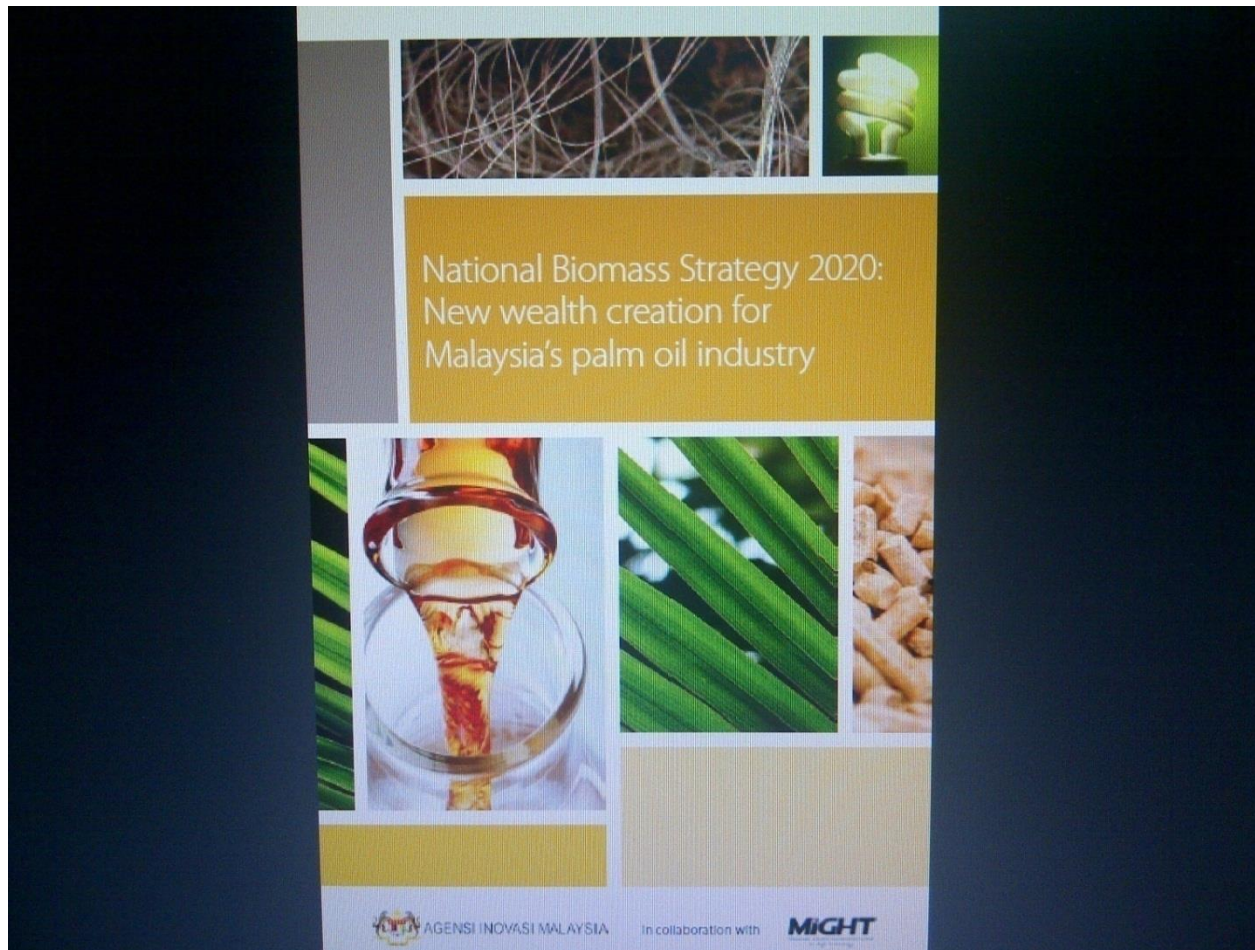


- Paradigm shift towards biomass
 - Not waste
 - Renewable
 - Sustainable Resource
- Uncertainties of biomass
 - Technological proven ?
 - Economically feasible ?
 - Quality, quantity, availability ?

↑ value ladder



National Biomass Strategy 2020

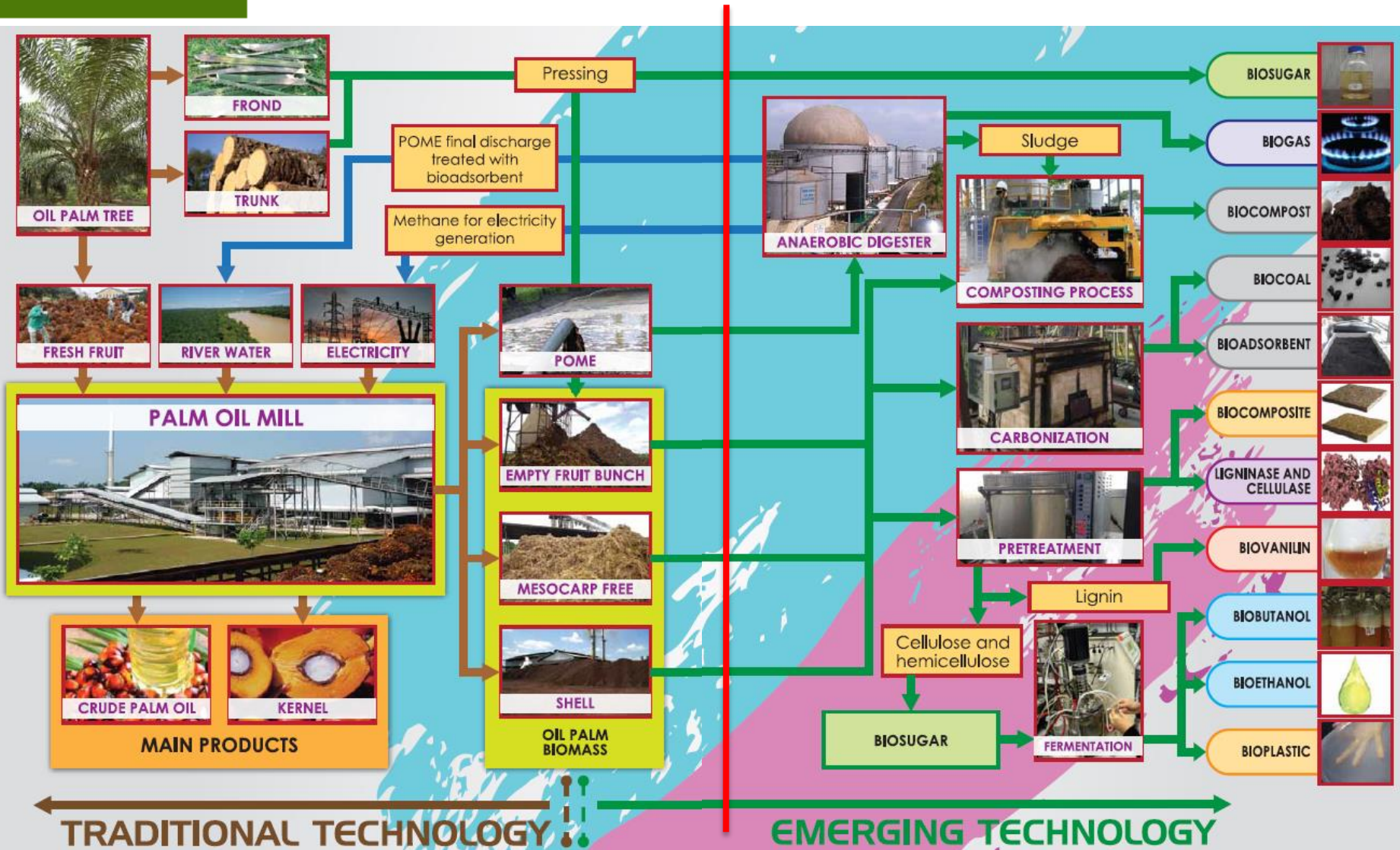


>>> for Bioeconomy Transformation Programme (BTP)

R&D&C ON OIL PALM BIOMASS

EB GROUP

WASTE TO WEALTH THROUGH BIOTECHNOLOGY



ZERO EMISSION CONCEPT IN PALM OIL MILL

Palm Biomass Refinery



Standardised biomass available
"business as usual"



Empty Fruit Bunch
16 million t/yr



Palm Oil Mill Effluent
50 million t/yr

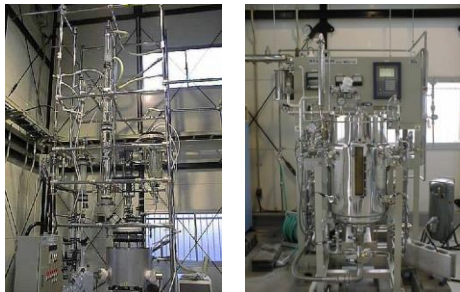
"zero emission"
waste-to-wealth

+ water recycling

Bioplastic (PLA)
or Bioethanol

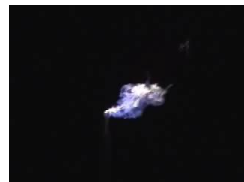
Compost

Pre-treatment and
Saccharification



Fermentation in
bioreactors

Sugars



Biomass Energy



Biogas, CH₄ (+ Biohydrogen)

Bio-acids

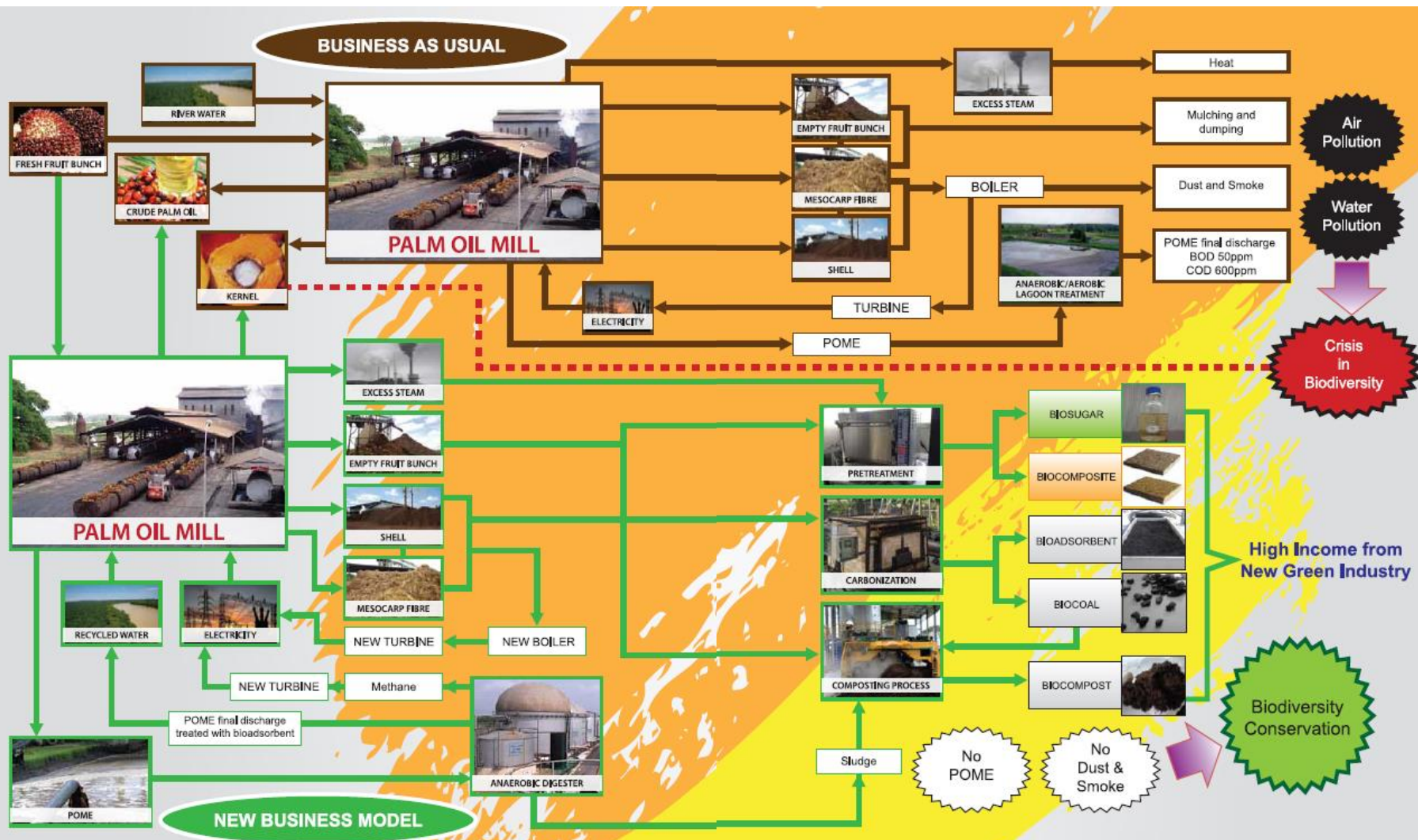


Bioplastic
(PHA)

JICA-JST SATREPS PROJECT 2013-2018

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WASTE TO WEALTH THROUGH BIOTECHNOLOGY



ZERO EMISSION AND BIODIVERSITY REBOUND

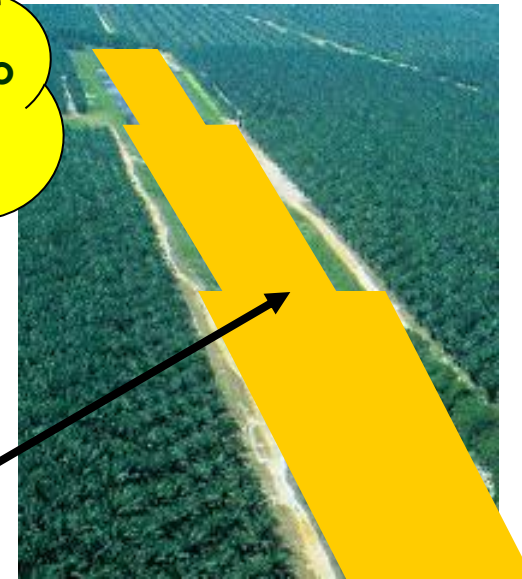
Target.. A Truly Sustainable Palm Oil Industry in Malaysia ☺



Providing a profitable area for new business to which biomass energy can be supplied from palm oil industry at a reasonable price



for new biomass business



Installing a complete methane fermentation system and change lagoon area into a profitable area.

Providing electricity from methane fermentation system for new business
>>> towards zero emission and **w2w!**
(remove “pain” from the industry)

1. Reduction of greenhouse gases emission by sealing the lagoons.
2. Prevention of undesirable smell and water pollution by modern treatment (+ water recycling).
3. Local employment can be encouraged from new business.

Based on the economic growth in Malaysia, the development of new oil palm plantations in the tropical rainforest will soon be no longer feasible.
In order to meet the increasing demand for palm oil in the future, palm oil industry must co-exist with other industries and people... >>> 3P (**Profit, People, Planet**)