

Value Creation and Zero Emission in the Palm Oil Industry

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Palm Oil Industry and Malaysian Socio-Economy



Facts and figures..

- 5 million hectares (~10% of Malaysia)
- (more than 50% of Malaysia is rainforest)
- (Malaysia is net carbon absorber/sink)
- Oil palm canopy is similar to rainforest
- 440 mills throughout Malaysia
- Highest oil yielding crop in the world
- Palm oil - Malaysia's gift to the world!
- USD15 billion export in 2010
- More than 600,000 people employed
- Poverty alleviation
 - land ownership & stable income
 - >>> FELDA's success story (50 years!)
- Sustainable Development
 - 3Ps: Profit, People and Planet
 - challenge: "win-win-win" strategy
 - need to address the bigger picture



Malaysian Palm Oil Industry



Fresh Fruit Bunch
80 million tonnes



Palm Kernel Oil
2 million tonnes

Oil Extraction

Crude Palm Oil
18 million tonnes

Renewable Resources

Fronds 80MT!
Trunks 15MT!

Fiber
8 million tonnes

Shell
4 million tonnes

Palm Oil Mill Effluent
50 million tonnes

Empty Fruit Bunch
17 million tonnes

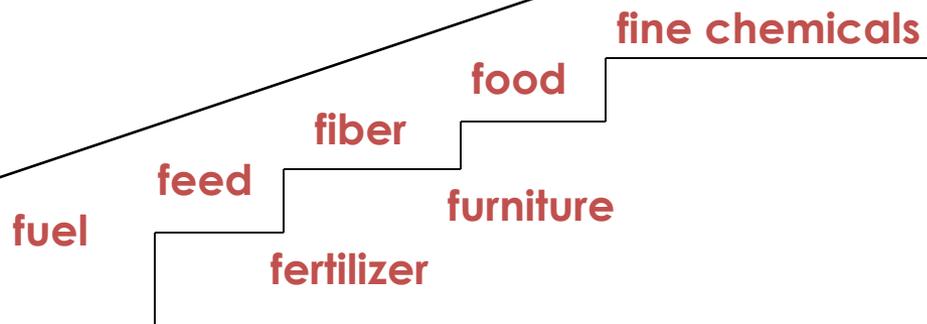


Adding Value to Palm Biomass

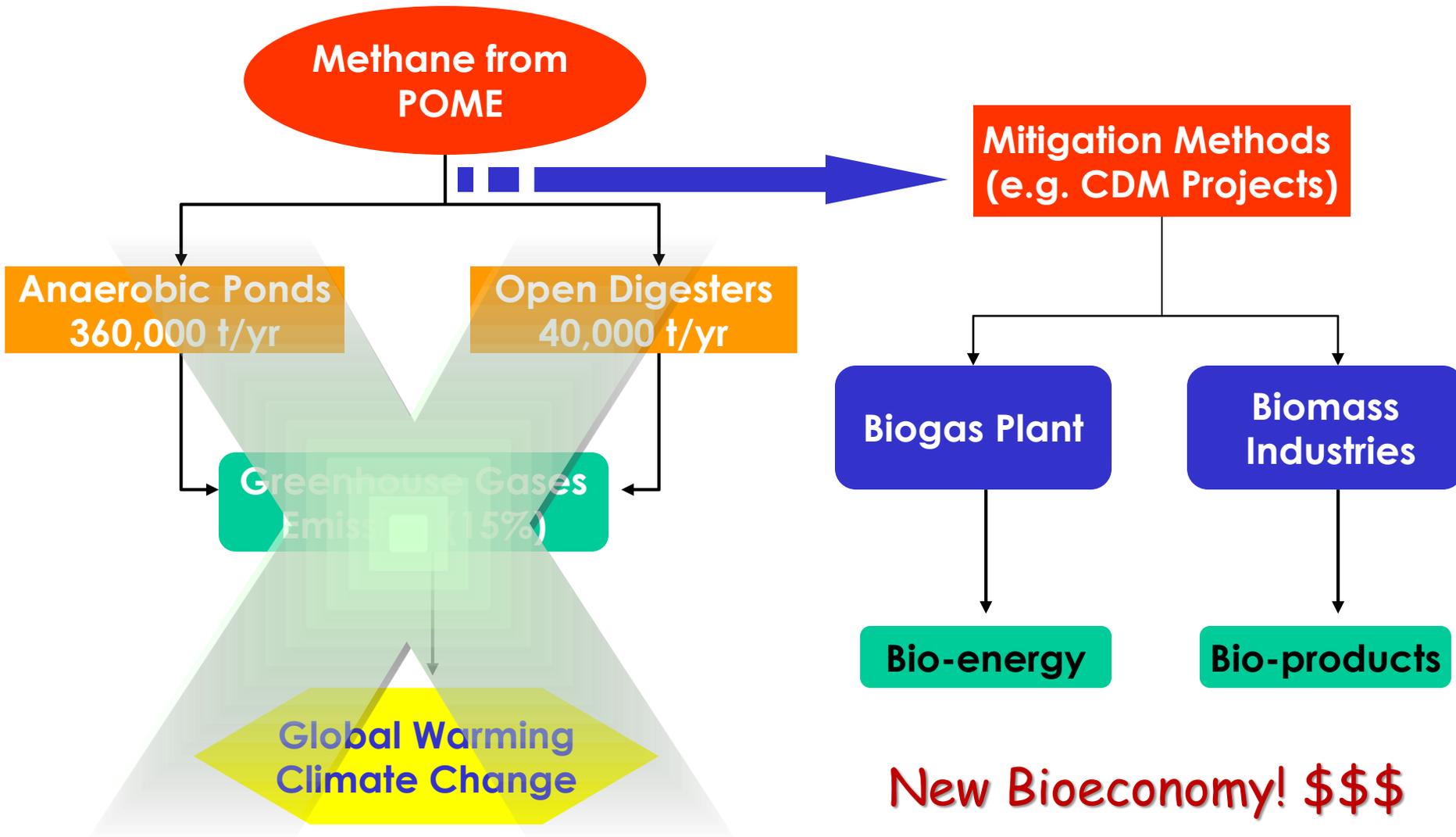


- Paradigm shift towards biomass
 - Not waste
 - Renewable
 - Sustainable Resource
- Uncertainties of biomass
 - Technological proven ?
 - Economically feasible ?
 - Quality, quantity, availability ?

↑ value ladder



Methane Emission Mitigation





FELDA Serting Hilir Mill Biogas CDM Project

About
380,000 tons
CO₂ reduced
in 10 years



Approved by UN CDM
9th March 2009

Biogas Plant @ FELDA Serting Hilir Mill



EPP #5,
NKEA Palm Oil

Options for biogas energy:

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





UPM
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI



BIOREFINERY @ UPM

UNIVERSITI PUTRA MALAYSIA

Biorefinery @ UPM

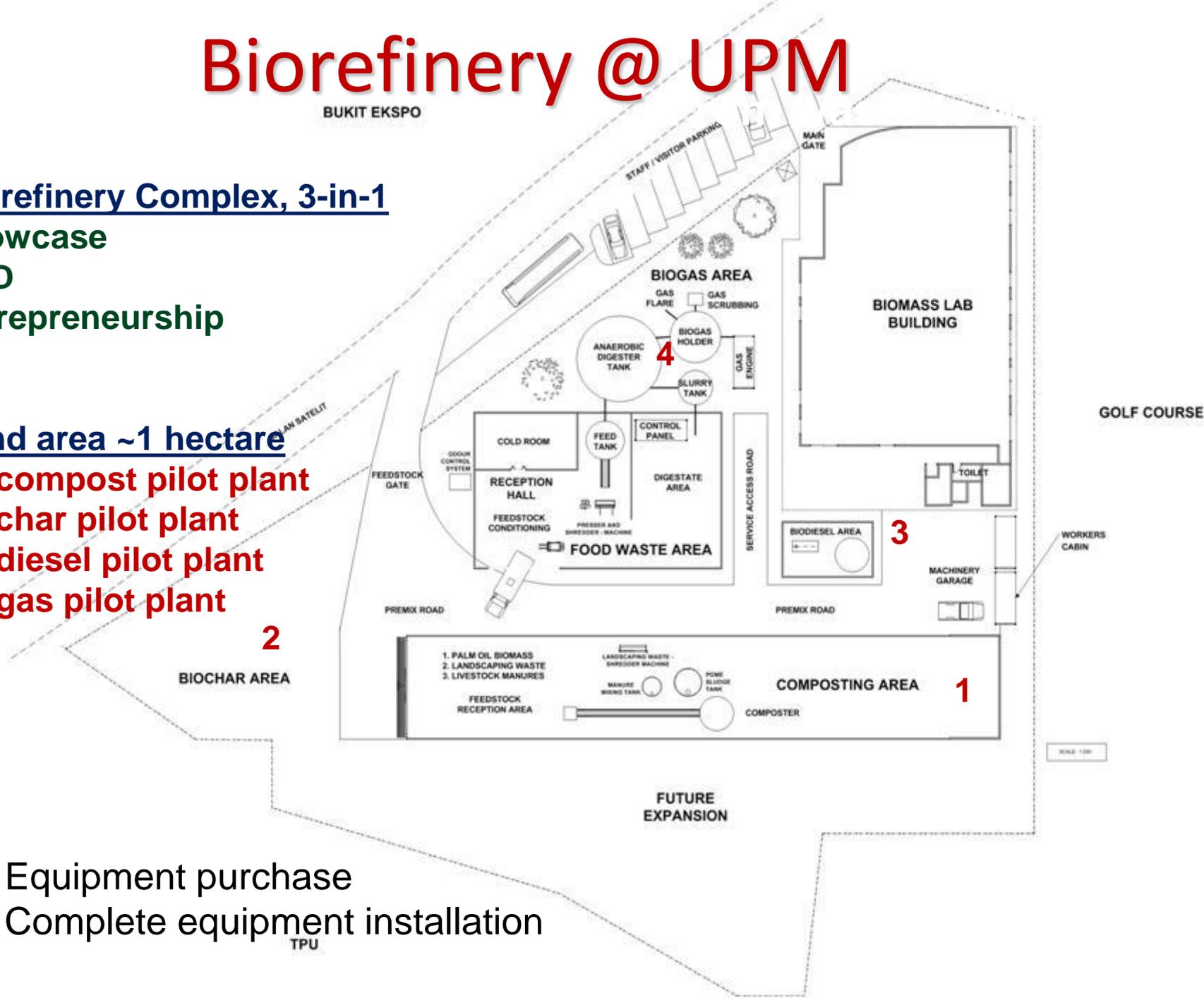
BUKIT EKSPLO

Biorefinery Complex, 3-in-1

1. Showcase
2. R&D
3. Entrepreneurship

Land area ~1 hectare

1. Biocompost pilot plant
2. Biochar pilot plant
3. Biodiesel pilot plant
4. Biogas pilot plant



2012: Equipment purchase

2013: Complete equipment installation

TPU

Compost Pilot Plant @ UPM



Yamasen Carbonization System (Shimane, Japan)



Overall View



Biochar Product



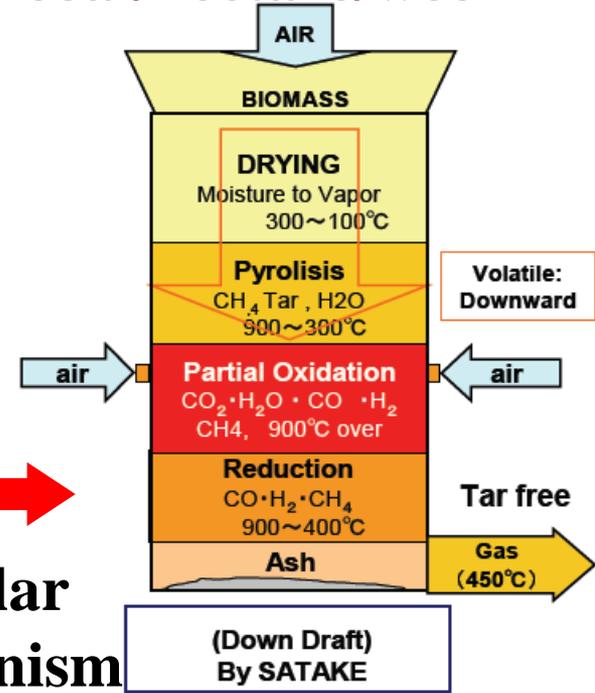
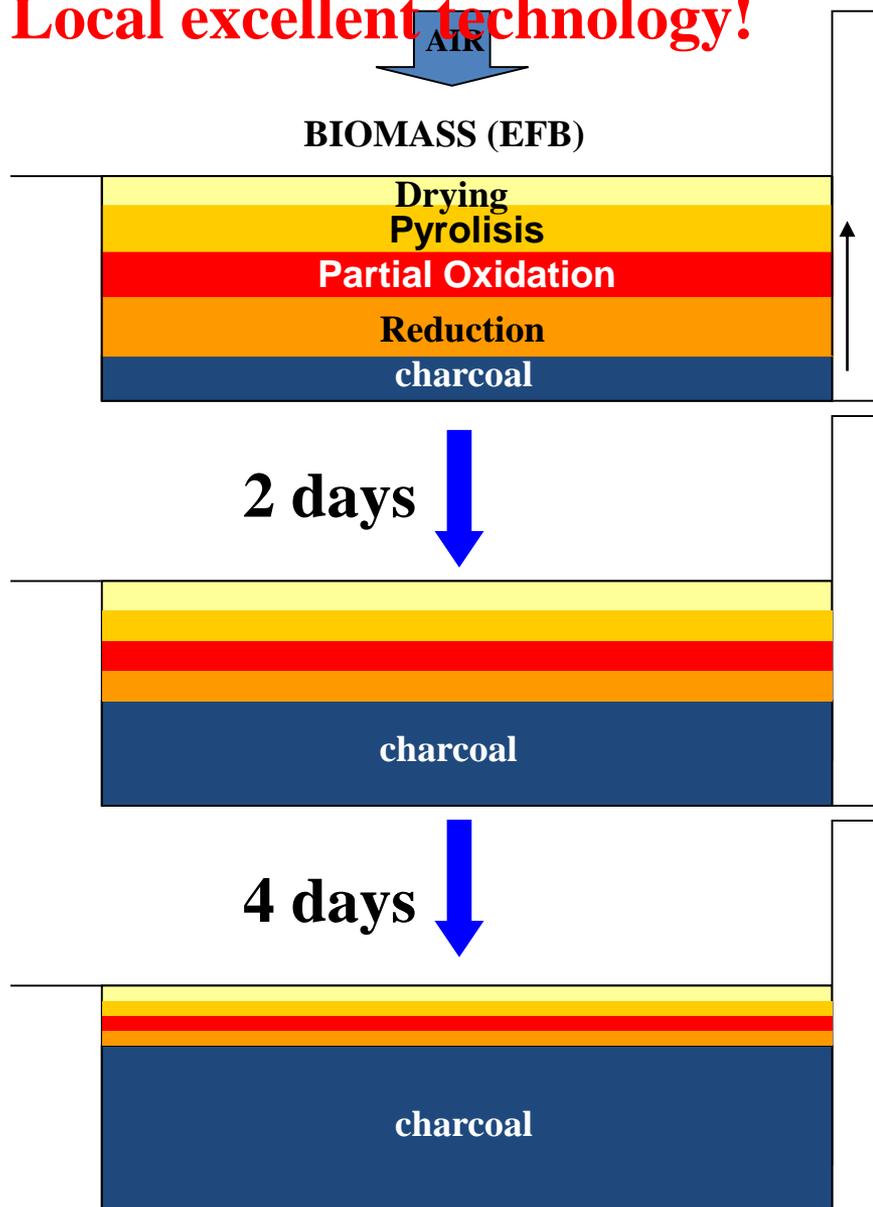
No smoke!

Carbonization Method

By Yamasen Co., Japan
Local excellent technology!

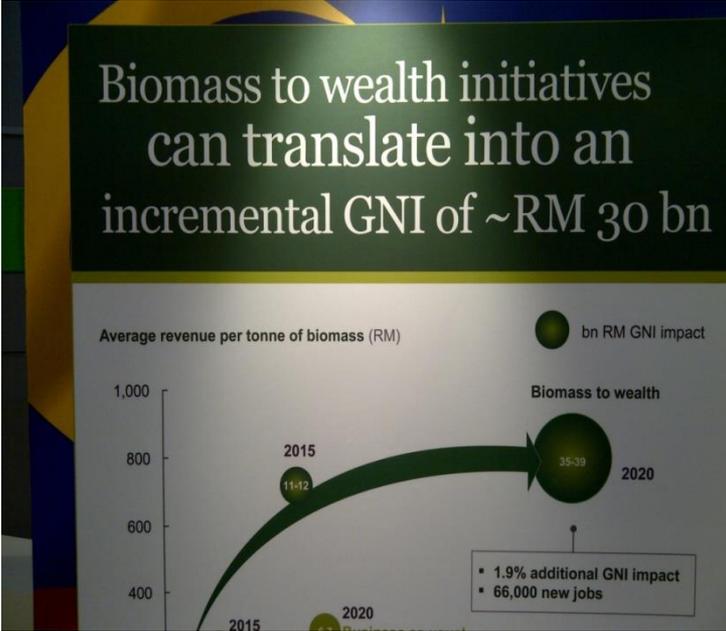
100 ton Charcoal/hectare/week

20% yield

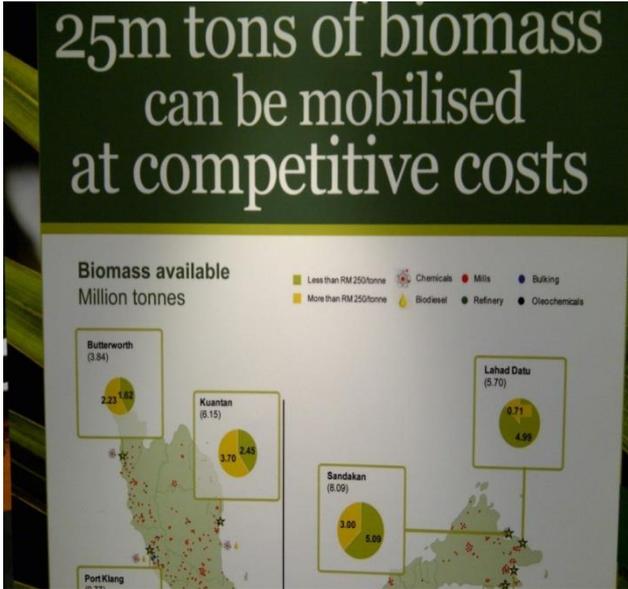


Biochar pool in UPM

National Biomass Strategy 2011-2020



80MT palm biomass available!



USD 10b contribution to GNI

- ↑ GDP
- ↑ Jobs
- ↓ GHG emission



Sustainable Palm Biomass Refinery



Standardised biomass available
"business as usual"



Empty Fruit Bunch
17 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

Sugars

Bio-acids

Fermentation in
bioreactors

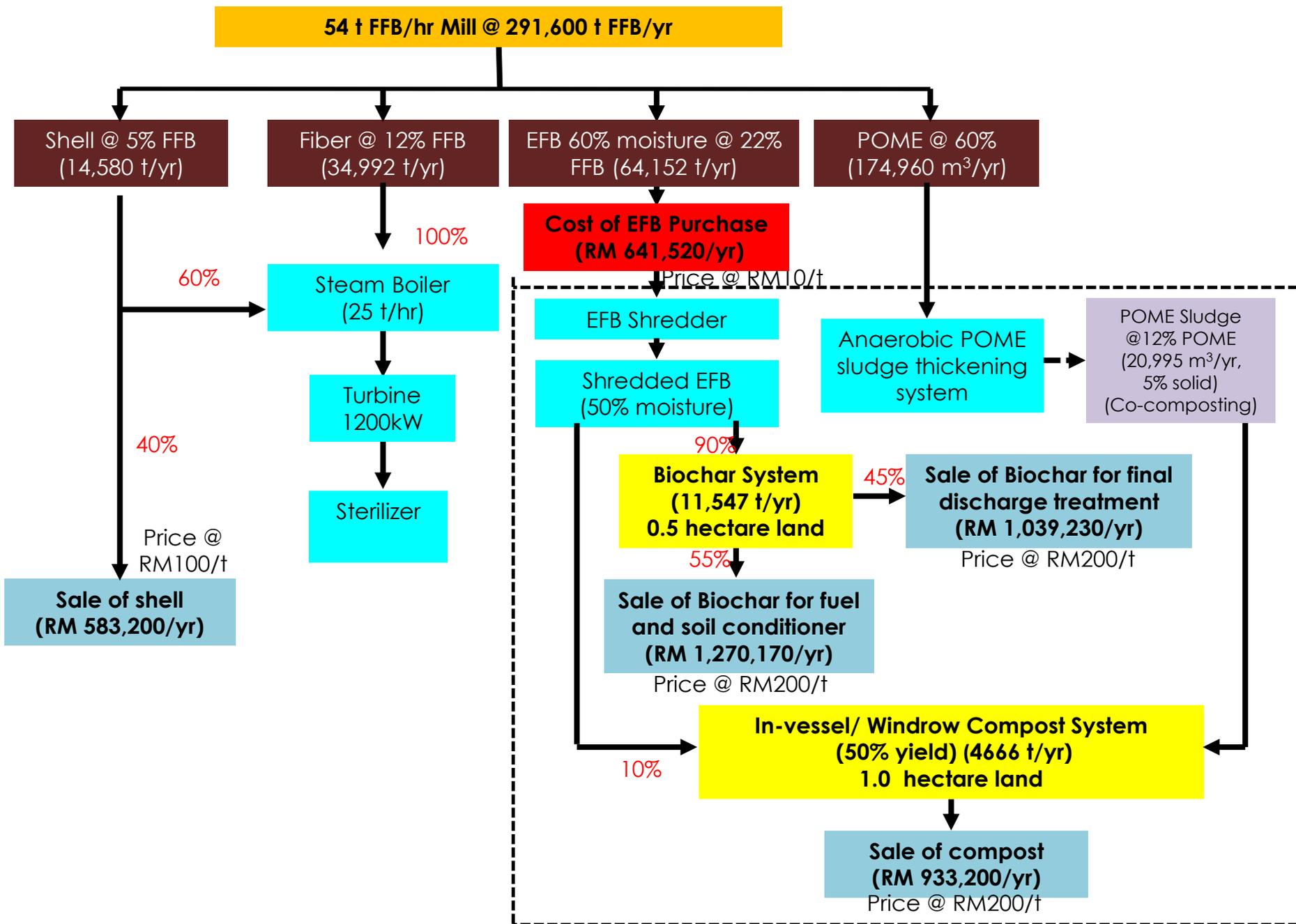
Biomass Energy

Biogas, CH₄ (+ Biohydrogen)

Bioplastic
(PHA)



EFB Biomass Utilization : 90% for Biochar, 10% for Biocompost



Material Balance and Zero Emission Strategy in A Palm Oil Mill



Water 300,000t/y
 (40,000t/y from FFB
 260,000t/y from river)

In theory no need for water from river!
 No-discharge!

5,400MWh
 (4.6)

CPO
 60,000t/y

Seed (for
 PKO, PKC)
 40,000t/y



Mesocarp Fiber
 40,000t/y
 (1.1 × 10⁸Mcal)



Rain
 20,000t/y

Con-
 dense

Condensed
 water
 240,000t/y

A.C.
 (2,000t/y)

Process Water
 260,000t/y

Com-
 post

80,000t/y

On demand
 from market

Bio-Coal

Bio-Coke

Bio-fuel

Bio-chem.

On demand
 from mill

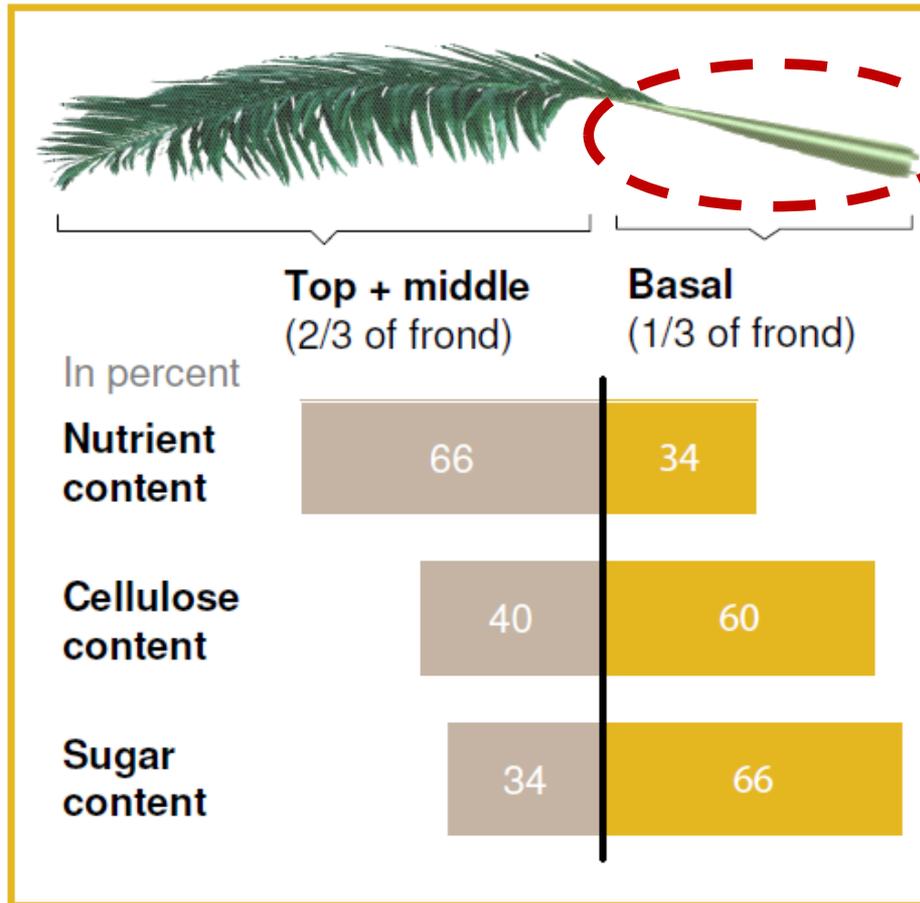
Current Material Balance
 Proposed Material Balance

National Biomass Strategy

National Biomass Strategy 2020:
New wealth creation for
Malaysia's palm oil industry

AGENSI INOVASI MALAYSIA In collaboration with **MIGHT**

Oil Palm Frond (OPF)



Petiole

Sugars composition in OPF juice

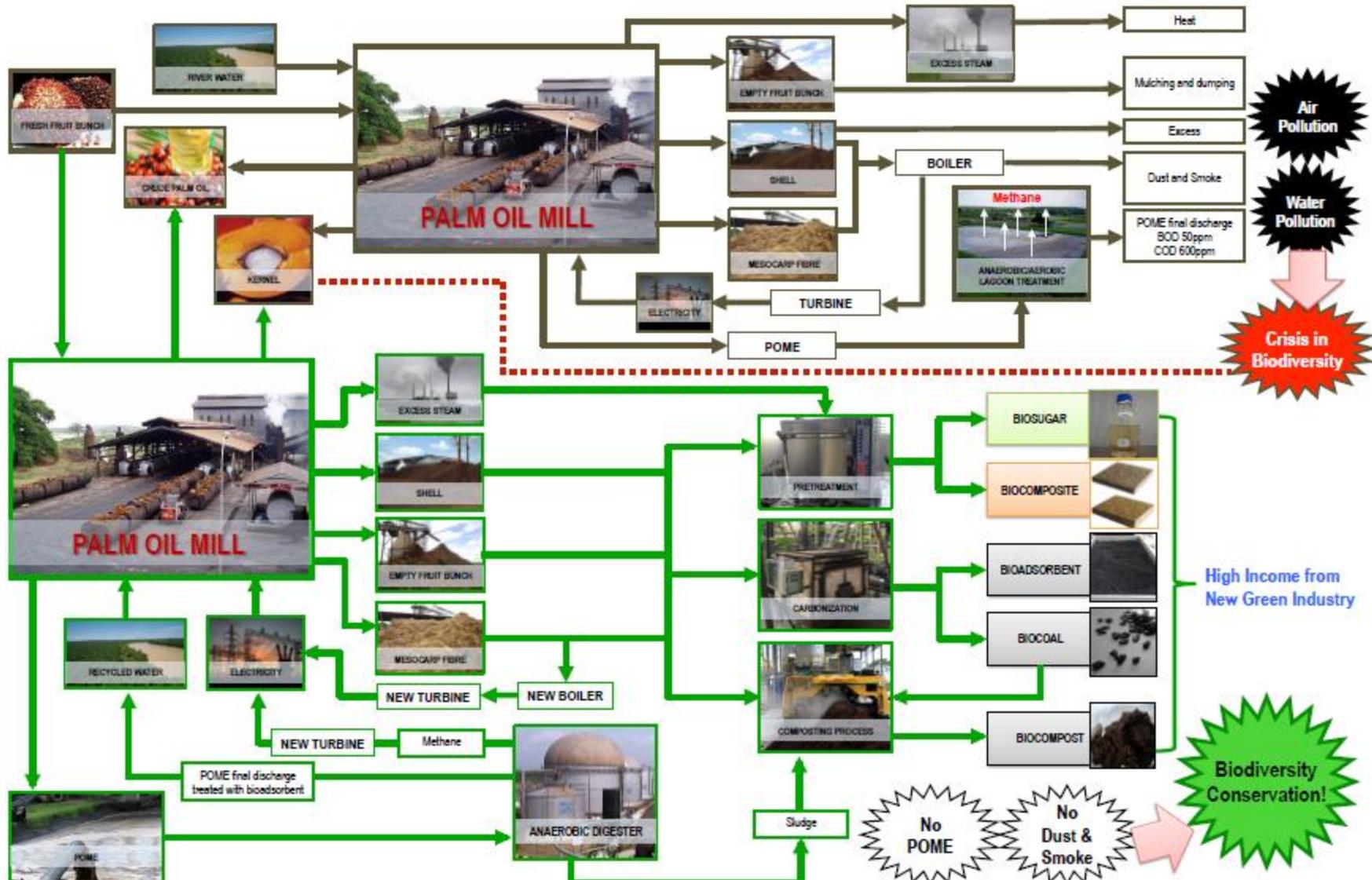
Sugars	OPF juice	
	Concentration (g/L)*	%
Glucose	63	78
Sucrose	15	18
Fructose	3	4
Galactose	ND[#]	-
Xylose	ND[#]	-
Rhamnose	ND[#]	-
Others	ND[#]	-
Total sugars	81	100

*Determined by HPLC analysis

Not detected

JICA-JST SATREPS Project

Value Addition, Zero Emission & Biodiversity Conservation



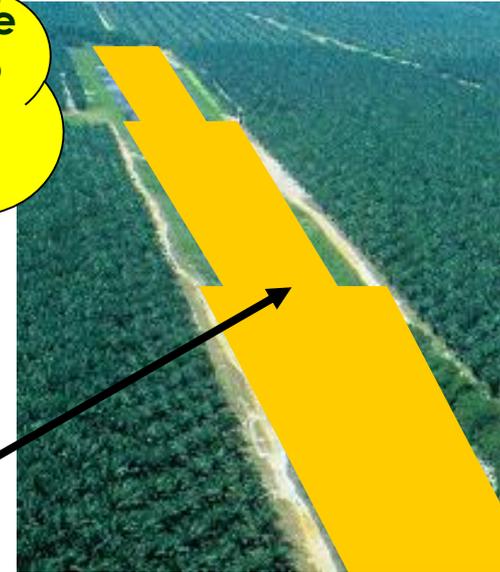
The Ultimate Goal.. A Truly Sustainable Palm Oil Industry in Malaysia



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



for new biomass business



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

CDM provides 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**)