

Comparative Life Cycle Assessment: - RSPO-certified vs non-certified

Jannick Schmidt

6th November 2019



2.-0 LCA consultants
Rendsburggade 14, room 1.431
9000 Aalborg, Denmark
www.lca-net.com
Jannick.Schmidt@lca-net.com



Background

- Sustainable palm oil: Certification is the most acknowledged choice
- But what is the benefit?
 - GHG emissions
 - Biodiversity and nature conservation
 - Other impacts

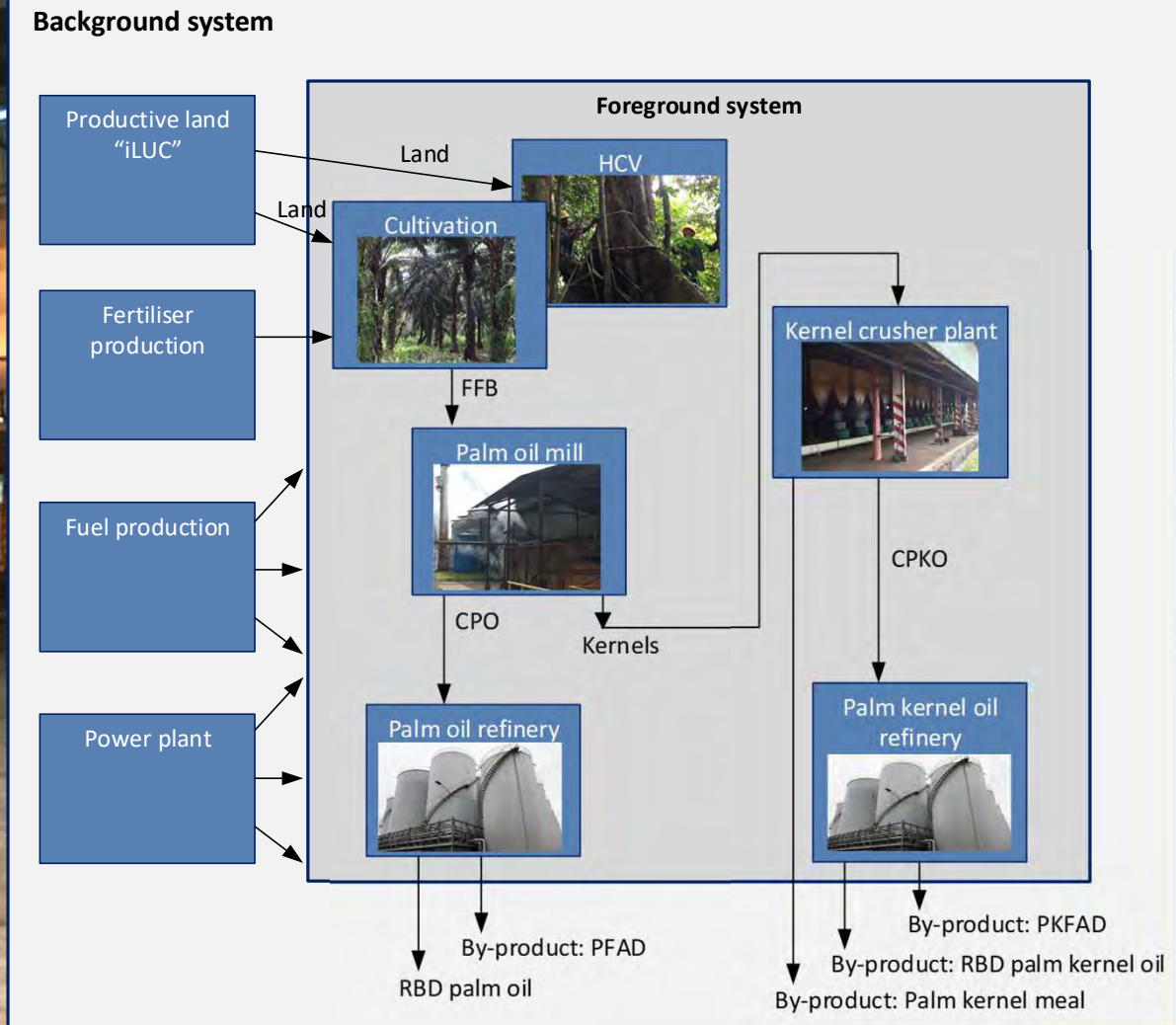
- Crowdfunded project: <https://lca-net.com/clubs/palm-oil/>
- Launched November 2016
- Finalized August 2019
- 16 members



Project promoted and supported by RSPO
Carried out independently of RSPO



Life cycle assessment (LCA)



Picture: Jannick Schmidt. Hanau palm oil mill, Sinarmas, Central Kalimantan 2018

Methods

- Functional unit = 1 kg refined palm oil
- Scope: 2016 and Indonesia and Malaysia
- Land use changes and nature conservation included
- Consequential and attributional LCA model
- Very detailed models
 - N-balances
 - Peat emissions
 - Oil mill boiler energy balance and stack emissions
 - Palm oil mill effluent (POME) model



Picture: Jannick Schmidt. Sinarmas, Central Kalimantan 2018

Data collection

- Total industry
 - Statistics and GIS
 - LCA coefficients to close gaps
- RSPO certified: Assessment reports
 - 634 estates (58% of all certified FFB)
 - 165 oil mills (58% of all certified CPO)

Input data

Industry total

Estates

Yield
Fertiliser
Peat
Fuels
Conservation

Oil mills

OER
KER
Fuels
POME

minus

Input data

RSPO certified



Estates

Yield
Fertiliser
Peat
Fuels
Conservation

Oil mills

OER
KER
Fuels
POME

=

Input data

Non-certified

Estates

Yield
Fertiliser
Peat
Fuels
Conservation

Oil mills

OER
KER
Fuels
POME

Picture: Jannick Schmidt. Hanau palm oil mill, Sinarmas, Central Kalimantan 2018

What do the data show?

Estates

Key performance indicators for oil palm cultivation

Flows	Unit	Total industry (ID & MY)	RSPO-certified	Non-certified
Total planted area	Million ha	14.4	2.44	12.0
Share of oil palm on peat	%	18%	11%	19%
Drainage depth (DD) of peat	cm	73	57	75
FFB yield, mature	t/ha	18.9	21.1	18.5
Fuel use	MJ/ha	2,940	2,940	2,940
Applied mineral N	kg N/ha	82	170	64
Applied organic N	kg N/ha	21	24	21
Applied mineral P ₂ O ₅	kg P ₂ O ₅ /ha	41	103	28
Applied organic P ₂ O ₅	kg P ₂ O ₅ /ha	28	31	27
Applied mineral K ₂ O	kg K ₂ O	156	245	138
Applied organic K ₂ O	kg K ₂ O	138	153	135

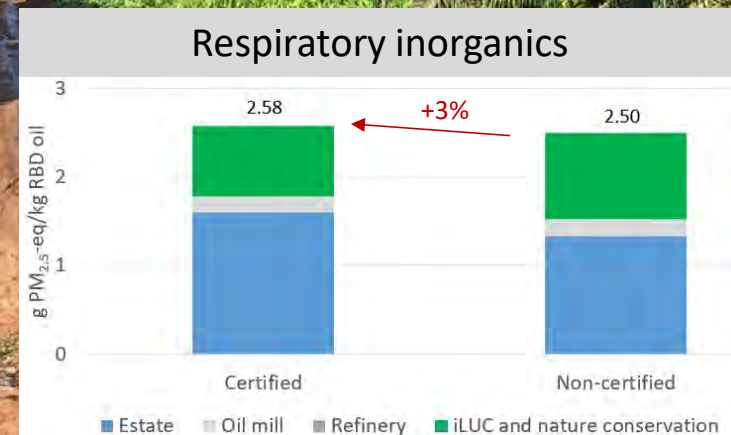
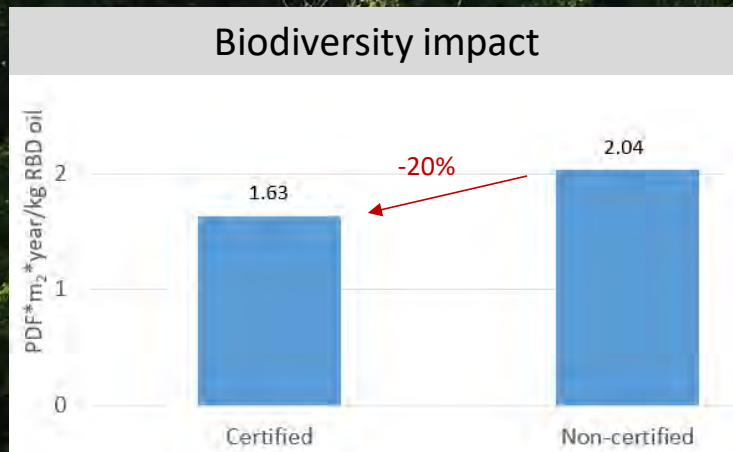
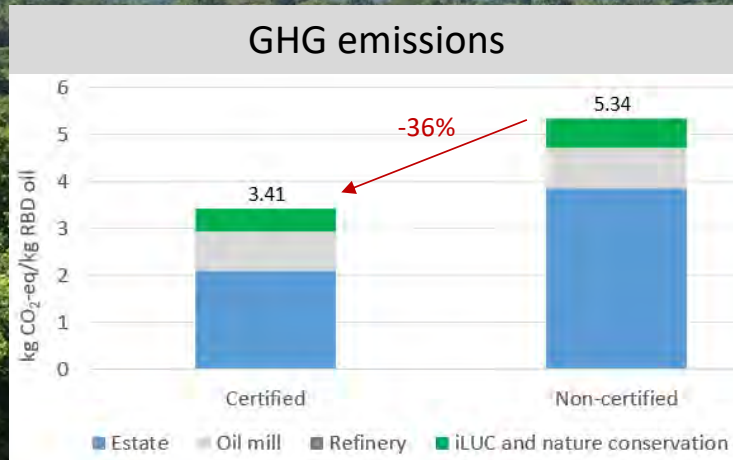
Oil mills

Key performance indicators for palm oil mills

Flows	Unit	Total industry (ID & MY)	RSPO certified	Non- certified
OER	%	20.2%	21.9%	19.8%
KER	%	5.4%	5.6%	5.4%
Share of POME treated with biogas capture	%	5.0%	16%	2.4%
Share of landbank in supply base set-aside as HCV	%	0.6%	3.1%	0%

Picture: Jannick Schmidt. UIE palm oil mill, United Plantations, Peninsular Malaysia 2017

Where do the LCA results take us?



Picture: Jannick Schmidt. Nature conservation, Sungai Rungau estate, Sinarmas, Central Kalimantan 2017

The devil lies in the detail...

- GHG emissions

Life Cycle Stage	Contribution	Certified	Non-certified
Oil crop cultivation			
	Field emissions (related to nutrient cycle)	0.72	0.92
	Field emissions (related to peat drainage)	0.77	2.36
	Indirect Land Use Changes (iLUC)	0.49	0.62
	Material inputs: fertiliser, pesticides, capital goods etc.	0.33	0.21
	Energy	0.07	0.08
	Other (transport, waste treatment, assets and services)	0.20	0.27
	Total crop cultivation stage	2.58	4.46
Palm oil mill			
	POME treatment	1.19	1.51
	Energy inputs	-0.03	-0.06
	Other (transport, waste treatment, assets and services)	0.17	0.18
	By-product: kernel	-0.43	-0.70
	By-product: energy and EFB to field application	-0.04	-0.04
	HCV nature conservation	-0.01	0.00
	Total palm oil mill stage	0.85	0.89
Refinery			
	Materials: chemicals, water etc.	0.02	0.02
	Energy	0.03	0.03
	Other (transport, waste treatment, assets and services)	0.02	0.02
	By-products: PFAD/PKFAD	-0.08	-0.08
	Total refinery stage	-0.01	-0.01
All stages			
Total		3.41	5.34

Low peat share
Low drainage depth

High yield

Higher fertiliser

More biogas capture

What matters? Peat and water management

Account for 22-45% of GHG emissions
Average: 73 cm $\Rightarrow$ 41 t CO₂/ha*year
Certified: 57 cm $\Rightarrow$ 32 t CO₂/ha*year

Good water management
RSPO certified grower

Poor water management
non-certified grower

0.3 m

1.2 m

O₂ ↓
CO₂ ↑
+ C

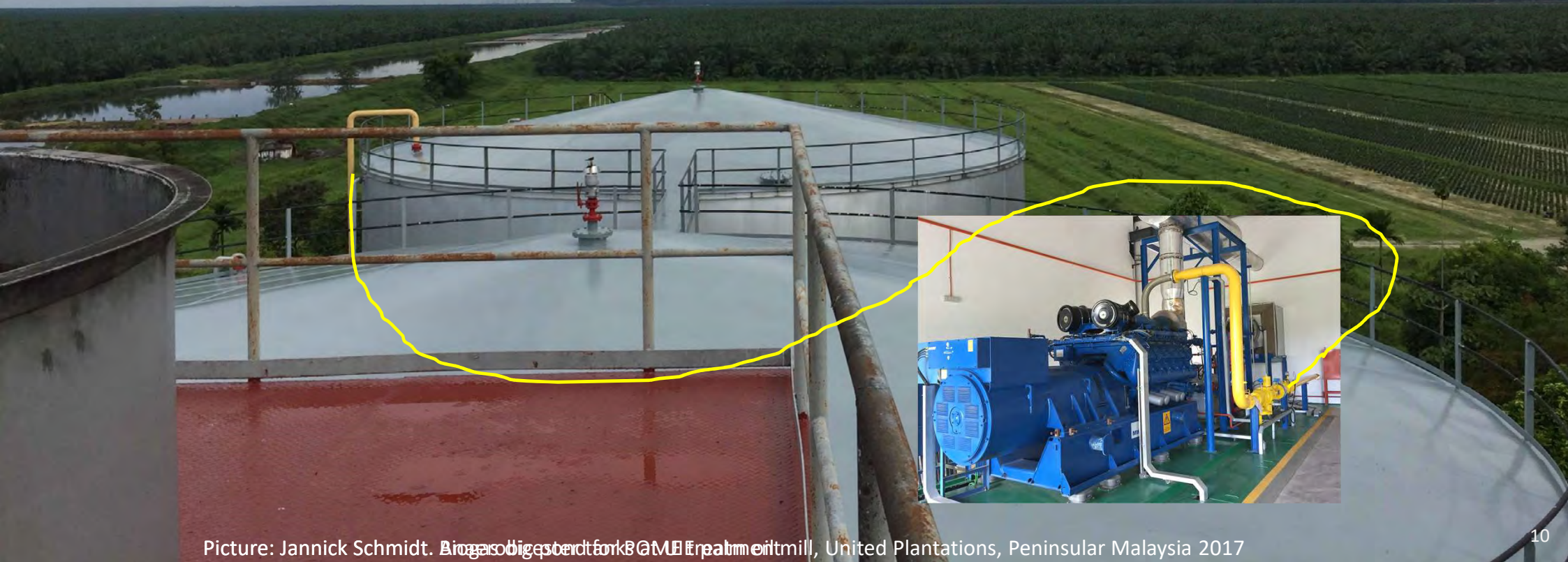
Drainage

Peat = Organic soil (high carbon)

Picture: Jannick Schmidt. Peat water management, Central Kalimantan 2018

What matters? Biogas capture

- Anaerobic ponds $\Rightarrow$ methane
- POME emissions account for around 1/3 of GHG emissions
- Can be more than eliminated by biogas capture



Picture: Jannick Schmidt. Biogas digester for POME treatment, United Plantations, Peninsular Malaysia 2017

What matters? Nature conservation

- Nature conservation – how to calculate impacts?
 - Net-saving = local saving minus remote impact
 - Local saving: Avoiding local transformation of forest to oil palm (dLUC)
 - Remote impact: Nature conservation does not reduce demand for palm oil => land needed somewhere else (iLUC)
- 1 ha*year nature conservation (mineral soil) = saves 1 tonne CO₂
- 1 ha*year nature conservation (peat soil) = saves 33-42 tonne CO₂

Picture: Jannick Schmidt. Nature conservation, Sungai Rungau estate, Sinarmas, Central Kalimantan 2017

Conclusions

- Model
 - Detailed and compatible with SimaPro
 - Runs with >600 estates and >150 oil mills
 - Two sets of results:
 - Consequential (cause-effect)
 - Attributional (similar to PalmGHG)
- Results: RSPO certified vs. non-certified
 - 36% lower GHG emissions
 - 20% lower nature occupation
 - 3% higher respiratory inorganics
 - LCA guides what matters

Pictures: Jannick Schmidt, Tanjung Puting, Central Kalimantan 2018



Conclusions

- What can the results be used for?
 - Now the impact of certification can be measured!
 - Companies can include the benefits of committing to certified oil in their environmental accounts
 - The industry can document that palm oil can be produced more sustainable
 - Inputs for next criteria for certification
 - Now RSPO can set measurable targets for reductions in GHG emissions and biodiversity impacts

Pictures: Jannick Schmidt, Tanjung Puting, Central Kalimantan 2018



What is next?

- New crowdfunded project
<https://lca-net.com/clubs/palm-oil/>
- Features
 - 2016 ⇒ Time-series
 - ID&MY ⇒ ID, MY, TH, CO, NG etc.
 - All growers ⇒ estates, smallholders
- Become a member and:
 - Shape the scope of the study
 - Get access to all data and materials

Pictures: Jannick Schmidt, Tanjung Puting, Central Kalimantan 2018



References

- **Crowdfunded project**

- Schmidt J and De Rosa M (2019). Comparative LCA of RSPO-certified and non-certified palm oil. 2.-0 LCA consultants: <https://lca-net.com/clubs/palm-oil/>
- **LCA of RSPO certified palm oil:** <https://lca-net.com/clubs/palm-oil/>

- **iLUC**

- Schmidt J, Weidema B P, Brandão M (2015). A framework for modelling indirect land use changes in life cycle assessment. Journal of Cleaner Production 99:230-238
- Webinar, slides and application examples: <https://lca-net.com/projects/show/indirect-land-use-change-model-iluc/>

- **Nature conservation**

- Schmidt J (2015). Nature conservation in life cycle assessment – new method and case study with the palm oil industry. Extended abstract for presentation at the SETAC2015, Barcelona 3-7 May 2015 <http://lca-net.com/p/1818>
- Schmidt J (2016). Life cycle assessment of palm oil – investigating nature conservation and other GHG mitigation options. Presentation at the 5th International Conference on Oil Palm and Environment (ICOPE), 2016. <http://lca-net.com/p/2479>
- Schmidt J (2018). Life cycle assessment of palm oil – PT SMART pilot study on GHG and biodiversity mitigation options. Paper presented at the International Conference on Oil Palm and the Environment (ICOPE), 25-27 April 2018, Bali