Palm Oil Residues for Biogas Production

Heinz Stichnothe
Thünen Institute of Agricultural Technology,
Bundesallee 50, 38116 Braunschweig, Germany

Intertask-project: MOBILISING SUSTAINABLE SUPPLY CHAINS – BIOGAS CASES

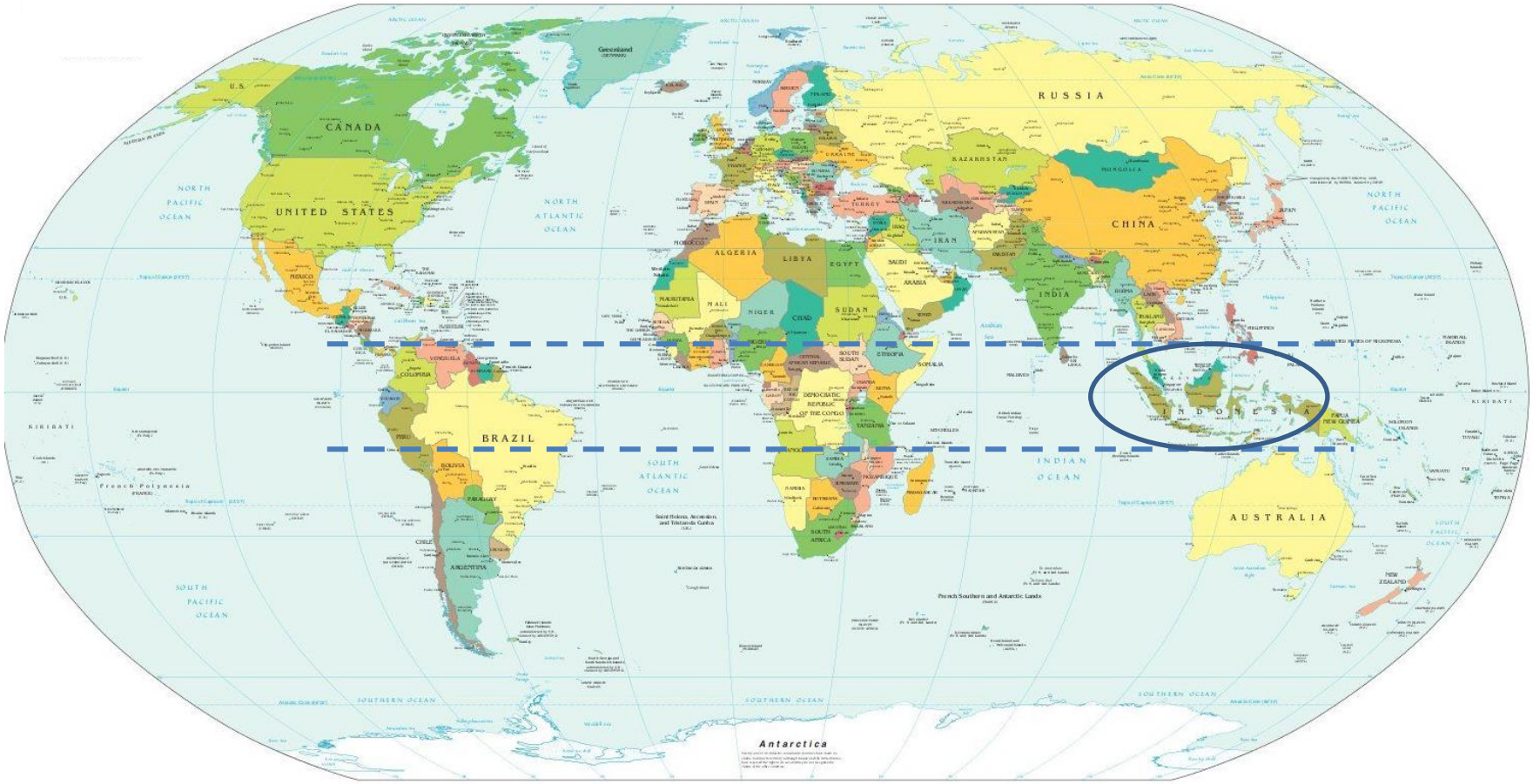
BIOGAS PRODUCTION FROM MUNICIPAL SOLID WASTE, OIL PALM RESIDUES AND CO-DIGESTION

J.W.A. Langeveld (Biomass Research), R.Guisson (VITO), and H. Stichnothe (TI)

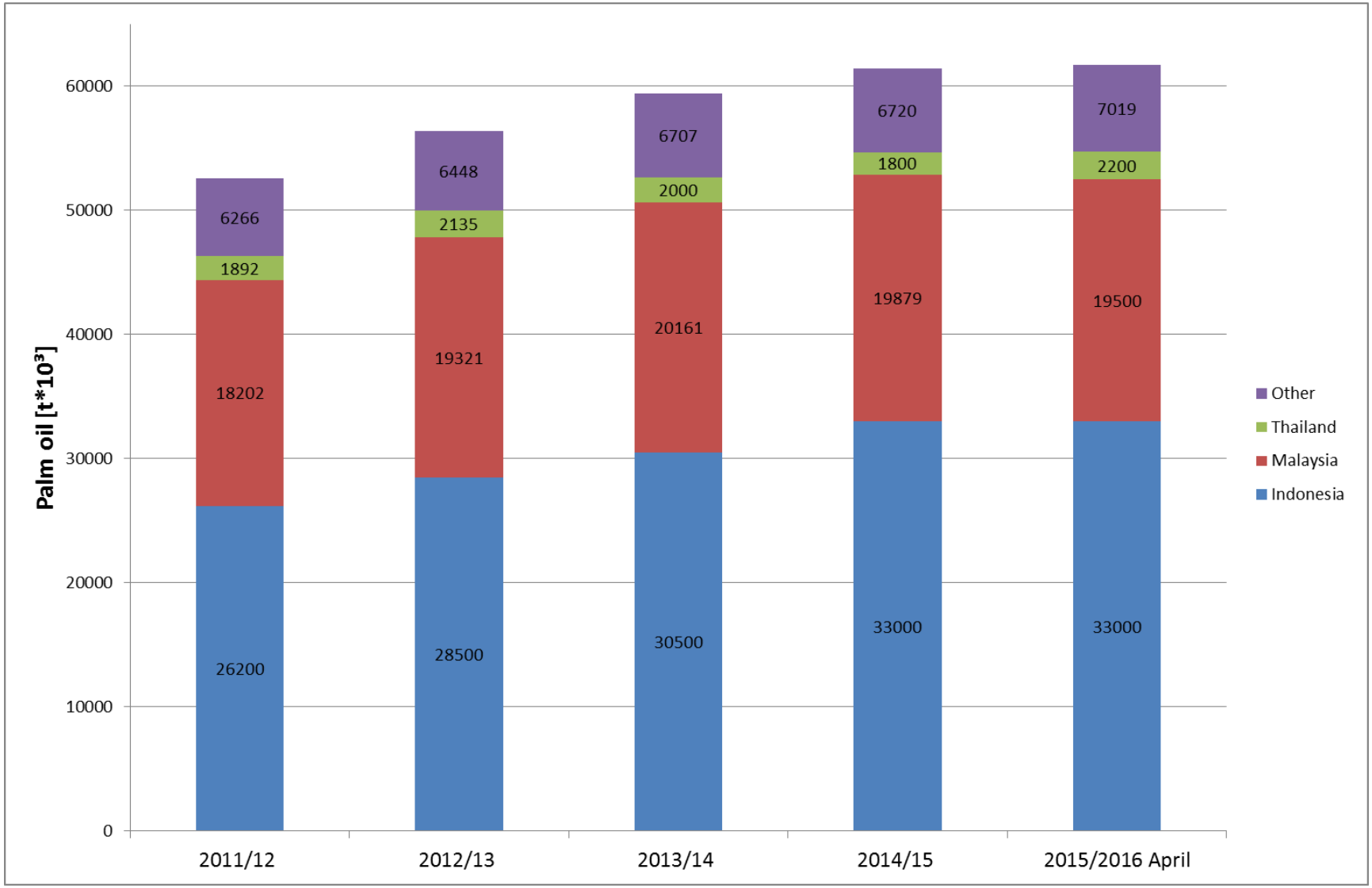
Agenda

- Palm oil production
- Residues – current practises
- Potentially available resource for bioenergy
- Cascade use - towards a cicular economy
- Drivers and barriers
- Life cycle thinking - Biorefinery approach
- Overview biomass treatment technologies
- Summary
- Additional information

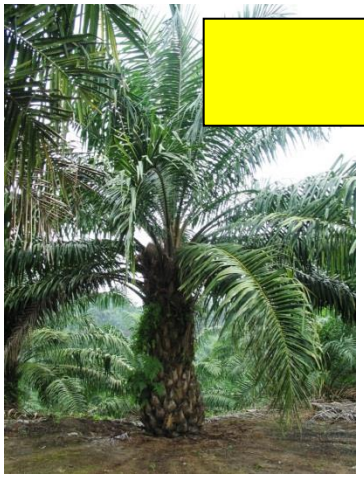
Region suitable for palm oil



Global palm oil production



Palm oil-production



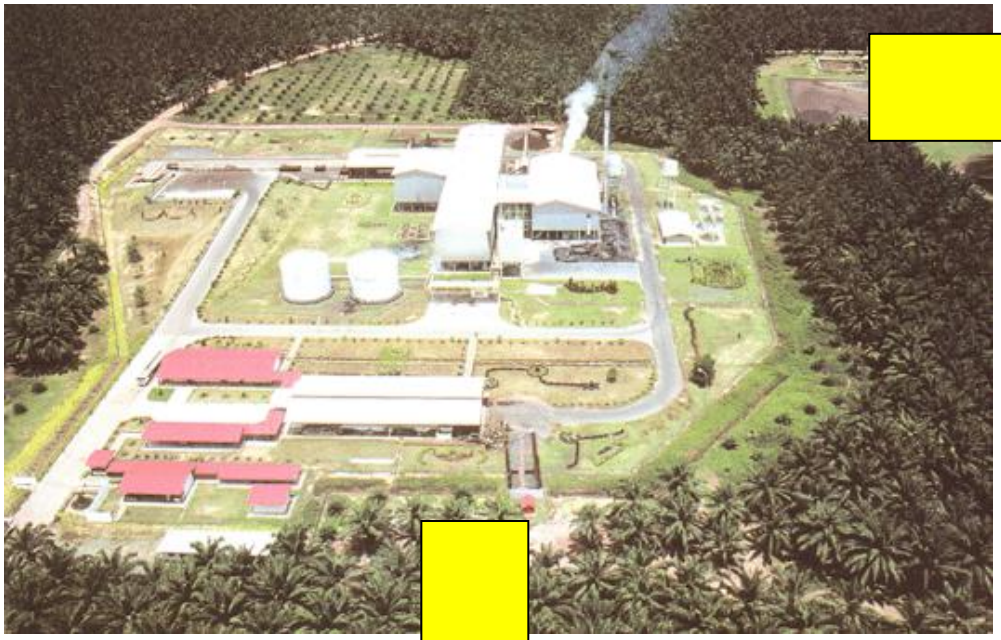
Fresh Fruit Bunch (FFB)
1000 kg

Oil mill

Crude Palm Oil (CPO), 200 kg

Kernels
75 kg

“Waste or resources”



Mesocarp fibre
140 kg

Shells
55 kg

Palm Oil Mill Effluent (POME) 0,65 m³

Empty Fruit Bunches (EFB)
230 kg

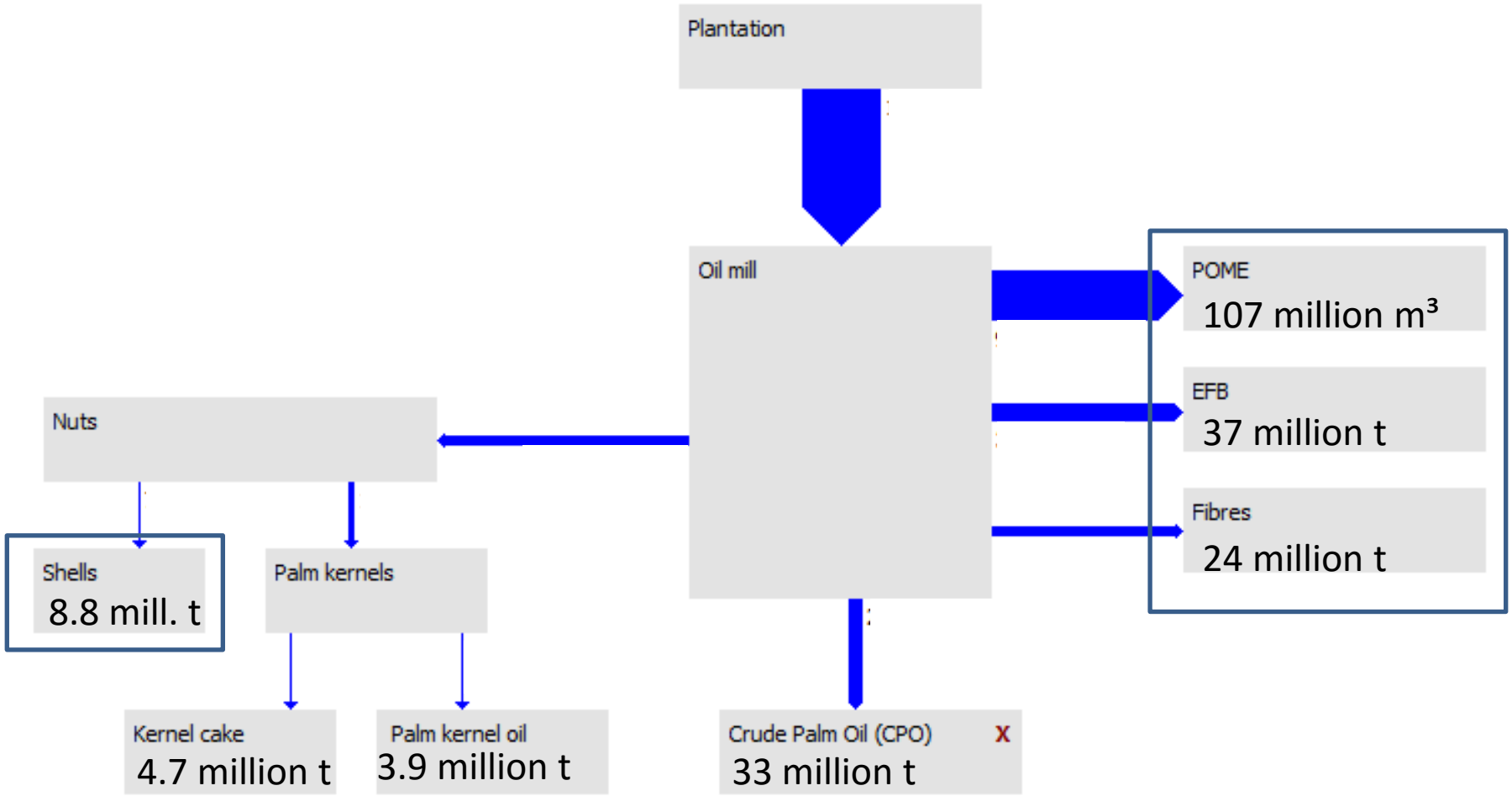
EFB


TASPU
kualitas prima olahan pabrik
memperbaiki struktur tanah
meningkatkan penyerapan unsur hara
menyuburkan tanaman

POME

- Waste water treatment
- Irrigation
- Co-composting
- Algae production

Residue potential
Estimation for Indonesia (2015)

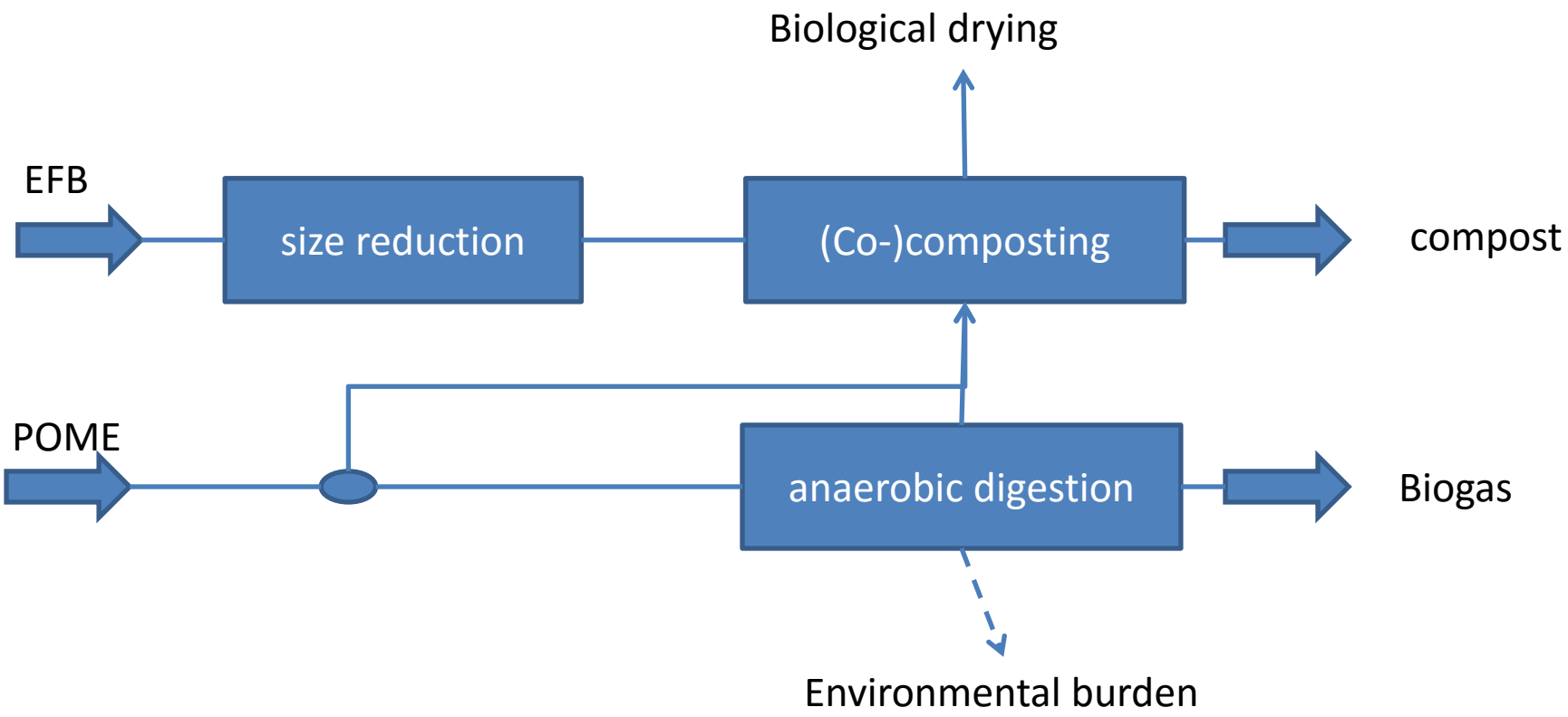


Mass flow analysis

Palm oil mill 30 t CPO/h → approx. 150,000 t FFB/a

	Mass [t/a]	% Moisture	LCV [GJ/t]	Energy content [TJ]	Curently used as
Fibre	21,000	40	11.0	231	Fuel in oil mills
Shells	8,200	25	13.4	110	Fuel in oil mills, construction
EFB	35,000	65	4.4	154 (75 -120 as biogas)	Soil improver, rarely disposed
Energy demand POM				220	
POME	97,500	95	40 [MJ/m³]	32 (as biogas)	Treated and discharged or irrigation(?)

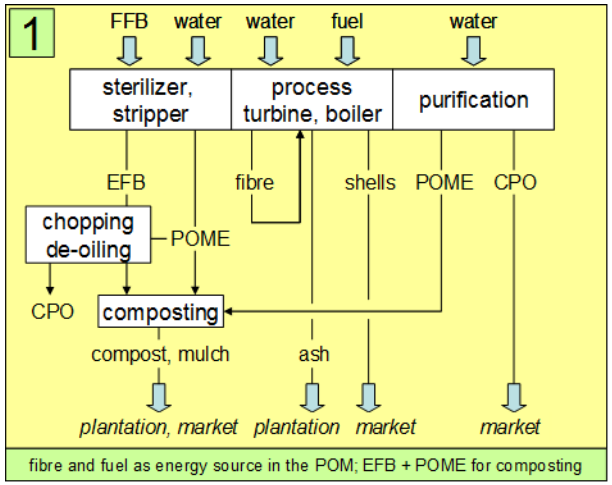
Cascade use


Biological drying
EFB
size reduction
(Co-)composting
compost
POME
anaerobic digestion
Biogas
Environmental burden

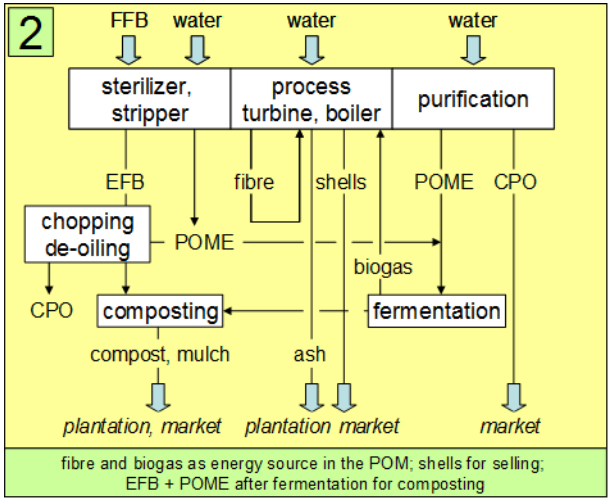
Co-composting

Payback time (2002)

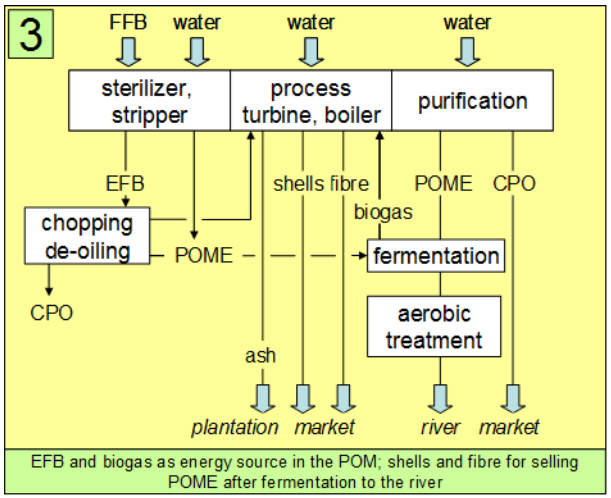
20€/t fibre or shells, no feed-in tarif, throughput 150,000 t FFB/a



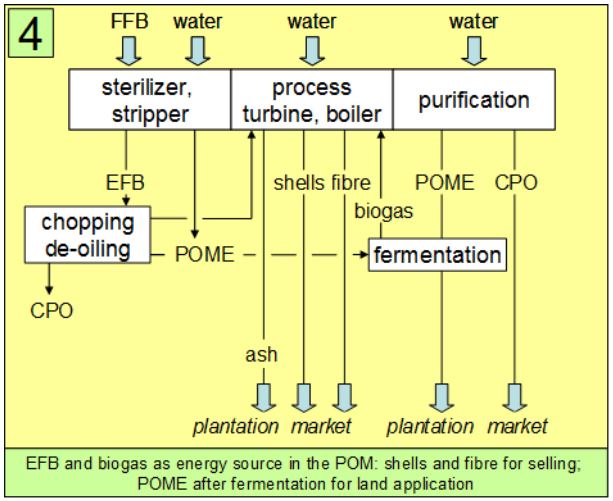
0.63 yr



1.34 yr



0.84 yr



3.05 yr

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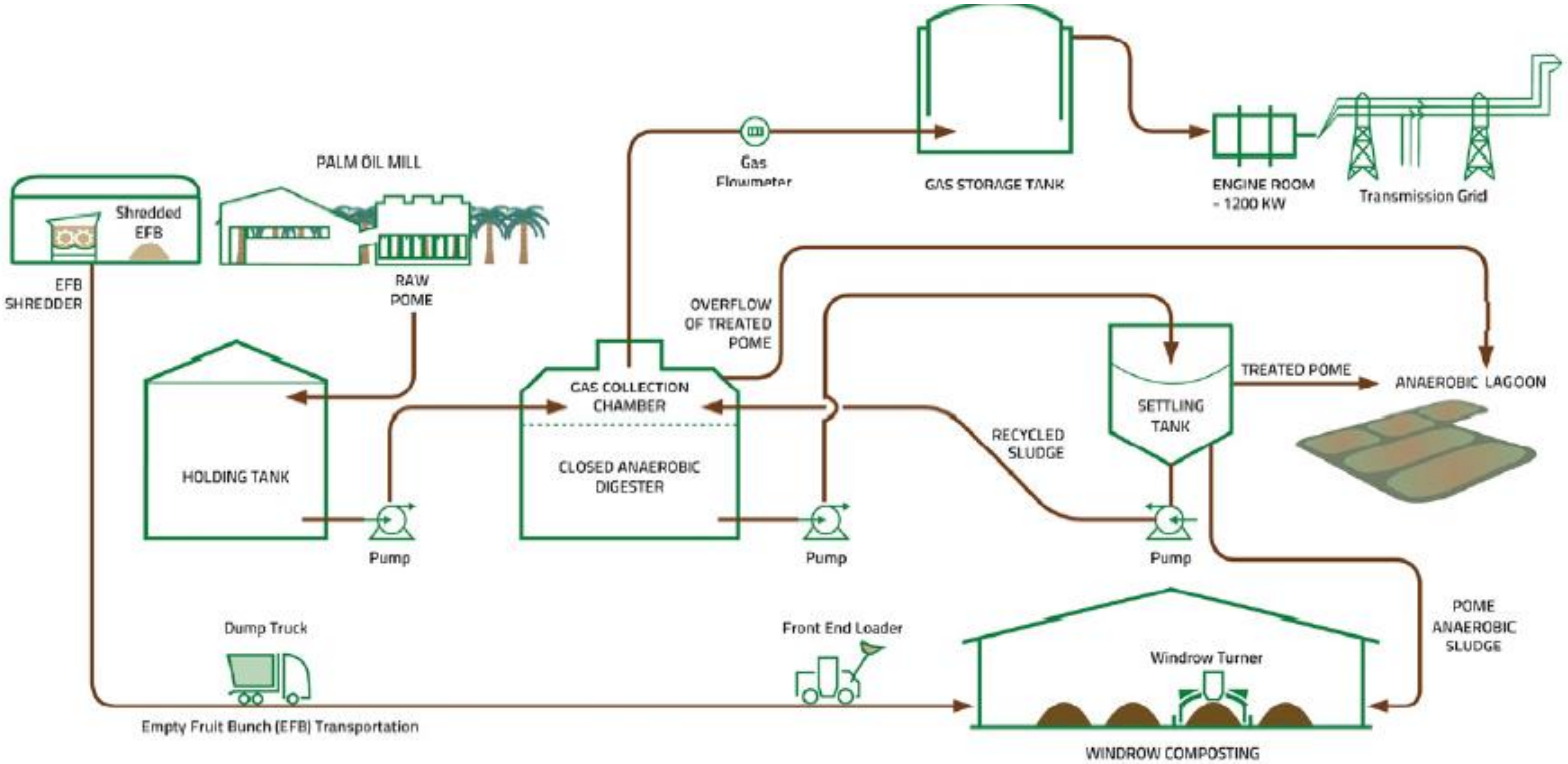
Improved economic viability of integrated biogas energy and compost production for sustainable palm oil mill management



Drivers and barriers

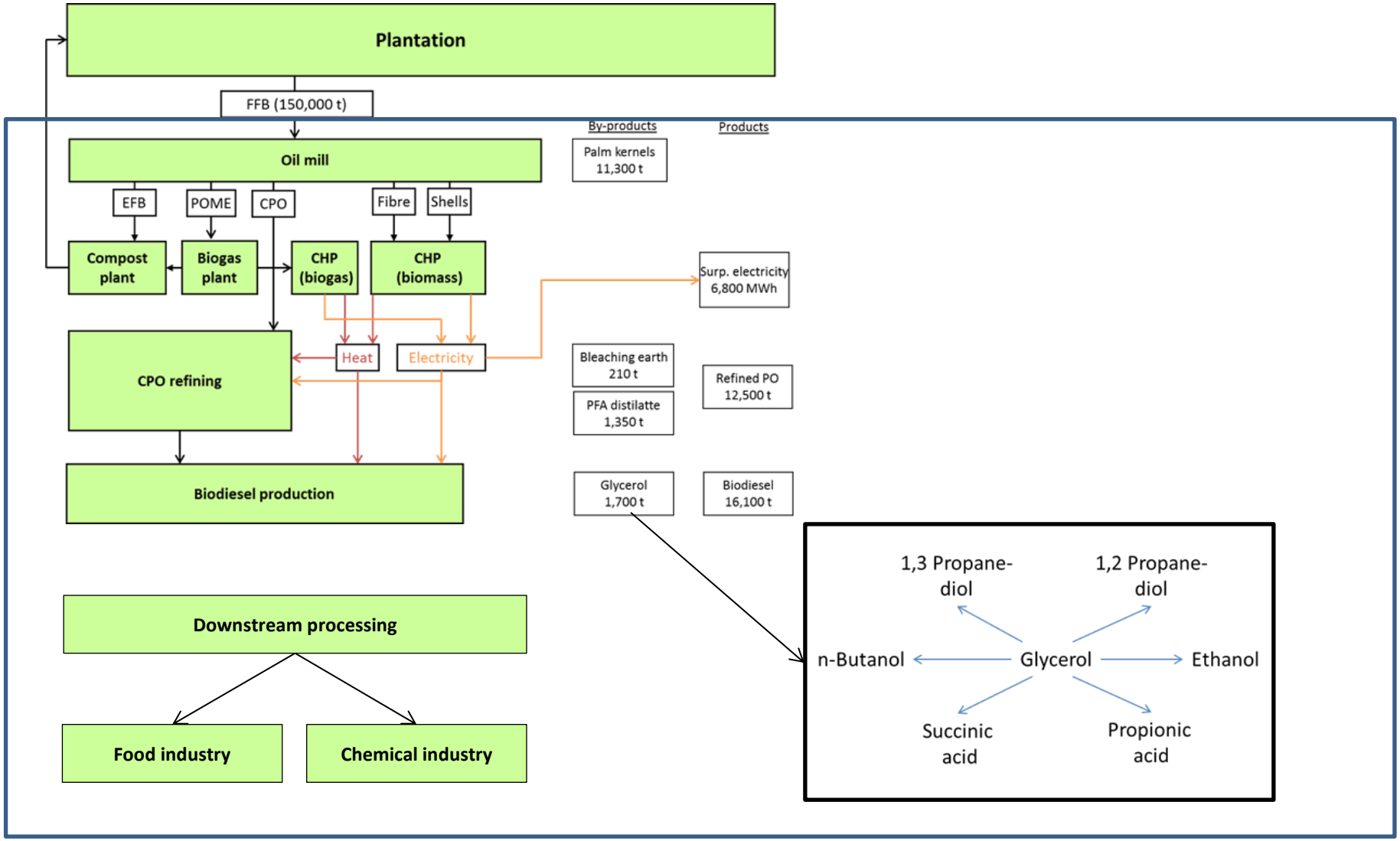
Drivers

- Legislation, electricity provider has to purchase
- Feed-in-tariffs
- National targets for palm oil as energy source
- Progressive export tax to boost downstream processing
- Growing energy/electricity demand

Barriers

- Inconsistent regulatory framework
- Implementation of national regulations
- National targets but no penalty
- Public perceptions
- Access to finance
- Low planning security

LCT- Biorefinery approach



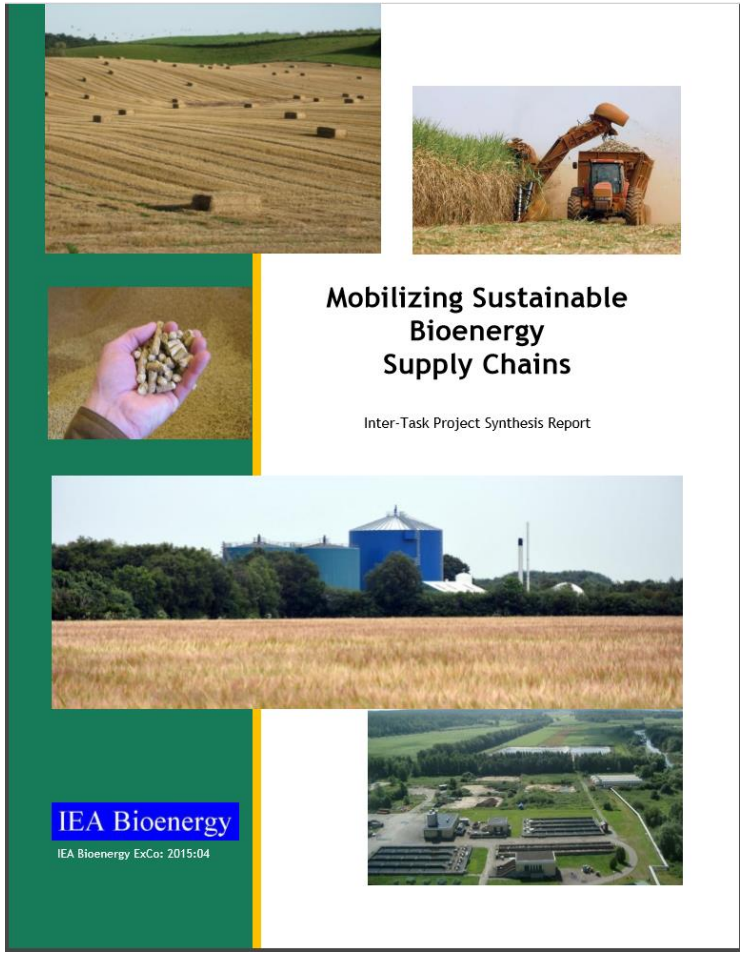
Overview biomass treatment technologies

	Technology					
Stage	Residues	Existing		Proven	Under development	Prospective
Plantation	Fronds	Soil improver / soil erosion protection (left on the ground)			Cattle feed	Pyrolysis/BtL
Plantation	Trunks/stems	Soil improver (left on the ground)			Incineration (CHP)	Pyrolysis/BtL
Palm oil mill	POME	Lagoons	With biogas capture	**Biogas**		Algae production
Palm oil mill	EFB	Dumped	Soil improver	Co-composting	**Biogas**	Pyrolysis/BtL/ HTC
Palm oil mill	Shells	Construction material	Incineration (CHP)			Pyrolysis/BtL
Palm oil mill	Boiler ash	Disposal	Nutrient recovery			
Palm oil -refinery	Spent bleaching earth	Disposal or incineration		**Biogas**		
Palm oil -refinery	Palm fatty acid distillate	Animal feed and soap ingredient		2nd gen. biodiesel	Feedstock for oleochemistry	Phytochemicals, e.g. vitamin E
BD	Glycerol	Purified glycerol			Fermentation (1,3-PD)	Sugar replacement in fermentations

Summary

- Huge potential for biogas in Indonesia
  - Easily available 32 PJ/a from POME
  - Potentially available 60 – 100 PJ/a from EFB
  - Low CO_2 abetment costs
- Trade-off energy versus nutrient recycling and soil fertility/ erosion protection → focus on underutilised resources
- Low-cost and low-tech technologies are available
- Drivers are in place
  - Regulations, national targets
  - Feed-in tariff
  - Growing demand for energy
- But major hurdles
  - Governance, public perception
  - High investment in not-core business required
  - Insufficient planning security for investors
- Life cycle thinking - local conditions – no one-fits-all
  - Biorefinery approach , food – feed- fuel and electricity

Additional information



http://www.ieabioenergy.com/publications/mobilizing-sustainable-bioenergy-supply-chains

Available soon