ICOPE
enhancing sustainable oil palm

BICC, The Westin Resort Nusa Dua, Bali
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Life cycle assessment of palm oil

– PT SMART pilot study on GHG and biodiversity mitigation options

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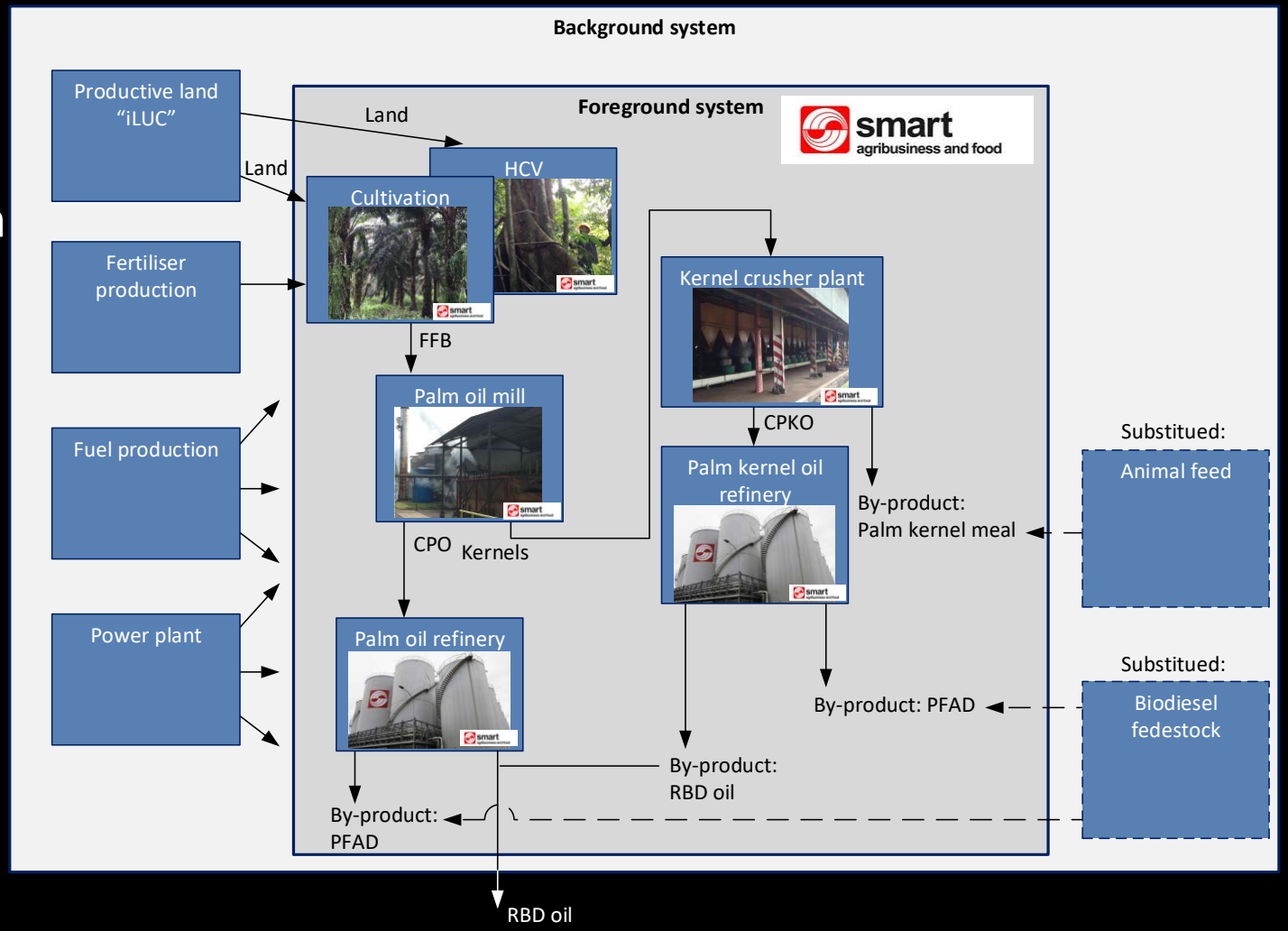
Background and purpose

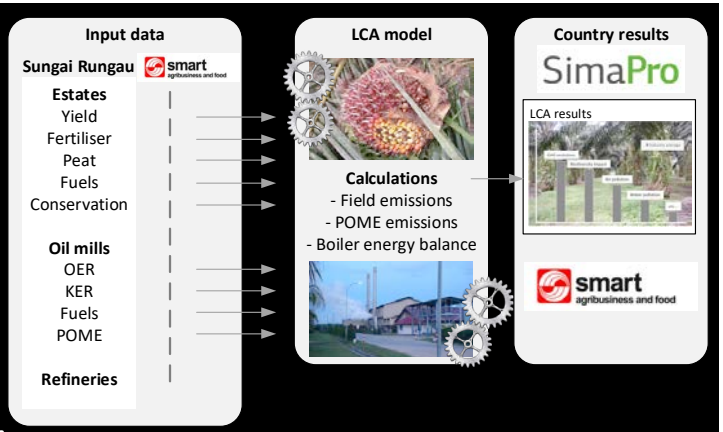
- **PT SMART pilot study**
  - LCA study for Sungai Rungau palm oil mill in Central Kalimantan
- **Purpose**
  - Overview of environmental impact and hotspots
  - Compare with industry average
  - Investigate achievable reductions in GHG emissions and biodiversity
- **Intended use**
  - Communication
  - Knowledge on improvement options

Methods

- Modelled system
- Functional unit
  1 kg RBD oil
- Year: 2016
- Impacts: 16
  Focus on: GHG and biodiversity



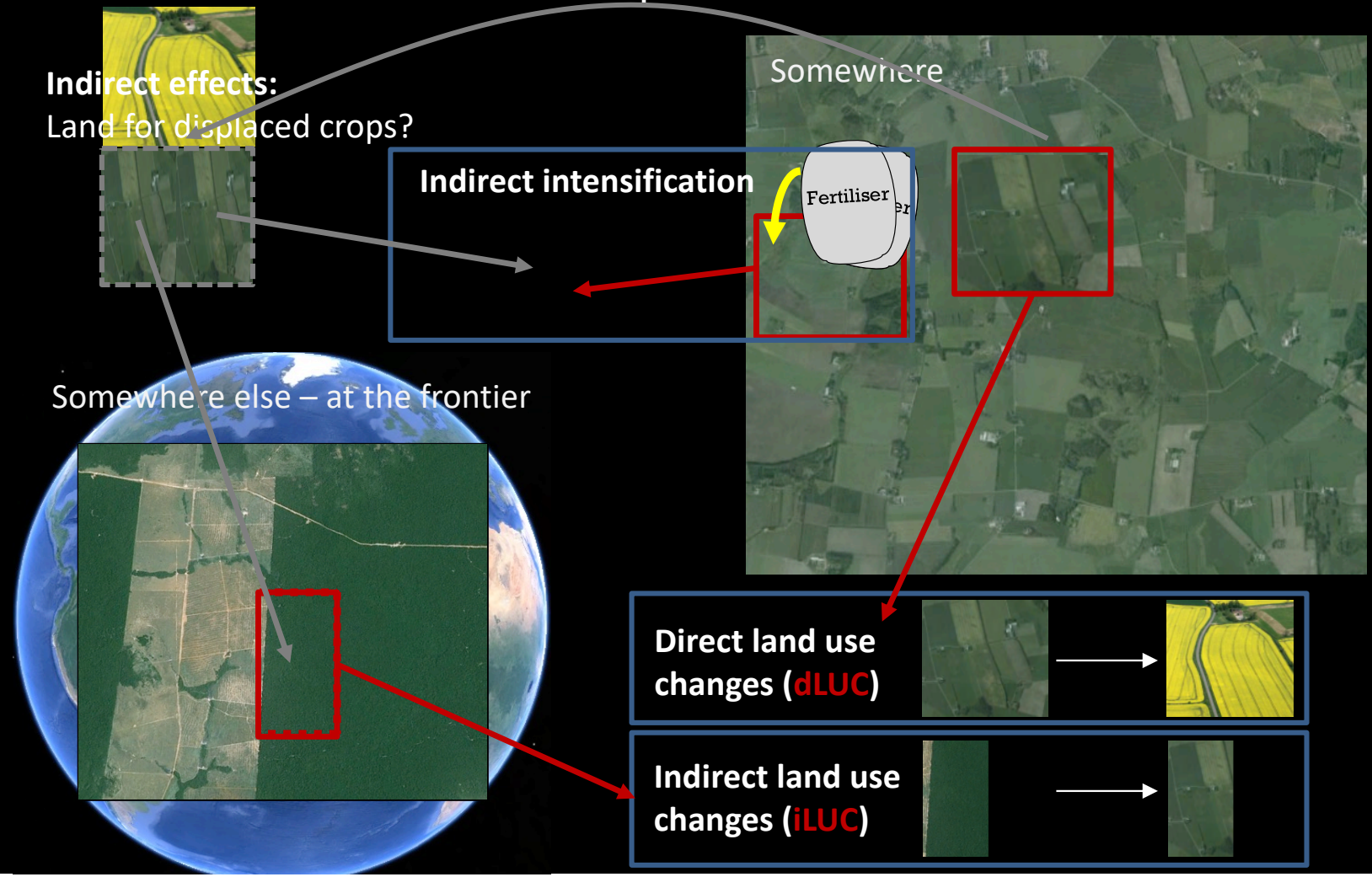
Methods



- Field emissions
  - N_2O: IPCC (2006) tier 2 + detailed N-balance
  - Peat CO_2: IPCC (2014) + extensive literature review
- POME emissions
  - UNFCCC CDM methodology
- GHG indicator
  - IPCC (2013) Global warming potential (GWP100)
  - Time-dependent GWP: Land use changes and nature conservation
- Biodiversity indicator
  - Effect: Direct + indirect land use changes
  - Species richness
  - Relative difference between current land use and marginal alternative

Direct and indirect land use changes

- Effect of 1 ha additional rapeseed field somewhere?

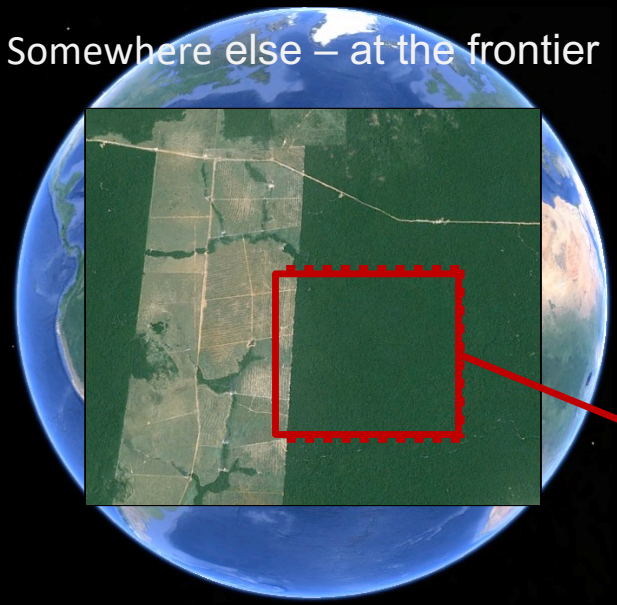


Nature conservation

Effect of 1 ha Nature conservation

The choice:

- Cultivate oil palm, or
- Nature conservation



Avoided direct land use changes (-dLUC)

Indirect land use changes (iLUC)

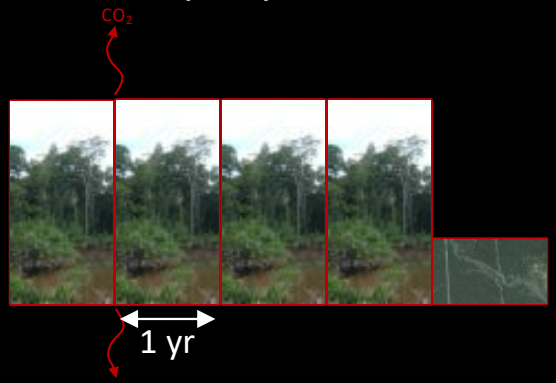
Net effect

Emissions from LUC

- CO_2 emissions = 44/12 x ($C_{stock,before}$ – $C_{stock,after}$)

Temporal effects of emissions

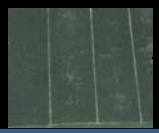
- Conservation areas may be lost
- ⇨ effect per year

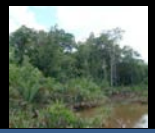


- Effect of 1 year = postponing LUC
- Net CO_2 = 0
- GWP100 = >0

(See Schmidt et al. 2015)

Avoided direct land use changes (dLUC)



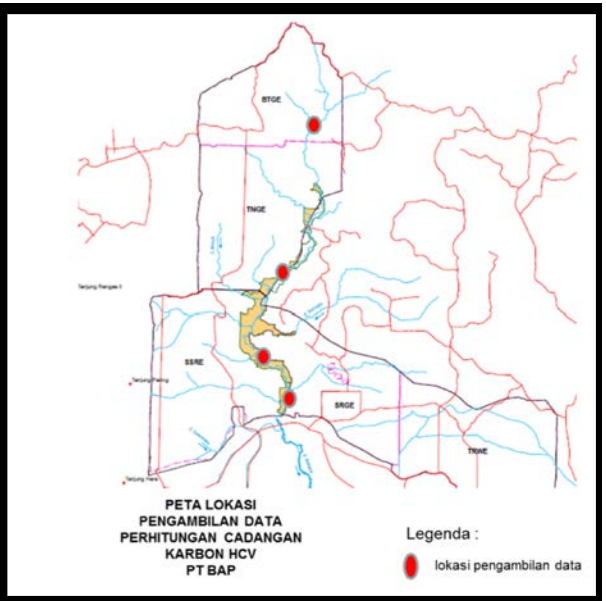


Data

Key data	Unit	PT SMART	Industry average Malaysia and Indonesia
Estate			
FFB yield (mature)	ton/ha*year	26.1	19.3
Share of oil palm on peat	%	0%	18%
Land bank set-aside as HCV nature conservation	%	7.5%	0%
Carbon stock of HCV nature conservation (below and above ground)	ton C/ha	213	n.a.
N-fertiliser	kg N/ha*year	112	178
P-fertiliser	kg P_2O_5/ha*year	75	88
K-fertiliser	kg K_2O/ha*year	29	34
Palm oil mill			
Oil extraction rate (OER)	%	22.2%	20.3%
Kernel extraction rate (KER)	%	5.6%	5.2%
POME treated with biogas capture	%	0%	5%
COD conc. of raw POME	ppm	98,000	79,000
Refinery			
Electricity	kWh/ton RBD oil	12	27
Coal	GJ/ton RBD oil	0.37	0.32
PFAD to CPO	%	5.2%	4.6%

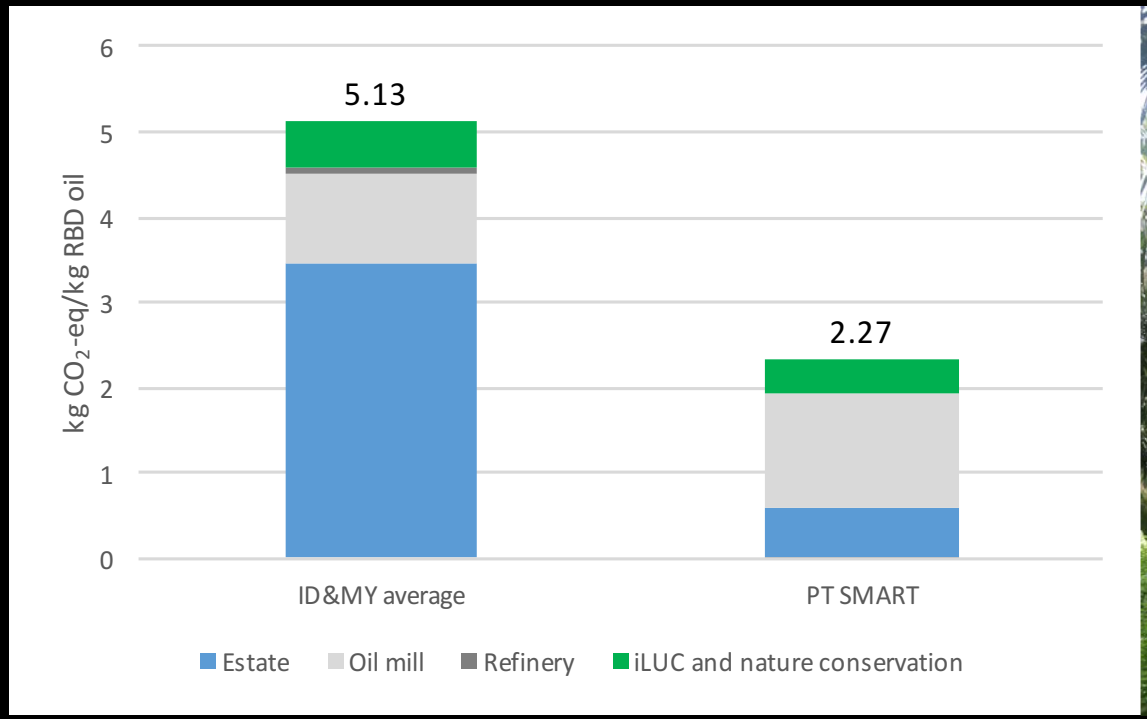
Data

- Carbon stock in nature conservation
- Detailed field survey July 2017
- 25 plots
- Biomass calculation approach (Hairiah et al. 2011)

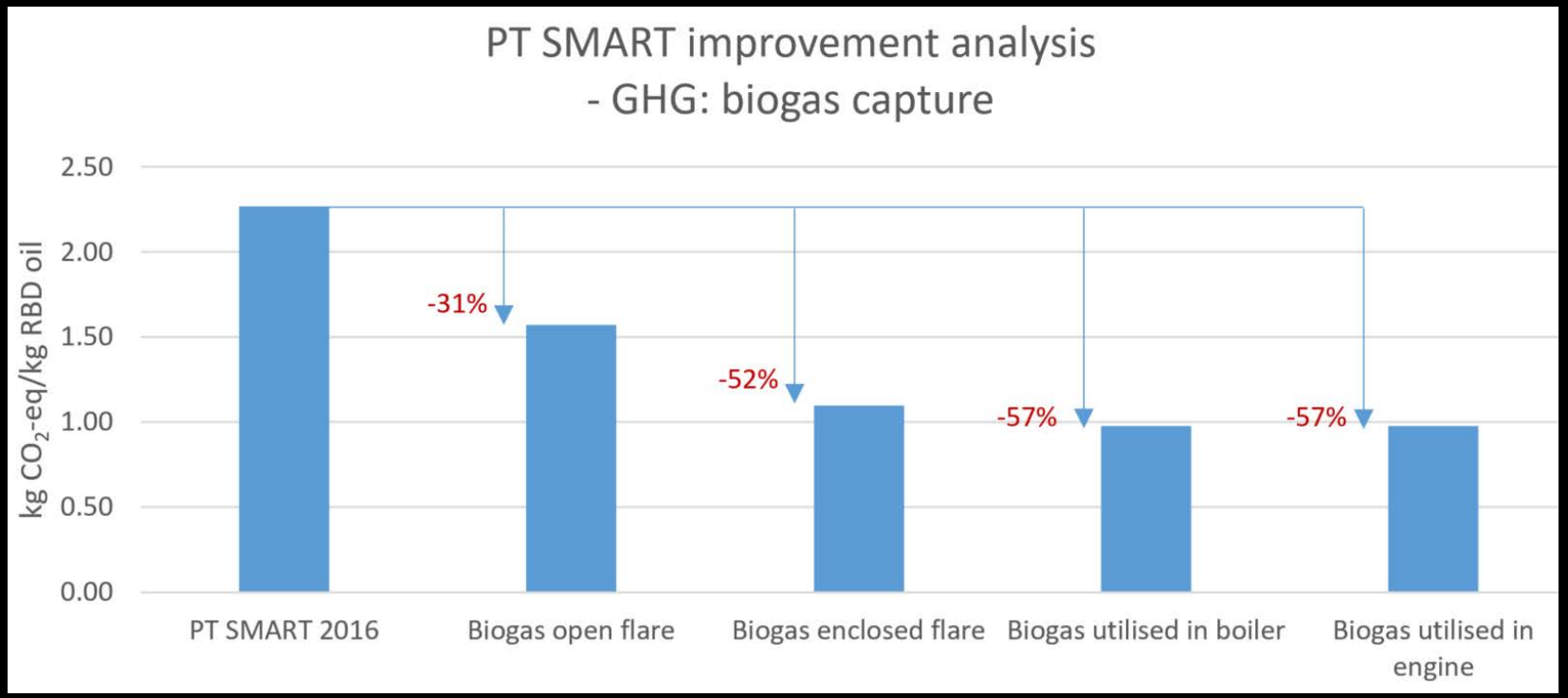


No	Carbon sources	Average stock of carbon (Ton C/ha)
1	Trees	109.90
2	Understorey Vegetation	0.0434
3	Litter	0.46
4	Soil	9.05
5	Below ground biomass	93.88
Total		213.35

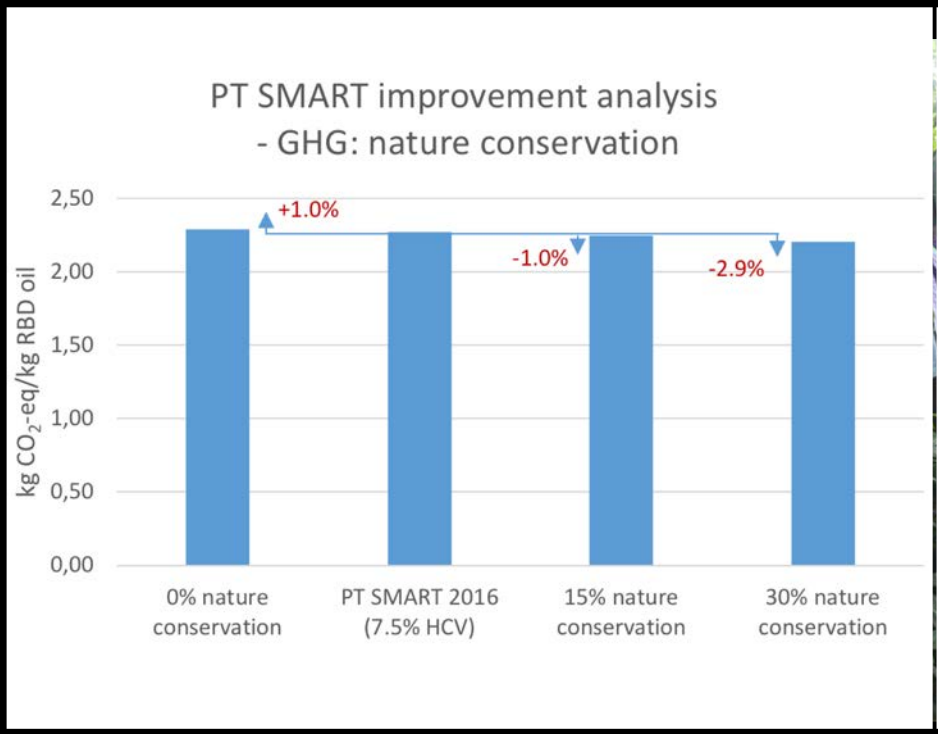
PT SMART compared with industry average - GHG emissions

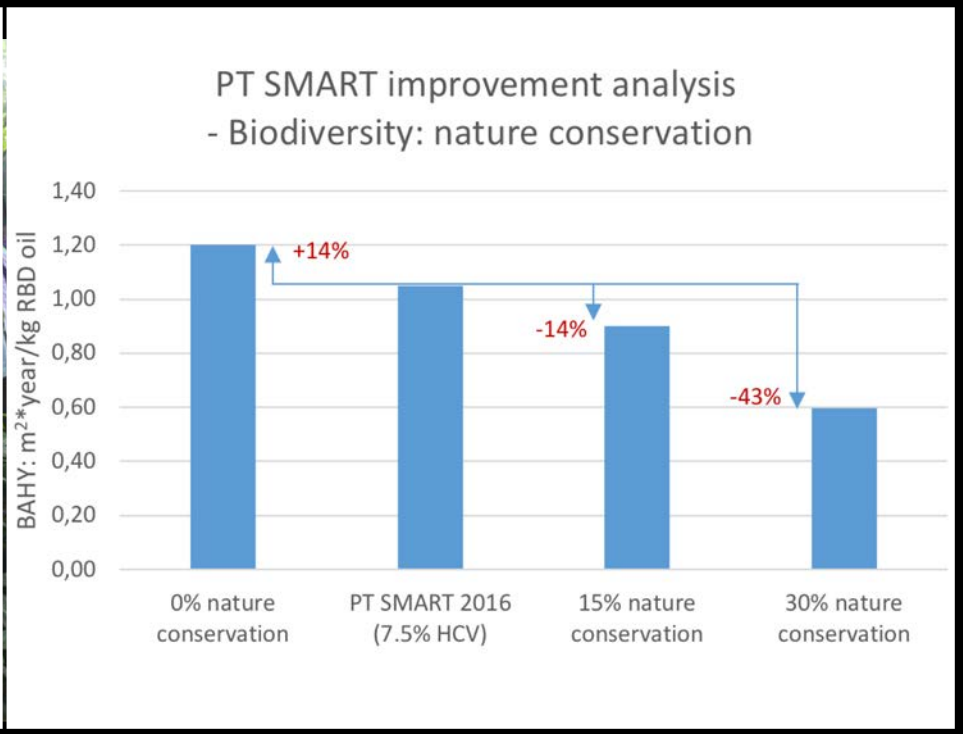


Mitigation options: biogas capture



Mitigation options: nature conservation





Conclusions

- **PT SMART Sungai Rungau**
  - **Significantly better performance than industry average**
  - **7.5% HCV reduces GHG 1% and biodiversity 14%**
- **Mitigation options**
  - Biogas capture: up to 57% GHG reduction potential
  - HCV: Increase from 7.5% to 30%
    - 3% GHG reduction potential
    - 43% biodiversity reduction potential
- **Model**
  - Fully parameterised model
  - Can be implemented for all PT SMART's palm oil mill supply bases
  - Option for calculating annual updates of the results

Thank You

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